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
9228	26	71-9228	USA/9228/B(U)F-96	1	OF	9

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

The packaging 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 packaging overall dimensions are approximately 131.5 inches in height and 72.0 inches in diameter, and its gross weight is approximately 33,550 lbs. The cavity of the packaging is approximately 26.5 inches in diameter and 54.0 inches deep.

The lid is fully recessed into the packaging top flange and secured to the packaging body by 15, 1.25-inch diameter socket head screws. The packaging is equipped with a seal test port on the side of the body, a vent port in the lid, and a drain port near the bottom of the packaging.

The overpack is constructed from two 0.5-inch thick concentric 304 stainless steel cylindrical shells (ASTM A 240), separated radially by eight 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 packaging. The top of the overpack is joined to the base by 15, 1-3/8-inch diameter shoulder screws. Gussets on the top and bottom impact limiters provide tie-down points for the package. The lifting devices are detached during transport.

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

(3) Drawings

(i) The packaging is constructed and assembled in accordance with General Electric Company Drawing Nos. 129D4946, Rev. 11; "Model 2000 Shipping Cask All S/N's Except S/N 2001" Drawing No. 105E9520, Rev. 5; and "Model 2000 Cask Overpack All S/N's Except S/N 2001" Drawing No. 105E9521, Rev. 5.

(ii) Packaging Serial No. 2001 is constructed and assembled in accordance with General Electric Company Drawing Nos. 129D4946, Rev. 11; 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. 3.

(vi) The material basket is constructed in accordance with General Electric Company Drawing No. 183C8356, Rev. 3.

(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 Rod Separator (5X, 19.3 in) is constructed and assembled in accordance with Drawing No. 147C8410, Rev. 0. The Rod Separator (4X, 15.6 in) is constructed and assembled in accordance with Drawing No. 147C8411, Rev. 0. The Basket Filler Upper End is constructed and assembled in accordance with Drawing No. 147C8414 Rev. 0.

(x) The basket support is constructed in accordance with General Electric Company Drawing No. 000N2016, Rev. 0.

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. Gamma emitting nuclides are limited to the following isotopes: ^{137}Cs, ^{60}Co, ^{181}Hf, ^{90}Sr/Y, and ^{95}Zr/Nb.

(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).

(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.

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) 33 (max. 20 rods per basket cell)	140	220	44 (max. 15 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, and secondary containers.

(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. A single package shall not mix nuclides except as allowed below. Quantities and minimum shielding and shoring requirements for isotopes listed in Condition No. 5(b)(1)(ii) of gamma emitting nuclides are specified as follows:

^{137}Cs	422,000 Ci. Source must be divided in two, each source not exceeding 211,000 Ci, and placed into the "two-tier" option of the multifunctional rack described in 5(a)(3)(iv). The top source must be shielded on the bottom by a 1" thick steel end plug and a minimum of 2.375" of steel from the plates in the top and bottom sections of the multifunctional rack. The bottom source must also be shielded on the bottom by a 1" end plug and an additional minimum 1.375" of steel.
^{60}Co	7,000 Ci, with an allowed concurrent maximum of 100 Ci Zr/Nb-95. The two separators and basket filler described in 5(a)(3)(ix) shall be used, stacked inside of the material basket described in 5(a)(3)(vi). The material basket shall be inside of the barrel rack described in 5(a)(3)(v). A basket support, as described in 5(a)(3)(x), shall be used to hold up the shield plug and material basket inside the barrel rack.
^{181}Hf, or ^{90}Sr/Y	456,000 Ci for ^{181}Hf. 596,000 Ci for ^{90}Sr/Y. The multifunctional rack as described in 5(a)(3)(iv) shall be used for either.
^{95}Zr/Nb	100 Ci. The configuration specified above for ^{60}Co, or the multifunctional rack as described in 5(a)(3)(iv), shall be used.

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

(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.

(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 standard temperature and pressure (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. The package shall be shipped in a vertical configuration. For the contents described in 5(b)(1)(v) and 5(b)(1)(vi), the package may be transported horizontally, with the top end of the package (closure end) facing the front (cab) of the truck.

17. Packagings must be marked with Package Identification Number USA/9228/B(U)F-96.

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. This certificate shall not be renewed until NRC receives and approves a consolidated application.

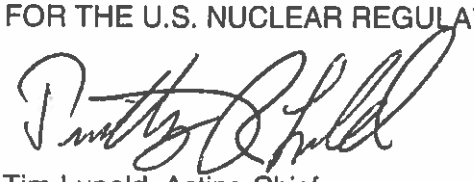
21. Expiration date: May 31, 2016.

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; February 14, 2011; October 10, 2012; July 1, 2013, November 15, 2013, November 22, 2013; and November 27, 2013.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION



Tim Lupold, Acting Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Date: Aug 29, 2014

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

SAFETY EVALUATION REPORT

Docket No. 71-9228
Model No. 2000
Certificate of Compliance No. 9228, Rev. No. 26

SUMMARY

A series of events and interactions with the NRC regarding the Model No. 2000 led General Electric Hitachi (GEH) to submit an October 10, 2012 application for amendment of the certificate of compliance (CoC). After consideration of the information provided by the applicant in the application, supplements, public meetings, and letter authorization requests, staff is issuing CoC No. 9228, Rev. No. 26. The staff is approving configurations and contents that the staff concludes have been demonstrated to meet the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71. This provides a more restrictive authorization then requested by the licensee.

BACKGROUND

In 2012, events at Clinton and Hope Creek led staff to re-evaluate the design, in particular the adequacy of shielding, potentially inadequate design control, and the CoC for the Model No. 2000 package. On July 23, 2012, NRC staff issued a request for information (Reference 1) in order to evaluate potentially safety-significant issues pertaining to the shielding evaluation for package contents below 600 watts, the use of the optional shielding liner without the shield lid, issues related to the variable shield thickness of the barrel racks, the configuration and shielding specifications for Co-60 sources above 600 watts, and the overall evaluation of allowable package contents. GEH indicated by an August 6, 2012 email (Reference 2) and letter dated August 21, 2012 (Reference 3), that they had issued a management directive to suspend use of the Model No. 2000 package with the optional lead liner configuration until the NRC questions regarding the liner shipping configuration were resolved. The NRC issued a Confirmatory Action Letter (CAL) to this effect on September 21, 2012 (Reference 4).

By letter dated October 10, 2012, GEH responded to the July 23, 2012, request for information and requested an amendment to CoC No. 9228 for the Model No. 2000 package (Reference 5). Staff issued a request for additional information (RAI) in connection with the review of the amendment request on December 17, 2012 (Reference 6). GEH responded to both the RAI and the CAL on July 1, 2013 (Reference 7). Staff issued a second round of RAI on September 18, 2013 (Reference 8), to which GEH provided responses on November 15 and 22, 2013 (References 9 and 10).

In order to support shipping needs, GEH requested a special authorization for one shipment on November 27, 2013 (Reference 11). NRC authorized the shipment on December 31, 2013 and extended the authorization on January 17, 2014 (References 12 and 13).

By letter dated January 24, 2014 (Reference 14), GEH requested a meeting with the NRC to discuss resolution of issues to allow ongoing uses of the Model No. 2000 for transport beyond the one-time NRC special authorization. The meeting was conducted on February 12, 2014 (Reference 15). GEH presented to NRC on their expected near term shipping needs (see Reference 16). GEH expressed concern about the uncertainty of these shipments in light of the current amendment review for the Model No. 2000 package and the previous issues that GEH had been addressing. NRC staff stated that these shipments could be licensed by special authorizations, for specific contents and configurations as long as appropriate analyses demonstrating safety are included. NRC also stated that GEH should demonstrate effort in producing a consolidated safety analysis report (SAR) that demonstrates compliance to safety regulations according to the design for all desired contents, including bounding safety analyses and classifications of important to safety components. GEH stated that the submittal of such a consolidated SAR is targeted for mid-2015. For the current amendment being reviewed, NRC staff stated that the CoC would be issued for the quantity of contents supported by the analyses supplied so far. GEH stated they agreed with this approach since they would support near-term needs with special authorization requests.

CoC No. 9228 has been amended to authorize shipment of revised quantities of byproduct, source, or special nuclear material in solid form, with gamma emitting nuclides limited to the following isotopes: ^{137}Cs, ^{60}Co, ^{181}Hf, ^{90}Sr/Y, and ^{95}Zr/Nb. As requested by GEH in Reference 7, the lead liner and lid configuration as an option are removed as a configuration for the Model No. 2000, and lr-192 is deleted from the authorized contents of Section 5(b)(1)(ii). For transport of ^{60}Co, the configuration requested by GEH in Reference 11 is incorporated into the CoC. Based on the statements and representations in the application, as supplemented, the staff concludes that with the effected changes, the package meets the requirements of 10 CFR Part 71.

EVALUATION

Structural/Materials

Staff previously evaluated the configuration being approved in Revision No. 26 of the CoC for a special authorization (Reference 12).

After evaluation of the analysis and drawings submitted in Reference 7, the staff determined that GEH had not provided reasonable assurance that the material basket (Drawing No. 183C8356, Rev. 3) would be able to withstand the hypothetical accident condition drops specified in 10 CFR 71.73(c)(1). More specifically, GEH had not provided a proper shear stress analysis to prove that the dowel pin supporting the tungsten plug of the material basket would not fracture resulting in a loss of shielding at the bottom of the source. GEH designed a basket support as an additional shoring component for the material basket. The basket support would geometrically and structurally prevent the bottom tungsten plug from exiting the barrel rack during all transport conditions assuming all non-important to safety (ITS) welds and components were to fail.

As part of the special authorization request in Reference 11, GEH provided a structural and geometric analysis for a material basket support (Drawing No. 000N2016, Rev. 0). GEH assumed the most severe hypothetical accident conditions (HAC) conditions: (1) a bottom drop orientation imparting the highest stress on the basket support, (2) a high accident temperature (400°F), and (3) failure of supporting non-ITS welds. GEH demonstrated a safety factor of greater than 10 under these compressive stress conditions. Buckling was ruled out as a

potential failure mode since the basket support is recessed within the barrel rack and is short relative to its diameter. GEH also calculated a 10^{-4} probability for the basket support exiting the barrel rack during HAC. Their analysis also showed a 10^{-4} probability that the increased basket height would interfere with cask lid closing. The staff considers these analyses as defense in depth complements to previous analysis by GEH, in which the arms of the barrel rack are assumed to fail, essentially rendering them non-ITS. With these demonstrations, staff has reasonable assurance that the package maintains structural integrity under normal conditions of transport and HAC.

Based on the information provided by the applicant and safety evaluation performed by the staff, the staff concludes that the Model No. 2000 package meets the regulatory requirements of 10 CFR Part 71.

Shielding

Rev. 25 of the CoC (Reference 17) specifies the following contents in condition No. 5.(b)(1)(ii) *"Byproduct, source, or special nuclear material in solid form."* The quantities of this material are limited in Section 5(b)(2)(ii), which states: *"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."*

According to the information submitted by the applicant as discussed in the Background section of this safety evaluation report, the staff is removing the lead liner component from the CoC and referencing updated drawings of the carrier racks as well as specifying the nuclides and configurations that are currently supported by analyses submitted to the NRC. This evaluation applies to the gamma emitting nuclides specified in Condition No. 5(b)(1)(ii) of the CoC. The allowed nuclide quantities and configurations are based on staff confirmation that they were bounded by previously reviewed SARs on record as well as the information in recent submittals by GEH. Other proposed configurations that were under review by NRC staff are not approved in the CoC and not discussed in this SER because sufficient information was not provided by the applicant for staff to reach a regulatory finding.

NRC has informed GEH of the limits to these nuclide quantities and shielding configurations being applied in the CoC (References 7 and 18). The bases of these nuclide quantities and shielding/shoring configuration are listed below. The approval for the nuclides assumes they are not mixed in a single package (only one nuclide type per package), except the quantity of ^{60}Co which is allowed to have a concurrent amount of ^{95}Zr/Nb equal to 100 Ci:

^{137}Cs	422,000 Ci	Reference 19
^{60}Co	7,000 Ci	Reference 12
^{181}Hf or ^{90}Sr/Y	456,000 Ci for ^{181}Hf 596,000 Ci for ^{90}Sr/Y	Reference 19
^{95}Zr/Nb	100 Ci	Reference 12

In addition to the modifications to the allowable contents discussed above, the staff is also modifying Condition No. 16 of the CoC. This condition previously allowed transport of the Model No. 2000 in a horizontal configuration for contents 5(b)(1)(i) and 5(b)(1)(ii). These contents were only allowed to be shipped in the horizontal configuration with the presence of the lead

liner. Since the lead liner is being removed from the CoC, this condition is modified to delete the contents that are no longer authorized to be shipped horizontally.

Based on the above considerations and additional requirements, the staff concludes that the Model No. 2000 package meets the regulatory requirements of 10 CFR Part 71.

CONDITIONS

The conditions specified in the certificate of compliance have been revised to incorporate several changes as indicated below:

Condition No. 5.(a)(2) has been updated to eliminate mention of lead liner, simplify the description, and use the correct term "package."

Condition No. 5.(a)(3) has been updated to reference updated and new drawings.

Condition No. 5(b)(1)(ii) has been updated to read: *"Byproduct, source, or special nuclear material in solid form. Gamma emitting nuclides are limited to the following isotopes: ^{137}Cs, ^{60}Co, ^{181}Hf, $^{90}Sr/Y$, and $^{95}Zr/Nb$."*

Condition No. 5(b)(2) has been updated to delete mention of the lead liner.

Condition No. 5(b)(2)(ii) has been updated to read: "*2000 watts decay heat. Fissile contents not to exceed 500 grams U-235 equivalent mass. A single package shall not mix nuclides except as allowed below. Quantities and minimum shielding and shoring requirements for isotopes listed in Condition No. 5(b)(1)(ii) of gamma emitting nuclides are specified as follows:*

^{137}Cs	*422,000 Ci. Source must be divided in two, each source not exceeding 211,000 Ci, and placed into the "two-tier" option of the multifunctional rack described in 5(a)(3)(iv). The top source must be shielded on the bottom by a 1" thick steel end plug and a minimum of 2.375" of steel from the plates in the top and bottom sections of the multifunctional rack. The bottom source must also be shielded on the bottom by a 1" end plug and an additional minimum 1.375" of steel.*
^{60}Co	*7,000 Ci, with a maximum of 100 Ci Zr/Nb-95. The two separators and basket filler described in 5(a)(3)(ix) shall be used, stacked inside of the material basket described in 5(a)(3)(vi). The material basket shall be inside of the barrel rack described in 5(a)(3)(v). A basket support, as described in 5(a)(3)(x), shall be used to hold up the shield plug and material basket inside the barrel rack.*
^{181}Hf, or $^{90}Sr/Y$	*456,000 Ci for ^{181}Hf. 596,000 Ci for $^{90}Sr/Y$. Multifunctional rack as described in 5(a)(3)(iv) shall be used for either.*
$^{95}Zr/Nb$	*100 Ci. The configuration specified for ^{60}Co, or the multifunctional rack as described in 5(a)(3)(iv), shall be used.*

Condition No. 9(a)(i) now spells out "standard pressure and temperature" instead of "STP."

Condition No. 16 has been updated to remove the option of horizontal transport for contents that relied on the lead liner configuration.

Condition No. 17 has been updated to delete package marking requirements that are no longer applicable.

Condition No. 20, which allowed use of Revision No. 24 of the certificate, has been deleted. The new Condition 20 has been added to require a consolidated application for renewal of the certificate.

The References section has been updated to include the supplements submitted by GEH in the course of the review leading to this amendment.

CONCLUSION

CoC No. 9228 has been amended to authorize shipment of revised quantities of byproduct, source, or special nuclear material in solid form, with gamma emitting nuclides limited to the following isotopes: ^{137}Cs, ^{60}Co, ^{181}Hf, ^{90}Sr/Y, and ^{95}Zr/Nb. The lead liner and lid configuration is removed as an option for the Model No. 2000, and ^{192}Ir is deleted from the authorized contents of CoC Section 5(b)(1)(ii). For transport of ^{60}Co, the configuration previously requested by GEH in Reference 11 and approved by NRC in Reference 12 is incorporated into the CoC. Based on the statements and representations in the application, as supplemented, the staff concludes that that with the effected changes, the package meets the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9228, Revision No. 26.

REFERENCES

1. Letter from M. D. Lombard (NRC) to D. R. Krause (GEH), “Request for Information for Continued Use of the Model No. 2000 Package, Certificate of Compliance No. 9228,” July 23, 2012 (ADAMS Accession No. ML12205A258).

2. Email from C. Martinez (GEH) to P. Saverot (NRC), “Model 2000 Type B Package (CoC 9228),” August 6, 2012 (ADAMS Accession No. ML122270431).

3. Letter from D. R. Krause (GEH) to P. Saverot (NRC), “Response Extension to NRC Request for Information for the Model No. 2000 Package, Certificate Of Compliance No. 9228, Docket No. 71-9228.” August 21, 2012 (ADAMS Accession No. ML12234A691).

4. Letter from M. D. Lombard (NRC) to D. R. Krause (GEH), “Confirmatory Action Letter (CAL) No. NMSS-2012-001,” September 21, 2012 (ADAMS Accession No. ML12269A255).

5. Letter from A. McFadden (GEH) to M. D. Lombard (NRC), “GEH Response to Request for Information for Continued use of the Model No. 2000 Package, Certificate of Compliance No. 9228, Docket 71-9228, TAC LA0129.” October 10, 2012 (ADAMS Accession No. ML12286A039).

6. Letter from P. Saverot (NRC) to D. R. Krause (GEH), “Request for Additional Information for the review of the Model No. 2000 Package.” December 17, 2012 (ADAMS Accession No. ML12352A263).

7. Letter from A. McFadden (GEH) to M. D. Lombard (NRC), “GEH Response to Confirmatory Action Letter NMSS-2012-001 and requests regarding the GE2000 Type B

Shipping Cask, Certificate 9228, Docket 71-9228, TAC Nos: LA0129 and L24690," July 1, 2013 (ADAMS Accession Nos. ML13182A700 and ML13197A396).

8. Letter from P. Saverot (NRC) to D. R. Krause (GEH), "Second Request for Additional Information for the review of the Model No. 2000 Package." September 18, 2013 (ADAMS Accession No. ML13266A413).

9. Letter from T. Caine (GEH) to P. Saverot (NRC), "GEH Response to Second Request for Additional Information for the Review of the Model No. 2000 Package, Docket No. 71-9228, TAC No. L24690," November 15, 2013 (ADAMS Accession No. ML13322A444).

10. Letter from T. Caine (GEH) to P. Saverot (NRC), "GEH Response to Second Request for Additional Information for the Review of the Model No. 2000 Package, Docket No. 71-9228, TAC No. L24690," November 22, 2013 (ADAMS Accession No. ML13329A228).

11. Letter from T. Caine (GEH) to NRC, "GEH Request for Special Authorization to Use the Model No. 2000 Package, Docket No. 71-9228," November 27, 2013 (ADAMS Accession Nos. ML13344A978 and ML13344A979).

12. Letter from M. Sampson (NRC) to T. Caine (GEH), "Special Authorization for shipment using the Model No. 2000 Package (TAC No. L24861)," December 31, 2013 (ADAMS Accession No. ML13365A138).

13. Letter from M. Sampson (NRC) to S. Murray (GEH), "Request to extend special authorization for one time shipment (TAC No. L24877)." January 17, 2014 (ADAMS Accession No. ML14017A421).

14. Letter from S. Murray (GEH) to NRC, "GEH/NRC Management Meeting Request to Discuss Model 2000 Package." January 24, 2014 (ADAMS Accession No. ML14024A430).

15. Memorandum from J. Vera (NRC) to T. Hsia (NRC), "Summary of February 12, 2014, Meeting with General Electric-Hitachi Nuclear Energy." March 20, 2014. (ADAMS Accession No. ML14083A566).

16. Email Chain between J. Vera (NRC) and GEH, "GEH GE 2000 Letter Authorization Requests." May 14, 2014 to May 22, 2014 (ADAMS Accession No. ML14148A000).

17. Letter from M. Waters (NRC) to D. R. Krause (GEH), "Revision No. 25 of Certificate of Compliance No. 9228 for the Model No. 2000 Package," May 4, 2011 (ADAMS Accession Nos. ML111240595 and ML11200A101).

18. Letter from M. Sampson (NRC) to D. Krause (GEH), "New Conditions of Certificate of Compliance No. 9228 for the Model No. 2000 Package," January 3, 2013 (ADAMS Accession No. ML13003A169).

19. Enclosure 2 ("Approval Record") to letter from C. Chappell (NRC) to G. Cunningham (General Electric Company), "Transmittal of Certificate of Compliance No. 9228, Revision No. 8." September 15, 1995 (ADAMS Accession No. ML030860096).