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June 23, 2003

PG&E Letter DCL-03-076

U.S. Nuclear Regulatory Commission
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Docket No. 50-323, OL-DPR-82
Diablo Canyon Unit 2
Special Report 03-02 - Results of Steam Generator Inspections for
Diablo Canyon Power Plant Unit 2 Eleventh Refueling Outage

Dear Commissioners and Staff:

In accordance with Technical Specification (TS) 5.6.10 and commitments to maintaining steam generator (SG) tube integrity, PG&E is submitting this report of the SG tube condition monitoring and operational assessment as a result of inspections performed during the Unit 2 eleventh refueling outage (2R11).

In accordance with TS 5.6.10.e and 5.6.10.f, Enclosure 1 provides the 90-day reporting of the results of the 2R11 W* alternate repair criteria (ARC) tubesheet inspections and calculated steam line break leakage from application of all ARC.

In accordance with TS 5.6.10.h, Enclosure 2 provides the 120-day reporting of the results of the 2R11 primary water stress corrosion cracking (PWSCC) ARC inspections at dented tube support plate (TSP) intersections.

In accordance with PG&E's commitment to NEI 97-06, Revision 1, Enclosure 3 provides the 120-day SG condition monitoring (CM) report. This report is required when greater than one percent of inspected SG tubes are classified as defective. Enclosure 3 provides the complete results of secondary side pressure testing and insitu pressure testing to support CM assessments, and also provides the operational assessment (OA) for completeness. Enclosure 3 focuses on CM and OA for non-ARC degradation.

In accordance with PG&E's commitment to Generic Letter (GL) 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking" (ODSCC), Enclosure 4 provides the 90-day reporting of the results of the 2R11 SG voltage-based ARC inspections at TSP intersections, prepared by Framatome ANP for PG&E. Enclosure 4 provides the details of the CM and OA for ODSCC ARC and incorporates the probability of detection and growth rates as discussed below.

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Enclosure 5 contains an analysis of the destructive examinations of TSP ODSCC tube samples pulled during 2R11, prepared by Framatone ANP for PG&E.

Enclosure 6 contains a probabilistic risk assessment evaluation performed to determine the risk significance of operating a full cycle following 2R11 with axial ODSCC indications left in service.

The 2R11 SG tube inspection results identified two significant findings:

First, Plus Point rotating coil probes detected circumferential PWSCC in the U-bend region of rows 3 to 10, an area of the SG tube bundle that had not been previously 100% inspected by rotating probe technology. The largest indication was 100% through-wall, detected by 2R11 secondary side pressure testing, and is the likely cause of primary to secondary operational leakage in prior cycles. The root cause, CM, and OA for this degradation is discussed in Enclosure 3. The root cause of this degradation was related to the U-bend region high residual stresses inherent to the tube bending manufacturing process. The OA demonstrates the acceptability a full cycle 12 operation based on 100% Plus Point inspection of the U-bend region (rows 1 to 46) conducted during 2R11 to detect this degradation, insitu pressure testing of detected indications to demonstrate satisfaction of CM criteria, plugging of all detected indications, slow defect growth assessment, and large structural margins.

Second, large bobbin voltage increases were detected for TSP axial ODSCC indications that had been left in service per the voltage-based ARC. Specifically, an indication in the SG 2-4 tube at row 44, column 45, at the second TSP on the hot leg side (R44C45-2H) experienced a bobbin voltage change from 2 volts to 21.5 volts during Unit 2 Cycle 11. The cause of the large voltage increase was related to the exponential dependence of voltage to flaw depth and to flaw 100% throughwall length. The flawed tube was pulled, leak and burst tested, and destructively examined as documented in Enclosure 5. The leak and burst testing demonstrated satisfaction of CM acceptance criteria. The destructive examination test results validated the conclusions of the cause assessment.

In response to the ODSCC findings, several NRC notifications were made. On February 13, 2003, PG&E reported the initial 2R11 SG inspection findings by teleconference notification in accordance with TS 5.6.10.d, and Emergency Notification System (ENS #39584) reporting in accordance with TS 5.5.9, Table 5.5.9-2, and 10 CFR 50.72(b)(3)(ii)(A). On March 14, 2003, Licensee Event Report (LER) 2-2003-001, "Steam Generator Tube Plugging Due to Stress Corrosion Cracking," was submitted via DCL-03-031 in accordance with 10 CFR 50.73 (a)(2)(ii)(A), and TS 5.6.10.a and TS 5.6.10.c Special Report requirements. On March 4, 2003, the 2R11 inspection results and an analysis of the results were presented to the NRC staff at a public meeting, at which PG&E concluded that the ODSCC findings were not risk significant.

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The large voltage indication in R44C45-2H, in conjunction with using a probability of detection (POD) of 0.6 as required by GL 95-05, resulted in the calculation of a probability of burst (POB) that exceeded the 1×10^{-2} reporting threshold in GL 95-05 and TS 5.6.10.d.5 for Unit 2 Cycle 12. To reflect the virtual certainty of detecting the R44C45-2H flaw, PG&E requested use of a POD of 1.0 for the R44C45-2H flaw in License Amendment Request (LAR) 03-04, which was approved in NRC License Amendment No. 158, "Diablo Canyon Nuclear Power Plant, Unit 2 – Issuance of Amendment – Alternate method of Determining Probability of Detection for Steam Generator Tubes, TAC No. MB7875," dated June 3, 2003.

Using a POD of 1.0 for the R44C45-2H flaw and 0.6 for other indications, and using a voltage-dependent growth (VDG) methodology as presented to the NRC at the March 4, 2003, meeting, DCCP Unit 2 is projected to exceed the 1×10^{-2} POB reporting threshold during Unit 2 Cycle 12 in October 2003. Therefore, a further refinement of the POD was requested in PG&E letter DCL-03-017, dated February 24, 2003, requesting NRC approval for use of a voltage dependent POD methodology referred to as probability of prior cycle detection (POPCD). A public meeting to discuss POPCD was held with the NRC Staff on April 15, 2003. PG&E will submit a LAR requesting NRC approval to use a DCCP-specific POPCD for Unit 2 Cycle 12. Calculations using POPCD, combined with VDG methods, clearly demonstrate that the TS 5.6.10.d.5 reporting threshold for POB of 1×10^{-2} will be met for Unit 2 Cycle 12.

Sincerely,

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Enclosures

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