



COMBUSTION ENGINEERING OWNERS GROUP

**CENPD-279
SUPPLEMENT 10**

**ANNUAL REPORT ON ABB CE ECCS
PERFORMANCE EVALUATION MODELS**

FINAL REPORT

CEOG TASK 1095

**Prepared for the
C-E OWNERS GROUP**

February 1999



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ABSTRACT

This report describes changes and errors in the ABB Combustion Engineering evaluation models for PWR ECCS performance analysis in calendar year 1998 per the requirements of 10CFR50.46. For this reporting period, there were no changes or errors in the evaluation models or application of the models.

The sum of the absolute magnitude of the PCT changes for large break LOCA from all reports to date continues to be less than 1°F excluding plant specific effects. The total effect relative to the 50°F definition of a significant change in PCT would be the sum of <1°F and plant specific effects, if any, described in Appendices A-E. The sum of the absolute magnitude of the maximum cladding temperature changes for small break LOCA from all reports to date is less than 3°F. No change occurred in the PCT for post-LOCA long term cooling.

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APPENDICES (Plant Specific Considerations)

- A. ARIZONA PUBLIC SERVICE COMPANY (PVNGS Units 1-3)
- B. BALTIMORE GAS AND ELECTRIC COMPANY (Calvert Cliffs Units 1 & 2)
- C. SOUTHERN CALIFORNIA EDISON COMPANY (SONGS Units 2 & 3)
- D. FLORIDA POWER AND LIGHT COMPANY (St. Lucie Unit 2)
- E. ENTERGY OPERATIONS, INCORPORATED
 - 1. Arkansas Nuclear One Unit 2
 - 2. Waterford Unit 3

1.0 INTRODUCTION

This report addresses the NRC requirement to report changes or 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 a cumulation 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 all the errors corrected in and/or changes to the presently licensed ABB CE ECCS performance evaluation models, 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. ABB CE reports for earlier years are given in References 2-11.

2.0 ABB CE CODES USED FOR ECCS EVALUATION

ABB CE uses several digital computer codes for ECCS performance analysis that are described in topical reports, are licensed by the NRC, and are covered by the provisions of 10CFR50.46. Those for large break LOCA (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 small break LOCA (SBLOCA) calculations. The codes for post-LOCA long term cooling analysis are BORON, CEPAC, NATFLOW, and CELDA.

3.0 EVALUATION MODEL CHANGES AND ERROR CORRECTIONS

This section discusses all error corrections and model changes to the ABB CE ECCS performance evaluation models for PWRs which may affect the calculated PCT.

There were no changes to or errors in the ECCS evaluation models for PWRs or changes to their application for calendar year 1998.

4.0 CONCLUSIONS

There were no changes or errors in the ABB CE ECCS evaluation models for PWRs or their application for LBLOCA, SBLOCA, or post-LOCA long term cooling. The sum of the absolute magnitude of the changes in PCT calculated using the ABB CE ECCS evaluation models for LBLOCA, including those from previous annual reports, References 2-11, remains less than 1°F relative to the 50°F criterion for a significant change in PCT. The total LBLOCA PCT impact for a given plant is <1°F plus the plant specific effects, if any, discussed in Appendices A through E.

The sum of the absolute magnitude of the changes in maximum cladding temperature for SBLOCA (due to the change in application of the SBLOCA evaluation model described in Reference 11) is less than 3°F. Plant specific SBLOCA considerations for each plant, if any, are discussed in Appendices A-E.

The cumulative sum of the absolute magnitude of the change in cladding temperature from the post-LOCA long term cooling model is zero.

5.0 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.
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, March, 1997.
11. "Annual Report on ABB CE ECCS Performance Evaluation Models," CENPD-279, Supplement 9, February, 1998.

APPENDIX C

SOUTHERN CALIFORNIA EDISON COMPANY

Plant Specific Considerations for SONGS Units 2 and 3

The LBLOCA analyses in effect for Cycle 9 operation of Units 2 and 3 were performed with the erroneous energy redistribution factor (ERF). The resulting sum of the absolute magnitude of changes in PCT is 40°F as discussed in Supplement 9. The Cycle 10 LBLOCA ECCS performance analyses for Songs Units 2 and 3 explicitly incorporate the corrected ERF. The resulting sum of the absolute magnitude of changes in PCT for Cycle 10 operation of Units 2 and 3 is less than 1°F.

ENCLOSURE 2

**1998 LOSS OF COOLANT ACCIDENT (LOCA) MARGIN SUMMARY
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 AND 3**

Large Break LOCA

Table 1 provides a time line of the items which affect the large break LOCA peak cladding temperature (PCT) during 1998. The 10 CFR 50.46 PCT limit of 2200°F was not exceeded during 1998.

Table 1

1998 Limiting Large Break LOCA (LBLOCA) PCT Time Line	Δ PCT	PCT
Limiting LBLOCA PCT (end of 1997)	N/A	2160°F
Model Errors and Changes (during 1998):		
<ul style="list-style-type: none"> ● Errors and changes discovered prior to 1998 which affect cycle 9 operation during 1998 	+40°F	2160°F*
<ul style="list-style-type: none"> ● Errors and changes discovered in 1998 	+0°F	2160°F*
1998 Penalty Factor		
<ul style="list-style-type: none"> ● Existing plant operating penalty credited to compensate for the energy redistribution factor error discovered in 1997 	-40°F	2160°F*
Limiting LBLOCA PCT (end of 1998)	N/A	2160°F
<p>* The existing plant setpoints had sufficient conservatism to accommodate the penalty factor without the need to change the setpoints. Therefore, the energy redistribution factor error merely reduced the available margin in the plant setpoint without affecting the PCT.</p>		

The cumulative 10CFR50.46 changes and errors for 1998 for the Large Break LOCA evaluation model are shown in Table 2.

Table 2

1998 Cumulative LBLOCA 10 CFR 50.46 Changes/Errors	Δ PCT	Σ Δ PCT
Cumulative 10 CFR 50.46 Changes/Errors Prior to 1998 (Sum of the absolute magnitude of the 10 CFR 50.46 changes and errors found since the approval of the August 1994 LBLOCA analysis through 1997)	N/A	40°F
10 CFR 50.46 Changes/Errors Discovered in 1998: <ul style="list-style-type: none"> • None 	0°F	40°F
1998 Cumulative 10 CFR 50.46 Changes/Errors (Sum of the absolute magnitude of the 10 CFR 50.46 changes and errors found since the approval of the August 1994 LBLOCA analysis)	N/A	40°F

Small Break LOCA

Table 3 provides a time line of the items which affect the small break LOCA peak cladding temperature (PCT) during 1998. The 10 CFR 50.46 PCT limit of 2200°F was not exceeded during 1998, and the SBLOCA remained bounded by the LBLOCA.

Table 3

1998 Limiting Small Break LOCA (SBLOCA) PCT Time Line	Δ PCT	PCT
Limiting SBLOCA PCT (end of 1997)	N/A	1732°F
Model Errors and Changes (during 1998):		
<ul style="list-style-type: none"> • Errors and changes discovered prior to 1998 which affect cycle 9 operation during 1998 	<3°F	<1735°F
<ul style="list-style-type: none"> • Errors and changes discovered in 1998 	+0°F	<1735°F
Limiting SBLOCA PCT (end of 1998)	N/A	<1735°F

The cumulative 10CFR50.46 changes and errors for 1998 for the small break LOCA evaluation model are shown in Table 4.

Table 4

1998 Cumulative SBLOCA 10 CFR 50.46 Changes/Errors	Δ PCT	$\Sigma \Delta$ PCT
Cumulative 10 CFR 50.46 Changes/Errors Prior to 1998 (Sum of the absolute magnitude of the 10 CFR 50.46 changes and errors found since the approval of the original SBLOCA analysis)	N/A	<3°F
10 CFR 50.46 Changes/Errors Discovered in 1998: <ul style="list-style-type: none"> ● None 	0°F	<3°F
1998 Cumulative 10 CFR 50.46 Changes/Errors (Sum of the absolute magnitude of the 10 CFR 50.46 changes and errors found since the approval of the original SBLOCA analysis)	N/A	<3°F

ENCLOSURE 3



5 March, 1999

Annette Gilliam, Esq.
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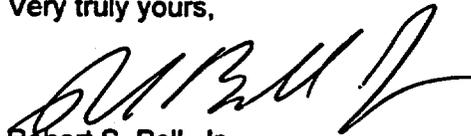
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