NRC FORM 618
(8-2000)
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
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\+ 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 Federal Services LLC
505 S. 336th Street, Suite 400
Federal Way, WA 98003

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION

Packaging Technology, Inc., application dated June 25, 2004, 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.: Mixed Oxide Fresh Fuel Package (MFFP)

(2) Description

The MFFP is designed to transport unirradiated mixed oxide (MOX) fuel assemblies and individual MOX fuel rods contained in rod boxes.

The MFFP body is made of a 9/16-inch thick XM-19 austenitic stainless steel cylindrical shell with the flange section and a 1-1/2 inch bottom end plate welded to it. A circumferentially continuous doubler plate, constructed of Type XM-19 austenitic stainless steel, is welded to each end of the shell, near the end of each impact limiter. Welded to the doubler plate are the impact limiter attachment lugs, six per impact limiter. The doubler plate also serves to provide a tiedown interface with the transportation skid.

The seal flange is located at the open end of the body, and consists of a locally thicker wall section to accommodate the closure lid sealing area and the closure bolt threaded holes. The transition between the shell and the seal flange section is a 3:1 taper. Polyurethane foam is used to build the outer diameter of the body out to the full diameter of the sealing flange and closure lid.

5.(a)(2) continued

The closure lid is a weldment constructed of Type XM-19 3/4-inch outer plate and 5/8-inch thick inner plate, stiffened with eight 1/2-inch thick radial ribs that are three inches deep. A 1/2-inch thick, 6 inch inner diameter cylinder forms a hub at the inner end of the radial ribs. The ribs are welded on all four edges to the adjacent structure. Each rib has a projection that passes through a slot in the outer plate, and the ribs and outer plate are welded together.

The closure lid inner plate is welded to the outer ring. The seal flange of the closure lid has a minimum thickness of one inch, and provides location for three O-ring bore seals with the middle seal providing the containment seal. The seals are 3/8-inch diameter butyl rubber O-ring.

Up to three unirradiated fuel assemblies are held in place inside the overpack by a strongback assembly which is constructed from 1/4-inch thick Type 304 stainless steel weldment, a series of clamp arm assemblies, a top, and a bottom plate assemblies. For shipping less than three fuel assemblies, non-fuel dummy assemblies are used in the strongback locations not occupied by the fuel assemblies. The physical size and weight of the non-fuel dummy assemblies are nominally the same as the MK-BW/MOX1 17 x 17 design. Neutron poison plates are placed inside the weldment. A series of fuel control structure (FCS) limits lateral expansion of fuel rods during vertical and near vertical hypothetical accident condition (HAC) free drops and also hold neutron poison plates.

A pair of conical-shaped impact limiters filled with polyurethane foam provide thermal and impact protections. The closure lid end impact limiter has 1/4-inch thick shells to resist perforation from the HAC puncture drop, and to protect the closure lid and sealing area from puncture and HAC fire damage. Shock indicators are attached to the outside of the MFFP shell.

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

Overall package outside dimensions (inches)	
Without Impact Limiters	
Diameter	30
Length	171
With Impact Limiters	
Diameter	60
Length	201
Maximum content weight	4,740 lbs
Maximum package weight (Including contents)	14,260 lbs

(3) Drawings

The packaging shall be constructed and assembled in accordance with Packaging Technology, Inc., drawing numbers:

(a) Shipping Package	99008-10, Rev. 5, Sheet 1
(b) Body Assembly	99008-20, Rev. 4, Sheets 1 through 6
(c) Strongback Assembly	99008-30, Rev. 6, Sheets 1 through 7
(d) Top Plate Assembly	99008-31, Rev. 2, Sheets 1 through 3
(e) Bottom Plate Assembly	99008-32, Rev. 2, Sheets 1 and 2
(f) Clamp Arm Assembly	99008-33, Rev. 4, Sheets 1 through 4
(g) Fuel Control Structure Assembly	99008-34, Rev. 5, Sheets 1 and 2
(h) Impact Limiter	99008-40, Rev. 3, Sheets 1 through 3
(i) AFS-B Assembly	99008-60, Rev. 1, Sheets 1 and 2
(j) AFS-C Assembly	99008-61, Rev. 1, Sheets 1 and 2

(b) Contents

(1) Type and Form of Material

Unirradiated 17 x 17 fuel assemblies with solid PuO_2+UO_2 pellets in zirconium based alloy (M5) tubes. The fuel assemblies are based on the MK-BW/MOX1 17 x 17 PWR design. The fuel assemblies may contain Burnable Poison Rod Assemblies (BPRA). The physical specifications for the unirradiated fuel assemblies and the burnable poison rod assemblies are provided in Tables 1 and 2. For shipping less than three fuel assemblies, non-fuel dummy assemblies are used in the strongback locations not occupied by the fuel assemblies. The physical size and weight of the non-fuel dummy assemblies are nominally the same as the MK-BW/MOX1 17 x 17 design.

5.(b)(1) continued

The ARB-17 is a rod container designed to transport up to 17 MOX fuel rods. The rods type is identical to the rods comprising the standard MOX fuel assembly. The rods may be either undamaged, damaged, or a combination of both (e.g., 9 undamaged and 8 damaged). Damaged fuel rods may be bent, scratched, or dented, but under no circumstances may exhibit cladding breaches. A 2-inch Schedule 40 pipe mounted with pipe clamps against one wall of the ARB-17 is used to transport undamaged or slightly damaged fuel rods. Damaged fuel rods may be transported within this pipe only if the bending in the fuel rod is minor. The ARB-17 MOX fuel rod container has been designed with outer dimensions consistent with a standard fuel assembly so that it will interface with the strongback and clamp arms.

The AFS-B Rod Container is designed to contain up to 175 MOX fuel rods. The container has outer cross sectional dimensions of 8.4 inches square, a length from bottom to top of 159.9 inches, and an overall length (to the lift ring bolt head) of 161.2 inches. The primary material of construction of the container is ASTM 6061-T651 aluminum alloy.

The AFS-C Rod Container is designed to contain up to 116 Exxon rods, up to 69 Pacific Northwest Laboratory (PNL) rods, or both quantities together. The container is the same as the AFS-B Rod Container except the AFS-C container has two internal 2-inch thick aluminum plates which form rod cavities to accommodate both types of rods the AFS-C Rod Container may hold.

The EMA is similar to MOX fuel assemblies with the exceptions that the OD of the fuel pellets may be out of tolerance (nominal pellet diameter = 0.323 inch), and the weight percent Pu-238 exceeds the 0.05 wt.% limit specified in Table 1.2-2 of the SAR (EMA fuel rods have Pu-238/Pu as high as 0.19 wt.%).

5.(b)(1) continued

Table 1 - Fuel Assembly Physical Parameters
(nominal values unless stated otherwise)

Parameter	Values
Fuel Rod Cladding Material	M5
Fuel Rod Array	17 x 17
Fuel Rods per Fuel Assembly	264
Guide Tubes per Fuel Assembly	24
Instrument Tubes per Fuel Assembly	1
Guide/Instrument Tube Thickness (inches)	0.016
Fuel Assembly Length (inches)	161.61
Fuel Assembly Maximum Width (inches)	8.565
Fuel Rod Pitch (inches)	0.496
Fuel Rod Length (inches)	152.4
Fuel Rod Outside Diameter (inches)	0.374
Fuel Rod Clad Thickness (inches)	0.023
Active Fuel Length (inches)	144.0
$PuO_2 + UO_2$ Weight (pounds)	1,157
Heavy Metal Weight (pounds)	1,020
Maximum Fuel Assembly Weight including Burnable Poison Rod Assembly (pounds)	1,580
Maximum Initial Pu Loading (weight% of heavy metal)	6.0

Table 2 - Burnable Poison Rod Assembly Parameters

Parameter	Value
Poison Rod Cladding Material	Zircaloy-4
Poison/Thimble Plug Rod Array	Up to 24 rods
Burnable Poison Material	Al_2O_3-B_4C

5. (b) (2) Maximum Quantity of Material per Package

Three unirradiated fuel assemblies with specifications on fuel pellets and enrichment are provided in Table 3. Three Areva Rod Box 17 (ARB-17) containers may contain up to 17 standard MOX fuel rods. One AFS-B rod container may contain up to 175 standard MOX fuel rods and one Excess Material Assembly. Three AFS-C rod containers may contain up to 116 Exxon rods and 69 PNL rods. The permissible configurations of contents are summarized in Table 4.

Table 3 - Nuclear Design Parameters for Fuel Assemblies

Parameter	Value
Nominal Pellet Diameter (inches)	0.323
Maximum Effective Pellet Density (gram/cm^3)	10.85
Maximum Total Plutonium (Pu) Content	0.06 g Pu/g Heavy Metal (Pu+U)
Plutonium Isotopic Contents	Pu-238: Up to 0.0005 g/g Pu Pu-239: 0.90 to 0.95 g/g Pu Pu-240: 0.05 to 0.09 g/g Pu Pu-241: Up to 0.01 g/g Pu Pu-242: Up to 0.001 g/g Pu
Minimum Total Uranium (U) Content	0.94 g U/g Heavy Metal (Pu+U)
Uranium Isotopic Contents	U-234: Up to 0.0005 g/g U U-235: Up to 0.003 g/g U U-238: Remainder of U content

Table 4 – Payload Table

Payload Type	Strongback Positions (3)		
MOX Fuel	MOX FA	MOX FA or dummy FA	MOX FA or dummy FA
MOX Fuel and ARB-17 Rod Container	MOX FA or ARB-17	MOX FA, ARB-17, or dummy FA	MOX FA, ARB-17, or dummy FA
EMA	EMA	dummy FA	dummy FA
AFS-B and EMA	AFS-B	EMA or dummy FA	dummy FA
AFS-C	AFS-C	AFS-C or dummy FA	AFS-C or dummy FA

(c) Criticality Safety Index 0.0

6. 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 of Chapters 7, 7A, 7B, and 7C of the application, as applicable, as supplemented.

(b) The packaging must meet the Acceptance Tests and Maintenance Program of Chapters 8, 8A, 8B, and 8C of the application, as applicable, as supplemented.

(c) The boron-10 areal density within each of the internal neutron poison plates shall be verified as described in Section 8.1.5.2 of the application, as supplemented.

(d) Wrapping shall not be used on the unirradiated fuel assemblies.

(e) Non-fuel dummy assemblies with the same nominal size and weight as the MK-BW/MOX1 17 x 17 design shall be used in the case of loading less than three fuel assemblies in a MFFP packaging.

7. Transport by air of fissile material is not authorized.

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

9. Expiration date: August 31, 2020.

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REFERENCES

Packaging Technology, Inc., application dated June 25, 2004.

Supplement dated: February 4, February 10, April 8, and June 3, 2005; January 19, August 15, and November 26, 2007; April 4 and July 24, 2008; May 24, 2010; October 31, 2011; and May 20, 2015.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

/RA/ J. A. Vera For

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

Date: August 19, 2015