

U. S. NUCLEAR REGULATORY COMMISSION  
OFFICE OF INSPECTION AND ENFORCEMENT  
REGION IV

Report No. 99900075/81-01

Program No. 51300

Company: MCC-Pacific Valves  
3201 Walnut St.  
Long Beach, CA 90807

Inspection Conducted: June 25-26, 1981

Inspector.

*CJ Hale*  
Wm D. Kelley, Contractor Inspector-Mechanical  
Reactive Inspection Section  
Vendor Inspection Branch

*8-11-81*  
Date

Approved by:

*CJ Hale*  
I. Barnes, Chief  
Reactive Inspection Section  
Vendor Inspection Branch

*8-11-81*  
Date

Summary

Inspection conducted on June 25-26, 1981 (Report No. 99900075/81-01)

Areas Inspected: Implementation of 10 CFR Part 21, 10 CFR Part 50, Appendix B, and applicable codes and standards in following up on Pennsylvania Power and Light Company's construction deficiency notice concerning excessive wear of discs in check valves installed in their Susquehanna Steam Electric Station, Units 1 and 2. The inspection involved 12 inspector-hours on site by one NRC inspector.

Results: In the one area inspected, no nonconformances or unresolved items were identified.

DETAILSA. Persons ContactedMCC-Pacific Valves (MCC-PV)

L. B. Blenz, Senior Contract Coordinator  
G. Brown, Chief Engineer  
N. J. Condon, Supervisor R&D Laboratory  
\*F. W. Heckencamp, Vice President Engineering  
J. P. Pepe, Materials Application Engineer

\*Denotes the person who attended the exit interview.

B. Excessive Wear of the MCC-PV 10 Inch Swing Check Valve Hinge/Disc Pins Interfaces1. Background

Pennsylvania Power and Light Company (PP&LC) notified Region I of the Nuclear Regulatory Commission (NRC), Office of Inspection and Enforcement (IE), by letter dated March 11, 1981, of the excessive wear at the hinge and disc anti-rotation pins of the 10 inch 150 psi swing check valves installed in the RCIC turbine exhaust system of their Susquehanna Steam Electric Station, in accordance with the reporting requirements of 10 CFR Part 50.55(e).

2. Objectives

The objectives of this area of the inspection were to ascertain whether MCC-PV had determined the cause of the failure of the 10 inch 150 psi swing check valve anti-rotation design feature and whether the failure had been processed, evaluated, and reported in a manner consistent with NRC rules and regulations and 10 CFR Part 21.

3. Method of Accomplishment

The objectives of this area of the inspection were accomplished by:

- a. Review of the customer Purchase Order No. 8856-P-12-BC, and "Technical Specification for Nuclear Service Valves for the Susquehanna Steam Electric Station, Units 1 and 2 . . . , " Specification No. 8856-M-221 to determine:

- (1) the applicable codes and standards;
- (2) the design operating conditions, pressure, temperature and functions; and

- (3) whether Appendix B of 10 CFR Part 50 and/or 10 CFR Part 21 had been imposed.
- b. Review of the MCC-PV Quality Assurance Manual to verify that they had a quality assurance program that met the requirements of NRC rules and regulations, Appendix B of 10 CFR Part 50, and the customer's purchase documents and/or design specifications.
  - c. Review of MCC-PV "Technical Service Report: Project 5004," to verify that an analysis had been made by MCC-PV of the type of failure and the dimensions of parts after failure had been recorded.
  - d. Review of Bechtel Power Corporation (BPC) - San Francisco, California letter to MCC-PV dated April 7, 1981; "Subject: Swing Check Valve," to verify that the customer had expressed his concern to MCC-PV of the check valve failure in a non-safety system.
  - e. Review of PP&LC letter to Region I of NRC dated March 11, 1981, to verify that the licensee had issued an interim report of the check valve failure pursuant to the provisions of 10 CFR Part 50.55(e).
  - f. Review of MCC-PV letter to BPC dated April 21, 1981, to verify that MCC-PV had answered BPC concerns expressed in their letter of April 7, 1981.
  - g. Review of MCC-PV inter-office correspondence dated June 18, 1981; "Subject: Bechtel Susquehanna 10 inch 180 Disc," to verify that MCC-PV had made a metallurgical evaluation of the check valve failure.
  - h. Review of BPC letter to MCC-PV dated June 8, 1981: "Subject: . . . RCIC Turbine Exhaust Check Valve Failure," to verify that BPC had addressed the metallurgical aspect of the check valve disc failure.
  - i. Review of BPC Purchase Order No. 8856-P-12-BC, Requisition No. 8856-P-12, Revision 1, to determine: (1) the applicable code requirements, (2) service condition, and (3) system startup and testing requirements.
  - j. Review of Franklin Institute Research Laboratory, Inc. (FIRL), Technical Report 031-A5465-01 (1728) dated May 13, 1981, titled, "Metallurgical Analysis of a Cast Stainless Steel Valve Disc," to ascertain their conclusions as to the type of failure.

k. Review of the following documents for Disc Serial No. XN083.

- (1) Mill Test Reports;
- (2) Heat treatment chart; and
- (3) Magnetic Particle Inspection Report;

to verify that the part met the specified material requirements.

- l. Telephone conversation with MCC-PV Chief Engineer at the Susquehanna Steam Electric Station on June 26, 1981, to determine the nature of the failure of the replacement disc in the RCIC turbine exhaust system check valve.
- m. Visual inspection of the disc from the check valve in the nonsafety-related system to verify the nature of the failure.
- n. Interviews with cognizant personnel to ascertain their professional evaluation as to the probable cause of the failures.

#### 4. Findings

a. Within this area of the inspection, no nonconformances or unresolved items were identified.

b. The inspector was informed by MCC-PV personnel that there had been three failures of 10 inch 150 psi swing check valves at the PP&LC Susquehanna Steam Electric Station.

##### (1) Failure Number One:

(a) MCC-PV received a telephone call from BPC on October 28, 1980, informing them that the 10 inch 150 psi swing check valve (MCC-PV Figure No. 180-2-WE) had failed to close properly. When the valve was disassembled it was found that one of the anti-rotation pins of the disc was wedged under the hinge preventing the valve disc from seating correctly; thus, permitting excessive seat leakage. The MCC-PV Chief Engineer was sent to the site on November 3, 1980, and he returned on November 4, 1980, with the hinge for evaluation.

(b) PP&LC submitted to Region I of NRC an interim 10 CFR Part 50.55(e)/Part 21 report on March 11, 1981, based on an inspection of four identical 10 inch swing check valves in Non "Q" systems which was documented on BPC NCR-6791, dated November 3, 1981;

however, the NCR was written against 94 identical check valves supplied by MCC-PV for use in "Q" systems. The interim report identifies the problem as, "Excessive wear at hinge arm/disc stud interface on MCC/Pacific Swing Check Valves."

- (c) One hinge was returned to MCC-PV where it was inspected and evaluated by the Research and Development Laboratory which issued a "Technical Service Report: Project 5004," with their analysis and conclusions. The "R&D Analysis," section of the report states in part, "The Susquehanna hinge was characterized by a slightly elongated disc nut hole and significant indentations and abnormal wear in both the hinge/washer contact area and along the hinge sides . . . . Further material and dimensional checks were conducted on the hinge returned from Susquehanna . . . Except as previously indicated, the hinge was found to be within acceptable tolerance."

The "Conclusion," section of the report states in part, ". . . A dimensional analysis further reveals that the hinge exhibits wear and out-of-print conditions in three areas affecting fit-up of mating parts . . . Since further dimensions checked were within print tolerances, the hinge appears to have been fabricated to acceptable manufacturing practices and would be expected to perform satisfactorily under normal operating conditions."

- (d) The NRC inspector was shown two hinge/disc assemblies, (1) one assembly employed new identical parts from stock inventory, and (2) the second assembly employed new identical parts from stock inventory except for the hinge returned from the Susquehanna site. The inspector was informed by MCC-PV that the washer that seats on the disc-stud shoulder was missing and presumed lost in the system. The inspector observed (1) deep indentations worn on each side of the hinge returned from Susquehanna site that had been caused by the anti-rotation pins, (2) a deep indentation

worn around the disc-stud hole in the Susquehanna hinge which was the diameter of the washer, and (3) the new disc from stock inventory could be cocked and rotated in the Susquehanna hinge which would allow one of the anti-rotation pins to locate under the hinge and thereby preventing proper alignment of the disc with the valve seat ring.

(2) Failure Number Two

- (a) MCC-PV received a telephone call from the Susquehanna site on February 26, 1981, reporting that during the preoperational test of the RCIC system the disc stud sheared in a MCC-PV 10 inch check valve installed in the turbine exhaust piping system. The valve was identified as Item No. 13.5 on BPC Purchase Order 8856-P-12-BC, MCC-PV Figure No. 180-2-WE, and Serial No. 0089-6. This valve is identical to the first valve that failed in the Non "Q" System.
- (b) The disc was sent to FIRL for a metallurgical analysis; however, the threaded portion of the disc/stud was not made available to them. In FIRL "Technical Report 031-A5465-01 (1728)" to PP&LC it states in the introduction, "... According to the information furnished FIRL, Inc. the fracture occurred during a test in which the valve experienced unanticipated vibration and struck the sides of the housing, imposing an impact load on the supporting stem. The fracture appeared brittle indicating a possible deficiency in the cast CA15 material which had been specified in accordance with ASME (ASTM) SA-351.1974."
- (c) The inspector reviewed the certified mill test report and verified that the test data and chemical analysis met the specified ASME material specification SA-351, Grade CA15. Review of the certified copy of the heat treatment time - temperature chart showed that the disc had been heat treated in accordance with SA-351, 1974 requirements.

The NRC inspector also reviewed the BPC purchase order and verified that no flow media and/or temperature and pressure were



specified for the 10 inch check valve identified as Item 13.5. MCC-PV presented to the NRC inspector a field sketch made by their Chief Engineer of the installation of the check valve. The check valve, according to the field sketch, was installed in a vertical five foot section of the RCIC turbine exhaust piping that has short radius elbows connecting it with the horizontal piping.

- (d) MCC-PV informed the inspector that the valve was repaired by removing the disc from an identical check valve in Unit 2 and installing it in the Unit 1 valve. The startup test continued until failure number three.

### (3) Failure Number Three

MCC-PV informed the NRC inspector that their Chief Engineer was at the Susquehanna Steam Electric Station to investigate another problem with the same 10 inch swing check valve that had the Unit 2 disc installed in it. The valve design uses the contact between the disc stud and the valve cover as a position stop in the full open position. The NRC inspector discussed the failure in a telephone conversation on June 25, 1981, with the MCC-PV Chief Engineer and was informed that the valve had opened repeatedly with such force that the disc stud peened a hole in the disc cover and the end of the disc stud had "mushroomed" and shortened approximately one half inch.

## 5. Evaluation of Reportability

MCC-PV has taken the position that the valve failures are due to system design and location of their swing check valve with respect to fitting and equipment and therefore is not reportable under the provisions of 10 CFR Part 21.

The General Electric Company (GEC), Nuclear Energy Division, BWR Services, San Jose, California, issued SIL No. 30 dated October 21, 1973, titled "HPCI/RCIC Turbine Exhaust Line Vacuum Breakers" which states in part, "Surveillance testing of HPCI/RCIC systems at many BWRs has disclosed an undesirable exhaust line vacuum condition that causes one or more of the following adverse effects: . . . 2. Cycling and slamming of the exhaust line check valves . . . 4. Water slug carryover."

The results of this inspection indicate that: (a) conditions of service were not specified to MCC-PV; and (b) the most probable cause of valve failures is related to system design.

C. Exit Interview

At the conclusion of the inspection on June 26, 1981, the inspector met with the company's management representative, identified in paragraph A, for the purpose of informing him as to the results of the inspection. During this meeting management was informed no nonconformances or unresolved items were identified.

The company's management representative acknowledged the inspector's statement and had no additional comments.