NRC FORM 618
(8-2000)
10 CFR 71

U.S. NUCLEAR REGULATORY COMMISSION

CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES

a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE		PAGES
9341	1	71-9341	USA/9341/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)*

AREVA Federal Services LLC
1102 Broadway Plaza, Suite 300
Tacoma, WA 98402

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION

AREVA Federal Services LLC
application dated March 25, 2009.

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.: BEA Research Reactor (BRR) Package

(2) Description

A package used to transport fuel elements that have been irradiated in various test and research reactors. The package is comprised of a lead–shielded cask body, payload basket, an upper shield plug, a closure lid, upper and lower impact limiters, and utilizes ASTM Type 304 stainless steel as its primary structural material. The cask is a right circular cylinder 77.1 inches long and 38 inches in diameter, not including the impact limiter attachments and the thermal shield. Lead shielding is located between two circular shells, in the lower end structure, and in the shield plug. The payload cavity has a diameter of 16 inches and a length of 54 inches.

Impact limiters are attached to each end, having essentially identical design. Each limiter is 78 inches in diameter and 34.6 inches long overall, with a conical section 15 inches long towards the outer end. The impact limiter design consists of ASTM Type 304 stainless steel shells and approximately 9 lb/ft^3 polyurethane foam. There are four baskets used with the package, one for each type of fuel transported. The baskets are made from welded construction using ASTM Type 304 stainless steel in plate, bar, pipe, and tubular forms. Each basket has a diameter of 15.63 inches and a length of 53.45 inches, and features a number of cavities that fit the size and shape of the fuel.

The package is designed to be transported as one package per conveyance, with its longitudinal axis vertical, by highway truck or by rail in exclusive use. When loaded and prepared for transport, the package is 119.5 inches long, 78 inches in diameter (over the impact limiters), and weighs 32,000 lb.

5.(a) Packaging (continued)

(3) Drawings

The packaging is constructed in accordance with AREVA Federal Services LLC drawings:
- 1910–01–01–SAR, BRR Package Assembly SAR Drawing, Sheets 1-4, Rev. 4
- 1910–01–02–SAR, BRR Package Impact Limiter SAR Drawing, Sheets 1-2, Rev. 1
- 1910–01–03–SAR, BRR Package Fuel Baskets SAR Drawing, Sheets 1-3, Rev. 4

(b) Contents

(1) Type and form of material

(i) Irradiated MURR fuel element to a maximum burnup of 180 MWD or a U-235 depletion of 30.9%. The minimum cooling time is 180 days after reactor shutdown. Each MURR element contains 24 fuel plates. Each fresh MURR element contains 775.0 ± 7.8 g U–235. The enrichment range is 93 ±1 wt.% U-235. The MURR element overall length, including irradiation growth, is 32.75 inches. The maximum decay heat per fuel element is 158 W. The maximum number of fuel elements per basket is 8. The bounding weight of one element is 15 lb. Pre-irradiated MURR fuel element dimensions are in Table 1.1.

Table 1.1

MURR - Key Fuel Element Parameters	
Maximum active fuel length (inches)	24.8
Overall length (inches)	32.75
Minimum cladding thickness (inch)	0.011 - 0.015
Nominal fuel matrix thickness (inch)	0.02
Fuel matrix	U-Al (x)
Cladding material	Aluminum
Maximum U-235 per element (g)	782.8
Maximum enrichment (wt.%)	94.0
Maximum U-235 per fuel plate (g)	46.0

(ii) Irradiated MITR–II fuel element to a maximum burnup of 165 MWD or a U–235 depletion of 43.9%. The minimum cooling time is 120 days after reactor shutdown. Each MITR-II element contains 15 fuel plates. Each fresh MITR–II element contains 510.0 +3.0/-10.0 g U–235, which is 500 - 513 g U-235. The enrichment range is 93 ±1 wt.% U-235. The MITR–II element overall length, including irradiation growth, is 26.52 inches. The maximum decay heat per element is 150 W. The maximum number of fuel elements per basket is 8. The bounding weight of one element is 10 lb. Pre-irradiated MITR–II fuel element dimensions are in Table 1.2.

5.(b)(1) Type and form of material (continued)

Table 1.2

MITR-II - Key Fuel Element Parameters	
Maximum active fuel length (inches)	22.76
Overall length (inches)	26.52
Minimum cladding thickness (inch)	0.017
Nominal fuel matrix thickness (inch)	0.03
Maximum fuel matrix width (inches)	2.171
Fuel matrix	U-Al (x)
Cladding material	Aluminum
Maximum U-235 per element (g)	513
Maximum enrichment (wt.%)	94.0
Maximum U-235 per fuel plate (g)	34.3

(iii) Irradiated ATR fuel element to a maximum burnup of 480 MWD or a U–235 depletion of 58.6%. The minimum cooling time is 1,670 days (4.6 years) after reactor shutdown. Each ATR fuel element contains 19 plates. The YA fuel element has 19 plates, but only 18 contain fuel. There are two general classes of ATR fuel element, XA and YA. The enrichment range is 93 ±1 wt.% U-235. The XA fuel element has a fresh fuel loading of 1,075 ± 10 g U–235. The YA fuel element has a fresh fuel loading of 1,022.4 ± 10 g U–235. A second YA fuel element design (YA–M) has the side plate width reduced by 15 mils. The ATR element overall length, after removal of the end box structures, 51.0 inches max. The maximum number of fuel elements per basket is 8. The bounding weight of one element is 25 lb. The maximum decay heat per element is 30 W. Pre-irradiated ATR fuel element dimensions are in Table 1.3.

Table 1.3

ATR - Key Fuel Element Parameters	
Maximum active fuel length (inches)	48.77
Overall length (inches)	51
Minimum cladding thickness (inch)	0.03/0.015/0.04
Nominal fuel matrix thickness (inch)	0.02
Fuel matrix	U-Al (x)
Cladding material	Aluminum
Maximum U-235 per element (g)	1,085
Maximum enrichment (wt.%)	94.0
Maximum U-235 per fuel plate (g)	85.2

5.(b)(1) Type and form of material (continued)

(iv) Irradiated TRIGA fuel elements. Pre-irradiated TRIGA fuel element dimensions are in Table 1.4. The TRIGA fuel matrix is uranium mixed with zirconium hydride. The BRR package is limited to five specific TRIGA fuel types:

1. 8 wt% uranium in the fuel matrix, U - U/Zr with uranium aluminum clad element (General Atomics catalog number 101).
2. 8.5 wt% uranium in the fuel matrix, U - U/Zr with uranium stainless steel clad element (General Atomics catalog number 103).
3. 8.5 wt% uranium in the fuel matrix, U - U/Zr with uranium stainless steel clad element, high enriched uranium (General Atomics catalog number 109). This fuel element is sometimes referred to in the literature as a Fuel Life Improvement Program (FLIP) element.
4. 20 wt% uranium in the fuel matrix, U - U/Zr with uranium stainless steel clad element (General Atomics catalog number 117). This fuel element is sometimes referred to in the literature as a FLIP–LEU–I element.
5. 8.5 wt% uranium in the fuel matrix, U - U/Zr with uranium stainless steel clad element, instrumented (General Atomics catalog number 203).

Table 1.4

TRIGA - Fresh Fuel Element Characteristics					
Parameter	**GA Cat. # 101**	**GA Cat. # 103**	**GA Cat. # 109**	**GA Cat. # 117**	**GA Cat. # 203**
Maximum Active Fuel Length (in)	14	15	15	15	15
Fuel Pellet OD (in)	1.41	1.44	1.44	1.44	1.44
Overall Element Length (in)	28.37	28.9	28.9	29.68	45.25
Cladding OD (in)	1.48	1.48	1.48	1.48	1.48
Minimum Cladding Thickness (in)	0.0285	0.0185	0.0185	0.0185	0.0185
Graphite Reflector Length Top/Bottom (in)	4.0 / 4.0	2.6 / 3.7	2.6 / 3.7	2.6 / 3.7	3.1 / 3.4
Maximum Zr Mass in Fuel Matrix (g)	2,070	2,088	2,060	2,060	2,088
Maximum U-235 Mass (g) per element	36	39	137	101	39
Maximum U-235 Enrichment (wt%)	20	20	70	20	20
Maximum H/Zr atom ratio	1.0	1.7	1.6	1.6	1.7

The maximum length of a TRIGA fuel element, including irradiation growth, is 45.50 inches. For all fuel elements, spacers are utilized within the TRIGA baskets. The bounding weight of any TRIGA fuel element is 10 lb. The maximum decay heat per element is 20 W. The number of TRIGA rods per element is 1. TRIGA fuel parameters are in Table 1.5.

5.(b)(1) Type and form of material (continued)

Table 1.5

TRIGA - Fuel Parameters			
Fuel Type	**Maximum U-235 depletion (%)**	**Maximum Burnup (MWD/MTU)**	**Minimum Decay Time**
GA Cat. # 101	22.42	36,953	28 days
GA Cat. # 103/203	20.72	34,111	28 days
GA Cat. # 109	59.74	339,368	1 year
GA Cat. # 117	43.81	75,415	1 year

5.(b)(2) Maximum quantity of material per package

(i) For the contents described in 5(b)(1)(i):

8 irradiated MURR fuel elements. Only one fuel element is allowed per basket location.

(ii) For the contents described in 5(b)(1)(ii):

8 irradiated MITR-II fuel elements. Only one fuel element is allowed per basket location.

(iii) For the contents described in 5(b)(1)(iii):

8 irradiated ATR fuel elements. Only one fuel element is allowed per basket location.

(iv) For the contents described in 5(b)(1)(iv):

19 irradiated TRIGA fuel elements. Only one fuel element is allowed per basket location.

(c) Criticality Safety Index (CSI): 0

6. In addition to the requirements of Subpart G of 10 CFR Part 71:

(a) Each package shall be operated and prepared for shipment in accordance with Chapter 7 of the application, as supplemented.

(b) Each package shall be acceptance tested and maintained in accordance with Chapter 8 of the application.

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

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

9. Expiration date: January 22, 2015.

REFERENCES

AREVA Federal Services LLC application dated March 25, 2009.

Supplements dated August 6, 2009, November 5, 2009, June 4, 2010, and December 16, 2010.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

/RA/

John M. Goshen, Acting Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Date: April 18, 2011