AREVA

E-31699

October 28, 2011

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Subject: Response to Request for Supplemental Information (Docket No. 71-9301, TAC No. L24570)

Reference: Letter from Jennie Rankin, Project Manager (NRC) to Jayant Bondre (TN), "Application for the Model No. TNF-XI Transport Cask Supplemental Information Needed" (Docket No. 71-9301, TAC No. L24570), October 18, 2011

The letter referenced above advised TN that NRC staff had completed an acceptance review of our September 8, 2011 application for a revision to Certificate of Compliance (CoC) No. 9301 and that supplemental information is needed for the staff to continue their review. The information needed was enclosed in the letter as Request for Supplemental Information (RSI).

The purpose of this submittal is to respond to the submitted RSI. Enclosure 1 provides the TN response to the RSI. Only page 3-1 of the Safety Analysis Report (SAR) is changed in response to the RSI. Enclosures 2 and 3 provide the proprietary and non-proprietary versions of the SAR changed page, respectively. Changed areas are indicated by italicized text and revision bars. Enclosure 4 provides a mark-up of CoC 9301, which encompasses the changes related both to the initial application and the RSI responses for completeness. The changes related to the RSI response are indicated by blue color font, italicized text and revision bars.

Transnuclear looks forward to working with the NRC staff on this application. Should the NRC staff require additional information to support review of this application, please do not hesitate to contact Mr. Kamran Tavassoli at 410-910-6944 or me at 410-910-6881.

Sincerely,

Jayant Bondre

Jayant Bondre, PhD
Vice President - Engineering

cc: Jennie Rankin, Project Manager, NRC SFST, as follows:
- 5 paper copies of this cover letter and Enclosures 1, 2, and 4

TRANSNUCLEAR INC.
7135 Minstrel Way • Suite 300 • Columbia, MD 21045
Tel: 410-910-6900 • Fax: 410-910-6902
www.transnuclear.com

NMSS01

Enclosures:

1. Response to Request for Supplemental Information
2. Changed Pages for Safety Analysis Report, Revision 6, Proprietary Version
3. Changed Pages for Safety Analysis Report, Revision 6, Non-proprietary Version
4. CoC Marked up encompassing Proposed Changes related both to the Application for Revision 5 to CoC 9301 and to the RSI Response

TRANSNUCLEAR INC.

7135 Minstrel Way • Suite 300 • Columbia, MD 21045
Tel: 410-910-6900 • Fax: 410-910-6902
www.transnuclear.com

Enclosure 1 to TN E-31699

Response to Request for Supplemental Information

Request for Supplemental Information

Page 1-1 of the Safety Analysis Report state that the contents may be packaged in, "polyethylene bags or bags with hydrogen concentration less than polyethylene." Confirm that the temperature of the "polyethylene bags or bags with hydrogen concentration less than polyethylene," is below the material's auto-ignition temperature during hypothetical accident conditions.

The maximum temperature during hypothetical accident conditions of the bag(s) used to hold the contents should be provided. Confirm that this temperature is lower than the bag material's (polyethylene or other material) auto-ignition temperature.

This information is needed to determine compliance with 10 CFR 71.73.

Response

Section 3.5 of the SAR, "Thermal Evaluation for Hypothetical Accident Conditions," provides a summary of the HAC thermal testing that was done to qualify the TNF-XI package. Because the qualification was done by testing, temperature measurements were available for a limited number of locations. Two locations that had recorded temperatures were the neutron-poisoning resin that lines the inside of the inner wells and the primary lid seals that seal the inner wells. The maximum temperatures recorded were 101°C and 140°C, respectively. The polyethylene bags in question are located inside the cans which are in turn contained in the inner well. Section 3.5.1 of the SAR reports a maximum payload temperature of 88°C. Therefore, the polyethylene bag temperature will remain well below 140°C throughout the HAC.

Physicochemical properties of polyethylene vary depending upon the molecular mass. In general, the thermal degradation of polyethylene starts typically at 290°C and the auto-ignition temperature is between 330°C and 410°C as shown in the following document.

http://www.inchem.org/documents/icsc/icsc/eics1488.htm

The auto-ignition temperature of polyethylene is well above the maximum temperature of 140°C experienced by the bags within the pails of TNF-XI packaging.

Section 3.3 of the SAR, "Technical Specification for Components," has been revised to include a requirement that any material used for fabrication of the bags have an auto-ignition temperature above 140°C.

Enclosure 3 to TN E-31699

Changed Page
for Safety Analysis Report, Revision 6, Non-proprietary Version

3.0 THERMAL

3.1 Discussion

This chapter establishes the compliance of the TNF-XI packaging to transport a payload of up to 300 kg of 5 weight percent (w/o) maximum enrichment uranium oxide powder to the thermal requirements of 10 CFR 71.

3.2 Summary of Thermal Properties of Materials

Analysis of the heat transfer within the TNF-XI requires that thermal properties be defined for the materials used in its fabrication. Only properties for materials that constitute a significant heat transfer path are defined.

The TNF-XI consists of an outer stainless steel sheet metal body and top support plate that encase phenolic foam, and four equally spaced individually sealed stainless steel inner wells. Each inner well is sealed by a primary lid with an elastomer gasket. An upper plug containing phenolic foam protects each primary lid from puncture and thermal damage. The cylindrical inner and outer surfaces of each inner well enclose a layer of neutron poison material.

The thermal properties of the principal materials used in the thermal evaluations are presented in Paragraph 2.4 of the thermal analysis contained in Appendix 3.6.2. The thermal properties of the borated steel are the same as steel without boron. BORA resin has a thermal conductivity of 0.55 W/m/K. The specific heat of the BORA resin as a function of temperature is provided in Table 3-1.

3.3 Technical Specification for Components

As the payload gives off negligble decay heat, it will have no effect on the temperatures of the package components, even when large numbers of packages are shipped in a transport container.

The containment for the TNF-XI package is provided by the inner wells and primary lids. The maximum allowable temperature for the elastomer inner well seal is 150 °C in steady state conditions, and 180 °C during a short time which corresponds to the duration of the fire test. Since the structural integrity of the package is established by testing, the only pertinent temperature limits on *most* components are established by their melting temperatures for the fire-based Hypothetical Accident Condition (HAC). The melting temperatures for stainless steel and the neutron-poison resin "BORA" are 1,565 °C and 150 °C, respectively. *The exception is the material used for bags containing the payload that are placed inside the stainless steel pails. The material used to fabricate the bags (normally polyethylene) must have an auto-ignition temperature of more than 140 °C. The auto-ignition temperature limit is selected based on the maximum expected temperature of the primary lid seals during HAC, which bounds the maximum temperature of the bags.*

Enclosure 4 to TN E-31699

CoC Marked up encompassing Proposed Changes related both to the Application for Revision 5 to CoC 9301 and to RSI Response

Justifications for the CoC proposed changes related to RSI Response:

Change	Page No.	Justification
Replace "5.(b)91)(ii)" with "5.(b)(1)(ii)"	Page 3 (insert 2)	Editorial correction
Add a condition specifying the minimum auto-ignition temperature of the bags	Page 3 (insert2)	The change is required to ensure that using bags is safe for hypothetical accident condition (HAC)

The proposed CoC changes, which encompass items related both to the Application for Revision 5 to CoC 9301 and to the RSI Response, are provided as markups in the next six pages. The changes related to the RSI response are indicated by blue color font, italicized text and revision bars.

NRC FORM 618
(8-2000)
10 CFR 71

U.S. NUCLEAR REGULATORY COMMISSION

5

CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES

96

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE		PAGES
9301	~~4~~	71-9301	USA/9301/AF-~~85~~	1	OF	4

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

Packaging Technology, Inc., application dated July 24, 2002, 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.: TNF-XI

(2) Description

A shipping container for unirradiated enriched forms of homogenous and heterogeneous uranium oxides. The packaging body is a parallelepiped and is approximately 44 inches x 44 inches x 37 inches. The package contents are enclosed in pails which each have a borated stainless steel ring. Three pails are stacked inside four inner wells of the packaging body. Each inner well is closed by a primary lid and an upper plug.

The packaging body is constructed of an outer stainless steel envelope which is 0.08 inches thick. The space between the outer shell and the inner wells is filled with fire-retardant, open cell phenolic foam.

The four inner wells each have an inside diameter of 14 inches and height of 27 inches. The inner wells are constructed of (1) and outer shell of stainless steel sheet 0.04 inches thick, with a diameter of 17 inches, (2) and inner shell of stainless steel sheet 0.04 inches thick with a diameter of 14 inches, and (3) a flat bottom of 0.04 inch thick stainless steel sheet with a 0.08 inch thick borated stainless steel plate glued to it. A molded annular layer of neutron-poison BORA resin is inserted between the inner and outer steel shells of the inner well.

Each upper plug consists of two thermal insulating disks of phenolic foam, with an internal stiffener disk made of aluminum alloy. The upper plug assembly is encapsulated inside a 0.03 inch thick stainless steel envelope.

NRC FORM 618 (8-2000) 10 CFR 71		U.S. NUCLEAR REGULATORY COMMISSION
	CERTIFICATE OF COMPLIANCE FOR RADIOACTIVE MATERIAL PACKAGES	

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE		PAGES
9301	~~4~~	71-9031	USA/9301/AF-~~85~~	2	OF	4

5.(a) (2) Description (continued)

The four primary lids closing off the inner wells are stainless steel circular plates 0.2 inches thick on the center part, and 0.4 inches thick on the periphery. Four bayonet teeth are welded to the primary lid to lock in the well flanges. A primary lid locker is located between the well flange and the primary lid to prevent the rotation of the primary lid during transport. The primary lid and the inner well are sealed by an elastomer gasket set in a rectangular groove machined on the inner face of the primary lid.

The approximate dimensions and weights of the package are as follows:

Inner well inside diameter	14 inches
Overall package dimensions	
Width	44 inches
Length	44 inches
Height	41 inches
Maximum weight of contents in any pail	25 kg
Maximum content weight	300 kg
Maximum package weight (including contents)	1050 kg

(3) Drawings

The packaging is constructed in accordance with the Packaging Technology, Inc., Drawing No. 10799-SAR, Rev. 3, Sheets 1 through 7.

(b) Contents

(1) Type and form of material

(i) Uranium oxide pellets, powder, and scrap meeting the requirements of Enriched Commercial Grade Uranium, as defined in ASTM C996-~~96~~. U_3O_8 or $UO_{x,\ x>2}$ are authorized provided that the equivalent UO_2 mass is less than the limits specified below:

NRC FORM 618
(8-2000)
10 CFR 71

U.S. NUCLEAR REGULATORY COMMISSION

5

CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES

96

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
9301	~~4~~	71-9301	USA/9301/AF-~~85~~	3 OF	4

5.(b)(1) (i) Type and Form of Material (continued)

Material (Pellet and Scrap)

Max ^{235}U Enrichment (weight percent)	Homogenous UO_2 Powder Maximum Loading (kg)	Heterogeneous UO_2 ~~Pellet~~ Maximum Loading (kg)
≤4.05	300	300
4.1	300	293
4.15	300	287
4.25	300	271
4.35	300	259
4.45	300	247
4.55	294	238
4.65	281	228
4.75	265	219
4.85	255	208
4.95	244	202
5.0	239	197

INSERT 1

(2) Maximum quantity of material per package

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

INSERT 2

No more than 25 kg of contents per pail. No more than 300 kg of contents per package.

(c) Criticality Safety Index: 0.5

6. Transport by air is not authorized.

7. In addition to the requirements of Subpart G of 10 CFR Part 71:

(a) The package shall be prepared for shipment and operated in accordance with the operating procedures in Chapter 7 of the application, as supplemented;

(b) The package must by acceptance tested and maintained in accordance with the Acceptance Tests and Maintenance Program in Chapter 8 of the application, as supplemented; and,

NRC FORM 618 (8-2000) 10 CFR 71	CERTIFICATE OF COMPLIANCE FOR RADIOACTIVE MATERIAL PACKAGES			U.S. NUCLEAR REGULATORY COMMISSION
1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE / PAGES
9301	~~4~~ 5	71-9031	USA/9301/AF-~~85~~ 96	4 OF 4

(c) Prior to each shipment, the stainless steel components of the packaging must be visually inspected. Packagings in which stainless steel components show pitting corrosion, cracking, or pinholes are not authorized for transport.

8. The packaging authorized by this certificate is hereby approved for use under the general license provision of 10 CFR 71.71.

9. Expiration date: August 31, 2013.

provided by Packaging Technology, Inc.

REFERENCES

Packaging Technology, Inc., application dated July 24, 2002.

Supplements dated: October 29, 2002; March 7, April 3, May 6, June 26, July 21, 2003; November 26, 2007; and August 6, 2008.

Supplements provided by Transnuclear, Inc. dated: September 7, 2011

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Kimberly J. Hardin

Eric J. Benner, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Date: ~~September 12, 2008.~~ TBD

INSERT 1 to mark-up of the CoC 9301, Rev. 5:

(ii) Uranium oxide pellets, powder, and scrap meeting the requirements of Enriched Commercial Grade Uranium, as defined in ASTM C996-10. U_3O_8 or $UO_{x,\ x>2}$ are authorized provided that the equivalent UO_2 mass is less than the limits specified below:

Max ^{235}U Enrichment (weight percent)	Homogenous UO_2 Powder Maximum Loading (kg)	Heterogeneous UO_2 Material (Pellet and Scrap) Maximum Loading (kg)
≤ 4.05	300	300
4.15		284
4.25		271
4.35		256
4.45		247
4.55	286	236
4.65	271	224
4.75	259	216
4.85	248	208
4.95	238	202
5.0	232	196

INSERT 2 to mark-up of the CoC 9301, Rev. 5

Presence of hydrogenated materials (with a hydrogen concentration less than hydrogen concentration in water) or water inside cavities and pails is allowed.

The auto-ignition temperature of the bag material shall be greater than 140 °C (284 °F).

The presence of materials containing more hydrogen than water is not allowed in the package.

(ii) For the contents described in 5.(b)(1)(ii), no more than 25 kg of contents per pail. No more than 300 kg of contents per package. In each pail, the contents can be put in a polyethylene bag (CH_2) or in a bag made of a material with a hydrogen concentration less than that of polyethylene. The maximum hydrogen content of the bags within each cavity is a mass of 56 g H, which is equivalent to a maximum mass of 390 g polyethylene, considering all sources of hydrogenous material within each cavity.

The auto-ignition temperature of the bag material shall be greater than 140 °C (284 °F).

The presence of materials containing more hydrogen than polyethylene is not allowed in the package.