I. INTRODUCTION

The Systematic Assessment of Licensee Performance (SALP) process is used to develop the Nuclear Regulatory Commission's (NRC) conclusions regarding a licensee's safety performance. Four functional areas are assessed: Plant Operations, Maintenance, Engineering, and Plant Support. The SALP report documents the NRC's observations and insights on a licensee's performance and communicates the results to the licensee and the public. It provides a vehicle for clear communication with licensee management that focuses on plant performance relative to safety risk perspectives. The NRC utilizes SALP results when allocating NRC inspection resources at licensee facilities.

This report is the NRC's assessment of the safety performance at Quad Cities for the period October 27, 1996, through December 20, 1997.

An NRC SALP Board, composed of the individuals listed below, met on January 7, 1998, to assess performance in accordance with the guidance in NRC Management Directive 8.6, "Systematic Assessment of Licensee Performance."

Board Chairperson

Geoffrey E. Grant, Director, Division of Reactor Projects, RIII

Board Members

Robert A. Capra, Director, Project Directorate III-2, NRR
John M. Jacobson, Acting Deputy Director, Division of Reactor Safety, RIII

II. PERFORMANCE ANALYSIS

A. Operations

Overall performance in operations remained good throughout the period. Efforts made in the last period to improve control room performance in communications, supervisory oversight and self-assessments were sustained this period. Personnel performance was good, and contributed to two lengthy periods of dual unit operations. Routine and transient operations were performed well. Operators exhibited good out-of-service tagging performance, which was an improvement over the last period. In contrast, ineffective communications resulted in several missed surveillances. In some cases, operator tolerance of repetitive equipment problems negatively affected plant performance. Although daily risk management of out-of-service equipment was usually a strength, several situations indicated a lack of conservative approach to equipment availability or operability.

Control room performance was normally a strength during this period, with good communications, supervisory oversight, and self or peer-check activities. Operator response to two loss of shutdown cooling events and an inadvertent high pressure coolant injection initiation at power was prompt and appropriate. Some exceptions to good panel monitoring occurred, including operators not identifying an indication of a fuel failure for several shifts, and tolerance of alarming annunciators without taking corrective action. Physical and process changes improved the control room environment and minimized distractions to operators. The physical modifications improved supervisory panel oversight and resulted in a more organized and quieter atmosphere. Process improvements included restrictions to control room access, and movement of all but essential functions outside the control room.

Self-assessments of operator performance remained strong, with management overviews of complex activities, peer reviews, and supervisory oversight of crews being emphasized. Some self-assessment and human performance resources were shared with the Quality and Safety Assessment department to improve self-assessment station wide.

Daily assessment of risk was considered a strength. However, some notable exceptions involving non-conservative operating decisions occurred. The high pressure coolant injection system was inappropriately taken out of service for surveillance testing and a 12-hour shutdown limiting condition for operation was entered while portions of the low pressure coolant injection system were inoperable. Other areas where risk considerations were not fully considered included maintenance affecting fire pump availability and alarm capability, and maintenance affecting ultimate heat sink capability.

Although material condition of the plant improved during the period, repeat equipment problems resulting in downpowers and shutdowns indicated an operational tolerance of material condition problems. Examples included several downpower operations due to gland seal level control valve problems, and a unit shutdown initiation caused by a standby liquid control flow indicator which had been previously identified as needing replacement.

While communications between operations and other departments showed improvement in some areas, important weaknesses were also apparent. Out-of-service errors, a previous problem area, were fewer and less significant this period. Electronic out-of-service tagging was implemented with few problems, indicating good coordination with maintenance and engineering. However, ineffective communications on post maintenance and surveillance activities resulted in missed testing requirements. For example, several control rods were not tested following maintenance before reaching 40 percent power after the Unit 2 refueling outage. Offgas sampling requirements were missed because of communication errors between operations and chemistry. Some failures to require testing prior to mode changes were also identified. The most significant example involved taking the reactor critical prior to hydrostatic testing of the reactor coolant system as noted in the Maintenance and Engineering functional areas.

The performance rating in Operations is Category 2.

B. Maintenance

Overall, performance in the area of maintenance was adequate. Improvements were observed in the work control process, plant material condition, and work backlog reduction. Nevertheless, repetitive equipment problems continued to present challenges to plant operations. Significant problems were noted in the surveillance test program and in hydrostatic testing per the American Society of Mechanical Engineers (ASME) Code. Poor implementation of the maintenance rule prevented rule-based actions from contributing to improved equipment performance.

Emphasis on material condition improvements resulted in reducing the non-outage corrective and safety-related backlogs. Reductions were also achieved in operator workarounds, control room corrective maintenance, and temporary alterations. Improvement was also made in safety system availability. The maintenance initiative to replace the recirculation pump motor and impeller was good. However, repetitive equipment problems impacted plant operations, causing forced shutdowns and power derates on several occasions. For example, a packing leak on a low pressure coolant injection (LPCI) check valve and a failed reactor recirculation pump seal were identified as resulting from poor quality work during the Unit 2 refueling outage. Unit 1 also experienced equipment problems, including a bonnet leak on a reactor core isolation cooling system valve, numerous gland seal condenser level control valve failures, repeat problems with standby liquid control pump flow indication, cracked 4160 volt breaker auxiliary switches, and low oil levels on a reactor recirculation pump.

The maintenance rule program was poorly implemented and did not provide adequate monitoring of systems and components. Corporate support to ensure strong implementation of a company-wide program and incorporation of lessons learned from other Commonwealth Edison sites was not evident. As a result, the maintenance rule program was not an effective maintenance tool for identifying or addressing failures of the fire pumps, emergency diesel generators, the containment atmosphere monitoring system, and other equipment. Engineering support for implementation of the maintenance rule was also not effective as discussed in the Engineering functional area.

The work control process improved during the SALP period. Several task-oriented work groups were established to focus on tasks in specific areas. Effective use of the Fix-It-Now (FIN) Team to complete emergent work items contributed to meeting maintenance work schedules. Good planning and execution were demonstrated during a brief planned outage on Unit 2. Work scheduling and planning and the quality of work packages were generally satisfactory with some difficulties noted on specific work activities, such as the failure to perform preventive maintenance tasks on General Electric Magne-blast breakers. Also, work histories were not consistently recorded, which complicated resolution of the emergency diesel generator air start motor problems.

Maintenance work was normally performed safely and in accordance with procedures. Teamwork improved and increased worker knowledge and skills were noted in the quality of work. The reduction in maintenance backlogs demonstrated the ability of maintenance personnel to get work done. Although rework was reported as low, some problems with procedure adherence and proper self-checking were evident, causing notable rework items, such as the reactor recirculation pump seal and LPCI check valve packing replacements. Some recent improvements were noted in maintenance self-assessments and trending and in the involvement of quality control in maintenance activities.

In the area of surveillance, a number of significant problems were identified with missed surveillances and procedural adequacy. The upward trend in missed surveillances was due to defective procedures, inadequate review to incorporate new Technical Specification requirements, poor scheduling, and human error. In addition, several surveillance test procedures were observed to not include all the appropriate testing. For example, not all of the required residual heat removal service water valves were included in a monthly surveillance test.

Some substantial problems with the implementation of specific ISI/IST activities were identified. Main steam safety relief valves did not receive set pressure tests within 12 months of removal as required by the ASME Code. Of greater significance, however, was the failure to perform the ASME Code required hydrostatic leakage test of the Unit 2 reactor coolant system prior to taking the reactor critical as specified by 10 CFR Part 50, Appendix G. Further, the visual examinations for leakage conducted during the test were found to be inadequate in several instances. Performance of the hydrostatic test at power demonstrated a lack of safety focus, poor knowledge of the testing requirements, and a lack of strong oversight by the corporate center for

ASME Code testing expertise. Initial recognition of this issue demonstrated good problem identification, however, follow up to determine the extent of the problem was neither thorough nor aggressive.

The performance rating in Maintenance is Category 3.

C. Engineering

Engineering performance remained adequate with some notable weaknesses. While some aspects of engineering support to the plant improved, problems were experienced with testing acceptance criteria, understanding and application of the design basis, 10 CFR 50.59 safety evaluations, parts replacement, and resolution of problems. Substantial problems were encountered with fire protection safe shutdown capability in accordance with 10 CFR Part 50, Appendix R, in support of the implementation of the maintenance rule. Self-assessments were effective at identifying problems, but resolutions of the findings were, in some cases, neither comprehensive nor timely.

Substantial problems were experienced in significant technical areas. Implementing procedures for safe shutdown in the event of a fire were inconsistent with the approved 10 CFR Part 50, Appendix R, "Fire Protection," safe shutdown analysis and a heavy reliance was placed on opposite unit equipment. Unit 2 was conservatively shutdown early as a result. However, the safe shutdown capability and Appendix R issues were not comprehensively resolved prior to expiration of an administrative limiting condition of operation on Unit 1, and led to the unit being shut down. Significant problems were also identified regarding the process for changing the Appendix R licensing basis, completing the safe shutdown analysis, implementing new procedures, and establishing the operability of the new safe shutdown strategy. Engineering support for implementation of the maintenance rule was also not effective. Although portions of the maintenance rule program involving scoping, risk ranking, and risk assessment from out-of-service equipment were acceptable, inadequacies were identified in the development of performance criteria, the evaluation of maintenance preventable functional failures, the establishment of goals and monitoring, and the historical reviews of operating data.

Some aspects of engineering support to the station improved. Effective use of system engineers and a project manager during a safe shutdown makeup pump system outage helped ensure that modification work progressed smoothly. In-depth reviews of design basis information and detailed system walkdowns were performed in support of the high pressure coolant injection (HPCI) system operational performance inspection. A high sensitivity toward identification and documentation of HPCI problems was noted. Engineering resources were effectively applied to resolving material condition issues; nonetheless, many material condition issues remained. Problems with the emergency diesel generator (EDG) air start system were initially not comprehensively addressed and engineering made significant errors in revising battery test acceptance criteria and maintaining the battery testing load profile.

The quality of engineering products was not consistent. While the threshold for identifying problems was low, poor root cause determinations and insufficient corrective actions were evident on several occasions. Improper application of the Alternate Parts Replacement Program allowed installation of parts which adversely affected the safety functions of related equipment. Corrective actions initially taken were ineffective to prevent repetition. For the refuel bridge interlocks, long term controls and corrective actions to guard against potential inadvertent criticality were not aggressively pursued. Additionally, corrective actions were inadequate when intergranular stress corrosion cracking was found in reactor coolant system piping previously treated with the induction heating stress improvement process. However, modifications on the HPCI system were noted to be implemented in an acceptable manner. Many functional calculations to determine important design parameters, such as the HPCI pump minimum discharge pressure at maximum reactor pressure, and the HPCI pump minimum suction water level to preclude vortexing, were identified as missing or non-retrievable and had to be reconstituted. These problems reflected continuing weaknesses in accuracy and accessibility of design basis information. A design basis documentation (DBD) group was formed to improve the DBD and to generate required or missing calculations. In addition, a line-by-line validation of Updated Final Safety Analysis Report (UFSAR) design basis information was commenced and an Engineering Assurance Group (EAG) was formed to improve the overall quality of engineering products.

Licensing action submittals were generally good. Submittals for licensing actions on the revised IPE, IPEEE, emergency core cooling suction strainer replacement, and Siemens fuel were good and staff questions were addressed responsively. A review of the UFSAR to assure all changes to the facility were included identified many changes that had not been incorporated. The review and resultant corrective actions were considered positive initiatives. However, substantial deficiencies were noted with the 10 CFR 50.59 safety evaluation process. Safety Evaluation Summary Report submittals did not include all safety evaluations and all applicable UFSAR sections were not identified during the screening process. An inadequate 10 CFR 50.59 safety evaluation screening performed for the Class 1 system boundary leakage test exhibited a lack of comprehensive engineering review and allowed the pressure and leak test to be performed while the reactor was critical, contrary to the requirements of 10 CFR Part 50, Appendix G, and the ASME Code.

Self-assessment activities were effective at identifying problems, however, in some cases this was offset by untimely or ineffective corrective action. Good technical issues involving residual heat removal pump testing were identified, but resolution of the findings was not technically rigorous or comprehensive. The June 1997 maintenance rule self-assessment utilized independent personnel, identified problems with implementation of the rule, and provided a clear set of major issues to address. However, these self-assessment results were not aggressively pursued.

The performance rating in Engineering is Category 3.

D. **Plant Support**

Overall, plant support performance was good. Radiation protection and chemistry performance remained effective. Station dose was lower than projected due to strengthened "as low as reasonably achievable" (ALARA) planning. However, problems were identified with valve work ALARA controls and maintenance of the high radiation sampling system. Both the security and emergency preparedness programs were well implemented. Fire protection performance was adequate. Problems were identified with the implementation of compensatory actions for fire protection deficiencies, the reliability of diesel fire pumps, and with slow corrective actions for degraded fire pump and sprinkler system flow problems.

Radiation protection and chemistry performance remained good. Continued emphasis on improving ALARA planning and controls kept station dose lower than projected. Station dose was also lower than anticipated due to less emergent work and reduced work scope during outages. However, problems with work planning and conduct of maintenance and operations activities continued to have a negative impact on dose. Additionally, an unexpected intake of radioactive material indicated a continuing problem with ALARA controls specific to valve work. Radioactive material control and radworker performance improved, but there were several isolated events. Routine chemistry sampling activities were well conducted and department response to the Unit 2 fuel leak was effective. However, there were several problems with maintenance of chemistry equipment, including the high radiation sample system, and with chemistry procedural quality. Reactor water quality was considered excellent, but declined due to main condenser problems.

Security performance was good. Routine and tactical readiness of security facilities, equipment, and personnel were effective. However, isolated examples of ineffective maintenance oversight activities resulted in the implementation of additional security compensatory measures. Positive management support and aggressive implementation of an "error-reduction" program resulted in improved security force personnel performance. New security computer equipment also improved officer effectiveness. Security management personnel generally demonstrated positive capability to identify and resolve security issues in a timely and effective manner. Individual performance inadequacies involving vehicle search and fitness for duty issues were noted and effectively corrected early in the assessment period.

Overall, the emergency preparedness program was maintained in an effective state of operational readiness. Emergency response facilities, equipment, and supplies were well maintained. Management support to the program was strong and key emergency response personnel demonstrated competent knowledge of responsibilities and emergency procedures. Personnel performance observed during a medical drill was effective and demonstrated good teamwork. An emergency preparedness audit and self-assessment were of the appropriate scope and depth with identified issues properly tracked and resolved.

The fire protection program was adequately implemented. Fire brigade performance during a fire drill was good, although a weakness was identified regarding an excessive number of drill participants credited for meeting training requirements. Control of combustibles was generally good. Some compensatory actions were not adequately implemented for fire protection deficiencies. This was of particular concern, because additional controls had been previously implemented as a result of the determination that internal plant fires were a significant risk contributor in core damage frequency calculations. The majority of fire protection equipment was well maintained, although a significant program weakness was identified regarding the reliability of diesel fire pumps. Corrective action development and implementation were slow for degraded fire pump and sprinkler system flow problems, resulting in several administrative limiting conditions for operation requirements being exceeded.

The performance rating in Plant Support is Category 2.