

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report Nos. 50-254/94004(DRP); 50-265/94004(DRP)

Docket Nos. 50-254; 50-265

License Nos. DPR-29; DPR-30

Licensee: Commonwealth Edison Company  
Executive Towers West III  
1400 Opus Place, Suite 300  
Downers Grove, IL 60515

Facility Name: Quad Cities Nuclear Power Station, Units 1 and 2

Inspection At: Quad Cities Site, Cordova, Illinois

Inspection Conducted: February 7 through March 7, 1994

Inspectors: R. Walton  
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Reactor Projects Section 1B

3/11/94  
Date

Inspection Summary

Inspection from February 7 through March 7, 1994 (Report Nos. 50-254/94004(DRP); 50-265/94004(DRP))

Areas Inspected: Special unannounced safety inspection to review and categorize the licensee's response to the diagnostic evaluation team report to ascertain whether the proposed plans for improvement addressed the reported weaknesses and the root causes.

Results: Four violations, ten unresolved items, and 45 inspector follow-up items were identified. The adequacy of the licensee's response to the diagnostic team report will require additional review since a significant number of the implementation plans were being developed by the licensee.

## DETAILS

### 1. Persons Contacted

#### Commonwealth Edison Company (CECo)

- \*R. Pleniewicz, Site Vice President
- \*R. Baumer, Regulatory Assurance
- \*J. Burkhead, Quality Verification Program Supervisor
- \*S. Childers, Operations Department
- N. Chrissotimos, Regulatory Assurance Supervisor
- \*H. Hentschel, Operations Manager
- \*T. Kroll, Maintenance Supervisor
- \*J. Kudalis, Services Director
- \*B. Moravec, Engineering and Nuclear Construction Site Manager
- \*A. Scott, System Engineering
- \*L. Tucker, Technical Services Superintendent

\*Denotes those attending the exit interview conducted on March 7, 1994.

### 2. Follow-up of Licensee Response to DET Report for Quad Cities Nuclear Power Plant (92701, 92700)

By letter dated November 17, 1993, the Executive Director of Operations, Mr. James M. Taylor, forwarded the Diagnostic Evaluation Team (DET) Report for the Quad Cities Nuclear Power Station to the licensee. That letter requested the licensee to evaluate the report and provide a written response. The licensee's responses, dated December 30, 1993, January 24 and March 7, 1994, provided the licensee's evaluation and response to the DET report. During this report period, the inspectors reviewed the DET report and identified follow-up items which are discussed in the following paragraphs.

### 3. Operations Deficiencies

#### a. Workarounds

As discussed in the Section 2.1.1 of the DET report, equipment problems caused unnecessary operator workarounds. For example, whenever the "A" pump-back compressor failed, plant operators maintained the drywell-to-torus differential pressure by feeding nitrogen into the drywell and continuously venting the torus by opening containment isolation valves. Although allowed by the updated final safety analysis report (UFSAR), containment venting at power is an Unresolved Item (50-254/265-94004-01(DRP)) pending the inspectors review of the plant design basis with the NRC's Office of Nuclear Reactor Regulation (NRR).

Additionally, there were many equipment problems that caused unnecessary challenges to operators following automatic reactor shutdowns. The following examples are Inspection Follow-up Items pending the inspectors review of the licensee's corrective actions:

- As discussed in Sections 2.1.1 and 2.3.6.1 of the DET report, Unit 2 experienced repeated spurious Group I isolations following automatic shutdowns (50-254/265-94004-02(DRP)).
- As discussed in Sections 2.1.1 and 2.3.3 of the DET report, an excessive number of electromatic relief valve (ERV) failures occurred (50-254/265-94004-03(DRP)).
- As discussed in Section 2.1.1 of the DET report, the 2B feed-regulating valve "locked up" during plant transients (50-254/265-94004-04(DRP)).

Section 2.1.3.3 of the DET report, discussed the licensee's use of the continuous air monitoring system (CAM) for de-inerting the drywell because of repeated problems with the oxygen analyzer. Use of the CAM for de-inerting the drywell is an Inspector Follow-up Item (50-254/265-94004-05(DRP)) pending the inspectors review of the licensee's corrective actions. Additionally, the licensee's program to identify and correct repetitive equipment problems in a timely manner will be reviewed.

Section 2.2.3(4) of the DET report, discussed back-leakage through residual heat removal (RHR) valve 1-RHR-7B into the torus which resulted in reactor vessel water level dropping about 1 inch per hour during shutdown cooling operations, requiring operator actions to maintain level. Eliminating the back-leakage through the RHR valve is an Inspector Follow-up Item (50-254/265-94004-06(DRP)) pending the inspectors review of the licensee's corrective actions.

b. Prioritization and Scheduling of Work Requests

As discussed in Sections 2.1.1, 2.2.4, and 2.2.5 of the DET report, the maintenance process was cumbersome to control and implement. The work process was so burdened by a large number of nuclear work requests (NWRs) that only high priority corrective maintenance items could be worked. There was no central focus on establishing equipment priorities. For example, a work request was written for manual valve 2-1101-33 because it was difficult to open; the valve was not repaired in a timely manner. The work control process is an Inspector Follow-up Item (50-254/265-94004-07(DRS)) pending the inspectors review of the licensee's actions to improve the work prioritization program.

Additionally, in some instances, insufficient time was allotted to complete maintenance on degraded components scheduled for repair during refueling outages. The subject of scheduled corrective maintenance is an Inspector Follow-up Item (50-254/265-94004-08(DRS)) pending the inspectors review of the licensee's maintenance planning program.

c. Backlog Characterization

As discussed in Section 2.2.4 of the DET report, management seemed more focused on industry performance indicator goals rather than focusing on

the level of effort required to reduce the maintenance backlog. The backlog was not accurately reported or effectively managed. The subject of maintenance backlog is an Inspector Follow-up Item (50-254/265-94004-09(DRP)) pending the inspectors review of the licensee's efforts to improve the backlog tracking system.

d. Licensee Awareness of Equipment Degradation

As discussed in Sections 2.1.1 and 2.3.1 of the DET report, the licensee was tolerant of degraded equipment, delayed repairing equipment problems, and was not always aware of equipment degradation. For example:

- A reactor core isolation cooling (RCIC) steam admission valve had sheared bolts. This is an Inspector Follow-up Item (50-254/265-94004-10(DRP)) pending the inspectors review of the licensee's root cause investigation and corrective actions.
- Because the toxic gas analyzers failed frequently, the control room ventilation system was routinely operated in the recirculating mode. Operation of the control room ventilation system in the recirculating mode due to toxic gas analyzer failures is an Inspector Follow-up Item (50-254/265-94004-11(DRP)) pending the inspectors review of the licensee's evaluation and corrective actions.
- The reactor building ventilation and standby gas treatment systems tripped while attempting to maintain negative pressure in the reactor building. Reactor building ventilation and standby gas treatment unexpected trips is an Inspector Follow-up Item (50-254/265-94004-12(DRP)) pending the inspectors review of the licensee's root cause investigation and corrective action.
- The Class 1E field exciter cabinet for the Unit 2 emergency diesel generator (EDG) was not seismically anchored. This was identified during a system walkdown performed by the DET inspectors. The condition existed since initial plant construction. 10 CFR 50, Appendix B, Criterion III, "Design Control," required in part, that applicable design basis be correctly translated into drawings, procedures, and instructions. Failure to correctly translate the seismic design requirement into the as-built configuration is an example of a Violation (50-254/265-94004-13a(DRP)) of Criterion III.
- More than 40 hard DC grounds had occurred in 1993. Although each ground was individually evaluated and corrected, the licensee had not determined the root cause(s) for the recurring grounds. The subject of DC grounds is an Inspector Follow-up Item (50-254/265-94004-14(DRS)) pending the inspectors review of the licensee's root cause evaluation and corrective actions.

e. Operability Evaluations

As discussed in Sections 2.1.2 and 2.3.3 of the DET report, minimal operations involvement and the absence of operability determination showed a lack of responsibility and accountability by operations department management for evaluation of degraded equipment. The failure to evaluate degrading, deteriorating, or indeterminate conditions led to an approach of proving inoperability instead of assuring operability. The subject of evaluating operability is an Inspector Follow-up Item (50-254/265-94004-15(DRP)) pending the inspectors review of licensee's operability evaluation improvement program.

As discussed in Sections 2.1.2(4) and 2.3.3.1 of the DET report, no operability evaluation had been performed on non-safety related auxiliary steam lines, fire protection water distribution lines, and other water piping above or near both divisions of safety related switchgear. This is an Unresolved Item (50-254/265-94004-16(DRS)) pending the inspectors review of the licensee's operability evaluations.

As discussed in Section 2.3.3.2 of the DET report, the control room air conditioner compressor was to be manually loaded onto the swing emergency diesel generator (EDG) during a design basis accident before the control room design temperature was exceeded. The control room heatup time had been evaluated during the licensee's station blackout review; however, the loading time was not established or identified in station procedures. Additionally, no calculation was completed to show whether this additional load could be put on the swing EDG without having to shed some other load. Failure to translate the loading time into plant procedures and failure to validate the additional loading of the EDG is another example of a Violation (50-254/265-94004-13b(DRP)) of 10 CFR 50, Appendix B, Criterion III, "Design Control."

As discussed in Section 2.3.3.3 of the DET report, the licensee had calculated that the standby liquid control (SBLC) system would remain operable with degraded heat tracing circuits given certain tank temperature and sodium pentaborate concentration limits. However, these calculations might not address certain off-normal conditions. SBLC system operation with degraded heat tracing is an Unresolved Item (50-254/265-94004-17(DRS)) pending the inspectors review of the licensee's evaluation.

As discussed in Section 2.1.2(1) of the DET report, no operability evaluation was performed for the feedwater flow nozzles. A modification performed (about 1974) changed the flow element configuration, but the new configuration was not calibrated. The licensee had been using data from a calibration of similar flow nozzles at another facility and had applied this data to Quad Cities. The potential for having improperly calibrated feedwater flow instruments was identified by the licensee in November 1992. Subsequent to the DET in 1994, test results indicated that flow nozzle calibrations were inaccurate in a non-conservative direction by about 1.5 percent. Quad Cities License Condition 3.A authorized a maximum power of 2511 megawatts thermal, and 10 CFR 50,

Appendix B, Criterion XVI, "Corrective Action," stated in part that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances be promptly identified and corrected. Failure of the licensee to promptly correct the identified feedwater flow nozzle instrument calibration is an example of a Violation (50-254/265-94004-18a(DRP)) of Criterion XVI.

f. Valve Vibration Problems

As discussed in Section 2.1.2(3) of the DET report, various RHR valves were affected by cavitation induced vibrations. No operability evaluation had been performed for RHR 36A/B MOVs until the DET expressed a concern. An operability assessment, provided late in the DET evaluation, did not clearly state that the time frames for the vibration analysis enveloped those required for the long-term containment cooling function. The evaluation also failed to include verification of the assumptions used in the vendor analysis (50-254/265-94004-18b(1)(DRP)).

As discussed in Section 2.3.4.1(1) of the DET report, an engineering operability assessment, requested by the DET, documented the effects of system vibration on the RHR 36A/B MOVs. A root cause evaluation for four broken yoke-to-actuator bolts was previously performed by the licensee; however, that assessment failed to mention that fatigue stresses on the bolts were exceeded (50-254/265-94004-18b(2)(DRP)).

In Sections 2.2.3 and 2.3.1 of the DET report, further examples of weak root cause and corrective actions included:

- The operator for the Unit 2 RHR 28B valve was found in a degraded condition. The licensee corrected the deficiencies but failed to address why the deficiencies occurred or what actions could have been taken to prevent recurrence (50-254/265-94004-18b(3)(DRP)).
- The licensee found all 12 yoke-to-actuator bolts loose on the Unit 2 RHR 28B valve. The bolts were replaced with stronger bolts as part of implementing vendor recommendations. However, no root cause determination was performed for the bolt failures (50-254/265-94004-18b(4)(DRP)).
- A motor operator for the Unit 2 RHR 34A valve was replaced due to a cracked casing. Later, the same valve was rebuilt because of grease degradation. The licensee did not evaluate these failures to determine if they were related (50-254/265-94004-18b(5)(DRP)).
- Two cracked welds at the yoke-to-bonnet joint on valve 1-RHR-36B could be related to excessive thrust or cyclic fatigue. However, the licensee did not recognize these failures as repetitive (50-254/265-94004-18b(6)(DRP)).

- Valve 2-RHR-36A stem was replaced twice, in the past 5 years, without an evaluation for repetitive failure (50-254/265-94004-18b(7)(DRP)).

The above are further examples of a Violation (50-254/265-94004-18b(DRP)) of 10 CFR 50, Appendix B, Criterion XVI, "Corrective Action."

A motor failure on the Unit 1 RHR 50 valve was attributed to excessive current being drawn by the motor while trying to pull the valve off the closed seat. The licensee did not determine why the disk was stuck on the seat or why the breaker overloads were reset several times while attempting to operate the valve (This issue was previously reviewed and a non-cited violation was issued in Inspection Reports 50-256/91022 and 50-265/91018, dated January 10, 1992).

g. Decreased Sensitivity to Control Room Annunciators

As discussed in Section 2.1.4 of the DET report, operators sometimes failed to question or pursue annunciator indications. Some annunciator windows were back-lit green which apparently indicated that these alarms would be expected during power operation. For example, reactor vessel head seal leakage alarm on Unit 2 panel was back-lit green. In the case of repetitive alarms, the operators would silence the alarm from the sequence-of-events recorder panel; however, no guidance had been provided on how many alarms could be disabled or for how long they could remain disabled. Use of "green" backlit annunciators is an Inspector Follow-up Item (50-254/265-94004-19(DRP)) pending the inspectors review of the acceptability of this operating philosophy.

h. Oversight of Control Room Activities

As discussed in Section 2.1.5 of the DET report, oversight of control room (CR) activities during some busy periods was difficult. Although CR staffing levels exceeded the technical specification minimum, it was observed, at times, that it was a challenge for the shift control room engineer (SCRE) to adequately oversee CR activities. This is an Inspector Follow-up Item (50-254/265-94004-20(DRP)) pending the inspectors review of the impact of an additional unit supervisor in the control room.

For simulator training, about 25 percent of the scenarios have the shift engineer (SE) outside the control room at the beginning of the scenario. This did not accurately simulate the normal CR staffing since the SE was normally in the SE office located outside of the control room. The subject of simulator training is an Inspector Follow-up Item (50-254/265-94004-21(DRS)) pending the inspectors review of simulator scenarios, in particular, shift engineer presence.

i. Procedural Controls

Operations: As discussed in Section 2.1.3.1 of the DET report, operations management had not enforced effective standards of procedural adherence. For example:

- While starting a residual heat removal (RHR) pump in shutdown cooling, operators failed to follow the procedure when the RHR pump was started (50-254/265-94004-22a(1)(DRP)).
- Operators failed to follow an alarm response procedure while inerting the Unit 1 drywell (50-254/265-94004-22a(2)(DRP)).
- An equipment operator did not complete the prerequisites of a procedure before testing the standby liquid control system (50-254/265-94004-22a(3)(DRP)).

Quad Cities Technical Specification 6.2.A.1 stated the applicable procedures recommended in Appendix A of Regulatory Guide 1.33, Revision 2 dated February 1978, shall be established, implemented, and maintained. Regulatory Guide 1.33 Appendix A included plant operating, maintenance, and radiation protection procedures.

Failure to follow the above operating procedures is a Violation (50-254/265-94004-22a(DRP)) of Technical Specification 6.2.A.1.

Maintenance: As discussed in Section 2.2.2 of the DET report, appropriate maintenance requirements were not incorporated into work procedures. For example:

- In May 1993 core spray check valves 9A and 9B were torqued without an appropriate torque requirement for the mounting screws (50-254/265-94004-22b(1)(DRP)).
- On August 28, 1993, drawings used to work on the drywell equipment drain sump pumps were inaccurate and resulted in work on the wrong pump and multiple entries into the drywell (50-254/265-94004-22b(2)(DRP)).
- On August 26, 1993, an incorrect weld procedure was used when repairing the 2B regenerative heat exchanger outlet isolation valve resulting in multiple entries to complete the maintenance (50-254/265-94004-22b(3)(DRP)).

The above are further examples of a Violation (50-254/265-94004-22b(DRP)) of Technical Specification 6.2.A.1.

As discussed in Section 2.1.3.3 of the DET Report, the licensee failed to implement procedures to isolate and disable the high pressure coolant injection (HPCI) drain pot level switches for both units. This issue was previously identified as a violation in Inspection Report 50-254/265-93025(DRP), dated October 26, 1993. The issued Violation (50-



254/265-93025-01b(DRP)) will remain open pending the inspectors review of the licensee's corrective action.

As discussed in Section 2.1.3.2 of the DET report, some technical specification (TS) requirements appeared not to be properly implemented. Examples included not operationally verifying the reactor vessel temperature limits of TS 3.6 during a plant cooldown. Similarly, action statements were not implemented when TS instruments were removed from service for surveillance testing. This is an Unresolved Item (50-254/265-94004-23(DRP)) pending the inspectors review of the licensee's evaluation.

Three violations, four unresolved items, and 16 inspector follow-up items were identified.

#### 4. Maintenance and Testing Deficiencies

##### a. Adequacy of ASME Section XI Pump and Valve Testing Program

In Sections 2.2.1 and 2.3.1 of the DET report, numerous deficiencies were found with the licensee's American Society of Mechanical Engineers (ASME), Section XI, in-service test (IST) program. These deficiencies included:

- A number of safety related pump and motor vibration readings routinely exceeding alert thresholds without timely corrective actions being taken.
- Some safety related check valves were not tested in accordance with Section XI requirements. Relief requests were not submitted for NRC review and approval.

Overall resolution of these IST issues and licensee actions in response to Generic Letter 89-04, "Guidance on Developing Acceptable In-Service Test Programs," is an Inspector Follow-up Item (254/265-94004-24(DRS)) pending the inspectors review of the licensee's corrective action.

Several weaknesses were noted in the control of Section XI requirements for pumps, check valves, and safety related MOVs. Specific examples of these weaknesses included:

##### Pump Vibrations

- In Section 2.2.1(1) of the DET report, vibration readings for both HPCI pumps were reported as being in the alert range for an extended period of time. Instead of correcting the cause of the vibration, a relief request to increase the ASME Code Section XI alert threshold for the Unit 2 HPCI pump was submitted (50-254/265-94004-25a(DRP)).

- Residual heat removal service water (RHRSW) pump 1A had IST readings in the alert range for both vibration and flow; pump 1B was in the alert range for flow; pump 1C vibration reading were consistently in the alert range; pump 1D vibration readings were erratic and generally exceeded the alert threshold; and pump 2C vibration readings consistently exceeded alert range values (50-254/265-94004-25b(DRP)).
- Other safety related pumps and motors with vibration readings which routinely exceeded the administrative alert values included the standby liquid control pumps, core spray pumps, and a residual heat removal pump motor (50-254/265-94004-25c(DRP)).

The above are Inspector Follow-up Item (50-254/265-94004-25(DRP)) pending the inspectors review of the licensee's corrective actions.

Adverse vibration trends were also noted with the diesel generator cooling water (DGCW) pumps and HPCI pumps. The subject of vibration trends on the DGCW and HPCI pumps is an Inspector Follow-up Item (254/265-94004-26(DRS)) pending the inspectors review of additional pump vibration data.

#### Pump Head Data

In Section 2.2.1(2) of the DET report, discrepancies between actual pump head data and vendor pump head data were discussed for the core spray pumps and the Unit 1 HPCI pump. The core spray pump discrepancy is an Inspector Follow-up Item (50-254/265-94004-27(DRP)) pending the inspectors review of the licensee's evaluation.

In-service tests (IST) of the Unit 1 HPCI pump were signed off as acceptable with no evaluation performed to justify test anomalies. Lower pump capacity (700 gpm less) was obtained on Unit 1 HPCI when compared with Unit 2 HPCI. The test procedure instructed running the HPCI turbine at approximately 3900 rpm; however, the test was performed between 3700 and 3800 rpm. The subject of HPCI IST test performance is an Inspector Follow-up Item (50-254/265-94004-28(DRP)) pending review of the licensee's evaluation by the inspectors.

After replacement of diesel generator cooling water (DGCW) pumps, the pump capacity exceeded design flow. An engineering evaluation of the high pump flow failed to consider the potential negative effects on the DGCW pump heat exchangers. Effects of high flow through the DGCW heat exchanger is an Inspector Follow-up Item (254/265-94004-29(DRS)) pending the inspectors review of the licensee's evaluation.

#### Check Valve Testing

Sections 2.1.2(2) and 2.2.1(3) of the DET Report, discussed the failure to test safety related core spray check valves 9 A/B in accordance with ASME, Section XI requirements. This item was identified as a Violation and previously documented in Inspection Report 50-254/265-93025(DRP),

dated October 26, 1993. In addition to the core spray check valves, residual heat removal testable check valves 69 A/B were never tested for seat leakage in accordance with ASME Section XI. Failure to test RHR 69 A/B check valves is considered another example of the previously issued violation of 10 CFR 50, Appendix B, Criterion XI, "Test Control." The issued violation (50-254/265-93025-05(DRP)) will remain open pending the inspectors review of the licensee's corrective action.

Section 2.2.1(4) of the DET report, discussed repetitive failures of the reactor building floor drain check valves. This issue was previously identified as a violation in Inspection Report 50-254/265-93011(DRP), dated June 9, 1993. The issued violation (50-254/265-93011-03(DRP)) will remain open pending the inspectors review of the licensee's corrective action.

#### Relief Valve Testing

Section 2.2.1.(5) of the DET report, discussed the failure of 75 percent of the RHR relief valves to pass lift setpoint tests. Licensee Corrective Action Record (CAR) 04-92-036 was initiated to identify the fact that no action was taken to address the problem of relief valves failing the lift setpoint. The CAR was closed in August 1992 based on the stated action plan to test several relief valves during the next outage (Q2R12). No RHR relief valves were tested either during Q1R12 or Q2R12. This is an Unresolved Item (50-254/265-94004-30(DRS)) pending the inspectors review of the licensee's investigation and actions taken.

#### Valve Stroke Time Testing

Section 2.2.1(7) of the DET report, discussed the failure of several safety related motor operated valves (MOV) to meet the non-TS maximum allowable stroke times without being declared inoperable or being evaluated for operability. This is considered an Unresolved Item (50-254/265-94004-31(DRS)) pending the inspectors review of MOV stroke time test results.

Section 2.2.1(8) of the DET report, discussed the failure to test RHR containment isolation valves 7 and 28. This is considered an Unresolved Item (50-254/265-94004-32(DRS)) pending the inspectors review of the licensee's scope and test acceptance criteria for the IST and Appendix J programs.

Section 2.2.1(8) of the DET Report, discussed the failure to test and repair fire protection valve 1-8941-705 in accordance with ASME, Section XI requirements. This item is considered an Inspector Follow-up Item (50-254/265-94004-33(DRS)) pending the inspectors review of the licensee's IST program.

b. Maintenance Implementation

Sections 2.2.2, 2.2.4 and 2.2.5 of the DET report, identified several weakness in the conduct of maintenance activities. These weaknesses included:

- Limited pre-job briefings
- Poor communications
- Inaccurate drawings
- Work packages were cumbersome and difficult to implement
- Documentation of work history was confusing, incomplete, and difficult to track
- Minor document changes often required two shifts to complete

In addition, standardized work packages were almost equivalent to modification packages in size and detail for all jobs. This is considered an Inspector Follow-up Item (50-254/265-94004-34(DRS)) pending the inspectors review of the licensee's efforts to improve work package preparation, utilization, and processing.

c. Support to Maintenance

As discussed in Sections 2.2.2 and 2.2.5 of the DET report, maintenance management did not effectively utilize engineering support. Additionally, engineering support to maintenance was insufficient to maintain the effectiveness of the maintenance program. Also noted was a reluctance by operators to identify degraded components to the maintenance department. The subject of inter-departmental communications is an Inspector Follow-up Item (50-254/265-94004-35(DRP)) pending the inspectors review and assessment of the licensee's efforts to improve this area.

d. MOV Testing and Surveillance Deficiencies

As documented in Sections 2.2.3 and 2.3.5.1 of the DET report, neither Corporate nor Site Engineering had assumed a leadership role for implementation of NRC Generic Letter 89-10. Many of the MOV problems were related to deficiencies in engineering, plant design, system operation, and training. Maintenance management did not correct the root cause of MOV problems even when recommended by internal audits. The lack of detailed work history interfered with the planning of work activities and affected the ability of the site to track and identify repetitive failures. The NRC was concerned that CECO had not satisfied commitments to complete Generic Letter (GL) 89-10. The weaknesses in maintenance, testing and root cause analysis of MOV failures is an Inspector Follow-up Item (50-254/265-94004-36(DRS)) pending the inspectors review of improvements made in the licensee's MOV program.

e. Preventive Maintenance (PM) Program Implementation Deficiencies

As discussed in Section 2.2.6 of the DET report, the licensee's PM program had barriers hindering its implementation. Similarly, Section 2.2.2 of the DET report discussed the licensee's failure to incorporate vendor recommended maintenance in appropriate maintenance procedures. This resulted in a failure to torque a feedwater check valve at operating pressure. This is an Inspector Follow-up Item (50-254/265-94004-37(DRS)) pending the inspectors review of the licensee's practices for incorporating vendor recommendations into the PM program. In addition, a violation was previously issued for similar problems in Inspection Report 50-256/265-93025(DRP), dated October 26, 1993. The issued violation (50-254/265-93025-01a(DRP)) will remain open pending the inspectors review of the licensee's corrective action.

As discussed in Sections 2.2.6 and 2.3.4.2 of the DET report, the June 1993 HPCI rupture disk event may have been prevented had the PM program implemented vendor recommended action. This was the subject of a violation issued and discussed in Inspection Report 50-254/265-93017(DRS), dated August 13, 1993.

Three unresolved items and 11 inspector follow-up items were identified.

5. Engineering and Technical Support

a. RHR System Degradation

As discussed in Section 2.3.1 of the DET report, Quad Cities had a high percentage of gate valves of solid-wedge design in the RHR system that were vulnerable to thermal binding as shown by industry experience. Following MOV failures, due to thermal binding and pressure locking, screening criteria to identify susceptible MOVs were written for all CECO sites. However, the screening criteria had not been implemented at Quad Cities. The subject of thermal binding is an Inspector Follow-up Item (50-254/265-94004-38(DRS)) pending the inspectors review of the licensee's investigation of MOVs susceptible to such failures and the corrective actions taken.

b. Magnesium Alloy Rotor Bars in MOVs

As discussed in Section 2.3.1 of the DET report, certain magnesium alloys in the rotor bars of MOV actuator motors were susceptible to corrosion in high-temperature and high-humidity environments. Although the licensee had changed the purchasing specifications to prevent reordering of this material, there were no plans to inspect or replace the affected motors. The maintenance staff had earlier proposed a 10 CFR Part 21 report to Corporate Engineering, but it was evaluated as not meeting the threshold for reportability. The acceptability of continued use of magnesium alloy rotors in MOVs is an Unresolved Item (50-254/265-94004-39(DRS)) pending the inspectors review of the licensee's investigation and actions taken.

c. Plant Equipment Vibration

As discussed in Sections 2.1.1 and 2.3.2 of the DET report, equipment not included as part of ASME, Section XI test program experienced vibration problems. These included electromatic relief valves (ERVs), the main steam lines mechanical snubbers, and the cooling water line downstream of the Unit 1 EDG heat exchangers. Core Spray (CS) valves 4A and 4B experienced cavitation induced vibration from downstream orifices. A modification was planned to remove a flow-reducing orifice and install anti-cavitation trim in the CS test return valve. This issue is considered an Inspector Follow-up Item (50-254/265-94004-40(DRS)) pending the inspectors review of licensee's actions to mitigate the effects of vibration on plant equipment.

While observing a HPCI surveillance test, it was noted that the torus experienced significant displacement due to unstable steam condensation of the HPCI steam discharged to the torus. The inspectors consider this an Inspector Follow-up Item (50-254/265-94004-41(DRP)) pending licensee implementation of a modification (sparger addition) to improve system performance.

d. Engineering Support

As discussed in Section 2.3.4 of the DET report, engineering management had not developed a proactive role for plant support engineering. When involved in plant activities, plant support engineering was often narrowly focused and omitted broader implications. Additionally, plant support was not effective in correcting significant longstanding or emergent plant problems. As a result, maintenance and operations management had limited expectations regarding engineering support. This is considered an Inspector Follow-up Item (50-254/265-94004-42(DRS)) pending the inspectors review of the effectiveness of licensee improvements in the plant support engineering program.

As discussed in Section 2.3.4 of the DET report, significant weaknesses were identified in the system engineering program. Because of the system engineers' extensive responsibilities and relative inexperience, some repetitive or individually significant problems, which required additional engineering support, were not identified. Additionally, Section 2.4.3 of the DET report discussed the licensee's plan to implement a system engineering program by the end of 1994 to strengthen the performance of this group. This is an Inspector Follow-up Item (50-254/265-94004-43(DRS)) pending the inspectors review of the effectiveness of the licensee's improvements in the system engineering program.

As identified in Section 2.3.4 of the DET report, the primary means of communication between system engineering and plant support engineering organizations was the site engineering service request (SESR) process. However, SESRs were not a useful tool since prioritization or trending was not performed, and the status of overdue SESRs was not closely monitored. Managing of the SESR program is considered an Inspector

Follow-up Item (50-254/265-94004-44(DRS)) pending the inspectors review of the licensee's improvement programs.

As discussed in Section 2.1.1 of the DET report, Quad Cities was operated in "single-element" reactor level control since initial plant startup because three-element control was unstable. In addition, the "A" feed-regulating valves in both units were operated in the manual mode because the valves were unstable in the automatic mode. Although allowed by the UFSAR, the inspectors considered this an example of engineering not supporting the plant. Plant operation in single-element and with feedwater regulating valves in manual mode is an Inspector Follow-up Item (50-254/265-94004-45(DRP)) pending the inspectors review of the licensee's evaluation.

e. Operability Assessments

As discussed in Section 2.3.4.1 of the DET report, operability assessments were lacking in scope and engineering detail; root cause determinations had not been performed; and proposed corrective actions and appropriate findings were either not included or in error. This was identified as an inspector follow-up item in paragraph 3.d of this report.

As discussed in Section 2.3.4.1(3) of the DET report, four RHR spring cans were found out-of-tolerance during field verification by the licensee's IST group in November 1992. No operability evaluation was initiated to evaluate the spring cans' condition, and no effort was made to reset the spring cans in accordance with the applicable analysis. This is an Unresolved Item (50-254/265-94004-46(DRP)) pending the inspectors review of the licensee's investigation and actions taken.

As discussed in Section 2.3.4.1(5) of the DET report, the licensee had not performed an operability assessment for a scenario in which both units at Quad Cities were vulnerable to losses of both low pressure coolant injection (LPCI) trains and one of two core spray (CS) trains during a degraded grid condition. The subject of impact for a loss of LPCI trains and a CS train is an Inspector Follow-up Item (50-254/265-94004-47(DRP)) pending the inspectors review of the licensee's evaluation.

f. Operating Experience Feedback Reviews (OER)

Section 2.3.4.2 of the DET report, discussed the failure to adequately review industry and site OERs. Licensee reviews were not comprehensive or timely and failed to address problems and recommendations. For example, service information letter (SIL) No. 371, "RCIC Turbine Exhaust Pressure Trip Setpoint," dated February 1982, was still "under investigation." Similarly, four NRC Information Notices were reviewed to determine if Quad Cities had a process to screen operational experience. In each sample, records gave no evidence of actions taken or the reason for closure. The subject of licensee review of industry and site OERs is an Inspector Follow-up Item (50-254/265-94004-48(DRS))

pending the inspectors review ongoing corrective action. The licensee's program for review of OERs was the subject of a violation issued in Inspection Report 50-254/265-93024(DRP), dated December 1, 1993. The violation (50-254/265-93024-04a(DRS)) will remain open pending the inspectors review of the licensee's corrective action.

g. Corporate Engineering Involvement

As discussed in Section 2.3.5.1 of the DET report, Corporate Engineering was not focused on site specific issues. Programs requiring corporate interface with Site Engineering seemed to be more successful than those requiring corporate interface with plant personnel. This is an Inspector Follow-up Item (50-254/265-94004-49(DRS)) pending the inspectors review of licensee efforts to improve Corporate Engineering support to the plant.

Vulnerability Assessment Team Report (VAT)

As discussed in Section 2.3.5.2 of the DET report, management had not communicated its expectations regarding the disposition of issues raised in the vulnerability assessment team report (VAT). Resolution of the VAT and the action plan to address the Quad Cities safety evaluation program (SEP) topics is an Inspector Follow-up Item (50-254/265-94004-50(DRP)) pending the inspectors review of the licensee's corrective action.

Design Basis Documentation (DBD)

Sections 2.3.5.3 and 2.3.6.2 of the DET report, discussed Corporate Engineering's effort to reconstitute the plant's design-basis documentation (DBD). Engineering judgment had been used to a large extent rather than rigorous calculations in areas in which original calculations were not available. The licensee's efforts in performing operability determinations, engineering evaluations, and root cause determinations were sometimes ineffective partially due to a lack of complete DBD. The lack of design-basis documentation also hindered the licensee's 50.59 reviews. This is an Inspector Follow-up Item (50-254/265-94004-51(DRP)) pending the inspectors review of the licensee's efforts to reconstitute the Quad Cities DBD.

Individual Plant Evaluation (IPE)

As discussed in Section 2.3.5.4 of the DET report, the licensee's draft IPE assumed that the original design margins and equipment important to safety were being maintained so that generic industry reliability data could be used in many areas. However, since the operability determination process was flawed, some assumptions and data used in the draft IPE might not reflect actual plant conditions and risk to plant safety. The draft IPE did not consider appropriate plant-specific failure data, significant plant degradation affecting numerous safety systems, and certain plant design features which were considered weaknesses. This is an Inspector Follow-up Item (50-254/265-94004-



52(DRS)) pending the inspectors review of the licensee's submitted IPE to ensure it meets the intent of GL 88-20.

h. Untimely Modification Implementation

As discussed in Section 2.3.6 of the DET report, several safety-significant modifications were not implemented in a timely manner. Additionally, there was a large backlog of modifications that had been approved but not installed. This is an Inspector Follow-up Item (50-254/265-94004-53(DRP)) pending the inspectors review of the impact of deferred safety related modifications.

10 CFR 50.59 Reviews

As discussed in Section 2.3.6.2 of the DET Report, there were instances where the licensee had changed or altered plant operation as described in the updated final safety analysis report (UFSAR) and had not performed a 50.59 review or the evaluation performed was inadequate. Specific examples included:

- One of the two pumpback air compressors (described in the UFSAR) had never been operational.
- Numerous RHR yoke-to-bonnet bolt modifications were performed without a safety evaluation.
- The safety evaluation performed for a "minor modification" replacing the 1A RHR torus cooling and torus test return valve actuators did not evaluate the increased thrust capability of a larger motor and the potential adverse effect on valve actuator components.

10 CFR 50.59 required written safety evaluations when making changes to the facility as described in the safety analysis report which provides the bases that the changes do not involve an unreviewed safety question. Failure to perform adequate safety evaluations for the changes made to the facility as described above is a Violation (50-254/265-94004-54(DRP)) of 10 CFR 50.59.

i. Ceramic Fill and Coating Compounds not Controlled

Section 2.3.7 of the DET report discussed the lack of management involvement in the performance of temporary repairs and modifications of safety related equipment. This is an Inspector Follow-up Item (50-254/265-94004-55(DRS)) pending the inspectors review of licensee actions to improve management involvement in temporary repairs.

As discussed in Section 2.3.7 of the DET report, the licensee applied ceramic fill and coating material (Belzona) to the interior of safety related pumps and valves. These special process applications received little site engineering evaluation. In the case of a HPCI testable check valve, Belzona was used in a high temperature application and in a non-reinforced manner which was not addressed by the licensee's evaluation or by the vendor. The work packages for the HPCI valve and a diesel generator cooling water (DGCW) pump, did not contain any vendor cautions pertaining to the appropriate use of Belzona. The use of Belzona in safety related systems without an evaluation is an Unresolved Item (50-254/265-94004-56(DRP)) pending the inspectors review of the specific applications.

One violation, three unresolved items, and 15 inspector follow-up items were identified.

6. Management and Organization

a. Ineffective Corrective Action

As discussed in Section 2.4.1 of the DET report, ineffective site management of the corrective action processes and site management's failure to correct known deficiencies in these processes led to a number of equipment problems. The failure to trend and analyze repetitive equipment or performance problems, shallow (or nonexistent) root cause analyses, failure to perform operability and safety impact evaluations, and the lack of aggressive problem resolution resulted in short-term rather than long-term solutions to station problems. Despite large increases in work practice problems, personnel errors, and equipment failures, corrective actions to address these issues were not aggressively pursued by management. Failure to implement effective corrective actions is the subject of a violation in this inspection report.

Integrated Reporting Program

Section 2.4.1 of the DET report, discussed the licensee's implementation of a new corrective action process, the integrated reporting program (IRP). Most site personnel had not received training on the IRP or the new problem identification forms (PIFs). Existing failure data from departmental corrective action processes were not being transferred to the IRP. The newly established IRP program is an Inspector Follow-up Item (50-254/265-94004-57(DRP)) pending the inspectors review of the following:

- Training of licensee personnel on the PIF process
- Quality of root cause evaluations
- Identification and resolution of repetitive trends
- Accountability of problem resolution
- Transferral of departmental corrective action processes into the IRP

b. Quality Oversight

As discussed in Section 2.4.2 of the DET report, corporate management had weakened site quality verification (SQV) by staffing reductions and redirection of efforts. The onsite nuclear safety department was combined with the SQV group. SQV was directed to become more involved in site activities, and participated in event investigation teams and event review or screening committees. SQV personnel were expected to audit these activities concurrently. These changes, coupled with failure to elevate problems and other concerns, resulted in an ineffective quality oversight organization. This is an Inspector Follow-up Item (50-254/265-94004-58(DRP)) pending the inspectors review of the licensee's revised SQV organization and its effectiveness.

c. Site Management Effectiveness

Sections 2.4.4 and 2.4.5 of the DET report, discussed a major change in CECO management philosophy by hiring experienced managers from outside the company. The recent management realignments is an Inspector Follow-up Item (50-254/265-94004-59(DRP)) pending the inspectors review of site management's ability to effectively improve plant performance.

Three inspector follow-up items were identified.

7. Unresolved Items

Unresolved items are matters which require more information in order to ascertain whether it is an acceptable item, an open item, a deviation or a violation. Ten unresolved items disclosed during this inspection are discussed in paragraphs 3, 4, and 5.

8. Inspector Follow-up Items

Inspector follow-up items are matters which have been discussed with the licensee, which will be reviewed by the inspector and which involve some action on the part of the NRC or licensee or both. Forty-five Inspector follow-up items disclosed during the inspection are discussed in paragraphs 3, 4, 5, and 6.

9. Exit Interview

The inspectors met with the licensee representatives denoted in paragraph 1 during the inspection period and at the conclusion of the inspection on March 7, 1994. The inspectors summarized the scope and results of the inspection and discussed the likely content of this inspection report. The licensee acknowledged the information and did not indicate that any of the information disclosed during the inspection could be considered proprietary in nature.

Attachment: Inspection Items Cross Reference

IR 94004 INSPECTION ITEMS CROSS REFERENCE

REPORT 94004	ITEM TYPE	REPORT PARA. #	SUBJECT	LICENSEE ITEM #
-01	UI	3.a	CNTMT. VENT	NONE
-02	IFI	3.a	GRP 1 ISOLATIONS	2.1.1.a
-03	IFI	3.a	ERV FAILURES	2.1.1.b
-04	IFI	3.a	FEED REG LOCKUP	2.1.1.b
-05	IFI	3.a	O2 ANALYZER	2.1.1.b
-06	IFI	3.a	VALVE LEAKAGE	2.1.1.b
-07	IFI	3.b	TIMELY NWRs	2.2.2.e
-08	IFI	3.b	MAINT TIME	2.2.4.a-d
-09	IFI	3.c	BACKLOG/PIs	2.2.4.b
-10	IFI	3.d	BROKE RCIC BOLTS	NONE
-11	IFI	3.d	C.R.HVAC	NONE
-12	IFI	3.d	BLDG VENT TRIP	NONE
-13a	NOV	3.d	SEISMIC MOUNT	NONE*
-13b	NOV	3.e	ELMS CALC	NONE
-14	IFI	3.d	DC GROUNDS	NONE
-15	IFI	3.e	OPERABILITY	2.1.2.a-d
-16	UI	3.e	2 OVER 1	2.1.2.a-d
-17	UI	3.e	SBLC HEAT TRACE	NONE
-13a	NOV	3.e	FW NOZZLE	2.1.2.a-d
-18b	NOV	3.f	VALVE VIBRATION	2.3.1.c
-19	IFI	3.g	GREEN ALARMS	2.1.4.a
-20	IFI	3.h	UNIT SUP	2.1.5.a
-21	IFI	3.h	SIMULATOR	2.1.5.b
-22a	NOV	3.i	OPS PROCEDURES	2.1.3.a
-22b	NOV	3.i	MAINT PROCEDURES	2.2.2.a
-23	UI	3.i	TS REQMT MISSED	2.1.3.b
-24	IFI	4.a	1ST SECTION XI	2.2.1.a/b
-25	IFI	4.a	PUMP VIBRATION	2.2.1.a
-26	IFI	4.a	PUMP VIB TREND	2.2.1.a

-27	IFI	4.a	PUMP HEAD DATA	NONE
-28	IFI	4.a	HPCI TEST RESULTS	NONE
-29	IFI	4.a	EDGCW HX HI FLOW	NONE
-30	UI	4.a	RELIEF VALVE TEST	2.2.1.c
-31	UI	4.a	STROKE TIMES	2.2.1.e
-32	UI	4.a	CNTMT VALVE TEST	2.2.1.f
-33	IFI	4.a	FIRE VALVE TEST	2.2.1.f
-34	IFI	4.b	MAINT IMPLEM	2.2.2.a
-35	IFI	4.c	MAINT SUPPORT	2.2.5.a-e
-36	IFI	4.d	MOV TEST PROGRAM	2.2.3.a-c
-37	IFI	4.e	PM PROGRAM	2.2.6.a-c
-38	IFI	5.a	THERMAL BINDING	2.3.1.a-d
-39	UI	5.b	MAG ALLOY USE	2.3.1.b
-40	IFI	5.c	EQPMT VIBRATION	2.3.2.a
-41	IFI	5.c	HPCI TORUS MOD	NONE
-42	IFI	5.d	ENG SUP TO MAINT	2.3.4.a-g
-43	IFI	5.d	SYS ENGINEERING	2.3.4.a-g & 2.4.3.a
-44	IFI	5.d	SESRs	2.3.4.e
-45	IFI	5.d	SNGL ELEM/FEEDREG	NONE
-46	UI	5.e	RHR SPRING CANS	NONE
-47	IFI	5.e	DEGRADED GRID	NONE
-48	IFI	5.f	OERs	2.3.4.c
-49	IFI	5.g	CORP ENG SUPPORT	2.3.5.a-d
-50	IFI	5.g	VAT/SEP	2.3.5.d
-51	IFI	5.g	DPDs	2.3.5.d
-52	IFI	5.g	IPE	NONE
-53	IFI	5.h	MOD PROGRAM	2.3.6.a/b
-54	NOV	5.h	50.59 REVIEWS	2.3.6.c
-55	IFI	5.i	INVOLV TEMP MOD	2.3.7.a
-56	UI	5.i	BELZONA	2.3.7.a
-57	IFI	6.a	IRP	2.4.1.a-f
-58	IFI	6.b	SITE SQV	2.4.2.a-j
-59	IFI	6.c	STAFFING	2.4.4.a-c +2.4.5.a-m