Pacific Gas and Electric Company

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April 17, 2003

PG&E Letter DCL-03-041

U.S. Nuclear Regulatory Commission
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Washington, DC 20555-0001

Docket No. 50-323, OL-DPR-82
Diablo Canyon Unit 2
Licensee Event Report 2-2003-002-00
Unanalyzed Condition in the Unit 2 Component Cooling Water System Due To a Valve Liner Failure

Dear Commissioners and Staff:

In accordance with 10 CFR 50.73(a)(2)(ii)(B), Pacific Gas and Electric (PG&E) is submitting the enclosed licensee event report regarding a Unit 2 component cooling water (CCW) valve liner failure, resulting in an unanalyzed condition for CCW System header separation.

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

Sincerely,

James R. Becker

SWH/2246/N0002156
Enclosure
cc/enc: Ellis W. Merschoff
David L. Proulx
Girija S. Shukla
Diablo Distribution
NPO

IE22

LICENSEE EVENT REPORT (LER)

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

TITLE (4)

Unanalyzed Condition in the Unit 2 Component Cooling Water System Due to a Valve Liner Failure

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
02	17	2003	2003	- 0 0 2 -	0 0	04	17	2003		

OPERATING MODE (9)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR (11)	
N	X	10 CFR 50.73(a)(2)(ii)(B)
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	
Lawrence M. Parker, Senior Regulatory Services Engineer	805	545-3386

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
A	C C	V	F 1 3 0	No					

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 February 17, 2003, at 0830 PDT, with Unit 2 defueled, Pacific Gas and Electric (PG&E) determined that the unit had been in an unanalyzed condition as a result of the damaged valve liner for Component Cooling Water (CCW) manual valve CCW-2-18. This valve, in its damaged condition, could have caused intersystem leakage between redundant headers in excess of licensing/design requirements. An 8-hour non-emergency report was made to the NRC at 1057 PDT on February 17, 2003, in accordance with 10CFR50.72(b)(3)(ii)(B).

The root cause is unknown. PG&E believes the liner was torn as a result of valve manipulation during the Unit 2 eighth refueling outage during an attempt to use this valve as an isolation clearance boundary.

Immediate corrective actions included:

1. Replacing the CCW-2-18 damaged valve liner,
2. Verifying the travel stop for valve CCW-2-18 to ensure the valve disc stops on the valve seat, and
3. Verifying the CCW System train separation function for similar butterfly valves in the CCW Systems of both units.

Corrective actions to prevent recurrence include requiring periodic testing for similar valves to ensure the licensing bases for header separation and leakage are maintained within requirements.

TEXT

I. Plant Conditions

Unit 2 was defueled in the eleventh refueling outage (2R11).

II. Description of Problem

A. Background

The component cooling water (CCW) System [BI] provides a heat sink for the removal of heat from safety related and non-safety related components during a design basis accident (DBA) or transient. During normal operation, the CCW System provides this function for safety related components, various nonessential components, and the spent fuel storage pool [DA]. The CCW System serves as a barrier to the release of radioactive byproducts between potentially radioactive systems and the Auxiliary Saltwater (ASW) System [BS], and thus to the environment.

The CCW System consists of three CCW pumps powered from separate vital buses, two CCW heat exchangers, and a shared CCW surge tank with a divider plate. The piping system consists of three normally cross-tied headers. The headers extend from the outlet of the heat exchangers, through the header heat loads (components), to the suction of the CCW pumps.

The two vital headers serve redundant engineered safety feature (ESF) loads. A third, nonvital header serves nonvital equipment. Only one ASW pump and one CCW heat exchanger are required, as assumed in the safety analysis, to provide sufficient heat removal from containment to mitigate a DBA. However, to ensure maximum heat removal capability, operators are instructed to place the second CCW heat exchanger in service early in the emergency operating procedures.

Each of the vital headers can be isolated from the others to mitigate a CCW System passive single failure, such as a pipe break, during post-loss of coolant accident (LOCA) long term cooling. The divided surge tank is connected to the vital header return piping and is sized to meet system leakage requirements and maintain adequate net positive suction head (NPSH) on system pumps. In the event that CCW System leakage occurs and system makeup is not available, the surge tank volume provides a minimum of 20 minutes, based on a nonmechanistic leakage rate of 200 gpm, for operators to locate and isolate the leak or separate the CCW System into separate headers before the system becomes impaired due

TEXT

to water loss as discussed in Supplemental Safety Evaluation Report (SSER) 16. This scenario does not credit available automatic or manual CCW makeup to mitigate a CCW System leak.

Additional information on the design and operation of the system, along with a list of the components served, is presented in the Final Safety Analysis Report, Section 9.2.2.

Abnormal Operating Procedure OP AP-11, "Malfunction of Component Cooling Water System" provides direction on various potential system malfunctions including outleakage. When CCW System outleakage is identified, the first step is to verify that makeup water is available to the CCW surge tank. Makeup water is automatically supplied from a normally running makeup water transfer pump through two automatic valves that open on a low CCW surge tank level. If these automatic valves malfunction, OP AP-11 directs Operations personnel to open the manual bypass valves around the automatic valves to maintain adequate level in the CCW surge tank. If the normal makeup water source is not available, operators are directed to line up water from other available sources.

Operating Procedure OP F-2:VII, "Alternate Makeup Water to the CCW System" provides guidance to establish an alternate supply from three different sources. One of the sources consists of all Class I components.

Emergency Operating Procedure EOP E-1.4, "Transfer to Hot Leg Recirculation," directs Operators to align the CCW System into two separate vital headers to minimize the impact of a passive failure in the CCW System during the long term cooling phase of an accident. Automatic or manual makeup to the CCW surge tank, if available, would be used to mitigate outleakage.

B. Event Description

On February 17, 2003, at 0830 PDT, with Unit 2 defueled, Pacific Gas and Electric (PG&E) determined that the unit had been in an unanalyzed condition as a result of the damaged valve liner for manual valve CCW-2-18. This valve, in its damaged condition, could have caused cross-header leakage in excess of licensing/design requirements. An 8-hour non-emergency report was made to the NRC at 1057 PDT on February 17, 2003, in accordance with 10CFR50.72(b)(3)(ii)(B).

This reporting determination was based on the evaluation in SSER 16, which credits only operator action to isolate a postulated CCW leak and did not credit automatic or manual CCW makeup.

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

None

D. Other Systems or Secondary Functions Affected

None

E. Method of Discovery

During routine maintenance of an adjacent CCW valve, utility maintenance personnel observed the damaged valve liner for valve CCW-2-18, and notified management.

F. Operator Actions

None

G. Safety System Responses

None

III. Cause of the Problem

A. Immediate Cause

CCW-2-18 valve liner failed due to mechanical overload.

B. Root Cause

The root cause is unknown.

The valve liner was installed in 1978. Based on a review of operating history of this valve, PG&E believes the liner was torn as a result of valve manipulation during the Unit 2 eighth refueling outage when CCW-2-18 was attempted to be used as an isolation clearance boundary. The removed valve liner showed no signs of embrittlement or discoloration. Valve liner

failure analyses, such as chemical and physical evaluations, are ongoing. If PG&E obtains significant new information, this LER will be supplemented.

IV. Analysis of the Event

The CCW System is required to provide cooling to safety-related components to assure that they are capable of performing their required functions following an accident. As previously described, the CCW System consists of normally cross-tied vital and nonvital headers. The headers can be separated from each other within 20 minutes following an assumed CCW leak of 200 gpm, as discussed in SSER 16.

Had a 200 gpm leak occurred in header B, and makeup was not available, the leakage would not have been fully terminated when the subject valves were closed. Left uncorrected, the ongoing out leakage would result in a loss of the CCW function.

However, the combination of operator action and the addition of makeup water would maintain the CCW function. Establishment of makeup to the CCW System would allow sufficient time for operators to identify leakage paths and isolate the headers. Makeup is automatically available through automatic makeup valves, which open on low surge tank level, to provide at least 300 gpm makeup to the CCW surge tank. There are also Class I manual bypass valves around the automatic makeup valves and an alternate alignment to a Class I makeup water source.

Based on the above makeup capabilities, given a design basis 200 gpm leak, it is concluded that the cross header leakage resulting from a failed liner in CCW-2-18 would have been completely mitigated.

Based upon the characteristics of the remaining liner and the geometry of the missing section, it appears that 50 percent of the liner was torn away from the valve liner and that the missing piece was ripped off in one section. The piece would then travel downstream into the 2-1 CCW heat exchanger.

The CCW heat exchangers are shell and tube type heat exchangers, with CCW flowing on the shell side. Water flows into the heat exchangers through an Inlet nozzle on the top of the heat exchanger. The water flows around a flow distributor and into the heat exchanger horizontally through two large openings. The most probable location for the liner remnant is between the heat exchanger outside shell and the flow distributor. Should the liner have entered the tube area, the largest clearance inside the heat exchangers is 0.82", which is the

tube-to-tube clearance in the bundle. The missing piece has a thickness of about 0.8" in the center. The clearance between the outside of the tube bundle and the shell is close to the liner maximum thickness; the missing piece is not expected to have migrated past the inlet area of the tube bundle.

The presence of the liner piece lodged inside the heat exchanger does not significantly impair the ability to transfer heat since the size of the missing liner is very small when compared to the heat transfer surface area on the outside of the tubes. The liner piece lodged in the tube bundle will not contribute to tube fretting or vibration induced fatigue failure since a liner piece in contact with tubes will tend to dampen tube vibration.

It is judged that the missing liner section is in one piece and is lodged in the 2-1 CCW heat exchanger. The liner piece will not adversely impact system flows or heat transfer capability nor will it degrade the heat exchanger.

Therefore, the CCW System was capable of performing its required safety function. There were no actual safety consequences involved in this event because CCW System makeup capability was available and in excess of the postulated leakage.

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

The condition is not a Safety System Functional Failure.

The event was evaluated using the NRC's Significance Determination Process in accordance with NRC Inspection Manual Chapter 0609 and was determined to be of very low risk significance.

V. Corrective Actions

A. Immediate Corrective Actions

1. The valve liner for valve CCW-2-18 was replaced and tested for leak tightness.
2. Verifying the travel stop for valve CCW-2-18 to ensure the valve disc stops on the valve seat.
3. Similar valves on both units were evaluated and/or tested. No evidence was discovered that would show that other CCW System header separation valves had excessive leakage.

B. Corrective Actions to Prevent Recurrence

PG&E will develop and implement a periodic testing program to verify CCW valve leakage is within the licensing bases for CCW System header separation.

VI. Additional Information

A. Failed Components

The valve is a manual 20-inch butterfly valve, made of carbon steel with EPT liner.
Manufacturer: Fisher Controls Company
Model number: 9170

B. Previous Similar Events

"CCW Valves Relied Upon For Header Isolation Have Leakby," (NCR N0002117, LER 1-00-009-00 (DCL-00-147), due to incorrectly set valve travel stops. Corrective actions to prevent recurrence included maintenance activities to properly set the valve travel stops. This corrective action did not prevent the liner from experiencing mechanical overload for CCW-2-18.

"Aux Feed Pump STP Terminated Due to Low Flow," (NCR N002110) due to an incorrectly installed valve liner. Corrective actions to prevent recurrence included maintenance activities to properly install valve liners. This corrective action would not have prevented the liner from experiencing mechanical overload for CCW-2-18.