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W3F1-2007-0026

May 31, 2007

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Subject: Annual Report on Westinghouse Electric Company LLC Combustion
Engineering Emergency Core Cooling System Performance Evaluation
Models
Waterford Steam Electric Station, Unit 3 (Waterford 3)
Docket No. 50-382
License No. NPF-38

Dear Sir or Madam:

Pursuant to 10CFR50.46(a)(3)(ii), Entergy Operations, Inc. (EOI) hereby submits the Waterford Steam Electric Station Unit 3 annual evaluation of changes and errors identified in the Westinghouse Electric Company LLC Combustion Engineering Emergency Core Cooling System (ECCS) performance evaluation models used for Loss-of-Coolant Accident (LOCA) analyses. The results of the annual evaluation for the calendar year (CY) 2006 are provided in the attachment to this report entitled, "Annual Report on Combustion Engineering ECCS Performance Evaluation Models for PWRs."

During the CY 2006 reporting period, no errors were identified associated with the 1999 Evaluation Model (EM) for Large Break LOCA that affects the cladding temperature calculation. As discussed in Section 3 of the attachment, one discretionary change to a utility code used in the 1999 EM was made during CY 2006, but the modification has no impact on determination of the limiting peak cladding temperature in the Waterford 3 analyses.

In the CY 2006 reporting period, no errors were identified in the Small Break LOCA S2M EM or in the post-LOCA Long Term Cooling EM.

Per the criteria of 10 CFR 50.46, no action beyond this annual report is required.

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There are no commitments contained in this submittal. Should you have any questions regarding the attached report, please contact Paul Melancon at (504) 739-6614.

Sincerely,

A handwritten signature in black ink, appearing to read "R.J. Murillo". The signature is written in a cursive style with a large initial "R" and a long horizontal flourish at the end.

R.J. Murillo

RJM/RLW/

Attachment 1: Annual Report on Combustion Engineering ECCS Performance Evaluation
Models for PWRs

cc: Dr. Bruce S. Mallett
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Attachment 1

W3F1-2007-0026

**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) Pressurized Water Reactors (PWRs) in Calendar Year (CY) 2006 per the requirements of 10CFR50.46.

For this reporting period, a forward-fit discretionary enhancement in the Large Break LOCA (LBLOCA) 1999 EM was developed for the REX utility code used in the rod-to-rod enclosure selection procedure. This enhancement has no impact on the Waterford 3 Large Break LOCA Analysis of Record, which supports the transition to Cycle 15 during this reporting period. There were no other changes to or errors in the Large Break LOCA 1999 EM to report for CY 2006.

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

No change occurred in the Peak Clad Temperature (PCT) due to post-LOCA Long Term Cooling (LTC) issues for CY 2006.

1.0 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, spells 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.

2.0 COMBUSTION ENGINEERING ECCS EVALUATION MODELS AND CODES

Evaluation models (EM) for ECCS performance analyses 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. 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.

3.0 APPENDIX K LARGE BREAK – 1999 EM RELATED ITEMS

3.1 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 ZrB₂ 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.

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.

4.0 APPENDIX K SMALL BREAK – S2M RELATED ITEMS

There are no issues to report for CY 2006.

5.0 CONCLUSIONS

For this reporting period, a forward-fit discretionary enhancement in the Large Break LOCA 1999 EM was developed for the REX utility code used in the rod-to-rod enclosure selection procedure. This enhancement has no impact on the Waterford 3 Large Break LOCA Analysis of Record, which supports the transition to Cycle 15 during this reporting period.

There were no other EM changes to or errors in the Large Break LOCA 1999 EM, Small Break LOCA S2M, or Long Term Cooling (LTC) EM to report for CY 2006 that have an impact on the Waterford 3 Large Break, Small Break and LTC Analyses of Record, which support operation for the CY 2006 reporting period.

6.0 PLANT SPECIFIC CONSIDERATIONS FOR WATERFORD 3

During CY 2006, operation of Waterford 3 Cycle 14 was completed late in the year under extended power uprate operating conditions that were previously submitted and approved in 2005. There were no changes to or errors in the Analyses of Record supporting Cycle 14 for the CY 2006 reporting period. The Annual Report for CY 2005 in support of operation of Waterford 3 Cycle 14 is given in Reference 20.

For Waterford 3 Cycle 15, which began late in CY 2006, a new Emergency Core Cooling System (ECCS) performance analysis was performed during CY 2006 to demonstrate compliance with the NRC Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors, 10 CFR 50.46. The results which demonstrated compliance with NRC Acceptance Criteria consisted of the Large Break Loss-of-Coolant Accident (LBLOCA), Small Break LOCA (SBLOCA), and Post-LOCA Long Term Cooling (LTC) analyses. Consistent with 10 CFR 50.46 reporting requirements, the results of these new ECCS performance analyses for

Waterford Cycle 15 were submitted to NRC in a 30-Day Report (Reference 21) to document a significant change in Peak Cladding Temperature (PCT) as defined in 10 CFR 50.46(a)(3)(i). As documented in Reference 21, the new LBLOCA and SBLOCA analyses constitute new licensing basis analyses-of-record (AORs) effective with Cycle 15, thereby replacing the previous analyses for Cycle 14.

The new ECCS performance analyses for Waterford 3 Cycle 15 were necessary due to the implementation of (1) ZrB₂ IFBA fuel rods with ZIRLO™ cladding, (2) an increase in the allowable steam generator tube plugging limit to 20%, and (3) revisions of other key plant design data including the minimum high pressure safety injection pump flow rate, containment passive heat sinks for sump screen modifications, maximum fan cooler data, and reactor coolant pump locked rotor hydraulic loss coefficient. The new ECCS analyses demonstrate acceptable results for operation under the same extended power uprate operating conditions that were approved and first applicable for Cycle 14.

These new ECCS performance analyses for Cycle 15 replace the previous analyses for Cycle 14 and thereby reset the reference points or baseline for evaluating the cumulative impact on PCT of changes to and/or errors in the evaluation models. Starting with Cycle 15, which began late in CY 2006, the cumulative impact on PCT remains 0°F for both LBLOCA and SBLOCA analyses.

7.0 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.
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9. "Annual Report on ABB C-E ECCS Performance Evaluation Models," CENPD-279, Supplement 7, February, 1996.

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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. "U.S. Nuclear Regulatory Commission, 10 CFR 50.46 Annual Notification and Reporting for 2005," LTR-NRC-06-8, Letter from B. F. Maurer (Westinghouse) to J. S. Wermiel (U.S. Nuclear Regulatory Commission), March 16, 2006.
20. "Waterford 3 SES Docket No. 50-382, License No. NPF-38, Annual Report on Westinghouse Electric Company LLC Combustion Engineering Emergency Core Cooling System Performance Evaluation Models," Letter from R. J. Murillo (Entergy) to the U.S. Nuclear Regulatory Commission, W3F1-2006-0025, May 31, 2006. (ADAMS Accession Number: ML061560115).
21. "Waterford 3 Docket No. 50-382, 10CFR50.46 Thirty-Day Report for Changes to the Waterford 3 Emergency Core Cooling System Performance Analysis," Letter from R. J. Murillo (Entergy) to the U.S. Nuclear Regulatory Commission, W3F1-2006-0063, December 6, 2006. (ADAMS Accession Number: ML063460297).