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## CALVERT CLIFFS NUCLEAR POWER PLANT

March 20, 2014

U. S. Nuclear Regulatory Commission  
Washington, DC 20555

**ATTENTION:** Document Control Desk

**SUBJECT:** Calvert Cliffs Nuclear Power Plant  
Unit No. 1; Docket No. 50-317  
10 CFR 50.46 30-day Report and Annual Report for Changes to the Emergency  
Core Cooling System Performance Analysis

**REFERENCES:**

- (a) Letter from Mr. D. V. Pickett (NRC) to Mr. G. H. Gellrich (CCNPP), dated February 18, 2011, Amendment re: Transition from Westinghouse Nuclear Fuel to AREVA Nuclear Fuel
- (b) Letter from Ms. N. S. Morgan (NRC) to Mr. G. H. Gellrich (CCNPP), dated December 19, 2012, Safety Evaluation of the Realistic Large-Break Loss-of-Coolant Accident Summary Report
- (c) Letter from Mr. J. J. Stanley (CCNPP) to Document Control Desk (NRC), dated April 30, 2012, 10 CFR 50.46 30-day Report and Annual Report for Changes to the Emergency Core Cooling System Performance Analysis
- (d) Letter from Mr. J. J. Stanley (CCNPP) to Document Control Desk (NRC), dated April 22, 2013, 10 CFR 50.46 30-day Report and Annual Report for Changes to the Emergency Core Cooling System Performance Analysis

This letter is submitted pursuant to 10 CFR 50.46(a)(3)(ii) to provide notification of a significant change to the peak cladding temperature analysis result for the large break loss-of-coolant accident (LB LOCA). Because the effect on the LB LOCA peak cladding temperature of the changes is greater than 50°F from the temperature calculated for the limiting transient using the last acceptable model, the analysis changes qualify as significant as defined in 10 CFR 50.46(a)(3)(i) and, consequently, are provided in Attachment (1).

The analyses for the LB LOCA Emergency Core Cooling System performance have been re-performed for Unit 1, Cycle 22. The analysis applied the latest Nuclear Regulatory Commission accepted version of

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the AREVA evaluation model for pressurized water reactors to Calvert Cliffs (References a and b). The new analyses explicitly model the AREVA fuel used in Unit 1, Cycle 22 in the spring of 2014.

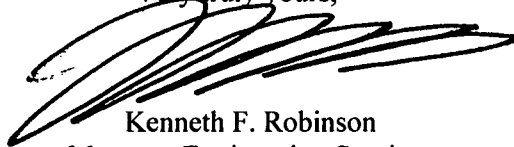
The analysis for the small break loss-of-coolant accident (SB LOCA) Emergency Core Cooling System performance has been assessed for Unit 1, Cycle 22. The SB LOCA analysis performed for Unit 1, Cycle 21 is applicable to Unit 1, Cycle 22. The analysis applied the latest Nuclear Regulatory Commission accepted version of the AREVA evaluation model for pressurized water reactors to Calvert Cliffs (Reference a). A 10 CFR 50.46 30-day letter (Reference c) was previously submitted to document a greater than 50°F change in peak clad temperature for the SB LOCA analysis for Unit 1 due to an error.

The results of the SB LOCA and the new LB LOCA analyses conform to the Emergency Core Cooling System acceptance criteria of 10 CFR 50.46(b) and are discussed in References (a) and (b), respectively. With the implementation of the approved license amendment on Unit 1, the new LB LOCA analysis constitutes the new licensing basis for Unit 1 on March 12, 2014 when Unit 1 entered Mode 4. The SB LOCA assessment for Unit 1 Cycle 22 maintains the current SB LOCA licensing basis for Unit 1. Attachment (1) contains the results of the change in the peak cladding temperature based on the change to the LB LOCA evaluation model used for the analysis for Unit 1. The LB LOCA change is required to be reported within 30 days of the new licensing basis for Unit 1 because the magnitude of the peak cladding temperature change and absolute peak cladding temperature assessment exceeds 50°F.

AREVA has reported changes to, or errors in, the acceptable evaluation models for calendar year 2013. There are no changes in the peak clad temperature for the SB LOCA reported for 2013. The LB LOCA analysis is changed by an error reported in 2013. The annual report is contained in Attachment (2). Changes that occurred prior to 2013 were previously reported in Reference (d).

Should you have questions regarding this matter, please contact Mr. Douglas E. Lauver at (410) 495-5219.

Very truly yours,



Kenneth F. Robinson  
Manager-Engineering Services

KFR/PSF/bjd

Attachments: (1) 10 CFR 50.46 – 30 Day Report  
(2) 10 CFR 50.46 – Annual Report

cc: N. S. Morgan, NRC  
W. M. Dean, NRC

Resident Inspector, NRC  
S. Gray, DNR

**ATTACHMENT (1)**

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**10 CFR 50.46 – 30 DAY REPORT**

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**Calvert Cliffs Nuclear Power Plant, LLC  
March 20, 2014**

**ATTACHMENT (1)**  
**10 CFR 50.46 – 30 DAY REPORT**

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**INTRODUCTION**

This letter is submitted pursuant to 10 CFR 50.46(a)(3)(ii) to provide notification of a significant change to the peak cladding temperature analysis result for the Unit 1 large break loss-of-coolant accident (LB LOCA) analysis.

Because the effect on the peak cladding temperature of the changes is greater than 50°F due to a previously reported error combined with a change in the LB LOCA methodology, the analysis changes qualify as significant as defined in 10 CFR 50.46(a)(3)(i) and, consequently, are provided below.

Calvert Cliffs' request to amend the Unit 1 renewed operating licenses to transition from Westinghouse to AREVA-designed fuel was approved by the Nuclear Regulatory Commission (NRC) in Reference 1. As part of the transition, the Emergency Core Cooling System (ECCS) performance for both the LB LOCA and the SB LOCA were re-analyzed. The NRC acceptance of the LB LOCA analysis permitted a single cycle of operation for Unit 1. A revised realistic LB LOCA methodology that included fuel burned in multiple cycles and removed the statistical treatment on decay heat multiplier was approved by the NRC in Reference 2. This approved methodology was used to re-perform the LB LOCA analysis for Unit 1 Cycle 22.

**REFERENCE ANALYSES**

**LB LOCA**

The Unit 1 LB LOCA ECCS performance analysis was performed with the AREVA evaluation method approved in Reference 2. The analysis included twice burned AREVA fuel and restricted the decay heat multiplier to a single value of 1.0, rather than ranging the multiplier.

The analysis resulted in an absolute change in peak clad temperature (PCT) from prior analysis of record of 50°F. The analysis used the S-RELAP5 code version that contains an error in the treatment of the Sleisher-Rouse correlation. That error changes the PCT by 8°F, and was previously reported (Reference 3). An additional error in the "trapped stack model" was discovered in 2013. The estimated impact of the error on the Calvert Cliffs LB LOCA analysis calculated PCT is +6°F. This error is reported in Attachment (2) to this document. The combined difference from the last acceptable evaluation model is greater than 50°F. A comparison of PCT results is provided in Table 1.

**Table 1, AREVA LB LOCA PCT Analysis Results**

<b>Item</b>	<b>PCT, °F</b>
New Analysis of Record (twice burned AREVA fuel)	1,620
Old Analysis of Record (first-burned AREVA fuel)	1,670

**ATTACHMENT (1)**  
**10 CFR 50.46 – 30 DAY REPORT**

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Table 2 provides the results of the new LB LOCA analysis demonstrating conformance with the acceptance criteria of 10 CFR 50.46(b).

**Table 2, LB LOCA versus Acceptance Criteria**

<b>Parameter</b>	<b>Criterion</b>	<b>Result</b>
Peak Cladding Temperature, °F	2200	1620
Maximum Cladding Oxidation, %	<17	2.460
Maximum Core-Wide Cladding Oxidation, %	<1	0.0111
Coolable Geometry	Yes	Yes

**SUMMARY**

The new LB LOCA analysis constitutes a new licensing basis analyses (analyses-of-record) for Calvert Cliffs Unit 1. It is used as the reference analysis to evaluate the impact on peak cladding temperature of changes to, or errors in, the AREVA LB LOCA evaluation model and its application to Calvert Cliffs.

**REFERENCES**

1. Letter from Mr. D. V. Pickett (NRC) to Mr. G. H. Gellrich (CCNPP), dated February 18, 2011, Amendment re: Transition from Westinghouse Nuclear Fuel to AREVA Nuclear Fuel
2. Letter from Ms. N. S. Morgan (NRC) to Mr. G. H. Gellrich (CCNPP), dated December 19, 2012, Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 – Safety Evaluation of the Realistic Large-Break Loss-of-Coolant Accident Summary Report
3. Letter from Mr. J. J. Stanley (CCNPP) to Document Control Desk (NRC), dated April 30, 2012, 10 CFR 50.46 30-day Report and Annual Report for Changes to the Emergency Core Cooling System Performance Analysis

**ATTACHMENT (2)**

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**10 CFR 50.46 – ANNUAL REPORT**

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**Calvert Cliffs Unit 1 and Unit 2 NUCLEAR PLANTS - 10CFR50.46 ANNUAL REPORT -  
EMERGENCY CORE COOLING SYSTEM (ECCS) EVALUATION MODEL CHANGES**

In accordance with the annual reporting requirements of 10CFR50.46 (a)(3)(ii), the following is a summary of the limiting design basis accident (loss-of-coolant accident) analysis results established using the current Calvert Cliffs ECCS evaluation model from January 2013 to end of December 2013.

**Table 1- Calvert Cliffs RLBLOCA PCT for ANP-2834-000 Report**

Analysis	PCT (°F)	Delta PCT (°F)	Year	Notes
Licensing Basis - Analysis of Record	1670		2009	September 2009
Updated Licensing Basis PCT at the end of 2012	1678			December 2012 Annual Report
S-RELAP5 routine associated with the RODEX3a fuel rod model in the code		+6	2013	See Attachment A
Net Change in 2013		6		
Updated Licensing Basis PCT at the end of 2013	1684			

**Table 2 - Calvert Cliffs RLBLOCA PCT for ANP-3043-001 Report**

Analysis	PCT (°F)	Delta PCT (°F)	Year	Notes
Licensing Basis - Analysis of Record	1620		2011	December 2011
Updated Licensing Basis PCT at the end of 2012	1628			2012 Annual Report
S-RELAP5 routine associated with the RODEX3a fuel rod model in the code		+6	2013	See Attachment A
Net Change in 2013		6		
Updated Licensing Basis PCT at the end of 2013	1634			

**Table 3- Calvert Cliffs Small Break LOCA PCT for ANP-2871-003 Report**

Analysis	PCT (°F)	Delta PCT (°F)	Year	Notes
Licensing Basis - Analysis of Record	1626		2009	September 2009.
Updated Licensing Basis PCT at the end of 2012	1695		2012	2012 Annual Report
Net Change (no 2013 PCT change)		0	2013	
Updated Licensing Basis PCT at the end of 2013	1695			

There are no changes in the PCT reports for Small Break LOCA to be reported in 2013 annual 50.46 reporting.



## **Attachment A**

### **AREVA Condition Report 2013-4230 Issue with S-RELAP5 Routine Associated with the RODEX3a Fuel Rod Model in the Code**

While performing code restructuring activities a code developer reported an issue in an S-RELAP5 routine associated with the RODEX3a fuel rod model in the code.

In realistic large break loss of coolant accident (RLBLOCA) analyses, RODEX3a is used to calculate the fuel rod conditions. The issue involves the trapped stack model in subroutine mdatr3, which is part of the RODEX3a fuel rod model in the code. The error affects any RODEX3a based S-RELAP5 analysis which contains a "trapped stack" of fuel pellets. A "trapped stack" condition exists in any fuel rod containing a "locked" gap with open gaps lying at lower axial levels. A gap is locked when the calculated gap dimension is less than 0.5 mils (0.0005 inches). That dimension was chosen for the locked criteria to account for roughness, pellet cocking, and cladding ovality effects. All axial levels below the lowest locked gap are part of a trapped stack.

The erroneous coding in mdatr3 involves incorrect variable addressing which essentially deactivates the trapped stack model. The effect of this error would not be obvious in existing analyses since preliminary assessments indicate the effect of a functioning trapped stack model is very small. Although the effect is small it was determined that it can be conservative or non-conservative depending on the steady-state initial stored energy.

The estimated impact of this change on the Calvert Cliffs RLBLOCA analysis calculated peak cladding temperature is +6°F. The SBLOCA analysis is not affected by this change because RODEX2, as opposed to RODEX3a, is used in the analysis.