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

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James D. Shiffer
Vice President
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September 30, 1988

PG&E Letter No. DCL-88-230

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
Supplemental Response to Bulletin 88-04, "Potential Safety-related Pump Loss"

Gentlemen:

In the initial response to Bulletin 88-04, DCL-88-180, dated July 8, 1988, PG&E committed to conduct tests of the RHR systems in both Diablo Canyon units. These tests have been completed and Enclosure 1 provides a summary report of the data.

Based upon evaluations performed by Westinghouse and PG&E, PG&E concluded that, although pump interaction was observed, the RHR pumps retain their functionality and perform in compliance with General Design Criteria 35, "Emergency Core Cooling" and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling System for Light Water Nuclear Power Reactors." No issues have been identified that would affect continued safe operation of Diablo Canyon Units 1 and 2.

Enclosure 2 provides additional clarification of two items discussed in PG&E's initial response to Bulletin 88-04.

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Subscribed to in San Francisco, California this 30th day of September 1988.

Respectfully submitted,

Pacific Gas and Electric Company

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

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

Subscribed and sworn to before me
this 30th day of September 1988

By _____
Dan G. Lubbock

C. T. Neal-Madison

C. T. Neal-Madison, Notary Public in
and for the City and County of
San Francisco, State of California

My commission expires October 16, 1990.

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

Sincerely,

OFFICIAL SEAL
C.T. NEAL-MADISON
NOTARY PUBLIC - CALIFORNIA
CITY & COUNTY OF SAN FRANCISCO
My Commission Expires Oct. 16, 1990

J. D. Shiffer

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Enclosure

2307S/0063K/JWB/2070

ENCLOSURE 1

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

Bulletin 88-04 requested, in part, that licensees evaluate the potential for deadheading of one or more pumps in a safety related system that has a miniflow line common to two or more pumps or other piping configurations that do not preclude pump-to-pump interaction during miniflow operation. In the response to Bulletin 88-04, (DCL 88-180, July 8, 1988) PG&E identified the Residual Heat Removal (RHR) Pumps as the only safety related pumps potentially susceptible to deadheading.

In response to Bulletin 88-04 item 2, and item 3 for the RHR pumps, PG&E conducted testing to determine the sensitivity of Units' 1 & 2 RHR systems to parallel pump operation. This report discusses the test program and results.

Test Program

PG&E developed a test program specifically to identify pump interactions in a variety of pump start configurations. In addition, the test program evaluated the miniflow capacity of singly operated RHR pumps. The following plant conditions were established for the test:

(1) RCS in modes 1, 2, or 3 to preclude RHR pump injection into the reactor coolant system

(2) RHR normal valve lineup for Emergency Core Cooling; injection mode

(3) Offsite electrical power available to the pump motors

(4) Refueling Water Storage Tank valves lined up to ensure proper Net Positive Suction Head (NPSH) at pump suction

Both pumps were simultaneously started from the control room during the testing. After flow had stabilized, test engineers recorded the miniflow rates on both trains. One pump was then shutdown. Miniflow rates were again recorded. The pump was restarted against the head of the running pump and flow rates again recorded. This process was repeated for each pump. The acceptance criteria required that each pump meet or exceed the pump vendor minimum recommended flow rate of 500 gpm and that the pump motor current be stable and less than 57.5 amperes.

Test Results

The tests conducted in September 1988, confirmed previous surveillance testing for pumps running alone. All four pumps, operating in a single train configuration, met the acceptance criteria. The lowest miniflow rate observed under this mode of operation was 550 gpm.

Parallel RHR pump operation showed evidence of flow interaction as described in the Bulletin. Table 1 is a summary of the RHR miniflow test results. The lowest observed miniflow was 390 gpm. Using calculated instrument error bands, the miniflow range was 469 gpm maximum to 291 gpm minimum. These flow rates are outside the test acceptance criteria and are indicative of flow interaction of one pump with the other pump.

Evaluation

The results of the RHR miniflow test modify the preliminary conclusions of PG&E's initial, short term response (DCL-88-180) to Bulletin 88-04. Appropriate corrective action may be required at DCPP with respect to RHR pump mini-recirculation flow decrease during parallel pump operation. PG&E is evaluating RHR miniflow rates which are lower than the pump manufacture's recommendation. Ingersoll-Rand, the pump manufacturer, supports long term RHR operation under recirculation conditions with a miniflow of 500 gpm or greater. No corrective action is necessary for installed miniflow configuration with single RHR pump operation.

As part of the safety evaluation process, PG&E amended the Emergency Operating Procedure (EOP) to require the plant operators to secure one RHR pump at an early point after an SI (Step 7, E-0). This EOP amendment adds additional conservatism by ensuring the shortest exposure to any RHR miniflow rate reduction that may occur during operation of two pumps in parallel.

An engineering evaluation of the test data performed by Westinghouse for DCPP indicates that a RHR pump can operate at 290 gpm in excess of 30 minutes based on system fluid temperature rise. A miniflow recirculation flow rate of 390 gpm was the lowest flow observed during the tests. Conservatively applied potential instrument inaccuracies resulted in the 290 gpm used for the evaluation. With cooling provided by the CCW, a RHR pump could continue to operate for at least another hour and a half without degradation and complete a postulated worst case ECCS duty cycle. This duty cycle is defined as low head injection for a large break LOCA followed by thirty days of containment sump recirculation. This evaluation confirmed that the RHR pumps would retain their functionality and perform in compliance with General Design Criteria 35, "Emergency Core Cooling" and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling System for Light Water Nuclear Power Reactors."

Conclusions and Actions

The following conclusions were reached based on the tests:

1. The RHR pump miniflow tests have shown evidence of pump interaction similar to that described in Bulletin 88-04 when multiple pumps were operated in parallel.

2. Appropriate miniflow rates are maintained during single RHR pump operation.

3. Total flow rate through the miniflow recirculation loops is approximately constant in all parallel test modes.

PG&E will evaluate potential effects of pump interactions on pump lifetime and provide the results of this evaluation in the forthcoming May 1989 supplemental response to Bulletin 88-04. Emergency operating procedures have been changed to minimize RHR pump exposure to miniflow conditions while in parallel operation. An engineering evaluation has established the acceptability of short term RHR pump parallel operation at the lowest miniflow rate observed during the tests.

TABLE 1

RHR MINIFLOW TEST RESULTS

Configuration	Train	Unit 1		Unit 2	
		Observed (in GPM)	Error Band	Observed (in GPM)	Error Band
Coincident Start					
	A	725	770 max 677 min	770	813 max 725 min
	B	425	498 max 336 min	390	469 max 291 min
Single Train	B	550	608 max 485 min	550	608 max 485 min
Restart Train A	A	730	775 max 682 min	765	808 max 720 min
	B	425	498 max 336 min	390	469 max 291 min
Single Train	A	610	663 max 552 min	605	658 max 546 min
Restart Train B	A	730	775 max 682 min	760	803 max 714 min
	B	430	502 max 342 min	390	469 max 291 min

ENCLOSURE 2

CLARIFICATION OF INITIAL RESPONSE TO BULLETIN 88-04

The following is a clarification of two items discussed in PG&E's initial response (DCL-88-180, July 8, 1988) to Bulletin 88-04.

1. Enclosure, page 1, third paragraph

   Statement - "Procedures exist at DCPP which instruct the operators to check for signs of deadheading during accident conditions . . ."

   Clarification - The Emergency Operating Procedures (EOP) check for RHR pump motor currents at various steps, but only where injection is expected.

2. Attachment 1, page 2, note 3

   Statement - "The RHR pump configuration is sensitive to deadheading of a weaker pump; however, operating tests with both pumps running indicate they are well matched."

   Clarification - The operating tests discussed were performed with a single RHR pump running. These tests remain valid and demonstrate that the RHR pumps miniflow rate are well matched (within the accuracy of the test instrumentation). The results of these tests were included as Attachment 2 to the July 8 letter.