PDR

79

ACTION PLAN # 10

TITLE: REVIEW OF THE OPERATION OF THE PORV

REV	DATE	REASON FOR REVISION	BY	CHAIRMAN TASK FORCE
0	6/22/85	Initial Issue	T. Isley	E K Beyer

TITLE: REVIEW OF THE OPERATION OF THE PORV

REPORT BY: Tom Isley PLAN NO: 10

DATE PREPARED: 6/22/85 PAGE 1 of 4

This report has been prepared in accordance with the "Guidelines to Follow When Troubleshooting or Performing Investigative Actions into the Root Causes Surrounding the June 9, 1985 Reactor Trip", Rev. 4.

I. INTRODUCTORY STATEMENT:

This report describes the way the PORV responded during the transient on 6/9/85 and identifies analysis and actions needed to identify root cause(s).

II. SUMMARY OF DATA:

During the transient on 6/9/85, the PORV cycled three (3) times. The first time the PORV opened for 3 seconds and then closed at the proper setpoint. The second time the PORV opened at the proper setpoint for 3 seconds and then closed approximately 25 psi below the required setpoint. The third time the valve opened at the proper setpoint but did not reseat at the proper pressure. The operator manually closed the PORV block valve. RCS pressure stopped decreasing at approximately 2075 PSIG. The block valve was reopened 2 min. 13 sec. later and the PORV appeared to hold RC pressure. When the PORV failed to close, the operator noticed that the close light was lit indicating the control circuit worked properly, deenergizing the PORV solenoid.

It should be noted the PORV block valve stoke time is approximately nine seconds. The accoustical monitor indicated that flow stopped in approximately seven seconds after the block valve started to move to the close position. The exact time at which flow stopped is uncertain because the accoustical monitors are not designed to indicate accurately at low flow rates. Therefore, it cannot be positively identified if the PORV reset (at approximately 300 psi below the required setpoint) or the block valve closed which stopped the flow through the PORV.

Reviewing the previous operations of the PORV shows a total of 91 hot cycles and 17 cold prior to 6/9/85. Adding the 3 hot cycles gives a total of 94 hot and 17 cold, as compared to an allowable number of 440 hot and 25 cold cycles. It has also been determined that the temperature of the loop seal was 469°F which is greater than the required 400°F (minimum), therefore, no piping analysis is needed.

III. MAINTENANCE AND SURVEILLANCE/TEST HISTORY:

12-14-76 The PORV was disassembled, inspected, and the seating surfaced lapped (MWO 2161). The valve had lifted 8 times since it was installed.

08-01-77 The PORV failed to open. Replaced power fuses (MWO 77-1592).

09-06-77 The PORV was disassembled, inspected, and seating surfaces lapped (MWO 77-1903). The valve had lifted 14 times since last maintenance.

09-24-77 The PORV failed open during a loss of feedwater accident. The valve was disassembled and the pilot valve was found stuck open. The pilot valve stem was replaced and the nozzle guide was cleaned. When the valve was reassembled and tested, the valve again failed open on the sixth cycle. The valve was again disassembled and inspected. The pilot valve stem was machined to correct the pilot stem-nozzle guide clearance, and the stroke of the pilot valve was adjusted. The valve was cycled 12 times at reduced pressure and once at 2200 psig with no problems. (Reportable Occurrence NP-32-77-16, MWO 77-2120 and MWO 77-2256.)

01-18-79 Because the PORV was leaking, it was disassembled and inspected. The disc, seat, and pilot valve were found to have minor cutting. They were lapped and the valve was reassembled (MWO 79-1307). The valve had lifted 67 times since last maintenance.

04-19-79 The PORV actuating linkage was checked for proper operation and proper supply voltage to the solenoid coil was verified. No problems found (MWO 79-1978).

05-17-79 The setpoints for the PORV were changed to open at 2400 psig and close at 2350 psig (FCR 79-169).

10-29-79 Because the PORV was leaking, it was disassembled and inspected. The valve disc and pilot disc were lapped and the valve was reassembled (MWO 79-3433). The valve had lifted 2 times since last maintenance.

03-24-82 Because the PORV was leaking, the valve was disassembled and repaired (MWO 81-3662). No lifts since last maintenance.

09-01-82 The PORV was stroked per PT 5164.02. No problems found.

09-06-83 The setpoints for the PORV were changed to open at 2425 psig and close at 2375 psig (FCR 79-348).

09-14-83 The bistable setpoints were checked by ST 5040.02 and found to be acceptable.

12-28-84 The bistable setpoints were checked by ST 5040.02 and found to be acceptable.

Maintenance and Test Summary

The majority of the maintenance was to correct for minor leakage. The valve failed open one time, was repaired, and had operated properly prior to June 9, 1985. The routine testing has not found any problems with the PORV.

Change Analysis

Since the PORV was last operated on September 1, 1982, the only change was to the bistable setpoints. Since the bistable functioned properly and the setpoints have been verified twice since they were changed, this did not have any effect on the operation of the PORV. There have been no other changes since the last successful operation.

} Note this

Failure Hypotheses Summary

A discussion with B&W about the way the PORV operated, produced several possible causes.

1. During the first two lifts of the PORV, the loop seal could have emptied which would have allowed the valve to pass only steam during the third lift. The hot steam could have caused the disc to expand more rapidly than the valve body causing the disc to stick. After the valve temperatures had equalized, the disc would free up and then reseat. Subsequent Toledo Edison calculations have shown that the loop seal would have been emptied during the first lift of the PORV.

2. The linkage for the pilot valve could have broken allowing closed indication but the pilot valve would still be open, keeping the PORV open.

3. One of the solenoid coil guides could have broken causing the valve to stay open. This has happened on a similar valve by a different manufacturer.

4. Possible corrosion or boric acid buildup on the solenoid coil linkage causing the linkage to stick.

5. A piece of foreign material inside the valve caused the disc or pilot valve to stick open.

6. The possibility exists that pressurizer level was high enough to put water through the valve. This has been rejected as a possible cause for the failure because the valves tested by EPRI all worked properly when tested with water.

The Crosby Valve and Gage Co. was contacted and they were unable to provide any additional information about possible failure modes for

the PORV. They reminded us that their valve worked very well in all of the testing done by EPRI.

We have reviewed the EPRI test data to determine if the testing done would provide any information. The testing done by EPRI used a similar Crosby valve with a 1 3/8" bore while ours has a 1½" bore. They had some problems initially with the pilot valve bellows cracking or being improperly machined but the valve functioned properly after those problems were corrected. Previous maintenance has detected no problems with the bellows in the valve at Davis-Besse. The EPRI test demonstrated that the tested valve closed in 0.1 to 0.2 seconds.

The EPRI test set up did have a loop seal. In one test, the conditions were very close to the conditions experienced on June 9, 1985 immediately prior to the first lift of the valve. In the EPRI test the valve closed properly, however, they only did one cycle while we experienced multiple cycles.

Our review of the NPRDS data since TMI 2 found a PORV failed open at another utility one time. The valve that failed is a different design and that failure is not believed to be related to the failure we experienced.

IV. HYPOTHESES:

1. The PORV stuck open due to differential expansion of the disc and body.

2. The valve mechanically malfunctioned causing it to not close during the transient.

3. The solenoid coil linkage could be broken or have corrosion buildup causing faulty operation.

4. A piece of foreign material caused the disc or pilot valve to stick.

TRI:lrh
Attachment

ACTION PLAN
ED 6408

Rev. 0

PLAN NUMBER	PAGE
10	1 of 1
DATE PREPARED	PREPARED BY
6/21/85	T. R. Isley

TITLE: REVIEW OF THE OPERATION OF THE PORV

SPECIFIC OBJECTIVE

STEP NUMBER	ACTION STEPS	PRIME RESPONSIBILITY	ASSIGNED TO	START DATE	TARGET DATE	DATE COMPLETED
	ALL STEPS OF THIS PLAN ARE TO BE PERFORMED IN ACCORDANCE WITH THE LATEST REVISION OF "GUIDELINES TO FOLLOW WHEN TROUBLESHOOTING OR PERFORMING INVESTIGATIVE ACTIONS INTO THE ROOT CAUSES SURROUNDING THE JUNE 9, 1985 REACTOR TRIP".					
1	Perform a visual inspection of the PORV and associated linkage. Check for broken or missing parts, boric acid buildup, or other abnormalities.	Isley				
2	Under the direction of the Crosby representative, disassemble the PORV. Check the internals for damage, proper clearances, abnormal wear, or foreign material. Also check the bellows for proper fit or cracking.	Isley				
3	Analyze the results of the inspection and data surrounding the transient to determine if differential expansion caused the valve to stick open. This analysis is expected to take several weeks and will require the results of the valve inspection before proceeding.	Isley				

What about taking valve out for testing elsewhere if problem can't be found