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January 31, 2007

PG&E Letter DCL-07-009

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, D.C. 20555-0001

Docket No. 50-275, OL-DPR-80  
Docket No. 50-323, OL-DPR-82  
Diablo Canyon Units 1 and 2  
Inspection and Mitigation of Alloy 600/82/182 Pressurizer Butt Welds

Dear Commissioners and Staff:

In October of 2006, while performing inspections of its pressurizer Alloy 600/82/182 butt welds in accordance with EPRI Materials Reliability Program Report 139 (MRP-139), a pressurized water reactor licensee discovered several circumferential indications in its pressurizer surge, safety, and relief nozzles. Because of the potential importance of this issue, Pacific Gas & Electric Company (PG&E) is submitting this letter to commit to the following actions taken or planned for Diablo Canyon Power Plant (DCPP) Units 1 and 2 for inspecting or mitigating Alloy 600/82/182 butt welds on pressurizer spray, surge and relief lines.

The pressurizer at DCPP Unit 1 does not have Alloy 600/82/182 butt welds. Future inspections of pressurizer butt welds at DCPP Unit 1 will be performed in accordance with ASME Code requirements and the Inservice Inspection Program.

Inspection or mitigation of pressurizer Alloy 600/82/182 butt welds, as described in MRP-139, has not yet been completed for DCPP Unit 2, but PG&E intends to complete all the inspection and mitigation activities on these locations during the DCPP Unit 2 Fourteenth Refueling Outage (2R14) currently scheduled to begin February 4, 2008. Details concerning the DCPP Unit 2 inspection and mitigation activities are provided in the table contained in Enclosure 1. The results of pre MRP-139 completed inspections are described in Enclosure 2. Future inspections of pressurizer butt welds at DCPP Unit 2 will be performed in accordance with industry guidance (MRP-139). The results of the next DCPP Unit 2 inspection or mitigation of pressurizer Alloy 600/82/182 butt weld locations will be reported to the NRC within 60 days of plant restart following the next inspection.

A member of the STARS (Strategic Teaming and Resource Sharing) Alliance  
Callaway • Comanche Peak • Diablo Canyon • Palo Verde • South Texas Project • Wolf Creek

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Inspection and mitigation activities at DCP Unit 2 will be completed by the spring of 2008. PG&E believes the February 2008 scheduled date for mitigation is acceptable based on the information provided below.

#### Review of Wolf Creek Pressurizer Butt Weld Indications

A review of the Wolf Creek pressurizer butt weld indications relative to safety and current inspection requirements has been performed in EPRI Letter MRP 2007-003, Attachment 1, "Implications of Wolf Creek Pressurizer Butt Weld Indications Relative to Safety Assessment and Inspection Requirements," dated January 2007. The report summary states: "In summary, it is concluded that the industry inspection schedule remains valid, supports continued uninterrupted safe plant operation, and that acceleration of the inspection schedule is not warranted."

#### Previous DCP Unit 2 Inspection Results

The results of previous DCP Unit 2 pressurizer butt weld inspections are contained in Enclosure 2. For each inspection the date performed, examination method, coverage obtained, and findings are provided. None of the examinations performed were qualified to Performance Demonstration Initiative (PDI) requirements.

In 1995, PG&E designed and procured Alloy 600/82/182 dissimilar metal weld mockups with implanted flaws specifically for ultrasonic test examiner practice on pressurizer safe end weld inspections. While the examinations preceded the qualification protocol of PDI, PG&E believes the use of the mockups enhances the credibility of the inspection results obtained.

#### Assessment of Original Fabrication Welds Documentation for Welds That Had Been Reworked

PG&E has performed a review of the available DCP Unit 2 pressurizer weld repair records. The review of the weld repair records identified that there were repairs performed to the three safety nozzles, as well as the spray nozzle. The repairs occurred during the fabrication process.

#### Unique Weld Design, Configuration, Materials, and Accessibility

Westinghouse has performed a primary water stress corrosion cracking (PWSCC) susceptibility assessment of the Alloy 600 and Alloy 82/182 components in DCP Units 1 and 2, which is documented in WCAP-16330-P, "PWSCC Susceptibility Assessment of the Alloy 600 and Alloy 82/182 Components in Diablo Canyon Units 1 and 2," dated October 2004. This assessment included a detailed review of the

DCCP Unit 2 pressurizer drawings, and determined that the upper head nozzles are equipped with stainless steel liners. This liner covers the inside surface of the spray, safety, and relief nozzles in the region of the safe-end weld. After insertion, the liner would generally be rolled tight against the nozzle bore and welded to the safe-end and nozzle cladding, sealing the safe-end weld from the pressurizer vapor space. Each liner was welded to the nozzle cladding using stainless steel weld metal, and to the nozzle safe-end using Alloy 82 metal. Therefore, the nozzle-to-safe-end weld may be isolated from the vapor space, and only the Alloy 82 weld metal at the top of the liner is exposed. Although this configuration is expected to be potentially less susceptible to cracking, the tightness of this seal has not been verified.

Electricite de France (EdF) and Framatome conducted a comprehensive series of tests on weld alloys of various chromium contents. The data consistently showed the susceptibility to PWSCC decreased as chromium content increased. Alloy 82 (Cr 18-22 percent) would then be more resistant to PWSCC than Alloy 182 (Cr 13-17 percent). This results in an overall reduction in PWSCC susceptibility at Alloy 82 weld locations over that of an Alloy 182 weld.

#### Water Chemistry, Zinc Addition

Addition of zinc to the primary coolant has been demonstrated to mitigate PWSCC in nickel-based alloy laboratory test specimens. Laboratory tests have demonstrated that zinc appears to extend the time to crack initiation and may retard crack propagation rates of active PWSCC. DCCP Units 1 and 2 have injected zinc into the reactor coolant system (RCS) since mid-1998 for Unit 1 and early 1999 for Unit 2. Zinc has had a beneficial effect on PWSCC initiation and growth rates for DCCP Units 1 and 2 Alloy 600 mill annealed steam generator (SG) tubing as described in EPRI Report 1011775, "Evaluation of Plant Data to Determine Effects of Zinc on PWSCC," dated October 2005. The DCCP Unit 2 pressurizer surge line has been subjected to a zinc environment of nominally 16 to 25 parts per billion since early 1999. This applies to the surge line only, and not to the spray or relief lines.

#### Plant Age

By 2R14, currently scheduled to begin in February 2008, DCCP Unit 2 will have operated for approximately 19.03 effective full power years (EFPY). Diablo Canyon's relative age in the industry was tabulated in EPRI MRP-48, "PWR Materials Reliability Program Response to NRC Bulletin 2001-01," dated August 2001. Of the 69 plants listed, DCCP Unit 2 is in the bottom 36 percent of EFPY time. In terms of operating history, DCCP Unit 2 is approximately the same age as Wolf Creek.

### Leakage Monitoring for Unidentified Primary System Leakage

DCCP performs a RCS leak rate calculation every 24 hours using surveillance test procedure (STP) STP I-1B. Technical Specification (TS) Surveillance Requirement (SR) 3.4.13.1 requires this calculation be performed on a 72-hour frequency. STP I-1B has a leak rate threshold of 0.3 gpm. If this threshold is exceeded, STP I-1B requires that a leak search be performed within 24 hours. STP I-1B further stipulates that if containment sump indications or radiation monitor indications suggest that a leak in containment exists, then a containment entry to search for leakage should be performed within 24 hours.

If the RCS is not stable because of power changes, or if the plant process computers are unavailable, a TS tracking sheet is initiated to assure that the calculation is run within the 72-hour SR 3.4.13.1 requirement. The mean cycle leak rate for DCCP Unit 2 Cycle 14 is 0.025 gpm with a standard deviation of 0.025 gpm.

It should be noted that due to equipment capabilities, DCCP calculates and reports total RCS leakage instead of identified leakage. Therefore, the RCS leakage that PG&E reports to the NRC via INPO and used for the leak rate calculation for comparison against the threshold value is conservative.

### Additional Leak Monitoring Actions

PG&E is evaluating PWR Owners Group standardized leak monitoring guidance and an NRC proposed leakage detection program and will inform the NRC if there are any planned changes to the leak monitoring program by March 31, 2007. In addition, PG&E is currently evaluating the feasibility of plant modifications to install diverse leakage detection capability. PG&E will submit to the NRC by May 31, 2007, any plans for additional monitoring capability, which reliably and meaningfully add to the ability to diagnose primary system leakage, and the installation schedules as appropriate.

### EPRI Advanced Non-linear Finite Element Analysis

In response to the dissimilar metal weld indications discovered in the Wolf Creek pressurizer, NEI and EPRI have initiated work to develop an advanced non-linear finite element analysis of PWSCC circumferential crack propagation in dissimilar metal welds.

Industry Actions

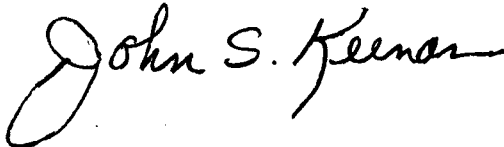
Industry actions being taken associated with pressurizer butt welds are contained in the letter from NEI to the NRC, "Industry Actions Associated with Potential Generic Implications of Wolf Creek Inspection Findings," dated January 26, 2007.

Enclosure 3 contains a list of commitments associated with this letter.

PG&E will inform the NRC prior to any revision of the pressurizer butt weld inspection schedules or RCS leak monitoring actions described in this letter.

PG&E is available to meet with the NRC to discuss any of the information in this letter. If there are any questions, please contact Stan Ketelsen at 805-545-4720.

Sincerely,



Enclosures

cc: Edgar Bailey, DHS  
Terry W. Jackson  
Bruce S. Mallett  
Diablo Distribution

cc/enc: Alan B. Wang

**Diablo Canyon Power Plant Unit 2 Previous Pressurizer Butt Weld Inspection Results**

<b>Component</b>	<b>Date</b>	<b>Outage</b>	<b>Examination Method*</b>	<b>Coverage**</b>	<b>Finding</b>
Pressurizer Spray Line	10/4/1991	2R4	Dye Penetrant	100%	No Recordable Indication (NRI)
Pressurizer Spray Line	10/5/1991	2R4	Ultrasonic	80%	NRI
Pressurizer Spray Line	4/11/1996	2R7	Ultrasonic	100%	NRI
Pressurizer Spray Line	4/11/1996	2R7	Dye Penetrant	100%	NRI
Pressurizer Spray Line	5/8/1996	2R7	Ultrasonic	100%	NRI
Pressurizer Spray Line	5/15/1996	2R7	Radiography	100%	NRI
Pressurizer Spray Line	11/17/2004	2R12	Bare Metal Visual	100%	NRI
Pressurizer Spray Line	4/24/2006	2R13	Bare Metal Visual	100%	NRI
Pressurizer Surge Line	9/29/1994	2R6	Dye Penetrant	100%	NRI
Pressurizer Surge Line	9/29/1994	2R6	Ultrasonic	92%	NRI
Pressurizer Surge Line	11/4/2004	2R12	Bare Metal Visual	100%	NRI
Pressurizer Surge Line	4/30/2006	2R13	Bare Metal Visual	100%	NRI
Pressurizer Safety 8010A	4/14/1987	2R1	Ultrasonic	100%	NRI
Pressurizer Safety 8010A	4/14/1987	2R1	Dye Penetrant	100%	NRI
Pressurizer Safety 8010A	10/4/1991	2R4	Ultrasonic	100%	NRI
Pressurizer Safety 8010A	2/26/1998	2R8	Ultrasonic	90%	NRI
Pressurizer Safety 8010A	2/26/1998	2R8	Dye Penetrant	100%	NRI
Pressurizer Safety 8010A	11/17/2004	2R12	Bare Metal Visual	100%	NRI
Pressurizer Safety 8010A	4/30/2006	2R13	Bare Metal Visual	100%	NRI
Pressurizer Safety 8010B	4/14/1987	2R1	Ultrasonic	100%	NRI
Pressurizer Safety 8010B	4/14/1987	2R1	Dye Penetrant	100%	NRI
Pressurizer Safety 8010B	10/4/1991	2R4	Ultrasonic	100%	NRI

**Diablo Canyon Power Plant Unit 2 Previous Pressurizer Butt Weld Inspection Results**

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Pressurizer Safety 8010B	2/26/1998	2R8	Ultrasonic	<100%	NRI
Pressurizer Safety 8010B	2/26/1998	2R8	Dye Penetrant	100%	NRI
Pressurizer Safety 8010B	11/17/2004	2R12	Bare Metal Visual	100%	NRI
Pressurizer Safety 8010B	4/30/2006	2R13	Bare Metal Visual	100%	NRI
Pressurizer Safety 8010C	9/6/1991	2R4	Ultrasonic	100%	NRI
Pressurizer Safety 8010C	9/6/1991	2R4	Dye Penetrant	100%	NRI
Pressurizer Safety 8010C	11/17/2004	2R12	Bare Metal Visual	100%	NRI
Pressurizer Safety 8010C	4/30/2006	2R13	Bare Metal Visual	100%	NRI
Pressurizer PORV's	9/6/1991	2R4	Ultrasonic	100%	NRI
Pressurizer PORV's	9/6/1991	2R4	Dye Penetrant	100%	Indication/Removed***
Pressurizer PORV's	11/17/2004	2R12	Bare Metal Visual	100%	NRI
Pressurizer PORV's	4/30/2006	2R13	Bare Metal Visual	100%	NRI

\* Ultrasonic examinations performed on safe-end welds were not qualified to PDI requirements. In 1995, PG&E designed and procured Alloy 600/82/182 dissimilar metal weld mockups with implanted flaws specifically for ultrasonic test examiner practice on pressurizer safe end weld inspections. While the examinations preceded the qualification protocol of PDI, PG&E believes the use of the mockups enhances the credibility of the inspection results obtained.

\*\* Where less than 100% coverage is noted, the coverage limitations are due to weld geometry.

\*\*\* Surface indication detected and removed, post removal examination resulted in no recordable indications.

## Commitments

### Commitment 1

Future inspections of pressurizer butt welds at DCP Unit 2 will be performed in accordance with industry guidance (MRP-139). The results of the next DCP Unit 2 inspection or mitigation of pressurizer Alloy 600/82/182 butt weld locations will be reported to the NRC within 60 days of plant restart following the next inspection.

### Commitment 2

PG&E is evaluating PWR Owners Group standardized leak monitoring guidance and an NRC proposed leakage detection program and will inform the NRC if there are any planned changes to the leak monitoring program by March 31, 2007. In addition, PG&E is currently evaluating the feasibility of plant modifications to install diverse leakage detection capability. PG&E will submit to the NRC by May 31, 2007, any plans for additional monitoring capability which reliably and meaningfully add to the ability to diagnose primary system leakage and the installation schedules as appropriate.

### Commitment 3

PG&E will inform the NRC prior to any revision of the pressurizer butt weld inspection schedules or RCS leak monitoring actions described in this letter.