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Dr. Thomas E. Murley
Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19406

SUSQUEHANNA STEAM ELECTRIC STATION
ADDITIONAL INFORMATION ON A CONDITION
INVOLVING PACIFIC SWING CHECK VALVES
ER 100450/100508 FILES 821-10/900-10
PLA-1793

Docket Nos. 50-387
50-388

References:
(1) PLA-654 dated 3/11/81
(2) PLA-819 dated 5/29/81
(3) PLA-916 dated 8/27/81
(4) PLA-1005 dated 2/5/82
(5) PLA-1091 dated 8/19/82
(6) PLA-1667 dated 5/13/83 (LER 83-066)

Dear Dr. Murley:

This letter and its attachment serve to provide the Commission with additional information regarding two different problems on swing check valves manufactured by the Pacific Valve Company (Mark Controls Corp.). The previously reported problems were unrelated; however, the final corrective actions implemented bear on both problems. The discussion of both problems under one letter will provide clarification of the present status of these valves at SSES. This letter was requested by Mr. J. T. McCann, Sr. Resident Inspector at the conclusion of a meeting regarding Pacific check valves.

Based on the information presented within this letter and its attachment, PP&L considers all actions associated with the resolution of these deficiencies to be complete.

Very truly yours,

R J Shorlin for

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

Attachment

cc: Mr. J. T. McCann - NRC
Mr. G. G. Rhoads - NRC

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SUBJECT

This report discusses two problems associated with swing check valves manufactured by the Pacific Valve Company (Mark Controls Corp.) and in use at Susquehanna Steam Electric Station.

DESCRIPTION

The following is a brief descrition of each problem:

(1) The Pacific swing check valves in use at Susquehanna have valve discs with two stubs, one on either side of the hinge arm. The stubs prevent the valve from spinning during service. Excessive wear at the valve hinge arm/disc stud interface can allow the disc to have enough play for the stubs to jam behind the hinge arm resulting in improper seating of the disc. Consequently a leakage path is available by the seat. This problem was discovered during an inspection of four 10 inch check valves (187044, 187054, 188040, 188050) all of which are "non-Q" (Reference 1).

(2) During functional testing of the RCIC pump turbine, the RCIC turbine exhaust line check valve failed. The failure was caused by erratic steam flow conditions which caused the valve disc to cycle violently open and closed. During the failure analysis it was discovered that the valve disc stud had failed in a brittle manner (Reference 2).

CAUSE

The following is a brief description of the cause of each problem:

(1) Two factors were evaluated as causes of the wear at the valve hinge arm/disc stud interface:

(a) Pacific Valves assessed the discrepant condition to be due to abnormally high flow induced loading which is substantially the result of the dynamic effects which accompany turbulence and/or vorticity.

(b) Inspections of selected "Q" valves of similar class and installation configurations as the defective "non-Q" valves revealed no evidence of the wear condition identified on the "non-Q" check valves. The use of a formal QA/QC program during the manufacture, inspection, and testing process is unique to "Q" valves and was considered as basis for the deficiency being limited to "non-Q" valves (Reference 3).

(2) Two factors were also evaluated as causes of the RCIC turbine exhaust line check valve failure.

(a) The check valve was sized for full flow; consequently, operational testing of the system at low flow caused the disc to cycle erratically. As a result, the end of the disc stud gradually wore a

hole in the valve bonnet (cover) which served as the stop. The swing check valve's design adequacy was evaluated in this type of service (Reference 4).

(b) The loads and stresses experienced by the disc resulted in the failure of the valve. Since the failure was noted as being brittle in nature, the material properties of the valve were analyzed to ascertain their suitability for this service (Reference 4). The results of this analysis indicated that a higher grade material would be more suitable for the general spectrum of services for which Pacific swing check valves were in use.

CORRECTIVE ACTION

The following is a brief description of the corrective action for each problem:

(1) As mentioned previously, an inspection of selected "Q" valves of similar class and installation configurations revealed no evidence of the wear condition identified on the "non-Q" check valves. Valves located downstream of elbows, pump discharges, and/or expanders were included in this inspection. Bechtel reviewed the layout of the discrepant "non-Q" check valves and found no unusual turbulence or high velocity.

(2) The RCIC and HPCI turbine exhaust Pacific swing check valves were replaced with Anchor-Darling lift type check valves. The Anchor-Darling valves operate with an inherent dampening action which enables the valve to withstand erratic steam flow conditions (Reference 5). In addition, as a result of a material analysis done in conjunction with this problem, PP&L decided to replace all "Q" Pacific swing check valves with parts made of higher grade materials (Reference 4).

After the new valve materials were installed, an inspection was done by Bechtel on the original valve materials. As a result of this inspection four valves were identified as having experienced significant wear. This wear was not near what might be considered a failure point, but it was cause for some concern. The four valves (011053, 011054, 111100, 111101) were located downstream of flow orifices in the ESW system. Service time before the material replacement program was between 500 and 8000 hours with the majority of the valves having approximately 2000 hours service. This service time was during startup which is more severe than actual operational service. Since the valves had new higher grade materials, it was felt that the four valves could operate at least another 2000 hours. The expected service time for the ESW system was noted as being 260 hours per year.

A modification was planned for implementation during the first refueling outage for Unit 1. Subsequent investigation into the function of these check valves and discussions with Bechtel revealed that these check valves (011053, 011054, 111100, 111101, and Unit 2 valves 211100, 211101) were installed to prevent reverse flow in the ESW system when RHR Service Water is on and ESW is off. However, ESW reverse flow is eliminated by the ESW pump discharge check

valves. In addition, plant operating procedures require that ESW be running before RHRSW is started, thereby providing a redundant means of preventing reverse flow in the ESW system. Upon this basis it was decided that these check valves are unnecessary. A modification was planned to remove the internals on check valves 011053 and 011054 and replace valves 111100, 111101, 211100, and 211101 with locked open butterfly valves. The butterfly valves provide an ESW isolation capability in the reactor building and are more reliable than check valves since they are considered less likely to fail.

The modification was completed in April of 1983. During the modification, it was discovered that the valve disc on valve 011053 had become detached from the hinge pin. This failure resulted from unanticipated extensive system run time which the ESW system has experienced to resolve the ESW water hammer problem (Reference 6).