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PG&E Letter DCL-11-118

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 1-2011-005-01
Emergency Diesel Generator Actuations Upon Loss of 230 kV Startup Due to Electrical Maintenance Testing Activities

Dear Commissioners and Staff:

Pacific Gas and Electric Company submits the enclosed Licensee Event Report (LER) regarding the Diablo Canyon Power Plant Unit 1 emergency diesel generator actuations after 230 kV startup power was lost due to maintenance activities. This LER is submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A) and 10 CFR 50.73(a)(2)(v)(D). This supplement provides cause for the events, along with associated corrective actions.

There are no new or revised regulatory commitments in this report.

These events did not adversely affect the health and safety of the public.

Sincerely,

James R. Becker

dnpo/50412203
Enclosure
cc/enc: Elmo E. Collins, NRC Region IV
Michael S. Peck, NRC Senior Resident Inspector
James T. Polickoski, NRR Project Manager
Alan B. Wang, NRR Project Manager
INPO
Diablo Distribution

NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2013

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.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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4. TITLE

Emergency Diesel Generator Actuations Upon Loss of 230 kV Startup Due to Electrical Maintenance Testing Activities

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
										05000
05	26	2011	2011	- 5 -	1	11	08	2011	FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE

1

10. POWER LEVEL

100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☑ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☑ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
Thomas R. Baldwin, Manager, Regulatory Services	(805) 545-4720

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

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☑ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

At the time of the events, the Unit 2 Sixteenth Refueling Outage (2R16) was ongoing and electrical maintenance personnel were performing scheduled 230 kV system testing on the 230 kV electrical protection equipment. On May 26, 2011, at 0226 PDT, and again on May 27, 2011, at 1212 PDT, while personnel were performing testing on Unit 2 to verify functionality of the 230 kV electrical protection equipment, Unit 1 lost 230 kV startup power.

The isolation of the offsite standby power source, and subsequent loss of power to startup feeder breakers for the 4.16 kV operating buses, caused all Unit 1 emergency diesel generators (EDGs) to start in standby mode. For both events, all Unit 1 EDGs started as designed, and were shutdown and returned to auto with no problems observed. Plant operators returned Startup Transformers 1-1 and 1-2 to service, and declared Unit 1 startup power operable. Startup power on Unit 2 was cleared due to the maintenance activities being performed; therefore, it was unaffected by the events.

The cause of the events was human error enabled by inconsistent reinforcement of human performance tools on the part of Electrical Maintenance leadership. A contributing cause for the event on May 26, 2011 was an inadequate procedure which lacked precise written work instructions, and did not call for the use of human performance tools and verification practices. Corrective actions focus on developing precise work instructions and strengthening the consistent use of correct human performance tools. Also, for equipment which can potentially impact both units, plant personnel will use robust barriers while work is in progress.

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NARRATIVE

I. PLANT CONDITIONS

When the events occurred, Unit 1 was in Mode 1 (Power Operation) at approximately 100 percent power.

II. DESCRIPTION OF PROBLEM

A. BACKGROUND

The Diablo Canyon Power Plant (DCPP) electrical systems are designed to ensure an adequate supply of electrical power to all essential auxiliary equipment during normal operation and under accident conditions. Nonvital 4.16 kV alternating current (AC) auxiliary buses are energized by either offsite power or power from the main generator. Vital AC buses [EA] [BU] have an additional available source: onsite power delivered by diesel generators. The electrical systems are designed so that failure of any one electrical device will not prevent operation of the minimum required engineered safety feature (ESF) equipment.

General Design Criteria (GDC) 17 states, in part,

"An onsite electric power system and an offsite electric power system shall be provided to permit functioning of structures, systems, and components important to safety. The safety function for each system (assuming the other system is not functioning) shall be to provide sufficient capacity and capability to assure that (1) specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences and (2) the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents."

DCPP offsite power is supplied by two systems that are physically and electrically separated and independent of each other: a 230 kV system and a 500 kV system. This satisfies requirements established by GDC 17. The 230 kV system provides startup power and is immediately available following a loss-of-coolant accident (LOCA) to assure that core cooling, containment integrity, and other vital safety functions are maintained. To make power available to the vital 4.16 kV buses, the 230 kV system provides power to Startup Transformer (SUT)[EA][XFMR] 1-1 (230 kV to 12 kV), energizing the 12 kV bus which then feeds SUT 1-2 (12 kV to 4.16 kV). The 500 kV system provides for transmission of the plant's power output, and is also available as a delayed access source of offsite power after the main generator is disconnected.

To produce onsite power, each unit has three emergency diesel generators (EDGs)[EK][DG] which supply power to the 4.16 kV vital AC buses when power is unavailable or when a degraded voltage condition exists. After the EDGs start, they will supply power to their respective vital bus if the buses are deenergized. If the vital buses are not deenergized, the EDGs will continue to run in standby mode, ready to provide power if required. The EDGs will also start in standby mode on loss of startup power availability.

B. EVENT DESCRIPTION

At the time of the events, the Unit 2 Sixteenth Refueling Outage (2R16) was ongoing and electrical maintenance personnel were performing scheduled 230 kV system testing on the 230 kV electrical protection equipment. On May 26, 2011, at 0226 PDT, and again on May 27, 2011, at 1212 PDT, while personnel were performing testing on Unit 2 to verify functionality of the 230 kV electrical protection equipment, Unit 1 lost 230 kV startup power.

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The isolation of the offsite standby power source, and subsequent loss of power to startup feeder breakers for the 4.16 kV operating buses, caused all Unit 1 EDGs to start in standby mode. For both events, all Unit 1 EDGs started as designed, and were shutdown and returned to auto with no problems observed. Plant operators returned SUTs 1-1 and 1-2 to service and declared Unit 1 startup power operable on May 26, 2011, at 1710 PDT, for the first event, and on May 27, 2011, at 1337 PDT, for the second event.

Startup power on Unit 2 was cleared due to the maintenance activities being performed; therefore, it was unaffected by the events.

On May 26, 2011, at 0957 PDT, and on May 27, 2011, at 1712 PDT, Pacific Gas & Electric (PG&E) made 8 hour nonemergency reports (Reference NRC Event Notification 46894 and 46900) in accordance with 10 CFR 50.72(b)(3)(iv)(A).

C. STATUS OF INOPERABLE STRUCTURE, SYSTEMS, OR COMPONENTS THAT CONTRIBUTED TO THE EVENT

There were no inoperable structures, systems, or components that contributed to the event. All systems functioned as designed.

D. OTHER SYSTEMS OR SECONDARY FUNCTIONS AFFECTED

No other systems or secondary functions were affected.

E. METHOD OF DISCOVERY

The event was immediately known to licensed plant operators by alarms and indications received in the control room.

F. OPERATOR ACTIONS

Plant operators performed required surveillances, secured the Unit 1 EDGs, and proceeded to restore the availability of startup power to Unit 1.

G. SAFETY SYSTEM RESPONSES

All Unit 1 EDGs started as designed with no problems observed.

III. CAUSE OF THE PROBLEM

A. IMMEDIATE CAUSE

PG&E concluded that the event on May 26, 2011, was caused by personnel attaching test equipment to terminals associated with the incorrect 230 kV protection system circuit (incorrect current transformer). The event on May 27, 2011, was caused by personnel attaching test equipment to terminals associated with a 230 kV protection system relay on the incorrect unit.

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B. CAUSE

The cause of the events was human error enabled by inconsistent reinforcement of human performance tools on the part of Electrical Maintenance leadership.

Plant personnel involved with testing on May 26, 2011, retained an inadequate mental model of the electrical circuitry being tested. A contributing cause for this event was an inadequate procedure which lacked precise written work instructions, and did not call for the use of human performance tools and verification practices.

On May 27, 2011, electrical maintenance personnel conducted a dry run of the Unit 2 test. They connected test equipment to terminals on the Unit 1 terminal block as that was easier to access and was similar to the Unit 2 terminal block. When proceeding to conduct the actual test on Unit 2, the individual inadvertantly attached test equipment to the Unit 1 terminal block, as practiced. Lack of proceduralized use of human performace tools such as place keeping, concurrent verification practices, and operational flagging contributed to this error.

IV. ASSESSMENT OF SAFETY CONSEQUENCES

At DCPP, the 230 kV startup system is the only offsite power system which is designed to be immediately available to mitigate the consequences of postulated accidents; therefore, this event could have prevented fulfillment of a safety function of the offsite electric power system. However, the Class 1E onsite EDGs remained available and would have provided power following a loss of offsite power.

The voltage on operating 12 kV buses was not affected by the isolation of 230 kV startup power, and the EDGs were not required since all vital buses were energized by Unit 1 auxiliary power (the Unit 1 main generator). As a result, no vital loads were affected by this event.

The increased conditional core damage probability for this event was assessed and found to be less than 4E-07.

This event had no adverse effect on the health and safety of the public.

V. CORRECTIVE ACTIONS

A. IMMEDIATE CORRECTION ACTIONS

For the May 26, 2011 event, PG&E performed troubleshooting to verify that the circuit was configured per the approved design; no issues were noted. The day and nightshift employees that perform this work were briefed on the event and on the station human performance tools that prevent such occurrences. Shortly after, with direct management oversight, the current circuit loop functional test was re-performed successfully.

For the event on May 27, 2011, PG&E re-performed the pre-job brief, focusing on roles and responsibilities, and installed barriers on all inservice relays that were not part of the testing. Management provided direct oversight, and independent verification was used for all restoration actions of the procedure.

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NARRATIVE

B. CORRECTIVE ACTIONS (CAs)

CAs Common to Both Events:

1. Procedure AD7.DC8, "Work Planning," will be revised to include additional steps for work involving panels which contain sensitive or repositionable components or equipment that impact both Units 1 and 2. The procedure will instruct personnel to install temporary protective barriers in order to shield components or equipment associated with the opposite unit. It will also require performance of an engineering evaluation for any physical work on electrical relays (e.g., cutting, hammering), as well as recommendations for risk mitigation.

2. Personnel will install permanent signage or hardened barriers on electrical panels containing components or equipment that can potentially impact both Units 1 and 2.

3. PG&E will strengthen correct component verification practices for maintenance activities, requiring use of robust barriers on adjacent components, as well as provide initial and refresher training on the use of these barriers.

4. Create a dynamic learning activity to emphasize and demonstrate consistent, sustained use of human performance tools directly applicable to plant work.

Additional CAs Unique to Event on May 26, 2011:

5. Maintenance Services training (initial and recurring) will be developed for successful supervisor coaching. The training will focus on effective coaching for accomplishing work while demonstrating appropriate behaviors, such as correct use of human performance tools and verification practices. It will also focus on identifying opportunities for coaching.

6. PG&E will provide precise written instructions for the performance of current circuit tests.

VI. ADDITIONAL INFORMATION

A. FAILED COMPONENTS

All components functioned as designed.

B. PREVIOUS SIMILAR EVENTS

A previous event occurred during 2R16 when personnel were modifying a panel that houses 230 kV electrical protection equipment. During modification, there was a similar loss of 230 kV startup power and EDG actuation on Unit 1 (See ML111820377, Licensee Event Report submitted on June 30, 2011).