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A Edward Scherer
Manager of Nuclear
Oversight and Regulatory Affairs

August 12, 2002

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

Subject: **Docket Nos. 50-361 and 50-362**
2001 Emergency Core Cooling System Annual 10 CFR 50.46 Report
San Onofre Nuclear Generating Station, Units 2 and 3

References: 1. October 22, 2001 Letter to NRC, "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."

2. Westinghouse Letter LTR-OA-02-42, Rev. 1, "Calendar Year 2001 Annual Report on Combustion Engineering ECCS Performance Evaluation Models for PWRs, CENPD-279, Supplement 13, Rev. 1", April 16, 2002.

Gentlemen:

This letter transmits as Enclosures 1 and 2 the San Onofre Units 2 and 3 annual report for the 2001 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.

The 2000 Emergency Core Cooling System Annual 10 CFR 50.46 Report was submitted to the NRC in Reference 1.

For the 2001 Reporting period;

- There were no errors or changes to the large break Loss of Coolant Accident (LOCA) ECCS evaluation models or any changes to their application.
- There were no changes to the small break LOCA ECCS evaluation models or any changes to their application. However, a code error in the CEFLASH-4AS code was identified which adversely impacted Peak Clad Temperature (PCT) by 16 °F.

P. O. Box 128
San Clemente, CA 92674-0128
949-368-7501
Fax 949-368-6085

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- There were no errors or changes to the post-LOCA long term cooling evaluation models or any changes to their application.

Enclosure 1 provides two attachments of Reference 2. Attachment 1 of Enclosure 1, the "Annual Report on ECCS Performance Evaluation Models" (Attachment 1 of Enclosure 1), describes the codes and methodology used by the Westinghouse Electric Company for the San Onofre Units 2 and 3 ECCS analysis for the 2001 reporting period. Appendix C of Enclosure 1, Attachment 1, summarizes the plant specific evaluation for San Onofre Units 2 and 3. Appendices A, B, D, E, F, and G of Enclosure 1, Attachment 1, apply to plants other than San Onofre, and therefore, are not included. Attachment 2 of Enclosure 1 provides a discussion of problems in codes used for Pressurized Water Reactor (PWR) ECCS Performance Analysis.

SCE made no changes to the LOCA evaluation models.

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 2001. 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 10CFR50.46(a)(3)").

Operating Cycle Information

Unit 2 and Unit 3 operation for the year 2001 is outlined below.

Unit	Year	Cycle 10	Cycle 11
2	2001	N/A	January 1, 2001 to December 31, 2001
3	2001	January 1, 2001 to January 2, 2001	February 3, 2001 to December 31, 2001

SONGS Units 2 & 3 Large Break LOCA Evaluation Model

The Large Break LOCA analysis uses the evaluation model approved by the NRC in June 1985.

In 2001, the limiting large break LOCA PCT did not exceed the 10 CFR 50.46(b)(1) acceptance criterion of 2200 °F.

Table 1 (Enclosure 2) documents the individual model changes and errors for the Large Break Loss of Coolant Accident (LBLOCA) analysis.

The cumulative (sum of the absolute magnitudes of PCT changes) LBLOCA 10 CFR 50.46 model changes and model errors, since the approval of the "June 1985 Evaluation Model", is less than 1 °F for the 2001 reporting period. This is documented in Table 2 (Enclosure 2).

SONGS Units 2 & 3 Small Break LOCA Evaluation Model

The Small Break Loss of Coolant Accident (SBLOCA) analysis uses the S2M evaluation model approved on February 22, 2000.

In 2001, 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.

Table 3 (Enclosure 2) documents the individual model changes and errors for the SBLOCA analysis.

The cumulative (sum of the absolute magnitudes of PCT changes) SBLOCA 10 CFR 50.46 model changes and model errors, since the approval of the "S2M Evaluation Model", is 16 °F for the 2001 reporting period. This is documented in Table 4 (Enclosure 2).

An authorization for the NRC to reproduce the copyrighted Reference 2 is provided in Enclosure 1 in the "Copyright Notice" Section.

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

Sincerely,

Enclosures

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

Enclosure 1

CENPD-279
Supplement 13, Rev. 1

ANNUAL REPORT ON COMBUSTION ENGINEERING ECCS PERFORMANCE EVALUATION MODELS for PWRs

April 2002

Westinghouse Electric Company LLC

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ABSTRACT

This report describes changes and errors in the ECCS performance analysis models for PWRs developed by Combustion Engineering in calendar year (CY) 2001 per the requirements of 10CFR50.46. For this reporting period, there were four changes and one error in the evaluation models or application of the models that affect the cladding temperature calculation.

1. The 1999 Evaluation Model (EM) for LBLOCA was accepted by the NRC at the end of CY 2000 and introduced for licensing analyses in CY year 2001. Introduction of the new models and methodology for the 1999 EM has no effect on ECCS performance analysis results for the other LBLOCA and SBLOCA evaluation models.
2. The hot rod heat-up codes HCROSS, PARCH, and STRIKIN-II were combined into an Integrated STRIKIN-II code to support the 1999 EM. This has no effect on the PCT for the other LBLOCA and SBLOCA evaluation models.
3. Properties for ZIRLO™ cladding were introduced into the computer codes used for the 1999 EM for LBLOCA and the S2M for SBLOCA and NRC accepted in CY 2001. This has no effect on the PCT for licensing analyses with Zircaloy-4 cladding.
4. The computer system state was changed for the ECCS performance analysis computer codes. The changes include use of a new version of the FORTRAN 77 compiler, new compiler and loader options for codes that were compiled in calendar year 2001 (CEFLASH-4A, COMPERC-II, HCROSS, PARCH, STRIKIN-II, COMZIRC, CEFLASH-4AS and some of the related utility codes), and operation under a new version of the computer operating system. These changes had a negligible effect on the PCT (< 0.1°F) for each of the evaluation models – 1985 EM and 1999 EM for LBLOCA and the S1M and S2M for SBLOCA.
5. An error in the CEFLASH-4AS code for SBLOCA blowdown analysis was found and corrected. The effect on the SBLOCA PCT is different for each plant or related set of plants. Plant specific results are given in Appendices A-G.

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 < 3°F plus the plant specific results in Appendices A-G. The accumulated change in cladding temperature for the small break LOCA S2M evaluation model is limited to plant specific effects given in Appendices A-G. No change occurred in the PCT due to post-LOCA long term cooling issues.

Revision 1 corrects the applicable time period for the report in the Abstract to be CY 2001, corrects the SBLOCA results for Palisades in Appendix D, and makes minor editorial changes.

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APPENDICES (Plant Specific Considerations)

A. ARIZONA PUBLIC SERVICE COMPANY (PVNGS Units 1-3)

B. CALVERT CLIFFS NUCLEAR POWER PLANT INCORPORATED (Calvert Cliffs Units 1 & 2)

C. SOUTHERN CALIFORNIA EDISON COMPANY (SONGS Units 2 & 3)

D. CONSUMER ENERGY COMPANY (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. DOMINION RESOURCES (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 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 2-14.

2.0 COMBUSTION ENGINEERING ECCS EVALUATION MODELS AND CODES

Five evaluation models (EM) for ECCS performance analysis of PWRs developed by Combustion Engineering 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 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 digital computer codes developed by Combustion Engineering 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 ECCS performance evaluation models for PWRs developed by Combustion Engineering that may affect the calculated PCT.

3.1 1999 Evaluation Model for LBLOCA

A revised Appendix K model for LBLOCA called the 1999 EM was NRC accepted at the end of calendar year 2000 per Reference 15 and introduced for licensing analysis in calendar year 2001. Implementation of the 1999 EM methodology included changes to the following codes: CEFLASH-4A, COMPERC-II, HCROSS, PARCH, STRIKIN-II, and COMZIRC as well as some supporting utility codes. The new models and methodology for the 1999 EM are added as an option to the existing codes that support the 1985 EM for LBLOCA and the SBLOCA models. These changes have no effect on results produced for the June 1985 EM, S1M or S2M.

3.2 Integrated STRIKIN-II Rod Temperature Code

The codes used for rod temperature calculations for all LBLOCA and SBLOCA methodologies (HCROSS, PARCH, and STRIKIN-II) have been integrated into a single code to accommodate data flow requirements between them for the 1999 EM methodology. Each code is incorporated as a module that can perform all of its previous functions as a stand-alone code or can be used in a linked mode for the 1999 EM. The combined tool is called the Integrated STRIKIN-II code. It supports the 1985 and 1999 EM for LBLOCA licensing analyses, the S1M and S2M for SBLOCA licensing analyses, and a realistic evaluation model used for non-licensing calculations. Testing has demonstrated that all previous functions of the stand-alone codes are supported and the modules of the Integrated STRIKIN-II code give the same results as the stand-alone codes.

3.3 ZIRLO™ Cladding Properties

Physical properties for ZIRLO™ cladding were added to the following codes for use in the 1999 EM and the S2M: CEFLASH-4A, COMPERC-II, PARCH, STRIKIN-II, COMZIRC, and CEFLASH-4AS. They are a new option in addition to the Zircaloy-4 cladding properties that continue to be supported in these codes. These changes have no effect on results produced for

Zircaloy-4 cladding. NRC acceptance of the models and methodology for ZIRLO™ cladding is documented in Reference 16.

3.4 Change in Computer System State

Changes to the version of the FORTRAN 77 compiler, the operating system (OS), and the computer hardware are accommodated as part of the code changes summarized in Sections 3.1, 3.2, and 3.3. In addition, the coding for CEFLASH-4A, COMPERC-II, HCROSS, PARCH, STRIKIN-II, COMZIRC, CEFLASH-4AS and some of the related utility codes were revised to address three issues related to portability and stability of the codes. The codes were tested for occurrence of out-of-range subscripts and corrected as needed. The compilation options were changed to stop execution when a floating-point arithmetic exception occurs and coding was revised as necessary to avoid floating-point arithmetic exceptions. Finally, the linking options for the loader were changed to statically link the FORTRAN libraries to the executables which makes the coding insensitive to changes in the OS version (changes in the FORTRAN library routines).

The revised codes were tested to evaluate the effect of these changes and introduction of the new models described in Sections 3.1, 3.2, and 3.3 on the existing methodologies for LBLOCA and SBLOCA. The effect of correcting out-of-range subscripts for the SBLOCA PCT is documented on a plant specific basis as discussed in Section 3.5 and Appendices A-G. The effect of the other changes on PCT for SBLOCA is discussed here. Test results for PCT are summarized in the table below.

Model	PCT Change (°F)
1985 EM for LBLOCA	None
1999 EM for LBLOCA	< 0.1
S1M for SBLOCA	< 0.1
S2M for SBLOCA	< 0.1

The PCT for the 1985 EM is not affected by the changes in the computer system state described above. The PCT effect for the 1999 EM is less that 0.1°F which is negligible. The PCT effects for the S1M and S2M are also less than 0.1°F. Their effect is included in the plant specific SBLOCA results discussed in Appendices A-G.

3.5 Code Error in CEFLASH-4AS

The testing for out-of-range subscripts described in Section 3.4 identified one important subscripting error in CEFLASH-4AS that affects the leak flow rate and PCT results for both the S1M and S2M SBLOCA. A couple of additional subscripting errors had a minor effect (< 1°F) on the PCT results. Two additional code problems were discovered during the code testing process with the new compiler options enabled that stop the code from completing the transient calculation. These problems were addressed and the effects of the necessary coding changes were evaluated. Only the out-of range subscript error for the leak flow rate affected the PCT. Addressing the other problems allowed CEFLASH-4AS to run to the end of the transient but had no PCT consequences. The SBLOCA PCT effect of the out-of-range subscripts is plant specific and is discussed in Appendices A-G.

4.0 CONCLUSIONS

There were four changes to and one error in the ECCS evaluation models for PWRs developed by Combustion Engineering for LBLOCA, SBLOCA, or post-LOCA long term cooling in CY 2001. Two of the changes are implementation of the 1999 EM for LBLOCA and incorporation of ZIRLO™ properties in the LBLOCA and SBLOCA codes which were accepted by the NRC per References 15 and 16; therefore, they have no effect on the results for this report. The third change is integration of PARCH and HCROSS as modules of the Integrated STRIKIN-II code. This has no effect on results for the 1985 EM for LBLOCA or the SBLOCA S1M and S2M. It was done to support creation of the 1999 EM. The fourth change is installation of the computer codes on a new computer system state including coding changes to address out-of-range subscripts and floating point arithmetic exceptions. This has a negligible effect on the PCT results except as discussed below for SBLOCA. 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 2-14, remains less than 1°F relative to the 50°F criterion for a significant change in PCT. The total 1985 EM LBLOCA impact on PCT 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.

Out-of-range subscripts in CEFLASH-4AS affected the PCT results for both S1M and S2M SBLOCA evaluation modes in a plant specific way as discussed in Appendices A through G. In addition, there is an effect on maximum cladding temperature for the SBLOCA S1M (due to the change in application of the SBLOCA S1M described in Reference 11) that is less than 3°F. There is no previous accumulated change in cladding temperature for the S2M. Plant specific SBLOCA considerations for each plant are discussed in Appendices A through G.

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

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.
14. "Annual Report on Combustion Engineering ECCS Performance Evaluation Models for PWRs," CENPD-279, Supplement 12, April, 2001.
15. "Calculative Methods for the CE Nuclear Power Large Break LOCA Evaluation Model," CENPD-132, Supplement 4-P-A, March 2001.

16. "Implementation of ZIRLO™ Cladding Material in CE Nuclear Power Fuel Assembly Designs," CENPD-404-P-A, Revision 0, November, 2001.

APPENDIX C

SOUTHERN CALIFORNIA EDISON COMPANY

Plant Specific Considerations for SONGS Units 2 and 3

Introduction

As described in Section 3.5, an error in the leak flow rate for the CEFLASH-4AS code due to out-of-range subscripts produced a plant specific impact on cladding temperature for SBLOCA. A 10 CFR 21 evaluation was performed. Based on the results of sensitivity analyses, as well as known results from improved Appendix K and best estimate SBLOCA methodologies for CENP plant designs, it was determined that the error was not capable of creating a substantial safety hazard, as defined in 10 CFR 21 (Reference 1); therefore, it was not reportable.

Effect

Plant specific sensitivity studies for San Onofre Nuclear Generating Station Units 2 and 3 were transmitted to Southern California Edison Company by Reference 2. The results of those sensitivity studies are summarized in the table below.

CORRECTED SBLOCA RESULTS FOR CEFLASH-4AS COMPUTER CODE ERROR

RESULT / PARAMETER	PEAK CLAD TEMPERATURE, °F	MAXIMUM LOCAL CLADDING OXIDATION, %	CORE-WIDE CLADDING OXIDATION, %
CORRECTED CODE VERSION LIMITING CASE	1900	3.98	0.49
AOR BENCHMARK UNCORRECTED CODE VERSION LIMITING CASE	1884	3.81	0.48
DIFFERENTIAL IMPACT	+16	+0.17	+0.01

The analysis underlying these results has been independently reviewed pursuant to CE Nuclear Power LLC's (now WEC) quality procedures and the verification status is categorized as "COMPLETE". In particular, this information has been verified to be applicable to SONGS Units 2 and 3 Cycle 11.

Conclusion

The effect of the CEFLASH-4AS code error on the SBLOCA PCT is 16°F based on the S2M analysis to eliminate credit for the charging pumps. There is no prior accumulated PCT difference for the S2M used for this analysis so the total effect is 16°F. WEC believes that the impact of the error does not exceed the 50°F reporting criterion for a significant error.

References:

1. NSAL-01-002, "Small Break LOCA ECCS Performance Computer Code Error," C. M. Molnar, et al., April 4, 2001.
2. Letter from R. A. Loretz (WEC) to P. D. Myers (SCE), S-2001-027, "SBLOCA Results for SONGS Unit 2 and Unit 3 after Correction of CEFLASH-4AS Code Error," April 30, 2001.

Attachment 2

Problems in Codes Used for PWR ECCS Performance Analysis

The code problems described here were identified in calendar year 2001 during code maintenance activities done per the provisions of the computer software section, QP 3.13, of the WEC QMS. They have no impact on the peak cladding temperature (PCT); therefore, they are not reported under the provisions of 10CFR50.46. This information is provided for completeness in the reporting process.

PARCH Module of Integrated STRIKIN-II Code

The PARCH module of the Integrated STRIKIN-II code is part of the PWR ECCS analysis evaluation models developed by Combustion Engineering. It calculates steam-cooling heat transfer coefficients for the LBLOCA 1985 and 1999 evaluation models (85EM and 99EM), performs SBLOCA rod temperature calculations for the SBLOCA S1M and S2M and is part of the non-licensed realistic evaluation model (REM) for SBLOCA.

Preliminary use of the Integrated STRIKIN-II code revealed three problems with the PARCH module for LBLOCA analyses – power shape renormalization, temperature initialization of the rupture node at the one-inch per second time for steam heat transfer, and the 99EM automatic nodal mapping of steam cooling heat transfer data for rupture in STRIKIN-II Node 19. PARCH was modified to ensure that the power shape is renormalized to exactly 1.0 instead of a total slightly different than 1.0 when the 20 node axial shape is linearly interpolated to obtain values for 50 axial nodes. This affects both the 85EM and 99EM. Initialization of fuel and cladding temperature at the one-inch per second time was changed to improve consistency of the STRIKIN-II and PARCH temperatures for the 99EM. Mapping of the steam heat transfer coefficient node number interface between PARCH and STRIKIN-II for rupture in STRIKIN-II Node 19 was corrected. Finally, an error message is provided and the calculation is stopped when the cladding temperature is increasing in an unbounded manner above 2200°F due to heat from the zirconium water reaction.

The impact of these changes on the 10CFR50.46 acceptance criteria results including PCT is negligible for LBLOCA based on testing of the PARCH module for 85EM and 99EM applications. SBLOCA results are not affected by these changes.

Enclosure 2

2001 REPORTING PERIOD

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 2001. The 10 CFR 50.46 PCT limit of 2200 °F was not exceeded during 2001.

Table 1

Limiting Large Break LOCA PCT

	Unit 2	Unit 3
Limiting Large Break LOCA PCT *End of 2000*	2143 °F	2139 °F
Changes in PCT *during 2001* due to: a) Model changes or Model errors • Cycle 10 • Cycle 11 b) Cycle Dependent Input Changes • Cycle 10 • Cycle 11	 N/A 0 °F N/A 0 °F	 0 °F 0 °F 0 °F -3 °F
Limiting Large Break LOCA PCT *End of 2001*	2143 °F	2136 °F

The cumulative 10CFR50.46 model changes and model errors for 2001 for the "Large Break LOCA June 1985 Evaluation Model" are shown in Table 2.

Table 2

Cumulative LBLOCA 10 CFR 50.46
Model Changes & Errors
$\sum |\Delta PCT|$ *

	Unit 2	Unit 3
Cumulative LBLOCA 10 CFR 50.46 Model Changes & Errors *Prior to 2001*	< 1 °F	< 1 °F
Changes in LBLOCA PCT due to Model Changes & Errors *Discovered in 2001* • Cycle 10 • Cycle 11	 N/A 0 °F	 0 °F 0 °F
Cumulative LBLOCA 10 CFR 50.46 Model Changes & Errors *End of 2001*	< 1 °F	< 1 °F

* Sum of the absolute magnitude of the 10 CFR 50.46 model changes and model errors in the LBLOCA analysis.

Small Break LOCA

Table 3 provides a time line of the items which affect the small break LOCA peak cladding temperature (PCT) during 2001. The 10 CFR 50.46 PCT limit of 2200 °F was not exceeded during 2001, and the SBLOCA remained bounded by the LBLOCA.

Table 3

Limiting Small Break LOCA PCT

	Unit 2	Unit 3
Limiting Small Break LOCA PCT *End of 2000*	1884 °F	1884 °F
Changes in PCT *during 2001* due to: a) Model changes or Model errors • Cycle 10 • Cycle 11 b) Cycle Dependent Input Changes • Cycle 10 • Cycle 11	 N/A 16 °F N/A 0 °F	 0 °F 16 °F 0 °F 0 °F
Limiting Small Break LOCA PCT *End of 2001*	1900 °F	1900 °F

The cumulative 10CFR50.46 model changes and model errors for 2001 for the "Small Break LOCA S2M Evaluation Model" are shown in Table 4.

Table 4

Cumulative SBLOCA 10 CFR 50.46
Model Changes & Errors
$\sum |\Delta PCT|$ *

	Unit 2	Unit 3
Cumulative SBLOCA 10 CFR 50.46 Model Changes & Errors *Prior to 2001*	0 °F	0 °F
Changes in PCT due to Model Changes & Errors *Discovered in 2001* • Cycle 10 • Cycle 11	 N/A 16 °F	 0 °F 16 °F
Cumulative SBLOCA 10 CFR 50.46 Model Changes & Errors *End of 2001*	16 °F	16 °F

* Sum of the absolute magnitude of the 10 CFR 50.46 model changes and model errors in the SBLOCA analysis.