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
5957	6	USA/5957/B( )F	1	6

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)*:

Battelle Columbus Laboratories
505 King Avenue
Columbus, OH 43201

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

Battelle Columbus Laboratories application dated June 11, 1980.

3.(c) Docket No. 71-5957

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.: BMI-1

(2) Description

A steel-encased lead shielded shipping cask. The basic cask body is a cylinder 33.37 inches in diameter by 73.37 inches high formed by two concentric stainless steel shells whose annular region is filled with lead. The outer 1/2-inch thick shell has a 0.12-inch thick plate spot welded to it, providing a 0.06-inch thick air gap insulator. The inner shell is 15.5 inches inside diameter by 54 inches inside length. The cask lid is a stainless steel weldment having 7.75 inches of lead shielding. The cask lid is secured to the cask by twelve steel studs which are welded to the cask body. Cask appurtenancies include a drain line with needle valve and plug, pressure gauge, and a pressure relief valve. The total cask weight, including maximum contents of 1,800 lbs, is 23,660 lbs.

(3) Drawings

The cask is constructed in accordance with the following Battelle Memorial Institute (BMI) Drawing Nos.: 0001, Rev. B; and 0003, Rev. B.

5. (a) Packaging (continued)

(4) Product Containers

The various authorized product containers are constructed in accordance with the following Drawing Nos.:

(i) Inner can assembly as shown in BMI Drawing No. 00-000-421, Rev. C.

(ii) Basket Assembly as shown in BMI Drawing No. 0004, Rev. B.

(iii) Fermi Fuel Element copper casting assembly as shown in BMI Drawing No. 0049, Rev. to May 12, 1966.

(iv) Basket Assembly as shown in BMI Drawing No. 1020, Rev. B.

(v) Basket Assembly defined by BMI Drawing No. 0004, Rev. B, as modified by BMI Drawing No. 00-00-236, Rev. A.

(vi) Basket Assembly and storage can defined by BMI Drawing No. 00-000-391, Rev. C, and Atomic International Drawing No. AIHL, S8DR 0019-01, Rev. A, respectively.

(vii) BMI-1 Cask Basket Spacer for ALRR Converter Fuel; Ames Laboratory Research Reactor, Drawing No. RRM 245, Dated 4/3/77.

(viii) Basket Assembly as shown in BMI Drawing No. 0004, Rev. B, as modified by BMI Drawing No. 00-001-376, Rev. A, and fuel canister as shown in BMI Drawing No. 00-001-375, Rev. 0.

(b) Contents

(1) Type and form of material

(i) Intact irradiated MTR or BRR fuel assemblies containing not more than 200 grams U-235 per assembly prior to irradiation. Uranium may be enriched to a maximum 93 w/o in the U-235 isotope. Active fuel length shall be 25 inches.

(ii) Intact irradiated Enrico Fermi Core. A fuel assembly containing not more than 4.77 kgs U-235 prior to irradiation. Uranium may be enriched to 25.6 w/o in the U-235 isotope.

(iii) Greater than Type A quantities of radioactive material which may include uranium enriched in the U-235 isotope, U-233, plutonium, as metal, oxides, or compounds which are thermally stable up to 600°F. Plutonium in excess of twenty (20) curies per package must be in the form of metal, metal alloy, or reactor elements.

(iv) Greater than Type A quantities of byproduct material in special form.

(b) Contents (continued)

(1) Type and form of material (continued)

(v) Greater than Type A quantities of byproduct material in normal form as metal, oxides, or compounds which are thermally stable up to 600°F.

(vi) Irradiated Triga Type III fuel assemblies containing not more than 40 grams U-235 per assembly prior to irradiation. Uranium may be enriched to a maximum 20 w/o in the U-235 isotope. Active fuel length shall be 15 inches for stainless steel clad assemblies and 14 inches for aluminum clad assemblies.

(vii) Irradiated S8DR fuel elements 0.56-inch OD by 18.7 inches long by 0.010-inch wall thickness of Hastelloy-N. The fuel material is UZrH fully enriched in U-235.

(viii) Intact irradiated CP-5 fuel assemblies containing not more than 176 grams U-235 per assembly prior to irradiation Uranium may be enriched to a maximum 93 w/o in the U-235 isotope. Active fuel length shall be 28.5 inches.

(ix) Irradiated Pulstar Zircaloy clad fuel pins containing not more than 31 grams U-235 per pin prior to irradiation. Uranium may be enriched to a maximum 6.0 w/o in the U-235 isotope. Active fuel length shall be 24 inches.

(x) Solid nonfissile irradiated hardware which may contain encapsulated fission monitors.

(2) Maximum quantity of material per package

The minimum cooling time of each fuel assembly and rod shall be 90 days, maximum decay heat generation per package not to exceed 1.5 kw, and the external dose rate not to exceed 10 mrem/hr 3 feet from the external surface of the cask and:

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

Twenty-four (24) fuel assemblies as contained in product containers specified in 5(a)(4)(ii) or 12 fuel assemblies as contained in product containers specified in 5(a)(4)(v).

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

One (1) fuel assembly as contained in product container specified in 5(a)(4)(iii).

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

480 grams U-235 or 480 grams Pu-239 or 800 grams U-235 as contained in product container specified in 5(a)(4)(i).

5. (b) Contents (continued)

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

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

Gamma sources securely confined in the cask cavity to preclude secondary impacts during accident conditions of transport. Thermal heat generation rate shall be limited to 200 watts.

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

Contained in product containers specified in 5(a)(4)(i) and limited as follows:

10 CFR 71 Transport Group	Quantity Curies
I	1,000
II	8,120
Mixed Fission Products	Unlimited
III	4,960
IV	11,070
V	8,120
VI and VII	800,000

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

Thirty-eight (38) fuel assemblies as contained in product containers specified in 5(a)(4)(iv).

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

Twenty-four (24) fuel elements per can and six sealed cans per basket as described in 5(a)(4)(vi). Each of the six cans may contain up to 818 g U-235 and 158 g hydrogen. The cask is limited to 4.908 kg U-235.

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

Twelve (12) fuel assemblies.

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

Twelve (12) canisters containing 21 fuel pins each, contained within the canister and fuel basket specified in 5(a)(4)(viii). (Dummy fuel canisters, non-buoyant, shall occupy empty basket positions.)

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

Hardware shall be securely confined in the cask cavity to preclude secondary impacts during accident conditions of transport, thermal heat generation rate shall be limited to 200 watts.

5. (c) Fissile Class — I and III

(1) Class I — For the contents specified in 5(b)(1)(iii) and limited in 5(b)(2)(iii).

(2) Maximum number of packages per shipment as Fissile Class III — For the contents specified in 5(b)(1)(i), 5(b)(ii), 5(b)(1)(vi), 5(b)(1)(vii), 5(b)(1)(viii), and 5(b)(1)(ix); and limited in 5(b)(2)(i), 5(b)(2)(ii), 5(b)(2)(vi), 5(b)(2)(vii), 5(b)(2)(viii), and 5(b)(2)(ix).

One (1) package.

6. For Item 5(b)(1)(iii), mixtures of fissile material are authorized, provided the following equation is satisfied:

$$\frac{X}{480} + \frac{Y}{480} + \frac{Z}{800} \leq 1, \text{ where}$$

X = Grams U-233 to be shipped
Y = Grams Pu-239 to be shipped
Z = Grams U-235 to be shipped

7. Except for contents described in 5(b)(1)(ii) and 5(b)(1)(iv); and limited in 5(b)(2)(ii) and 5(b)(2)(iv), the cask shall be shipped dry.

8. If the cask contents of 5(b)(1)(ii) or 5(b)(1)(iv) are shipped wet, the licensee shall confirm that the pressure relief valve is operable (set pressure - 75 psig). When needed, sufficient antifreeze in the cask shall be used to prevent damage of any component of the package by freezing.

9. Loading and unloading operations of the contents described in 5(b)(1)(iii) and limited in 5(b)(2)(iii) shall preclude contact of water with the contents.

10. The presence and effectiveness of the Boral poison plate in the Basket Assemblies as shown in BMI Drawing Nos. 0004, Rev. B, and 00-000-236, Rev. A, shall be verified by neutron measurements prior to first use and records maintained of such verification. Verification of the presence of the Boral shall be made in each subsequent use.

11. Prior to each use, adequacy of containment vessel shall be demonstrated by performance of the leak test described in Section 7.1.1.1 of the application.

12. Gaskets and seals (cask and fuel canister) shall be replaced at least every 12 months or earlier if visible degradation occurs.

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

14. Expiration date: July 31, 1985.

REFERENCE

Battelle Columbus Laboratories application dated June 11, 1980.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Charles E. MacDonald

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

Date: JUL 28 1980