SAFETY EVALUATION REPORT
MONITORING OF ELECTRICAL POWER TO THE
REACTOR PROTECTION SYSTEM
E. I. HATCH - UNIT 1

1.0 INTRODUCTION

On August 8, 1978, (Reference 1) the NRC issued an Order for Modification of the Hatch 1 license and on the same date issued an interim Exemption (Reference 2) to certain requirements of General Design Criterion 2 (GDC-2). The Order required the licensee to perform periodic surveillance actions on the electric power applied to the Reactor Protection Systems (RPS). The purpose of these actions was to allay the concern that electric power of unacceptably poor quality could cause equipment damage of RPS equipment that could lead to system-level failure of the RPS.

On January 10, 1979 (Reference 3) the licensee met with the NRC to discuss the conceptual design for an electric power monitoring system. The licensee has proposed in its letter of May 22, 1979 (Reference 4) to modify the facility design so as to automatically prevent unacceptable power from being applied to the RPS. This proposal included appropriate changes to the facility Technical Specifications. This proposal was supplemented by the licensee on June 4, 1979 (Reference 5). A meeting to discuss the proposal was held June 13, 1979 (Reference 6). The licensee supplemented the proposal on June 25, 1979 (Reference 7).

2.0 BACKGROUND

The BWR Reactor Protection System uses four sets of instrumentation channels which are combined to provide a one-out-of-two-taken-twice logic for protective action. Each trip system of the RPS (i.e., a pair of channels) provides a one-out-of-two trip signal (i.e., "half scram"). The outputs of the two trip systems are combined in a logical "and" fashion such that protective action will occur if, and only if, both trip systems produce trip signals (i.e., the "taken twice" function).

Each trip system receives electric power from a separate source, typically a motor-generator set. Additionally, to accommodate maintenance on a motor-generator set, an alternate source may be connected to one trip system at a time.

These sources of electric power for the RPS are not Class IE. Being non-Class IE, periodic surveillance actions are typically not required to be performed on the power supplies. Being non-Class IE, the power supplies are not qualified to survive substantial seismic events.

During the Operating Licensee review for Hatch 2, the NRC staff raised a concern about the capability of the Class IE RPS to operate after suffering sustained abnormal electric power from a non-Class IE power supply. Abnormal electric power could be produced as a result of two possible causes: combinations of undetected single failures, or multiple failures caused by a seismic event. These causes relate to General Design Criterion 21 (single failures) and General Design Criterion 2 (seismic capability). The power supplies for Hatch 1 were determined to be identical to the Hatch 2 design.

3.0 REQUIREMENTS

The NRC requires that the components of the Reactor Protection System not be exposed to unacceptable electric power, i.e., sustained abnormal quality that could damage the RPS. This involves providing means: to detect any over-voltage, under-voltage, or under-frequency condition that is outside the design limits of the RPS equipment; and to disconnect the RPS from such abnormal electric power before damage to the RPS can occur. The equipment which performs this function must satisfy the single failure criterion and be seismically qualified.

4.0 DESIGN DESCRIPTION

The licensee has proposed to install an electric power monitoring system on each of the three sources of power for the reactor protection system (i.e., M-G sets "A" and "B", and the Alternate Source). Each system will consist of two identical and redundant channels. Each channel will include a power monitoring module and a circuit breaker. When abnormal electric power is detected by either monitoring module, the circuit breaker will be tripped and thus the RPS is disconnected from the abnormal power.

Each monitoring module will detect potential over-voltage, under-voltage, or under-frequency as follows:

1. Over-voltage: Provides an instantaneous trip of the breaker when the voltage is greater than the setpoint.

2. Under-voltage: Provides a time-delayed trip plus an instantaneous trip.

3. Under-frequency: Provides a time-delayed trip.

Each channel including all adjustments, setpoints, etc. is mounted in a separate, locked cabinet under administrative control.

5.0 EVALUATION

We have reviewed the design details of the licensee's proposal, including electrical drawings and equipment specifications that were provided. We find that the protection of the RPS is initiated automatically and deliberate operator action is necessary to reset the circuit breaker. This protection cannot be lost by any single component failure.

The setpoints proposed by the licensee are given in Table 1. The limiting values of the setpoints are ± 10% on voltage and 5% on low frequency. Such values will adequately protect the RPS from harmful electric power.

TABLE 1

CONDITION	LIMITING SETPOINT	NOMINAL SETPOINT	TIME DELAY
Over-voltage	132.0 vac (max.)	129.0 vac	instantaneous
Under-voltage	108.0 vac (min.)	110.0 vac 86 vac	* instantaneous
Under-frequency	57.0 Hz	57.2 Hz	*

*Set to zero time delay.

As shown in Table 1, the design includes a time delay on under-voltage and under-frequency for which the licensee had proposed values of 2.15 seconds and 2.25 seconds respectively. We indicated that time delays could not be allowed unless it could be shown that no damage would result. The licensee has agreed to set all time delays to zero pending the justification of time delay value(s).

Each channel of the monitoring system is physically and electrically independent on any other channel. The equipment involved is seismically qualified as Category I in conformance to IEEE Standard 344-1975.

The design is testable. The licensee has proposed functional testing semi-annually, and a calibration frequency of once every refueling outage. Such a frequency is the same as that approved for similar Class IE equipment and has been found to be adequate.

We have reviewed the Limiting Conditions for Operations specifications and the Surveillance specifications and find them adequate.

6.0 CONCLUSIONS

We conclude that no single component failure can cause the RPS to be exposed to electric power of unacceptable quality. The equipment involved is qualified such that seismic events are not expected to lead to failures. In view of these considerations we conclude that the proposed electric power monitoring systems are acceptable.

Although the design includes a time-delay for the under-voltage and under-frequency protection, this delay will be set to zero pending the justification and NRC approval of acceptable time delay values. The Technical Specifications are acceptable.

7.0 REFERENCES

1. NRC Order for Modification of License, Hatch Nuclear Plant 1 Docket 50-32, August 8, 1978.

2. NRC Exemption to certain requirements of General Design Criterion 2, Hatch Nuclear Plant 1, Docket 50-321; August 8, 1978.

3. Meeting minutes dated January 17, 1979, "Summary of meeting held January 10, 1979 with GPC regarding modifications to the Hatch 1 and 2 RPS power supplies," D. Verrelli, NRC.

4. Letter C. F. Witmar (Georgia Power) to Division of Nuclear Reactor Regulation (NRCO, May 22, 1979, "Reactor Protection System Motor Generator Sets."

5. Letter C. F. Witmar (GPC) to Director of Nuclear Reactor Regulation (NRC), June 4, 1979, "Additional Information on RPS MG Sets."

6. Meeting Summary, dated June 19, 1979 covering June 13, 1979 meeting, D. Verrelli, NRC.

7. Letter C. F. Witmar (GPC) to Director of Nuclear Reactor Regulation (NRC, June 25, 1979, "Alternate Power Supply to RPS).