Enclosure 2

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TECHNICAL EVALUATION OF THE MONITORING OF ELECTRIC POWER TO THE REACTOR PROTECTION SYSTEM FOR THE COOPER NUCLEAR STATION

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SELECTED ISSUES PROGRAM

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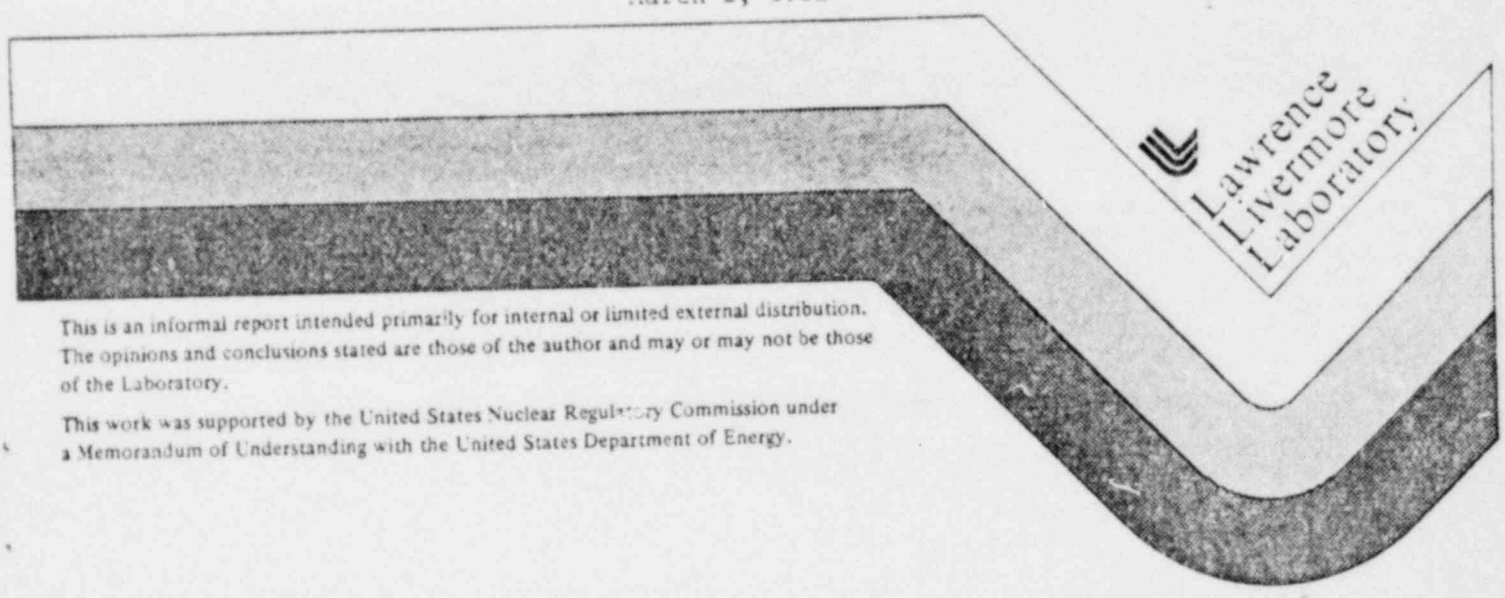

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ABSTRACT

This report documents the technical evaluation of the monitoring of electric power to the reactor protection system (RPS) at the Cooper Nuclear Station. The evaluation is to determine if the proposed design modification will protect the RPS from abnormal voltage and frequency conditions which could be supplied from the power supplies and will meet certain requirements set forth by the Nuclear Regulatory Commission.

The proposed design modifications with time delays verified by GE, will protect the RPS from sustained abnormal voltage and frequency conditions from the supplying sources.

FOREWORD

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TABLE OF CONTENTS

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1. INTRODUCTION

During the operating license review for Hatch 2, the Nuclear Regulatory Commission (NRC) staff raised a concern about the capability of the Class 1E reactor protection system (RPS) to operate after suffering sustained, abnormal voltage or frequency conditions from a non-Class 1E power supply. Abnormal voltage or frequency conditions could be produced as a result of one of the following causes: combinations of undetected, random single failures of the power supply components, or multiple failures of the power supply components caused by external phenomena such as a seismic event.

The concern for the RPS power supply integrity is generic to all General Electric (GE) boiling water reactors (BWR) MARK 3's, MARK 4's, and MARK 5's and all BWR MARK 6's that have not elected to use the solid state RPS design. The staff therefore pursued a generic resolution. Accordingly, GE proposed a revised design, in conceptual form, for resolution of this concern [Ref. 1]. The proposed modification consists of the addition of two Class 1E "protective packages" in series between each RPS motor-generator (M-G) set and it's respective RPS bus, and the addition of two similar packages in series in the alternate power source circuit to the RPS buses. Each protective package would include a breaker and associated overvoltage, undervoltage and underfrequency relaying. Each protective package would meet the testability requirements for Class 1E equipment.

With the protective packages installed, any abnormal output type failure (undetectable random or seismically caused) in either of the two RPS M-G sets (or the alternate supply) would result in a trip of either one or both of the two Class 1E protective packages. This tripping would interrupt the power to the effected RPS channel, thus producing a scram signal on that channel, while retaining full scram capability by means of the other channel. Thus, fully redundant Class 1E protection is provided, bringing the overall

3. EVALUATION

The NRC stated several requirements that the licensee must meet in their design modification to monitor the power to the RPS. A statement of these requirements followed by an evaluation of the licensee's submittals is as follows:

(1) "The components of the RPS shall not be exposed to unacceptable electric power of any sustained abnormal quality that could damage the RPS."

The monitoring module will detect overvoltage, undervoltage, and underfrequency conditions with the following setpoints. The chosen setpoints are within the ratings of the RPS components and thus ensures their protection from sustained abnormal power:

Nominal voltage 120 volts, 60 Hz nominal

Condition	Setpoint	Time Delay
Overvoltage	$\leq$ 132 Volts	*
Undervoltage	$\geq$ 108 Volts	*
Underfrequency	$\geq$ 57 Hz	*

* The licensee states that the actual time delays selected (with respect to their voltage and frequency setpoints) will fall within the range of .1 seconds to 3.0 seconds which is available from the GE design. Upon installation and testing, the final time delays selected will be verified by GE to ensure that the RPS components will be protected with the chosen setpoints from sustained abnormal power [Ref. 11].

(2) "Disconnecting the RPS from the abnormal power source shall be automatic."

The monitoring module will automatically disconnect the RPS buses from the abnormal power supply after the set time delay should the parameters setpoints be exceeded.

(3) "The power monitoring system shall meet the requirements of IEEE 279-1971, GDC-2 and GDC-21."

The monitoring packages meet the Class 1E requirements of IEEE 279, the single failure criteria of GDC-21, and the seismic qualifications of GDC-2.

REFERENCES

1. General Electric Company letter, MFN 408-78 (G. G. Sherwood) to NRC (R. S. Boyd), dated October 31, 1978.

2. General Design Criteria-2 (GDC-2), "Design Bases for Protection Against Natural Phenomena," of Appendix A, "General Design Criteria for Nuclear Power Plants," in the Code of Federal Regulations, Title 10, Part 50 (10 CFR 50).

3. General Design Criteria-21 (GDC-21), "Protection System Reliability and Testability," of Appendix A, "General Design Criteria for Nuclear Power Plants," in the Code of Federal Regulations, Title 10, Part 50 (10 CFR 50).

4. IEEE Std. 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations."

5. NUREG-75/087, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants."

6. NRC memorandum from Faust Rosa to J. Stolz, T. Ippolito, and G. Lainas, dated February 19, 1979.

7. NRC letter to Operating BWR's, dated September 24, 1980.

8. NPPD letter (Jay M. Pilant) to NRC (Thomas A. Ippolito), dated December 2, 1980.

9. NPPD letter (J. M. Pilant) to NRC (Thomas A. Ippolito), dated May 15, 1981.

10. NPPD letter (Jay M. Pilant) to NRC (Thomas A. Ippolito), dated September 29, 1981.

11. Telecon, Jeff Weaver (NPPD), Iqbal Ahmed and Byron Siegel (NRC), and James Selan (LLNL), dated February 17, 1982.