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March 30, 2015

PG&E Letter DCL-15-041

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

10 CFR 50.73

Docket No. 50-323, OL-DPR-82
Diablo Canyon Power Plant, Unit 2
Supplemental Licensee Event Report 2-2013-004-01, Technical Specification 3.8.1
Not Met Due to Failed Wire Lug on Emergency Diesel Generator 2-3

Dear Commissioners and Staff:

In accordance with 10 CFR 50.73(a)(2)(i)(B) and 10 CFR 50.73(a)(2)(v)(D), Pacific Gas and Electric Company (PG&E) is submitting the enclosed Supplemental Licensee Event Report (LER) regarding Technical Specification 3.8.1, "AC Sources – Operating," not being met due to a failed wire lug on Emergency Diesel Generator 2-3.

PG&E is issuing this supplemental LER to update the assessment of safety consequences.

PG&E makes no new or revised regulatory commitments (as defined by NEI 99-04) in this report. All the corrective actions identified in this letter will be implemented in accordance with the Diablo Canyon Power Plant Corrective Action Program.

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

Sincerely,

Barry S. Allen

aph8/6470/ 50691194

Enclosure

cc/enc: Marc L. Dapas, NRC Region IV Administrator
Thomas R. Hipschman, NRC Senior Resident Inspector
Siva P. Lingam, NRR Project Manager
INPO
Diablo Distribution

APPROVED BY OMB: NO. 3150-0104

EXPIRES: 01/31/2017

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 and Information Collections Branch (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.

| | | |
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| 4. TITLE |
|--|
| Technical Specification 3.8.1 Not Met Due to Failed Wire Lug on Emergency Diesel Generator 2-3 |

| 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 | 08 | 2013 | 2013 | 004 | - 01 | 03 | 30 | 2015 | FACILITY NAME | DOCKET NUMBER |

| 9. OPERATING MODE | 11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: <i>(Check all that apply)</i> | | | |
|-------------------|--|---|---|---|
| 1 | <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 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 | <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 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 checked="" 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 | |
| LICENSEE CONTACT Andrew Heffner, Regulatory Services Engineer | TELEPHONE NUMBER <i>(Include Area Code)</i> 805-545-6470 |

| 13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT | | | | | | | | | | |
|---|--------|-----------|-------------------|-----------------------|--|-------|--------|-----------|-------------------|-----------------------|
| CAUSE | SYSTEM | COMPONENT | MANU- FACTURER | REPORTABLE TO EPIX | | CAUSE | SYSTEM | COMPONENT | MANU- FACTURER | REPORTABLE TO EPIX |
| B | EK | CON | T198 | Y | | | | | | |

| | | | | |
|--|-------------------------------------|-------|-----|------|
| 14. SUPPLEMENTAL REPORT EXPECTED <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO | 15. EXPECTED SUBMISSION DATE | MONTH | DAY | YEAR |
| | | | | |

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On June 8, 2013, at 08:40 PDT, with Diablo Canyon Power Plant (DCPP) Unit 2 in Mode 1 at 100 percent power, Emergency Diesel Generator (EDG) 2-3 failed to complete a scheduled surveillance run. Cyclic fatigue failure of a wire lug in the EDG 2-3 current differential protection circuit caused an automatic EDG shut down 21 hours and 42 minutes into the 24-hour load run. DCPP determined the last time EDG 2-3 would have been able to complete its 24-hour surveillance run was greater than the technical specification allowed outage time. Additionally, during the time that EDG 2-3 was unable to complete its load run, EDGs 2-1 and 2-2 also had been declared inoperable on several occasions.

DCPP determined that a vibrating terminal block cover induced cyclical fatigue in the wire lug, causing it to fail. DCPP replaced the broken wire lug and permanently removed the cover. Additionally, DCPP will revise a procedure to periodically inspect for wear on the wires and lugs.

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

**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

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 and Information Collections Branch (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.

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NARRATIVE**I. Plant Conditions**

At the time of the event, Unit 2 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**

Diablo Canyon Power Plant (DCPP) Units 1 and 2 each have three emergency diesel generators (EDGs) [DG] that provide vital backup power to each unit's three electrical buses [BU] to mitigate the consequences of a design basis accident (DBA) if off-site power sources are unavailable. DCPP EDGs are designed to function so that a single failure of any EDG will not jeopardize the capability of the remaining EDGs to start and provide power to operate the systems required to mitigate any DBA condition. In order to ensure that an EDG can perform its design function, it is tested by continuously operating at full-load for an interval of not less than 24 hours.

Each EDG has differential relays [87] that monitor phase currents and compare them with the corresponding phase currents on the 4 kV Bus side of the generator output breaker [BKR]. If a phase current is different between generator [GEN] and bus sides of the breaker, that differential relay actuates. This condition actuates an alarm [ALM] in the Control Room [NA], energizes blue lights in the Control Room and on the 4 kV relay board [PL], and energizes the diesel shutdown lockout relay [86], which shuts down the EDG.

The wire terminations for the current transformer inputs to the differential relays are located in junction boxes [JBX]. The configuration of the junction boxes in the EDG rooms is not the same for all six EDGs. EDGs 1-1, 1-2, 1-3, 2-1, and 2-2 have their junction box mounted directly onto the generator housing, roughly 4-1/2 feet above ground on the generator centerline. They are lower to the ground and extremely secure, whereas the junction box on EDG 2-3 is mounted to two supports [SPT] that are connected to the top of the high voltage termination cabinet [CAB], roughly 7 feet above ground. When EDG 2-3 is running, its junction box experiences a higher level of vibration than the other EDG junction boxes. Additionally, the equipment inside the junction boxes is not the same for all six EDGs. EDGs 1-1, 1-2, 1-3, 2-1, and 2-2 have a terminal block [BLK] inside of their junction boxes and no terminal block cover. EDG 2-3 has a terminal block and state switches [89] beneath a terminal block cover inside of its junction box.

B. Event Description

During a performance of DCPP Procedure STP M-9G, "Diesel Generator 24-Hour Load Test and Hot Restart Test," on June 8, 2013, the control room received two unexpected alarms for EDG 2-3. Operators recognized that 4 kV, Bus F, Differential Relay 87HFG had actuated and shut down EDG 2-3 21 hours and 42 minutes into the 24-hour load run. DCPP determined that a broken wire lug [CON] in the Differential Relay 87HFG circuit removed an input signal to the relay. Subsequent evaluation concluded that terminal block cover vibration against the wire [WEL] induced a cyclical fatigue in the wire lug. Inspection of the junction boxes for the other EDGs showed no signs of wear.

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Due to the nature of the failure, DCPD determined that the last time that EDG 2-3 would have been able to meet its surveillance requirement to complete a 24-hour load run was April 11, 2013.

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

EDG 2-3 was unable to perform its safety function from April 11, 2013, until June 8, 2013. During this window, EDGs 2-1 and 2-2 were declared inoperable on multiple occasions, but remained capable of performing their safety function via manual operator action.

EDG 2-1 was declared inoperable on the following four occasions (all times PDT):

- May 1, 2013, from 01:32 – 04:21, for scheduled surveillance
- May 28-29, 2013, from 21:43 – 00:13, for scheduled surveillance
- May 27, 2013, from 20:19 – 22:57, for corrective maintenance
- May 29, 2013, from 03:05 – 14:21, for corrective maintenance

EDG 2-2 was declared inoperable on the following two occasions (all times PDT):

- April 25-26, 2013, from 21:59 – 00:32, for scheduled surveillance
- May 24-25, 2013, from 10:01 – 16:38, for scheduled surveillance

For those periods that EDG 2-1 or 2-2 were declared inoperable, DCPD Unit 2 only had one operable EDG, when two are required to be operable to perform the designed safety function of providing vital emergency power. This condition could have prevented the fulfillment of the EDG's designed safety function to mitigate the consequences of a DBA.

D. Other Systems or Secondary Functions Affected

None.

E. Method of Discovery

Annunciators PK18-14, "DSL GEN 2-3 BKR DIFFERENTIAL TRIP" and PK18-15, "DSL 2-3 SHUTDOWN RELAY TRIP" alarmed in the Control Room.

F. Operator Actions

Operators observed EDG 2-3 coasting down normally, DG 2-3 blue light lit on Panel VB4, and 4 kV, Bus F, Differential Relay 87HFG actuated. Operators declared EDG 2-3 inoperable.

G. Safety System Responses

None.

III. Cause of the Problem

The apparent cause of the EDG 2-3 trip was a broken wire lug in the Differential Relay 87HFG current transformer circuit. This broken lug removed one phase of the generator-side current input signal to the differential relay.

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Subsequent evaluation concluded that terminal block cover vibration against the wire induced a cyclical fatigue in the wire lug.

IV. Assessment of Safety Consequences

DCPP performed a quantitative risk analysis for a 58-day exposure period. This timeframe is based on the last time that EDG 2-3 would have been able to successfully complete a 24-hour load run. EDGs 2-1 and 2-2 were capable of performing their safety function (via manual operator action) and EDG 2-3 would start, load the associated bus, and run for at least 22 hours prior to failure. In that time, the offsite power supply would likely have been recovered. Based on these considerations, DCPP concluded that the incremental conditional core damage probability was less than 1E-06.

V. Corrective Actions

A. Immediate Corrective Actions

DCPP replaced and reconnected the broken wire lug.

B. Other Corrective Actions

DCPP permanently removed the terminal block cover, and will revise DCPP Procedure STP M-81G, "Diesel Engine Generator Inspection," to include a step to inspect terminations at the generator junction box for tightness and cyclic fatigue.

VI. Additional Information

A. Failed Components

DCPP discovered a broken wire lug at Junction Box BTA503 in the current transformer input circuit for Differential Relay 87HFG.

B. Previous Similar Events

Diablo Canyon – On December 11, 1989, EDG 1-2 tripped due to a differential relay actuation. Troubleshooting found a broken lug in the current transformer output circuit for a differential relay.