

VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

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10 CFR 50.46

U.S. Nuclear Regulatory Commission
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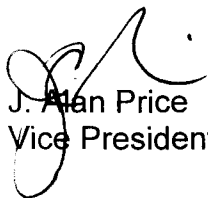
VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
SUBMITTAL OF RESULTS OF SMALL BREAK LOCA REANALYSIS
AND 30-DAY 10 CFR 50.46 REPORT OF EMERGENCY CORE
COOLING SYSTEM (ECCS) MODEL CHANGES
PURSUANT TO THE REQUIREMENTS OF 10 CFR 50.46

In accordance with 10 CFR 50.46(a)(3)(ii), Virginia Electric and Power Company (Dominion) hereby submits information regarding the results of a full reanalysis of the Westinghouse Small Break Loss of Coolant Accident (SBLOCA) analyses using the NOTRUMP methodology for Surry Power Station Units 1 and 2 (SPS 1 and 2).

The attachment provides a report describing the reanalysis results for SPS 1 and 2. The results satisfy the acceptance criteria defined in 10 CFR 50.46(b). Dominion has determined that the peak cladding temperature (PCT) result of 2012 °F for SPS 1 and 2 represents a significant change in PCT, as defined in 10 CFR 50.46(a)(3)(i), versus the previous analysis of record PCT of 1717 °F. 10 CFR 50.46(a)(3)(ii) requires the licensee to provide a report within 30 days, which includes a proposed schedule for providing a reanalysis or taking other action as may be needed to show compliance with 10 CFR 50.46. Since the PCT result described above is based on a full reanalysis, Dominion considers the scheduler requirements of 10 CFR 50.46(a)(3)(ii) to be satisfied with the submission of this notification. Dominion routinely tracks adjustments to the SBLOCA calculated PCT values to ensure that reasonable margins to the acceptance value set by 10 CFR 50.46 are maintained.

If you have any questions regarding this submittal, please contact Mr. Gary Miller at (804) 273-2771.

Sincerely,



J. Alan Price
Vice President – Nuclear Engineering

Commitments made in this letter: None

Attachment:

- Summary of SBLOCA Reanalysis Results and 30-Day 10 CFR 50.46 Report – Surry Power Station Units 1 and 2

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ATTACHMENT

**SUMMARY OF SBLOCA REANALYSIS RESULTS
AND
30-DAY 10 CFR 50.46 REPORT**

SURRY POWER STATION UNITS 1 AND 2

**VIRGINIA ELECTRIC AND POWER COMPANY
(DOMINION)**

Summary of SBLOCA Reanalysis Results and 30-Day 10 CFR 50.46 Report Surry Power Station Units 1 and 2

Surry Units 1 and 2 utilize the Westinghouse NOTRUMP Evaluation Model for the analysis of the Small Break Loss of Coolant Accident (SBLOCA). The analysis methodology has received NRC approval for referencing in licensing calculations as documented in WCAP-10054-P-A, Revision 0, *Westinghouse Small Break ECCS Evaluation Model Using the NOTRUMP Code*, August 1985, and WCAP-10079-P-A, Revision 0, *NOTRUMP, A Nodal Transient Small Break and General Network Code*, August 1985. These reports are the licensing basis methodology for Surry Units 1 and 2, as documented in Surry Technical Specification 6.2.C, *Core Operating Limits Report*, and Surry UFSAR Section 14.5.2.1. The NOTRUMP methodology was employed for the SBLOCA reanalysis. The SBLOCA reanalysis was performed for two key reasons:

1. To resolve all Evaluation Model errors and changes that incur peak cladding temperature (PCT) changes against the analysis of record that was performed in 1995. Several evaluations had been performed for SBLOCA Evaluation Model errors and plant changes. The SBLOCA reanalysis clears all identified PCT changes that were assessed against the analysis of record, as documented in Surry UFSAR, Revision 40, Table 14.5-16, *Peak Clad Temperature Including All Penalties and Benefits, Small Break LOCA*.
2. To incorporate changes in plant input parameters. The most significant change is a reduction in high head safety injection minimum delivered flow rates to provide margin for pump periodic testing.

The results of the SBLOCA analysis for Surry Units 1 and 2 are summarized in Tables 1 through 4 below. Table 1 presents the beginning of life (BOL) fuel cladding heat up calculations, and Table 2 presents the limiting burnup calculations for the limiting 2.75 inch break case. Table 3 presents the annular pellet evaluation for the 2.75 inch break case. NOTRUMP runs were performed for 1.5, 2, 2.25, 2.50, 2.75, 3, 4, and 5.5 inch equivalent diameter breaks. An initial scoping study for the 3 inch break resulted in a PCT above 1700°F, prompting the use of a refined break spectrum with size spacing of 0.25 inches between the more limiting breaks of 2 inches and 3 inches. Based on the NOTRUMP results, BOL SBLOCA code calculations were performed for all cases, and the 2.75 inch break case produced the limiting results. A full burnup study was performed for this break size. Partial burnup studies for the 2.25 inch and 2.5 inch break cases were performed to confirm that the 2.75 inch break size was indeed limiting.

The 2.75 inch break case resulted in a limiting PCT of 1984°F at 4,500 MWD/MTU, a limiting transient oxidation of 11.86% at 7,000 MWD/MTU, and the maximum total oxidation occurring at 62,000 MWD/MTU. The core wide oxidation was calculated to be less than 1% for the entire burnup study. Additional SBLOCA calculations were performed to evaluate the effects of annular pellets and were determined to produce the limiting PCT of 2012°F at 5,000 MWD/MTU. The PCT has increased from 1717°F in the analysis of record to 2012°F. The main reasons for the more limiting results are the reduction in high head safety injection flow rates to increase pump periodic test margins and the explicit analysis of a refined break spectrum with burnup studies.

Evaluation of 10 CFR 50.46 Acceptance Criteria

Table 4 compares the most limiting results of the SBLOCA analysis to the acceptance criteria from 10 CFR 50.46(b)(1), (b)(2), and (b)(3), demonstrating acceptable margins. The pre-transient oxidation increases with burnup from zero at BOL to a maximum value at the discharge of the fuel (end of life). It has been confirmed that the sum of the pre-transient plus transient oxidation remains below 17% at all times in life.

10 CFR 50.46 criterion (b)(4) is addressed implicitly via the blockage model used when SBLOCA predicts rod burst. Therefore, acceptance criterion (b)(4) is satisfied.

10 CFR 50.46 acceptance criterion (b)(5) requires that long-term core cooling be provided following successful initial operation of the ECCS. Long-term cooling is dependent on the demonstration of continued delivery of cooling water to the core. The actions, automatic or manual, that are currently in place to maintain long-term cooling remain unchanged with the SBLOCA reanalysis. 10 CFR 50.46 criterion (b)(5) is addressed implicitly by the termination criteria for the NOTRUMP calculation including the extension to after switchover from injection to cold leg recirculation. Therefore, acceptance criterion (b)(5) is satisfied.

10 CFR 50.46 Reporting Considerations

Dominion has reviewed the results of the SBLOCA reanalysis for Surry Units 1 and 2. The new PCT of 2012°F represents a "significant" change in PCT, as defined in 10 CFR 50.46(a)(3)(i), relative to the Analysis of Record (AOR) PCT of 1717°F. Thus, a 30-day report to the NRC is required per 10 CFR 50.46(a)(3)(ii). The enclosed PCT margin utilization sheets summarize the PCT results for the SBLOCA reanalysis for Surry Units 1 and 2.

10 CFR 50.46(a)(3)(ii) requires that the 30-day report include a "proposed schedule for providing a reanalysis or taking other action as may be needed to show compliance with

Section 50.46 requirements.” Since the PCT result described above is based on a full reanalysis of the SBLOCA event, Dominion considers the submittal of this 30-day report to satisfy the schedular requirements of 10 CFR 50.46(a)(3)(ii).

Table 1: SBLOCTA Results at Beginning of Life⁽¹⁾

Break Size, inch	1.5	2	2.25	2.5	2.75	3	4	5.5
PCT, °F	1132	1756	1802	1870	1907	1766	1442	1438
PCT Time, sec	7796.2	3303.1	2948.3	2174.3	1687.6	1451.6	700.5	363.2
PCT Elevation, ft	11.50	12.00	12.00	12.00	12.00	11.75	10.75	10.50
Maximum HR ZrO ₂ , %	0.12	3.75	5.06	4.87	4.64	2.47	0.25	0.14
Maximum HR ZrO ₂ Elevation, ft	11.50	12.00	12.00	12.00	11.75	11.75	11.00	10.50
HR Average ZrO ₂ , %	0.02	0.50	0.65	0.65	0.66	0.38	0.05	0.03

(1) Cladding burst was not calculated to occur for any of these break sizes.

Table 2: Limiting 2.75 Inch SBLOCTA Burnup Results

Burnup, MWD/MTU	4,500 ⁽¹⁾	6,000 ⁽²⁾	7,000 ⁽³⁾
PCT, °F	1984	1971	1943
Maximum HR Transient ZrO ₂ , %	10.10	11.37	11.86
HR Average Transient ZrO ₂ , %	0.63	0.73	0.73

(1) The limiting time-in-life PCT was calculated to be at 4,500 MWD/MTU.

(2) The limiting time-in-life HR average transient ZrO₂ was calculated to be at 6,000 MWD/MTU.

(3) The limiting time-in-life HR transient ZrO₂ was calculated to be at 7,000 MWD/MTU.

Table 3: Limiting 2.75 Inch SBLOCTA Burnup Results with Annular Pellets

Burnup, MWD/MTU	5,000 ⁽¹⁾	5,500 ⁽²⁾	6,000 ⁽³⁾
PCT, °F	2012	1996	1937
Maximum HR Transient ZrO ₂ , %	11.65	11.76	11.43
HR Average Transient ZrO ₂ , %	0.67	0.67	0.72

(1) The limiting time-in-life PCT was calculated to be at 5,000 MWD/MTU.

(2) The limiting time-in-life HR transient ZrO₂ was calculated to be at 5,500 MWD/MTU.

(3) The limiting time-in-life HR average transient ZrO₂ was calculated to be at 6,000 MWD/MTU.

Table 4: Summary of Limiting Results versus 10 CFR 50.46 Acceptance Criteria

	Result	Criterion
Peak Cladding Temperature (b1)	2,012°F	< 2,200°F
Local Maximum Oxidation (b2)	11.86%	< 17%
Core Wide Oxidation (b3)	0.73%	< 1%

10 CFR 50.46 MARGIN UTILIZATION - WESTINGHOUSE SMALL BREAK LOCA

Plant Name:	Surry Power Station, Unit 1		
Utility Name:	Virginia Electric and Power Company		
Analysis Information			
EM:	NOTRUMP	Limiting Break Size:	2.75 inches
Analysis Date:	2009		
Vendor:	Westinghouse		
FQ:	2.5	FΔH:	1.7
Fuel:	SIF	SGTP (%):	7
Notes:	None		
			Clad Temp (°F)
LICENSING BASIS			
Analysis of Record PCT			2012
PCT ASSESSMENTS (Delta PCT)			
A. Prior ECCS Model Assessments			
1. None			0
B. Planned Plant Modification Evaluations			
1. None			0
C. ECCS Model Assessments			
1. None			0
D. Other			
1. None			0
LICENSING BASIS PCT + PCT ASSESSMENTS			PCT = 2012

10 CFR 50.46 MARGIN UTILIZATION - WESTINGHOUSE SMALL BREAK LOCA

Plant Name: Surry Power Station, Unit 2
Utility Name: Virginia Electric and Power Company

Analysis Information

EM: NOTRUMP **Limiting Break Size:** 2.75 inches
Analysis Date: 2009
Vendor: Westinghouse
FQ: 2.5 **FΔH:** 1.7
Fuel: SIF **SGTP (%):** 7
Notes: None

Clad Temp (°F)

LICENSING BASIS

Analysis of Record PCT 2012

PCT ASSESSMENTS (Delta PCT)

A. Prior ECCS Model Assessments

1. None 0

B. Planned Plant Modification Evaluations

1. None 0

C. ECCS Model Assessments

1. None 0

D. Other

1. None 0

LICENSING BASIS PCT + PCT ASSESSMENTS

PCT = 2012