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SUBJECT: LER 94-010-00:on 940510,completed shutdown to Mode 5,per TS 3.8.1.1 Action b due to degraded condition on C Phase 500 kV transformer.Root cause & corrective actions for event under investigation.W/940608 ltr.

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Gregory M. Rueger
Senior Vice President and
General Manager
Nuclear Power Generation

June 8, 1994

PG&E Letter DCL-94-123
U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Docket No. 50-275, OL-DPR-80
Diablo Canyon, Unit 1
Licensee Event Report 1-94-010-00
Unit 1 Shutdown in Accordance with Technical Specification 3.8.1.1 Action b Due to a Degraded Condition on the C Phase 500 kV Transformer

Gentlemen:

Pursuant to 10 CFR 50.73(a)(2)(i)(A), PG&E is submitting the enclosed Licensee Event Report (LER) concerning Technical Specification 3.8.1.1 required shutdown following a loss of offsite power source due to a degraded condition on the Unit 1 C phase 500 kV transformer. The root cause and corrective actions to prevent recurrence are being investigated and if determined will be provided in a supplement to this LER.

This event did not adversely affect the health and safety of the public.

Sincerely,

Gregory M. Rueger

cc: L. J. Callan
Mary H. Miller
Kenneth E. Perkins
Sheri R. Peterson
Diablo Distribution
INPO

Enclosure

DC1-94-EM-N029

1214S/JAL/2246

JE22

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) Unit 1 Shutdown in Accordance with Technical Specification 3.8.1.1 Action b Due to a Degraded Condition on the C Phase 500 kV Transformer

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MON	DAY	YR	YR	SEQUENTIAL NUMBER	REVISION NUMBER	MON	DAY	YR	FACILITY NAMES	DOCKET NUMBER (S)
05	10	94	94	- 0 1 0 -	0 0	06	08	94		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (11)
5	X 10 CFR 10 CFR 50.73(a)(2)(i)(A)
POWER LEVEL (10): 0 0 0	OTHER -
	(Specify in Abstract below and in text, NRC Form 366A)

LICENSEE CONTACT FOR THIS LER (12)

	TELEPHONE NUMBER	
	AREA CODE	
David P. Sisk - Senior Regulatory Compliance Engineer	805	545-4420

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
[X] YES (If yes, complete EXPECTED SUBMISSION DATE)	[ ] NO		01	06	95

ABSTRACT (16)

On May 10, 1994, at 2245 PDT, Unit 1 completed a shutdown to Mode 5 (Cold Shutdown) as required by Technical Specification (TS) 3.8.1.1 Action b. The Unit 1 shutdown was due to a loss of an offsite power source when the Unit 1 main transformer bank was declared inoperable after acetylene was detected in the Unit 1 C phase 500 kV transformer oil. An Unusual Event was declared at 1145 PDT on May 10, 1994, and an immediate, emergency report was made to the NRC in accordance with the requirements of 10 CFR 50.72(a)(1)(i). At 2245 PDT, Unit 1 entered Mode 5 and the Unusual Event was terminated.

On May 20, 1994, replacement of the Unit 1 C phase 500 kV transformer with the Unit 2 spare transformer was completed.

The root cause and corrective actions for this event are under investigation. A supplemental LER will be issued to report the root cause and corrective actions to prevent recurrence if determined.

I. Plant Conditions

Unit 1 was in Mode 5 (Cold Shutdown), with an average reactor coolant system (RCS) temperature of less than 200 degrees Fahrenheit.

II. Description of Problem

A. Summary

On May 10, 1994, at 2245 PDT, Unit 1 completed a shutdown from Mode 2 (Startup) to Mode 5 (Cold Shutdown) as required by Technical Specification (TS) 3.8.1.1 Action b. The Unit 1 shutdown was due to a loss of an offsite power source when the Unit 1 main transformer bank [EB][XFMR] was declared inoperable after acetylene was detected in the Unit 1 C phase 500 kV transformer [EB][XFMR] oil. An Unusual Event was declared at 1145 PDT on May 10, 1994, and an immediate, emergency report was made to the NRC in accordance with the requirements of 10 CFR 50.72(a)(1)(i). At 2245 PDT, Unit 1 entered Mode 5 and the Unusual Event was terminated.

On May 20, 1994, replacement of the Unit 1 C phase 500 kv transformer with the Unit 2 spare transformer was completed.

B. Background

Technical Specification 3.8.1.1 requires that as a minimum, the following AC electrical power sources shall be operable: two independent circuits (one with delayed access) between the offsite transmission network and the Onsite Class 1E distribution system, and three separate and independent diesel generators [EB][DG]. With one of the offsite circuit power sources inoperable, operability of the remaining AC sources must be demonstrated by restoring the offsite circuit to operable status within 72 hours or be in at least Mode 3 (Hot Standby) within the next 6 hours and in Mode 5 (Cold Shutdown) within the following 30 hours.

Electrical power generated by the main generators [TB] is converted from 25 to 500 kV by the three, single-phase main transformer banks. The 500 kV power is then directed to the 500 kV switchyard [FK] via two onsite transmission circuits (one for each unit). The electrical power is transmitted offsite via three transmission circuits. Offsite power for startup and standby service is provided from the 230 kV transmission system. Two offsite 230 kV transmission circuits provide power to a 230 kV switchyard.

Two methods for monitoring combustible (fault) gas in oil-filled transformers are used at Diablo Canyon Power Plant (DCPP). One method is the gas-in-gas method where a sample of the nitrogen mixture is measured for fault gas. The other method is the gas-in-oil method where an oil sample is extracted and sent to a lab for fault gas analysis.

Each of the main bank transformers has a Hydran 201R monitor [EB][XFMR][MON] installed which provides on-line detection and monitoring of fault gases in oil. The Hydran is sensitive to hydrogen, carbon monoxide, and acetylene, which are primary indicators of incipient faults in electrical equipment.

C. Event Description

During the Unit 1 sixth refueling outage (1R6), bushing replacement was performed on B and C phase 500 kV transformers as part of the five-year bushing replacement program.

On March 27, 1994, after bushing replacement, the Unit 1 C phase 500 kV transformer vacuum structural support was overpressurized during preparations to refill the transformer with oil. PG&E visually inspected and discussed the overpressurization with Cooper Power Systems and concluded that the overpressurization could not have adversely affected the Unit 1 C phase 500 kV transformer. Also, there were no apparent weld cracks, no damage to the bushings, no stress on the line leads to the bushings, and no clearance problems in the area of the bulge. On March 28, 1994, at 1000 PDT, the transformer was filled with nitrogen with no indication of an oil leak. On April 4, 1994, the Unit 1 main transformer bank was reenergized and returned to service.

On May 8, 1994, in the morning, the Hydran monitor was reading 23 ppm. On May 8, 1994, at 2300 PDT, the Hydran monitor was reading 225 ppm. On May 9, 1994, at 1917 PDT, with Unit 1 in Mode 1 (Power Operation) (at approximately 35 percent reactor power) during power ascension, the radio frequency (RF) monitor [EB][MON] alarmed, indicating potential arcing in the 25 kV system. As a precautionary measure, the power ascension was halted while investigating the RF monitor alarming condition. On May 9, 1994, at 2215 PDT, the Hydran monitor was reading 728 ppm. An oil sample from the Unit 1 C phase 500 kV transformer was taken. The analysis results showed that the concentration of acetylene was at 127 ppm, which was above the allowed average. This indicated a high energy arcing discharge. Another oil sample was taken later which indicated that the amount of acetylene had increased to 260 ppm. At this time, a decision was made to commence shutdown of Unit 1.

On May 10, 1994, at 2245 PDT, Unit 1 completed a cooldown to Mode 5 (Cold Shutdown) as required by Technical Specification (TS) 3.8.1.1 Action b, upon loss of an offsite power source when the Unit 1 main transformer bank was declared inoperable after acetylene was detected in the Unit 1 C phase 500 kV transformer oil. TS 3.8.1.1a limiting condition for operation was not met when the transformer could not be made operable within the allowed 72 hours. An Unusual Event was declared at 1145 PDT on May 10, 1994, and an immediate, emergency report was made to the NRC in accordance with the requirements of 10 CFR 50.72(a)(1)(i). At 2245 PDT, Unit 1 entered Mode 5 and the Unusual Event was terminated.

On May 20, 1994, replacement of the Unit 1 C phase 500 kV transformer with the Unit 2 spare transformer was completed.

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

None.

E. Dates and Approximate Times for Major Occurrences

1.	May 8, 1994:	Instrumentation indicated a high energy discharge and arcing in the Unit 1 C phase 500 kV transformer.
2.	May 10, 1994, at 1145 PDT:	Event Date/Discovery Date: Unusual event declared on Unit 1 due to initiation of a TS required shutdown.
3.	May 10, 1994, at 1145 PDT:	An immediate notification was made to the NRC in accordance with 10 CFR 50.72(a)(1)(i).
4.	May 10, 1994, at 2245 PDT:	Unusual Event terminated when Unit 1 entered Mode 5.

F. Other Systems or Secondary Functions Affected

None.

G. Method of Discovery

A degraded condition in the Unit 1 C phase 500 kV transformer was suspected due to the alarming of the transformer radio frequency (RF) monitor in the control room and above normal levels of hydrogen as detected by the Hydran monitor. An oil sample was taken, which revealed high levels of acetylene and confirmed the degraded condition.

H. Operator Actions

Unit 1 commenced a cooldown to Mode 5.

I. Safety System Responses

None.

III. Cause of the Problem

A. Immediate Cause

Unit 1 commenced cooling down to Mode 5 due to increased levels of acetylene and hydrogen in the C phase 500 kV transformer oil. These changes in the transformer oil chemistry were indications of hot spots or arcing within the Unit 1 C phase 500 kV transformer.

B. Root Cause

The root cause of this event has not been determined. The Unit 1 C phase 500 kV transformer was visually inspected. A winding resistance check, transformer turns ratio test, a bushing megger test, and micro-ohm test of the connections were conducted. The connections were tight and had acceptable micro-ohmmeter readings. There were no indications of damage to the bushings. There is evidence of arcing at the shunt packs which are located in the lower part of the transformer near the core. Several potential root causes have been investigated as follows and do not appear to be the cause of the degraded condition:

1. Possible transformer damage during bushing replacement

Physical inspection of the transformer after it was removed from service, found tight connections and no indication of arcing or other physical damage that would indicate that the work performed during the bushing replacement was a cause of the degraded condition.

2. Overpressurization

Based on visual inspections and discussions with the vendor, Cooper Power Systems, it was concluded that the overpressurization did not appear to be the cause of the degraded condition based on the following:

a. There were no apparent weld cracks.

b. The no load tap changer [EB][TTC] operated smoothly.

c. The high and low bushings were not damaged.

d. There was no stress on the line leads to the bushings.

e. There were no clearance problems in the area of the bulge.

3. Random event

The cause or causes of the degraded condition are unknown.

Summary

In order to conduct a thorough investigation, PG&E is planning to disassemble and inspect the transformer. In addition, PG&E has contracted with an independent transformer expert to provide recommendations for reconciling the degraded condition. A supplemental LER will be issued when the final root cause is determined.

IV. Analysis of the Event

The primary function of the 500 kV transformer is to transmit the power generated by the main generators to the 500 kV transmission system. Power from the 500 kV transmission system is capable of backfeeding through the 500 kV transformer to the plant's electrical system to power plant safe shutdown and auxiliary loads.

In the event of a loss of the 500 kV offsite power circuit, the 230 kV system is designed to supply the maximum demand of the loads for a design basis accident in one unit and a concurrent safe shutdown in the other unit. When the 500 kV system is unavailable, the 230 kV system provides sufficient power to operate the plant within its design bases.

In the event of a complete loss of offsite power and a turbine trip, a loss of power to the plant auxiliaries occurs. The events following a loss of offsite power with a turbine and reactor trip will eventually result in the emergency diesel generators starting on a loss of voltage and supplying plant electrical vital loads.

With the 230 kV offsite power and emergency diesel generators available, all plant systems were operable. .Thus, the health and safety of the public were not affected by this event.

V. Corrective Actions

A. Immediate Corrective Actions

1. Unit 1 was shutdown from Mode 2 to Mode 5.

2. The Unit 1 C phase transformer was replaced with the Unit 2 spare transformer.

B. Corrective Actions to Prevent Recurrence

Corrective actions, when determined, will be provided in a supplemental LER.

VI. Additional Information

A. Failed Components

None.

B. Previous LERs on Similar Problems

None.