Pacific Gas and Electric Company

David H. Oatley
Vice President
Diablo Canyon Operations

Diablo Canyon Power Plant
P.O. Box 56
Avila Beach, CA 93424

805.545.4350
Fax: 805.545.4234

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PG&E Letter DCL-02-064

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 1-2002-002-00
Steam Generator Tube Plugging Due to Stress Corrosion Cracking

Dear Commissioners and Staff:

In accordance with Technical Specification (TS) 5.6.10.c, PG&E is submitting the enclosed licensee event report regarding steam generator (SG) tube plugging due to stress corrosion cracking identified during the Unit 1 eleventh refueling outage. TS 5.6.10.c requires a special report since more than one percent of the tubes inspected in SG 1-2 were identified as defective, and TS 5.6.10.a requires reporting of the number of tubes plugged in each SG.

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

Sincerely,

DH Oatley

David H. Oatley

wec/2246
Enclosure
cc: Ellis W. Merschoff
David L. Proulx
Girija S. Shukla
Diablo Distribution
INPO

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 6

TITLE (4)

Steam Generator Tube Plugging Due to Stress Corrosion Cracking

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
05	19	2002	2002	- 0 0 2 -	0 0	05	22	2002		

OPERATING MODE (9)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (11)		
6	X	10 CFR	50.73(a)(2)(ii)(B)
POWER LEVEL (10)	X	OTHER	Special Report per TS 5.6.10.a and c
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	A B	S G	W 1 2 0	N					

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

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

On May 19, 2002, with Unit 1 in Mode 6 (Refueling), analysis of eddy current testing on Steam Generator (SG) 1-2 indicated that greater than one percent of the tubes were defective. On May 19, 2002, at 1759 PDT, PG&E made a nonemergency report to the NRC as required by Technical Specification (TS) Table 5.5.9-2, "Steam Generator (SG) Tube Inspection."

On May 20, 2002, PG&E discussed the preliminary results of the eddy current inspection with the NRC during a phone conference. PG&E also notified the NRC that primary water stress corrosion cracking and circumferential indications were detected at tube support plate (TSP) intersections, satisfying TS 5.6.10 paragraph d.

The majority of the tube defects were attributed to outside diameter stress corrosion cracking and to primary water stress corrosion cracking at TSP intersections.

PG&E has plugged all defective Unit 1 tubes identified during the current refueling outage in accordance with TS 5.5.9. All defective tubes met the criteria of Regulatory Guide 1.121 for structural integrity at the end of Cycle 11. PG&E maintains a comprehensive program to minimize SG tube degradation.

TEXT

I. Plant Conditions

Unit 1 was in Mode 6 (Refueling) in its eleventh refueling outage (1R11).

II. Description of Problem

A. Background

Technical Specification (TS) 5.5.9, "Steam Generator (SG) Tube Surveillance Program," requires that the results of each SG tube inspection be classified as Category C-3 if more than one percent of the total tubes inspected are defective. Defective tubes must be repaired or removed from service by plugging.

TS 5.6.10, "Steam Generator (SG) Tube Inspection Report," paragraph a, requires the number of tubes plugged in each SG [AB][TBG] to be reported within 15 days following the completion of each inservice inspection. TS 5.6.10, paragraph c, requires the results of SG tube inspections, which fall into Category C-3, to be reported in a special report to the Commission within 30 days and prior to resumption of plant operation. TS 5.6.10, paragraph d, requires NRC notification prior to returning the SG to service if circumferential crack-like indications are detected at tube support plate (TSP) intersections, or if indications are identified at TSP intersections that are attributable to primary water stress corrosion cracking (PWSCC).

If the results of the SG tube inspections are classified as Category C-3, then NRC notification is required in accordance with 10 CFR 50.72(b)(3)(ii), and submittal of a special report is required in accordance with TS 5.6.10.c.

B. Event Description

On May 19, 2002, final analysis of eddy current testing on SG 1-2 indicated that greater than one percent of the active tubes inspected were defective, therefore classifying SG 1-2 as Category C-3, per TS 5.5.9. Defects in 36 active tubes in SG 1-2 were removed from service by tube plugging in 1R11. Two additional non-defective tubes were plugged as a preventive measure.

On May 19, 2002, at 1759 PDT, a nonemergency report was made in accordance with TS Table 5.5.9-2 and 10 CFR 50.72(b)(3)(ii)(B).

TEXT

On May 20, 2002, PG&E discussed the preliminary results of the inspection with the NRC during a phone conference. During this phone conference, PG&E also notified the NRC that PWSCC and circumferential indications were detected at TSP intersections, satisfying TS 5.6.10 paragraph d.

In SGs 1-1, 1-3, and 1-4, the number of defective tubes plugged in 1R11 was 22, 9, and 10, respectively, thus classifying these SG inspection results as Category C-2, per TS 5.5.9.

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

None.

D. Other Systems or Secondary Functions Affected

None.

E. Method of Discovery

The defective tubes were found during routine scheduled eddy current testing of Unit 1 SG tubing performed during 1R11.

F. Operator Actions

None.

G. Safety System Responses

None.

III. Cause of the Problem

A. The number of defective tubes in SG 1-2 identified during 1R11 exceeded one percent of the total tubes inspected, placing the SG in Category C-3, per TS 5.5.9.

B. Root Cause

The majority of the tube defects are attributed to outside diameter stress corrosion cracking (ODSCC) and PWSCC at hot leg TSP intersections.

C. Contributory Cause

None.

IV. Assessment of Safety Consequences

The licensing-basis, large-break, loss-of-coolant accident analysis assumes a tube-plugging limit of 15 percent per SG. Including the tubes plugged during 1R11, the following table presents the number of tubes (out of a total of 3,388 tubes for each SG) that are currently plugged in each of the four Unit 1 SGs.

SG NO.	Active Defective Tubes Plugged in 1R11	Total Tubes Plugged to Date	Total Percentage of Tubes Plugged
1-1	22	154	4.5
1-2	36	230	7.0
1-3	9	49	1.5
1-4	10	75	2.2

The plugging percentage for each Unit 1 SG remains within the current allowable limit of 15 percent.

There were no actual safety consequences involved in this event since all defective tubes met the criteria of Regulatory Guide 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes," for structural integrity at the end of Cycle 11.

Also, the condition is not considered a Safety System Functional Failure.

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

V. Corrective Actions

A. Immediate Corrective Actions

All Unit 1 SG tubes classified as defective during 1R11 have been plugged in accordance with Diablo Canyon Power Plant (DCPP) TS 5.5.9.

B. Corrective Actions to Prevent Recurrence

PG&E has initiated several programs to minimize SG tube degradation, license alternate repair criteria, and license tube repair techniques.

TEXT

Secondary side initiatives to minimize tube degradation:

1. Electric Power Research Institute secondary chemistry recommendations were implemented to minimize ODSCC at TSPs (e.g., hydrazine levels were increased in 1992, the secondary side pH treatment was converted from ammonia to ethanol amine in 1993/1994, and a molar ratio control program was implemented in 1993).

2. Tube sheets are sludge lanced during each refueling outage to minimize ODSCC at the tube sheet.

3. DCPP has an upgraded plant makeup water system to minimize SG contaminate levels.

4. SG blowdown is maintained at approximately one percent of the main steaming rate to minimize SG contaminate levels.

5. A boric acid addition program is in effect, including boric acid soaks at startup to mitigate denting and ODSCC at TSPs.

6. DCPP has condensate polishers and emergency (plant curtailment) procedures to protect against seawater condenser tube leaks.

Primary side initiatives to minimize tube degradation:

1. Rows 1 and 2 U-bends have been heat treated in 1987/1988 to prevent PWSCC.

2. The tubes in the hot leg tube sheet region were shot peened in 1992/1993 to minimize PWSCC.

3. Reactor coolant system (RCS) contaminants are maintained at low levels in accordance with EPRI guidelines.

4. Lithium and boron concentrations are coordinated to minimize pH swings in the RCS.

5. Zinc addition to the RCS was implemented in Units 1 and 2 starting in Cycle 9 to inhibit PWSCC in SG tubes.

TEXT

Alternate repair criteria (ARC):

1. Voltage-based ARC for axial ODSCC at TSPs was implemented starting in Unit 2 eighth refueling outage and Unit 1 ninth refueling outage.

2. W* ARC for axial PWSCC contained in the WEXTEX tube sheet was implemented starting in Unit 1 ninth refueling outage and Unit 2 ninth refueling outage.

3. PWSCC ARC for axial PWSCC at dented TSPs was implemented starting in 1R11.

Tube repair techniques:

PG&E is reviewing methods of tube repair and sleeving techniques for application at DCPP.

VI. Additional Information

A. Failed Components

Component: SG tubes (Series 51 SG)
Manufacturer: Westinghouse

B. Previous Similar Events

LER 1-97-007 reported that greater than one percent of the tubes inspected in SG 1-1 and 1-2, during the Unit 1 eighth refueling outage, were defective.

LER 1-2000-010-00 reported that greater than one percent of the tubes inspected in SG 1-2, during the Unit 1 tenth refueling outage, were defective.