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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

NINE MILE POINT, UNIT NO. 1

DOCKET NO. 50-220

ADEQUACY OF STATION ELECTRIC DISTRIBUTION SYSTEM VOLTAGES

Introduction and Summary

Niagara Mohawk Power Corporation (NMPC) was requested by NRC letter dated August 8, 1979 to review the electric power system at Nine Mile Point Unit 1. The review was to consist of:

a) Determining analytically the capacity and capability of the offsite power system and onsite distributionsystem to automatically start as well as operate all required 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 General Design Criterion (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. NMPC responded by letters dated September 27, 1982, January 28, 1983, March 31, 1983; a telephone conference call on May 18, 1983, and letter dated November 16, 1983.

A detailed review and technical evaluation of the submittals was performed by Lawrence Livermore National Laboratory (LLNL) under contract to the NRC, with general supervision by NRC staff. This work is reported by LLNL in Technical Evaluation Report (TER), "Adequacy of Station Electric Distribution System Voltages, Nine Mile Point Nuclear Station, Units 1", dated May 1983 (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 LLNL in this technical evaluation of the analysis includes GDC 5 ("Sharing of Structures, Systems, and Components"), 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 ("Voltages Ratings for Electric Power

Systems and Equipment - 60 Hz"), and the staff positions and guidelines in NRC letter to NMPC dated August 8, 1979.

Analysis and Test Features

NMPC analyzed each offsite power source to the onsite distribution system under maximum and minimum load conditions with the offsite power sources at maximum and minimum anticipated voltages, 121.47 KV and 111.8 KV on the 115 KV system. The analysis included the transient effects on the Class 1E equipment from starting a large Class 1E and non-Class 1E load. The maximum and minimum voltages expected at the 4 KV bus are within the equipment rating as shown in NMPC analysis. It has been established that the 4160 volts, 575 volts and 208 volt emergency loads will operate within allowable voltage limits when supplied from the offsite power system with the following exceptions.

The analysis results for the worst-case undervoltage condition indicated that several motors rated at 575 volts would have to be replaced or rewound to 550-volt rating to meet the -10% design ratings. Those motors to be replaced or rewound are the diesel 102 air compressors 1 and 2 on both redundant load groups, motors 1 and 2 for water chillers 11 and 12 and chilled water circulating pumps 11 and 12. These motors are to be rewound by the end of the 1984 refueling outage.

Niagara Mohawk Power Corporation verified their analytical results by performing several tests. Tests were performed for each RRST with at least a 50% loading and a 50% loading on 600-volt power boards 16B and 17B. Recording meters were used to record electrical parameters prior to and during various load starting conditions. Analysis results for the same condition were compared to actual recorded parameters. The worst case percentage errors for steady state conditions were -0.48% on the 4260-volt base and 1.22% on the 600-volt base. Under transient conditions, the worst-case percentage errors were -1.37% on the 4260-volt base and -2.07% on the 600-volt base. In all the test cases the test results were higher (negative percentage error) than the analytical which demonstrates that the load flow models are conservative.

The licensee has identified that a fault within the bus disconnect switch assembly between the two 115 KV transmission lines could result in the loss of both offsite circuits. Should this event occur, the onsite sources could be used until the switch can be isolated (approximately 2 hours) at which time at least one offsite source could be restored. However, GDC 17 Criterion assumes the "loss of all onsite alternating current power supplies." The licensee submitted documentation, for the 10 CFR 50 Appendix "R" review which demonstrated core cooling can be provided by the isolation condenser (no electrical power available) for 8 hours without providing makeup water. This

ensures that the reactor could be maintained in a safe condition until the restoration (approximately 2 hours) of at least one offsite source (delayed) is accomplished for supplying power to the Class 1E equipment.

Conclusions

We have reviewed the LLNL Technical Evaluation Report and concur in the findings that:

(1) The offsite power source in conjunction with the onsite distribution system has the capacity and capability to supply voltage to the Class 1E equipment within the voltage design ratings under worst-case condition with selected 575-volt motors replaced or rewound with a 550-volt rating.

(2) Spurious tripping from the offsite sources will not occur under the worst-case conditions analyzed.

(3) The Class 1E equipment's maximum voltage design limit will not be exceededunder maximum grid voltage minimum plant load conditions.

(4) Acceptable test verifications were made to verify the analytical data submitted.

With regard to the loss of both offsite circuits form a fault within the bus disconnect assembly, we find that, since the core can be cooled for approximately eight hours with no electrical power available and restoration of power to at least one offsite source could be accomplished in approximately two hours, the intent of GDC 17 is met. Further, the licensee in a letter dated November 16, 1983 has commited to complete an evaluation of the design of the 115 KV switchyard by December 30, 1983 to further assess if offsite power reliability could readily be improved.

We, therefore, find Nine Mile Point Unit 1 design to be acceptable with respect to adequacy of station electric distribution system voltages.

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Dated: December 20, 1983