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PG&E Letter DCL-99-131

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


Docket No. 50-275, OL-DPR-80  
Diablo Canyon Unit 1  
Licensee Event Report 1-1999-008-00  
Engineered Safety Feature Actuation - Auxiliary Feedwater Pump 1-1 Started on  
12 kV Undervoltage due to Personnel Error

Dear Commissioners and Staff:

PG&E is submitting the enclosed licensee event report regarding an engineered safety features actuation during a transfer to startup power due to a personnel error.

This event was not considered risk significant and did not adversely affect the health and safety of the public.

Sincerely,



for DHO

David H. Oatley

cc: Steven D. Bloom  
Malkiat S. Dhillon  
Marji A. Hernandez  
Ellis W. Merschoff  
David L. Proulx  
Diablo Distribution  
INPO

Enclosure

LMP/2246/Q0012148

201006

JE 22/1

# LICENSEE EVENT REPORT (LER)

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TITLE (4)  
**Engineered Safety Feature Actuation - Auxiliary Feedwater Pump 1-1 Started on 12 kV Undervoltage due to Personnel Error**

EVENT DATE (5) MO DAY YEAR			LER NUMBER (6) YEAR SEQUENTIAL NUMBER REVISION NUMBER				REPORT DATE (7) MO DAY YEAR			OTHER FACILITIES INVOLVED (8) FACILITY NAME DOCKET NUMBER									
09	23	1999	1999	-	0	0	8	-	0	0	10	22	1999						

OPERATING MODE (9) <b>3</b>	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (11)	
POWER LEVEL (10) <b>0 0 0</b>	<input checked="" type="checkbox"/> <b>X</b>	<b>10 CFR 50.73(a)(2)(iv)</b>
	<input type="checkbox"/> <b>OTHER</b>	
(SPECIFY IN ABSTRACT BELOW AND IN TEXT, NRC FORM 366A)		

LICENSEE CONTACT FOR THIS LER (12)		TELEPHONE NUMBER	
<b>Roger L. Russell - Senior Regulatory Services Engineer</b>		AREA CODE <b>805</b>	NUMBER <b>545-4327</b>

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)									
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14) <input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)	<input checked="" type="checkbox"/> NO	EXPECTED SUBMISSION DATE (15) MON DAY YR
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ABSTRACT (Limit to 1400 spaces. i.e., approximately 15 single-spaced typewritten lines.) (16)

On September 23, 1999, at 1752 PDT, with Unit 1 in Mode 3 (Hot Standby), an engineered safety features (ESF) actuation, automatic start of Turbine Driven Auxiliary Feedwater Pump (TDAFW) 1-1 from 12 kV bus undervoltage, occurred during an automatic transfer of offsite power from the 500 kV system source to the 230 kV system startup source. The automatic transfer was initiated when Diablo Canyon Switching Center personnel cut in a 500 kV overvoltage (OV) protective relay with a trip signal picked up. All equipment responded as designed. Operators secured the TDAFW pump within 5 minutes. A 4-hour non-emergency report was made in accordance with 10CFR 50.72(b)(2)(ii) at 2313 PDT; however, the report was made 1 hour and 21 minutes late.

The ESF actuation was caused by an undervoltage condition on the 12 kV buses which was caused by a slow transfer to startup power. The transfer to startup power was caused by a personnel error, noncognitive. The late notification to the NRC was caused by a cognitive personnel error.

Corrective actions include training the switchyard operators on the unique design of the OV relay, modifying or replacing the OV relays, and training the licensed plant operators on reportability requirements of 10CFR50.72.

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I. Plant Conditions

Unit 1 was shut down in Mode 3 (Hot Standby), with the reactor coolant system (RCS) at 547 degrees F and 2235 psig. Operators were preparing to restart the unit after a reactor trip on September 22, 1999, due to a lightning strike (LER 1-1999-006).

II. Description of Problem

A. Summary

On September 23, 1999, at 1752 PDT, Unit 1 experienced an engineered safety features (ESF) actuation [JE], automatic start of turbine driven Auxiliary Feedwater (TDAFW) Pump 1-1 [BA] from 12 kV bus [EA] undervoltage [27], during an automatic transfer of offsite power from the 500 kV system source [EL] to the 230 kV system startup source. The automatic transfer was initiated when Diablo Canyon Switching Center (DCSC) [FK] personnel cut in a 500 kV overvoltage (OV) protective relay [59] with a trip signal picked up. All equipment responded as designed. Operators secured the TDAFW pump within 5 minutes. A 4-hour non-emergency report was made in accordance with 10CFR 50.72(b)(2)(ii) at 2313 PDT; however, the report was made 1 hour and 21 minutes late.

B. Background

On September 22, 1999, Unit 1 tripped from 100 percent power when lightning caused a 500 kV protective relay (559-1, General Electric model IAV 71-B) to trip the 500 kV breakers. Refer to LER 1-1999-006-00 for details. The AC overvoltage (OV) 500 kV line relay 559-1 protects the plant from OV conditions on the 500 kV transmission system. The relay was designed with two settings - instantaneous at 650 kV phase to phase and 606 kV with a time delay relay. The function of the relay is OV, not lightning protection. When actuated, the relay trips the 500 kV breakers, but does not initiate a unit trip. This design allows the unit to attempt recovery from a full load rejection.

The lightning arrestors are designed to protect the high voltage winding of the main and startup transformers against impulse and switching surges on the transmission line.

DCPP has two offsite power sources available: 1) auxiliary power backfed from the 500 kV switchyard, and 2) startup power supplied from the 230 kV switchyard.

When the 500 kV breakers open, an automatic bus transfer signal is initiated to transfer to the startup power source. This transfer may be

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either "fast" or "slow" depending on whether the 12 kV bus voltage is in synchronism with the startup power source. In this case, the bus transfer was "slow" because the OV relay does not initiate a unit trip, rather the transfer is initiated through a series of auxiliary relays that sense the position of the power circuit breakers (PCB's) whose time delays prevent a fast transfer. The "slow" transfer typically occurs in about 0.5 seconds compared to a few cycles for the "fast" transfer. During the "slow" transfer, the supply breaker from auxiliary power opens, 12kV bus voltage decays to 25 percent of rated voltage (3000 volts), and then the supply breaker from the startup source closes to reenergize the bus. For the TDAFW pump ESF actuation, the voltage decay is sensed by two relays on each of the two 12 kV buses. The actuation setpoint is 8050 volts on the 12 kV bus. When one of two relays on both of the buses senses the undervoltage condition, TDAFW pump is given a start signal. This is an anticipatory ESF actuation for a loss of AC power.

C. Event Description

On September 22, 1999, at 0932 PDT, Unit 1 500 kV generator output breakers opened after a lightning strike caused the OV protection relay to actuate (see LER 1-1999-006-00). Technicians in the 500 kV switchyard removed the relay for investigation, and reinstalled the relay. The switchyard operator checked the visible time OV contacts open and cut in the relay in accordance with standard practice and general operating instructions.

On September 23, 1999, at 0722 PDT, because of an impending lightning storm, the relay's trip feature was again cut out by recommendation of PG&E system protection engineers.

On September 23, 1999, at approximately 1100 PDT, the 500 kV switchyard charts recorded another apparent lightning strike. This voltage transient caused the instantaneous OV unit to actuate again; however, because the relay's output was cut out, the 500 kV breakers remained closed and the relay's instantaneous OV unit remained picked up. Further, no alarm was generated to alert the switchyard operators to either the voltage spike on the recorder or the relay actuation.

On September 23, 1999, at 1743 PDT, with power being supplied by backfeeding from the 500 kV switchyard, plant operators began Unit 1 reactor start-up by pulling shutdown banks.

On September 23, 1999, at 1752 PDT, switchyard operators cut in the OV trip feature. The switchyard operator did not check the relay for a trip signal before cutting it in. There had been no work accomplished on the

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relay and the condition of the relay was not expected to have changed since the last time the operator had checked the relay. The relay opened the Unit 1 500 kV PCBs, 532 and 632, causing a loss of offsite power. The power loss initiated a "slow" automatic transfer to the 230 kV source of offsite power (startup). The "slow" bus transfer actuated the TDAFW pump as designed. The transfer to startup power automatically started a second auxiliary saltwater (ASW) pump, and the standby containment fan cooler units. The emergency diesel generators did not automatically start because the 4 kV bus undervoltage setpoints were not reached. All equipment operated as designed.

On September 23, 1999, at 1756 PDT, plant operators secured from the reactor start-up, and began manually inserting all control rods.

On September 23, 1999, at approximately 1757 PDT, plant operators secured the TDAFW pump.

On September 23, 1999, at 1804 PDT, switchyard operators reclosed PCB 632 restoring availability of the 500 kV offsite power source.

On September 23, 1999, at 1805 PDT, plant operators opened the reactor trip breakers.

On September 23, 1999, at approximately 2230 PDT, an off-duty senior reactor operator who learned of the event, called the Unit 1 shift foreman to question if there was a reportable ESF actuation. The shift foreman informed the shift supervisor that the TDAFW pump had actuated.

On September 23, 1999, at 2313 PDT, the 4-hour non-emergency notification was made to the NRC, in accordance with 10CFR 50.72(b)(2)(ii), however, the report was 1 hour and 21 minutes late.

**D. Inoperable Structures, Components, or Systems that Contributed to the Event**

None

**E. Dates and Approximate Times for Major Occurrences**

1. September 23, 1999 at 0722 PDT: The OV relay's trip feature was cut out for further monitoring.
2. September 23, 1999 at 1100 PDT: A lightning strike caused the OV relay to seal in a trip signal.
3. September 23, 1999, at 1752 PDT: Switchyard operators cut in the OV protection relay causing a loss of offsite power.

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- 4. September 23, 1999, at 1752 PDT:      12 kV undervoltage ESF relays actuated starting the TDAFW
- 5. September 23, 1999, at 1757 PDT:      Plant operators secured the TDAFW pump.
- 6. September 23, 1999 at 1804 PDT:      Switchyard operators restored 500 kV offsite power source.
- 7. September 23, 1999 at 2313 PDT:      A 4-hour non-emergency notification was made to the NRC in accordance with 10 CFR 50.72(b)(2)(ii).

**F. Other Systems or Secondary Functions Affected**

The excess feedwater flow delivered by the TDAFW pump combined with the steam flow supplying the TDAFW pump caused an RCS cooldown of approximately 7 degrees F. The cooldown caused pressurizer level to drop below the letdown isolation setpoint.

The automatic transfer tripped the spent fuel pool cooling pump [DA].

**G. Method of Discovery**

The alarms and control board indications made the event immediately apparent to the operators.

**H. Operator Actions**

Operators noted the RCS cooldown and took prompt action to secure the TDAFW pump, and recover plant temperature in accordance with normal operating procedures. Operators secured from the reactor startup, inserted all control rods, and opened the reactor trip breakers. The 500 kV offsite power source was restored within 12 minutes. Operators recovered pressurizer level, and restored letdown within 18 minutes, and restored spent fuel pool cooling within 50 minutes.

**I. Safety System Responses**

The TDAFW pump start occurred as designed in response to the anticipatory loss of offsite power signal as described above. Several other components, such as containment fan coolers, and ASW pumps also automatically restarted after the bus transfer but these were not ESF actuations.

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**III. Cause of the Problem**

**A. Immediate Cause**

The immediate cause of the TDAFW pump actuation was the decay of 12kV bus voltage during the automatic transfer. This occurred as designed.

**B. Root Cause**

The root cause of the TDAFW pump actuation was personnel error, noncognitive, on the part of the switchyard operator who cut in the OV relay, General Electric model IAV 71-B, with the instantaneous unit picked up.

**C. Contributory Cause**

Several contributory causes to the personnel error were determined relating to the unique nature of the OV relay. This particular design does not automatically reset after actuation unless the protective function succeeds in deenergizing the supervised circuit. In this case, when the OV condition occurred, the relay was not cut in; therefore, the breakers did not open and the line remained energized. This feature was not known to switchyard operations personnel or maintenance technicians at the time of the event. The relay's trip contacts are not readily visible. The cover of the relay must be removed to observe the position of the trip contacts.

The cause of the late NRC notification was a cognitive personnel error by the plant operators in their failure to recognize the TDAFW pump automatic start as an ESF actuation. The shift foreman (SFM) did not explicitly inform the shift supervisor (SS) of the TDAFW pump start, but assumed the SS had heard the control operator state that TDAFW pump had started. The SS, who is responsible for evaluating reportable events, did not report the event or mention the ESF actuation during the shift turnover. The actuation of several other components during the transfer, and the shift turnover activities, contributed to the miscommunication between the SFM and SS.

**IV. Analysis of the Event**

The TDAFW pump start resulted in a 7 degree F cooldown of the RCS. A shutdown margin determination shows the RCS boron concentration was over 100 ppm greater than required. Operators secured the TDAFW pump to prevent further cooldown, and reinserted the shutdown banks. No reactor trip was initiated due to P-7 (low power permissive protection interlock) blocking the reactor trip signal from

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the 12 kV undervoltage condition. This event would not occur later in the start-up sequence, because the unit would be on the startup source. After a review of the data, PG&E determined that the plant response was correct. Thus, the health and safety of the public were not affected by this event.

The event was not evaluated using the criteria defined in the NRC's significance determination process because events while shutdown are not addressed in the process.

V. Corrective Actions

A. Immediate Corrective Actions

Plant operators determined that TDAFW pump feedwater flow was not required, secured the pump, and restored RCS temperature and pressurizer level.

Switchyard operators cut out the OV relay, and restored the availability of the 500 kV system offsite power source by closing breakers 532 and 632.

B. Corrective Actions to Prevent Recurrence

1. PG&E system protection engineers determined that the instantaneous OV feature of the 559-1 relay was not required for adequate protection of the main bank transformers. The instantaneous OV feature is now defeated. A timer will be added and the circuitry will be modified to ensure a trip signal will not lock in regardless of the protective feature status (cut in or cut out).
2. Switchyard operators received training on the unique design of the OV relay as to how to determine its trip state and how to reset the device. Cautionary lamacoids have been posted to remind switchyard operators to reset the relays before cutting in the devices each time. Relays that will not reset will not be placed in service.
3. Licensed plant operators were provided "just in time" training on reportability requirements of 10CFR50.72 as described in Diablo Canyon Power Plant procedure XI1.ID2, "Regulatory Reporting Requirements and Reporting Process".

VI. Additional Information

A. Failed Components

None.

B. Previous Similar Events

DCPP has not experienced similar events in the last three years.