VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

10CFR50.90

June 23, 2011

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Serial No. 11-346
NL&OS/ETS R0
Docket Nos. 50-338/339
License Nos. NPF-4/7

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2
SUPPLEMENTAL INFORMATION TO SUPPORT
PROPOSED LICENSE AMENDMENT REQUEST (LAR)
ADDITION OF ANALYTICAL METHODOLOGY TO COLR
BEST-ESTIMATE LARGE BREAK LOSS OF COOLANT ACCIDENT (BE-LBLOCA)

In a October 21, 2010 letter (Serial No. 10-575), Virginia Electric and Power Company (Dominion) requested amendments, in the form of changes to the Technical Specifications (TS) to Facility Operating License Numbers NPF-4 and NPF-7 for North Anna Power Station Units 1 and 2, respectively. The proposed LAR requests the inclusion of the Westinghouse BE-LBLOCA analysis methodology using the Automated Statistical Treatment of Uncertainty Method (ASTRUM) for the analysis of LBLOCA to the list of methodologies approved for reference in the Core Operating Limits Report (COLR) in TS 5.6.5.b. This LAR also removes four obsolete COLR references that supported North Anna Improved Fuel (NAIF) product (i.e., Westinghouse Vantage 5H). The NAIF product is not planned to be used in future North Anna cores.

In Section 4.4 of Attachment 1 of the October 21, 2010 letter, Dominion stated that "...effects of LOCA and seismic loads on core geometry do not need to be considered unless grid crushing extends beyond the 28 assemblies in the low-power channel. This situation had been calculated not to occur for North Anna Units 1 and 2." Recently, Westinghouse identified an issue in their calculation associated with the reactor vessel structural model used to assess effects of LOCA loads. Correction of this issue results in changes to the LOCA loads and to the core plate motions at the top and bottom of the core, which are used to determine the amount of grid crush. Using the revised plate motions in the LOCA/seismic fuel structural analysis results in grid crush being predicted in locations beyond the 28 fuel assemblies in the low-power channel. The locations for which grid crush is predicted are on the core periphery (i.e., they have at least one fuel assembly face against a baffle plate). The peaking factors for the fuel assembly locations predicted to have grid crush were reviewed and confirmed to be categorized as low power, consistent with the BE-LBLOCA methodology. Therefore, it is concluded that no additional calculations are required, no PCT penalty is necessary, and coolable core geometry can be maintained. As such, it is concluded that North Anna Units 1 and 2 will satisfy the limit

prescribed by 10 CFR 50.46 acceptance criterion (b)(4). Additional discussion is provided in the Attachment to this letter.

The enclosed supplement does not impact the conclusion of the existing significant hazards consideration determination as defined in 10 CFR 50.92 or the evaluation for eligibility for categorical exclusion as set forth in 10 CFR 51.22(c)(9).

Dominion is currently planning to use Westinghouse RFA-2 fuel in North Anna Units 1 and 2 commencing with North Anna Unit 1, Cycle 23 (Spring 2012) and North Anna Unit 2, Cycle 23 (Spring 2013). Therefore, Dominion continues to request approval of the proposed amendments by November 1, 2011. Dominion also continues to request a 60-day implementation period following NRC approval of the requested license amendments.

If you have any questions or require additional information, please contact Mr. Thomas Shaub at (804) 273-2763.

Sincerely,

J. Alan Price
Vice President – Nuclear Engineering

VICKI L. HULL
Notary Public
Commonwealth of Virginia
140542
My Commission Expires May 31, 2014

COMMONWEALTH OF VIRGINIA

COUNTY OF HENRICO

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by J. Alan Price, 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 June, 2011.

My Commission Expires: May 31, 2014

Vicki L. Hull
Notary Public

Attachment:

Supplemental Information – Addition of Analytical Methodology to COLR

Commitments made in this letter: None

cc: U.S. Nuclear Regulatory Commission
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ATTACHMENT

SUPPLEMENTAL INFORMATION

ADDITION OF ANALYTICAL METHODOLOGY TO COLR

Virginia Electric and Power Company
(Dominion)
North Anna Power Station Units 1 and 2

Background

In an October 21, 2010 letter (Ref. 1), Virginia Electric and Power Company (Dominion) submitted a license amendment request (LAR), in the form of changes to the Technical Specifications (TS) to Facility Operating License Numbers NPF-4 and NPF-7 for North Anna Power Station Units 1 and 2, respectively. The proposed LAR requests the inclusion of the Westinghouse best estimate large break loss of coolant accident (BE-LBLOCA) analysis methodology using the Automated Statistical Treatment of Uncertainty Method (ASTRUM) for the analysis of LBLOCA to the list of methodologies approved for reference in the Core Operating Limits Report (COLR) in TS 5.6.5.b. This LAR also removed four obsolete COLR references that supported the Westinghouse 17x17 Vantage 5H fuel product since the Westinghouse 17x17 Vantage 5H fuel product is not planned to be used in future North Anna cores. In a November 10, 2010 communication, the NRC provided the results of the NRC staff's acceptance review of this amendment request.

Supplemental Information

In Section 4.4 of Attachment 1 of the October 21, 2010 letter, Dominion stated:

> "10 CFR 50.46 acceptance criterion (b)(4) requires that the calculated changes in core geometry are such that the core remains amenable to cooling. This criterion has historically been satisfied by adherence to criteria (b)(1) and (b)(2), and by assuring that fuel deformation due to combined LOCA and seismic loads is specifically addressed. It has been demonstrated that the PCT and maximum cladding oxidation limits have been satisfied for Best-Estimate LBLOCA applications. The approved methodology (Reference 1) specifies that effects of LOCA and seismic loads on core geometry do not need to be considered unless grid crushing extends beyond the 28 assemblies in the low-power channel. This situation has been calculated not to occur for North Anna Units 1 and 2. The actions, automatic or manual, that are currently in place at the North Anna Power Station Unit 1 and Unit 2 to maintain long-term cooling remain unchanged with the application of the ASTRUM methodology (Reference 1). Therefore, acceptance criterion (b)(4) is satisfied."

The LAR text was based on the determination that grid crush did not extend beyond the 28 low power/peripheral assemblies as defined/modeled in the WCOBRA/TRAC vessel model for North Anna Units 1 and 2. It was noted in the LAR that since grid crush had been calculated not to occur beyond the 28 low power/peripheral assemblies for North Anna Units 1 and 2, the effects of LOCA and seismic loads on coolable core geometry did not need to be considered.

Westinghouse recently identified an issue in their calculation associated with the reactor vessel structural model used to assess effects of LOCA loads. Specifically, a non-conservative value was assumed for the reactor vessel internals lower radial

keyway stiffness. This component connects the lower support plate to the inside of the reactor vessel. Using a corrected stiffness value causes more severe motions of the plates at top and bottom of the core. The revised core plate motions in the LOCA/seismic fuel structural analysis results in grid crush being predicted in locations beyond the 28 fuel assemblies in the low-power channel. The additional locations for which grid crush is predicted are on the core periphery, i.e., they have at least one fuel assembly face against a baffle plate.

Per WCAP-12945-P-A (Ref. 2) (specifically, Westinghouse's responses to NRC RAI 5-53b) and WCAP-16009-P-A (Ref. 3) (page 13-31, cross-reference to WCAP-12945-P-A RAI 5-53b), the BE-LBLOCA methodology for evaluating the effects of grid crush due to combined LOCA and seismic loads is dependent on the amount of crushing which occurs. If assemblies on the core periphery (i.e., at least 1 face on the baffle) are the only assemblies to experience grid crushing, it is concluded that additional analyses are not warranted, and no PCT penalty is necessary. This conclusion is based on taking credit for the low power generation in the periphery assemblies, and the observation that any flow redistribution which may occur would tend to benefit the inboard assemblies. If inboard assemblies are also affected by grid crush, a specific WCOBRA/TRAC calculation would be performed to assess the effects.

The peaking factors for the fuel assembly locations predicted to have grid crush were reviewed and confirmed to be categorized as low power locations. The criterion of significance with respect to consideration of whether further calculations are required is the determination of whether grid crush is limited to low power locations. Since it has been confirmed, as required by the approved methodology (Refs. 2 and 3), that the 36 peripheral assemblies are at lower power, it is concluded that no additional calculations are required, no PCT penalty is necessary, and coolable core geometry can be maintained. As such, it is further concluded that North Anna Units 1 and 2 satisfy the limit prescribed by 10 CFR 50.46 acceptance criterion (b)(4).

Therefore the LAR 10 CFR 50.46 acceptance criterion (b)(4) text is revised as shown below (updated text underlined):

> "10 CFR 50.46 acceptance criterion (b)(4) requires that the calculated changes in core geometry are such that the core remains amenable to cooling. This criterion has historically been satisfied by adherence to criteria (b)(1) and (b)(2), and by assuring that fuel deformation due to combined LOCA and seismic loads is specifically addressed. It has been demonstrated that the PCT and maximum cladding oxidation limits have been satisfied for Best-Estimate LBLOCA applications. The approved methodology (Reference 1) specifies that effects of LOCA and seismic loads on core geometry do not need to be considered unless grid crushing extends beyond the <u>core periphery (i.e., at least one face on the baffle). This conclusion is based on the low power generation in the periphery assemblies, and the observation that any flow redistribution which may occur would tend to benefit the inboard assemblies. For North Anna Units 1 and 2, grid crushing has been predicted to occur only on the core</u>

periphery, and low power generation has been confirmed for all core peripheral assemblies. The actions, automatic or manual, that are currently in place at North Anna Units 1 and 2 to maintain long-term cooling remain unchanged with the application of the ASTRUM methodology (Ref. 1). Therefore, acceptance criterion (b)(4) is satisfied."

References

1. Letter from L. N. Hartz (Dominion) to USNRC, "Virginia Electric and Power Company, North Anna Power Station Units 1 and 2, Proposed License Amendment Request (LAR), Addition of Analytical Methodology to COLR, Best-Estimate Large Break Loss of Coolant Accident (BE-LBLOCA)," October 21, 2010 (Serial No. 10-575).

2. WCAP-12945-P-A, Volume 1, Revision 2, and Volumes 2 through 5, Revision 1, "Code Qualification Document for Best Estimate LOCA Analysis," Bajorek, S. M., et al., 1998. (RAI 5-53b responses).

3. WCAP-16009-P-A, "Realistic Large-Break LOCA Evaluation Methodology Using the Automated Statistical Treatment of Uncertainty Method (ASTRUM)," Nissley, M. E., et al., January 2005. (Page 13-31, cross reference to WCAP-12945-P-A, RAI 5-53b).