Pacific Gas and Electric Company

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PG&E Letter DCL-00-146

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 1-2000-008-00
Engineered Safety Feature Actuation - Auxiliary Saltwater Pump 1-2 Trip Due to Failed Test Switch

Dear Commissioners and Staff:

PG&E is submitting the enclosed licensee event report regarding an engineered safety feature actuation during restoration of protective relays due to a failed test switch.

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

Sincerely,

David H. Oatley

cc: Ellis W. Merschoff
David L. Proulx
Girija S. Shukla
Diablo Distribution
INPO

Enclosure

JER/2246/A0517611

IE22

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Diablo Canyon Unit 1	0 5 0 0 0 2 7 5	1 OF 7

TITLE (4)

Engineered Safety Feature Actuation - Auxiliary Saltwater Pump 1-2 Trip Due to Failed Test Switch

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
10	21	2000	2000	- 0 0 8 -	0 0	11	20	2000		

OPERATING MODE (9)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (11)	
	X	10 CFR 50.73(a)(2)(iv)
POWER LEVEL (10)		OTHER
0 0 0		(SPECIFY IN ABSTRACT BELOW AND IN TEXT, NRC FORM 366A)

LICENSEE CONTACT FOR THIS LER (12)

	TELEPHONE NUMBER	
	AREA CODE	
Roger Russell - Senior Regulatory Services Engineer	805	545-4327

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
B	E A	D I S C	4 8 5 S						

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MON	DAY	YR
[ ] YES (If yes, complete EXPECTED SUBMISSION DATE)	[X] NO				

ABSTRACT (Limit to 1400 spaces. i.e., approximately 15 single-spaced typewritten lines.) (16)

On October 21, 2000, at 1800 PDT, with Unit 1 in no mode (defueled) with the core in the spent fuel pool (SFP), an engineered safety feature (ESF) actuation occurred when Auxiliary Saltwater (ASW) Pump 1-2 tripped due to an initiation of a load shed signal to 4kV Vital Bus G components during the return of undervoltage protective relays to service. ASW Pump 1-2 was supplying cooling to the Unit 1 SFP. Operators aligned ASW flow from Unit 2 to Unit 1 within about 5 minutes, during which time the Unit 1 SFP temperature did not change. At 1940 PDT, operators restored Unit 1 ASW lineup to normal. At 2122 PDT, a 4-hour nonemergency report was made in accordance with 10 CFR 50.72(b)(2)(ii).

The root cause of the ESF actuation was high resistance in a test switch pivot point that prevented adequate reset voltage from being applied to the undervoltage relays. A contributory cause was operator unfamiliarity with returning the relays to service.

Corrective actions included repairing the switch. An operations department incident summary was issued to alert operators to issues related to returning solid state relays to service.

TEXT

I. Plant Conditions

Unit 1 was shut down in no mode (defueled) in the tenth refueling outage (1R10).

II. Description of Problem

A. Summary

On October 21, 2000, at 1800 PDT, with Unit 1 in no mode (defueled) with the core in the SFP, an engineered safety feature (ESF) actuation [JE] occurred. Auxiliary Saltwater (ASW) Pump 1-2 [BI] tripped due to an initiation of a load shed signal to 4kV Vital Bus G [EK] components during the return of undervoltage protective relays [27] to service. ASW Pump 1-2 was supplying cooling to the Unit 1 SFP [DA]. Operators aligned ASW flow from Unit 2 to Unit 1 within about 5 minutes, during which time the Unit 1 SFP temperature did not change. At 1940 PDT, operators restored Unit 1 ASW lineup to normal. At 2122 PDT, a 4-hour nonemergency report was made in accordance with 10 CFR 50.72(b)(2)(ii).

B. Background

Diablo Canyon Power Plant (DCPP) ESF loads are supplied by three 4kV vital buses or from 480V buses supplied by the vital 4kV buses. Each of the three vital 4kV buses, designated F, G, and H, can be powered from three sources: auxiliary power (from either the 500kV system or the main generator), 230kV startup power, or from a dedicated emergency diesel generator (EDG).

An automatic transfer is provided for each vital 4kV bus to the 230kV startup supply upon loss of power from the main generator or the 500kV system. If a 4kV vital bus transfer to startup is not successful, the bus will automatically transfer to its respective EDG.

If the transfer to startup power is unsuccessful or if there is a loss of voltage from the startup transformer, undervoltage protection for each 4kV vital bus is provided by first and second level undervoltage relays (FLURs and SLURs). Either set of relays will start the EDG for its respective bus in the event offsite power is unavailable or degraded.

The first level of undervoltage protection is provided by the FLURs. Each 4kV vital bus has one EDG start and two load shed FLURs. To prevent

spurious transfers, both load shed FLURs, one instantaneous and one time delayed, must activate for the transfer to the EDG to occur.

A problem with the existing FLURs may occur during a successful bus transfer. An occasional EDG start occurs when its vital bus is lightly loaded. To resolve this problem, a FLUR replacement program has been implemented to replace the time delayed FLUR load shed relay and the diesel start relay with new solid-state type relays that have better operating characteristics. The instantaneous FLUR load shed relay was previously replaced with a solid-state relay, and was not replaced as part of this project.

During the FLUR replacement project, the vital bus remained energized while the relays were replaced. Only the relay circuitry was cleared including opening the load shed trip cutout (TCO) switches to each vital bus load to prevent tripping on a load shed signal. When fuses were reinstalled to reenergize the circuitry, the FLURs reset, which allowed the bus load shed relay to reset. After all relays were reset, the TCO switches were cut in to restore the load shed trip feature to each load.

Prior to the event, the FLUR replacement project had been successfully completed on Unit 1 4kV Vital Buses F and H during 1R10.

At the time of the event, the only 4kV Vital Bus G load running was ASW Pump 1-2, which was supplying cooling via the component cooling water (CCW) system to the Unit 1 SFP. ASW Pump 1-1 was cleared for installation of seismic braces on its motor following maintenance.

C. Event Description

On Saturday, October 21, 2000, at approximately 1645 PDT, craft personnel completed the FLUR replacement project on 4kV Vital Bus G. This consisted of replacing the time delayed FLUR load shed relay 27HGT1 and the EDG start relay 27HGB2 with new solid-state type relays. The instantaneous FLUR load shed relay, 27HGT2, was replaced previously and, therefore, was not replaced as part of this project. The task coordinator (licensed operator) conducted a clearance review session with the two operators (non-licensed) assigned to remove the clearance for the job. Prior to going to the electrical breaker cabinets, the two operators informed the Unit 1 control operator (licensed operator) that they were going to remove the clearance. The two operators proceeded with the clearance removal and reinstalled the DC fuses to provide 125VDC power to the automatic transfer circuitry, and AC fuses to provide 120VAC

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power to the bus potential circuits. With AC and DC power restored to these circuits, the FLUR relays 27HGT1 and 27HGT2 should have reset which, in turn, would have reset the bus load shed relay 27XHGT. The operators were unaware that this automatic reset action did not occur.

On Saturday, October 21, 2000, at 1750 PDT, the control room received several 4kV Bus G undervoltage alarms because the FLURs were not really reset. The control room crew correctly attributed these alarms to the clearance in progress. Having no involvement in the clearance review session, the control room staff did not realize that the next step would close the TCO switches for all the 4kV Vital Bus G components. The operators at the breaker enclosures proceeded to close all of the TCOs, one of which was for ASW Pump 1-2.

On Saturday, October 21, 2000, at 1800 PDT, ASW Pump 1-2 tripped when its load shed TCO switch was closed. When the TCO was shut, 27XHGT sent a load shed signal to the trip coil for the ASW Pump 1-2 breaker, and the breaker opened as designed. The control room operators entered Abnormal Operating Procedure (OP) AP SD-3, "Loss of Auxiliary Salt Water," to restore ASW flow for Unit 1.

On Saturday, October 21, 2000, at approximately 1805 PDT, control room operators restored ASW flow to Unit 1 by starting a second ASW pump on Unit 2 and opening the ASW Cross-Tie Valve FCV-601. During this time the Unit 1 SFP temperature did not increase.

On Saturday, October 21, 2000, at 1940 PDT, ASW Pump 1-1 was placed in service and Unit 1 ASW lineup was restored to normal.

On Saturday, October 21, 2000, at 2122 PDT, a 4-hour nonemergency report was made in accordance with 10 CFR 50.72(b)(2)(ii).

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

A knife switch, used for testing, located in the circuit that provides AC voltage to relays 27HGT1, 27HGT2, and 27HGB2, failed to provide sufficient voltage to reset the relays. This switch was not operated during the FLUR replacement project, nor during removal of the clearance, and remained in the closed position during the event.

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E. Other Systems or Secondary Functions Affected

None.

F. Method of Discovery

The loss of ASW Pump 1-2 was immediately apparent to plant operators due to control room annunciators.

G. Operator Actions

Plant operators entered Abnormal Operating Procedure OP AP SD-3 and restored ASW flow to Unit 1 from Unit 2 through ASW Cross-Tie Valve FCV-601.

H. Safety System Responses

ASW Pump 1-2 tripped on the load shed signal as designed.

III. Cause of the Problem

A. Immediate Cause

ASW Pump 1-2 tripped due to a load shed signal from the 4kV Vital Bus G load shed relay.

B. Root Cause

The 4kV Vital Bus G load shed relay did not reset when the FLUR circuit was reenergized due to degradation of a test switch. Looseness and corrosion in the pivot of the switch prevented full voltage to be applied to the FLURs to reset them.

C. Contributory Cause

During the clearance removal, the two new solid state relays, 27HGT1 and 27HGB2, which have light emitting diode status lights and trip indicating magnetic orange flags, indicated they were in their tripped condition. Also the load shed relay, 27XHG, indicated it was tripped. It has a starwheel handle that rotates from the normal to the tripped position when actuated as indicated by an orange flag. These indications were available to the operators once the circuitry was reenergized. However, the operators

were unfamiliar with the consequences of having these trip indications active while the clearance removal was in progress.

IV. Analysis of the Event

Loss of cooling to the SFP has been evaluated in the Final Safety Analysis Report Update which states:

> "The SFP cooling and cleanup system has no emergency function during an accident. This manually controlled system may be shut down for limited periods of time for maintenance or replacement of malfunctioning components. Redundancy of the SFP cooling and cleanup system components is not required because of the large heat capacity of the pool and the slow heatup rate. In the unlikely event that the SFP pump should fail, the backup pump can provide circulation of the pool water through the SFP heat exchanger. If a failure should occur that would prevent the use of the SFP heat exchanger for cooling the SFP water (e.g., severance of the piping which constitutes the cooling recirculation path), natural surface cooling would maintain the water temperature at or below the boiling point. A Design Class I backup makeup water source is provided to ensure that the water level in the SFP can be maintained."

Thus, the short time (approximately 5 minutes) that the Unit 1 SFP was without ASW cooling (via CCW) was insignificant.

Also, this event occurred when the Unit 1 reactor was defueled and the only ESF load running on 4kV Vital Bus G was ASW Pump 1-2. No other ESF loads were tripped.

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

This event did not involve a Safety System Functional Failure.

This event was not evaluated using significance determination process (SDP) because the SDP does not address events that occur while the reactor vessel is defueled.

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V. Corrective Actions

A. Immediate Corrective Actions

1. The Unit 1 ASW system flow was restored by aligning it to the Unit 2 ASW system through ASW Cross-Tie Valve FCV-601.

2. The failed test switch was disassembled, cleaned, reassembled and placed back in service.

B. Corrective Actions to Prevent Recurrence

1. An evaluation was performed to determine whether the switch failure in this event was a generic problem. The failed switch is a double pole knife switch manufactured by States Company. Similar switches are installed throughout the plant to facilitate testing electrical meters, isolating trip circuits, and shorting current transformers. A search of INPO industry events and DCPP events found no failures of States test switches related to loose or corroded parts. As a result, the switch degradation in this event is considered to be an isolated incident.

2. An operations department incident summary has been issued to alert operators to issues related to returning solid state relays to service.

VI. Additional Information

A. Failed Components

None.

B. Previous Similar Events

None.