



**Pacific Gas and
Electric Company®**

Barry S. Allen
Site Vice President

Diablo Canyon Power Plant
Mail Code 104/6
P. O. Box 56
Avila Beach, CA 93424

805.545.4888
Internal: 691.4888
Fax: 805.545.6445

August 22, 2013

PG&E Letter DCL-13-085

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

10 CFR 50.73

Docket No. 50-275, OL-DPR-80
Diablo Canyon Unit 1
Licensee Event Report 1-2013-005-00, Both Trains of Residual Heat Removal
Inoperable Due to Circumferential Crack on a Socket Weld

Dear Commissioners and Staff;

Pacific Gas and Electric Company (PG&E) submits the enclosed Licensee Event Report (LER) regarding completion of a shutdown of Diablo Canyon Power Plant, Unit 1, as required by the technical specifications when both trains of the residual heat removal system were declared inoperable due to a circumferential crack on a socket weld. PG&E is submitting this LER in accordance with 10 CFR 50.73(a)(2)(i)(A), 50.73(a)(2)(ii)(B), and 50.73(a)(2)(v)(D). All systems operated as designed with no problems observed.

PG&E makes no new or revised regulatory commitments (as defined by NEI 99-04) in this report.

This event did not adversely affect the health and safety of the public.

Sincerely,

Barry S. Allen

dnqd/4955/50570623

Enclosure

cc: Thomas R. Hipschman, NRC Senior Resident Inspector
Jennivine K. Rankin, NRR Project Manager
Steven A. Reynolds, Acting NRC Region IV
Diablo Distribution
INPO

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|--|---|---|--|----------------|--------------------------|---|------------------------------|---------------|-------------------------------------|---|--|---|-------------------------------------|--|---|---|--|--|--|---|---|--|---|---|-----------------------------------|--|--|---|---|---|---|--------------------------------------|--|--------------------------------------|--|--|--|--------------------------------------|---|---|--|--------------------------------|--|--|---|---|
| NRC FORM 366 (10-2010) | | U.S. NUCLEAR REGULATORY COMMISSION | | | APPROVED BY OMB: NO. 3150-0104 | | EXPIRES: 10/31/2013 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LICENSEE EVENT REPORT (LER) (See reverse for required number of digits/characters for each block) | | | | | Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@nrc.gov , and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. FACILITY NAME Diablo Canyon Power Plant, Unit 1 | | | | | 2. DOCKET NUMBER 50-275 | | 3. PAGE 1 OF 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4. TITLE Both Trains of Residual Heat Removal Inoperable Due to Circumferential Crack on a Socket Weld | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5. EVENT DATE | | | 6. LER NUMBER | | | 7. REPORT DATE | | | 8. OTHER FACILITIES INVOLVED | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REV NO. | MONTH | DAY | YEAR | FACILITY NAME | DOCKET NUMBER | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 06 | 25 | 2013 | 2013 | - 005 - | 00 | 08 | 22 | 2013 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9. OPERATING MODE 1 | | | 11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) <table style="width: 100%; font-size: x-small;"> <tr> <td><input type="checkbox"/> 20.2201(b)</td> <td><input type="checkbox"/> 20.2203(a)(3)(i)</td> <td><input type="checkbox"/> 50.73(a)(2)(i)(C)</td> <td><input type="checkbox"/> 50.73(a)(2)(vii)</td> </tr> <tr> <td><input type="checkbox"/> 20.2201(d)</td> <td><input type="checkbox"/> 20.2203(a)(3)(ii)</td> <td><input type="checkbox"/> 50.73(a)(2)(ii)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(viii)(A)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(1)</td> <td><input type="checkbox"/> 20.2203(a)(4)</td> <td><input checked="" type="checkbox"/> 50.73(a)(2)(ii)(B)</td> <td><input type="checkbox"/> 50.73(a)(2)(viii)(B)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(i)</td> <td><input type="checkbox"/> 50.36(c)(1)(i)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(iii)</td> <td><input type="checkbox"/> 50.73(a)(2)(ix)(A)</td> </tr> <tr> <td colspan="2">10. POWER LEVEL 100</td> <td><input type="checkbox"/> 20.2203(a)(2)(ii)</td> <td><input type="checkbox"/> 50.36(c)(1)(ii)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(iv)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(x)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(iii)</td> <td><input type="checkbox"/> 50.36(c)(2)</td> <td><input type="checkbox"/> 50.73(a)(2)(v)(A)</td> <td><input type="checkbox"/> 73.71(a)(4)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(iv)</td> <td><input type="checkbox"/> 50.46(a)(3)(ii)</td> <td><input type="checkbox"/> 50.73(a)(2)(v)(B)</td> <td><input type="checkbox"/> 73.71(a)(5)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(v)</td> <td><input checked="" type="checkbox"/> 50.73(a)(2)(i)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(v)(C)</td> <td><input type="checkbox"/> OTHER</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(vi)</td> <td><input type="checkbox"/> 50.73(a)(2)(i)(B)</td> <td><input checked="" type="checkbox"/> 50.73(a)(2)(v)(D)</td> <td>Specify in Abstract below or in NRC Form 366A</td> </tr> </table> | | | | | | | | <input type="checkbox"/> 20.2201(b) | <input type="checkbox"/> 20.2203(a)(3)(i) | <input type="checkbox"/> 50.73(a)(2)(i)(C) | <input type="checkbox"/> 50.73(a)(2)(vii) | <input type="checkbox"/> 20.2201(d) | <input type="checkbox"/> 20.2203(a)(3)(ii) | <input type="checkbox"/> 50.73(a)(2)(ii)(A) | <input type="checkbox"/> 50.73(a)(2)(viii)(A) | <input type="checkbox"/> 20.2203(a)(1) | <input type="checkbox"/> 20.2203(a)(4) | <input checked="" type="checkbox"/> 50.73(a)(2)(ii)(B) | <input type="checkbox"/> 50.73(a)(2)(viii)(B) | <input type="checkbox"/> 20.2203(a)(2)(i) | <input type="checkbox"/> 50.36(c)(1)(i)(A) | <input type="checkbox"/> 50.73(a)(2)(iii) | <input type="checkbox"/> 50.73(a)(2)(ix)(A) | 10. POWER LEVEL 100 | | <input type="checkbox"/> 20.2203(a)(2)(ii) | <input type="checkbox"/> 50.36(c)(1)(ii)(A) | <input type="checkbox"/> 50.73(a)(2)(iv)(A) | <input type="checkbox"/> 50.73(a)(2)(x) | <input type="checkbox"/> 20.2203(a)(2)(iii) | <input type="checkbox"/> 50.36(c)(2) | <input type="checkbox"/> 50.73(a)(2)(v)(A) | <input type="checkbox"/> 73.71(a)(4) | <input type="checkbox"/> 20.2203(a)(2)(iv) | <input type="checkbox"/> 50.46(a)(3)(ii) | <input type="checkbox"/> 50.73(a)(2)(v)(B) | <input type="checkbox"/> 73.71(a)(5) | <input type="checkbox"/> 20.2203(a)(2)(v) | <input checked="" type="checkbox"/> 50.73(a)(2)(i)(A) | <input type="checkbox"/> 50.73(a)(2)(v)(C) | <input type="checkbox"/> OTHER | <input type="checkbox"/> 20.2203(a)(2)(vi) | <input type="checkbox"/> 50.73(a)(2)(i)(B) | <input checked="" type="checkbox"/> 50.73(a)(2)(v)(D) | Specify in Abstract below or in NRC Form 366A |
| | | | | | | | | | | | <input type="checkbox"/> 20.2201(b) | <input type="checkbox"/> 20.2203(a)(3)(i) | <input type="checkbox"/> 50.73(a)(2)(i)(C) | <input type="checkbox"/> 50.73(a)(2)(vii) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> 20.2201(d) | <input type="checkbox"/> 20.2203(a)(3)(ii) | <input type="checkbox"/> 50.73(a)(2)(ii)(A) | <input type="checkbox"/> 50.73(a)(2)(viii)(A) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> 20.2203(a)(1) | <input type="checkbox"/> 20.2203(a)(4) | <input checked="" type="checkbox"/> 50.73(a)(2)(ii)(B) | <input type="checkbox"/> 50.73(a)(2)(viii)(B) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> 20.2203(a)(2)(i) | <input type="checkbox"/> 50.36(c)(1)(i)(A) | <input type="checkbox"/> 50.73(a)(2)(iii) | <input type="checkbox"/> 50.73(a)(2)(ix)(A) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10. POWER LEVEL 100 | | <input type="checkbox"/> 20.2203(a)(2)(ii) | <input type="checkbox"/> 50.36(c)(1)(ii)(A) | <input type="checkbox"/> 50.73(a)(2)(iv)(A) | <input type="checkbox"/> 50.73(a)(2)(x) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> 20.2203(a)(2)(iii) | <input type="checkbox"/> 50.36(c)(2) | <input type="checkbox"/> 50.73(a)(2)(v)(A) | <input type="checkbox"/> 73.71(a)(4) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> 20.2203(a)(2)(iv) | <input type="checkbox"/> 50.46(a)(3)(ii) | <input type="checkbox"/> 50.73(a)(2)(v)(B) | <input type="checkbox"/> 73.71(a)(5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> 20.2203(a)(2)(v) | <input checked="" type="checkbox"/> 50.73(a)(2)(i)(A) | <input type="checkbox"/> 50.73(a)(2)(v)(C) | <input type="checkbox"/> OTHER | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> 20.2203(a)(2)(vi) | <input type="checkbox"/> 50.73(a)(2)(i)(B) | <input checked="" type="checkbox"/> 50.73(a)(2)(v)(D) | Specify in Abstract below or in NRC Form 366A | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12. LICENSEE CONTACT FOR THIS LER | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FACILITY NAME Dan Gibbons, Engineer, Regulatory Services | | | | | | | | TELEPHONE NUMBER (Include Area Code) 805-545-4955 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO EPIX | CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO EPIX | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| B | BP | N/A | N/A | Y | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14. SUPPLEMENTAL REPORT EXPECTED | | | | | 15. EXPECTED SUBMISSION DATE | | MONTH DAY YEAR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) <p>On June 25, 2013, during a walkdown of the Diablo Canyon Power Plant (DCPP) Unit 1 containment, maintenance personnel noted an accumulation of boric acid on the inlet pipe to residual heat removal system relief valve RHR-1-RV-8708. Subsequent cleanup of the boric acid accumulation revealed an active leak of 3 drops per minute. A visual inspection identified that the source of the leak was a circumferential crack on the socket weld.</p> <p>DCPP determined that system vibration induced a low-stress, high-cycle fatigue which caused the socket weld to fail. DCPP replaced the socket weld. The new weld has improved fatigue resistance over the original, equal-leg socket weld. Additionally, DCPP will install a new support to reduce the chances of piping vibration amplification by increasing its natural frequencies to significantly higher than the current resonant frequencies.</p> <p>This condition did not adversely affect the health and safety of the public.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**LICENSEE EVENT REPORT (LER) U.S. NUCLEAR REGULATORY COMMISSION
CONTINUATION SHEET**

| 1. FACILITY NAME | 2. DOCKET | 6. LER NUMBER | | | 3. PAGE |
|-----------------------------------|-----------|---------------|----------------------|------------|---------|
| Diablo Canyon Power Plant, Unit 1 | 50-275 | YEAR | SEQUENTIAL NUMBER | REV NO. | 2 OF 4 |
| | | 2013 | - 005 | - 00 | |

NARRATIVE

I. Plant Conditions

At the time of the event, Diablo Canyon Power Plant (DCPP) Unit 1 was in Mode 1 (Power Operation) at approximately 100 percent reactor [RCT] power with normal operating reactor coolant temperature and pressure.

II. Problem Description

A. Background

The function of the emergency core cooling system (ECCS) is to provide core cooling and negative reactivity to ensure that the reactor core is protected after any of the following accidents:

- a. loss-of-coolant accident, non-isolable coolant leakage greater than the capability of the normal charging system [CB];
- b. rod ejection accident;
- c. loss-of-secondary-coolant accident, including uncontrolled steam release or loss of feedwater; and
- d. steam generator tube rupture.

The addition of negative reactivity is designed primarily for the loss-of-secondary-coolant accident where primary cooldown could add enough positive reactivity to achieve criticality and return to significant reactor power. The ECCS consists of three separate subsystems: centrifugal charging (high head) [BQ], safety injection (intermediate head), and residual heat removal (RHR) (low head) [BP]. Each subsystem consists of 2 redundant, 100 percent capacity trains.

The design function of relief valve [RV] RHR-1-RV-8708 is to protect the RHR discharge piping from exceeding its design pressure rating. The inlet pipe to the valve is connected to a 12-inch RHR header line, which provides a flow path for injection to Reactor Coolant System (RCS) [AB] Hot Legs 1 and 2. This line is occasionally used to fill the reactor cavity during refueling outages. The normal flow path for shutdown cooling (Modes 4 and 5) does not use this line.

B. Event Description

On June 25, 2013, during a walkdown of the Unit 1 containment, maintenance personnel noted an accumulation of boric acid on the inlet pipe to relief valve RHR-1-RV-8708. The problem was entered into the corrective action program. Subsequent cleanup of the boric acid accumulation revealed an active leak of 3 drops per minute (dpm). A visual inspection identified a circumferential crack on the socket weld.

The active boric acid leak was located on the common header from the RHR pump [P] discharge to RCS Hot Legs 1 and 2. The active boric acid leak could not be isolated. Both trains of the RHR system were declared inoperable and Technical Specification (TS) 3.0.3 was entered on June 25, 2013 at 2158 PDT. DCPP made a 4-hour report to the NRC about the TS-required shutdown of Unit 1 (NRC Event Notification Number 49148).

LICENSEE EVENT REPORT (LER) U.S. NUCLEAR REGULATORY COMMISSION
CONTINUATION SHEET

| 1. FACILITY NAME | 2. DOCKET | 6. LER NUMBER | | | 3. PAGE |
|-----------------------------------|-----------|---------------|----------------------|------------|---------|
| Diablo Canyon Power Plant, Unit 1 | 50-275 | YEAR | SEQUENTIAL NUMBER | REV NO. | 3 OF 4 |
| | | 2013 | - 005 | - 00 | |

NARRATIVE

C. Status of Inoperable Structure, Systems, or Components That Contributed to the Event

None.

D. Other Systems or Secondary Functions Affected

None.

E. Method of Discovery

During a walkdown of the Unit 1 containment, maintenance personnel noted an accumulation of boric acid on the inlet pipe to relief valve RHR-1-RV-8708. Subsequent cleanup of the boric acid accumulation revealed an active leak of 3 dpm. A visual inspection identified that the source of the leak was a circumferential crack on the socket weld.

F. Operator Actions

Operators declared both RHR trains inoperable.

G. Safety System Responses

None.

III. Cause of the Problem

DCCP determined that the socket weld on the inlet piping to relief valve RHR-1-RV-8708 failed due to low-stress, high-cycle fatigue (from operation-induced system vibration) and a lack of fusion in the weld root. The crack initiated at a stress riser and propagated due to cyclical loading.

IV. Assessment of Safety Consequences

DCCP assessed the Unit 1 risk significance of a leak in the vent line of the RHR supply line to the Hot Leg 1 and 2 supply lines. This assessment concluded that the incremental conditional core damage probability was less than 1.0E-06/year. Therefore, the event is not considered risk significant and did not adversely affect the health and safety of the public.

V. Corrective Actions

A. Immediate Corrective Actions

DCCP replaced the socket weld on June 27, 2013. The new weld uses a 2:1-leg ratio fillet weld, which has improved fatigue resistance over the original equal-leg socket weld. This weld configuration has been

**LICENSEE EVENT REPORT (LER) U.S. NUCLEAR REGULATORY COMMISSION
CONTINUATION SHEET**

| 1. FACILITY NAME | 2. DOCKET | 6. LER NUMBER | | | 3. PAGE |
|-----------------------------------|-----------|---------------|----------------------|------------|---------|
| Diablo Canyon Power Plant, Unit 1 | 50-275 | YEAR | SEQUENTIAL NUMBER | REV NO. | 4 OF 4 |
| | | 2013 | - 005 | - 00 | |

NARRATIVE

recommended by the Electric Power Research Institute and is used by the industry and DCPD where enhanced fatigue resistance is required.

B. Other Corrective Actions

DCPD will install new, rigid-lateral support(s) on the discharge line from relief valve RHR-1-RV-8708. The new support(s) will reduce the chances of piping vibration amplification by increasing its natural frequencies to significantly higher than the current resonant frequencies. DCPD will also assess extent of cause for additional socket welds in susceptible locations.

VI. Additional Information

A. Failed Components

DCPD discovered a circumferential crack on the socket weld on the inlet to relief valve RHR-1-RV-8708.

B. Previous Similar Events

DCPD – On February 8, 1999, an operator observed a leak on the weld for chemical and volume control system valve CVCS-2-839 while on routine rounds. The cause of the leak was determined to be high-cycle fatigue of the socket-welded connection due to degraded positive displacement pump operation causing excessive vibration of the piping near the pumps, which led to the growth of through-wall cracks. The corrective action was to remove the valve/pipe assembly and install a plug in the fitting.