U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

Division of Quality Assurance, Vendor, and Technical Training Center Programs

Quality Assurance Branch

Report No.:	50-440/84-29, Supplement 2
Docket No.:	50-440
Licensee:	Cleveland Electric Illuminating Company P.O. Box 5000 Cleveland, Ohio 44101
Facility Name:	Perry Nuclear Power Plant
Inspection at:	Gilbert/Commonwealth, Reading, Pennsylvania NRC Offices, Bethesda, Maryland
Inspection Conducted:	May 9 and 10, 1985
Inspection Team Members:	
Team Leader	D. P. Norkin, Senior Inspection Specialist, IE
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Mechanical Components	W. F. Anderson, Senior Mechanical Engineer, IE
Electrical Power	G. W. Morris, Consultant, WESTEC Services

Donald P. Norkin 5-30-85
Donald P. Norkin Date
Team Leader, IE

Approved by: James L. Milhoan 5-30-85
James L. Milhoan Date
Section Chief, Quality Assurance Branch

PERRY IDI FOLLOW-UP REINSPECTION

1. Background and Persons Contacted

The NRC conducted an Integrated Design Inspection of the Perry Nuclear Power Plant between August 6 and October 12, 1984. The inspection report was issued on December 12, 1984. The applicant responded to the report on January 24, 1985. The NRC reviewed the response and an NRC letter dated February 25, 1985 identified IDI items to be addressed in an NRC reinspection which was conducted on February 27 through March 1, 1985. The applicant's letter dated March 8, 1985 documented additional actions and clarifications discussed during the reinspection. The reinspection report was issued on March 26, 1985, and indicated that 15 IDI items remained open. The applicant's letter dated April 15, 1985 provided information on some of these open items.

On May 9 and 10, 1985 an additional NRC reinspection was conducted to address the remaining open items. This report indicates that each of these items has now been closed out.

The team contacted the following personnel during the May 9 and 10, 1985 reinspection:

Name	Organization	Position
R. Vondrasek	CEI	General Supervising Engineer
E. C. Willman	CEI	Senior Engineer
D. R. Nester	CEI	Assoc. Engineer
J. Ioannidi	G/C	Perry Site Project Manager
C. Whitehead	G/C	Project Engineer Piping
J. Zalewski	G/C	Lead Piping Analyst
T. Hatch	G/C	Piping Analyst
S. Ferrarello	G/C	Piping Analyst
R. P. Cronk	G/C	Electrical Dept. Section Manager
R. A. McNabb	G/C	Project Electrical Engineer
W. J. Leininger	G/C	Project Manager
B. Kohout	G/C	Electrical Engineer
P. B. Gudikunst	G/C	Consulting Engineer
R. J. Sheldon	G/C	Project Mechanical Engineer
M. Z. Lee	G/C	Supervisor, Piping Engineering (Analysis)

2. Mechanical Systems

(Closed) Deficiency D2.1-3, Failure to Document Substantiation for Emergency Service Water Pump Vacuum Breaker Check Valve Size

This item concerned assurance that the emergency service water system design had adequately considered the effects of potential water hammer loads. In response to this concern, Gilbert reviewed the system for potential causes of water hammer and identified representative test transients for confirming that water hammer would not cause excessive loads in piping and supports. This review determined that there is considerable length of piping above the highest elevation at which the water level is expected to settle immediately after

system shutdown. Due to anticipated system leakage, piping at these higher elevations might contain air voids, which could cause water hammer upon starting the system (e.g. restart after pump trip).

Gilbert issued a Work Change Request dated April 19, 1985 to effect necessary design/hardware changes in order to make the elevation of the piping to the discharge tunnel the system high point, and to install a "keep full" system to preclude the level in the piping to the discharge tunnel from falling below the system high point. It is planned to operate the system prior to completing this change by closing valves P45 F526 and F527 before shutting down the system, which will have the effect of making the overflow to the swale pipe the system high point.

The applicant's April 15, 1985 letter enclosed an ESW system water hammer preoperational test program which includes test transients considering (1) pump restart 40 seconds after trip and (2) pump start with the RHR heat exchanger isolated.

This response is acceptable. Region III has been requested to monitor the actual testing and any resultant corrective actions.

3. Mechanical Components

(Closed) Deficiency D3.2-5, Interface Between Piping and Equipment

This item concerns failure to include (1) equipment with a fundamental frequency less than 33 Hz in seismic analyses of piping and (2) thermal loading in emergency and faulted conditions for NSSS equipment. The applicant's April 15, 1985 letter identified GE and HVAC equipment which were reanalyzed to resolve this concern. The team reviewed these reanalyses.

RHR Pump A was modeled dynamically and incorporated thermal loads properly in the loading combinations. The resultant nozzle loads exceeded the original GE allowables, but GE found these loads to be acceptable. For M-23 and M-25 HVAC plenums, Gilbert's review of vendor stress reports resulted in design changes to stiffen the framework and preclude the need for dynamic modeling of the plenums. The nozzle loads calculated on that basis were acceptable.

Recalculated nozzle loads on the RCIC turbine exceeded GE allowables by 2%, which Gilbert considered acceptable in view of the conservatism in the reanalysis. Reanalyses for other equipment found nozzle loads to be within allowables.

This response is acceptable.

4. Electrical

(Closed) Deficiency D5.4-1, Battery Voltage Selection

This item concerned failure to consider the minimum acceptable equipment voltage during the selection of battery voltage. The team reviewed calculation R42-13 dated 3/6/85 which conservatively established 112.8 volts as the battery voltage during the initial minute. The results of this calculation were used in the voltage drop calculations. Calculation R42-10E, Revision 1 dated 3/30/85 pertained to the eleven RCIC DC motor operated valves, and correctly addressed

cable runs which the team had identified (in the initial reinspection) as not being considered in Revision 0. Revision 1 found that nine of the eleven valves would have insufficient available motor operator torque under reduced voltage conditions. One of the remaining two valves has not been evaluated due to unavailability of motor data.

As a result of these calculations, Gilbert issued Form QAD 600, Serial No. 107 dated 5/8/85, which identifies a "possible reportable event", and Change Request CR 5124 which takes action to redesign the sizes of the power feeder cables for the nine valves found to have insufficient available torque plus the one valve that has not been evaluated due to unavailability of motor data.

This response is acceptable.

(Closed) Deficiency D5.6-1, 4000 Volt Motor Overload Protection

This item concerned (1) failure to follow a FSAR commitment in the sizing of the ESW pump motor overload protection, and (2) review and design control for all 4000 volt relay settings. The team reviewed new relay setting calculations for the ESW, RHR and LPCS pumps. The new calculations reflected the FSAR commitment that overload relay settings are to be based upon 150% of the motor full load current at 100% of rated motor voltage. For the ESW pump motor, the motor thermal damage curve had not been included on the relay plot because it had not yet been received from the vendor. The team considers that the present setting shown in the calculation is sufficiently close to the actual motor starting characteristics such that no relay setting change will be required upon receipt of the thermal damage curve.

This response is acceptable.

(Closed) Deficiency D5.6-2, 460 Volt Motor Overcurrent Protection

This item concerned failure to meet the FSAR commitment for long time overcurrent protection to be approximately 150% of motor full load current. Calculation 686-85-3 covers all 460 volt motors fed from the 480 volt switchgear. The team reviewed four subcalculations on ESF loads (fuel pool cooling pump, switchgear room ventilation fan, emergency closed cooling water pump and chilled water pump). In all cases, relay protection was consistent with the above FSAR commitment.

(Closed) Deficiency D5.6-4, Motor Control Center Breaker Coordination

This item concerned the failure of breaker coordination for the motor control center feeders to account for the normally connected and running loads. The team reviewed two new coordination calculations. Calculation 686-85-36 for AC Motor Control Center EF1B09 confirmed the coordination between the largest fuse and the incoming breaker when the remaining normal running loads were included. In accordance with the verifier's comments, the long term setting for the incoming breaker was established at 110% of the bus rating, which was allowed by the MCC vendor for coordination only. The higher breaker setting provides sufficient protection for the MCC feeder cable. For calculation 686-85-48 (DC Motor Control Center ED1A06), Cleveland Electric stated that the margin for the incoming breaker relay curve over the fuse for the largest load

is adequate. This is due to (1) the momentary nature of the diesel generator load, (2) branch circuit fusing for loads from switch 27, and (3) the time dependent nature of the relay/fuse curves.

This response is acceptable.

(Closed) Deficiency D5.6-5, DC Fuse Characteristic Curve

This item concerned coordination studies which did not use the correct fuse curve and the minimum tolerance band of the relay curve. The team's review of protection and coordination studies pertinent to Deficiencies D5.6-1, D5.6-2, and D5.6-4 confirmed that Cleveland Electric and Gilbert are now using the correct fuse characteristics and correctly proportioning in cases where there is no fuse curve for a specific fuse size. This response is acceptable.

(Closed) Deficiency D5.7-1, Inadequate Cable Voltage Drop Calculation

This item concerned substantiation that class 1E AC motor operated valves could perform during bus low voltage and motor starting conditions, considering cable voltage drop. During the previous reinspection, the team found that calculations in response to this concern were based on the generic assumption that the degraded bus low voltage is 442 volts at the 480 volt bus; this assumption remained to be confirmed. During the second reinspection the team found that calculation R24-007, Revision 1 incorporates a revision in the MCC minimum bus voltage from the above 442 volts to the actual specific minimum MCC voltage calculated in the load flow study performed in response to Deficiency D5.14-1. (See below).

This response is acceptable.

(Closed) Deficiency D5.7-3, Inadequate Review of Maximum Allowable Circuit Lengths

This item concerned the program to identify and evaluate circuits which exceed allowable lengths. Based on the team's comments during the initial reinspection, Gilbert revised the procedure for the class 1E voltage drop evaluation program to provide clarification with respect to review of elementary diagrams, minimum voltage requirements for motor operated valves, and final battery discharge voltage. This evaluation program has been completed. The team sampled two new calculations: (1) R31010A, page 3 for the 120 vac control circuit for motor operated valve E12 F028; and (2) R 31-004, Revision 1, page 8. The latter calculation confirmed the voltage drop problem identified by the team in Deficiency D5.7-7 for the P45 C001 (ESW pump motor) DC control circuit. Deviation Analysis Report 224 was issued to correct the problem.

Gilbert informed the team that as a result of this program, six Forms QAD 600 have been initiated to address "Possible Reportable Events" and potential design changes. These are serial numbers 103, 104, 105, 106, 107 (discussed in Deficiency D5.4-1 above), and 111. Systems affected in these cases are ESW Pump House HVAC, Standby Liquid Control, Hydrogen Igniter, and RCIC. In addition, 460 vac Class 1E motor operated valves and control and power circuits for various systems are affected.

This response is acceptable.

(Closed) Deficiency D5.9-1, Control Room Duct Fill Criteria Inadequate and Unjustified

This item concerned confirmation that the practice of completely filling cable ducts does not result in cable damage. The team reviewed General Electric's analysis dated March 15, 1985, "Cable Temperatures in Raceways".

The analysis addressed the insulation temperature rise in cables within control room floor ducts for cases exceeding 40% fill. The analysis found that the maximum temperature rise of the cable insulation does not approach its continuous temperature rating, and therefore duct fill in excess of 40% does not impair safety. This response is acceptable.

(Closed) Deficiency D.5.10-3, Electrical Separation Violations in PGCC Floor Section Raceways

This item concerned violation of electrical separation requirements. General Electric Test Report A00-794-6 was presented as the basis for resolving this item. The applicant's letter dated April 15, 1985 includes additional information requested by the team pertinent to the test report, e.g., on thermal gain of the barrier. This response is acceptable.

(Closed) Deficiency D5.14-1, Class 1E Motor Operating Voltages

This item concerned the failure to determine the minimum operating and starting voltages at the terminals of the 460 volt motors during degraded grid conditions and diesel generator loading. Load flow studies in response to this concern identified that, with the present design, a LOCA in combination with a degraded off-site power supply condition could result in insufficient voltage required to start AC motors for the Diesel Generator Building HVAC, LPCS, HPCS, and ESW systems. To correct this, Cleveland Electric letter PY-CEI/GAI-7853 dated 4/23/85 and Work Change Request PWC-219 dated 4/22/85 took action to resequence the LOCA starting times for four ESF 4000 volt motors. This would enable the voltages on the 460 volt motor control center buses to remain above the required 75% of rated voltage (for starting). The team confirmed this by reviewing calculation 431-85-2, sheet 38, which represented the worst case found in the original IDI.

(Closed) Unresolved Item U5.2-1, Motor Accelerating Time

This item concerned the ability of motors connected to the diesel generator to attain rated speeds before the next loading step on the diesel generator begins. The team reviewed calculation R43-002, Rev. 1, which included the acceleration calculations for non-1E loads P41C001 and P43C001A, and indicated maximum accelerating times at minimum voltage of 2.7 and 6.2 seconds respectively. The 6.2 seconds case is acceptable because it conservatively assumes 75% of rated voltage for the whole period, while the diesel generator exciter will restore voltage to greater than 95% in less than 3 seconds. At the higher voltage, the accelerating time is expected to be within the 5 seconds requirement.

This response is acceptable.

5. Instrumentation and Control

(Closed) Deficiency D6.2-1, Failure to Meet the Single Failure Criterion for Loss of Off-Site Power from Loss of Divisional Bus Sensors

This item had resulted in a design change to correct a situation where both divisions of emergency equipment could have been lost due to single failure of the Division 1 battery. In response to subsequent questions by the team, the applicant's April 15, 1985 letter provides an analysis dated 4/10/85 which concludes that a failure which results in the Division 1 and 2 contacts of the undervoltage relays becoming electrically connected does not prevent the Division 1 and 2 undervoltage circuits and "LOOP" logic from performing their safety functions. This response is acceptable.

(Closed) Deficiency D6.2-2, Main Steam Line Leak Detection Circuit Separation

This item concerned physical separation and electrical isolation requirements in redundant electrical circuits for main steam line leak detection annunciators. Gilbert's single failure analysis for panels H13-P868 and 869 dated 3/28/85 addresses potential isolation problems identified by the team in the initial reinspection. This response is acceptable.