Public Service
Electric and Gas
Company

Steven E. Miltenberger
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August 11, 1988
NLR-N88126

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

RESPONSE TO NRC BULLETIN 88-04
SALEM GENERATING STATION
UNIT NOS. 1 AND 2
DOCKET NOS. 50-272 AND 50-311

Public Service Electric and Gas Company (PSE&G) has received the subject NRC Bulletin regarding potential safety-related pump loss. PSE&G requested and was granted a 31-day extension to the July 11, 1988, due date, on July 6, 1988. The information requested by this Bulletin as related to Salem Generating Station is provided in the enclosure to this letter.

Should you have any questions with regard to this transmittal, please do not hesitate to contact us.

Sincerely,

Steven E Miltenberger

Enclosure

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ADD:
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C Mr. D. C. Fischer
USNRC Licensing Project Manager

Mr. R. W. Borchardt
USNRC Senior Resident Inspector

Mr. W. T. Russell, Administrator
USNRC Region I

Mr. D. M. Scott, Chief
Bureau of Nuclear Engineering
Department of Environmental Protection
380 Scotch Road
Trenton, NJ 08628

Ref: RESPONSE TO NRC BULLETIN 88-04

STATE OF NEW JERSEY)
) SS.
COUNTY OF SALEM)

Steven E. Miltenberger, being duly sworn according to law deposes and says:

I am Vice President and Chief Nuclear Officer of Public Service Electric and Gas Company, and as such, I find the matters set forth in our letter dated August 11, 1988 , concerning our response to NRC Bulletin 88-04, are true to the best of my knowledge, information and belief.

Steven E. Miltenberger

Subscribed and Sworn to before me
this 11th day of August, 1988

Eileen M. Ochs
Notary Public of New Jersey

EILEEN M. OCHS
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires July 16, 1992

My Commission expires on _____

ENCLOSURE

RESPONSE TO NRC BULLETIN 88-04
SALEM GENERATING STATION
DOCKET NOS. 50-272 AND 50-311

The subject of this bulletin requested licensees to investigate and correct, as applicable, two miniflow design concerns. The first concern involves the potential for dead-heading 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. The second concern is whether or not the installed miniflow capacity is adequate for even a single pump in operation.

The written response requested in Action Item 4 of NRC Bulletin 88-04 is presented below.

NRC BULLETIN 88-04, ACTION ITEM 4

Provide a written response that (a) summarizes the problems and the systems affected, (b) 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, (c) identifies an appropriate schedule for long-term resolution of this bulletin, and (d) 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

4.(a) Summarize the problems and systems affected.

At Salem, the charging pump, the safety injection pumps and the auxiliary feedwater (Aux Feed) pumps are the only safety related systems which incorporate the shared miniflow line configuration. Each of these systems have flow orifices installed off of each recirc line upstream of the common header. This negates the strong pump/weak pump concern as the pressure at the entrance to the common header is reduced.

The charging, safety injection, aux feed and residual heat removal (RHR) pumps all utilize minimum flow recirc lines. For the charging and safety injection pumps, operation in recirc is minimized to short periods of pump startup for required surveillance testing and inadvertant safety injections. Additionally, these pumps have been operated in recirc every 92 days for surveillance testing per ASME Boiler and Pressure Vessel code Section XI. These surveillances are performed to detect changes in pump performance. They monitor various pump

parameters including vibration, differential pressure, and bearing temperature. Alert and unacceptable ranges are clearly defined and require further testing or evaluation. As such, any pump performance degradation caused by insufficient recirc flow, would be detected during these pump surveillances. Investigation would then reveal impeller damage as the root cause. Consequently, if Salem had a recirc flow problem with the charging or safety injection systems, evidence would have surfaced in its surveillance testing. Salem has also contacted the pump vendor and verified that the recommended recirc flow rate is maintained.

The RHR pumps have individual recirc lines that discharge back to the associated pump's suction line. The recirc flow is controlled by a recirc control valve that maintains a minimum flow of 500 gpm through the pump. Like the charging and safety injection pumps, the RHR pumps are subject to quarterly surveillance testing. Indications indicative of internal pump problems (excessive vibration, high bearing temperature, low discharge pressure or low flow) have not been exhibited during RHR surveillances. Recent pump inspections on Unit 2 did not reveal any excessive pump impeller wear. Operation of the RHR pumps on recirc is also limited to short periods of time.

The aux feed system has two motor driven pumps with a recirc flow of 230 to 250 gpm. This flow more than satisfies the manufacturers recommendation for minimum flow. The third aux feed pump is turbine driven. It's recirc flow is approximately 140 gpm. The turbine driven pump is never run on recirc for significant periods of time as its discharge valves are fully open for injection into the steam generator. Should it become necessary to run the turbine driven pump in recirc for extended periods, an additional recirc line can be manually opened on Unit 1 to ensure adequate recirc flow. This additional recirc line will be added on Unit 2 during the 4th refueling outage. Surveillance testing on the aux feed pumps have been performed monthly, with no indication of internal pump degradation.

In conclusion, these safety related pumps do not have a problem with potential dead heading or miniflow capacity. Salem's safety related pumps have sufficient recirc flow to ensure the present manufacturers recommended flow requirements. Additionally, Salem is pursuing further evaluation of recirc flow requirements with the pump manufacturers. Salem will utilize this information as it becomes available.

4.(b) Identify 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.

Operation in the minimum flow mode, which includes the potential for dead-head operation, is already minimized to the short periods of pump startup during routine testing and to system startup during emergency conditions. The Emergency Operating Procedures (EOPs) are written such that the ECCS pumps (charging, safety injection, RHR) are stopped when they are not needed for injection based on RCS pressure and level. Thus, the ECCS pumps

should not be run on recirc for more than (30) minutes during a safety injection event. Consequently, the frequency of running the pumps in recirc is low and the duration of pump operation in this configuration is small.

The Salem Units do not have the strong pump/weak pump concern, as all common recirc lines are orificed. Furthermore, the required surveillance testing is designed to identify pump degradation, thus allowing corrective measures to be taken prior to ultimate pump failure. As discussed in 4.(a), various parameters which would be indicative of internal pump damage are monitored at least quarterly. Based on previous surveillance and inspection results along with the fact the pump recirc lines ensure the vendors recommended recirc rate is maintained; no corrective actions are needed. However, the additional Unit 2 turbine driven aux feed pump recirc line will be installed to allow for higher flow testing as previously planned.

4.(c) Identify an appropriate schedule for long-term resolution of this and/or other significant problems that are identified as a result of this bulletin.

No significant problems have been identified as a result of this bulletin. However, Salem is pursuing further evaluation of the recirc flow requirements with the pump vendors to ensure that the latest hydraulic instability studies will be incorporated.

4.(d) Provide justification for continued operation, particularly with regard to 10 CFR 50, Appendix A, GDC 35, "Emergency Core Cooling," and 10 CFR 50.46, "Acceptance Criteria for ECCS for Light Water Nuclear Power Reactors."

The items discussed below provide the basis for concluding that the continued operation of the Salem Generating Station is justified.

1. The potential for excessive pump wear attributable to minimum flow operation and/or dead-heading is negligible. System operation in the minimum flow mode is limited to surveillance testing and system start during emergency conditions. The potential for dead-heading is negated by the fact that all common recirc lines have orifices off the independent lines upstream of the common header.

2. Operating experience demonstrates that short-term operation in the minimum flow mode and/or dead-heading has little or no impact on pump life. Recent inspections of RHR pumps, which have undergone normal testing over a period of approximately ten years, have indicated no pump impeller excessive wear due to minimum flow.

   There have been occasions (at other plants) when pumps have operated dead-headed inadvertently (i.e., dead-heading was not caused by minimum flow operation but, for instance, by incorrectly closing a valve). These pumps have continued to function normally.

3. Pump wear attributable to minimum flow and/or dead-heading is not a significant contributor to total system unavailability. Other factors (such as loss of emergency power, loss of cooling, etc.) are more significant.

4. The only design basis events that would lead to ECCS pumps running in the minimum flow mode and/or dead-heading are events that result in an ECCS initiation signal while the reactor is at high pressure (above the pump shutoff head). These events seldom occur and the pumps are only in this configuration for short durations. The present miniflow bypass lines provide adequate protection for these pumps for the short durations postulated for these conditions.

5. The aux feed pumps are utilized for steam generator feedwater supply in accident situations. The motor driven pumps may be in operation for significant periods of time. Although, they will usually be injecting into the steam generators, they may also be in recirc for extended periods. The recirc flow capability provides adequate protection for this condition. The turbine driven pump is utilized for long periods only if the motor driven pump(s) fail. If need be (on Unit 2, after the 4th refueling outage) an additional recirc path can be utilized to ensure adequate recirc flow under these conditions.

6. Routine inspection, maintenance and surveillance practices should detect excessive pump wear well before the system performance is degraded.

7. Adequate redundancy is provided in the design of the ECCS systems. The Salem Technical Specification ensure that the requirements of 10CFR50.46 and General Design Criteria 35 of 10CFR50 Appendix A are satisfied. Technical Specification Surveillance requirements, Inservice Testing requirements, preventative maintenance requirements along with vendor/ utility experience interface provide additional ensurance that the aforementioned requirements are met.