

**CERTIFICATE OF COMPLIANCE  
FOR RADIOACTIVE MATERIAL PACKAGES**

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## 2. PREAMBLE

a. This certificate is issued to certify that the package (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*)

Transnuclear, Inc.  
7135 Minstrel Way  
Columbia, MD 21045

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION

Transnuclear, Inc., application dated March 25, 1991,  
as supplemented

## 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.: TN-8 AND TN-8L

(2) Description

The TN-8 and TN-8L are lead, steel and resin-shielded irradiated fuel shipping casks. The cask approximates a right circular cylinder 1,718 mm in diameter and 5,516 mm long. The cavity consists of three stainless steel square pressure vessels welded to an end plate and a circular stepped top flange, separated by a T-shaped copper plate and surrounded with B4C + Cu plates. Each cavity is 230 x 230 mm and 4,280 mm long. The main shielding consists of 135 mm of lead, 26 mm of steel, and 150 mm of resin. A wet cement layer is located between the lead and the outer shell. Radial copper fins are welded to the outer shell and cover the surface of the cask between each end drum. The Model No. TN-8 has 150 rows of fins and the Model No. TN-8L has 104 rows of fins.

The lid is a welded stainless steel shell containing lead and resin shields. The pressure vessel is closed and sealed by sixteen, 1-1/4-inch diameter bolts and two silicone rubber or Viton O-rings located within recessed grooves on the top flange. Each extremity of the cask is surrounded by circular stainless steel drums reinforced by radial gusset plates and filled with balsa wood. A disk shaped impact limiter, constructed of carbon steel and balsa wood, is fastened to each drum with four, 1-1/4-inch bolts. The vent and drain lines which penetrate the inner cavity are equipped with positive closures. In addition, all access ports are protected by the impact limiters.

The lid of the cask may be replaced with a modified lid which increases the cavity length to 4,362 mm or to 4,394 mm with the lid plate removed. This arrangement is referred to as "Configuration X."

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5.(a)(2) (Continued)  
Trunnions are used for lifting and tie-down of the package. The package weighs approximately 36,000 kg.

(3) Drawings

The Model No. TN-8 packaging is constructed in accordance with Transnuclear Drawing No. 9317.01, Rev. J. The Model No. TN-8L is constructed in accordance with Transnuclear Drawing No. 9317.138, Rev. A. The materials of construction and welds shall be in accordance with Annexes A, B, and C to Chapter II of the application.

The lid for Configuration X is constructed in accordance with Transnuclear Drawing Nos. 9040-500-1, Rev. 1, 9040-500-2, Rev. 1 and 9040-500-3, Rev. 0.

(b) Contents

(1) Type and form of material

(i) Irradiated PWR uranium oxide fuel assemblies of the following specifications:

Fuel form	Clad UO <sub>2</sub> Pellets
Cladding material	Zr or SS
Maximum initial U content/assembly, kg	469
Maximum average initial U-235 enrichment with Zr cladding, w/o	3.2
Maximum average initial U-235 enrichment with SS cladding, w/o	4.0
Maximum bundle cross section, in	8.5
Maximum active fuel length, in	146
Minimum cooling time, day	150
Maximum weight/fuel assembly, kg	733; and

Group I fuel assemblies

Initial fuel pin pressure at 100°F, psig	250
Maximum average burnup, MWD/MTU	38,500; or

Group II fuel assemblies

Maximum average burnup, MWD/MTU	36,000
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For the casks in Configuration X, the minimum cooling time of the fuel assemblies shall be 1,460 days with the lid plate installed and 2,190 days with the lid plate removed.

(ii) Solid non-fissile irradiated hardware. As needed, appropriate component spacers must be used when loading irradiated hardware into the cask cavity to limit movement of the contents during accident conditions of transport.

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(iii) Intact BWR and PWR fuel rods. The rods shall be constrained by a basket or grid structure; initial U-235 content shall be less than 15.0 kg per rod bundle; cross sectional area of the rods, tubes, and full length structural material shall not be less than 29.6 square inches; and the bundle cross section shall not be greater than 8.5 inches. Maximum weight per bundle shall not exceed 733 kg. The Group I and Group II burnup limits of paragraph 5.(b)(1)(i) apply.

(2) Maximum quantity of material per package

(i) For the contents described in Item 5.(b)(1)(i), Group I fuel assemblies:

Three PWR assemblies. The maximum decay heat load is not to exceed 35.5 kilowatts per package and 12 kilowatts per assembly for the Model No. TN-8 packaging and 23.7 kilowatts per package and 7.9 kilowatts per assembly for the Model No. TN-8L packaging.

(ii) For the contents described in Item 5.(b)(1)(i), Group II fuel assemblies:

Three PWR assemblies. The maximum decay heat load and the maximum free gas volume are not to exceed the limits listed in the table below:

Decay Heat per Shipment, kw(a)	Maximum Free Gas for 3 Assemblies	Configuration X Maximum Free Gas for 3 Assemblies
	m <sup>3</sup> (NTP)(b)	m <sup>3</sup> (NTP)(b)
1.5	0.558	0.601
3.0	0.543	0.585
9.0	0.483	0.520
15.0	0.441	0.475
21.0	0.408	0.439
27.0	0.384	0.413

- Notes:
- (a) Decay heat load per assembly must not exceed 7.9 kilowatts for Model No. TN-8L packaging.
  - (b) NTP conditions are 25°C and one (1) bar.

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## 5.(b)(2) (Continued)

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

Three rod bundles. The maximum decay heat load and maximum free gas volume are not to exceed the limits listed in Paragraph 5.(b)(2)(ii).

- (c) Criticality Safety Index: 100
6. Group I and Group II fuel assemblies, either Zr or SS clad, and bundles of PWR and/or BWR fuel rods that individually meet all the appropriate specifications of 5.(b)(1)(i), 5.(b)(2)(i), 5.(b)(1)(iii), and 5.(b)(2)(iii) above may be packaged in any combination.
  7. PWR assemblies may be shipped either with or without burnable poison rod, thimble plug, or control rod assemblies.
  8. As needed, appropriate component spacers may be used in the cask cavity to properly position the fuel assemblies.
  9. The maximum weight of the contents (fuel assemblies, component spacers, inserts, irradiated hardware, etc.) must not exceed 2,200 kg.
  10. The cask cavity must be dry (no free water) when delivered to a carrier for transport. Residual moisture must be promptly removed from the cask cavity by the methods described in Annex I to Chapter VIII of the application. For contents 5.(b)(1)(i) and 5.(b)(1)(iii), the cavity must be promptly backfilled with 1.0 atm of helium, nitrogen, or argon gas.
  11. Known or suspected failed fuel assemblies (rods) and fuel cladding defects greater than pin holes and hairline cracks are not authorized.
  12. For contents 5.(b)(1)(ii), the dryness verification test is required but leakage tests for containment assembly verification are not required.
  13. The package contents must be so limited that under normal conditions of transport, the total dose rates must not exceed 17 mrem/hr at one meter from the surface of the package.
  14. Any system used for cooling down the package must be provided with a pressure relief device set so that the maximum pressure in the containment vessel cannot exceed 7 atmospheres during the cool-down process.
  15. The systems and components of each packaging must meet the periodic tests and criteria specified in Chapter VIII of the application. The Keff verification and shielding efficiency verification tests in Chapter VIII of the application must be performed on each packaging within the two year period preceding any shipment of contents listed in 5.(b)(1)(i) and 5.(b)(1)(iii). The Keff verification and shielding efficiency verification tests need not be performed on packaging during periods (which may exceed two years) when only irradiated hardware as specified in 5.(b)(1)(ii) is shipped.

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16. In addition to the requirements of 10 CFR Part 71:
- (a) The package must be prepared for shipment and operated in accordance with the Operating Procedures in the application dated March 25, 1991.
  - (b) Each package must be tested, repaired, and maintained in accordance with the Acceptance Tests and Maintenance Procedures in the application dated March 25, 1991.
17. All valves, fittings, seals, and relief devices must be of the type, size, model and manufacture as indicated on the design drawings. The resin material must be of the specifications stated in Annex A to Chapter II of the application.
18. In accordance with Annex L to Chapter VIII, at periodic intervals not to exceed two years, the thermal performance of the cask must 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 loading 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 in Annex L of the application must be withdrawn from service until corrective action can be completed or the license amended to limit the package to a lower heat load.
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- \*The thermal performance test is not required at periodic intervals when the maximum decay heat load per package does not exceed 25% of the design heat load.
19. The Configuration X lid shall be operated and maintained in accordance with Annex N to Chapter VIII, in the application dated March 25, 1991.
20. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR §71.17.
21. Revision 20 of this certificate may be used until May 31, 2007.
22. Expiration date: October 1, 2008.

REFERENCES

Transnuclear, Inc., application dated March 25, 1991, and supplements dated April 22, 1991; April 22, 1996; March 22, 2001 and April 26, 2006.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

**/RA/ for James R. Hall**

Robert A. Nelson, Chief  
Licensing Section  
Spent Fuel Project Office  
Office of Nuclear Material Safety  
and Safeguards

Date: May 9, 2006