January 17, 2012

Dr. Jayant Bondre, Vice President
Transnuclear, Inc.
7135 Minstrel Way, Suite 300
Columbia, MD 21045

SUBJECT: REVISION NO. 5 OF CERTIFICATE OF COMPLIANCE NO. 9301 FOR THE MODEL NO. TNF-XI TRANSPORT PACKAGE

Dear Dr. Bondre:

As requested by your application dated September 8, 2011, as supplemented October 28 and December 23, 2011, and January 6, 2012, enclosed is Certificate of Compliance No. 9301, Revision No. 5, for the Model No. TNF-XI transport package. Changes made to the enclosed certificate are indicated by vertical lines in the margin. The staff's Safety Evaluation Report is also enclosed.

This approval constitutes authority to use the package for shipment of radioactive material and for the package to be shipped in accordance with the provisions of 49 CFR 173.471. Registered users of the package under the general license provisions of 10 CFR 71.17 or 49 CFR 173.471 have been provided a copy of this certificate.

If you have any questions regarding this certificate, please contact me or Jennie Rankin of my staff at (301) 492-3268.

Sincerely,

/RA/

Michael D. Waters, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9301
TAC No. L24570

Enclosures:
1. Certificate of Compliance No. 9301, Rev. No. 5
2. Safety Evaluation Report

cc w/encls. 1&2: R. Boyle, Department of Transportation
Registered Users

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Closes TAC No. L24570
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G:\SFST\PART 71 CASEWORK/9301.R5.LETTER&SER.doc **ADAMS Package No.: ML120180063**

OFC:	SFST	E	SFST		SFST		SFST		SFST	
NAME:	JRankin		DForsyth		JBorowsky		MSampson		MRahimi	
DATE:	12/18/11		1/6/12		1/19/11		1/9/12		1/12/12	

OFC:	SFST	E	SFST		SFST		SFST		SFST	
NAME:	MDeBose		MWaters							
DATE:	1/11/12		1/17/12							

C = COVER **E = COVER & ENCLOSURE** **N = NO COPY**

SAFETY EVALUATION REPORT
Docket No. 71-9301
Model No. TNF-XI Transport Package
Certificate of Compliance No. 9301
Revision No. 5

SUMMARY

By application dated September 8, 2011, as supplemented October 28 and December 23, 2011, and January 6, 2012, Transnuclear, Inc. (TN) submitted an amendment request to revise the Certificate of Compliance (CoC) for the Model No. TNF-XI transport package. The application proposes to add polyethylene as approved contents, remove a surface temperature measurement prior to transport, and update the design to meet AF-96 certification standards in 10 CFR Part 71. Additionally, the application addresses a few editorial corrections and clarifies that the package will not be transported by air. Based on the statements and representations in the application, as supplemented, the staff agrees that these changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

1.0 GENERAL INFORMATION

The TNF-XI packaging consists of a stainless steel outer box with four internal wells. Thermo-mechanical protection is provided by phenolic foam between the wells and the outer box. Containment is provided by the internal wells (which contains a neutron poisoning resin) and the primary lid of each well which is sealed by an elastomer gasket. The primary lids are protected by upper plugs which includes a steel upper lip. Additionally, a polymer cleanliness cover protects the top of the package. This transportation system is used to transport homogeneous oxide forms of uranium oxides (UO_2, UO_3 and U_3O_8) enriched to a maximum of 5% (w/o). Uranium oxide powder is contained in individual stainless steel pails contained in the inner wells.

The revision adds polyethylene bags or bags with hydrogen concentration less than polyethylene as contents. The maximum hydrogen content of the bags within each cavity is 56g H, which is equivalent to a maximum mass of 390g of polyethylene. These bags are used to contain the uranium oxide powder, scraps, or pellets that are placed within the pails.

Evaluation for the -96 Designation

On January 26, 2004, the U.S. Nuclear Regulatory Commission (NRC) published its final rule revising 10 CFR Part 71 to address compatibility with the 1996 Edition of the International Atomic Energy Agency's (IAEA) transportation safety standards, "Regulation of the Safe Transport of Radioactive Material" (TS-R-1), and other transportation safety amendments. The revised 10 CFR Part 71 final rule became effective on October 1, 2004 (69 FR 3698).

By application dated September 8, 2011, TN requested an amendment to Certificate of Compliance No. 9301 for its Model No. TNF-XI package to include the designation "-96" in the identification number, as specified in 10 CFR 71.19(e). The staff evaluated the applicant's request, as described below.

- Issue 1, Changing Part 71 to the International Systems of Units (SI) Only.

  This proposal was not adopted in the final rule, and therefore no changes are needed in the package application or the CoC to conform to the new rule.

- Issue 2, Radionuclide Exemption Values.

  The final rule adopted radionuclide activity concentration values and consignment activity limits in TS-R-1 for the exemption from regulatory requirements for the shipment or carriage of certain radioactive low-level materials. In addition, the final rule adopted an exemption from regulatory requirements for certain natural material and ores containing naturally occurring radionuclides. This revision was not applicable to the Model No. TNF-XI package based on the design purpose of the package and the allowed contents specified in the certificate. Thus, no changes are needed to conform to the new rule.

- Issue 3, Revision of A_1 and A_2.

  The final rule adopted changes in the A_1 and A_2 values from TS-R-1, with the exception of two radionuclides. The A_1 and A_2 values were modified in TS-R-1 based on refined modeling of possible doses from radionuclides, and the NRC agreed that incorporating the latest in dosimetric modeling would improve transportation regulations. This revision was not applicable to the Model No. TNF-XI package based on the design purpose of the package and the allowed contents specified in the certificate. Thus, no changes are needed to conform to the new rule.

- Issue 4, Uranium Hexafluoride (UF_6) Package Requirements.

  These changes are not applicable, since the package is not authorized for the transport of uranium hexafluoride. Therefore, no changes are needed to conform to the new rule.

- Issue 5, Criticality Safety Index (CSI).

  The final rule adopted the CSI requirement from TS-R-1. The applicant has incorporated the CSI nomenclature. The CoC has no reference to the Transport Index for criticality control.

- Issue 6, Type C Packages and Low Dispersible Material.

  This proposal was not adopted for the final rule. Thus, no changes are necessary.

- Issue 7, Deep Immersion Test.

  The final rule adopted an extension of the previous version of 10 CFR 71.61 from packages for irradiated fuel to any Type B package containing activity greater than 10^5 A_2. The TNF-XI package is not a Type B package. Thus, no changes are necessary.

- Issue 8, Grandfathering Previously Approved Packages.

  The final rule adopted a process for allowing continued use, for specific periods of time, of a previously approved packaging design without demonstrating compliance to the final rule. The applicant has decided in accordance with 10 CFR 71.19(e) to submit information demonstrating compliance with the final rule. Thus, grandfathering the design of the package is not necessary.

- Issue 9, Changes to Various Definitions.

  The final rule adopted several revised and new definitions. These changes were adopted to provide clarity to Part 71. No change is necessary to conform to the new rule.

- Issue 10, Crush Test for Fissile Material Packages.

  The revised 10 CFR 71.73 expanded the applicability of the crush test to fissile material packages. The crush test is required for packages with a mass not greater than 500 kilograms (1100 pounds). Since the Model No. TNF-XI package has a mass greater than this, the crush test is not applicable. Therefore the requirement to perform a crush test is not applicable to the package, and no change is necessary to conform to the new rule.

- Issue 11, Fissile Material Package Design for Transport by Aircraft.

  The final rule adopted a new section, Section 71.55(f), which addresses packaging design requirements for packages transporting fissile material by air. The applicant did not request transport of fissile material by air. The CoC already included Condition No. 6 which states that transport by air is not authorized. No additional changes are necessary.

- Issue 12, Special Package Authorizations.

  The final rule adopted provisions for special package authorization that will apply only in limited circumstances and only to one-time shipments of large components. This provision is not applicable to the Model No. TNF-XI package. Thus, no change is necessary to conform to the new rule.

- Issue 13, Expansion of Part 71 Quality Assurance (QA) Requirements to Certificate Holders.

  The final rule expanded the scope of Part 71 QA requirements to apply to any person holding or applying for a CoC. QA requirements apply to design, purchase, fabrication, handling, shipping, storing, cleaning, assembly, inspection, testing, operation, maintenance, repair, and modification of components of packaging that are important to safety. TN has an approved QA program (Docket No. 71-0250) which satisfies the requirements of 10 CFR Part 71, Subpart H. Thus, no change is necessary to conform to the new rule.

- Issue 14, Adoption of the American Society of Mechanical Engineers (ASME) code.

  This proposal was not adopted in the final rule. Thus, no change is needed to conform to the new rule.

- Issue 15, Change Authority for Dual-Purpose Package Certificate Holders.

  This proposal was not adopted for the final rule. Thus, no change is necessary to conform to the new rule.

- Issue 16, Fissile Material Exemptions and General License Provisions.

  The final rule adopted various revisions to the fissile material exemptions and the general license provisions in Part 71 to facilitate effective and efficient regulation of the transport of small quantities of fissile material. The criticality safety of the package does not rely on limiting fissile materials to exempt or generally licensed quantities. Chapter 6 of the package application demonstrates criticality safety of the package with the authorized fissile contents. Therefore, no change is necessary to conform to the new rule.

- Issue 17, Double Containment of Plutonium.

  The final rule removed the requirement that packages with plutonium in excess of 0.74 terabecquerel (20 curies) have a second separate inner container. These changes are not applicable, since this package contains uranium oxides. Therefore, no changes are needed to conform to the new rule.

- Issue 18, Contamination Limits as Applied to Spent Fuel and High Level Waste Packages.

  This proposal was not adopted for the final rule. Thus, no change is needed to conform to the new rule.

- Issue 19, Modification of Events Reporting Requirements.

  The final rule adopted modified reporting requirements. While the final rule is applicable to the package, no change is needed to either the CoC or the package application to conform to the new rule.

Based on the statements and representations in the application, the staff concludes that the design has been adequately described and meets the requirements of the revised 10 CFR Part 71. Thus, the staff agrees that including the designation “-96” in the identification number is warranted. To allow time to modify the packaging markings to include the “-96” designation in the package identification number, the certificate has been conditioned to allow use of packagings marked with the “-85” designation for a period of approximately one year. After January 31, 2013, the packaging must be marked with the package identification number including the “-96” designation.

2.0 STRUCTURAL EVALUATION

The addition of polyethylene as approved contents, removal of a surface temperature measurement prior to transport, and the update of the design to meet the designation of AF-96 did not affect the previous structural evaluation.

3.0 THERMAL

The thermal review of the application, as supplemented, focused on the effect of adding polyethylene bags, or bags with hydrogen concentration less than polyethylene, to the contents. The applicant addressed the issue of preventing combustion of the bags at thermal hypothetical accident conditions by stating in the Safety Analysis Report (SAR) that the bags used in the package must have an auto-ignition temperature greater than 140°C. This was considered a conservative value for two reasons. First, 140°C was the maximum recorded temperature of the primary lid seals that seal the inner wells of the package during hypothetical accident condition testing. The applicant's calculation showed a maximum payload temperature of 88°C, indicating margin between content temperature and the minimum auto-ignition temperature (140°C) of the bag material. Second, polyethylene, which is the expected choice of bag material, has an auto-ignition temperature greater than 300°C, well above the minimum auto-ignition temperature of the bag material.

Based on the review of the statements and representations in the application, as supplemented, the staff finds reasonable assurance that the performance of the package meets the thermal requirements of 10 CFR Part 71.

4.0 CONTAINMENT EVALUATION

The addition of polyethylene as approved contents, removal of a surface temperature measurement prior to transport, and the update of the design to meet the designation of AF-96 did not affect the previous containment evaluation.

5.0 SHIELDING EVALUATION

The enriched uranium oxide contents do not require a shielding evaluation.

6.0 CRITICALITY EVALUATION

This revision to the SAR adjusts the amount of polyethylene moderator allowed in the criticality analysis for shipments of homogenous oxide forms of uranium oxides. It was discovered that the use of polyethylene bags during operations to control contamination was not permitted under the existing CoC. This practice has been subject to a 10 CFR 71.95 review. The staff's evaluation of the criticality of the TNF-XI package with the inclusion of polyethylene material is discussed in this safety evaluation report. In addition, the applicant has included additional information to comply with the designation as a "-96" package.

6.1 Areas of Review

6.1.1 Criticality Design Criteria and Features

Staff reviewed the changes and information in the current SAR revision and verified that the information is consistent as well as all descriptions, drawings, figures, and tables are sufficiently detailed to support an in-depth staff evaluation.

6.1.2 Packaging and Design Features

The package consists of a sheet metal outer box, equipped with a top face including four outer bayonets. Type-1, type-2, and type-3 phenolic foam provides thermo-mechanical protection. Containment is provided by four internal wells, made of stainless steel sheets enclosing a layer of neutron absorbing resin. A primary lid closes each internal well. Each 6 mm thick stainless steel plate lid includes an outer bayonet and is sealed by an elastomer gasket. Plugs consisting of a stainless steel lip and internal bayonet are used to protect the primary lids.

The payload is contained in individual pails, stacked three high, within the four internal wells. The payload is enriched uranium oxide powder. Pails are constructed with stainless steel having a nominal wall thickness of 1.2 mm and a stainless steel lid equipped with a closure ring. The internal cavity has a useful height and diameter of 205 mm and 285 mm respectively.

The TNF-XI package does not incorporate any component that would permit continuous venting.

The TNF-XI package maintains criticality control by means of mass limits and neutron absorbing material in both the pails and the inner wells. The pails contain borated stainless steel rings having a natural boron content of 1% by weight, and the inner well has a shell of neutron absorbing resin with a minimum thickness of 34 mm.

6.1.3 Codes and Standards

The applicable regulations considered in the review of the criticality safety portion of this application include the fissile material requirements in 10 CFR Part 71, specifically the general requirements for fissile material packages in §71.55, and the standards for arrays of fissile material packages in §71.59. The staff also used the review guidance contained in NUREG-1617.

6.1.4 Summary Table of Criticality Evaluations

Table 6-1. UO_2 mass limits per TNF-XI package

^{235}U Enrichment	Homogeneous UO_2 Powder Maximum Loading, kg	Heterogeneous UO_2 Material Maximum Loading, kg
≤4.05%	300	300
4.10%		293
4.15%		287
4.25%		271
4.35%		259
4.45%		247
4.55%	294	238
4.65%	281	228
4.75%	265	219
4.85%	255	208
4.95%	244	202
5.00%	239	197

6.1.5 Criticality Safety Index (CSI)

The applicant determined the minimum upper subcritical limit (USL) over the parameter range for UO_2 powder and UO_2 pellets and scrap is 0.9388 and 0.9398 respectively.

The number of packages to be transported at one time is limited to 108. For Normal Conditions of Transport (NCT), an array of 8x9x8 (5N) packages was shown to remain subcritical. For Hypothetical Accident Conditions (HAC), an array the size of 6x6x6 (2N) was also shown to remain subcritical. Using the method given in 10 CFR 71.59(b), the CSI = 0.5.

6.1.6 Contents

The package shall be used to transport uranium in oxide form (U_3O_8 or $UO_{x,x\geq2}$) which meet the requirements for Enriched Commercial Grade Uranium defined in ASTM C996-10. The isotopic uranium distribution is shown in Table 6-2. The maximum net UO_2 equivalent payload limits are presented in Table 6-1.

Table 6-2. Uranium Isotopic Distribution

Isotope	wt%
^{234}U	0.0054 – 0.0500
^{235}U	0.7110 – 5.0000
^{236}U	0.0000 – 0.0250
^{238}U	99.2836 – 94.9295

6.2 General Considerations for Criticality Evaluations

6.2.1 Model Configuration

The TNF-XI package is modeled as an axially finite model of the normal geometry based upon the drawings in Section 1.3 of the SAR. The model consists of four cavities inserted into the primary body of phenolic foam. BORA resin surrounds each cavity and acts as a neutron absorber for criticality control. Within each cavity, the stack of three pails is modeled as a single stainless steel can with a borated stainless steel liner containing a mixture of uranium oxide, polyethylene, and water. The modeled pail rests on a borated stainless steel disk at the bottom of the cavity. The pails are shifted inward to the maximum extent allowed by the geometry for a conservative criticality calculation. The lid of each cavity is modeled with layers of phenolic foam and reduced density homogeneous aluminum to account for the honeycomb structure. The entire package is clad in stainless steel.

Under HAC some dimensions in the model are altered to reflect predicted damage. Axial crush reduced the height of the package by 1.5 cm. This was achieved by reducing the thickness of the bottom foam. Side crush results in a 2 cm reduction which is incorporated by reducing each lateral face by 1 cm. Punch bar damage is modeled as a hole, 3.9 cm deep and 15 cm in diameter. In addition, the top foam disk for each canister and 2.7 cm of foam on all surfaces is assumed to be consumed in the fire and is modeled as charred foam. In the damaged model, fuel material is modeled both inside and outside the pail, and void space within the package is assumed to be flooded with water.

6.2.2 Material Properties

The contents and structural materials are taken from the SCALE standard composition libraries and are summarized in Table A.6-4 of the SAR.

The powder is modeled as a homogenized mix of UO_2, polyethylene and water with the volume fractions based on known mass and volume of the components of the mixture. The density of polyethylene is varied from 0.90 – 0.96 g/cm^3 with the 0.92 g/cm^3 being a nominal density.

Pellets and scrap were modeled as a lattice of UO_2 in a homogenous mixture of water and polyethylene. The volume fraction of the moderator is based on the known mass and volume (with variable height) occupied by the mixture.

Water was only modeled under HAC for the flooded cases.

The BORA resin has a density of 1.74 g/cm^3 and contains natural boron, with ^{10}B taken at 75% credit or 13.5 wt%.

The types of phenolic foam are modeled with appropriate densities and in the case of charred foam are modeled with carbon.

Aluminum honeycomb structure is modeled as homogenous aluminum at reduced density.

6.2.3 Computer Codes and Cross Section Libraries

The applicant used the CSAS5 module of the SCALE 6 code package for criticality analysis. The 238-group ENDF/B-V cross-section data is used with all materials assumed to be at room temperature. The cross-section processing uses three lattice-cell options, square and triangular lattices and spherical fuel in a hexagonal lattice, for the pellet/scrap analyses. An infinite homogeneous option was used for the powder analyses. NITAWL is used to process the cross sections in all cases.

6.2.4 Demonstration of Maximum Reactivity

Under NCT, both single package and array models assume the pail has filled with water to optimum level of moderation and closely reflected by 30.48 cm (12”) of full-density water.

For the HAC array analysis, the pails and inner cavity are modeled as full of water and fuel mixture to obtain the optimum level of moderation. The pail and cavity volume unoccupied by the fuel and water mixture is conservatively assumed to be full of full-density water. The array is closely reflected by 30.48 cm (12”) of full-density water.

Additional conservative assumptions are carried through the criticality analyses:

1. Fuel material (powder, pellet, and scrap) is modeled at 100% theoretical density.
2. Temperature is assumed to be room temperature.
3. The maximum allowed mass (390 g) of polyethylene is assumed to be present in the fuel mixture.
4. Optimum moderation is determined by varying the fill height of the pail under NCT and the pail and cavity under HAC.
5. Heterogeneous lattice cell assumptions are varied in all cases to determine optimum pitch and radius.

6.2.5 Confirmatory Analyses

Staff modeled the TNF-XI package as described in the SAR and pictured in Figure A.6-1 in KENO-VI, part of the SCALE 6.1 package. The continuous energy libraries in ENDF/B-6 and -7 were used when available; otherwise ENDF/B-5 libraries were utilized. Staff did a comparative, single-package analysis to confirm that the effect of 390 g of polyethylene, when modeled both homogeneously throughout the fuel mixture and as a thin layer on the outside of the pail cavity, is negligible in any credible case.

Staff evaluated selected heterogeneous and homogeneous array cases under NCT (8x9x8) and HAC (6x6x6) using the same uranium loading, package flooding, and assumptions as the applicant. The cases chosen for review were ones that resulted in the highest value of k_{eff} in that comparative group. Staff results were within reasonable agreement with those of the applicant.

6.3 Single Package Evaluation

6.3.1 Configuration

In addition to the conservative assumptions described in Section 6.2.4, the parameters to determine optimum pitch, radius and fill height are calculated over the range of enrichment and mass limits. The results are presented in Table A.6-5 in the SAR.

6.3.2 Results

In all cases, the most reactive single package k_{eff} under NCT remains below the stated USL as presented in Tables A.6-6 through A.6-23 in the SAR.

6.4 Evaluation of Package Arrays under Normal Conditions of Transport (NCT)

6.4.1 Configuration

The NCT array consists of an 8x9x8 lattice of packages. The array is closely reflected by 30.48 cm (12”) of full density water while the packages are assumed to be in close contact with no space in between the outer clad of adjacent packages. This is conservative as it allows the maximum neutron “communication” between packages.

Since the single package evaluation limiting case was with the pails completely full, an additional analysis was done to rule out the possibility that the system is under-moderated and reactivity could increase with decreasing fissile mass. The results presented in Figure A.6-5 in the SAR demonstrate this is not the case.

In addition to the conservative assumptions described in Section 6.2.4, the parameters to determine optimum pitch, radius and fill height are calculated over the range of enrichment and mass limits. The results are presented in Table A.6-24 in the SAR.

6.4.2 Results

In all cases, the most reactive array k_{eff} under NCT remains below the stated USL as presented in Tables A.6-25 through A.6-48 in the SAR.

6.5 Evaluation of Package Arrays under Hypothetical Accident Conditions (HAC)

6.5.1 Configuration

The HAC array consists of a 6x6x6 lattice of packages. The array is closely reflected by 30.48 cm (12”) of full density water while the packages are assumed to be in close contact with no space in between the outer clad of adjacent packages. This is conservative as it allows the maximum neutron “communication” between packages.

The packages are assumed to have been crushed and are reduced by the appropriate dimensions. A puncture is modeled as a hole filled with water and fire damage is assumed and modeled with additional carbon in the phenolic foam material. The fuel mixture exists both within and outside the pail, and void space not containing fuel material is filled with water.

The polyethylene density was varied and demonstrated to have negligible effect in Table A.6-64 in the SAR.

Additional analysis was repeated to rule out the possibility that the system is under-moderated and reactivity could increase with decreasing fissile mass. The results presented in Figure A.6-6 in the SAR demonstrate this is not the case.

In addition to the conservative assumptions described in Section 6.2.4, the parameters to determine optimum pitch, radius, and fill height are calculated over the range of enrichment and mass limits. The results are presented in Tables A.6-43 through A.6-45 in the SAR.

6.5.2 Results

In all cases, the most reactive array k_{eff} under HAC remains below the stated USL as presented in Tables A.6-46 through A.6-63 in the SAR.

6.6 Benchmark Evaluations

The applicant used the CSAS5 module in SCALE 6. NITAWL was used for cross-section processing and is appropriate for fissile uranium analysis. The 238-group ENDF/B-V cross section library has a small bias and is appropriate for hydrogen moderated LEU systems. A USL is determined for both powder and pellet/scrap using the results of the benchmark calculations.

6.6.1 Experiments and Applicability

The material and geometric characteristics of the 18 critical experiments selected for the powder USL evaluation are presented in Table A.6-65 in the SAR. The experiments, calculated results, uranium enrichment, and H/X values are listed in Table A.6-66 in the SAR.

The material and geometric characteristics of the 23 critical experiments selected for the scrap/pellet USL evaluation are presented in Table A.6-67 in the SAR. All 23 critical experiments are part of the NUREG/CR-6361 critical experiments. Of those, 15 have steel reflecting walls. The experiments, calculated results, uranium enrichment, and H/X values are listed in Table A.6-68 in the SAR.

All parameters were evaluated for trends and the applicant used the USLSTATS 6 Program to determine the most conservative USL. The results from the USL evaluation are presented in the SAR in Table A.6-69 for powder and Table A.6-70 for scrap/pellets.

6.6.2 Bias Determination

The calculated USL for the evaluations includes both the bias and uncertainty in the bias, with the most limiting of these being 0.9388 for powder 0.9398 for scrap/pellets.

6.7 Burnup Credit

No credit is taken for fuel reactivity reduction due to burnup. All analyses are modeled using un-irradiated uranium.

6.8 Evaluation Findings

The staff has reviewed the description of the packaging design and concludes that it provides an adequate basis for the criticality evaluation.

The staff has reviewed the summary information of the criticality design and concludes that it indicates the package is in compliance with the requirements of 10 CFR Part 71.

The staff has reviewed the description of the contents and concludes that it provides an adequate basis for the criticality evaluation.

The staff has reviewed the criticality description and evaluation of the package and concludes that it addresses the criticality safety requirements of 10 CFR Part 71.

The staff has reviewed the criticality evaluation of a single package and concludes that it is subcritical under the most reactive credible conditions.

The staff has reviewed the criticality evaluation of an infinite array of the most reactive configuration in under both NCT and HAC and concludes that it is subcritical under these conditions.

The staff has reviewed the benchmark evaluation of the calculations and concludes that they are sufficient to determine an appropriate bias and uncertainty for the criticality evaluation.

7.0 PACKAGE OPERATIONS

Package operations described in Chapter 7 of the application, as supplemented, were slightly changed to reflect the removal of a package surface temperature determination prior to transport. Removal of this requirement is appropriate because there is negligible decay heat associated with the uranium oxide content. Therefore, packages exposed to a 38°C (100°F) ambient temperature while in the shade would have surface temperatures below the 10 CFR 71.43(g) allowable values.

During the review of this amendment, it was noted on a recent inspection of a Model No. TNF-XI user, that there was a need to clarify which bayonets required visual inspections in Section 7.1.1. TN submitted this clarification by letter dated December 23, 2011. The submittal clarifies that visual inspections are required of all the bayonets mating with the primary lid and with the upper plug.

The staff reviewed the effect of removing the requirement of surface temperature measurement in the shade prior to transport and concludes that the revision of the operating procedures meets the requirements of 10 CFR Part 71 and that these procedures are adequate to assure the package will be operated in a manner consistent with its evaluation for approval.

8.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM EVALUATION

The addition of polyethylene as approved contents, removal of a surface temperature measurement prior to transport, and the update of the design to meet the designation of AF-96 did not affect the previous acceptance tests and maintenance program evaluation.

CONDITIONS

The following changes are included in Revision No. 5 to Certificate of Compliance No. 9301:

Condition No. 5(b)(1) was modified to distinguish the maximum enrichment and loading requirements for packages using bags with hydrogen concentration less than the hydrogen concentration in water (Condition No. 5(b)(1)(i)) and polyethylene bags (Condition No. 5(b)(1)(ii)). The ASTM reference was also updated to ASTM C996-10.

Condition No. 5(b)(2) was modified to distinguish the maximum quantity of material for packages using bags with hydrogen concentration less than the hydrogen concentration in water (Condition No. 5(b)(1)(i)) and polyethylene bags (Condition No. 5(b)(1)(ii)). In addition, the maximum auto-ignition temperature of the bag material was included.

Condition No. 9 was revised to specify that packagings used after January 31, 2013, be marked with Package Identification Number USA/9301/AF-96. As a consequence of the inclusion of the new Condition No. 9, the previous Condition No. 9 was renumbered 11.

Condition No. 10 was added to authorize use of the previous revision for a period of approximately one year. As a consequence of the inclusion of the new Condition No. 10, the previous Condition No. 9 was renumbered 11.

The References section was modified to distinguish the documents provided by Packaging Technology, Inc., and Transnuclear, Inc., and to include the supplements dated September 8, October 28, and December 23, 2011, and January 6, 2012.

CONCLUSION

Based on the statements and representations contained in the application, and the conditions listed above, the staff concluded that the Model No. TNF-XI package meets the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9301, Revision No. 5
on January 17, 2012.