PP&L Pennsylvania Power & Light Company
Two North Ninth Street • Allentown, PA 18101 • 215 / 770-5151

Norman W. Curtis
Vice President-Engineering & Construction-Nuclear
215 / 770-5381

March 26, 1982

Mr. R. C. Haynes
Regional Administrator, Region I
U. S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, Pennsylvania 19406

SUSQUEHANNA STEAM ELECTRIC STATION
FINAL REPORT OF A DEFICIENCY INVOLVING
RHR SYSTEM THROTTLING VALVES
ERs 100450/100508 FILE 821-10
PLA-1045

Dear Mr. Haynes:

This letter serves to provide the Commission with a final report on a deficiency involving throttling characteristics of RHR system throttling valves.

This deficiency was originally reported by telephone to Mr. E. C. McCabe of NRC Region I on November 12, 1981 by Mr. A. R. Sabol of PP&L. At that time the condition was identified as "Potentially Reportable".

The attachment to this letter contains a description of the deficiency, its cause, an analysis of safety implications and the corrective action taken and planned. This information is furnished pursuant to the provisions of 10 CFR 50.55(e).

Since the details of this report provide information relevant to the reporting requirements of 10 CFR 21, this correspondence is considered to also discharge any formal responsibility PP&L may have in compliance thereto.

We trust the Commission will find this report to be satisfactory.

Very truly yours,

N. W. Curtis

N. W. Curtis
Vice President-Engineering & Construction-Nuclear

JS:jmk

Attachment

IE27
5/1/1

cc: Mr. Richard C. DeYoung (15)
Director-Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. G. McDonald, Director
Office of Management Information & Program Control
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. Gary Rhoads
U. S. Nuclear Regulatory Commission
P.O. Box 52
Shickshinny, PA 18655

Attachment to PLA-1045

Final Report

Subject:

Anchor/Darling Valve Co. globe valves used in throttling service.

Description of Deficiency:

During the start-up testing of the Residual Heat Removal System (RHR), a problem was identified with the throttling characteristics of several Anchor/Darling globe valves. It was found that the valves either cavitated or were very difficult to throttle within the Technical Specification ranges. Specifically, valves F024A and B were required to be throttled closed approximately 85% to obtain the flow rate required to test the single pump Low Pressure Coolant Injection Mode (LPCI) and the single pump Suppression Pool Cooling Mode of the RHR system. This resulted in cavitation as identified by a very loud valve noise.

Through further investigation of the remaining valves in the RHR System, throttling problems were identified in valves F017A and B and F040. Valves F017A and B were uncontrollable in the ranges required for the Shutdown Cooling Mode of the RHR system, and valve F040 was difficult to control while discharging water to liquid radwaste system. When throttling was attempted by briefly jogging the motor operator for these valves, valve overtravel was experienced and accurate control was not possible.

Cause:

An investigation of the design of these valves indicated that they met all the requirements of the purchase specification and the applicable codes. It was determined, however, that the valves, while being identified as "throttling" valves, did not have the actual throttling ranges provided to the valve vendor on the valve data sheets. This resulted in the vendor supplying globe valves which are difficult to throttle within certain ranges. The difficulty in throttling can be attributed specifically to two causes:

1. The throttling ranges of the valves are wide (e.g. valves F024A&B must throttle from 2000 gpm to 23,000 gpm during full flow testing).

Attachment to PLA-1045

2. The system resistance is relatively low to ensure that the Low Pressure Coolant Injection (LPCI) and Suppression Pool Cooling Modes are not restricted. Because of the low system resistance (especially during low flow and testing conditions) the pressure drops across the throttling valves are high (in some cases it is > 100 psid).

As a result of the above design conditions, the valves are frequently required to be throttled in 10 to 40% open position.

Analysis of Safety Implications:

Valves F024A and B are located in the RHR System test lines, and are used both for testing and for cooling water return to the Suppression Pool during the suppression pool cooling mode. In the suppression pool cooling mode, valve F024A or B is required to be throttled to approximately 85% closed with a potential for cavitation damage and, ultimately, valve failure.

Valves F017A and B are located in the LPCI injection lines attached to the reactor recirculation loops. They are used for LPCI injection and for shutdown cooling. During the shutdown cooling mode, the valve in use must be throttled to control the rate of cooling. Such throttling is very difficult to achieve with the present valve. Additionally, attempts at throttling may result in cavitation with subsequent valve damage. Shutdown cooling is not a design basis accident mode; however, cavitation damage resulting from throttling in this mode may impair the valve's performance and/or integrity during the LPCI injection mode.

Valve F040 is used to discharge water from the RHR System to liquid radwaste during normal heat up, system flushing, etc. There are no nuclear safety related modes utilizing this valve except system integrity (passive function). During system flushing, throttling with this valve was difficult; and, while no evidence of cavitation was present, the valve was throttled in the 10 to 30% open position. Good control of the flow with this valve was accomplished only when manual throttling with the handwheel was used. "ALARA" considerations and operator availability make manual control an undesirable alternative.

As a result of the information presented above, PP&L has concluded that valve performance could have adversely affected the safe operation of Susquehanna SES. PP&L therefore considers the condition to be reportable under the provisions of 10 CFR50.55(e).

Attachment to PLA-1045

Corrective Action:

Because of the complexity in making permanent repairs/replacement immediately, the corrective action will be in two phases - an interim phase to be implemented immediately and a final phase to be implemented at the first refueling outage.

The interim modification for valves F017A and B will be to replace the present valve discs prior to fuel load with discs specifically designed for the throttling conditions expected. Replacement of the discs will improve the throttling characteristics of the valves and will reduce, and possibly eliminate, cavitation throughout the required throttling range. This modification will guarantee integrity of the system and function of the valves until the first refueling outage. At that time these valves will be dissassembled and inspected by Anchor/Darling Valve Co. and PP&L. The final corrective action will be based upon this inspection and, if warranted, the valves will be replaced at that time. Any sign of cavitation erosion which could compromise minimum wall requirements, valve integrity or valve function will be considered as justification for replacement of the valves.

The interim corrective action for valves F024A and B is to use the valve "as-is" based upon the recommendation of Anchor/Darling Valve Co. Their recommendation stated that only slight erosion may occur in the seat area of the body or disc due to the throttling required during a one time accident and no erosion should be observed during normal plant operations.

It was the opinion of Anchor/Darling Valve Co. that erosion, if any, would not effect valve integrity or valve function. The final corrective action for valves F024A and B is to be accomplished during the first refueling outage. It is to remove the valves and reverse them in their respective lines. Reversing each valve will have flow over-the-disc, in lieu of under-the-disc, providing an inherently higher pressure drop across the valve. In addition, the present discs will be replaced with discs specifically designed to eliminate any cavitation and to improve throttling characteristics.

For valve F040 the final corrective action will be implemented prior to fuel load (negating the need for interim action). Valve F040 will be removed and reoriented in the line to take advantage of the higher pressure drop resulting from flow over-the-disc. In addition the present disc will be replaced with a disc specifically designed for the throttling conditions expected.

Attachment to PLA-1045

Conclusion:

The Anchor/Darling Valve Co. globe valves used in the RHR system have exhibited problems with throttling and with cavitation which could damage the valves when used for prolonged periods of time. An investigation performed by Anchor/Darling Valve Co. of similar valves with similar flow conditions indicate that the cavitation problems are minimal and may not cause any erosion. PP&L feels, however, that the uncertainty of the amount of potential damage which may occur warrants a program of inspection and corrective action.

The remaining Anchor/Darling Valve Co. globe valves used in the RHR system and other ECCS applications were inspected and determined not to have throttling and/or cavitation problems.

The interim corrective actions are being documented by Design Control Package 558; the final corrective actions are being documented by Plant Modification Request 82-051.