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	8	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 poly-tetrafluoroethylene 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,

5. (a) Packaging (continued)

(2) Description (continued)

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.

(3) Drawings

The NFS-4 shipping cask is constructed in accordance with Nuclear Fuel Services, Inc., Drawing No. E 10080, Rev. 16 (Sheets 1 through 4). 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, inches	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

5. (b) Contents (continued)

(1) Type and form of material (continued)

(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 non-fissile 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 diemnsions not to exceed 7.8" x 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) Irradiated PWR uranium oxide fuel assemblies including additional irradiated fuel rods inserted and secured in the guide thimbles. The fuel assemblies shall conform to the maximum active dimensions as described in item 5(b)(1)(i) and partially disassembled fuel assemblies 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) Maximuum quantity of material per package

Not to exceed a decay heat generation of 11.5 kw and

(i) Item 5(b)(1)(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 Dwg. No. 1A-T-1107, Rev. 0: or

5. (b) Contents (continued)

(2) Maximum quantity of material per package (continued)

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

Maximum Enrichment (w/o U-235)	Maximum Fissile Mass Limit (kg of U-235)
3	2.0
4	1.6
5	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

(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 with coolant in the cask cavity except that coolant is optional for shipments limited to 5(b)(1)(iv) components. In addition, coolant is optional for shipments limited to fuel assemblies when

the maximum decay heat generation per package is 2.5 kw. When the coolant is used, the operating procedures for loading the cask shall require that 24 gallons of coolant shall be drained off from the water-filled cavity.

7. The coolant, when present, is considered part of the package contents. The radioactive contamination limits specified in 10 CFR § 71.35(a)(4) do not apply.

8. 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.

9. When needed, sufficient antifreeze in the cask cavity shall be used to prevent damage of the package by freezing.

10. 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.

11. 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.

12. 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.

13. 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) shall be withdrawn from service until corrective action can be completed.

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

15. 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*
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.)

16. Note 14 on Sheet 4 of NFS Drawing No. 10080, Rev. 16, shall read as follows:

"In addition to prescribed tolerances, the effective thickness of the lead shielding underlying up to 2.4% of the cylindrical surface area described by parts 69 and 71 may vary in reduction up to 13.5% of the nominal radial thickness provided, however, that 1) such reduction shall not be additive to the allowable normal tolerance, and 2) the aggregate linear measure of such reduction along any nominal line colinear with the cylinder axis shall not exceed 4.2 inches."

17. The package shall be fabricated in accordance with Nuclear Fuel Services (NFS) NFS-4 Shipping Container Quality Assurance plan submitted October 6, 1972 or in accordance with the Nuclear Assurance Corporation (NAC) Quality Assurance Program dated January 28, 1974, as supplemented April 10, 1974. In addition, each package fabricated under the NAC Quality Assurance program shall bear a serial number preceded by the prefix NAC. Fabrication of this package is not authorized other than by NFS or NAC.

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

19. Expiration date: November 30, 1979.

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; and May 25, July 18, and September 25, 1978.

ADDITIONAL REFERENCES REQUIRED FOR PACKAGES FABRICATED IN ACCORDANCE WITH NAC QUALITY ASSURANCE PROGRAM.

Nuclear Assurance application dated January 28, 1974, as supplemented April 10, 1974, to authorize delivery of radioactive material to a carrier for transport in the Model No. NFS-4 shipping container.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

R F Odegaarden

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

Date: OCT 25 1978