NRC FORM 618
10 CFR 71

U.S. NUCLEAR REGULATORY COMMISSION

CERTIFICATE OF COMPLIANCE FOR RADIOACTIVE MATERIALS PACKAGES

1. a CERTIFICATE NUMBER	b REVISION NUMBER	c PACKAGE IDENTIFICATION NUMBER	d PAGE NUMBER	e TOTAL NUMBER PAGES
5450	28	USA/5450/AF	1	6

2 PREAMBLE

a. This certificate is issued to certify that the 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)

Westinghouse Electric Corporation
P.O. Box 355
Pittsburgh, PA 15230

b TITLE AND IDENTIFICATION OF REPORT OR APPLICATION

Westinghouse Electric Corporation application dated December 20, 1985, as supplemented.

c. DOCKET NUMBER 71-5450

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.:

RCC, RCC-1, RCC-2, RCC-3, and RCC-4

(2) Description

Steel fuel element cradle assembly consisting of a strongback and adjustable fuel element clamping assembly, shock mounted to a 14-gauge steel outer container by shear mounts. Neutron absorber plates are required for the contents as specified. Gross weight for the RCC and RCC-2 is 6,300 lbs., RCC-1 and RCC-3 is 7,200 lbs., and RCC-4 is 8,400 lbs.

(3) Drawings

The packagings are constructed in accordance with the following Westinghouse Electric Corporation Drawing Nos.:

For the RCC and RCC-2 packagings: 1596E24, Sheets 1 through 3, Sub 1; 1596E25, Sheets 1 & 2, Sub 1; 1553E31, Sub 1; SKD-86008, Sheets 1 through 3, Rev. 2.

For the RCC-1 and RCC-3 packagings: 1596E24, Sheets 1 through 3, Sub 1; 1596E25, Sheets 1 & 2, Sub 1; 1553E30, Sub 1; SKD-86008, Sheets 1 through 3, Rev. 2.

For the RCC-4 packaging: SKE-85002, Sub 3; SKD-86009, Sub 3; SKE-85004, Sheet 1, Sub 3, and Sheet 2, Sub 2; SKE-86004, Sub 3; SKD-86009, Sub 2.

(4) Fuel rod container reinforced 13-gauge steel box constructed in accordance with Westinghouse Electric Corporation Drawing No. C5650D55, Rev. 7.

(5) Dimensions and placement of neutron absorber plates in accordance with unnumbered drawing attached to Westinghouse Letter # LA 89-19 dated 2/14/89.

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5. (b) Contents

(1) Type and form of material

(i) Uranium dioxide as Zircaloy or stainless steel clad unirradiated fuel elements. Two neutron absorber plates consisting of 0.19" thick, full length stainless steel containing 1.3% minimum boron or 0.19" thick OFHC copper are required between fuel elements of the following specifications:

Type	14x14 Zr Clad	15x15 Zr Clad	14x14 SST Clad	15x15 SST Clad	17x17 Zr Clad	16x15 Zr Clad	14x14 Zr Clad.
Pellet diameter (nom), in	0.344-0.367	0.367	0.384	0.834	0.308-0.322	0.322	0.3805
Rod diameter (nom), in	0.400-0.422	0.422	0.422	0.422	0.360-0.374	0.374	0.44
Maximum fuel length, in	144	144	120	120	168	144	144
Maximum rods/element	180	204	180	204	264	235	176
Maximum cross section, (nom), in sq	7.8	8.4	7.8	8.4	8.4	7.8	7.98
Maximum U-235/element, kg	17.7	18.3	18.5	18.7	16.95 (144"L) 19.8 (168"L)	16.6	19.0
Maximum U-235 enrichment, w/o	4.0	3.65	4.0	3.65	3.65	4.0	3.85

(ii) Uranium dioxide as Zircaloy clad unirradiated fuel elements contained within the Model No. RCC-4 packaging. Two neutron absorber plates consisting of 0.19" thick carbon steel are required between fuel elements of the following specifications:

Type	17x17 Zr Clad
Pellet diameter, in	0.308 - 0.322
Rod diameter, in	0.360 - 0.374
Maximum fuel length, in	168
Maximum rods/element	264
Maximum cross section (nom) in sq	8.4
Maximum U-235/element, kg	19.3
Maximum U-235 enrichment, w/o	3.55

5. (b) Contents (continued)

(iii) Uranium dioxide as Zircaloy clad unirradiated fuel elements. Two neutron absorber plates consisting of carbon steel, 0.035 inches in thickness, with 4 mils of Gd_2O_3. (0.02 gm - Gd_2O_3/cm^2) affixed to each side of the plate are required between fuel elements of the following specifications:

Type	14x14 Zr Clad	15x15 Zr Clad	14x14 SST Clad	15x15 SS Clad	17x17 Zr Clad	17x17 Zr Clad	16x16 Zr Clad	16x16 Zr Clad
Pellet diameter (nom), in	0.344-0.367	0.367	0.384	0.384	0.322	0.308	0.322	0.325
Rod diameter (nom), in	0.400-0.422	0.422	0.422	0.422	0.374	0.360	0.374	0.382
Maximum fuel length, in	144	144	120	120	168	168	144	150
Maximum rods/ element	180	204	180	204	264	264	235	236
Maximum cross section, (nom), in sq	7.8	8.4	7.8	8.4	8.4	8.4	7.8	7.98
Maximum U-235/ element, kg	22.1	21.5	23.1	22.0	21.75 (144"L) 25.5 (168"L)	19.9 (144"L) 23.3 (168"L)	20.7	21.1
Maximum U-235 enrichment, w/o	5.0	4.3	5.0	4.3	4.7	4.3	5.0	5.0

(iv) Uranium dioxide as Zircaloy clad unirradiated fuel elements containing a minimum of 48 IFBA rods and 25 Instrument/Guide tubes per specification and loading pattern described in Westinghouse drawing SKA-89044, Sheet 1, Rev. 2. Two neutron absorber plates consisting of carbon steel, 0.035 inches in thickness, with 4 mils of Gd_2O_3 (0.02 gm-Gd_2O_3/cm^2) affixed to each side of the plate are required between fuel elements of the following specifications:

Type	17 x 17 Zr Clad
Pellet diameter (nom), in	0.308
Rod diameter (nom), in	0.360

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5. (b) Continued

Maximum fuel length, in	168
Maximum rods/element	264
Maximum cross section, (nom), in sq	8.4
Maximum U-235/element, kg	22.5 (144"L)
Minimum ZrB_2 rods/assembly	48
Minimum ZrB_2 IFBA length, in	108
Maximum U-235 enrichment, w/o	4.85

(v) Uranium dioxide as Zircaloy clad unirradiated fuel elements. Two neutron absorber plates consisting of carbon steel 0.035 inches in thickness, with 4 mils of Gd_2O_3 (0.02gm-Gd_2O_3/cm^2) affixed to each side of the plate are required between fuel elements of the following specification:

Type	17 x 17 Zr Clad
Pellet diameter (nom), in	0.308
Rod diameter (nom), in	0.360
Maximum fuel length, in	168
Maximum rods/element	264
Maximum cross section (nom) in sq	8.4
Maximum U-235/element, kg	22.5 (144"L)
Maximum U-235/enrichment, w/o	4.85

(vi) Uranium dioxide as Zircaloy or stainless steel clad unirradiated fuel rods of the following specifications:

Type	SST Clad	Zr Clad	Zr Clad	Zr Clad	Zr Clad	Zr Clad
Pellet diameter (nom), in	0.384	0.344-0.367	0.308-0.322	0.322	0.3805	0.325
Rod diameter in	0.422	0.400-0.422	0.360-0.374	0.374	0.44	0.382

Fuel length (max), in	120	144	168	144	144	150
U-235 enrichment (max), w/o						
Note (1)	4.0	4.0	3.65	4.0	3.85	---
Note (2)	4.2	4.2	4.3	4.3	---	4.2
Note (3)	---	---	3.55	---	---	---

Notes:

(1) Two neutron absorber plates consisting of 0.19-inch thick, full length stainless steel containing 1.3% (minimum) Boron or 0.19-inch thick OFHC copper are required between the rod boxes.

(2) Two neutron absorber plates consisting of carbon steel, 0.035 inch in thickness, with 4 mils of Gd_2O_3 (minimum 0.02 gm Gd_2O_3/cm^2) affixed to each side of the plate are required between the rod boxes.

(3) Two neutron absorber plates consisting of 0.19-inch thick carbon steel are required between the rod boxes.

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(2) Maximum quantity of material per package

(i) For the contents described in 5(b)(1)(i), 5(b)(1)(ii), 5(b)(1)(iii), and 5(b)(1)(iv):

Two fuel elements

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

One fuel element

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

Two inner containers containing not more than 80 kilograms U-235.

5. (c) Fissile Class I

6. Fuel rods must be closely packed in the fuel rod container on no more than an equivalent metal-to-metal square lattice. Partially loaded fuel rod containers must be fitted with a minimum of three, equally spaced blocks, of which the noncombustible portion of the blocks and the method by which they are secured must assure that the rods are maintained on no more than an equivalent metal-to-metal square lattice within the fuel rod container.

7. Each fuel assembly must be unsheathed or must be enclosed in an unsealed, polyethylene sheath which will not extend beyond the ends of the fuel assembly. The ends of the sheath must not be folded or taped in any manner that would prevent the flow of liquids into or out of the sheathed fuel assembly.

   Alternatively, the fuel assembly may be enclosed in an elongated plastic bag or sheath along its full length. At the bottom end of the fuel assembly, the bag will be cut off or folded back to assure that the entire cross section of the lower end of the assembly is unobstructed. When folding is used, the portion of the sheath that is folded back will be cinched with tape near its end to hold it in place, and the length will be such that when the assembly is loaded in the packaging, the folded sheath will be clamped in place in at least two grid locations. The top end of the bag may be gathered together and taped closed. However, the top end then will be slit on all four sides. The slits will run perpendicular to the axis of the assembly and will extend the inner distance between the top nozzle pads and spring clamps (approximately 60% of the length of each side). The slits will be made in a plane near that formed by the top of the pads and clamps.

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

9. Expiration date: July 31, 1991.

REFERENCES

Westinghouse Electric Corporation application dated December 20, 1985.

Supplements dated: April 28, July 1, July 21, 1986, January 4, February 14, April 18, October 5, and November 30, 1989.

Department of Energy supplement dated: March 1, 1984.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Charles E. MacDonald

Charles E. MacDonald, Chief
Transportation Branch
Division of Safeguards
and Transportation, NMSS

Date: DEC 2 2 1989

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

APPROVAL RECORD
Model RCC Package
Certificate of Compliance No. 5450
Revision No. 28

By application dated October 5, 1989, as supplemented November 30, 1989, the applicant requested an amendment to the Certificate of Compliance to allow shipment of either one 17 x 17 OFA fuel assembly enriched to 4.85% or two 17 x 17 OFA assemblies enriched to 4.85% if each assembly contains a minimum of 48 Integrated Fuel Burnable Absorber (IFBA) rods as specified in Westinghouse drawing SKA-89044.

The reduction in reactivity of the fuel assembly caused by the IFBA rods is important in maintaining the subcriticality of the package. Therefore, it is important that the Zirconium diboride coating on the fuel pellets in these IFBA rods remain in place during both normal and hypothetical accident conditions of transport. The applicant performed tests on sections of these fuel rods which have shown that the coating is not significantly affected by these conditions.

The applicant performed a criticality analysis on the proposed loadings for an infinite array of damaged packages using the model defined in previous amendments. This analysis is sufficient to satisfy the requirements for shipment as Fissile Class I.

The boron coating on the IFBA pellets was modeled in the cladding instead of an explicit coating on the pellet due to modeling constraints. Studies were performed by the applicant to quantify the effect of this modeling approach, and biases were applied to correct for the differences in reactivity. Also, a 5% reduction in boron content in the IFBA rods was taken to account for variabilities in the coating process.

Both of the proposed loadings were modeled using the KENO Va code. The results are presented below, with the reported k_{eff} values including biasis and maximum 95% confidence level uncertainties.

Applicant's Analysis
KENO Va Results
Infinite Array of Damaged Packages

Loading	K_{eff} w/uncertainty applied
One 17 x 17 OFA	0.9457
Two 17 x 17 OFA w/ 48 IFBA rods	0.9368

Calculations were performed by NRC staff to verify the results obtained by the applicant. These calculations were performed using the CSAS4 sequence in the SCALE library (NUREG/CR-200). This sequence was used to create input for the KENO Va code.

To determine a conservative value for boron loading to be used in the analysis, staff performed calculations based on the boron loading measurements from representative IFBA pellets presented in Table 2 of the November 30, 1989 application. These numbers were averaged, then reduced to determine the nominal loading at a 95% confidence level. This nominal boron loading was used to calculate the nominal B-10 loading, which was then reduced by 25% to encompass any uncertainties resulting from the coating and pellet loading processes. These assumptions are deemed to be conservative in this analysis.

A comparison study was then performed using XSDRN-PM to perform infinite lattice cell calculations, including the B-10 alternatively in the fuel, gap and clad regions. From this study, it was determined that modeling the B-10 in the fuel produced only slightly higher values of k_{inf}, with the increased reactivity resulting from modeling in the fuel being only 1.9% higher than the reactivity when modeling the poison in the cladding. Staff concluded that modeling the B-10 in the fuel region would provide conservative results while producing only slightly higher values of k_{eff} than would result from modeling the boron coating explicitly.

The confirmatory calculations were then performed with KENO Va using these assumptions. The results of this analysis are presented below.

Confirmatory Analysis
KENO Va Results
Infinite Array of Damaged Packages

Loading	k_{eff} w/uncertainty
One 17 x 17 OFA	0.931 ± .004
Two 17 x 17 OFA w/ 48 IFBA rods	0.941 ± .004

The results of the analysis for one assembly were similar to that achieved by the applicant and found to be satisfactory. The analysis for two assemblies yielded a k_{eff} value of 0.941 ± .004. Although this number is higher than that predicted by the applicant, the maximum value at a 95% confidence level if 0.949, which is below 0.95.

Based on the applicant's analyses and staff evaluation, the staff has determined that the proposed amendment would not affect the ability of the Model No. RCC package to meet the subcriticality requirements of 10 CFR Part 71.

Charles E. MacDonald, Chief
Transportation Branch
Division of Safeguards
and Transportation, NMSS

Date: DEC 2 2 1989