72-1027

TRANSNUCLEAR

May 12, 2006
E-23568

Mr. Jose Cuadrado
Spent Fuel Project Office, NMSS
U. S. Nuclear Regulatory Commission
11555 Rockville Pike M/S 0-6-F-18
Rockville, MD 20852

Subject: TN-68 Updated Final Safety Analysis Report (UFSAR), Revision 3
Docket 72-1027

Dear Mr. Cuadrado:

As required by 10 CFR 72.248, Transnuclear hereby submits the following replacement pages for revision 3 of the TN-68 UFSAR:

Cover Page/ (reverse blank)
Pages 1.1-1 / (1.1-2)
Drawing 972-70-1, rev 7
Drawing 972-70-2, rev 11
Drawing 972-70-3, rev 8
Drawing 972-70-4, rev 7
Drawing 972-70-5, rev 5
Drawing 972-70-6, rev 4
Pages (4.5-3) / 4.6-1
Pages 8.2-2 / (8.3-1)
Table 8.2-1 (Continued) / (Table 8.2-1 (Continued))

Pages in parentheses do not have changes in content, but are included for purposes of double-sided copying. All of the revisions were made under the provisions of 10 CFR 72.48, and have not been previously submitted to the Commission.

I certify that this information accurately represents changes made since the previous submittal dated May 19, 2004.

Sincerely,

Jayant Bondre

Jayant Bondre, PhD
Director of Engineering and Licensing

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Phone: 410-910-6900 • Fax: 410-910-6902

NMSS01

Enclosure: Ten (10) copies of the Replacement Pages for TN-68 UFSAR Revision 3

cc: (without enclosure)

Joseph Sebrosky (SFPO)

Enclosure to E-23568

Ten (10) copies of the Replacement Pages for TN-68 UFSAR Revision 3

List of Changed Pages

Cover Page
Page 1.1-1
Drawing 972-70-1, rev 7
Drawing 972-70-2, rev 11
Drawing 972-70-3, rev 8
Drawing 972-70-4, rev 7
Drawing 972-70-5, rev 5
Drawing 972-70-6, rev 4
Page 4.6-1
Page 8.2-2
Table 8.2-1 (Continued)

TRANSNUCLEAR

TN-68 DRY STORAGE CASK UPDATED FINAL SAFETY ANALYSIS REPORT

Transnuclear, Inc.
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Rev. 3 5/06

CHAPTER 1

GENERAL DESCRIPTION

This Updated Final Safety Analysis Report (UFSAR) (the terms UFSAR, Final Safety Analysis Report (FSAR), and Safety Analysis Report (SAR) are used interchangeably in this document) addresses the safety related aspects of storing spent fuel in TN-68 dry transport/storage casks. The format follows the guidance provided in NRC Regulatory Guide 3.61[1]. The report is intended for review by the NRC under 10CFR72[2]. A second SAR will be submitted to address the safety related aspects of transporting spent fuel in TN-68 casks in accordance with 10CFR71[3].

The TN-68 dry transport/storage cask provides confinement, shielding, criticality control and passive heat removal independent of any other facility structures or components. The cask also maintains structural integrity of the fuel during storage.

It is intended that a Certificate of Compliance under the requirements of 10CFR72 Subpart L be issued such that the casks can be used for the storage of spent fuel in an independent spent fuel storage installation (ISFSI) at power reactor sites under the conditions of a general license in accordance with 10CFR72 Subpart K.

1.1 Introduction

The TN-68 cask accommodates 68 intact BWR fuel assemblies with or without channels. Only intact fuel will be stored in the TN-68 cask. Known or suspected failed fuel assemblies (rods) and fuel with cladding defects greater than pin holes and hairline cracks are not to be stored in the TN-68 cask. It consists of the following components in its storage configuration:

- A basket assembly which locates and supports the fuel assemblies, transfers heat to the cask body wall, and provides neutron absorption to satisfy nuclear criticality requirements.
- A confinement vessel including a closure lid and seals which provides radioactive material confinement and a cavity with an inert gas atmosphere.
- Gamma shielding surrounding the confinement vessel.
- Radial neutron shielding surrounding the gamma shield which provides additional radiation shielding. This neutron shielding is enclosed in an outer steel shell.
- A top neutron shield which rests on the cask lid and provides additional neutron shielding.
- An overpressure system which monitors the pressure between the cask closure seals and provides a positive pressure differential between the seals.
- A protective cover which provides weather protection for the closure lid, top neutron shield and overpressure system.

- Sets of upper and lower trunnions which provide support, lifting and rotation capability for the cask.

The type of fuel to be stored in the TN-68 cask is light water reactor (LWR) fuel of the Boiling Water Reactor (BWR) type. The maximum allowable initial lattice-average enrichment is 3.7% U-235 and the maximum bundle average burnup is 40,000 MWD/MTU. The fuel must be cooled at least 10 years prior to storage. The cask is designed for a maximum heat load of 21.2 kW or 0.312 kW/assembly.

The fuel which may be stored within the TN-68 cask is presented in Table 2.1-4.

The casks are intended for storage on a reinforced concrete pad at a nuclear power plant.

Figure Withheld Under 10 CFR 2.390

N 721027-019	IF	JJD	PS	N/A	SBS
VISIONS	DWN.	CHK'D	M.D.	N.D.	P.E.

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I-68 DRY STORAGE CASK
GENERAL ARRANGEMENT

SAR

ONE CALE	B SIZE	972-70-1 DWG. NO.	7 REV.

Figure Withheld Under 10 CFR 2.390

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REVISIONS	DWN.	CHK'D.	M.D.	N.D.	P.E.

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TN-68 DRY STORAGE CASK
GENERAL ARRANGEMENT
CROSS SECTION & DETAILS

SAR

NONE	B	972-70-2	11
SCALE	SIZE	DWG. NO.	REV.

Figure Withheld Under 10 CFR 2.390

REVISIONS	DWN. CHK'D. M.D. N.O. P.E.
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T.J.N.	
R.S.	
P.S. DES.	
J.N. BY	
T.G.	

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TN-68 DRY STORAGE CASK

LID ASSEMBLY & DETAILS

SAR

SCALE	SIZE	DWG. NO.	REV.
NONE	B	972-70-3	8

Figure Withheld Under 10 CFR 2.390

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TN-68 DRY STORAGE CASK
BASKET
GENERAL ARRANGEMENT

SAR

NONE	B	972-70-4	7
SCALE	SIZE	DWG. NO.	REV.

Figure Withheld Under 10 CFR 2.390

SEE FCN 721027-019	JF		PS	N/A	
REVISIONS	DWN.	CHK'D	M.O.	N.D.	P.E.

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TN-68 DRY STORAGE CASK
BASKET
TYPICAL CROSS SECTION

SAR

NONE	B	972-70-5	5
SCALE	SIZE	DWG. NO.	REV.

Figure Withheld Under 10 CFR 2.390

DATE	REVISIONS	DWN.	CHK'D	M.D.	N.D.	P.E.
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APPROVALS	DATE
.J.N.	11 SEPT. 98
L.R.S.	11 SEPT. 98
S.	11 SEPT. 98
L.N.	11 SEPT. 98
.C.	10 SEPT. 98

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TN-68 DRY STORAGE CASK
PRESSURE MONITORING SYSTEM

SAR

SCALE	SIZE	DWG NO	REV
NONE	B	972-70-6	4

4.5.1.4 Evaluation of Cask Performance During Fire Accident Conditions

It is concluded that the TN-68 maintains containment during the postulated fire accident. The results of the analysis show that no melting of the metallic cask components occurs. The neutron shield will off-gas during the fire event. A pressure relief valve is provided on the outer shell to prevent the pressurization of the outer shell. The shielding integrity of the neutron shielding is assumed to be lost after the fire event and the resulting accident dose rates have been evaluated in Chapter 5. The maximum seal temperature is well below the 536°F long-term limit specified for continued seal function and the fuel cladding temperature is below the short-term limit (Section 4.1) of 1058°F (570°C).

A comparison of the results with the temperature limits is tabulated below:

	Temperature, °F	
Component	**Maximum**	**Limit**
Seal	340	536
Fuel Cladding	550	1058

4.5.2 Buried Cask Thermal Evaluation

The TN-68 cask dissipates heat to the environment by radiation and convection. If the cask is accidentally buried in medium that will not provide the equivalent cooling of natural convection and unrestricted radiation to the environment, component temperatures will increase to a higher steady state condition after long-term burial. Of interest is the containment integrity which is assured as long as the metallic seals remain below 536°F (280°C) and the cavity pressure remains below 100 psig.

The temperature response of the TN-68 cask is evaluated using the cask cross-section thermal model described in Section 4.5.1.1. For this analysis, the cask is assumed to be completely buried in dry soil with such poor heat transfer characteristics that it effectively insulates the cask. The resulting analysis therefore determines the time required to reach limiting temperatures for the containment integrity.

Initial conditions before burial are established by using the steady state temperatures reported for normal conditions of storage. The transient analysis is performed with a cask heat load of 21.2 kW.

The results of the analysis show that if the cask is not uncovered within 12 hours, the neutron shield temperature will exceed the allowable value of 300°F (149 °C). Thereafter, cask body temperatures will reach 536°F (280°C) about 64 hours after burial. At this time the cavity gas temperature is 620 °F (327°C). The cavity pressure, if all fuel fails, will not exceed 100 psig. The fuel temperature loading/unloading limit of 1058°F is reached about 177 hours after burial occurs.

4.6 Thermal Evaluation for Loading/Unloading Conditions

All fuel transfer operations occur when the cask is in the spent fuel pool (with the cask lid removed). The fuel is always submerged in free-flowing pool water permitting heat dissipation. After fuel loading is complete, the cask is removed from the pool, drained and dried. During draining, pressure build-up is not an issue since the cask is vented during this operation.

The loading condition evaluated for the TN-68 would be the heatup of the cask before its cavity can be backfilled with helium. This typically occurs during the performance of the vacuum drying operation of the cask cavity. A transient thermal analysis is performed to predict the heatup time history for the cask components assuming air is in the cask cavity.

Unloading of the cask would require the flooding of the cask prior to the removal of the fuel. A quench analysis of the fuel is performed in Chapter 3 and concludes that the total stress on the cladding as a result of this operation is below the cladding material's minimum yield stress. The pressure evaluation is presented below.

4.6.1 Pressure During Unloading of Cask

To unload the fuel from the cask, flooding of the cask cavity is required. This occurs by first releasing the pressure in the cask to atmospheric conditions followed by introducing water into the cask through the drain port and venting using the vent port. Since fuel temperatures are expected to be above 400°F, flooding of the hot cask will result in steam being generated which if not vented instantly, will result in a higher cavity pressure.

The flow rate of water into the cask during unloading is controlled such that the pressure within the cask stays below the design pressure of 100psig (114.7psia). The initial flow rate used keeps the internal pressure of the cask below 75.3psig (90psia) in the bounding event that all of the flow is evaporated. In the event that the cask internal pressure increases to 75.3psig (90psia) the check valve shuts off the flow of water into the cask preventing the pressure from increasing. See the unloading operations in Section 8.2.

will be set at about 3.0 gallon per minute. With the vent port quick connect fitting removed per Table 8.2-1 step 11, once the pressure falls below 60 psig and is maintained for a period of thirty five minutes, the flow rate can then be gradually increased while monitoring the pressure at the outlet. If the pressure gage reading exceeds 65.6 psig, close the inlet valve until the pressure falls below 60 psig. Reflooding can then be resumed.

The water/steam mixture from the vent port discharge may contain some radioactive material. Gases shall be closely monitored to determine if there is a radiological hazard and appropriately processed. A typical set up for filling the cask is shown in Figure 8.2-1. The flow restriction valve and the monitoring of the exit pressure will ensure that the water vapor pressure generated during unloading does not exceed the cask design pressure.

When the cask is full of water, the fill and drain lines will be removed. The remaining lid bolts will be removed. The cask will then be lowered to the pool bottom where the lid would be removed making the fuel accessible for transfer.

Provided that the TN-68 cask is within its design life, the cask can be reused after unloading. Inspection procedures should verify that the cask is still in its design configuration after unloading.

The TN-68 cask is designed so that it will not need to be opened after it has been closed and leak tested until it is time to unload the fuel.

8.3 Surveillance and Maintenance

Chapters 9 and 12 discuss required surveillance and maintenance of the TN-68 cask. Most required activities are very simple and do not require additional detail here. The most complex surveillance and maintenance operation is overpressure system maintenance, which is discussed below.

The term "switches" in the following refers to switches or transducers, either of which are used to monitor the pressure in the overpressure tank.

Redundant overpressure system switches are mounted on the side of the cask, and communicate with the overpressure tank via stainless steel tubing which penetrates the weather protective cover. Each switch has an isolation valve and an access valve provided for the calibration and maintenance procedure. The access valve outside port may have a capped fitting or a quick connect fitting.

To verify the functioning of the switches, a Channel Operational Test (COT) shall be performed. A helium pressure source and the appropriate test equipment is required. A typical procedure outline is provided below.

a) Close the isolation valve.

b) Remove the cap from the access valve, and connect the test equipment while maintaining a slow helium purge.

c) Pressurize test manifold to about 75 psig from the helium cylinder, then isolate the helium source and open the access valve.

d) Open the bleed down valve, and reduce the pressure slowly (Radioactive gases are not expected. However, provisions should be made to prevent any potential releases). For transducers, verify the pressure reading on the transducers against the reference gauge at a number of points. For both switches and transducers, verify that the alarm is actuated at the correct pressure.

e) Adjust the set point or calibrate as required and repeat the above test.

f) Repressurize the manifold with helium to the original system pressure (73.5 psig), close the access valve, disconnect the test equipment, cap the access valve, and open the isolation valve.

g) Repeat the procedure for the second switch if in service.

h) If replacement of a switch is required, the switch must be leak tested after installation.

TABLE 8.2-1
SEQUENCE OF OPERATIONS - UNLOADING
(Continued)

10. In accordance with site requirements, vent cavity gas through the hose until atmospheric pressure is reached.

11. Remove vent port quick disconnect and drain port cover. Attach vent port adapter.

12. Loosen lid bolts and remove all but 6 approximately equally spaced lid bolts.

13. Attach cask to crane using lift beam. Attach lid lifting equipment.

14. Attach fill and drain lines to the drain quick disconnect coupling and the vent port adapter.

15. Ensure appropriate measures are in place to ensure proper handling of steam. Both fill and drain lines should be designed for steam at 100 psig minimum to prevent steam burns and radiation exposures due to line failure.

16. Lower cask into spent fuel pool/cask pit while spraying exterior of cask with demineralized water to minimize contamination. Lower until the cask top surface is just above the water level. Note: The cask may be filled before lowering the cask into the pool or with the cask partially submerged in the spent fuel pool.

C. Cask Loading Pool

Note: In BWR spent fuel pools, there may be significant amounts of fuel crud particulate material. Precautions should be taken to ensure that this particulate does not become airborne or become a radiation concern due to material floating on the surface of the water. Precautions may include enhanced filtering of the pool water during loading and unloading operations, increased ventilation and monitoring airborne contamination during all spent fuel pool activities.

1. Begin pumping pool or demineralized water into the cask through the drain port at a rate no more than 3 gpm while continuously monitoring exit pressure (See Setup shown in Figure 8.2-1). Continue pumping at a rate up to 3 gpm for at least thirty five minutes. By this time, the water level in the cask will have reached the active fuel length.

2. The flow rate can then be gradually increased while monitoring the pressure at the outlet. If the pressure gage reading exceeds 65.6 psig, close the inlet valve until the pressure falls below 60 psig. Reflooding can then be resumed.

TABLE 8.2-1
SEQUENCE OF OPERATIONS - UNLOADING
(Continued)

3. Take a grab sample for chemistry analysis.

4. When the cask is full of water, remove the hose from the drain port and the hose and vent port adapter from the vent port. Remove the remaining 6 lid bolts.

5. Lower the cask and place it on the bottom of the pool/pit while rinsing the lift beam with demineralized water.

6. Raise the lift beam from the cask removing the cask lid.

7. Unload spent fuel assemblies in accordance with site procedures.