U. S. NUCLEAR REGULATORY COMMISSION
REGION III

Reports No. 50-373/91019(DRS); No. 50-374/91019(DRS)

Docket Nos. 50-373; 50-374 Licenses No: NPF-11; No. NPF-18

Licensee: Commonwealth Edison Company
Opus West III
1400 Opus Place
Downers Grove, IL 60515

Facility Name: LaSalle County Station - Units 1 and 2

Inspection At: Marseilles, IL 61341

Inspection Conducted: October 7 through November 8, 1991

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Inspection Summary

Inspection on October 7 through November 8, 1991 (Reports No. 50-373/91019(DRS); No. 50-374/91019(DRS))

Special electrical distribution system functional inspection in accordance with Temporary Instruction (TI) 2515/107 ( ).

Results: The team determined that the electrical distribution system was generally functional and that engineering and technical support was good. Two violations were identified regarding the failure to demonstrate the capability of the loss of offsite power undervoltage relay logic circuitry to automatically de-energize the emergency busses for both units (Paragraph 4.3), and two examples of inadequate testing; one involving 480Vac circuit breakers (Paragraph 3.1.1), and the other involving calibration of safety related relays (Paragraph 4.1.1). Four deviations were identified regarding starting capabilities of safety related motors (Paragraph 3.1.9), loading values for EDG 2A (Paragraph 3.1.10), conformance of the diesel

fuel oil storage and transfer system to the safety requirements of ANSI N-195 (Paragraph 3.3.1), and a lack of a setpoint program for degraded voltage relays (Paragraph 4.2.1). Two unresolved items were identified regarding adequacy of voltage provided to safety related equipment (Paragraph 4.2.2) and a lack of a voltage drop study for 125Vdc circuits (Paragraph 3.2.3). Two open items were identified regarding improper settings of overcurrent relays to protect the 4.16kV ESF motors from short circuits (Paragraph 3.1.6) and replacement of the Unit 2, Division Two, 125 volt battery (Paragraph 3.2.1). The team observed both strengths and weaknesses which are more fully described in the Executive Summary of this report.

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Executive Summary

During the period of October 7 through November 8, 1991, a Region III inspection team conducted an electrical distribution system functional inspection (EDSFI) at the LaSalle County Station to review the design and implementation of the plant electrical distribution system (EDS) and the adequacy of the Engineering and Technical Support (E&TS) organizations. The team reviewed the electrical and mechanical support systems of the EDS, examined installed EDS equipment, observed field activities, reviewed EDS testing and procedures, and interviewed selected corporate and site personnel.

The team considered the design and implementation of the EDS at LaSalle to be generally acceptable. Design attributes of the EDS were retrievable and verifiable. The team found the EDS and related support equipment properly installed in the plant and considered the external material condition and housekeeping of the EDS to be strengths. In addition, the team considered the quality of the surveillance testing program and the Lessons Learned Program to be strengths. The team concluded that overall the engineering and technical support organizations were adequate. Engineering staffing levels appeared to be adequate; however, the training program for engineers needed improvement. Engineering calculations were technically sound, although the team identified some calculation weaknesses. The interface between Engineering and Operations appeared to be adequate. In addition, the team considered the knowledge and expertise of the engineering staff that interfaced with the team to be very good.

Several of the teams's concerns resulted in identification of violations of NRC requirements. Examples included:

- Inadequate testing of 480Vac circuit breakers.
- Lack of a program to perform calibration of non Technical Specification safety related relays.
- Failure to test the capability of the safety related undervoltage auxiliary relay contacts to de-energize the safety related buses.

Several of the team's concerns resulted in deviations of UFSAR requirements. For example:

- Safety related motors were purchased with starting capabilities which were limited to 80% of their nominal voltage value.
- The loading on EDG 2A was 2727kW while the UFSAR identified a rating of 2627kW.

Executive Summary

- A formal setpoint methodology for the degraded voltage relays that addresses all known instrument errors was not established.

- The diesel fuel oil storage and transfer systems did not conform to the safety requirements of ANSI N-195.

1.0 Action on Previously Identified Inspection Findings

a. Closed (373/88012-01) Violation - This violation concerned the failure to properly identify and correct deficiencies associated with the drywell temperature monitoring program.

The team determined that the noted deficiencies had been corrected by the licensee. The drywell temperature recorder was repaired. Also, the licensee increased frequency of temperature monitoring and qualified life evaluations when temperature excursions were experienced. This was done until the drywell modification to add additional cooling capacity was completed in 1990. The team had no further concerns. This item is considered closed.

b. Closed (373/88012-02) Unresolved Item - This item related to equipment deficiencies identified during an inspection performed inside the drywell. Large reflective insulation gaps were noted near the MSIVs which contributed to the excessive drywell temperature problem. In addition, broken seal tight conduits were noted at junction boxes.

The team was informed that the insulation gaps were repaired and that an insulation walkdown was performed prior to drywell closeout. In addition, work requests were issued to correct the noted deficiencies and measures were taken to prevent recurrence. The team had no further concerns. This item is considered closed.

c. Closed (374/88011-01) Violation - This violation concerned failure to submit a special report to the NRC which included an analysis to demonstrate the continued operability of safety relief valves (SRVs) affected by excessive drywell temperatures.

The team reviewed the licensee's corrective actions taken to address this violation. The actions included revision to the drywell temperature monitoring surveillance program to provide clear directions on required actions when Technical Specification limits or equipment qualification setpoints have been exceeded; and to provide a mechanism to record the data which tracks abnormal temperature conditions. The team had no further concerns. This item is considered closed.

2.0 Introduction

During electrical inspections at various operating plants in the country, the NRC staff identified various significant EDS deficiencies. Examples included unmonitored and uncontrolled load growth on safety buses and inadequate modifications, design calculations, testing, and qualification of commercial-grade equipment used in safety related applications. The NRC considered weak Engineering and Technical Support (E&TS) to be one cause of these deficiencies.

The objectives of this inspection were to assess the performance capability of the LaSalle EDS and the capability and performance of the licensee's E&TS in this area. For this inspection, the EDS included all the emergency sources of power to systems required to remain functional during and following the design basis events. EDS components reviewed included the EDGs, 125Vdc Class 1E and 250Vdc batteries and chargers, offsite circuits and switchyard, 4kV and 480Vac switchgears, 480Vac and 120Vac Motor Control Centers (MCCs), inverters, associated buses, breakers, relays, and other miscellaneous components.

The team reviewed the adequacy of the emergency, offsite and onsite power sources for EDS equipment, the regulation of power to essential loads, protection for postulated fault currents, and coordination of the current interrupting capability of protective devices. The team also reviewed the mechanical systems that interface with the EDS, including air start, lube oil, and cooling systems for the EDGs, plus the cooling and heating systems for the EDS equipment. The team walked-down originally installed and as-modified EDS equipment for configuration and equipment ratings and reviewed qualification, testing, and calibration records. The team assessed the capability of the licensee's E&TS organization with respect to personnel qualifications and staffing, timely and adequate root cause analyses for failures and recurring problems, and engineering involvement in design and operations. The team also reviewed training for E&TS personnel relative to the EDS.

The team verified conformance with General Design Criteria (GDC) 17 and 18 and the applicable 10 CFR 50, Appendix B criteria. The team also reviewed plant Technical Specifications (TS), the Updated Safety Analysis Report (UFSAR), and appropriate safety evaluation reports (SERs) to verify that TS requirements and licensee commitments were met.

The areas reviewed and the concerns and strengths that were identified are described in Sections 3, 4, 5 and 6 of this report. Conclusions are given at the end of each of these sections. A list of the personnel contacted and those who attended the exit meeting on November 8, 1991, is provided in Appendix A of the report.

3.0 Electrical Systems and Components

3.1 Class 1E AC Systems

In order to assess the capability of the electrical distribution system (EDS), the team reviewed the sizing, regulation, protection and installation of selected EDS loads. The review included system descriptions, station UFSAR, equipment sizing calculations, equipment specifications, electrical design drawings, protective relaying curves, operating procedures and plant walkdowns.

Various critical EDS components were evaluated to assess the adequacy of important parameters such as continuous loading, short circuit capability, etc. In addition, the EDS was reviewed to assess its capability to provide adequate voltage to safety related loads under both starting and steady state operating conditions. The preferred power source transformers were reviewed for their kVA capability, connections to the safety buses and voltage regulation. The emergency diesel generators (EDGs) were reviewed to assess the adequacy of kW rating for the operation of EDS loads. The 4kV safety buses and their loads were reviewed to assess load current, short circuit current capabilities, voltage regulation, adequacy of cable connections between loads and buses and the adequacy of the degraded grid and loss of power relaying schemes. The 480Vac safety buses and their connected loads were reviewed to assess load current, short circuit current capabilities, voltage regulation, and the adequacy of cable connections between loads and buses.

3.1.1 Testing of 480Vac Circuit Breakers

The team determined that the licensee was performing instantaneous trip tests on 480Vac circuit breakers using a trip current of 20 to 40 times the normal rating of the breaker trip coils, rather than the maximum 15 times specified by the vendor. The vendor, General Electric (GE), indicated that high trip currents could cause more than nominal breaker contact wear (pitting or deformation) and could result in damage to breaker overcurrent trip devices (insulation damage from overheating). GE recommended that Commonwealth Edison Company (CECo) perform visual inspections and testing to determine whether breaker contact damage or breaker trip device damage had occurred. On November 6, 1991, during subsequent testing, two 480V breakers failed to meet the acceptance criteria of 65 to 125 seconds for the long time delay trip test. Since the failed breakers were Technical Specification related, the licensee entered the appropriate Limiting Condition for Operation (LCO) on Units 1 and 2. After the failed breakers were repaired, the licensee exited the LCOs.

The team determined that the licensee's engineering staff failed to verify that the test currents specified by Sargent & Lundy (S&L) were appropriate for the trip devices and breakers being tested. The team considered the failure to perform testing on safety related 480Vac circuit breakers in accordance with the requirements and acceptance limits contained in applicable design documents to be an example of a violation of 10 CFR 50, Appendix B, Criterion XI (373/91019-01A; 374/91019-01A).

The licensee has not developed a comprehensive program to periodically test low voltage (480Vac) circuit breakers and molded case circuit breakers. The team considered this to be a weakness.

3.1.2 Degraded Grid Undervoltage Relaying Calculation

The team observed that calculation No. 4266/19AZ13, dated October 7, 1991, did not take into account the errors/tolerances of the various devices used in the undervoltage detecting circuits such as tolerances of potential transformers and relays, and errors in calibrating the relays. The team considered the exclusion of errors and tolerances from the pertinent calculations to be a design weakness.

3.1.3 Cable Sizing Design Basis

The team noted that the licensee did not have calculations to verify that power cables were sized such that the cables would not be damaged during the time it took the appropriate circuit breaker(s) to clear a fault. The licensee stated that if the cable was damaged, it would be replaced. The team considered the lack of the sizing calculations to be a design weakness.

3.1.4 Transient Voltage Regulation

The team found that there was no transient analysis to model EDG voltage regulation under transient conditions. The EDGs are required to accelerate under load to full speed while maintaining acceptable voltage at the bus. Adequate demonstration of this requirement can only be provided by a combination of analysis and testing; however, the only documentation available for demonstrating compliance were strip recorder charts containing voltage and frequency traces taken during a test conducted in 1982. At that time, the momentary frequency dip was 5.2% versus 5% specified in the UFSAR. Due to the fact that the frequency dip was of an extremely short duration, the team did not consider this to be a problem. However, the team considered the lack of a transient loading study for the EDGs to be a design weakness.

3.1.5 EDG Neutral Grounding Resistor

The team observed that the EDG grounding resistors had been installed within the EDG control cabinets. The licensee had not performed a thermal analysis to determine whether the components located within the cabinets could successfully operate at the high temperatures generated by the grounding resistors. The licensee proposed to open the door of the cabinets following a ground fault alarm; however, this proposed solution may not be adequate until verified by analysis. During a ground fault condition, the energy dissipated by the grounding resistors could be as high as 4.5kW. The team considered the lack of such a thermal analysis to be a design weakness.

3.1.6 4kV ESF Circuit Breaker Overcurrent Protection

The team determined that the overcurrent protection relays for the Division 3 4kV ESF feeder breakers were not properly set to clear a fault when powered from the Division 3 EDG. In addition, the licensee could not demonstrate that the overcurrent protection relays for the Division 1 and 2 4kV ESF feeder breakers would clear a fault when powered from the Division 1 and 2 EDGs. The team determined that the licensee had set the Division 3 relays to protect the 4kV busses and loads from the higher fault currents that would be expected when the busses were supplied by offsite power. In the event of a fault, the failure to isolate Class 1E components from the resulting fault currents could lead to component degradation or failure.

The licensee responded by stating that the consequences of an uncleared fault would be limited to one division. The team concurred with the licensee. However, the team considered this condition to be a design weakness. This item is considered open pending additional licensee analysis (373/91019-02(DRS); 374/91019-02(DRS)).

3.1.7 Seismic Qualification of 480Vac ESF Switchgear

The team determined that a seismic evaluation had not been performed to demonstrate the adequacy of racked out spare 480Vac ESF circuit breakers installed in ESF switchgear. The licensee subsequently generated calculation No. CQD 053566, dated October 10, 1991. The calculation demonstrated that the switchgears' seismic qualification remained valid.

3.1.8 Fast Transfer from Unit Auxiliary Transformer to System Auxiliary Transformer

The licensee lacked an analysis to demonstrate fast transfer logic. The team noted that during normal plant operation the 4kV busses are supplied from the unit auxiliary transformer. In case of loss of power from the normal source, the affected busses are fast transferred to the alternate system auxiliary transformer. However, the team noted that if the voltages are sufficiently out of phase at this stage, the motors already connected to the busses will experience high inrush current and transient torques. This could cause failure of some motors. No study had been performed to evaluate this concern.

The licensee responded by developing a calculation which demonstrated that the fast transfer would be completed in 4.88 cycles with a motor volts/hertz ratio that would not exceed 1.33. The values of six cycles and 1.33 motor volts/hertz are considered to be industry acceptable values. The team found this response acceptable.

3.1.9 Starting Voltages at Safety Related Motors

The team noted that the design documentation for the majority of 4kV and 480Vac safety related motors specified that the motor starting voltage must be at least 80% of nominal voltage. This is contrary to UFSAR Section 8.2.3.2.2 which states that all safety related motors are capable of starting with voltage at their terminals equal to 75% of the nominal values. Inadequate motor starting voltages could prevent the motors from performing their safety functions. The licensee acknowledged this concern and indicated that this issue would be addressed as part of the ongoing degraded voltage reviews being conducted at Commonwealth Edison facilities.

The team considered the 80% motor starting voltage requirement for safety related motors to be a deviation (373/91019-05A(DRS); 374/91019-05A(DRS)) from the commitment made in UFSAR Section 8.2.3.2.2.

3.1.10 EDG 2A Loading

The team noted that the loading calculation for EDG 2A identified a continuous loading value of 2727kW. This is contrary to UFSAR Table 8.3-1 which states that the continuous loading on EDG 2A is 2627kW. The EDG is rated for 2600kW continuous and 2860kW for 2000 hours. The licensee indicated that the safety significance of this issue was minor since the 2000 hour rating was not exceeded. The team concurred with this position; however, the team pointed out that the actual EDG 2A loading may be higher than 2727kW since the existing loading calculation did not account for all EDS losses such as cable losses.

The team considered the identified 2727kW loading of EDG 2A to be a deviation (373/91019-05B(DRS); 374/91019-05B(DRS)) from the commitment made in UFSAR Table 8.3-1.

3.1.11 Conclusion

The team did not identify any condition which would indicate that the safety related AC distribution systems would be unable to performs its safety function. A significant weakness was observed in the area of 480Vac circuit breaker testing.

3.2 DC Systems

The team reviewed the station Class 1E DC systems. The inspection included the review of the 125Vdc battery design with respect to sizing, duty cycle loading, electrolyte temperature, battery age and capacity. The associated battery charger designs were reviewed for total loading requirements and the bases of these calculations were checked for their adequacy. The battery chargers' sizing and design criteria were reviewed for their ability to meet applicable standards and power input/output requirements. Short circuit calculations for the 125Vdc and the 250Vdc systems were reviewed relative to system parameters and requirements, applicable standards, correctness, accuracy and standard engineering practices. Voltage drop studies and cable sizing calculations for the 125Vdc (ATWS circuit breaker controls) and the 250Vdc system were reviewed relative to system parameters and requirements, applicable standards, correctness, accuracy and standard engineering practices. A review of breaker/fuse coordination and sizing was performed to determine if protection schemes for the DC systems conformed to standards and practices used for station design.

3.2.1 Battery Sizing Calculation

The team's review of the battery sizing calculations indicated that temperature, design, and aging margins were not applied when sizing the Unit 2, Division 2, 125Vdc battery. Technical Specification 3.7.7.1 allows the temperature in the battery room to go down to 50°F. The team noted that at this temperature, the battery would not have the required temperature margin of 19% to ensure adequate voltage output. The team considered this to be a design weakness. The licensee indicated that the battery was scheduled to be replaced during the next Unit 2 refueling outage in January 1992. This is considered an open item (374/91019-08(DRS)) for the NRC to followup on the battery replacement.

3.2.2 125Vdc Battery Main Fuse

The team determined that no fuse or circuit breaker was provided to protect the 125V battery and the main distribution bus from short circuits. A catastrophic failure of the battery could occur if a fault is not removed from the battery in a matter of milliseconds. The team considered the lack of a protective device between the battery and main distribution bus to be a design weakness.

3.2.3 125Vdc Voltage Drop Calculation

The team determined that 125Vdc voltage drop analyses were not available. The licensee stated that the cables feeding 125Vdc loads were sized in accordance with Sargent and Lundy requirements and standards. To resolve this issue, the licensee performed a voltage drop analysis which considered four worst case safety related circuits fed by the 125Vdc batteries. Subsequently, on November 26, 1991, the licensee provided voltage drop calculation No. 4266/19D49. The team considered this calculation to adequately address the four circuits selected by the licensee. The licensee committed to perform a comprehensive 125Vdc voltage drop study, to include safety related circuits.

This study will be completed by January 31, 1992. Pending completion of the study and subsequent NRC review, this item is unresolved (373/91019-03(DRS); 374/91019-03(DRS)).

3.2.4 250Vdc Short Circuit Calculation

During review of the 250Vdc short circuit calculation, the team noted that the values used for cable resistance were nonconservative. The cable resistance values selected reflected elevated cable temperatures instead of the minimum operating temperatures. The licensee subsequently revised the calculation using the more conservative resistance values. The revised calculation showed increased values of short circuit current but did not change the acceptability of the calculation. However, the team considered the initial use of nonconservative cable resistances to be a design weakness.

3.2.5 250Vdc Voltage Drop Calculation

During review of the voltage drop calculation for the Anticipated Transient Without Scram (ATWS) control circuit, the team noted that the value used for inrush current (between battery and battery bus) was nonconservative. The licensee subsequently revised the calculation using the more conservative inrush current value. The revised calculation demonstrated that the voltage available on the ATWS control circuit was acceptable. However, the team considered the use of a nonconservative value to be design weakness.

3.2.6 Conclusion

The team determined that the overall design and installation of the DC systems were generally acceptable. Design attributes were generally retrievable and verifiable. However, 125Vdc voltage drop calculations were not available and the Unit 2 battery had an inadequate design margin. Most of the concerns noted above were due to insufficient attention to details when performing DC system analyses.

3.3 Mechanical Systems

The team reviewed the adequacy of the mechanical system design for support of the EDGs. The review included system walkdowns, examination of the mechanical support system design documentation, engineering, vendor, purchasing and plant operations documents including the UFSAR, Technical Specifications, and Regulatory Guides. The team examined mechanical system calculations, process and instrument diagrams, pump and fan performance curves, fuel oil tank capacities, heating, ventilation and air conditioning (HVAC) flow diagrams, manufacturers technical manuals and detailed component drawings.

3.3.1 EDG Fuel Oil Transfer and Storage Systems

The team identified a number of deviations between the as-built EDG fuel oil transfer and storage systems and ANSI N-195. Section 9.5.4.2 of the UFSAR states that the LaSalle EDG fuel oil transfer and storage systems conform to the safety requirements of ANSI N-195. The team identified the following deviations to this commitment:

a. Section 7.3 of ANSI N-195 prohibits permanent interconnections between the fuel oil storage tanks and auxiliary equipment such as engine driven fire pumps. Contrary to this requirement, the LaSalle fuel oil system design had such a connection between the Division 3 (HPCS) storage tanks and the diesel driven fire pump day tanks. The licensee evaluated this issue and concluded that the fire pump connection did not affect the HPCS EDG minimum fuel inventory because the piping of the fire pump fuel oil transfer system was completely independent of the EDG fuel oil transfer system piping. Further, significant loss of fuel from the Division 3 storage tanks due to failure of the non-seismic diesel fire pump fuel transfer system was prevented by means of a fail-closed solenoid valve. This valve was normally closed except when the diesel fire pump fuel transfer pump is operating. In addition, the HPCS EDG minimum inventory included a 1000 gallons contingency margin for manual fire pump day tank filling, testing and sampling. The team agreed with the licensee's evaluation.

b. Section 8 of ANSI N-195 requires that each of the seven day fuel oil storage tanks be provided with high level alarms. Contrary to this requirement, none of the storage tanks were provided with high level alarms. The licensee evaluated this issue and subsequently concluded that the tank filling procedure would normally protect against overflow and that in the unlikely event an excessive amount of fuel oil was added to the storage tanks, it would be directed to the room sumps. An alarm set at 2'11" below the top of the sump was signalled in the control room to alert the operator to initiate appropriate action. The team agreed with the licensee's evaluation.

c. Section 5.4 of ANSI N-195 requires that a minimum margin of 10% be added to the calculated minimum fuel storage requirement if a conservative alternate calculation is not used. Contrary to this requirement, the team determined that a non-conservative approach had been used in determining the minimum requirement for on site fuel storage for the Division 3 EDGs and that the licensee had only provided a 1000 gallons margin instead of the required 10% margin (approximately 2975 gallons). The minimum required on site storage should be 32725 gallons instead of the

29750 gallons specified in Section 3.8.1.1 of the Technical Specifications. The licensee evaluated this issue and subsequently concluded that the margin provided was sufficient to allow for manual fire pump day tank filling, testing and sampling. The team agreed with the licensee's evaluation.

The team considered items a, b and c as examples of a deviation (373/91019-05C(DRS); 374/91019-05C(DRS)) from UFSAR Section 9.5.4.2.

3.3.2 EDG Air Damper

The team noted that the fresh air intake damper for each EDG room was designed to fail in the closed position. Failure of the damper in the closed position would cut off the supply of outside air. This could result in EDG failure due to heat buildup in the room. The team considered this a design weakness.

3.3.3 EDG Air Start System

The team determined that the licensee had no piping stress analysis for instrument air lines connected to the EDG air start receivers. The team requested the licensee to demonstrate that the lines could withstand a seismic event. During the course of the audit, the licensee had an analysis prepared by Sargent and Lundy which demonstrated that the lines were adequately supported.

3.3.4 Conclusion

The team concluded that the design and operability of the mechanical systems supporting the LaSalle EDGs were adequately demonstrated during the course of the inspection. In general, the team found the licensee's staff to be knowledgeable in their respective fields of expertise, particularly the design and operability of the EDG auxiliary systems and HVAC systems.

4.0 Calibration, Surveillance Testing and Configuration Control

The team performed walkdown inspections of the EDS to identify the material condition of the electrical equipment and panels. Portions of the "as installed" configuration of the EDS were examined to determine its compliance with design drawings and documents. Certain electrical maintenance procedures and work orders were reviewed to ensure the EDS was being properly tested and maintained. Data sheets from completed calibration and surveillance procedures were reviewed to verify the EDS operated in accordance with design specifications. The protective relay setting drawings were reviewed to verify that calibration requirements were addressed. The method used for fuse control was examined to ensure correct fuse sizes and types were installed.

4.1 Relay Calibration Program

4.1.1 Time Delay Relay Calibration

The team noted the following discrepancies between design drawings and the EDG time delay relay settings associated with relays installed in panel ODGO3JB:

Time Delay Relay No.	Function	Time Setting on Drawing (Seconds)	Actual Time Setting on the Relay (Seconds)
K-32	Field Flash Relay	5.0	1.5
K-33	Diesel Low Lube Oil Pressure Bypass Relay	50.0	43.0
K-39	Overcrank TD Auxiliary Relay	15.0	14.0

The above relays were part of the EDG-0 start logic. The team determined that these non Technical Specification safety related relays were not calibrated since plant startup and were not included in the licensee's calibration program. Investigation by the licensee revealed an additional two time delay relays installed on EDG 1A and EDG 2A that were improperly set. The licensee stated that the as-found relay settings would not adversely affect EDG operability. The team considered the failure to include non Technical Specification safety related EDG time delay relays in the station's calibration program to be a violation of 10 CFR 50, Appendix B, Criterion XI (373/91019-01B(DRS); 374/91019-01B(DRS)).

4.2 Degraded Voltage

4.2.1 Degraded Voltage Setpoint Methodology

The team determined that the setpoints for the degraded voltage protection relays contained in Table 3.3.3-2 of the Technical Specifications were not based on a setpoint methodology that addressed all known errors associated with this instrument. The licensee, in response to FSAR Question Q31.159, committed to address instrument accuracy, calibration, and drift allowance.

Technical Specification Table 3.3.3-2, Trip Function D.2.a requires 3814 $\pm$ 76 volts. The team's review of historical asleft and as-found data indicated that these relays had drifted as much as -94.5 volts over a 4 month period which exceeded the ±76 volt Technical Specification allowance. Sargent and Lundy Calculation 4266/19AN15 also indicated an accuracy of +42 volts is typical for the potential transformers associated with the degraded voltage protection. Additionally, the relay manufacturer and Sargent and Lundy identified other relay tolerances that could add another ±38.5 volts to the actual setpoint.

Since the maximum deviation of ±76 volts allowed by the Technical Specifications is not large enough to account for these errors and the licensee lacks a setpoint methodology to establish a setpoint with all known errors included, the relays may not detect degraded voltage conditions and transfer safety loads to the emergency diesel generators at a voltage level adequate to ensure proper safety equipment performance or to prevent safety equipment damage. The team considered this to be an example of a deviation (373/91019-05D(DRS); 374/91019-05D(DRS)) from the commitment made in response to FSAR Question Q31.159.

4.2.2 4160 Volt Degraded Voltage

During the team's review of the degraded voltage protection, the licensee provided an October 2, 1991, letter containing the results of preliminary Sargent and Lundy and Bechtel calculations intended to verify the adequacy of the existing degraded voltage relay setpoint (3814 ± 76 volts). These preliminary calculations indicated that the current setpoint may be non-conservative in that at least 4040 volts is required to start selected emergency loads and that greater than 4040 volts is required to ensure that all motor control circuits will have adequate voltage.

In response to the October 2, 1991 calculation results, the licensee took the following compensatory measures:

- Increased the degraded voltage relay setpoints to 3885 volts.
- Increased undervoltage alarm setpoint to 4040 volts.
- Will declare 4160 volt bus inoperable if voltage is below 4040 volts.
- Will notify the load dispatchers to raise LaSalle switchyard voltage if voltage is less than 4040.
- Will verify proper operation of equipment that required greater than 4040 volts if voltage was below 4040.

Also, the licensee committed to the following future actions:

- Complete motor control circuit (120 volt) voltage drop analysis for Division 3 by November 27, 1991.

- Revise preliminary calculations utilizing actual equipment data by December 31, 1991.

- Finalize dates for all future actions (design changes, Technical Specification changes, etc.) required to correct any issues resulting from revised calculations by April 30, 1992.

Pending NRC review of the licensee's evaluation of this issue, this is considered an unresolved item (373/91019-06(DRS); 374/91019-06(DRS)).

4.3 Surveillance Testing Program

The team determined that surveillance testing of the Unit 1, Division 1, safety related loss of offsite power (LOOP) undervoltage (UV) logic circuitry did not test the capability of auxiliary relay contacts to automatically de-energize emergency bus No. 141Y by tripping the associated tie breakers. The licensee was performing this test function by de-energizing bus No. 141Y by manually tripping breaker No. ACB 1412. This LOOP simulation did not demonstrate that the UV logic design could automatically de-energize the emergency bus in response to an undervoltage condition.

Failure of a tie breaker to trip open would prevent the automatic re-energization (by the emergency diesel generator) of that emergency bus in response to a LOOP or LOOP in conjunction with a loss of coolant accident (LOCA). This finding affected all safety related electrical divisions for both units (total of six (6) divisions). The team considered the licensee's failure to adequately demonstrate the de-energization of the emergency busses in response to a LOOP to be a violation (373/91019-07(DRS); 374/91019-07(DRS)) of Technical Specification 4.8.1.1.2.d.4. The licensee entered the appropriate LCOs and took immediate corrective actions. By November 8, 1991, the licensee had successfully demonstrated the capability of the auxiliary relays to automatically trip their associated tie breakers.

The team reviewed 43 additional surveillance test procedures and concluded the quality of the procedures was very good. Overall, the licensee's surveillance test program was considered a strength.

4.4 Electrical Field Inspections

During field inspections of safety related panels ODG03JB, 1H13-P628, 2H13-P625, and 1H22-P028, the team identified as-built discrepancies between electrical design drawings and field installations. Examples included relay setting, wiring, and fuse size discrepancies. The team was informed that based on the licensee's evaluations of the discrepancies, most of the identified discrepancies were due to drawing errors. The licensee initiated corrective actions to address the drawing deficiencies. The team considered the as-built discrepancies to be a weakness. The team also noted that some of the electrical components inside the panels contained excessive dust. The licensee was considering a preventive maintenance program to clean the panel components.

4.5 Fuse Control Program

The team observed that three fuses installed in safety related panel 1H13-P629 were not sized in accordance with design specifications. Two fuses were sized at 3A instead of the required 5A and one fuse was sized at 15A instead of the required 10A. The licensee stated that the discrepant fuses would be replaced with the proper fuses. The team had no further concerns.

4.6 Material Condition

The team walked down the EDS to assess the overall material condition of installed EDS components. The external condition of the plant and equipment was generally good. However, the team did observe a number of instances in which housekeeping improvements were necessary including the nonsafety related switchyard batteries which exhibited excessive battery terminal corrosion and excessive dust noted on components in safety related panels. The licensee initiated actions to correct identified housekeeping deficiencies.

4.7 Conclusion

The team considered the licensee's surveillance program to be a strength. However, a significant weakness was noted in the licensee's methodology of testing undervoltage relays. In addition, several EDG safety related time delay relays were not calibrated since initial plant operation.

5.0 Engineering and Technical Support (E&TS)

The team assessed the licensee's capability and performance regarding engineering and technical support associated with the EDS. The team reviewed the licensee's engineering organization, modification program, quality assurance audits and quality verification program, adequacy of engineering interface with the corporate engineering and with various plant departments, and the training of electrical engineers. In addition, the team also reviewed the licensee's programs for reporting equipment failures, 10 CFR 50.59 evaluations, and for root cause analysis, such as problem analysis data sheets (PADS).

5.1 Engineering Staffing and Training

The team noted that the licensee had recently increased the engineering staff to approximately 90 engineers including 44 system engineers. Since January 1990, the licensee hired approximately 40 engineers. The licensee did not have a formal training program for system engineers. The existing informal program varied in duration from one to six weeks. The team considered this to be a weakness. The average engineering experience for the engineering staff was approximately two years. The licensee stated that the more experienced engineers were routinely assigned to support less experienced engineers.

The team noted that the system engineers were generally not involved in trending equipment failures, performing equipment failure analyses or reviewing completed work requests. The team considered this to be a weakness.

5.2 Engineering Interfaces

A comprehensive management plan was initiated to coordinate engineering activities between corporate engineering and field engineering offices. This plan delineated responsibilities and interfaces between CECo engineering and CECo contractors. The team considered management initiative in establishing this program to be a strength. During the inspection, the team observed indications that the plan was having positive results. However, the team identified weaknesses in the evaluation and timely resolution of several technical issues which were a result of ineffective communication between CECo engineering and Sargent and Lundy. Examples included the use of unacceptable current values during 480Vac circuit breaker testing and the lack of calculations for potentially overloaded cable trays.

5.3 Conclusion

The team concluded that overall, the licensee provided adequate technical support to the operational staff. Engineering organizations providing technical support were appropriately staffed and the system engineers were generally dedicated. However, the team noted that a large part of the plant engineering staff was relatively inexperienced and received minimal training.

6.0 Quality Programs

As part of the overall evaluation of the EDS, the team performed a review of selected licensee initiated programs related to the EDS. Areas reviewed included component aging program, load growth program, lessons learned program, predictive maintenance program, modification program, and selected quality assurance audits.

6.1 Lessons Learned Program

The team noted during the inspection that two "Lessons Learned Initial Notifications" were issued informing other CECo plants of significant EDSFI findings identified at LaSalle. These were the inappropriate testing of overcurrent devices on 480Vac circuit breakers and the licensee's failure to demonstrate the capability of the loss of offsite power undervoltage relay logic to initiate automatic deenergization of the emergency buses. Subsequently, both Byron and Braidwood Stations identified the same problem at their facilities. The team considered the Lessons Learned Program a strength.

6.2 Quality Assurance (QA) Audits

The team reviewed several completed quality assurance audits performed during early 1991. The audits covered areas such as technical services, maintenance, and training. The team determined that the quality of the QA audits was improving. The audits were thorough, comprehensive, generally performance based and included observations of work being audited.

6.3 Predictive Maintenance Program

The licensee initiated predictive maintenance programs such as vibration analysis, periodic megger tests and lube oil analysis. However, the team noted that the licensee had not yet initiated a thermography program to detect loose electrical connections.

6.4 Load Growth Program

The team noted that the licensee had instituted a procedure to control changes to the loading of the EDS. No addition of a load was permitted without verifying that the distribution system could accommodate this addition load without a detrimental effect on the rest of the loads. The team considered this to be a strength.

6.5 Conclusion

The team considered the Lessons Learned Program and the Load Growth Program to be strengths. In addition, the quality of the QA audits selected for review was improving. A thermography program had not been initiated to detect loose electrical connections.

7.0 Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, violations, or deviations. Unresolved items disclosed during this inspection are included in Paragraphs 3.2.3 and 4.2.2.

8.0 Open Items

Open items are matters which have been discussed with the licensee, which will be reviewed further by the team, and which involve some action on the part of the NRC or licensee or both. Open items disclosed are discussed in Paragraphs 3.1.6 and 3.2.1.

9.0 Exit Interview

The team conducted an exit meeting on November 8, 1991, at the LaSalle County Station to discuss the major areas reviewed during the inspection, the strengths and weaknesses observed and the inspection results. Licensee representatives and NRC personnel in attendance at this exit meeting are documented in Appendix A of this report. The team also discussed the likely informational content of the inspection report with regard to documents reviewed by the team during the inspection. The licensee did not identify any such documents or processes as proprietary.

Appendix A

Commonwealth Edison Company (CECo)

*N. Kalivianakis, General Manager, BWR Operations
*G. Wagner, Nuclear Engineering Manager
*G. Diederich, Station Manager
*W. R. Huntington, Technical Superintendent
*R. Shields, Technical Staff Supervisor
*G. Swihart, License Coordinator, Regulatory Assurance
*P. Massin, BWR SD Superintendent, NED
*T. D. Williams, Site Design Supervisor, NED
*R. J. Moravec, Program Manager, ENC
*T. O'Brien, Mechanical/Structural Design Group, NED

U. S. Nuclear Regulatory Commission (NRC)

*T. Martin, Deputy Director, Division of Reactor Safety
*R. Gardner, Chief, Plant Systems Section, Division of Reactor Safety
*C. Phillips, Resident Inspector, LaSalle County Station

*Denotes those attending the exit meeting on November 8, 1991.