NON-PROPRIETARY

TN-68 DRY STORAGE CASK UPDATED FINAL SAFETY ANALYSIS REPORT

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REVISION LOG SHEET

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2	5/19/2004	FCN-01-001 FCN-02-023 FCN-02-074	Dwg 972-70-2 Rev-10 Page 3.1-4 Table 3.3-6
3	5/12/2006	FCN 721027-011 FCN 721027-012 FCN 721027-015 FCN 721027-018 FCN 721027-019	Dwg 972-70-1 Rev-7 Dwg 972-70-2 Rev-11 Dwg 972-70-3 Rev-8 Dwg 972-70-4 Rev-7 Dwg 972-70—5 Rev-5 Dwg 972-70-6 Rev-4 Pages 1.1-1, 4.6-1, 8.2-2 Table 8.2-1 (Continued)
4	5/12/2008	FCN 721027-020 FCN 721027-021	See list of changed pages
5	5/12/2010	FCN 721027-025	Pages 4.8-1, 4.8-1a, 4.13-2
6	5/14/2012	FCN 721027-029 FCN 721027-031 FCN 721027-033 FCN 721027-035	Page 1.4-1 Table 8.1-1 (Continued)
7	5/14/2014	FCN 721027-030 FCN 721027-036 FCN 721027-037 FCN 721027-039 FCN 721027-040	See List of Effective Pages
8	*5/12/2016*	*FCN 721027-048* *FCN 721027-056* *FCN 721027-061* *FCN 721027-062*	*See List of Effective Pages*

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Fig. 6.4-1	0	2/00
Fig. 6.4-2	0	2/00
Fig. 6.4-3	0	2/00
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Fig. 7.1-2	0	2/00
Fig. 7.1-3	0	2/00
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Fig. 8.2-1	0	2/00
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ALL DIMENSIONS ARE NOMINAL UNLESS A SPECIFIC TOLERANCE IS INDICATED WITH THE DRAWING DIMENSION

DIMENSIONS ARE IN INCHES AND DEGREES UNLESS OTHERWISE SPECIFIED. DIMENSIONING IN ACCORDANCE WITH ANSI Y14.5M-2009.

INTERPRET WELD SYMBOLS

AREVA

SAFETY ANALYSIS REPORT
TN-68 DRY STORAGE CASK
GENERAL ARRANGEMENT

DRAWING NO.	SCALE	SHEET
972-70-1	NONE	1 OF 1

SECURITY RELATED INFORMATION
WITHHELD UNDER 10 CFR 2.390

REVISION	DESCRIPTION	DATE
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11	SEE DCR 721027-072 AND FCN 721027-019	05/12/08

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INTERPRET WELD SYMBOLS

AREVA

SAFETY ANALYSIS REPORT

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

DRAWING NO.	SCALE	SHEET
972-70-2	NONE	1 OF 1

SECURITY RELATED INFORMATION
WITHHELD UNDER 10 CFR 2.390

REVISION	DESCRIPTION	DATE
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INTERPRET WELD SYMBOLS

AREVA

SAFETY ANALYSIS REPORT
TN-68 DRY STORAGE CASK
LID ASSEMBLY & DETAILS

DRAWING NO.	SCALE	SHEET
972-70-3	NONE	1 OF 1

SECURITY - RELATED INFORMATION
WITHHELD PURSUANT TO 10 CFR 2.390

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INTERPRETATION OF WELD SYMBOLS PER ANSI / AWS 2.4

TRANSNUCLEAR
AN AREVA COMPANY

SAFETY ANALYSIS REPORT
TN-68 DRY STORAGE CASK
DAMAGE FUEL
ASSEMBLY

DRAWING NO.	SCALE	SHEET
972-70-7	NONE	1 OF 1

TABLE 2.3-1

CLASSIFICATION OF COMPONENTS

IMPORTANT TO SAFETY	NOT IMPORTANT TO SAFETY
Confinement Vessel including Lid, Flange, Inner Confinement Shell and Bottom Confinement Plate	Drain Tube
Cask Body Shell	Hansen Couplings
Cask Body Bottom	Pressure Monitoring System
Lid Shield Plate	Protective Cover, Bolts, Seal, *Washers*, and Threaded Inserts
Lid Bolts and Threaded Inserts	Basket Shear Key
Lid Seals	Fuel Spacers
Lid Vent, Drain, and Overpressure Covers, Bolts, and Gaskets	Basket Rail Shims
Basket Assembly including fuel compartments, poison plates, and structural plates	Security Wire & Seals
Trunnions, Trunnion Bolts, and Trunnion Cover Screws	Lid Alignment Pins
Radial Neutron Shield	Top Neutron Shield including Bolts and Washers
Outer Shell	Shield Ring
Shim (between shield shell and flange)	Pressure Relief Valve (on outer shell)
Basket Holddown	Basket rail studs, nuts, & washers
Basket Rails	

The cask exterior carbon steel components is protected from corrosion by the paint (*high solids epoxy, polysiloxane or* epoxy, acrylic urethane or equivalent). The interior is protected by the helium environment inside the cask. The aluminum, carbon steel, and stainless steel components are not subject to significant corrosion as discussed in Section 3.4.1.

Studies have been conducted to show that neither of the neutron absorber materials used in the basket will degrade significantly as both have excellent resistance to thermal and radiation alteration in the service environments of interest to this application.

Non-metallic components:

The radial neutron shield resin is a proprietary reinforced polymer. Appendix 9A provides information on the composition and the radiation and temperature resistance of the resin. Polyester is inert with respect to water, and the fire retardant mineral fill makes it self-extinguishing. Furthermore, the resin is contained in aluminum tubes inside a steel shell, so that the material is retained in place, and isolated from both water and from sources of ignition.

Elastomer o-rings or gaskets in the weather cover, quick disconnects, drain tube, and pressure relief valve are not important to safety. The quick disconnects are not part of the confinement boundary.

Stem tips on overpressure system valves are Kel-F or similar material, and are not important to safety; at the valve locations, the radiation level and temperatures are low.

Paint is subject to routine maintenance and touch-up. Radiation levels and temperature on the cask exterior are not high enough to damage the paint. This is confirmed by dry cask experience.

The top neutron shield (polypropylene) is Not Important to Safety. Polypropylene is slow burning to non-burning according to Table 24, Section 1 of the Handbook of Plastics and Elastomers[23]. Polypropylene is inert with respect to water. Furthermore, the weather protective cover isolates the top neutron shield material from sources of ignition and from water.

3.4 General Standards for Casks

3.4.1 Chemical and Galvanic Reactions

The materials of the TN-68 cask have been reviewed to determine whether chemical, galvanic or other reactions among the materials, contents and environment might occur during any phase of loading, unloading, handling or storage. This review is summarized below:

The TN-68 cask components are exposed to the following environments:

- During loading and unloading, the casks are submerged in pool water. For BWR plants the pool water is deionized. This affects the interior and exterior surfaces of the cask body, lid and the basket. The protective cover, the top neutron shield, and the overpressure system are not submerged in the spent fuel pool. The casks are only kept in the spent fuel pool for a short period of time, typically about 6 hours to load or unload fuel, 1 - 2 hours to drain, and another 8 - 10 hours to completely dry, evacuate and backfill the cask with helium.

- During handling and storage, the exterior of the cask is exposed to normal environmental conditions of temperature, rain, snow, etc. All of the exterior surfaces with the exception of stainless steel components are protected from environmental exposure by *high solids epoxy, polysiloxane or* a polyamide enamel epoxy coating. The paint is touched up periodically if there are any areas which peel or otherwise deteriorate. Therefore, the cask exterior is protected from chemical, galvanic or other reactions during storage.

- During storage, the interior of the cask is exposed to an inert helium environment. The helium environment does not support the occurrence of chemical or galvanic reactions because both moisture and oxygen must be present for a reaction to occur. The cask is thoroughly dried before storage by a vacuum drying process. It is then sealed and backfilled with helium, thus stopping corrosion. Since the cask is vacuum dried, galvanic corrosion is also precluded since there is no water present at the point of contact between dissimilar metals.

- The radial neutron shielding materials and the aluminum resin boxes are sealed during all normal operations. The amount of oxygen in the sealed region is very small. The resin material is inert after it has cured and does not affect the aluminum boxes or the carbon steel housing.

3.4.1.1 Cask Interior

The TN-68 cask materials are shown in the Parts List on Drawing 972-70-2. The confinement vessel is made from SA-203 Grade E and SA-350 LF3. This low-alloy carbon steel is uncoated.

All sealing surfaces are stainless steel clad by weld overlay.

Within the cask cavity, there are basket rails made from 6061-T6 aluminum. The cask basket is assembled from SA-240, Type 304 stainless steel boxes which are joined together by a

steel [19]. Thus, the combination of low chlorides, low temperature and short time of exposure to the corrosive environment eliminates the possibility of stress corrosion cracking in the basket welds.

The chloride content of all expendable materials which come in contact with the basket materials are restricted and water used for cleaning the baskets is restricted to 1.0 ppm chloride.

Behavior of Aluminum Based Neutron Poison in Deionized Water

The aluminum component of the borated aluminum is a ductile metal having a high resistance to corrosion. Its corrosion resistance is provided by the buildup of a protective oxide film on the metal surface when exposed to a corrosive environment. As stated above for aluminum, once a stable film develops, the corrosion process is arrested at the surface of the metal. The film remains stable over a pH range of 4.5 to 8.5.

Tests were performed by Eagle Picher[14] which concluded that borated aluminum exhibits a strong corrosion resistance at room temperature in deionized water. Satisfactory long-term usage in these environments is expected. At high temperature, the borated aluminum still exhibits high corrosion resistance in the pure water environment.

From tests on pure aluminum, it was found that borated aluminum was more resistant to uniform corrosion attack than pure aluminum.

The alternate neutron poison material is a boron carbide / aluminum composite. The billet is produced by blending of aluminum and boron carbide powders, cold isostatic compacting, and vacuum sintering. The plates are formed from the billet by rolling or extrusion. The result is a matrix of full-density aluminum with a fine dispersion of boron carbide particles throughout. The corrosion behavior is similar to that of the base aluminum alloy.

There are no chemical, galvanic or other reactions that could reduce the areal density of boron in the TN-68's neutron poison plates with either of the poison plate materials.

3.4.1.2 Cask Exterior

The exterior of the cask is carbon steel. The exterior of the cask, with the exception of the trunnion bearing surfaces is painted using *high solids epoxy, polysiloxane or* an epoxy, acrylic urethane, or equivalent enamel coating with the appropriate primer. The paint should be compatible with the pool water and easy to decontaminate.

The paint is visually inspected prior to installation of the cask in the spent fuel pool and periodically during storage. Touch up painting is performed if the paint deteriorates.