

June 22, 2000

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Gentlemen:

**Subject: Docket Nos. 50-361 and 50-362
1999 Emergency Core Cooling System Annual 10 CFR 50.46 Report
San Onofre Nuclear Generating Station, Units 2 and 3**

- References:
1. December 7, 1999 Letter from A. E. Scherer (SCE) to Document Control Desk (NRC), "Docket Nos. 50-361 and 50-362, 1998 Emergency Core Cooling System Annual 10 CFR 50.46 Report, San Onofre Nuclear Generating Station, Units 2 and 3"
 2. March 27, 2000 Letter from R. S. Bell, Jr. (ABB CE) to A. Gilliam (SCE), Subject: Limited Authorization to Reproduce a Copyrighted Document

This letter transmits as Enclosures 1 and 2 the San Onofre Units 2 and 3 annual report for the 1999 calendar year required by paragraph (a)(3)(ii) of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors." This regulation requires Southern California Edison (SCE) to annually report to the NRC for San Onofre Units 2 and 3 the nature of each change to or error discovered in the Emergency Core Cooling System (ECCS) evaluation model or in the application of this model that affects the temperature calculation and estimated effects of any such changes, errors, or applications on the limiting ECCS analysis. Any significant change or error is required to be reported to the NRC within 30 days.

There were no changes to or errors in the ECCS evaluation models or changes to their application that affect the peak cladding temperature (PCT) calculation for calendar year 1999.

The "Annual Report on ABB CENP ECCS Performance Evaluation Models, CENPD-279 Supplement 11" (Enclosure 1) describes the codes and methodology used by Asea Brown Boveri Combustion Engineering (ABB CE) for the San Onofre Units 2 and 3 ECCS analysis for the 1999 reporting period. CENPD-279 Supplement 11 Appendix C summarizes the plant specific evaluation for San Onofre Units 2 and 3. Appendices A, B, D, E, F, and G of CENPD-279 Supplement 11 apply to plants other than San Onofre, and are therefore not included.

For the 1997 reporting period, a 40°F error was found in the large break Loss of Coolant Accident (LOCA) analysis, as described in Reference 1. This error, which affected Cycle 9 operation of both Unit 2 and Unit 3, continued to be applicable during 1999 (until January 2, 1999 for Unit 2, and until March 27, 1999 for Unit 3). No other changes or errors which affect the large break LOCA analysis were found in 1999. No changes or errors which impact the peak clad temperature were found in 1999 in the evaluation models or application of the models for the small break LOCA or post-LOCA long term cooling calculations. SCE made no changes to the LOCA evaluation models per 10 CFR 50.59.

Enclosure 2 provides a summary of the effect on PCT of the errors or changes to the ECCS evaluation model reported under 10 CFR 50.46 for 1999. While not limiting with regard to PCT, detailed information for the small break LOCA is also included in Enclosure 2, Tables 3 and 4 (in accordance with Supplement 1 to Information Notice 97-15, "Reporting of Errors and Changes in Large-Break/Small-Break Loss-of-Coolant Evaluation of Fuel Vendors and Compliance with 10CFR50.46(a)(3)").

Large Break LOCA Evaluation Model

The arithmetic sum of the PCT effects of both the 10 CFR 50.46 and 10 CFR 50.59 changes is a 40°F effect on the large break LOCA analysis PCT for Cycle 9 operation. Unit 2 operated in Cycle 9 until January 2, 1999. Unit 3 operated in Cycle 9 until March 27, 1999. Following Cycle 10 startup, this error was incorporated in the analysis producing a change in PCT of 37 °F. Cycle 10 startup was February 23, 1999 for Unit 2, and May 7, 1999 for Unit 3.

In 1999 the limiting large break LOCA PCT did not exceed the 10 CFR 50.46(b)(1) acceptance criterion of 2200°F.

The sum of the absolute magnitude of the 10 CFR 50.46 evaluation model changes and errors found since the approval of the August 1994 large break LOCA analysis (which used the June 1985 evaluation model) is 40 °F for Cycle 9, and less than 1 °F for Cycle 10 operation.

Small Break LOCA Evaluation Model

The arithmetic sum of the PCT effects of both the 10 CFR 50.46 and 10 CFR 50.59 changes is a less than 3°F effect on the small break LOCA analysis PCT for Cycle 9 and Cycle 10 operation.

In 1999 the limiting small break LOCA PCT did not exceed the 10 CFR 50.46(b)(1) acceptance criterion of 2200°F, and remained bounded by the PCT for the large break LOCA.

The sum of the absolute magnitude of the 10 CFR 50.46 evaluation model changes and errors found since the approval of the original small break LOCA analysis is less than 3°F.

A March 27, 2000 ABB CE letter (Reference 2) providing limited authorization for the NRC to reproduce the copyrighted CENPD-279 Supplement 11 (Enclosure 1) is provided as Enclosure 3.

If you have any questions or need additional information on this subject, please let me know.

Sincerely,

A handwritten signature in black ink, appearing to read "R. R. Assa". The signature is fluid and cursive, with a large initial "R" and "A".

Enclosures

cc: E. W. Merschoff, Regional Administrator, NRC Region IV
J. A. Sloan, NRC Senior Resident Inspector, San Onofre Units 2 & 3
R. R. Assa, NRC Project Manager, San Onofre Units 2 and 3

Enclosure 1

CENPD-279
Supplement 11

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

CEOG Task 1144

Prepared for the
C-E OWNERS GROUP

March 2000

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**ABB C-E Nuclear Power
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ABB C-E Nuclear Power, Inc.

ABSTRACT

This report describes changes and errors in the ABB C-E Nuclear Power (CENP) models for PWR ECCS performance analysis in calendar year 1999 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 that affect the cladding temperature calculation.

The sum of the absolute magnitude of the peak cladding temperature (PCT) changes for the large break LOCA June 1985 EM 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 is the sum of <1°F and plant specific effects, if any, described in Appendices A-G. The sum of the absolute magnitude of the maximum cladding temperature changes for the small break LOCA SIM evaluation model from all reports to date is less than 3°F. The accumulated change in cladding temperature for the small break LOCA S2M evaluation model is 0°F. No change occurred in the PCT due to post-LOCA long term cooling issues.

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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. CONSUMERS ENERGY (Palisades)
- E. ENTERGY OPERATIONS, INCORPORATED
 - 1. Arkansas Nuclear One Unit 2
 - 2. Waterford Unit 3
- F. FLORIDA POWER AND LIGHT COMPANY (St. Lucie Unit 2)
- G. NORTHEAST UTILITIES (Millstone Unit 2)

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, 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 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 CENP ECCS performance evaluation models for PWRs, 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 CENP reports for earlier years are given in References 2-12.

2.0 ABB CENP ECCS EVALUATION MODELS AND CODES

Four ABB CENP evaluation models (EM) for ECCS performance analysis of 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 June 1985 EM. There are two evaluation models for small break LOCA (SBLOCA): the original SBLOCA Evaluation Model (S1M) and the S2M SBLOCA EM accepted by the NRC in 1997. Post-LOCA long term cooling (LTC) analyses are performed with the LTC evaluation model.

ABB CENP uses several digital computer codes 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 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 CENP 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 1999 that affect the cladding temperature calculation.

4.0 CONCLUSIONS

There were no changes or errors in the ABB CENP ECCS evaluation models for PWRs or their application for LBLOCA, SBLOCA, or post-LOCA long term cooling that affect the cladding temperature calculation during 1999. The sum of the absolute magnitude of the changes in PCT calculated using the ABB CENP June 1985 EM for LBLOCA, including those from previous annual reports, References 2-12, 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 G.

The sum of the absolute magnitude of the changes in maximum cladding temperature for the SBLOCA S1M evaluation model (due to the change in application of the SBLOCA S1M evaluation model described in Reference 11) is less than 3°F. The accumulated change in cladding temperature for the S2M evaluation model is 0°F. Plant specific SBLOCA considerations for each plant, if any, are discussed in Appendices A through G.

The sum of the absolute magnitude of the changes in cladding temperature for the post-LOCA long term cooling evaluation 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.
12. "Annual Report on ABB CE ECCS Performance Evaluation Models," CENPD-279, Supplement 10, February, 1999.

APPENDIX C

SOUTHERN CALIFORNIA EDISON COMPANY

Plant Specific Considerations for SONGS Units 2 and 3

There are no outstanding plant specific considerations for SONGS Units 2 and 3 identified in 1999.

Errors in Codes Used for PWR ECCS Performance Analysis

The code errors described here were resolved in calendar year 1999 per the provisions of the computer software section, QP 3.13, of the ABB CENP Quality Procedures Manual, Ref. 1. They have a lower level of severity than the items in the formal report on ECCS performance codes and methods changes and errors in that there was no impact on the peak cladding temperature (PCT); therefore, these errors are not reportable under the provisions of 10CFR50.46. This information is provided for completeness in the error reporting process.

COMPERC-II Errors

COMPERC-II performs the refill/reflood hydraulic and reflood heat transfer coefficient calculations in the ABB CENP ECCS performance evaluation model for PWRs.

An option in COMPERC-II to model simultaneous injection of safety injection tanks (SITs) and safety injection pumps (SIPs) for analysis of non-CE PWRs does not account for spillage of SIP flow to containment. This option is not used for ECCS performance analysis of ABB CENP PWRs; hence, the error has no effect on the licensing analysis results for ECCS performance analyses.

The treatment of ECCS spillage flow for a suction leg break in the COMPERC-II code is inconsistent with the description in the topical report for the LBLOCA evaluation model (EM). Since suction leg breaks are non-limiting compared to discharge leg breaks, this inconsistency has no effect on the PCT of the limiting ECCS analysis.

STRIKIN-II Error

STRIKIN-II performs the hot rod heatup calculation in the LBLOCA EM and is used in the SBLOCA EM for PWRs.

A STRIKIN-II option that allows the code to identify the cladding rupture node was found to malfunction. This option is not used since the current methodology is to perform a sensitivity study to determine the limiting cladding rupture node. In each case of the sensitivity study, cladding rupture is forced at a different user specified node. The PCT and oxidation results reported for the licensing analysis are taken from the case with the rupture node that produces the highest PCT. Consequently, the code error has no effect on licensing results for LBLOCA ECCS performance analyses since the option that malfunctions is not used. The error has no impact on SBLOCA analyses.

Reference

1. "ABB Combustion Engineering Nuclear Power Quality Procedures Manual," QPM-101, Rev. 04, March 13, 2000.

Enclosure 2

1999 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 1999. The 10 CFR 50.46 PCT limit of 2200°F was not exceeded during 1999.

For Unit 2, Cycle 9 operation ended on January 2, 1999 and Cycle 10 operation (initial criticality) began on February 23, 1999. For Unit 3, Cycle 9 operation ended on March 27 1999 and Cycle 10 operation (initial criticality) began on May 7, 1999.

Table 1

1999 Limiting Large Break LOCA (LBLOCA) PCT Time Line	Δ PCT	PCT
Limiting LBLOCA PCT (end of 1998)	N/A	2160°F
Model Errors and Changes (during 1999):		
<ul style="list-style-type: none"> ● Errors and changes discovered in 1999 	+0°F	2160°F
1999 Cycle 10 Operation		
<ul style="list-style-type: none"> ● PCT change due to Cycle 10 operation (Includes correction of error discovered in 1997) 	+37°F	2197°F
Limiting LBLOCA PCT (end of 1999)	N/A	2197°F

The cumulative 10CFR50.46 changes and errors for 1999 for the Large Break LOCA evaluation model are shown in Table 2.

Table 2

1999 Cumulative LBLOCA 10 CFR 50.46 Changes/Errors	Δ PCT	Σ Δ PCT
Cumulative 10 CFR 50.46 Changes/Errors Prior to 1999 (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 1999: <ul style="list-style-type: none"> ● None 	0°F	40°F
1999 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) <ul style="list-style-type: none"> ● Cycle 9 operation ● Cycle 10 operation 	N/A N/A	40°F <1 °F

Small Break LOCA

Table 3 provides a time line of the items which affect the small break LOCA peak cladding temperature (PCT) during 1999. The 10 CFR 50.46 PCT limit of 2200°F was not exceeded during 1999, and the SBLOCA remained bounded by the LBLOCA.

Table 3

1999 Limiting Small Break LOCA (SBLOCA) PCT Time Line	Δ PCT	PCT
Limiting SBLOCA PCT (end of 1998)	N/A	<1735°F
Model Errors and Changes (during 1999): <ul style="list-style-type: none"> ● Errors and changes discovered in 1999 	+0°F	<1735°F
Limiting SBLOCA PCT (end of 1999)	N/A	<1735°F

The cumulative 10CFR50.46 changes and errors for 1999 for the small break LOCA evaluation model are shown in Table 4.

Table 4

1999 Cumulative SBLOCA 10 CFR 50.46 Changes/Errors	Δ PCT	$\Sigma \Delta$ PCT
Cumulative 10 CFR 50.46 Changes/Errors Prior to 1999 (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 1999: <ul style="list-style-type: none"> ● None 	0°F	<3°F
1999 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



ANNETTE GILLIAM

MAR 29 2000

LAW DEPARTMENT

27 March, 2000

Annette Gilliam, Esq.
Southern California Edison
2244 Walnut Grove Avenue
Rosemead, CA 91770

Subject: Limited Authorization to Reproduce a Copyrighted Document

Dear Ms. Gilliam:

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ABB C-E Nuclear Power, Inc.

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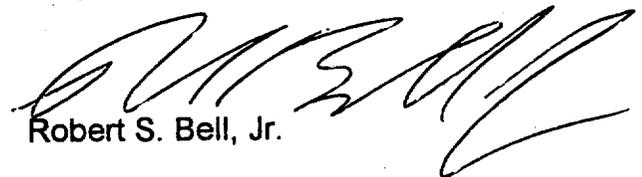
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Robert S. Bell, Jr.

RSB/vag

cc: J. M. Wade
S. W. Lurie