

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES**

a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
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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

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| a. ISSUED TO (<i>Name and Address</i>)
TN Americas LLC
7135 Minstrel Way, Suite 300
Columbia, MD 21045 | b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION
TN Americas LLC application
dated January 29, 2018. |
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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-RAM
- (2) Description

The package is a steel encased lead shielded cask with wood impact limiters attached at both ends. The cask is a right circular cylinder. The overall dimensions of the packaging are approximately 178 inches long and 92 inches diameter with the impact limiters installed. The cask body is approximately 129 inches long with an outer diameter of 51 inches. The cask cavity has a length of approximately 111 inches and an inside diameter of 35 inches. The cask body is made of a 0.75-inch stainless steel inner shell, a 5.88-inch thick lead annulus, a 1.5-inch thick stainless steel outer shell, a 0.5-inch thick inner bottom plate and a 2.5-inch thick outside bottom plate. The lead shielding is approximately 6 inches thick in the bottom end of the cask. The outer shell of the cask body is covered with a stainless steel thermal shield. The closure lid consists of a 2.5-inch thick outer stainless steel plate and a 0.5-inch thick inner stainless steel plate separated by approximately 6 inches of lead shielding. An optional lid, with the lead shielding in the form of a separate shielding disk, can also be used. The lid is secured by sixteen 1.5-inch diameter closure bolts. Two concentric silicone O-rings are installed in grooves on the underside of the lid. The cask is equipped with a sealed leak test port between the O-rings, a vent port in the closure lid and a sealed drain port in the bottom of the cask. Each impact limiter is attached to the cask by eight 1.75-inch diameter bolts. The cask is equipped with 6 trunnions, four at the top and two at the bottom. The gross weight of the package is approximately 80,000 pounds, including maximum contents of 9,500 pounds. There are two models of the TN-RAM: TN-RAM No. 01 and TN-RAM No. 02, with different allowed radioactive quantities, as described in Condition 5.(b)(2)(ii) of this Certificate.

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5.(a) Packaging (continued)

(3) Drawings

The packaging is constructed in accordance with Transnuclear, Inc. Drawing Nos. 990-701, Rev. 10; 990-702, Rev. 10; 990-703, Rev. 11; 990-704, Rev. 7; 990-705, Rev. 8; 990-706, Rev. 5; 990-707, Rev. 6; 990-708, Rev. 10; 990-709, Rev. 2; and 990-710, Rev. 2.

(b) Contents

(1) Type and Form of Material

Dry irradiated and contaminated non-fuel-bearing solid materials contained within a secondary container. No powdered material is authorized.

Materials other than steel must show shielding equivalence or better to steel for ^{60}Co . Localized regions of low-density material (e.g., B_4C in a control rod blade) are acceptable if the low-density regions contain negligible source. The mass of any low-density regions shall not be credited in the specific activity calculation.

(2) Maximum quantity of material per package

- (i) Greater than Type A quantities of radioactive material which may include fissile material provided that the fissile material does not exceed the mass limits of 10 CFR 71.15. The combined quantity of all radioactive material per package is limited to 3,000 times an A_2 quantity (as determined by using Table A-1 of Appendix A to 10 CFR Part 71).

Pure Alpha and Beta emitting nuclides are limited to 3,000 times an A_2 quantity. Significant neutron sources are not allowed.

The maximum total package neutron source is 1×10^6 neutrons/second for materials that produce neutrons (other than fissile neutrons) through any means, including spontaneous fission, alpha-neutron reactions, and gamma-neutron reactions.

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5.(b)(2) Maximum quantity of material per package (continued)

- (ii) Gamma emitting radionuclides are limited to a combined total of 30,000 Ci of ⁶⁰Co or equivalent for TN-RAM No. 01, or 18,000 Ci of ⁶⁰Co or equivalent for TN-RAM No. 02, as determined by the following equation:

$$\sum_i \frac{S_i(E)}{ActivityLimit_i(E)} \leq 1$$

Where E is the energy of the gamma emitter, $S_i(E)$ is the source strength of the gamma emitter, and $ActivityLimit_i(E)$ is the limit in gammas per second (γ/s) as a function of energy. For gammas with energies that do not correspond exactly to one of the energies in the table, the $ActivityLimit_i(E)$ used shall correspond to the next highest energy. Limits can be found in the following table:

Energy (MeV)	Activity Limit (γ/s)	
	TN-RAM No. 01	TN-RAM No. 02
0.6	7.62E+17	4.45E+17
0.8	1.25E+17	6.64E+16
1	2.03E+16	1.13E+16
1.1732	4.49E+15	2.63E+15
1.3325	1.47E+15	8.92E+14
1.5	6.15E+14	3.84E+14
1.75	2.40E+14	1.50E+14
2	1.25E+14	7.76E+13
2.5	5.52E+13	3.47E+13
3	3.42E+13	2.22E+13
3.5	2.55E+13	1.67E+13
4	2.14E+13	1.41E+13
4.5	1.90E+13	1.23E+13
5	1.78E+13	1.18E+13
6	1.66E+13	1.10E+13
8	1.58E+13	1.04E+13
10	1.49E+13	9.69E+12

The average specific activity of discrete components is limited to 10 Ci/kg of ⁶⁰Co or equivalent.

The volume of discrete components shall be divided into ten or more nearly equal volumes no greater than 0.1 m³. The specific activity of each volume is assessed (through measurements, calculations, or process knowledge) and the specific activity of individual volumes shall not exceed 10 Ci/kg.

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5.(b)(2) Maximum quantity of material per package (continued)

Materials other than steel must show shielding equivalence or better to steel for ^{60}Co . Localized regions of low-density material (e.g., B_4C in a control rod blade) are acceptable if the low-density regions contain negligible source. The mass of any low-density regions shall not be credited in the specific activity calculation.

The decay heat of the contents may not exceed 500 W.

The maximum gross weight of the contents, which includes the secondary container and shoring, is limited to 9,500 lb (4,309 kg).

6. As appropriate, shoring must be used in the secondary container sufficient to prevent significant movement of the contents under accident conditions.
7. Both the inner cask cavity and the secondary container must be free of water when the package is delivered to a carrier for transport.
8. In addition to the requirements of Subpart G of 10 CFR Part 71:
 - (a) Prior to each shipment, the lid seals must be inspected. The seals must be replaced with new seals if inspection shows any defects or every 12 months, whichever occurs first;
 - (b) The package shall be prepared for shipment and operated in accordance with the Operating Procedures of Section 7.0 of the application; and
 - (c) The package must meet the Acceptance Tests and Maintenance Program of Section 8.0 of the application.
9. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.
10. Revision No. 15 of this certificate may be used until April 30, 2019.
11. Expiration date: January 31, 2021.

REFERENCES

TN Americas LLC, safety analysis report letter dated January 29, 2018.

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FOR THE U.S. NUCLEAR REGULATORY COMMISSION

/RA/

John McKirgan, Chief
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Date: 4/20/18

