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Constellation Energy
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May 9, 2007

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Submittal of Emergency Core Cooling System Codes and Methods Report

As required by 10 CFR 50.46(a)(3)(ii), the Emergency Core Cooling System Codes and Methods Report is provided in Attachment (1).

Should you have questions regarding this matter, please contact Mr. Jay S. Gaines at (410) 495-5219.

Very truly yours,

for
James A. Spina
Vice President - Calvert Cliffs Nuclear Power Plant

JAS/CAN/bjd

Attachment: (1) Annual Report on Combustion Engineering ECCS Performance Evaluation Models for PWRs, Westinghouse Electric Company, LLC, May 1, 2007

cc: D. V. Pickett, NRC

(Without Attachment)
S. J. Collins, NRC
Resident Inspector, NRC
R. I. McLean, DNR

A002

ATTACHMENT (1)

Annual Report on Combustion Engineering ECCS Performance Evaluation Models for PWRs, Westinghouse Electric Company, LLC, May 1, 2007

Attachment 1
Our ref: LTR-OA-07-43
May 2, 2007

Annual Report on Combustion Engineering ECCS Performance Evaluation Models for PWRs

ABSTRACT

This report describes changes to and errors in the Westinghouse Electric Company LLC Emergency Core Cooling System (ECCS) performance Evaluation Models (EMs) for Combustion Engineering (CE) PWRs per the requirements of 10 CFR 50.46 used in analyses that support Calvert Cliffs Units 1 and 2 operation during calendar year (CY) 2006.

For this reporting period, forward fit enhancements in the Large Break LOCA 1999 EM were developed and are described in detail herein. These enhancements have no impact on the Calvert Cliffs Large Break LOCA Analysis of Record which supports Units 1 Cycles 17, Unit 1 Cycle 18 and Unit 2 Cycle 16 for this reporting period. There were no other EM changes to or errors in the Large Break LOCA 1999 EM to report for CY 2006.

There were no EM changes to or errors in the Small Break LOCA S2M EM to report for CY 2006.

INTRODUCTION

This report addresses the Nuclear Regulatory Commission (NRC) requirement to report changes and errors in ECCS performance evaluation models. The ECCS Acceptance Criteria, Reference 1, spell out reporting requirements and actions required when errors are corrected or changes are made in an evaluation model or in the application of a model for an operating licensee or construction permittee of a nuclear power plant.

The action requirements in 10CFR50.46(a)(3) are:

1. Each applicant for or holder of an operating license or construction permit shall estimate the effect of any change to or error in an acceptable evaluation model or in the application of such a model to determine if the change or error is significant. For this purpose, a significant change or error is one which results in a calculated peak fuel cladding temperature (PCT) different by more than 50°F from the temperature calculated for the limiting transient using the last acceptable model, or is an accumulation of changes and errors such that the sum of the absolute magnitudes of the respective temperature changes is greater than 50°F.
2. For each change to or error discovered in an acceptable evaluation model or in the application of such a model that affects the temperature calculation, the applicant or licensee shall report the nature of the change or error and its estimated effect on the limiting ECCS analysis to the Commission at least annually as specified in 10CFR50.4.
3. If the change or error is significant, the applicant or licensee shall provide this report within 30 days and include with the report a proposed schedule for providing a reanalysis or taking other action as may be needed to show compliance with 10CFR50.46 requirements. This schedule may be developed using an integrated scheduling system previously approved for the facility by the NRC. For those facilities not using an NRC approved integrated scheduling system, a schedule will be established by the NRC staff within 60 days of receipt of the proposed schedule.
4. Any change or error correction that results in a calculated ECCS performance that does not conform to the criteria set forth in paragraph (b) of 10CFR50.46 is a reportable event as described in 10CFR50.55(e), 50.72 and 50.73. The affected applicant or licensee shall propose immediate steps to demonstrate compliance or bring plant design or operation into compliance with 10CFR50.46 requirements.

This report documents the errors corrected in and/or changes to the presently licensed ECCS performance evaluation models for PWRs developed by Combustion Engineering, made in the year covered by this report, which have not been reviewed by the NRC staff. This document is provided to satisfy the reporting requirements of the second item above. Reports for earlier years are given in References 2-19.

Attachment 1
Our ref: LTR-OA-07-43
May 2, 2007

APPLICABLE COMBUSTION ENGINEERING ECCS EVALUATION MODELS AND CODES

Evaluation Models (EM) for ECCS performance analysis of Combustion Engineering (CE) designed PWRs are described in topical reports, are licensed by the NRC, and are covered by the provisions of 10CFR50.46. The evaluation model for Large Break LOCA (LBLOCA) is the 1999 EM. For the Small Break LOCA (SBLOCA), the evaluation model is the S2M EM.

Several digital computer codes are used to do ECCS performance analyses of PWRs for the evaluation models described above that are covered by the provisions of 10CFR50.46. Those for LBLOCA calculations are CEFLASH-4A, COMPERC-II, HCROSS, PARCH, STRIKIN-II, and COMZIRC. CEFLASH-4AS is used in conjunction with COMPERC-II, STRIKIN-II, and PARCH for SBLOCA calculations.

Appendix K Large Break – 1999 EM Related Items

Rod-to-Rod Radiation Enclosure Selection Process Improvement for the 1999 EM
(Enhancements/Forward-Fit Discretionary Changes)

Background

The Appendix K ECCS Performance Analysis for LBLOCA for CE plants is performed with the 1999 Evaluation Model (1999 EM). The hot rod heat-up portion of this analysis contains a component model for rod-to-rod radiation, which utilizes an enclosure of fuel rods. In the Evaluation Model Topical Report, the rod-to-rod radiation methodology and a related SER limitation/constraint require that a bounding radiation enclosure will be used in the analysis. Search criteria are specified in the NRC-accepted Topical Report for ensuring that these conditions are met. The process for identifying candidate limiting enclosures for the rod-to-rod radiation model includes the use of an automated survey of the core on a pin-by-pin basis. The REX Code is the utility code that executes the surveying process for identifying potentially limiting radiation enclosures for evaluation in the LBLOCA Performance Analysis.

In 2005, a problem developed with the REX code, in that inappropriate radiation enclosures for the rod-to-rod radiation model were being identified. This had the potential for adding considerable inefficiency to the reload analysis process, since all identified candidates must be dispositioned for the analysis. This problem coincided with the introduction of ZrB_2 IFBA bearing cores, which have flatter power distributions. It was found that some candidate enclosures contained target hot rods operating below the power of the average rod of the hot assembly. This result produced candidate enclosures that fall outside the range of applicability of the rod-to-rod radiation methodology and therefore are inappropriate for the analysis. The REX utility code was modified to eliminate inappropriate enclosures derived from the survey process. This modification has no impact on the final limiting enclosure used in determining PCT.

Affected Evaluation Model

Appendix K LBLOCA Evaluation Model, 1999 EM

Estimated Effect

This process improvement has no impact on the licensed methodology or on the NRC-accepted search criteria and does not conflict with the SER limitation/constraint imposed on the radiation model. There is no impact on PCT for 10 CFR 50.46 reporting purposes.

Attachment 1
Our ref: LTR-OA-07-43
May 2, 2007

Appendix K Small Break – S2M

No Issues to Report for 2006

CONCLUSIONS

There were no EM changes to or errors in the Large Break LOCA 1999 EM or the Small Break LOCA S2M to report for CY 2006 that have an impact on the Calvert Cliffs Large and Small Break LOCA Analyses of Record which support Units 1 Cycles 17, Unit 1 Cycle 18 and Unit 2 Cycle 16 operation for the CY 2006 reporting period.

REFERENCES

1. "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors," Code of Federal Regulations, Title 10, Part 50, Section 50.46.
2. "Annual Report on C-E ECCS Codes and Methods for 10CFR50.46," CENPD-279, April 1989.
3. "Annual Report on C-E ECCS Codes and Methods for 10CFR50.46," CENPD-279, Supplement 1, February 1990.
4. "Annual Report on C-E ECCS Codes and Methods for 10CFR50.46," CENPD-279, Supplement 2, April 1991.
5. "Annual Report on C-E ECCS Codes and Methods for 10CFR50.46," CENPD-279, Supplement 3, April 1992.
6. "Annual Report on C-E ECCS Codes and Methods for 10CFR50.46," CENPD-279, Supplement 4, April 1993.
7. "Annual Report on C-E ECCS Codes and Methods for 10CFR50.46," CENPD-279, Supplement 5, February 1994.
8. "Annual Report on ABB C-E ECCS Performance Evaluation Models," CENPD-279, Supplement 6, February 1995.
9. "Annual Report on ABB C-E ECCS Performance Evaluation Models," CENPD-279, Supplement 7, February 1996.
10. "Annual Report on ABB CE ECCS Performance Evaluation Models," CENPD-279, Supplement 8, February 1997.
11. "Annual Report on ABB CE ECCS Performance Evaluation Models," CENPD-279, Supplement 9, March 1998.
12. "Annual Report on ABB CE ECCS Performance Evaluation Models," CENPD-279, Supplement 10, February 1999.
13. "Annual Report on ABB CE ECCS Performance Evaluation Models," CENPD-279, Supplement 11, March 2000.
14. "Annual Report on Combustion Engineering ECCS Performance Evaluation Models for PWRs," CENPD-279, Supplement 12, April 2001.
15. "Annual Report on Combustion Engineering ECCS Performance Evaluation Models for PWRs," CENPD-279, Supplement 13, Rev. 1, April 2002.
16. "Annual Report on Combustion Engineering ECCS Performance Evaluation Models for PWRs," CENPD-279, Supplement 14, Rev. 1, April 2003.
17. "Annual Report on Combustion Engineering ECCS Performance Evaluation Models for PWRs," CENPD-279, Supplement 15, March 2004.
18. "Annual Report on Combustion Engineering ECCS Performance Evaluation Models for PWRs," CENPD-279, Supplement 16, March 2005.
19. "10 CFR 50.46 Annual Notification and Reporting for 2005," March 2006.

Attachment 2
Plant Specific Text for Calvert Cliffs Units 1 and 2

Calvert Cliffs Unit 1 operated under two fuel cycles during Calendar Year (CY) 2006: Cycle 17 for the months of January - March 2006, Cycle 18 for the months of April - December 2006. Calvert Cliffs Unit 2 operated under fuel Cycle 16 throughout CY 2006.

For Unit 1 Cycle 17, as reported for CY 2005 (Reference 1), the Peak Cladding Temperature (PCT) impact due to a corrected steam cooling model in the STRIKIN-II program was 0 °F. There is no additional plant specific PCT impact for the 1999 EM Large Break Loss-of-Coolant (LBLOCA) analysis during CY 2006. There is no PCT impact for the S2M EM Small Break LOCA (SBLOCA) analysis during CY 2006.

For Unit 1 Cycle 18, a new LBLOCA Analysis of Record (AOR) was completed to implement the use of Zirconium Diboride (ZrB_2) Integral Fuel Burnable Absorber (IFBA) fuel. This analysis was first used in support of Unit 2 Cycle 16 operation. A 10 CFR 50.46 30-Day letter (Reference 2) was submitted to the NRC to document a >50 °F change in PCT due to the use of this fuel. The new AOR resets the reference PCT for Unit 1 Cycle 18. There is no additional PCT impact for the 1999 EM LBLOCA analysis during CY 2006. There is no PCT impact for the S2M EM Small Break LOCA (SBLOCA) analysis during CY 2006.

For Unit 2 Cycle 16, as reported for CY 2005 (Reference 1), the PCT impact due to a corrected steam cooling model in the STRIKIN-II program was 0 °F. There is no additional PCT impact for the 1999 EM LBLOCA analysis during CY 2006. As reported for CY 2005 (Reference 1), the PCT impact due to a correction to the input values for the clad rupture model in the S2M SBLOCA EM Small Break LOCA was made which resulted in a PCT increase of 40 °F. However, this PCT impact has been reported via 30-Day letter in Reference 2 and therefore, the SBLOCA AOR reference PCT impact has been reset to 0 °F. There is no PCT impact for the S2M EM SBLOCA analysis during CY 2006.

The total PCT impact for the LOCA analyses for Calvert Cliffs Units 1 and 2 is summarized in the table below.

Unit	Cycle	Applicable Evaluation Model and PCT Impact	
		LBLOCA	SBLOCA
1	17	1999 EM, 0 °F	S2M, 0 °F
1	18	1999 EM, 0 °F	S2M, 0 °F
2	16	1999 EM, 0 °F	S2M, 0 °F

References:

1. Letter from Mr. J.A. Spina to Document Control Desk (NRC), dated May 9, 2006, "Calvert Cliffs Nuclear Power Plant Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318 Submittal of Emergency Core Cooling System Codes and Methods Report".

2. Letter from Mr. J.A. Spina to Document Control Desk (NRC), dated May 3, 2006, "10 CFR 50.46 30-Day Report for Changes to the Calvert Cliffs Nuclear Power Plant Emergency Core Cooling System Performance Analysis".

Attachment 3 – PCT Rackup Sheets

Attachment 3
Our ref: LTR-OA-07-43
May 1, 2007

Westinghouse LOCA Peak Clad Temperature Summary for Appendix K Large Break

Plant Name: Calvert Cliffs Unit 1
Utility Name: Constellation Energy Generation Group
Revision Date: 1 /23/07

Analysis Information

EM:	1999 EM	**Analysis Date:**	12/9/04	**Limiting Break Size:**	0.6 DEG/PD
Fuel:	CE 14x14	**SGTP (%):**	10		

Notes:
1. Plant Configuration: Rated Core Power = 2754 MWt including power measurement uncertainty, Replacement Steam Generators.
2. Fuel Design: CE 14x14 Value Added Pellets, ZIRLO™ cladding, ZrB2 Integral Fuel Burnable Absorber, Turbo Mid-Grids.
3. Introduced in Region X, Cycle 18.

	Clad Temp (°F)
LICENSING BASIS	
Analysis-Of-Record PCT	**2057**
PCT ASSESSMENTS (Delta PCT)	
A. PRIOR ECCS MODEL ASSESSMENTS	
1 . None	0
B. PLANNED PLANT MODIFICATION EVALUATIONS	
1 . None	0
C. 2006 ECCS MODEL ASSESSMENTS	
1 . None	0
D. OTHER*	
1 . None	0
LICENSING BASIS PCT + PCT ASSESSMENTS	**PCT =** 2057

* It is recommended that the licensee determine if these PCT allocations be considered with respect to 10 CFR 50.46 reporting requirements.

Attachment 3
Our ref: LTR-OA-07-43
May 1, 2007

Westinghouse LOCA Peak Clad Temperature Summary for Appendix K Small Break

Plant Name: Calvert Cliffs Unit 1
Utility Name: Constellation Energy Generation Group
Revision Date: 1 /12/07

Analysis Information

EM:	S2M	**Analysis Date:**	12/19/05	**Limiting Break Size:**	0.08 sq ft / PD
Fuel:	CE 14x14	**SGTP (%):**	10		

Notes:
1. Plant Configuration: Rated Core Power = 2754 MWt including power measurement uncertainty, Replacement Steam Generators.
2. Fuel Design: CE 14x14 Value Added Pellets, ZIRLO™ cladding, ZrB2 Integral Fuel Burnable Absorber, Turbo Mid-Grids.
3. Introduced in Region X, Cycle 18.

	Clad Temp (°F)
LICENSING BASIS	
Analysis-Of-Record PCT	**1855**
PCT ASSESSMENTS (Delta PCT)	
A. PRIOR ECCS MODEL ASSESSMENTS	
1 . None	0
B. PLANNED PLANT MODIFICATION EVALUATIONS	
1 . None	0
C. 2006 ECCS MODEL ASSESSMENTS	
1 . None	0
D. OTHER*	
1 . None	0
LICENSING BASIS PCT + PCT ASSESSMENTS	**PCT =** 1855

* It is recommended that the licensee determine if these PCT allocations be considered with respect to 10 CFR 50.46 reporting requirements.

Attachment 3
Our ref: LTR-OA-07-43
May 1, 2007

Westinghouse LOCA Peak Clad Temperature Summary for Appendix K Large Break

Plant Name: Calvert Cliffs Unit 2
Utility Name: Constellation Energy Generation Group
Revision Date: 1 /23/07

Analysis Information

EM:	1999 EM	**Analysis Date:**	12/9/04	**Limiting Break Size:**	0.6 DEG/PD
Fuel:	CE 14x14	**SGTP (%):**	10		

Notes:
1. Plant Configuration: Rated Core Power = 2754 MWt including power measurement uncertainty, Replacement Steam Generators.
2. Fuel Design: CE 14x14 Value Added Pellets, ZIRLO™ cladding, ZrB2 Integral Fuel Burnable Absorber, Turbo Mid-Grids.
3. Introduced in Region V, Cycle 16.

	Clad Temp (°F)
LICENSING BASIS	
Analysis-Of-Record PCT	2057
PCT ASSESSMENTS (Delta PCT)	
A. PRIOR ECCS MODEL ASSESSMENTS	
1 . None	0
B. PLANNED PLANT MODIFICATION EVALUATIONS	
1 . None	0
C. 2006 ECCS MODEL ASSESSMENTS	
1 . None	0
D. OTHER*	
1 . None	0
LICENSING BASIS PCT + PCT ASSESSMENTS	**PCT =** 2057

* It is recommended that the licensee determine if these PCT allocations be considered with respect to 10 CFR 50.46 reporting requirements.

Attachment 3
Our ref: LTR-OA-07-43
May 1, 2007

Westinghouse LOCA Peak Clad Temperature Summary for Appendix K Small Break

Plant Name: Calvert Cliffs Unit 2
Utility Name: Constellation Energy Generation Group
Revision Date: 1 /23/07

Analysis Information

EM:	S2M	**Analysis Date:**	12/19/05	**Limiting Break Size:**	0.08 sq ft / PD
Fuel:	CE 14x14	**SGTP (%):**	10		

Notes:
1. Plant Configuration: Rated Core Power = 2754 MWt including power measurement uncertainty, Replacement Steam Generators.
2. Fuel Design: CE 14x14 Value Added Pellets, ZIRLO™ cladding, ZrB2 Integral Fuel Burnable Absorber, Turbo Mid-Grids.
3. Introduced in Region V, Cycle 16.

	Clad Temp (°F)
LICENSING BASIS	
Analysis-Of-Record PCT	**1855**
PCT ASSESSMENTS (Delta PCT)	
A. PRIOR ECCS MODEL ASSESSMENTS	
1 . None	0
B. PLANNED PLANT MODIFICATION EVALUATIONS	
1 . None	0
C. 2006 ECCS MODEL ASSESSMENTS	
1 . None	0
D. OTHER*	
1 . None	0
LICENSING BASIS PCT + PCT ASSESSMENTS	**PCT =** 1855

* It is recommended that the licensee determine if these PCT allocations be considered with respect to 10 CFR 50.46 reporting requirements.