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May 12, 2006

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

Subject: **Docket Nos. 50-361 and 50-362**
10 CFR 50.46 30-Day Report for Changes to the Emergency Core Cooling System Performance Analysis
San Onofre Nuclear Generating Station Units 2 and 3

References:
1. CENPD-132, Supplement 4-P-A, "Calculative Methods for the CE Nuclear Power Large Break LOCA Evaluation Model," March 2001.
2. CENPD-137, Supplement 2-P-A, "Calculative Methods for the ABB CE Small Break LOCA Evaluation Model," April 1998.
3. Letter dated August 26, 2004 from D.E. Nunn (SCE) to Document Control Desk (NRC), Subject: Docket Nos. 50-361 and 50-362, Proposed Change Number (PCN) 553, Request to Revise Technical Specifications 4.2.1, "Fuel Assemblies" and 5.7.1.5, "Core Operating Limits Report (COLR)," San Onofre Nuclear Generating Station Units 2 and 3.
4. CENPD-404-P-A, Revision 0, "Implementation of ZIRLO™ Cladding Material in CE Nuclear Power Fuel Assembly Designs," November 2001.
5. Letter dated September 14, 2005 from J.N. Donohew (NRC) to H.B. Ray (SCE), Subject: San Onofre Nuclear Generating Station, Units 2 and 3 – Issuance of Amendments on ZIRLO™ Clad Fuel (TAC Nos. MC4243 and MC4244).

Dear Sir or Madam:

This letter is submitted pursuant to 10 CFR 50.46(a)(3)(ii) to provide notification of a "significant" change to the peak cladding temperature of the Large Break Loss-of-Coolant Accident (LBLOCA) and Small Break Loss-of-Coolant Accident (SBLOCA) Emergency Core Cooling System (ECCS) performance analyses for San Onofre Nuclear Generating Station (SONGS) Units 2 and 3.

The "significant" changes to the peak cladding temperature of the SONGS Units 2 and 3 LBLOCA and SBLOCA analyses are a result of re-analyses performed in support of the introduction of ZIRLO™ as the fuel rod cladding material. The re-analyses were performed with the latest Nuclear Regulatory Commission (NRC)-accepted versions of

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the Westinghouse evaluation models for Combustion Engineering pressurized water reactors (References 1 and 2). The new analyses explicitly model ZIRLO™ cladding, which was introduced in Unit 2 for Cycle 14 operation during the recently completed refueling outage. ZIRLO™ clad fuel assemblies are scheduled to be loaded into Unit 3 in the fall of 2006.

In a letter dated August 26, 2004 (Reference 3), Southern California Edison (SCE) requested an amendment to the SONGS Units 2 and 3 operating license to add the methodology references for ZIRLO™ cladding (Reference 4) and the Reference 1 LBLOCA evaluation model to the list of analytical methods used to determine core operating limits. The NRC approved the request on September 14, 2005 (Reference 5).

Enclosure 1 to this letter summarizes the results of the new LBLOCA and SBLOCA analyses and their compliance with 10 CFR 50.46.

The results of the new LBLOCA and SBLOCA analyses conform to the ECCS acceptance criteria of 10 CFR 50.46(b). Because the sums of the absolute magnitudes of the changes in cladding temperature associated with the changes implemented in the new analyses are greater than 50°F, the changes qualify as "significant" as defined in 10 CFR 50.46(a)(3)(i). Consequently, they are being reported in this 30-day report.

As described in Enclosure 1, the analyses constitute new licensing basis analyses (analyses-of-record) for Unit 2 and, after its next refueling outage, for Unit 3. A description of the analyses will be incorporated into a future revision of the SONGS Units 2 and 3 Updated Final Safety Analysis Report.

If you have any questions or require additional information, please contact Jack Rainsberry at (949) 368-7420.

Sincerely,

Enclosures

1. 10 CFR 50.46 Thirty-Day Report for Changes to the San Onofre Nuclear Generating Station Units 2 and 3 ECCS Performance Analysis

cc: B. S. Mallett, Regional Administrator, NRC Region IV
N. Kalyanam, NRC Project Manager, San Onofre Units 2 and 3
C. C. Osterholtz, NRC Senior Resident Inspector, San Onofre Units 2 and 3

Enclosure 1

10 CFR 50.46 Thirty-Day Report for Changes to the San Onofre Nuclear Generating Station Units 2 and 3 ECCS Performance Analysis

1.0 Introduction

This 30-day report is provided for San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 in accordance with the requirements of 10 CFR 50.46(a)(3)(ii) for reporting:

- the nature of a change in an acceptable evaluation model or in the application of such a model that affects the temperature calculation and
- the estimated effect of the change on the limiting Emergency Core Cooling System (ECCS) analysis.

Because the effects on the Peak Cladding Temperature (PCT) of the changes described herein are greater than 50°F, the changes qualify as "significant" as defined in 10 CFR 50.46(a)(3)(i) and, consequently, are provided in this 30-day report.

The Large Break Loss-of-Coolant Accident (LBLOCA) and the Small Break Loss-of-Coolant Accident (SBLOCA) ECCS performance analyses have been re-analyzed for SONGS Units 2 and 3 in support of the implementation of ZIRLO™ as the fuel rod cladding material. The analyses were performed with Nuclear Regulatory Commission (NRC)-accepted versions of the Westinghouse Appendix K evaluation models for Combustion Engineering Pressurized Water Reactors (PWRs).

The new LBLOCA and SBLOCA analyses for the implementation of ZIRLO™ cladding are not assessments (i.e., they do not provide an estimate of the effect of the changes on the limiting ECCS analysis). Rather, they are complete re-analyses that use NRC approved evaluation models that are applicable to SONGS Units 2 and 3. The following sections provide a summary description of the new analyses, their applicability to Units 2 and 3, and their compliance with 10 CFR 50.46.

2.0 LBLOCA ECCS Performance Analysis

2.1 LBLOCA Evaluation Model

The current SONGS Units 2 and 3 LBLOCA analysis uses the 1985 Evaluation Model (EM) version of the Westinghouse LBLOCA evaluation model for Combustion Engineering PWRs (Reference 5). The new LBLOCA ECCS performance analysis was performed with the 1999 EM version of the Westinghouse LBLOCA evaluation model for Combustion Engineering PWRs (Reference 1). Additionally, the analysis used the ZIRLO™ cladding models described in Reference 2. The 1999 EM and the ZIRLO™ cladding topical reports were generically accepted by the NRC in References 3 and 4 for licensing applications for Combustion Engineering PWRs.

The 1999 EM and the ZIRLO™ cladding topical reports are listed in Technical Specification 5.7.1.5 of the SONGS Units 2 and 3 Technical Specifications and Licensee Controlled Specification 5.0.105 as approved analytical methodologies that can be used to determine core operating limits in the Core Operating Limits Report (COLR).

The new LBLOCA analysis complies with the limitations/constraints imposed by the Safety Evaluation Reports (SERs) for the 1999 EM and the ZIRLO™ cladding topical reports as well as the applicable limitations/constraints imposed by the SERs for earlier versions of the LBLOCA evaluation model.

After the new LBLOCA analysis was completed, an error was discovered in the 1999 EM and was corrected. The error occurred in the implementation of a constraint imposed by one of the SERs associated with the 1999 EM. The SER constraint stipulates that the steam cooling model in the PARCH module of the STRIKIN-II program can be used for calculating the hot rod PCT provided the resulting heat transfer coefficients are no greater than those calculated using the FLECHT heat transfer correlation. The STRIKIN-II main program was not providing the correct value for the limiting FLECHT heat transfer coefficient to the PARCH module for use in checking the SER constraint. It was determined that the STRIKIN-II program was providing the value of the steam cooling model heat transfer coefficient from the previous time step for the check. The error in the STRIKIN-II program was corrected by a coding change that ensures the use of the FLECHT heat transfer coefficient for confirming that the SER constraint is met. In conformance with 10 CFR 50.46(a)(3)(i), the impact of the correction of the error on the PCT of the new LBLOCA analysis was determined. As noted below in Section 2.5 and in Table 2, the correction of the error resulted in a +1°F increase in the limiting PCT of the new LBLOCA analysis. Although not required by 10 CFR 50.46(a)(3)(i), the impact of the correction of the error on the limiting maximum cladding oxidation of the new LBLOCA analysis was also quantified and found to be a decrease of 0.40%.

2.2 ZIRLO™ Cladding Material

Starting with Cycle 14 (Batch R), the SONGS Units 2 and 3 fuel assemblies utilize ZIRLO™ as the fuel rod cladding material. Prior to Batch R, Zircaloy-4 was used as the cladding material. The Cycle 14 cores thus contain a mixture of ZIRLO™ and Zircaloy-4 clad fuel. The new LBLOCA analysis explicitly analyzed ZIRLO™ and Zircaloy-4 clad UO_2 and erbia burnable absorber fuel rods.

2.3 Other Plant Parameter Changes

In addition to the change in the cladding material, the new LBLOCA analysis introduced changes to the values for several other plant parameters used in the analysis. The maximum number of plugged steam generator tubes was increased to 2000 per steam generator. In the current LBLOCA analysis the maximum number of plugged steam generator tubes was limited to 1000 per steam generator for a hot rod peak linear heat generation rate (PLHGR) of 12.8 kW/ft. Tube plugging above 1000 plugged tubes per

steam generator required a reduction in the PLHGR. The new LBLOCA analysis also incorporated new values for several physics parameters in order to bound cycle-to-cycle variations in the values of the parameters.

2.4 Results and Conclusion of the New LBLOCA Analysis

The new LBLOCA analysis analyzed a break spectrum consisting of four reactor coolant pump discharge leg breaks ranging in size from a full double-ended break to a 0.4 double-ended break. The analysis included a study to determine the most damaging single failure of ECCS equipment. The study analyzed no failure, failure of an emergency diesel generator, and failures of a low pressure and a high pressure safety injection pump. The analysis also included studies that investigated the impact of variations in initial safety injection tank conditions and refueling water tank temperature on PCT and maximum cladding oxidation. As noted above, both ZIRLO™ and Zircaloy-4 clad fuel rods were explicitly analyzed.

Table 1 compares several important inputs used in the new LBLOCA analysis to those used in the current analysis for Unit 2 (i.e., Cycle 13). Table 2 compares important results from the two analyses. A description of the new analysis, including tables and figures that present the results of the break spectrum analysis, will be incorporated into a future revision of the SONGS Units 2 and 3 Updated Final Safety Analysis Report.

As shown in Table 2, the net change in PCT that resulted from the new LBLOCA analysis is -1°F (excluding the impact of the correction of the STRIKIN-II steam cooling model error). The reduction in PCT associated with the implementation of the 1999 EM, which is greater than 50°F, was primarily offset by the increase in the number of plugged tubes and, to a lesser degree, by the use of more bounding values for several physics parameters. The introduction of ZIRLO™ cladding did not directly impact the PCT since a Zircaloy-4 clad rod was found to produce the highest PCT.

2.5 Summary

The results of the new LBLOCA analysis, in conjunction with the impact of the correction of the STRIKIN-II steam cooling model error, conform to the acceptance criteria of 10 CFR 50.46(b) as summarized below.

Parameter	Criterion	Result[(a)]
Peak Cladding Temperature	≤2200°F	2170°F
Maximum Cladding Oxidation	≤17%	15.19%
Maximum Core-Wide Oxidation	≤1%	<0.99%
Coolable Geometry	Yes	Yes

(a) The results include a +1°F delta for PCT and a -0.40% delta for maximum cladding oxidation for the correction of the STRIKIN-II steam cooling model error.

The PCT was calculated to occur for a Zircaloy-4 clad fuel rod. The maximum cladding oxidation was calculated to occur for a ZIRLO™ clad fuel rod.

The new LBLOCA analysis uses the 1999 EM, which is accepted by the NRC for licensing applications for Combustion Engineering PWRs such as SONGS Units 2 and 3. The analysis complies with the limitations/constraints imposed by all applicable SERs. The analysis uses values for plant design data that are either applicable to or bound the configuration of Unit 2 Cycle 14. Southern California Edison (SCE) and Westinghouse have ongoing processes that ensure that the as-operated plant values for parameters, to which the PCT is sensitive, remain bounded by the values used in the analysis.

3.0 SBLOCA ECCS Performance Analysis

3.1 SBLOCA Evaluation Model

The new SBLOCA ECCS performance analysis was performed with the S2M (Supplement 2 to CENPD-137 Evaluation Model) version of the Westinghouse SBLOCA evaluation model for Combustion Engineering PWRs (Reference 6). This is the same evaluation model that is used in the current SONGS Units 2 and 3 SBLOCA ECCS performance analysis. The new analysis also used the ZIRLO™ cladding models described in Reference 2. The S2M and the ZIRLO™ cladding topical reports were generically accepted by the NRC in References 7 and 4 for licensing applications for Combustion Engineering PWRs. The analysis included a study to determine the rod internal pressures that resulted in the highest PCT and maximum cladding oxidation for each break size.

The S2M and the ZIRLO™ cladding topical reports are listed in Technical Specification 5.7.1.5 of the SONGS Units 2 and 3 Technical Specifications and Licensee Controlled Specification 5.0.105 as approved analytical methodologies that can be used to determine core operating limits in the COLR.

The new SBLOCA analysis complies with the limitations/constraints imposed by the SERs for the S2M and the ZIRLO™ cladding topical reports as well as the applicable limitations/constraints imposed by the SERs for earlier versions of the SBLOCA evaluation model.

3.2 ZIRLO™ Cladding Material

The new SBLOCA analysis analyzed ZIRLO™ and Zircaloy-4 clad fuel rods. The limiting results presented in Section 3.4 are applicable to ZIRLO™ and Zircaloy-4 clad UO_2 and erbia burnable absorber fuel rods.

3.3 Other Plant Parameter Changes

In addition to the change in the cladding material, the new SBLOCA analysis introduced changes to the values for other plant parameters used in the analysis. The maximum number of plugged steam generator tubes was increased from 2000 to 2805 per steam generator. Also, a small discretionary conservatism that had been applied to the safety

analysis values for the high pressure safety injection pump delivery curve in the current analysis was removed.

3.4 Results and Conclusion of the New SBLOCA Analysis

The new SBLOCA analysis analyzed a break spectrum of three reactor coolant pump discharge leg breaks, namely, 0.03 ft^2, 0.04 ft^2, and 0.05 ft^2.

Tables 3 and 4 compare important inputs and results of the new SBLOCA analysis to those of the current SBLOCA analysis. A description of the new analysis, including tables and figures that present the results of the break spectrum analysis, will be incorporated into a future revision of the SONGS Units 2 and 3 Updated Final Safety Analysis Report.

As shown in Table 4, the net change in PCT that resulted from the new SBLOCA analysis is +174°F. The increase in PCT is primarily due to the changes noted above, namely, an increase in the number of plugged steam generator tubes and the impact of the limiting rod internal pressure study. The implementation of ZIRLO™ cladding did not have a significant impact on the PCT.

3.5 Summary

The results of the new SBLOCA analysis conform to the acceptance criteria of 10 CFR 50.46(b) as summarized below.

Parameter	Criterion	Result
Peak Cladding Temperature	≤2200°F	2077°F
Maximum Cladding Oxidation	≤17%	14.11%
Maximum Core-Wide Oxidation	≤1%	<0.74%
Coolable Geometry	Yes	Yes

The results of the SBLOCA analysis continue to be bounded by those of the LBLOCA analysis. The new SBLOCA analysis uses the S2M, which is accepted by the NRC for licensing applications for Combustion Engineering PWRs such as SONGS Units 2 and 3. The analysis complies with the limitations/constraints imposed by all applicable SERs. The analysis uses values for plant design data that are either applicable to or bound the configuration of Unit 2 Cycle 14. SCE and Westinghouse have ongoing processes that ensure that the as-operated plant values for parameters, to which the PCT is sensitive, remain bounded by the values used in the analysis.

4.0 Applicability of the New Analyses to Units 2 and 3

The new LBLOCA and SBLOCA analyses for the implementation of ZIRLO™ cladding were performed to be applicable to both Unit 2 and Unit 3 after the introduction of fuel assemblies with ZIRLO™ clad fuel rods. Fuel assemblies with ZIRLO™ cladding were loaded into Unit 2 during the Cycle 14 refueling outage prior to Cycle 14 startup. As part of the Unit 2 Cycle 14 reload analysis activities, SCE and Westinghouse confirmed

the applicability of the new analyses to Unit 2 Cycle 14 by verifying that the Cycle 14 values for PCT-sensitive parameters were bounded by the values used in the new analyses.

ZIRLO™ clad fuel assemblies are scheduled to be loaded into Unit 3 during the Cycle 14 refueling outage prior to Cycle 14 startup. A confirmation similar to that performed for Unit 2 Cycle 14 will be performed as part of the Unit 3 Cycle 14 reload analysis activities. Another 30-day report will not be provided to the NRC for Unit 3 unless the Cycle 14 reload analysis activities result in significant changes to the results of the new analyses described in this enclosure.

5.0 Summary of Compliance with 10 CFR 50.46

The new LBLOCA and SBLOCA analyses comply with 10 CFR 50.46 as follows:

- The analyses were performed with acceptable evaluation models and included sensitivity studies that assured the limiting LBLOCA and SBLOCA were analyzed [10 CFR 50.46(a)(1)(i)].
- The results of the new LBLOCA and SBLOCA analyses conform to the ECCS acceptance criteria [10 CFR 50.46(b)].
- This 30-day report provides NRC with notification of the change in the application of the evaluation models and their effect on the limiting ECCS analyses [10 CFR 50.46(a)(3)(ii)].

The new LBLOCA and SBLOCA analyses for the implementation of ZIRLO™ cladding constitute new licensing basis analyses (analyses-of-record) for Unit 2. It is planned that they will become the new licensing basis analyses for Unit 3 after its next refueling outage. The new LBLOCA analysis was used as the reference analysis to evaluate the impact of the correction of the STRIKIN-II steam cooling model error on PCT. The new analyses will be used as the reference analyses to evaluate the impact on PCT of future changes to or errors in the 1999 EM and the S2M and their application to Unit 2 and, as described above, to Unit 3 after its next refueling outage.

6.0 References

1. CENPD-132, Supplement 4-P-A, "Calculative Methods for the CE Nuclear Power Large Break LOCA Evaluation Model," March 2001.
2. CENPD-404-P-A, Revision 0, "Implementation of ZIRLO™ Cladding Material in CE Nuclear Power Fuel Assembly Designs," November 2001.
3. Letter dated December 15, 2000 from S.A. Richards (NRC) to P.W. Richardson (Westinghouse), Subject: Safety Evaluation of Topical Report CENPD-132, Supplement 4, Revision 1, "Calculative Methods for the CE Nuclear Power Large Break LOCA Evaluation Model" (TAC No. MA5660).

4. Letter dated September 12, 2001 from S.A. Richards (NRC) to P.W. Richardson (Westinghouse), Subject: Safety Evaluation of Topical Report CENPD-404-P, Revision 0, "Implementation of ZIRLO Material Cladding in CE Nuclear Power Fuel Assembly Designs" (TAC No. MB1035).

5. CENPD-132, Supplement 3-P-A, "Calculative Methods for the C-E Large Break LOCA Evaluation Model for the Analysis of C-E and W Designed NSSS," June 1985.

6. CENPD-137, Supplement 2-P-A, "Calculative Methods for the ABB CE Small Break LOCA Evaluation Model," April 1998.

7. Letter dated December 16, 1997 from T.H. Essig (NRC) to I.C. Rickard (ABB Combustion Engineering), Subject: Acceptance for Referencing of the Topical Report CENPD-137(P), Supplement 2, "Calculative Methods for the C-E Small Break LOCA Evaluation Model" (TAC No. M95687).

Table 1
SONGS Unit 2[a] LBLOCA ECCS Performance Analysis
Comparison of Important Input Parameters

Parameter	Current Analysis[b]	New Analysis
LBLOCA Evaluation Model	1985 EM	1999 EM
Cladding Material	Zircaloy-4	ZIRLO™, Zircaloy-4
Core Power Level, MWt (including power measurement uncertainty)	3458	3458
PLHGR of the Hot Rod, kW/ft	12.8	12.8
PLHGR of the Average Rod in Assembly with Hot Rod, kW/ft	11.93	12.07
Reactor Coolant System (RCS) Flow Rate, lbm/hr	144.9×10^6	144.9×10^6
Core Flow Rate, lbm/hr	140.6×10^6	140.6×10^6
RCS Pressure, psia	2250	2250
Cold Leg Temperature, °F	530	530
Hot Leg Temperature, °F	592.7	592.7
Number of Plugged Tubes per Steam Generator	1000, up to 1380 with PLHGR reduction to 12.7 kW/ft	2000

(a) Unit 3 expected to be similar
(b) Unit 2 Cycle 13

Table 2
SONGS Unit 2[a] LBLOCA ECCS Performance Analysis
Comparison of Important Results

Parameter	Current Analysis[b][c]	New Analysis[d]
Limiting Break Size	0.8 DEG/PD[e]	0.6 DEG/PD[e]
Peak Cladding Temperature, °F	2170	2170[f]
Maximum Cladding Oxidation, %	10.5	15.19[g]
Maximum Core-Wide Cladding Oxidation, %	<0.99	<0.99

(a) Unit 3 expected to be similar
(b) Unit 2 Cycle 13
(c) Based on 1380 plugged tubes per steam generator and a reduced PLHGR of 12.7 kW/ft
(d) Results include a +1°F delta for PCT and a -0.40% delta for maximum cladding oxidation for the correction of the STRIKIN-II steam cooling model error
(e) DEG/PD = Double-Ended Guillotine Break in Reactor Coolant Pump Discharge Leg
(f) Zircaloy-4 clad fuel rod
(g) ZIRLO™ clad fuel rod

Table 3
SONGS Unit 2[(a)] SBLOCA ECCS Performance Analysis
Comparison of Important Input Parameters

Parameter	Current Analysis[(b)]	New Analysis
SBLOCA Evaluation Model	S2M	S2M
Core Power Level, MWt (including power measurement uncertainty)	3458	3458
Peak Linear Heat Generation Rate, kW/ft	13.5	13.5
RCS Flow Rate, lbm/hr	139.4×10^6	139.4×10^6
Core Flow Rate, lbm/hr	135.2×10^6	135.2×10^6
RCS Pressure, psia	2250	2250
Cold Leg Temperature, °F	560	560
Hot Leg Temperature, °F	620	621
Number of Plugged Tubes per Steam Generator	2000	2805

(a) Unit 3 expected to be similar
(b) Unit 2 Cycle 13

Table 4
SONGS Unit 2[(a)] SBLOCA ECCS Performance Analysis
Comparison of Important Results

Parameter	Current Analysis[(b)]	New Analysis
Limiting Break Size	0.05 ft^2	0.04 ft^2
Peak Cladding Temperature, °F	1903	2077
Maximum Cladding Oxidation, %	3.90	14.11
Maximum Core-Wide Cladding Oxidation, %	<0.49	<0.74

(a) Unit 3 expected to be similar
(b) Unit 2 Cycle 13