Burns and Roe Pacific, Inc.

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Subject: W. O. 3900/4000
Washington Public Power Supply System
WNP-2 Project
ECCS Pump Discharge Pressure Switches
Responds to:

October 7, 1982
BRGO-RO-82-010
Response Req'd by:

Mr. R. H. Engelken
U. S. Nuclear Regulatory Commission
Region V
1450 Maria Lane, Suite 210
Walnut Creek, California 94956

Reference: Burns and Roe Letter to NRC, "Reportable Condition 82-04," BRGO-RO-82-007, dated August 24, 1982

Gentlemen:

Burns and Roe has identified a concern which we have determined to be reportable under 10CFR21. The concern deals with ECCS Pump Discharge Pressure Switches being located in a location such that they are subjected to potential damage due to waterhammer (details in attachment). We have already initiated the action required to correct the situation.

We had sent a previous letter on the subject (referenced) providing some details of this concern with regard to the RHR pump (discharge pressure switches) only. Our final evaluation has concluded that pump discharge pressure switches on the HPCS and LPCS pumps were affected.

If you have any questions, please contact this office at (509) 943-8241.

Very truly yours,

W G Conn

W. G. CONN
Senior Group Supervisor

WGC:ATL/kac

IE-19

Attachment

cc: W. S. Chin/BPA
K. D. Cowan/SS
L. C. Floyd/SS
L. M. Harrold/SS
B. A. Holmberg/SS
R. T. Johnson/SS
E. LeBlanc/Bechtel
J. G. Tellefson/SS

ATTACHMENT

Description of Defect

On the discharge side of the Residual Heat Removal (RHR) and Low Pressure Core Spray (LPCS) pumps are redundant pressure switches (RHR-PS-16A, B & C, RHR-PS-19A, B & C, LPCS-PS-1 and LPCS-PS-9) with nominal setpoints of 100 psig for RHR 150 psig for LPCS. Their function is to "tell" the Automatic Depresurrization System (ADS) that the low pressure ECCS pumps are running. This permissive is needed before the ADS depressurizes the reactor vessel in a post-LOCA situation. On the discharge side of the HPCS pump is pressure switch HPCS-PS-12 with a nominal setpoint of 120 psig. Its function is to "tell" the HPCS minimum flow valve, HPCS-V-12, that the HPCS pump is running. This signal, in series with a low flow signal from HPCS-FIS-6, will open the minimum flow valve. The present installed locations for all these pressure switches may subject them to water hammer and disable them such that they cannot meet their safety function.

These pressure switches all have sensing points upstream of their respective pump discharge check valves at about El. 422'. During normal plant operation, with the ECCS pumps in standby mode (not running), they will "see" the static head of the suppression pool, whose minimum elevation is 466' - 0 3/4". All the pressure switches are located on racks whose elevation is greater than suppression pool water level. They are as follows:

PRESSURE SWITCH	INSTRUMENT RACK	FLOOR ELEVATION OF RACK
RHR-PS-16A	H22-P018	501'
RHR-PS-16B	H22-P021	501'
RHR-PS-16C	H22-P021	501'
RHR-PS-19A	H22-P018	501'
RHR-PS-19B	H22-P021	501'
RHR-PS-19C	H22-P021	501'
HPCS-PS-12	H22-P024	471'
LPCS-PS-1	H22-P001	471'
LPCS-PS-9	H22-P001	471'

For the instrument racks on El. 501', the instrument tubing is approximately 250' long and runs up to El. 516' before hooking into the pressure switch at approximately El. 505' (see attached sketch). For the instrument racks on El. 471', the instrument tubing is approximately 200' long and runs up to approximately El. 490' before hooking into the pressure switch at approximately El. 475'.

During normal plant operation, the sensing lines cannot be completely filled with water because the suppression pool can only fill it to El. 466'. With an air pocket in the sensing line, the pressure switch will not actuate at the required setpoint if it had been compensated for the static head difference between the sensing point and the pressure switch. This in itself is not a significant safety issue because the switch will trip early, although how early has not been determined. It would be difficult to accurately compensate for the air pocket due to the sensing line's tortuous routing and intermediate high point. However, there is a potential for water hammer in the sensing lines which could damage the pressure switches and not allow the ADS to function or the HPCS minimum flow valve to open.

Analysis of Safety Implications

If water hammer disables the pressure switches, then a substantial safety hazard could be created during a small break LOCA scenario. Using design basis accident assumptions, the HPCS is assumed to fail after a small break. The reactor remains pressurized so that the low pressure systems (RHR and LPCS) cannot inject. At reactor water Level 1 (just above the active fuel), the ADS two-minute timer is started and waits for water level to recover. Because HPCS is assumed to fail, water level continues to drop until the timer times out. The ADS logic then verifies that the RHR and LPCS pumps are running before it depressurizes the reactor. If the pressure switches are disabled at the start of the accident due to water hammer during pump start, no verification will occur and the reactor will not automatically depressurize. Manual depressurization can still occur, but using design basis accident assumptions, it cannot be taken credit for at least 10 minutes. With no automatic depressurization, we would be outside the safety analysis of FSAR Chapter 6 for a small break accident.

Failure of the HPCS pressure switch due to water hammer could cause a significant safety hazard in a small break scenario in which HPCS maintains reactor water level up to Level 8 trip. At Level 8, the HPCS injection valve closes and the pump is supposed to go into minimum flow recirculation. However, with HPCS-PS-12 damaged and unable to verify "pump running", the minimum flow valve will not open. The HPCS pump can damage itself such that no high pressure makeup is available. Now the plant is in the same situation described in the previous paragraph.

Corrective Action

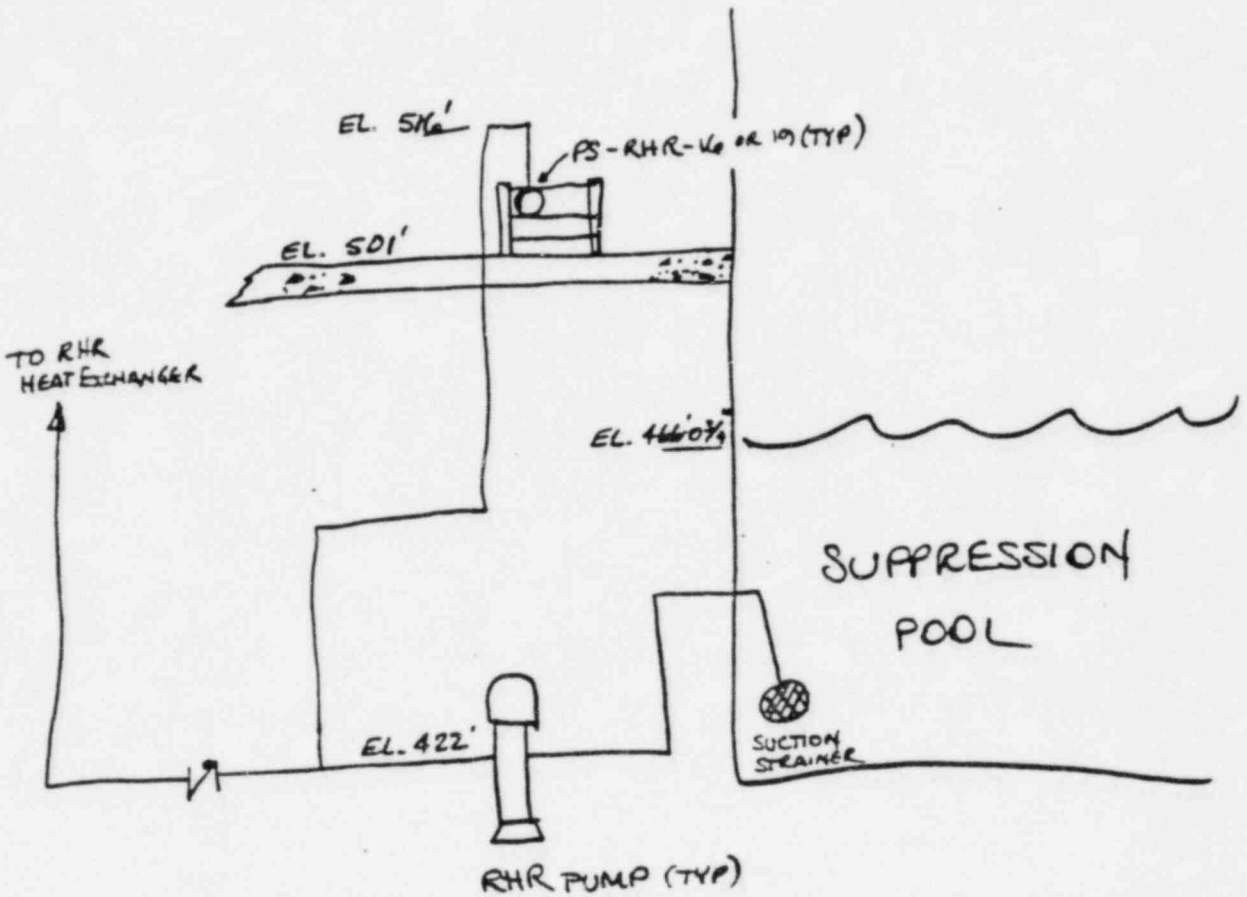
The instrument sensing line root valves will be relocated to points downstream of the ECCS pump discharge line check valves. Those portions of the lines are maintained under pressure by a water-leg pump.

Other Facilities Affected

The only other BWR that Burns and Roe had design responsibility for the piping was the Cooper Nuclear Station, Brownsville, Nebraska. We reviewed the system design of all safety-related systems and determined that this was not a problem on Cooper.

Date and Method of Discovery

The concern was initially identified on June 8, 1982. The potential defect was identified during setpoint evaluations for the subject instruments.


EL. 516'
PS-RHR-V6 OR 19 (TYP)
EL. 501'
TO RHR
HEAT EXCHANGER
EL. 466'0"
SUPPRESSION
POOL
EL. 422'
SUCTION
STRAINER
RHR PUMP (TYP)

F-82-3587

Log Sheet No. [redacted] 21a
Follow-up

PART 21 REPORT LOG SHEET

1. Subject of Report - ECCS Pump Discharge Pressure Switches (Followup - Final Report)

2. Date Verbal Notification Received - _____ Received By - _____

3. Date Information Placed in Daily Report - _____

4. Name and Address of Person Providing Verbal Notification

   a) Name - Bernard Roe

   b) Company and Address - 601 William Blvd
   Richland, WA 99352

   c) Telephone No. - 509-943-8200

5. Description of Problem - ECCS pump discharge pressure switches could be disabled by waterhammer

6. Nuclear Facilities Affected - WNP-2

7. Date 5-day Written Report Due - _____ Date Received - _____

8. Mail Written Report to HQ's and Other Affected Regions

   a) Date Mailed to HQ's (Bill Mills) - _____

   b) Date Mailed to Other Regions - _____ Regions Mailed To - _____

9. Give Written Report to Each Region V Affected Principal Inspector

   a) Date Given to Principal Inspector(s) - _____

   b) Name(s) of Inspectors Given To - _____

10. Additional Comments - B/R determined only applicable to WNP-2. Will relocate sensing line root valves to portion of line to be maintained under pressure by a water-leg pump.