



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR

REGULATION

RELATED TO PROCEDURES FOR DEGRADED

GRID VOLTAGE PROTECTION FOR CLASS 1E

POWER SYSTEMS FOR FACILITY OPERATING LICENSE NO. DPR-28

VERMONT YANKEE NUCLEAR POWER CORPORATION

VERMONT YANKEE NUCLEAR POWER STATION

DOCKET NO. 50-271

INTRODUCTION

The on-site alternating current (AC) safety class 1E electric system is supplied power from either the off-site transmission grid or from the on-site standby emergency diesel generators (EDG). During normal plant operating conditions, the class 1E busses are supplied power from the transmission grid. Should the grid voltage degrade and become low enough so that the voltage at the class 1E equipment is below its qualified operating voltage, equipment damage could occur.

The NRC requested that the licensee address this degraded voltage condition by responding to NRC Generic Letter dated June 3, 1977. The generic letter requested the licensee to analyze the class 1E system to determine the grid voltage at which damage could occur. As a result, the licensee made plans to install voltage sensing devices on the class 1E busses with coincident logic and with the low voltage set point above a value where equipment damage could occur. This voltage device would then cause the off-site grid supply to be disconnected from the class 1E system at voltages below this value. The class 1E busses would then be supplied power from their respective emergency diesel generators. However, New England licensees were concerned that significant degradation of the grid would result if automatic disconnection occurred as a result of the large number of nuclear plants in the New England area. It was their view that automatic disconnection from the grid should only be required if a low grid voltage occurred at the same time as a Loss of Coolant Accident (LOCA). They agreed that should their plant have a LOCA at the same time there was a degraded grid voltage condition, they would automatically disconnect from the off-site grid. The emergency diesel generators would then supply power to the class 1E systems. However, if there was a degraded grid voltage condition without a LOCA the operator would take the necessary manual action to protect the class 1E system.

This proposal has been reviewed and accepted by the NRC with the condition that the licensee develop an operating procedure to provide the necessary operator guidance to protect the Class 1E system under degraded grid voltage conditions without a LOCA condition. By letter dated November 2, 1984, the licensee submitted to the staff a draft operating procedure OP-3140 Low Grid Voltage Without An Accident Signal, Alarm Annunciator Response Procedure and further stated that the final procedure would be available for review onsite.

This safety evaluation provides the staff's review of the acceptability of the licensee's procedures to provide the necessary operator guidance to protect the Class 1E systems under a degraded grid voltage condition without a concurrent LOCA.

Discussion

Procedure OP-3140 was reviewed with the licensee during the staff's inspection conducted at the facility October 7 - 11, 1985. (Refer to Inspection Report No. 50-271/85-29). During this review the staff recommended procedural changes to clarify and aid operator decision making. These recommendations primarily involved establishing time limitations during which operator action is required for each level of degraded voltage in the procedure. These changes were agreed to by the licensee. In a letter to the NRC dated January 22, 1986, the licensee agreed to implement the subject degraded grid voltage procedure prior to restart from the 1985/1986 outage.

Procedure OP-3140 provides two degraded grid undervoltage levels (3700 volts and 3600 volts) at which operator actions are to be taken to assure protection of Class 1E electrical equipment to avoid possible damage from low voltage. The basis for selection of these two undervoltage levels is presented in a study "YAEC 1205 Auxiliary Power Systems Voltage" which was transmitted to the NRC by letter dated March 17, 1980.

Degraded Grid Voltage at 3700 ±40 volts

Two undervoltage sensing relay circuits are connected to each of the 4160 volt emergency buses (3 and 4). The relays in these circuits are calibrated to actuate when the bus voltage decays to 3700 ±40 volts. Actuation of any one or more of the relays will actuate a low voltage alarm in the main control room following a 10 second time delay. (The time delay prevents nuisance alarms from short term operating voltage transients such as those caused by starting a large motor).

Procedure OP-3140 requires immediate operator action upon receipt of the degraded bus alarm. The operator is required to contact the Rhode Island, Eastern Massachusetts and Vermont Energy Control Center (REMVEC) systems operator to request assessment of the degraded grid condition and that appropriate actions be taken to restore the grid to normal voltage. If the grid voltage is

not restored sufficiently to clear the degraded grid alarm within 15 minutes, the operator is required to start the emergency diesel generators, open the electrical grid breakers to the emergency buses and power them from the diesel generators.

Degraded Grid Voltage at 3600 Volts or Lower

Procedure OP-3140 requires the operator to monitor the voltage following receipt of the low voltage alarm at 3700 volts. If the voltage decays to 3600 volts or lower at any time, the operator immediately starts the emergency diesel generators and connects the emergency buses to them without delay.

Additional circuitry has been provided to automatically power the emergency buses from the diesel generators if a degraded grid voltage alarm occurs coincident with an ESF actuation. Additional circuitry also provides for automatic load shedding if a diesel generator circuit breaker opens during a loss of off-site power condition. It includes automatic reclosing of the diesel generator circuit breaker and sequencing essential loads onto the emergency bus.

Evaluation

The Vermont Yankee degraded grid voltage protection system and operating procedure OP-3140 enhances overall plant safety in the following ways.

- The operator is warned of a voltage decay on the emergency buses at a voltage level (3700 volts) that permits continued operation of the plant without degradation of safety related electrical equipment. However if continued for a long period of time or if further significant voltage degradation were to occur equipment damage or mal-operation could be a problem. The warning alarm provides the operator time to assess the situation, attempt to correct it, and if correction is not imminent it allows time for an orderly transition of the 1E safety loads to the emergency diesel generators.
- If the voltage drop is to a level at which damage or mal-operation may occur (3600 volts or below), the operator immediately initiates a loss of voltage signal to the emergency buses by tripping the grid feeder breakers which automatically starts and loads the diesel generators with the automatically sequenced Class 1E loads.
- The degraded voltage sensing relay circuits are provided with ESF signal contacts such that at any time there is a degraded voltage alarm coincident with an ESF signal, the diesel generators will automatically start and power the Class 1E safety loads.

CONCLUSION

The staff has concluded, based upon the above considerations and the licensee's commitment to implement the subject procedures prior to restart from the 1985/1986 outage, that:

- (1) The licensee revised procedure OP-3140, provides technically acceptable operator actions during degraded grid voltage conditions without a LOCA to assure protection of Class 1E electrical systems and equipment.

- (2) There is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner.

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Principal Contribution: Carl H. Woodard