

October 22, 2001

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

Gentlemen:

Subject: **Docket Nos. 50-361 and 50-362**  
**2000 Emergency Core Cooling System Annual 10 CFR 50.46 Report**  
**San Onofre Nuclear Generating Station, Units 2 and 3**

Reference: Letter dated February 22, 2000, from L. Raghavan (NRC) to Harold B. Ray (SCE), Subject: San Onofre Nuclear Generating Station, Units 2 and 3 Issuance of Amendments on Small Break Loss-Of-Coolant Accident Charging Flow and Main Steam Safety Valve Setpoints (TAC Nos. MA5700 and MA5702).

This letter transmits as Enclosures 1 and 2 the San Onofre Units 2 and 3 annual report for the 2000 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 large break Loss of Coolant Accident (LOCA) ECCS evaluation models or changes to their application that affect the peak cladding temperature (PCT) calculation for calendar year 2000.

No changes or errors were found in 2000 in the evaluation models or application of the models for the small break LOCA or post-LOCA long term cooling calculations. The small break LOCA evaluation model changed per the referenced letter.

A001

The "Annual Report on ECCS Performance Evaluation Models, CENPD-279 Supplement 12" (Enclosure 1) describes the codes and methodology used by Westinghouse Electric Company for the San Onofre Units 2 and 3 ECCS analysis for the 2000 reporting period. CENPD-279 Supplement 12 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 12 apply to plants other than San Onofre, and are therefore not included.

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 2000. While not limiting with regard to PCT, detailed information for the small break LOCA is also included in Enclosure 2 (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 10 CFR 50.46(a)(3)").

#### Operating Cycle Information

Unit 2 and Unit 3 operation dates for the year 2000 were the following:

Unit	Year	Cycle 10 Operation	Cycle 11 Operation
2	2000	January 1, 2000 to October 7, 2000	November 16, 2000 to December 31, 2000
3	2000	January 1, 2000 to December 31, 2000	N/A

#### Large Break LOCA Evaluation Model

The Large Break LOCA analysis uses the evaluation model approved on June 1985.

In 2000 the limiting large break LOCA PCT did not exceed the 10 CFR 50.46(b)(1) acceptance criterion of 2200°F.

The arithmetic sum of the PCT effects of both the 10 CFR 50.46 and 10 CFR 50.59 changes is a less than 1 °F effect on the large break LOCA analysis PCT for both Cycle 10 and Cycle 11 operation.

The sum of the absolute magnitude of the 10 CFR 50.46 evaluation model changes and errors in the large break LOCA analysis (which used the June 1985 evaluation model) is less than 1 °F for both Cycle 10 and Cycle 11 operation.

#### Small Break LOCA Evaluation Model

The Small Break LOCA analysis uses the S2M evaluation model approved on February 22, 2000 (Reference).

In 2000 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 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 S1M small break LOCA analysis PCT, and a 0 °F effect on the S2M small break LOCA analysis PCT.

The sum of the absolute magnitude of the 10 CFR 50.46 evaluation model changes and errors for the small break LOCA S1M analysis is less than 3 °F. The sum of the absolute magnitude of the 10 CFR 50.46 evaluation model changes and errors for the small break LOCA S2M analysis is 0 °F.

An authorization for the NRC to reproduce the copyrighted CENPD-279 Supplement 12 is provided in Enclosure 1 in the "Copyright Notice" Section.

If you have any questions on this subject, please call me or Mr. J. L. Rainsberry (949/368-7420).

Sincerely,



#### Enclosures

cc: E. W. Merschoff, Regional Administrator, NRC Region IV  
C. C. Osterholtz, NRC Senior Resident Inspector, San Onofre Units 2 & 3  
M. L. Scott, NRC Project Manager, San Onofre Units 2 and 3

**Enclosure 1**

**CENPD-279**  
**Supplement 12**

**ANNUAL REPORT ON**  
**COMBUSTION ENGINEERING ECCS**  
**PERFORMANCE EVALUATION MODELS**  
**for PWRs**

**April 2001**

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## ABSTRACT

This report describes changes and errors in the Combustion Engineering ECCS performance analysis models for PWRs in calendar year 2000 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 accumulated change in cladding temperature for the large break LOCA 1999 EM is 0°F. The sum of the absolute magnitude of the maximum cladding temperature changes for the small break LOCA S1M 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. ENERGY 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 Combustion Engineering 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. Reports for earlier years are given in References 2-13.

## 2.0 COMBUSTION ENGINEERING ECCS EVALUATION MODELS AND CODES

Five Combustion Engineering 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 models for Large Break LOCA (LBLOCA) are the June 1985 EM and the 1999 EM accepted by the NRC in 2000. 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.

Several Combustion Engineering 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 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 Combustion Engineering 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 2000 that affect the calculated cladding temperature.

#### 4.0 CONCLUSIONS

There were no changes to or errors in the Combustion Engineering ECCS evaluation models for PWRs or their application for LBLOCA, SBLOCA, or post-LOCA long term cooling that affect the calculated cladding temperature during 2000. The sum of the absolute magnitude of the changes in PCT calculated using the June 1985 EM for LBLOCA, including those from previous annual reports, References 2-13, 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, described in Appendices A through G. There is no accumulated PCT error for the 1999 EM for LBLOCA.

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.
13. "Annual Report on ABB CE ECCS Performance Evaluation Models," CENPD-279, Supplement 11, March, 2000.

**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.

**Enclosure 2**



**2000 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 2000. The 10 CFR 50.46 PCT limit of 2200°F was not exceeded during 2000.

**Table 1**

Limiting Large Break LOCA PCT	Unit 2		Unit 3	
	Δ PCT	PCT	Δ PCT	PCT
Limiting LBLOCA PCT (end of 1999)	N/A	2197 °F	N/A	2197 °F
Model Errors or Changes (during 2000)	0 °F	2197 °F	0 °F	2197 °F
Cycle Dependent Input Changes (during 2000)				
Cycle 10 *	-58 °F	2139 °F	-58 °F	2139 °F
Cycle 11	+4 °F	2143 °F	N/A	N/A
Limiting LBLOCA PCT (end of 2000)	N/A	2143 °F	N/A	2139 °F

\* During 2000, SCE revised the Licensee Controlled Specifications to lower the maximum allowable linear heat rate, which lowered the large break LOCA PCT.

The cumulative 10CFR50.46 changes and errors for 2000 for the Large Break LOCA evaluation model are shown in Table 2.

**Table 2**

Cumulative LBLOCA 10 CFR 50.46 Changes/Errors	Unit 2		Unit 3	
	$\Delta$ PCT	$\sum  \Delta$ PCT	$\Delta$ PCT	$\sum  \Delta$ PCT
Cumulative 10 CFR 50.46 Changes/Errors Prior to 2000	N/A	< 1 °F	N/A	< 1 °F
10 CFR 50.46 Changes/Errors Discovered in 2000	0 °F	0 °F	0 °F	0 °F
2000 Cumulative 10 CFR 50.46 Changes/Errors				
<ul style="list-style-type: none"> <li>● Cycle 10 operation</li> <li>● Cycle 11 operation</li> </ul>	N/A N/A	< 1 °F < 1 °F	N/A N/A	< 1 °F N/A

## **Small Break LOCA**

Table 3 provides a time line of the items which affect the small break LOCA peak cladding temperature (PCT) during 2000. The 10 CFR 50.46 PCT limit of 2200°F was not exceeded during 2000, and the SBLOCA remained bounded by the LBLOCA.

**Table 3**

<b>Limiting Small Break LOCA PCT</b>	<b>Δ PCT</b>	<b>PCT</b>
Limiting SBLOCA PCT (end of 1999)	N/A	< 1735 °F
Model Errors or Changes (during 2000)		
S1M Evaluation Model	0 °F	< 1735 °F
S2M Evaluation Model *	0 °F	< 1884 °F
Cycle Dependent Changes (during 2000)	0 °F	< 1884 °F
Limiting SBLOCA PCT (end of 2000)	N/A	< 1884 °F

\* The NRC approved use of the SBLOCA S2M model on February 22, 2000 (Reference).

The cumulative 10CFR50.46 changes and errors for 2000 for the small break LOCA evaluation model are shown in Table 4.

**Table 4**

<b>Cumulative SBLOCA 10 CFR 50.46 Changes/Errors</b>	<b>Δ PCT</b>	<b>Σ  Δ PCT </b>
Cumulative 10 CFR 50.46 Changes/Errors Prior to 2000 (S1M evaluation model)	N/A	< 3 °F
10 CFR 50.46 Changes/Errors Discovered in 2000		
S1M Evaluation Model	0 °F	< 3 °F
S2M Evaluation Model	0 °F	0 °F
2000 Cumulative 10 CFR 50.46 Changes/Errors (S2M evaluation model)	N/A	0 °F