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 FACIL: 50-323 Diablo Canyon Nuclear Power Plant, Unit 2, Pacific Ga      05000323  
 AUTH. NAME      AUTHOR AFFILIATION  
 WILSON, S.D.      Pacific Gas & Electric Co.  
 SHIFFER, J.D.      Pacific Gas & Electric Co.  
 RECIP. NAME      RECIPIENT AFFILIATION

SUBJECT: LER 88-024-01: on 881231, auxiliary feedwater pump potentially inoperable due to pressure gauge tap root valve being open.  
 W/8      ltr.

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Pacific Gas and Electric Company

77 Beale Street  
San Francisco, CA 94106  
415/972-7000  
TWX 910-372-6587

James D. Shiffer  
Vice President  
Nuclear Power Generation

May 19, 1989

PG&E Letter No. DCL-89-140



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

Re: Docket No. 50-323, OL-DPR-82  
Diablo Canyon Unit 2  
Licensee Event Report 2-88-024-01  
Auxiliary Feedwater Pump Potentially Inoperable  
Due to Pressure Gauge Tap Root Valve Being Open

Gentlemen:

PG&E is submitting the enclosed revision to Licensee Event Report 2-88-024 concerning a pressure gauge tap root valve on the steam supply to an auxiliary feedwater (AFW) pump that was found open during surveillance testing. It has been determined that this event most likely did not cause the AFW pump to be inoperable. This revision provides corrective actions resulting from PG&E's investigation of the causes of valve mispositioning events at Diablo Canyon Power Plant.

This event has in no way affected the public's health and safety.

Kindly acknowledge receipt of this material on the enclosed copy of this letter and return it in the enclosed addressed envelope.

Sincerely,

A handwritten signature in cursive script, appearing to read 'J. D. Shiffer'. The signature is written in dark ink on a white background.

J. D. Shiffer

cc: J. B. Martin  
M. M. Mendonca  
P. P. Narbut  
H. Rood  
B. H. Vogler  
CPUC  
Diablo Distribution  
INPO

Enclosure

DC2-89-OP-N005  
DCO-89-OP-N003

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**LICENSEE EVENT REPORT (LER)**

FACILITY NAME (1): <b>DIABLO CANYON UNIT 2</b>						DOCKET NUMBER (2): <b>05000323</b>			PAGE (3): <b>1 OF 08</b>	
TITLE (4): <b>AUXILIARY FEEDWATER PUMP POTENTIALLY INOPERABLE DUE TO PRESSURE GAUGE TAP ROOT VALVE BEING OPEN</b>										

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)			
MONTH	DAY	YEAR	YEAR	NUMBER	NUMBER	MONTH	DAY	YEAR	FACILITY NAMES			DOCKET NUMBER(S)
12	31	1988	02	4	01051989							050000
											050000	

OPERATING MODE (9): <b>1</b>	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (11)									
POWER LEVEL (10): <b>100</b>	<input checked="" type="checkbox"/> 10 CFR <u>50.73 (a)(2)(i)(B)</u> <input type="checkbox"/> OTHER (Specify in Abstract Below and in Text, NRC Form 305A)									

LICENSEE CONTACT FOR THIS LER (12):								TELEPHONE NUMBER			
<b>STEPHEN D. WILSON, REGULATORY COMPLIANCE ENGINEER</b>								AREA CODE: <b>805 5957351</b>			

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFAC TURE	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFAC TURE	REPORTABLE TO NRC

SUPPLEMENTAL REPORT EXPECTED (14):							EXPECTED SUBMISSION DATE (15):		MONTH	DAY	YEAR
<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO							<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO				

**ABSTRACT (16)**

On December 31, 1988, at 0129 PST, operations personnel were performing STP P-6B on AFW pump 2-1. The initial portion of the STP requires warming the pump turbine by closing the turbine throttle-trip valve (FCV-152) and then opening the turbine steam supply valve (FCV-95) to warm the steam inlet line to the turbine. A non-licensed auxiliary operator closed FCV-152 locally at the turbine, and then requested that FCV-95 be opened from the control room. When FCV-95 was opened, steam began blowing into the pump room. The auxiliary operator immediately exited the room, called the control room, and requested that FCV-95 be closed. A subsequent investigation revealed that a pressure test connection (PX-213) was uncapped with its root valve, MS-2-923, open, creating a direct steam path into the pump room from the 5/8 inch inside diameter pressure gauge connection.

The root cause of the valve being open could not be determined.

PG&E has investigated several recent valve mispositioning events on a generic basis and has concluded that these events can be attributed to several possible causes: (1) personnel error, (2) inadequate or incorrect procedures or drawings, and (3) unauthorized operation of plant components. To prevent recurrence, appropriate administrative procedures have been and will be strengthened, operating procedures will be reviewed against OVID drawings, an Operating Order has been developed, an Operations Policy has been revised, and a work planning policy memo has been issued. The procedural changes will be reviewed with all plant operators.



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**I. Plant-Conditions**

The unit was in Mode 1 (Power Operation) at approximately 100 percent power.

**II. Description of Event**

**A. Event:**

On December 31, 1988, at 0129 PST, operations personnel were performing Surveillance Test Procedure (STP) P-6B, "Routine Surveillance Test of Steam-Driven Auxiliary Feedwater Pump" on auxiliary feedwater (AFW) pump (BA)(TRB)(P) 2-1. The initial portion of the STP requires warming the pump turbine by closing the turbine throttle trip valve (FCV-152) (SB)(FCV) and then opening the turbine steam supply valve (FCV-95) (SB)(ISV) to warm the steam inlet line to the turbine. A non-licensed auxiliary operator closed FCV-152 locally at the AFW turbine, and then requested that FCV-95 be opened from the control room. When FCV-95 was opened, steam began blowing into the pump room. The auxiliary operator immediately exited the room, called the control room, and requested that FCV-95 be closed. A subsequent investigation revealed that a pressure test connection (PX-213) (SB)(TV) was uncapped with its root valve, MS-2-923 (SB)(RTV), open, creating a direct steam path into the pump room from the 5/8 inch inside diameter pressure gauge connection.

A review of operating records indicated that on November 30, 1988, AFW pump 2-1 was taken out of service for a bearing oil change following the routine pump surveillance STP P-6B. PX-213 was used as the required "visible vent" for that clearance. The root valve for PX-213, MS-2-923, was documented as being closed and independently verified as closed on December 1, 1988, following completion of the pump bearing oil change. A post maintenance test after the bearing oil change was not performed because the oil change was not considered by operations and maintenance personnel to have any potential impact on the operability of the AFW pump. The independent valve alignment verification was considered adequate to verify operability.

**B. Inoperable structures, components, or systems that contributed to the event:**

None

**C. Dates and approximate times for major occurrences:**

1. November 30, 1988 at 0511 PST: AFW pump 2-1 routine surveillance is performed (STP P-6B) satisfactorily.
2. November 30, 1988 at 1349 PST: AFW pump 2-1 is taken out of service for a bearing oil change.

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- 3. December 1, 1988 at 0700 PST: AFH pump 2-1 is returned to service following the oil change.
- 4. December 31, 1988 at 0129 PST: AFH pump 2-1 STP P-6B identifies an open pressure tap PX-213.

D. Other systems or secondary functions affected:

None

E. Method of discovery:

The open pressure tap was immediately obvious to the operator in the pump room due to steam blowing out of the pressure gauge connection (PX-213).

F. Operator actions:

The steam supply valve (FCV-95) to AFH pump 2-1 was closed, PX-213 was properly isolated and capped.

G. Safety system responses:

None

III. Cause of the Event

A. Immediate Cause:

The immediate cause of this event is that PX-213 was uncapped and unisolated, creating a steam leakage path from the AFH pump turbine steam supply line.

B. Root Cause:

Generic Root Cause Investigation:

The root cause of this specific event could not be positively determined. However, during the investigation PG&E has reviewed several recent valve mispositioning events on a generic basis and has concluded that these problems can be attributed to several possible root causes:

- 1. Personnel error due to a failure to follow established procedures or policies or failure to use established operating techniques during valve positioning.
- 2. Inadequate or incorrect operating procedures or OVID drawings.
- 3. Unauthorized operation of plant components.

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Event-Specific Root Cause Investigation:

The root cause for the valve being open could not be positively determined. The root valve, MS-2-923, was closed, and verified closed on December 1, 1988. MS-2-923 is located approximately at waist height in the AFW pump 2-1 room. Lighting in the area allows the valve tag for MS-2-923 to be read without the aid of a flashlight and is therefore considered adequate. The pressure gauge connection consisted of a pipe coupling that should have had a plug screwed into the open end. It is possible that an operator could look at the pipe coupling while operating MS-2-923 and conclude that the pipe coupling was plugged or mistake the coupling for a pipe cap, although this is considered unlikely due to the orientation of the valve (the valve protrudes directly into the walkway) and the lighting in the area. MS-2-923 was inspected after the event to see if its operational characteristics could have misled operators into believing it was shut. The valve was found to be difficult to operate, but not so difficult as to lead the operators to believe that the valve was closed. This is considered especially unlikely as the initial operator expected to find the valve open and anticipated having to shut the valve in order to place it in the position required by the clearance request form. In an effort to determine the cause of this problem, an extensive investigation was conducted which included the following steps:

1. Operating logs and maintenance records applicable to the November 30 to December 31, 1988 time periods were reviewed, no maintenance or testing activities involving this equipment were found. Clearance requests and applicable work orders were reviewed in an effort to determine any activities that may have led to the pressure gauge connection being open. Additionally, Unit 1 records were reviewed to determine if maintenance had inadvertently been performed on the wrong unit, and again no activities were identified which would have required use of the Unit 1 PX-213 gauge connection.
2. The operations personnel directly involved with this evolution were interviewed. No additional information was obtained from the interviews that contradicted the valve positions recorded on the clearance request form.
3. All operations personnel were questioned to attempt to obtain additional information. No additional information was obtained.

It is postulated that the valve was either left open by the two non-licensed operators who were assigned to shut and verify the valve shut and capped or the valve was opened and uncapped during undocumented maintenance activities. There is no-conclusive evidence to support either postulation.

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**IV. Analysis of the Event**

An initial engineering analysis of this event concluded that the temperature in the turbine-driven AFW pump room due to steam discharge from the uncapped pressure test connection would have exceeded the specified turbine operating range. Based on this analysis, it was conservatively concluded that the AFW pump turbine may have failed if required to operate for an extended period of time (over two hours) under the high temperature condition. However, operating records indicated that both motor-driven AFW pumps were operable during that time period and the physical size and orientation of the motor-driven pump room is such that the steam would not have rendered them inoperable. Therefore, it was concluded that no unanalyzed safety implications or consequences had resulted from this event.

Further evaluation following PG&E's initial report indicates that the turbine-driven AFW pump most likely would not have been disabled by the steam discharge from the uncapped pressure test connection if called upon to operate. PG&E's auxiliary steam header crack analysis shows that the duration of high room temperature resulting from a header crack is less than one hour. The temperature rise is terminated when pressure buildup due to the steam leak causes a door to fail. Following the door failure, the room temperature rapidly decreases. Because the blowdown rate from the uncapped pressure connection would exceed that for the header crack, the pressure buildup and consequent door failure would occur sooner. Also, the actual door integrity is less than that conservatively assumed in the header crack analysis. Therefore, PG&E concludes that the high temperature condition in the turbine-driven AFW pump room resulting from the uncapped pressure connection leak would last significantly less than one hour.

In conjunction with this, actuation of the fire suppression system sprinkler heads in the turbine-driven AFW pump room occurs at a temperature between 160-180°F. These fusible-link actuated sprinklers would quench the temperature rise, and thus provide an additional likelihood that the peak room temperature for either the postulated header crack or the subject pressure connection leak would not approach the 341°F peak temperature calculated in the steam header crack analysis.

A vendor assessment of equipment operability at 350°F indicated that pump bearing failure is possible, but the pump is likely to perform its design function for several days. Turbine bearing failure due to increased ambient temperature is also possible, but the turbine is likely to be operable for at least one to two hours. When the above mitigating events are coupled with the manufacturer's assessment of equipment operability, it is judged that the turbine-driven AFW pump would have been operable if required.

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In conjunction with the potential inoperability of the turbine-driven AFW pump, the following conditions which could disable the motor-driven AFW pumps were evaluated:

- o Actuation of the sprinkler system in the motor-driven AFW pump room, or
- o A loss of all AC power.

A qualitative evaluation based on the auxiliary steam header crack analysis indicates that the temperatures in the motor-driven AFW pump room resulting from the pressure connection blowdown will not reach the sprinkler actuation temperature. Additionally, the sprinkler heads in the motor-driven pump room are actuated by fusible-links and therefore operate independently from and are not actuated by the sprinklers in the turbine-driven pump room. Therefore, it can be concluded that sprinkler actuation in the motor-driven pump room would not occur during the subject event.

With regard to a loss of all AC power, it is noted that this is beyond the design bases of the Diablo Canyon Power Plant. Nevertheless, the manufacturer's estimate of one hour pump/turbine operability provides a significant time period to restore AC power using one of two offsite power sources or the onsite emergency generators.

Therefore, as previously concluded, no unanalyzed safety implications or consequences resulted from this event, and the health and safety of the public therefore were not adversely affected.

#### V. Corrective Actions

##### A. Immediate Corrective Actions:

The steam leakage path was isolated by isolating PX-213, and the pump was verified operable by completing STP P-6B.

##### B. Corrective Actions to Prevent Recurrence:

Because of this event and other recent recurring valve mispositioning events, PG&E has investigated these events on a generic basis and has determined the following corrective actions to prevent recurrence:

1. Administrative Procedure (AP) C-6S1, "Clearances," has been revised to ensure that all vents and drains not connected to a closed system have a pipe cap installed whenever the vent and drain valve is closed. Additionally, a work planning policy letter has been issued

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to require documentation of pipe cap removal and reinstallation in the applicable clearance request or other controlling work document.

2. Operating procedures containing system alignment checklists will be reviewed and cross-checked with the OVID drawings to ensure that all system valves (excluding instrument valves downstream of instrument root valves) are included in the alignment checklists. Checklists will require that appropriate vents and drains be capped.
3. AP C-6S1 and AP C-53, "Authorization for Equipment Operation and Maintenance," have been revised to strengthen requirements for non-operator plant personnel to operate plant components. These revisions include specific requirements to control those valves which may be operated by persons other than operations personnel.
4. Operating Order O-17, "Manual Valve Alignment," has been developed to provide explicit generic instructions for performing valving operations. This procedure incorporates expected operator techniques and established "good practice" policies to be used as guidance for performing valving type operations.
5. AP C-9S1, "Sealed Valves," has been revised to strengthen requirements for sealing valves and breaking valve seals and implement a periodic walkdown of sealed valved checklists.
6. AP C-104S1, "Independent Verification of Operating Activities," will be revised to clarify independent verification requirements and responsibilities.
7. Operations Policy B-1, "Conduct of Operations," has been revised to include a section providing required techniques to be used whenever manual valve manipulations are to be performed.
8. The procedural changes discussed above will be reviewed with all plant operators in on-shift training sessions. In addition, changes to AP C-6S1 and AP C-53 will be reviewed with all affected personnel in tailboards or management meetings.

Corrective actions for equipment status control, including generic valve mispositioning, were discussed at an April 25, 1989, meeting with NRC management.

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**VI. Additional Information**

**A. Failed Components:**

None

**B. Previous LERs on similar events:**

**LER 1-88-026-01** Reactor Trip due to Turbine Trip from Anti-motoring Relay Caused by a Closed Root Valve on the Low Pressure Side Sensing Line.

This event was a turbine trip and subsequent reactor trip that occurred as a result of a mispositioned valve associated with the main turbine anti-motoring relay. The corrective actions included issuance of Administrative Procedure AP C-53, "Authorization for Equipment Operation and Maintenance," and AP C-153, "Plant Status Controls," to provide improved documentation of changes in component status. Since the root cause of the event in LER 2-88-024 could not be determined, it can not be stated whether these corrective actions would have prevented this event. However, it is believed that these administrative procedure changes should reduce the frequency of events related to loss of plant component status.

**LER 2-88-013-01** Reactor Cavity Sump Level Instrument Channel Out of Service Due to a Closed Valve on the Instrument Air Line

This event involved exceeding the time requirements of a TS action statement when an air supply valve was left closed making the sump level instrument channel inoperable. The root cause of this event was determined to be lack of a requirement in the appropriate operating procedures to verify the alignment of this air supply valve after extended maintenance periods. This valve was added to the applicable valve alignment checkoff list to ensure that its position is verified to be correct. This corrective action did not prevent the occurrence of the event in LER 2-88-024 because the AFW pump had not been in an extended maintenance period and a complete system lineup check was therefore not performed nor required.

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