LER 265/82-017 and -018

Event Description: HPCI and One EDG Inoperable

Date of Event: October 1, 1982

Plant: Quad Cities 2

Summary

On October 1, 1982, during routine surveillance a small leak was discovered in the steam line break flange of the high-pressure coolant injection (HPCI) system supply due to a failed flange gasket. The licensee stated that the steam leakage may have been sufficient to cause HPCI isolation on a high HPCI area temperature following prolonged operation. A few days later on October 6, 1982, following monthly preventive maintenance on emergency diesel generator (EDG) 2, the EDG tripped on high temperature 10 minutes after loading due to fouled heat exchangers in the EDG cooling water system. Thus, this event was modeled as an unavailability of HPCI and one EDG. Assuming that both HPCI and the EDG were faulted for a period of half their surveillance periods prior to the discovery of the faults, the duration of the unavailability was estimated to be me 10 days (240 hours). To reflect the failure of EDG 2, one train of emergency power was set to failed and all system trains that relied on EDG 2 (bus 24-1) given a loss of offsite power (LOOP) were set to unavailable. Since Unit 2 bus 24-1 can be fed by Unit 1 bus 14-1 through cross-connection, recovery of power to bus 24-1 was assumed possible from Unit 1 bus 14-1 by the closure of the normally open breakers 2429 and 1421 for plant-centered LOOPs.

This event was modeled as two cases. The first case examines the likelihood of the occurrence of a plant-centered LOOP during the unavailability with credit given for the ability to recover power through the use of the cross-connect. In this case, the LOOP frequency was revised to 1.39×10^{-5} with a short-term non-recovery probability of 0.5, and offsite power recovery prior to battery depletion (EP.REC) was modified to 6.4×10^{-3} to reflect values for plant-centered LOOPs determined from the models described in *Revised LOOP Frequency and PWR Seal LOCA Models,* ORNL/NRCILTR-89/11, August 1989. The probability of failing to close breakers before battery depletion was assumed to be 0.10 (see Appendix A) and reflects the probability of the operators performing the required non-routine actions in the required time from the control room. The probability of failing to recover power prior to battery depletion was revised to 0.29 (0.1 non-recovery probability for closing the breakers + 0.19 probability of EDG 1 failing given that EDG 2 and the swing EDG were failed). To reflect the inoperability of HPCI, HPCI was set to failed, and the non-recovery probability for HPCI was set to 1.0 to reflect the likelihood that operators would not be able to recover HPCI within the allotted recovery time.

The second case examines the likelihood of the occurrence of a dual unit LOOP from grid or weather-related LOOPs. In this case, the LOOP frequency was revised to 2.78×10^{-6} with a short-term non-recovery probability of0.66, and offsite power recovery prior to battery depletion (EP.REC) was modified to 0.21 to reflect values for grid and weather-related LOOPs determined from the models described in *Revised LOOP Frequency and PWR Seal LOCA Models,* ORNL/NRCILTR-89/11, August 1989. Since both units would need their designated EDGs, no credit was given for recovery using the breakers, and the probability of failing to recover power prior to battery depletion was left at 1.0. To reflect the inoperability of HPCI, HPCI was set to failed, and the non-recovery probability for HPCI was set to 1.0 to reflect the likelihood that

operators would not be able to recover HPCI within the allotted recovery time.

The increase in core damage probability (CDP), or importance, over the event duration for the first case is 3.6×10^{-6}. The base-case CDP for the same period is 9.1×10^{-7} resulting in an estimated conditional core damage probability of 4.5×10^{-6}. The dominant sequence involved a postulated plant-centered LOOP with the failure of emergency power, recovery of offsite power, the failure of HPCI, and the failure of reactor core isolation cooling (RCIC). The increase in core damage probability over the event duration for the second case is 5.1×10^{-6}. The dominant sequence involved a postulated grid/weather-related LOOP with the failure of emergency power and failure to recover offsite power prior to battery depletion.