James A. Spina
Vice President

Calvert Cliffs Nuclear Power Plant, Inc.
1650 Calvert Cliffs Parkway
Lusby, Maryland 20657
410.495.4455
410.495.3500 Fax

Constellation Energy
Generation Group

May 9, 2006

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. L. S. Larragoite at (410) 495-4922.

Very truly yours,

JAS/PSF/bjd

Attachment: (1) Annual Report on Combustion Engineering ECCS Performance Evaluation Models for PWRs, Westinghouse Electric Company, LLC, March 2006

cc: P. D. Milano, NRC

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

A001

ATTACHMENT (1)

Annual Report on Combustion Engineering ECCS Performance Evaluation Models for PWRs, Westinghouse Electric Company, LLC, March, 2006

Calvert Cliffs Nuclear Power Plant, Inc.
May 9, 2006

Attachment 1 – 10 CFR 50.46 Reporting Text
Our ref: LTR-LIS-06-117
March 6, 2006

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 (Westinghouse) Emergency Core Cooling System (ECCS) performance evaluation models (EMs) for Combustion Engineering (CE) PWRs in calendar year (CY) 2005 per the requirements of 10CFR50.46. For this reporting period, an error in the Large Break LOCA 1999 EM steam cooling model was identified and corrected. The maximum plant specific impact of this error correction is an increase in the peak cladding temperature (PCT) of 2 °F. Other changes to LOCA analysis methods in CY 2005 did not have an impact on PCT.

The sum of the absolute magnitudes of the generic PCT changes for the large break LOCA 1985 EM from all reports to date continues to be less than 1 °F excluding plant specific effects. The generic impact on the PCT for the large break LOCA 1999 EM is less than 1.2 °F for plants analyzed with the Automated/Integrated Code System (AICS) and less than 3 °F for plants analyzed with the Advanced AICS (AAICS). There is no generic accumulated change in PCT for the small break LOCA S2M evaluation model. No change occurred in the PCT due to post-LOCA long term cooling issues. The total effect relative to the 50 °F definition of a significant change in PCT for each evaluation model is the sum of the generic effects for that model and plant specific effects, if any, described in the plant specific text provided in this report.

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 2-18.

COMBUSTION ENGINEERING ECCS EVALUATION MODELS AND CODES

Four 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 models for large break LOCA (LBLOCA) are the 1985 EM and the 1999 EM. For the small break LOCA, the evaluation model is the S2M EM. Post-LOCA long term cooling (LTC) analyses use the LTC evaluation model.

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. The codes for post-LOCA LTC analyses are BORON, CEPAC, NATFLOW, and CELDA.

Appendix K Large Break – 1999 EM Related Items

LBLOCA STEAM COOLING MODEL ERROR CORRECTION (Non-Discretionary Change)

Background

The LBLOCA Evaluation Model, 1999 EM, has an NRC imposed Safety Evaluation Report (SER) constraint. The constraint stipulates that the steam cooling model in the PARCH module of the STRIKIN-II program can be used for calculating the hot rod PCT provided the resulting heat transfer coefficients are no better than those calculated using the FLECHT heat transfer correlation. An error in the implementation of this constraint in the 1999 EM was discovered in calendar year 2005 and was corrected. The error pertains to the STRIKIN-II main program not providing the correct limiting FLECHT heat transfer coefficient value to the PARCH module for use in checking the SER constraint. It was determined that the STRIKIN-II program was providing the steam cooling model heat transfer coefficient value from the previous time step for this check.

Estimated Effect

The error in the STRIKIN-II program was corrected by a coding change to ensure the use of the FLECHT heat transfer coefficient for confirming that the SER constraint was met. The maximum plant specific impact on PCT due to correcting the steam cooling model was an increase of 2 °F. The impact of the correction on PCT for each applicable CE fleet plant is shown in the plant specific text of this report.

COMPONENT MODEL IMPROVEMENT TO INCLUDE EFFECT OF SPACER GRIDS FOR LBLOCA ANALYSIS
(Discretionary Change)

Background

The implementation of an Advanced Automated/Integrated Code System (AAICS) was previously identified as a change in the implementation of the 1999 EM LOCA Evaluation Model in the Annual 10 CFR 50.46 Report for calendar year 2004 (Reference 18). A change to the 1999 EM has been implemented since last year's report. This change pertains to the PARCH module of the STRIKIN-II program and was implemented via a component model improvement to include the effects of spacer grids. The improved component model is the 1999 EM steam cooling model for less than 1 in/sec core reflood flow rate. This improvement to the existing 1999 EM component model is intended to be an optional feature of the LBLOCA 1999 EM that is applicable to the CE 16x16 Next Generation Fuel (NGF) design as well as to any other CE fuel design for future applications. The improved model is described in Reference 19 which has been submitted to the NRC for review and approval.

Estimated Effect

There is no change in PCT with regard to the current analyses of record for the CE fleet plants since the component model improvement mentioned above is not used in these analyses.

ADDITIONAL AUTOMATION OF LOCA ANALYSIS METHODS (Discretionary Change)

Background

Automation of the LBLOCA and SBLOCA analysis methods using AAICS had been previously reported in last year's 10 CFR 50.46 report (Reference 18). Additional automation of methods was implemented for both the LBLOCA and SBLOCA analyses. For both analyses, the case inputs for various computer case runs were automatically generated using case matrix generation programs. The case inputs refer to input values for simulating a specific LOCA scenario for a specific plant using the EM. The case matrix refers to a set of parametric cases with differing break sizes and/or plant operating conditions. The utility program CMG99A was used for LBLOCA 1999 EM case matrix generation, while program CMGS2M was used to create the case matrix for the SBLOCA S2M EM. These programs eliminated much of the manual effort required in setting up LOCA case runs and reduced the potential for errors.

Estimated Effect

The use of these utility programs did not result in any changes to the EM or any of its components including those controlled by Appendix K. The use of the case matrix generation programs, CMG99A and CMGS2M, for automating the LOCA analyses has no impact on the analysis results, including the PCT.

Appendix K Small Break – S2M Related Items

ADDITIONAL AUTOMATION OF LOCA ANALYSIS METHODS (Discretionary Change)

Background

Automation of the LBLOCA and SBLOCA analysis methods using AAICS had been previously reported in last year's 10 CFR 50.46 report (Reference 18). Additional automation of methods was implemented for both the LBLOCA and SBLOCA analyses. For both analyses, the case inputs for various computer case runs were automatically generated using case matrix generation programs. The case inputs refer to input values for simulating a specific LOCA scenario for a specific plant using the EM. The case matrix refers to a set of parametric cases with differing break sizes and/or plant operating conditions. The utility program CMG99A was used for LBLOCA 1999 EM case matrix generation, while program CMGS2M was used to create the case matrix for the SBLOCA S2M EM. These programs eliminated much of the manual effort required in setting up LOCA case runs and reduced the potential for errors.

Estimated Effect

The use of these utility programs did not result in any changes to the EM or any of its components including those controlled by Appendix K. The use of the case matrix generation programs, CMG99A and CMGS2M, for automating the LOCA analyses has no impact on the analysis results, including the PCT.

CONCLUSIONS

The correction of errors in LOCA analysis models and/or changes to LOCA analysis methods during CY 2005 had the following impact on LOCA analysis results.

(1) The correction of the steam cooling model in the STRIKIN-II program of the 1999 EM for LBLOCA results in a maximum plant specific impact on PCT of 2 °F.

(2) The component model improvement to include the effects of spacer grid has no impact on the current analyses of record for CE fleet plants since this improvement is not used in these analyses.

(3) The automation of the LBLOCA and SBLOCA analysis methods for the 1999 EM and S2M EM using the case matrix generation programs, CMG99A and CMGS2M, respectively, has no impact on analysis results, including the PCT.

The sum of the absolute magnitude of the changes in PCT calculated using the 1985 EM for LBLOCA, including those from previous annual reports, References 2-18, remains less than 1°F. The maximum generic impact on PCT calculated with the 1999 EM is less than 3°F (from Reference 18). There are no additional generic PCT changes for the Year 2005 for the 1985 EM and the 1999 EM models. Plant specific LBLOCA considerations for each plant in the CE fleet including the application of the corrected steam cooling model are discussed in the plant specific text provided in this report.

Previous plant specific PCT effects for the S2M SBLOCA evaluation model are discussed in Appendices A through F of Reference 15. There is no previous generic accumulated change in cladding temperature for the S2M EM. There are no additional PCT changes for calendar year 2005 for the S2M evaluation model. Plant specific SBLOCA considerations for each plant in the CE fleet are discussed in the plant specific text provided in this report, as applicable.

There is no PCT effect for the post-LOCA long term cooling evaluation model.

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. "CE 16x16 Next Generation Fuel Core Reference Report", WCAP-16500-P, Rev. 0, February 2006.

Plant Specific Text for Calvert Cliffs Units 1 and 2

Calvert Cliffs Unit 1 operated under fuel cycle 17 throughout calendar year 2005. Unit 2 operated under two fuel cycles during year 2005: Cycle 15 for the months of January –February 2005, Cycle 16 for the months of March – December 2005.

For LBLOCA analysis that uses the 1999 EM, the PCT impact of the corrected steam cooling model in the STRIKIN-II program was an increase of 0 °F. There is no additional plant specific PCT impact for the 1999 EM LBLOCA analysis during calendar year 2005. For Unit 2 Cycle 16, a new LBLOCA Analysis of Record (AOR) was completed to implement the use of Zirconium Diboride (ZrB_2) Integral Fuel Burnable Absorber (IFBA) fuel in the reactor core. A 10 CFR 50.46 thirty day letter (Reference 1) 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, resulting in 0 °F change in PCT for carry-over into year 2006.

For Unit 1 Cycle 17 and Unit 2 Cycle 15, the SBLOCA analysis, that uses the S2M EM, results in no change in PCT. For Unit 2 Cycle 16, the 10 CFR 50.46 thirty day letter (Reference 1) resets the reference PCT. Subsequent to the submittal of Reference 1 to the NRC, a correction to the input values that impacted the clad rupture model was made which resulted in a PCT increase of 40 °F. There is no additional plant specific PCT impact for the S2M EM SBLOCA analysis during calendar year 2005.

The total effect on PCT for all LOCA analyses of Calvert Cliffs Units 1 and 2 is summarized in the table below.

Unit	Cycle	Applicable Evaluation Model and PCT Effect	
		LBLOCA	SBLOCA
1	17	1999 EM, 0 °F	S2M, 0 °F
2	15	1999 EM, 0 °F	S2M, 0 °F
2	16	1999 EM, 0 °F	S2M, 40 °F

Reference

1. Letter from Mr. G. Vanderheyden to Document Control Desk (NRC), dated April 6, 2005, "Calvert Cliffs Nuclear Power Plant Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318, 10 CFR 50.46 30-Day Report for Changes to the Calvert Cliffs Nuclear Power Plant Emergency Core Cooling System Performance Analysis".