50-275/323-OLA-2 Repter 026.1429 197355

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Gregory M. Rueger
Senior Vice President and
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I-MFP-64

October 7, 1992

'93 OCT 28 P6:09

PG&E Letter No. DCL-92-215

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

Re: Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
Licensee Event Report 1-92-006-01
Diesel Fuel Oil Transfer System Degradation due to General Corrosion

Gentlemen:

PG&E is submitting a revision to the voluntary Licensee Event Report 1-92-006-00 concerning degradation of piping in the diesel fuel oil transfer system. This revision is submitted to reflect the results of a stress analysis. This report is submitted for information purposes only as described in Item 19 of supplement 1 to NUREG-1022. Revision bars in the margin indicate the revised LER sections.

This event has in no way affected the health and safety of the public.

Sincerely,

Gregory M. Rueger

cc: Ann P. Hodgdon
John B. Martin
Philip J. Morrill
Harry Rood
CPUC
Diablo Distribution
INPO

DC2-92-TN-N028

Enclosure

1061S/85K/SDL/2246

NUCLEAR REGULATORY COMMISSION
Docket No. 50-275-OLA Official Exh. No. MFP-64
In the matter of PACIFIC GAS and ELECTRIC Co
Staff ____ IDENTIFIED ✓
Applicant ____ RECEIVED ✓
Intervenor ✓ ____ REJECTED ____
Governor ____
Contractor Ann Riley & Assoc DATE 8-19-93
Other ____ Witness ____
Reporter Dollie Feigel

LICENSEE EVENT REPORT (LER)

197355

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
DIABLO CANYON UNIT 1	0 5 0 0 0 2 7 5	1 OF 10

TITLE (4) DIESEL FUEL OIL TRANSFER SYSTEM DEGRADATION DUE TO GENERAL CORROSION

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 (8)
07	02	92	92	- 0 0 6 -	0 1	10	07	92	DIABLO CANYON UNIT 2	0 5 0 0 0 3 2 3
										0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (11)
POWER LEVEL (10)	1 0 0	___ 10 CFR ___ X OTHER - VOLUNTARY (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	
C	D E	P S P		N							

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
| | YES (if yes, complete EXPECTED SUBMISSION DATE)	| X | NO				

ABSTRACT (16)

This voluntary LER is being submitted for information purposes only as described in Item 19 of Supplement 1 to NUREG-1022.

On July 2, 1992, ultrasonic testing identified one location on the diesel fuel oil (DFO) train 0-1 piping that was below the minimum wall thickness requirement; this piping was subsequently replaced. Subsequent engineering analysis concluded that the piping would have remained operable under all design basis loading conditions.

The root cause of the event was general corrosion due to a degradation or breakdown in the coal tar coating exposing the pipe to standing water and saltwater air environment.

Corrective actions include development and implementation of a repair program to repair and/or replace the remaining areas of corrosion on the DFO piping.

I. Plant Conditions

Units 1 and 2 were in Mode 1 (Power Operation) at 100 percent power.

II. Description of Event

A. Summary:

On June 21, 1992, corrosion was discovered on piping (DE)(PSP) associated with diesel fuel oil (DFO) Train 0-1 (DE)(PSP) and the two fire suppression system carbon dioxide (CO_2)(KQ)(PSP) lines contained in pipe trenches located in the Unit 2 west buttress area trench. Immediate visual inspection of the corroded areas determined the pipe to be operable.

On June 23, 1992, at 0240 PDT, DFO Train 0-2 was removed from service for the tie-in of new Emergency Diesel Generator (EDG) 2-3 (EK)(GEN).

On July 2, 1992, ultrasonic thickness (UT) examination identified one location on DFO Train 0-1 piping that was below the minimum wall thickness requirement; this piping was subsequently replaced.

On July 8, 1992, plant management conservatively determined that, because the corrosion experienced by the DFO system piping must have required a significant period of time to degrade below a minimum wall condition, Technical Specification (TS) 3.8.1.1 action g. may not have been met. In addition, since DFO Train 0-2 was removed from service on June 23, 1992, at 0240 PDT, and DFO Train 0-1 may have been inoperable due to the minimum wall conditions, TS 3.8.1.1 action h. may not have been met.

An engineering analysis has concluded that the piping would have remained operable under all design basis loading conditions.

B. Background:

The DFO system supplies fuel oil to the Units 1 and 2 EDGs. There are two redundant DFO pipe trains, 0-1 and 0-2. These two trains each consist of a 40,000 gallon underground DFO storage tank (DE)(TK), a fuel oil transfer pump (DE)(P), and associated piping, filters (DE)(FLT), and valves (DE)(V) (refer to Figure 1).

The DFO transfer system supplies DFO from the underground storage tanks to the individual EDG day tanks (DE)(TK). The day tanks have a capacity of 572 gallons, but contain a minimum of 200 gallons of DFO for each EDG at all times. Each EDG uses approximately 200 gallons per hour at a full load.

TS 3.8.1.1 action statements g. and h. govern the DFO transfer system. With one supply train of the DFO storage and transfer system inoperable, action g. requires that the inoperable supply train must be restored to operable status within 72 hours or be in at least Mode 3 (Hot Standby) within the next 6 hours and be in Mode 4 (Hot Shutdown) within the following 6 hours. With both supply trains of the DFO storage and transfer systems inoperable, action h. requires that one supply train must be restored to operable status within 1 hour or be in at least Mode 3 within the next 6 hours and be in Mode 5 (Cold Shutdown) within the following 30 hours.

TS 4.8.1.1.3.e requires visual examination of accessible DFO piping during an operating pressure leak test at least once every 10 years. Surveillance Test Procedure (STP) M-91, "Diesel Fuel Oil Transfer System, Piping and Component Inspection," implements this 10-year visual inspection for DFO piping leakage, but does not specifically require inspecting all DFO piping for corrosion. STP M-91 is performed every 5 years in accordance with administrative requirements.

STP M-9A, "Diesel Engine Generator Routine Surveillance Test," requires a series of EDG tests to be performed on a frequency ranging from 1 test per 7 days to 1 test per 31 days, depending upon the number of valid starts. The tests performed under STP M-9A determine the overall operability of a single EDG and verify that the DFO trains transfer fuel.

STP P-12B1 (P-12B2), "Routine Surveillance Test of Diesel Fuel Oil Transfer Pump 0-1 (0-2)," requires testing of the DFO transfer pumps on a quarterly basis.

Event Description:

On February 2, 1990, STP M-91 was performed and corrosion was identified on DFO Train 0-1. In early May 1990, the corroded area was cleaned, inspected, and recoated. The maintenance engineer documented that there was no damage to the pipe due to corrosion or pitting. However, as a result of this event, the frequency of STP M-91 was changed from 10 to 5 years in August 1991.

On June 18, 1992, corrosion was discovered in auxiliary saltwater (ASW) annubar piping (BA)(PSP). The ASW system piping, DFO system piping, and the CO_2 piping are found in a common area in one location of the DFO pipe trench.

On June 21, 1992, a work crew was inspecting the DFO trenches to determine the extent of an acid/caustic spill in the Unit 2 west buttress. Corrosion was found on the DFO Train 0-1 system piping and two fire suppression system CO_2 lines. Design Engineering performed an immediate evaluation of the worst corroded areas identified by the work crew. The piping was concluded to be operable and an inspection

plan was formulated to mechanically clean the corroded areas and non-destructively examine the piping to determine remaining wall thickness.

On June 23, 1992, during implementation of the inspection plan, corrosion was identified on DFO Train 0-2 and additional corrosion areas were identified on the two CO_2 lines. Again, based upon the findings of the visual inspections and selective UT examinations of the DFO line, these pipes were evaluated to be operable.

On June 23, 1992, at 0240 PDT, DFO Train 0-2 was removed from service and TS 3.8.1.1 action g. was entered for the tie-in of EDG 2-3 to DFO Train 0-2 (with the addition of EDG 2-3, Units 1 and 2 will each have three dedicated EDGs). As part of the tie-in activities, an operational pressure test was performed on the pipe train. The previously identified areas of corrosion were observed and no leakage was identified.

On June 24, 1992, at 0320 PDT, DFO Train 0-2 was returned to service and TS 3.8.1.1 action g. was exited.

On June 24, 1992, a comprehensive inspection plan was developed to evaluate the condition of the piping and associated supports on both trains of the DFO system. The plan involved a complete visual inspection of each DFO train from the transfer pump vaults to the EDG day tank level control valves (DE)(LCV), including pipe supports (DE)(PSP)(SPT), and UT inspection of the worst corrosion areas to verify wall thickness.

On June 25, 1992, at 0230 PDT, DFO Train 0-1 was removed from service and TS 3.8.1.1 action g. was entered to tie-in EDG 2-3 to DFO Train 0-1. Also on June 25, 1992, the visual inspection plan for DFO Train 0-1 was implemented. As part of the tie-in activities, an operational pressure test of the pipe was performed. The exposed sections of the train were walked down and no leakage was identified. This walkdown included the section of pipe that later was found to be below minimum wall thickness requirements.

On June 26, 1992, at 0224 PDT, DFO Train 0-1 was returned to service and TS 3.8.1.1 action g. was exited.

On June 29, 1992, the visual inspections were completed. The visual inspections identified 6 areas on the DFO Train 0-1 for UT examination.

On July 2, 1992, at 0500 PDT, DFO Train 0-1 was cleared and drained for UT testing. At 1700 PDT, one location on DFO Train 0-1 was identified as being below the minimum wall thickness requirement. DFO Train 0-1 was conservatively declared inoperable.

On July 3, 1992, at 0500 PDT, the repair plans for DFO Train 0-1 were implemented. At 1700 PDT, the visual inspection plan for DFO Train 0-2 piping for the Unit 2 EDGs was initiated. This visual examination determined that the Train 0-2 section of piping had the worst corrosion of the DFO piping. Since the UT examination did not identify concerns with the other areas tested, the validity of the visual examination was confirmed.

On July 4, 1992, at 1300 PDT, the section of pipe with below minimum wall thickness on DFO Train 0-1 was replaced and the train was declared operable.

On July 4, 1992, at 1500 PDT, the visual inspection of the portion of DFO Train 0-2 supplying the Unit 2 EDGs was completed and 7 areas were chosen for UT examinations.

On July 5, 1992, at 1100 PDT, the UT tests on DFO Train 0-2 were completed and no areas of pipe were found below minimum wall thickness. At 1200 PDT, the inspection of the portion of DFO Train 0-2 supplying the Unit 1 EDGs began. At 2300 PDT, the visual inspection for Train 0-2 supply piping for Unit 1 was completed and 5 areas were chosen for UT testing.

On July 6, 1992 at 1200 PDT, the UT tests were completed and no areas were found below the minimum wall thickness requirements.

On July 8, 1992, plant management conservatively determined that because the corrosion on the DFO system piping had required a significant period of time to degrade below a minimum wall condition, TS 3.8.1.1 action g. may not have been met for an indeterminate period of time and action h. may not have been met for the period when DFO Train 0-2 was removed from service.

Between July 8, 1992, at 0700 PDT, and July 13, 1992, the CO_2 supply line inspections were implemented and all lines were determined to meet the minimum wall thickness requirements.

Inspections of the DFO and CO_2 pipe supports were also performed at the same time as the pipe wall thickness inspections. As a result of the inspections, two of the DFO pipe supports on DFO Train 0-1 and one CO_2 pipe support were determined to be degraded. A conservative engineering analysis was performed and determined that the degraded supports would not affect the operability of the piping.

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

None.

E. Dates and Approximate Times for Major Occurrences:

1.	June 21, 1992:	Corrosion was discovered on the DFO supply piping.
2.	June 23, 1992, at 0240 PDT:	TS 3.8.1.1 action g. was entered for DFO Train 0-2 for EDG 2-3 tie-in.
3.	June 24, 1992, at 0320 PDT:	DFO Train 0-2 was returned to service and TS 3.8.1.1 action g. was exited.
4.	June 25, 1992, at 0230 PDT:	TS 3.8.1.1 action g. was entered for DFO Train 0-1 for EDG 2-3 tie-in and subsequent pipe pressure test.
5.	June 26, 1992, at 0224 PDT:	DFO Train 0-1 was returned to service and TS 3.8.1.1 action g. was exited.
6.	July 2, 1992, at 1700 PDT:	Event Date. DFO Train 0-1 was found below minimum wall thickness. TS 3.8.1.1 action g. was entered.
7.	July 4, 1992, at 1400 PDT:	Corroded section of DFO Train 0-1 pipe was replaced. TS 3.8.1.1 action g. was exited.
8.	July 8, 1992:	Discovery date. An evaluation conservatively determined that TS 3.8.1.1 actions g. and h. may not have been met.
9.	August 27, 1992:	An engineering analysis concluded that DFO transfer piping would have remained operable under all design basis loading conditions.

F. Other Systems or Secondary Functions Affected:

Corrosion was also discovered on ASW and CO_2 system piping.

G. Method of Discovery:

On June 21, 1992, a work crew was inspecting the DFO trenches to determine the extent of an acid/caustic spill in the Unit 2 west buttress. Corrosion was found on the DFO Train 0-1 system piping and two fire suppression system CO_2 lines.

H. Operator Actions:

None.

I. Safety System Responses:

None.

III. Cause of the Event

A. Immediate Cause:

The immediate cause of the event was DFO Train O-1 piping below the minimum wall thickness requirements.

B. Root Cause:

The root cause of the event was general corrosion due to a degradation or breakdown in the DFO piping coal tar coating, which exposed the pipe to a standing water and saltwater air environment. Standing water seeping through the coating corroded the pipe, especially at the water/air interface. As the iron oxide rust formed, it expanded in volume (at a volumetric ratio of approximately 7 to 1). This bulging or blistering further degraded the coal tar and accelerated the corrosion process. The standing water was due to inadequate drainage caused by plugging of the trench drains due to flow blockage by pipe supports and external debris.

C. Contributory Cause:

1. The existing DFO inspection procedure does not provide instructions to identify corrosion and only requires inspection of accessible DFO transfer piping.

2. Initial application and maintenance of the coal tar protective coating on the underside of piping was inadequate.

IV. Analysis of the Event

A portion of the DFO Train O-1 piping was found severely corroded and has been replaced. This section of corroded pipe was judged to have the worst corrosion of both DFO trains. Preliminary examination of the corroded section found some areas below the required minimum pipe wall thickness and numerous small pits that were very nearly through-wall. The pits are considered to not have affected operability; this was demonstrated when the piping was pressurized without any indication of leakage on June 25, 1992, during tie-in of EDG 2-3.

An engineering analysis was performed to evaluate the effect of the degraded pipe wall condition on the integrity of the DFO piping. Seismic, thermal, pressure, and dead loads were considered. The fracture mechanics method of NRC Generic Letter (GL) 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping," was used, except for at one location where the Section XI draft Code Case was used. These methods provide a reasonable means for evaluating operability of a piping system that has areas of significant wall loss, in that they address the ability of the remaining pipe wall to withstand the design loads. The Code Case method is essentially the same as that of GL 90-05, except that it is less restrictive in the selection of depth at which the flaw is evaluated. According to the design loads in the piping stress analysis, a minimum pipe wall of .071 inches or less is required. All flaws that were deeper than the minimum pipe wall were evaluated using the fracture mechanics equations of GL 90-05 or the Code Case. The analysis determined that all of the flaws were able to meet the criteria of at least one of these two documents. Thus, from a stress standpoint, the pipe would have remained operable under all design basis loading conditions.

Based on the above it is concluded that this event did not adversely affect the health and safety of the public.

V. Corrective Actions

A. Immediate Corrective Actions:

1. The section of pipe below minimum wall thickness requirements on DFO Train 0-1 was replaced.

2. The trenches containing the DFO trains have been cleaned to minimize standing water. In addition, interim measures are being taken to minimize further pipe support corrosion until Corrective Action to Prevent Recurrence #1 below is completed.

3. Visual inspection of both trains of the DFO transfer system has been completed, along with UT examination on the worst areas of corrosion.

4. Additional visual, UT, and/or radiography examination of both DFO trains and associated pipe support contact areas is ongoing to establish a comprehensive basis for adequacy of the piping.

B. Corrective Actions to Prevent Recurrence:

1. A program will be developed and implemented to repair and/or replace the remaining areas of corrosion on the DFO piping. The program will also address the following issues:

   - improving the protective coating
   - improving the drainage in the trenches
   - minimizing standing water in trenches
   - improving the surveillance program

2. A plan is being developed for a comprehensive review to identify other systems with piping and conduit that may be susceptible to similar corrosion mechanisms.

VI. Additional Information

A. Failed Components:

The carbon steel piping in the DFO transfer system was found corroded below minimum wall thickness requirements.

B. Previous Similar LERs:

None.

TEXT (17)

Diesel Fuel Oil Transfer System

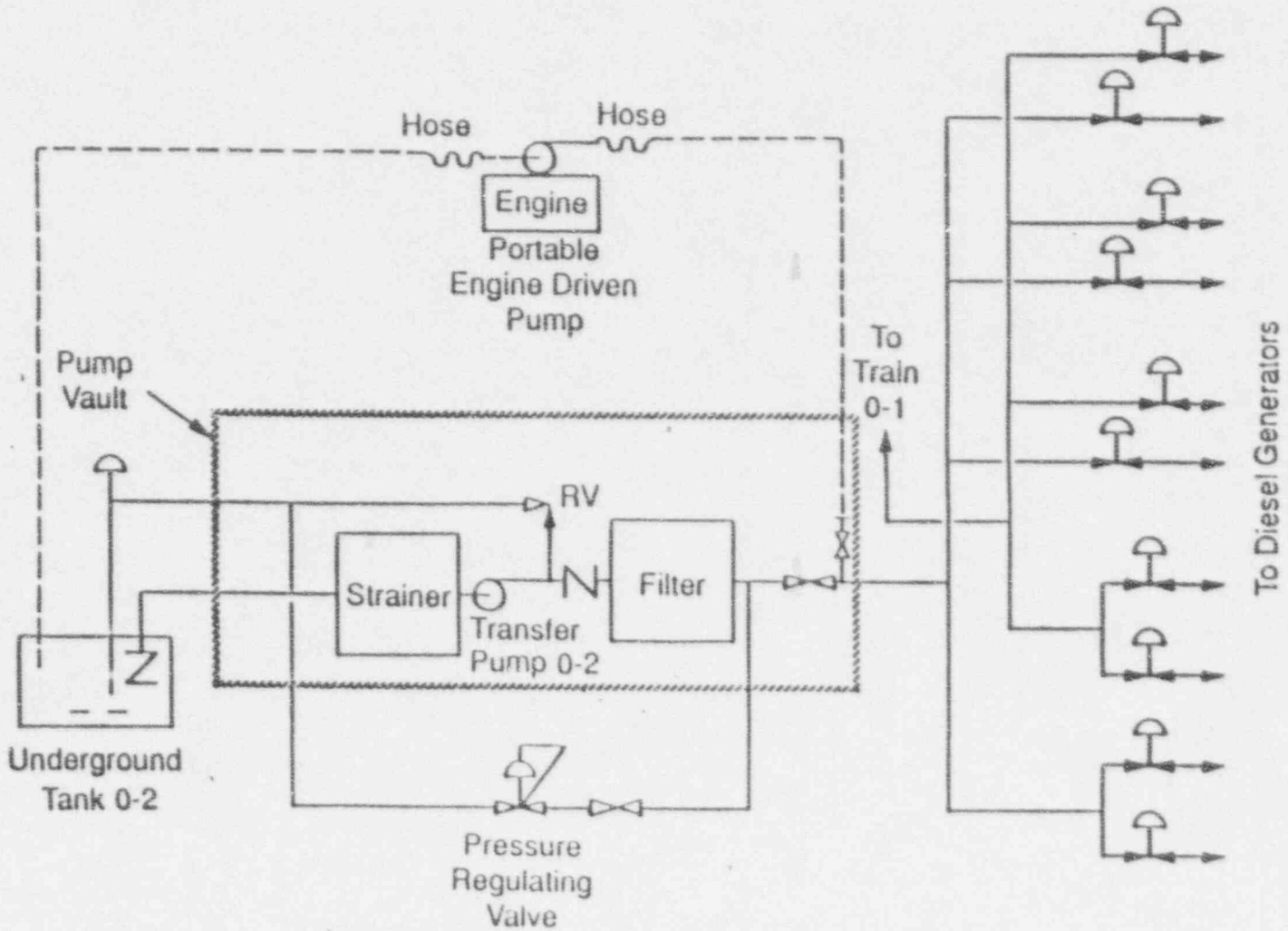

Figure 1
DFO Transfer System