U.S. NUCLEAR REGULATORY COMMISSION

REGION III

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EXECUTIVE SUMMARY

Quad Cities Nuclear Power Station
NRC Inspection Reports 50-254/97017; 50-265/97017

This inspection included a review of the licensee's implementation of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The report covers a two-day site visit, a four-day in-office inspection, and a one-week on-site inspection by regional and Office of Nuclear Reactor Regulation inspectors, and two contractors from the Idaho National Engineering & Environmental Laboratory.

The team concluded that the maintenance rule had not been properly implemented at Quad Cities. Numerous examples of incorrect, inadequate, or inappropriate performance criteria for (a)(2) functions existed. Further, the Quad Cities staff repeatedly failed to properly assess events and problems for maintenance preventable functional failures. Finally, implementation of goals and monitoring for (a)(1) functions was weak.

<u>Maintenance</u>

- Scoping of structures, systems, and components (SSCs) was considered adequate. Recent rescoping efforts appropriately placed additional systems and functions of SSCs under the maintenance rule program scope; however, a few functions were still inappropriately excluded.

- The expert panel was a well-balanced group of qualified, experienced personnel. The panel used their experience in conjunction with the probabilistic risk assessment to adequately assess SSC safety significance; however, the panel demonstrated weak understanding of performance criteria as evidenced by numerous examples of improper reliability, availability, and condition monitoring criteria. Use of the Plant Operations Review Committee in place of the expert panel for about one year resulted in weak oversight of maintenance rule implementation during that period.

- Based on reviews of the licensee's risk ranking results, the team concluded that the licensee's approach to establishing the risk ranking for SSCs within the scope of the maintenance rule was good. However, two SSCs that should have been classified as having high safety significance were misclassified as having low safety significance.

- The periodic assessment performed in October 1996 met station procedural requirements and satisfied the regulatory requirements of 50.65(a)(3).

- Adequate processes were in place to incorporate information from industry operating experience into goal development and the periodic assessments.

- The team concluded that the process to balance availability and reliability was consistent with current industry practice. However, there was no assurance that the results were valid because the performance criteria used in many cases were

considered unacceptable. Consequently, the team could not conclude that balancing reliability and unavailability had been properly performed at Quad Cities.

- The team viewed the licensee's process for assessing plant risk resulting from equipment out of service for on-line maintenance to be good. Use of the Operational Safety Predictor software and information from the Individual Plant Examination for External Events fire risk study to assess plant risk while at power was considered to be a strength in the licensee's implementation of the maintenance rule.

- Performance criteria established to demonstrate the effectiveness of preventive maintenance of (a)(2) systems and functions were frequently inappropriate, inadequate, or incorrect. Multiple examples of several types of performance criteria deficiencies were identified by the team, even after the licensee had conducted a review. The widespread nature of the deficiencies indicated that the licensee did not understand how to apply industry guidance on maintenance rule implementation and had a fundamental misunderstanding of what purpose performance criteria served. The scope and spectrum of problems identified was indicative of a breakdown in this aspect of maintenance rule program implementation.

- The process for evaluating events and problems for functional failures and maintenance preventable functional failures was not adequately implemented. System engineers responsible for performing these determinations did not have a consistent understanding of when and how to make these determinations. The team identified multiple examples or untimely and incorrect evaluations; examples where the licensee had not evaluated events and problems were also identified. The number of problems identified and the system engineers' inconsistent understanding of the evaluation process indicated a breakdown in this aspect of maintenance rule program implementation.

- Implementation of goals and monitoring for systems and functions classified (a)(1) was weak. The team identified a number of examples where (a)(1) systems and functions had either no goals or improper goals established.

- The team concluded that the licensee had selected the correct structures to be monitored under the maintenance rule and had established a systematic program for monitoring the condition of these structures.

<u>Quality Assurance</u>

- With the exception of the failure to identify problems with maintenance preventable functional failure evaluations, the licensee's self assessments and audits generally identified problems with the maintenance rule implementation. In particular, the June 1997 assessment provided a clear set of major issues and provided the licensee with an opportunity to begin an aggressive improvement initiative. The use of independent personnel provided significant insights into the maintenance rule program. However, the licensee did not respond aggressively to the self-assessment results.

Engineering

- System engineers were experienced and knowledgeable with regard to their assigned systems; however, their knowledge of the station's maintenance rule program was weak. Although the licensee relied heavily on the system engineers to implement the maintenance rule, based on the extent of problems identified with the performance phases of the program, the team concluded that the system engineers were not prepared to deal with the task.

Report Details

Summary of Plant Status

Both Units 1 and 2 were operating at full power during the inspection.

Introduction

This inspection included a review of the licensee's implementation of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The report covers a two-day site visit, a four-day in-office inspection, and a one-week on-site inspection by regional and Office of Nuclear Reactor Regulation inspectors, and two contractors from the Idaho National Engineering & Environmental Laboratory.

I. Operations

O4 Operator Knowledge and Performance

O4.1 Operator Knowledge of Maintenance Rule

a. Inspection Scope (62706)

During the inspection of the implementation of 10 CFR 50.65, the team interviewed three senior reactor operators and three reactor operators to determine if they understood the general requirements of the maintenance rule and their particular duties and responsibilities for its implementation.

b. Observations and Findings

The operators had a general knowledge of the maintenance rule and their role in its implementation. The operators stated that their duties included recording equipment out-of-service times and using the Operational Safety Predictor program to evaluate plant configurations for emergent work, and as an additional check before taking equipment out-of-service for on-line maintenance and surveillances.

The operators indicated that the maintenance rule helped to improve the reliability of balance-of-plant equipment, made them more cognizant of out-of-service times to minimize risk, and minimized the challenges to the operators due to maintenance-related equipment failures. The operators also noted that although they were required to log more equipment, the additional burden caused by the rule was minimal.

Conclusions

The operators' knowledge was sufficient to perform their part in the implementation of the maintenance rule. The maintenance rule aided the operators in monitoring and limiting risks associated with taking equipment out-of-service.

II. Maintenance

M1 Conduct of Maintenance (62706)

M1.1 Scope of Structures, Systems, and Components Included Within the Rule

a. Inspection Scope

The team reviewed the licensee's data base of functions and verified that required SSCs were included in the scope of the rule in accordance with 10 CFR 50.65 (b). The team selected an independent sample of functions that were expected to have been included within the scope of the rule. The team also reviewed functions that were previously included in the Quad-Cities maintenance rule, but that had been removed during the recent rescoping effort.

b. Observations and Findings

The licensee's maintenance rule program was described in procedure QCAP 0400-18, "Station Compliance with the Maintenance Rule," Revision 1, August 15, 1997. The procedure described the methodology used to select (scope) SSC functions under the maintenance rule. The methodology was consistent with the guidance of Nuclear Management Resource Council 93-01.

The expert panel and system engineers initially identified functions for plant systems and determined which functions should be within scope of the rule. Site structures were also placed within the scope of the rule. A rescoping effort, based on recent self-assessment findings, was conducted to ensure all systems and system functions were adequately addressed by the maintenance rule program. In general, the results of the rescoping effort were adequate. A large number of functions were added to the scope, some functions were combined, and others were separated from the original functions. Documentation to support scoping decisions was limited. The team identified the following functions which should have been included in the scope of the rule:

- *High Pressure Coolant Injection (Z2300):* The team noted that although the licensee had identified specific functions for automatic trips of the main and reactor core isolation cooling pump turbines, no comparable function for the high pressure coolant injection pump turbine was identified nor scoped into the maintenance rule program.

- *Reactor Manual Control (Z0281-01):* This low safety significance function prohibited the movement of control rods upon receipt of a rod block signal from the rod block monitor (which was in scope). As of August 21, 1997, this function had not been included within scope of the maintenance rule contrary to 10 CFR 50.65(b)(2)(I).

- *Intraplant Communications (Z9050-01):* This high safety significance function provided on-site communications during normal and emergency conditions.

Prior to August 15, 1997, this function had not been included within scope of the maintenance rule contrary to 10 CFR 50.65(b)(2)(I). Although the licensee had added this function to the scope prior to the inspection, the inspectors considered this omission to be NRC-identified because communication systems were explicitly discussed as within the scope of the maintenance rule by Regulatory Guide 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," revision 2, dated March 1997 and Information Notice 97-18, "Problems Identified During Maintenance Rule Baseline Inspections," dated April 14, 1997. The licensee's recognition, approximately five months later, that communication systems should be in scope was untimely.

The failure to include the above functions within the scope of the rule is considered an apparent violation of 10 CFR 50.65(b) (Escalated Enforcement Item (EEI) 50-254/97017-01(DRS); 50-265/97017-01(DRS)).

c. Conclusions

The team concluded that the rescoping effort was generally adequate. With the exception of the functions listed above, required functions had been scoped into the maintenance rule.

M1.2 Safety (Risk) Determination, Risk Ranking, and Expert Panel

a. Inspection Scope

Paragraph (a)(1) of the maintenance rule required that goals be commensurate with safety. Implementation of the rule using the guidance contained in Nuclear Management Resource Council 93-01 also required that safety be taken into account when setting performance criteria and monitoring under (a)(2) of the rule. This safety consideration would then be used to determine if the SSCs should be monitored at the plant, system, or train level. The team reviewed the methods that the licensee established for making these required safety determinations. The team also reviewed the safety determinations that were made for the systems that were examined in detail during this inspection.

b.1 Observations and Findings on the Expert Panel

Expert panel knowledge of the maintenance rule was mixed. In general, the expert panel members appeared knowledgeable concerning the requirements of the maintenance rule and understood their responsibilities as expert panel members. The panel had received training and demonstrated an understanding in the use of probabilistic risk assessment. Expert panel composition included personnel from maintenance, system engineering, probabilistic risk assessment, operations, and emergency operating procedures. The panel used their experience in conjunction with the probabilistic risk assessment to assess SSC safety significance. The expert panel's responsibilities also included review and approval of scoping decisions, goal-setting action plans, performance criteria selection, and dispositions to reclassify SSCs from (a)(2) to (a)(1) and (a)(1) to (a)(2). Meeting minutes described the panel's activities, although the bases for decisions were not always well documented.

The expert panel had little input to the maintenance rule program from July 10, 1996, when the maintenance rule was required to be implemented, until approximately one year later when it was reconstituted. During that period the expert panel did not meet on a periodic basis and was replaced by the Plant Operations Review Committee. The team considered this a weakness because the Plant Operations Review Committee did not have an individual knowledgeable in probabilistic risk assessment nor an individual as knowledgeable of the maintenance rule as the expert panel members. In one instance which involved the emergency diesel generators, the Plant Operations Review Committee rejected the system engineers' request to place the diesels in (a)(1) based on engineering judgement following identification of air start motor problems. The system was eventually placed in (a)(1); however, approval by the station manager was required to override the Plant Operations Review Committee decision.

The team determined that the expert panel's understanding of performance criteria was weak. The team noted examples where high safety significance SSCs and functions did not have proper availability, reliability, or condition monitoring criteria. This is further discussed in section M1.6.

c.1 Conclusions on the Expert Panel

The expert panel was a well-balanced group of qualified, experienced personnel. The panel used their experience in conjunction with the probabilistic risk assessment to adequately assess SSC safety significance; however, the panel demonstrated weak understanding of performance criteria as evidenced by numerous examples of improper reliability, availability, and condition monitoring criteria. Use of the Plant Operations Review Committee in place of the expert panel for about one year resulted in weak oversight of maintenance rule implementation during that period.

b.2 Observations and Findings on Risk Determinations

b.2.1 Analytical Risk Determining Methodology

The licensee's process for establishing the safety significance of SSCs within the scope of the maintenance rule was documented in Quad Cities procedure QCAP 0400-18, "Station Compliance with the Maintenance Rule," Revision 1, August 15, 1997. This document was reviewed and found to adequately describe the process of determining safety significance.

For SSCs modeled in the licensee's Individual Plant Examination, three importance measures were evaluated (core damage frequency contribution, risk achievement worth, and risk reduction worth), as recommended in Nuclear Management Resource Council 93-01. If a basic event's importance measure met one or more of the criteria, then the SSC associated with that basic event was judged to have potentially high safety significance. Because the Nuclear Management Resource Council 93-01 guidance specified that a basic event had potentially high safety significance if any of the three importance measure criteria were met, the approach used by the licensee was adequate. The expert panel then made the final determinations with respect to safety significance. No SSCs indicated to have high safety significance from the Individual Plant Examination importance measures were intentionally downgraded to low safety significance. However, two SSCs modeled in the 1996 Individual Plant Examination update, high pressure coolant injection room cooler (Z5711-01) and safe shutdown makeup pump room cooler (Z5711-03), with importance measures above the Nuclear Management Resource Council 93-01 criteria, were inadvertently misclassified as having low safety significance. The 1993 Individual Plant Examination had not modeled these room coolers because initial room cooling calculations indicated the coolers were not needed. However, follow-on calculations indicated that room cooling was needed. Reclassification of these two functions and establishing appropriate performance criteria are an inspection follow-up item (IFI 50-254/97017-02(DRS); 50-265/97017-02(DRS)).

b.2.2 Adequacy of Expert Panel Evaluations

For SSCs not modeled in the Individual Plant Examination, the expert panel determined the safety significance by using a weighted average decision process, which was an expert judgment, Delphi approach. This approach considered how important each SSC was with respect to four accident response functions and six normal operations functions. Results for each function were weighted and summed to obtain a single importance number (ranging from 112.8 to 1128) for each SSC function. SSCs with importance numbers greater than or equal to 300 were considered to have high safety significance. Although the cutoff criterion of 300 had no strong basis, the use of this structured approach for SSCs not modeled in the Individual Plant Examination was considered conservative.

c.2 Conclusions on Risk Determinations

Based on the reviews discussed above, the team concluded that the licensee's approach to establishing the risk ranking for SSCs within the scope of the maintenance rule was good. However, two SSCs that should have been classified as having high safety significance were misclassified as having low safety significance.

M1.3 (a)(3) Periodic Evaluations

a. Inspection Scope

Paragraph (a)(3) of the maintenance rule requires that performance and condition monitoring activities, associated goals, and preventive maintenance activities be evaluated, taking into account where practical, industry wide operating experience. This evaluation was required to be performed at least one time during each refueling cycle, not to exceed 24 months between evaluations. The team reviewed the licensee's October 1996 evaluation.

b. Observations and Findings

Procedure QCAP 0400-18, Rev. 1, "Station Compliance With the Maintenance Rule," section D.8., required a periodic assessment of maintenance rule program effectiveness once every calender year. The team reviewed the first assessment covering the period October 1995 through October 1996. The 1997 assessment had not yet been completed.

The team found that the completed assessment covered all elements of the maintenance rule. The assessment met the station procedural requirements and satisfied regulatory requirements of 50.65(a)(3). While the assessment missed weaknesses in the program identified in this report, it suggested some improvements to strengthen the program. In particular, the review of completed modifications for the effect on scoping, the assessment of integrated risk over the year, and the review of maintenance rework issues were good initiatives.

c. Conclusions

The periodic assessment performed in October 1996 met station procedural requirements and satisfied the regulatory requirements of 50.65(a)(3).

M1.4 (a)(3) Balancing Reliability and Unavailability

a. Inspection Scope

Paragraph (a)(3) of the maintenance rule requires that adjustments be made where necessary to assure that the objective of preventing failures through the performance of preventive maintenance was appropriately balanced against the objective of minimizing unavailability due to monitoring or preventive maintenance. The team reviewed the plans to ensure this evaluation was performed as required by the maintenance rule.

b. Observations and Findings

Balancing reliability and availability at Quad Cities consisted of monitoring SSC function performance against the established performance criteria. If the performance criteria were met, then reliability and availability were considered balanced. While this process was acceptable, the team determined that balancing reliability and availability had not been properly implemented because of problems with reliability and availability criteria. Availability was not established as a performance criterion for some high safety significance functions. Furthermore, because reliability criteria for many functions were improperly established, the results of balancing evaluations previously conducted were suspect. Problems with performance criteria are discussed in section M1.6. The acceptability of the licensee's reliability and availability balance after performance criteria problems are resolved is an Unresolved Issue (URI 50-254/97017-03(DRS); 50-265/97017-03(DRS)).

c. Conclusions

The team concluded that the process to balance availability and reliability was consistent with current industry practice. However, there was no assurance that the results were valid because the performance criteria used in many cases were considered unacceptable. Consequently, the team could not conclude that balancing reliability and unavailability had been properly performed at Quad Cities.

M1.5 (a)(3) On-line Maintenance Risk Assessments

a.. Inspection Scope

Paragraph (a)(3) of the maintenance rule states that the total impact on plant safety should be taken into account before taking equipment out-of-service for monitoring or preventive maintenance. The team reviewed the licensee's procedures and discussed the process with the Individual Plant Examination representatives, plant operators, work planners, and schedulers.

b. Observations and Findings

The licensee's process for determining plant safety when equipment was taken out of service was documented in procedure QCAP 0400-18, Revision 1. While the plant was at power, the licensee's process was outlined in the procedures QCAP 2200-08, "Voluntary On-Line Maintenance of Equipment Important to Safety," Revision 5 (August 4, 1997) and QCAP 2200-07, "Probabilistic Risk Assessment of On-Line Maintenance Activities," Revision 2 (May 22, 1997). When the plant was shut down, the process was outlined in procedure QCAP 1800-01, "Shutdown Risk Management," Revision 5 (May 23, 1997).

The Operational Safety Predictor was used by the cycle manager for planning and scheduling operating cycle work and was also used by the operators and/or the cycle manager to evaluate emergent failures. The program searched a database compiled from the licensee's 1993 Individual Plant Examination submittal to provide risk-related information based on current or proposed plant configurations. The licensee stated that the database contained approximately 600 plant configurations. The program's software provided a color code based on the risk level for when equipment was out of service: green when the core damage frequency was less than 2 times the nominal core damage frequency, yellow when the core damage frequency was less than 12 times the nominal core damage frequency, orange when the core damage frequency was less than 20 times the nominal core damage frequency, red when the core damage frequency was greater than 20 times the nominal core damage frequency, and white when the data was not available in the database. Other risk-related information included a prioritized listing of unavailable equipment which reduced risk most as the equipment was returned to service.

The team cross-referenced the list of system top events that met one or more of the Nuclear Management Resource Council 93-01 probabilistic safety assessment criteria for safety significance, as used by the licensee, with the list of SSCs available in the Operational Safety Predictor. The two lists compared favorably, and for systems that were not covered by the Operational Safety Predictor (e.g., instrument air, residual heat removal heat exchangers, or relief valves) the licensee stated that other more restrictive technical specifications would apply or that those plant configurations were not entered on a voluntary basis without the plant configuration being analyzed by the licensee's probabilistic risk assessment staff. For involuntary or emergent conditions for plant configurations that were not in the database (i.e., white condition), the licensee stated that there were procedural requirements for these conditions and that the probabilistic risk assessment staff was on-call to evaluate these specific plant configurations. The licensee stated that the database was updated as new configurations were evaluated and that a hard copy of the risk information was available in case the computer system failed.

The team also reviewed the licensee's approach for determining plant fire risk from SSC outages while the plant was at power. That process was documented in a site letter, "Administrative Guidance for Monitoring Core Damage Risk Due to Fire, Revision 1," (June 4, 1997). That process was based on results from the licensee's Individual Plant Examination for External Events, and used the same color scheme adopted by the Operational Safety Predictor to indicate the increase in core damage frequency.

The team also reviewed Operator Log Books covering June and July 1997 to identify different plant configurations. The log books indicated a daily plant status (e.g., green, yellow), indicating the maximum risk configuration that would be encountered that day from existing SSC outages and planned activities for that day. No situations of emergent work were identified that required additional risk evaluations.

The team also reviewed the licensee's shutdown risk management. The licensee's process was based on a standard industry approach, using guidance from Nuclear Management Resource Council, Institute for Nuclear Power Operations, and Electric Power Research Institute.

c. Conclusions

The licensee's process for assessing plant risk resulting from equipment out of service for on-line maintenance was good. Use of the Operational Safety Predictor software and information from the Individual Plant Examination for External Events fire risk study, to assess plant risk while at power, was considered to be a strength in the licensee's implementation of the maintenance rule.

M1.6 (a)(1) Goal Setting and Monitoring and (a)(2) Preventive Maintenance

a. Inspection Scope

The team reviewed program documents in order to evaluate the process established to set goals and monitor under (a)(1) and to verify that preventive maintenance was effective under (a)(2) of the maintenance rule. The team also discussed the program with appropriate plant personnel and reviewed the following systems in depth:

Control Rod Drive Hydraulics - Z0300
Nuclear Instrumentation - Z0700
Reactor Core Isolation Cooling - Z1300
Residual Heat Removal - Z1500
High Pressure Coolant Injection - Z2300
Containment Atmosphere Monitoring - Z2400
Fire Protection - Z4100
Instrument Air - Z4700
Emergency Diesel Generators - Z6600
Station Blackout Diesel Generators - Z6620
125 VDC - Z8300
250 VDC - Z8350

The team reviewed each of these systems to verify that goals or performance criteria were established in accordance with safety, that industry wide operating experience was taken into consideration where practical, that appropriate monitoring and trending were being performed, and that corrective actions were taken when an SSC failed to meet its goal or performance criteria or experienced a maintenance preventible functional failure.

The team reviewed Commonwealth Edison corporate procedure NEP-17-03, Revision 0, "Structures Monitoring Program" and QCAP 0400-20, Revision 0, "Structures Monitoring Program" to understand the licensee's program for inspecting structures in the maintenance rule. The team reviewed which onsite structures had been included in the maintenance rule. Additionally, a review of the performance criteria and monitoring established for structures within scope was performed. Structures evaluated by the team included buildings, enclosures, storage tanks, earthen structures, and passive components and materials housed in the aforementioned. In addition, the team assessed how structures within scope were monitored for degradation.

b. Observations and Findings

As a result of maintenance rule program changes during August 1997, reliability performance criteria, in general, applied to both units combined over a rolling 36-month period. The team considered the combination of both units and use of a 36-month period to be a strength of the licensee's program because the performance criteria applied to a greater number of demands on equipment. Most reliability performance criteria were set sufficiently low to prevent masking of poor reliability of individual equipment trains. In general, availability performance criteria were applied to equipment on the train level over a rolling 18-month period. Application at the train level prevented masking of poor equipment availability in most cases. Prior to August 1997, performance criteria were generally applied at the train level over a cycle period.

Initially, performance criteria appeared to be well-documented and retrievable. However, during the inspection, the Station Maintenance Rule Owner identified that some of the material which had been retrieved from the Maintenance Rule Database and presented to the team was in error. Consequently, the team was unable to conclude that performance criteria were consistently retrievable in an error-free manner.

The licensee had initiated a review of maintenance rule scoping determinations and performance criteria for systems in late July 1997 in response to a self-assessment (see Section M7.1). Despite the licensee's review effort, numerous performance criteria problems still existed at the time of the inspection; the team identified many examples of performance criteria problems which existed after the performance criteria had been revised.

A significant number of performance criteria were inappropriate in that they could not effectively gauge the performance of the function. The existence of numerous examples of inappropriate performance criteria indicated a misunderstanding of what purpose performance criteria served. In addition, examples existed where there were insufficient performance criteria to gauge the performance of high safety significance functions. The breadth and type of problems associated with performance criteria are discussed in the following paragraphs and represent one aspect of a programmatic breakdown of the maintenance rule program.

b.1 Reliability Performance Criteria

b.1.1 Inadequate Reliability Performance Criteria

The team identified examples where the reliability performance criteria permitted a failure rate over an order of magnitude greater than the failure rate assumed in the probabilistic risk assessment. The licensee had not provided a technical justification for the performance criteria which allowed the high failure rate. In response to questions by the team, the licensee performed a sensitivity study which showed that the impact of the increased failure rates would be acceptable. The examples were:

Recirculation System Pump Trip (Z0202-09): This high safety significance function was for automatically tripping the recirculation pumps in response to events (including anticipated transient without scram). The reliability performance criterion for this function was one maintenance preventable functional failure per 36-month rolling period. Due to having only eight expected demands in a 36-month period, the failure rate permitted by the criterion was 1.25E-1 failures per demand, a failure rate significantly greater than the failure rate of 1.0E-4 failures per demand assumed in the probabilistic risk assessment.

4160 Volt Switchgear Crosstie (Z6700-09): This high safety significance function was for providing power to the other unit using the 4 kV bus tie breakers. The reliability performance criterion for this function was originally no maintenance preventable functional failures, but was revised during the week of September 2, 1997, to one maintenance preventable functional failure per 36-month rolling period. Due to having only eight expected demands in a 36-month period, the failure rate permitted by the criterion was 1.25E-1 failures per demand, a failure rate significantly greater than the failure rate of 1.6E-3 failures per demand assumed in the probabilistic risk assessment.

480 Volt Transformer (Z6750-02): This high safety significance function was for providing power to safe shutdown makeup pump motor-operated-valves, room cooler, lighting, and local instrumentation. The reliability performance criterion for this function was one maintenance preventable functional failure per 36-month rolling period which resulted in allowing a failure rate of 3.8E-5 failures per hour, a failure rate significantly greater than the failure rate of 1.7E-6 failures per hour assumed in the probabilistic risk assessment.

480 Volt Transformer and Switchgear (Z6800-01): This high safety significance function was for providing power to turbine building switchgear and associated motor control centers. The reliability performance criterion for this function was one maintenance preventable functional failure per 36-month rolling period which resulted in allowing a failure rate of 1.9E-5 failures per hour, a failure rate significantly greater than the failure rate of 6.4E-7 failures per hour assumed in the probabilistic risk assessment.

250 Volt DC System (Z8350-01): This high safety significance function was for providing power to the 250 VDC bus and maintaining a charge on the battery. The reliability performance criterion for this function was one maintenance preventable functional failure per 36-month rolling period which resulted in allowing a failure rate of 1.9E-5 failures per hour, a failure rate significantly greater than the failure rate of 4.6E-7 failures per hour assumed in the probabilistic risk assessment.

The functions associated with the 4160 volt switchgear crosstie, 480 volt transformer, 480 volt switchgear, and the 250 volt DC system were classified as (a)(2). By establishing reliability criteria which allowed failure rates over an order of magnitude greater than the failure rate assumed in the probabilistic risk assessment without technical justification, the licensee failed to establish adequate measures to evaluate the effectiveness of the performance of appropriate preventive maintenance on these high safety significance functions prior to placing these functions under Section (a)(2). Consequently, the licensee failed to monitor these high safety significance functions in accordance with 10 CFR 50.65(a)(1). This is considered an example of an apparent violation of 10 CFR 50.65(a)(2) (EEI 50-254/97017-04a(DRS); 50-265/97017-04a(DRS)).

b.2 Unavailability Performance Criteria

b.2.1 Inappropriate Availability Performance Criteria

Based on reviews of performance criteria dated August 20, 1997, the team identified a number of functions where only unplanned limiting condition for operation time was specified as an availability performance criterion. As such, planned unavailability, such as for maintenance activities, was not reflected. Consequently, a system could be out of service for an unacceptably significant portion of the time for planned maintenance activities and yet not exceed the established performance criteria. In addition, not monitoring planned unavailability would hinder balancing of availability and reliability as required by 10 CFR 50.65(a)(3). The identified examples were:

Internal Flood Protection (Z0012-02): This high safety significance function was for protection against ground water in-leakage and internal flood protection for emergency core cooling system pump rooms and the condensate pump room. The only availability performance criterion specified for this function was "Unplanned LCO Time Criteria: LCO time no more than 350 hours per rolling 18-month period."

Main Steam Isolation Valve Closure Function (Z0203-01): Main Steam Isolation Valve closure was a high safety significance function. The only availability performance criterion specified for this function was "Unplanned LCO Time Criteria: LCO time no more than 12 hours per rolling 18-month period."

Main Steam Valve System Relief Valves (Z0203-02, 03): These high safety significance functions were for manual operation of the relief valves and automatic operation to prevent primary system overpressure. The only availability performance criterion specified for these functions was "Unplanned LCO Time Criteria: LCO time no more than 525 hours per rolling 18-month period."

Automatic Depressurization System (Z0287-01): This high safety significance function was for manual or automatic depressurization of the reactor pressure vessel under loss of coolant accident or transient conditions. The only availability performance criterion specified for this function was "Unplanned LCO Time Criteria: LCO time no more than 18 hours per rolling 18-month period."

Residual Heat Removal (Z1000-01, 02, 03, 06): These high safety significance functions were for automatic low head injection following a loss of coolant accident, containment spray, residual heat removal, and removing heat from the torus. The only availability performance criterion specified for these functions was "Unplanned LCO Time Criteria: LCO time less than 450 hours per rolling 18-months; 300 hours per loop per rolling 18-month."

Reactor Core Isolation Cooling (Z1300-03, 04, 05, 07): These high safety significance functions were for water injection into the reactor pressure vessel, providing reactor pressure vessel level and pressure control when the reactor was isolated, manual operation of the reactor core isolation cooling turbine, and local reactor core isolation cooling control. The only availability performance criterion specified for these functions was "Unplanned LCO Time Criteria: Less than 210 hours LCO time per rolling 18-month period."

High Pressure Coolant Injection (Z2300-03, 04): These high safety significance functions were for providing high head injection to the reactor pressure vessel and providing manual control of the high pressure coolant injection turbine. The only availability performance criterion specified for these functions was "Unplanned LCO Time Criteria: Less than 350 hours LCO time per unit per rolling 18-month period."

Standby Gas Treatment (Z7500-02): This high safety significance function was for maintaining a negative pressure in secondary containment. The only availability performance criterion specified for this function was "Unplanned LCO Time Criteria: LCO time no more than 262.5 hours per rolling 18-month period."

The functions associated with the internal flood protection, automatic depressurization, and standby gas treatment systems were classified as (a)(2). By establishing inappropriate availability criteria, the licensee failed to demonstrate it had established adequate measures to evaluate the effectiveness of preventive maintenance on these high safety significance functions prior to placing them under Section (a)(2). Consequently, the licensee failed to monitor these high safety significance functions in accordance with 10 CFR 50.65(a)(1). This is considered an example of an apparent violation of 10 CFR 50.65(a)(2) (EEI 50-254/97017-04b(DRS); 50-265/97017-04b(DRS)).

b.2.2 Inadequate Availability Performance Criteria

The team identified examples where monitoring against established availability performance criteria would not provide adequate assurance that the equipment would function when needed.

Containment Atmosphere Monitoring (Z2400-01): This low safety significance function was for providing indication of hydrogen and oxygen concentration in the drywell and torus. The performance criteria for this function were revised on August 7, 1997 (documented by Expert Panel Meeting 97-08 minutes) to have an availability performance criterion of 90 percent train availability and no reliability performance criteria. In practice, only limiting condition for operation time was tracked against availability. The team reviewed work history for 1997 and verified that not all significant testing and corrective maintenance activities were reflected in the unavailability time tracked. However, when a containment atmosphere monitor failed a monthly test, the time between the last successful test and the failed test was counted toward unavailability. Consequently, if functional failures were corrected quickly, unacceptable reliability could be masked because the availability performance criteria would still be met. The team noted that had the time back to the last successful test been counted for the 1B containment atmosphere monitor, the availability criterion would not have been met due to two test failures. The failure to establish availability criteria that provided an adequate basis to demonstrate effective preventive maintenance for this function is considered an example of an apparent violation of 10 CFR 50.65(a)(2) (EEI 50-254/97017-04c(DRS); 50-265/97017-04c(DRS)).

125 Volt and 250 Volt DC Systems: An additional example of an inadequate availability criterion is discussed in section M2.1.b.10.

b.3 Insufficient Performance Criteria for High Safety Significant Functions

The team identified examples where performance criteria for high safety significance functions were inadequate because there was no criterion for availability. Nuclear

Management Resource Council 93-01 guidance for high safety significance functions specified monitoring against both reliability and availability.

480V Transformers and Switchgear (Z7100-02, 03; Z7200-02, 03): These high safety significance functions were for fault protection and protective relaying for safety-related buses. These functions had reliability performance criteria of "No MPFFs" but lacked availability performance criteria.

Reactor Building Heating, Ventilation, and Air Conditioning (Z5704-04): This high safety significance function was for tripping the reactor building heating, ventilation, and air conditioning fans automatically and closing the isolation dampers upon a secondary containment isolation signal. This function had a reliability performance criterion of "No MPFFs" but lacked availability performance criteria.

345kV Switchyard (Z9700-01): This high safety significance function was for providing diverse means of supplying reliable power sources back to the station. This function had a reliability performance criterion of "No MPFFs" but lacked availability performance criteria.

Fire Protection Alternate Water Supply to Reactor Pressure Vessel (Z4100-02): This high safety significance function was for providing an alternate water supply for reactor pressure vessel level control and drywell flooding. This function had a reliability performance criterion of no more than three maintenance preventable functional failures per 36 month rolling period but lacked availability performance criteria.

4160 Volt Switchgear Fault Protection and Protective Relaying (Z6700-06, 07): These high safety significance functions were for providing circuit breakers to interrupt an electrical fault and protective relaying. These functions had a reliability performance criterion of no maintenance preventable functional failures but lacked availability performance criteria.

In addition to the above examples, the team identified additional examples of high safety significance functions which lacked documented justification for the omission of availability performance criteria. The additional examples included pressure boundary, primary containment isolation (Z0010-01), fire barriers (Z4100-10), and condensate system (Z3300-01, 02) functions. The lack of availability criteria for these additional examples was acceptable because such criteria would provide little additional value. However, the lack of documented justification for omitting availability criteria was considered a weakness.

The functions associated with the 480 volt transformers and switchgear, reactor building heating, ventilation, and air conditioning, fire protection alternate water supply to a reactor pressure vessel, 4160 volt switchgear, and 345kV switchyard were classified as (a)(2). By failing to establish both reliability and availability criteria, the licensee failed to demonstrate that adequate measures were established to evaluate the effectiveness of preventive maintenance on these high safety significance functions prior to placing them under Section (a)(2). Consequently, the licensee failed to monitor these high safety significance functions in accordance with 10 CFR 50.65(a)(1). This is considered an example of an apparent violation of 10 CFR 50.65(a)(2) (EEI 50-254/97017-04d(DRS); 50-265/97017-04d(DRS)).

The team identified a series of functions, all intended to ensure zero-leakage integrity of the pressure boundary, for the reactor coolant systems and systems connected to it. Among these systems were the nuclear boiler instrumentation, source range monitor drive control, recirculation, standby liquid control, reactor core isolation cooling, and high pressure coolant injection systems. These high safety significance functions were classified (a)(2) and the licensee selected the following performance criteria to measure their performance:

- no unavailability criterion
- a stand-alone criterion of no repetitive maintenance preventable functional failures
- a condition monitoring measure of no through-wall leakage that had no predictive value

The team noted that a stand-alone criterion of no repetitive maintenance preventable functional failures was not an indicator of reliability but rather an indicator of ineffective corrective action. The team also noted that use of condition monitoring criteria in lieu of availability was inappropriate because condition monitoring is a predictor of reliability and was therefore redundant to reliability. Further, the condition monitoring criterion of no through-wall leakage was inappropriate because when the criterion was reached, the function was already failed. Consequently the team determined that the licensee had failed to establish any acceptable performance criteria to evaluate the effectiveness of preventive maintenance on these high safety significance functions prior to placing them under Section (a)(2). This is considered an example of an apparent violation of 10 CFR 50.65(a)(2) (EEI 50-254/97017-04e(DRS); 50-265/97017-04e(DRS)).

b.4 <u>Inappropriate Use of Plant Level Performance Criteria</u>

The team identified examples where plant level performance criteria were inappropriately used to monitor a function. In these examples, failure of the function would not consistently result in a plant level performance criteria being affected.

Rod Position Indication System (Z0280-01, 02): These low safety significance functions were for control rod position indication. These functions only had a plant level performance criteria of an unplanned capability loss factor and capability factor. As established, a plant shutdown due to a total loss of position indication would affect the performance criteria. However, a failure of individual rod position indication would not be captured by the performance criteria. The team noted that knowing the position of all rods was necessary to support to emergency operating procedure decisions.

Reactor Refueling Platform (Z0833-01): This low safety significance function was for providing a means of handling fuel. This function only had a plant level performance criteria of unplanned capability loss factor. As established, extensions of refueling outages due to failures of the refueling bridge would affect the performance criterion. However, failures which could prevent refueling platform safety features (such as interlocks) from functioning would not be captured by the performance criterion.

Process Computer (Z0940-01, 04, 05): These low safety significance functions were for scanning and evaluating plant parameters on a periodic basis, and providing the Safety Parameter Display System. These functions only had a plant level performance criterion of unplanned capability loss factor. However, failures which would prevent these functions from being accomplished would not be captured by the performance criterion.

120VAC Computer Uninterruptible Power Supply (Z0943-01): This low safety significance function was for supplying power to computer equipment (e.g., the process and rod worth minimizer computers). This function only had a plant level performance criterion of unplanned capability loss factor. However, failures which would prevent this function from being accomplished would not be captured by the performance criterion.

Control Rod Drive Hydraulics (Z0300-08): This low safety significance function was for providing a constant fill to the reactor pressure vessel level reference legs to minimize the effect of "gassing" during rapid depressurization events. No performance criteria were identified for monitoring this function until August 22, 1997 when plant level criteria were adopted (as documented by Expert Panel Meeting 97-19 minutes). The plant level performance criteria adopted were unplanned scrams, unplanned safety system actuation, unplanned capability loss factor, and unplanned capability loss factor. However, a failure of this function would not be readily detectable during plant operation.

In addition to the above examples, the team identified one other example of where plant level criteria were inappropriately used for a function. For control room panels (Z0905-01), the licensee had identified a low safety significance function of providing structural support for instrumentation and controls. For monitoring this function, the plant level performance criteria of scrams, unplanned safety system actuation, and unplanned capability loss factor were used. The team questioned the correlation between maintenance of the structural function and the plant level criteria adopted. However, the safety significance of this example was minimal due to the inherently reliable nature of the control room panel structural function.

The functions associated with the rod positioning, process computer, and 120 volt AC computer uninterruptable power supply were classified as (a)(2). By establishing plant level performance criteria which could not demonstrate that these functions would be performed as required, the licensee failed to demonstrate it had established adequate measures to evaluate the effectiveness of preventive maintenance on these functions prior to placing them under Section (a)(2). Consequently, the licensee failed to monitor these high safety significance functions in accordance with 10 CFR 50.65(a)(1). This is considered an example of an apparent violation of 10 CFR 50.65(a)(2) (EEI 50-254/97017-04f(DRS); 50-265/97017-04f(DRS)).

b.5 <u>Inadequate Monitoring Against Established Performance Criteria</u>

The team identified examples of functions for which no method of monitoring had been identified. Consequently, the licensee failed to demonstrate that reasonable assurance existed that the SSCs for these functions would work when called upon. The examples were:

Reactor Core Isolation Cooling Minimum Flow Line (Z1300-09): This low safety significance function was for filling the torus from the Condensate Storage Tank through the minimum flow line. This function has a reliability performance criterion of no more than three maintenance preventable functional failures per 36-month rolling period. The licensee was unable to identify a surveillance or other activity which monitored this function.

High Pressure Coolant Injection Steam Line Drains (Z2300-02): This low safety significance function was for venting the reactor pressure vessel using high pressure coolant injection steam line drains. This function has a reliability performance criterion of no more than three maintenance preventable functional failures per 36-month rolling period. The licensee was unable to identify a surveillance or other activity which monitored this function.

High Pressure Coolant Injection Cooling Water Pump (Z2300-09): This low safety significance function was for injecting water into the reactor pressure vessel using the high pressure coolant injection cooling water pump. This function has a reliability performance criterion of no more than three maintenance preventable functional failures per 36-month rolling period. The licensee was unable to identify a surveillance or other activity which monitored this function.

Nitrogen System (Z8700-04): This low safety significance function was for controlling the relative concentration of hydrogen and oxygen by dilution. This function has a reliability performance criterion of no more than three maintenance preventable functional failures per 36-month rolling period. The licensee was unable to identify a surveillance or other activity which monitored this function.

The functions associated with the nitrogen system were classified as (a)(2). By establishing performance criteria for which no surveillance activity would provide the information necessary to demonstrate adequate preventive maintenance, the licensee failed to demonstrate it had established adequate measures to evaluate the effectiveness of preventive maintenance on these functions prior to placing them under Section (a)(2). Consequently, the licensee failed to monitor these functions in accordance with 10 CFR 50.65(a)(1). This is considered an example of an apparent violation of 10 CFR 50.65(a)(2) (EEI 50-254/97017-04g(DRS); 50-265/97017-04g(DRS)).

b.6 Performance Criteria for Low Safety Significant Normally Operating SSCs

The licensee specified the use of plant level performance criteria for low safety significance normally operating SSCs. Procedure QCAP 0400-18 specified that the target values for plant level performance criteria be set by plant senior management annually. The plant level performance criteria used included:

Unplanned Scrams
Unplanned Safety System Actuations
Capability Factor
Unplanned Capability Loss Factor

The feedwater system (Z3200), feedwater heater drains (Z3500), feedwater heater vents (Z3600), and electro-hydraulic control, system (Z5650), had been classified as (a)(1) due to plant level performance criteria being exceeded.

b.7 Inadequate Evaluation Against Performance Criteria

Containment Atmosphere Monitoring System (Z2400): The original performance criteria for the hydrogen and oxygen analysis function (Z2400-01) of the containment atmosphere monitoring system included a reliability performance criterion of "No more than 2 Failed Surveillances/cycle." This reliability performance criterion existed until it was deleted on August 7, 1997 (documented by Expert Panel Meeting 97-08 minutes). For Unit 2, the licensee had identified three surveillance failures dated June 20, 1995, April 19, 1995, and November 22, 1996 which had occurred during the same cycle. The team noted that in addition to the surveillance failures identified, problem identification forms 95-0477 and 95-0477, dated February 25, 1995 and March 14, 1995, documented maintenance preventable functional failures. Although the reliability performance criteria had been exceeded for Unit 2 on November 22, 1996, the system was not classified as (a)(1) until April 10, 1997 by which time a repetitive maintenance preventable functional failure had occurred. The classification as (a)(1) was untimely. Failure to properly consider surveillance failures which occurred between February 25, 1996 and November 22, 1996 and to correctly classify these functions (a)(1) in a timely manner is considered an example of an apparent violation of 10 CFR 50.65(a)(2) (EEI 50-254/97017-05a(DRS);50-265/97017-05a(DRS)).

Control Rod Drive Hydraulics (Z0300): The original reliability performance criteria for the reactor shutdown function (Z0300-02) of the system were no maintenance preventable functional failures and no more than one spurious single rod scram. These criteria were in place until August 22, 1997 when the reliability criteria were revised to "No more than 2 MPFFs per 36 month rolling period," (documented by Expert Panel Meeting 97-19 minutes). The team identified three separate instances which individually exceeded the performance criterion of no maintenance preventable functional failures. In the first instance, four failures of "115 check valves" on control rod drive hydraulic control units were documented by problem identification form 95-2694, October 23, 1995. The "115 check valves" formed a safety related pressure boundary between the hydraulic control unit accumulators and the non-safety related control rod drive water supply. Failures of the check valves could only be detected during refueling outage surveillance testing. Corrective actions were initiated as a result of the check valve failures. The failures were not evaluated as maintenance preventable functional failures at the time. The control rod drive hydraulics system had not been classified as (a)(1) as of July 10, 1996 (maintenance rule implementation date). In the second instance, two failures of 115 check valves on control rod drive hydraulic control units were documented by problem identification form 96-2375, dated July 23, 1996. The failures were not evaluated as maintenance preventable functional failures at the time and the licensee, for a second time, failed to classify the system as (a)(1). In the third instance, one failure of a scram discharge volume level transmitter was documented by problem identification form 97-1884, dated April 14, 1997. The failure of the transmitter would have prevented one instrumentation channel from initiating a scram signal when required. The failure was not evaluated as a maintenance preventable functional failure at the time and the licensee, for a third time, failed to classify the system as (a)(1). The misclassifications were due to the erroneous belief that age-related failures were not maintenance preventable. The control rod drive hydraulic system was not classified as (a)(1) until August 22, 1997. However, the reason for (a)(1) classification was the lack of evaluated historical data to support (a)(2) classification for a function added to the maintenance rule scope on August 22, 1997, as opposed to an (a)(1) classification due to reliability problems. Failure to evaluate the appropriateness of the performance of preventive maintenance on these functions prior to July 10, 1996, and incorrectly allowing them to remain under Section (a)(2) is considered an example of an apparent violation of 10 CFR 50.65(a)(2) (EEI 50-254/97017-05b(DRS); 50-265/97017-05b(DRS)).

b.8 <u>Goals and Monitoring for (a)(1) SSCs</u>

The team identified examples where either goals for systems classified as (a)(1) were not established in a timely manner or the goals established were inadequate.

Containment Atmosphere Monitoring System (Z2400): The containment atmosphere monitoring system was classified as (a)(1) on April 10, 1997 due to exceeding the reliability performance criterion for the hydrogen and oxygen analysis function, and due to having experienced a repetitive maintenance preventable functional failure. Although a preventive maintenance action plan had been developed for the system on March 18, 1997, no maintenance rule goals had been established for performance to be monitored against until August 7, 1997 (documented by Expert Panel Meeting 97-08 minutes). The failure to establish goals for this (a)(1) function over a four-month period is considered an example of an apparent violation of 10 CFR 50.65(a)(1) (EEI 50-254/97017-06a(DRS); 50-265/97017-06a(DRS)).

The team noted that a number of systems had been classified as (a)(1) during late July 1997 through the inspection period as a result of the licensee's review of maintenance rule scoping determinations and performance criteria for systems. The systems were classified as (a)(1) because, based on the licensee's review, prior scoping determinations or performance criteria were inadequate and continued (a)(2) classification could not be justified. Although these systems had been classified as (a)(1), effective goals and monitoring had not yet been developed for most of these systems. The systems included:

Grounding - Z0001
Rod Worth Minimizer - Z0206
Nuclear Boiler Instrumentation - Z0263
Rod Position Indication - Z0280
Control Rod Dive Hydraulics - Z0300
Source Range Monitor Drive Control - Z0702
Process Rad Monitoring - Z1700
Safe Shutdown Make-Up Pump - Z2900
Extraction Steam - Z3100
Fire Protection - Z4100
Heating Boiler - Z5773
480V Motor Control Centers - Z7800
Nitrogen System - Z8700
Intraplant Communications - Z9050

Because these systems were recently classified (a)(1), the team determined that a period of time, commensurate with the safety significance and complexity of the system, was acceptable to establish goals and monitoring for these systems. Evaluation of the action plan and goals set for these recently classified (a)(1) systems is an inspection follow-up item (IFI 50-254/97017-07(DRS); 50-265/97017-07(DRS)).

b.9 <u>Structures and Structure Monitoring</u>

The Quad Cities maintenance rule selection process identified six structural systems to be specifically included in the scope of the maintenance rule. These structural systems were: Primary Containment - Z0010, Crib House - Z0014, Reactor Building - Z0020, Turbine Building - Z0030, Chimney - Z0095, and Miscellaneous Structures - Z0002.

The monitoring procedure included guidance for evaluating structural elements, such as: concrete, structural steel, vertical tanks, masonry, equipment foundations, component supports, buried piping, structural isolation gaps, watertight doors, building siding, and roofing. For each of the structural elements, the procedure identified items that would be considered a functional failure of the element.

The licensee's evaluation process included three classifications: (1) acceptable conditions, (2) acceptable with deficiencies, and (3) unacceptable. The licensee used civil engineers to perform the structural inspections. The team reviewed the licensee's results from the reactor drywell and the condensate hotwell inspections. The licensee had scheduled completion of the baseline inspections for structures in the maintenance rule by 1998. All of the structural functions were classified (a)(1) until the inspections are completed. The performance criteria for when structures were classified (a)(2) were considered acceptable.

c. Conclusions

Performance criteria established to demonstrate the effectiveness of preventive maintenance of (a)(2) systems and functions were frequently inappropriate, inadequate, or incorrect. Multiple examples of several types of performance criteria deficiencies were identified by the team, even after the licensee had conducted a review. The widespread nature of the deficiencies indicated that the licensee did not understand how to apply industry guidance on maintenance rule implementation and had a fundamental misunderstanding of what purpose performance criteria served. The scope and spectrum of problems identified was indicative of a breakdown in this aspect of maintenance rule program implementation.

The process for evaluating events and problems for functional failures and maintenance preventable functional failures was not adequately implemented. System engineers responsible for performing these determinations did not have a consistent understanding of when and how to make these determinations. The team identified multiple examples or untimely and incorrect evaluations; examples where the licensee had not evaluated events and problems were also identified. The number of problems identified and the system engineers' inconsistent understanding of the evaluation process indicated a breakdown in this aspect of maintenance rule program implementation.

Implementation of goals and monitoring for systems and functions classified (a)(1) was weak. The team identified a number of examples where (a)(1) systems and functions had either no goals or improper goals established.

The team concluded that the licensee had selected the correct structures to be monitored under the maintenance rule and had established a systematic program for monitoring the condition of these structures.

M1.7 Use of Industry-wide Operating Experience

a. Inspection Scope

Paragraph (a)(1) of the maintenance rule states that goals shall be established commensurate with safety and, where practical, take into account industry-wide operating experience. Paragraph (a)(3) of the maintenance rule states that performance and condition monitoring activities and associated goals and preventive maintenance activities shall be evaluated at least every refueling cycle. The evaluation shall be conducted taking into account industry operating experience. The team reviewed the program to integrate industry operating experience into the maintenance rule monitoring program.

b. Observations and Findings on Use of Industry-wide Operating Experience

Procedure NSWP-A-06, Revision 0, "Operating Experience (OPEX)," provided the methodology for evaluating and initiating action for operating experience information at all of the licensee's nuclear stations. The objective given for this evaluation was to ensure that lessons learned from operating experiences were used to prevent occurrences of such events and to improve plant safety and reliability.

The initial evaluation and processing of industry operating experience for site applicability was performed by the Operating Experience Coordinator. Applicable information was further processed through electronic means to the cognizant individual for further review. The system engineers were able to discuss the program, and how they used the information to identify system improvements as well as the mechanism to process in-house information for outside distribution.

c. Conclusions for Use of Industry wide Operating Experience

Adequate processes were in place to incorporate information from industry operating experience into goal development and the periodic assessments.

M2 Maintenance and Material Condition of Facilities and Equipment (61706, 71707)

M2.1 General System Review

a. Inspection Scope

The team conducted a detailed examination of thirteen systems from a maintenance rule perspective to assess the effectiveness of the program when it was applied to individual systems.

b.1 Observations and Findings for the Emergency Diesel Generator System

The emergency diesel generators were considered a high safety significance, standby system with performance criteria to monitor availability and reliability. The emergency diesel generators were being monitored under (a)(1) of the maintenance rule because of failure to meet the availability performance criterion of 98 percent and because of two separate repetitive maintenance preventable functional failures. However, the emergency diesel generators were not classified (a)(1) until April 10, 1997, although the performance criterion for no repetitive maintenance preventable functional failures had already been exceeded in 1995. In March 1997, the resident inspectors asked (due to repetitive problems with the air start motors) why the emergency diesel generators had not been classified (a)(1).

The team noted that problem identification form 95-2071 identified failures of the governor shutdown solenoid and binding of the air start motor. The team's review indicated that the failures were maintenance preventable and also repetitive. The team also noted that the licensee failed to identify problem identification form 95-2982 as a maintenance preventable functional failure during the historical search. This problem identification form documented problems with the storage of the air start motors. Failure to properly store the air start motors was identified as a violation in the Quad Cities Inspection Report 96002. However, during the historical review prior to July 10, 1996, the emergency diesel generator system engineers had failed to properly classify the failures as maintenance preventable and as repetitive. In April 1997, the system engineers proposed that the emergency diesel generator system be classified (a)(1) based on the engineers' discretion. The Plant Operations Review Committee rejected the engineers' request. On April 10, the Quad Cities station manager overrode the Plant Operations Review Committee's decision and approved classifying the emergency diesel generator as (a)(1). This system should have been classified (a)(1) on July 10, 1996, because of the repetitive failures of the air start motor and governor solenoid which occurred during the historical review period. Although the licensee placed this system in (a)(1) before the start of the inspection, this issue was inspector-identified. The failure to properly perform the historical review, identify maintenance preventable functional failures, and classify this system (a)(1) despite evidence of numerous reliability problems is considered an apparent violation of 10 CFR 50.65(a)(2) (EEI 50-254/97017-05c(DRS); 50-265/97017-05c(DRS)).

b.2 Observations and Findings for the Station Blackout Diesel Generator System

The Station Blackout Diesel was considered a high safety significance, standby system with performance criteria to monitor availability and reliability. The team learned that the two station blackout diesels were not in a preventive maintenance program and had been classified (a)(1) on July 26, 1997, because maintenance history and availability and reliability data were lacking. Although maintenance, availability and reliability data were lacking, the station blackout diesel was classified (a)(2) when the maintenance rule became effective. On June 29, 1996, the system engineer evaluated the performance criteria and determined that although the availability for the Unit 2 station blackout diesel was less than the criterion of 95 percent, the system would be classified (a)(2) because the failure to meet the availability criterion was not maintenance preventable. The classification of the station blackout diesels as (a)(2) between July 10, 1996 and June 26, 1997, without an adequate basis to conclude that preventive maintenance was effective, is an apparent violation of 10 CFR 50.65(a)(2) (EEI 50-254/97017-05d(DRS); 50-265/97017-05d(DRS)).

In August 1997, the licensee modified the station blackout performance criteria and placed additional functions within the scope of the maintenance rule. The inspector noted that the new reliability criterion was set at 98 percent to correspond to the availability of the safety related emergency diesel generators. However, the goal set for the station blackout diesel was 90 percent. This goal was less than the established performance criteria and less than the industry standard reliability goal of 95 percent; an adequate technical justification was not provided. The failure to establish adequate goals and monitoring for the station blackout diesels is considered an apparent violation of 10 CFR 50.65(a)(1) (EEI 50-254/97017-06b(DRS); 50-265/97017-06b(DRS)).

b.3 Observations and Findings for the Fire Protection System

The availability performance criteria for fire protection functions were appropriate with the exception of Z4100-02, which addressed fire protection alternate supply to the reactor pressure vessel. The reliability performance criteria were also found to be appropriate with the exception of Z4100-06, which addressed alternate water supply for the spent fuel pool. This reliability criterion specified three maintenance preventable functional failures. The team observed that there was almost no probability that a functional failure could be detected given the surveillance testing and preventive maintenance specified for its associated equipment. Other examples where the licensee established inappropriate or inadequate performance criteria were discussed in section M1.6.

The team identified several examples where the licensee failed to properly evaluate maintenance preventable functional failures as a result of system problems. Specifically, the following problem identification forms were not identified as maintenance preventable functional failures: 96-1606, 96-2394, 96-2498, 96-2510, 96-3054, 96-3102, and 97-0028. These examples did not affect the classification of the fire protection system functions.

In addition to instances where maintenance preventable functional failures were not properly evaluated, the team identified that the licensee had not monitored the performance of recently revised or rescoped fire protection functions in the maintenance rule. The maintenance preventable functional failures assigned to deleted fire protection functions during rescoping had not been reassigned to new fire protection functions.

The team identified that the historical review of performance data for fire protection functions specified by Nuclear Management Resource Council 93-01, paragraph 9.3.3. Without an evaluation of the historical system and function performance, no basis existed for classifying fire protection functions as (a)(2). The licensee recently classified several of the fire protection functions as (a)(1) because the maintenance rule status of these functions was unknown. As a result, the licensee was in the process of establishing an action plan with goals for those fire protection functions in (a)(1). An inspection follow-up item pertaining to this was discussed in section M1.6.

b.4 Observations and Findings for the Instrument Air System

The instrument air system had no standby functions, two high safety significance functions, and one (a)(1) function. The (a)(1) function was classified at the initial evaluation because the function had exceeded the availability criteria. The performance criteria for each function were appropriate.

b.5 Observations and Findings for the High Pressure Coolant Injection System

The high pressure coolant injection system had seven standby functions, four high safety significance functions (three of which were safety-related), and two (a)(1) functions. The two functions were classified as (a)(1) at the initial evaluation because the functions had exceeded the availability criteria.

The performance criteria were appropriate, with the exception of function Z2300-05, which addressed the reactor coolant pressure boundary for portions of the system connected to the reactor coolant system. The reliability criterion of no repetitive maintenance preventable functional failures was found to be unacceptable. This was discussed in section M1.6. In addition, the turbine automatic trip function was not identified or scoped as within the station's maintenance rule program. This was discussed in section M1.1.

b.6 Observations and Findings for the Reactor Core Isolation Cooling System

The Reactor Core Isolation System was considered a high safety significance, standby system with performance criteria to monitor availability and reliability. The reactor core isolation cooling system was being monitored under (a)(1) of the maintenance rule because of failure to meet the availability performance criterion of 98 percent. However, the original historical search did not identify two failed surveillances that should have been classified as maintenance preventable functional failures. Either of these two events would have caused the reactor core isolation cooling system to be classified (a)(1). In addition, on April 16, 1997, the reactor core isolation cooling temperature switch 1-1360-14D failed to trip below the required setpoint. Although the temperature switch trip point exceeded the technical specification's limit, this instrument failure was not considered a maintenance preventable functional failure by the licensee during the initial review of the problem. Although these are additional examples of inadequate problem and event evaluation, they did not affect the licensee's classification of the system and its functions.

b.7 Observations and Findings for the Residual Heat Removal/Residual Heat Removal Service Water System

The residual heat removal/residual heat removal service water systems had eleven functions within the scope of the maintenance rule; seven were considered as high safety significance. The team concluded that the system functions were properly scoped. The system was monitored under (a)(1) of the maintenance rule since the rule came into effect on July 10, 1996 after exceeding the (a)(2) performance criteria for maintenance preventable functional failures and unplanned limiting condition for operation time. An action plan was developed to resolve system performance problems but no system performance goals were established until August 1997 when a review of performance criteria was initiated. At that time, the newly revised performance criteria for availability were set as the (a)(1) goal. The failure to monitor the performance and establish goals commensurate with safety for the residual heat removal/residual heat removal service water systems although the systems were classified as (a)(1) on July 10, 1996 is considered an apparent violation of 10 CFR 50.65(a)(1) (EEI 50-254/97017-06c(DRS); 50-265/97017-06c(DRS)).

Although many of the changes to the performance criteria in August 1997 were improvements, the team identified problems with the monitoring of availability criteria for the functions of the residual heat removal system used during plant shutdown periods. For example, function Z1000-4, Shutdown Cooling, utilized the same availability criteria as function Z1000-1, Low Pressure Coolant Injection. The criteria were stated as, "Limiting condition for operation time less than 450 hours per pump per rolling 18 months; 300 hours per loop per rolling 18 months." Since Technical Specification limiting condition for operations governing the residual heat removal-shutdown cooling function were different from the limiting condition for operations for the residual heat removal - low pressure coolant injection function, counting only "LCO time" was not an appropriate measure for the unavailability of the shutdown cooling function. For example, unavailability resulting from residual heat removal loops removed from service during outage periods was not properly accounted for against the residual heat removal - shutdown cooling function under the maintenance rule. Also, in one case, on April 18, 1997, shutdown cooling was interrupted on Unit 1 for 1 hour and 50 minutes due to an isolation caused by an electrical problem. During this period, the shutdown cooling function was unavailable but the time was not recorded against the maintenance rule function. An apparent violation involving inadequate availability criteria was discussed in section M1.6.

Two problems were noted with the current reliability criteria. Functions Z1000-2, Drywell Spray, and Z1000-4, Shutdown Cooling, had conflicting reliability criteria. The two criteria were no maintenance preventable functional failures and no more than one maintenance preventable functional failure per 36-month rolling period for the system. The second problem was common to all systems in contact with the primary coolant pressure boundary. Function Z1000-13, residual heat removal - primary coolant pressure boundary, had an inappropriate condition monitoring criterion of no through wall leaks. This was discussed in section M1.6.

Several maintenance preventable functional failures were identified during the team's review of problem identification forms that had not previously been identified as maintenance preventable functional failures. During discussions, the licensee indicated that a complete review of historical problem identification forms for the past three years was in progress to identify maintenance preventable functional failures that were previously missed. The following list of problem identification forms had not been properly identified as maintenance preventable functional failures:

Problem identification form Q1997-02383	05/21/97	Failure of MO[Motor-Operator] 2-1001-37B during DP[differential pressure] test.
Problem identification form 96-2757	10/31/95	Recurring problem with shutdown cooling pressure switches 23A&B found out of tolerance.
Problem identification form 96-0095	01/15/96	Breaker for MCC 19-4, compartment A1, for valve 1-1001-26B did not trip instantaneously.

These were additional examples of the licensee's failure to properly evaluate problems and events; however, they did not affect the classification of the system or its functions.

b.8 Observations and Findings for the Control Rod Drive Hydraulic System

The team identified failures by the licensee to properly evaluate multiple failures of No. 115 check valves on control rod drive hydraulic control units which occurred as early as October 1995. The team also identified the licensee's failure to properly evaluate the failure of a scram discharge volume level transmitter in April 1997. These problems exemplified an example of an apparent violation and were discussed in detail in section 1.6.

b.9 Observations and Findings for the Containment Atmospheric Monitoring System

The containment atmosphere monitoring system was classified as (a)(1) on April 10, 1997; however, no maintenance rule goals were established until August 7, 1997. This example of an apparent violation was discussed in Section M1.4

b.10 Observations and Findings for the 125 and 250 Volt DC Distribution Systems

The 125 volt and 250 volt dc systems were considered high safety significance systems with performance criteria to monitor reliability but not availability. The reliability criterion for both battery systems was no more than one maintenance preventable functional failure per rolling 36-month period. However, there was no availability criterion set for either of the batteries. This example of an apparent violation was discussed in Section M1.6.

The 125 volt and 250 volt dc systems each had been previously classified as (a)(1) for exceeding 700 hours of unavailability battery charger time for both units per fuel cycle. On June 29, 1996, the total unavailability for both units was documented at 1894 hours. This high unavailability had been attributed to the battery chargers. The system engineer found that the battery chargers were not being calibrated correctly; subsequently the licensee developed proper procedures for calibration and testing. Although these corrective actions were taking place, the licensee did not establish goals and document corrective action under the maintenance rule in 1996. On August 22, 1997, the licensee changed the performance criterion of 700 hours to the sum of 2160 hours of unplanned limiting condition for operation time per unit per rolling 18-month period. This criterion was subsequently changed to delete the word unplanned on August 29. As a result, the licensee removed both the 250 volt and 125 volt dc systems from (a)(1) and classified them (a)(2) because the newly revised criterion of 2,160 hours of limiting condition for operation time was met. Quad Cities technical specification limiting condition for operation 3.9.C required that the two station 250 volt and the two 125 volt batteries each with a full capacity battery charger be operable. With both units operating the total number of operable battery chargers required was four. Both units would enter a 72-hour limiting condition for operation when operating with less than two 125 volt or two 250 volt battery chargers. The performance criterion set by the licensee would allow the battery chargers to enter into 8,640 hours of limiting condition for operation time per rolling 18-month period before any monitoring or action would be taken. This would mean that due to the battery chargers, the two units could enter into a limiting condition for operation 66 percent of the time and the performance criterion would not be exceeded. The failure to establish availability criteria that provided an adequate basis to demonstrate effective preventive maintenance for these high safety significance systems is considered an example of an apparent violation of 10 CFR 50.65(a)(2) (EEI 50-254/97017-04c(DRS); 50-265/97017-04c(DRS)).

b.11 Observations and Findings for the Neutron Monitoring Systems

The team identified that there was no tracking system to identify instrumentation and control repairs to the neutron monitoring systems (source range, intermediate range, local power range, average power range monitors). One specific example of this issue was the repair or replacement of electronic cards was not tracked nor were problem identification forms written when cards were repaired or replaced. Consequently, no evaluations for functional failures or maintenance preventable functional failures have been conducted. This was a major deficiency in evaluating the performance of these functions. The classification of these functions as (a)(2) between July 10, 1996 and September 12, 1997, without an adequate basis to conclude that preventive maintenance was effective, is considered an example of an apparent violation of 10 CFR 50.65(a)(2) (EEI 50-254/97017-05e(DRS); 50-265/97017-05e(DRS)).

c. Conclusions for General System Review

The maintenance rule program was not adequately implemented for the majority of the systems the team reviewed. Multiple examples of inadequate or inappropriate performance criteria existed. Goals and monitoring for (a)(1) systems and functions were inconsistently implemented. The team also identified many examples of inadequate evaluation of events and problems for maintenance preventable functional failures during both the historical review period and since the maintenance rule became effective on July 10, 1996.

M2.2 Material Condition

a. Inspection Scope

In the course of verifying the implementation of the maintenance rule, using Inspection Procedure 62706, the inspectors performed walkdowns using Inspection Procedure 71707, Plant Operations, to examine the material condition of the systems listed in Section M1.6.

b. Observations and Findings

With some exceptions, based upon external condition, the systems appeared to be properly maintained. Significant improvements in the condition of the high pressure coolant injection and reactor core isolation cooling systems were noted, compared to observations of system conditions about three years ago.

c. Conclusions

The systems appeared to be adequately maintained.

M7 Quality Assurance in Maintenance Activities (40500)

M7.1 Licensee Self-Assessments of the Maintenance Rule Program

a. Inspection Scope

The team reviewed the following documents related to self assessments and audits conducted to evaluate implementation of the maintenance rule.

- Quad Cities Maintenance Rule Improvement Plan (no date available)
- Maintenance Rule Implementation Assessment (06/27/97)
- Site Quality Verification surveillance report, "Evaluation of the Current Status of Quad Cities Maintenance Rule Program and Its Readiness for Inspection" QAS 04-95-027, 12/11/95
- Corrective Action Record (CAR) 04-95-095, 01/08/96 and responses dated 02/07/96 and 05/06/96
- Site Quality Verification surveillance report, "Comprehensive Surveillance on the Maintenance Rule Program and Quad Cities Station" QAS 04-96-015, 06/29/96 and responses dated 07/31/96, 08/01/96, 08/28-30/96
- Problem identification form 97-1991, "Review Tech Alert 97-13 concerning maintenance rule inspection results" 04/21/97

b. Observations and Findings

The site quality verification surveillances performed in 1995 and 1996 identified a number of problems with the implementation of the maintenance rule. Some of these issues were again identified as problems in the assessment performed by the corporate maintenance rule staff and outside contractors in June 1997. Two issues were identified as potential problems in both reviews, (1) evaluating the cumulative effect of removing non risk-significant maintenance rule SSCs from service and (2) implementing the process for balancing unavailability and reliability.

In one area the site quality verification surveillance was found to be inadequate. The 1996 surveillance reviewed (a)(1) systems and goals and concluded that the assessments and goals were adequate. This site quality verification finding conflicted with the numerous problems identified in this inspection with respect to the lack of adequate (a)(1) goals and monitoring.

The June 1997 assessment was notably thorough and identified a significant number of issues. Performance criteria problems were first noted in problem identification form 97-1991 which was generated after the NRC inspection of the maintenance rule at the Byron Station. The existence of the performance criteria problems was substantiated as a major issue in the June 1997 assessment. In response to the assessment, the licensee planned to review all SSCs within the scope of the maintenance rule for scoping, risk ranking, performance criteria, historical performance, and goals. While the licensee had made some progress at the time of the inspection with respect to scoping and performance criteria, a comprehensive maintenance rule improvement plan that addressed all of the issues was not available. The existing plan did not contain accurate completion dates for tasks and was not tracked in the licensee's administrative tracking system.

One major problem area was identified by the team that was not previously identified in any of the self assessments/audits. The team found numerous examples of the failure to properly identify maintenance preventable functional failures. This was a significant problem area that had gone undetected until the NRC inspection.

c. Conclusions

With the exception of the failure to identify problems with maintenance preventable functional failure evaluations, the licensee's self assessments and audits generally identified problems with the maintenance rule implementation. In particular, the June 1997 assessment provided a clear set of major issues and provided the licensee with an opportunity to begin an aggressive improvement initiative. The use of independent personnel provided significant insights into the maintenance rule program. However, the licensee did not respond aggressively to the self-assessment results.

III. Engineering

E4. Engineering Staff Knowledge and Performance (62706)

E4.1 Engineer's Knowledge of the Maintenance Rule

a. Inspection Scope (62706)

The team interviewed engineers and managers to assess their understanding of probabilistic risk assessment, the maintenance rule, and associated responsibilities.

b. Observations and Findings

The team interviewed the system engineers assigned responsibility for SSCs selected, and walked down systems with them. The system engineers were experienced and knowledgeable about their systems. Some maintenance rule and probabilistic risk assessment training had been provided to the system engineers. The licensee's program relied heavily on the system engineering staff to implement the program. The system engineers' responsibilities for the maintenance rule included monitoring performance criteria, the maintenance preventable functional failure decision process, and the preparation of (a)(1) corrective action plans.

The team determined that the system engineers did not demonstrate a consistent familiarity with the station's maintenance rule program. Several of the system engineers interviewed by the team were unaware of the need to monitor system performance with respect to the established performance criteria. In some cases, unavailability was either improperly tracked or not tracked at all. In addition, the team found that the system engineers did not always recognize maintenance rule maintenance preventable functional failures, and in some cases, events and problems were not being evaluated at all with respect to reliability criteria. Consequently, many maintenance preventable functional failures were missed and the maintenance rule status of those systems was indeterminate. This appeared to have occurred because of either the lack of adequate training or inadequate program guidance.

During interviews, several of the system engineers were skeptical with regard to the value of maintenance rule. The program was viewed as an additional task with little benefit, and these system engineers expressed dissatisfaction over a perceived lack of direction from the maintenance rule staff and supervision.

c. Conclusions

System engineers were experienced and knowledgeable with regard to their assigned systems; however, their knowledge of the station's maintenance rule program was weak. Although the licensee relied heavily on the system engineers to implement the maintenance rule, based on the extent of problems identified with the performance phases of the program, the team concluded that the system engineers were not prepared to deal with the task.

V. Management Meetings

X1 Exit Meeting Summary

The team discussed the progress of the inspection with licensee representatives on a daily basis and presented the inspection results to members of licensee management at the conclusion of the inspection on September 12, 1997. The licensee acknowledged the findings presented.

The team asked the licensee whether any materials examined during the inspection should be considered proprietary; none was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

A. Chernick, Regulatory Assurance
D. Craddick, System Engineering Supervisor
P. Cretans, Corporate PRA Engineer)
R. Detwiler, Cycle Manager
R. Eizenga, Senior Reactor Operator
R. Fairbank, Deputy Site Engineering Manager
F. Famulari, Quality and Safety Assurance Manager
R. Gayley, Site Maintenance Rule Owner
L. Hamilton, Regulatory Assurance
J. Hutchinson, Site Engineering Manager
P. Knoespel, Site PRA Engineer
T. Kolb, Shift Engineer
J. Kudalis, Business Manager
M. Nelnicoff, Corporate PRA Engineer
E. Pannel, Senior Reactor Operator
W. Pearce, Site Vice President
C. Peterson, Regulatory Assurance
T. Peterson, Regulatory Assurance
J. Purkis, Work Control Supervisor
T. Rieck, Nuclear Engineering Services
J. Robinson, Senior Reactor Operator
C. Sibley, Corporate Maintenance Rule Owner
S. Specht, Unit Supervisor
M. Strait, Corporate Engineering
D. Swartz, Corporate PRA Engineer
R. Tubbs, Outage Engineer
R. Venci, Unit Supervisor
M. Wayland, Maintenance Manager

NRC

S. Black, Branch Chief, Office of Nuclear Reactor Regulation
J. Jacobson, Acting Deputy Director, RIII
W. Kropp, Branch Chief, RIII
C. Miller, Senior Resident Inspector, RIII

LIST OF INSPECTION PROCEDURES USED

IP 62706: Maintenance Rule
IP 40500: Effectiveness of Licensee Controls in Identifying, Resolving, and Preventing Problems
IP 71707: Plant Operations

LIST OF ITEMS OPENED

50-254/97017-01(DRS); 50-265/97017-01(DRS)	EEI	Scoping errors
50-254/97017-02(DRS); 50-265/97017-02(DRS)	IFI	Correct misclassification of two functions
50-254/97017-03(DRS); 50-265/97017-03(DRS)	URI	Acceptability of reliability-availability balance
50-254/97017-04a(DRS); 50-265/97017-04a(DRS)	EEI	Unjustified reliability criteria
50-254/97017-04b(DRS); 50-265/97017-04b(DRS)	EEI	Inappropriate availability criteria
50-254/97017-04c(DRS); 50-265/97017-04c(DRS)	EEI	Inadequate availability criteria
50-254/97017-04d(DRS); 50-265/97017-04d(DRS)	EEI	Insufficient performance criteria
50-254/97017-04e(DRS); 50-265/97017-04e(DRS)	EEI	No performance criteria
50-254/97017-04f(DRS); 50-265/97017-04f(DRS)	EEI	Inappropriate plant level criteria
50-254/97017-04g(DRS); 50-265/97017-04g(DRS)	EEI	Inability to monitor criteria
50-254/97017-05a(DRS); 50-265/97017-05a(DRS)	EEI	Containment Atmosphere Monitoring system functional failures
50-254/97017-05b(DRS); 50-265/97017-05b(DRS)	EEI	Control Rod Drive functional failures
50-254/97017-05c(DRS); 50-265/97017-05c(DRS)	EEI	Emergency Diesel Generator functional failures
50-254/97017-05d(DRS); 50-265/97017-05d(DRS)	EEI	Station Blackout Diesel maintenance history
50-254/97017-05e(DRS); 50-265/97017-05e(DRS)	EEI	Neutron Monitoring maintenance history
50-254/97017-06a(DRS); 50-265/97017-06a(DRS)	EEI	No goals for Containment Atmosphere Monitoring

50-254/97017-06b(DRS); 50-265/97017-06b(DRS)	EEI	Station Blackout Diesel Inadequate Goal
50-254/97017-06c(DRS); 50-265/97017-06c(DRS)	EEI	No goals or monitoring for Residual Heat Removal
50-254/97017-07(DRS; 50-265/97017-07(DRS)	IFI	Action plans and goals for recent (a)(1) systems

LIST OF ACRONYMS USED

CFR	Code of Federal Regulations
DRS	Division of Reactor Safety
EEI	Escalated Enforcement Item
IFI	Inspection Follow-up Item
NOV	Notice of Violation
NRC	Nuclear Regulatory Commission
PDR	Public Document Room
SSC	Structure, System, or Component
URI	Unresolved Item

LIST OF DOCUMENTS REVIEWED

QCAP 0200-15, "Work Activity Screening," Revision 7, May 9, 1997
QCAP 0400-18, "Station Compliance with the Maintenance Rule," Revision 1, August 15, 1997
QCAP 1800-01, "Shutdown Risk Management," Revision 5, May 23, 1997
QCAP 2200-01, "Long Range Planning and Scheduling," Revision 2, July 31, 1996
QCAP 2200-03, "Planning, Scheduling Operating Cycle Work," Revision 9, August 7, 1997
QCAP 2200-07, "Probabilistic Risk Assessment of On-Line Maintenance Activities," Revision 2, May 22, 1997
QCAP 2200-08, "Voluntary On-Line Maintenance on Equipment Important to Safety," Revision 5, August 4, 1997
QDC-0201-N-0469, "PSA Basis for Maintenance Rule Performance Criteria," September 5, 1997
James Masterlark and Paul Knoespel Letter, "Administrative Guidance for Monitoring Core Damage Risk Due to Fire, Revision 1," June 4, 1997
Paul Knoespel Letter, "Maintenance Rule PSA Criteria Based on the 1996 Update of the Quad Cities PSA Model," February 26, 1997
Operational Safety Predictor (OSPRE) User's Manual, Commonwealth Edison Company, Quad Cities Nuclear Generating Station, Revision 1.02 for IBM PC