

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES**

1.	a. CERTIFICATE NUMBER 9301	b. REVISION NUMBER 8	c. DOCKET NUMBER 71-9301	d. PACKAGE IDENTIFICATION NUMBER USA/9301/AF-96	PAGE 1	PAGES OF 7
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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*)
AREVA Inc.
7135 Minstrel Way
Columbia, MD 21045
- b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION
Packaging Technology, Inc., application
dated July 24, 2002, 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.: TNF-XI
- (2) Description

A shipping container for unirradiated enriched forms of homogenous and heterogeneous uranium oxides. The packaging body is a parallelepiped and is approximately 44 inches x 44 inches x 37 inches. The package contents are enclosed in pails which each have a borated stainless steel ring. Three pails are stacked inside four inner wells of the packaging body. Each inner well is closed by a primary lid and an upper plug.

The packaging body is constructed of an outer stainless steel envelope which is 0.08 inches thick. The space between the outer shell and the inner wells is filled with fire-retardant, open cell phenolic foam.

The four inner wells each have an inside diameter of 14 inches and height of 27 inches. The inner wells are constructed of (1) and outer shell of stainless steel sheet 0.04 inches thick, with a diameter of 17 inches, (2) and inner shell of stainless steel sheet 0.04 inches thick with a diameter of 14 inches, and (3) a flat bottom of 0.04 inch thick stainless steel sheet with a 0.08 inch thick borated stainless steel plate glued to it. A molded annular layer of neutron-poison BORA resin is inserted between the inner and outer steel shells of the inner well.

Each upper plug consists of two thermal insulating disks of phenolic foam, with an internal stiffener disk made of aluminum alloy. The upper plug assembly is encapsulated inside a 0.03 inch thick stainless steel envelope.

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5.(a) (2) Description (continued)

The four primary lids closing off the inner wells are stainless steel circular plates 0.2 inches thick on the center part, and 0.4 inches thick on the periphery. Four bayonet teeth are welded to the primary lid to lock in the well flanges. A primary lid locker is located between the well flange and the primary lid to prevent the rotation of the primary lid during transport. The primary lid and the inner well are sealed by an elastomer gasket set in a rectangular groove machined on the inner face of the primary lid.

The approximate dimensions and weights of the package are as follows:

Inner well inside diameter	14 inches
Overall package dimensions	
Width	44 inches
Length	44 inches
Height	41 inches
Maximum weight of contents in any pail	25 kg
Maximum content weight	300 kg
Maximum package weight (including contents)	1050 kg

(3) Drawings

The packaging is constructed in accordance with the Packaging Technology, Inc., Drawing No. 10799-SAR, Rev. 3, Sheets 1 through 7.

(b) Contents

(1) Type and form of material

The following provides a description of the three types of material authorized in 5.(b)(1)(i), 5.(b)(1)(ii), and 5.(b)(1)(iii):

Homogeneous UO₂ powder: Powders, such as fine powder, are those materials that were not subjected to any treatment that would lead to agglomeration.

Heterogeneous UO₂ material: Heterogeneous materials, such as coarse powder, granulated powders, pellets, and scrap, are those materials that do not meet the definition of homogeneous powders.

In case of a mix of several forms of fissile material, the mix shall be considered heterogeneous material.

- (i) The uranium oxide pellets, powder, and scrap meets the requirements of Enriched Commercial Grade Uranium, as defined in ASTM C996-10. U₃O₈ or UO_{x, >2} are authorized provided that the equivalent UO₂ mass is less than the limits specified below:

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5.(b)(1)(i) Type and Form of Material (continued)

Max ²³⁵ U Enrichment (weight %)	Homogenous UO ₂ Powder Maximum Loading (kg)	Heterogeneous UO ₂ Material (Pellet and Scrap) Maximum Loading (kg)
≤ 4.05	300	300
4.1	300	293
4.15	300	287
4.25	300	271
4.35	300	259
4.45	300	247
4.55	294	238
4.65	281	228
4.75	265	219
4.85	255	208
4.95	244	202
5.0	239	197

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- (ii) The uranium oxide pellets, powder, and scrap meets the requirements of Enriched Commercial Grade Uranium, as defined in ASTM C996-10. U_3O_8 or $UO_{x, x>2}$ are authorized provided that the equivalent UO_2 mass is less than the limits specified below:

Max ^{235}U Enrichment (weight %)	Homogenous UO_2 Powder Maximum Loading (kg)	Heterogeneous UO_2 Material (Pellet and Scrap) Maximum Loading (kg)
≤ 4.05	300	300
4.15	300	284
4.25	300	271
4.35	300	256
4.45	300	247
4.55	286	236
4.65	271	224
4.75	259	216
4.85	248	208
4.95	238	202
5.0	232	196

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- (iii) The uranium oxide powder scrap, which may contain impurities, meets the requirements of Enriched Commercial Grade Uranium, as defined in ASTM C996-10. The impurities aluminum and carbon shall not exceed 5,000 ppm and 10,000 ppm, respectively. U_3O_8 or $UOx.x_2$ are authorized provided that the equivalent UO_2 mass is less than the limits specified below:

Max ^{235}U Enrichment (weight %)	Homogenous UO_2 Powder Maximum Loading (kg)
≤ 4.05	300
4.15	300
4.25	300
4.35	300
4.45	300
4.55	286
4.65	271
4.75	259
4.85	248
4.95	238
5.0	232

(2) Maximum quantity of material per package

- (i) For the contents described in 5.(b)(1)(i), no more than 25 kg of contents per pail. No more than 300 kg of contents per package. Presence of hydrogenated materials (with a hydrogen concentration less than hydrogen concentration in water) or water inside cavities and pails is allowed.

The auto-ignition temperature of the hydrogenated materials (with a hydrogen concentration less than hydrogen concentration in water) shall be greater than 140°C (284°F).

The presence of materials containing more hydrogen than water is not allowed in the package.

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- (ii) For the contents described in 5.(b)(1)(ii), no more than 25 kg of contents per pail. No more than 300 kg of contents per package. In each pail, the contents can be put in a polyethylene bag (CH₂) or in a bag made of a material with a hydrogen concentration less than that of polyethylene. The maximum hydrogen content of the bags within each cavity is a mass of 56 g H, which is equivalent to a maximum mass of 390 g polyethylene, considering all sources of hydrogenous material within each cavity.

The auto-ignition temperature of the bag material shall be greater than 140°C (284°F).

The presence of materials containing more hydrogen than polyethylene is not allowed in the package.

- (iii) For the content described in 5.(b)(1)(iii), no more than 25 kg of uranium oxide powder scrap contents per pail. No more than 300 kg of uranium oxide powder scrap contents per package. In each pail, the contents can be put in a polyethylene bag (CH₂) or in a bag made of a material with a hydrogen concentration less than that of polyethylene. The maximum hydrogen content of the bags within each cavity is a mass of 56 g H, which is equivalent to a maximum mass of 390 g polyethylene, considering all sources of hydrogenous material within each cavity.

The auto-ignition temperature of the bag material shall be greater than 140°C (284°F).

The presence of materials containing more hydrogen than polyethylene is not allowed in the package.

(c) Criticality Safety Index: 0.5

6. Transport by air is not authorized.

7. 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 of the application, as supplemented;
- (b) The package must be acceptance tested and maintained in accordance with the Acceptance Tests and Maintenance Program in Chapter 8 of the application, as supplemented; and,
- (c) Prior to each shipment, the stainless steel components of the packaging must be visually inspected. Packagings in which stainless steel components show pitting corrosion, cracking, or pinholes are not authorized for transport.

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8. The packaging authorized by this certificate is hereby approved for use under the general license provision of 10 CFR 71.17.
9. Revision No. 7 of this certificate may be used until February 28, 2016.
10. Expiration date: November 30, 2018.

REFERENCES

Packaging Technology, Inc., application dated July 24, 2002.

Supplements provided by Packaging Technology, Inc., dated: October 29, 2002; March 7, April 3, May 6, June 26, July 21, 2003; November 26, 2007; and August 6, 2008.

Supplements provided by Transnuclear, Inc., dated: September 8, October 28 and December 23, 2011; January 6, 2012; June 27, 2013 and November 1, 2013; and January 27, 2014.

Supplement provided by AREVA Inc., dated December 9, 2014.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION



Michele Sampson, Chief
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Date: *February 4, 2015*



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

SAFETY EVALUATION REPORT
Docket No. 71-9301
Model No. TNF-XI
Certificate of Compliance No. 9301
Revision No. 8

SUMMARY

By letter dated December 9, 2014, AREVA Inc., (AREVA) requested an amendment to Certificate of Compliance No. 9301, for the Model No. TNF-XI transportation package. The letter requested adding a new content, UO₂ powder containing impurities. The certificate has been updated to Revision No. 8 to reflect the changes.

EVALUATION

The contents requested to be added do not exceed the mass limits of Revision No. 7 of the Certificate, nor do they require any changes in the evaluation of package performance in the areas of structural, materials, thermal, or shielding.

Criticality Evaluation

The applicant requested inclusion of impurities (i.e., powder scrap), as allowable contents in the TNF-XI shipping container when shipping unirradiated uranium oxides. The uranium oxides, which include UO₂, UO₃ and U₃O₈, are powdered scrap that is enriched to a maximum of 5.0 weight percent and may contain impurities primarily consisting of aluminum and carbon. These impurities are not allowed to exceed 5,000 ppm for aluminum and 10,000 ppm for carbon. The maximum weight allowed as payload in the TNF-XI is 300 kg of uranium oxides.

The applicant performed a series of calculations on the allowable contents assuming the conservative maximum aluminum and carbon impurities, and demonstrated that the resulting addition of the impurities indicated no discernable difference from the baseline calculations performed on uranium oxide powders with no impurities. Calculations were performed on both single packages and packages in arrays at various enrichments, UO₂ loading levels, and optimal fill heights under both normal conditions of transport and hypothetical accident conditions, and in all cases the results were found statistically insignificant from those assuming only pure uranium oxide powder.

Based on the review of the statements and representations in the application, the calculations performed by the applicant, and a review of the representative input files provided, the staff has reasonable assurance that the nuclear criticality safety design of the package continues to meet the criticality safety requirements of 10 CFR Part 71.

CONDITIONS

The following changes have been made to the certificate of compliance:

Condition No. 5.(b)(1) is updated to include the new content.

Condition No. 5.(b)(1)(iii) is added to establish equivalent UO₂ mass limits for the new contents.

Condition No. 5.(b)(2)(iii) is added to establish maximum quantity of material per package for the new content.

Condition No. 8 reflects a correction of a typographical error: "10 CFR 71.71" is corrected to "10 CFR 71.17".

Condition No. 9 now allows use of Revision No. 7 of the certificate until February 28, 2016.

The References section has been updated to include the amendment request.

CONCLUSION

Based on the statements and representations in the amendment request and the staff's evaluation, the staff finds that these changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9301, Revision No. 8.