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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 18, 2013

Mr. Peter T. Dietrich
Senior Vice President and Chief Nuclear Officer
Southern California Edison Company
San Onofre Nuclear Generating Station
P.O. Box 128
San Clemente, CA 92674-0128

SUBJECT: SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 2 – SECOND REQUEST FOR ADDITIONAL INFORMATION REGARDING RESPONSE TO CONFIRMATORY ACTION LETTER (TAC NO. ME9727)

Dear Mr. Dietrich:

On March 27, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12087A323), the U.S. Nuclear Regulatory Commission (NRC) issued a Confirmatory Action Letter (CAL) to Southern California Edison (SCE, the licensee) regarding the San Onofre Nuclear Generating Station (SONGS), Units 2 and 3. The CAL confirms certain actions that SCE will take to address steam generator tube degradation issues at both units. The CAL also confirms that SCE will not resume power operation at either unit until the NRC completes its review of those actions and formally communicates its permission to restart in written correspondence.

By letter dated October 3, 2012 (ADAMS Accession No. ML12285A263), SCE submitted its response to the CAL for SONGS, Unit 2. SCE submitted proprietary versions of several reports included in that response by letter dated November 28, 2012 (ADAMS Accession No. ML12348A287). By letter dated February 18, 2013 (ADAMS Accession No. ML13051A190), SCE submitted proprietary and non-proprietary versions of three additional documents referenced in the October 3, 2012, CAL response.

The NRC staff is conducting a detailed review of SCE's CAL response for SONGS, Unit 2. The staff transmitted its initial request for additional information (RAI) containing 32 questions in a letter to SCE dated December 26, 2012 (ADAMS Accession No. ML12361A065). SCE has provided responses to all 32 questions in the initial RAI in several letters submitted to the NRC in January and February 2013, and the staff is currently reviewing those responses.

Since the issuance of that initial RAI, the NRC staff has identified the need for further information, and an additional set of 35 questions is provided in the enclosures to this letter. Please note that the staff has designated several of the questions as proprietary, based on the requests for withholding provided in your letters dated November 28, 2012, and February 18, 2013. The staff previously issued these RAI questions in draft form, on February 1, 20, and 21,

NOTICE: Enclosure 1 to this letter contains Proprietary Information. Upon separation from Enclosure 1, this letter is DECONTROLLED.

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2013 (redacted versions at ADAMS Accession Nos. ML13053A367, ML13056A092, and ML13053A164, respectively). These RAI questions (numbers 33 through 67) were discussed at a public meeting on February 27, 2013, between NRC and SCE. Based on those discussions, the enclosed final version of these questions is unchanged from the previous draft versions. In that meeting, SCE stated that it expected to provide responses to RAI questions 33 through 67 by mid-March of 2013. The NRC staff expects to issue additional RAIs to SCE as our review continues.

If you have any further questions regarding this letter, please contact me at (301) 415-4032 or via e-mail at randy.hall@nrc.gov.

Sincerely,

James R. Hall

James R. Hall, Senior Project Manager
San Onofre Special Projects Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-361

Enclosures:
1. Request for Additional Information (proprietary)
2. Request for Additional Information (non-proprietary)

cc w/Encl 2: Distribution via Listserv

ENCLOSURE 2

REQUEST FOR ADDITIONAL INFORMATION

ON SOUTHERN CALIFORNIA EDISON'S RESPONSE TO

THE MARCH 27, 2012, NRC CONFIRMATORY ACTION LETTER FOR

SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 2

(NON-PROPRIETARY)

Proprietary information pursuant to Section 2.390 of Title 10 of
the *Code of Federal Regulations* has been redacted from this document.

Redacted information is identified by blank space enclosed within double brackets.

OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ADDITIONAL INFORMATION ON

SOUTHERN CALIFORNIA EDISON'S RESPONSE TO

MARCH 27, 2012, NRC CONFIRMATORY ACTION LETTER

SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 2

DOCKET NO. 50-361

TAC NO. ME9727

By letter dated October 3, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML122850320), Southern California Edison (SCE, the licensee) submitted its response to the U.S. Nuclear Regulatory Commission (NRC) Confirmatory Action Letter (CAL) dated March 27, 2012, for San Onofre Nuclear Generating Station (SONGS), Unit 2. By letter dated November 28, 2012 (ADAMS Accession No. ML12348A287), SCE submitted proprietary versions of several reports enclosed with the October 3, 2012, CAL response.

The NRC staff is continuing its detailed review of SCE's CAL response for SONGS, Unit 2, and has determined that additional information is needed in order to complete our evaluation. This request for additional information (RAI) addresses some of the proprietary information submitted by SCE on November 28, 2012, and will be withheld from public disclosure as marked, pending the NRC staff's final determination on SCE's request for withholding under 10 CFR 2.390.

The NRC transmitted previous RAI questions to SCE by letter dated December 26, 2012 (ADAMS Accession No. ML12361A065). For continuity, the numbering scheme for these additional questions begins where the NRC's previous RAI questions ended.

33. Reference 1, Figure 5-5: [[

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34. Reference 1, Section 6.4.2, page 60 of 129: [[

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35. Reference 1, Section 7.3, page 98 of 129: The "upper bound contact forces" shown in Figure 7-2 are average values. Clarify whether these "average values" are averages of the upper bound contact forces for each tube in the bundle at each AVB. Why is it acceptable that the calculated upper bound contact force prevents motion for only 97.7 percent of the force spectrum from turbulence? Finally, why has only turbulence excitation been considered in the development of these upper bound contact forces?

36. Reference 1, Section 7.4, page 98 of 129: [[

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37. Reference 1, Section 8.0, page 107 of 129, and Figure 8-3 indicate that Unit 2 can be operated for 8 months after BOC 17 before exceeding the 5% probability limit. What is the sensitivity of this estimate to a higher assumed value of median contact force for support effectiveness?

38. In Reference 2, p. 8-3 (308 of 474), Section 3.2), "Loading conditions," please explain how ATHOS output is being converted to hydrodynamic pressure. The NRC staff is not aware that this quantity is a direct output of the ATHOS code. Please show a derivation of this parameter, explain how it is computed for the purposes of data reduction and display, and explain its technical significance.

39. In Reference 3, p. 36, Bottom of page, the term β is not defined. Please define the parameter, and explain (1) how it is formulated, and (2) how it is related to the ATHOS-computed nodal void fraction.

40. In Reference 3, p. 40, it is stated that "...plugged tubes are assumed to be in wet condition despite the void fraction." Please explain why this assumption is used, and provide information to justify that it is appropriate (i.e., valid, conservative, or insignificant) for the purposes of the relevant analyses.

41. Reference 3, p. 61 and 63, Tables 8.1.1-1 and 8.1.2-1. The data in Table 8.1.1-1 are based on an assumption that [[ ]], whereas the data in Table 8.1.2-1 are based on an assumption that [[

]]

42. In Reference 4, p. 4 (4 of 62), SCE does not conclusively state which screened tubes were actually plugged. Please discuss the threshold and implementation of the criteria (with exceptions) and provide or refer to a list of confirmed plugged tubes in Unit 2.

43. In Reference 5, p. 15, Section 6.3, "Assumption," Item (1) "Fluid force," please explain the basis for the statement, [[

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44. In Reference 5, p. 15, Section 6.3, "Assumption," Item (1) "Fluid force," it is assumed there is no in-plane motion if the stability ratio (SR) is less than 1.0. How has MHI accounted for the potential that in-plane tube motion may occur at a SR less than 1.0 and how is the analysis result affected if a smaller value is used for this threshold?

45. In Reference 7, p. 4-12 (38 of 66), Section 4.7, "Effect of Power Reduction," the probability of initiation (POI) is based on a calculation of dynamic pressure. Please provide the location in the U-bend selected to compute the parameter and provide justification for selection for this application. It is not clear that dynamic pressure is a key parameter for correlation of the TTW damage patterns experienced at SONGS.

46. In Reference 7, p. 15 of 131, please provide justification for selection of β=5.0 for the threshold value of the fluid elastic instability constant, and explain why it is a conservative selection for this application, considering the T/H conditions and size of the SONGS replacement SGs.

47. In Reference 8, p. 87, Section 4.2.3, please explain how [[

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48. In Reference 8, p. 88, Section 4.2.4, please provide information to demonstrate that the [[

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49. In Reference 8, p. 95, Figure 4-3 is provided for [[

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50. In Reference 8, p. 102 through 137, Figures 4-5 through 4-40 show local SR results. Please provide a tabulated summary of the results for [[

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51. In Reference 8, p. 101, in order for NRC staff to better understand the Westinghouse methodology and overall results, please provide a summary of analytic results that includes a breakdown of [[

]]

52. In Reference 8, p. 254, Section 7.2.2.1, [[

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53. In Reference 9, Section 4.6.2, "[Tube-to-Tube (TTW)] Growth Model," was the regression fit slope and intercept uncertainty modeled (e.g., as was done for the burst pressure versus voltage model in NRC Generic Letter 95-05)? If not, why is this conservative? Was the data scatter about the regression fit modeled as normally distributed? If so, provide justification for the adequacy of this assumption (i.e., normal distribution) to fully capture the upper tail of the distribution as shown in Figure 4-12 on page 4-25.

54. In Reference 9, Figures 4-11 and 4-13, the maximum depths in Figure 4-11 have been divided by the Unit 3 cycle length of 0.926 years to yield the growth rates in Figure 4-13. The staff understands that Figure 4-13 should be simply a scaled version of Figure 4-11. Please explain why some of the data in Figure 4-11 are not shown in Figure 4-13; for example, the three flaws shown in Figure 4-11 with maximum depths ranging from 89 to 100% (AREVA resized).

55. In Reference 10, page 107 of 129, second to last paragraph, did total gap also include wear of the anti-vibration bars (AVBs) themselves? If not, explain why the approach is conservative. If so, how was wear of the AVBs determined? (This question is a follow-up on RAI No. 26 from the NRC's December 26, 2012, letter).

56. For Reference 10, Figure 8-3, provide an assessment of the robustness of the Figure 8-3 predictions of the probability of instability versus time in terms of how well it accommodates uncertainty in these predictions for purposes of ensuring acceptable tube integrity margins during the planned 5-month inspection interval for Unit 2. Robustness refers in part to accommodating increases or decreases in the rate at which instability increases with time and the calculated value of the probability of instability at the beginning of cycle (BOC) 16 for Units 2 and 3 and BOC 17 for Unit 2. Robustness also considers the time interval between onset of instability and the loss of acceptable tube integrity margins.

57. In Reference 11, Appendix 9, Table 6.2-1, why is tube support plate (TSP) hole mis-location not included in the table headings? If not accounted for in the analysis, explain why the approach is conservative. If used in the analysis, provide an updated table that includes the TSP hole mis-location parameter.

58. In Reference 11, Appendix 9, Table 6.2-1, which parameters are sampled randomly at each tube/AVB intersection? Why is this appropriate in lieu of assuming a functional relationship for each given parameter from tube to tube in a given column of tubes? For parameters (e.g., AVB twist) assumed to follow a functional relationship from tube to tube in the same column, provide the basis for the assumed relationship. For AVB twist, how does the assumed relationship relate to Figure 6.2-2?

59. In Reference 11, Appendix 9, Attachment 9-1; define the statistical distributions which were actually sampled for Unit 2 and Unit 3. What is the technical justification for the assumed distributions compared to the actual distribution of the data?

60. In Reference 11, Appendix 9, Figures 7.2-3 and 7.2-5 apply to Unit 3. Please provide similar figures for Unit 2.

61. Reference 11, Appendix 9, Attachment 9-3, Figure 4.1.2-3. Discuss the pedigree of the data in this figure and how it differs from Reference 2, Figure 6-19 and 6-20. Please explain the differences between the Reference 3 versus the Reference 2 figures for dings exceeding 0.5 volts?

62. In Reference 10, Figure 8-3, the staff understands that the stability ratio (SR) in the context of Figure 8-3 is a 95% upper bound estimate, both for the last operating period for both Units 2 and 3 and for the next operating period for Unit 2. Why wasn't a best estimate SR used for benchmarking the probability of SR>1 at the conclusion of the last operating period for both Units 2 and 3? (Benchmarking refers to selecting a contact force criterion for effective AVB support such as to produce probabilities of SR>1 at the end of the last operating period consistent with what was actually observed.) How would a best estimate SR have affected the curves presented for the last operating period? Discuss whether the use of a 95% upper bound estimate for benchmarking purposes essentially negates the conservatism of using 95% upper bound SR estimates for future operation of Unit 2?

63. In Reference 11, Page 66, the last sentence on this page states, "Therefore, the difference of the contact forces between Unit-2 and Unit-3 is caused by the difference of the manufacturing dimensional tolerances other than the outer-most tube-to-AVB gaps." Explain the basis for this conclusion in light of the omission of the measured tube-to-AVB gaps at the outer tubes as a boundary condition in the contact force model described in Appendix 9 of Reference 3.

64. In Reference 11, Appendix 9, page 9-6 (355 of 474), it is stated, "Especially for AVB twist, AVB twist factor in consideration of torsion stiffness is defined as a decrease function of distance from AVB bending peak, because the more contact points leave from AVB nose, the less AVB torsion stiffness is." Please clarify the meaning of this sentence by answering the following questions: What is the "AVB twist factor?" What is meant by "AVB twist factor in consideration of torsion stiffness?" What parameter is decreasing as a function of distance from the AVB nose, AVB twist or AVB torsional stiffness? Why does torsional stiffness vary as function of distance from the AVB nose? Describe the specific variation of torsional stiffness with distance from nose function that was used in the analysis. How was this variation determined?

65. In Reference 11, Appendix 9, Figure 6.2.2 shows AVB twist factor as a function of distance from AVB nose tip. Is this the function that was used in the contact force analysis? For all AVBs? If not, what twist factor functions were used for the other

AVBs? How were these twist factor functions determined? Explain the relationship between twist factors shown in this figure versus those shown in Table 6.2-1.

66. In Reference 11, Appendix 9, page 9-6 (355 of 474) it is also stated, "In AVB nose area, the factor is always 1, because increased twist from nose tip and decreased stiffness from nose tip cancel each other." Please provide a detailed clarification of this sentence. The staff further notes that "twist" and "stiffness" have different units. How can they cancel each other out?

67. Reference 11, Appendix 9, Attachment 9-3; describe in detail any "tuning" of the contact force model that was performed to replicate the ding signals observed during pre-service inspection.

REFERENCES

1. Letter from Richard J. St. Onge, SCE, to Document Control Desk, USNRC, "Docket No. 50-361, Confirmatory Action Letter Response – Proprietary Documents, San Onofre Nuclear Generating Station, Unit 2," November 28, 2012. (ADAMS Accession No. ML12348A287); Enclosure 6, "SONGS U2C17 Steam Generator Operational Assessment for Tube-to-Tube Wear," prepared by Areva NP Inc., Document No. 51-9187230-000.

2. Letter from Richard J. St. Onge, SCE, to Document Control Desk, USNRC, "Docket No. 50-361, Confirmatory Action Letter Response – Proprietary Documents, San Onofre Nuclear Generating Station, Unit 2," November 28, 2012. (ADAMS Accession No. ML12348A287); Enclosure 3, MHI Document L5-04GA564 Rev. 9, "Tube Wear of Unit-3 RSG – Technical Evaluation Report." **[Proprietary]** [Note: a non-proprietary version of this report was provided as Enclosure 2, Attachment 4, to SCE's letter dated October 3, 2012. See ADAMS Accession Nos. ML12285A265-ML12285A267]

3. Letter from Richard J. St. Onge, SCE, to Document Control Desk, USNRC, "Docket No. 50-361, Supplemental Document Submittal Regarding Confirmatory Action Letter Response (TAC No. ME9727), San Onofre Nuclear Generating Station, Unit 2," February 18, 2013; (ADAMS Accession No. ML13051A190); Enclosure 1, MHI document L5-04GA567, "Evaluation of Stability Ratio for Return to Service," Rev. 6. **[Proprietary]** [A non-proprietary version of this report was provided as Enclosure 4 to SCE's letter dated February 18, 2013. See ADAMS Accession No. ML13051A192].

4. Letter from Richard J. St. Onge, SCE, to Document Control Desk, USNRC, "Docket No. 50-361, Confirmatory Action Letter Response – Proprietary Documents, San Onofre Nuclear Generating Station, Unit 2," November 28, 2012. (ADAMS Accession No. ML12348A287); Enclosure 4, MHI Document L5-04GA571 Rev. 6, "Screening Criteria for Susceptibility to In-Plane Tube Motion." **[Proprietary]** [Note: a non-proprietary version of this report was provided as Enclosure 2, Attachment 5, to SCE's letter dated October 3, 2012. See ADAMS Accession No. ML12285A267]

5. Letter from Richard J. St. Onge, SCE, to Document Control Desk, USNRC, "Docket No. 50-361, Supplemental Document Submittal Regarding Confirmatory Action Letter Response (TAC No. ME9727), San Onofre Nuclear Generating Station, Unit 2," February 18, 2013; (ADAMS Accession No. ML13051A190); Enclosure 2, MHI document L5-04GA585, "Analytical Evaluations for Operational Assessment," Rev. 2. **[Proprietary]** [A non-proprietary version of this report was provided as Enclosure 5 to SCE's letter dated February 18, 2013. See ADAMS Accession No. ML13051A193].

6. Letter from Peter T. Dietrich, SCE, to Elmo E. Collins, USNRC, "Docket No. 50-361, Confirmatory Action Letter – Actions to Address Steam Generator Tube Degradation, San Onofre Nuclear Generating Station, Unit 2," October 3, 2012; **Enclosure 2**, "San Onofre Nuclear Generating Station Unit 2 Return to Service Report, Revision 0." **Attachment 6**, "SONGS U2C17 Steam Generator Operational Assessment," **Appendix C**, "Operational Assessment for SONGS Unit 2 SG for Upper Bundle Tube-to-Tube Wear Degradation at End of Cycle 16," prepared by Intertek APTECH for Areva, Report No. AES 12068150-2Q-1, Revision 0, September 2012. (ADAMS Accession No. ML12285A269)

7. Letter from Peter T. Dietrich, SCE, to Elmo E. Collins, USNRC, "Docket No. 50-361, Confirmatory Action Letter – Actions to Address Steam Generator Tube Degradation, San Onofre Nuclear Generating Station, Unit 2," October 3, 2012; **Enclosure 2**, "San Onofre Nuclear Generating Station Unit 2 Return to Service Report, Revision 0." **Attachment 6**, "SONGS U2C17 Steam Generator Operational Assessment," **Appendix D**, "Operational Assessment of Wear Indications In the U-Bend Region of San Onofre Unit 2 Replacement Steam Generators," prepared by Westinghouse Electric Company LLC, Report No. SG-SGMP-12-10, Revision 3, October 2012. (ADAMS Accession No. ML12285A269)

8. Letter from Richard J. St. Onge, SCE, to Document Control Desk, USNRC, "Docket No. 50-361, Supplemental Document Submittal Regarding Confirmatory Action Letter Response (TAC No. ME9727), San Onofre Nuclear Generating Station, Unit 2," February 18, 2013; (ADAMS Accession No. ML13051A190); Enclosure 3, Westinghouse document, LTR-SGDA-12-36, "Flow-Induced Vibration and Tube Wear Analysis of the San Onofre Nuclear Generating Station Unit 2 Replacement Steam Generators Supporting Restart," Rev. 3. **[Proprietary]** [A non-proprietary version of this report was provided as Enclosure 6 to SCE's letter dated February 18, 2013. See ADAMS Accession No. ML13051A197].

9. Letter from Peter T. Dietrich, SCE, to Elmo E. Collins, USNRC, "Docket No. 50-361, Confirmatory Action Letter – Actions to Address Steam Generator Tube Degradation, San Onofre Nuclear Generating Station, Unit 2," October 3, 2012; **Enclosure 2**, "San Onofre Nuclear Generating Station Unit 2 Return to Service Report, Revision 0." **Attachment 6**, "SONGS U2C17 Steam Generator Operational Assessment," **Appendix C**, "Operational Assessment for SONGS Unit 2 Steam Generators for Upper Bundle Tube-to-Tube Wear Degradation at End of Cycle 16," prepared by Intertek APTECH for Areva, Report No. AES 12068150-2Q-1, Revision 0, September 2012. (ADAMS Accession No. ML12285A269)

10. Letter from Richard J. St. Onge, SCE, to Document Control Desk, USNRC, "Docket No. 50-361, Confirmatory Action Letter Response – Proprietary Documents, San Onofre Nuclear Generating Station, Unit 2," November 28, 2012. (ADAMS Accession No. ML12348A287); Enclosure 6, "SONGS U2C17 Steam Generator Operational Assessment for Tube-to-Tube Wear," prepared by Areva NP Inc. Document No. 51-9187230-000, Revision 0), October 2012. **[Proprietary]** [Note: a non-proprietary version of this report was provided as Enclosure 2, Attachment 6, Appendix B, to SCE's letter dated October 3, 2012. See ADAMS Accession Nos. ML12285A267, ML12285A268, and ML12285A269]

11. Letter from Richard J. St. Onge, SCE, to Document Control Desk, USNRC, "Docket No. 50-361, Confirmatory Action Letter Response – Proprietary Documents, San Onofre Nuclear Generating Station, Unit 2," November 28, 2012. (ADAMS Accession No. ML12348A287); Enclosure 3, MHI Document L5-04GA564 Rev. 9, "Tube Wear of Unit-3 RSG – Technical Evaluation Report." **[Proprietary]** [Note: a non-proprietary version of this report was provided as Enclosure 2, Attachment 4, to SCE's letter dated October 3, 2012. See ADAMS Accession Nos. ML12285A265, ML12285A266, and ML12285A267]

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If you have any further questions regarding this letter, please contact me at (301) 415-4032 or via e-mail at randy.hall@nrc.gov.

Sincerely,

/RA/

James R. Hall, Senior Project Manager
San Onofre Special Projects Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-361

Enclosures:
1. Request for Additional Information (proprietary)
2. Request for Additional Information (non-proprietary)

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