U. S. NUCLEAR REGULATORY COMMISSION

REGION III

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Licensee:	Commonwealth Edison Company (ComEd)
Facility:	Quad Cities Nuclear Power Station, Units 1 and 2
Location:	22710 206th Avenue North Cordova, IL 61242
Dates:	September 24 - October 26, 1996
Inspectors:	C. Miller, Senior Resident Inspector K. Walton, Resident Inspector L. Collins, Resident Inspector R. Ganser, Illinois Department of Nuclear Safety
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EXECUTIVE SUMMARY

Quad Cities Nuclear Power Station, Units 1 & 2
NRC Inspection Report 50-254/96014, 50-265/96014

This inspection included aspects of licensee operations, maintenance, engineering, and plant support. The report covers a 5 week period of inspection from September 24 - October 26, 1996, by resident inspectors.

Operations

- The inspectors identified an unapproved copy of a pressure-temperature limit graph from Quad Cities Operating Surveillance (QCOS) 0201-02, "Primary System Boundary Thermal Limitations," posted in the control room (Section O2.1).

- Good panel monitoring by control room operators resulted in detection of a combined intercept valve drifting closed. However, transient swings in generator output were not detected by control room operators in a timely manner (Section O2.1).

- A control room supervisor inadvertently contacted a computer touch screen which resulted in a station blackout diesel generator starting (Section O5.1).

Maintenance

- The inspectors identified instances where failure to adhere to procedures during maintenance on the shared standby diesel generator (SBDG) resulted in rework. The inspectors also identified poor supervisory oversight of some important job activities. Other problems identified by the inspectors included the use of unqualified workers for the SBDG and use of a vendor service representative who did not have a certification letter on file (Section M1.1).

- Standby diesel generator maintenance planning was good and resulted in completion of work and testing in accordance with the schedule. Although improved implementation of risk significant work scheduling were noted, some aspects of risk planning were not fully considered (Section M1.1).

- The inspectors observed good maintenance practices implemented during work on a residual heat removal service water pump. Some communications weaknesses between the vendor and licensee resulted in pump casing leakage. A poor quality pump casing also led to the leakage (Section M1.2).

- The inspectors noted that neither the licensee' nor the vendor's quality control programs prevented substandard parts from reaching the maintenance shop. The parts were identified by workers during the maintenance and testing process (Section M7.1).

Engineering

- Control room ventilation original design errors led to system inoperability. A good questioning attitude by a system engineer led to identification and subsequent repair of the design deficiency in the safety-related portion of the control room ventilation system (Section E1.2).

- A thorough root cause analysis by engineering staff helped to resolve problems associated with improper venting of the high pressure coolant injection system (Section E2.1).

- The inspectors identified a discrepancy between the Updated Final Safety Analysis Report and the Stanöby Diesel Generator (SBDG) design document relating to starting air requirements (Section M1.1).

Plant Support

- Licensee response to a fire training exercise was good (Section F5.1).

Report Details

Summary of Plant Status:

Unit 1 operated at or near full power throughout this inspection period. The unit was placed in a 30-day limiting condition for operation (LCO) while the licensee changed out the 1C residual heat removal service water pump. The work was successfully completed and the system returned to service as scheduled in approximately 21 days.

Unit 2 operated at or near full power during most of the inspection period, but material condition issues necessitated several load drops. Operators reduced power due to problems maintaining condenser vacuum. Later, operators reduced power and removed the generator from service due to problems with a combined intercept valve (CIV) drifting closed. The licensee experienced problems with venting the high pressure coolant injection (HPCI) system during a routine surveillance. The licensee took additional interim measures to assure proper HPCI system venting until engineering could determine the root cause of the problem.

On October 21, 1996, the licensee entered a 7-day LCO, applicable to both units, to perform scheduled maintenance on the shared standby diesel generator (SBDG). Maintenance and subsequent testing was completed within the LCO time period.

I. Operations

O1 Conduct of Operations[1]

O1.1 General Comments (71707)

Using Inspection Procedure 71707, the inspectors conducted frequent reviews of ongoing plant operations.

During the inspection period, several events occurred which required prompt notification of the NRC pursuant to 10 CFR 50.72. The events and dates are listed below.

September 24	Emergency Notification System (ENS) call. The licensee lost the health physics network (HPN) phone line due to phone lines being severed off site. Communications were restored to service one hour later.
September 26	Operators reduced Unit 2 power due to problems maintaining condenser vacuum.
October 9	Unit 2 HPCI was declared inoperable due to inability to verify the HPCI discharge piping filled.

[1]Topical headings such as O1, M8, etc., are used in accordance with the NRC standardized reactor inspection report outline. Individual reports are not expected to address all outline topics.

October 12	ENS call. The safety-related control room ventilation system was declared inoperable due to the refrigerant crank case heater being fed from non-safety-related power supply.
October 23	Unit 2 power was decreased due to a CIV drifting closed.
October 24	Operators remove Unit 2 generator from service after testing a CIV produced undesirable results to turbine auxiliary equipment.

O1.2 Control Room Inspections and Plant Area Walkdowns

a. Inspection Scope

The inspectors walked down various safety-related systems and observed various operations and plant work activities to verify adherence to safe and proper work practices and plant procedures.

b. Observations and Findings

The inspectors identified a copy of a pressure-temperature limit graph from procedure QCOS 0201-02, "Primary System Boundary Thermal Limitations," Revision 5, posted in the control room. The graph was used during plant start-ups and heat-up to ensure that important parameters remained within required limits. The graph was not a controlled copy, was from an out of date procedure revision, and was not approved by the Shift Engineer. The inspectors informed the unit supervisor who later removed the unauthorized copy from the control room. During initial license examination inspections prior to this finding, NRC inspectors had identified a similar problem which the licensee had later indicated was corrected. Having an unapproved posted version of the pressure-temperature limit graph was contrary to Quad Cities Administrative Procedure (QCAP) 217-2, "Plant Posting Control," Revision 0, August 5, 1994, which required in-plant postings to be approved by the Shift Engineer and logged in the Plant Posting log index. Failure to follow QCAP 217-2 is **an example of a Violation (50-254/265-96014-01a)** of Technical Specifications.

The inspectors observed operators and electricians perform post maintenance tests (PMT) on the 4 Kv feeder breaker to the 1C residual heat removal service water pump (RHRSWP). At the approximate time that the operator reinstalled the control power fuses and racked in the breaker for ground testing, annunciator power was lost to the 901-6 annunciator panel in the control room. The unit supervisor terminated the breaker test until the cause for the loss of power to alarms was determined. The cause for the loss of alarms was subsequently determined to be a blown fuse, apparently not related to the breaker testing. With this determined, breaker testing was satisfactorily completed by the oncoming shift.

Area walkdowns revealed only minor deficient conditions (excluding the reactor building basement area discussed in Section E2.3 of this report). General housekeeping in the 1B residual heat removal (RHR) room was acceptable. Dirt and debris had accumulated on top of the 1D RHR pump motor. The handwheel for the

manual core spray pump discharge valve, 1-1402-8A, was in contact with the minimum flow line. The valve could be operated normally and no signs of pipe damage were present. There was insulation damage on three sections of the 1C RHRSWP piping. The inspector brought these issues to the attention of the unit supervisor. The licensee expended effort to improve the condition and appearance of the RHRSWP rooms.

c. Conclusions

Corrective actions for improper postings in the control room failed to prevent similar occurrences and resulted in a violation. The unit supervisor made a conservative decision to stop breaker testing when power was lost to an annunciator panel.

O2 Operational Status of Facilities and Equipment

O2.1 Combined Intercept Valve (CIV) Drifted Closed

a. Inspection Scope (71707)

The inspectors observed the licensee's troubleshooting efforts and reviewed the work package and engineering evaluation for installation of jumpers in the electro-hydraulic control cabinet. The inspectors reviewed trend recordings associated with a transient induced by the troubleshooting efforts and Updated Final Safety Analysis Report (UFSAR) sections 10.2 and 15.2.3.1.

b. Observations and Findings

Unit 2 operators noted the number 1 CIV slowly drifted from its normally full open condition to closed. Operators lowered Unit 2 turbine load in preparation for troubleshooting the CIV. With the reactor at about 25 percent power, technicians removed the servo amplifier, demodulator, and indicator (SADI) control board for the number 1 CIV. When the SADI board was removed, the number 1 CIV and number 4 CIV (slave to number 1 CIV) closed as anticipated.

The licensee determined the SADI board removed from the number 1 CIV was faulted. A spare SADI board was bench checked satisfactorily, but a feedback parameter needed to be measured from the faulted SADI board with the faulted board installed in the electro-hydraulic control cabinet. Engineering prepared an evaluation for installation of jumpers to maintain both the number 1 and number 4 CIVs closed during calibration of the SADI card with the Unit 2 turbine on line.

The faulted SADI board was reinstalled and the number 1 CIV was cycled to obtain information. Rapid and frequent cycling of the number 1 CIV produced feedwater heater alarms. Operators responded to the alarms, but were not aware of transient swings in generator output. Testing continued until operators noted a large swing in generator output (from 10 Mwe to 280 Mwe). Operators stopped troubleshooting activities until the Unit 2 turbine was removed from operation.

Testing was suspended pending engineering determination of the cause of the transient during testing. The inspectors considered this an **Inspector Followup Item (50-254/265-96014-02)** pending review of the licensee's root cause evaluation and corrective actions.

c. Conclusions

The inspectors concluded that panel monitoring by control room operators was good in detecting the number 1 CIV not fully open as required but could have been better in detecting generator swings produced by troubleshooting activities. Operations' response to the CIV drifting closed was conservative.

O2.2 Indication of High Pressure Coolant Injection (HPCI) System Automatic Initiation in Bypass

a. Inspection Scope (71707)

The inspector reviewed UFSAR section 7.3.1.3.1.12 and Institute of Electrical and Electronic Engineers (IEEE) Standard 279-1968 to verify compliance with requirements for indications of automatic initiation in bypass of the HPCI system.

b. Observations and Findings

During a routine monthly surveillance, the licensee was unable to verify the discharge of Unit 2 HPCI piping was filled and declared the system inoperable (See Section E2.1). The inspectors noted the operators engaged a mechanical device to keep the Unit 2 HPCI trip push button on the main control board detented. Operators indicated the abnormal condition by placing an orange disc around the switch.

Section 4.13 of IEEE 279-1968 required that if a safety system had been rendered inoperative, that this condition be continuously indicated in the control room. Licensee procedure, QAP 300-13, "Tagging Equipment," required operators to indicate abnormal conditions with an orange disc.

c. Conclusions

The inspectors concluded the licensee was in compliance with IEEE 279-1968 for the trip functions listed in UFSAR section 7.3.1.3.1.12. Similarly, the use of the orange disc adequately complied with IEEE 279-1968. However, QAP 300-13, "Tagging Equipment," did not reference, and operations staff were not aware of, the IEEE standard which required continuous indication when the automatic initiation of a safety system was bypassed. The inspectors were concerned that the lack of awareness of the IEEE standard was a potential weakness in the licensee's tagging program.

O5 Operator Training and Qualification

O5.1 Inadvertent Start of Station Blackout Diesel Generator (SBODG)

a. Inspection Scope

The inspectors reviewed the licensee's investigation of an unexpected start of the Unit 2 SBODG. The inspectors reviewed the SBODG controls and discussed its operation with operators.

b. Observations and Findings

During the midnight shift on October 5, a control room operator identified the SBODG was running unloaded based on indications on the touch-screen control panel. No activities involving either of the SBODGs were in progress. The operators immediately began an investigation to determine how and when the diesel was started and also initiated the surveillance procedure for testing the SBODG. Based on information from an equipment operator who heard a diesel start, the licensee concluded that the SBODG had been running for approximately 20 minutes before discovery by control room operators. There were no annunciators associated with the event.

The licensee concluded that the diesel was most likely started inadvertently by the shift engineer (SE) leaning up against the touch screen control panel. The SE was in the control room for 20-30 minutes, standing next to the screen and talking with operators.

From the human factors perspective, this event was considered by the manufacturer to be highly unlikely. An operator would need to inadvertently scroll through three different screens, bumping them in just the right places to start the SBODG. However, the licensee's investigation did not find any other starting method that would result in the as found condition of the touch-screen control panel.

To prevent future recurrences, the licensee has planned to include this information in future training classes. The operating crews were also keeping the control screen positioned so four screens must be scrolled through to start the diesel.

c. Conclusions

The licensee concluded that the root cause of the event was a training deficiency. Operators had been told this event could not happen. The inspectors concluded that the licensee's corrective action would be sufficient to minimize the potential for recurrence.

O8 Miscellaneous Operations Issues (92700, 92701)

O8.1 (Closed) Inspector Followup Item (50-254/265-94004-19): Annunciator Indication Problems. During the Diagnostic Evaluation Team (DET) inspection, the inspectors identified operators failing to pursue annunciator alarms received in the control room. Additionally, operators were provided no guidance on how many and how long annunciators could be disabled. The inspectors also observed green annunciator windows indicating reactor vessel head seal leakage was an acceptable condition during operations.

The inspectors noted increased sensitivity to acknowledging and responding to annunciator alarms by control room personnel. The licensee removed all green tiled annunciators from the control room. Reactor vessel head seal leakage was repaired on Unit 2 but remained in an alarmed status in Unit 1. The inspectors reviewed operator logs for disabled annunciators in both units and identified that no annunciators were disabled. Although allowed by an operating procedure, disabling annunciators were not routinely used. This item is closed.

O8.2 (Closed) Unresolved Item 50-254/265-96012-02 and (Closed) LER 50-254-96020: Control Room Emergency Filtration System (CREFS) Inoperable. On September 7, operators unsuccessfully attempted to start the CREFS for a routine surveillance test. The system failed to start due to the toxic gas analyzer (TGA) being deenergized for preventive maintenance. The operators did not know that the TGA being deenergized would inhibit the CREFS booster fans from starting. The equipment performed as designed. The licensee attributed this event to an operator knowledge deficiency. The inspectors reviewed the licensee's immediate corrective actions and planned long term corrective actions. These items are closed.

II. Maintenance

M1 Conduct of Maintenance

M1.1 Shared Standby Diesel Generator (SBDG) On-line Maintenance

a. Inspection Scope

The inspectors observed portions of the shared SBDG 18-month preventive maintenance and other corrective maintenance activities. The inspectors reviewed work packages, worker training qualifications, on-line maintenance risk assessment and contingency plans, and spoke with maintenance personnel, supervisors, vendor representatives, and system engineers during normal day shift and off normal shift hours. The inspectors also reviewed applicable portions of the Technical Specifications and UFSAR.

b. Observations and Findings

i. Poor Coordination of Relay Cabinet Maintenance

The scope of this work included replacement of old wiring in the shared SBDG control cabinet after similar wiring for the Unit 1 SBDG was discovered to be brittle and cracked. The inspectors found that this work had been well-planned and executed. This activity had been planned as the critical path job and was completed well ahead of schedule due to detailed work plans and round-the-clock work coverage. However, the inspectors found that the post maintenance testing (PMT) for this work had not been specified prior to entry into the LCO on the shared SBDG. Complicating the issue further, electricians identified several cracked terminal blocks in the control cabinet which required additional lead lifts, and also affected the PMT requirements. The final PMT for this activity was not approved until day 4 of the 7-day LCO and was inadequate, as discussed below.

As part of the PMT, the logic for starting the SBDG ventilation fan and the field flashing circuit was required to be tested and verified. Field flashing and fan starting should have occurred as the diesel reached 800 rpm (normal operating speed is 900 rpm). However, during this slow start of the diesel, neither of these actions occurred at 800 rpm. At the time, engineers believed the problem to be with the setting of the relay which should have energized at 800 rpm. After consulting with operations, the decision was made to manually start the fan and continue the testing which would culminate with an overspeed trip test. The overspeed trip test failed when the SBDG tripped at 1020 rpm, outside of the 1035 to 1050 rpm acceptable range. As the speed was increased during the test, the field did flash, contributing to the engineers' theory that the relay required calibration.

After adjusting the overspeed trip setting, another test was performed. The field flashed and the ventilation fan started at an engine speed of 800 rpm without any adjustments. Engineers reviewed the previous test procedure and concluded that the PMT had lifted a lead in the control circuit prior to the diesel start such that the relay would not have energized. The lead was later landed during the overspeed test which was the actual reason the field flashed later. The engineers found that the sequencing of steps in the PMT had caused the problems with the ventilation fan and field flash circuit.

The overspeed test was required to be performed a third time after further adjustment was made to the setting. The third test was successful.

ii. Maintenance Procedure Adherence and Supervisory Weaknesses

The inspectors observed several mechanical maintenance activities including injector testing, air start motor replacement, and seal replacements. Numerous findings pointed to the lack of adequate supervisory oversight for the work, especially during off-normal shifts. The inspectors found weaknesses with worker

qualifications, procedure adherence, chemical controls, quality oversight, and communications.

On October 23, during replacement of the air start motors, the inspectors noted that the technicians were not performing certain steps of the guiding procedure QCMMS 6600-3 "Emergency Diesel Generator Periodic Preventive Maintenance Inspection," in sequence. Steps I.12.f and 12.g of the procedure required workers to add oil to the air start motors, rotate by hand, then check for proper rotation using air. Step I.12.h required workers to install the air motors.

The inspector noted that the workers were installing the motors prior to oiling or testing. Additionally, when the workers tried to test the motors for rotation, there was not an acceptable air supply available to perform the test. After unsuccessfully trying to use portable air tanks for the test, the workers eventually had to remove the motors, take them to a location for testing, and then reinstall them.

When the inspector asked the workers if they had supervisory approval to deviate from the procedure, the workers indicated they did not. Later, when speaking to the supervisor, the inspector found that the supervisor had no knowledge of the change in procedure sequence, of the fact that the workers tried an alternate means (portable air tanks) to test the air motors, and that the air motors had been removed and reinstalled contrary to the procedure. The inspectors found later that a Problem Identification Form (PIF) had not been written to document the problem.

Quad Cities "Procedure Use and Adherence" procedure QCAP 1100-12 step D.4.d.(5) required: "Following procedural steps in sequence unless deviations are allowed by procedure." Procedure QCMMS 6600-03 steps G.1 and I.2 allowed portions of the procedure to be performed out of sequence at the discretion of the supervisors involved. Step I.12.h was performed before steps I.12.f and g. without authorization of the supervisor involved. Technical Specification 6.8.A required applicable procedures recommended in Appendix A of Regulatory Guide 1.33, Revision 2, February 1978 be implemented. This regulatory guide included administrative procedures dealing with procedure adherence and maintenance procedures dealing with safety related equipment. Failure to adhere to QCAP 1100-12 and QCMMS 660-03 is **an example of a Violation (50-254/265-96014-01b)** of station procedures and Technical Specifications .

The inspectors noted on several occasions little to no supervisory oversight of jobs being performed, especially on jobs performed during the 11:00 p.m. to 7:00 a.m. shift. These observations were made during periods when the work being performed was on critical path for completion of the 7 day LCO. The inspectors questioned the supervisors and found a lack of knowledge about critical path activities in some cases.

The inspectors reviewed records for personnel entries into the power block and discovered that on the night shift involved with the air motor replacement and other mechanical maintenance activities, the mechanical supervisor was only in the

vicinity of the work for a total of 49 minutes on 3 visits. One of those visits of 15 minute duration was accompanying an NRC inspector in response to NRC questioning about job status and procedural adherence.

Other minor discrepancies which demonstrated a lack of attention to detail by supervision and craft included failure to fill out a limited stainless steel use tag on lubricant used on the SBDG, an out-of-service tag which indicated a switch should be in the pull-to-lock position when that switch had no position labelled as such, and a failure to identify stray voltages to workers performing maintenance on the SBDG control cabinet. The inspectors review attributed little safety significance to these individual issues, but noted a weakness in overall control of and attention to maintenance activity details.

iii. Qualification of Maintenance Personnel

The inspectors identified discrepancies during a review of the qualification records of the workers involved in the mechanical maintenance activities on the shared SBDG. None of the workers on the 11:00 p.m. to 7:00 a.m. shift were qualified in accordance with the licensee's training program and job assignment matrix to independently perform diesel generator maintenance. As indicated above, supervisory oversight was minimal during this period. A vendor technical representative was providing the supervisory oversight function for two of the three mechanical maintenance workers during most of this period.

Appendix B of 10 CFR Part 50, Criterion II, " Quality Assurance Program," requires the licensee's quality assurance program to provide for indoctrination and training of personnel performing activities affecting quality as necessary to assure that suitable proficiency is achieved and maintained. Procedure QCAP 0900-01, Revision 6, "Quad Cities Training Program," required training programs to ensure personnel received training appropriate to applicable positions or tasks. The Quad Cities Maintenance Department Memorandum 800-01, dated February 28, 1996, required department training coordinators to establish a task qualification matrix to ensure employee qualification prior to assignment to the task. The mechanical maintenance job assignment matrix updated, September 18, 1996, indicated that the three mechanical maintenance personnel working on the shared SBDG on the midnight shift of October 22 were not qualified on the criteria PSE-02 "Diesel Engines."

Other options in the licensee's maintenance program when qualified persons were not used included direct oversight of the unqualified workers by (1) qualified technicians or supervision, or (2) by use of an original equipment manufacturer technical service representative "assigned to support the employee." The licensee failed to ensure direct oversight of all three technicians working on the shared SBDG by either a qualified technician or supervisor, and failed to assure the qualification of the technical service representative assigned to overview two of the technicians. When the inspector asked Quality Assurance personnel to verify the qualifications of the vendor representatives from Engine Systems, Inc., the licensee discovered these certifications were never sent or verified even though this was

required by the Commonwealth Edison purchase order number 356975. Based on additional discussions with the licensee, the inspector determined that the licensee did not have a process in place to verify the qualification of the vendor or to qualify the vendor for supervisory oversight activities.

Based on the information above, the inspector concluded that the licensee failed to ensure the work affecting quality on the shared SBDG was properly performed by qualified technicians or technicians with oversight by qualified personnel, which is a **Violation (50-254/265-96014-03)** of Appendix B of 10 CFR 50, Criterion II "Quality Assurance Program."

The inspector noted further weaknesses in the maintenance program in that the supervisor assigned to provide direct oversight was not required to have any specific technical training for the task. Also, the level of technical service representative qualifications for oversight were not specified by the purchase order, nor was the level of support to the unqualified technician by the service representative specified by the 800-01 memorandum. Maintenance department supervisors interviewed expressed a wide variety of opinions on the level of oversight required for unqualified personnel on equipment such as SBDGs.

The inspectors noted maintenance quality oversight reviews were not scheduled for most backshift periods. Quality control inspectors were present but had not identified similar maintenance problems during the backshift periods when the NRC inspectors found maintenance weaknesses and violations. Site Quality Verification management indicated that quality control personnel were only looking for traditional hold point discrepancies. However, expanded use of quality control inspectors was planned.

iv. Good LCO Planning With Post Maintenance Testing Weaknesses

The original planned duration of the LCO was 109 hours and the actual duration was 128 hours. The actual maintenance work was completed ahead of schedule, but delays associated with the return to service and testing extended the LCO duration. The inspectors found the planning of the maintenance work was thorough but that the coordination of the post maintenance testing requirements was not specified in as great detail and therefore resulted in delays.

The inspectors found the LCO planning with respect to work package preparation to be good. The inspectors found an excellent example of good work package preparation in the control panel wiring work, as work analysts had performed a thorough review of the panel wiring with the electrical prints and prepared lead lift sheets in a logical working order. Based on interviews with electrical maintenance personnel and field observations, the inspectors concluded that the rewiring on the shared SBDG was a success based on good planning and lessons learned from the same job on the Unit 1 SBDG.

Two other on-line maintenance activities concluded during the inspection period. The licensee completed the work associated with the 1C RHRSW pump and also

finished the cleaning of the circulating water bay which rendered the shared "A" fire pump inoperable, requiring entry into an administrative (not a Technical Specification) LCO. The LCO for the 1C RHRSW pump was planned for 21 days and was completed in 21 days, even with the problems found with the pump casing (see Section M1.2). The inspectors found that both the shared SBDG and 1C RHRSW LCO schedules were well executed. However, the licensee underestimated the scope of work on the circulating water bay, which resulted in the shared A fire pump being inoperable for 3 days versus the 12 hours originally planned. Other problems contributed to the delays, such as badging of contract divers and turnover communication problems.

v. Incomplete Risk Assessment and UFSAR Discrepancy

While reviewing the risk assessment performed for the shared SBDG work, the inspectors questioned the SBDG system engineer about the impact of the degraded air start system on the Unit 2 SBDG. Two of the four air receiver tanks (one pair) on the Unit 2 SBDG were depressurized and isolated due to faulty pressure switches that maintain the required air pressure in the tanks. The Technical Specification bases clearly stated that with either pair of air receiver tanks at the minimum specified pressure, there is sufficient air in the tanks to start the associated diesel generator. Therefore, the Unit 2 SBDG was still considered operable. However the UFSAR, stated that with both pairs of air receiver tanks at a pressure of 230 pounds per square inch gauge (psig), there was sufficient air in the tanks to allow two 15-second starting attempts. The licensee's design basis document for the SBDGs, approved in January 1996, stated that one pair of air receiver tanks was sufficient for two unsuccessful plus one successful start of the SBDG. The inspectors concluded that there was a discrepancy between the UFSAR and the current design basis document with respect to the possible number of SBDG start attempts with one or both pairs of air receiver tanks at minimum pressure. The Technical Specification bases only stated that the SBDG can be started with one pair of tanks but not specified how many start attempts were possible.

The inspectors noted that the starting air system for the Unit 2 SBDG was degraded but operable, and that this effect on risk was not explicitly considered in the on-line maintenance risk assessment that was performed. However, the licensee had verified, prior to the LCO entry, the operability of the single pair of air tanks and compressor on Unit 2 SBDG by performing the monthly surveillance.

The licensee's plan also had not considered the effects of performing this work in conjunction with the Unit 1 alternate 125 volt battery being inoperable. Also, when troubleshooting the Unit 2 CIV which could have impacted plant stability was considered, the licensee chose to perform the troubleshooting rather than wait for the return of the SBDG. Finally, the risk associated with the SBDG maintenance could have been significantly reduced had it been performed from May through August of 1996 when both units were in cold shutdown conditions.

c. Conclusions

The inspectors concluded that the control of risk significant activities had improved somewhat in that activities were being controlled in accordance with a schedule. However, the poor supervisory oversight and procedure adherence shown in parts of the SBDG work were indicative of a broader problem in maintenance activities. Some post maintenance testing activities were not well defined prior to the LCO, and some risk aspects of the maintenance were not fully considered.

M1.2 Observation of Mechanical Maintenance Replacement of 1C RHRSW Pump

a. Inspection Scope

The inspectors observed activities by mechanical maintenance division (MMD) during replacement of the 1C residual heat removal service water pump (RHRSWP) for modification of the low pressure pump. Activities observed included work in the shop and in the field. The inspectors reviewed documentation associated with the work package, modification testing, and final test results for pump operability. The inspectors interviewed workers and maintenance supervisors associated with RHRSWP work.

b. Observations and Findings

Quad Cities has had a history of poor performance from these pumps due to past maintenance difficulties and operation of the low pressure pump near the "run-out" portion of the pressure and flow curve. Resultant cavitation, combined with excessive system vibration, had resulted in a high pump failure rate. The licensee modified six of the eight low pressure RHRSWPs by enhancing impellers and re-cutting pump casings. This resulted in the RHRSWPs operating in a more efficient portion of the pump curve.

The work area in the RHRSWP room was generally orderly and well controlled. The inspector observed alignment work in various stages of pump assembly and noted workers exercised care to properly align the pumps to the motor and to the system piping. The rotating equipment engineer worked closely with the other maintenance workers. The licensee's quality control inspector identified that the work package needed to be revised to control and document the shop leak test of the new pump. The licensee identified problems with the casing surface of the vendor supplied pump and the gasket material the vendor had used for the pre-shipment pressure test (See Section M7.1).

c. Conclusions

The station MMD's valve and rotating equipment team performance through this maintenance activity was good. There were no significant deficiencies throughout the entire job except problems with the casing surface of the vendor supplied pump and the gasket material the vendor had used for the pre-shipment pressure test. Effective work management and teamwork were demonstrated.

M1.3 Work Control Process Performance

The inspectors reviewed the licensee's trends on work control performance for the past several months. The licensee adopted a 13-week rolling work planning process late in 1995. However, the majority of the time since the new process was started, one or both units were involved in an outage. Since outage work and schedules were not managed by the 13-week system, the licensee had difficulty in measuring true performance of the work control process. During the current inspection period, the licensee showed some progress in the implementation of the work control process, as exhibited by a small decrease in corrective maintenance backlog and some increase in schedule adherence.

M7 Quality Assurance in Maintenance Activities

M7.1 Maintenance Workers Identified Problems with Quality Parts

a. Scope

The inspectors observed maintenance work being performed on the 1 "C" RHRSWP and "B" CREFs. The inspectors spoke to workers and supervisors and reviewed maintenance procedures. The inspectors reviewed receipt inspection documentation associated with the 1 "C" RHRSWP. The inspectors also attended a meeting between the licensee and Ingersoll-Dresser Pumps, the RHRSWP vendor, to discuss quality of parts.

b. Observations and Findings

i. Unit 1 "C" RHRSWP

After assembling 1 "C" RHRSWP, workers conducted a pressure test on the newly installed pump casing. The pump casing inboard seal area leaked at about 10 psig pressure. This failed hydrostatic test required workers to remove and replace the pump. Workers later identified the casing surface was machined by the vendor with some low spots, and that the vendor had used a different gasket material (more compressive) for the pre-shipment pressure test than the licensee used on site. The licensee replaced the new pump casing.

Licensee and vendor representatives met to discuss this and other parts problems recently identified by workers at the facility. The vendor noted the subject pump casing was hydrostatically tested satisfactorily prior to delivery to the licensee's CRIT (Central Receipt Inspection and Test) facility. The CRIT facility verified proper paper work but was not required to perform any dimensional checks of the pump casing. An independent inspection contractor determined the vendor used a different type of gasket for hydrostatic testing than was used by the licensee. This information was not transferred to the site.

Based on direct observations and interviews, the inspectors determined that maintenance workers on this job expended the majority of their time and effort on

verifying dimensions of newly supplied vendor parts prior to pump reassembly. The leaking RHRSWP casing resulted in an additional 4 days of pump inoperability in a 30 day LCO to correct the condition.

ii. "B" Control Room Emergency Filtration System

During repair of an old design deficiency, (see Section E1.2), maintenance workers identified that a red-tagged (quality part important to safety) terminal board was bowed. During installation of the part, a hair-line fracture developed requiring the part to be replaced. A replacement part staged in supply was similarly bowed. The licensee later determined that the wrong type of terminal board was ordered. The proper type of terminal board was located and installed. The system was later successfully tested.

iii. Site Quality Verification (SQV) Response

In response to parts problems identified by maintenance personnel, SQV planned to review all receipt and inspection packages for material received from CRIT for the Quad Cities Station. Additionally, all six ComED SQV organizations planned to audit the CRIT facility in the near future.

Quad Cities staff met with the pump vendor and personnel from ComEd CRIT facility to discuss product quality and other issues. The Quad Cities SQV manager issued a "stop work" order on the leaking RHRSWP casing until ComEd could observe the vendor rework the defective pump casing and to audit the vendor's quality assurance program.

As a result of an audit by an independent inspection contractor, both ComEd and the pump vendor were tasked to address various quality assurance discrepancies. The licensee documented ComEd assigned discrepancies on PIFs for resolution. The independent auditor also placed a procurement warning on the ComEd Quality Approved Bidders List to limit new procurements or changes to existing procurements due to programmatic concerns with the pump vendor's quality processes.

c. Conclusions

The licensee has the responsibility to ensure the quality of safety-related components procured through vendors. This was primarily accomplished through licensee quality verification audits of vendor processes and facilities. Other assurances were through ComEds' CRIT quality assurance processes, including review of purchase specifications and receipt inspections. Previously, defects in safety-related materials had not been found until the equipment was installed in a plant system.

The inspectors concluded that neither the licensees' nor the vendors' quality assurance program inhibited the delivery of substandard quality parts to the

maintenance shop. However, in these two cases the substandard parts were detected prior to returning the systems to operation.

M8 Miscellaneous Maintenance Issues (92902)

M8.1 (Closed) Inspector Followup Item (50-254/265-95007-01): Misapplication of Muriatic Acid in the Unit 1 Station Blackout Building (SBO). In late September 1995 a contract work force misapplied a highly concentrated acid solution to the floor of the SBO building in preparation for coating the floor with an epoxy compound. In both units SBOs, sensitive electrical components were damaged by the effects of the acid. The licensee restored Unit 2 SBO equipment and returned the equipment to operations by December 27, 1995. All Unit 1 major equipment was inspected, repaired as necessary, and reinstalled later. Unit 1 SBO was turned over to Operations on June 28. The licensee implemented numerous changes to construction department work procedures, contractual agreements, and first line supervisor expectations. The inspectors reviewed the licensee's corrective actions and consider this item closed.

III. Engineering

E1 Conduct of Engineering

E1.1 Control Room Ventilation System Inoperable

a. Inspection Scope (37551)

The inspectors reviewed the UFSAR sections 6.4, and observed maintenance and testing activities associated with the safety-related control room ventilation system.

b. Observations and Findings

A system engineer, questioning a design feature of the Control Room Emergency Filtration System (CREFS), identified a vulnerability in the refrigeration compressor unit, (RCU). Specifically, a refrigerant crankcase heater was fed off a non-safety related power supply. The UFSAR section 6.4.2.E required the CREFS be capable of functioning during and after a design basis accident including a loss of offsite power (LOOP). Since the CREFS' RCU heater would become deenergized during a LOOP, the CREF system was considered inoperable. The licensee reported the design deficiency to the NRC.

The condition was corrected by routing a safety-related power supply to newly installed heaters. Operators then declared the system operable. The inspectors will continue to review this item and its relation to other recently discovered design discrepancies on control room ventilation as **Unresolved Item (50-254/265-96014-04)**.

c. Conclusions

Design deficiencies could have allowed control room ventilation to become inoperable if the non-safety related power supply was lost. The inspectors concluded a good questioning attitude by a system engineer resulted in identification of the design vulnerability with the RCU.

E2 Engineering Support of Facilities and Equipment

E2.1 Unit 2 High Pressure Coolant Injection (HPCI) Vent Verification Problems

a. Inspection Scope (37551)

The inspectors reviewed the operations surveillance test and compliance with TS. The inspectors reviewed engineering root cause analysis process and performed a walkdown of Unit 2 HPCI system.

b. Observations and Findings

On October 9, during routine monthly surveillance to vent the Unit 2 HPCI discharge piping, operators were unable to verify the piping was filled as required by TS 4.5.A.1.a. Operators declared Unit 2 HPCI inoperable and notified the NRC. Operators switched the HPCI system suction from the normal source (contaminated condensate storage tank (CCST)) to the alternate source (torus) and successfully vented the system. Operators declared Unit 2 HPCI operable. The licensee later switched the HPCI suction back to the CCST and vented the piping successfully on a daily basis until an engineering evaluation could determine the root cause of the condition.

The venting surveillance had been successfully completed in August and September 1996. The routine quarterly pump surveillance, completed on October 8, cycled a valve in the pump discharge piping which was not operated during the monthly venting surveillance. Engineering determined that cycling the valve during the quarterly surveillance had allowed a pocket of trapped air to move. The combination of the trapped air and the configuration of the vent piping resulted in a "water trap" which produced a static condition that prevented venting the HPCI piping.

The root cause appeared to be the air pocket trapped in the HPCI pump discharge piping after work had been performed on the HPCI discharge check valve in August 1996. The licensee determined that the pocket of air was small and would not have rendered HPCI inoperable. Engineering determined this condition could not exist in Unit 1 and recommended corrective actions to prevent recurrence in Unit 2.

c. Conclusions

The inspectors concluded the root cause analysis was good. Engineering systematically identified potential causes of failure and eliminated causes based on analysis and/or testing.

E2.2 Facility Adherence to the UFSAR

While performing the inspections discussed in this report, the inspectors reviewed the applicable portions of the UFSAR that related to the areas inspected. The inspectors compared plant practices, procedures, and/or parameters to that described in the UFSAR and documented the findings in this inspection report. The inspectors reviewed the following sections of the UFSAR:

IR Section	UFSAR Section	Applicability
O2.1	10.2	Turbine-Generator
	15.2.3	Accident Analysis - Turbine Trip
O2.2	7.3.1.3.1.12	Indication of HPCI Bypasses
E1.2	6.4	Control Room Habitability
E2.2	8.3.2.2	125 Volt D.C. alternate battery

E2.3 Inspection of Torus Baseplate Bolts

a. Inspection Scope (37551)

The inspector performed an inspection of the under-torus area and observed inconsistencies in the clearances and angular relationships in the torus baseplate mounting bolts.

b. Observations and Findings

The licensee installed these baseplates to add support to the torus in the Mark I containment modification program. The design allowed movement of the support feet for thermal expansion. The bolting specification stated the baseplate mounting nuts on the baseplates were to be finger tight against the upper of two beveled washers, backed off 1/6 turn, and secured with a lock nut. The inspector observed some nuts appeared snug, other nuts appeared to have excessive clearance, and some had an angular relationship to the beveled washers. Several lock nuts were not secured.

The inspectors were concerned that angular orientation between the lower nut to the upper surface of the beveled washer would produce a shear force to the mounting studs rather that a linear force in the event of vertical acceleration forces caused by dynamic loading. The inspector contacted licensee structural engineers who accompanied the inspector on a subsequent walkdown of the baseplates.

c. Conclusions

The licensee and NRC were unable to determine during the walkdown whether the apparent discrepancies would adversely effect the structural support of the torus. The inspectors consider this an **Inspector Followup Item (50-254/265-96014-05)** pending review of the engineering evaluation of the existing condition.

IV. Plant Support

F5 Fire Protection Staff Training and Qualification

F5.1 Observation of Fire Training Exercise

The inspector observed a training scenario that simulated a plant fire at the electro-hydraulic control reservoirs. This exercise combined a simulator training activity with the fire brigade facility and included response from a number of offsite fire departments. This combined exercise provided a more realistic challenge for the operating crew and response team to respond to an emergency in the control room, activate the onsite fire brigade, and facilitate the assistance of the offsite fire fighters.

The operators in the simulator maintained good command and control. The onsite fire brigade responded effectively. When offsite units arrived, the onsite Fire Brigade Leader coordinated the fire fighting effort while maintaining communication between the control room and the scene of the fire.

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 October 25, 1996. The licensee acknowledged the findings presented.

The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

E. Kraft	Site Vice President
B. Pearce	Station Manager
D. Cook	Operations Manager
M. Wayland	Maintenance Manager
J. Hutchinson	Engineering Manager
F. Tsakeres	Radiological Protection/Chemistry Manager
C. Peterson	Regulatory Affairs Manager
M. DiPonzio	Corporate Licensing
F. Famulari	Site Quality Verification Manager

INSPECTION PROCEDURES USED

IP 40500:	Effectiveness of Licensee Controls in Identifying, Resolving, and Preventing Problems
IP 62703:	Maintenance Observation
IP 64704:	Fire Protection Program
IP 71707:	Plant Operations
IP 73051:	Inservice Inspection - Review of Program
IP 73753:	Inservice Inspection
IP 83729:	Occupational Exposure During Extended Outages
IP 83750:	Occupational Exposure
IP 92700:	Onsite Followup of Written Reports of Nonroutine Events at Power Reactor Facilities
IP 92902:	Followup - Maintenance
IP 92903:	Followup - Engineering
IP 93702:	Prompt Onsite Response to Events at Operating Power Reactors

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-254/265-96014-01a	VIO	Failure to adhere to QCAP 217-2
50-254/265-96014-02	IFI	CIV drifted closed
50-254/265-96014-01b	VIO	Failure to adhere to QCAP 1100-12 and QCMMS 660-03
50-254/265-96014-03	VIO	10 CFR 50 Appendix B Criterion II
50-254/265-96014-04	URI	Control room ventilation system inoperable
50-254/265-96014-05	IFI	Inspection of torus baseplate bolts

Closed

50-254/265-94004-19	IFI	Annunciator indication problems
50-254/265-96012-02	URI	CREFs inoperable
50-254/96020	LER	CREFs inoperable
50-254/265-95007-01	IFI	Misapplication of muriatic acid in the Unit 1 SBO

LIST OF ACRONYMS USED

CIV	-	Combined Intercept Valve
CREF	-	Control Room Emergency Filtration
CRIT	-	Central Receipt Inspection and Test
DET	-	Diagnostic Evaluation Team
ENS	-	Emergency Notification System
ESF	-	Engineered Safety Feature
HELB	-	High Energy Line Breaks
HPCI	-	High Pressure Coolant Injection System
HPN	-	Health Physics Network
IDP	-	Ingersoll-Dresser Pumps
IDNS	-	Illinois Department of Nuclear Safety
IEEE	-	Institute of Electrical and Electronic Engineers
LCO	-	Limiting Condition for Operation
LER	-	Licensee Event Report
LOCA	-	Loss of Coolant Accidents
LOOP	-	Loss of Offsite Power
MEL	-	Master Equipment List
MMD	-	Mechanical Maintenance Division
NRR	-	Nuclear Regulatory Commission Office of Nuclear Reactor Regulation
PIF	-	Problem Identification Form
PMT	-	Post Maintenance Tests
psig	-	pounds per square inch gauge
RCU	-	Refrigeration Compressor Unit
RHR	-	Residual Heat Removal
RHRSWP	-	Residual Heat Removal Service Water Pump
SADI	-	Servo Amplifier, Demodulator, and Indicator
SBDG	-	Standby Diesel Generator
SBGTS	-	Standby Gas Treatment System
SBO	-	Station Blackout Building
SBODG	-	Station Blackout Diesel Generator
SE	-	Shift Engineer
SQV	-	Site Quality Verification
TGA	-	Toxic Gas Analyzer
UFSAR	-	Updated Final Safety Analysis Report