U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Reports No.: 50-315/90018(DRS); 50-316/90018(DRS)

Docket Nos.: 50-315; 50-316 Licenses No.: DPR-58; DPR-74

Licensee: Indiana Michigan Power Company
1 Riverside Plaza
Columbus, OH 43216

Facility Name: D. C. Cook Nuclear Power Station, Units 1 and 2

Inspection At: Bridgman, MI 49106

Inspection Conducted: September 10-14, October 5 and November 6, 1990

Inspectors: Joseph M. Ulie for
David Butler — Date: 11-9-90

Jay Lennartz — Date: 11-9-90

Joseph M. Ulie for
Anthony Fresco - BNL — Date: 11-9-90

Joseph M. Ulie for
Kenneth Sullivan - BNL — Date: 11-9-90

Joseph M. Ulie for
Thomas Storey - SAIC — Date: 11-9-90

Joseph M. Ulie
Joseph M. Ulie
Team Leader — Date: 11-9-90

Approved By: Joseph M. Ulie for
Ronald N. Gardner, Chief
Plant Systems Section — Date: 11-9-90

Inspection Summary

Inspection on September 10-14, October 5 and November 6, 1990 (Reports No. 50-315/90018(DRS); 50-316/90018(DRS))
Areas Inspected: Special, announced inspection of licensee action on previous inspection findings and a full scope reinspection of Sections III.G, J and L of 10 CFR Part 50, Appendix R. The inspection was performed in accordance with NRC Manual Chapter Procedures 30703, 64100, 64704, 92701 and 92702.
Results: In the areas that were reviewed, the following items were identified: one violation of audit team composition requirements (Paragraph 3.i.); one non-issued deviation from a commitment to protect structural steel (Paragraph 4.a.); one apparent violation with three examples of inadequate design control (Paragraphs 4.b., 4.c. and 5.e.); one apparent violation with three examples of failure to take adequate corrective actions including human factor procedural deficiencies and emergency lighting deficiencies (Paragraphs 5.b., 5.c. and 7.); one apparent violation concerning an inadequate shift staffing procedure (Paragraph 5.c.); one apparent violation regarding the loss of heating, ventilating, and air conditioning (HVAC) for both units' control rooms (Paragraph 5.e.); and one unresolved item regarding the lack of a completed high impedance fault analysis (Paragraph 8.a.).

DETAILS

1. Persons Contacted

Indiana Michigan Power Company

*J. Allard, Computer Science
*R. Allen, Maintenance-Regulatory Group
*G. P. Arent, Operations
*K. R. Baker, Assistant Plant Manager of Production
M. E. Barfelz, Senior Engineer
*P. Carteaux, Superintendent, Safety and Assessment
*J. Dwyer, Maintenance-Regulatory Group
R. J. Heydenburg, Computer Science
*P. Jacques, Fire Protection Coordinator
*E. V. Kincheloe, Superintendent, Training
J. Labis, Supervisor
*D. Loope, Radiation Protection
*L. J. Matthias, Administrative Superintendent
*W. A. Nichols, Operations Training Supervisor
T. Postlewait, Project Engineering Superintendent
R. Russell, Project Engineering
J. R. Sampson, Operations Superintendent
*B. A. Svensson, Manager, Licensing Action Coordinator
*T. L. Wagoner, Maintenance

American Electric Power Service Corporation

*M. P. Alexich, Vice-President, Nuclear Operation
D. R. Beam, Quality Assurance Engineer
°*S. J. Brewer, Manager, Nuclear Safety and Licensing
S. R. Gane, Site Quality Assurance Auditor
*B. J. Gerwe, Piping, HVAC and Fire Protection (PHF)
*R. A. Green, Nuclear Safety and Licensing Engineer
*B. McLean, Nuclear Safety and Licensing Engineer
*G. Patel, Nuclear Design
*P. J. Russell, PHF
*R. L. Shoberg, Section Manager
*E. Taylor, Electrical Engineer
*K. J. Toth, Licensing
*L. H. VanGinhoven, Site Design
*S. J. Wolf, Senior Quality Assurance Auditor
*H. Young, PHF-HVAC

Impell Corporation

*D. R. Brecken, Technical Services
*D. S. Turley, Technical Services
*G. A. Weber, Section Manager

U.S. Nuclear Regulatory Commission

*R. N. Gardner, Chief, Plant Systems Section, DRS, Region III
*J. A. Isom, Senior Resident Inspector
*H. J. Miller, Director, Division of Reactor Safety, Region III
*D. G. Passehl, Resident Inspector

*Denotes those persons in attendance at the exit interview on September 14, 1990.

°Denotes those persons participating in the telecon exit interview on November 6, 1990.

The inspectors also contacted other licensee personnel during this inspection.

2. Executive Summary

A full scope, post fire safe shutdown capability (10 CFR Part 50, Appendix R) reinspection was conducted at the D. C. Cook Nuclear Power Plant during the period of September 10 to November 6, 1990. The NRC inspection team reviewed the design and implementation of Sections III.G, J and L of Appendix R to 10 CFR Part 50, to ascertain whether the licensee was in conformance with the identified post fire safe shutdown capability requirements including exemptions and other requirements approved by the Office of Nuclear Reactor Regulation (NRR).

Significant post fire safe shutdown capability deficiencies were identified by the licensee just before the inspection and by the NRC inspection team during the inspection period. These deficiencies included the following: (1) an inadequate emergency lighting evaluation of two Emergency Remote Shutdown (ERS) procedure revisions; (2) inadequate corrective actions regarding emergency lighting system unit components; (3) a postulated Appendix R fire in any of five fire zones could have resulted in a loss of HVAC for both units control rooms potentially affecting the ability to maintain the plant in a safe shutdown condition; (4) design translation deficiencies that could have resulted in the loss of control power to all four ESW pumps or all four CCW pumps; (5) local shutdown instrumentation (LSI) panel cable routing errors; (6) lack of a completed high impedance fault analysis; (7) an inadequate shift staffing procedure; (8) examples of mislabeling and/or difficult to accomplish steps in the ERS procedures; and (9) a failure to design for a loss of control room ventilation due to postulated fires outside of the control room. Issues (1), (7), and (8) were determined to be deficiencies having similarities to those deficiencies identified during the 1982 Appendix R post fire safe shutdown inspection. The deficiencies identified in Issue (8) were determined to be the types of deficiencies also identified during the 1988 Emergency Operating Procedures (EOP) inspection. Additionally, the inspection addressed two other issues that are not related to the post fire safe shutdown capability aspects of the inspection. These additional issues are: (1) utilizing a licensee staff member for a triennial auditing team while this individual had direct responsibilities in the area being auditied; and (2) a deviation from an FSAR commitment to protect structural steel.

During the course of this inspection, the following strengths were noted:

- The reorganization of the ERS Procedures (Revision 9) facilitated the implementation of these procedures.

- The licensee's administrative control of combustibles and maintenance of fire protection equipment and fire area boundary features were found to be of high quality.

- The engineering analyses of fire detection, suppression, and fire barriers were found to be thorough and detailed.

- The ERS procedure status tracking sheet was found to be very beneficial during the implementation of this procedure.

3. Action On Previous Inspection Findings

a. (Closed) Violation (315/82-08-01; 316/82-08-01): Redundant trains of equipment, cabling or associated circuits for systems necessary to achieve and maintain hot shutdown conditions were not provided with the fire protection features required by 10 CFR 50, Appendix R, Sections III.G.2 or III.G.3.

Each of the examples from this issue are noted below along with the inspector's conclusions:

(1) The Unit 1 component cooling water (CCW) redundant pumps were separated by approximately 13 feet. The Unit 2 CCW redundant pumps were also separated by approximately 13 feet. The Unit 1 and Unit 2 redundant pumps were in the same area separated by approximately 11 feet. An ionization fire detection system was installed in the pump area. Fire barriers were not installed separating any of these pumps, and a fixed fire suppression system was not installed in the area.

During this inspection, it was determined that by letter dated December 23, 1983, the NRC had granted an exemption to the licensee allowing partial height fire barriers separating the CCW pumps. In addition, the exemption was based on the installation of an automatic water suppression system protecting the pumps.

The inspector observed the area containing the CCW pumps and determined that the fire protection features described in the Safety Evaluation Report (SER) had been properly installed. Based on the approved exemption request and field verification, this item is considered resolved.

(2) The Unit 1 CCW redundant heat exchangers were separated by approximately 12 feet. Redundant valves servicing the Unit 1 CCW heat exchangers were also separated by approximately 12 feet. Ionization fire detection and pre-action sprinkler fire suppression systems were installed in the area. No fire barriers were installed separating the redundant components.

Subsequent to this finding, the licensee modified their analysis to rely on the unaffected unit for safe shutdown. The Unit 1 and Unit 2 CCW heat exchangers are separated by approximately 40 feet. Automatic suppression protects the area around each unit's heat exchangers. Smoke detection is provided in the area of concern. Any manual actions necessary to realign CCW from one unit to another are in a different fire area on another elevation. This arrangement is considered satisfactory to address the above stated finding. This issue is considered resolved.

(3) The Unit 2 CCW redundant heat exchangers were separated by approximately 12 feet. Redundant valves servicing the Unit 2 CCW heat exchangers were also separated by approximately 12 feet. Ionization fire detection and pre-action sprinkler fire suppression systems were installed in the area. Fire barriers were not installed separating the redundant components.

Based on the discussion provided for issue (2) above, this example of the issue is also considered closed.

(4) The Unit 1 redundant essential service water (ESW) pumps were separated by more than 20 feet. The Unit 2 redundant ESW pumps were also separated by greater than 20 feet. Fire detection and automatic fire suppression systems were not installed in these areas.

During this inspection, it was determined that the December 23, 1983, SER issued by the NRC approved an exemption for lack of automatic suppression for the areas containing the ESW pumps. The exemption was based on the installation of detection in these areas. During this inspection, the inspector verified that detection had been installed in the areas identified in the SER. This issue is considered resolved.

(5) The Unit 1 redundant ventilation system fan motor heater control switches and breakers for the redundant ESW pump rooms were separated by approximately 18 inches. The Unit 2 redundant ventilation system fan motor heater control switches and breakers for the redundant ESW pump rooms were also separated by approximately 18 inches. These Unit 1 and Unit 2 controls were separated from each other by approximately 4 feet. Fire barriers were not installed separating any of these control switches or breakers. Fire detection and automatic fire suppression systems were not installed in the area.

This finding pertained to Fire Zone 29G which is below the ESW pumps. The December 23, 1983 SER approved an exemption for lack of suppression in this Zone. The redundant cables necessary for safe shutdown were identified in the SER as being protected with 1-hour rated material. No other breakers or switches were identified by the licensee in their request for exemption as being required for safe shutdown. During this inspection, it was verified that the cables discussed in the SER were in fact protected. It was also verified by the licensee that the redundant fan motor control switches and breakers mentioned in the original findings were not required for safe shutdown. Therefore, based on the approved exemption for this Zone and a field verification of the fire protection features, this issue is considered resolved.

(6) The Unit 1 redundant non-essential service water system (NESWS) pumps were separated by approximately 50 feet. The Unit 1 redundant NESWS pump discharge valves (1-WMO 901 and 1-WMO 902) were also separated by approximately 50 feet. Fire barriers were not installed separating these redundant components. Fire detection and automatic fire suppression systems were not installed in the area.

Based on a re-analysis by the licensee since the original inspection, the NESWS pumps were determined not to be necessary for safe shutdown of the plant. This was verified by the licensee during the inspection. Therefore, the original concern is no longer applicable and this issue is considered resolved.

(7) The Unit 2 redundant NESWS pumps were separated by approximately 30 feet. The Unit 2 redundant NESWS pump discharge valves (2-WMO 901 and 2-WMO 902) were also separated by approximately 30 feet. Conduits servicing the redundant NESWS pump discharge valves (Conduit 4126-2 for Valve 2-WMO 901 and Conduit 4140-2 for Valve 2-WMO 902) were separated by approximately one foot. Fire barriers were not installed separating these redundant components. Fire detection and automatic fire suppression systems were not installed in the area.

As with the Unit 1 NESWS pumps discussed above, the Unit 2 pumps have been determined to be not necessary for safe shutdown. Therefore, this issue is considered resolved.

(8) The Unit 1 plant air system (PAS) and control air system (CAS) compressors were separated by approximately 11 feet. A wet pipe sprinkler system was installed in the area. Fire barriers were not installed to separate the redundant components. A fire detection system was not installed in the area.

Based on a re-analysis by the licensee, the PAS and CAS compressors are no longer necessary for safe shutdown. Since the above stated issue is no longer applicable, this issue is considered resolved.

(9) The Unit 2 PAS and CAS compressors were separated by approximately 11 feet. A wet pipe sprinkler system was installed in the area. Fire barriers were not installed to separate the redundant components. A fire detection system was not installed in the area.

As with the Unit 1 compressors discussed above, the Unit 2 compressors are no longer required for safe shutdown and this issue is considered resolved.

(10) The Unit 1 and 2 control rooms were provided with alternative shutdown capability (Hot Shutdown Panels). These panels were separated from their respective control rooms by a three-hour rated fire barrier. Functional fire detection and fixed fire suppression systems were not installed in the control rooms.

During this inspection, it was determined that the December 23, 1983 SER approved an exemption for lack of automatic suppression in the control rooms. It was identified in the SER that detection was provided in each control room. During this inspection, it was verified that detection was present in both control rooms including the hot shutdown rooms. Based on the approved exemption and verification that detection was present, this issue is considered resolved.

(11) The Unit 1 and 2 cable vaults are separated from each other by a three hour fire barrier. The Unit 1 and 2 cable vaults contain redundant cabling for all safe shutdown equipment including instrumentation and control to both the respective control rooms and hot shutdown panels. The separation requirements of Section III.G.2 were not satisfied in these areas, and alternative or dedicated shutdown capability was not provided in accordance with Section III.G.3. Fire detection and automatic fire suppression systems were installed in these areas.

During this inspection, it was verified that alternate shutdown could be achieved independent of the affected cable vaults. The verification included electrical and mechanical systems and procedural reviews which are discussed in detail in other sections of this report. Therefore, since alternate shutdown capability has now been provided for each cable vault mentioned above, this issue is considered resolved.

b. (Closed) Violation (315/82-08-06A; 316/82-08-06A): Examples of inadequate alternate safe shutdown procedure.

This issue is addressed in Paragraph 5 of this report.

c. (Closed) Open Item (315/82-08-07; 316/82-08-07): The ERS procedure lacked organization.

This issue is addressed in Paragraph 5 of this report.

d. (Closed) Open Item (315/82-08-08; 316/82-08-08): The inspectors examined the procedure review process and found that the review and approval of procedures did not include a walk-through to determine procedure feasibility and adequacy.

This issue is addressed in Paragraph 5 of this report.

e. (Closed) Open Item (315/87016-03; 316/87016-03): Numerous concerns regarding the completeness, technical adequacy, and prioritization of various steps in the ERS procedure were identified.

This issue is addressed in Paragraph 5 of this report.

f. (Closed) Open Item (315/89004-01(DRS); 316/89004-01(DRS)): The licensee had not ensured that all fire dampers would close under air-flow conditions. The licensee had tested Ruskin dampers which were the subject of a Part 21 report. However, the licensee was requested to verify that all dampers regardless of manufacturer would close under air-flow conditions. In addition, the licensee was requested to make the test results available for inspector review.

During this inspection, the inspector reviewed fire damper test results. The licensee presented closure test data for the majority of fire dampers under actual air-flow conditions. The licensee stated that for some dampers it was not practical to perform an actual test, either due to damper size or location. For these dampers, the licensee performed calculations to determine if the dampers would close. The inspector discussed both the test data and the calculations and found them to be acceptable. Based on the licensee's damper test program, it was determined that a number of dampers may not close under air-flow conditions. The licensee had implemented administrative controls to manually shut-off ventilation for a fire in the affected areas. The inspector reviewed these procedures and found that they did not clearly state which fans required shutdown for given fire locations. The licensee presented the inspector with modified procedures prior to the end of the inspection. These revised procedures, 1-OHP 4024.102, Revision 4, 2-OHP 4024.201, Revision 4, and 1-OHP 40240.10, Revision 4, clearly identified which fans required shutdown. This issue is considered closed.

g. (Closed) Unresolved Item (315/89004-04(DRS); 316/89004-04(DRS)): During a review of Plant Manager Instruction (PMI) No. PMI-2270, Revision 19, "Fire Protection," it was noted that the procedure pertained only to specified areas of the plant which contained safe shutdown equipment. The inspector observed that the corridor to the diesel generator rooms of each unit contained safe shutdown cabling, but these areas were omitted from the procedure.

The licensee provided a response to this issue that clarified that the intent of Paragraph 4.9 of the PMI was to identify the entire auxiliary building as having a more restrictive administrative control than certain other plant areas. To add clarity to the PMI-2270 specified paragraph, the licensee implemented a procedure change to specifically address the diesel generator corridors. This issue is considered resolved.

h. (Closed) Violation (315/89004-05(DRS); 316/89004-05(DRS)): During a plant walkdown of the carbon dioxide (CO_2) system valves, an inspector observed an operator verify that a valve was open as required; however, with the chain and seal in their as-found condition, the valve could have been closed without disturbing the seal.

During this inspection, an inspector verified that the previous improperly sealed valve (No. 12-FCO-174) was sealed properly and was in the correct (open) position. In addition, two other carbon dioxide (CO_2) system valves were also verified to be sealed properly and in the correct position. Further, the licensee provided Operating Memo 89-071 (I) which emphasized the importance of proper sealing of CO_2 valves and, in particular, the type of valve related to the above issue. On the above basis, this issue is considered resolved.

i. (Closed) Unresolved Item (315/89004-06(DRS); 316/89004-06(DRS)): A concern was raised regarding the audit team composition in that audit team personnel selected by the licensee had direct responsibility for the fire protection program which was being audited.

On September 19, 1990, discussions regarding this issue were conducted by telecon between licensee staff and a Region III inspector. The licensee reiterated points discussed in the licensee's internal response to the issue dated September 6, 1990. Specifically, the licensee emphasized that the individual in question, although identified as an audit team member, served in a technical advisor/facilitator capacity only. The licensee also cited additional NRC guidance information which the licensee believed to be appropriate for the issue in question. The inspector concurred that having qualified licensee personnel available who are responsible for fire protection, to clarify and answer audit related questions during an audit is most appropriate; however, including these individuals as audit team members was not considered appropriate.

In accordance with the QA audit criterion and Generic Letter 82-21, the three-year audit must (emphasis added in the Generic Letter) be performed by an outside independent fire protection consultant. The fire protection engineer can be a licensee employee who is not directly responsible for the site fire protection program for two of three years, but must also be an outside independent fire protection consultant every third year.

During this inspection, it was the inspector's conclusion that the audit team member identified in NRC Inspection Report Nos. 315/89004-06(DRS) and 316/89004-06(DRS) had direct responsibility for portions of the fire protection program (design) being audited. Those portions of the fire protection program being audited included the Safe Shutdown Capability Assessment, the Fire Hazards Analysis, Information Notice No. 88-04, and other requirements. Having an audit team composition as described in the licensee's internal response did not assure the independence of future fire protection audit teams. Therefore, based on the above, this issue is considered a violation (315/90018-01(DRS); 316/90018-01(DRS)) as described in the Notice of Violation.

On September 28, 1990, the AEP Director of Quality Assurance specified that for future triennial fire protection audits, individuals having direct fire protection responsibility for this program will no longer be included as members of the audit team. On this basis, this issue is considered resolved.

j. (Closed) Violation (315/89004-07; 315/89004-07): This issue regarded the incorrect rerouting of the control cables for the Unit 1 East and Unit 2 West ESW pump discharge valves out of the opposite Unit control room cable vaults. The licensee implemented modification No. 12-MM-028 to reroute the affected cables out of the opposite Unit control room cable vaults. The rerouting was completed on May 10, 1989, in Unit 1 and on February 15, 1989, in Unit 2. In addition, the licensee enhanced procedure Nos. GP.3.1 (Design Changes) and PMP 5040 MOD.004 (Request For Change) by strengthening the design verification process. The procedure changes should prevent the recurrence of design control problems in the future. The inspectors have no further questions on this item.

k. (Closed) Violation (315/89004-08; 316/89004-08): The incorrect ESW electrical cable routing that was identified during the licensee's corporate design reviews on September 15, 1988, was not communicated to the plants' staff in a timely manner (greater than 90 days from the date of discovery). The licensee reviewed their corrective action process and determined that existing controls were sufficient to ensure that violations in this area would be prevented in the future. In addition, involved licensee personnel were instructed as to the importance of prompt communication of problem report evaluation results.

The inspectors had reviewed the licensee's corrective actions for LER Nos. 315/90008 (refer to Paragraph 4.b.) and 315/90010 (refer to Paragraph 4.c.). The corrective actions were initiated in a timely manner and they were adequate in the short term until the final corrective actions are implemented in upcoming outages. The inspectors have no further questions on this item.

l. (Closed) Unresolved Item (315/89004-09; 316/89004-09): Determine if non high/low pressure interface control cables should be analyzed for two hot shorts within a multiconductor cable.

The NRC has determined that multiple shorts within a multiconductor cable is not a credible event for a non high/low pressure interface circuit. This position is consistent with the guidance contained in Generic Letter 86-10. The inspectors have no further questions on this item.

4. Reportable Events

The inspectors reviewed the following Licensee Event Reports (LERs) by means of direct observation, discussions with licensee personnel, and a review of related documentation.

a. (Closed) LER (315/90007-LL; 316/90007-LL): This LER, although not reportable, was voluntarily submitted by the licensee. The LER regards the failure to apply fire resistive material on exposed structural steel within five lube oil storage rooms. This failure to protect the structural steel was determined to be a deviation from a licensee commitment which was described to the NRC in a January 31, 1977 response to Appendix A to Branch Technical Position 9.5.1.

According to the licensee's evaluation, each of the lube oil rooms is equipped with fire detection and fire suppression capability, in addition to fire brigade availability following identification of a fire condition. The licensee's corrective action to protect the exposed structural steel was scheduled for completion by October 1, 1990.

During this inspection, an inspector toured the identified areas and three others the licensee had found in need of additional structural steel protection. The inspector observed that fire resistive material installation activities were in progress and certain of these rooms were nearing completion. Discussions held between Region III staff and NRC Headquarters Fire Protection personnel did not reveal any further required actions, including interim compensatory measures. However, this issue is considered a deviation (315/90018-02(DRS); 316/90018-02(DRS)) from the licensee's January 31, 1977 commitment. This issue meets the tests of 10 CFR Part 2, Appendix C, Section V.G.; consequently, no Notice of Deviation will be issued and this issue is considered closed.

b. (Closed) LER (315/90008-LL; 316/90008-LL): This LER regarded 10 CFR Part 50, Appendix R design translation deficiencies which could have resulted in the loss of control power to all four ESW pumps or all four of the CCW pumps.

On June 19, 1990, the licensee identified that the isolation relay circuitry for the ESW low header pressure auto-start circuitry had been incorrectly installed. The Unit 1 pressure switches (WPS 701 and WPS 705) are located in the ESW Pipe Tunnel (Fire Zone 112). The Unit 2 pressure switches (WPS 702 and WPS 706) are also located in the ESW Pipe Tunnel (Fire Zone 113). However, the four pressure switches are located within approximately 3 feet of each other in the center of the shared pipe tunnel. There is no automatic detection or suppression capability located in this area.

The proposed design (RFC-01-2668 and RFC-02-2685) was to install isolation fuses (10A) and the isolation relay (63X-HPL) in the start circuitry of each ESW pump. The relay coil was to connect directly (through fuses) to the DC control bus through the pressure switch auto-start contact. A fire in the ESW pipe tunnel would have caused the isolation relay fuses to blow, isolating the affected pressure switches. Control power would therefore be available for starting the ESW pumps.

The design sketch was sent to drafting for incorporation onto the installation drawings. However, during translation, the isolation relay fuses were shown connected to the breaker's internal DC control power. The breaker's control power is fused through a 10A fuse in series with a 35A bus fuse. A fire induced short in a pressure switch had the potential to blow that breaker's 10A control power fuse. Because of the close proximity of all four pressure switches, all four of the ESW pumps could have lost their control power.

On June 20, 1990, the licensee identified that the same condition existed in the isolation relay circuit for the low header pressure auto-start circuit for the CCW pumps. The CCW pressure switches and pumps are located in Fire Zone 44 south. The licensee had installed a 78 inch high, three (3) hour rated fire wall between the Unit 1 and Unit 2 pumps. There were no intervening combustibles traversing the fire wall. The pressure switches were installed approximately 15 feet on either side of the wall, and automatic detection and suppression was provided in the fire zone.

The inspectors reviewed the two request for change (RFC) packages that installed the modifications. Both packages proposed the correct design. The installation drawings that were received back from drafting with the incorrect design had been checked, and approved for construction by the cognizant engineer. This condition has existed since the installation of other Appendix R type modifications (1985 time frame).

Failure of the licensee to verify that the ESW and CCW isolation relay design had been correctly translated onto drawings by a design interface organization is an example of an apparent violation (315/90018-03a(DRS); 316/90018-03a(DRS)) of 10 CFR 50, Appendix B, Criterion III, Design Control.

The licensee took immediate corrective actions when the above discrepancies were discovered. The negative and positive leg 10A fuses that were in series with the isolation relay coil were replaced with 5A fuses. This established an acceptable fuse to fuse selectivity ratio with the 10A breaker control power fuse. Minor modification 12-MM-110 was issued to restore the wiring and fuses to the original design intent. Unit 2 rewiring is in progress and Unit 1 rewiring will be completed during the next refueling outage.

The ESW and CCW systems are placed in service to support residual heat removal (RHR) cooldown in Procedure No. 1-OHP 4023.001.001, "Remote Shutdown Procedure." If either of these systems are not available, the procedure provided instructions on how to initiate restoration. Local control of the above system breakers is established by removing the control fuses, stripping all the outgoing wires and installing a jumper on Terminal Block No. AJ. If electrical power cannot be restored to the breaker, it is up to the control room operator to direct a manual closing of the breaker. The charging spring should be charged at this time which would permit one manual close attempt. If this failed, a jacking bar would be used to manually recharge the spring.

A reactor operator accompanied by the inspectors walked through the manual closing steps and the manual jacking steps. All of the reactor operators and auxiliary equipment operators had received training on manual operation of the 4160 Vac breakers.

The equipment utilized for manual operation of the breakers was provided in locked storage near the breakers. The Appendix R tool box was located in the switchgear room and contained the jumpers and the breaker manual trip cord. Personal safety gear, such as face shield, gloves and protective clothing, and the jacking bar were stored in a locked cabinet just outside of the switchgear room. The reactor operator was able to collect the necessary equipment in a reasonably short time frame.

Based on the above, the licensee would have been able to mitigate the consequences of a complete loss of ESW or CCW control power and restore ESW or CCW flow to support RHR cooldown.

c. (Closed) LER(315/90010-LL; 316/90010-LL): This LER regarded 10 CFR, Part 50, Appendix R cable routing deficiencies that had the potential to cause a loss of power to the Local Shutdown Indication (LSI) panels.

The licensee identified in Problem Report No. 90-874, dated July 20, 1990, that a number of Appendix R safe shutdown cables had been incorrectly routed.

The licensee determined on August 24, 1990, that Unit 1 safe shutdown cable No. 1-29685G, which runs between LSI panels No. 1-LSI-6 and 1-LSI-6X, ran through fire zones 41, 55, and 56 (fire areas (FA) 40, 48, and 49) which required complete alternative shutdown.

The Unit 1 normal power feed to the 1-LSI panels was assumed to be lost for a fire in any one of the above fire zones. A fire induced fault in cable No. 1-29685G would have eliminated the Unit 2 alternate feed to the 1-LSI panels. Due to the cable misrouting, the 1-LSI panel indications would have been lost. The existing plant operating and emergency procedures did not cover such an event. On September 6, 1990, it was discovered that a similar condition existed for one plant area involving the Unit 2 LSI panels. Cable No. 1-1936R, which provides the Unit 2 LSI panel's alternate power, had been run through fire zone 24 (FA 29) along with the LSI panel's normal power supply cable (2-12467). Neither of the cables had been provided with acceptable protection from fire. Consequently, a fire in fire zone 24 could have caused a complete loss of normal and alternate power to the Unit 2 LSI panels. However, fire zone 24 is not a complete alternate shutdown area and the Unit 2 LSI panels would not be required for a fire in this zone. These conditions have existed since the installation of other Appendix R type modifications (1985/1986 time frame).

For two of the affected locations (FA 40 and 29), the licensee claimed either a power source was subsequently found available or that an indirect means was available to obtain instrumentation information. For the remaining two areas (FA 48 and 49), no alternative methods or means were known to have existed for obtaining the lost instrumentation information. This could have adversely affected an orderly plant cooldown or could have adversely affected the licensee's ability to maintain the reactor in a safe condition. For a fire in fire zone 41 (FA 40), the licensee has determined that control room indication would not have been lost. The preferred power source to the control room instrumentation distribution inverters is located in fire zone 42C. Therefore normal control room process monitoring indication would have been available. However, safe shutdown procedures did not address the complete loss of the LSI panels and did not provide instructions to use the control room instrumentation.

For a fire in fire zones 55 and 56 (FA 48 and 49), both control room and 1-LSI power would have been lost. The licensee has determined that local steam pressure indication would have been available. However, instrumentation such as RCS pressure, pressurizer level, letdown and charging flow, T-hot, T-cold, source range, steam generator level, and RCS wide range temperature which are required for complete alternate shutdown areas would not have been available.

Failure of the licensee to verify or check that Cable No. 1-29685G and Cable No. 1-1936R were routed correctly are additional examples of an apparent violation (315/90018-03b(DRS); 316/90018-03b(DRS)) of 10 CFR 50, Appendix B, Criterion III, Design Control.

The licensee took immediate corrective action (Unit 1 LSI panels) and installed a 1A fuse to provide electrical isolation of cable No. 1-29685G. This fuse satisfactorily coordinates with the upstream 2.5A fuse. The two fuses were of the same class, rating and manufacturer. Cable No. 1-29685G will be rerouted out of the affected fire zones in the near future.

The licensee has initiated Minor Modification 2-MM-132 (Unit 2 LSI panels) to provide a one (1) hour fire wrap around approximately 10 feet of conduit No. 2-12467 that is run through fire zone 24 (FA 29). Upon completion, this will bring this fire zone into compliance with Appendix R. The fire wrap was to be completed during the Fall 1990 Unit 2 outage.

In all of the above fire zones, suppression and detection capability was available.

5. ERS Procedure Review

a. ERS Procedure 1-OHP 4023.001.001, Revision 9

The licensee has developed Procedure 1-OHP 4023.001.001 to provide an alternate method of achieving safe shutdown in Unit 1 with or without offsite power available in the event of a fire which precludes control of Unit 1 equipment from the control room or hot standby panel.

Once the procedure is entered and the decision is made to evacuate the control room, the reactor is tripped from the control room and the ERS team is assembled. Several other immediate actions will be attempted from the control room prior to evacuation. If unsuccessful, the remaining immediate actions can be performed from outside the control room. The Unit Supervisor will assign specific procedural attachments to the four reactor operators assigned to the ERS team by the Shift Supervisor. When an operator is assigned an attachment by the Unit Supervisor, he/she will perform that attachment in its entirety and then inform the Unit Supervisor when completed, and await further instructions. The Unit Supervisor will track attachment assignments and completions on the ERS Procedure Status Tracking Sheet which allows the Unit Supervisor to maintain a complete record of the procedure and ERS team member status during procedure implementation.

b. Plant Walkdowns

Plant walkdowns of selected ERS procedure attachments were performed during this inspection. The walkdowns were performed by a team consisting of one NRC inspector and two licensee representatives. The walkdowns were performed to verify that the ERS procedure specified actions could be accomplished using existing equipment, controls, and instrumentation. During inspector discussions with licensee personnel, it was indicated that the ERS procedures had been previously walked down in accordance with their administrative procedures. However, the following are specific examples of procedure deficiencies that were identified during the inspection:

- Attachments LS-2-1, "Cross-tie 1E/2W AFW," and LS-2-2, "Cross Tie 1W/2E AFW," Step 2.a directs an operator to manually open the motor driven auxiliary feedwater pump discharge cross-tie valves. However, the valves are located approximately 8 feet from the floor and would be difficult to reach without the use of a ladder. There was no dedicated ladder available for this purpose. The NRC inspector determined that a competent operator could reach the valves by standing on existing supports located on the floor below the valves.

- Attachment LTI-3-1, "DG1AB Trip And Isolation," Step 1.a.2.c directs the operator to close DG1AB Air Receiver Outlet Valves 2-DG-184A and 2-DG-186A. However, the valves in the plant are labeled as DG1AB Air Receiver Outlet Valves 1DG-183A and 1DG-185A. The fact that there are only two valves on the outlet of the air receivers allowed the licensee representative to identify the valves that were required to be closed even though the procedure referenced the incorrect valves. The procedure deficiency delayed completion of this step due to confusion on the part of the licensee representative, but did not prevent the task from being accomplished. Therefore, this deficiency is not considered to be safety significant. In addition, completion of this particular attachment is not required to achieve hot shutdown conditions for the plant.

- Attachment LTI-1-3, "Local Generator Output Breaker Trip And Isolation," Step 1.c.2.a directs the operator to install a jumper between points H1 and K1 on terminal blocks H and K in the circuit breaker K control cubicle. The procedure, as written, implies that the location of the circuit breaker K control cubicle is the 345kv switchyard control building. Contrary to this, the circuit breaker K control cubicle is actually located in the 345kv switchyard area. Due to this procedure deficiency, the licensee representative searched for terminal blocks H and K in the control building for approximately 30 minutes prior to locating them in the switchyard. Completion of this attachment is strictly for equipment protection, specifically the main generator, and is not required to achieve hot shutdown conditions in the plant. Therefore, this is not considered safety significant.

- Attachment LS-2-3, "Relatch U1 Turbine Driven Auxiliary Feedwater Pump (TDAFP)," Step 3.a.2.b directs the operator to install a jumper across terminal block TCF points 14A and 15 for local TDAFP turbine speed indication. However, there was no dedicated jumper available at the cabinet to complete this step which would delay completion of this attachment. Completion of this particular attachment is not required to achieve hot shutdown conditions in the plant. Therefore, this finding is not considered to be safety significant.

It was determined following an in-office review that similar human factor procedure deficiencies were identified during the 1982 Appendix R inspection and 1988 Emergency Operating Procedure inspection. Based on the recurring human factor procedural deficiencies identified during this inspection, these repetitive types of deficiencies are considered an apparent violation (315/90018-04a(DRS); 316/90018-04a(DRS)) of 10 CFR 50, Appendix B, Criterion XVI, Corrective Action.

c. Simulated Fire Scenario

A simulated fire in the cable vault requiring control room evacuation was conducted utilizing a crew of licensed operators that were on their continuing training week. The crew consisted of a Shift Supervisor, a Unit Supervisor and four reactor operators. This is the required ERS team composition necessary for ERS procedure implementation as committed to by the licensee. A member of the inspection team accompanied each operator performing the tasks assigned by the Unit Supervisor. The scenario was terminated after stable hot standby conditions were achieved.

The scenario was a timed exercise in which the inspection team could analyze the following time sensitive actions and their associated required completion times as identified by the licensee:

- Perform a reactor trip prior to control room evacuation.
- Establish RCS isolation within 8 minutes of spurious pressurizer PORV operation.
- Restore process monitoring instrumentation within 20 minutes of control room evacuation.
- Restore RCP seal injection within 30 minutes of loss of charging and thermal barrier cooling.
- Restore Auxiliary Feedwater flow within 40 minutes of reactor trip.
- Commence RCS cooldown within 90 minutes of initiating seal injection.

The inspection team noted the following items as a result of the simulated fire scenario timed exercise:

- The communications to and from the Unit Supervisor were clear, concise and easily understood.

- The ERS procedure status tracking sheet is a very effective tool for the Unit Supervisor during procedure implementation.

- All of the identified time sensitive actions were completed within the allowed time.

- The external speaker for the radio at the hot Shutdown Panel failed to function. However, the headset that the Unit Supervisor was wearing did function properly.

- The operators displayed a good understanding of the procedure and the safe shutdown equipment required.

- After initial control room evacuation, some operators re-entered the control room through the affected fire barrier to get assignments from the Unit Supervisor. When the inspection team questioned the licensee about this inappropriate transit route, the licensee identified an appropriate alternate route that would be used by the operators in the case of a real fire emergency.

- CVCS cross-tie flow indicator 12-QFI-201 is a 0-150 gpm dual gauge which is to be used to locally monitor CVCS flow for pressurizer level control. The dual gauge design allows the same gauge to be used when Unit 1 is supplying Unit 2 as well as when Unit 2 is supplying Unit 1. The gauge design along with its proximity to the CVCS cross-tie flow control valve rendered the flow indication difficult to read.

- While executing attachment LTI-2-1, "Steam Line Isolation," vent valves 1-CA-2515 and 1-CA-2480 are required to be opened to bleed control air from 1-MRV-242 and 1-MRV-231 causing them to fail open. It was noted that 1-CA-2515 and 1-CA-2480 had installed pipe caps which required a wrench for their removal to accomplish the task. No dedicated wrench was available for this purpose. This could preclude completion of this attachment in a timely manner. Completion of this attachment is not required to achieve hot shutdown conditions and is therefore not considered to be safety significant. This item is a further example of an apparent violation (315/90018-04b(DRS); 316/90018-04b(DRS)) of 10 CFR 50, Appendix B, Criterion XVI, Corrective Action.

At the conclusion of the simulated fire scenario, the findings were discussed in detail with the licensee. The licensee acknowledged the inspection team's observations and stated that they would evaluate the need for a different method of verifying CVCS cross-tie flow. The licensee also stated that any tools required to accomplish procedural tasks would be dedicated for that purpose.

In general, the inspection team concluded that the D. C. Cook ERS procedure was technically accurate and could be accomplished using existing equipment, controls and indications. This inspection review encompassed an overall re-review of the ERS procedure. The current ERS procedure revision eliminated many of the previous ERS procedure deficiencies identified in previous inspections. Other current ERS procedure deficiencies are discussed in this report. On the above basis, inspection report items 315/82-08-06A and 07; 316/82-08-06A and 07 are considered closed. In addition, inspection report item 315/87016-03; 316/87016-03 is also considered closed. The licensee committed to perform complete walkdowns on both Unit 1 and Unit 2 ERS procedures, and to incorporate any applicable human factor procedure deficiencies identified including the human factor procedure deficiencies identified by the inspection team.

The team noted that the minimum staffing requirements described in OHI-4011, "Conduct Of Operations" (Shift Staffing), Revision 4, were not sufficient to ensure that the required number of licensed operators would be available to implement the ERS procedure. The minimum shift staffing requirements identified in OHI-4011, Step 3.1.7, were as follows:

a) With both units operating (Modes 1 through 4)

1 Shift Supervisor (SRO)
2 Unit Supervisors (SRO)
4 Reactor Operators (RO)
4 Auxiliary Operators

b) With one unit operating (Modes 1 through 4)

1 Shift Supervisor (SRO)
1 Unit Supervisor (SRO)
3 Reactor Operators (RO)
3 Auxiliary Equipment Operators

In addition, Step 3.1.2 of OHI-4011 states, "A unit supervisor with a Senior Reactor Operators license (SRO), shall, at all times be in the control room from which a reactor is being operated," and Step 3.1.3 of OHI-4011 states, "A licensed Reactor Operator shall be present at the controls at all times." In the event of a fire in one unit with both units operating, a minimum of <u>five</u> Reactor Operators would be required. Four Reactor Operators would be required to implement the ERS procedure and one Reactor Operator would be required to remain "at the controls" in the unaffected unit. Contrary to this, the minimum staffing requirement described in OHI-4011, Step 3.1.7.a, for both units operating, was 4 Reactor Operators.

Additionally, an Appendix R fire with only one unit operating would also require a minimum of five reactor operators. Contrary to this, the minimum staffing requirement described in OHI-4011 Step 3.1.7.b. for one unit operating, was three reactor operators. In this situation, the minimum staffing requirements would fail to ensure enough licensed personnel were available to implement the ERS procedure.

The licensee took prompt corrective actions when the inspection team identified the inadequate minimum staffing requirements. Standing Order OSO.100, "Administrative Manning Requirements-Appendix R," Revision 0, was issued on September 26, 1990, to specify the following minimum shift manning requirement when one unit is in Modes 1-4:

Three (3) - Senior Reactor Operators
Five (5) - Reactor Operators (can hold SRO license)
Six (6) - Auxiliary Equipment Operators

In addition, the licensee has committed to revising OHI-4011 by December 15, 1990, to reflect the minimum shift manning requirements described in Standing Order OSO.100.

The licensee was informed that failure to assure that activities affecting quality are prescribed by adequate procedures and accomplished in accordance with the procedures is an apparent violation (315/90018-05(DRS); 316/90018-05(DRS)) of 10 CFR 50, Appendix B, Criterion V, Instructions, Procedures and Drawings.

d. ERS Procedure Review and Approval Process

With the exception of one procedural deficiency which the licensee promptly corrected, the inspection team considered the review and approval process in place for the ERS procedure to be adequate. On this basis, Inspection Report item 315/82-08-08; 316/82-08-08 is considered closed.

e. April 1990 SER Issue 2.8.1 - Need for HVAC to Support Safe Shutdown

The staff noted that except for certain electrical equipment such as the emergency diesel generators HVAC was not identified as being required to maintain the viability of safe shutdown equipment.

During the audit, the licensee provided calculations addressing the following equipment and scenarios:

(1) Steady state temperature in the diesel generator transfer pump room under loss of HVAC.

(2) Maximum ambient temperatures in the West motor-driven auxiliary feedwater pump room 72 hours after loss of HVAC due to a fire.

(3) Maximum ambient temperatures in the East and West switchgear rooms 72 hours after loss of HVAC. Also included were similar calculations for the 4KV switchgear rooms, inverter room, CRDM power cabinet room and battery room.

(4) 72 hour time-temperature curve calculations for centrifugal charging pump rooms with the pumps running and no forced ventilation.

(5) Steady state temperature in any RHR pump cubicle with the pump running and no forced ventilation.

Also provided was an undated "Loss of HVAC Study" which attempted to answer the staff's concerns, and an internal memorandum dated April 26, 1988, which addressed the loss of ventilation to the diesel generator rooms, the inverter rooms and the AB and CD battery rooms from the perspective of routing of electrical cables and associated circuits.

The most obvious omissions in the licensee's information were the following:

(1) An analysis regarding the loss of control room ventilation due to postulated fires outside the control room.

(2) An analysis regarding loss of ventilation to one unit's mechanical components such as the centrifugal charging pumps or auxiliary feedwater pumps.

The failure to verify that the design of the HVAC fan motors' circuits precluded, for fire zones 44N/44S, 51/52 or 69, the vulnerability of a simultaneous loss of HVAC for both Unit 1 and Unit 2 control rooms is considered a further example of an apparent violation (315/90018-03c(DRS); 316/90018-03c(DRS)) of 10 CFR 50, Appendix B, Criterion III, Design Control.

In response to the inspector's questions, it was determined that a postulated fire in fire zones 44S/44N, 51/52 or 69, as described in LER Nos. 315/90009-LL; 316/90009-LL, could result in a loss of HVAC to both units' control rooms simultaneously. The licensee's evaluation of control room temperature response for a loss of both unit's HVAC, without a concurrent loss of off-site power, concluded that the control room temperature would reach 120 degrees F in two hours, 135 degrees F in ten hours and 175 degrees F at the end of the 72 hour period. Additional control room temperature evaluations were conducted by the licensee utilizing different event criteria. Two additional evaluations that were performed concluded the following:

- If normal control room lighting was shut off, (with the operators utilizing emergency lighting) combined with propping open the control room doors leading to the turbine building, the control room temperature would reach 120 degrees F in 18 hours and the maximum control room temperature would be 133.9 degrees F.

- If both the control room doors leading to the turbine building and the door leading to the auxiliary building were propped open while using portable fans to circulate air through the control room at 4000 cfm, with normal control room lighting, the

control room temperature would reach 120 degrees F in 10 hours. The maximum control room temperature under those criteria would be 132.2 degrees F.

It was concluded that for all cases the operators could achieve hot standby and execute actions to be in hot shutdown from each unit's control room. Following the time period to reach 120 degrees F, the control rooms would become uninhabitable. Evacuation of both control rooms would be required and the ERS procedure would be implemented for both units. The following is the issue of concern regarding loss of HVAC to both units simultaneously.

- The ERS procedures in effect during the inspection were not designed to shutdown both plants simultaneously. This could adversely affect the licensee's ability to maintain hot standby conditions and subsequently achieve cold shutdown conditions within 72 hours. Additionally, simultaneous implementation of the ERS procedures for Unit 1 and Unit 2, if both units were operating, would appear to require 11 licensed operators, 1 Shift Supervisor (SS), 2 Unit Supervisors (USs), and 8 Reactor Operators (ROs) (4 ROs for each unit). Contrary to this, the licensee recently issued Operations Standing Order OSO.100, "Administrative Manning Requirements - Appendix R," Revision 0, which requires only 8 licensed operators (3 Senior Reactor Operators (SROs), 5 ROs) as the minimum shift manning with one unit operating. This would provide the number of licensed operators needed to shut down one unit, but would fail to ensure enough licensed operators were available to simultaneously implement the ERS procedure if both units were operating. OSO.100 is presently the most conservative requirement regarding shift manning in effect.

This issue is considered an example of an apparent violation (315/90018-06(DRS); 316/90018-06(DRS) of Sections III.G.3 and III.L of Appendix R to 10 CFR 50.

During discussions with the NRC inspectors regarding this event, the licensee indicated that the control rooms would not necessarily be evacuated, and implementation of the ERS procedure for both units simultaneously would not be required. The licensee stated that the ERS procedures would be entered upon initiation of the event but would be exited prior to assembly of the ERS team, once the fire in the affected zone was contained, and it was determined that the fire had not come in contact with any normal safe shutdown equipment. At this point, the unit supervisors would make the decision to allow the units to remain at power or be shut down. In either case, normal operating procedures would be utilized and not the ERS procedures. Concurrently, a restoration procedure, which is under development, would be implemented to restore HVAC to the control rooms to preclude simultaneous evacuation of both control rooms.

The licensee took prompt interim compensatory measures upon identification of the potential for simultaneous loss of HVAC to both control rooms. These compensatory measures involved the establishment of roving fire watches in the affected areas. The

roving fire watch will continue to be posted in the areas of concern until: 1) plant procedures are revised to incorporate actions for restoration of control room cooling capability in the event of fire induced loss of this capability; 2) the necessary repair equipment is made available for restoration of HVAC to both control rooms and power supplies required by the restoration procedure have been committed for Appendix R use (these repairs are not required to achieve hot shutdown conditions); and 3) cognizant personnel are made aware of the actions required to mitigate the loss of control room cooling during a fire. The long term corrective action is to institute procedures to cope with fire induced loss of normal control room HVAC.

f. April 1990 SER Issue 2.10.1 - Diagnostic Instrumentation

The staff noted that in the 1987 revised safe shutdown methodology, no diagnostic instrumentation was identified as being required for post fire safe shutdown. This is contrary to the information provided in Information Notice 84-09.

During the audit, the licensee maintained that no diagnostic instrumentation was required beyond the process monitoring functions explicitly identified in Information Notice 84-09 (i.e., source range monitoring, pressurizer pressure and level, etc.). However, the inspectors noted that during the emergency procedure walkdown certain instruments such as a CVCS cross-tie flowmeter and a steam generator PORV nitrogen accumulator pressure gauge were procedurally called out. The licensee agreed to identify these as diagnostic instrumentation. On this basis, this issue is considered resolved.

g. April 1990 SER Issue 2.11.1 - Manual Operator Actions

The staff noted that the licensee was taking credit for a number of manual operator actions to achieve safe shutdown. The staff's concerns were:

(1) Operator actions were credited in the fire area within the first hour after the discovery of a fire, and

(2) An unrecoverable plant condition may develop due to fire damage before operator actions are implemented in any fire area.

In reviewing Procedure 1-OHP 4023.001.001, Revision 9, "Emergency Remote Shutdown," the only direct reference to performing operator actions in a fire area after the discovery of a fire occurs in Attachment LTI-6, "Trip/Isolation of Spuriously Actuated Pumps." For spurious operation of the charging, safety injection, containment spray or residual heat removal pumps, the procedure states that if the 4KV switchgear room is accessible and free of fire damage, enter the room to remove control power fuses and trip the pump breaker for the respective pump. An alternative step is provided which involves actions outside the switchgear room (i.e., to locally open the circuit breaker for the respective pump's miniflow

recirculation valve and manually open the valve so that the pump is in the recirculation mode).

The remote shutdown procedure is also intended to apply for all of the fire zones which require either complete or partial alternative shutdown. For those fire zones, reliable control from inside the control room may not be feasible. A concern was noted during the procedural walkdown that the individual sub-procedures within the numerous attachments are not performed in any rigid sequence by specific operators. Rather, as individual operators complete the sub-procedures, they report back to the Unit Supervisor, who then assigns them to perform possibly a completely different sub-procedure in another attachment. This causes the operators to traverse the plant in an almost random order. Depending upon which fire zone the fire occurs in, the access path between the location of one operator action point to the next assigned location will vary. This has implications from both the point of view of the necessity for operators to traverse the fire affected area and the time required to take alternative routes, as well as the location of emergency lighting throughout the plant. The licensee was questioned as to whether the time-manpower studies that had been performed accounted for the need to avoid the fire affected areas for those fires outside the Control Room. The response was that it had not been specifically addressed, but that access paths to and from the control room to the individual locations could be considered to simplify the analysis.

A sample walkthrough considering realistic access paths between action locations specified in the procedure was developed by the licensee during the inspection for Fire Zone 44S, auxiliary building South - EL.609'. These access paths were partially walked down by the inspector on September 14, 1990. The feasibility of performing the required actions was considered adequate. Based on this limited sampling, the inspectors considered the feasibility of performing the required manual actions for fires in fire zones outside the control room which require complete alternative shutdown to be adequate.

h. <u>April 1990 SER Issue 2.12.1 - Hot Shutdown Repairs</u>

The staff had two specific concerns:

(1) that repairs for hot shutdown were being proposed and

(2) that shutdown procedures indicated that certain actions would only be taken after consultation with a corporate engineering team and the potential delay involved.

These issues were closed out in the SER based on the licensee's response, in the first case, that repairs to the RHR system were only required to achieve cold shutdown, not hot shutdown, since RHR is not required during hot shutdown and, in the second case, that the consultation (which involves the repairs to the RHR system) would only take place after hot shutdown had been achieved.

In addition, for cold shutdown, repowering of one RHR pump in the fire affected unit may be required. This is accomplished by repowering the pump through disconnection of the power supply to either the RHR or containment spray pumps in the unaffected unit. This is a cold shutdown repair and is procedurally addressed.

During the onsite visit to verify the SER closeout assumptions, Maintenance Procedure No. 1MHP2140.082.001, Revision 2, "Maintenance Procedure for Repowering an RHR Pump," was walked down. Only two problems of a minor nature were noted. One was that a label on the cable spool with the cable designated for the RHR pump repair indicated that the cable was purchased for an auxiliary feedwater pump. The other was that some confusion could result from step 7.3.3 which states, "Route the temporary power cable between the Unit 2 supply 4KV breaker and the Unit 1 motor." This is preceded by step 7.3.2 which states, "Route the jumper cable assembly between the U-2 motor and the U-1 motor." Step 7.3.3 is really an alternative to 7.3.2, and is not necessarily preferred.

Prior to the exit interview, the licensee indicated that the cable spool label had been removed and also provided a procedural change notice which clarified the procedural steps. Therefore, this item remains satisfactorily addressed and closed.

i. April 1990 SER Issue 2.13.1 - Hot Shutdown Panel Isolation

The staff's concern regarded a fire in the local shutdown indication panel area that might result in damage to the normal shutdown capability in the control room.

The licensee noted that the local shutdown indication (LSI) panels were physically and electrically isolated from the control room. During the onsite review, the licensee's method of providing physical and electrical separation for the LSI panels was reviewed and found to be acceptable. The LSI panels are physically located in fire areas separate from the control room and are adequately provided with electrical isolation through the use of isolation/transfer switches.

j. Safe Shutdown Systems Review

The licensee has made provisions to utilize all of the systems necessary to achieve safe alternative shutdown conditions from initial hot standby to hot shutdown and finally to cold shutdown. The measures taken provide reactivity control, reactor coolant system level and pressure control, decay heat removal, process monitoring, and all appropriate support systems. These measures are in accordance with the November 22, 1983 SER and subsequent exemption request approvals.

k. Alternate Shutdown Method(s) Review

Of the five alternate shutdown methods, Method AS1, "Complete Alternative Shutdown" was reviewed and evaluated during the walkdown

and drill of Emergency Operating Procedure 1-OHP 4023.001.001, "Emergency Remote Shutdown," Revision 9, dated September 7, 1990 (which applies to Unit 1). The drill was conducted to the point of achieving hot standby conditions. The procedure and method satisfactorily addressed all of the required actions to achieve reactivity control, reactor coolant pressure and level control, decay heat removal, and process monitoring, and assured the availability of appropriate support systems.

1. Summary

The inspection team identified a number of "Human Factor" type procedural weaknesses during the procedure walkdowns and simulated fire scenario. The procedure review process in place should have identified these procedure deficiencies. The fact that these items were not identified during the review process demonstrates a lack of "attention to detail" on the part of the licensee.

In addition, the inspection team reviewed procedure weaknesses that were identified during a recent SSFI regarding the plant alternate shutdown capability. It was determined by the inspection team that the ERS procedure currently in effect, 1-OHP 4023.001.001, Revision 9, adequately addresses the procedure weaknesses identified above.

6. Communications

The normal communications system used at this site was the Public Address (PA) system. The fire and emergency two-way radio system initially used a single repeater which was located in the Unit 2 4KV switchgear room. During operator training on the emergency remote shutdown procedures, the radio system was used and was found acceptable at all critical safe shutdown equipment locations.

For a fire in any fire zone in Unit 1, the radio system was available. For most fires in Unit 2, the radio system would be available with normal PA communications also available. The only Unit 2 fire which would disable the radio system was a fire in the Unit 2 switchgear room, a safe shutdown fire area (FA NN). The inspectors determined that the PA system would have been available to back up the radio system for a fire in FA NN.

The licensee has proposed enhancements to the entire radio system. The changes should provide broader plant radio coverage and provide a total of three channels for use during an emergency. Also, a second radio system has been installed in Unit 1.

7. Emergency Lighting

During the original post fire safe shutdown inspection (April 12-16, 1982), three areas of the plant did not have emergency lighting units installed as required. Subsequently, licensee letters dated May 4, May 10 and June 11, 1982, addressed the corrective actions to be taken in the emergency lighting area. The June 11, 1982 letter indicated that the emergency lighting requirements had been corrected in areas identified as requiring emergency lighting. The June 1982 letter further specified that

the safe shutdown capability reanalysis could necessitate the installation of additional emergency lighting units in new areas. The previously deficient three areas were confirmed to have emergency lighting units installed during a subsequent inspection. The inspection report pertaining to that inspection noted that the overall adequacy of the installed emergency lighting system was scheduled for review during this inspection. Consequently, during this inspection, the inspectors conducted a review of the emergency lighting area.

The review consisted of the following: (1) witnessing an eight hour emergency lighting battery draw down (discharge) test; (2) witnessing a simulated loss of AC power test; (3) selective walkdown of emergency lighting to determine that adequate lighting units were in place; and (4) emergency lighting surveillance procedure review.

On September 12, 1990, a full eight hour discharge test was conducted on five emergency lighting units to determine the operability of the units in their installed condition. An inspector witnessed the initiation of each unit's test and periodically checked these units during the test. Each of the five emergency lighting units continued to light after eight hours. Therefore, all tested units passed the eight hour discharge test.

Also, on September 12, 1990, a simulated loss of AC power test was performed in five plant areas to determine the adequacy of illumination provided by the units in their installed locations. As a result of this test, the NRC concluded that an appropriate number of emergency lighting units were installed in each of these plant areas and that with one exception, adequate illumination was provided. Emergency lighting unit No. 364, located in the Unit 1 reciprocating charging pump room, was observed to be inoperable at the initiation of the test. However, it was concluded that this defective emergency lighting unit would have been identified during the next surveillance. Prior to the team's departure from the site, the licensee installed an operable lighting unit at the Unit 1 reciprocating charging pump room location.

An inspector also reviewed the emergency lighting unit periodic planned maintenance (PM) Task 9, dated May 24, 1990, and the annual preventive maintenance Task 9, dated April 13, 1989. These procedures were determined to be generally satisfactory. However, no administrative system was in place to ensure that the yearly draw down test included a sampling of emergency lighting units required for safe shutdown. Also, the licensee needs to consider having a formal process for assuring that following the annual testing of the sampled emergency lighting units, adequate interim lighting (e.g., hand held lights) is available for operator use, if needed, until the tested batteries have been adequately recharged. Finally, the inspector requested the licensee to determine whether the three types of emergency lighting unit bulbs could be physically interchanged. If so, the procedure should be revised to require that defective bulbs are replaced by identical type bulbs.

As part of the emergency lighting review, an evaluation of LER No. 90006 (dated August 28, 1990) was conducted. This LER regarded three emergency lighting walkdowns (April 19, June 20-21, and July 17, 1990) that had determined that lighting needed to be improved in certain plant areas to

facilitate the accomplishment of the emergency remote shutdown procedures. During this inspection, inspectors walked down plant areas that had been identified as having inadequate lighting along with other designated alternative shutdown routes not identified as having lighting deficiencies but still required for safe shutdown. In addition, during the timed emergency remote shutdown procedure drill (postulated Unit 1 control room/cable vault fire scenario) the adequacy of emergency lighting was observed. On the above basis, along with the lighting system tests noted previously, it was determined that adequate emergency lighting was now in place. However, for Revision 8 of the emergency remote shutdown procedure (addressed in the LER) and for Revision 0 of the emergency remote shutdown procedure (in effect as of June 10, 1986), it was concluded that numerous examples of an inadequate emergency lighting evaluation were known to have occurred. Also, during this inspection, a review of completed emergency lighting surveillance procedures determined that adequate timely corrective actions had not been taken until recently to preclude repetitive failures of emergency lighting system unit components. In April 1990, the licensee recognized this deficiency and took proper corrective actions. At that time, it was confirmed that the same repetitive lighting problems were being identified during successive surveillances; however, the need to complete the surveillances rather than the corrective actions were taking priority. The inadequate emergency lighting evaluation and the failure to take adequate timely corrective action to preclude repetitive failures of the same emergency lighting units are considered as further examples of an apparent violation (315/90018-04c(DRS); 316/90018-04c(DRS)) of 10 CFR 50, Appendix B, Criterion XVI, Corrective Action.

In addition, the licensee received an NRC exemption (May 26, 1987) from installing an emergency lighting unit with eight-hour battery power in the outdoor yard adjacent to the nitrogen regulator valves. The existing outdoor lighting system is powered from a normal power source and may be powered from the security diesel generator. The lighting system power and control cables are run external to the plant. The security diesel generator is tested monthly and is also located external to the plant. Based on the above, this portion of the outdoor lighting system satisfies the 10 CFR 50, Appendix R, Section III.J emergency lighting requirement.

8. Associated Circuits

a. Review of the Common Power Source Associated Circuit Concern

The sample of circuits selected for in-depth review of this concern was based on a pre-inspection review of related documentation submitted to the inspection team by the licensee. This documentation included the D. C. Cook Safe Shutdown Capability Assessment Report (SSCA), Revision 1, dated December 1986 and a contractor (Impell) evaluation entitled Electrical Protection Coordination Study, Report Number 09-0120-0146, Revision 1, dated November 21, 1988.

As a result of this review, the Impell coordination study was found to identify several examples of power supplies, which may be relied on to achieve post fire safe shutdown, that lacked an adequate level of coordination. The scope of the Impell coordination study included

all onsite power sources (4160Vac and below) and was not limited to a review of only those power sources identified in the SSCA as required to achieve post fire safe shutdown. The licensee has initiated corrective actions under Request for Change (RFC) DC-12-3008 which will address, and correct as necessary, all coordination deficiencies identified in the Impell report.

During the audit, the licensee was requested to provide additional technical justifications regarding Appendix R coordination deficiencies identified by the Impell study. The licensee was subsequently able to provide sufficient information necessary to adequately address all of the inspector's concerns.

(1) High Impedance Faults

As stated in Section 5.3.8 of Generic Letter 86-10, the NRC staff has determined that to meet the separation criteria of Sections III.G.2 and III.G.3 of Appendix R, simultaneous high impedance faults (below the trip point of the breaker on each individual circuit) for all associated circuits located within the fire area should be considered in the evaluation of safe shutdown capability. Therefore, circuit coordination studies should not be limited to a review of low impedance "bolted" type faults, such as those considered in the Impell study, but must also consider the affects of high impedance (arcing) type faults which may occur simultaneously as a result of fire on all associated circuits of a required power supply that are located in a fire area of concern.

The D. C. Cook circuit coordination studies and related documentation did not include a detailed evaluation of the potentially adverse affect of simultaneous high impedance faults. In its response, dated February 21, 1990, to an NRC Request for Additional Information (RAI) related to this issue, the licensee described its "position" on the credibility of occurrence for such faults, rather than provide a detailed technical evaluation of the concern. The licensee's response stated, in part, "The Generic Letter GL 86-10 postulates a fault potentially affecting associated safe shutdown circuits that is unlikely to happen and does not justify detailed evaluation." The status of the licensee's evaluation of the high impedance fault concern remained open in the Safety Evaluation Report (SER) issued by the staff on April 26, 1990. In its response (SER item 2.23), the staff stated that the licensee's position would be scrutinized during the upcoming fire protection audit.

At the time of the audit, the licensee was requested to provide a technical basis which would support its argument presented in the February 21, 1990 submittal. In response, the licensee presented an "Executive Summary" of a currently ongoing evaluation of the concern. A review of this summary document found it to state the basic assumptions being applied during the evaluation. The electrical systems reviewer found these

assumptions to be comparable to those previously found to be acceptable by the NRC/NRR staff during its review of similar evaluations performed by other facilities. Based on the initial implementation of the basic assumptions, however, the summary document was found to identify numerous required power sources for each unit as being potentially affected as a result of such faults. It should be noted that the overall objective of this preliminary study was to screen for potentially affected supplies by applying the basic fault assumptions to all power sources required to achieve post fire safe shutdown. As a result, those supplies which would not be affected under any postulated fire scenario were segregated from those which exhibited a potential for loss due to the occurrence of such faults on connected cabling. The limiting factors for determining if a specific supply would actually be affected by such faults are typically the current interrupting rating of the feeder breaker/fuse to the supply and the number of power supply load cables that may be located within a specific fire area. The licensee was currently in the process of identifying the specific cable routing, by fire area, of load cables associated with required power sources which have the potential for loss due to the occurrence of such faults. During a telecon between the licensee and NRC personnel, the licensee indicated that no examples of high impedance faults affecting safe shutdown had been found.

The licensee was to have completed the Appendix R review including the high impedance fault analysis by July 11, 1986. This issue is considered an unresolved item (315/90018-07(DRS); 316/90018-07(DRS)) pending further review of this issue.

This issue also correlates to an NRR open item numbered 2.23.1 as described in the April 26, 1990 SER.

b. Review of the Spurious Signals Associated Circuit Concern

The licensee's analysis of this concern is documented in Section 4 of the Safe Shutdown Capability Assessment Report (SSCA). Section 4.7 of this report indicates that Failure Modes and Effects Analyses (FMEA) were performed to determine if the mal-operation of control circuit interlocks between required equipment and other equipment could prevent the proper operation of the safe shutdown equipment; or if fire initiated conductor-to-conductor shorts, open circuits or shorts to ground on cables of equipment that had the potential to defeat safety functions as a result of their spurious operation, could result in a component transition to an unacceptable state.

A review of the licensee's analysis and method of protection for fire initiated spurious signals did not identify any items of concern and was found to be acceptable.

c. Common Enclosure Associated Circuit Concern

Based on a review of a sample of raceways known to contain circuits required to achieve post fire safe shutdown, the licensee's protection for the Common Enclosure concern was found to be acceptable.

d. Review of Redundant Train Cable Separation (Cable Routing)

During the inspection, the routing of power and control cables associated with redundant components required to achieve post fire shutdown was reviewed. The objective of this review was to verify, on a sample basis, compliance with the separation requirements of Section III.G.2 and III.G.3 for redundant trains of cabling of required equipment. The licensee's method of compliance was found to be acceptable based on the inspector's review of color coded cable tray and raceway drawings which depicted the power and control cable routing of selected components.

9. Fire Barriers

a. Doors

Fire doors in fire area boundaries were reviewed to determine if the doors were rated to the fire resistance requirements defined in the Fire Hazards Analysis. In addition, doors were inspected to determine if modifications have been performed which may degrade the fire rating of the door. Based on a plant walkdown, no doors within fire area boundaries were found which were not properly rated. Modifications were noted on some doors for security hardware. However, the licensee had evaluated each of the modifications including having Underwriter's Laboratories, Inc. perform an independent review of the doors. This review was documented in a report dated January 23, 1985. The UL report identified a number of minor changes required to correct door deficiencies. These changes had been performed by the licensee. Procedures were also reviewed which require prior approval by the Fire Protection Coordinator before any new modifications to doors can be performed.

During the plant walkdown, some doors were found to be in a degraded state and would not close properly. These doors, however, were appropriately identified as inoperable. A fire watch patrol had been established. As a result of the review of fire doors, it was determined that the licensee had installed rated doors in fire area boundaries, had adequately evaluated modifications to these doors and had in place adequate administrative procedures to control door modifications and impairments.

b. Penetrations

The inspector reviewed fire barrier penetration seals to determine if they were adequately installed and qualified to the required fire rating. Design documentation was reviewed in addition to visual inspection of randomly selected seals. Although the seals inspected were properly in place and did not appear to be degraded, the

inspector was concerned that the fire resistive rating of a number of seals in the plant could not be supported by fire test data. NRC Generic Letter 88-04 provides guidance on the qualification of fire barrier penetration seals and references acceptable test criteria. The licensee stated that subsequent to the issuance of Generic Letter 88-04, a program had been initiated to review penetration seal qualifications. This program is intended to substantiate seal qualification by analyzing a minimum of 100 randomly selected seals. The licensee stated that if problems were found with these seals, the sample would be expanded. The licensee committed to an August 1, 1991 completion date for this program. The inspector reviewed penetration seal documentation that had been collected at the time of the inspection. Based on this review and a determination that no substantial problems had been identified to date, this issue is considered closed.

c. Barrier Evaluations

Section 3.1.2 of NRC Generic Letter 86-10 provides guidance on evaluating fire area boundaries. This section states that "where boundaries are not sealed floor-to-ceiling and/or wall-to-wall, evaluations must be performed to determine if the barriers can withstand the fire hazards associated with the adjoining fire areas. These evaluations can be submitted to the NRC staff but must be available for NRC audit."

During this inspection, the inspector requested to see any evaluations that had been performed on fire area boundaries that had not been previously reviewed by the NRC. The licensee presented a list of 21 evaluations that had been performed in accordance with criteria in Generic Letter 86-10. The inspector randomly selected fire evaluations from this list (Appendix A) and reviewed them for acceptability. Based on this review, the inspector found the evaluations to adequately address discrepancies in fire area boundaries and to provide a sound engineering basis for acceptability of the stated discrepancy. In addition, a field walkdown was performed to assess barrier adequacy. No discrepancies in barrier integrity were found which had not been previously addressed by the licensee.

d. Structural Steel Protection

The inspector reviewed measures used to protect structural steel members that were either part of a fire barrier or could affect the integrity of a fire barrier should they fail. Unprotected structural steel was identified in several areas of the plant. The licensee presented the inspector with an analysis which calculated projected steel member temperatures during a fire. The analysis methodology was the same used at several other plants and had been previously accepted by the NRC. The licensee's analysis identified one area where the unprotected steel would reach its failure point during a fire. For the one area, the Screenhouse, it was determined that the potential existed for the roof to collapse. However, the licensee concluded that collapse of the roof would not impact the ESW pumps

due to the design of the ESW pump enclosures. After review of the analysis, the inspector concluded that the licensee had adequately addressed concerns related to unprotected structural steel.

e. Conduit and Cable Tray Protection

The inspector reviewed cable tray and conduit protection including drawing review, installation procedure review and field verification. The licensee has utilized Thermalag manufactured by TSI, for protection of safe shutdown circuits. This material is qualified as a 1-hour barrier and has been accepted by the NRC for use at a number of plants. The inspector reviewed the licensee's installation procedure which was based on manufacturer supplied design details. This procedure was found acceptable. The inspector reviewed the installation drawing accuracy by randomly selecting raceways and conduits, from the safe shutdown analysis, which required protection to meet the requirements of Appendix R. A field walkdown of these raceways and conduits was performed to verify that Thermalag was adequately applied. Based on the walkdown, no discrepancies were observed relating to the appropriate installation of Thermalag.

10. Fire Detection and Suppression

a. Partial Coverage Detection and Suppression

Appendix R and supplemental guidance provided in Generic Letter 86-10 requires that where detection and suppression is necessary to meet the requirements of Appendix R, it should be installed throughout the fire area of concern. Generic Letter 86-10 states that partial coverage suppression and/or detection in the fire area of concern is acceptable if it can be demonstrated through engineering analysis that partial coverage would provide adequate protection. The Generic Letter also states that these analyses must be available for NRC audit. The inspector requested the licensee to provide all analyses which pertain to partial coverage detection and suppression. The licensee presented a list of 21 analyses that addressed either partial coverage detection or partial coverage suppression. From this list, the inspector randomly chose seven analyses for review (Appendix B). Based on a review of these analyses, the inspector found that the licensee provided adequate documentation to justify the lack of either full area detection or suppression in the areas addressed. In addition, no partial coverage conditions were noted during a plant walkdown which had not been evaluated by the licensee.

b. NFPA Code Conformance

Generic Letter 86-10, Section 8.9, states, in part, "NRC guidelines reference certain NFPA codes as guidelines to the systems acceptable to the staff, and therefore such codes may be accorded the same status as Regulatory Guides." The inspector reviewed the design and installation of suppression and detection systems protecting safe shutdown components and circuits to determine if they are in accordance with guidance provided in the National Fire Protection

Association (NFPA) Fire Codes. The licensee has conducted a series of NFPA Code compliance studies. Item 2.2 of the April 26, 1990 SER issued by the NRC addressed these code compliance reviews. The SER identified this issue as an open item pending submission of the results of the licensee's code review to the staff for review.

During this inspection, the inspector requested a status of these reviews and any modifications that may be deemed necessary as a result of the reviews. The licensee informed the inspector that the final code compliance review was in the process of final review by the licensee. In addition, the licensee provided copies of two design change packages which addressed required system modifications resulting from the design review. The licensee stated that these modifications would be completed by December 31, 1991. The inspector reviewed the design change packages and concluded that none of the issues identified would impact the operability of the Fire Protection system and that the licensee was adequately addressing code compliance issues. However, the open issue in the SER will still remain open pending NRR review of this issue.

c. Fire Suppression Affects on Safety-Related Components

The inspector requested information from the licensee regarding their response to issues discussed in Information Notice (IEN) 87-14 concerning inadvertent actuation of fire suppression systems affecting safety-related components. Based on a review of the licensee's response to this issue, it was determined that the response to IEN 87-14 was adequate.

11. Instrumentation That Supports Surveillance Requirements

The inspectors reviewed the fire protection section of D. C. Cook's Technical Specifications (TS).

Based on the review, inspectors determined that the licensee was adequately maintaining process instrumentation that was used to support fire protection systems surveillance requirements.

12. Unresolved Item

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items; items of noncompliance, or deviations. An unresolved item disclosed during this inspection is discussed in Paragraph 8.a.

13. Deviations for Which A "Notice of Violation/Deviation" Will Not be Issued

The NRC uses the Notice of Violation/Deviation as a standard method for formalizing the existence of a violation/deviation of a legally binding requirement/commitment. However, because the NRC wants to encourage and support licensee's initiatives for self-identification and correction of problems, the NRC will not generally issue a Notice of Violation/Deviation for a violation/deviation that meets the tests of 10 CFR 2, Appendix C, Section V.G. These tests are: (1) the violation/deviation was identified

by the licensee; (2) the violation/deviation would be categorized as Severity Level IV or V; (3) the violation/deviation was reported to the NRC, if required; (4) the violation/deviation will be corrected, including measures to prevent recurrence, within a reasonable time period; and (5) it was not a violation/deviation that could reasonably be expected to have been prevented by the licensee's corrective action for a previous violation.

One violation/deviation of a regulatory commitment being addressed as a result of this inspection for which a Notice of Violation/Deviation will not be issued is discussed in Paragraph 4.a.

14. Exit Interview

The inspectors met with licensee representatives (denoted in Paragraph 1) at the conclusion of the inspection on September 10-14, and November 6, 1990, and summarized the scope and findings of the inspection. The inspectors also discussed the likely informational content of the inspection report with regard to documents reviewed by the inspectors during the inspection. The licensee did not identify any of the documents as proprietary.