

Interconnecting Floor Drain Impact on ECCS Safety Function

Clinton Power Station letter U-603981, dated September 1, 2010, contests NRC NCV 05000461/2010003-01, Failure to Satisfy 10CFR50.72 and 50.73 Reporting Requirements. This discussion provides further discussion of the logic contained in that letter.

The basis for denial is that the level of the suppression pool will not drop below the minimum NPSH requirement for ECCS systems in the postulated scenario until well after cold shutdown is reached.

The scenario involved is a postulated moderate energy leakage crack or passive failure of the 20" RHR suction pipe between the remote manual MOV, 1E12F004A, at the containment wall and the RHR pump suction. This is coupled with a single active failure of the safety related MOV itself and a loss of offsite power, rendering non-safety make-up sources unavailable. This event is coupled with the condition of a potential leakage path between the RHR A pump room and the Radwaste Pipe tunnel due to an interconnecting floor drain.

This scenario is described in the LER 2010-001-00 and the Summary of Findings enclosed with the inspection report discusses a failure of the moderate energy 20" suction piping and the single active failure requirement.

Technical Specification (TS) LCO 3.6.2.2 requires the plant to be in Mode 3, hot shutdown, in 12 hours if suppression pool level cannot be restored to 19'-0" (elevation 731'-0") within 2 hours. However, a postulated LOOP would lead to a reactor scram immediately.

The LER notes that Mode 4, cold shutdown, could be achieved in approximately 11 hours per USAR Fig. 5.4-12, while minimum vent coverage (elev. 727'-1" or a pool depth of 15'-1") would not be reached until 18 hours with the postulated leak. Once Mode 4 is reached, minimum vent coverage is no longer a concern since the pressure suppression function of the containment has been accomplished. [At this time about 222,565 gallons of suppression pool water would have drained out of the suppression pool.]

Also, the TS requirements for ECCS are less restrictive in Mode 4. Per TS 3.5.2, ECCS-Shutdown, if pool level were to drop below 12'-8", TS require initiating actions to (1) suspend OPDRVs, (2) restore secondary containment to an operable status, (3) restore a standby gas treatment system to an operable status, (4) restore secondary containment isolation capability, and (5) close one door in the upper containment personnel airlock. (Each of these actions would be met and entry into this condition could continue indefinitely.) [By the time the suppression pool reached 12'-8", approximately another 138,675 gallons of water would have drained out of the suppression pool, or a total of 361,240 gallons.]

The potential drainage path from the RHR A pump room would be through the Radwaste Pipe Tunnel in the Control Bldg. The floor of the Radwaste Pipe Tunnel is at elevation 720'-6", which is the lowest level to which the suppression pool could drain regardless of elapsed time. Pool elevation of 720'-6" is a pool depth of 8'-6". It has been calculated that it would take about 46.9 hours for the suppression pool level to drop to the top of the RHR suction line at elevation 720'-10". [At this elevation, approximately 580,000 gallons would have drained out of the suppression pool.]

Letter RS-01-250 dated November 16, 2001 requested a TS change to the suppression pool level and upper containment pool level requirements during Mode 3 at a reactor pressure of 235 psig or less. The NRC approved this change under License Amendment 156. In the request, it stated that 9 feet of pool depth is sufficient for ECCS NPSH requirements based on modification M-083 which installed a new ECCS strainer in the bottom of the suppression pool. The 9 feet depth (721'-0" pool elevation) was based on post-LOCA suppression pool conditions of 212°F water temperature, maximum pump runout flow, and a fully fouled strainer.

A Gothic analysis was performed for this license amendment application based on a LOCA occurring at 235 psig reactor pressure. This low pressure LOCA analysis is bounding for pool temperature for cold shutdown ECCS function. The bounding suppression pool temperature for this event is 173.2° F. In another calculation at 185° F suppression pool temperature, the NPSH available is 26.1 feet at a pool elevation of 727'-1". Based on these calculations, at 185° F, virtually any pool depth will provide adequate NPSH for the ECCS pumps.

In Clinton's denial letter, the following discussion was made:

"Based on the conservatively assumed leakage rate of the moderate energy line break and the elevation of the embedded drain line described in the LER, the lowest elevation the suppression pool could be drained is 720'-6" (or 8'-6"). The center line elevations of the ECCS pumps range from 710'-0" to 710'-6 3/4", yielding 9'-11 1/4" of NPSH for the RHR pumps, 10'-0" of NPSH for the LPCS pump, and 10'-6" of NPSH for the HPCS pump. All of these values are greater than the minimum required NPSH of 5 feet described in the CPS USAR. Consequently, there was no condition that resulted in unanalyzed condition that significantly degraded plant safety or that could have prevented fulfillment of the safety function of the ECCS. Hence, there is no need to make an 8-hour Emergency Notification System report or a 60-day LER for this issue."

The term "NPSH" was used rather than "elevation head available" at each of the pumps. Based on the calculations used to determine the minimum NPSH requirements for the pumps, all of these "elevation head available" values would ensure that the minimum NPSH requirements of the pumps would be met.

Conclusion: Based on the above, it seems reasonable to conclude that if this event were to occur, and assuming that off site power was not restored, there is sufficient time to determine that a leak is occurring and to determine the source of the leak. Once cold shutdown is achieved, the ECCS requirements in TS are also diminished. The time (greater than 46.9 hours) that the water level of the suppression pool would drop to a level that might start to be of concern for adequate NPSH for the ECCS pumps is sufficiently long to take other measures to restore level, if needed. The event involves the draining of a large volume of water (nearly 600,000 gallons of suppression pool water draining into the RHR room and into the radwaste tunnel) and would take a relatively long time. There is a sufficient amount of time for someone to identify that a leak is occurring to take action.

References:

Calculation IP-M-0662

Calculation 01ME132

Letter RS-01-250 dated November 16, 2001

License Amendment 156 dated June 12, 2003

Letter U-603981 dated September 2, 2010

Letter U-603949 dated March 25, 2010, Licensee Event Report 2010-001-00



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