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GREBEL,T.L. Pacific Gas & Electric Co.
SHIFFER,J.D. Pacific Gas & Electric Co.
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SUBJECT: LER 88-029-01:on 881019,abnormal deterioration of auxiliary salt water pump impellers due to inadequate heat treatment.
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A10-4

Pacific Gas and Electric Company

77 Beale Street
San Francisco, CA 94106
415/972-7000
TWX 910-372-6587

James D. Shiffer
Vice President
Nuclear Power Generation

January 15, 1990

PG&E Letter No. DCL-90-009

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 1-88-029-01
Abnormal Deterioration of Auxiliary Salt Water Pump Impellers Due to Inadequate Heat Treatment (Part 21 Notification)

Gentlemen:

Pursuant to 10 CFR 21.21, PG&E is submitting a revision to the enclosed Licensee Event Report (LER) regarding abnormal deterioration of auxiliary salt water pump impellers due to inadequate heat treatment.

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,

J. D. Shiffer

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

Enclosure

DC1-88-MM-N042

2956S/0076K/ALN/2246

IE28
1/1

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 1 OF 0 4

TITLE (4): ABNORMAL DETERIORATION OF AUXILIARY SALT WATER PUMP IMPELLERS DUE TO INADEQUATE HEAT TREATMENT (PART 21 NOTIFICATION)

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 (S)
1 0	1 9	8 8	88	0 2 9	0 1	0 1	15	90	DIABLO CANYON UNIT 2	0 5 0 0 0 3 2 3
										0 5 0 0 0 1 1

OPERATING MODE (9)	1
POWER LEVEL (10)	1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR : (11)

X 10 CFR Part 21.21

OTHER (Specify in Abstract below and in text, NRC Form 366A)

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER AREA CODE	TELEPHONE NUMBER
TERENCE L. GREBEL, SUPERVISING ENGINEER	805	595 - 4720

COMPLETE ONE LINE FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
B	BI S	P I I	4 1 7 I 1 B	YES							

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR

ABSTRACT (16)

On October 21, 1988, PG&E notified Region V, U.S. Nuclear Regulatory Commission, in accordance with 10 CFR Part 21.21, regarding abnormal deterioration of auxiliary salt water pump impellers due to inadequate heat treatment and failure of the vendor to control special processes.

The components are ASTM A 296 Grade CF-8M stainless steel impellers provided by Sulzer Bingham International, P.O. Box 10247, Portland, Oregon 97210, for use in safety related Auxiliary Salt Water Pumps.

Based upon metallurgical analysis performed on the impeller material, PG&E has determined that the ASTM A 296 cast stainless steel did not receive adequate solution heat treatment which resulted in accelerated intergranular corrosion.

The Auxiliary Salt Water Pump impellers have been replaced on both Units 1 and 2. Special testing has been performed to determine the condition of the heat treatment of the replacement impellers. This testing has been inconclusive. To verify satisfactory material condition, further testing or inspection will be performed each refueling outage, until these impellers are replaced with impellers which have been verified to be fully qualified for use.

On May 25, 1988, STP P-7A was performed satisfactorily on ASW Pump 1-2, the pump declared operable and returned to service. Also, after pump 1-2 was returned to service pump 1-1 was removed from service and disassembled to replace the impeller with the new design.

On June 2, 1988, STP P-7A was performed satisfactorily on ASW Pump 1-1, the pump was declared operable and placed in service. Metallurgical samples were removed from the old impellers and sent to PG&E Technical and Ecological Services for further examination of the metal to determine the cause of the deterioration.

On September 2, 1988, PG&E metallurgical testing personnel notified the plant that metallurgical testing of the old impellers reflected that they had not been heat treated to the purchase specified condition and were found to be in the sensitized condition. The impellers were purchased to ASTM A296 Grade CF-8M austenitic stainless steel casting requirements that mandate solution heat treatment after casting. The PG&E analysis determined that the impellers were not properly heat treated and consequently exhibited accelerated intergranular corrosion. Based upon this finding, the question was raised whether the "new" recently installed impellers had received the required heat treatment. A safety evaluation was conducted which assumed the "new" impellers had not received the required heat treatment. That safety analysis concluded that the failure of the impellers was not considered feasible based on the pumps service life and the period of time required for intergranular corrosion deterioration to occur.

On September 21 and 22, 1988, PG&E Quality Assurance (QA) performed audit 88244S of Sulzer Bingham International (SBI) and identified significant deficiencies regarding control of suppliers of special processes. On October 4 and 5, 1988, QA returned to SBI for a follow up audit of its suppliers to further investigate deficiencies of special processes.

On September 27, 1988, PG&E Technical and Ecological Services personnel performed on site testing of both the new and old impellers for Unit 2 in accordance with ASTM A 262, Practice A. PG&E metallurgical testing personnel documented their results of this test by letter to DCPP dated October 14, 1988. The Practice A results indicated inadequate heat treatment was provided for the old impellers removed from Unit 2. The Practice A test performed on the new impellers was inconclusive. To verify satisfactory material condition, further testing or inspection will be performed each refueling outage. These investigations will continue until such time as the impellers are replaced with impellers which have been verified to be properly treated and fully qualified for use.

On October 21, 1988, at 13:30 PST, Mr. James D. Shiffer, Vice President of Pacific Gas and Electric Co., 77 Beale St., San Francisco, California

I. Initial Conditions

Units 1 and 2 have operated in various Modes 1 through 6 during this event.

II. Description of Event

A. Event:

On April 4, 1988, Unit 1 Auxiliary Salt Water (BS) Pump (P) 1-1 was removed from service to perform a routinely scheduled pump inspection when it was determined the the lower pump shaft required replacement because of observed corrosion under the shaft sleeves. During this maintenance activity the impeller was removed and sandblasted clean prior to reinstallation.

On April 21, 1988, the cleaned impeller was inspected and observed to have pitting throughout the material and cracks in the hub area. The impeller was replaced with a new impeller from warehouse stock.

On May 9, 1988, Surveillance Test Procedure (STP) P-7A, "Performance Test of Auxiliary Salt Water Pump," was performed after impeller replacement. The STP was not acceptable due to low flow and pressure throughout the pump performance curve. The vendor was contacted and concluded that the present impeller is slightly smaller in volute area and therefore the additional replacement impellers being manufactured should be machined to revised diameter dimensions to achieve the correct performance.

On May 11, 1988, the temporary use of the installed impeller for Auxiliary Salt Water (ASW) Pump 1-1 was authorized for Modes 5 and 6. The use of this impeller was required in order to allow the removal from service of ASW pump 1-2 for inspection of the old impeller and replacement as required based upon the results of the inspection.

Between May 11 and May 20, 1988, the ASW Pump 1-2 was disassembled and inspected by DCPP personnel and on-site vendor personnel. A preliminary examination indicated that the 1-2 impeller had pitting and cracking indications throughout the impeller similar to the 1-1 impeller. PG&E metallurgical testing and on-site vendor personnel inspected both the 1-1 and 1-2 "old" impellers and concluded that although the deterioration was abnormal for the ten years of use, the observed condition did not constitute an immediate danger and warranted a more detailed metallurgical examination.

On May 19, 1988, design change DCO-EM-39834 was approved to authorize the use of a new impeller with corrected dimensions to achieve the required flow rate.

94106, notified Mr. Al Toth of Region V, U.S. Nuclear Regulatory Commission, 1450 Maria Lane, Suite 210, Walnut Creek, California 94596-5268 of the abnormal deterioration of auxiliary salt water pump impellers in accordance with the requirements of 10 CFR Part 21.21.

B. Inoperable structures, components, or systems that contributed to the event:

None.

C. Dates for major occurrences.

1.	On April 4, 1988	Unit 1 Auxiliary Saltwater Pump was removed from service for scheduled pump inspection.
2.	On April 21, 1988	During corrective plant maintenance the impeller for aux saltwater pump was observed to have pitting and cracks in the hub area.
3.	On May 9, 1988	STP P-7A was performed following replacement of the impeller and found unsatisfactory due to low flow.
4.	On May 19, 1988	Design change DCO-EM-39834 was approved to replace the pump impeller with a new impeller with improved flow characteristics.
5.	On September 2, 1988	A safety evaluation was conducted for the new impellers.
6.	On September 19, 1988	PG&E Technical and Ecological Services report was issued to document the as found condition of the ASW impellers that were removed from Unit 1.
7.	On September 21, 1988	Quality Assurance performed audit 88244S at the vendor's facility.
8.	On September 27, 1988	PG&E Technical and Ecological Services personnel were on site to perform testing of the new impellers from the vendor.
9.	On October 4, 1988	Quality Assurance returned to SBI for further investigation of special process suppliers.
10.	On October 21, 1988	The responsible officer of PG&E made initial notification of defect to the NRC.

D. Other systems or secondary functions affected:

None.

E. Method of Discovery:

As a result of corrective maintenance of the Aux Saltwater Pump to replace the pump shaft wear sleeve the impeller was removed from the pump. The impeller was to be balanced and therefore was sandblasted clean prior to reassembly. When inspected for cleanliness, the pitted condition and crack-like corrosion were found on the impeller.

F. Operator Actions:

None.

G. Safety System Responses:

None.

III. Cause of the Event:

A. Immediate Cause:

PG&E metallurgical testing personnel determined that the crack-like defects and pitting of the ASW impeller were the result of accelerated intergranular corrosion due to improper solution heat treatment.

B. Root Cause:

PG&E has concluded that the vendor failed to provide the impellers as specified in the procurement documents due to quality assurance deficiencies regarding control of special processes and suppliers of special processes.

C. Contributory Cause:

Those Quality Assurance audits of the vendor performed by contract personnel were not adequate to detect inadequate control of sub-suppliers.

IV. Analysis of Event

A. Reportability:

This problem was reviewed under 10CFR Part 21.21 and determined to be reportable as a failure of the vendor to control special processes and suppliers of special processes.

B. Safety Analysis:

This event has been determined not to constitute an immediate danger that would result in the pump inoperability or loss of the intended safety function of the pump. The defects observed if allowed to continue without corrective action could have resulted in failure of the pump at some future time that cannot be accurately predicted but is well within the safety margins of the impeller design. A justification for continued operation (JCO) was written and approved, for continued operation of the pumps with the presently installed impellers that may have not have been properly heat-treated, for each unit. The JCO was revised to include considerations of other vendor-supplied components that were provided without adequate quality assurance dedication activities by the vendor. The ASW pumps were operable throughout this investigation, therefore there were no safety consequences or implications as a result of this event.

V. Corrective actions

A. Immediate Corrective Action:

Auxiliary Salt Water Pump impellers were replaced with new impellers and returned to service. A safety evaluation was written and approved to allow the continued use of the new impellers.

B. Corrective Action to Prevent Recurrence:

1. The vendor has been removed from the qualified suppliers list pending resolution of deficiencies identified by QA audit 88244S (and related audits). All replacement components provided by the vendor will require dedication testing by PG&E to criteria established by Nuclear Engineering and Construction Services (NECS) to verify quality until such time that the vendor has been reaudited satisfactorily.

2. PG&E metallurgical testing personnel will perform further testing and inspections each refueling outage to verify the component quality, ASW pump condition and advise NECS of the limiting conditions for continued operation as specified in JCO 88-07. This will continue until such time as the impellers are replaced with impellers which have been verified to be fully qualified for use.

3. PG&E has reviewed other components supplied by the vendor and concluded that no other safety-related component is adversely affected.

4. The concerns related to the vendor audit 88244S have been addressed and corrected by the vendor. However, PG&E's investigation of the quality assurance audits performed at the vendor's plant and other related audits resulted in additional findings that are not within the scope of this LER. The results of those further investigations have been reported to the Nuclear Regulatory Commission (NRC) Region V at a meeting on July 25, 1989, and PG&E Letters to the NRC DCL-89-207, dated August 7, 1989, and DCL-89-255 dated October 2, 1989.

VI. Additional Information

A. Failed components:

The ASW pump impellers were manufactured by Sulzer Bingham International, part no. 1792210 (old designation of company was Bingham Willamette, vendor drawing B-22858X, part #113), PG&E stock code 93-2738.

B. Previous LERs on similar events:

None.

C. Other Materials Supplied by Vendor:

1. Safety-Related:

Component Cooling Water (CCW) Pumps (P) 1-1, 1-2, 1-3, 2-1, 2-2, and 2-3 were purchased from the vendor. These pumps utilize a bronze alloy impeller that does not require special process heat treatment.

The CCW pumps and replacement component parts are evaluated in JCO 88-07 as well.

2. Non-Safety Related:

Feedwater Heater Drip (SJ) Pump (P) 1-1 and 2-1, and Condensate Booster (SD) Pumps (P) 1-1, 1-2, 1-3, 2-1, 2-2, and 2-3 were purchased from the vendor. These pumps utilize an ASTM A 296 Grade CA 15 impeller that requires special process heat treatment. The liquid service condition of these pumps is steam generator feedwater which is maintained to strict chemistry standards. Based upon the inservice liquid chemistry and length of service it has been determined that these pumps are satisfactory for service pending further investigation.

D. Advice Related to Failure Given to Licensees:

(Not applicable - refers to supplier)