August 24, 2006

Mr. John S. Keenan
Senior Vice President and CNO
Pacific Gas and Electric Company
Diablo Canyon Power Plant
P.O. Box 770000
San Francisco, CA 94177-0001

SUBJECT: DIABLO CANYON POWER PLANT, UNIT NO. 2 - SUMMARY OF CONFERENCE CALL REGARDING THE SPRING 2006 STEAM GENERATOR TUBE INSPECTIONS (TAC NO. MD0513)

Dear Mr. Keenan:

By email dated May 2, 2006 (Enclosure 2), Pacific Gas and Electric Company (PG&E, the licensee) submitted information summarizing some of the results of the 2006 steam generator (SG) tube inspections performed at Diablo Canyon Power Plant (Diablo Canyon), Unit 2. These inspections were performed during the thirteenth refueling outage (1R13). On May 3, 2006, the NRC staff participated in a conference call with representatives from Diablo Canyon, Unit 2, to discuss its 2006 SG tube inspection activities. As a result of this call, PG&E provided additional information by email dated May 9, 2006 (Enclosure 3).

The NRC staff has reviewed the above and did not identify any issues that warrant follow-up action at this time. The summary of the conference call is enclosed.

If you or your staff have any questions concerning the resolution of this matter, please contact me at (301) 415-1445.

Sincerely,

***/RA/***

Alan B. Wang, Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-323

Enclosures:
1. Summary of May 3, 2006, Conference Call
2. Email dated May 2, 2006
3. Email dated May 9, 2006

cc w/encl: See next page

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2006 REFUELING OUTAGE NO. 13 STEAM GENERATOR TUBE INSPECTION ACTIVITIES

CONFERENCE CALL SUMMARY

DIABLO CANYON POWER PLANT, UNIT 2

DOCKET NOS. 50-323

OPERATING LICENSE NOS. DPR-82

On May 3, 2006, the Nuclear Regulatory Commission (NRC) staff conducted a phone call with representatives from Pacific Gas and Electric Company (the licensee) to discuss their 2006 steam generator (SG) tube inspections at Diablo Canyon Power Plant (DCPP), Unit 2, during their 13th refueling outage. The DCPP, Unit 2, SGs are scheduled to be replaced at the next refueling outage in approximately 1.6 effective full-power years.

DCPP, Unit 2, has four Westinghouse Series 51 recirculating SGs. Each SG has 3,388 mill-annealed Alloy 600 tubes which have an outside diameter of 0.875 inch and a nominal wall thickness of 0.050 inch. The tubes were explosively expanded at each end for the full depth of the tubesheet. The tubes are supported by support plates and anti-vibration bars. The tube support plates are carbon steel and are drilled to permit tube passage.

At the time of the May 3, 2006, conference call, the SG inspection was nearly complete (scheduled to be completed by the end of the day). In support of the phone call, the licensee provided several documents by email dated May 2, 2006 (Enclosure 2), summarizing the SG tube inspection activities during the 2006 outage. Additional clarifying information discussed during the call is summarized below:

- The licensee detected two dings with axial outside-diameter stress-corrosion cracking (ODSCC). This is the first occurrence of this degradation mechanism in Unit 2. These indications were detected with the bobbin coil probe and confirmed with the +Point™ coil. One approximately 0.3 volt indication was identified in a 0.8 volt ding that was located just below the third cold-leg support plate in SG-21. Another approximately 0.8 volt indication was identified in a 3.8 volt ding that was located approximately 40 inches above the cold-leg tubesheet in SG-22. Since cracking was detected in these two free span dings, the licensee expanded the inspection scope according to Item 27 in Table 1 (see Enclosure 2, Email dated May 2, 2006). No additional ODSCC indications were identified in the free span dings at the time of the call. The NRC staff discussed the free span ding expansion criteria with the licensee. The licensee indicated that there were 36 dings greater than 5 volts in SG-21 and 20 dings greater than 5 volts in SG-22. Since the expansion criteria only included dings greater than 5 volts, the staff inquired about the previous plant inspection history of dings with amplitudes less than 5 volts. Given the occurrence of axial ODSCC at two free span ding locations, the NRC staff questioned whether any circumferential ODSCC had been detected at free span dings in other Westinghouse-designed SGs. The licensee indicated (at the time of the call) that they were not aware of any circumferential ODSCC that has occurred at dings and that they had inspected some smaller (i.e., 2 to 5 volt) dings.

ENCLOSURE 1

- The staff and licensee discussed rotating probe inspection criteria for cold-leg thinning indications. The licensee agreed to send an optical disc with samples of three cold-leg thinning indications to the NRC. During the last outage, all potential cold-leg thinning indications were inspected with a rotating probe. All bobbin indications were either dispositioned as either no detectable degradation or as volumetric cold-leg thinning indications as a result of these rotating probe exams. All new bobbin indications of potential cold-leg thinning are inspected with a rotating probe. If bobbin indications are outside the zone affected by cold-leg thinning, rotating probe inspection is not performed and they are assumed to be ODSCC indications. No cold-leg ODSCC has been detected at tube support plates in DCPP, Unit 2.

- During the call, the licensee stated that signals from an inner diameter axial and circumferential indication in an SG-22 tube was conservatively identified as an "interacting" mixed mode indication per the primary water stress-corrosion cracking (PWSCC) alternate repair criteria. Subsequent to the call, the licensee reported that the final eddy current analysis showed that these two indications are not interacting.

- The licensee reported 2,444 distorted outside diameter signals (DOS) less than 2 volts at tube support plates, which is approximately 300 more than the previous outage. A total of 32 tubes were plugged with greater than 2 volt DOS indications at tube support plates. One tube with a less than 2.0 volt DOS was plugged since it was assessed as having the potential for large voltage growth during the next operating cycle.

- The licensee did not perform sludge lancing or a secondary side foreign object search and retrieval inspection during the outage. The licensee based this decision on several factors, including: no eddy current indications of possible loose parts, no SG secondary side maintenance had been performed during the outage, no loose parts had been found for several outages, and no tube wear had been attributed to loose parts during the current inspection.

- No indications were found during the outage that could be attributed to the approximately 0.4 gallon per day primary-to-secondary leak that had been observed during the previous two cycles. The leakage could be occurring past mechanical tube plugs.

- The licensee expected to plug six tubes for axial PWSCC at tube supports. Two tubes were plugged since the indications extended past the tube support plates and the depth of these indications exceeded 40 percent through-wall. Another two tubes were plugged since the axial PWSCC indications were occurring at the same tube support elevation where axial ODSCC indications were detected. The final two tubes were plugged for mixed mode indications (i.e., axial and circumferential indications at the same tube support plate elevation).

- Voltage dependent growth was observed for ODSCC indications at the tube support plate indications in SG-24, but not in the other SGs.

- One tube with an ODSCC indication at a tube support plate elevation was plugged as a preventative measure since the indication's +Point™ amplitude was large (approximately 2 volts) in comparison to the bobbin coil amplitude (approximately 1.9 volts).

- The number of new axial PWSCC indications was expected to increase to four due to the recent discovery of two indications in SG-21.

- Eddy current data noise during the current inspection was similar to the noise observed in previous outages (i.e., the data quality was similar to previous outages). The DCPP, Unit 2, SGs had been chemically cleaned in 2R12. Crevice cleaning had not been performed during that outage.

- No rotating probe inspections were performed in the cold-leg tubesheet region during the outage.

- At the conclusion of the call, the licensee provided verbal notification that circumferential indications were detected at the tube support plate elevations and axial PWSCC indications were also detected at the tube support plate elevations.

Subsequent to the May 3, 2006 call, the licensee provided additional information by email dated May 9, 2006 (Enclosure 3) concerning several topics discussed during the outage call including: (1) industry experience with circumferential ODSCC at free span dings, (2) recent inspections at DCPP of less than 5 volt dings, (3) eddy current data of cold-leg thinning indications, and (4) wear scar inspection in relation to Section 3.4.3 of the Electric Power Research Institute Pressurized-Water Reactor SG Examination Guidelines. Based on the information provided in Enclosure 3, the licensee concluded that circumferential ODSCC at free span dings is not a potential degradation mechanism at the DCPP Plant, Unit 2. In addition, based on previous inspection results with rotating probes, the licensee concluded that no cracking exists in regions of wear/thinning.

The NRC staff review did not identify any issues that warrant follow-up action at this time.

Email dated May 2, 2006

| | |
|---|---|
| From: | "Arhar, John" <JHA1@pge.com> |
| To: | Alan Wang <ABW@nrc.gov>; <kjk1@nrc.gov>; |
| CC: | <JIT@nrc.gov>; <JAC@nrc.gov> "Bailey, Janis" <JxDj@pge.com>, "Beals, David" <DJBz@pge.com>; "Fleck, Jeff" <Jeff.Fleck@framatome-anp.com>; "Grozan, Thomas C" <TCG5@pge.com>; "Malone, Donald" <DDM1@pge.com> |
| Subject: | Response to NRC Questions on 2R13 SG inspections |

<<2R13 NRC phone call_Tables 2 and 3.pdf>> <<2R13 NRC phone call_responses and Table 1.pdf>>

See attachments for responses to NRC questions to support the 1000 PDT phone call on Wednesday.

John Arhar

ENCLOSURE 2

Email dated May 9, 2006

From: "Arhar, John" <JHA1@pge.com>
To: <kjk1@nrc.gov>, "Alan Wang" <ABW@nrc.gov>
Date: 05/09/2006 5:43:11 PM
Subject: Draft response to NRC questions on 2R13 results

CC: "Grozan, Thomas C" <TCG5@pge.com>, "Bailey, Janis" <JxDj@pge.com>

Draft PG&E Response to NRC Questions from 2R13 Phone Call on May 3, 2006

NRC Question 1:

Review industry experience for circumferential ODSCC at free span dings.

PG&E Response:

This response is limited to original Westinghouse designed SGs.

Circumferential ODSCC at free span "paired dings" was reported at South Texas Project (STP) Unit 1 original SGs in 1999. Paired dings result from the tube being rotated out of plane while engaged with a TSP during tube insertion. Three small voltage (less than 1 volt) circumferential indications were reported in paired ding voltages of 0.77 volts, 2.15 volts, and 3.91 volts. The indications were proof tested to 5000 psi with no change in the eddy current signal; therefore, these signals could have been false calls.

Comanche Peak Unit 1 original SGs also have paired dings, and 2 to 5 volt paired dings are sampled with Plus Point as a result of the STP-1 experience, along with 100% of greater than 5 volt dings, with no circumferential ODSCC degradation being reported.

Both STP-1 and Comanche Peak-1 have experienced modest numbers of ODSCC at dings, and all have been axially oriented with the exception of the STP-1 1999 experience.

In conclusion, reporting of ding circumferential ODSCC in original Westinghouse SGs has been limited to STP-1 experience at paired free span dings. Also, hoop stresses due to operation are twice longitudinal stresses, thus axial ODSCC would be more likely than circumferential ODSCC due to the direction of dominant operating stress.

DCPP Units 1 and 2 do not have paired dings. Therefore, circumferential ODSCC at free span dings is not a potential degradation mechanism at DCPP Units 1 and 2.

NRC Question 2:

Provide a summary of less than 5 volt ding Plus Point inspections that have been done in recent outages.

PG&E Response:

Table 1 summarizes the inspection scopes for dings at DCPP Units 1 and 2. Plus Point sample inspections of greater than 2 volt dings were routinely performed prior to 2R11, at which time the bobbin coil was credited for detection of cracking in less than or equal to 5 volt dings and Plus Point inspections were focused on greater than 5 volt dings.

Table 2 provides the less than 5 volt ding population for DCPP Units 1 and 2, along with the number of Plus Point inspections conducted on less than 5 volt dings over the last four inspections on each unit (R10 to R13). Some of the <5 volt dings may have been inspected more than once in this study period. Most of the <5 volt ding inspections have occurred in the U-bends as a result of Plus Point inspections to detect circumferential PWSCC, with a much smaller sample in the straight legs.

NRC Question 3:

Provide eddy current data of some DCPP cold leg thinning indications (large, medium, small).

PG&E Response:

PG&E has prepared an optical disk containing bobbin and Plus Point data for three 2R13 CLT indications (small 7%, medium 24%, and large 35%). The optical disk will be mailed to Alan Wang.

NRC Question 4:

Describe DCPP compliance with Section 3.4.3 of the EPRI guidelines.

PG&E Response:

EPRI PWR SG Examination Guidelines, Revision 6, Section 3.4.3, states:

Bobbin coil is capable of sizing volumetric wear, thinning, pitting, and impingement indications. However, it is not capable of differentiating between these indications and cracking. Therefore, when bobbin coil volumetric indications occur in the same region of the SG that cracking has been identified, then the bobbin coil volumetric indications in the overlapping regions shall be examined using techniques that provide for signal characterization such that the appropriate repair criteria can be applied.

PG&E's SG inspection surveillance procedure incorporates this EPRI recommendation into its checklist.

For DCPP Units 1 and 2, bobbin coil indications due to wear and thinning are routinely detected in the U-bend due to AVB wear and at lower cold leg TSPs in the periphery due to cold leg thinning (CLT). AVB wear has been detected as low as Row 15, and CLT has been detected up to TSP 4C. No cracking has been detected in these regions; therefore, there are no overlapping regions of wear/thinning and cracking. The highest row U-bend in which PWSCC has been detected is Row 10. The coldest TSP where PWSCC and ODSCC have been detected is 7C and 7H, respectively.

The basis for concluding that no cracking exists in regions of wear/thinning is determined from many Plus Point inspections.

All cold leg TSP indications have been inspected by Plus Point at least once in history to verify that the signal is non-crack like.

In Unit 2 in 2R11, 100% of the U-bends were inspected with Plus Point, along with all AVB wear scars, and no crack-like indications were detected at AVB wear locations. It is noted that AVB wear coincident with cracking has not been reported in Westinghouse Model 51 SGs.

Table 1
DCPP Units 1 and 2 Inspection Scope of Dings

| | Plus Point Inspection Scope | | Bobbin Credit |
|---|---|---|---|
| | General | ≥2v UB ding at AVB | |
| 2R7 | 20% >2v dings at lower HL elevations | | |
| 1R8 | 20% >2v dings at lower HL elevations | | |
| 2R8 | 20% >2v dings at lower HL elevations | | |
| 1R9 | 20% >2v dings at lower HL elevations | | |
| 2R9 | 20% >2v dings at lower HL elevations | | |
| 1R10 | 20% >2v dings at lower HL elevations | | |
| 2R10 | 20% >2v dings at lower HL elevations | | |
| 1R11 | 20% >2v dings at each HL elevation | | |
| 2R11 | 100% >5v dings | 100% | ≤5v dings |
| 1R12 | 100% >5v dings | 100% | ≤5v dings |
| 2R12 | 100% >5v dings | 20% | ≤5v dings |
| 1R13 | 20% >5v dings in UB, 20% >5v dings in straight legs (sample biased to lower HL elevations) | 20% | ≤5v dings |
| 2R13 | 20% >5v dings in UB, 20% >5v dings in straight legs (sample biased to lower HL elevations) | 20% | ≤5v dings |

Table 2
DCPP Units 1 and 2 Less Than 5 Volt Dings
Population and Number of Plus Point Inspections

| Elevation | <5 volt ding population | | # PP inspections of <5 volt dings over last four inspections | |
|---|---|---|---|---|
| | Unit 1 | Unit 2 | Unit 1 | Unit 2 |
| TSH-1H | 93 | 79 | 40 | 26 |
| 1H-2H | 51 | 81 | 22 | 10 |
| 2H-3H | 54 | 29 | 21 | 5 |
| 3H-4H | 63 | 43 | 28 | 6 |
| 4H-5H | 74 | 34 | 24 | 1 |
| 5H-6H | 78 | 38 | 30 | 4 |
| 6H-7H | 93 | 40 | 21 | 1 |
| 7H-7C | 774 | 281 | 758 | 555 |
| 7C-6C | 86 | 41 | 12 | 11 |
| 6C-5C | 70 | 36 | 10 | 2 |
| 5C-4C | 85 | 34 | 19 | 1 |
| 4C-3C | 103 | 38 | 21 | 1 |
| 3C-2C | 67 | 43 | 5 | 1 |
| 2C-1C | 51 | 57 | 0 | 1 |
| 1C-TSC | 83 | 92 | 5 | 10 |
| Total | 1825 | 966 | 1016 | 635 |

Diablo Canyon Power Plant, Units 1 and 2
cc:

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