Lent, Susan

From:	Hall, Randy
Sent:	Monday, December 10, 2012 2:28 PM
To:	Ryan.Treadway@sce.com
Cc:	joseph.bashore@sce.com; John.Brabec@sce.com; Broaddus, Doug; Jackson, Christopher; Kulesa, Gloria; Elliott, Robert; Pelton, David; Paige, Jason; Murphy, Emmett; Karwoski, Kenneth; Thurston, Carl; Hoxie, Chris; Grover, Ravinder; Beaulieu, David; Parks, Benjamin; Clifford, Paul; Schulten, Carl; Lantz, Ryan; Werner, Greg; Taylor, Nick; Rahn, David; Thorp, John; Benney, Brian
Subject:	Draft Request for Additional Information on SCE's Response to NRC's Confirmatory Action Letter for San Onofre Nuclear Generating Station Unit 2 (ME9727) - Resent w/ Attachment
Attachments:	SONGS Draft RAI Dec 10.docx

December 10, 2012

Mr. Ryan Treadway
Manager, Nuclear Regulatory Affairs
San Onofre Nuclear Generating Station
Southern California Edison Company

Ryan:

By letter dated October 3, 2012, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML122850320) Southern California Edison (SCE) submitted its response to the NRC Confirmatory Action Letter (CAL) dated March 27, 2012, for San Onofre Nuclear Generating Station (SONGS), Unit 2. The NRC staff is continuing its detailed review of SCE's CAL response and Return to Service report for SONGS Unit 2 and has determined that further additional information is needed in order to complete our evaluation. The NRC staff's initial draft request for additional information (RAI) regarding the CAL response was transmitted to you on November 30, 2012. The staff's latest RAI is attached. The staff may develop additional questions, which we will transmit to SCE as they become available.

The NRC staff will hold a public meeting with SCE at NRC headquarters on December 18th to discuss the previous RAIs, these additional RAIs, and SCE's plans and schedule for response. Please contact me if you have any questions.

Sincerely,

Randy Hall, Senior Project Manager
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Division of Operating Reactor Licensing
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OFFICE OF NUCLEAR REACTOR REGULATION
REQUEST FOR ADDITIONAL INFORMATION
SOUTHERN CALIFORNIA EDISON
SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 2
RESPONSE TO MARCH 27, 2012, NRC CONFIRMATORY ACTION LETTER
DOCKET NO. 50-361
TAC NO. ME9727

By letter dated October 3, 2012, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12285A263; ADAMS Package No. ML122850320), Southern California Edison (SCE) submitted its response to the NRC Confirmatory Action Letter (CAL) dated March 27, 2012, for San Onofre Nuclear Generating Station (SONGS), Unit 2. 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. The staff's additional questions are stated in this draft request for additional information (RAI) below. The staff previously issued a set of RAI questions on this subject on November 30, 2012 (ADAMS Accession No. ML12338A110). For continuity, the numbering scheme for these additional questions begins where the prior RAI questions ended.

15. In Reference 1, Section 8.3.2, page 48 – How will the continued integrity of the non-stabilized, preventively-plugged tubes adjacent to the retainer bars be ensured? "Integrity" in this context refers to the tubes remaining intact and unable to cause damage to adjacent tubes.

16. Reference 1, Section 9.3, page 50 – Provide additional information concerning the "Operational Decision Making" process and describe how it would be applied if the proposed criterion is exceeded. Provide the procedural action statement.

17. Reference 1, Section 9.4.1, page 50 – Provide the procedural action levels/statements.

18. Reference 1, Section 11.1, page 52 – SCE proposes to upgrade the vibration and loose parts monitoring system (VLPMS) as a defense-in-depth measure to enhance plant monitoring capability to facilitate early detection of a steam generator tube leak and ensure immediate and appropriate plant operator and management response.

    Fluid Elastic Instability (FEI) was identified as a main cause of the tube wear for both the Unit 2 and 3 steam generators. The FEI experienced is due to a combination of the conditions of steam quality, secondary side fluid velocity in the vicinity of the tube bundle, and steam void fraction, and the degree of such fluid elastic instability is related to the damping provided by internal support structures. According to your report, "steam quality directly affects the fluid density outside the tube, affecting the level of hydrodynamic pressure that provides the motive force for tube vibration. When the energy imparted to the tube from hydrodynamic pressure (density times velocity squared, or ρv^2) is greater than the energy dissipated through damping, FEI will occur." However, the proposed plant VLPMS enhancement does not appear to directly monitor steam quality, secondary side fluid velocity, or steam void fraction.

Please provide the following information to address the effectiveness of the enhanced VLPMS:

a. Describe the specific purpose of using the enhanced VLPMS equipment for monitoring steam generator performance. For example, is it to be used for monitoring acoustic noise indicative of flow velocity, steam quality, and void fraction, or for the measurement of metallic noise indicative of vibration of tubes against each other or against tube support structures? Exactly how will this be done? What is the theory of operation? If it will be used to monitor an increase in ρv^2 leading to the onset of FEI, provide a description of the correlation of the velocity of steam voids through the secondary side of the steam generator and the relative changes in characteristics of the signal output from the various VLPMS accelerometers. If it is to be used for detecting actual tube vibration, provide a description of the process that will be used for discerning actual tube vibration noise from background noise, and the required threshold identification criteria that will be applied to reach the conclusion that tube vibration is occurring.

b. Identify the ranges of amplitudes and frequencies of the acoustic noise signals from each accelerometer that are indicative of an approach to the conditions leading to FEI or actual tube vibration, and the reasons for selection of the more sensitive accelerometers. Also, discuss the required response time of the signal processing equipment needed to detect and continuously monitor either fluid velocities within the steam generator or tube impact noise, depending on the intended use of the enhanced VLPMS, and the actual response time capabilities of the equipment, from sensor through processed signal output, that is being proposed for use.

c. Discuss the acceptance criteria (e.g., magnitude of signal, plant power level, etc.) that will be used to establish the setpoints for the alarms described in Section 11 of your report: "The signals from these sensors are compared with preset alarm setpoints." Provide a description of how the alarm setpoints were established, and at what point during the start-up of Unit 2 will these alarm setpoints be calibrated into the VLPMS. If the setpoints have not yet been determined, provide a description of your plan for determining and implementing these settings.

d. Describe the planned operator actions and any changes to the procedures for responding to alarms or signals potentially indicative of tube-to-tube contact, including time limits for analyzing the signals and taking any necessary action including plant shutdown. Describe the lessons learned that have been drawn from the signals of potential metal-to-metal contact experienced in Unit 3 and how these lessons have been factored into current procedures.

e. A description of how you determined that acoustic noise monitoring and predictive signal processing was the best method for monitoring either the onset of FEI or actual tube vibration, including a list of other methods (e.g., time domain reflectivity probes calibrated for steam void propagation monitoring) that had been considered for enhancing steam generator tube monitoring during start-up of Unit 2, and the reasons for their rejection.

19. Reference 1, Section 11.2, page 52 – Provide additional details on how the GE Smart Signal System will be used in the context of tube-to-tube wear and/or the circumstances associated with tube-to-tube wear. What information/data will the system be evaluating? For what purpose?

20. Reference 3, page 17 of 129, refers to tube-to-support design clearance of 2 mils diametral. Confirm that this is the nominal diametral clearance under ambient conditions, or clarify the statement otherwise.

21. Reference 3, page 44 of 129, states that the plugged tubes have an effect on local thermal/hydraulic conditions upon returning to power and have been included in the stability ratio calculations. The staff interprets this to mean the effect of the plugged tubes on the calculated thermal/hydraulic conditions were considered in the stability ratio calculations and that the stability ratio calculations included the plugged (and stabilized) tubes. Is this correct? Clarify, if not.

22. Reference 3, page 57 of 129, first full paragraph beginning with the words "Figure 6-1" – The third sentence states, "... it is not practical to use an individual run of the quarter model as a single Monte Carlo trial for contact forces." However, the staff was unable to ascertain from the subsequent discussion exactly what was done as an alternative? Nor was the staff able to discern this from Reference 6, Appendix 9. Provide or cite by reference a more complete description of how the cumulative distributions of contact forces were determined. For example, what is a "run?" What does it mean to "combine runs?" How were zones employed in order to provide a more practical approach? Are all tubes in a given zone assumed to have the same initial clearances, final clearances, and contact forces? Do all AVB #5 in a zone have the same cumulative distribution of contact forces? Is a Monte Carlo performed for each zone?

23. Reference 3 – Provide figures similar to Figures 6-19 and 6-20 for Unit 3, SG E-088, and Unit 2, SG E-088.

24. Reference 3, page 59 of 129, last paragraph – The sentence, "AVBs 2, 3, 11 and 10 near row 27 have sporadic dents in the vicinity of the noses of AVBs 1, 4, 9 and 12" does not appear to make sense. Provide further clarification relative to the discussion of Figure 6-20.

25. Reference 3, page 59 of 129 – There is a statement in the last paragraph that reads, "Patterns of dents and associated high contact forces are in good agreement with the final quarter model calculations." Provide or show this comparison.

26. Reference 3, page 107 of 129, second to last paragraph – Provide additional details of the wear growth model at the tube supports. Were cumulative probability functions of observed wear rates constructed and randomly sampled when developing the contact force probability distributions at each intersection? Was total gap at each intersection (prior to applying temperature and allowing the model to settle, leading to the development of contact forces) assumed to be the sum of the manufacturing gap and the maximum wear depth?

27. Reference 6, Appendix 8, "SG Tube Flowering Analysis", page 8-2 (307 of 474) – MHI concludes, in part, that the tube-to-AVB gaps in the center columns increase due to hydrodynamic pressure by [ ] when the manufacturing tolerance dispersion is not taken into account. MHI also concludes that the gap increase due to hydrodynamic pressure is small when the manufacturing tolerance dispersion is taken into account. Discuss whether this latter finding may simply reflect the hydrodynamic pressures acting to relieve the tube-to-AVB contact forces caused by the manufacturing tolerance dispersion, such that the gaps are relatively unchanged relative to the case were the hydrodynamic pressure is not considered. Reference 6, Appendix 9, "Simulation of Manufacturing Dispersion for Unit-2/3," does not seem to make specific mention of whether the calculated tube-to-AVB contact forces directly considered the effect of the hydrodynamic effect on tube-to-tube contact forces, but the staff understands that they did not. If the staff's understanding is correct, explain how the resulting contact forces are conservative.

28. Reference 5, Section 2.6.1 – What is the estimated growth rate of the tube-to-tube wear in steam generator 3E0-88, tube R106C78? Describe how it was determined.

29. Reference 5, Figures 2-12 and 2-13 – Provide similar figures for Case 78 (all AVBs missing).

30. Reference 1, Figure 8-2 – Provide similar figure for maximum interstitial velocities.

31. In References 7 and 8 (specifically, in Section 7.2 of Reference 7 and in Section 8.0 of Reference 8), AREVA used Revision 3 of the Electric Power Research Institute "Steam Generator Management Program: Steam Generator Integrity Assessment Guidelines," in part, to assess the most limiting structural integrity performance criteria (e.g., the more limiting structural limit determined from (a) the three times the normal operating differential pressure criterion or (b) the safety factor of 1.2 on combined primary loads and 1.0 on axial secondary load criterion). In some cases, it appears that the limits in the Integrity Assessment Guidelines may have been based on specific tests and plant data. Please discuss whether you have confirmed the applicability of the limits in the Integrity Assessment Guidelines (in particular, those related to when non-pressure loads need to be considered) to the SONGS replacement steam generators.

REFERENCES

1. 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 (ADAMS Package No. ML122850320); Enclosure 2, "San Onofre Nuclear Generating Station Unit 2 Return to Service Report, Revision 0." (ADAMS Accession No. ML12285A263)

2. Attachment 6 to Reference 1, "SONGS U2C17 Steam Generator Operational Assessment," Appendix A, Revision 2, "SONGS U2C17 Outage - Steam Generator Operational Assessment," prepared by Areva NP Inc. Document No. 51-9182833-002 (NP), Revision 2), October 2012. (ADAMS Accession No. ML12285A267)

3. Attachment 6 to Reference 1, "SONGS U2C17 Steam Generator Operational Assessment," Appendix B, Revision 0, "SONGS U2C17 Steam Generator Operational Assessment for Tube-to-Tube Wear," prepared by Areva NP Inc. Document No. 51-9187230-000 (NP), Revision 0), October 2012. (ADAMS Accession Nos. ML12285A267, ML12285A268, and ML12285A269)

4. Attachment 6 to Reference 1, "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)

5. Attachment 6 to Reference 1, "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)

6. Attachment 4 to Reference 1, "MHI Document L5-04GA564, Tube Wear of Unit-3 RSG - Technical Evaluation Report," Revision 9, October 2012, prepared by Mitsubishi Heavy Industries, LTD. (ADAMS Accession Nos. ML12285A265, ML12285A266, and ML12285A267)

7. Attachment 2 to Reference 1, AREVA NP Inc., Engineering Information Record, Document No. 51-9182368 – 003 (NP), "SONGS 2C17 Steam Generator Condition Monitoring Report." (ADAMS Accession No. ML12285A263)

8. Attachment 3 to Reference 1, AREVA NP Inc., Engineering Information Record, Document No. 51-9180143 – 001 (NP), "SONGS Unit 3 February 2012 Leaker Outage - Steam Generator Condition Monitoring Report." (ADAMS Accession No. ML12285A264)