VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

~~PROPRIETARY INFORMATION – WITHHOLD UNDER 10 CFR 2.390~~

September 23, 2016

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

Serial No. 16-055D
NLOS/TJS R0
Docket No. 72-16
License No. SNM-2507

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION INDEPENDENT SPENT FUEL STORAGE INSTALLATION
PROPOSED TECHNICAL SPECIFICATION CHANGE REQUEST REGARDING STORAGE OF INCREASED MAXIMUM ENRICHMENT AND BURN-UP FUEL IN A MODIFIED TN-32B STORAGE CASK
SECOND REQUEST FOR ADDITIONAL INFORMATION RESPONSE

On August 24, 2015, Virginia Electric and Power Company (Dominion) requested an amendment (ADAMS Accession No. ML15239B251) in the form of revisions to the Technical Specifications to License Number SNM-2507 for the North Anna Power Station (NAPS) Independent Spent Fuel Storage Installation (ISFSI). The proposed amendment would allow storage of spent fuel in a modified TN-32B bolted lid cask as part of the High Burn-up (HBU) Dry Storage Cask Research and Development Project sponsored by the Department of Energy (DOE) and the Electric Power Research Institute (EPRI). This initial submittal was subsequently supplemented several times (see References) in response to NRC requests for supporting information.

On August 16, 2016, Dominion received a second Request for Additional Information (RAI) (ADAMS Accession No. ML16231A397) pertaining to the HBU Dry Storage Cask neutron shield material. The response to the second RAI is provided in Attachment 1. Supporting documentation for the RAI response is provided in Attachments 2, 3, 4, and 6. Attachment 6 contains information that has been determined by AREVA/TN to be proprietary in its entirety; therefore, a non-proprietary version of this document has not been provided. AREVA TN is requesting that Attachment 6 be withheld from public disclosure in accordance with 10 CFR 2.390, as the information is proprietary. In support of the request to withhold Attachment 6, an affidavit has been prepared by AREVA TN and is provided as Attachment 5.

NMSS20
NMSS26

~~ATTACHMENT 6 CONTAINS INFORMATION THAT IS BEING WITHHELD FROM PUBLIC DISCLOSURE UNDER 10 CFR 2.390.~~ **UPON SEPARATION THIS PAGE IS DECONTROLLED.**

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

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 23rd day of September, 2016.

My Commission Expires: January 31, 2020 Wanda D. Craft

Notary Public

WANDA D. CRAFT
Notary Public
Commonwealth of Virginia
Reg. # 7520495
My Commission Expires January 31, 2020

References:

1. Dominion Letter No. 15-369A, dated 10/08/15 (ADAMS Accession No. ML15289A189)
2. Dominion Letter No. 15-369C, dated 11/18/15 (ADAMS Accession No. ML15328A483)
3. Dominion Letter No. 15-369D, dated 11/19/15 (ADAMS Accession No. ML15331A132)
4. Dominion Letter No. 15-369E, dated 12/01/15 (ADAMS Accession No. ML15342A065)
5. Dominion Letter No. 15-369F, dated 11/19/15 (ADAMS Accession No. ML16022A073)
6. Dominion Letter No. 15-369G, dated 12/28/15 (ADAMS Accession No. ML16004A108)
7. Dominion Letter No. 15-369H, dated 01/14/16 (ADAMS Accession No. ML16019A335)
8. Dominion Letter No. 15-369I, dated 02/04/16 (ADAMS Accession No. ML16043A371)
9. Dominion Letter No. 16-055, dated 03/22/16 (ADAMS Accession No. ML16089A092)
10. Dominion Letter No. 16-055A, dated 04/21/16 (ADAMS Accession No. ML16118A206)
11. Dominion Letter No. 16-055B, dated 06/21/16 (ADAMS Accession No. ML16176A239)
12. Dominion Letter No. 16-055C, dated 07/26/16 (ADAMS Accession No. ML16211A077)

Attachments:

1. Response to Second RAI
2. Dominion Engineering Technical Evaluation, ETE-NAF-2016-0111, Rev. 0, "TN-32 Cask Decay Heats for AREVA TN's High Burnup Cask Thermal Analysis."
3. Dominion Calculation, SF-0017, Rev. 0, "TN-32B HBU Cask ORIGEN Decay Heat Calculation."
4. Dominion Engineering Technical Evaluation, ETE-NAF-2016-0119, Rev. 0, "Daily Average Temperatures for Louisa, VA."
5. AREVA TN Affidavit
6. AREVA TN Calculation, 19885-0411, "Sensitivity Evaluation for TN-32B HBU Resin Temperature." (Proprietary)

Commitments made in this letter: None

cc: U.S. Nuclear Regulatory Commission (w/o Attachments)
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North Anna Power Station

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Richmond, Virginia 23219

Serial No. 16-055D
Docket No. 72-16

ATTACHMENT 1

Response to Second RAI

North Anna Power Station ISFSI

Virginia Electric and Power Company

NRC Question

"Shielding

1. *Perform shielding analyses, consistent with the neutron shield material performance, to demonstrate that the North Anna Power Station ISFSI can still meet the regulatory dose limit of 10 CFR 72.104(a) for the duration of the storage of the TN-32B HBU cask.*

   In their response to RAI-8 (Chapter 6 "Thermal Evaluation"), the applicant referenced Appendix 9A of the TN-32 FSAR, Rev. 6 to indicate that the neutron shield does not exhibit significant performance degradation at a temperature of 311 °F. However, the staff notes that Figure 9A-1 shows there is a 1.5% to 2% material loss after 100 days at 311 °F.

   In addition, based on the conference call on August 2, 2016 between the applicant and the NRC staff, the maximum calculated temperatures of the radial neutron shield in the TN-32B HBU cask were defined to be about [320 °F] on the inner side and [250 °F] on outer side, respectively. As such, the bulk of the radial neutron shield appears to be working at a temperature significantly above the allowable temperature limit (300°F). Therefore, NRC staff is concerned that the elevated working temperature may result in accelerated degradation of the neutron shield and impair its ability to perform its intended safety function. Since the radial neutron shield experiences a greater temperature than was analyzed in the FSAR there may be a greater material loss resulting in a higher site boundary dose that may challenge the limit of 10 CFR 72.104(a).

   Staff needs this information to determine if the TN-32B HBU cask meets the regulatory requirements of 10 CFR 72.104(a)."

Response to NRC Question

The resin temperature for normal operation of the TN-32B HBU Cask was calculated in AREVA TN Calculation 19885-0403 [Reference 1]. This calculation used conservative inputs that resulted in a peak resin temperature of 322 °F. In order to demonstrate to the NRC that the peak resin temperature of the TN-32B HBU Cask is, in fact, less than 300°F including uncertainty, the following conservatisms were reduced in a supplemental thermal analysis:

1) The actual decay heat loads of the surrounding casks at the time of TN-32B HBU Cask loading were used instead of the design basis heat loads,
2) Decay heat loads for the TN-32B HBU Cask were further refined by calculating the individual assembly average decay heat values with ORIGEN-ARP using actual burnup histories of each of the 32 fuel assemblies, and
3) The maximum average ambient air temperature was reduced to 93.5°F.

The details of each of these reductions in conservatism are provided below.

1. The original thermal analysis assumed that the casks surrounding the TN-32B HBU Cask on Pad 1 of the NAPS ISFSI each had a heat load of 27.1 kW. In reality, the surrounding casks have significantly lower heat loads due to the time elapsed since the surrounding casks were loaded onto Pad 1. Using a July 1, 2017 date for decay time (i.e., the currently planned TN-32B HBU Cask load date), the decay heat of the surrounding casks was recalculated using the NUHOMS® HD decay heat algorithm [Reference 2]. The calculated surrounding cask decay heat was reduced from 27.1 kW to 19.732 kW for the hottest cask and 10.161 kW for the coolest cask. The recalculation of the heat load for each of the surrounding casks used in the supplemental analysis is contained in Dominion Engineering Technical Evaluation, ETE-NAF-2016-0111 (Attachment 2).

   Note that the analysis presented in Attachment 2 also recalculates the TN-32B HBU Cask decay heat load using the conservative NUHOMS® HD decay heat algorithm. However, the decay heat load for the TN-32B HBU Cask presented in Attachment 2 was NOT used in the supplemental thermal analysis. Rather, a more refined decay heat load calculation for the TN-32B HBU Cask, as presented in Attachment 3, was used in the supplemental thermal analysis.

2. The original thermal analysis for the TN-32B HBU Cask used the NUHOMS® HD decay heat algorithm [Reference 2] and predicted a heat load of 36.96 kW. The basis for the TN-32B HBU Cask decay heat algorithm is an ORIGEN analysis that calculated a forcing function defined in Section 14.6.2 of the AREVA Transnuclear NUHOMS® HD Updated Final Safety Analysis Report, Rev. 4 [Reference 2]. The underlying basis uses the SAS2H and the ORIGEN-S modules of the SCALE 4.4 computer code to calculate a non-linear regression analysis as a function of enrichment, cooling time, and burnup. While this decay heat algorithm is conservative and has been approved by the NRC, it is overly conservative for the purposes of this supplemental thermal analysis.

   Therefore, for this supplemental thermal analysis, the ORIGEN-ARP/ORIGEN-S code was used to recalculate the TN-32B HBU Cask decay heat load using the specific burnup history of each fuel assembly. As stated in Section 3 of NUREG/CR-6748 [Reference 3]:

   > "The burnup credit sequence uses the well-established code modules currently available in the SCALE-4 code system. These code modules include ARP and ORIGEN-S to perform the depletion analysis phase of the calculations. ORIGEN-ARP is a sequence within the SCALE system that serves as a faster alternative to the SAS2H sequence of SCALE to perform point-irradiation calculations with the ORIGEN-S code using

problem dependent cross sections. ARP (Automatic Rapid Processing) uses an algorithm that enables the generation of cross-section libraries for the ORIGEN-S code by interpolation over pregenerated SAS2H cross-section libraries."

The heat load for the TN-32B HBU Cask was recalculated using ORIGEN-ARP with nominal uranium loading, batch average enrichments, and actual cycle-average power for each of the 32 assemblies. Uncertainties for burnup and enrichment were incorporated into the analysis. The details of this reanalysis of the TN-32B HBU Cask decay heat load are contained in Dominion Calculation SF-0017 (Attachment 3).

The decay heat calculated for the TN-32B HBU Cask for use in the supplemental thermal analysis has been reduced to 32.934 kW.

3. The last conservatism that was adjusted was the daily average ambient temperature. The daily average ambient temperature used in the original analysis was 100°F, with a peak daytime temperature of 115°F. The daily average ambient temperature was reduced from 100°F to 93.5°F in this supplemental thermal analysis. After reviewing the last 50 years of temperature data from a National Oceanic and Atmospheric Administration (NOAA) weather station just north of the town of Louisa, Virginia (i.e., the closest temperature data set to NAPS), the highest daily average ambient temperature observed was 87.5°F. This weather station is approximately 11.5 miles from the NAPS ISFSI. Use of a daily average ambient temperature in the thermal analysis is consistent with the TN-32 licensing basis as approved by the NRC. The 93.5°F value used in the supplemental thermal analysis is 6 degrees higher than the highest daily average ambient temperature of 87.5°F experienced near NAPS in the last 50 years. See Dominion Engineering Technical Evaluation, ETE-NAF-2016-0119 (Attachment 4) for additional details.

   The use of average ambient temperatures is consistent with previous thermal analysis, as detailed in Reference 4. As stated in Section 2.2.5.2.7 of the TN-32 TSAR [Reference 4], "Because the cask thermal inertia is large, the cask temperature response to changes in atmospheric conditions will be relatively slow. Ambient temperature variations due to changes in atmospheric conditions (i.e., sun, ice, snow, rain and wind) will not affect the performance of the cask. The cyclical variation of insolation during a day will also create insignificant thermal gradients."

When the above three conservatisms are adjusted in the supplemental thermal analysis, the peak resin temperature calculated in the model is 295.7°F. Including the 3.5°F resin temperature uncertainty, the peak resin temperature is 299.2°F which is less than the 300°F resin temperature limit. The supplemental thermal analysis is provided in AREVA TN Calculation, 19885-0411 (Attachment 6).

The result of the supplemental thermal analysis demonstrates that the resin temperature does not exceed the 300 °F limit, and therefore, accelerated degradation of the neutron shield will not occur. The neutron shield will maintain its design and safety functions for postulated conditions.

The shielding analysis presented to the NRC demonstrated that regulatory requirements for dose limits specified in 10 CFR 72.104(a) will continue to be met with the loading and placement of the TN-32B HBU Cask onto Pad 1 of the NAPS ISFSI. The shielding analyses remain conservative and bounding as a result of the supplemental thermal analysis. Sensitivity studies performed in Section 11 of AREVA TN Calculation, 19885-0502 [Reference 5] illustrate that some degradation of the neutron resin shield would increase the dose rates by less than 10%, which is within the MCNP code uncertainty.

No other analyses associated with the TN-32B HBU Cask have been updated as a result of this RAI response. The previous analyses of the TN-32B HBU Cask using a decay heat load of 36.96 kW remain conservative and bounding. The calculated TN-32B HBU Cask decay heat load was only utilized in the supplemental thermal analysis provided in response to this second RAI.

References

1. AREVA TN Calculation 19885-0403, Rev. 2, "Thermal Evaluation of TN-32B HBU Cask for Normal and Accident Conditions," July 6, 2016. (Provided to the NRC in Dominion Letter 16-055B on June 21, 2016, ML16176A239.)

2. AREVA Transnuclear, "NUHOMS® HD Horizontal Modular Storage System for Irradiated Nuclear Fuel," Updated Final Safety Analysis Report, Revision 4, September 2013.

3. NUREG/CR-6748, "STARBUCS: A Prototypic SCAL Control Module for Automated Criticality Safety Analyses Using Burnup Credit," October 2001.

4. TN-32 Dry Storage Cask Topical Safety Analysis Report (TSAR), Revision 9A, December 1996.

5. AREVA TN Calculation 19885-0502, Rev. 1, "TN-32B HBU Shielding Analysis," dated March 17, 2016 (Provided to NRC in Dominion Letter 16-055A on April 21, 2016, ML16118A206.)

Serial No. 16-055D
Docket No. 72-16

ATTACHMENT 5

AREVA TN Affidavit

North Anna Power Station ISFSI

Virginia Electric and Power Company

AREVA

Sept. 16, 2016
E-46376 Rev. 0

Don McGee, PM
Mail Code CLT-1A
7207 IBM Dr.
Charlotte, NC 28262

Subject: Supporting Documentation for License Amendment Request Serial No. 15-369 to License SNM-2507 Docket No. 72-16, Request for Additional Information

Dear Mr. McGee:

This correspondence is written to provide AREVA TN documentation that was referenced in or revised due to RAI responses to the NRC for the subject 10 CFR 72 license amendment. This license amendment is for the storage of high burn up nuclear fuel at the North Anna Power Station as part of a project to monitor the effects of long-term storage. The document requested is being transmitted to Dominion Power under proprietary agreement and, subsequently, forwarded on to the NRC via an affidavit pursuant to 10 CFR 2.390.

The specific document are being transmitted electronically is identified as follows:

- AREVA TN Calculation 19885-0411 Rev. 0 {Proprietary – Trade Secret}

Sincerely,

T. M. Edwards

Tom Edwards
Design Project Engineer

cc: Phil Lozmack (PM)
Todd Young (QAS)
Dennis Williford (Licensing)
John McEntire (PM)
Rod Gooch (PM)
Lauren Naggs (DCA)
Project File 19885 – Outgoing Correspondence

AREVA TN

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AFFIDAVIT PURSUANT
TO 10 CFR 2.390

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

I, Jeff Isakson, 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 listed below:

- Calculation 19885-0411, Revision 0

This document has 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 a document (design analysis) related to the design of the modified TN-32B dry storage cask (High Burnup Fuel Cask Demonstration Project), which is owned and has 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.

Jeff Isakson
Vice President, AREVA Inc.

Subscribed and sworn before me this 20th day of September, 2016.

Notary Public
My Commission Expires 10/16/19

RONDA JONES
NOTARY PUBLIC STATE OF MARYLAND
My Commission Expires October 16, 2019