U. S. NUCLEAR REGULATORY COMMISSION

REGION III

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License Nos:	DPR-29; DPR-30
Report No:	50-254/98013(DRP); 50-265/98013(DRP)
Licensee:	Commonwealth Edison Company (ComEd)
Facility:	Quad Cities Nuclear Power Station, Units 1 and 2
Location:	22710 206th Avenue North Cordova, IL 61242
Dates:	July 16 through September 1, 1998
Inspectors:	C. Miller, Senior Resident Inspector K. Walton, Resident Inspector L. Collins, Resident Inspector R. Ganser, Illinois Department of Nuclear Safety
Approved by:	Mark Ring, Chief Reactor Projects Branch 1

EXECUTIVE SUMMARY

Quad Cities Nuclear Power Station, Units 1 & 2
NRC Inspection Report 50-254/98013(DRP); 50-265/98013(DRP)

This inspection included aspects of licensee operations, engineering, maintenance, and plant support. The report covers a 6-week period of resident inspection.

Operations

- Operators discovered four high pressure coolant injection system and reactor core isolation cooling system vent valves in the wrong position. Procedure usage by the operator and independent verification problems were contributors to the error. This was considered a non-cited violation (Section O2.1).

- An event involving miscommunication between operators caused the control room emergency ventilation system to trip and become inoperable. A non-cited violation was issued for the improperly implemented surveillance procedure (Section O8.2).

Maintenance

- Condensate pump maintenance activities observed were performed correctly and in accordance with procedures. For most of the activities observed, supervisors visited the work site on a limited basis.

- The licensee continued to reduce the corrective maintenance non-outage backlog. Although some of the reported reduction was due to cancellation of work requests, the inspectors did not identify any inappropriate cancellations (Section M1.3).

- One of the observed priority maintenance activities was completed successfully, but completed 5 days later than originally scheduled, with no major scope changes to the work. Weaknesses in work package preparation and coordination, communication between departments, knowledge of environmentally qualified splice techniques, parts qualification, and engineering and operations department support were evident. These types of problems were partial contributors to a 50 percent completion rate of corrective maintenance (Section M1.4).

- Three separate maintenance errors delayed work or affected plant conditions, but did not jeopardize operability of safety systems. Configuration control problems occurred which were not prevented by second checks. One non-cited violation was issued for the failure to properly implement a maintenance work package (Section M2.1).

- The 2A 125 Vdc battery charger failed a 4-hour load test when the feed breaker to the charger tripped. This was a repetitive problem, and no root cause was determined. The test was rerun satisfactorily and further actions were planned to determine the root cause. The test procedure initially allowed for preconditioning of the equipment prior to the test (Section M2.2).

- The licensee successfully resolved a repetitive problem with control rod drive hydraulic control unit annunciators. Operator response to the most recent occurrence was improved over the response to a previous event (Section M2.3).

- The licensee ultimately determined the root cause of the scram discharge instrument volume transmitter failure after incorrectly identifying two other causes. Maintenance personnel failed to correctly reference the vendor manual when interchanging electronic boards between transmitters. The parts evaluation process also missed this error which resulted in the scram discharge instrument volume transmitter being inoperable for 18 days. This condition resulted in a non-cited violation (Section M2.4).

- The licensee's identification of additional missed surveillance tests in response to a previous notice of violation was noteworthy. Corrective actions have been effective and no missed surveillance tests have been identified in over 6 months. The additional missed surveillance tests were considered to be a non-cited violation (Section M8.2).

Engineering

- The inspectors determined that the licensee, in applying Regulatory Guide 1.9, "Selection, Design, Qualification, and Testing of Emergency Diesel Generator Units Used as Class 1E Onsite Electric Power Systems at Nuclear Power Plants," in determining emergency diesel generator reliability, did not properly address emergency diesel generator start failures. Two additional examples of incorrectly classified starts were identified (Section E1.2).

- The inspectors concluded that the licensee's troubleshooting efforts were thorough in determining the root cause of the Unit 2 high pressure coolant injection turning gear failure (Section E1.3).

Plant Support

- Poor maintenance package records resulted in an additional entry of maintenance workers into a locked high radiation area to plan corrective maintenance (Section M1.4).

Report Details

Summary of Plant Status

Unit 1 operated at or near full power for the entire inspection period with the exception of two power reductions to approximately 350 MWe to conduct moisture separator drain system repairs on July 17 through 19, 1998, and again on July 24 through 25, 1998. Unit 2 operated at or near full power for the entire inspection period.

I. Operations

O1 Conduct of Operations

O1.1 General Comments (71707)

Operations performance was good throughout the period and plant performance was reliable even with a number of emergent equipment problems. One configuration control error was committed and not corrected by independent verification. Station management continued to emphasize the identification and correction of plant problems and was actively involved in plan-of-the-day meetings.

O2 Operational Status of Facilities and Equipment

O2.1 Configuration Control Problem

a. Inspection Scope (71707)

The inspectors reviewed the licensee's root cause investigation and corrective actions for a configuration control issue regarding high pressure coolant injection system and reactor core isolation cooling system valves.

b. Observations and Findings

During a return to service of the Unit 1 high pressure coolant injection (HPCI) system on August 16, 1998, an operator discovered two high pressure coolant injection system vent valves and two reactor core isolation cooling system vent valves in the open position. These valves were normally closed and were located in a locked high radiation area.

Based on a prompt investigation, the licensee determined that the last entry into this area was on August 12, when an operator and a radiation protection technician entered the room to perform the required monthly vent verifications for both the high pressure coolant injection system and the reactor core isolation cooling system. The licensee concluded that this was most likely the time when the valving error occurred but did not pinpoint exactly how it occurred. The individuals involved stated that all four valves were left in the closed position.

Station procedure Quad Cities Operations Manual 1-2300-1, "Unit 1 HPCI Checkoff List," and Quad Cities Operations Manual 1-1300-03, "Unit 1 Reactor Core Isolation Cooling Valve Checklist," required that these valves be in the closed position. However, the failure to maintain these valves in the proper position had no effect on system operability. Although the exact cause was not determined, the investigation revealed weaknesses in the independent verification method used and procedural usage problems. A radiation protection technician was allowed to perform verifications in a locked high radiation area to minimize radiation dose, although minimal training on verifications had been given to radiation protection technicians. The operations manager immediately suspended the practice of allowing radiation protection technicians to perform independent verification. Secondly, the investigation revealed that the procedure was not in hand during manipulation of the valves. This was important because the expectation to initial the procedure as the step was performed could not be carried out without the procedure.

Other configuration control problems have occurred at the station and configuration control is an area that has received high management attention. Previous inspection reports addressed several of the problems (see Inspection Report 50-254/98004; 50-265/98004). This most recent incident had not occurred before and was less significant because system operability was not impacted. The failure to maintain the plant configuration in accordance with procedures was a violation of 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings." This non-repetitive, licensee-identified and corrected violation is being treated as a **Non-cited Violation (50-254/98013-01; 50-265/98013-01)**, consistent with Section VII.B.1 of the NRC Enforcement Policy.

c. Conclusions

Operators discovered four high pressure coolant injection system and reactor core isolation cooling system vent valves in the wrong position. The mispositioned valves had no effect on system operability. The licensee's investigation revealed a weakness in the independent verification of the position of these valves and problems with procedural usage. Appropriate corrective actions were taken. This was a non-cited violation.

O8 Miscellaneous Operations Issues (92700)

O8.1 (Closed) Licensee Event Report 50-254/98009-00: Method of Daily Standby Liquid Control Pump Suction Piping Temperature Verification Did Not Support Technical Specification (TS) Requirement. This issue was previously discussed, and a violation issued, in Inspection Report 50-254/98004; 50-265/98004. The inspectors reviewed the licensee's corrective actions described in the subject LER, spoke to operators, reviewed logs, and concluded the actions taken were adequate. This item is closed.

O8.2 (Closed) Licensee Event Report 50-254/98017-00: Control Room Emergency Air Conditioning Compressor Tripped on Loss of Cooling Water During the Monthly Surveillance. This issue was previously discussed in detail in Inspection

Report 50-254/98012; 50-265/98012. The root cause was determined to be miscommunication between operators. The corrective actions included a change to the surveillance procedure and institution of a new policy regarding supervisory review of all procedural steps marked "not applicable." The failure to properly implement this surveillance procedure was considered to be a violation of TS 6.8.A.1, which requires that procedures listed in Regulatory Guide 1.33, Appendix A, be implemented. Appendix A recommends procedures for surveillance activities. However, this non-repetitive, licensee-identified and corrected violation is being treated as a **Non-Cited Violation (50-254/98013-02; 50-265/98013-02)**, consistent with Section VII.B.1 of the NRC Enforcement Policy. The inspectors reviewed the licensee's root cause investigation results and corrective actions and found them to be adequate. This licensee event report is closed.

II. Maintenance

M1 Conduct of Maintenance

M1.1 General Observations (71707)

During the inspection period, the inspectors observed an increase in on-line maintenance activities with an emphasis on reduction of the corrective maintenance backlog (see Section M1.3). Delays in restoring equipment to service due to rework, work scope increase, or work coordination problems continued to occur and extended planned out-of-service times. The inspectors observed significant delays due to poor work coordination during testing (see Section M1.4).

Several personnel errors occurred this inspection period during maintenance activities. In one case, a scram discharge instrument volume level switch was inoperable for greater than the TS allowed outage time. Although ultimately identified by a system engineer, several prior opportunities existed to discover the error (see Section M2.4).

M1.2 Maintenance Observations

a. Inspection Scope (62707, 61726)

The inspectors observed portions of the following maintenance and surveillance activities.

- 1B condensate booster pump replacement
- Unit 1 emergency diesel generator quarterly preventive maintenance
- 2D condensate booster pump seal replacement
- 2A 125 Vdc battery charger load testing
- inspection of the ½ "B" diesel fire pump suction strainer
- troubleshoot/repair of the Unit 2 high pressure coolant injection turning gear
- repair of brazed pipe on "B" train control room ventilation Freon system

- average power range monitor functional test
- high drywell pressure scram functional test

b. Observations and Findings

The inspectors noted that workers demonstrated appropriate knowledge of the assigned tasks and followed procedures. Several minor documentation problems were noted with the work packages for the 2D condensate booster pump seal replacement work. These problems did not affect the physical work. For most of the activities observed, supervisors visited the work site on a limited basis. In all cases, the equipment was returned to service and operated satisfactorily. However, rework and work scope increases resulted in the 1B condensate booster pump being out-of-service for a longer time than expected.

The inspectors had the following additional observations:

- In an attempt to eliminate the effects of zebra mussel infestation on important safety-related components, the licensee established a zebra mussel task force in early 1997. One of the proposals implemented by the team included coating of the fire diesel suction strainers and separation screens to the safety-related intake bay with a biologically-resistant paint. On July 29, 1998, the inspectors observed the images filmed during a diver inspection of the ½ "B" fire diesel suction strainer and separation screens. The images revealed that no zebra mussels had developed on these safety-related components.

- During a plant tour, the inspectors identified the presence of oil on the underside of one of four Freon return lines to the compressor for the safety-related "B" train of control room ventilation. The inspectors notified the system engineer of a possible small leak in the Freon system. Later, the licensee confirmed the presence of a small leak in the Freon system and initiated repairs.

- During observation of the battery charger testing, the inspectors noted that the procedure allowed preconditioning of the equipment prior to testing. This issue is discussed in greater detail in Section M2.2.

c. Conclusions

Condensate pump maintenance activities observed were performed correctly and in accordance with procedures. For most of the activities observed, supervisors visited the work site on a limited basis. The licensee's use of a biologically resistant coating on safety-related components successfully prevented the growth of zebra mussels this season.

M1.3 Backlog Reduction

a. Inspection Scope (62707)

The inspectors reviewed the licensee's recent efforts to reduce the maintenance backlog.

b. Observations and Findings

From July 1 through August 18, 1998, the backlog of corrective maintenance tasks decreased from 1005 to 816. During this time, 526 corrective maintenance tasks were removed from the backlog by completion, cancellation, or reclassification (not corrective maintenance). The inspectors reviewed data supplied by the electronic work control system which showed that approximately 60 percent of the work request tasks removed were due to work completion and 40 percent were due to cancellation and reclassification. The inspectors reviewed a sample of cancelled work requests and concluded that cancellation was appropriate due to duplicate work requests or work being performed under another work request.

c. Conclusions

The licensee continued to reduce the corrective maintenance non-outage backlog. Although some of the reported reduction was due to cancellation of work requests, the inspectors did not identify any inappropriate cancellations.

M1.4 Recirculation Sample Line Isolation Valve Maintenance

a. Inspection Scope (62707)

The inspectors observed coordination of radiation protection, operations, and maintenance activities and reviewed work packages related to replacement of the solenoid valve for the 1-220-45 reactor recirculation sample line air operated valve. Due to material condition concerns and the fact that emergent work and work control and implementation problems had been preventing timely completion of work, the inspectors observed the preliminary stages of the work preparation process in order to determine the effectiveness and efficiency of the maintenance process. The station corrective maintenance work completion rates for the previous weeks were on the order of 50 percent, indicating that only about half of the jobs scheduled to be completed in a given week were finished on time.

b. Observations and Findings

The solenoid valve replacement was scheduled to start on the morning of August 7 and was expected to take 2 to 3 hours. A surveillance test earlier in the week revealed slow sample line valve operation and maintenance personnel determined that replacement of the solenoid valve was the necessary repair. Problems with valve timing had been experienced several times in the past on the four recirculation sample isolation valves in Units 1 and 2. Electrical maintenance was the lead shop for the repair, and shop

workers were preparing for the job with the work package on the morning of August 7. Expected activities included removing the old solenoid valve, installing the new solenoid valve using an environmentally qualified splice on the electrical cable, and performing electrical checks on the connections. The valve was returned to service on August 12, shortly after work completion and testing, approximately 5 days later than scheduled. The only work scope increase for the job involved adding new push lock air line fittings which were found to be leaking after they were disturbed during the solenoid valve replacement. The inspectors found several points where coordination, communication, planning, and parts difficulties extended the unavailability of the recirculation sampling system and prevented the workers from being able to address other scheduled activities. These issues are addressed below.

The solenoid valve was located in the reactor water cleanup room which is a locked high radiation area. The radiation brief for the job was scheduled by the maintenance foreman to start at 8:00 a.m. central standard time. The brief did not start until about 8:30 a.m. causing a delay for the five workers present because all supporting groups were not in attendance. Quality control and nuclear oversight representatives arrived at 8:30 a.m. once they were informed of the start of the brief. Operations personnel were not at the briefing and were not able to support the maintenance, the required radiation and pre-job briefings, or the required out-of-service tagout until later in the morning.

Later in the morning, a maintenance foreman determined that the work package for the job was not sufficient because the need for an additional splice was identified. The need for the splice was found by reviewing the work package from the previous replacement of the solenoid valve. The inspectors asked why the information on the splice was not included in the original package, and were informed that the expectation that previous maintenance records be included in the work package had not been met due to an error in package preparation. Additionally, the previous work package lacked sufficient detail to enable electricians to properly plan for the additional splice. This condition necessitated an additional entry into the locked high radiation area to investigate the details of the splice.

Once the splice details had been properly included in the package, electricians performed some of the splice connections in the shop to reduce radiation exposure. However, electricians were not familiar with how to splice using Raychem shrink tubing. Additional delays were incurred while proper splice preparations were determined. The work lasted longer than one shift, which required the rehanging of the out-of-service tagout, and additional radiation and pre-job briefs. Electricians successfully replaced the solenoid valve, but post-maintenance testing revealed leaks in the air line tubing which had been reconnected. Workers determined that replacing the air line fittings was necessary.

Planners found that the air line fittings were not listed in the parts qualification list. The required fittings were for 1/4 inch tubing, and the list was only written to allow 3/8 inch fittings. The engineering authorization to allow 1/4 inch fittings was not received until late afternoon on August 11. Once the list was corrected, the fittings were installed late on August 11. The air operated valve was then stroke time tested successfully and returned to service on August 12.

c. Conclusions

One of the observed priority maintenance activities was completed successfully, but completed five days later than originally scheduled, with no major scope changes to the work. The inspectors concluded that although this work was emergent, and consequently disrupted the weekly work schedule, many of the problems identified were common throughout the maintenance process at Quad Cities. Weaknesses in work package preparation and coordination, communication between departments, knowledge of environmentally qualified splice techniques, parts qualification, and engineering and operations support department were evident. These types of problems were partial contributors to a 50 percent completion rate of corrective maintenance.

M2 Maintenance and Material Condition of Facilities and Equipment

M2.1 Maintenance Personnel Errors

a. Inspection Scope (61726)

The inspectors reviewed the root cause reports and corrective actions for several maintenance personnel errors that occurred during the inspection period.

b. Observations and Findings

The licensee identified that after calibration and testing of the 2B offgas hydrogen analyzer on July 16, 1998, an instrument maintenance technician incorrectly closed the isolation valve on the outlet of the calibration gas bottle. This valve was normally open to allow for auto-injection of the calibration gas periodically to verify proper response of the instrument. Isolation of the calibration gas did not make the analyzer inoperable. However, other problems which led to the discovery of the mispositioned valve did cause the analyzer to be inoperable. Based on the root cause investigation, the licensee determined that the procedure did not address opening or closing of the valve and the print was incorrect (although not used during this work).

On July 21, electricians incorrectly set up digital timers to be used during the Unit 1 emergency diesel generator surveillance of the Time Delay -1 and Time Delay -2 relays. The emergency diesel generator itself was unaffected. However, the emergency diesel generator had to be restarted to obtain the data. The timers were set up incorrectly because one worker misread a procedure step and the other worker did not catch the error.

On July 24, operations and engineering personnel identified that mechanical maintenance workers had failed to install two strainer drain valves during a modification to the Unit 2 high pressure coolant injection room cooler service water line. At the time of discovery, work had been completed and a return to service request submitted to the operations department. Upon discovery, maintenance workers installed the valves without first retracting the return to service request. However, the system was still isolated while the valves were installed. The licensee's root cause investigation

concluded that the maintenance supervisor signed the work package indicating that work was complete without completing an adequate review of the work package documents. The work package included the design documents which adequately addressed the installation of these valves. The failure to adequately implement Work Request 980048815-01 was considered to be a violation of TS 6.8. A.1, which requires that procedures listed in Regulatory Guide 1.33, Appendix A, be implemented. Appendix A recommends that procedures for the control of maintenance and modification work be established. However, this licensee-identified and corrected violation is being treated as a **Non-Cited Violation (50-254/98013-03; 50-265/98013-03)** consistent with Section VII.B.1 of the NRC Enforcement Policy.

The root cause report identified a number of deficiencies that contributed to this error including mechanical maintenance supervisors were overloaded, a perceived pressure to finish the work existed, and poor work practices were followed. The corrective actions in the root cause report appeared to be adequate to address the identified deficiencies.

The errors previously described did not adversely affect safety equipment. A more significant error, discussed in Section M2.4, did result in safety-related equipment becoming inoperable. Several of these configuration control problems resulted in the reset of the station event-free clock. A short maintenance stand down occurred in July to discuss the events, and no further events occurred in the inspection period.

c. Conclusions

Three separate maintenance errors delayed work on affected plant equipment, but did not jeopardize operability of safety systems. Configuration control problems occurred which were not prevented by second checks. One non-cited violation was issued for the failure to properly implement a maintenance work package.

M2.2 Battery Charger Testing

a. Inspection Scope (61726)

The inspectors observed the 4-hour load test of the 2A 125 Vdc battery charger and reviewed the associated test procedure and TS requirements.

b. Observations and Findings

The inspectors observed the 2A 125 Vdc battery charger testing as performed by the system engineer and two electricians. The test was designed to satisfy TS Surveillance Requirement 4.9.C.3.d, which required that once every 18 months the battery chargers be tested to demonstrate they will supply a load equal to the manufacturer's rating for at least 4-hours. The 2A battery charger was last tested on September 11, 1996, and therefore was past the 18-month due date, but still within the 25 percent extension allowed by the TSs.

The inspectors noted that the test procedure contained several preventive maintenance tasks which were performed prior to the 4-hour load test. These tasks included battery charger filter capacitor replacement (if necessary based on a visual inspection), high voltage shutdown setpoint verification, low voltage alarm setpoint verification, and current limit setpoint verification. The procedure directed adjustment and calibration of these setpoints if found out of tolerance. The inspectors were concerned that these adjustments prior to the load test could result in preconditioning such that the test would not be conducted with the battery charger in the "as-found" condition.

During the testing, the current limit setpoint was found slightly out of tolerance and was adjusted as directed by the procedure. However, approximately 2 ½ hours into the load test, the 480 VAC feed breaker to the charger from Motor Control Center 28-2 tripped. A problem identification form (Q1998-02915) was initiated. The sensing and current limit circuit board was replaced, the current limit setpoint adjusted, and the test was rerun satisfactorily. No cause for the breaker tripping was identified and monitoring of the breaker during the test revealed no problems. A previous battery charger load test on August 30, 1996, had also failed in the same way. At that time, the 60 amp breaker at Motor Control Center 28-2 was replaced with a 100 amp breaker, and the test was run successfully. Since this appeared to be a repetitive problem, the licensee generated a nuclear tracking system action item to prompt replacement of the breaker during the next work week window and to perform further testing.

The licensee agreed that the test procedure could allow preconditioning prior to battery charger testing and changed the procedure to ensure the test was performed with the charger in the "as-found" condition. The inspectors verified that the procedure changes had been completed. In this particular instance, the inspectors concluded that any possible preconditioning had no effect because the test failed and corrective actions were required and appropriately completed prior to restoring the charger to an operable status.

c. Conclusion

The 2A 125 Vdc battery charger failed a 4-hour load test when the feed breaker to the charger tripped. This was a repetitive problem, and no root cause was determined. The test was rerun satisfactorily and further actions were planned to determine the root cause. The inspectors identified that the procedure allowed for preconditioning prior to the test. The licensee agreed and changed the test procedure.

M2.3 Control Rod Drive Accumulator Problems

a. Inspection Scope (62707)

The inspectors reviewed Problem Identification Form 1998-03395 which addressed a Unit 2 recurrent blown fuse condition that occurred during lightning storms and circuit testing.

b. Observations and Findings

On August 10, 1998, a lightning strike occurred which caused Fuse F-1 in Panel 2202-20 to blow on Unit 2. The blown fuse caused control rod drive hydraulic control unit accumulator alarms on Panel 902-5 for Bank 3 rods. The licensee evaluated the loss of monitoring for the affected 44 control rods in accordance with Quad Cities Administrative Procedure 0230-07, "Operability Determination Checklist." Operators determined the affected hydraulic control units were operable and began local monitoring of control rod drive pressures and accumulator water levels.

The licensee's initial corrective action consisted of replacing the blown fuse, which immediately blew again. The fuse was again replaced and did not blow, but the alarm indicating light for Rod 50-35 illuminated. When the alarm indicating light switch was depressed to further isolate the circuit malfunction, the F-1 fuse blew again. The troubleshooting was then stopped and a project manager was assigned to conduct an investigation. A troubleshooting plan was developed under Engineering Operational Problem Response 98-02-0300-072 to attempt to identify what caused the blown fuse. The licensee identified the root cause as a damaged wire. Technicians concluded that over time the insulation degraded, and the wire began arcing to ground which caused the F-1 fuse to blow during voltage perturbations on the circuit. The instrument maintenance department initiated Work Request 980080920-02 to conduct repairs which were subsequently completed.

Similar symptoms had occurred previously as discussed in Inspection Report 50-254/98012; 50-265/98012, but the root cause was not identified. In that previous occurrence, the inspectors identified that operators had failed to use the formal process for operability determinations. Operator performance in this event had improved in that the formal process for operability evaluation was used and operator follow-up actions were in accordance with procedures. In this most recent event, the licensee had enough information to identify the root cause of the blown fuse. Followup by the licensee to successfully locate and repair the condition was thorough.

c. Conclusions

The licensee successfully resolved a repetitive problem with control rod drive hydraulic control unit annunciators. Operator response to this most recent occurrence was improved over a previous occurrence.

M2.4 Inoperable Scram Discharge Volume Level Transmitter

a. Inspection Scope (62707)

The inspectors reviewed the licensee's root cause investigation and corrective actions concerning a recurrent problem with a level transmitter in the scram discharge instrument volume.

b. Observations and Findings

In Inspection Report 50-254/98012; 50-265/98012, the inspectors documented their review of the licensee's response to an automatic reactor trip on June 27, which was caused by a failed scram discharge instrument volume level transmitter during a reactor protection system surveillance test. The licensee initially, and incorrectly, concluded that the transmitter electronic circuit board failed. Later, the licensee determined that the electronic board worked correctly and concluded that a leak in the instrument's capillary sensing line was the likely cause of the failure. An additional half scram signal was introduced several weeks after the June 27 reactor trip due to additional problems with the same transmitter.

However, during the current inspection period, the licensee concluded that the root cause for the failure was not related to a leak in the capillary sensing line but was due to crud buildup in the level transmitter sensing bellows. Licensee Event Report 50-254/980018 was written to document this event. Immediate corrective action addressed crud intrusion into the system. Planned corrective action included investigation of possible crud intrusion mechanisms which may still exist but have not yet been identified. These corrective actions were planned for future plant outages.

Operability of the other transmitters in the system was addressed with Problem Identification Form 1998-03257. The inspectors noted that the final reviewer of the root cause report had unresolved concerns as the issue was presented to the Plant Operations Review Committee. The final reviewer, who was an Operations staff member, was also a member of the Plant Operations Review Committee in which the root cause was presented. The inspectors' assessment was that involvement by the operations' staff member in both the independent review of the root cause and the Plant Operations Review Committee challenged the independent aspect of the Plant Operations Review Committee. The inspectors discussed this concern with licensee management who agreed that this example challenged the intent of the Plant Operations Review Committee administrative procedure. The issues were later presented to the Plant Operations Review Committee after a completed independent review. The licensee reviewed the calibration data for the other transmitters in the system, determined that they were operable, and documented this in the problem identification form closure.

During this root cause investigation, the licensee discovered that replacement of the electronic board in the scram discharge instrument volume transmitter had rendered the instrument inoperable. The licensee replaced the faulty transmitter with a new transmitter from stores, and installed the circuit board which was removed from the original transmitter into the new transmitter. Procurement engineering personnel then added the identification number for the circuit board to the safety-related parts list to indicate that the circuit board was a separate part which could be used on any Barton Model 764 level transmitter interchangeably. During the failure analysis of the original transmitter, the system engineer contacted the vendor and questioned whether it was acceptable to transfer control circuit boards between transmitters. The vendor's response was that each control board was factory matched to an individual transmitter to achieve accurate temperature compensation. The licensee initiated an operability

assessment for the 1-0302-109D transmitter and determined that it had been inoperable for a period of 18 days between June 28 and July 16, 1998. Technical Specification 3.1.A stated that a minimum of two scram discharge volume water level high delta-P switches must be operable in Modes 1 and 2; and with less than the minimum operable channels, the inoperable channel must be placed in the trip condition within 1 hour and the plant must be in hot shutdown within 12 hours. Since Unit 1 operated in modes 1 and 2 with an inoperable channel for greater than 1 hour as allowed by the TS action statement, this condition was considered to be a violation of TSs. This licensee-identified and corrected violation is being treated as a **Non-cited Violation (50-254/98013-04; 50-265/98013-04)** consistent with Section VII.B.1 of the NRC Enforcement Policy.

The licensee generated Licensee Event Report 50-254/98011 to document this event. The licensee attributed the cause of the inoperable transmitter to personnel error, in that a sufficient review of the vendor manual was not done. The troubleshooting section of the vendor manual stated that no field repair or component replacement on the Model 764 transmitter was authorized in order to maintain certification of the instrument; however, maintenance personnel did not refer to this section. It was only after the system engineer questioned the vendor that the licensee realized that the circuit boards could not be replaced separately. A second opportunity to catch the error was missed when the safety-related parts list was expanded using the parts evaluation process to include the control circuit boards as a separate repair part. The parts evaluation did not sufficiently justify the acceptability of using non-matched circuit boards as replacement parts and did not appear to include a thorough review of vendor manual guidance.

The safety significance of the inoperable instrument was low due to redundancy and diversity in the scram discharge instrument volume inputs to the reactor protection system. The licensee's completed corrective actions included counseling individuals involved, changing the vendor manual to give clearer direction, conducting a history search to evaluate whether any other circuit boards had been interchanged (none were identified), researching the vendor manuals to identify other Rosemount transmitter models with the same type of restrictions (no new models were identified), and removing the affected circuit board from the safety-related parts list. anned corrective actions included briefings on the licensee event report with instrument mechanics, procurement engineering personnel, and system engineers and revising the parts evaluation and the safety-related parts list to give a clear indication that the transmitter and circuit board are a matched set. The licensee's completed and proposed corrective actions were adequate.

c. Conclusions

The licensee ultimately determined the root cause of the scram discharge instrument volume transmitter failure after incorrectly identifying two other causes. Maintenance personnel failed to correctly reference the vendor manual when interchanging electronic boards between transmitters. The parts evaluation process also missed this error which resulted in the scram discharge instrument volume transmitter being inoperable for 18 days. This condition resulted in a non-cited violation.

M8 Miscellaneous Maintenance Issues (92902)

M8.1 (Closed) Violation 50-254/97026-03; 50-265/97026-03: Missed TSs Surveillances. A large number of surveillance tests had been missed since the implementation of the upgraded TSs in September 1996. Corrective actions included the appointment of a new TSs coordinator, development of a manual tracking system, corrections to the electronic work control system, creation and implementation of a mode change checklist, and further reviews of the surveillance test requirements and implementing procedures. As a result, a surveillance test had not been missed since February 1998. The inspectors concluded that the licensee's corrective actions were successful in arresting the trend in missed surveillance tests. As a result of the licensee's corrective actions, a number of additional missed surveillance tests were identified and reported in licensee event reports. In addition to closure of this violation, all associated licensee event reports are also closed as noted in M8.2. This violation is closed.

M8.2 Licensee Event Reports Associated With Missed Surveillances

The following licensee event reports were submitted by the licensee after the discovery of additional missed surveillance tests during the corrective actions in response to the violation issued in Inspection Report 50-254/97026; 50-265/97026. The licensee's identification of these additional missed surveillance tests was noteworthy, and corrective actions are complete. No additional missed surveillance tests have occurred in over 6 months. These additional examples of missed surveillances are considered to be multiple examples of a violation of TS 4.0.A which requires that surveillance requirements be met during reactor operational modes. This non-repetitive licensee-identified and corrected violation is being treated as a **Non-cited Violation (50-254/98013-06; 50-265/98013-06)**, consistent with Section VII.B.1 of the NRC Enforcement Policy.

- (Closed) Licensee Event Report 50-254/97029-00: Rod Block Monitor Surveillance Testing Not Performed as Required. See Section M8.1. This licensee event report is closed.

- (Closed) Licensee Event Report 50-265/98001-00: Source Range Monitor TS Surveillance Test Not Performed. See Section M8.1. This licensee event report is closed.

- (Closed) Licensee Event Report 50-254/98002-00: Drywell High Pressure Monthly Surveillance Interval Exceeded. See Section M8.1. This licensee event report is closed.

- (Closed) Licensee Event Report 50-265/98002-00: Offgas Hydrogen Samples Not Collected in Accordance With TS Requirements. See Section M8.1. This licensee event report is closed.

- (Closed) Licensee Event Report 50-254/98010-00: Technical Specification Surveillance Interval for Snubber Inspection Exceeded. See Section M8.1. This licensee event report is closed.

M8.3 (Closed) Licensee Event Report 50-265/97001-00: Instrument Maintenance Surveillance Caused a High Pressure Coolant Injection to the Reactor. Revision 1 to this licensee event report was closed in Inspection Report 50-254/97011; 50-265/97011. Therefore, Revision 0 is being administratively closed. This licensee event report is closed.

M8.4 (Closed) Licensee Event Report 50-254/97013-00: Reactor Core Isolation Cooling Area High Temperature Switch Would Not Actuate Due to Excess Sealing Varnish Applied by Technician. During channel functional testing, instrument technicians found that the 1-1360-14D temperature switch would not actuate due to a previous technician error. Excess sealing varnish had been applied after the previous calibration. The three other similar temperature switches functioned correctly. Technical Specification Table 3.2.A.1 requires a minimum of two operable channels per trip system or the closure of the reactor core isolation cooling system steam supply isolation valves within 1 hour. The licensee determined that the switch had been inoperable from September 1996 until the inoperable condition was discovered on April 17, 1997. The failure to comply with the limiting condition for operation was considered to be a violation of TS 3.2.A.1. The licensee removed the excess varnish and calibrated and functionally tested the switch. All other similar switches were checked and functioned correctly. Other corrective actions included a procedure change to caution technicians on the amount of sealing varnish to apply and a requirement to bench test switches both in the as-found condition and after the varnish has been applied. This non-repetitive, licensee-identified and corrected violation is being treated as a **Non-cited Violation (50-254/98013-05; 50-265/98013-05)**, consistent with Section VII.B.1 of the NRC Enforcement Policy.

M8.5 (Closed) Licensee Event Report 50-254/97023-00: Average Power Range Monitor Surveillance Test Not Performed as Required. The licensee informed the inspectors of an error in the safety analysis section of the licensee event report which states that an intermediate range power monitor would produce a rod block. However, the intermediate range power monitors do not provide a rod block with the reactor in the RUN mode. This error did not impact the description of the issue which involved a missed surveillance tests nor did it impact the conclusion with regard to safety significance. The licensee did not plan to resubmit the licensee event report and the inspectors concluded that a revision was not necessary. A violation was issued for this missed surveillance test in Inspection Report 50-254/97026; 50-265/97026 (see Section M8.1). This licensee event report is closed.

M8.6 (Closed) Licensee Event Report 50-254/97025-00: Average Power Range Monitor Calibration Not Performed as Required. A violation was issued for this missed surveillance test in Inspection Report 50-254/97026; 50-265/97026 (see Section M8.1). This licensee event report is closed.

M8.7 (Closed) Licensee Event Report 50-254/97026-00; 50-254/97026-01: Instrument Channel Checks and Primary Containment Sump Flow Rate Surveillance Tests Not Completed as Required. A violation was issued for this missed surveillance test in Inspection Report 50-254/97026; 50-265/97026 (see Section M8.1). This licensee event report is closed.

M8.8 (Closed) Licensee Event Report 50-254/98018-00: Full Reactor Scram During Average Power Range Monitor Surveillance Testing. See Section M2.4. This licensee event report is closed.

M8.9 (Closed) Licensee Event Report 50-254/98011-00: Unqualified Circuit Card Installed in the Scram Discharge Instrument Volume Transmitter. See section M2.4. This licensee event report is closed.

III. Engineering

E1 Conduct of Engineering

E1.1 Review Of 10 CFR 50.59 Summary Report

a. Inspection Scope (37551)

In following up on an issue discussed in Inspection Report 50-254/97022; 50-265/97022, the inspectors completed a review of "Summary Report of Changes, Tests and Experiments Completed," dated March 31, 1998. The inspection included a review of 50.59 summary reports and discussions with regulatory assurance personnel.

b. Observations and Findings

In Licensee Event Report 50-254/97024, the licensee stated that summaries of all safety evaluations were not previously transmitted in the 1995, 1996, and 1997 submittals. In the October 31, 1997, submittal, the licensee committed to provide the NRC with the missing safety evaluation summary information in a future 10 CFR 50.59 summary. The subject information was forwarded to the NRC in the March 31, 1998, submittal which contained a concise description of the changes and resultant evaluations.

The licensee had identified that Safety Evaluation 97-041, which constituted an Updated Final Safety Analysis Report change, was not included in the October 31, 1997, submittal. The licensee prepared and approved the change package and planned to include the change in the next Updated Final Safety Analysis Report update.

c. Conclusions

The conclusions reached by the licensee in the 10 CFR 50.59 summary report appeared adequate and included information from 1995 through 1997 that had not been submitted in previous summary reports.

E1.2 Emergency Diesel Generator Reliability Data

a. Inspection Scope (37551)

The inspectors reviewed the emergency diesel generator performance data used to estimate reliability.

b. Observations and Findings

In Inspection Report 50-254/96020; 50-265/96020, the inspectors documented a concern with the failure classification of the shared emergency diesel generator start failure that occurred on January 17, 1997. That failure was classified as an invalid start failure and therefore would not be counted in determining diesel generator reliability. The inspectors disagreed with the classification of this start failure and requested that the licensee respond with a written explanation. The licensee's response was dated March 20, 1997, in which the licensee stated that the diesel generator reliability program was consistent with guidelines in Regulatory Guides 1.9, "Selection, Design, Qualification, and Testing of Emergency Diesel Generator Units Used As Class 1E Onsite Electric Power Systems at Nuclear Power Plants". The licensee's basis for concluding that the failure was invalid was a successful start approximately 15 minutes later with no maintenance in the interim. Engineers concluded that this scenario was similar to test failure exceptions described in Regulatory Guide 1.9, specifically, "Component malfunctions or operating errors that did not prevent the emergency diesel generator from being restarted and brought to load within a few minutes (i.e., without corrective maintenance or significant problem diagnosis)." The inspectors disagreed with the licensee's interpretation because the diesel's start failure was due to an inherent defect that would cause intermittent failure and affect the reliability until corrected.

More recently, the inspectors reviewed emergency diesel generator performance data and noted additional classification problems. On May 18, 1998, an emergency diesel generator failed to start when the autostart relay failed to fully actuate. This failure was classified as invalid because a manual start signal would have started the engine. After the inspectors challenged the classification, the licensee changed the classification to valid.

Upon further review of the January 17, 1997, start failure, the inspectors noted that while the failure was classified as invalid, the successful start 15 minutes later was classified as valid. The inspectors expressed concern that failures were classified as invalid while successful starts were counted as valid which could skew the estimated

emergency diesel generator reliability data. The licensee ultimately changed the classification of the successful start to an invalid success since the start was a follow up to troubleshooting.

An inspection follow up item generated in Inspection Report 50-254/96020; 50-265/96020 will remain open pending review of the licensee's application of Regulatory Guide 1.9 in estimating emergency diesel generator reliability.

c. Conclusions

The inspectors continued to be concerned that the licensee, in applying Regulatory Guide 1.9 in determining emergency diesel generator reliability, did not properly characterize diesel generator start failures. Two additional examples of incorrectly classified starts were identified. This issue remains open pending a review by technical staff in the Office of Nuclear Reactor Regulation regarding the licensee's interpretation of guidance in Regulatory Guide 1.9.

E1.3 Unit 2 High Pressure Coolant Injection Pump Turning Gear Failure

a. Inspection Scope (71707)

The inspectors observed the operation of the Unit 2 high pressure coolant injection pump during a surveillance test. The inspectors observed portions of subsequent troubleshooting activities. The inspectors also reviewed the licensee's troubleshooting plans and operability evaluations.

b. Observations and Findings

On July 29, 1998, operators started and operated the Unit 2 high pressure coolant injection pump and turbine for routine surveillance testing. The pump operated properly, but at the conclusion of the test, operators identified that the turning gear failed to engage the turbine. The turning gear slowly turns the turbine to avoid bowing of the turbine during turbine cool down. Operators manually engaged the turning gear and declared the Unit 2 high pressure coolant injection pump inoperable. This single train safety system failure was reported to the NRC.

A systematic process with support from a multi-disciplined team was used to conduct the root cause evaluation. Through troubleshooting activities, the licensee identified multiple problems. A limit switch failed due to mechanical interference caused by aging. Also, an oil pressure switch in the turning gear motor logic had a high resistance across the contacts. This condition produced a high current which resulted in damage to an electrical relay. The limit switch, pressure switch, and relay were replaced. The licensee was trying to determine what caused the high resistance in the oil pressure switch. In addition, the licensee identified that the turning gear engagement exceeded the allowed travel length. Engineering personnel were concerned with the turning gear engagement condition, but after further evaluation, determined that it did not affect system operability. The inspectors noted that the system engineers maintained a chronological log of troubleshooting activities which assisted in determining the root

cause of the failure. The turning gear was repaired and the Unit 2 high pressure coolant injection pump was operated satisfactorily. The pump was declared operable on August 4, 1998.

c. Conclusion

The inspectors concluded that the licensee's troubleshooting efforts were thorough in determining the root cause of the Unit 2 high pressure coolant injection turning gear failure. The corrective actions adequately addressed the cause of the failure.

E8 Miscellaneous Engineering Issues (92902)

E8.1 (Closed) Unresolved Item 50-254/94004-03; 50-265/94004-03: Electromatic Relief Valve Failures. This item related to a large number of problems with electromatic relief valves. The licensee had planned to change out the relief valves on both units. After replacing the Unit 2 valves with Target Rock valves in 1995, some high tailpipe temperature problems were experienced. The licensee decided not to replace the relief valves on Unit 1, but to repair them instead. In 1998, engineers evaluated recent failures and considered them to be much fewer and less significant than the 1993 failures. Consequently, system engineers, in a February 9, 1998, letter, recommended canceling the modification of Unit 1 relief valves. The licensee was planning to issue a change in commitment letter detailing the change in plans for the relief valves. This item is closed.

E8.2 (Closed) Unresolved Item 50-254/94004-53; 50-265/94004-53: Modification Backlog. This item pertained to the high number of backlogged engineering modifications. The inspectors reviewed the backlog numbers for March 1998, and noted that there were 443 backlogged modifications, compared to over 1000 in 1994. Most of the significant modifications planned in 1994 had been accomplished. Some had been deleted following further review. Prioritizing engineering resources continued to be an issue in 1998, and will be followed during routine engineering inspections. This item is closed.

E8.3 (Closed) Licensee Event Report 50-254/95003-00: Traversing In-core Probe System Primary Containment Isolation Valves Outside of Design Basis. The licensee identified that upon resetting of a Group 2 primary containment isolation signal, both unit traversing in-core probe isolation valves would automatically reopen. The Updated Final Safety Analysis Report Section 7.3.2.2 stated, "The operator must operate switches in the control room to manually reset the isolation signal and reopen a valve which has been automatically closed."

Based on discussion with the owners group, the licensee concluded that this condition had low safety significance. The licensee implemented modifications to ensure the traversing in-core probe isolation valves would remain closed upon reset of a Group 2 primary containment isolation signal. The inspectors reviewed the completed modification and supporting paperwork.

The inspectors considered the original noncompliance with design requirements to be a violation of design control per Criterion III of Appendix B to 10 CFR Part 50. However,

this failure constituted a violation of minor safety significance and is not subject to formal enforcement.

E8.4 Inspection Follow-up Item 50-254/96020-05; 50-265/96020-05: Weak Operability Assessment for the Safe Shutdown Makeup Pump. The inspectors noted that a weak operability assessment had been performed for the safe shutdown makeup pump system when valve motors were identified as undersized. Additionally, the licensee's corrective action system at the time was not properly used. Since this inspection report was issued, the system was restored to a fully operable status and the new corrective action program implemented. This item is closed.

E8.5 (Closed) Licensee Event Report 50-265/98005-00: Failure of Unit 2 High Pressure Coolant Injection Pump Turning Gear. This issue was discussed in Section E1.3. This item is closed.

E8.6 (Closed) Licensee Event Report 50-254/98015-00: Residual Heat Removal Service Water Valve to Control Room Emergency Ventilation System Failed. During a surveillance test, an operator identified that the valve failed to fully open. The licensee determined that the failed valve and a similar valve from the nonsafety-related service water supply system needed to be included in a periodic maintenance program. The inspectors reviewed the periodic maintenance program and identified that only one of the two valves had been included in the program. The inspectors spoke to licensee management about this issue. As a result, the licensee documented the deficient condition on Problem Identification Form Q1998-03392 and developed a preventive maintenance task for the second valve. This item is closed.

IV. Plant Support

R8 Miscellaneous Radiation Protection Issues

R8.1 (Closed) Violation 50-254/97011-05: High Radiation Area Neither Locked Nor Guarded. During a tour of the facility, the inspectors identified an improper posting of a locked high radiation area. Radiation protection technicians improperly used a red flashing light as a method to prevent entry into the area in lieu of locking or guarding the gate. The licensee concluded there was no unauthorized entry into the locked high radiation area. The licensee changed the method for locking down the reactor building basement area during high pressure coolant injection system testing. The licensee changed an administrative procedure to ensure that the use of a red flashing light was authorized by management prior to use. The inspectors concluded that the licensee's corrective actions were adequate. This item is closed.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors presented the inspection results to members of licensee management at the conclusion of the inspection on September 1, 1998. The licensee acknowledged the findings presented.

INSPECTION PROCEDURES USED

IP 37551:	Onsite Engineering
IP 61726:	Surveillance Observations
IP 62707:	Maintenance Observations
IP 71707:	Plant Operations
IP 92700:	Onsite Follow-up of Written Reports of Nonroutine Events at Power Reactor Facilities
IP 92902:	Follow-up - Engineering

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-254/98013-01; 50-265/98013-01	NCV	configuration control problems
50-254/98013-02; 50-265/98013-02	NCV	failure to properly implement surveillance procedure
50-254/98013-03; 50-265/98013-03	NCV	maintenance personnel errors
50-254/98013-04; 50-265/98013-04	NCV	inoperable scram discharge volume level transmitter
50-254/98013-05; 50-265/98013-05	NCV	reactor core isolation cooling area high temperature switch
50-254/98013-06; 50-265/98013-06	NCV	missed surveillances

Closed

50-254/98009-00	LER	method of daily standby liquid control pump suction piping temperature did not support TS requirement
50-254/98017-00	LER	control room emergency air conditioning compressor tripped on loss of cooling water during the monthly surveillance
50-254/97026-03; 50-265/97026-03	VIO	missed TS surveillances
50-254/97029-00	LER	rod block monitor surveillance testing not performed as required
50-265/98001-00	LER	source range monitor TS surveillance not performed
50-254/98002-00	LER	drywell high pressure monthly surveillance interval exceeded
50-265/98002-00	LER	offgas hydrogen samples not collected in accordance with TS requirements
50-254/98010-00	LER	Technical Specification surveillance interval for snubber inspection exceeded
50-265/97001-00	LER	instrument maintenance surveillance caused a high pressure coolant injection to the reactor

50-254/97013-00	LER	reactor core isolation cooling area high temperature switch would not actuate due to excess sealing varnish applied by technician
50-254/97023-00	LER	average power range monitor surveillance not performed as required
50-254/97025-00	LER	average power range monitor calibration not performed as required
50-254/97026-00; 50-254/97026-01	LER	instrument channel checks and primary containment sump flowrate surveillances not completed as required
50-254/98018-00	LER	Full Reactor Scram
50-254/98011-00	LER	Unqualified Circuit Card in Scram Discharge Volume
50-254/94004-03; 50-265/94004-03	URI	electromatic relief valve failures
50-254/94004-53; 50-265/94004-53	URI	modification backlog
50-254/95003-00	LER	traversing in-core probe system primary containment isolation valves outside of design basis
50-254/96020-05; 50-265/96020-05	IFI	weak operability assessment for the safe shutdown makeup pump
50-265/98005-00	LER	failure of Unit 2 high pressure coolant injection pump turning gear
50-254/98015-00	LER	residual heat removal service water valve to control room emergency ventilation system failed
50-254/97011-05	VIO	high radiation area neither locked nor guarded
50-254/98013-01; 50-265/98013-01	NCV	configuration control problems
50-254/98013-02; 50-265/98013-02	NCV	failure to properly implement surveillance procedure
50-254/98013-03; 50-265/98013-03	NCV	maintenance personnel errors
50-254/98013-04; 50-265/98013-04	NCV	inoperable scram discharge volume level transmitter
50-254/98013-05; 50-265/98013-05	NCV	reactor core isolation cooling area high temperature switch
50-254/98013-06; 50-265/98013-06	NCV	missed surveillances

Discussed

50-254/96020-04; 50-265/96020-04	IFI	Reliability problems with the shared emergency diesel generator

LIST OF ACRONYMS AND INITIALISMS USED

CFR	Code of Federal Regulations
ComEd	Commonwealth Edison Company
IDNS	Illinois Department of Nuclear Safety
IFI	Inspection Follow-up Item
MWe	Mega-watts Electric
QCIS	Quad Cities Instrument Surveillance
QCOS	Quad Cities Operating Surveillance
RG	Regulatory Guide
URI	Unresolved Item
Vdc	Volt direct current
VIO	Violation