NRC FORM 618
(6-83)
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
5874	4	USA/5874/B( )F	1	3

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 of Radioactive Materials for Transport and Transportation of Radioactive Material Under Certain Conditions."

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. PREPARED BY (*Name and Address*)

Department of Energy
Division of Naval Reactors
Washington, DC 20585

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION

Safety Analysis for Radioactive Material Shipping Cask No. WAPD-40 dated December 1984, as supplemented.

c. DOCKET NUMBER

71-5874

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.: WAPD-40

(2) Description

The WAPD-40 shipping container is a cylindrical, stainless steel clad, lead shielded, shipping container used to ship irradiated fuel and non-fuel test specimens. The container has an outer 304L stainless steel shell 1/2-inch thick and an inner 304L stainless steel shell 1/4-inch thick, with 10 inches of lead between the shells. The overall size of the container, including an integral skid, is 24 inches in diameter by 168 inches in length. Gross weight (including skid) of the container is approximately 27,500 pounds. The heat removal capacity is approximately 2000 BTU/hour. The cylindrical inner cavity is 2 inches in diameter and 135 inches in length. Stainless steel clad, lead shielded end plugs bolt into each end. One-half inch thick plates are bolted over the end plugs to provide a total end plug flange thickness of 1.0 inch for puncture resistance. Metallic, pressure-filled O-rings between the end plugs and the container seal the package. A special holddown cradle is used during truck shipments. This cradle weighs approximately 5,000 pounds.

(3) Drawings

The WAPD-40 cask is fabricated in accordance with Westinghouse Assembly Drawing Nos. 936F577, Rev. 11; and 936F578, Sheet 1, Rev. 9, and Sheet 2, Rev. 4.

5. (b) Contents

(1) Type and form of material

Byproduct and special nuclear material contained within inner product containers. The contents must be dry and unmoderated (H to X atomic ratio <2).

(2) Maximum quantity of material per package

The fissile content of the cask must be limited to a maximum of 350 equivalent grams of U-235. The number of equivalent grams of U-235 is determined by the equation: 1.0 x grams U-235 + 1.4 x grams U-233 + 1.6 x grams plutonium.

(c) Fissile Class II

Minimum transport index to be shown on label 3.2

6. Maximum decay heat per package must not exceed 2,000 BTU/hr.

7. As needed, shoring must be used to limit movement of contents under accident conditions of transport.

8. The lifting trunnions must be covered during transport to preclude their use as tie-down devices.

9. The contents of the container must be limited so that the maximum measured gamma dose rate (above background) on the side of the cask for normal conditions does not exceed the value defined by $C_S = (1000-N_A)/F$.

where C_S = the maximum permissible gamma dose rate on the side of the cask in mrem/hour for normal conditions.

N_A = 00.0 mrem/hour for shipments of irradiated sturctural materials and 37.0 mrem/hour for shipments of irradiated fuel.

F = factor obtained directly from Table 1 or Table 2 (attached).

For non-fuel whose principal isotope is not included in Table 1, an F factor must be determined based on calculated ratios of the limiting accident radiation levels to the normal condition radiation levels for each of the principal isotopes.

For U^{233} with approximately 30,000 hours of effective full power operation and greater than 17,520 hours of decay, the F factors in Table 2 for U^{235} are conservative and may be used.

The maximum measured neutron level dose rate on the side of the cask must not exceed 10.7 mrem/hour for normal conditions.

9. Continued

For mixed shipments of fuel and irradiated non-fuel, the more limiting C_S value must be employed.

If C_S is below the maximum measurable level of the gamma instrument, other methods (e.g., thermal luminescent detectors, source strength calculations) must be employed to estimate the expected level for comparison with C_S.

10. The acceptance tests and maintenance program must be in accordance with Chapter 8.0 to WAPD-REO(C)-270, Rev. 3.

11. Expiration date: May 31, 1990.

REFERENCES

Safety Analysis for Radioactive Material Shipping Cask No. NRBK-40 dated December 1984 (WAPD-REO(C)-270, through Rev. No. 4).

Naval Reactors supplement dated: July 3, 1985 (S#85-1328).

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

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

Date: JUL 25 1985

Table 1

F Factors [1] For Use in Formula $C_S = (1000-N_A)/F$
For Irradiated Structural Material Shipments by
Principal Isotope

Isotope	Energy and Yield		Factor
	MeV	(γ/decay)	
Manganese-56	0.47	0.99	174
	1.81	0.29	
	2.11	0.15	
Cobalt-60	1.17	1.0	1492
	1.33	1.0	
Iron-59	1.095	0.56	1875
	1.292	0.44	

[1]The F factor is a constant for each isotope because the energy spectrum of the emitted gamma radiation of each isotope does not change as a function of time.

Table 2

F Factors For Use in Formula $C_S = (1000-N_A)/F$
For Irradiated U^{235} Fuel Shipments

Effective Hours Full Power Operation	Hours Decay								
	720	1440	2160	4320	6480	8760	17,520	43,800	87,600
100	339	339	330	219	200	194	192	208	698
500	338	338	325	219	203	198	198	237	648
1000	338	337	318	219	206	203	206	268	629
5000	332	317	283	230	228	229	250	382	606
10,000	317	300	271	242	243	248	278	427	607
15,000	310	294	269	249	253	258	292	445	610
20,000	306	290	268	254	257	265	300	457	612
25,000	302	286	268	256	260	267	305	464	617
30,000	300	285	267	257	263	270	308	466	624
40,000	295	282	266	258	264	271	310	472	637
50,000	292	279	265	259	264	272	311	472	651

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

Transportation Certification Branch
Approval Record
Model No. WAPD-40 Package
Docket No. 71-5874

By application dated July 3, 1985, Department of Energy, Division of Naval Reactors, requested several changes to Certificate of Compliance No. 5874 for the Model No. WAPD-40 package (cask). This includes not referencing the revision numbers to which the packaging is constructed, deleting list of approved inner containers and use of derived "F Factors" in determining compliance with 10 CFR Part 71 shielding requirements.

In the NRC staff review process, the specific construction of each package design is necessary and, therefore, the drawing revision numbers have been retained. The inner containers are not necessary to provide containment under accident conditions of transport and those specific drawings have been deleted from the certificate. The cask provides containment under accident conditions of transport.

The application requests that permissible gamma radiation dose rate levels (for approved contents: irradiated U-235 and U-233 test specimens or irradiated structural steels) be determined by a cask surface-gamma dose-rate measurement coupled with a computed (and tabulated) "F" factor (described below).

For any of the approved contents in the Model No. WAPD-40 cask which have an irradiation history and decay cooling time, a gamma dose rate measurement C_S is made at the cask surface and the "F" factors applied for:

(a) Irradiated components (steels) only

$$C_S = \frac{1000}{F}$$

where: C_S = measured γ-dose rate at cask surface, (mrem/hr);
1000 = represents the maximum permitted γ dose rate under accident conditions at 3 feet from cask surface (mrem/hr);

$$F = \frac{\text{Calculated Maximum Accident } \gamma \text{ dose rate 3 feet from surface}}{\text{Calculated Maximum Normal } \gamma \text{ dose rate at cask surface}}$$

$$= \frac{\text{taken from Table 5.6-3 SAR* as function of irrad time \& cool time}}{\text{taken from Table 5.6-2 SAR as function of irrad time \& cool time}}$$

When C_S is greater than 1000/F, the value of the radiation level in the accident condition will exceed 1000 mrem/hr and thus not satisfy 10 CFR §71.73.

*Safety Analysis Report for the cask.

(b) Irradiated U-235 or U-233 Fuels (specimens) only

$$C_S = \frac{1000-37}{F}$$

where C_S = as above and

37 = represents the maximum neutron dose rate at 3 feet from cask surface for approved contents; thus

1000-37 = represents maximum permissible gamma dose rate under accident condition, 3 feet from cask surface.

$$F = \frac{\text{taken from Table 5.6-5 SAR as function of irrad \& cool time}}{\text{taken from Table 5.6-4 SAR as function of irrad \& cool time}}$$

As in (a) above, C_S must be less than (1000-37/F) to satisfy 10 CFR §71.73.

The applicant has performed the arithmetic divisions indicated above in the separate definitions of the "F's" for irradiated steels and irradiated fuels and submitted a Table (1) in the application, reflecting the numerators and denominators from the SAR, for the F's for irradiated steels

and

Table (2) in the application, reflecting the numerators and denominators from the SAR, for the F's for irradiated fuels.

The staff has verified the F calculations and found them to be correct.

The applicant has estimated that the cited U-235 tables of the SAR can be used in a conservative manner for U-233 fuels.

The maximum value of the heat load has been correct to correspond to the safety analysis report (SAR) for the package.

Based on the SAR for the cask and the July 3 application, it is concluded the requirements of the regulations (10 CFR Part 71)are met.

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

Date: JUL 25 1985