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

SAFETY EVALUATION
FORT CALHOUN NUCLEAR STATION
DOCKET NO. 50-285
ADEQUACY OF STATION ELECTRIC DISTRIBUTION SYSTEM VOLTAGES

INTRODUCTION AND SUMMARY

Omaha Public Power District (OPPD) was requested by NRC letter dated August 8, 1979 to review the electric power system at Fort Calhoun Nuclear Station. The review was to consist of:

(a) Determining analytically the capacity and capability of the offsite power system and onsite distribution system to automatically start as well as operate all necessary loads within their required voltage ratings in the event of 1) an anticipated transient, or 2) an accident (such as LOCA) without manual shedding of any electric loads.

(b) Determining if there are any events or conditions which could result in the simultaneous or, consequential loss of both required circuits from the offsite network to the onsite electric distribution system and thus violating the requirements of GDC 17.

The August 8, 1979 letter included staff guidelines for performing the required voltage analysis and the licensee was further required to perform a test in order to verify the validity of the analytical results. The OPPD responded by letters dated August 31, 1979, March 20, 1980, July 2, 1981, August 31, 1981, March 19, 1982, May 21, 1982, December 1, 1982, April 22, 1983, August 30, 1983, December 19, 1983 and May 4, 1984. A detailed review

and technical evaluation of the above submittals was performed by EG&G under contract to the NRC, with general supervision by NRC staff. This work is reported by EG&G in Technical Evaluation Report (TER), "Adequacy of Station Electric Distribution System Voltages, Fort Calhoun Station," dated June 1984 (attached). We have reviewed this report and concur in the conclusions that the offsite power system and the onsite distribution system are capable of providing acceptable voltages for worst case station electric load and grid voltages.

EVALUATION CRITERIA

The criteria used by EG&G in this technical evaluation of the analysis includes GDC 13 ("Instrumentation and Control"), GDC 17 ("Electric Power Systems") of Appendix A to 10 CFR 50; IEEE Standard 308-1974 ("Class 1E Power Systems for Nuclear Power Generating Stations"), ANSI C84.1-1977 ("Voltage Ratings for Electric Power Systems and Equipment - 60 Hz"), and the staff positions and guidelines in NRC letter to OPPD dated August 8, 1979.

ANALYSIS AND TEST FEATURE

Offsite power to the onsite distribution system at Ft. Calhoun is normally provided by two Station Auxiliary Transformers T1A-3 and T1A-4 which are connected to the 161 kV grid. A second source of offsite power to the onsite distribution system can be provided via Generator Auxiliary Transformers T1A-1 and T1A-2 by opening the generator motor operated disconnect switch and back-feeding from 345 kV grid through the main transformer.

OPPD analyzed the 161 kV and 345 kV offsite power sources to the onsite distribution system under maximum and minimum loading conditions. With 161 kV grid at its minimum anticipated voltage, 101.1% and maximum anticipated voltage, 105.1% respectively, and 345 kV grid at its minimum anticipated voltage, 100.6% and maximum anticipated voltage, 104% respectively. The analysis also included transient effects on the Class 1E equipment from starting a large non-Class 1E load under accident condition. The analysis shows that the offsite power system and the onsite distribution system are capable of providing acceptable voltage for worst case station electric load and grid voltages. However, the analysis also shows that starting a reactor coolant pump (RCP) or feedwater pump (FWP) when the grid is at its minimum during an accident condition will cause actuation of the undervoltage relays and subsequent transfer of Class 1E equipment to the standby emergency diesel generator. The licensee states that starting of a RCP or FWP under accident condition is not required and hence is highly improbable. We concur with the licensee that the probability of such an occurrence is small; however, should this condition arise there is no safety consequence since the safety buses will be automatically isolated from the offsite power system and emergency diesel generators will supply power to the safety buses to effect a safe plant shutdown.

OPPD performed tests as part of an undervoltage study on the Fort Calhoun Station's electrical distribution system, including all Class 1E buses down to the 120/208 V level, during December 1977. The tests were performed by loading the station distribution buses, including all Class 1E buses down

to the 120/208 V level, to at least 30% of full load. Motor-starting transient voltages were measured for the existing grid and Class 1E buses down to the 480 V level.

Comparison of the calculated voltages and measured voltages shows that calculated voltages are 3.4% lower than the measured voltages. This indicates that the assumptions used in the voltage analysis were conservative.

CONCLUSIONS

We have reviewed the EG&G's Technical Evaluation Report (TER) and concur in the findings that:

(1) OPPD has provided voltage analyses to demonstrate that the Class 1E equipment terminal voltages remain within acceptable operating limits for the postulated worst case conditions.

(2) The test performed by OPPD verifies the accuracy of the voltage analysis, and shows the analysis to be conservative.

(3) The licensee has determined that no potential exist for either a simultaneous or a consequential loss of both offsite power circuits.

(4) Tripping from the offsite sources will occur under accident condition coincident with minimum grid voltage if a large non-Class 1E motor such as reactor coolant pump or feedwater pump is started. The licensee states, however, that starting a large non-Class 1E load

under accident condition is not required and hence is highly improbable. We concur with the licensee that occurrence of the above has a low probability; however, should it occur there is no safety consequence since the Class 1E buses will be automatically isolated from the offsite power system and the emergency diesel generators will supply power to safety loads to effect safe plant shutdown.

We, therefore, find the Fort Calhoun Nuclear Station design acceptable with respect to the adequacy of station electric distribution system.