TRANSNUCLEAR
AN AREVA COMPANY

April 11, 2007
E-24908

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

Subject: Transnuclear, Inc. Comments on the Preliminary Certificate of Compliance and Safety Evaluation Report for Amendment No. 1 to the TN-68 Dry Storage Cask
Docket 72-1027, TAC L23802

Reference: Letter from Jose Cuadrado (NRC) to Donald Shaw (TN), dated April 4, 2007, "Preliminary Certificate of Compliance and Safety Evaluation Report for Amendment No. 1 to the TN-68 Dry Storage Cask"

Gentlemen:

In accordance with the referenced letter, Transnuclear, Inc. has reviewed the preliminary copy of the Certificate of Compliance, with its corresponding Technical Specifications, and Safety Evaluation Report. Enclosure 1 to this letter provides a list of enclosed pages, with the reason for comments on those pages, and Enclosure 2 provides hand mark-ups of the enclosed pages.

Should you or your staff require additional information, please do not hesitate to contact me at 410-910-6878 or Dr. Jayant Bondre at 410-910-6881.

Sincerely,

Donis Shaw
Licensing Manager

cc: Mr. Jose Cuadrado (NRC SFST)
Jeff Gagne, Transnuclear
David Shortes, Exelon

Enclosures:

1. List of Enclosed Pages
2. Hand Mark-ups of Enclosed Pages
3. Page 1 and Page 29 from TN letter E-16500, September 14, 1998

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List of Enclosed Pages

Page	Reason for Comment
CoC Page 3	Feedback from a client seeking clarification that testing and training performed under the original CoC need not be repeated due to amendments.
Technical Specifications Page 2.0-1	Clarification that if missing fuel pins or fuel pin segments are replaced by dummy rods, damaged fuel may be stored.
Technical Specifications Page 3.1.1-1	Feedback from a client indicating that the original note is clearer than the revised note, although the requirement is essentially unchanged.
Technical Specifications Page 3.1.2-1	Feedback from a client indicating that the original note is clearer than the revised note, although the requirement is essentially unchanged.
Technical Specifications Page 4.0-7	Clarification added for basket fusion welds to be consistent with TN's response to RAI 3-8 shown in Enclosure 3 of this submittal, and SAR drawings.
SER Page 1-1	Information is added regarding bundle average burnup to be consistent with other SER sections.
SER Page 4-6	Information is deleted to provide clarification regarding degradation of the neutron shield material.
SER Page 6-1	For completeness, Boral® is added to borated aluminum alloy and boron carbide/aluminum composites.
SER Page 9-1	For completeness, borated aluminum alloy is added to Boral® and boron carbide/aluminum composites.

Hand Mark-ups of Enclosed Pages

4. QUALITY ASSURANCE

Activities in the areas of design, procurement, fabrication, assembly, inspection, testing, operation, maintenance, repair, modification of structures, systems and components, and decommissioning that are important to safety shall be conducted in accordance with a Commission-approved quality assurance program which satisfies the applicable requirements of 10 CFR Part 72, Subpart G, and which is established, maintained, and executed with regard to the cask system.

5. HEAVY LOADS REQUIREMENTS

Each licensed facility must ensure that cask lifting is evaluated in accordance with the existing heavy loads requirements and procedures of the licensed facility in which the lift is made. An additional safety review (under 10 CFR 50.59 or 10 CFR 72.48, if applicable) is required to show operational compliance with existing facility/site-specific heavy loads requirements.

6. APPROVED CONTENTS

Contents of the TN-68 system must meet the specifications given in Appendix A to this certificate.

7. DESIGN FEATURES

Features or characteristics for the site, cask, or ancillary equipment must be in accordance with Appendix A to this certificate.

8. PRE-OPERATIONAL TESTING AND TRAINING EXERCISE

A dry run training exercise of the loading, closure, handling, unloading and transfer of the TN-68 cask shall be conducted by the cask user prior to the first use of the system to load spent fuel assemblies. The dry run may be performed in an alternate step sequence from the actual procedures. The dry run shall include but is not limited to the following:

Preparation of the TN-68 cask for loading and moving the TN-68 cask into the spent fuel pool.

Selection and verification of specific fuel assemblies to ensure type conformance.

Loading a dummy fuel assembly into the TN-68 and performing appropriate independent verification.

Installation of the TN-68 lid and removal of the TN-68 cask from the spent fuel pool.

Cask draining, vacuum drying, helium backfilling, and leakage testing.

Loading the TN-68 cask onto the cask transporter.

Transferring the cask to the ISFSI.

Placement of the TN-68 cask at the ISFSI.

Unloading operations including reflooding.

Previous Pre-operational and training exercises performed as part of the original C of C for this system may be credited as meeting the requirements of this condition.

2.0 FUNCTIONAL AND OPERATIONAL LIMITS

2.1 Functional and Operational Limits

2.1.1 Fuel to be Stored in the TN-68 Cask

The spent nuclear fuel to be stored in the TN-68 cask shall meet the following requirements:

A. Fuel shall be unconsolidated INTACT FUEL ASSEMBLIES except that up to 8 fuel assemblies with damage consisting of known or suspected cladding defects greater than pinholes or hairline cracks may be stored subject to the following limitations:

i. they must be HANDLED BY NORMAL MEANS
ii. they must be stored in a basket configured for damaged fuel, in the designated compartments shown in Figure 2.1.1-1, with end caps installed top and bottom,
iii. there must be no missing fuel pins or fuel pin segments, and
iv. assembly average burnup is limited to ≤45 GWd/MTU.

unless dummy rods are used to displace an amount of water equal to or greater than that displaced by the original fuel rod(s)

B. Fuel shall be limited to fuel with Zircaloy cladding. Fuel having stainless steel replacement rods may be stored provided that a shielding analysis demonstrates that the dose rate contribution from such rods is bounded by the design basis fuel rods.

C. Fuel shall be limited to the following fuel types or equivalents by other manufacturers with the following unirradiated specifications:

Assembly Type		Designation	#of Fuel Rods	Max Rod Pitch	Min Rod OD	Max Uranium Content (MTU/assy)
GE	7x7	2,2A,2B	49	0.738	0.563	0.1977
GE	7x7	3,3A,3B	49	0.738	0.563	0.1923
GE	8x8	4,4A,4B	63	0.640	0.493	0.1880
GE	8x8	5,6,6B,7,7B	62	0.640	0.483	0.1876
GE	8x8	8,8B	62	0.640	0.483	0.1885
GE	8x8	8,8B,9,9B,10	60	0.640	0.463	0.1824
GE	9x9	11,13	74	0.566	0.440	0.1757
GE	10x10	12	92	0.510	0.404	0.1857

Fuel designs 6, 6B, 7 and 7B may also be designated as P, B or BP. Fuel designs may be C, D or S lattice only.

D. Fuel assemblies may be channeled or unchanneled. Channel thickness up to 0.120 inches thick are acceptable.

E. 7x7 fuel assemblies shall have the bounding characteristics specified in Table 2.1.1-1.

3.1 CASK INTEGRITY

3.1.1 Cask Cavity Vacuum Drying

LCO 3.1.1 The cask cavity vacuum drying pressure shall be sustained at or below 4 mbar absolute for a period of at least 30 minutes after isolation from the vacuum drying system.

APPLICABILITY: During LOADING OPERATIONS

helium is removed

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
-------NOTE------- Not applicable until SR 3.1.1.1 is performed. ----------	-------NOTE---------- Action A.1 applies until *a gas other than helium is introduced into the cask* for subsequent operations. ----------	
A. Cask cavity vacuum drying pressure limit not met.	A.1 Achieve or maintain a nominal helium environment in the cask. AND	*6* hours
	A.2 Establish cask cavity drying pressure within limits.	*Prior to helium backfill (SR 3.1.2.1)*
B. Required Action A.1 and associated Completion Time not met.	B.1 *Return cask to pool and reflood.*	7 days
C. Required Action A.2 and associated Completion Time not met.	C.1 *Return cask to pool and reflood.*	30 days

3.1 CASK INTEGRITY

3.1.2 Cask Helium Backfill Pressure

LCO 3.1.2 The cask cavity shall be filled with helium to a pressure of 2.0 atm absolute (+0/-10%).

APPLICABILITY: During LOADING OPERATIONS.

helium is removed

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
-------NOTE------- Not applicable until SR 3.1.2.1 is performed. ---------- A. Cask initial helium backfill pressure limit not met.	-------NOTE---------- Action A.1 applies until a gas other than helium is introduced into the cask for subsequent operations ---------- A.1 Achieve or maintain a nominal helium environment in the cask AND A.2 Establish cask cavity backfill pressure within limits.	 *Immediately* *Prior to leak testing (SR 3.1.3.1)*
B. Required Action A.1 and Associated Completion Time not met.	B.1 *Return cask to pool and reflood.*	7 days
C. Required Action A.2 and associated Completion Time not met.	C.1 *Return cask to pool and reflood.*	30 days

Table 4.1-1
TN-68 ASME Code Exceptions

Component	Reference ASME Code/Section	Code Requirement	Exception, Justification & Compensatory Measures
Basket Compartment longitudinal weld joint	NG-5231	Table NG-3352-1 specifies that in order to utilize a quality factor of 0.9 for a full penetration weld, examination must be in accordance with NG-5231. NG-5231 specifies that either a liquid penetrant or magnetic particle examination be performed "of the root, each subsequent layer, and on the external weld surfaces and adjacent base material for ½" on each side of the weld."	*If these welds are made in a single pass, the requirement of NG-5231 is satisfied by surface examination on the outside of the compartment, and the inside for one diameter's length from each end. Automated autogenous PAW welds followed by autogenous GTAW in the same pass through the welding equipment may be regarded as a single pass in accordance with Code Case N-642.* *This is a clarification, not an exception.*
Basket Fusion Welds	NG-3352 NG-4330	NG-3352 specifies permissible types of welded joints and their examination NG-4330 requires weld qualification in accordance with ASME Section IX	The fusion welds are not included in the permissible weld types listed in NG-3352. The welds near the end of each tube are examined by VT to the acceptance criteria of NG-5360; the remaining welds are visually examined to verify correct location. Visual inspection is supplemented by pre-shift mechanical testing. ASME Section IX does not provide qualification tests for this type of weld. The weld is qualified following Section IX to the degree applicable, supplemented by mechanical testing as specified on drawing 972-70-5 note 1.

1.0 GENERAL INFORMATION

The objective of the general description review of Amendment 1 to the TN-68 Dry Storage Cask is to ensure that TN has provided a non-proprietary description that is adequate to familiarize reviewers and other interested parties with the pertinent features of the system, as amended.

1.1 Cask Description and Operational Features

The applicant revised the general description of the TN-68 Dry Storage Cask to incorporate changes requested in the amendment application. These changes involved minor revisions to the cask description. The most significant revision of the cask description involves the reduction of the spacing between casks on the storage pads from 16 ft to 14 ft.

1.2 Drawings

The applicant provided revised non-proprietary versions of the cask drawings with its amendment application. Section 1.5 of the SAR contains the revised drawings, which properly identify all structures, systems, and components (SSCs) that are important to safety, and specifies all changes from the previous drawing revision. The applicant included two additional drawings (Drawing No. 972-70-7, and No. 972-70-8) to the drawings list. The staff determined that the drawings contained sufficient detail to perform its review of the amendment request.

1.3 Cask Contents

The applicant requested to change the parameters of the fuel to be stored in the TN-68 Storage Cask. The TN-68 cask is designed to store up to 68 BWR fuel assemblies with or without fuel channels. The maximum allowable initial lattice-average enrichment varies from 3.7 to 4.7 wt% U-235, depending on the B-10 areal density in the basket neutron absorber plates. The maximum bundle average burnup, maximum decay heat, and minimum cooling time are 40 GWd/MTU, 0.312 kW/assembly, and 10 years for 7 x 7 fuel, 60 GWd/MTU, 0.441 kW/assembly, and 7 years for all other fuel. The cask is designed for a maximum heat load of 30 kW. Fuel specifications are detailed in Section 2.1 of the Technical Specifications (TS).

The applicant also requested to include damaged fuel as contents of the TN-68 cask. Damaged fuel that can be handled by normal means may be stored in eight peripheral compartments fitted with damaged fuel end caps designed to retain gross fragments of fuel within the compartment.

1.4 Qualifications of the Applicant

Section 1.3 of the SAR contains reference to the applicant's qualifications and has not changed from the previous FSAR.

1.5 Evaluation Findings

F1.1 A general description of the TN-68 Dry Storage Cask, as amended, is presented in Chapter 1 of the SAR.

Damaged fuel assemblies are limited to a bundle average burnup of 45 GWd/MTU.

The staff determined that the view factor of the emitting cask in Figure 1 to the environment, with the concrete storage pads and access road conservatively considered to have no communication with the cask surface, was approximately 0.33. The applicant's original value of 0.62 for the view factor was considered to be non-conservative.

The staff requested that the applicant submit a calculation of the view factor in order to more appropriately capture the actual behavior of radiative exchange between a cask in an array of casks situated on a storage pad. The applicant submitted a view factor calculation that utilized the radiosity method of the ANSYS FEA code, and completed a sensitivity study of the effect of variations of the view factor on the thermal performance of the cask. The applicant documented this effort in Sections 4.10.1.1 and 4.10.1.3 of the SAR.

The staff reviewed the ANSYS model that was submitted by the applicant and found some minor errors related to the mirror plane and the resolution of the view factor calculation in the submitted model. The staff discussed the issues with the applicant, and, by letter dated March 16, 2007, the applicant provided a revised model that the staff found acceptable.

The applicant should use the modeling approach accepted by the staff for any future calculations related to the exchange of radiation between the cask and the surrounding environment for the TN-68 cask design. The applicant must consider the geometry of the cask storage pad when evaluating site specific application of the TN-68 cask design at a storage facility, since their view factor calculation method is dependent on the pad geometry.

Section 4.10.1.4 of the SAR describes the potential degradation of the neutron shield due to temperatures potentially exceeding the service temperature limit of 300°F. The staff finds that the uncertainties related to the potential increase in thermal conductivity of the neutron shield material due to exposure to temperatures in excess of the recommended service temperatures could result in degradation exceeding that described in this section. The staff finds that additional degradation of the neutron shield is acceptable given the thermal margin demonstrated in the staff's confirmatory analyses, as well as the practices of cask users under approved 10 CFR Part 20 radiation protection programs.

4.5.4 Conclusion

The staff accepts the applicant's thermal analysis for storage of fuel as stated in Section 4.1 above, within the limits described in the Technical Specifications.

4.6 Evaluation Findings

F4.1 The staff finds that the thermal SSCs important to safety are described in sufficient detail in the SAR to enable an evaluation of their effectiveness. Based on the applicant's analyses, there is reasonable assurance that the system is designed with a heat removal capability consistent with its importance to safety. The staff also finds that there is reasonable assurance that analyses of the systems demonstrate that the applicable design and acceptance criteria have been satisfied for the storage of the authorized fuel assemblies.

6.0 CRITICALITY EVALUATION

The staff reviewed the proposed amendment to the TN-68 Dry Storage Cask criticality analysis to ensure that all credible normal, off-normal and accident conditions have been identified and their potential consequences on criticality considered such that storage of spent fuel in the TN-68 cask meet the regulatory requirements of 10 CFR Part 72. The factors affecting criticality safety proposed in the amendment include higher enrichment fuel and damaged fuel added to the TN-68 cask. Both the revised SAR and the applicant's responses to RAI questions were used to determine the acceptability of the proposed amendment.

6.1 Criticality Design Criteria and Features

The design criterion for criticality safety is that the effective neutron multiplication factor, k_{eff}, remains below a value of 0.95 for all postulated arrangements of fuel within the cask under normal, off-normal and accident conditions, including statistical biases and uncertainties. The TN-68 cask relies primarily on the basket geometry and the fixed neutron poisons in the basket to maintain subcriticality of the cask. The maximum lattice-average enrichment of U-235 varies with the basket type, which is determined by the 10B areal density in the fixed neutron absorber and can vary between 27 to 63 mg B10/cm^2. Each level of areal density corresponds to a different basket type and an associated fuel enrichment limit. For intact fuel the limit is based on the lattice-averaged enrichment, while for damaged fuel (as added under the proposed amendment) is based on the maximum pellet enrichment.

6.2 Fuel Specification

No new fuel assembly types were added in this amendment. However, enrichment was increased to a maximum of 4.70 wt% U-235 for both intact assembly lattice average enrichment and for damaged assembly peak pellet enrichment.

6.3 Model Specification

6.3.1 Configuration

The TN-68 cask was modeled using the appropriate geometry options in KENO V.a of the CSAS25 module in SCALE-4.4. A KENO model was generated in the analysis to determine the initial enrichment for intact and damaged fuel assemblies as a function of fixed neutron poison loading. The active fuel region was modeled explicitly except for axially, which was modeled as infinite. The applicant did not take credit for the burnup of the fuel or for burnable absorber in the fuel. The fixed poison modeled in the calculation is modeled as aluminum and boron, which is adequate to represent the borated aluminum alloy or boron carbide/aluminum composites.

The applicant performed a number of parametric cases similar in procedure and underlying assumptions to the originally approved license application to determine the most reactive model for normal conditions and used this calculation model to determine the maximum allowable enrichment as a function of the fixed neutron poison loading. Staff reviewed the applicant's models and agrees that they are consistent with the description of the cask and contents given in the proposed amendment. The staff also reviewed the applicant's methods, calculations, and

, Boral®

9.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

The purpose of the review of the acceptance tests and maintenance procedures for Amendment 1 to the TN-68 Dry Storage Cask is to ensure that the changes requested by the applicant meet the requirements of 10 CFR Part 72. The changes requested by the applicant in its amendment request include the addition of new types of neutron absorber materials for use in the TN-68 cask basket. Only those sections revised by this amendment request are discussed below.

borated aluminum alloys

9.1 Acceptance Tests

9.1.1 Structural/Pressure Tests

The applicant made minor revisions to the SAR to state the specific acceptance criteria used for the shield shell and lid shield plate. The staff has reviewed these changes and found them acceptable.

9.1.2 Neutron Absorber Tests

The amendment request includes the use of Boral® and boron carbide/aluminum metal matrix composites (MMC) as neutron absorber materials for the TN-68 cask basket.

Sections 9.1.7.1 and 9.1.7.2 specify a direct chill (DC) or permanent mold casting process for manufacturing selected neutron absorber materials. The arguments made in the SAR for qualification of material produced through this process are regarded as acceptable. The acceptance testing specified for any lot of materials to be used in a service application and produced under this process are acceptable and adequately supplement the specified qualification testing.

Sections 9.4.2 and 9.4.3.5 specify various acceptance tests for all neutron absorber materials, which, in the criticality calculations, are given 90% credit for the boron added to these. The applicant states that the specified acceptance testing assures that at any location in the material, the minimum specified areal density of B10 will be found with 95% probability and 95% confidence. The requirements of these sections ensure quality and safety of the materials proposed for use under this amendment.

The staff requested that selected portions of the acceptance tests for the neutron absorber materials be incorporated by reference into the technical specifications. The specific sections referenced in the technical specifications are discussed in Section 12 of this SER. These sections have been reviewed and found to be consistent with current accepted practices for neutron absorber materials used in storage and transport cask systems.

9.2 Evaluation Findings

F9.1 The staff concludes that the acceptance tests for the TN-68 Dry Storage Cask, as amended, are in compliance with 10 CFR Part 72 and that the applicable acceptance criteria have been satisfied. The evaluation of the acceptance tests provides

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File No # 4.6.7
Record # 17

TRANSNUCLEAR, INC.

File No # 4.6.7 98

Record No # _____

E-16500
September 14, 1998

Ms. Mary Jane Ross-Lee
Spent Fuel Project Office
Division of Industrial and Medical Nuclear Safety
Office of Nuclear Material Safety and Safeguards
Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Subject: Transnuclear Project No. 972, Docket 72-1027

Dear Ms. Ross-Lee:

Enclosed for your review are:

1. One (1) copy of the Responses to RAI 1 dated July 10, 1998
2. One (1) copy of an original affidavit and application for Withholding Proprietary Information From Public Disclosure, E-16498 and E-16499.
3. One (1) controlled copy of the proprietary version of the TN-68 SAR Rev. 1 pages
4. One (1) controlled copy of the nonproprietary version of the TN-68 SAR Rev. 1 pages
5. Document Transmittal Form
6. Review of Compliance with the Standard Review Plan for the TN-68 Application
7. Superseded SAR drawings
8. Record of Changes

As part of this submittal, the drawings presented in Chapter 1 have been revised to meet the guidelines of NUREG-CR-5502, "Engineering Drawing for 10 CFR Part 71 Package Approvals." . Since the submittal of Rev. 0 of the SAR, the Chapter 1 drawings have been revised a few times. The superseded drawings and a record of changes have been included so that the reviewers can understand what changes have been made.

Many of the questions requested that additional analyses be performed to ensure that the analyses presented are conservative. We have incorporated these new analyses into the SAR where possible and the revised pages are attached.

In addition, a few changes have been made to the SAR:

1. The structural, thermal and criticality models have been reevaluated for an increased opening in the basket. The maximum basket opening is 6.08 inches. The thermal model of the fuel assembly and basket opening presented in Appendix 4A is now conservatively

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Therefore, the aluminum alloy SB-221, 6061-T6 can be used to fabricate the basket rails since:

- **NUREG-3854 and 1617 allow materials other than ASME Code materials to be used in the cask fabrication.**
- **The material of construction meets the requirements of ASME Section III, Subsection NG and Code Case N-519.**
- **Additional margin is provided by basing the allowables for the basket rails on S rather than S_m while performing the detailed structural analysis required for Class 1 materials.**

3-8 Provide justification that the fusion welds in the 304 SS cans can be inspected in accordance with Subsection NG requirements.

It is not obvious to the reviewer how these welds will be accessible for inspection after fabrications. On Detail E, dwg. 972-70-5, there appears to be an error. The drawing gives the impression that the square SS tubing is being fusion welded to the poison plates.

The welds between the stainless steel plates and the stainless steel tubes are performed using an automated fusion welding process. This welding process produces a nugget of weld metal with a minimum of 0.20 in^2 weld shear area at the interface of the tubes and the stainless steel plates. The weld fully penetrates the stainless tube wall.

A mechanical test of one test coupon from each welding machine used will verify proper machine settings and operation prior to the start of each working shift. The acceptance criteria are the failure of the base metal prior to failure of the weld area and a physical measurement of the fused weld zone. Weld repairs will be made by approved weld repair procedures.

A 100% visual inspection of the welds is performed in accordance with NG-5260 .

- **Welds located up to 24" from the openings of the basket assembly and directly visible shall be examined by direct visual inspection and meet the acceptance criteria of ASME Code Paragraph NG-5360.**
- **All other welds shall be examined by a remote visual inspection using mirrors and auxiliary lighting. This inspection shall verify the location, configuration and uniformity of the welds.**

Drawing 972-70-5, Rev. 0, detail E, item 33 has been changed to 34. This error is corrected in the enclosed updated drawing.

CHAPTER 4 - THERMAL

The following regulatory requirements are applicable in this chapter: 10CFR72.11, 72.2(c)(3), 72.24(d), 72.122(h)(1), 722.122(1), 72.128(a)(4), 72.236(f), 72.236(g), and