**From:** Gerald Wiseman, R2
**To:** Fillion, Paul; O'Donohue, Kathleen; Payne, Charlie
**Date:** 2/5/04 10:06AM
**Subject:** Re: Analysis of Valves

I have attached to this writeup a summary of the potential fire exposures for the areas under consideration for these valve probems . We acan then evaluste the likely severity and timeframes for cable and equipment damage and effects on manual actions.

Gerry W

>>> Paul Fillion 02/05/04 09:51AM >>>
I finally completed the analysis of the two valves. Please review and comment. It contains at least one new potential problem. See summary at end of analysis.

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H-14

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| **From:** | Gerald Wiseman |
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TURKEY POINT 2004 TFP INSPECTION
DISCUSSION OF
VCT OUTLET VALVE
AND
RCP THERMAL BARRIER CCW SUPPLY ISOLATION VALVE
by
Paul J. Fillion

LCV-3-115C

There is only one volume control tank outlet valve at Turkey Point, as opposed to the standard two valves in series. The number of this valve is LCV-3-115C for Unit 3. It is a motor operated valve powered from motor control center 3B, which is in Fire Area T63, the control rod drive room. Of course, the valve is open during normal at power operation.

The 115C valve has two post-fire shutdown functions. Early on, i.e. from fire initiation to realignment to the RWST or BAT, the function is to remain open to maintain flow through the running charging pump. Later, i.e. to achieve realignment to the RWST or BAT, the function is to close and remain closed. These specific functions relate to the larger shutdown functions of inventory control, reactivity control and RCP seal protection.

The Essential Equipment List states that the valve is important to hot shutdown, cold shutdown and alternative shutdown.

Review of the control circuit and the cable routing leads to the conclusion that a short-circuit between two wires within the same cable or inside a panel in either Fire Area T63 or in the control room, Fire Area MM106, could cause the valve to spuriously close. It is also observed that valve LCV-3-115B, the RWST to charging pump suction header valve, is designed to open when the VCT outlet valve starts to close. However, no credit is given for this automatic transfer for the control room fire because circuitry for both the 115C and 115B could be subject to the same control room fire. Cable routing will have to be reviewed to determine if automatic transfer could be affected by the MCC room fire. A fire in the Train B 4160 V switchgear room could lead to loss of Train B power, and therefore loss of power to operate the 115C valve.

The licensee's Safe Shutdown Analysis (SSA) recognizes the potential problems with spurious closure of 115C, and resolves the issue by specifying manual actions. For the control room fire, the SSA specifies immediately stopping charging pump 3B (and also 4B) before leaving the control room and re-establishing charging per ONOP-105. For the fire in the MCC room, the SSA specifies manual action #343, which is really swap over to the RWST source. CR 03-1330, which addresses licensee identified problems with RCP seal protection, summarizes required actions and procedures required to protect the seals for each fire area. I made the point to Bharat Thaker that the CR supercedes the SSA. Bharat said it did not. Since the CR and the SSA don't match, this issue bears further investigation. The CR only recognizes alternative shutdown for the control room fire. For fire in the MCC room, the CR specifies immediately tripping charging pump 3A, de-energizing MCC 3B, and verifying CCW valves 626 and 716B are open [3 min/20min], de-energize charging pump 3B within 15 minutes and start charging pump 3A or 3C within one hour.

MOV-3-716B

This is the RCP thermal barrier CCW supply isolation valve. It is a motor operated valve powered from motor control center 3B, the same as 115C . This valve is open in normal at power operation, and its shutdown function is to remain open.

Review of the control circuit and cable routing leads to the conclusion that a short-circuit between two wires within the same cable or inside a panel in Fire Area T63, Fire Area MM106, and Fire Area V67 (based on similarity between Units) could cause the valve to spuriously close. The control circuit also shows that the valve can be operated from the alternate shutdown panel after operation of a transfer switch. It is also observed that a short circuit at Fire Area T63, the MCC room, could cause spurious closure and by pass the torque switch and limit switches.

For the CR fire, the SSA states that electrical isolation is provided. For the MCC room fire, the SSA specifies manual action #217, which is actually a three-part action. First, trip RCPs if valve closes; second, open and disable feeder breaker to MCC; and third, if possible verify locally that VV is open (3 min/20 min). For the switchgear room fire [note Unit 3B SWGR room is not on the inspection plan, so I will look at Unit 4 for discussion purposes] the SSA specifies xxxxxx. CR 1330 specifies the following: Trip charging pump A, use RCP trip criteria in ONOP 41.1, de-energize 716B valve breaker and verify valve open (3 min/20min), and start charging pump A within one hour. The CR also refers to some errors in the analysis with respect to this valve.

Short Term Considerations

Control room fire where operators remain in control room

Since procedure (which one?)calls for immediately switching away from charging pump 3B to either charging pump 3A or 3C upon recognition of a fire, the charging pump is protected from damage and would be available for use at the alternate shutdown panel if needed later. All RCP seal cooling would be interrupted if the VCT outlet valve closed and CCW valve 716B spuriously closed (two spurious operations). However, spurious operation of both valves is not considered credible for a smaller control room fire corresponding to a scenario where operators remain in the control room because the controls are on separate panels not near each other. Spurious closure of the VCT outlet valve could cause damage to either charging pump A or C, but this event is not considered crucial to safe shutdown. Spurious closure of 716B would not by itself interrupt all seal cooling.

Control room fire where decision is made immediately to abandon the control room

In this scenario, operators are following ONOP-105, alternate shutdown. The larger control room fire holds the possibility that both the VCT outlet valve and the RCP thermal barrier CCW valve could spuriously close. This procedure, as it existed at the start of the inspection, allowed 15 minutes to get the alternate shutdown facility operational. Then would have performed operational steps to reestablish RCP thermal barrier cooling 3 minutes later. The design

concept of this procedure in effect had an underlying assumption that two spurious operations terminating all RCP seal cooling would not take place for a period of about 18 minutes immediately following initiation of a fire. The inspection team questioned this concept, pointing out that loss of all RCP seal cooling should be assumed at about T=7 minutes for the large fire scenario and that RCP seal maximum allowable temperature for a running pump could be exceeded well before 18 minutes. The licensee agreed that their procedure was inadequate in this regard and they instituted a standing order to manually de-energize the 716B valve within three minutes of initiating ONOP-105. This new procedure was accepted by the team as being timely enough to protect against RCP seal damage, and a seal LOCA, given a reasonable delay time between fire initiation and two spurious operations occurring.

MCC room fire

Valves 115C and 716B can spuriously close due to fire induced short circuits. If a reasonable "grace period" for spurious operations is assumed, then procedures specified in CR 03-1330 (i.e. immediately de-energizing MCC 3B and tripping charging pump 3A) would suffice topreclude spurious operations, thus protecting the most important charging pump and maintaining RCP seal cooling. Note that manual opening of valve 716B after a spurious closure may be a problem due to torque switch bypass.

4160 switchgear room B fire

The 115C valve should not spuriously close for the switchgear room fire. The 716B valve could spuriously close, and, for a bigger fire, Train B power could be lost. This could cause a temporary loss of seal injection similar to that experienced in a LOOP. It is not apparent from consideration of valves 115C and 716B why CR 1330 specifies the steps mentioned above for the switchgear room fire.

## Long Term Considerations

Control room fire where operators remain in control room

With regard to the VCT outlet valve, a wire burn open means that the valve could not be closed from the control room to execute the swap to RWST or BAT. Alternatively, if the valve can be closed from the control room and the RWST path is established, the concern becomes spurious opening. This could lead to hydrogen entrainment in the running charging pump. As far as I know, the procedures do not call for de-energizing this valve. We gave the licensee a question on this at the Thursday meeting. On the other hand, it appears that any damage due to hydrogen entrainment would occur on charging pump A or C, since the procedure called for switching to these. It probably is not reasonable to postulate that charging pump A could have been damaged by spurious closure of the VCT outlet valve early in the scenario, then charging pump C damaged by spurious opening later.

Again we would not postulate loss of all seal cooling for this scenario.

Control room fire and alternate shutdown

If the RWST path has been established from the alternate shutdown panel for the case of a big control room fire, charging pump B would be in service. Spurious opening of the VCT outlet valve presents a concern for hydrogen entrainment into that pump which is the only pump credited for alternate shutdown. Valve 716B has already been de-energized.

MCC room fire

MCC 3B has already been de-energized immediately after a fire. Therefore spurious operations are not a concern.

4160 V switchgear room B fire

The VCT outlet valve should not spuriously operate for the switchgear room fire. Valve 716B has been de-energized.

SUMMARY OF COMMENTS AND FINDINGS

1. Does safe shutdown analysis have to be revised in light of CR 1330?
2. Does CR 1330 represent a licensee identified violation?
3. ONOP-105 inadequacy identified by Charley Payne.
4. During alternate shutdown panel operation spurious opening of the VCT outlet valve is a problem.

**The following tables summarize the potential fire growth characteristics estimated for the areas selected. Consider this information in evaluating the fire exposure to the equipment and cables for the above valve discussion:**

The following table summarizes the results of the FDS analysis FOR TPN FZ63.

| Fire Area T, Fire Zone 63 - Unit 3 Control Rod Drive Equipment Room Fire | | | | | | |
|---|---|---|---|---|---|---|
| Room Fire-Door Closed HRR (kW) | Time for Gas Layer to Reach 700°F (min) | Hot Gas Layer Temp. at 5 minutes (°F) | Smoke Gas Layer Height at 5 minutes (above floor) (ft) | Smoke Gas Layer Height at 10 minutes (above floor) (ft) | Smoke Gas Layer Height at 15 minutes (above floor) (ft) | Smoke Gas Layer Height at 20 minutes (above floor) (ft) |
| 100 | >20 | 534 | 4 | 3.75 | 3.7 | 3.5 |
| 200 | 2 | 802 | 2.6 | 2.5 | 2.4 | 2.3 |
| 300 | < 1 | 1028 | 2.0 | 1.8 | 1.7 | 1.6 |
| 500 | << 1 | 1413 | 1.3 | 1.2 | 1.1 | 1.0 |

The following table summarizes the results of the FDS analysis FOR FZ67.

| Fire Area U, Fire Zone 67 - Unit 4 Train B 4160V Switchgear Room Fire | | | | | | |
|---|---|---|---|---|---|---|
| Room Fire- Door Closed HRR (kW) | Time for Gas Layer to Reach 700°F (min) | Hot Gas Layer Temp. at 15 minutes (°F) | Smoke Gas Layer Height at 5 minutes (above floor) (ft) | Smoke Gas Layer Height at 10 minutes (above floor) (ft) | Smoke Gas Layer Height at 15 minutes (above floor) (ft) | Smoke Gas Layer Height at 20 minutes (above floor) (ft) |
| 200 | 17.5 | 681 | 9.0 | 8.6 | 8.4 | 8.3 |
| 300 | 3.5 | 868 | 7.3 | 6.9 | 6.7 | 6.5 |
| 500 | << 1 | 1189 | 5.3 | 4.9 | 4.7 | 4.6 |

The following table summarizes the results of the FDS analysis FOR TPN FZ106.

| Fire Area MM, Fire Zone 106 - Main Control Room Fire | | | | | | |
|---|---|---|---|---|---|---|
| Room Fire- Door Closed HRR (kW) | Time for Gas Layer to Reach 700°F (min) | Hot Gas Layer Temp. at 15 minutes (°F) | Smoke Gas Layer Height at 5 minutes (above floor) (ft) | Smoke Gas Layer Height at 10 minutes (above floor) (ft) | Smoke Gas Layer Height at 15 minutes (above floor) (ft) | Smoke Gas Layer Height at 20 minutes (above floor) (ft) |
| 200 | >20 | 599 | 10.5 | 10.3 | 10.2 | 10.1 |
| 300 | 8 | 760 | 9.7 | 9.5 | 9.3 | 9.2 |
| 500 | 1 | 1038 | 8.4 | 8.1 | 8 | 7.9 |