## Allen, William

**From:** Tom Szymanski (Generation - 6) <tom.szymanski@dominionenergy.com>
**Sent:** Wednesday, June 14, 2017 9:33 AM
**To:** Allen, William
**Subject:** [External_Sender] Proposed Clean TS Pages
**Attachments:** Proposed TS HBU Cask - Clean (2017 06 12).pdf

Chris,

I know we spoke about waiting for your reviewer(s) to finish before sending these to you, but just in case there are no additional changes please find attached the clean TS pages proposed for the HBU cask at NAPS. If there are no further changes, you can use these. If there are changes, just delete.

Tom

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North Anna ISFSI Amendment 5 Technical Specification Page Changes

| Remove Page | Insert Revised Page |
|---|---|
| iii | iii |
| 2.0-2 | 2.0-2 |
| 2.0-3 | 2.0-3 |
| 2.0-4 | 2.0-4 |
| 2.0-5 | 2.0-5 |
| 2.0-8 | 2.0-8 |
| 3.1.2-2 | 3.1.2-2 |
| 3.1.3-1 | 3.1.3-1 |
| 3.3.1-1 | 3.3.1-1 |
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Table 2.1-1 (page 1 of 2)
Fuel Assembly Limits

| SSSC Model | LIMIT |
|---|---|
| 1. TN-32 | |
| a. Initial Enrichment | ≤ 4.30 wt. % |
| b. Average Burnup | ≤ 45,000 MWD/MTU |
| c. Cooling Time After Discharge | See Figure 2.1-1 |
| d. Decay Heat Including BPRA/TPD | ≤ 1.02 kW/assembly |
| e. Fuel Assembly Design | Westinghouse 17 x 17 Standard<br>Westinghouse 17 x 17 Vantage 5H |
| f. Fuel Assembly Inserts | Fuel assemblies may contain burnable poison rod assemblies (BPRAs) and/or thimble plugging devices (TPDs) |
| g. Fuel Assembly Weight, Including BPRA/TPD | ≤ 1,533 pounds |
| h. Cooling Time After Shutdown for BPRAs in TN-32 Dry Storage Casks | See Figure 2.1-2 |
| i. Cooling Time After Shutdown for TPDs in TN-32 Dry Storage Casks | See Figure 2.1-3 |
| j. Fuel Assembly Initial Uranium Content | ≤ 467.1 KgU/assembly |
| 2. TN-32B HBU | |
| a. Initial Enrichment | ≤ 4.60 wt. % (Areva Advanced Mark BW)<br>≤ 3.64 wt. % (Westinghouse Standard)<br>≤ 4.50 wt. % (Westinghouse Vantage 5H) |
| b. Average Burnup | ≤ 60 GWD/MTU |
| c. Zone Heat Load Limits | See Figure 2.1-4 |
| d. Decay Heat | ≤ 32.934 kW |
| e. Fuel Assembly Design | Areva Advanced Mark BW (AMBW)<br>Westinghouse Standard (LOPAR)<br>Westinghouse Vantage 5H (NAIF) |

Table 2.1-1 (page 2 of 2)
Fuel Assembly Limits

| SSSC Model | LIMIT |
|---|---|
| f. Fuel Assembly Inserts | Poison Rod Assemblies (unirradiated) |
| g. Fuel Assembly Weight Including PRA | ≤ 1551 pounds |
| h. Fuel Assembly Initial Uranium Content | ≤ 469.0 KgU/assembly |

Table 2.2-1 (page 1 of 1)
Decay Heat Load Methodology for Fuel Stored in TN-32B HBU Cask

| |
|---|
| The ORIGEN-ARP code of the SCALE 6.0 computer code package, or later, is to be used to determine the individual fuel assembly decay heat load for the zone loading represented in Figure 2.1-4. |

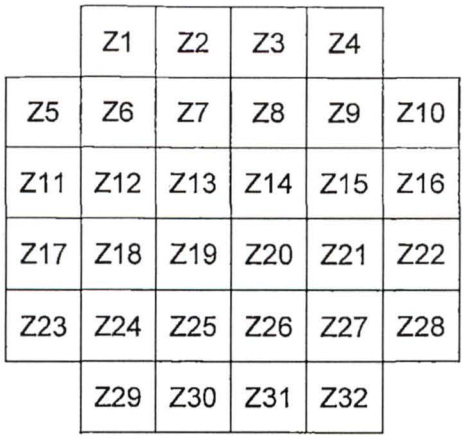
Figure 2.1-1
Minimum Acceptable Cooling Time in Years
As a Function of Burnup and Initial Enrichment
(For TN-32 Casks)

| Initial Enrichment (wt % U-235) (1) | Burnup (GWD/MTU) (2) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 20 | 30 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
| 1.2 | 7 | 7 | | | | | | | | | | | | | | | |
| 1.3 | 7 | 7 | | | | | | | | | | | | | | | |
| 1.4 | 7 | 7 | | | | | | | | | | | | | | | |
| 1.5 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 9 | | | | | | | | | |
| 1.6 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 9 | 9 | | | | | | |
| 1.7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 10 | | | | | |
| 1.8 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 9 | 10 | | | | | |
| 1.9 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 9 | 10 | 10 | | | |
| 2.0 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 10 | 10 | | |
| 2.1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 9 | 10 | 10 | | |
| 2.2 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 9 | 10 | 10 | |
| 2.3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 9 | 10 | 10 | |
| 2.4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 10 | 10 |
| 2.5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 10 |
| 2.6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 9 | 9 | 10 |
| 2.7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 9 | 9 | 9 |
| 2.8 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 9 | 9 | 9 |
| 2.9 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 9 | 9 |
| 3.0 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 |
| 3.1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 |
| 3.2 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 |
| 3.3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 |
| 3.4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 |
| 3.5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 3.6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 3.7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 3.8 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 3.9 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 4.0 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 4.1 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 4.2 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 4.3 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |

■ - not evaluated

(1) Round actual value down to next lower tenth.
(2) Round actual value up to next higher Gwd/Mtu.

Figure 2.1-4
Zone Heat Load Limits for TN-32B HBU Cask




| Zone No. | Heat Load Limit (W)[1] | Zone No. | Heat Load Limit (W)[1] |
|---|---|---|---|
| 1 | 960 | 17 | 1045 |
| 2 | 1047 | 18 | 1276 |
| 3 | 962 | 19 | 968 |
| 4 | 853 | 20 | 664 |
| 5 | 858 | 21 | 1280 |
| 6 | 1111 | 22 | 1010 |
| 7 | 1287 | 23 | 982 |
| 8 | 1263 | 24 | 963 |
| 9 | 1043 | 25 | 1278 |
| 10 | 853 | 26 | 1277 |
| 11 | 834 | 27 | 1061 |
| 12 | 1279 | 28 | 965 |
| 13 | 581 | 29 | 970 |
| 14 | 1115 | 30 | 1035 |
| 15 | 1267 | 31 | 977 |
| 16 | 1009 | 32 | 861 |
| **Total Heat Load (kW)** | | | **32.934** |

[1] Refer to Table 2.2-1 for decay heat calculation method to be used when making comparisons to limits

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| C. Required Action A.2 and Associated Completion Time not met. | C.1 Remove all fuel assemblies from the SSSC. | 30 days |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.1.2.1 | Verify SSSC helium backfill pressure is within limit. | ------NOTE------<br>SR 3.0.2 is not applicable.<br>----------<br><br>Within 6 hours after verifying SSSC cavity vacuum drying pressure is within limit<br><br>AND<br><br>Within every 96 hours thereafter until LCO 3.1.3 is met |

## 3.1 SSSC INTEGRITY

### 3.1.3 SSSC Combined Helium Leak Rate

LCO 3.1.3 The SSSC combined helium leak rate for all closure seals and overpressure system shall not exceed the limit specified in Table 3-1 for the applicable SSSC design.

APPLICABILITY: During LOADING OPERATIONS.

ACTIONS

- - - - - - - - - - - - - - - - - - - - NOTE - - - - - - - - - - - - - - - - - - - -
Separate Condition entry is allowed for each SSSC.
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. SSSC helium leak rate limit not met. | A.1 Establish SSSC helium leak rate within limit. | 48 hours |
| B. Required Action and Associated Completion Time not met. | B.1 Remove all fuel assemblies from the SSSC. | 30 days |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.1.3.1 | Verify SSSC combined helium leak rate is within limit. | ------NOTE------<br>SR 3.0.2 is not applicable.<br>----------<br>In accordance with Table 3-1, "SSSC Model-Dependent Limits" |

## 3.3 SSSC RADIATION PROTECTION

### 3.3.1 SSSC Average Surface Dose Rates for TN-32 Casks

LCO 3.3.1 The average surface dose rates of each SSSC shall not exceed:

b. 218 mrem/hour (neutron + gamma) on the side; and

b. 58 mrem/hour (neutron + gamma) on the top.

APPLICABILITY: During LOADING OPERATIONS.

ACTIONS

- - - - - - - - - - - - - - - - - - - - NOTE - - - - - - - - - - - - - - - - - - - -
Separate Condition entry is allowed for each SSSC.
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. SSSC average surface dose rate limits not met. | A.1 Administratively verify correct fuel loading.<br><br>AND<br><br>A.2 Perform analysis to verify compliance with the ISFSI offsite radiation protection requirements of 10 CFR Part 20 and 10 CFR Part 72. | 24 hours<br><br>Prior to TRANSPORT OPERATIONS |
| B. Required Action and Associated Completion Time not met. | B.1 Remove all fuel assemblies from the SSSC. | 7 days |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.3.1.1 | Verify average surface dose rates of SSSC containing fuel assemblies are within limits. | Prior to TRANSPORT OPERATIONS |

## 3.3 SSSC RADIATION PROTECTION

### 3.3.2 SSSC Average Surface Dose Rates for TN-32B HBU Cask

LCO 3.3.2 The average surface dose rates of each SSSC shall not exceed:

a. 218 mrem/hour (neutron + gamma) on the side; and

b. 96.1 mrem/hour (neutron + gamma) on the top.

APPLICABILITY: During LOADING OPERATIONS.

ACTIONS

NOTE

Separate Condition entry is allowed for each SSSC.

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. SSSC average surface dose rate limits not met. | A.1 Administratively verify correct fuel loading.<br><br>AND<br><br>A.2 Perform analysis to verify compliance with the ISFSI offsite radiation protection requirements of 10 CFR Part 20 and 10 CFR Part 72. | 24 hours<br><br>Prior to TRANSPORT OPERATIONS |
| B. Required Action and Associated Completion Time not met. | B.1 Remove all fuel assemblies from the SSSC. | 7 days |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.3.2.1 | Verify average surface dose rates of SSSC containing fuel assemblies are within limits. | Prior to TRANSPORT OPERATIONS |

## 3.3 SSSC RADIATION PROTECTION

### 3.3.3 SSSC Surface Contamination

LCO 3.3.3 Removable contamination on the SSSC exterior surfaces shall not exceed:

a. 1000 dpm/100 $cm^2$ from beta and gamma sources; and

b. 20 dpm/100 $cm^2$ from alpha sources.

APPLICABILITY: During LOADING OPERATIONS.

ACTIONS

NOTE

Separate Condition entry is allowed for each SSSC.

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. SSSC removable surface contamination limits not met. | A.1 Restore SSSC removable surface contamination to within limits. | Prior to TRANSPORT OPERATIONS |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.3.3.1 | Verify that the removable contamination on exterior surfaces of SSSC containing fuel assemblies is within limits. | Prior to TRANSPORT OPERATIONS |

Table 3-1 (page 1 of 1)
SSSC Model-Dependent Limits

| SSSC MODEL | LIMITS |
|---|---|
| 1. TN-32 | |
| a. Cavity Vacuum Drying Pressure | $\leq$ 4 mbar held for 30 minutes |
| b. Helium Backfill Pressure | 2230 mbar $\pm$ 100 mbar |
| c. Combined Helium Leak Rate | $\leq 1.0 \times 10^{-5}$ mbar-liter/sec |
| d. SSSC Inter-seal Pressure | $\geq$ 3250 mbar |
| e. Dissolved Boron Concentration | $\geq$ 2500 ppm |
| f. Maximum Lifting Height | eighteen inches |
| g. Low Pressure Alarm Setting of SSSC Inter-Seal Pressure Monitoring Device | > 3250 mbar absolute |
| h. Frequency to Verify Surveillance Requirement 3.1.3.1 is Within Limit | 48 hours |
| 2. TN-32B HBU | |
| a. Cavity Vacuum Drying Pressure | $\leq$ 4 mbar held for 30 minutes |
| b. Helium Backfill Pressure | 2230 mbar $\pm$ 100 mbar |
| c. Combined Helium Leak Rate | $\leq 1.0 \times 10^{-5}$ mbar-liter/sec |
| d. SSSC Inter-seal Pressure | $\geq$ 3250 mbar |
| e. Dissolved Boron Concentration | $\geq$ 2500 ppm |
| f. Maximum Lifting Height | eighteen inches |
| g. Low Pressure Alarm Setting of SSSC Inter-Seal Pressure Monitoring Device | > 3250 mbar absolute |
| h. Frequency to Verify Surveillance Requirement 3.1.3.1 is Within Limit | 23 days |

# 4.0 DESIGN FEATURES

## 4.1 Site

### 4.2.2 Site Location

The North Anna ISFSI is located approximately 2000 feet southwest of the North Anna Power Station Units 1 and 2 protected area and within the boundaries of the North Anna site. The North Anna site is located in the north-central portion of Virginia in Louisa County and is approximately 40 miles north-northwest of Richmond, 36 miles east of Charlottesville; 22 miles southwest of Fredericksburg; and 70 miles southwest of Washington, D.C. The site is on a peninsula on the southern shore of Lake Anna at the end of State Route 700.

## 4.3 Storage Features

### 4.2.1 Storage Cask

The North Anna ISFSI is licensed to store spent fuel in the TN-32 dry storage cask and a single TN-32B HBU Dry Storage Cask.

### 4.2.2 Storage Capacity

The total storage capacity of the North Anna ISFSI is limited to 839.04 metric tons uranium.

### 4.2.3 Storage Pad

The North Anna ISFSI storage pad is reinforced concrete, with nominal dimensions of 224 feet x 32 feet x 2 feet thick with a 40-foot ramp on each end for vehicle access. The pad is designed to store 28 SSSCs arranged in two rows. The SSSCs in each row will be spaced a minimum of 14 feet apart center to center. Each row of SSSCs will be spaced a minimum of 14 feet apart center to center. For SSSCs whose heat load exceeds 27.1 KW the spacing shall be a minimum of 16 feet apart center to center. The facility will have up to three storage pads.

### 4.2.4 Criticality

The boron content of the SSSC basket poison material shall have a minimum areal density of 10 mg boron-10/$cm^2$. Fabrication testing to ensure the minimum areal density of the basket poison material is met is outlined in the North Anna ISFSI FSAR.