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SUBJECT: Responds to NRC Bulletin 88-004, "Potential Safety-Related Pump Loss."

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James D. Shiffer
Vice President
Nuclear Power Generation

July 8, 1988

PG&E Letter No. DCL-88-180

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
Response to NRC Bulletin No. 88-04, "Potential Safety-Related Pump Loss"

Gentlemen:

As requested in NRC Bulletin No. 88-04, "Potential Safety-Related Pump Loss," PG&E has reviewed all safety-related pumps at Diablo Canyon Units 1 and 2 for possible deadheading and flow rate degradation. The enclosure provides a summary of results to date. Further response to item 2 of the Bulletin, the results of the deadheading tests for the RHR pumps, will be submitted by September 1988. A supplemental report to address Bulletin item 3 regarding flow rate degradation will be submitted by May 1989.

Kindly acknowledge receipt of this material on the enclosed copy of this letter and return it in the enclosed addressed envelope.

Subscribed to in San Francisco, California this 8th day of July 1988.

Respectfully submitted,

Pacific Gas and Electric Company

By _____
J. D. Shiffer
Vice President
Nuclear Power Generation

Howard V. Golub
Richard F. Locke
Attorneys for Pacific
Gas and Electric Company

By _____
Richard F. Locke

Subscribed and sworn to before me this 8th day of July 1988

_____
Therese Toliver, Notary Public in and for the City and County of San Francisco, State of California

My commission expires December 25, 1990.

cc: J. B. Martin
M. M. Mendonca
P. P. Narbut
B. Norton
H. Rood
B. H. Vogler
CPUC
Diablo Distribution

Enclosure

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ENCLOSURE

RESPONSE TO NRC BULLETIN NO. 88-04,
"POTENTIAL SAFETY-RELATED PUMP LOSS"

In response to NRC Bulletin No. 88-04 (Bulletin), PG&E has reviewed all safety-related pumps at Diablo Canyon Power Plant (DCPP) Units 1 and 2, for possible deadheading and flow rate degradation. As requested by Bulletin action item 4, this enclosure provides the results of the review.

As described in the response to Bulletin action items 1 and 2, only the RHR system is of concern for deadheading. The review to date indicates that no corrective action at DCPP is required with respect to the safety-related pump deadheading or flow rate degradation concerns expressed in the Bulletin. Neither procedural enhancements or hardware modifications, nor justification for continued operation are required.

Procedures exist at DCPP which instruct the operators to check for signs of deadheading during accident conditions; further alarms in the control room would alert operators should RHR flow decrease to a point where deadheading may occur. PG&E will perform further evaluation in accordance with Bulletin action items 2 and 3 with supplemental reports submitted to the NRC by September 1988 and May 1989 respectively.

The following is PG&E's response to the action items requested in the Bulletin.

Bulletin Action Item 1 - Identification of Pumps Susceptible to Deadheading

PG&E has reviewed all safety-related pumps at DCPP for susceptibility to a loss of flow due to interconnection with a higher head parallel pump. Attachment 1 summarizes the results of this survey. Pumps were not considered for deadheading if (a) they were not centrifugal, (b) they were not linked by a discharge manifold or shared discharge piping, (c) their miniflow lines were routed separately from upstream of the pump discharge check valves, (d) they were not operated near their shutoff head, or (e) they were parallel pumps not operated simultaneously.

Using the above criteria, only the residual heat removal (RHR) pumps were identified. Evaluation of the RHR pumps is provided below.

Bulletin Action Item 2 - Evaluation of Pumps for Deadheading Concerns

PG&E compared the RHR pump performance data generated as part of the regular surveillance testing program for both units to determine if any one pump had a significantly higher head than its parallel pump. As shown on the RHR pump curves in Attachment 2, each units RHR pumps have closely matched performance curves. This operational test data includes allowances for error as required by Bulletin item 2(c).

Each RHR pump outlet has a flow switch that would actuate an alarm in the control room should flow from the operating pump be less than 500 gpm. Individual pump flows and pump motor currents are indicated in the control room. Emergency Operating Procedure E-0.0, "Reactor Trip or Safety Injection,"

further instructs the operators to promptly secure the RHR pumps, if the RCS pressure remains above the RHR low pressure coolant injection shutoff head. Except during large break LOCA, the RHR pumps would normally be secured within 10 minutes.

PG&E will conduct testing of both units' RHR pumps to ensure that deadheading does not occur at normal operating pressure. These tests will run both pumps in the recirculation mode of the low pressure coolant injection alignment. PG&E will provide the results by September 1988.

Bulletin Action Item 3 - Low Flow Rate Pump Degradation

All safety-related centrifugal pumps at DCPP that are required to operate close to shutoff head have minimum flow lines designed in accordance with the vendor's recommendation. The vendor's recommended minimum (recirculation) flow rates are listed in Attachment 1. DCPP operating and maintenance experience indicates that no unusual wear or degradation has occurred as a result of safety-related pump operation. Additionally, the RHR pump manufacturer has not changed its recommendations for minimum recirculation flow from the valve used in designing the minimum flow lines.

PG&E will verify the adequacy of these minimum flow rates using a combination of three methods. First, DCPP's maintenance and testing program data will be reviewed to assure that any chronic degradation that has or could occur will be identified and corrective actions initiated. Second, a review of operating history, both from PG&E and other industry sources such as NPRDS, will be performed to determine if DCPP pump models have any history of abnormal degradation. Third, the maximum flow rate at which internal recirculation effects occur will be calculated. The results of these three efforts will be compiled and decisions as to the necessity of any hardware or procedural changes will be made. The scheduled completion of this effort is April 1989. By May 1989, PG&E will submit a supplemental report to the NRC to document the results and any further actions which may be necessary.

Bulletin Action Item 4 - Short-Term Response

As requested, this letter provides a written response within 60 days of receipt of the Bulletin. PG&E's review to date indicates that neither procedural enhancement or hardware modifications, nor justification for continued operation is required. As indicated above, a supplemental report will be submitted.

Bulletin Action Item 5 - Long-Term Response

No long-term resolution actions are necessary at this time.

Bulletin Action Item 6 - Documentation and Maintenance of Evaluation

As requested, PG&E will document and maintain an evaluation of actions taken in response to the Bulletin at the DCPP site for a minimum of two (2) years.

ATTACHMENT 1

SUMMARY OF EVALUATION OF SAFETY-RELATED PUMPS FOR NRC BULLETIN NO. 88-04

SUMMARY OF EVALUATION OF SAFETY-RELATED PUMPS FOR NRC BULLETIN No. 88-04

Pump Designation	Vendor	Type	Model	Design Flow (GPM)	Minimum Recirc Flow (GPM)	Recirc Basis	Deadheading
Auxiliary Feedwater Pumps (motor driven)	Byron-Jackson	Centrifugal	3x6x9E DVMX	490	50	Vendor orifice	None [1]
Auxiliary Feedwater Pump (turbine driven)	Byron-Jackson	Centrifugal	4x6x9D DVMX	930	50	Vendor orifice	None [1]
Centrifugal Charging Pumps	Pacific	Centrifugal	RL-IJ 2-1/2"	150[8]	60	Vendor orifice	None [1]
Charging Pump Lube Oil Pumps	Brown & Sharpe	Gear Type	N/A	N/A	N/A	N/A	N/A
Boric Acid Transfer Pumps	Goulds	Centrifugal	3196 1x2-8	75	3	Westinghouse spec	None [2]
Safety Injection Pumps	Pacific	Centrifugal	JTCH 2-1/2"	425	30	Vendor orifice	None [1]
Residual Heat Removal Pumps	Ingersoll-Rand	Centrifugal	8x20W	3000	500	Vendor spec	[3]
Containment Spray Pumps	Goulds	Centrifugal	3415 8x10-22	2600	None	N/A	None [4]
Spent Fuel Pool Cooling Pumps	Goulds Hayward Tyler	Centrifugal Centrifugal	3405/8x10-12 8x10x17/NHSM	2300 3000	None None	N/A N/A	None [5] None [5]
Component Cooling Water Pumps	Bingham	Centrifugal	16x20x21 HSL	9200	[9]	N/A	[9]
CCW Lube Oil Pumps	Bingham	Gear type	N/A	N/A	N/A	N/A	N/A
Makeup Water Transfer Pumps	Ingersoll-Rand	Centrifugal	2-CMRV	250	None	N/A	None [6]
Auxiliary Salt Water Pumps	Bingham	Centrifugal	20x34B VCM	11,000	None	N/A	None [7]
Diesel Fuel Oil Transfer Pumps	Delaval	Rotary screw	N/A	N/A	N/A	N/A	N/A
Diesel Fuel Oil Booster Pump	Viking	Gear type	N/A	N/A	N/A	N/A	N/A
Diesel Engine Lube Oil Pumps	ALCO	Gear type	N/A	N/A	N/A	N/A	N/A

SUMMARY OF EVALUATION OF SAFETY-RELATED PUMPS
FOR NRC BULLETIN No. 88-04

Notes:

N/A: Not Applicable.
All flows are in gallons per minute.
Recirculation flows are per vendor's original recommendation or design.

[1] For these pumps, the miniflow line originates upstream of the pump discharge check valve and before joining the common miniflow line, each individual miniflow line has a flow restricting orifice. The orifice design reduces the pressure at the entrance to the common miniflow line low enough so that the weak pump will still be able to recirculate miniflow. Essentially, an orifice in the individual miniflow desensitizes the system to strong/weak pump miniflow concerns addressed in this Bulletin.

[2] The boric acid transfer pumps recirculate through an orifice on the boric acid storage tank inlet. While the recirculation line originates downstream of the discharge check valve, the trains are normally separated by manual valves. They can be manually aligned in parallel to the charging pump suction to provide emergency boration; however, deadheading would not be expected in this mode.

[3] The RHR pump configuration is sensitive to deadheading of a weaker pump; however, operating tests with both pumps running indicate they are well matched. Furthermore, a low flow alarm is provided for each pump to alert the operator of a potential deadheading situation.

[4] The containment spray pump trains are physically independent and do not require a minimum flow recirculation line. However, a test line is provided for pump performance testing. The test flow of 300 gpm is compatible with vendor's guidance for minimum flow. The performance test would detect any degradation due to pump performance testing.

[5] The two SFPC pumps are supplied by different vendors and are not run simultaneously. Their shutoff heads are such that the Goulds pump could deadhead the Hayward Tyler pump, if they were run in parallel. The pumps do not normally run close to shutoff head.

[6] While it is physically possible to operate the makeup water transfer pumps in parallel, there is no apparent reason to do so. The pumps operate in a variety of configurations under various head conditions. No miniflow lines are provided. The pumps are normally operated manually.

[7] The auxiliary salt water pumps do not operate close to their shutoff head. While the two trains are normally tied together, they do not operate close to shutoff, so deadheading of the weaker pump is not a concern.

[8] See FSAR Section 6.3.2.2.4.2 for various design flow rates during a LOCA condition.

[9] Each CCW pump has a 4-inch recirculation line used to keep water flowing through the pump in case the pump discharge path is cut off. The recirculation line flow is controlled by CCW pump recirculation valve FCV-606(607, 608). Each recirculation valve is a normally closed, air-to-close, fail-open valve. When a CCW pump is running at shutoff head, its motor draws about 40 amps compared to the 51.5 amps it draws during normal operation. If the pump motor current drops to 44 amps, the recirculation valve for the pump will open. This configuration is not susceptible to the concerns of this bulletin.

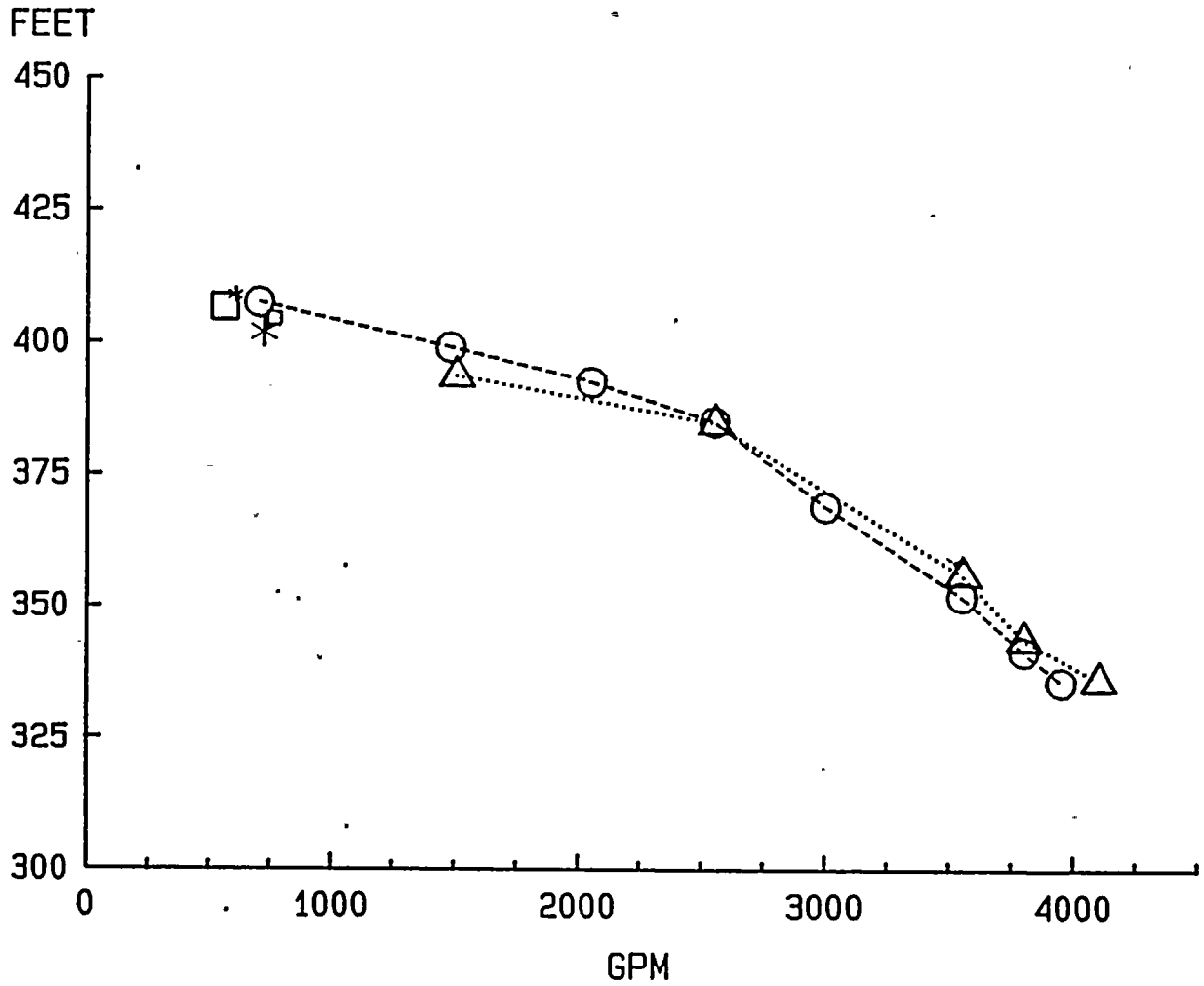
ATTACHMENT 2

RHR PUMP CURVES

DIABLO CANYON UNIT 1

RHR PUMP 1-1 AND 1-2

TOTAL PUMP HEAD vs FLOW



Pump 1-1, 11-83 data

Pump 1-2, 11-83 data

Pump 1-1, 4-88 data

Pump 1-1, 1-88 data

Pump 1-2, 1-88 data

Pump 1-2, 3-88 data

DIABLO CANYON UNIT 1
RHR PUMP 1-1 AND 1-2

TOTAL PUMP HEAD vs FLOW

RHR Pump 1-1

Date	Flow	Range(+/-)	Total Pump Head	Range(+/-)
11-83	700	31	407.5	9.24
11-83	1480	15	399	9.24
11-83	2050	119	392.5	9.24
11-83	2550	96	385	9.24
11-83	3000	82	369	9.24
11-83	3550	70	352	9.24
11-83	3800	65	341.5	9.24
11-83	3950	63	335.7	9.24
04-83	760	29	404.25	9.24
01-88	600	36	408.87	9.24

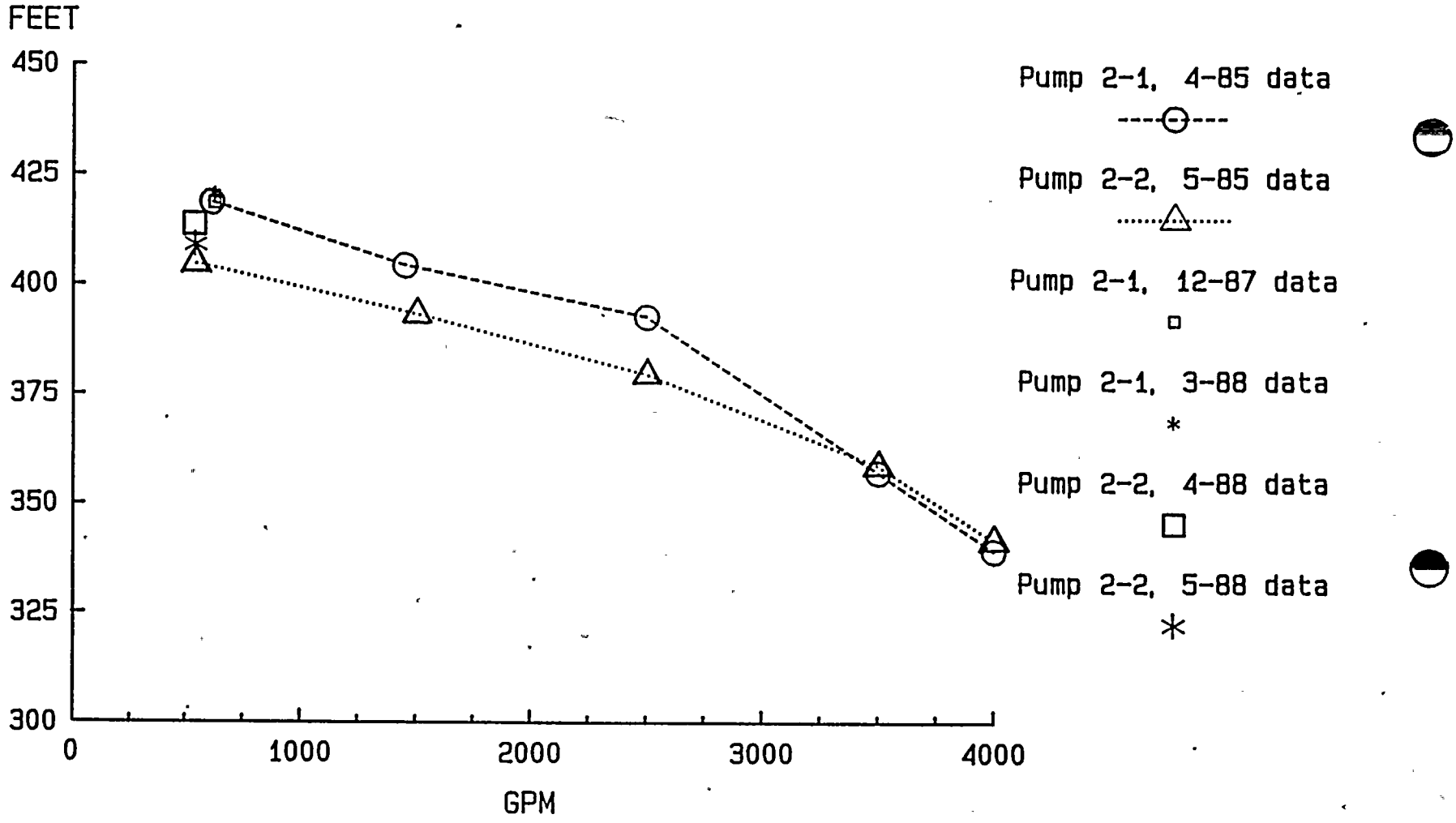
RHR Pump 1-2

11-83	1500	15	393.6	9.24
11-83	2550	96	384.7	9.24
11-83	3550	70	356.0	9.24
11-83	3800	65	343.6	9.24
11-83	4100	61	336.0	9.24
01-88	555	39	406.6	9.24
03-88	720	31	401.9	9.24

DIABLO CANYON UNIT 2

RHR PUMP 2-1 AND 2-2

TOTAL PUMP HEAD vs FLOW



DIABLO CANYON UNIT 2 Sheet 2 of 2
RHR 2-1 AND 2-2

TOTAL PUMP HEAD vs FLOW

RHR Pump 2-1

Date	Flow	Range(+/-)	Total Pump Head	Range(+/-)
04-85	610	36	418.52	9.24
04-85	1450	15	404.2	9.24
04-85	2500	98	392.55	9.24
04-85	3500	71	357.09	9.24
04-85	4000	62	339.20	9.24
12-87	620	35	418.11	9.24
03-88	620	35	420.42	9.24

RHR Pump 2-2

05-85	540	40	404.57	9.24
05-85	1500	15	393.04	9.24
05-85	2500	98	379.36	9.24
05-85	3500	71	358.57	9.24
05-85	4000	62	341.50	9.24
04-88	530	41	413.49	9.24
05-88	540	40	408.87	9.24