VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

~~Proprietary Information – Withhold Under 10 CFR 2.390~~

August 24, 2015

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Director, Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety and Safeguards
Washington, D. C. 20555-0001

Serial No. 15-369
NL&OS/TJS R0
Docket No. 72-16
License No. SNM-2507

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION (NAPS) INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI)
LICENSE AMENDMENT REQUEST REGARDING PROPOSED ISFSI TECHNICAL SPECIFICATION CHANGES TO ALLOW STORAGE OF INCREASED MAXIMUM ENRICHMENT AND BURN-UP FUEL IN A MODIFIED TN-32B STORAGE CASK

Pursuant to 10CFR72.56, Virginia Electric and Power Company (Dominion) requests an amendment, in the form of revisions to the Technical Specifications to License Number SNM-2507 for the NAPS ISFSI. The proposed changes would allow storage of spent fuel in a modified TN-32B bolted lid cask as part of the High Burn-up Dry Storage Cask Research and Development Project sponsored by the Department of Energy (DOE) and the Electric Power Research Institute (EPRI). Data gathered from the cask will be used to confirm the effects of long-term dry storage on high burn-up assemblies.

The fuel proposed for storage in the TN-32B cask would have a higher initial enrichment and burn-up than currently specified in the NAPS ISFSI Technical Specifications. A discussion of the proposed Technical Specification changes is provided in Attachment 1.

The proposed Technical Specification changes have been reviewed and approved by the NAPS Facility Safety Review Committee. Marked-up Technical Specifications and revised Technical Specifications that reflect the proposed changes are provided in Attachments 2 and 3, respectively.

The TN-32B cask is scheduled to be loaded at NAPS in the summer of 2017. To support the planned loading of this cask, Dominion requests the NRC complete its review of the proposed Technical Specification changes by January 31, 2017.

Supporting documentation in the form of a Design/Licensing Basis Document developed by AREVA Inc. is included with this submittal as Attachment 4. Attachment 4 contains information that is proprietary to AREVA, Inc. This is supported by an affidavit (Attachment 5) signed by a management representative of AREVA, Inc. This affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses the considerations listed in 10CFR2.390. Accordingly, it is requested that Attachment 4 of this letter, which contains information proprietary to AREVA, Inc., be

Attachment 4 contains information that is being withheld from public disclosure under 10 CFR 2.390. Upon separation from the attachment, this letter is decontrolled.

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withheld from public disclosure in accordance with 10CFR2.390. In compliance with the guidelines of NUREG-0390, a copy of Attachment 4 in which the proprietary information has been redacted is provided as Attachment 6.

If you have any questions or require additional information, please contact Mr. Thomas Szymanski at (804) 273-3065.

Sincerely,

Mark D. Sartain
Vice President – Nuclear Engineering

Vicki L. Hull
NOTARY PUBLIC
Commonwealth of Virginia
Reg. # 140542
My Commission Expires May 31, 2018

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Mark D. Sartain, who is Vice President – Nuclear Engineering, of Virginia Electric and Power Company. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 24TH day of August, 2015.

My Commission Expires: May 31, 2018.

Notary Public

Commitments made in this letter: None

Attachments:

1. Discussion of Change
2. Technical Specification Pages (Mark-ups)
3. Technical Specification Pages (Clean)
4. AREVA Proprietary Document E-42038
5. AREVA Proprietary Affidavit
6. AREVA Document E-42038 (REDACTED)

cc: U.S. Nuclear Regulatory Commission
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Attachment 1

Discussion of Change

North Anna Power Station
Independent Spent Fuel Storage Installation
Virginia Electric and Power Company
(Dominion)

1.0 Summary Description

Pursuant to 10 CFR 72.56, Virginia Electric and Power Company (Dominion) is proposing an amendment in the form of changes to the Technical Specifications (TS) to the Independent Spent Fuel Storage Installation (ISFSI) License SNM-2507 for North Anna Power Station (NAPS).

The proposed change would revise the ISFSI License to allow storage of spent fuel in a modified TN-32B bolted lid cask, as part of the High Burnup Dry Storage Cask Research and Development Project sponsored by the Department of Energy (DOE) and the Electric Power Research Institute (EPRI). This particular cask will be referred to herein as the sealed surface storage cask (SSSC) model "TN-32B HBU." The pre-existing TN-32 casks already licensed in SNM-2507 will be identified by the SSSC model "TN-32."

Internal temperatures in the TN-32B HBU cask will be monitored for the duration of the project, subject to continued acceptable performance of installed thermocouple temperature monitors. The data obtained from these instruments will be used to confirm the effects of long-term dry storage on high burnup fuel assemblies. The TN-32B HBU cask is scheduled to be loaded in 2017, stored onsite at NAPS until such time that it is transferred to a fuel examination facility capable of storing and handling the cask and fuel for further examination.

The proposed TS changes have been reviewed, and determined to not involve a significant hazards consideration as set forth in 10 CFR 50.92 and accordingly, a finding of "no significant hazards consideration" is justified. In addition, it has been determined that the changes are eligible for categorical exclusion from an environmental assessment as set forth in 10 CFR 51.22(c)(6); therefore, no environmental impact statement or environmental assessment is needed in connection with the approval of the proposed TS changes.

2.0 Detailed Description of Proposed Technical Specification Changes

The following changes to the NAPS ISFSI TS are proposed:

1. Functional and Operating Limits
    - Table 2.1-1, Fuel Assembly Limits
        - An additional page is added to Table 2.1-1 to reflect TN-32B HBU cask fuel assembly limits. All limits from the original Table 2.1-1 are defined for the TN-32B HBU cask with the exception of cooling time after shutdown for the Burnable Poison Rod Assemblies (BPRAs) and Thimble Plugging Devices (TPDs) identified for TN-32 casks. No BPRAs or TPDs are to be stored in the TN-32B HBU cask.
    - Table 2.2, Decay Heat Load Methodology for Fuel Stored in TN-32B HBU Cask
        - This table is added to prescribe the decay heat load calculation method for use in Figure 2.1-4. This is the same method that is used for the NRC

approved CoC 1030 NUHOMS HD storage system, which also includes applicability to high burn-up fuel.

- o Figure 2.1-1, Minimum Acceptable Cooling Time in Years As a Function of Burnup and Initial Enrichment
  - A parenthetical statement is added to the title of this figure to show that it only applies to the TN-32 casks, not the TN-32B HBU cask.
- o Figure 2.1-4, Zone Heat Load Limits for TN-32B HBU Cask
  - This figure is added to establish the cooling time requirements for fuel to be stored in the TN-32B HBU cask.

2. Limiting Condition for Operation

- o Surveillance Requirement (SR) 3.1.2.1, Verify SSSC helium backfill pressure is within limit.
  - An "AND" logical connector is added to verify SSSC helium backfill pressure is within the limit every subsequent 96 hour interval after the initial 6-hour frequency is met. This is to ensure that the helium backfill pressure is maintained within the limit even during the extended period (sometimes referred to as the thermal soak period) of thermal testing and cavity gas testing that will be conducted after vacuum drying.
- o Surveillance Requirement (SR) 3.1.3.1, Verify SSSC combined helium leak rate is within limit.
  - The specification frequency for verifying the combined helium leak rate is within the limit is relocated to Table 3-1, under the applicable SSSC model. There is no change to this frequency for TN-32 casks. However, for the TN-32B HBU cask, the frequency requirement is increased to allow for thermal testing and cavity gas testing. The combined helium leak rate test for the TN-32B HBU cask will be completed within 23 days after satisfactorily completing the initial helium backfill pressure test (i.e., within 6 hours after completing the vacuum dryness test). Twenty-three days allows for 21 days of thermal soak, plus 48 hours to complete the combined helium leak test.
- o Specification 3.3.1, SSSC Average Surface Dose Rates
  - This specification is changed to read, "SSSC Average Surface Dose Rates for TN-32 Casks," to clarify that it pertains only to TN-32 casks.

- o Specification 3.3.2, SSSC Average Surface Dose Rates for TN-32B HBU Cask
  - LCO 3.3.2 is added to reflect a different dose rate limit pertaining to the top of the TN-32B HBU cask. The Required Actions and Surveillance Requirement are the same as those identified for Specification 3.3.1.
- o Specification 3.3.2, SSSC Surface Contamination
  - The numbering for this specification is changed to 3.3.3, but is otherwise unchanged from the previously approved limits. This specification will apply to both the TN-32 casks and the TN-32B HBU cask.
- o Table 3-1, SSSC Model-Dependent Limits
  - An additional SSSC model, the TN-32B HBU cask, is added to the table. All limits from the original Table 3-1 are defined for the TN-32B HBU cask. In addition, the surveillance frequency for performance of SR 3.1.3.1 is added for each design (Item h). This parameter is defined as 48 hours for the TN-32 cask and 23 days for the TN-32B HBU cask.

3. Design Features
   - o Section 4.2.1, Storage Cask
     - The TN-32B HBU cask is added as an available design for spent fuel storage.

The proposed changes in this amendment request are intended to allow storage of high burn-up spent fuel in a modified TN-32B cask at the NAPS ISFSI.

Recent nuclear industry applications for ISFSI license renewal where high burnup spent fuel is involved have met with some challenges regarding the effects of long-term storage of high burnup fuel. The NRC has noted during review of these license renewal submittals that little operating experience is available associated with the storage of high burnup fuel. As described in Section 3.0, Dominion's NAPS site will host a research and development program to provide additional confirmatory data regarding the storage of high burnup fuel. This program is being conducted under the auspices of a joint EPRI and DOE research project.

The TN-32B HBU program results will be made available for use to the nuclear industry as a whole through EPRI. This will allow nuclear operators to reference the results in support of their ISFSI Aging Management Programs addressing the long-term storage of high burnup fuel in dry casks.

3.0 Discussion

NAPS is specifically licensed to store spent nuclear fuel in TN-32 casks at the ISFSI under SNM-2507. Currently, NAPS has twenty-seven TN-32 casks located on Pad 1 at the ISFSI. NAPS also uses the NUHOMS™ dry fuel storage system in compliance with Certificate of Compliance 1030 under a general license.

Recent industry aging management guidelines for dry fuel storage casks have prompted the NRC to request additional information regarding the state of the fuel stored in those casks after a period of time. In response, the nuclear industry has established a need for a demonstration cask where fuel temperatures can be monitored for the duration of storage and fuel assemblies can be removed and examined after storage. The fuel examinations are intended to demonstrate the condition of the fuel assemblies after storage.

Dominion has partnered with the EPRI, AREVA Federal Services, and AREVA TN to host a demonstration cask that can address the industry need. Under the current plan, NAPS will load a TN-32B cask with high burnup spent fuel assemblies in July 2017. After loading, the cask will be sealed and emplaced at the NAPS specifically licensed ISFSI on the single remaining Pad 1 location prior to the end of August 2017. The cask will reside at NAPS for approximately a ten year period, during which fuel temperatures inside the cask will be monitored. After this storage period, the cask will be shipped to a fuel examination facility for characterization of the stored fuel assemblies.

4.0 Technical Evaluation Summary

4.1 Introduction

The changes presented in this amendment request are summarized in this section. The **ANALYSIS SUMMARY** that follows presents a more detailed description and justification of the changes requested herein.

The site specific NAPS ISFSI TS currently limit the design of the dry storage casks used at the NAPS ISFSI under License SNM-2507 to the TN-32. This amendment request proposes an allowance for use of a single storage cask of the TN-32B design. A description of the TN-32B HBU cask, including the differences from the TN-32 design, is provided in the **Cask Design** sections of the **ANALYSIS SUMMARY** below. The higher initial enrichment, higher burnup, higher decay heat, and higher initial uranium content result in restrictions on the fuel that can be stored in the TN-32B HBU cask, which are discussed in more detail in the **ANALYSIS SUMMARY** below. These restrictions are captured by inclusion of a table in the TS.

The initial enrichment of fuel assemblies currently licensed for storage at the NAPS ISFSI in a TN-32 dry storage cask is limited to 4.3 weight percent U-235 or less. This amendment request, if approved, would permit fuel assemblies having an initial enrichment up to and including 4.60 weight percent U-235 to be stored only in the TN-32B HBU cask. The analysis [Reference 1] demonstrates the mechanical and operational limits of the TN-32B HBU cask are met with the higher initial enrichment values and, therefore, permits the use of the higher initial enrichment values. Additional details regarding these changes are presented in the **Criticality Evaluation** section of the **ANALYSIS SUMMARY** below.

The assembly average burnup currently licensed for storage at the NAPS ISFSI in a TN-32 dry storage cask is limited to 45,000 MWD/MTU or less. This amendment request, if approved, would permit fuel assemblies having a burnup up to and including 60.0 GWD/MTU (60,000 MWD/MTU) to be stored only in the TN-32B HBU cask. The analysis [Reference 1] demonstrates the mechanical and operational limits of the TN-32B HBU cask are met with the higher burnup values and, therefore, permits the use of the higher burnup values. Additional details regarding these changes are presented in the **Radiological Protection**, the **Accident Evaluation**, and the **Occupational Exposures** sections of the **ANALYSIS SUMMARY** below.

The NAPS ISFSI TS currently limit the spent fuel decay heat to 1.02 KW/assembly and insert. With 32 assemblies in a cask, this limit equates to a combined decay heat limit of 32.64 kW. This amendment request, if approved, would permit 32 fuel assemblies having a combined decay heat as high as 36.96 kW to be stored only in the TN-32B HBU cask. No irradiated inserts shall be inserted in the TN-32B HBU cask. The analysis [Reference 1] demonstrates the mechanical and operational limits of the TN-32B HBU cask are met with the higher decay heat values and, therefore, permits the use of fuel assemblies with higher decay heat values. Additional details regarding these changes are presented in the **Thermal Evaluation** section of the **ANALYSIS SUMMARY** below.

The NAPS ISFSI TS currently limit the initial uranium content of the spent fuel assemblies to 467.1 kgU/assembly. This amendment request, if approved, would permit fuel assemblies with initial uranium content as high as 469.0 kgU/assembly to be stored only in the TN-32B HBU cask. The analysis [Reference 1] demonstrates the mechanical and operational limits of the TN-32B HBU cask are met with the higher initial uranium content and, therefore, permits the use of the higher uranium content. Additional details regarding these changes are presented in the **Criticality Evaluation** section of the **ANALYSIS SUMMARY** below.

The NAPS ISFSI TS currently require the helium leak rate surveillance be completed within 48 hours of verifying the cask helium backfill pressure is within the TS limit. This amendment request, if approved, would permit the helium leak rate surveillance for only the TN-32B HBU cask to be completed within 23 days of verifying the cask helium backfill pressure. The TN-32B HBU cask will be automatically monitored during a 'thermal soak' period designed to equilibrate the fuel assembly and cask temperatures after cask loading. During this period, the pressure in the cask will be continuously monitored to ensure helium is not leaking. Additional details regarding these changes are presented in the **Thermal Evaluation** section of the **ANALYSIS SUMMARY** below.

Evaluations of the cask design in the **Structural Evaluation** section included the potential for the TN-32B HBU cask to experience earthquake conditions. These evaluations calculated the structural behavior of the TN-32B HBU cask due to the existing NAPS ISFSI design basis earthquake and the 2011 earthquake centered near Mineral, VA. Dominion is currently addressing a new site seismic earthquake spectra developed by the Electronic Power Research Institute. To perform this analysis, Dominion is using a probabilistic risk analysis method in compliance with NRC requirements. Dominion will continue to comply with future NRC

requirements related to this new spectra following the results of a scheduled NRC review of the analysis.

4.2 Analysis Summary

Cask Design

The standard TN-32B cask design only differs from the TN-32 cask design approved and in use at the NAPS ISFSI in that the TN-32B has larger, single-failure proof trunnions for handling of the cask. The cask body and basket for the standard TN-32B are the same as in a standard TN-32.

The TN-32B HBU cask is a modified TN-32B cask that accommodates thirty-two (32) intact spent fuel assemblies, with or without poison rod assemblies (PRAs). The TN-32B HBU cask was manufactured as a standard TN-32B cask in accordance with the TN-32 Safety Analysis Report and certified to comply with the NRC Certificate of Compliance No. 72-1021. The modifications to the standard TN-32B cask design for the demonstration cask consist of the following:

- To provide access to the cask cavity, seven new penetrations are made to the lid's confinement boundary and shield plate.
    - Thermocouple lance assemblies are mounted and secured in each of the seven penetrations noted above. Each lance, which contains nine Type K thermocouples, is inserted into a designated guide tube in the spent fuel assembly loaded under each penetration. Each thermocouple lance mounting assembly is designed with its own double metallic O-ring seal and comprises part of the confinement boundary.
- A funnel guide assembly is installed into the upper end fitting of each of the seven fuel assemblies that receive the thermocouple lance assemblies. The funnel assembly guides the lance into the fuel assembly guide tube during installation.
- The overpressure (OP) monitoring system is modified to provide leakage monitoring of the inner seal space of each double metallic silver O-ring seal for the thermocouple lance assemblies.
- The protective cover is provided with an additional access cover above the vent port cover for maintenance purposes and an instrumentation junction box closure is located on the perimeter surface of the lid to permit worker access to the thermocouple conductors in accordance with ALARA principles.
- Lid closure bolts are upgraded to an improved material, with a reduced diameter shank, and a captured hardened flat washer. The hole diameter for the lid bolts is increased.
- Four-paired bolting bars are attached to each end of the outer shell for attaching impact limiters to the TN-32B HBU cask for future transportation.
- The top neutron shield is elevated approximately one (1) inch by four (4) 1-inch thick steel bars that are welded to the through bolt holes on the bottom steel plate. This elevation is to provide space for the thermocouple wiring and for the OP system tubing routed to the instrument seals.

Confinement Boundary

The confinement boundary for the TN-32B HBU cask consists of the inner shell, the bottom plate, the welded flange forging, the lid outer plate, lid bolts, the seven thermocouple penetration sleeve inserts, the thermocouple instrument head and lance (see paragraph below), the jacking plates and retainer ring, the vent and drain cover plates and fasteners, and the inner metallic O-ring seals of the lid, vent and drain covers, and the thermocouple instruments.

When the thermocouple lance is inserted into the cask cavity, the outer lance sheath becomes part of the confinement boundary. To accommodate the thermocouple lance assemblies, the lid is modified to include seven penetration sleeves, which form part of the confinement boundary. The seal utilized for the thermocouple closure assembly is a double metallic, silver-jacketed O-ring seal, which is identical to the seal used for the vent and drain closures. As with the vent and drain seals, the thermocouple closure seals are connected to the OP monitoring system.

Structural Evaluation

Cask Pressure Evaluation

Using the ideal gas law, the design pressures in the TN-32B HBU cask cavity are calculated based on the amount of cavity gas with the average gas temperatures for normal, off-normal, and accident conditions.

Fuel rod fill and fission gases released into the cavity are calculated based on an assumed percentage of ruptured fuel rods: 1% for normal conditions, 10% for off-normal conditions, and 100% for accident conditions. In addition to the release of 100% of the fill gas, 30% of the fission gas generated within the fuel rods during operation is also considered.

The maximum calculated internal pressures for normal, off-normal, and accident conditions in the TN-32B HBU cask cavity are 21.3 psig, 26.9 psig, and 95.5 psig, respectively. Therefore, the maximum internal pressure of 100 psig utilized in the evaluation of the TN-32B HBU cask and basket is a bounding pressure.

Cask Body

The TN-32B HBU cask body was analyzed to meet the design criteria of the NAPS ISFSI with the addition of the analysis for the August 23, 2011 earthquake centered near Mineral, VA. The TN-32B HBU cask fuel assembly payload results in increased temperatures in the basket/rail structure from the increased decay heat load. For this payload, the applicable normal, off-normal, and accident load conditions of the NAPS ISFSI license were analyzed based on the temperatures discussed in the **Thermal Evaluations**. Note that only accident load conditions apply for analysis of the basket rails.

The TN-32B HBU cask body with fuel payload has been analyzed to demonstrate structural integrity with no loss of confinement for the following normal and off-normal load conditions:

- 1g down, cask vertical supported on bottom

- 100 psig internal pressure;
- 25 psig external pressure;
- Thermal stress due to 100 °F (38 °C) ambient hot environment with maximum decay heat load; and
- 3g vertical lift using upper trunnions.

The TN-32B HBU cask body with fuel payload has been analyzed to demonstrate structural integrity with no loss of confinement for the following accident load conditions:

- Seismic event in vertical storage position (includes the NAPS ISFSI design basis earthquake and the 2011 earthquake centered near Mineral, VA);
- 50g bottom end drop;
- 50g tip-over impact;
- Tornado, wind, and missile impacts; and
- 3g vertical lift plus 1g lateral.

Cask Lid

For the modified lid assembly as discussed in the **Cask Design**, the cask was analyzed for normal, off-normal, and accident load conditions.

The TN-32B HBU cask lid has been analyzed to demonstrate structural integrity with no loss of confinement for the following normal and off-normal load conditions:

- 1g down, cask vertical supported on bottom
- 100 psig internal pressure;
- 25 psig external pressure;
- Thermal stress due to 100 °F (38 °C) ambient hot environment with maximum decay heat load; and
- 3g vertical lift using upper trunnions.

The TN-32B HBU cask lid bolts have been analyzed in accordance with NUREG/CR-6007, "Stress Analysis of Closure Bolts for Shipping Casks," to demonstrate structural integrity with no loss of confinement for the following normal and off-normal load conditions:

- Lid bolt tightening torque;
- Lid bolt preload, lid sealing pressure;
- 100 psig internal pressure;
- 25 psig external pressure; and
- Thermal stress due to 100 °F (38 °C) ambient hot environment.

The TN-32B HBU cask fasteners for the vent port cover, drain port cover, and the lance assemblies have been analyzed in accordance with NUREG/CR-6007 to verify that the tightening torque would seat the metallic O-ring seal. Additionally, the fasteners were evaluated for the following normal and off-normal load conditions:

- 100 psig internal pressure (vent, drain, and lance assemblies only);

- Thermal expansion due to 100 °F (38 °C) ambient to 300 °F (149 °C) for the maximum decay heat load; and
- Fastener initial preload.

The TN-32B HBU cask lid has been analyzed to demonstrate structural integrity with no loss of confinement for the following accident load conditions:

- 100 psig internal pressure
- Seismic event in vertical storage position (includes the NAPS ISFSI design basis earthquake and the 2011 earthquake centered near Mineral, VA);
- 50g bottom end drop;
- 50g tip-over impact;
- Tornado, wind, and missile impacts; and
- 3g vertical lift plus 1g lateral.

The TN-32B HBU cask lid bolts have been analyzed in accordance with NUREG/CR-6007 to demonstrate structural integrity with no loss of confinement for the following accident load conditions:

- 100 psig internal pressure
- Thermal expansion due to 100 °F (38 °C) ambient to 400 °F (204 °C) fire event;
- 50g tip-over impact;
- 30-ft side free drop;
- 30-ft end free drop; and
- 30-ft center-of-gravity (CG)-over-top corner free drop.

The TN-32B HBU cask fasteners for the vent port cover, drain port cover, and the lance assemblies have been analyzed in accordance with NUREG/CR-6007 to demonstrate structural integrity with no loss of confinement for the following accident load conditions:

- 100 psig internal pressure
- Thermal expansion due to 100 °F (38 °C) ambient to 400 °F (204 °C) fire event;
- 50g tip-over impact; and
- Fastener preload.

Cask Basket and Rails Assembly

The TN-32B HBU cask basket and rails are unchanged from the standard TN-32B design. The TN-32B HBU cask basket with fuel payload has been analyzed to demonstrate structural integrity for the following normal and off-normal load conditions:

- 3g vertical lift plus 1g lateral; and
- Thermal stress due to 100 °F (38 °C) ambient hot environment with maximum decay heat load.

The TN-32B HBU cask basket with fuel payload has been analyzed to demonstrate structural integrity for the following accident load conditions:

- Thermal stress due to 100 °F (38 °C) ambient hot environment with maximum decay heat load;
- 50g bottom down drop; and
- 55g tip-over impact (treated as a side drop for basket).

Conclusions for Structural Evaluation

The structural evaluation of the TN-32B HBU cask body, lid, basket, and rails has demonstrated that all components satisfy the required design criteria for all of the normal, off-normal and accident conditions for the NAPS ISFSI including analysis of the 2011 earthquake centered near Mineral, VA. Cask internal pressures under normal conditions are acceptable.

During the side drop accident event, the basket/fuel assemblies are laterally displaced relative to the thermocouple lances, which are inserted into guide tubes in the fuel assemblies. The thermocouple lance has been analyzed and it has been demonstrated that the lance sheath confinement boundary satisfies the required design criteria for this lateral displacement.

The fuel assemblies used as payload in the TN-32 demonstration cask have been analyzed to demonstrate structural integrity with no loss of confinement for a postulated 18-inch end drop and a 50g side drop. The AREVA Advanced Mark BW assembly design is used in the analyses as a bounding assembly for all potential fuel assembly design loadings because it has the lowest yield strength. The analyses demonstrated that the payload fuel assemblies will maintain their structural integrity for all analyzed accident conditions during the storage period on the NAPS ISFSI.

Radiological Protection

New shielding and dose analyses were performed to support the TN-32B HBU cask loaded with fuel having the proposed limits. For the purposes of the analyses, a limiting fuel assembly with regards to source term was identified and all thirty-two assemblies were modeled as having the same initial conditions as that assembly. The use of these fuel parameters in the TN-32B HBU cask analyses, under normal and off-normal conditions, resulted in average surface dose rates of 91.1 mrem/hour for the side and 96.1 mrem/hour for the top (neutron plus gamma). The weighted side dose rate limit of 218 mrem/hr (neutron plus gamma) is currently in place for the TN-32 casks and exceeds that of the TN-32B HBU cask. Therefore, no changes are proposed for the TS limit for the weighted average side dose rate for the TN-32B HBU cask. However, the top dose rate analysis limit is higher than the current TN-32 cask limit and a change to this value for the TN-32B HBU cask is included in the proposed TS.

The total contributions to dose rates around the NAPS ISFSI due to the TN-32B HBU cask being located on the storage pad were determined using the Monte Carlo N-Particle (MCNP) transport code. To determine a conservative dose rate due to the TN-32B HBU cask at the nearest site boundary, which is also conservative with respect to the nearest permanent resident, calculations were performed at a distance of 500 meters from the cask. At this distance, the total dose rate from the cask is 9.37E(-4) rem/year (0.937 mrem/year).

Conclusions for Radiological Protection

The radiation shielding features of the TN-32B HBU cask with fuel having the proposed limits is sufficient to meet the radiation protection requirements of 10 CFR 20 and 10 CFR 72.104.

As described in the site specific NAPS ISFSI Safety Analysis Report (SAR), the maximum combined radiation contribution to the nearest permanent resident from the operation of the ISFSI (2.10 mrem/year) and the NAPS Units 1 and 2 (assuming 3.00 mrem/year) is 5.10 mrem/year. Conservatively adding the total dose rate at 500 meters for the TN-32B HBU cask (0.937 mrem/year) results in a total combined dose rate of 6.037 mrem/year. This is well below the 25 mrem/year limit imposed by 10 CFR 72.104(a). In addition, an evaluation was performed by Dominion that demonstrated the site boundary annual dose does not increase with the TN-32B HBU cask installed at the NAPS ISFSI. Therefore, there are no changes to the potential dose rates experienced by a member of the public near the station as a result of this project.

Accident Evaluation

Confinement of radioactivity during the storage of spent fuel is achieved by (1) the uranium dioxide fuel pellet matrix, (2) the metallic tubes (cladding) in which the pellets are contained, and (3) the SSSC in which the assemblies are stored.

The confinement function of the SSSC is achieved by totally enclosing the spent fuel assemblies within a double-seal rigid metal vessel. The SSSC is fabricated, delivered to the NAPS site, loaded, sealed, and emplaced at the ISFSI in a manner that ensures its integrity, the capability to perform its safety functions, and compliance with all applicable rules and regulations.

Once the SSSC is sealed, there are no credible events which could result in a release of radioactive material to the environment. Similarly, there are no credible scenarios which could result in contamination of the outside surface of the SSSCs or in the generation of radioactive waste products.

Despite the lack of credible scenarios which could result in a release of radioactive material to the environment, the loss of confinement barrier is evaluated for compliance with the requirements in the ANSI N14.5, Standard for Radioactive Materials – Leakage Tests on Packages for Shipments. The leakage rate for off-normal and accident conditions was assumed to be 1E(-5) standard cm^3/sec.

In the off-normal analysis, 10% of the rods are assumed to be failed and the condition exists over a one year period. In the accident analysis, 100% of the rods are assumed to be failed, temperatures inside the cask are consistent with the fire accident conditions, and the leaking condition exists over a thirty day period. Dispersion factors used in the analyses are consistent with the existing TN-32 site specific SAR.

Conclusions for Accident Evaluation

The Total Effective Dose Equivalent (TEDE) for the off-normal conditions at a point 500 meters from the TN-32B HBU cask is 1.92E(-1) mrem/year. The TEDE for the accident conditions at a point 500 meters from the TN-32B HBU cask is 9.71 mrem/30 days. Under off-normal and accident conditions, no amount of radioactive nuclides were found to be released that would result in doses approaching the limits specified in 10 CFR 72.104(a) or 10 CFR 72.106(b).

Occupational Exposures

AREVA TN analyzed dose rates from the loading, emplacement, and maintenance of the TN-32B HBU cask with a fuel payload at proposed limits. Exposures were calculated using the calculated dose rates and conservative estimations of person-hours associated with cask activities.

Relative to existing TN-32 analyses, estimated personnel doses increase for the TN-32B HBU cask because of the following:

- The fuel payload allowed for the TN-32B HBU cask includes assemblies with higher enrichments, higher burnup, and higher initial uranium weight;
- Cask loading includes two new activities, which require personnel to be in close proximity to the cask:
    - Thermocouple lance installation, and
    - Obtaining a cavity gas sample
- Cask emplacement includes a new activity, assembly and installation of a data package mounted on the cask at the ISFSI, which requires personnel to be in close proximity to the cask.

Conclusions for Occupational Exposures

Occupational exposures from the TN-32B HBU cask loaded with fuel having the proposed limits are expected to be higher than the current ISFSI licensing basis. Occupational exposure for loading and placement of the TN-32B HBU cask at the ISFSI is estimated to be 3.65 rem.

3.65 rem is approximately fifty percent higher than the occupational exposure estimated for the TN-32 and NUHOMS designs per the current North Anna TS. However, the calculational bases for these estimates are conservative and past experience at the site with TN-32 cask loadings has demonstrated that typical occupational dose is approximately twenty-five to thirty percent of the estimated value in the corresponding TS section. A similar relationship is expected for the TN-32B HBU cask.

An additional evaluation performed for the TN-32B HBU cask demonstrates that dose rates at the North Anna site boundary will be unchanged after the placement of the TN-32B HBU cask at the North Anna ISFSI pad. Therefore, there are no changes to the potential dose rates experienced by a member of the public near the station as a result of this project.

Criticality Evaluation

The criticality evaluations demonstrate that the TN-32B HBU cask with the planned high burnup spent fuel assemblies complies with the requirements of 10 CFR 72 for normal, off-normal, and accident conditions defined by the NAPS ISFSI SAR.

Criticality control in the TN-32B HBU cask is provided by the basket structural components which maintain the relative position of the spent fuel assemblies under normal and accident conditions, by the neutron absorbing plates between the basket compartments, by the poison rod assemblies (PRAs) inserted in six of the fuel assemblies stored in the cask, and by dissolved boron in the spent fuel pool water.

The standard TN-32B cask was previously analyzed by AREVA TN using older versions of the SCALE computer software. The TN-32B HBU cask is analyzed using the same SCALE control sequence, cross-section data, modeling methods, and code options as the standard TN-32B cask, but uses Version 6.0 of the SCALE computer code. The SCALE models for both casks are essentially identical, except that the TN-32B HBU cask is instrumented with thermocouple lances and uses PRAs in addition to borated water and poison plates for criticality control. Neither the thermocouple lances nor the PRAs affect the most reactive configuration. Therefore, the most reactive configuration of the standard TN-32B dry storage cask is also the most reactive configuration for the TN-32B HBU cask.

The TN-32B HBU cask stores thirty-two, high burnup, 17 × 17 spent fuel assemblies of three fuel types: AREVA Mark BW, Westinghouse Standard, and Westinghouse Vantage 5H. The criticality analysis of the TN-32B HBU cask was performed by AREVA TN using the following conservative assumptions:

- The fuel assemblies are assumed to be fresh (i.e., no burnup credit);
- All 32 fuel assemblies are modeled as the most reactive fuel type based on initial enrichment, AREVA Mark BW;
- Thermocouple lances are modeled as solid aluminum cylinders;
- PRAs are modeled as containing 50% of the as-designed B4C material.

In addition, for simplicity, all fuel cladding is modeled as Zircaloy-4.

The criticality analysis was performed for the TN-32B HBU cask using the above assumptions in the most reactive configuration under normal, off-normal, and accident conditions with various moderations. The limiting case identified for the normal and off-normal conditions is 90% moderation. The criticality analysis considers two accident conditions; the single fuel misplacement accident and the cask tip-over accident.

The single fuel misplacement accident was analyzed based on the limiting case identified for the normal and off-normal condition. The initial enrichment of the misplaced fuel is assumed to be 5.00 weight percent U-235. Five misplacement locations are analyzed.

The cask tip-over accident is represented by the side drop accidents described in the **Structural Evaluation**. The criticality modeling of the cask tip-over accident analysis focuses on the

integrity of the fuel rod location, fuel cladding, the grid spacers and the fuel compartment. Based on the results of the TN-32B HBU cask fuel structural evaluation, the cladding integrity is maintained. Based on the results of the TN-32B HBU cask basket accident analysis, the maximum transverse deformation of the fuel compartments is zero. Based on the results of the TN-32 Final Safety Analysis Report (FSAR), the grid spacers are assumed to crush and the fuel rod slides axially. The fuel rod axial sliding relative to the poison plate is modeled in the intact fuel analysis. Thus, only the fuel rod pitch reduction is modeled to account for the grid spacer collapse. The limiting case identified for normal and off-normal conditions is modified with four fuel rod pitch reductions.

Conclusions for Criticality Evaluation

The TN-32B HBU cask is designed to be substantially subcritical under all credible conditions. The criticality design is based on favorable geometry, fixed neutron poisons, neutron poison inserts, and soluble poisons in the spent fuel pool. The criticality design features of the TN-32B HBU cask are in compliance with 10 CFR 72 and the applicable design and acceptance criteria have been satisfied.

The acceptance criterion for the criticality analysis is defined by an Upper Subcriticality Limit (USL) that is set based on a 95% confidence band per NUREG/CR-6361, "Criticality Benchmark Guide for Light-Water-Reactor Fuel in Transportation and Storage Packages," with a correlation parameter of assembly separation distance. For all cases, normal, off-normal, and accident, an USL of 0.9388 was determined to be acceptable.

The results for the normal and off-normal conditions determined the limiting case is the 90% moderation case and the k_{eff} for this case is below 0.9388.

The results of the single fuel misplacement accident determined the limiting misplacement case has a k_{eff} below 0.9388.

For the cask tip-over accident, the reactivity effect of the fuel rod pitch reduction is negative, thus, the criticality safety margin is not impacted.

Thermal Evaluation

The proposed changes to the NAPS ISFSI TS include a higher limit on assembly decay heat. Normal, accident, and loading/unloading conditions were evaluated by AREVA TN.

The TN-32B HBU cask is designed to passively reject decay heat under normal, accident and loading/unloading conditions while maintaining appropriate cask temperatures and pressures within the specified temperature limits. To establish the confinement and heat removal capability, several thermal design criteria are established for the TN-32B HBU cask. These are:

- Seal temperatures must be maintained within specified limits. The silver-jacketed metallic O-ring seals that form part of the TN-32B HBU cask confinement boundary have a maximum temperature limit of 669 °F (354 °C).

- An allowable temperature range of -40 to 300 °F (-40 to 149 °C) is set for the neutron shield to maintain resin stability.
- Maximum and minimum temperatures of the confinement structural components must not adversely affect the confinement function.
- For normal conditions and all short term loading operations (including vacuum drying and backfilling of the cask cavity with helium), a fuel cladding temperature limit of 752 °F (400 °C) is established in accordance with NUREG-1536, "Standard Review Plan for Spent Fuel Dry Storage Systems at a General License Facility – Final Report." For accident conditions, the fuel cladding temperature limit is 1,058 °F (570 °C) per NUREG-1536.

Normal Conditions

The thermal evaluation for normal conditions was based on the following inputs:

- A maximum total decay heat load of 36.96 kW from all 32 fuel assemblies;
- An ambient temperature range of -20 °F to 100 °F. The temperature range is averaged over 24 hours and a maximum daily averaged ambient temperature of 100 °F is used for the maximum cask temperature evaluation;
- 10 CFR 71.71(c) insolation averaged over 24 hours.
- Inclusion of the effect of storing the TN-32B HBU cask in a two by infinite array with a 16 foot pitch from the existing TN-32 casks at the NAPS ISFSI (an array with a 14 foot pitch was also analyzed, see below).

Using these inputs, the thermal analysis for normal storage concluded that the TN-32B HBU cask met all applicable requirements.

- The predicted maximum fuel cladding temperature is less than the design criterion of 752 °F (400 °C).
- The maximum seal temperature is less than the long-term limit of 669 °F (354 °C) for continued seal function.
- Under the minimum daily average temperature condition of -20 °F (-29 °C) ambient, the resulting cask component temperatures will approach -20 °F (-29 °C) if no credit is taken for decay heat load. The cask materials including confinement structures and the seals continue to function at the temperature range between -40 °F (-40 °C) and 669 °F (354°C).
- The average bulk resin temperature in the radial neutron shield at the hottest cross section for normal conditions and the temperature of the resin in the top neutron shield are below the allowable limit of 300 °F (149 °C). Therefore, no degradation of the neutron shielding is expected for the storage period.

A sensitivity study was performed assuming storage in a two by infinite array with a 14 foot pitch between the existing TN-32 casks. The decrease in pitch between the TN-32 casks was shown to have no effect on the maximum temperatures of the TN-32B HBU cask.

Accident Conditions

The thermal evaluation for accident conditions was based on the following:

- 15 minute fire accident with the following conditions:
  - Average flame temperature of 1,550 °F (843 °C)
  - Average convective heat transfer of 4.5 Btu/hr-ft2-°F

Using these inputs for the fire accident, the thermal analysis concluded that the TN-32B HBU cask design met all applicable requirements.

- The predicted maximum fuel cladding temperature is less than the design criteria of 1,058 °F (570 °C) for accident conditions.
- The maximum seal temperature is less than the long-term limit of 669 °F (354 °C) for continued seal function.

Transfer Conditions

During transfer operations to the ISFSI pad, the TN-32B HBU cask is exposed to ambient conditions and is not surrounded by other casks. This ensures that there is no radiation heat transfer between the casks as there is during storage on the ISFSI pad. Therefore, the thermal evaluation performed for normal storage bounds the thermal performance of the TN-32B HBU cask during transfer to the NAPS ISFSI pad.

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 water, permitting heat dissipation. After fuel loading is complete, the cask is removed from the pool, drained, and the cavity is dried.

Helium is used for the cask blowdown operation and, therefore, its presence is credited during the vacuum drying operation. With helium being present during vacuum drying operations, the maximum temperatures, including those of the fuel cladding and cask components, are bounded by those calculated for transfer operations. Since the thermal evaluation for normal storage conditions bounds the transfer operations as discussed above, no further evaluation for loading/unloading conditions is performed.

Thermal Expansion Evaluation

Thermal expansion analysis of the TN-32B HBU cask evaluates the fuel assemblies and cask components clearances for thermal expansion including:

- The gap between an irradiated fuel assembly and the TN-32B HBU cask lid;
- The gap between the basket and basket rails of the TN-32B HBU cask body.

The maximum allowable gap between the fuel assemblies and the cask lid is 1.45 inches. The analytically demonstrated gap between the fuel assemblies and the cask lid is less than 1.45 inches. The minimum required gap between the fuel assemblies and the lid is 0.25 inches. The

analytically demonstrated gap between the fuel assemblies and the cask lid is greater than 0.25 inches.

The evaluation demonstrates that there will be an adequate hot radial gap between the basket assemblies and basket rails. The minimum gap between the basket assembly and the basket rails is adequate to provide sufficient clearance for thermal expansion. The basket plates are free to expand in the axial direction, since sufficient clearance is provided between the lid and the top of the basket for the maximum evaluated decay heat load.

Thermal Soak Period

To ensure the TN-32B HBU cask thermocouples are functioning correctly and that the cask and payload have reached a state of thermal equilibrium, the TN-32B HBU cask will remain in the NAPS loading bay for a maximum of 23 days from the time the cask is filled with helium. During this time period, temperatures within the cask will be monitored, gas samples will be taken from the cask cavity, and external temperature readings will be taken. These initial data will confirm when the cask and cask contents have reached thermal equilibrium and will provide a baseline for comparison with future measurements. After the TN-32B HBU cask has reached thermal equilibrium, and prior to exceeding the 23 day limit, the cask will be sealed and the final leak rate test will be performed.

Conclusions for Thermal Evaluations

The thermal design of the TN-32B HBU cask is in compliance with 10 CFR 72 and the applicable design and acceptance criteria have been satisfied.

The temperatures determined by the evaluation of the cask systems, structures, and components important to safety were found to remain within their operating temperature ranges for the design heat load. The TN-32B HBU cask provides adequate heat removal capacity at the ISFSI pad without active cooling systems. Spent fuel cladding will be protected against degradation that could lead to significant fuel failures by maintaining the cladding temperature below maximum allowable limits and by providing an inert environment in the cask cavity.

The NAPS ISFSI TS will be revised to specify the maximum total decay heat load of 36.96 kW for the TN-32B HBU cask.

4.3 Conclusions

Analytical support for the proposed changes has been demonstrated by Reference 1 and the discussion herein. All mechanical and operational limits for the TN-32B cask design are met.

5.0 Regulatory Evaluation

5.1 No Significant Hazards Consideration

The proposed change would revise the ISFSI License to allow storage of spent fuel in a modified TN-32B bolted lid cask, as part of the High Burnup Dry Storage Cask Research and Development Project sponsored by the Department of Energy (DOE) and the Electric Power Research Institute (EPRI).

Internal temperatures in the TN-32B HBU cask will be monitored for the duration of the project, subject to continued acceptable performance of installed thermocouple temperature monitors. The data obtained from these instruments will be used to confirm the effects of long-term dry storage on high burnup fuel assemblies. The TN-32B HBU cask is scheduled to be loaded in 2017, stored onsite at NAPS until such time that it is transferred to a fuel examination facility capable of storing and handling the cask and fuel for further examination.

Dominion has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

   Storage of high burnup spent nuclear fuel in the proposed configuration in the TN-32B HBU cask does not increase the probability of an accident previously evaluated in the NAPS ISFSI Safety Analysis Report (SAR). The only accident for which the probability of occurrence is potentially affected by use of the TN-32B HBU cask involves the potential for release of radioactive material from the site ISFSI. Evaluations have been performed to demonstrate that the integrity of the TN-32B HBU cask is maintained during postulated accident conditions as defined in the ISFSI SAR. These evaluations also account for the NAPS August 2011 design basis earthquake. All mechanical and operational limits associated with the TN-32B cask design are shown to be met and, therefore, the probability of occurrence of radioactive material release is not increased. In addition, while the burnup of the fuel stored in the TN-32B HBU cask is higher than that stored in existing TN-32 casks at the NAPS ISFSI, the evaluations of the cask have demonstrated that the existing analyses of radioactive release consequences for both the TN-32 and TN-32B HBU cask design are well within the limits of 10 CFR Part 72.

   Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

   The possibility of an accident which is different from any already discussed in the NAPS ISFSI SAR is not created. Storage of spent fuel in the TN-32B HBU cask in the proposed configuration meets all applicable cask design and operational criteria. The TN-32B HBU cask is subject to the same accident types defined in the existing ISFSI SAR for the TN-32 casks in use at NAPS. Adherence to the standards and criteria defined in the ISFSI Technical Specifications precludes new challenges to components and systems that could introduce a new type of accident.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed amendment involve a significant reduction in a margin of safety?

   Response: No.

   The evaluations performed for the TN-32B HBU cask demonstrate that all design and operational criteria associated with the TN-32B cask design are met. In addition, cask analyses demonstrate that the 10 CFR 72.104 and 10 CFR 72.106 limits on radioactive material release are not exceeded.

   The NAPS ISFSI Technical Specifications ensure that the ISFSI operates in a manner that provides acceptable levels of protection for the health and safety of the public. The Technical Specifications are based upon assumptions made in the safety and accident analyses, including those relating to the fuel being stored and the design of the casks. The existing ISFSI safety analyses for offsite dose remain applicable for the TN-32B HBU cask with high burnup spent nuclear fuel, and analyses have demonstrated that potential release of radioactive material is within license limits. Therefore the regulated margin of safety as defined in the Technical Specifications is not affected by the proposed storage of high burnup fuel in the TN-32B HBU cask.

   Based on the evaluations and analysis results presented in the foregoing safety significance evaluation, it has been demonstrated that storage of high burnup spent fuel in the TN-32B HBU cask will not result in the acceptable safety limits for any incident being exceeded. Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, Dominion concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements and Criteria

Dominion is licensed to store nuclear fuel under site specific license SNM-2507. SNM-2507 was issued with the following requirements:

1. Special Nuclear Material (SNM) consists of spent fuel assemblies from the NAPS Unit 1 and 2 reactors and associated radioactive materials

2. SNM has a physical form of UO_2 clad with zirconium alloys

3. Maximum SNM inventory is less than 839.04 TeU

4. SNM is stored in accordance with the license and Technical Specifications in casks of the TN-32 design

5. SNM is to be stored at the NAPS ISFSI

6. The Technical Specifications are maintained as part of the license
7. ISFSI physical security, training and qualification, and safeguards contingency plans are implemented, maintained, and amended pursuant to 10 CFR Part 72
8. Licensee shall maintain an approved Quality Assurance Program for the ISFSI
9. Licensee shall maintain an approved Emergency Plan for the ISFSI
10. Design, construction, and operation of the ISFSI shall be accomplished in accordance with NRC Regulations as specified in Title 10 of the Code of Federal Regulations.
11. Fuel and cask movement and handling are governed by the requirements of the NAPS Unit 1 and 2 Facility Operating Licenses and Technical Specifications
12. Licensee is exempted from:
    a. 10 CFR 72.124(b) verification of solid neutron absorbing material efficacy
    b. 10 CFR 72.44(d)(3) submittal dates for reporting radionuclide effluent releases

    10 CFR 72.72(d) duplicate storage of spent fuel records

5.3 Precedents

NAPS currently stores spent fuel onsite under License SNM-2507 in TN-32 casks that are similar to the TN-32B HBU cask discussed in this amendment request. However, there is no identified precedent for storing high burnup nuclear fuel in an instrumented dry storage cask at a commercial power reactor.

5.4 Conclusions

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

6.0 Environmental Considerations

Dominion has reviewed the proposed license amendment for environmental considerations. The proposed license amendment would allow procurement of confirmatory research that does not involve significant construction at the site. The TN-32B HBU cask would be placed at an available Pad 1 location without modification to Pad 1. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion from an environmental assessment as set forth in 10 CFR 51.22(c)(6). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

7.0 References

1. E-42038, Rev. 3, "TN-32B HBU Demonstration Cask Design/Licensing Basis Document," AREVA, August 2015. [AREVA-TN Proprietary]

Attachment 2

Technical Specifications Markups

North Anna Power Station
Independent Spent Fuel Storage Installation
Virginia Electric and Power Company
(Dominion)

Table 2.1-1 (page 1 of ~~1~~ 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 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

Add Table 2.1-1
page 2 of 2

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

	SSSC Model	Limit
2.	TN-32B HBU	
	a. Initial Enrichment	4.60 wt. % (Areva Mark BW) 3.64 wt. % (Westinghouse Standard) 4.50 wt. % (Westinghouse Vantage 5H)
	b. Average Burnup	≤ 60 GWD/MTU
	c. Cooling Time After Discharge	See Figure 2.1-4
	d. Decay Heat	≤ 36.96 kW
	e. Fuel Assembly Design	Areva Mark BW (AMBW) Westinghouse Standard Westinghouse Vantage 5H
	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
Decay Heat Load Methodology for Fuel Stored in TN-32B HBU Cask

The following algorithm is to be used to determine the individual fuel assembly decay heat load for the zone loading represented in Figure 2.1-4

The Decay Heat (DH) in watts is expressed as:

$$F1 = A + B*X1 + C*X2 + D*X1^2 + E*X1*X2 + F*X2^2$$

$$DH = F1*Exp(\{[1-(5/X3)]*G\}*[(X3/X1)^H]*[(X2/X1)^I]),$$ where

F1 is the Intermediate Function, basically the thermal source at five year cooling,
X1 is the assembly average burnup in GWd/MtU,
X2 is the assembly average initial enrichment in wt. % U-235, minimum of 1.5 percent and maximum of 5 percent.
X3 is the cooling time of the assembly in years

Constants:

A = 13.69479	B = 25.79539	C = -3.547739	D = 0.307917	E = -3.809025
F = 14.00256	G = -0.831522	H = 0.078607	I = -0.095900	

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

	Z1	Z2	Z3	Z4	
Z5	Z6	Z7	Z8	Z9	Z10
Z11	Z12	Z13	Z14	Z15	Z16
Z17	Z18	Z19	Z20	Z21	Z22
Z23	Z24	Z25	Z26	Z27	Z28
	Z29	Z30	Z31	Z32	

Zone No.	Heat Load Limit (W)(1)	Zone No.	Heat Load Limit (W)(1)
1	1013	17	1165
2	1167	18	1492
3	1015	19	1037
4	909	20	725
5	914	21	1496
6	1276	22	1121
7	1503	23	1036
8	1477	24	1031
9	1163	25	1495
10	903	26	1511
11	882	27	1178
12	1496	28	1035
13	858	29	1073
14	1281	30	1155
15	1482	31	1031
16	1120	32	918
		Total Heat Load (kW)	**36.96**

(1) Refer to Table 2.2 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------ SR 3.0.2 is not applicable. ---------------- Within 6 hours after verifying SSSC cavity vacuum drying pressure is within limit

AND

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------ SR 3.0.2 is not applicable. --------------- ~~Within 48 hours after verifying SSSC helium backfill pressure is within limit~~ 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:

a. 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.	24 hours
	AND		
	A.2	Perform analysis to verify compliance with the ISFSI offsite radiation protection requirements of 10 CFR Part 20 and 10 CFR Part 72.	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.~~1~~ 2 SSSC Average Surface Dose Rates FOR TN-32B HBU CASK

LCO 3.3.~~1~~ 2 The average surface dose rates of each SSSC shall not exceed:

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

b. ~~58~~ 9 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.	24 hours
	AND	
	A.2 Perform analysis to verify compliance with the ISFSI offsite radiation protection requirements of 10 CFR Part 20 and 10 CFR Part 72.	Prior to TRANSPORT OPERATIONS
B. Required Action and Associated Completion Time not met.	B.1 Remove all fuel assemblies from the SSSC.	7 days

FOR TN-32B HBU CASK

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.~~1~~ 2.1	Verify average surface dose rates of SSSC containing fuel assemblies are within limits.	Prior to TRANSPORT OPERATIONS

3.3 SSSC RADIATION PROTECTION

~~3.3.2~~ 3.3.3 SSSC Surface Contamination

LCO ~~3.3.2~~ 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 3.3.2.1	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	≤ 4 mbar held for 30 minutes
b. Helium Backfill Pressure	2230 mbar ± 100 mbar
c. Combined Helium Leak Rate	≤ 1.0 X 10^{-5} mbar-liter/sec
d. SSSC Inter-seal Pressure	≥ 3250 mbar
e. Dissolved Boron Concentration	≥ 2500 ppm
f. Maximum Lifting Height	eighteen inches
g. Low Pressure Alarm Setting of SSSC Inter-Seal Pressure Monitoring Device	> 3250 mbar absolute

Replace entirely w/ new Table 3-1

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

		SSSC Model	Limit
1.		TN-32	
	a.	Cavity Vacuum Drying Pressure	≤ 4 mbar held for 30 minutes
	b.	Helium Backfill Pressure	2230 mbar ± 100 mbar
	c.	Combined Helium Leak rate	≤ 1.0 X 10^{-5} mbar-liter/sec
	d.	SSSC Inter-seal Pressure	≥ 3250 mbar
	e.	Dissolved Boron Concentration	≥ 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	≤ 4 mbar held for 30 minutes
	b.	Helium Backfill Pressure	2230 mbar ± 100 mbar
	c.	Combined Helium Leak rate	≤ 1.0 X 10^{-5} mbar-liter/sec
	d.	SSSC Inter-seal Pressure	≥ 3250 mbar
	e.	Dissolved Boron Concentration	≥ 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

4.1.1 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.

4.2 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 pads are 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. Each pad is designed to store 28 SSSCs arranged in two rows. The SSSCs in each row will be spaced a nominal 16 feet apart center to center. Each row of SSSCs will be spaced a nominal 16 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.

Attachment 3

Technical Specifications (Clean)

North Anna Power Station
Independent Spent Fuel Storage Installation
Virginia Electric and Power Company
(Dominion)

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 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 Mark BW) ≤ 3.64 wt. % (Westinghouse Standard) ≤ 4.50 wt. % (Westinghouse Vantage 5H)
b. Average Burnup	≤ 60 GWD/MTU
c. Cooling Time After Discharge	See Figure 2.1-4
d. Decay Heat	≤ 36.96 kW
e. Fuel Assembly Design	Areva Mark BW (AMBW) Westinghouse Standard Westinghouse Vantage 5H

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 following algorithm is to be used to determine the individual fuel assembly decay heat load for the zone loading represented in Figure 2.1-4.

The Decay Heat (DH) in watts is expressed as:

$$F1 = A + B*X1 + C*X2 + D*X12 + E*X1*X2 + F*X2^2$$

$$DH = F1*Exp(\{[1-(5/X3)]*G\}*[(X3/X1)^H]*[(X2/X1)^I]), \text{ where}$$

F1 is the Intermediate Function, basically the thermal source at five year cooling,

X1 is the assembly average burnup in GWd/MtU,

X2 is the assembly average initial enrichment in wt. % U-235, minimum of 1.5 percent and maximum of 5 percent.

X3 is the cooling time of the assembly in years

Constants:

A = 13.69479	B = 25.79539	C = 3.547739	D = 0.307917	E = 3.809025
F = 14.00256	G = -0.831522	H = 0.078607	I = -0.095900	

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

	Z1	Z2	Z3	Z4	
Z5	Z6	Z7	Z8	Z9	Z10
Z11	Z12	Z13	Z14	Z15	Z16
Z17	Z18	Z19	Z20	Z21	Z22
Z23	Z24	Z25	Z26	Z27	Z28
	Z29	Z30	Z31	Z32	

Zone No.	Heat Load Limit (W)(1)	Zone No.	Heat Load Limit (W)(1)
1	1013	17	1165
2	1167	18	1492
3	1015	19	1037
4	909	20	725
5	914	21	1496
6	1276	22	1121
7	1503	23	1036
8	1477	24	1031
9	1163	25	1495
10	903	26	1511
11	882	27	1178
12	1496	28	1035
13	858	29	1073
14	1281	30	1155
15	1482	31	1031
16	1120	32	918
		Total Heat Load (kW)	**36.96**

(1) Refer to Table 2.2 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------ SR 3.0.2 is not applicable. ---------------- Within 6 hours after verifying SSSC cavity vacuum drying pressure is within limit <u>AND</u> 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------ SR 3.0.2 is not applicable. ---------------- 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.	24 hours
	AND	
	A.2 Perform analysis to verify compliance with the ISFSI offsite radiation protection requirements of 10 CFR Part 20 and 10 CFR Part 72.	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. <u>AND</u> 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 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 3.3.2.1 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	≤ 4 mbar held for 30 minutes
b. Helium Backfill Pressure	2230 mbar ± 100 mbar
c. Combined Helium Leak Rate	≤ 1.0 X 10^{-5} mbar-liter/sec
d. SSSC Inter-seal Pressure	≥ 3250 mbar
e. Dissolved Boron Concentration	≥ 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	≤ 4 mbar held for 30 minutes
b. Helium Backfill Pressure	2230 mbar ± 100 mbar
c. Combined Helium Leak Rate	≤ 1.0 X 10^{-5} mbar-liter/sec
d. SSSC Inter-seal Pressure	≥ 3250 mbar
e. Dissolved Boron Concentration	≥ 2500 ppm
f. Maximum Lifting Height	eighteen inches
g. Low Pressure Alarm Setting of SSSC Inter-Seal Pressure Monitoring Device	> 3250 mbar absolute
g. 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 pads are 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. Each pad is designed to store 28 SSSCs arranged in two rows. The SSSCs in each row will be spaced a nominal 16 feet apart center to center. Each row of SSSCs will be spaced a nominal 16 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.

Attachment 5

AREVA Proprietary Affidavit

North Anna Power Station
Independent Spent Fuel Storage Installation
Virginia Electric and Power Company
(Dominion)

AFFIDAVIT PURSUANT TO 10 CFR 2.390

AREVA Inc.)
State of Maryland) SS.
County of Howard)

I, Paul Triska, depose and say that I am a Vice President of AREVA Inc., duly authorized to execute this affidavit, and have reviewed or caused to have reviewed the information which is identified as proprietary and referenced in the paragraph immediately below. I am submitting this affidavit in conformance with the provisions of 10 CFR 2.390 of the Commission's regulations for withholding this information.

The information for which proprietary treatment is sought is contained in Attachment 4 and is listed below:

- Portions of Attachment 4 - the design/licensing basis document for the TN-32B Dry Storage Cask
- Attachment 4 (Appendix A) – Licensing design drawings

These documents have been appropriately designated as proprietary.

I have personal knowledge of the criteria and procedures utilized by AREVA Inc. in designating information as a trade secret, privileged, or as confidential commercial or financial information.

Pursuant to the provisions of paragraph (b) (4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure, included in the above referenced document, should be withheld.

1) The information sought to be withheld from public disclosure involves certain design details and analyses, experimental results, and modeling approaches related to the design of the modified TN-32B dry storage cask (high burnup demonstration cask), which are owned and have been held in confidence by AREVA Inc.

2) The information is of a type customarily held in confidence by AREVA Inc. and not customarily disclosed to the public. AREVA Inc. has a rational basis for determining the types of information customarily held in confidence by it.

3) Public disclosure of the information is likely to cause substantial harm to the competitive position of AREVA Inc. because the information consists of descriptions of the design and analysis of the modified TN-32B dry spent fuel storage cask, the application of which provide a competitive economic advantage. The availability of such information to competitors would enable them to modify their product to better compete with AREVA Inc., take marketing or other actions to improve their product's position or impair the position of AREVA Inc.'s product, and avoid developing similar data and analyses in support of their processes, methods or apparatus.

Further the deponent sayeth not.

Paul Triska
Vice President, AREVA Inc.

Subscribed and sworn to me before this 20th day of July, 2015.

Notary Public
My Commission Expires 10 / 17 / 2015

ZORA M. DOUGHERTY
My Commission Expires
NOTARY PUBLIC
10-17-2015
HOWARD COUNTY, MD