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ACCESSION NBR:8807250053 DOC.DATE: 88/07/18 NOTARIZED: YES DOCKET #
FACIL:50-250 Turkey Point Plant, Unit 3, Florida Power and Light C 05000250
50-251 Turkey Point Plant, Unit 4, Florida Power and Light C 05000251
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Document Control Branch (Document Control Desk)

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

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FPL

JULY 1 8 1988

L-88-295

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

Gentlemen:

Re: Turkey Point Unit Nos. 3 and 4
Docket Nos. 50-250 and 50-251
Response to NRC Bulletin 88-04
Potential Safety-Related Pump Loss

On May 5, 1988 the NRC issued NRC Bulletin 88-04 "Potential Safety-Related Pump Loss" which requested all licensees to investigate and address two miniflow design concerns. The first concern involves the potential for the dead-heading of one or more pumps in safety-related systems that have a miniflow line common to two or more pumps or other piping configurations that do not preclude pump-to-pump interaction during miniflow operation. A second concern was whether or not the installed miniflow capacity is adequate for even a single pump in operation. Action item 4 requested a response within 60 days of receipt of the bulletin.

Florida Power & Light Company (FPL) has completed the evaluation of the first concern and completed the first phase of the evaluation of the second concern. The next phase of the evaluation will be to interface with the appropriate pump suppliers and confirm the minimum acceptable recirculation flow rate for each pump. It is anticipated that FPL will be able to provide a schedule for completion of the second concern by November 1, 1988.

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The enclosed report provides a complete response to the first concern and a partial response to the second concern of the bulletin and is submitted under the provisions of Section 182a of the Atomic Energy Act of 1954, as amended. Should there be any questions, please contact us.

Very truly yours,

D A Sager

W. F. Conway
Senior Vice President - Nuclear

WFC/SDF/gp

Enclosure

cc: Dr. J. Nelson Grace, Regional Administrator, USNRC, Region II
Senior Resident Inspector, USNRC, Turkey Point Plant

STATE OF FLORIDA )
) ss.
COUNTY OF PALM BEACH )

D. A. Sager being first duly sworn, deposes and says:

That he is Acting Vice President - Nuclear Energy of Florida Power & Light Company, the Licensee herein;

That he has executed the foregoing document; that the statements made in this document are true and correct to the best of his knowledge, information, and belief, and that he is authorized to execute the document on behalf of said Licensee.

D A Sager
D. A. Sager

Subscribed and sworn to before me this
18 day of July, 1988.

Roberta S Economy
NOTARY PUBLIC, in and for the County
of Palm Beach, State of Florida

My Commission expires:

Notary Public, State of Florida
My Commission Expires June 1, 1989
Bonded Thru Troy Fain - Insurance, Inc.

RE: Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
L-88-295

TURKEY POINT UNITS 3 AND 4
RESPONSE TO IE BULLETIN 88-04
POTENTIAL SAFETY RELATED PUMP LOSS

ACTION ITEM 4A

ACTION REQUESTED:

Summarize the problems and systems affected. Action Item 1 requested licensees to promptly determine whether or not their facilities have any safety-related systems with a pump and piping system configuration that does not preclude pump-to-pump interaction during miniflow operation and could therefore result in dead-heading of one or more of the pumps.

Action Item 3 requested licensees to evaluate the adequacy of the minimum flow bypass lines for safety-related centrifugal pumps with respect to damage resulting from operation and testing in the minimum flow mode.

RESPONSE:

FPL has determined that the following pumps could potentially be affected by one or both of the NRC's concerns: Auxiliary Feedwater, High Head Safety Injection, Residual Heat Removal, Containment Spray and Boric Acid Transfer pumps.

A. DEAD-HEADING

The first concern regarding the potential for dead-heading a pump when more than one pump is operated through a common recirculation line is addressed below.

AUXILIARY FEEDWATER PUMPS

The Auxiliary Feedwater (AFW) pumps are standby emergency pumps driven by steam turbines. The AFW pumps have minimum flow paths through check valves and locked open valves which tie into a common header to the condensate storage tanks. This common minimum recirculation design, shown in Figure 1, has been reviewed. Calculations were performed to determine the pressure drop characteristics of the worst case line up. With three AFW pumps lined up to one CST, the results showed that dead-heading was not a concern. This calculation was performed using actual measured pump performance curves, piping configurations, and conservative assumptions.

These minimum recirculation flow paths are sized to provide 10 gpm for each pump, which the manufacturer has stated is acceptable for up to 30 minutes. Additionally, approximately 30 gpm of flow is routed from each of the pumps' second stage to their respective lube oil and governor oil coolers and recirculated back to the condensate storage tank. This provides an additional source of recirculation flow.

Based on the above discussion, the issues raised by IEB 88-04 are not a concern for the AFW pumps at Turkey Point.

SAFETY INJECTION PUMPS

The Safety Injection (SI) pump minimum recirculation design, as shown in Figure 2, normally consists of two Safety Injection pumps tying into a common header with two Containment Spray pumps recirculating to the Refueling Water Storage Tank. When one unit is in cold shutdown, its Safety Injection pumps' recirculation lines can be valved into the other unit's recirculation line (e.g. when the RWST is out of service). As a result four Safety Injection and two Containment Spray pumps can recirculate back through the same piping. This "worst" case alignment was reviewed and calculations were performed to determine the pressure drop characteristics. The result showed that dead-heading was not a concern. This calculation was performed using actual measured pump performance curves, piping configurations, and conservative assumptions.

The normal minimum recirculation flowpath for plant operation allows up to 30 gpm of Safety Injection miniflow per pump. While this flow is adequate to remove pump heat, it is less than recommended by the vendor. FPL is in the process of requesting an evaluation of this concern by the NSSS vendor. Operation of the SI pumps on miniflow would only occur during either a spurious SI or an accident with high RCS pressure. Westinghouse calculations have shown that the RCS pressure during an accident would only remain above the shut off head of the SI pumps for a period less than five minutes. Also, inservice testing records have been reviewed from February 1981 to November 1984 when the SI pumps were tested soley on mini-flow recirculation. No abnormal vibration readings, degradation of pump head, or other signs of pump degradation were noted during this review. Accordingly, accelerated pump degradation would not be expected.

RESIDUAL HEAT REMOVAL PUMPS

The concerns discussed in IEB 88-04 were first identified at Turkey Point with regard to the Residual Heat Removal (RHR) pumps. Each RHR pump has since been provided with an individual recirculation line as shown in Figure 3 that prevents the deadheading concern identified in IEB 88-04. Each recirculation line provides approximately 300 gpm of miniflow per pump. Higher flows of 500 gpm are recommended by the pump vendor for extended

periods of time. However, in accordance with Westinghouse requirements, operating procedures restrict operation in this configuration to no more than 30 minutes with RCS pressure greater than pump shutoff pressure. Because of limited operation in the normal recirculation configuration, pump degradation is not expected.

With regards to periodic testing, the vendor manual recommends 500 gpm for extended periods of time. The test line provides approximately 300 gpm (worst case) for a limited period of time. As discussed above, for the SI pumps, the pumps' vendor has been requested to evaluate this condition for acceptability.

CONTAINMENT SPRAY PUMPS

The Containment Spray (CS) pump recirculation design (see Figure 2) as described in the section for the SI pumps consists of two CS pumps normally aligned with the recirculation lines of two SI pumps. As described previously when one unit is shutdown, four SI pumps can recirculate with the two CS pumps. As previously described in the section on the SI pumps the "worst" case alignment has been reviewed and it has been determined that the possibility of a "stronger" pump deadheading a "weaker" pump due to parallel pump operation does not exist.

Recirculation flow for these pumps is sized for 50 gpm. The pump manufacturer has stated that the 50 gpm normal recirculation line is sufficient to prevent thermal damage but falls short of their requirement of 400 gpm for stable operation. Based on the system configuration, the 50 gpm recirculation was only relied on for pump protection during testing. Dedicated 400 gpm recirculation test lines have been designed to accommodate this concern. This modification has been installed on Unit 3. The Unit 4 installation is partially complete providing approximately 200 gpm. Completion of implementation is pending installation of the correct valve trim in one valve.

BORIC ACID TRANSFER PUMPS

The recirculation design for the Boric Acid Transfer pumps (BATP) has been identified as a concern as per NRC Bulletin No. 88-04. It is possible for the pumps to be lined up in such a way that two pumps can share a common recirculating line. This could possibly lead to dead-heading of one of the pumps. The Operations staff at Turkey Point has been notified of this problem and administrative controls have been developed.

B. HYDRAULIC INSTABILITY

Inservice testing is performed for the AFW, RHR SI, CS, and Boric Acid Transfer Pumps. During testing, readings are taken for vibration, bearing temperature, seal leakage and motor amperage. This information provides early indication of

potential pump degradation. The Inservice test procedures identify appropriate actions if any of the above parameters exceed allowables, to assure continued pump operations.

FPL is currently in the process of contacting all affected pump vendors to determine if the current orifice sizing for each pump is adequate to address hydraulic instability.

ACTION ITEM 4B

ACTION REQUESTED:

Provide a written response that identifies the short-term and long-term modifications to plant operating procedures or hardware that have been or are being implemented to ensure safe plant operations.

RESPONSE:

Based on the information currently available, and the discussions of Section II-A of this evaluation, no modification to hardware is planned for the SI, AFW, and RHR Systems.

In regard to the dead heading concern for the Boric Acid Transfer pumps, short-term administrative controls have been placed on the boric acid transfer system to prevent more than one pump from recirculating on a single recirculation line and orifice. Long-term modifications to the Boric Acid Transfer Pumps, are under review and modifications as required, will be put on the Integrated Schedule.

In regard to the mini-flow concern on the CS pumps the modifications of the Unit 4 CS test line to provide the addition 200 gpm flow still required will be completed during the next scheduled refueling outage.

Dependent upon the results of the pump manufacturer review of their supplied pumps for the "hydraulic instability" question, plans for modifications, should any be required, will be addressed at that time.

ACTION ITEM 4C

ACTION REQUESTED:

Provide a written response that identifies an appropriate schedule for long-term resolution of this and/or other significant problems that are identified as a result of this bulletin.

RESPONSE:

Should any problem arise as a result of the pump manufacturer's evaluation of the hydraulic instability question, the time necessary to resolve will be dependent on the degree of severity of the problem. The results of that evaluation will be submitted within sixty days of receipt of the pump manufacturer's mini-recirculation information. A due date of September 1, 1988 will be requested of the pump manufacturers. Within 60 days of the receipt of the manufacturers' evaluations, a plan/schedule to resolve any problems will be provided.

The concern with the Boric Acid Transfer pumps is being evaluated in more detail. Any modifications required by the evaluations will be placed on the integrated schedule within 90 days.

The Unit 4 CS test line modification will be completed during the next scheduled refueling outage.

ACTION ITEM 4D

ACTION REQUESTED:

Provide a written response that provides justification for continued operation particularly with regard to General Design Criterion 35 of Appendix A to Title 10 of the Code of Federal Regulations (10 CFR 50), "Emergency Core Cooling" and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling System for Light Water Nuclear Power Reactors."

RESPONSE:

Regarding hydraulic instability, there are no observable trends in degradation of the subject safety related pumps that could be attributed to the hydraulic instability phenomenon. BATP, SI, RHR, CS, and AFW pumps have been tested solely using the minimum recirculation lines with no identified abnormal degradation. The containment spray design function precludes reliance on mini-recirculation piping for pump protection during safeguards operation. Testing lines have been installed on Unit 3 which provide flows above the region where hydraulic instability is a concern. For Unit 4, a modification to the piping identical to the modification installed on Unit 3 has been issued. This modification is partially complete and provides flow significantly above original mini-recirculation flow. Testing through this current configuration has not resulted in any abnormal degradation that can be attributed to hydraulic instability.

The concern regarding the use of a common recirculation line for the Boric Acid Transfer pumps is currently being examined in more detail. The Operations Department at Turkey Point has been made aware of the issue. For the short-term, administrative controls have been placed on the boric acid transfer system to prevent more than one boric acid transfer pump from recirculating in a single recirculating line.

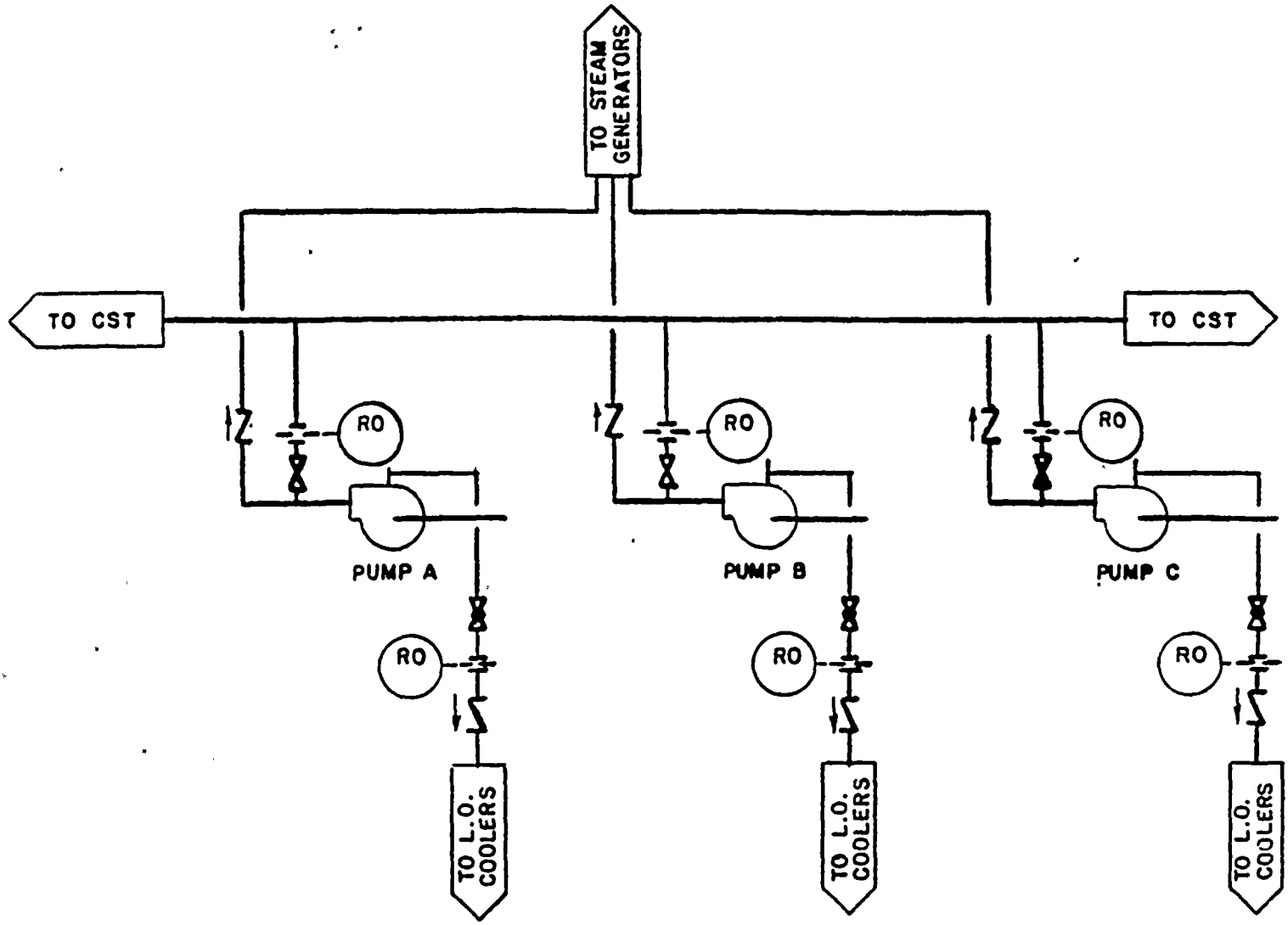
## MINIFLOW VALUES AND PUMP MANUFACTURERS

PTP-3

| System | Pump | Miniflow Measured (GPM) | Vendor | Common Header? | Return to: |
|---|---|---|---|---|---|
| SI | (SI)<br>3A<br>3B | 30 | Worthington | Yes | RWST |
| | (RHR)<br>3A<br>3B | 300 | Ingersol-Rand | No | Pump Suction |
| CS | 3A<br>3B | 50 | Goulds | Yes | RWST |
| AFW | 1A<br>1B<br>1C | 10 | Ingersol Rand | Yes | CST |
| BATU | 3A<br>3B | 15 | Goulds | No | BAST |

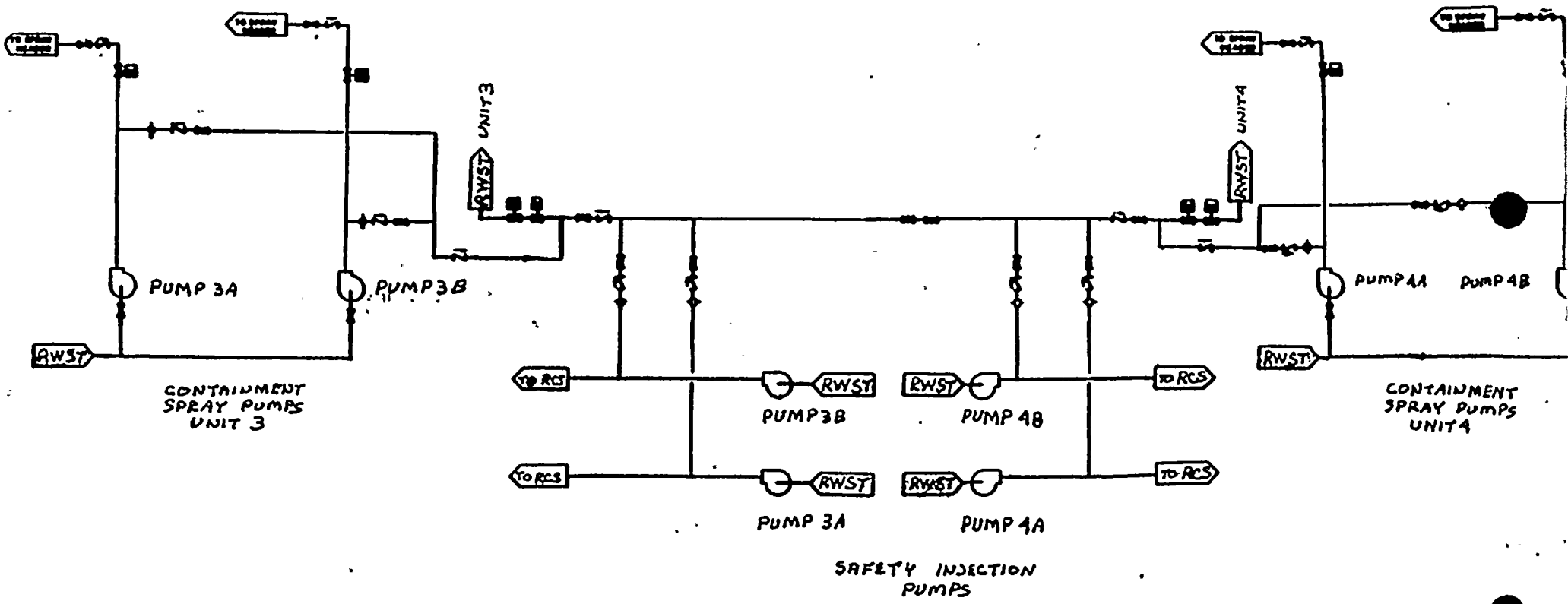
PTP-4

| System | Pump | Miniflow (GPM) | Vendor | Common Header? | Return to: |
|---|---|---|---|---|---|
| SI | (HPSI)<br>4A<br>4B | 30 | Worthington | Yes | RWST |
| | (LPSI)<br>4A<br>4B | 300 | Ingersol-Rand | No | Pump Suction |
| CS | 4A<br>4B | 50 | Goulds | Yes | RWST |
| AFW | Common with Units 3 | | | | |
| BATU | 4A<br>4B | 15 | | Yes | BAST |



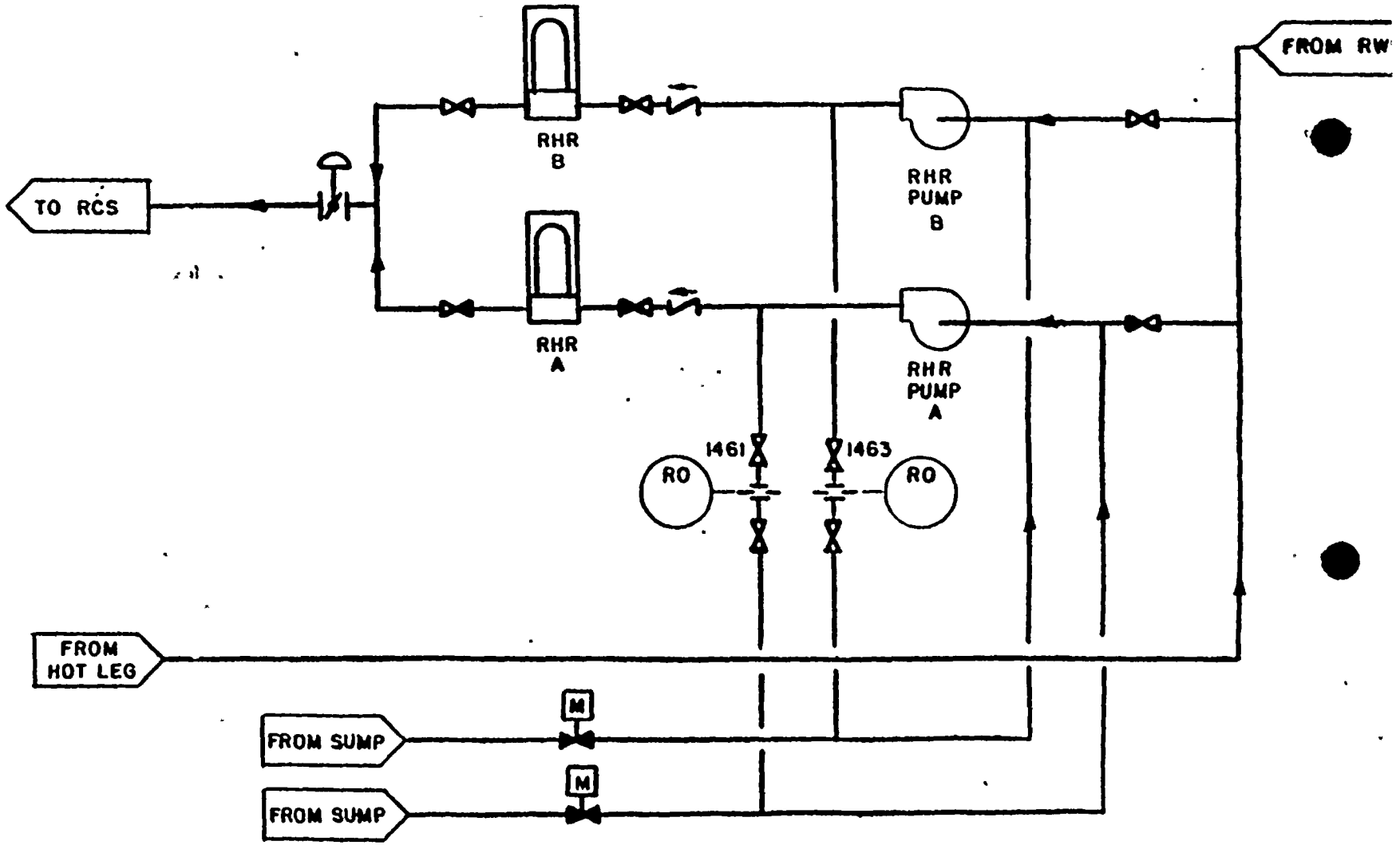

AUXILIARY FEEDWATER PUMPS

FIGURE 1



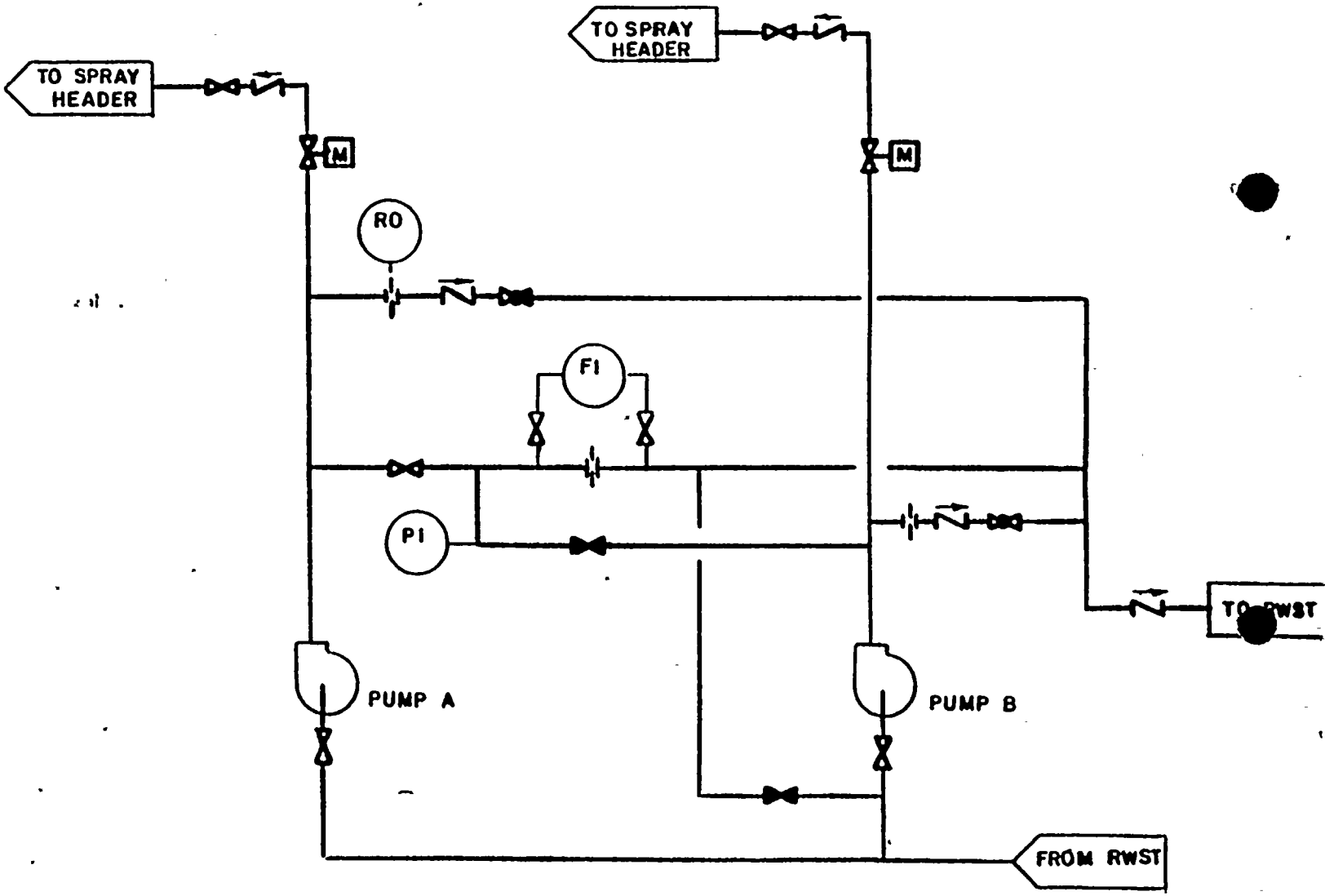

**CONTAINMENT SPRAY PUMPS AND SAFETY INJECTION PUMPS**

**FIGURE 2**




RESIDUAL HEAT REMOVAL PUMPS

FIGURE 3




NOTE DURING TESTING, VALVES THROTTLED TO PROVIDE 400 GPM

CONTAINMENT SPRAY PUMPS

FIGURE 4