Form NRC-618
(12-73)
10 CFR 71

U.S. NUCLEAR REGULATORY COMMISSION

CERTIFICATE OF COMPLIANCE

For Radioactive Materials Packages

1.(a) Certificate Number	1.(b) Revision No.	1.(c) Package Identification No.	1.(d) Pages No.	1.(e) Total No. Pages
6698	12	USA/6698/B( )F	1	7

2. PREAMBLE

2.(a) This certificate is issued to satisfy Sections 173.393a, 173.394, 173.395, and 173.396 of the Department of Transportation Hazardous Materials Regulations (49 CFR 170-189 and 14 CFR 103) and Sections 146—19—10a and 146—19—100 of the Department of Transportation Dangerous Cargoes Regulations (46 CFR 146-149), as amended.

2.(b) The packaging and contents described in item 5 below, meets the safety standards set forth in Subpart C of Title 10, Code of Federal Regulations, Part 71, "Packaging of Radioactive Materials for Transport and Transportation of Radioactive Material Under Certain Conditions."

2.(c) 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—

3.(a) Prepared by (*Name and address*):

Nuclear Fuel Services, Inc.
P.O. Box 124
West Valley, NY 14171

3.(b) Title and identification of report or application:

NFS application dated October 6, 1972, as supplemented.

3.(c) Docket No. 71-6698

4. CONDITIONS

This certificate is conditional upon the fulfilling of the requirements of Subpart D of 10 CFR 71, as applicable, and the conditions specified in item 5 below.

5. Description of Packaging and Authorized Contents, Model Number, Fissile Class, Other Conditions, and References:

(a) Packaging

(1) Model No.: NFS-4

(2) Description

A steel, lead and water shielded shipping cask. The cask is a right circular cylinder with upper and lower steel encased balsa impact limiters. The overall dimensions are 214 inches in length and 50 inches in diameter. The gross weight of the cask is approximately 50,000 pounds. The inner cavity is 178 inches long and 13.5 inches in diameter. The thickness of the inner shell is 5/16 inch and 1-1/4 inches for the outer shell. The two stainless steel shells are welded to a 2-inch thick stainless steel shield disc at the bottom. The annulus between the inner and outer shells is filled with lead (max. lead thickness 6-5/8 inches, minimum 5 inches).

The lid is stainless steel frustum of cone 7.5 inches thick. The lid is secured to the cavity flange by six ASTM-A320, Grade L43, 1-1/4 inch diameter bolts. The seal is provided by two polytetrafluoroethylene O-rings. Four neutron shield tanks, each with surge tank and rupture disc, provide a 4-1/2 inch thick (borated) water-ethylene glycol mixture around the outer shell. Four trunnions, two located on either side of the upper or lower impact limiter, are provided. Other cask features include two drain valves located in the bottom shield disc, vent valve, head closure gasket leak check valve, rupture disc-pressure relief valve system located in the cavity flange, fuel canisters for PWR and BWR shipments, and spacers to accommodate shorter fuel assemblies. For transport the cask may be enclosed in an expanded metal cage.

5. (a) Packaging (continued)

(3) Drawings

The NFS-4 shipping cask is constructed in accordance with Nuclear Fuel Services, Inc., Drawing No. E 10080, Sheets 1 through 4, Rev. 19. The fuel assemblies are positioned within the fuel canisters shown in Figure 2.1.3 of the application dated October 6, 1972. Spacers may be used to accommodate shorter fuel assemblies within the fuel canisters.

(b) Contents

(1) Type and form of material

The minimum cooling time of each fuel assembly and rod shall be 120 days; and

(i) Irradiated PWR or BWR uranium oxide fuel assemblies with the following maximum active dimensions and maximum compositions prior to irradiation:

Fuel Assembly Data	PWR	BWR
Envelope, in	8.60x8.60x150	5.44x5.44x144
Enrichment, w/o U-235	3.6	3.0
Weight of Uranium, kg	480	197
H/U atomic ratio	-	5.51

(ii) Fuel assembly enriched in the U-235 isotope to not more than 2.5 w/o, with active fuel dimensions not to exceed 4.2" x 4.2" x 110" long.

(iii) Byproduct and special nuclear material in the form of irradiated uranium oxide fuel rods.

(iv) Solid nonfissile irradiated hardware and neutron source components.

(v) Fuel assembly enriched in the U-235 isotope to not more than 4.1 w/o, with active fuel dimensions not to exceed 7.8" x 121" long.

(vi) Byproduct and special nuclear material in the form of irradiated uranium and plutonium oxide fuel rods. Prior to irradiation, the maximum enrichment in U-235 plus plutonium not to exceed 4.0 w/o.

(vii) Reconstituted PWR uranium oxide fuel assemblies with:

. less than the original number of fuel rods,

5. (b) Contents (continued)

. additional fuel rods secured in guide tube thimbles, or

. combinations of both cases above.

Fuel assembly described above shall conform to the maximum active dimensions given in item 5(b)(1)(i).

Any fuel assembly shipped without one or both end fittings shall be equipped with an assembly carrier as shown in Battelle Drawing No. 00-001-676 or equivalent.

(viii) Irradiated BWR uranium oxide fuel assemblies. Prior to irradiation, the maximum enrichment in the U-235 isotope shall not exceed 4.0 w/o with active fuel dimensions not to exceed 5.63" x 5.63" x 83.8" long.

(2) Maximum quantity of material per package.

Not to exceed a decay heat generation of 2.5 kw; and

(i) Item 5(b)(i) above:

One (1) PWR fuel assembly, or
Two (2) BWR fuel assemblies; or

(ii) Item 5(b)(1)(ii) above:

Four (4) fuel assemblies contained within the fuel basket shown in NFS Drawing No. 1A-T-1107, Rev. 0; or

(iii) Item 5(b)(1)(iii) above:

Maximum Enrichment (w/o U-235)	Maximum Fissile Mass Limit (kg of U-235)
3.0	2.0
4.0	1.6
5.0	1.5; or

(iv) Item 5(b)(1)(iv) above:

As needed, appropriate component spacers shall be used in the cask cavity to limit movement of contents during shipment; or

5. (b) Contents (continued)

(v) Item 5(b)(1)(v) above:

One (1) fuel assembly; or

(vi) Item 5(b)(1)(vi) above:

Fuel rods within the fuel canisters described in 5(a)(3). The maximum mass of U-235 plus plutonium shall not exceed 4.0 kg. A suitable fixture may be used to secure the fuel rods within the canister; or

(vii) Item 5(b)(1)(vii) above:

The maximum compositions of one PWR fuel assembly including additional rods shall conform to Item 5(b)(1); or

(viii) Item 5(b)(1)(viii) above:

Two (2) BWR fuel assemblies. Prior to irradiation, the maximum uranium content per assembly shall not exceed 122 kg.

(c) Fissile Class III

Maximum number of packages per shipment One (1)

6. The cask shall be shipped dry (no water coolant in cask cavity).

7. The water-ethylene glycol mixture in the neutron shield tanks may contain up to 1.0 weight percent boron. This mixture shall not freeze or precipitate in a temperature range from -40°F to 330°F.

8. The cask contents shall be so limited under normal conditions of transport that 27 times the neutron dose rate plus 1.4 times the gamma dose rate will not exceed 1,000 millirems per hour at three (3) feet from the external surface of the package.

9. The vent and drain valves shall be 1/2" FG466TSW Miser ball valves (Worchester Valve Company, Inc.). The ball of the valve may have a bleed hole to equalize the pressure between the cask cavity and the ball passage in a closed position. Alternatively, the vent and drain lines may be sealed with pipe plugs.

10. In addition to the requirements of Subpart D of 10 CFR Part 71, each package prior to first use shall meet the acceptance tests and criteria specified on pages A-21 thru A-34 of the Nuclear Fuel Services, Inc. application dated October 6, 1972, as amended, March 1, 1973 and Nuclear Assurance Corporation letter dated November 1, 1974. The results of these tests shall be documented and retained for the life of the cask.

11. At periodic intervals not to exceed (3) years, the thermal performance of the cask shall be analyzed to verify that the cask operation has not degraded below that which is licensed. Following the initial acceptance tests, the heat source may be that provided by the decay heat from the contents of the package provided that the heat source is equal to at least 25% of the design heat load for the package. Each cask that fails to meet the thermal acceptance criteria given on pages A-21(a) and A-21(b) using the TAP computer program, or equivalent, shall be withdrawn from service until corrective action can be completed.

12. The rupture disc for the neutron shield tanks shall be type "B" or "DV" (BS&B Safety Systems, Inc.) or equivalent.

13. In lieu of the requirements of 10 CFR §71.54(h), the licensee shall perform periodic maintenance and testing of O-rings, drain and vent ball valves, relief valves, and rupture discs of the cask as indicated in the table given below. During inactive periods, the maintenance and testing frequency may be disregarded provided that the package is brought into full compliance prior to the next use of the package.

Cask Component	Period	Test/Action
Ball Valve	Each shipment	Hydro test to 80 psig*
Ball Valve	Annually	Replace seats and seals
O-rings	Each shipment	Test to 80 psig*
O-rings	Quarterly	Test to 167 psig*
O-rings	Annually	Test to 1006 psig*
Inner Containment Vessel	Quarterly	Test to 250 psig*
Cavity Relief Valve	Annually	Test at set point
Cavity Rupture Disc	Annually	Replace
Neutron Shield Tank Rupture Disc	Annually	Replace
Impact Limiters	Annually	Test for leakage

*There shall be no visual (pressure gauge) indications of pressure drop for the component under test during a 10-minute test period. Otherwise, corrective action shall be taken and the test repeated until such time as the component meets the specified test. (Test to pressures equal to or greater than those indicated.)

14. (a) The containment vessel (cavity) dimension of each cask will be measured prior to the first shipment of irradiated fuel after December 12, 1979, and at intervals not exceeding six (6) months thereafter. Should a cask be removed from service, the cavity will be remeasured prior to the next shipment of irradiated fuel if the previous cavity measurements were made more than six months prior to the shipment.

(b) Cavity measurements will be accomplished using six (6) calibrated guages mounted on a six (6) armed fixture movable over the length of the cavity. The gauges are mounted and oriented such that "radial" measurements may be made at 30°, 90°, 150°, 210°, 270°, and 330° from a 0° point, which is the center of the center valve port. The measurements may then be converted to diameters at azimuthal locations of 30°-210°, 90°-270°, and 150°-330°. Axial locations for cavity measurements to be recorded will be nominal 4½ and 12½ inches from the top of the cavity and at nominal 6-inch intervals thereafter over the length of the cavity. This will result in "radial" measurements at 29 axial locations for a total of 174 values.

Three consecutive measurements will be considered a cavity measurement set. The measuring equipment will be removed from the cavity and disassembled between each measurement operation to assure as well as possible that measuring equipment and set up variance are incorporated in the results. The true cavity dimensions will be considered the average values from one or two consecutive cavity measurement sets. All measurement that are made of the cask cavity must be included when determing a cavity measurement set (i.e., no measurement may be excluded from the sample).

(c) The cask will be considered as meeting dimensional requirements when the difference between the maximum diameter at any location in the vessel and the minimum diameter at any location in the vessel is no greater than 0.270 inches and the straightness of the inner surface along the axis at azimuthal locations of 30°, 90°, 150°, 210° 270°, and 330° is within the tolerance specified in Drawing No. E10080 Sheet 1, Rev. 19. The meaning of the straightness tolerance shall be as described in ANSI Y14.5, 1973, "Dimensioning and Tolerancing."

(d) Any cask which does not meet the criteria stated in paragraph (c) above shall be withdrawn from service.

(e) The cavity measurements and data reduction to arrive at true dimensions will be carried out under an NRC approved Quality Assurance Program (10 CFR §71.51).

15. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR §71.12(b).

16. Expiration date: December 31, 1980.

REFERENCES

Nuclear Fuel Services, Inc. application dated October 6, 1972.

Supplements dated: November 9, 1972; January 10 and 22, February 1 and 28, March 1, 14, and 21, May 4, June 4, and July 26, 1973; July 17, 1974; May 4, 1976; and November 9, 1977.

Nuclear Assurance Corporation supplements dated: November 1, 1974; August 13 and December 24, 1975; September 13, 1976; October 20, 1977; May 25, July 18, and September 25, 1978; June 8, July 26, and October 31, 1979; and March 3, and July 3, 1980.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Charles E. MacDonald, Chief
Transportation Certification Branch
Division of Fuel Cycle and
Material Safety

Date: OCT 17 1980