CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE		PAGES
9228	25	71-9228	USA/9228/B(U)F-96	1	OF	10

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)*

GE-Hitachi Nuclear Energy Americas, LLC
3901 Castle Hayne Road
Wilmington, NC 28401

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION

General Electric Company* application
dated December 12, 2000, 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.: 2000

(2) Description

A steel encased lead shielded shipping cask. The cask is within a double-walled overpack with toroidal shell impact limiters at each end. The overall dimensions are approximately 131.5 inches in height and 72.0 inches in diameter. The cask is transported in the upright or horizontal position. The gross weight of the package is approximately 33,550 lbs.

The cask is constructed of two concentric 1-inch thick 304 stainless steel cylindrical shells (ASTM A 240) joined at the bottom end to a 6-inch thick 304 stainless steel forging (ASTM A 182). The annulus between the two shells is filled with lead approximately 4 inches thick. The cask is approximately 71.0 inches in height and has an outer diameter of 38.5 inches. The cask cavity is approximately 26.5 inches in diameter and 54.0 inches deep.

The cask lid is 304 stainless steel and lead, has a stepped design, and is fully recessed into the cask top flange. The lid is secured to the cask body by 15, 1.25-inch diameter socket head screws. The cask is sealed by elastomeric O-rings bonded to a thin aluminum disc-shaped ring. The cask is equipped with a seal test port on the side of the cask body, a vent port in the cask lid, and a drain port near the bottom of the cask.

The cask is positioned within an overpack constructed from two 0.5-inch thick concentric 304 stainless steel cylindrical shells (ASTM A 240). The shells are separated radially by eight

*This license was transferred from General Electric Company to GE-Hitachi Nuclear Energy Americas, LLC, in 2007.

equally spaced tubes and horizontally by two tube sections. A 304 stainless steel toroidal shell impact limiter is attached to each end of the overpack. The overpack opens just above the lower impact limiter for access to the cask. The top of the overpack is joined to the base by 15, 1-3/8-inch diameter shoulder screws.

5(a) (2) Description (Continued)

Gussets on the top and bottom impact limiters provide tie-down points for the package. The cask body is equipped with attachment plates for lifting devices. The cask lifting devices are detached during transport.

(3) Drawings

(i) The packaging is constructed and assembled in accordance with General Electric Company Drawing Nos. 129D4946, Rev. 10; 105E9520, Rev. 4; and 105E9521, Rev. 5.

(ii) Packaging Serial No. 2001 is constructed and assembled in accordance with General Electric Company Drawing Nos. 129D4946, Rev. 10; 101E8718, Rev. 12; and 101E8719, Rev. 12.

(iii) The HFIR fuel basket and liner are constructed and assembled in accordance with General Electric Company Drawing No. 105E9523, Rev. 3.

(iv) The multifunctional rack is constructed and assembled in accordance with General Electric Company Drawing No. 105E9555, Rev. 2.

(v) The barrel rack is constructed and assembled in accordance with General Electric Company Drawing No. 166D8066, Rev. 2.

(vi) The material basket is constructed in accordance with General Electric Company Drawing No. 183C8356, Rev. 2. The material basket may be used with the multifunctional rack and the barrel rack.

(vii) The TSR fuel basket is constructed and assembled in accordance with General Electric Company Drawing No. 105E9560, Rev. 2.

(viii) The MTR fuel basket is constructed and assembled in accordance with General Electric Company Drawing No. 105E9557, Rev. 9.

(ix) The optional lead liner is constructed and assembled in accordance with General Electric Company Drawing No. 129D4922, Rev. 2.

5.(b) Contents

(1) Type and form of material

(i) Irradiated fuel rods, which may be cut or segmented.

(ii) Byproduct, source, or special nuclear material in solid form.

(iii) Irradiated High Flux Isotope Reactor (HFIR) fuel assembly, positioned within the HFIR fuel basket and liner as specified in 5(a)(3). The HFIR fuel assembly is fabricated in accordance with Oak Ridge National Laboratory Drawing Nos. M-11524-OH-101-D, Rev. 0, and M-11524-OH-102-D, Rev. 0.

(iv) Irradiated Tower Shielding Reactor (TSR) fuel elements, positioned within the TSR fuel basket specified in 5(a)(3).

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

(v) Irradiated MTR-type fuel assemblies, positioned within the MTR fuel basket specified in 5(a)(3). The fuel assemblies may be sectioned only in the non-fuel bearing region of the assembly. The fuel assemblies are composed of aluminum clad plates, and are limited as follows:

Fuel material	U_3O_8	UAl_x	U_{METAL}
Max. uranium enrichment (w/o U-235)	94.0	94.0	95.0
Max. active fuel thickness (in)	0.023	0.020	0.020
Min. clad thickness (in)	0.014	0.015	0.015
Max. U-235 per fuel assembly (g)	355	290	110
Max. U-235 mass per fuel basket cell (g)	710	580	220
Max. burnup (GWd/MTU)	568	568	568
Min. cool time (days)	120	120	120

Fuel material	U_3Si_2	UAl_x
Max. uranium enrichment (w/o U-235)	20.0	20.0
Max. active fuel thickness (in)	0.020	0.100

Min. clad thickness (in)	0.015	0.010
Max. U-235 per fuel assembly (g)	347	150
Max. U-235 mass per fuel basket cell (g)	694	300
Max. burnup (GWd/MTU)	122	122
Min. cool time (days)	120	120

Note: The enrichments, masses, and dimensions shall be based on values prior to irradiation.

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

(vi) Irradiated TRIGA fuel elements, positioned with the MTR fuel basket specified in 5(a)(3). The fuel material consists of $UZrH_x$ in cylindrical elements, with aluminum, stainless steel, or inconel cladding. The H to Zr ratio in the fuel ranges from approximately 1.0 to 1.7. Some fuel elements contain graphite reflectors in each end of the fuel element. The fuel elements are limited as follows:

Approximate rod diameter (in)	1-1/2	½	1-1/2	1-1/2	½
Graphite reflectors	With or without reflectors	With or without reflectors	With reflectors	With reflectors	Without reflectors
Uranium concentration in fuel (w/o U)	8 - 45	10 - 45	8.5 min.	8.5 min.	10 min.
Max. rod length (in)	30	30	30	30	30
Max. active fuel length (in)	15	22	15	15	22
Min. clad thickness (in)	0.02	0.016	0.02	0.02	0.016
Max. uranium enrichment (w/o U-235)	20.0	20.0	70.0	94.0	94.0
Max. active fuel diameter (in)	1.435	0.51	1.435	1.435	0.51
Max. U-235 per rod (g)	165	44 (max. 15 rods per basket cell)	140	220	44 (max. 15 rods per basket cell)
		33 (max. 20 rods per basket cell)			33 (max. 20 rods per basket cell)
Max. U-235 mass per fuel basket cell (g)	560	660	560	660	660
Max. burnup (GWd/MTU)	427	427	427	568	568
Min. cool time (days)	120	120	120	120	120

Note: The enrichments, masses, and dimensions shall be based on values prior to irradiation.

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

Not to exceed 5,450 lbs, including fuel baskets, carrier racks, shoring, secondary containers, and shielding liner.

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

600 watts decay heat; and

Fissile contents not to exceed 1175 grams U-235 equivalent mass with initial enrichment not to exceed 5 weight percent in the fissile isotope; minimum pellet diameter of 0.3 inch, maximum burnup of 45 GWd/MTU, and minimum cooling time of 120 days; or

Fissile contents not to exceed 1750 grams U-235 equivalent mass with initial enrichment not to exceed 5 weight percent in the fissile isotope; minimum pellet diameter of 0.35 inch, maximum burnup of 38 GWd/MTU, and minimum cooling time of 120 days. Fuel rods must be contained in closed, 5-inch schedule 40 pipe, with a maximum of 437.5 grams U-235 equivalent per pipe; or

Fissile contents not to exceed 242 grams U-235 equivalent mass with initial enrichment not to exceed 5 weight percent in the fissile isotope; minimum pellet diameter of 0.3 inch, maximum burnup of 52 GWd/MTU, and minimum cooling time of 180 days.

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

2000 watts decay heat. Fissile contents not to exceed 500 grams U-235 equivalent mass. Carrier racks specified in 5(a)(3)(iv) or 5(a)(3)(v) must be used for contents exceeding 600 watts decay heat per package.

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

One HFIR fuel assembly. The fuel assembly is composed of one inner fuel element, with up to 2628 grams U-235, and one outer fuel element, with up to 6872 grams U-235. The maximum uranium enrichment is 93.2 weight percent U-235. The maximum burnup per assembly is 2300 MWd, the minimum cool time is two years. Decay heat not to exceed 600 watts per package.

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

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

A maximum of 4393 grams U-235 per package. The maximum uranium enrichment is 94.0 weight percent U-235. Decay heat not to exceed 35 watts per package. The TSR fuel elements must be positioned and limited within the TSR fuel basket as follows:

Lower fuel basket section - Up to 4 upper or lower fuel elements, or a combination of upper and lower fuel elements, for a total U-235 mass of 1412 grams.

Middle fuel basket section - Up to 4 fuel cover (lune) plates, for a total U-235 mass of 304 grams.

Upper fuel basket section - Up to 6 annular fuel elements plus one cylindrical fuel element, for a total U-235 mass of 2677 grams.

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

Weight of contents, including fuel elements, spacers, shoring, and hardware, not to exceed 42.8 lbs per fuel basket cell.

Decay heat not to exceed any of the following: 1500 watts per package, 120 watts per cell, 35 watts per cell in the upper half of the fuel basket, 85 watts per cell in the lower half of the fuel basket, 765 watts in the lower half of the fuel basket (i.e., the lower half of all 21 cells combined).

Failed fuel elements are permitted provided the damage is limited to cladding defects due to corrosion, nicks, and scratches. Failed fuel elements must be structurally and geometrically intact.

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

Weight of contents, including fuel elements, spacers, shoring, and hardware, not to exceed 42.8 lbs per fuel basket cell.

For stainless steel and inconel clad fuel, decay heat not to exceed any of the following: 1500 watts per package, 120 watts per cell, 35 watts per cell in the upper half of the fuel basket, 85 watts per cell in the lower half of the fuel basket, 765 watts in the lower half of the fuel basket (i.e., the lower half of all 21 cells combined).

For aluminum clad fuel, decay heat not to exceed either of the following: 630 watts per package, 30 watts per cell.

5.(c) Criticality Safety Index

For the contents described in 5(b)(1)(i), 5(b)(1)(ii) (except byproduct material), and 5(b)(1)(iii); and limited in 5(b)(2)(i), 5(b)(2)(ii), and 5(b)(2)(iii): 100

For the contents described in 5(b)(1)(iv), 5(b)(1)(v), 5(b)(1)(vi), and byproduct material from 5(b)(1)(ii); and limited in 5(b)(2)(iv), 5(b)(2)(v), 5(b)(2)(vi), and 5(b)(2)(ii): 0.0

6. Plutonium in excess of twenty curies per package must be in the form of metal, metal alloy or reactor fuel elements.

7. The U-235 equivalent mass is determined by U-235 mass plus 1.66 times U-233 mass plus 1.66 times Pu mass.

8. Bolt torque:

The cask lid bolts must be torqued to 690 ft-lbs (lubricated).

The bolts used to secure the top of the overpack to the overpack base must be torqued to 100 ft-lbs (dry).

9. (a) For any package containing organic or inorganic substances which could radiolytically generate combustible gases, determination must be made by tests and measurements or by analysis of a representative package such that the following criteria are met over a period of time that is twice the expected shipment time:

(i) The hydrogen generated must be limited to a molar quantity that would be no more than 5% by volume (or equivalent limits for other inflammable gases) of the secondary container gas void if present at STP (i.e., no more than 0.063 g-moles/ft^3 at 14.7 psia and 70°F); or

(ii) The secondary container and cask cavity must be inerted with a diluent to assure that oxygen must be limited to 5% by volume in those portions of the package which could have hydrogen greater than 5%.

For any package delivered to a carrier for transport, the secondary container must be prepared for shipment in the same manner in which determination for gas generation is made. Shipment period begins when the package is prepared (sealed) and must be completed within twice the expected shipment time.

(b) For any package containing materials with a radioactivity concentration not exceeding that for low specific activity material, and shipped within 10 days of preparation, or within 10 days after venting of drums or other secondary containers, the determination in (a) above need not be made, and the time restriction in (a) above does not apply.

10. Prior to each shipment (except for contents meeting the requirements of special form radioactive material), the package must be leak tested to 1 x 10^{-3} std cm^3/sec. Prior to first use, after the third use, and at least once within the 12-month period prior to each subsequent use, the package must be leak tested to 1 x 10^{-7} std cm^3/sec.

11. The cask must be vacuum dried prior to shipment if contents are loaded under water, or if water is introduced into the cask cavity. During shipments for which vacuum drying is performed, the cask cavity must be filled with helium.

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

    (a) Prior to each shipment the cask seal must be inspected. The seal must be replaced with a new seal if inspection shows any defects or every 12 months, whichever occurs first; and

    (b) Each package must meet the Acceptance Tests and Maintenance Program of Chapter 8 of the application, except that inspections in Section 8.2 of the application must be performed at least once within the 12-month period prior to each use; and

    (c) The package must be prepared for shipment and operated in accordance with the Operating Procedures of Chapter 7 of the application.

13. Appropriate carrier racks or shoring must be provided to minimize movement of contents during accident conditions of transport.

14. Each batch of ethylene propylene seals must be tested in accordance with Section 8.1.4.2 of the application.

15. Fissile mass limits for reactor fuel are based on fissile mass prior to irradiation.

16. For the contents described in 5(b)(1)(i), 5(b)(1)(ii), 5(b)(1)(v), and 5(b)(1)(vi), the package may be transported horizontally. For horizontal transport, the package must be secured to the truck bed with the top end of the package (closure end) facing the front (cab) of the truck. For horizontal transport of irradiated fuel and byproduct material contents described in 5(b)(1)(i) and 5(b)(1)(ii), the maximum decay heat is limited to 600 watts per package and the lead liner described in 5(a)(3)(ix) must be used.

17. Packagings may be marked with Package Identification Number USA/9228/B(U)F-85 until May 31, 2006, and must be marked with Package Identification Number USA/9228/B(U)F-96 after May 31, 2006.

18. Air transport of fissile material is not authorized.

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

20. Revision No. 24 of this certificate may be used until May 31, 2012.

21. Expiration date: May 31, 2016.

REFERENCES

General Electric Company application dated December 12, 2000.

Supplements dated: December 20, 2000; March 16 and 27, 2001; March 22, 2002; and March 25, May 4, 5, and 23, July 28, 2005, January 25, 2006, January 19, 2007, and February 14, 2011.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

/RA/
Michael Waters, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Date: May 4, 2011