

Dominion Resources Services, Inc.
Innsbrook Technical Center
5000 Dominion Boulevard, 2SE, Glen Allen, VA 23060



June 28, 2012

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Serial No. 12-424
NL&OS/GDM R0
Docket Nos. 50-305
50-336/423
50-338/339
50-280/281
License Nos. DPR-43
DPR-65/NPF-49
NPF-4/7
DPR-32/37

DOMINION ENERGY KEWAUNEE, INC.
DOMINION NUCLEAR CONNECTICUT, INC.
VIRGINIA ELECTRIC AND POWER COMPANY
KEWAUNEE POWER STATION
MILLSTONE POWER STATION UNITS 2 AND 3
NORTH ANNA POWER STATION UNITS 1 AND 2
SURRY POWER STATION UNITS 1 AND 2
2011 ANNUAL 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), Dominion Energy Kewaunee, Inc. (DEK), Dominion Nuclear Connecticut, Inc. (DNC) and Virginia Electric and Power Company (Dominion) hereby submit the annual summary of permanent changes to the emergency core cooling system (ECCS) evaluation models for Kewaunee Power Station (KPS), Millstone Power Station Units 2 and 3 (MPS2 and 3), North Anna Power Station (NAPS) Units 1 and 2, and Surry Power Station (SPS) Units 1 and 2, respectively.

Attachment 1 of this letter provides a report describing plant-specific evaluation model changes associated with the Westinghouse and AREVA Small Break Loss of Coolant Accident (SBLOCA) and Large Break Loss of Coolant Accident (LBLOCA) ECCS evaluation models for KPS, MPS2 and 3, NAPS 1 and 2, and SPS 1 and 2.

Information regarding the effect of the ECCS evaluation model changes upon the reported SBLOCA and LBLOCA analyses of record (AOR) results is provided for KPS, MPS2 and 3, NAPS 1 and 2, and SPS 1 and 2 in Attachments 2, 3, 4 and 5, respectively. The calculated peak cladding temperatures (PCT) for the SBLOCA and LBLOCA analyses for KPS, MPS2 and 3, NAPS 1 and 2, and SPS 1 and 2 are summarized below.

Kewaunee – Small break – Westinghouse Evaluation Model: 1065°F
Kewaunee – Large break – Westinghouse Evaluation Model: 2045°F
Millstone Unit 2 - Small break - AREVA Evaluation Model: 1801°F

ADD
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Millstone Unit 2 - Large break - AREVA Evaluation Model:	1845°F
Millstone Unit 3 - Small break - Westinghouse Evaluation Model:	1193°F
Millstone Unit 3 – Large break - Westinghouse Evaluation Model:	1781°F
North Anna Unit 1 - Small break - AREVA Evaluation Model:	1395°F
North Anna Unit 1 - Large break - AREVA Evaluation Model:	1884°F
North Anna Unit 2 - Small break - AREVA Evaluation Model:	1338°F
North Anna Unit 2 - Large break - AREVA Evaluation Model:	1888°F
Surry Units 1 and 2 - Small break - Westinghouse Evaluation Model:	2012°F
Surry Units 1 and 2 - Large break - Westinghouse Evaluation Model:	1867°F

The LOCA results for KPS, MPS2 and 3, NAPS 1 and 2, and SPS 1 and 2 are confirmed to have sufficient margin to the 2200°F limit for PCT specified in 10 CFR 50.46. Based on the evaluation of this information and the resulting changes in the applicable licensing basis PCT results, no further action is required to demonstrate compliance with the 10 CFR 50.46 requirements.

This information satisfies the 2011 annual reporting requirements of 10 CFR 50.46(a)(3)(ii).

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

Sincerely,



J. Alan Price
Vice President – Nuclear Engineering

Commitments made in this letter: None

Attachments:

1. Report of Changes in Westinghouse and AREVA ECCS Evaluation Models.
2. 2011 Annual Reporting of 10 CFR 50.46 Margin Utilization - Kewaunee Power Station
3. 2011 Annual Reporting of 10 CFR 50.46 Margin Utilization - Millstone Power Station Units 2 and 3
4. 2011 Annual Reporting of 10 CFR 50.46 Margin Utilization – North Anna Power Station Units 1 and 2
5. 2011 Annual Reporting of 10 CFR 50.46 Margin Utilization – Surry Power Station Units 1 and 2

cc: U. S. Nuclear Regulatory Commission, Region I
Regional Administrator
2100 Renaissance Blvd.
Suite 100
King of Prussia, PA 19406-2713

U. S. Nuclear Regulatory Commission, Region II
Regional Administrator
Marquis One Tower
245 Peachtree Center Ave., NE
Suite 1200
Atlanta, Georgia 30303-1257

U. S. Nuclear Regulatory Commission, Region III
Regional Administrator
2443 Warrenville Road
Suite 210
Lisle, Illinois 60532-4352

NRC Senior Resident Inspector
Kewaunee Power Station

NRC Senior Resident Inspector
Millstone Power Station

NRC Senior Resident Inspector
North Anna Power Station

NRC Senior Resident Inspector
Surry Power Station

Mr. K. D. Feintuch
NRC Project Manager Kewaunee
U. S. Nuclear Regulatory Commission
One White Flint North
Mail Stop O8 H-4A
11555 Rockville Pike
Rockville, MD 20852-2738

Dr. V. Sreenivas
NRC Project Manager North Anna
U. S. Nuclear Regulatory Commission
One White Flint North
Mail Stop O8 G-9A
11555 Rockville Pike
Rockville, MD 20852-2738

Mr. J. S. Kim
NRC Project Manager Millstone Units 2 and 3
U. S. Nuclear Regulatory Commission
One White Flint North
Mail Stop O8 C-2A
11555 Rockville Pike
Rockville, MD 20852-2738

Ms. K. R. Cotton
NRC Project Manager Surry
U. S. Nuclear Regulatory Commission
One White Flint North
Mail Stop O8 G-9A
11555 Rockville Pike
Rockville, MD 20852-2738

Mr. J. E. Reasor, Jr.
Old Dominion Electric Cooperative
Innsbrook Corporate Center, Suite 300
4201 Dominion Blvd.
Glen Allen, Virginia 23060

ATTACHMENT 1

**2011 ANNUAL REPORT OF EMERGENCY CORE
COOLING SYSTEM (ECCS) MODEL CHANGES
PURSUANT TO THE REQUIREMENTS OF 10 CFR 50.46**

**REPORT OF CHANGES IN
WESTINGHOUSE AND AREVA ECCS EVALUATION MODELS**

**DOMINION ENERGY KEWAUNEE, INC.
DOMINION NUCLEAR CONNECTICUT, INC.
VIRGINIA ELECTRIC AND POWER COMPANY
KEWAUNEE POWER STATION
MILLSTONE POWER STATION UNITS 2 AND 3
NORTH ANNA POWER STATION UNITS 1 AND 2
SURRY POWER STATION UNITS 1 AND 2**

**REPORT OF CHANGES IN WESTINGHOUSE AND AREVA
ECCS EVALUATION MODELS**

Kewaunee Power Station (KPS)

1. Westinghouse identified the following changes and errors affecting the 1985 Westinghouse Small Break (SB) LOCA Evaluation Model with NOTRUMP for KPS:

- **General Code Maintenance** - Various changes have been made to enhance the usability of the codes and to help preclude errors in analyses. This includes items such as modifying input variable definitions, units, and defaults; improving the input diagnostic checks; enhancing the code output; optimizing active coding; and eliminating inactive coding. These changes represent Discretionary Changes that will be implemented on a forward-fit basis in accordance with Section 4.1.1 of WCAP-13451. The nature of these changes leads to an estimated PCT impact of 0°F.
- **Radiation Heat Transfer Logic** - Two errors were discovered in the calculation of the radiation heat transfer coefficient in the SBLOCTA computer code. First, existing diagnostics did not preclude non-physical negative or large (negative or positive) radiation heat transfer coefficients from being calculated. These calculations occurred when the vapor temperature exceeded the cladding surface temperature or when the predicted temperature difference was less than 1 degree. Second, a temperature term incorrectly used degrees Fahrenheit instead of Rankine. These errors have been corrected in the SBLOCTA code and represent a closely-related group of Non-Discretionary Changes in accordance with Section 4.1.2 of WCAP-13451. This item was evaluated to have a 0°F impact on peak cladding temperature (PCT) for SBLOCA.
- **Maximum Fuel Rod Time Step Logic** - An error was discovered in the SBLOCTA code that allowed the fuel rod time step to exceed the specified maximum allowable time step. The time step logic has been corrected in the SBLOCTA code. This change represents a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451. This item was evaluated to have a 0°F impact on PCT for SBLOCA.
- **Evaluation of an Interruption of SI during the Switchover to Sump Recirculation on the Kewaunee SBLOCA Analysis** - Kewaunee Nuclear Power Station has identified a complete interruption in Safety Injection (SI) flow during the switchover to sump recirculation when a single train of Emergency Core Cooling System (ECCS) is available and system pressure is high enough to preclude low head SI (LHSI) flow. This interruption was not previously considered in the Small Break Loss-of-Coolant Accident (SBLOCA) Analysis of Record (AOR). A qualitative evaluation to assess the effect of a 150 second complete interruption of SI flow during the switchover to sump recirculation on the SBLOCA AOR has been performed. The evaluation concluded that this interruption in flow would not result in an additional cladding heat-up resulting in more limiting results

relative to the AOR; therefore, the results of the AOR remain bounding, leading to an estimated PCT impact of 0°F for 10 CFR 50.46 reporting purposes.

2. Westinghouse identified the following changes and errors applicable to the KPS 1999 Westinghouse Best Estimate LBLOCA Evaluation Model (BE LBLOCA EM) with application to PWRs with upper plenum injection:
 - General Code Maintenance - Various changes have been made to enhance the usability of codes and to streamline future analyses. Examples of these changes include modifying input variable definitions, units and defaults; improving the input diagnostic checks; enhancing the code output; optimizing active coding; and eliminating inactive coding. These changes represent Discretionary Changes that will be implemented on a forward-fit basis in accordance with Section 4.1.1 of WCAP-13451. The nature of these changes leads to an estimated PCT impact of 0°F.

Millstone Power Station Unit 2 (MPS2)

1. AREVA identified the following errors applicable to the S-RELAP5 based SBLOCA Evaluation Model for MPS2:
 - Sleicher-Rouse Heat Transfer Correlation - In developing a BWR LOCA analysis methodology using S-RELAP5, AREVA noticed that the behavior of the Sleicher-Rouse single-phase vapor heat transfer correlation differed from other correlations. Additionally, it was discovered that the formulation of the correlation in the S-RELAP5 code is different from the formulation of the correlation used in other industry codes. AREVA prepared an S-RELAP5 code version with the alternative formulation. The alternative formulation of the Sleicher-Rouse agreed more closely with the formulation of the correlation used in the other industry codes. The results of plant sample problems indicate that the predicted SBLOCA PCT for MPS2 should be increased by 83°F.

For MPS2, this issue resulted in the accumulation of changes to the calculated peak fuel cladding temperature to exceed 50°F, and was previously reported to the NRC in a letter dated January 25, 2012 (Serial No. 11-708) to meet the 30-day reporting requirements of 10 CFR 50.46(a)(3)(ii).

2. AREVA identified no changes and errors applicable to the SEM/PWR-98 evaluation model for Large Break (LB) LOCA for MPS2.

Millstone Power Station Unit 3 (MPS3)

1. Westinghouse identified the following changes and errors to the 1985 Westinghouse SBLOCA Evaluation Model with NOTRUMP:
 - General Code Maintenance - Various changes have been made to enhance the usability of the codes and to help preclude errors in analyses. This includes

items such as modifying input variable definitions, units, and defaults; improving the input diagnostic checks; enhancing the code output; optimizing active coding; and eliminating inactive coding. These changes represent Discretionary Changes that will be implemented on a forward-fit basis in accordance with Section 4.1.1 of WCAP-13451. The nature of these changes leads to an estimated PCT impact of 0°F.

- Radiation Heat Transfer Logic - Two errors were discovered in the calculation of the radiation heat transfer coefficient in the SBLOCTA computer code. First, existing diagnostics did not preclude non-physical negative or large (negative or positive) radiation heat transfer coefficients from being calculated. These calculations occurred when the vapor temperature exceeded the cladding surface temperature or when the predicted temperature difference was less than 1 degree. Second, a temperature term incorrectly used degrees Fahrenheit instead of Rankine. These errors have been corrected in the SBLOCTA code and represent a closely-related group of Non-Discretionary Changes in accordance with Section 4.1.2 of WCAP-13451. This item was evaluated to have a 0°F impact on PCT for SBLOCA.
 - Maximum Fuel Rod Time Step Logic - An error was discovered in the SBLOCTA code that allowed the fuel rod time step to exceed the specified maximum allowable time step. The time step logic has been corrected in the SBLOCTA code. This change represents a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451. This item was evaluated to have a 0°F impact on PCT for SBLOCA.
2. Westinghouse identified the following changes and errors applicable to the 2004 Westinghouse Best Estimate Large Break LOCA Evaluation Model using the Automated Statistical Treatment of Uncertainty Method (ASTRUM) for MPS3:
- General Code Maintenance - Various changes have been made to enhance the usability of codes and to streamline future analyses. Examples of these changes include modifying input variable definitions, units and defaults; improving the input diagnostic checks; enhancing the code output; optimizing active coding; and eliminating inactive coding. These changes represent Discretionary Changes that will be implemented on a forward-fit basis in accordance with Section 4.1.1 of WCAP-13451. The nature of these changes leads to an estimated PCT impact of 0°F.
 - Millstone Unit 3 Cycle 15 PBOT/PMID Violation - The MPS3 Cycle 15 reload core design resulted in several violations of the PBOT/PMID box used in the LB LOCA Analysis. This is expected to be an ongoing occurrence in future cycles therefore the PBOT/PMID box was expanded. This expanded PBOT/PMID box was evaluated for MPS3. This change represents a Discretionary Change in accordance with Section 4.1.1 of WCAP-13451. The impact of the PBOT/PMID violation for MPS3 was determined via a plant-specific evaluation to be 0°F.

North Anna Power Station (NAPS) Units 1 and 2

1. AREVA identified no changes or errors in the SBLOCA evaluation models for North Anna Units 1 and 2.
2. AREVA identified the following changes and errors applicable to the Realistic LBLOCA, RELAP5 based evaluation model for North Anna Units 1 and 2:

- RLBLOCA Upper Plenum Modeling - An issue was written to evaluate the impact of liquid and vapor flow spikes from the upper plenum (UP) into the hot channel (HC) and surrounding six assembly regions of the core and a nonphysical flow pattern in the upper plenum. Even though Counter Current Flow Limitation (CCFL) modeling was applied at the HC exit junction, it will not be activated due to the negative spikes in steam velocities (from upper plenum to HC).

The current RLBLOCA reactor vessel modeling was traced back to the EMF-2103 sample problem for a 3-loop Westinghouse plant. This Westinghouse 3-loop plant has a geometry feature in the upper plenum know as "flow mixers or standpipes." Due to this geometry feature, the upper plenum was broken into two sections, one to an open hole region and one to a flow mixer region. The modeling in the sample problem blocked the cross flow between radial junctions in the first level of upper plenum and this was carried through in plants without flow mixers as a methodology conservatism.

The UP nodalization for these plant cases was revised to make it consistent with the geometry. In addition, in all plant cases, a high reverse loss coefficient is applied to the HC and central core to UP junctions at the beginning of the core reflooding phase. Cases were rerun that had liquid down flow and potentially affect the AOR PCT limit. The corrections for this error were implemented and the PCT impact to North Anna Unit 1 is +8°F. The impact to North Anna Unit 2 is assessed to be 0°F.

- Sleicher-Rouse Heat Transfer Correlation - In developing a BWR LOCA analysis methodology using S-RELAP5, AREVA noticed that the behavior of the Sleicher-Rouse single-phase vapor heat transfer correlation differed from other correlations. Additionally, it was discovered that the formulation of the correlation in the S-RELAP5 code is different from the formulation of the correlation used in other industry codes. AREVA prepared an S-RELAP5 code version with the alternative formulation. The alternative formulation of the Sleicher-Rouse agreed more closely with the formulation of the correlation used in the other industry codes. The results of plant sample problems indicate that the predicted RLBLOCA PCT for both North Anna Unit 1 and 2 should be increased by 14°F.

For North Anna Unit 1, this issue resulted in the accumulation of changes to the calculated peak fuel cladding temperature to exceed 50°F, and was previously reported to the NRC in a letter dated January 30, 2012 (Serial No. 12-021) to meet the 30-day reporting requirements of 10 CFR 50.46(a)(3)(ii).

Surry Power Station (SPS) Units 1 and 2

1. Westinghouse identified the following changes and errors applicable to the 1985 Westinghouse SBLOCA Evaluation Model with NOTRUMP for Surry Power Station:

- General Code Maintenance - Various changes have been made to enhance the usability of the codes and to help preclude errors in analyses. This includes items such as modifying input variable definitions, units, and defaults; improving the input diagnostic checks; enhancing the code output; optimizing active coding; and eliminating inactive coding. These changes represent Discretionary Changes that will be implemented on a forward-fit basis in accordance with Section 4.1.1 of WCAP-13451. The nature of these changes leads to an estimated PCT impact of 0°F.
- Radiation Heat Transfer Logic - Two errors were discovered in the calculation of the radiation heat transfer coefficient in the SBLOCA computer code. First, existing diagnostics did not preclude non-physical negative or large (negative or positive) radiation heat transfer coefficients from being calculated. These calculations occurred when the vapor temperature exceeded the cladding surface temperature or when the predicted temperature difference was less than 1 degree. Second, a temperature term incorrectly used degrees Fahrenheit instead of Rankine. These errors have been corrected in the SBLOCA code and represent a closely-related group of Non-Discretionary Changes in accordance with Section 4.1.2 of WCAP-13451. This item was evaluated to have a 0°F impact on PCT for SBLOCA.
- Maximum Fuel Rod Time Step Logic - An error was discovered in the SBLOCA code that allowed the fuel rod time step to exceed the specified maximum allowable time step. The time step logic has been corrected in the SBLOCA code. This change represents a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451. This item was evaluated to have a 0°F impact on PCT for SBLOCA.

2. Westinghouse identified the following changes and errors applicable to the 2004 Westinghouse Best Estimate Large Break LOCA Evaluation Model using the Automated Statistical Treatment of Uncertainty Method (ASTRUM) for Surry Power Station Units 1 and 2:

- General Code Maintenance - Various changes have been made to enhance the usability of codes and to streamline future analyses. Examples of these changes include modifying input variable definitions, units and defaults; improving the input diagnostic checks; enhancing the code output; optimizing active coding; and eliminating inactive coding. These changes represent Discretionary Changes that will be implemented on a forward-fit basis in accordance with Section 4.1.1 of WCAP-13451. The nature of these changes leads to an estimated PCT impact of 0°F.

Conclusion

The LOCA results for KPS, MPS2 and 3, NAPS 1 and 2, and SPS 1 and 2 are confirmed in the PCT rackup tables, Attachments 2 through 5, to have sufficient margin to the 2200°F limit for PCT specified in 10 CFR 50.46. Based on the evaluation of this information and the resulting changes in the applicable licensing basis PCT results, no further action is required to demonstrate compliance with the 10 CFR 50.46 requirements. Reporting of this information is required per 10 CFR 50.46(a)(3)(ii), which obligates each licensee to report the effect upon calculated temperature of any change or error in evaluation models or their application on an annual basis.

This information satisfies the annual reporting requirements of 10 CFR 50.46(a)(3)(ii) covering calendar year 2011.

ATTACHMENT 2

**2011 ANNUAL REPORT OF EMERGENCY CORE
COOLING SYSTEM (ECCS) MODEL CHANGES
PURSUANT TO THE REQUIREMENTS OF 10 CFR 50.46**

2011 ANNUAL REPORTING OF 10 CFR 50.46 MARGIN UTILIZATION

**DOMINION ENERGY KEWAUNEE, INC.
KEWAUNEE POWER STATION**

10 CFR 50.46 MARGIN UTILIZATION - LARGE BREAK LOCA

Plant Name:	Kewaunee Power Station		
Utility Name:	Dominion Energy Kewaunee, Inc.		
<u>Analysis Information</u>			
EM:	UPI (1999)	Limiting Break Size:	Split
Analysis Date:	March 25, 2002		
Vendor:	Westinghouse		
FQ:	2.5	FdH:	1.8
Fuel:	422 Vantage +	SGTP (%):	10
Notes:	Update to 1772 MWt. Effective beginning Cycle 26.		

LICENSING BASIS	<u>Clad Temp (°F)</u>
Analysis of Record PCT	2084

PCT ASSESSMENTS (Delta PCT)

A. Prior ECCS Model Assessments

1. Pressurizer Fluid Volumes	0
2. Vessel Unheated Conductor Noding	0
3. Level Boundary Selection	0
4. Containment Relative Humidity Assumption	0
5. Diffuser Plate Modeling	0
6. Downcomer Momentum Area	0
7. Revised Blowdown Heatup Uncertainty Distribution	5
8. Spacer Grid Heat Transfer Model Inputs	5
9. Inconsistent Vessel Vertical Level Modeling	0
10. Revised Downcomer Gap Inputs	-59
11. Core Support Column Heat Slab Discrepancy	0
12. HOTSPOT Fuel Relocation Error	10
13. Revised Upper Plenum Volume Inputs	0
14. Steam Generator Nozzle Volume Accounting Error	0
15. Errors in Reactor Vessel Nozzle Data Collections	0
16. Lower Plenum Unheated Conductors	0
17. HOTSPOT Burst Temperature Logic Errors	0
18. Discrepancy in Metal Masses Used From Drawings (Lower Support Plate)	0
19. HOTSPOT Gap Heat Transfer Logic	0
20. HOTSPOT Statistical Output Logic	0
21. Treatment of Vessel Average Temperature Uncertainty	0
22. Treatment of Interfacial Drag Multipliers in Upper Plenum Injection Plants	0

B. Planned Plant Modification Evaluations

1. None	0
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C. 2011 ECCS Model Assessments

1. None	0
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D. Other

1. None	0
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LICENSING BASIS PCT + PCT ASSESSMENTS	PCT = 2045
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ATTACHMENT 3

**2011 ANNUAL REPORT OF EMERGENCY CORE
COOLING SYSTEM (ECCS) MODEL CHANGES
PURSUANT TO THE REQUIREMENTS OF 10 CFR 50.46**

2011 ANNUAL REPORTING OF 10 CFR 50.46 MARGIN UTILIZATION

**DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNITS 2 AND 3**

10 CFR 50.46 MARGIN UTILIZATION - SMALL BREAK LOCA

Plant Name: Millstone Power Station, Unit 2
Utility Name: Dominion Nuclear Connecticut, Inc.

Analysis Information

EM: PWR Small Break LOCA, S-RELAP5 Based
Limiting Break Size: 0.08 ft²
Analysis Date: 01/02
Vendor: AREVA
Peak Linear Power: 15.1 kW/ft
Notes: None

LICENSING BASIS	<u>Clad Temp (°F)</u>
Analysis of Record PCT	1941

PCT ASSESSMENTS (Delta PCT)

- | | | |
|-----------|---|------|
| A. | Prior ECCS Model Assessments | |
| 1. | Decay Heat Model Error | -133 |
| 2. | Revised SBLOCA Guideline | 0 |
| 3. | Core Exit Modeling-Upper Tie Plate Flow Area | -22 |
| 4. | Point Kinetics Programming Issue with RELAP5-Based Computer Codes | -8 |
| 3. | S-RELAP5 Choked Flow Error with Non-Condensables Present | 0 |
| 6. | Radiation to Fluid Heat Transfer Model Change | -64 |
| 7. | RELAP5 Kinetics and Heat Conduction Model | 4 |
| 8. | RODEX2 Thermal Conductivity Degradation | 0 |
| B. | Planned Plant Modification Evaluations | |
| 1. | None | 0 |
| C. | 2011 ECCS Model Assessments | |
| 1. | Sleicher-Rouse Correlation Modeling | 83 |
| D. | Other | |
| 1. | None | 0 |

LICENSING BASIS PCT + PCT ASSESSMENTS	PCT = 1801
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10 CFR 50.46 MARGIN UTILIZATION - LARGE BREAK LOCA

Plant Name:	Millstone Power Station, Unit 2	
Utility Name:	Dominion Nuclear Connecticut, Inc.	

Analysis Information

EM:	SEM/PWR-98	Limiting Break Size: 1.0 DECLG
Analysis Date:	11/98	
Vendor:	AREVA	
Peak Linear Power:	15.1 kW/ft	
Notes:	None	

LICENSING BASIS	Clad Temp (°F)
Analysis of Record PCT	1814

PCT ASSESSMENTS (Delta PCT)

A. Prior ECCS Model Assessments

1.	Corrected Corrosion Enhancement Factor	-1
2.	ICECON Coding Errors	0
3.	Setting RFPAC Fuel Temperatures at Start of Reflood	-2
4.	SISPUNCH/ujun98 Code Error	0
5.	Error in Flow Blockage Model in TOODEE2	0
6.	Change in TOODEE2-Calculation of QMAX	0
7.	Change in Gadolinia Modeling	0
8.	PWR LBLOCA Split Break Modeling	0
9.	TEOBY Calculation Error	0
10.	Inappropriate Heat Transfer in TOODEE2	0
11.	End-of-Bypass Prediction by TEOBY	0
12.	R4SS Overwrite of Junction Inertia	0
13.	Incorrect Junction Inertia Multipliers	1
14.	Errors Discovered During RODEX2 V&V	0
15.	Error in Broken Loop SG Tube Exit Junction Inertia	0
16.	RFPAC Refill and Reflood Calculation Code Errors	16
17.	Incorrect Pump Junction Area Used in RELAP4	0
18.	Error in TOODEE2 Clad Thermal Expansion	-1
19.	Accumulator Line Loss Error	-1
20.	Inconsistent Loss Coefficients Used for Robinson LBLOCA	0
21.	Pump Head Adjustment for Pressure Balance Initialization	-3
22.	ICECON Code Errors	0
23.	Containment Sump Modification and Replacement PZR	2
24.	Non-Conservative RODEX Fuel Pellet Temperature	20
25.	Array Index Issues in the RELAP4 Code	0

B. Planned Plant Modification Evaluations

1.	None	0
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C. 2011 ECCS Model Assessments

1.	None	0
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D. Other

1.	None	0
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LICENSING BASIS PCT + PCT ASSESSMENTS	PCT = 1845
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10 CFR 50.46 MARGIN UTILIZATION - SMALL BREAK LOCA

Plant Name:	Millstone Power Station, Unit 3		
Utility Name:	Dominion Nuclear Connecticut, Inc.		
Analysis Information			
EM:	NOTRUMP	Limiting Break Size:	4 Inches
Analysis Date:	February 07, 2007		
Vendor:	Westinghouse		
FQ:	2.6	FdH:	1.65
Fuel:	RFA-2	SGTP (%):	10
Notes:	None		

LICENSING BASIS	Clad Temp (°F)
Analysis of Record PCT	1193

PCT ASSESSMENTS (Delta PCT)

A. Prior ECCS Model Assessments	
1. Errors in Reactor Vessel Lower Plenum Surface Area Calculations	0
2. Discrepancy in Metal Masses Used From Drawings	0
3. Urania-Gadolinia Pellet Thermal Conductivity Calculation	0
4. Pellet Crack and Dish Volume Calculation	0
5. Treatment of Vessel Average Temperature Uncertainty	0
B. Planned Plant Modification Evaluations	
1. None	0
C. 2011 ECCS Model Assessments	
1. Maximum Fuel Rod Time Step Logic	0
2. Radiation Heat Transfer Logic	0
D. Other	
1. None	0

LICENSING BASIS PCT + PCT ASSESSMENTS	PCT = 1193
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10 CFR 50.46 MARGIN UTILIZATION - LARGE BREAK LOCA

Plant Name:	Millstone Power Station, Unit 3		
Utility Name:	Dominion Nuclear Connecticut, Inc.		
<u>Analysis Information</u>			
EM:	ASTRUM (2004)	Limiting Break Size:	Guillotine
Analysis Date:	April 17, 2007		
Vendor:	Westinghouse		
FQ:	2.6	FdH:	1.65
Fuel:	RFA-2	SGTP (%):	10
Notes:	None		

LICENSING BASIS	<u>Clad Temp (°F)</u>
Analysis of Record PCT	1781

PCT ASSESSMENTS (Delta PCT)

A. Prior ECCS Model Assessments	
1. HOTSPOT Burst Temperature Logic Errors	0
2. CCFL Global Volume Error	0
3. HOTSPOT Gap Heat Transfer Logic	0
4. Discrepancy in Metal Masses Used From Drawings	0
5. Error in ASTRUM Processing of Average Rod Burnup and Rod Internal Pressure	0
6. Treatment of Vessel Average Temperature Uncertainty	0
7. Error in ASTRUM Processing of Average Rod Burnup	0
B. Planned Plant Modification Evaluations	
1. None	0
C. 2011 ECCS Model Assessments	
1. PBOT and PMID Evaluation	0
D. Other	
1. None	0

LICENSING BASIS PCT + PCT ASSESSMENTS	PCT = 1781
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ATTACHMENT 4

**2011 ANNUAL REPORT OF EMERGENCY CORE
COOLING SYSTEM (ECCS) MODEL CHANGES
PURSUANT TO THE REQUIREMENTS OF 10 CFR 50.46**

2011 ANNUAL REPORTING OF 10 CFR 50.46 MARGIN UTILIZATION

**VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2**

10 CFR 50.46 MARGIN UTILIZATION - AREVA SMALL BREAK LOCA

Plant Name: North Anna Power Station, Unit 1
Utility Name: Virginia Electric and Power Company

Analysis Information

EM:	AREVA SB EM	Limiting Break Size:	5.2 Inches (SI Line)
Analysis Date:	2004		
Vendor:	AREVA		
FQ:	2.32	FΔH:	1.65
Fuel:	Advanced Mark-BW	SGTP (%):	7
Notes:	None		

Clad Temp (°F)

LICENSING BASIS

Analysis of Record PCT

1404

PCT ASSESSMENTS (Delta PCT)

A. Prior ECCS Model Assessments

- | | | |
|----|---|-----|
| 1. | Point Kinetics Programming Issue with RELAP5-Based Computer Codes | -8 |
| 2. | RCCA Reactivity Input | -3 |
| 3. | Critical Flow Transition | 26 |
| 4. | RELAP5 Kinetics and Heat Conduction Model | 0 |
| 5. | TACO3 – Thermal Conductivity Degradation | 0 |
| 6. | Revised Test Flow Curve for HHSI | -24 |
| 7. | Advanced Mark BW Top Nozzle Modification | 0 |

B. Planned Plant Modification Evaluations

- | | | |
|----|------|---|
| 1. | None | 0 |
|----|------|---|

C. 2011 ECCS Model Assessments

- | | | |
|----|------|---|
| 1. | None | 0 |
|----|------|---|

D. Other

- | | | |
|----|------|---|
| 1. | None | 0 |
|----|------|---|

LICENSING BASIS PCT + PCT ASSESSMENTS

PCT = 1395

10 CFR 50.46 MARGIN UTILIZATION - AREVA LARGE BREAK LOCA

Plant Name: North Anna Power Station, Unit 1
Utility Name: Virginia Electric and Power Company

Analysis Information

EM: AREVA RLBLOCA EM **Limiting Break Size:** DEGB
Analysis Date: 2004
Vendor: AREVA
FQ: 2.32 **FΔH:** 1.65
Fuel: Advanced Mark-BW **SGTP (%):** 12
Notes: None

LICENSING BASIS

Analysis of Record PCT

Clad Temp (°F)

1853

PCT ASSESSMENTS (Delta PCT)

A. Prior ECCS Model Assessments

- | | | |
|-----|--|-----|
| 1. | Forslund-Rohsenow Correlation Modeling | 64 |
| 2. | RWST Temperature Assumption | 8 |
| 3. | LBLOCA/Seismic SG Tube Collapse | 0 |
| 4. | ICECON Code Errors | 0 |
| 5. | RLBLOCA Choked Flow Disposition | -26 |
| 6. | RLBLOCA Changes in Uncertainty Parameters | 10 |
| 7. | Blowdown Quench | 0 |
| 8. | Mixture Level Model Limitation in the S-RELAP5 Code | -29 |
| 9. | Point Kinetics Programming Issue with RELAP5-Based
Computer Codes | -20 |
| 10. | Cold Leg Condensation Under Predicted by S-RELAP5 Following
Accumulator Injection | 0 |
| 11. | Cross-Flow Junction Area in S-RELAP Model | 0 |
| 12. | Radiation to Fluid Heat Transfer Model Change | -32 |
| 13. | S-RELAP5 Kinetics and Heat Conduction Model | -29 |
| 14. | RODEX3A – Thermal Conductivity Degradation | 0 |
| 15. | Steam Generator Entrainment Bias Factor (FIJ) Change | -4 |
| 16. | Advanced Mark-BW Top Nozzle Modification | 65 |
| 17. | GSI-191 Sump Strainer | 0 |
| 18. | MUR Implementation | 2 |

B. Planned Plant Modification Evaluations

- | | | |
|----|------|---|
| 1. | None | 0 |
|----|------|---|

C. 2011 ECCS Model Assessments

- | | | |
|----|-------------------------------------|----|
| 1. | RLBLOCA Upper Plenum Modeling | 8 |
| 2. | Sleicher-Rouse Correlation Modeling | 14 |

D. Other

- | | | |
|----|------|---|
| 1. | None | 0 |
|----|------|---|

LICENSING BASIS PCT + PCT ASSESSMENTS

PCT = 1884

10 CFR 50.46 MARGIN UTILIZATION - AREVA SMALL BREAK LOCA

Plant Name:	North Anna Power Station, Unit 2		
Utility Name:	Virginia Electric and Power Company		
Analysis Information			
EM:	AREVA SB EM	Limiting Break Size:	3 Inches
Analysis Date:	2004		
Vendor:	AREVA		
FQ:	2.32	FΔH:	1.65
Fuel:	Advanced Mark-BW	SGTP (%):	7
Notes:	None		

LICENSING BASIS	Clad Temp (°F)
Analysis of Record PCT	1370

PCT ASSESSMENTS (Delta PCT)

A. Prior ECCS Model Assessments	
1. Point Kinetics Programming Issue with RELAP5-Based Computer Codes	-8
2. RCCA Reactivity Input	-29
3. Critical Flow Transition	5
4. RELAP5 Kinetics and Heat Conduction Model	0
5. TACO3 – Thermal Conductivity Degradation	0
6. Advanced Mark BW Top Nozzle Modification	0
B. Planned Plant Modification Evaluations	
1. None	0
C. 2011 ECCS Model Assessments	
1. None	0
D. Other	
1. None	0

LICENSING BASIS PCT + PCT ASSESSMENTS	PCT = 1338
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10 CFR 50.46 MARGIN UTILIZATION - AREVA LARGE BREAK LOCA

Plant Name:	North Anna Power Station, Unit 2		
Utility Name:	Virginia Electric and Power Company		
Analysis Information			
EM:	AREVA RLBLOCA EM	Limiting Break Size: DEGB	
Analysis Date:	2004		
Vendor:	AREVA		
FQ:	2.32	FΔH:	1.65
Fuel:	Advanced Mark-BW	SGTP (%):	12
Notes:	None		

LICENSING BASIS	Clad Temp (°F)
Analysis of Record PCT	1789

PCT ASSESSMENTS (Delta PCT)

A. Prior ECCS Model Assessments		
1.	Forslund-Rohsenow Correlation Modeling	64
2.	RWST Temperature Assumption	8
3.	LBLOCA/Seismic SG Tube Collapse	0
4.	ICECON Code Errors	0
5.	RLBLOCA Choked Flow Disposition	22
6.	RLBLOCA Changes in Uncertainty Parameters	10
7.	Mixture Level Model Limitation in the S-RELAP5 Code	-19
8.	Point Kinetics Programming Issue with RELAP5-Based Computer Codes	-20
9.	Cold Leg Condensation Under Predicted by S-RELAP5 Following Accumulator Injection	0
10.	Cross-Flow Junction Area in S-RELAP Model	0
11.	Radiation to Fluid Heat Transfer Model Change	-32
12.	S-RELAP5 Kinetics and Heat Conduction Model	-29
13.	RODEX3A – Thermal Conductivity Degradation	0
14.	Steam Generator Entrainment Bias Factor (FIJ) Change	-4
15.	Advanced Mark-BW Top Nozzle Modification	65
16.	GSI-191 Sump Strainer	0
17.	MUR Implementation	20
B. Planned Plant Modification Evaluations		
1.	None	0
C. 2011 ECCS Model Assessments		
1.	RLBLOCA Upper Plenum Modeling	0
2.	Sleicher-Rouse Correlation Modeling	14
D. Other		
1.	None	0

LICENSING BASIS PCT + PCT ASSESSMENTS	PCT = 1888
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ATTACHMENT 5

**2011 ANNUAL REPORT OF EMERGENCY CORE
COOLING SYSTEM (ECCS) MODEL CHANGES
PURSUANT TO THE REQUIREMENTS OF 10 CFR 50.46**

2011 ANNUAL REPORTING OF 10 CFR 50.46 MARGIN UTILIZATION

**VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2**

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:	May 07, 2009		
Vendor:	Westinghouse		
FQ:	2.5	FΔH:	1.7
Fuel:	Mixed: Upgrade/SIF	SGTP (%):	7
Notes:	None		

LICENSING BASIS	Clad Temp (°F)
Analysis of Record PCT	2012

PCT ASSESSMENTS (Delta PCT)

A. Prior ECCS Model Assessments	
1. Urania-Gadolinia Pellet Thermal Conductivity Calculation.	0
2. Pellet Crack and Dish Volume Calculation.	0
3. Treatment of Vessel Average Temperature Uncertainty	0
B. Planned Plant Modification Evaluations	
4. 15X15 Upgrade Fuel	0
C. 2011 ECCS Model Assessments	
1. Maximum Fuel Rod Time Step Logic	0
2. Radiation Heat Transfer Logic	0
D. Other	
1. None	

LICENSING BASIS PCT + PCT ASSESSMENTS	PCT = 2012
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**10 CFR 50.46 MARGIN UTILIZATION - WESTINGHOUSE LARGE BREAK LOCA
WITH ASTRUM**

Plant Name:	Surry Power Station, Unit 1		
Utility Name:	Virginia Electric and Power Company		

Analysis Information

EM:	ASTRUM (2004)	Limiting Break Size:	DEG
Analysis Date:	October 6, 2010		
Vendor:	Westinghouse		
FQ:	2.5	FΔH:	1.7
Fuel:	Mixed: Upgrade/SIF	SGTP (%):	7
Notes:	None		

LICENSING BASIS	<u>Clad Temp (°F)</u>
Analysis of Record PCT	1853

PCT ASSESSMENTS (Delta PCT)

A. Prior ECCS Model Assessments	
1. None	0
B. Planned Plant Modification Evaluations	
1. Transition Core (applied to mixed SIF/Upgrade core only)	14
C. 2011 ECCS Model Assessments	
1. None	0
D. Other	
1. None	0

LICENSING BASIS PCT + PCT ASSESSMENTS	PCT = 1867
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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:	May 7, 2009		
Vendor:	Westinghouse		
FQ:	2.5	FΔH:	1.7
Fuel:	Mixed: Upgrade/SIF	SGTP (%):	7
Notes:	None		

LICENSING BASIS	Clad Temp (°F)
Analysis of Record PCT	2012

PCT ASSESSMENTS (Delta PCT)

A. Prior ECCS Model Assessments	
1. Urania-Gadolinia Pellet Thermal Conductivity Calculation.	0
2. Pellet Crack and Dish Volume Calculation.	
0	
3. Treatment of Vessel Average Temperature Uncertainty	0
4. 15X15 Upgrade Fuel	0
B. Planned Plant Modification Evaluations	
1. None	0
C. 2011 ECCS Model Assessments	
1. Maximum Fuel Rod Time Step Logic	0
2. Radiation Heat Transfer Logic	0
D. Other	
1. None	

LICENSING BASIS PCT + PCT ASSESSMENTS	PCT = 2012
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**10 CFR 50.46 MARGIN UTILIZATION - WESTINGHOUSE LARGE BREAK LOCA
WITH ASTRUM**

Plant Name:	Surry Power Station, Unit 2		
Utility Name:	Virginia Electric and Power Company		
Analysis Information			
EM:	ASTRUM (2004)	Limiting Break Size:	DEG
Analysis Date:	October 6, 2010		
Vendor:	Westinghouse		
FQ:	2.5	FΔH:	1.7
Fuel:	Mixed: Upgrade/SIF	SGTP (%):	7
Notes:	None		

LICENSING BASIS	<u>Clad Temp (°F)</u>
Analysis of Record PCT	1853

PCT ASSESSMENTS (Delta PCT)

A. Prior ECCS Model Assessments	
1. Transition Core (applied to mixed SIF/Upgrade core only)	14
B. Planned Plant Modification Evaluations	
1. None	0
C. 2011 ECCS Model Assessments	
1. None	0
D. Other	
1. None	0

LICENSING BASIS PCT + PCT ASSESSMENTS	PCT = 1867
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