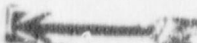




UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

JUL 18 1986

MEMORANDUM FOR: Dennis M. Crutchfield, Assistant Director   
for PWR-B  
Division of PWR Licensing-B

FROM: Brian W. Sheron, Deputy Director  
Division of Safety Review and Oversight

SUBJECT: RRAB ADDITIONAL INPUT TO DPL-B'S DECISION ON EFW SYSTEM  
BACKFIT AT OCONEE SITE

REFERENCES:

1. Memorandum from D. M. Crutchfield, DPL-B to B. Sheron, DSRO, dated January 7, 1986.
2. Memorandum from F. J. Congel, RRAB to O. Parr, PEICSB dated February 28, 1986
3. Memorandum for H. B. Tucker of Duke Power Company to H. R. Denton of U.S. NRC, dated April 28, 1986
4. Memorandum from H. B. Tucker of Duke Power Company to H. R. Denton of U.S. NRC, dated May 7, 1986

Reference 1 identified the need for a cost benefit assessment of a proposed Oconee emergency feedwater [EFW] system backfit. Reference 2 provided preliminary risk estimates for a seismically induced flood and its impact on the EFW system. Reference 2 also suggested that any proposed EFW system improvement by the licensee, Duke Power Company [DPC] should consider carefully the plant improvements which have been previously performed by DPC. Subsequent to the documentation of Reference 2, DPC provided additional information [Reference 3 and 4] regarding two additional plant improvements intended to reduce the core damage frequency contribution resulting from EFW system failures due to seismically induced circulating water [CCW] system failures and resulting turbine building [TB] flooding. We reviewed the additional information contained in References 3 and 4 and the following is our evaluation.

(1) Qualitative Impact: The Oconee PRA analysis of seismically induced flooding sequences assumed that the high pressure injection [HPI] pumps, low pressure injection [LPI] and reactor building spray [RBS] pumps located in the auxiliary building [AB] could be flooded and therefore, could be unavailable when the postulated TB flood due to CCW structural failures reaches about 6 feet height in the TB. The Oconee PRA made this assumption because the penetrations and door seals at the AB/TB interface walls were not water proof. Our review of the two plant improvements implemented by DPC [Reference 3] indicates that all penetrations in TB/AB interface walls have now been sealed up to TB elevation 795 feet; that is, to a height of about 20 feet from the TB basement. For

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example, some water-proof doors have been installed in door positions 101B, 102B and 103B and also all other existing doors in TB basement areas have been sealed against any water flow in to AB. However, the details of the water proof seals and door seals are not provided in Reference 3 for our review of seal effectiveness. Assuming that the penetration seals and all water tight doors of the AB-TB walls are effective, we believe that these flood protection measures implemented by DPC could prevent water flow in to AB and therefore, will not make the HPI, LPI and RBS pumps unavailable during the postulated TB flooding scenarios.

DPC also states in Reference 3, that some bypass lines and valves are installed around the atmospheric dump valve [ADV] system and therefore, the availability of the ADV system is increased to an extent that make up flow to the steam generators [SG] using the low head auxiliary service water [ASW] system can be achieved in the event of the total loss of EFW flow to the SGs. At this time, the above DPCs claim is somewhat judgmental without enough analysis, because DPC has not provided any modified system design and operational details to ensure the adequacy and reliability of ADV system bypass lines to depressurize the SGs in sufficient time interval to allow the ASW system to provide make up flow to the SGs. Also, DPC has not demonstrated that the structural integrity and operability of the ADV system bypass lines and valves can withstand seismic loadings. The availability of the ADV system including the bypass lines and valves are more important to risk during seismic scenarios than during other accident initiating events.

(2) Quantitative Impact: We reported in Reference 2 that the mean core damage frequency contribution due to seismically induced CCW failures in combination with the failure of the standby shutdown facility [SSF] is about  $2E-5$  per reactor year. Because the AB-TB interface walls were not water-proof, the above probabilistic estimate did not account for the availability of the HPI system for accident scenarios involving the failure of SG coolant make up and successful operation of safety relief valves. The Oconee PRA assumed that when the postulated seismic flood in TB reaches a height of 6 feet, water will enter into the HPI pump area in AB and could make them inoperable. Our review of the Oconee PRA indicates at this time that the maximum flooding that could be postulated inside TB will be at the location of the condenser inlet and outlet connections and the flood rate is estimated to be in the range of 50,000 to 350,000 gallons per minute (GPM). For the very large floods (350,000 GPM) the time to reach a level of 8 feet height in TB is estimated to be about 27 minutes. The above time estimate is based on the assumption that much of the TB flood could not be isolated and could not be drained out from TB. However, subsequent to the documentation of the Oconee PRA study, DPC has installed major provisions (reference 3) such as big holes of 4 feet diameter to drain water by gravitational flow. Also, DPC has installed flood alarms to enable the main control room operators to detect floods in various locations in TB, particularly in the vicinity of the condenser inlet and outlet connections. DPC has also improved the Oconee emergency procedures to enable the operators to quickly respond to TB floods, such as tripping CCW pumps, closing inlet and/or outlet CCW valves, initiating high pressure service water make up

flow to the steam generators and initiating feed and bleed using HPI pumps. Therefore, it is reasonable for the staff to make the assumption that the control room operator will be more likely [lower failure probability of about 0.001] to respond to TB floods including the successful initiation of the SSF and feed and bleed capability using HPI pumps. Since DPC has now provided flood protection measures against postulated TB floods, the staff could also make a reasonable assumption that the HPI system will be available during much of the postulated TB floods. Because the staff has not evaluated the seal effectiveness of the modified TB-AB interface wall and failure probability of seals and caulking is not readily available to the staff, a conservative assumption of 0.1 failure probability of seals is made for the purpose of the risk estimation of the seismically induced TB floods. Based on this assumption, the revised sequence [seismically induced CCW failures in combination with the SSF failures and water-seal failures] frequency is about  $2E-6$  per reactor year. It is noteworthy that providing water proof seals in the AB-TB walls does not improve the reliability of the EFW system, but significantly affects the core damage frequency contribution due to seismically induced CCW failures by enhancing the availability of HPI system to cool the core. Because we do not know the details regarding the adequacy of the ADV system bypass lines, particularly during seismic scenarios, the probabilistic treatment of the ADV system and its effect on the total availability of the heat removal function is not appropriate at this time. However, we believe that if the operation of the ADV system in combination with the successful operation of the low head ASW system were demonstrated in the future to be a viable way of removing decay heat and ADV system bypass lines were proven to be seismically qualified, then the core damage frequency contribution due to seismically induced flooding could be significantly reduced by adding such a procedure.

We note that the two additional plant improvements implemented by DPC do not affect the conditional probability of various containment failures given a core damage event. Also, conditional risk (person rem per event) associated with various release categories as estimated in the Oconee PRA are unaffected. Thus, the total risk due to postulated seismically induced TB flooding is now estimated to be about 2 person rem per reactor year. Prior to the implementation of the two additional plant improvements the total risk due to seismically induced flooding was about 18 person rem per reactor year (Reference 2). Thus, the risk reduction estimate of providing a water proof AB-TB interface wall is about 16 person rem per reactor year. If a factor of \$1000 per person rem for the benefit/cost estimates is applied and a reactor life of 30 years is assumed, then DPC's plant improvements will have an equivalent risk reduction worth of about \$480,000 per reactor. DPC has indicated, in Reference 3 that the completion of the two additional improvements will cost \$100,000 approximately. Therefore, we believe that DPC's proposal to resolve the seismically induced flood related safety issue is a reasonable approach and is cost effective.

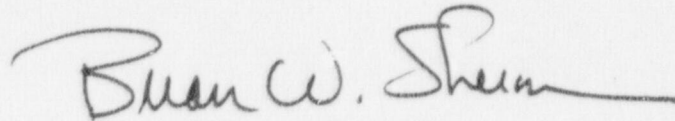
(3) Conclusion: DPC has recognized the risk significance of the postulated seismically induced TB floods and resulting EFW system failures. DPC has proposed to implement two specific plant improvements to correct core damage



accident vulnerabilities resulting from TB floods. These improvements are: (1) providing complete water proof seals to penetrations and water tight doors to AB-TB interface walls; and (2) addition of bypass lines to the ADV system to improve steam generator make up capability using the low head ASW system. The staff review finds that although DPC has not corrected the EFW system vulnerability to the seismically induced TB flood, DPC has provided plant improvements that will significantly reduce the vulnerability to core damage accidents. The staff also finds that DPC's proposed plant improvements are effective in risk reduction and are cost effective. Also, based on the revised estimate of the current level of risk due to seismically induced TB floods, we conclude that no further plant improvements to the EFW system to correct the seismic flooding vulnerability are warranted at this time.

This memorandum includes comments from J. Wermiel and M. Rubin of your staff on the draft of this memorandum.

This completes our input to your decision on the Oconee EFW system backfit. If you need further information regarding risk perspectives, please contact E. Cheliah at x28048



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