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 FACIL: 50-275 Diablo Canyon Nuclear Power Plant, Unit 1, Pacific Ga 05000275
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 RECIP. NAME RECIPIENT AFFILIATION

SUBJECT: LER 90-005-01: on 900614, reactor trip due to power range high
 positive rate caused by load rejection from false operation.
 W/9 ltr.

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James D. Shiffer
Senior Vice President and
General Manager
Nuclear Power Generation

July 16, 1990

PG&E Letter No. DCL-90-179



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

Re: Docket No. 50-275, OL-DPR-80
Diablo Canyon Unit 1
Licensee Event Report 1-90-005-00
Reactor Trip Due to Power Range High Positive Rate Caused by a
Load Rejection Resulting From a False Relay Operation

Gentlemen:

Pursuant to 10 CFR 50.73(a)(2)(iv), PG&E is submitting the enclosed
Licensee Event Report (LER) regarding a Unit 1 reactor trip due to
power range high positive rate which was caused by a load rejection.

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 dark ink, appearing to read 'J. D. Shiffer'. The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent. Below the signature, the name 'J. D. Shiffer' is printed in a standard serif font.

cc: A. P. Hodgdon
J. B. Martin
P. P. Narbut
S. A. Richards
H. Rood
CPUC
Diablo Distribution
INPO

Enclosure

DCL-90-OP-N045

3273S/0084K/ALN/2246

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PDR ADOCK 05000275
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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) DIABLO CANYON UNIT 1												DOCKET NUMBER (2) 0151010101 2 17 5				PAGE (3) 11 OF 16				
TITLE (4) REACTOR TRIP DUE TO POWER RANGE HIGH POSITIVE RATE CAUSED BY A LOAD REJECTION RESULTING FROM A FALSE RELAY OPERATION																				
EVENT DATA (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)											
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES						DOCKET NUMBER (5)					
06	14	90	90	01015	010	07	16	90							0151010101 1 1					
									0151010101 1 1											
OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR : (11)																		
POWER LEVEL (10)		<div style="text-align: center;"> X 10 CFR 50.73(a)(2)(iv) OTHER (Specify in Abstract below and in text, NRC Form 366A) </div>																		
LICENSEE CONTACT FOR THIS LER (12)																				
MARTIN T. HUG, REGULATORY COMPLIANCE SENIOR ENGINEER												TELEPHONE NUMBER								
												AREA CODE		805 595-4005						
COMPLETE ONE LINE FAILURE DESCRIBED IN THIS REPORT (13)																				
CAUSE	SYSTEM	COMPONENT	MANUFAC TURED	REPORTABLE TO NRC		CAUSE	SYSTEM	COMPONENT	MANUFAC TURED	REPORTABLE TO NRC										
SUPPLEMENTAL REPORT EXPECTED (14)												YES (if yes, complete EXPECTED SUBMISSION DATE)		X NO		EXPECTED SUBMISSION DATE (15)		MONTH	DAY	YEAR
ABSTRACT (16)																				
<p>On June 14, 1990, at 1555 PDT, with Unit 1 in Mode 1 (Power Operation), Unit 1 experienced a reactor trip on power range high positive rate during a load rejection from 100 percent power. The load rejection occurred due to an offsite 500 kV transmission system transient. Unit 1 reactor tripped due to increasing reactor coolant pump (RCP) speed and reactor coolant flow which resulted in lower coolant temperatures in the upper regions of the core. The increase in RCP speed was caused by an increased 12 kV bus frequency that was caused by main turbine speedup from load loss. The RCPs tripped on underfrequency as the generator frequency decreased after the turbine trip, placing the reactor into natural circulation.</p> <p>A four-hour, non-emergency report was made in accordance with 10 CFR 50.72(b)(2)(ii) on June 14, 1990, at 1756 PDT.</p> <p>The root cause of this event was a false relay operation at Midway Substation which caused the opening of the Unit 1 output breaker causing the load rejection and the subsequent reactor trip. The Unit 1 second output breaker had been cleared for 500 kV switchyard maintenance. The misoperating relay was found and isolated. The relay will be investigated and returned to service, and a memorandum has been sent to Power Control advising them of conditions which may put the plant at high risk of tripping if certain switchyard work is performed.</p>																				
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LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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	0 5 0 0 0					OF	

TEXT (If more space is required, use additional NRC Form 306A's) (17)

I. Plant Conditions

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

II. Description of Event

A. Event:

On June 14, 1990, at 1555 PDT, Unit 1 experienced a reactor (AB)(RCT) trip on power range high positive rate during a load rejection from 100 percent power. The load rejection occurred due to an offsite 500 kV transmission line phase comparison relay (78) actuation, which opened the Unit 1 500 kV output power circuit breaker (PCB) 632. Unit 1 reactor tripped on power range high positive rate which was caused by lower coolant temperatures in the upper regions of the core as a result of increased reactor coolant pump (RCP) speed and reactor coolant system (RCS) flow. The temperature reduction resulted in an actual power increase of approximately six percent in about 1.2 seconds. The increased reactor coolant pump speed was caused by increasing 12 kV bus frequency due to main turbine generator (TA)(TRB) speedup as a result of the load rejection.

Electrical energy from the main generator (TB) of each unit is normally supplied to two 500 kV busses in the 500kV switchyard through two PCBs and then transmitted offsite. Unit 1 is connected to the two busses through PCBs 532 and 632. At the time of the event PCB 532 was cleared open for substation maintenance, and power was being supplied to the PG&E transmission system Diablo-Midway 500 kV line 3 through PCB 632. Unit 2 was lined up to the Diablo-Midway 500 kV line 2. A brush fire under the Midway-Los Banos 500 kV transmission lines caused the lines to trip on phase comparison relay actuation at 1555 PDT. Phase comparison relays are used in the transmission system to sense faults in specific segments of transmission lines. If a fault in the transmission line is detected, the phase comparison relay actuates to trip breakers at either end of the segment to isolate the faulted segment. The system disturbance created when the Midway-Los Banos transmission line tripped caused the phase comparison relays on the Diablo-Midway line 3 to actuate which resulted in the opening of PCB 632 and a full load rejection. Had PCB 532 been closed and in service, the load rejection would not have occurred. The phase comparison relay on the Diablo-Midway line 3 should not have actuated, and the cause of the actuation is under investigation. Unit 2 PCBs were unaffected by the system disturbance since output was going to different transmission lines.

PCB 632 opened at 1555 PDT and initiated a load rejection. A unit trip was not generated by the anti-motoring relays because the main generator 500 kV PCBs had opened and locked out the anti-motoring generator trip, and therefore plant 4 kV and 12 kV electrical busses did not automatically transfer to start-up power. The reactor trip at 1555 PDT caused the turbine to trip at 1555 PDT. The generator remained energized with full voltage; however, its frequency decayed due to the generator slowing down from loss of momentum from the spinning turbine. This condition caused the frequency to drop on the 12 kV busses to the point where RCPs tripped on underfrequency at 1555 PDT. This placed the RCS into natural circulation.

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TEXT: If more space is required, use additional NRC Form 366A's (17)

At 1555:56 PDT, the operators manually initiated a Unit trip, which disconnected the vital and non-vital busses from the generator and transferred them to start-up power. Diesel Generator (DG) 1-1 started due to an undervoltage condition sensed when the transfer from the generator to the start-up bus took place. Per design, the DG will start but its output breaker will not close unless there is an undervoltage on its respective bus. Both circulating water pumps (CWPs) tripped per design. On a slow automatic transfer a trip signal is sent to the CWP breaker. Prior to the pump breaker reclosing, the following must have occurred:

1. Bus voltage must decay to approximately 25 percent of nominal voltage.
2. Less than 1.5 seconds has elapsed from the time the breaker has tripped open. If more than 1.5 seconds has elapsed, the CWP breakers will not automatically reclose and manual reclosure is blocked for 5 minutes.

The operators restarted RCP 1-2 at 1604 PDT, after the shift to start-up power, and subsequently restarted the remaining three RCPs.

In response to the loss of circulating water to the condenser, operators began to take actions to prevent a condenser overpressurization. Within 8 minutes from the loss of circulating water, condenser vacuum was broken. However, due to turbine steam seals, stop valve seat drains, feedwater heaters, and other steam sources to the condenser, the condenser pressurized and a rupture disc blew out. Due to the condenser overpressurization, the condenser developed a number of seawater leaks.

Also, due to a pressure transient in the condensate system, minor leaks developed on some of the main feedwater pump suction piping flanges. The rapid closure of the main feedwater pump discharge check valves caused the large volume of condensate flow to stop suddenly. The dynamics of the rapid change in flow caused a pressure wave to travel back into the feedwater pump suction piping. This pressure wave caused an increase in fluid pressure. The piping system flexed in response to the pressure wave and broke the seal at the gaskets.

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

The DCPD 500 kV output breaker PCB 532 was cleared for substation maintenance throughout the event. Had it been in service, the opening of PCB 632 would not have resulted in a full load rejection and no reactor trip would have occurred.

C. Dates and Approximate Times for Major Occurrences:

1. June 14, 1990, 1555:03 PDT: Event/discovery date. Midway-Los Banos 500 kV clears. Phase comparison relay opens PCB 632, initiating load rejection.

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LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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TEXT (If more space is required, use additional NRC Form 306A's) (17)

1555:04 PDT: Reactor trip due to high positive rate.

1555:05 PDT: Turbine trip on reactor trip. Generator does not trip because Unit 1 output breakers are open.

1555:27 PDT: RCPs trip per design due to decreasing bus frequency. Plant in natural circulation.

1555:56 PDT: Operators trip unit. CWP's deenergize per design.

2. June 14, 1990, 1604 PDT: Operators restart RCP 1-2, restoring RCS forced circulation.

3. June 14, 1990, 1756 PDT: A four-hour, non-emergency report was made to the NRC in accordance with 10 CFR 50.72.

4. June 14, 1990, 1802 PDT: Operators reclose PCBs 532 and 532. Unit 1 stable in Mode 3 (Hot Standby).

D. Other Systems or Secondary Functions Affected:

CWP 1-1 was selected for auto-reclose. If selected for auto-reclose, the pump will restart on a power supply transfer to start-up power, if the transfer is completed within 1.5 seconds. The transfer for this event took longer than 1.5 seconds, therefore the CWP did not restart. If the pump does not automatically restart in 1.5 seconds, pump circuitry prevents pump re-start until 5 minutes have elapsed.

E. Method of Discovery:

The event was apparent to the control room operators due to control room alarms and indications.

F. Operator Actions:

The operators took actions for a reactor trip, loss of RCS forced circulation and a loss of circulating water to the condenser, and stabilized the Unit in Mode 3.

G. Safety System Responses:

1. The reactor trip breakers (JC)(BKR) opened.
2. The main turbine tripped.

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TEXT (If more space is required, use additional NRC Form 306A's) (17)

3. The RCPs tripped on underfrequency.
4. The motor operated auxiliary feedwater pumps (BA)(MO)(P) started.
5. DG 1-1 started.

III. Cause of the Event

A. Immediate Cause:

The reactor tripped on high positive rate on excore power range detectors.

B. Root Cause:

The root cause of this event was a false relay operation during a transmission system fault on neighboring lines which caused the opening of the Unit 1 output breaker, causing the load rejection and the subsequent reactor trip. Had the Unit 1 second output breaker been shut, the Unit would not have tripped.

IV. Analysis of the Event

Westinghouse evaluated the event and determined that this event is bounded by the FSAR Update analysis for Loss of Electrical Load and/or Turbine Trip (FSAR Update Section 15.2.7) and that the plant responded as expected.

The safety analysis for a Loss of Electrical Load and/or Turbine Trip is performed to conservatively show that core and RCS integrity is maintained. This is shown by demonstrating that the Departure from Nucleate Boiling (DNB) design basis is met and that the RCS does not overpressurize as a result of the transient. The analysis assumes a complete loss of steam load with subsequent RCS heatup and pressurization until a reactor trip is initiated on high pressurizer pressure or overtemperature delta-T. Based on review of this event, Westinghouse determined that the sequence of events that occurred during this event are bounded by the FSAR Update analysis. Therefore, this transient was less severe than what is assumed in the FSAR Update.

The power excursion for this event would be at a higher rate at the end of life (EOL) due to the moderator temperature coefficient (MTC) being more negative at EOL than at beginning of life (BOL). However, FSAR Update Section 15.2.7.2(2) states that the total loss of load is analyzed for both BOL and EOL MTC conditions. Therefore, based on this analysis the health and safety of the public were not adversely affected by this event.

V. Corrective Actions

A. Immediate Corrective Actions:

Operators took actions per the emergency procedures and stabilized the Unit in Mode 3.

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TEXT (if more space is required, use additional NRC Form 306A's) (17)

B. Corrective Actions to Prevent Recurrence:

1. A misoperating relay was found and isolated. The relay misoperation will be investigated and corrected, and the relay will be returned to service.
2. A meeting was held between PG&E DCP, Power Control (System Dispatcher), substation and System Protection to develop a clearance scheme for the 500 kV switchyard. A memo was sent to Power Control, based on discussion from the meeting, advising Power Control of the items that should be considered when doing switchyard maintenance. Items that will be considered in the future when doing switchyard work include:
 - a. Plant conditions that effect the unit's ability to survive a load rejection.
 - b. Conditions that may effect the transmission system.
 - c. The need for performance of switchyard work on an expedited schedule when the plant is placed in high load rejection risk lineup.
3. The following actions will be performed to aid operators in responding to similar events:
 - a. This event will be reviewed with all Operations personnel in the form of an Operations Incident Summary.
 - b. A Simulator training session will be conducted to recreate this event for all licensed operators.
 - c. Emergency Operating Procedures E-0, "Reactor Trip or Safety Injection," and E-0.1, "Reactor Trip Response," will be revised to include steps to isolate the main steam lines and break condenser vacuum if both CWP's are lost following a reactor trip.
 - d. An evaluation will be performed to determine if a Unit trip feature on turbine trip following a load rejection should be installed.

VI. Additional Information

A. Failed Components:

1. Condenser rupture disc ruptured.
2. Condenser tube developed a leak.
3. Main Feed Pump suction flange developed a leak.

B. Previous LERs on Similar Events:

None.

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