

VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

July 14, 2004

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Serial No. 04-394
NLOS/ETS R0
Docket Nos. 50-338
50-339
License Nos. NPF-4
NPF-7

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2
30-DAY REPORT OF EMERGENCY CORE
COOLING SYSTEM (ECCS) EVALUATION MODEL CHANGES
PURSUANT TO THE REQUIREMENTS OF 10CFR50.46

Pursuant to 10CFR50.46(a)(3)(ii) Virginia Electric and Power Company (Dominion) is providing information concerning changes to the Westinghouse ECCS Evaluation Model for Large Break LOCA at North Anna Units 1 and 2 and its application in existing licensing analyses. Information is also provided which quantifies the effect of these changes upon reported results for North Anna Power Station Units 1 and 2, and demonstrates continued compliance with the acceptance criteria of 10CFR50.46.

Attachment 1 provides information describing plant-specific evaluation model changes associated with the application of the Westinghouse large break LOCA evaluation models for North Anna Units 1 and 2 (i.e., a reanalysis of the large break LOCA).

Information regarding the effect of the ECCS Evaluation Model changes upon the reported large break LOCA analysis of record (AOR) results is provided for North Anna Units 1 and 2 in Attachment 2. To summarize the information in Attachment 2, the calculated peak cladding temperature (PCT) for the large break LOCA analyses for North Anna Units 1 and 2 is 2086°F. This result represents a significant change, based on the criterion established in 10CFR50.46(a)(3)(i).

The large break LOCA results for North Anna Units 1 and 2 are confirmed to have sufficient margin to the 2200°F limit of 10CFR50.46. Based upon our evaluation of this information and the associated changes in the applicable licensing basis PCT results, no further action is required to demonstrate compliance with the 10CFR50.46 requirements.

This letter fulfills the commitment established in our letter dated May 21, 2003 (Serial No. 03-350) to reanalyze the North Anna large break LOCA. No further action is required at this time.

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

Very truly yours,



L. N. Hartz
Vice President – Nuclear Engineering

Commitments made in this letter:

1. None.

Attachments:

- 1) Report of Changes in Application of the Westinghouse ECCS Evaluation Model to the Large Break LOCA for North Anna Units 1 and 2
- 2) Reporting of 10 CFR 50.46 Margin Utilization - Westinghouse Large Break LOCA ECCS Evaluation Model - North Anna Units 1 and 2

cc: U.S. Nuclear Regulatory Commission
Region II
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Suite 23T85
Atlanta, GA 30303-8931

Mr. S. R. Monarque
U. S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Mail Stop 8-H12
Rockville, MD 20852

Mr. M. T. Widmann
NRC Senior Resident Inspector
North Anna Power Station

Attachment 1

**Report Of Changes
Application of the Westinghouse ECCS Evaluation Model
for the Large Break LOCA for North Anna Units 1 and 2**

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

Change in Application of the Westinghouse Large Break Loss of Coolant Accident (LOCA) Evaluation Model at North Anna Units 1 and 2 Revised Large Break LOCA Analysis

1.0 Background

This report provides a summary of changes in LOCA analysis results from those last reported for North Anna Units 1 and 2 (Reference 1). These changes are described in Section 2.0 below. It has been concluded that these changes are significant, as defined in 10 CFR 50.46(a)(3)(i).

2.0 Revised Large Break LOCA Analysis (North Anna Units 1 and 2)

Since our previous 10CFR50.46 report (Reference 1), a revised analysis of the large break LOCA transient for Westinghouse fuel has been performed for North Anna Units 1 and 2. This revised analysis has been implemented as the analysis of record in the Updated Final Safety Analysis Report (UFSAR) (Reference 2), consistent with the provisions of North Anna Technical Specification 5.6.5 (relating to the Core Operating Limits Report). This following discussion summarizes the key analysis inputs and assumptions incorporated in this analysis.

Previous Westinghouse large break LOCA sensitivity studies for a three loop plant similar to North Anna have indicated that the downflow configuration has PCT results which bound that of the upflow design. However, since these results can be somewhat variable between different plants, the North Anna reanalysis was performed for both upflow and downflow configurations. Results and limitations associated with this analysis are applicable to the operation of North Anna Units 1 and 2. The key input parameters and assumptions are listed below.

- Improved BASH Evaluation Model codestream
- Assumption of 7% uniform steam generator tube plugging in the replacement steam generators
- RCS total flow rate of 278,400 gpm
- Peak Heat Flux Hot Channel Factor, $F(Q)$, of 2.19
- Peak Enthalpy Hot Channel Factor, $F(\Delta h)$ of 1.55
- Hot Assembly Relative Power Factor of 1.45
- Containment Accumulator Water Temperature of 100°F
- One low head and one high head safety injection pump
- Upflow and downflow baffle/barrel designs
- North Anna Improved Fuel (NAIF) with ZIRLO™ cladding and PERFORMANCE+ design features
- Assumed fuel rod temperature and rod internal pressure from the PAD 4.0 code output
- Incorporation of skewed axial power distribution evaluation methodology

This analysis was performed using the Westinghouse 1981 large break LOCA evaluation model with BASH (Reference 3). Technical Specification 5.6.5 lists this as an acceptable

reference methodology for determination of relevant power distribution limits in the Core Operating Limits Report.

Large Break LOCA analyses have been traditionally performed using a symmetric, chopped cosine, core axial power distribution. In Reference 4, Westinghouse informed the NRC of the withdrawal of the Westinghouse Power Shape Sensitivity Model (PSSM) topical (Reference 5) effective October 30, 1995. This power shape methodology had been employed to support Reload Safety Evaluations (RSEs). Westinghouse further indicated that future large break LOCA analysis with the 1981 model with BASH would incorporate the explicit analysis approach to skewed power shapes as described in Reference 6. The analysis described herein employs the Reference 6 explicit analysis methodology.

The analysis assumed a peak Heat Flux Hot Channel Factor, $FQ(z)$, value of 2.19 and a peak Nuclear Enthalpy Hot Channel Factor, $F\Delta h$, value of 1.55. As required by Technical Specification 5.6.5, the Core Operating Limits Report (COLR) documents the applicable limit values of key core-related parameters for each reload core. These values bound the limits in the current cycle specific COLR's. For future reload cycles, the COLR will specify the appropriate limits which account for all design considerations, particularly large and small break LOCA effects.

The analysis assumes a full core of North Anna Improved Fuel (NAIF) with ZIRLO™ cladding and PERFORMANCE+ design features, which is similar and compatible to Westinghouse Vantage 5 Hybrid (V5H) fuel and the 17x17 Standard fuel. This modeling is applicable to full or mixed cores of either Westinghouse fuel product. The only mechanism available to cause a transition core to have a greater calculated large break LOCA PCT than a full core of either Westinghouse fuel product is the possibility of flow redistribution due to fuel assembly hydraulic resistance mismatch. It has been shown that the mixed core hydraulic resistance mismatches are not a significant factor, and it is not necessary to apply a LOCA analysis transition core penalty to mixed cores of Westinghouse fuel.

Employing these assumptions in the current version of the 1981 ECCS Evaluation Model with BASH, it has been demonstrated that operation at an assumed core thermal power of 2893 MWt with SGTP up to 7% in any SG will comply with all of the acceptance criteria specified in 10 CFR 50.46. Attachment 2 provides the PCT result for the revised analysis of record.

The revised analysis of record PCT for Westinghouse fuel is 2086°F assuming the limiting baffle/barrel configuration (downflow). Since the revised analysis of record is more than 50°F different from the existing analysis of record, implementation of this analysis represents a significant change, as defined in 10CFR50.46(a)(3)(i). The resulting licensing basis PCT demonstrates that operation at the rated thermal power of 2893 MWt will comply with all of the acceptance criteria specified in 10CFR50.46.

3.0 References

- (1) Letter from L. N. Hartz (Va. Electric & Power Co.) to USNRC, "Virginia Electric and Power Company, Surry and North Anna Power Stations Units 1 and 2, Annual Report and 30-Day Report of Emergency Core Coolant System (ECCS) Evaluation Model Changes Pursuant to Requirements of 10CFR50.46," Serial No. 04-334, June 18, 2004.
- (2) UFSAR Change Request FN 2004-016, Large Break Loss of Coolant Accident (LBLOCA), UFSAR Section 15.4.1, North Anna Power Station Units 1 and 2, June 24, 2004.
- (3) WCAP-10266-P-A, Rev. 2, "The 1981 Version of the Westinghouse ECCS Evaluation Model using the BASH Code," March 1987.
- (4) Letter from N. J. Liparulo (Westinghouse) to USNRC, "Withdrawal of WCAP-12909-P on Power Shape Sensitivity Model (PSSM)," NTD-NRC-95-4518, August 7, 1995.
- (5) WCAP-12909-P, "Westinghouse ECCS Evaluation Model: Revised Large Break LOCA Power Distribution Methodology," June 1991.
- (6) WCAP-10266-P-A, Addendum 1, Revision 2-P-A, "The 1981 Version of Westinghouse ECCS Evaluation Model Using the BASH Code, Addendum 1; Power Shape Sensitivity Studies," March, 1987.

Attachment 2

**Reporting of 10 CFR 50.46 Margin Utilization
Westinghouse Large Break LOCA ECCS Evaluation Model**

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

**Reporting of 10 CFR 50.46 Margin Utilization
Westinghouse Large Break LOCA ECCS Evaluation Model
North Anna Units 1 and 2**

The information provided herein is applicable to the Westinghouse large break LOCA ECCS Evaluation Model for North Anna Power Station, Units 1 and 2. It is based upon reports from Westinghouse for issues involving the ECCS evaluation models and plant-specific application of the models in the existing analyses. Peak cladding temperature (PCT) values and margin allocations represent issues for which permanent resolutions have been implemented. The assessments for large break LOCA are presented below.

10 CFR 50.46 Margin Utilization - Westinghouse Large Break LOCA ECCS Evaluation Model - North Anna Unit 1

A. PCT for Analysis of Record (AOR) {1}	2086°F
B. Prior PCT Assessments Allocated to AOR	0°F
C. PCT Assessments for 10CFR50.46(a)(3)(i) Accumulation	0°F
D. LBLOCA Licensing Basis PCT (AOR PCT + PCT Assessments){2}	2086°F

10 CFR 50.46 Margin Utilization - Westinghouse Large Break LOCA ECCS Evaluation Model - North Anna Unit 2

A. PCT for Analysis of Record (AOR) {1}	2086°F
B. Prior PCT Assessments Allocated to AOR	0°F
C. PCT Assessments for 10CFR50.46(a)(3)(i) Accumulation	0°F
D. LBLOCA Licensing Basis PCT (AOR PCT + PCT Assessments){2}	2086°F

Notes { } and References () on the following page.

**Reporting of 10 CFR 50.46 Margin Utilization
Westinghouse Large Break LOCA ECCS Evaluation Model
North Anna Units 1 and 2
(continued)**

Notes:

- {1} The current report is the initial quantification of a reanalysis of the large break LOCA at North Anna Units 1 and 2 with the Westinghouse LBLOCA Evaluation Model. Refer to the Report of Changes in Application of ECCS Evaluation Model Changes provided in Attachment 1.
- {2} For North Anna Units 1 and 2, the change in the licensing basis PCT from Reference 1 for the Westinghouse large break LOCA is greater than 50°F. This is a significant change, as defined in 10CFR50.46(a)(3)(i).

References:

- (1) Letter from L. N. Hartz (Va. Electric and Power Co.) to USNRC, "Virginia Electric and Power Company, Surry and North Anna Power Stations Units 1 and 2, Annual Report and 30-Day Report of Emergency Core Cooling System (ECCS) Evaluation Model Changes Pursuant to the Requirements of 10CFR50.46," Serial No. 04-334, June 18, 2004.