

VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

February 10, 1992

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

Serial No. 92-091
NL&P/JYR:jmj
Docket Nos. 50-338
50-339
License Nos. NPF-4
NPF-7

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2
REPORT OF ERRORS/CHANGES IN APPLICATION
OF ECCS EVALUATION MODELS PER REQUIREMENTS
OF 10 CFR 50.46 (30 DAY REPORT)


Pursuant to 10 CFR 50.46(a)(3)(ii) Virginia Electric and Power Company is providing information concerning an error and change in results obtained from application of the ECCS evaluation models used in existing licensing analyses. Information is also provided which quantifies the effect of these changes upon the existing analyses for North Anna Power Station, and demonstrates continued compliance with the acceptance criteria of 10 CFR 50.46.

Attachment 1 provides a report describing the changes associated with application of the ECCS Evaluation Model. As indicated in the Attachment 1 report, these changes have been concluded to be significant, based upon the criterion established in 10 CFR 50.46. The detailed effect of these changes upon peak clad temperature (PCT) results is presented in Attachment 2. To summarize the information in Attachment 2, the calculated PCT for the small and large break LOCA analyses for North Anna are given below. Results which include significant changes are designated with an asterisk.

North Anna Units 1 and 2 - Small break: 1873°F (*)
North Anna Unit 1 - Large break: 2169°F (*)
North Anna Unit 2 - Large break: 2131°F

Since none of the calculated temperatures exceed 2200°F, no further action is required. If you have further questions or require additional information, please contact us.

Very truly yours,



W. L. Stewart
Senior Vice President - Nuclear

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ADD 1/

Attachments:

- 1) Report of Changes/Errors in Application of Evaluation Models
- 2) Effect of Changes/Errors - North Anna

cc: United States Nuclear Regulatory Commission
Region II
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Mr. M. S. Lesser
NRC Senior Resident Inspector
North Anna Power Station

ATTACHMENT 1

Report of Errors/Changes in Application of ECCS Evaluation Model
Revised Small Break LOCA Analysis - NOTRUMP Evaluation Model
Accumulator Injection Volume Modeling - BASH Evaluation Model

North Anna Unit 1 and 2

1.0 Background

The current report provides an update of changes in LOCA analysis results from those last reported for North Anna Units 1 and 2 (1). There are two changes presented in this report, both of which have been concluded to be significant, per the definition in 10 CFR 50.46 (a)(3)(i). These changes are: a revised small break LOCA analysis using the NOTRUMP evaluation model and an error in application large break LOCA analysis using the BASH evaluation model.

2.0 Evaluation Model Changes/Errors

2.1 Revised Small Break LOCA Analysis

Reported herein are the summary results of a revised small break LOCA analysis performed with the NOTRUMP Evaluation Model (2). This analysis was performed to accommodate increased steam generator tube plugging, while including assumptions which provide potential margin for North Anna Unit 1 and 2 future operation. The major changes in assumptions in the Reference (2) analysis are:

- 35% uniform steam generator tube plugging
- Increased value of Normalized Hot Channel Factor, $K(z)$
- Peak value for Enthalpy Hot Channel Factor, $FN\Delta h$, of 1.60
- Assumed flow imbalance among the high head safety injection lines

This analysis is reported here since its peak clad temperature differs by more than 50°F from that of the last reported analysis and the assumption changes involve items which do not require prior NRC review and approval. The analysis was performed by Virginia Power staff, employing the Westinghouse NOTRUMP evaluation model and analytical techniques which comply with 10 CFR 50, Appendix K. North Anna Technical Specification 6.9.1.7 allows changes in the key core-related parameters above to be implemented and reported in the Core Operating Limits Report (COLR).

2.2 Accumulator Injection Water Volume ECCS Application Error

It has been determined that the large break LOCA analysis result last reported (1) included an error in the modeling of accumulator injection water volume available at the beginning of core recovery (BOC) time. This error was found during analyses being conducted to support operation of North Anna Unit 1 with extended steam generator tube plugging (SGTP). The error resulted in use of a total available accumulator water volume which was 193 ft³ too large for the two intact loop accumulators. A sensitivity analysis with the error corrected indicated that the peak clad temperature (PCT) increase could be as large as 224°F. The impact of this error and the demonstration of continued compliance with the 2200°F

acceptance limit of 10 CFR 50.46 is described separately below for Units 1 and 2.

2.2.1 Evaluation of Error Impact - North Anna Unit 1

After quantification of the error, an assessment was performed demonstrating that sufficient inherent cycle-specific core parameter margins existed to allow continued operation within the existing Technical Specifications licensing basis. This evaluation was applied to both units and involved use of a previous large break LOCA analysis which was performed with the 1981 BART evaluation model (3). The prior analysis remained applicable to both North Anna units because its assumptions were either: 1) shown to bound the current key core characteristics and SGTP or 2) evaluated using available PCT margin to accommodate the core and SGTP characteristics. A specific feature of the recent North Anna large break LOCA analyses made this approach possible. Analyses in recent years have been performed almost exclusively to address increased SGTP, while other key assumptions (e.g., core peaking factors) have remained unchanged. This allowed use of the prior analysis as the base case for the error assessment.

On December 23, 1991, North Anna Unit 1 was shut down to perform steam generator tube inspections. A revised large break LOCA analysis has since been performed using the 1981 Evaluation Model with BASH (4). The major assumption changes in the Reference (4) analysis are:

- Correction of accumulator injection volume error
- 30% uniform steam generator tube plugging
- Peak Heat Flux Hot Channel Factor, $F(Q)$, of 2.00
- Peak value for Enthalpy Hot Channel Factor, $FNAh$, of 1.545
- Fuel temperature and rod internal pressure for actual core burnup
- Single Failure Assumption: 1 low head SI pump fails to start

This analysis supports continued full power operation of Unit 1 with up to 30% SGTP until the planned steam generator replacement outage in early 1993. An additional analysis which assumes 95% rated thermal power and 35% SGTP has been submitted for NRC review and approval. Since these analyses have included assumptions which reflect the inherent Cycle 9 core margins, they are only applicable for the remainder of Cycle 9 operation.

2.2.2 Evaluation of Error Impact - North Anna Unit 2

As discussed in Section 2.2.1, the Reference (3) analysis was employed as the reference analysis to demonstrate continued compliance with the 10 CFR 50.46 requirements. Since this analysis adequately represents the key core characteristics and steam generator tube plugging of North Anna Unit 2, it is being retained as the Unit 2 base analysis. This is indicated in Attachment 2, along with applicable ECCS Evaluation Model penalty assessments.

3.0 References

- (1) Letter from W. I. Stewart (Va. Electric & Power Co.) to NRC, "Surry Power Station Units 1 and 2, North Anna Power Station Units 1 and 2 - Report of ECCS Evaluation Model Changes Per Requirements of 10 CFR 50.46," Serial No. 91-428, August 23, 1991.
- (2) "North Anna Power Station Units 1 and 2 - Implementation of Extended SGTP Small Break LOCA Analysis," 10CFR50.59 Safety Evaluation 92-SE-OT-005, January 21, 1992.
- (3) Letter from W. I. Stewart (Va. Electric & Power Co.) to NRC, "North Anna Power Station Units 1 and 2 - Large Break LOCA Analysis Input Error," Serial No. 89-619A, September 29, 1988.
- (4) "North Anna Power Station Units 1 and 2 - Implementation of Extended SGTP Large Break LOCA and Boron Dilution Analyses," 10CFR50.59 Safety Evaluation 92-SE-OT-006, January 21, 1992.

ATTACHMENT 2

Effect of ECCS Evaluation Model Error
Accumulator Injection Volume Modeling

North Anna Units 1 and 2

Effect of Errors/Changes in Application of ECCS Evaluation Models
North Anna Units 1 and 2

The information provided herein is applicable to North Anna Power Station, Units 1 and 2. It is based upon Virginia Power calculations using the Westinghouse ECCS evaluation models applied in the existing analyses. Peak cladding temperature (PCT) values and margin allocations represent issues for which permanent resolutions have been reported by Westinghouse. Section A presents the detailed assessment for small break LOCA. The large break LOCA details are given in Section B.

SECTION A - SMALL BREAK LOCA MARGIN UTILIZATION - NORTH ANNA UNITS 1 AND 2

A. Base Analysis PCT	1873 °F (1)
B. Evaluation Model PCT Assessments [1]	
1. Fuel Rod Initial Condition Inconsistency	0 °F [2]
2. NOTRUMP Solution Convergence Reliability	0 °F [2]
3. SBLOCA Rod Internal Pressure Assumption	0 °F [2]
4. AFW Enthalpy Switchover Assumption	0 °F [2]
5. ECCS Flow Inconsistencies	0 °F [2]
SBLOCA Licensing Basis PCT (Base Analysis PCT + PCT Assessments)	1873 °F

SECTION B - LARGE BREAK LOCA MARGIN UTILIZATION - NORTH ANNA UNITS 1 AND 2

	Unit 1 (3)	Unit 2 (4)
A. Base Analysis PCT	2125 °F	2116 °F
B. Evaluation Model PCT Assessments [1]		
1. Fuel Rod Initial Condition Inconsistency	+ 25 °F	+ 25 °F
2. LBLOCA Burst and Blockage Assumption	0 °F	0 °F
3. SG Tube Seismic/LOCA Assumption	0 °F [3]	0 °F [3]
4. LBLOCA Power Distribution Assumption	0 °F [4]	0 °F [4]
C. Evaluation Model Application Errors		
1. Accumulator Injection Water Volume	+ 224 °F	N/A
D. Reanalysis Using 1981 EM/BASH (5) (includes Item B.1, Cycle 9 fuel margins)	- 205 °F	N/A
LBLOCA Licensing Basis PCT (Base Analysis PCT + PCT Assessments)	2169 °F	2131 °F

Notes and References are on the following page

Effect of Errors/Changes in Application of ECCS Evaluation Models
North Anna Units 1 and 2

Notes

- [1] These issues were previously described in Reference (2) and are presented here to document their applicability to the revised base analysis.
- [2] The existing analysis was performed with a version of NOTRUMP which included corrections and/or input changes to address this issue.
- [3] An analysis of LOCA plus SSE loads has been performed by Westinghouse for North Anna. Total SG tube area reduction equivalent to 0.57% tube plugging is allocated as a permanent assessment.
- [4] Final resolution of this issue involves no permanent PCT assessment. Virginia Power will apply the Westinghouse methodology documented in Reference (6) for future reload cores.

References

- (1) "North Anna Power Station Units 1 and 2 - Implementation of Extended SGTP Small Break LOCA Analysis," 10CFR50.59 Safety Evaluation 92-SE-OT-005, January 21, 1992.
- (2) Letter from W. L. Stewart (Va. Electric & Power Co.) to NRC, "Surry Power Station Units 1 and 2, North Anna Power Station Units 1 and 2 - Report of ECCS Evaluation Model Changes Per Requirements of 10 CFR 50.46," Serial No. 91-428, August 23, 1991.
- (3) "North Anna Power Station Units 1 and 2 - LBLOCA Analysis for 20% Steam Generator Tube Plugging," 10CFR50.59 Safety Evaluation 90-SE-OT-178, December 6, 1990.
- (4) Design Change DC-89-15-3, "6°F Tavg Reduction," North Anna Power Station Units 1 and 2, November 1989.
- (5) "North Anna Power Station Units 1 and 2 - Implementation of Extended SGTP Large Break LOCA and Boron Dilution Analyses," 10CFR50.59 Safety Evaluation 92-SE-OT-006, January 21, 1992.
- (6) "Westinghouse ECCS Evaluation Model: Revised Large Break LOCA Power Distribution Methodology," WCAP-12909-P, June 1991.