THE CLEVELAND ELECTRIC ILLUMINATING COMPANY
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Dalwyn R. Davidson
VICE PRESIDENT
SYSTEM ENGINEERING AND CONSTRUCTION

June 8, 1982

Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Schwencer:

Perry Nuclear Power Plant
Docket Nos. 50-440; 50-441
SER Confirmatory Item -
Undervoltage Protection

Further review and analysis of the Class 1E undervoltage protection scheme has been conducted in response to FSAR question 430.77. A variety of grid conditions were evaluated and computer simulations used to study the effects of the 345 kV system grid voltages in relation to the Class 1E bus voltage. Voltage analyses in both steady state and transient condition were performed.

The acceptance criteria for the Class 1E bus voltages was based on the following purchase specification requirements:

1. Motors are capable of starting from rest and accelerating their specified load with 75% of rated nameplate voltage existing(during acceleration) at the motor terminals.

2. Motors are capable of delivering their rated horsepower continuously when the terminal voltage is ± 10% of rated voltage.

3. Motors are capable of delivering their rated full load torque at 70% of rated voltage for infrequent five minute intervals.

4. Motors are capable of starting with 110% of rated voltage applied at the motor terminals.

Review of all steady state cases, shows that the Class 1E buses sustained no degradation of voltage greater than 10% during operation under full load,

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shutdown, unit trip and LOCA modes. The transient cases posed a more severe test of the auxiliary system's ability to support a normal voltage during the starting of motors. In only one of the cases studied did the voltage on the Class 1E buses become depressed below the 75% level for starting motors. In this worst case scenario Perry was considered to be offline in a startup or just tripped mode with other major generating units of the CEI system offline and a feedwater pump(5000 HP) was manually started concurrent with receipt of a LOCA signal and the simultaneous starting of the zero second LOCA loads(2400 KW). In this case the voltage decays to 73% of motor rated voltage.

In evaluation of this study, the auxiliary system provides sufficent and reliable voltage necessary for starting Class 1E motors in all cases except the highly improbable sequence described above. In order to provide further assurance of required Class 1E operation even under the most adverse conditions, two levels of undervoltage protection will be provided for the Class 1E buses.

The first level of protection is provided to trip the offsite power source breakers and start and load the diesel generators in the case of a loss of offsite power. A set of undervoltage relays will be provided for each Class 1E bus, set to trip at 86% of motor rated voltage. The undervoltage relays, following a 3 second fixed time delay, will initiate the necessary logic to connect the Class 1E buses to the diesel generators. A LOCA signal initiates a diesel generator start signal, however, the diesel generator breaker is not closed unless an undervoltage condition exists. Hence, even if a LOCA signal is received during the 3 second time delay when voltage is 86%, a system performance within regulatory requirements is still met. A short time delay is required for this level of protection to allow time for fault clearing operations to attempt to return the system to an acceptable level.

The second level of undervoltage protection will be provided to insure the offsite power source does not degrade to a level which could jeopardize starting of Class 1E motors in an adverse situation.

A second set of undervoltage relays will be provided for each Class 1E bus, set to trip at 96% of motor rated voltage. The undervoltage relays will energize two separate time delay relays. The first time delay relay will initate undervoltage alarms and a diesel generator start signal after 15 seconds. The second time delay will be set for approximately 5 minutes at which time the offsite source breakers will be tripped and the diesel generator loaded on the bus. The five minute timer will also insure against motor overheating between 90% and 86% voltage. The motors purchased for Perry have performance characteristics such that they can operate for infrequent 5 minute periods at 70% voltage.

This undervoltage scheme described above is presently being incorporated into our design. Testing will also be conducted to insure correct relay settings. The final design and settings will be established after a review of our onsite preoperational test results.

Additionally, we are following the development of Class 1E inverse undervoltage relay which could have direct application in an undervoltage scheme. We are proceeding with the undervoltage protection system described herein. Any changes to this design would be reviewed with the staff prior to implementation.

Very truly Yours,

Dalwyn R. Davidson

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Vice President
System Engineering and Construction

DRD: mb

cc: Jay Silberg, Esq.
John Stefano
Max Gildner