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Facility Name: Catawba Nuclear Station Units 1 and 2

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Enclosure

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INTEGRATED PERFORMANCE ASSESSMENT OF CATAWBA

1.0 BACKGROUND, SCOPE, AND OBJECTIVES

In an effort to better integrate and assess licensee performance, and to better utilize inspection resources, the NRC initiated a new, trial program entitled the "Integrated Performance Assessment Process (IPAP)." This process is described in Draft NRC Inspection Procedure 93XXX, and was discussed in a public information meeting on April 11, 1995. A team of NRC personnel not directly associated with normal inspection activities of Catawba was assembled. This team developed an integrated perspective of licensee strengths and weaknesses based upon a review of historical NRC documents (reports/performance indicators/evaluations), licensee historical information, independent assessments, two weeks of onsite direct observations, and interviews with licensee personnel. Once this integrated perspective was gained, the team recommended where future NRC resources should be used for maximum safety benefit.

To accomplish this goal, the IPAP was divided into three phases that dealt directly with the facility. Phase I was the review of historical NRC documents covering the period October 3, 1993 - June 30, 1995. From these documents, an initial assessment was performed and a report was issued with preliminary conclusions on July 21, 1995. Phase II was a two week onsite inspection to validate this preliminary analysis cumulating with an exit meeting on August 18, 1995. Phase III comprised completing the analysis and issuing this inspection report documenting the final integrated assessment results with recommendations for utilization of future NRC inspection resources.

2.0 EVALUATION METHODOLOGY

The scope of the evaluation included the five functional areas of safety assessment/corrective action, plant operations, engineering, maintenance, and plant support. Within each functional area, key attributes of performance such as safety focus, problem identification, problem resolution, quality of actions, and programs and procedures were analyzed. Based upon this analysis, each key attribute was assigned a color [code] defined as follows:

- Green [Horizontal Lines] - Reduced Inspection. Licensee attention and involvement are properly focused on safety and result in a superior level of performance. The NRC will strongly consider reducing inspection effort.

- No Color [Dotted Background] - Normal Inspection. Licensee attention and involvement are normally well focused and result in a good level of performance. The NRC will consider applying a normal inspection effort.

- Blue [Diagonal Squares] - Increased Inspection. Licensee attention and involvement are often not well focused and performance suffers. The NRC will strongly consider increasing inspection effort and focus in these elements.

These results are depicted on a Performance Assessment/Inspection Planning Tree (Appendix A).

3.0 PLANT OPERATIONS - PERFORMANCE ASSESSMENT

The licensee's focus in operations was normally on safety. Prior to 1995, there were occasional performance weaknesses. However, the quality of operations decreased during the first six months of 1995. Operating procedures provided appropriate direction with few exceptions. Good performance was exhibited in the area of identifying and resolving plant equipment problems. Identification of human performance problems at the operational event level was effective. However, self-assessments were only partially effective. Corrective actions to problems identified at the operational event level, although occasionally slow, were positive.

3.1 Safety Focus

The licensee's focus in operations was normally on safety. Consideration of shutdown risk, especially during mid-loop operations, was strong. Conservative operability determinations were made with a rare exception. While onsite, the team noted that when operability was questioned, the component was declared inoperable and remained inoperable pending further evaluation. However, there were instances where management involvement was inconsistent. On March 23, 1995, a power excursion occurred during Unit 1 reactor physics testing. The relinquishment of authority from operations to engineering was identified as one of the contributors to this event. Prior to recommencing physics testing, command and control was reevaluated and operations assumed the leadership role. However, only engineering management attended the pre-activity briefing and witnessed recommencement of the testing. While onsite, the team witnessed maintenance on the A train of component cooling water that used a freeze seal for isolation between the A and B train. This non-routine evolution potentially affected the operable component cooling water train and did not invoke off-shift operations management presence.

Off-shift operations management expectations were effectively communicated during transients and emergency conditions as evidenced by the more than 30 simulator evaluations in 1995. Off-shift operations management communication of expectations during the performance of the day-to-day activities was not always apparent. Performance suffered because questioning attitudes, accountability, and command and control were not consistently reinforced. While onsite, the team noted that operations personnel exhibited a questioning attitude when interfacing with other departments. Also, operations personnel had a clear understanding of accountability as it related to them.

Normally, the operations shift manager ensured that conservative compensatory actions were established when degraded equipment performance was identified. An exception to this process, was testing a main feedwater pump following completion of the Unit 2 refueling outage in 1994. During power accession, the main feedwater pump bearings indicated a high temperature. With the unit at full power, personnel performed testing to determine if bearing temperatures would remain within the normal range. During the test, bearing temperature increased rapidly to the point where procedures required operators to trip the main feedwater pump causing a runback condition. During the ensuing transient conditions, the operators properly tripped the reactor. Also, the operations shift manager did not use all available resources, such as the Onsite Review Committee, when establishing a course of action for troubleshooting letdown system problems in June 1995.

Normal inspection is recommended.

3.2 Quality of Operations

Operators performed well and excelled during certain activities. Reduced reactor coolant system inventory and reactor refueling activities were consistently excellent. In addition, numerous transients and trips were handled well. Contributing to good operator performance was the operator training program, especially simulator usage. Good feedback between training and operations supervision enhanced simulator training. In addition, good operator examination results were achieved throughout the assessment period.

Prior to 1995, occasional performance weaknesses were observed. In December 1993, a senior reactor operator made a decision inconsistent with Technical Specification (TS) requirements and failed to recognize that the Unit 1 steam driven auxiliary feedwater train was inoperable with its manual steam supply valves to the turbine isolated. On occasion, senior reactor operators provided incorrect tagout/restoration orders or did not effectively oversee maintenance or test activities. Operators made errors but they were of minor consequence and usually during refueling outages.

However, the quality of operations decreased during the first six months of 1995. Starting in February 1995, the following human errors occurred:

- On February 11, a Unit 1 reactor coolant system power operated relief valve lifted three times when collapsing the pressurizer bubble. Roles and responsibilities were not adequately addressed during the pre-activity briefing which resulted in operators failing to properly monitor pressurizer pressure. Command and control did not meet management expectations.

- On February 17, two operators failed to follow station procedures when verifying the position of a Unit 1 steam generator blowdown containment isolation valve.

- On February 26, two operators failed to follow station self-checking requirements and isolated component cooling water to an operating Unit 2 residual heat removal pump motor.

- On March 7, a senior reactor operator failed to follow tagout restoration procedures and annotated that a motor operated disconnect was not returned to its normal position. This was later identified when the breaker could not be remotely operated.

- On March 23, a power excursion occurred during zero power physics testing in Unit 1. Roles and responsibilities were not adequately addressed during the pre-activity briefing which resulted in operators failing to properly monitor nuclear instrumentation. Command and control did not meet management expectations.

- On April 12, several control room indications for Unit 2 showed that reactor power exceeded the allowed license limit for normal power operations. This indication of overpower was questioned by the reactor operator and discussed with the operations shift manager who stated that it was acceptable. It was later identified that power had exceeded TS rated thermal power limit. In this case, the operations shift manager did not demonstrate a questioning attitude.

- On April 20, operations personnel inadvertently isolated nuclear service water flow from the control room chiller because a senior reactor operator failed to specify a proper restoration lineup. The procedure utilized to restore nuclear service water flow did not address all the valves operated to accomplish the tagout. The senior reactor operator did not adequately review the procedure to ensure that all the valves operated per the tagout were returned to their proper position.

- On April 24, a senior reactor operator did not include deactivation on the tagout associated with four containment isolation valves. This was inconsistent with the TS requirements. In addition, the wrong TS section was referenced specifying the actions being taken. The senior reactor operator failed to properly interpret TSs. The errors were not identified until after four shift turnovers occurred which indicated a lack of a questioning attitude during shift turnovers.

- On April 27, the Unit 2 senior reactor operator failed to properly interpret TSs and entered the incorrect action statement for an inoperable auxiliary feedwater flow instrument. The TS action log was annotated with the incorrect TS reference, and the error was not identified for approximately two days which indicated a lack of questioning attitude during shift turnovers.

- On May 1, an operator inadvertently isolated flow to the condensate booster pumps which resulted in a loss of main feedwater and a Unit 2 reactor trip. The operator failed to properly self-check when attempting to restore condensate flow.

- On June 21, a senior reactor operator developed a procedure to troubleshoot a Unit 1 letdown system orifice isolation valve that failed to stroke within acceptable time limits. This procedure was approved by the on-shift senior reactor operator. In order to stroke the valve, letdown was secured and a letdown system valve interlock was overridden. Operators followed the procedure which inadvertently de-pressurized the letdown system from 2235 psig to 600 psig when overriding the interlock. A waterhammer occurred when the system was re-pressurized to 2235 psig. Operators did not maintain a questioning attitude when developing the procedure to troubleshoot the letdown system valve.

Inadequate human performance in the areas of command and control, pre-activity briefings, self-checking or implementing a questioning attitude was a predominant cause of these events. The licensee recognized these deficiencies and implemented corrective actions. In November 1994 and again in May 1995, management conducted meetings with operators to emphasize the need to improve human performance. It was evident that management had communicated human performance expectations. The team concluded that these meetings improved performance in that thorough pre-activity briefings and consistent self-checking techniques with senior reactor operators establishing authoritative roles were observed while onsite. In order to improve the effectiveness of management visits to the control room and plant, an experienced senior reactor operator was assigned, at the end of the assessment period, the responsibility of monitoring the performance of operations personnel on shift.

Due to the recent nature of these corrective actions, without sustained improvement, increased inspection is recommended. Routinely, the effectiveness of the experienced senior reactor operator assigned to monitor the shift in influencing shift performance should be evaluated. Particular attention should be paid to non-emergency activities that are only periodically accomplished and how the heightened level of awareness program is used. Periodically, augmented inspections of operations should be performed with special emphasis on how the on-shift operations manager carries out his assigned duties and off-shift management communicates and reinforces performance expectations.

3.3 Programs and Procedures

Operating procedures provided appropriate direction to operators with few exceptions. The initial implementation use of probabilistic risk assessment (PRA) to regulate system availability was observed. While onsite, the team observed operations personnel stop several planned on-line maintenance evolutions when a Unit 1 power operated relief valve was unexpectedly declared inoperable. Performance of these maintenance evolutions would have been inconsistent with the licensee's PRA administrative matrix. In this case, the administrative PRA requirements were more conservative than TSs. Upgraded emergency operating procedures were developed and implemented during this assessment period. Reduced reactor coolant system inventory administrative controls were comprehensive, and station blackout procedures provided sufficient direction to mitigate such an event. The procedure revision backlog was higher than the licensee's goal but, while onsite the team did not identify any adverse performance examples associated with this situation.

Weaknesses were observed in the programs for designating tagout restorations and initiating TS Action Item Log (TSAIL) entries. In both programs only one senior reactor operator was required to perform these critical operations actions without a second review. These weaknesses did not contribute to operational events until 1995 with the advent of the following two changes: In January 1995, six new senior reactor operators were placed on shift, and management reduced coverage by the work control center senior reactor operator from full time to day shift - Monday through Thursday. The senior reactor operator designated as the unit supervisor, traditionally made TSAIL entries and approved tagout restorations. One of the functions, although not designated in the administrative controls, performed by the work control center senior reactor operator was to review entries into TSAIL and tagout restorations. Consequently, on April 20, 24, and 27, 1995, new senior reactor operators either improperly completed TSAIL entries or improperly designated tagout restorations when the work control center senior reactor operator was not on shift. On May 8, operations management rectified the program deficiency by implementing a new requirement requiring a second senior operator review of TSAIL entries and tagging restorations.

There were some instances where operations personnel did not strictly follow established processes. Examples included (1) operations maintaining an unnecessary tagout, inconsistent with administrative procedures, on the Unit 1 auxiliary feedwater system during a startup in December 1993, (2) operations personnel not annotating a change in tagging orders associated with the switchyard during the 1995 Unit 1 refuel outage, and (3) operations staff maintaining an abnormal feedwater system lineup on an open items list inconsistent with administrative procedures, on Unit 2 in May 1995. While onsite, the team did not identify any further instances where operators were using uncontrolled processes or not following established procedures.

Normal inspection is recommended.

3.4 Problem Identification and Resolution

Good performance was exhibited in the area of identifying and resolving plant equipment problems. Problem investigation reports and work requests were initiated when appropriate. While onsite, the team observed that management consistently reinforced the need to initiate problem investigation reports to document conditions adverse to quality. The team accompanied operators on their tours and in the control room and noted that plant deficiencies were identified and corrective action initiated. There were few operator work-arounds. Nuisance alarms or temporary jumpers did not cause plant problems. Chronic or recurring equipment problems were rare.

Human performance problems were effectively identified through the problem investigation process at the operational event level. However, self-assessments were only partially effective. The effective aspect of self-assessments was the off-shift operations management review and critique of simulator training. Since simulator training emphasized emergencies, transients, and mid-loop operations, these assessments focused in these areas. Resolution of these human performance deficiencies was good with prompt feedback and re-enforcement of correct practices. Self-assessments of non-emergency situations were primarily accomplished by the operations shift manager evaluating senior reactor operator performance, and senior reactor operators evaluating reactor operators' and non-licensed operators' performance, and were effective in improving individual standards. However, they were not effective in identifying command and control deficiencies or deficiencies associated with a lack of a questioning attitude when dealing with other departments or with shift activities. As previously mentioned in paragraph 3.2, an experienced senior reactor operator was assigned, at the end of the assessment period, the responsibility of monitoring the performance of operations personnel on shift; and thereby providing a consistent standard for on-shift performance.

Limitations within the problem investigation process trending process reduced the effectiveness of the information provided. Early in the assessment period, the particular work unit could not be identified. Also, the coding of the information only indicated that there were inadequate work practices and weaknesses in written and verbal communications while working on the equipment. This deficiency persisted throughout the assessment period. At the end of the assessment period, the licensee was revising the coding system to make it more useable.

Once human performance problems were identified at the operational event level, although on occasion slow, corrective actions did produce positive results. Management reduced the frequency and safety significance of valve mispositionings throughout the assessment period by monthly meetings and human performance enhancements. Three events associated with the lack of a second review of the TSAIL and tagout restorations occurred before effective corrective actions were instituted. Multiple events occurred where operations did not exhibit an aggressive questioning attitude before a declining performance trend was abated. Although not fully evaluated by the team due to the short implementation period, corrective actions to this recent declining human performance trend were positive. The team observed operators demonstrating a questioning attitude when interfacing with engineering and maintenance personnel. Through discussions with operators it was apparent that they were accountable for their actions. In addition, good pre-activity briefings were being conducted.

Normal inspection is recommended.

4.0 MAINTENANCE - PERFORMANCE ASSESSMENT

Maintenance and test activities were normally focused on safety. Safety equipment performance was generally good, and housekeeping was consistently good. Generally, when facility operation was adversely affected by maintenance, it was due to poor refuel outage mechanical maintenance versus the quality of maintenance at power. There were numerous maintenance and surveillance program weaknesses throughout the assessment period. The licensee's ability to identify problems was normally effective once the operational event threshold was reached. Also, there were limitations with the licensee's self-assessment capability throughout much of the assessment period with improvements noted at the end. Although not resolved, performance in these weak areas was improving.

4.1 Safety Focus

The licensee's maintenance and test activities were normally focused on safety. However, prior to the 1994 Unit 2 refuel outage, management failed to properly communicate or reinforce performance expectations as they related to procedure adherence and problem identification. Consequently, there was a discernable decrease in human performance until corrective actions were taken. Management had made some progress in communicating their expectations in these areas. For example, during the onsite period, the team observed work activities in which maintenance personnel stopped work in questionable situations to request assistance from supervision. However, some weaknesses were still noted by the team. For instance, there appeared to be a recent example in which maintenance workers performed a calibration without adequate procedural guidance and several examples of inadequate procedures were identified by the team. Also, while witnessing the single point of contact specialized maintenance crew during the performance of certain maintenance activities, there was a lack of a questioning attitude toward material condition deficiencies not directly associated with assigned tasks.

Normal inspection is recommended.

4.2 Equipment Performance/Material Condition

Safety equipment performance was generally good. There were a number of facility transients, downpowers, and reactor trips. Few equipment malfunctions complicated operator recovery actions to these events. Safety equipment, in almost every instance, properly responded when challenged in an actual event. When the transient was due to equipment failure, that equipment was generally an electrical component (relay, optical isolator, breaker, etc.). Maintenance necessary during power operations was completed within the time constraints of the TSs. Due to the corrosive composition of the service water, intensive maintenance and test activities were necessary to maintain the service water system operable. However, service water availability was consistent with probabilistic risk analysis. Housekeeping was consistently good. While onsite, the team observed only minor deficiencies (such as leaking EDG fuel filters) confirming the plant's good material condition.

Normal inspection is recommended.

4.3 Quality of Maintenance

Generally, when facility operation was adversely affected by maintenance, it was due to poor refuel outage mechanical maintenance. These activities contributed to (1) a plant transient that concluded with a reactor trip (partially obstructed main feedwater bearing oil supply line - Unit 2, July 1994), (2) two plant downpowers (loose main feedwater pump holddown bolts -Unit 1, September 1994 and leaking steam generator manway covers - Unit 1, March 1995), and (3) increased personnel radiation exposures (improper installation of steam generator channel head bowl drain plugs and nozzle dams - Unit 1, November 1993 and reactor coolant pump seal rework - Unit 2 July 1994). The team noted that contributing factors to some of these events were poor work practices, inadequate procedures and a failure to learn from past experiences identified during prior refuel outages performed at Catawba and the licensee's other nuclear facilities (Oconee and McGuire).

Normally, the quality of maintenance at power was good with some exceptions. Maintenance staff unknowingly rendered a train of control room ventilation inoperable causing a violation of TSs and contributed to a plant transient when corrective maintenance on a main feedwater pump lubrication supply line did not remove all the foreign material restricting flow to the bearings. While onsite, the team observed numerous maintenance activities where appropriate expertise was applied in accomplishing the given task. However, the team observed during calibration of the Volume Control Tank Level Loop LT-185, that extender cards (test instrumentation) were modified in an uncontrolled manner and were randomly stored. A failure to properly modify these cards during the calibration activity could result in a system transient.

Normal inspection effort is recommended with more emphasis on mechanical maintenance during refuel outage activities.

4.4 Programs and Procedures

There were numerous weaknesses associated with maintenance and surveillance programs throughout the assessment period. These weaknesses included not adhering to procedures, poor work control and surveillance scheduling, lack of operations involvement in reviewing work requests, and an unstructured troubleshooting process. While onsite, the team observed that although not resolved, performance in these areas of weakness was improving.

Problems with procedural adherence during maintenance were more prevalent during non-routine evolutions such as refuel outages and power changes and decreased after the 1994 Unit 2 refuel outage. Instances such as setting the reactor neutron flux setpoints less conservatively than directed by management due to a math error, improperly installing incore instrumentation seal table low pressure seals causing a leak, improperly assembling a service water system valve actuator, and not returning the main steamline radiation monitors to their proper mountings occurred during or prior to the 1994 Unit 2 refuel outage. Failures of strict adherence to procedures still occurred in April 1995, as evidenced by an individual manipulating a switch within the reactor protection system without procedural guidance. This caused actuation of the feedwater isolation circuitry. While onsite, the team observed maintenance personnel following procedures. Also, licensee problem investigation process trends indicated that procedural adherence was improving.

The lack of a structured troubleshooting approach detracted from corrective maintenance efforts. This was clearly demonstrated in September 1994, when emergency diesel generator (EDG) 1A troubleshooting efforts were inappropriately directed at a malfunctioning fuel oil system versus dirty air start valves. Towards the end of the assessment period, a structured Failure Investigation Process (FIP) was implemented with positive results. While onsite, the team observed the licensee's trouble shooting phase of a failed resistant temperature detector (RTD) associated with the Unit 1A EDG. The RTD failed due to a separated Raychem Splice which had been previously performed to repair the RTD wiring internal to the EDG. Part of the FIP involves maintaining the failed component in its as-found condition for failure analysis. However, the licensee was unable to perform an adequate failure analysis because a technician cut the splice lengthwise, significantly disturbing the as-found condition.

Management failed to effectively plan and implement a new work control process in late 1994, resulting in several operational events, such as instrument mechanics energizing inoperable reactor protection system channels during troubleshooting activities contrary to TSs and a reactor trip when instrument mechanics sequenced their own work involving two channels of the reactor protection system. Prior to initiation of the new work control process, the lack of operations involvement in reviewing work orders contributed to not identifying that main steam radiation monitors were improperly mounted following the Unit 2 1994 refuel outage.

The lack of an integrated surveillance test process, an inadequate mechanism for incorporating changes to the surveillance program when TS revisions occur, and limited verification of surveillance test status contributed to multiple missed surveillances throughout the assessment period. Examples included (1) exceeding the time interval for implementing the engineered safety features system (outside of containment) leakage reduction program, (2) exceeding the time interval for visual inspections of snubbers, (3) failure to incorporate certain equipment associated with the reactor nuclear instrumentation system into the surveillance program, and (4) testing the wrong train of control room emergency ventilation. Fortunately, when the equipment was eventually tested, it was operable.

While onsite, the team confirmed that substantial corrective actions to the work control process had been performed including, the development of a single point of contact for the purpose of reducing the scheduled maintenance backlog and performing emergent maintenance. Special authorization was also required prior to performing unscheduled maintenance work on non-scheduled trains for safety-related systems. In addition, the licensee initiated a special review process which required that all work requests receive an initial review by three key station personnel, the on-shift manager, shift technical advisor and work control manager. The purpose of the review was to determine the various risk (PRA) implications and to assess the potential impact the proposed work would have on safety systems. Also, an integrated surveillance program had been adopted. Other work control improvements included, the licensee's backlog reduction program which was responsible for effectively reducing the corrective maintenance backlog as well as identifying some safety-related component deficiencies. Some of the benefits of these process improvements were evident when, as part of the backlog reduction program, operations personnel identified that a backlogged work request had not been properly prioritized. The work request directed replacement of the wiring for a containment airlock door solenoid valve associated with primary containment integrity. The wiring was not environmentally qualified for its intended application beyond June 1996. The work request was properly prioritized commensurate with its safety importance.

The team noted, however, that several weaknesses still existed regarding the licensee's work control and surveillance scheduling process. For instance, (1) the team identified that maintenance work items remained in the single point of contact work backlog for periods which exceeded managements expectations and the close-out status of several items was not identified, (2) several problem investigation processes had been recently issued for the auxiliary feedwater (AFW) and EDG systems regarding safety system unavailability as a result of inadequate communications and, poor planning and scheduling practices, and (3) a TS surveillance was nearly missed due to potentially inaccurate computer data and cumbersome scheduling printouts.

The team also identified instances of inadequate maintenance procedures. For example, the licensee failed to incorporate vendor recommendations into the controlled EDG vendor manual regarding outdated and incorrect information effecting several safety-related components. In addition, the licensee failed to formally evaluate and incorporate several vendor preventive maintenance recommendations regarding safety-related components such as the EDG keep warm pumps and the EDG governor speed adjusting (synchronizing) motors. During a review of the Licensee's EDG vendor Service Information Memorandum (SIM) process, the team identified that several SIMs had not been formally evaluated or incorporated into the maintenance procedures. Prior to the team leaving onsite, the licensee developed a formal process for evaluating the SIMs received onsite and was in the process of evaluating or implementing the vendor's preventive maintenance recommendations identified by the team. In addition, the 18 month and quarterly hydrogen monitor channel calibration test procedure did not provide appropriate guidance regarding manipulation of the test valves and the design drawings did not reflect the actual field configuration. The licensee indicated that eight procedures were affected.

Although improvements in last part of the assessment period were evident, this element is recommended for increased inspection. The increased inspection resources should be applied to the licensee's self-assessment process initiatives (work control critique meetings, refueling outage critiques, re-work assessments and the blue card system), surveillance program corrective actions, electrical maintenance, and onsite control of vendor manuals.

4.5 Problem Identification and Resolution

The licensee's ability to identify problems associated with maintenance and test activities were normally effective once the operational event threshold was reached. Also, there were limitations with the licensee's self-assessment capability throughout much of the assessment period with improvements noted at the end.

Self-assessment activities did involve senior site management review of safety system unavailability throughout the assessment period. However, prior to March 1995, there was not an effective process for performing self-assessments of the work control process. Maintenance managers were assessing in-process maintenance via the "Blue Card" system which documented weaknesses observed by maintenance managers during maintenance. However, the "Blue Cards" were discontinued in 1994 because the system was determined to be cumbersome and not effective at trending maintenance weaknesses. In March 1995, the licensee instituted self-assessments of the work control, via three meetings per week, which are conducted by the Work Window Managers (WWM) and were attended by key maintenance personnel. During the meetings the WWMs identified past/present strengths and weaknesses observed during the performance of maintenance activities. This included various issues such as system unavailability caused by scheduling problems or equipment rework which may have resulted from poor maintenance work practices. Lessons learned from these meetings were documented and trended. The team partially observed this process and it appeared to be an effective tool as exemplified by the initiation of the problem investigation processes on EDG and AFW unavailability.

Discrete procedural adherence problems were identified in problem investigation process. However, the same trending process limitations as discussed in paragraph 3.4 of operations existed for maintenance. Therefore, the trending only provided a gross indicator as to whether the performance errors were increasing, decreasing, or remaining constant. At the end of the assessment period, the licensee was recoding problem investigation process for enhanced trending and preparing to implement a new, more user friendly "Blue Card" system which would enhance identification of procedural adherence and work control problems.

Self-assessment activities associated with the surveillance program were not effective but, improved by the end of the assessment period. Discrete missed surveillances were captured in the problem investigation process. However, the programmatic aspects were slow to be identified from a self-assessment perspective. Not until the end of the assessment period did missed surveillance become a senior site management focus issue. Also, with the initiation of the work control self-assessments in March 1995, the surveillance program was also included in those reviews.

Resolution of a discrete identified problem was very effective as evidenced by problem investigation process corrective actions preventing a particular surveillance implementation problem from recurring or the same problem recurring on a particular maintenance evolution. The more complex organizational and programmatic problems were being addressed and were generally showing performance improvements but, had not yet been resolved. A structured FIP process was implemented in the later part of the assessment period with some positive results noted when maintenance performed troubleshooting. Following the 1994 "time out," the problem investigation process trends indicated fewer personnel error and procedural adherence problems. The surveillance scheduling process has been improved by revising the computer program for scheduling and tracking and assigning one individual as accountable for identifying potential overdue surveillances. At the end of the assessment period the licensee determined that the specialized traveling maintenance crews would implement the problem investigation process as used by permanent station workers during the upcoming Unit 2 refueling outage.

As discussed in the quality of maintenance section above, the team noted performance problems with the maintenance performed by the specialized traveling maintenance crews which the licensee used during the outage periods. The licensee had a formal critique process for refuel outage activities performed at Catawba and the license's other nuclear facilities (Oconee and McGuire). The team noted that the critiques were a valuable tool for improving the quality of the maintenance activities performed for future refuel outages. However, the licensee had not developed a formal process to communicate the lessons learned from past refuel outage critiques to prevent future problems at the other licensee's facilities.

Some corrective actions were slow to be enacted such as those associated with the surveillance program. Independent assessments had recommended the need for centralized scheduling as early as January 1994, but corrective actions were not implemented until November 1994.

Normal inspection is recommended.

5.0 <u>ENGINEERING - PERFORMANCE ASSESSMENT</u>

The licensee was normally well focused on safety. Programs and procedures normally contributed to good performance. Although the quality of engineering input to modification and maintenance implementing instructions adversely affected facility performance, improvements in the problem areas had been achieved. For the most part, engineering problems were identified and resolution was normally good.

5.1 Safety Focus

The licensee was normally well focused on safety. Technical evaluations and inputs to operability decisions were performed when necessary and correct. Especially strong reviews and conservative recommendations were made involving steam generator tube degradation, a reactor flux anomaly, and incore thermocouple instrumentation port funnel deficiencies. Other issues receiving satisfactory analysis included reactor coolant system hot leg streaming and cracked welds in the closed loop cooling water system. While onsite, the team confirmed that good structural analysis had also been performed on numerous piping systems that had experienced waterhammer. There were infrequent exceptions to these good engineering evaluations such as an incorrect input to an operability decision associated with the pressurizer power operated relief valve, not recognizing the need for a past operability evaluation of degraded service water flow to the control room chillers, and an operating experience report technical evaluation based on a wrong filter configuration for the air system to the main steam isolation valves.

While onsite, the team identified recent management actions to strengthen the safety focus element. These included the communication of management expectations via individual performance appraisals and the establishment of higher than industry norms for component performance.

Normal inspection is recommended in this element.

5.2 Programs and Procedures

Programs and procedures normally contributed to good performance. Strengths included the program planned for replacing the Unit 1 steam generators in 1996, steam generator tube eddy current inspections, and monitoring for flow assisted corrosion in high energy pipes. While onsite, the team identified the thermography inspections as a strength, even though the program was not formalized in station procedures. Some weaknesses existed in the scope or program content of the in-service inspection, in-service test, motor operated valve diagnostic testing, service water heat exchanger monitoring, and service water piping flush programs. There was no particular commonality in these weaknesses. The calculation and design change programs had weaknesses in designating what documents were affected by the change. Specifically, there was no provision to change affected documents when calculations were revised, and fire fighting pre-plans were not on the list of documents to be considered when design changes were implemented. There were weaknesses in the original calculations for the facility as evidenced by the lack of calculations associated with station blackout mitigation and, the calculations supporting the thermal capability of the ultimate heat sink had technical errors. However, while onsite, the team determined that calculations performed during the assessment period were correct with rare exception.

Normal inspection is recommended in this element.

5.3 Quality of Engineering

Support to the operations department was uneven. Strong support to mid-loop and shutdown risk operations was evident with probabilistic risk analysis used. Engineering input to recovery plans due to malfunctioning equipment at power was also excellent. Test engineers performed well during complex emergency core cooling testing throughout the assessment period. Test engineers also performed well during Unit 2 zero power physics testing in 1994 but contributed to an unplanned reactivity excursion while performing the same zero power physics testing on Unit 1 in 1995. Also, critical information regarding high vibration of a residual heat removal pump while shutdown during the 1993 Unit 1 refueling outage, was not communicated to operations personnel in a timely manner.

Although the quality of engineering in select critical areas adversely affected facility performance, the team confirmed that improvements in the problem areas had been achieved. Prior to these corrective actions engineering input to modification and maintenance implementing instructions contributed to an inoperable emergency diesel generator, to a loss of residual heat removal cooling, and to facility transients. As discussed in paragraph 5.4 below, the initiation of the FIP and changing the modification process improved performance. Also, by the end of the assessment period, engineering backlogs were uniformly reduced except for temporary modifications.

As a result of the improvements associated with this area, by the end of the assessment period, normal inspection is recommended in this element.

5.4 Problem Identification and Resolution

For the most part, problems under the cognizance of the engineering department were identified. A significant strength in identifying problems were system engineers reviewing test results. Important safety issues such as an invalid assumption used in evaluating control rod wear, excessive blockage of cooling water flow to the control room chillers, and an improperly designed auxiliary building ventilation system were identified by system engineers. While onsite, the team observed a newly initiated equipment performance monitoring program entitled the Failure Analysis and Trending System which should significantly enhance engineering monitoring of equipment performance. In general, most of the mechanical and electrical equipment met the established goals with the exceptions including pumps, chillers, level switches, radiation monitors and power circuit breakers. Routinely, system health reports were issued on critical systems with expansion to all the systems underway. Also, at the end of the assessment period a more comprehensive set of performance indicators highlighting critical equipment and engineering processes for senior site management review on a monthly basis was issued. Self-assessments identified programmatic deficiencies such as the need to reduce engineering backlogs in the Fall of 1994, provide a more structured input into evaluating equipment deficiencies, utilize the vendor more frequently and problems with pump performance. The problem investigation process system provided an easy to use method to document problems. Problem investigation process trending provided a good perspective on emerging calculation and drawing errors. This trending was instrumental in identifying problems with drawing accuracy.

These diverse problem identification processes were not adequate to identify the collective deficiencies in the modification process even though there were operational problems with implementing modifications in 1994. Therefore, it was not until the March 18, 1995, loss of shutdown cooling, that management attention focused on the deficient implementation aspects of the modification process.

Once identified as a problem, resolution was normally good. While onsite, the team reviewed the comprehensive actions taken to rectify the modification process deficiencies which included the following: (1) establishing a management team focusing on process improvements, (2) establishing a cross-disciplinary team to review modification packages, (3) assigning a dedicated senior reactor operator-qualified individual to assist with modification package reviews and improve inter-organizational communications, (4) establishing an independent review of modifications with complex electrical isolations, (5) reducing the drawing backlog with a goal to maintain 99 percent of the drawings updated, and (6) establishing performance monitoring of modification quality. Consequently, modification quality improved. The development in the last part of the assessment period of the FIP enhanced engineering support to maintenance and provided a controlled method for reviewing equipment problems.

While onsite, the team reviewed the corrective actions to a number of long standing equipment problems. Effective corrective actions were being implemented to rectify deficient optical isolators which caused operational events including a reactor trip in 1994. Also, efforts were underway to deal with circuit board failures in the engineered safety features system. Some resolutions, though not addressing the root cause, ameliorated the deficiency and maintained the equipment operable with limited availability impact. Examples included the extensive service water system piping and valve replacement due to the corrosive nature of the water and replacement of the EDG batteries every other refuel outage due to the combined high temperature and high load demand for the type of batteries being used. There were exceptions such as the slow response to increasing reactor coolant pump seal leakage on Unit 2 and the inability to fully resolve component cooling water pump deficiencies associated with high bearing temperatures and operating at a sub-optimal point on the head flow curve.

Although normal inspection is recommended, inspection of structural matters such as piping and supports should be reduced. The re-directed resources should be applied to the licensee's new failure analysis and trends system initiative, rotating equipment improvements, and evaluating the system health reports. However, the same level of resources should remain committed to monitoring the upcoming steam generator replacement project.

6.0 PLANT SUPPORT - PERFORMANCE ASSESSMENT (SECURITY, EMERGENCY PREPAREDNESS, AND RADIATION PROTECTION)

Excellent performance was exhibited in the all the elements of emergency preparedness and security. Good performance was exhibited in numerous aspects of radiation protection; however, the quality of radiation protection with respect to ALARA and contamination control, especially during refuel outages, was uneven. Programs and procedures associated with radiation area postings and surveys were occasionally weak. The licensee normally identified problems, but the effectiveness of identification and resolution to those problems declined. Self-assessments were minimally effective.

6.1 Security

Consistent, excellent performance was exhibited in the all the elements. The security force was effectively supervised. Personnel were very well trained and understood their job responsibilities. The physical security plan fully defined the security requirements and the contingency plan implementation programs were a strength. With one exception, a detection equipment test, the security plan implementation procedures provided appropriate direction. And with rare exceptions, personnel properly implemented the security plan. Security equipment worked well with excellent intrusion detection features. Good equipment reliability existed with few compensatory measures needed. In addition, prompt corrective action to improperly performing equipment reduced the timeframe requiring compensatory measures. An exception in the corrective action element was repetitive vital door alarms which significantly contributed to loggable events. Eventually, the licensee applied added emphasis and resources to reduce the number of alarms.

In summary, reduced inspection in all the elements is recommended.

6.2 Emergency Preparedness

Consistent, superior performance was exhibited in all the elements. During the assessment period there was one activation of the emergency plan due to the offsite transportation of a contaminated, injured person. All aspects of the activation were handled properly. There were numerous exercises and drills which were successful with only minor, self-identified problems. Comprehensive evaluations of these drills and exercises were performed. A sufficient number of controllers and evaluators were used for an annual exercise as well as during quarterly drills which enhanced the evaluations and critique process. Problems from drills, exercises, and audits were properly resolved in a timely manner.

While onsite the team confirmed the licensee was implementing an aggressive emergency preparedness drill schedule and was capturing self-identified weaknesses in the problem investigation process. The team observed that the emergency response facilities and equipment were very good. Also, the licensee was continuing to improve the capabilities and reliability of emergency response centers and equipment.

There were significant personnel changes in key positions providing leadership and direction to the emergency preparedness function near the end of the assessment period. While onsite, the team determined that the change had not adversely impacted the effectiveness of the emergency preparedness organization, even though significant experience and leadership had been lost. The team verified significant experience remained within the emergency preparedness group and those personnel were appropriately supporting the new manager.

In summary, reduced inspection in all the elements is recommended.

6.3 Radiation Protection

Good performance was exhibited in all the elements of safety focus, quality of work and programs/procedures for the activities of radiological environmental monitoring, radiological effluent, plant water chemistry, personnel radiological monitoring, internal and external exposure controls, radioactive waste, and meteorological monitoring programs.

The quality of radiation protection with respect to ALARA and contamination control, especially during refuel outages, was uneven. Effective performance was apparent in high radiation exposure activities such as incore thermocouple funnel inspections and control rod assembly inspections were well planned and performed within the specified dose goals. All personnel exposures were within regulatory limits. Shielding was designated for installation at the most beneficial places for dose reduction. While onsite, the team witnessed proper response to a contaminated liquid spill within the auxiliary building, complicated by personnel contaminations. However collective radiation dose was negatively impacted during each refuel outage of the assessment period. Specifically:

- In 1995, in an effort to shorten the Unit 1 refueling outage management decided to perform a crud burst during a rapid cooldown in preparation for the Unit 1 refuel outage. Instead of reducing radiation levels as intended, the distribution of corrosion products in primary systems increased by a factor of four on some piping and increased radiation worker doses for the refueling outage by approximately 60 person-rem. Consequently, the collective refuel outage dose exceeded the established goals by approximately 64 person-rem. While onsite, the team concluded that the licensee did not fully understand the effect certain conditions would have on the crud burst process. Additionally, poor communications and the failure to rigorously challenge this change to a proven, successful evolution were the major contributors to the poor management decision.

- Of lesser significance, while onsite, the team ascertained that in 1995 some non-critical path work was allowed to proceed in the Unit 1 containment building prior to the installation of temporary shielding.

- In 1994, during the Unit 2 refuel outage, collective dose associated with re-work on a reactor coolant pump seal contributed to the licensee's failure to meet the outage dose goal.

- In 1993, during the Unit 1 refuel outage, inadequate planning, training, and procedures led to maintenance personnel improperly installing steam generator channel head bowl drain plugs and nozzle dams. Consequently, the job took an additional 30 percent dose (3.5 person-rem) over the goal to properly complete.

In general, the team determined the licensee was taking measures to correct previously identified problems. The licensee was attempting to do a better job of identifying re-work and taking corrective actions. A Rework Assessment Program was initiated in January 1995 to determine the root causes of personnel, equipment, procedural or programmatic failures. No significant exposures resulted from any one rework project in 1995. However, the licensee estimated total rework added approximately 8.3 person-rem (about 3 percent of the outage dose) during the Unit 1 1995 refuel outage. The licensee had recently made some progress in improving plant involvement in ALARA activities by assigning ALARA projects to various plant managers and requiring a plan to be developed for their implementation. Also, since the 1995 Unit 1 crud burst evolution, the licensee developed a crud burst procedure using proven techniques. The procedure was successfully utilized at another licensee facility. The licensee also planned to use additional personnel in the shielding installation reducing shielding installation completion from 100 hours to 48 hours.

Annual personnel contamination goals were exceeded in 1993, 1994, and 1995. Half way through the 1995 Unit 1 refuel outage, the outage goal was exceeded by 50 percent. A number of these Unit 1 contaminations were due to the ineffective crud-burst which increased the number of radioactive particles in the reactor coolant system.

Programs and procedures associated with radiation area postings and surveys were occasionally weak. This was evidenced by health physics personnel failing to identify and properly post a radiation area in an open area of the auxiliary building during the 1995 refueling outage. Also while onsite, the team observed other less safety significant posting discrepancies. When the discrepancies were identified to the licensee, the technician was unsure as to the posting requirements. Also, the team observed special radiological surveys made to support work activities and routine radiological surveys within the radiologically controlled area. The radiological surveys were adequate but could have been more thorough in some locations. For example, the use of large area swipes versus several 100 cm^2 swipes in the hot machine shop would have provided a more thorough and efficient contamination survey.

The licensee normally identified problems, but the effectiveness of identification and resolution to those problems declined. Early in the period, the licensee utilized Radiological Incident Investigation and Accountability Reports (RIIARs) to document minor radiological deficiencies and their corrective actions. The RIIARs were reviewed quarterly by the licensee staff and appeared beneficial in identifying minor radiation protection performance problems. The site problem investigation process was also used to document and correct more significant issues. However, the licensee abandoned the RIIAR process in 1994 and the problem investigation process was used to document radiological deficiencies. The threshold for entering radiological issues in the problem investigation process was higher than RIIAR with most of the radiation issues receiving the lowest problem investigation process priority assignment. While onsite, the team confirmed that the problem investigation process was not documenting minor, poor radiological work practices as frequently as the deleted RIIAR process due to the problem investigation process threshold. Also, the radiation protection issues described in most problem investigation processes had low priorities for resolution. Self-assessments in the radiation protection area were minimally effective. However, the licensee's response and corrective action completions to independent assessment findings improved late in the assessment period.

Reduced inspection effort is recommended for the radiation protection aspects of radiological environmental monitoring, radiological effluent, plant water chemistry, personnel radiological monitoring, internal and external exposure controls, radioactive waste, and meteorological monitoring programs for the elements of safety focus, quality, and programs and procedures. Normal inspection of problem identification/resolution in all aspects of radiation protection is recommended. Increased inspection is recommended in the quality of radiation protection element for ALARA and refueling outages, especially dealing with maintenance or operations that have tangible dose consequences if improperly performed.

7.0 SAFETY ASSESSMENT/CORRECTIVE ACTION - PERFORMANCE ASSESSMENT

Although slow, the licensee was normally effective at identifying problems. The effectiveness of self and independent assessment areas was variable. The licensee's ability to analyze and evaluate problems was not fully effective, especially in the area of human performance. Onsite Review Committee analyses were occasionally weak but, Offsite Review Committee evaluations were well focused. Problem resolution timeliness was poor at the beginning of the assessment period and significantly improved by the end of the assessment period. Corrective action effectiveness was mixed with normally good corrective actions to event identified issues.

7.1 Problem Identification

The licensee was generally effective at identifying problems. With the exception of the radiation protection area, the problem identification process provided a good mechanism for identifying problems to management. However, at one point in time during the first part of the assessment period there was an average of 11 days between event occurrence and problem investigation process initiation. Although, significantly improved to an average of 2 days by the end of the assessment period, 36 of the last 367 problem investigation processes generated were initiated greater than four days after the event. Eleven of these were generated at least ten days after the event and two were classified as more significant events. This situation is attributable to a lack of management emphasis in immediately initiating the problem investigation process.

The effectiveness of the combined self, and independent assessments in identifying problems in the functional areas was variable and to a large extend paralleled performance in these functional areas. The assessments in the functional areas of emergency preparedness and security were excellent in identifying the areas of weakness prior to significant operational events. With the exception of not identifying all the modification process weaknesses prior to the 1995 loss of residual heat removal (RHR) event, the combined self and independent assessments in the engineering area were instrumental in identifying performance weaknesses. Also, the licensee's presence at vendor and sub-vendor facilities involved in the fabrication of the replacement steam generators was a significant strength. Operations self-assessments were effective at identifying performance weaknesses during emergency and high risk mid-loop operations, and problems with valve mispositionings. Independent assessments of procedural adequacy and shutdown risk were excellent. However, neither self or independent assessments were effective at identifying problems associated with command and control during non-emergency conditions or the performance weaknesses in February to June 1995. Maintenance self-assessments in work control were weak until near the end of the assessment period. Conversely, independent assessments were effective in identifying the deficiencies with surveillance scheduling. Radiation protection assessments were minimally effective. During the Unit 1 1995 outage, the licensee's radiation protection staff was coping with staff reductions and increased radiation and contamination problems. However, an assessment conducted during the outage only documented findings dealing with administrative matters.

Multi-disciplined independent assessments improved. The self initiated technical audit (SITA) process improved through the use of outside expertise between the service water (early in the assessment period) and the component cooling water SITA (end of the assessment period). The significant event investigation team (SEIT) process, when used, was a strength in targeting performance errors associated with multi-functional areas.

While onsite, the team recognized that numerous changes were being implemented to improve the effectiveness of the licensee's self-assessment capability. These included appointment of one individual to "coach" the operating crews while on-shift. Also, a more comprehensive set of performance indicators was being assembled to provide earlier identification of problems to senior site management.

Although normal inspection is recommended, inspections of licensee assessments should be biased to those performed in operations, maintenance, and radiation protection. More emphasis should be applied to evaluating why the licensee's assessment process did or didn't work effectively when reviewing problems, especially when dealing with human performance.

7.2 Problem Analysis and Evaluation

The licensee's ability to analyze and evaluate problems was not fully effective. Following equipment failures, problem analysis and evaluation was generally good and initiation of the Failure Investigation Process was a significant enhancement. However, system trending of a predictive nature or on a generic component basis was only being implemented at the end of the assessment period. Also, late in the assessment period the licensee initiated a program for identifying and evaluating rework.

The reactive SEIT process, although of limited application, was an effective evaluation of human performance following significant events. The threshold for problem investigation process detailed root cause analyses was not centered on precursor events but on significant operational events consequently, this process was also somewhat reactive versus proactive. Also, the techniques used for analyzing human error were not fully effective. Therefore, following corrective action implementation, performance improved somewhat, but inappropriate human actions continued. There were a number of deficiencies associated with problem investigation process trending in the human performance area. At the beginning of the assessment period, personnel errors could not be coded to individual work units. Also, up until the end of the assessment period centralized cause coding was not being done. Even if uniformly cause coded, the codings had severe limitations except when dealing with drawing and calculational errors. Therefore, little insight was gained as to what truly were the casual factors behind human performance errors. Near the end of the assessment period, management acquired additional industry expertise to focus on analysis and evaluation of human performance. Also, while onsite the team observed the Safety Review Group performing centralized cause coding. Additionally, efforts were underway to expand how a problem investigation process was caused coded. The team observed that the licensee was trying to do more root cause analyses of less significant operational events, but substantial guidance was needed by senior supervision as to what method and to what detail the analysis would entail since administrative guidance had yet to be revised.

The analyses from the plant Onsite Review Committee, a committee created during the assessment period, were occasionally weak. Not until the end of the assessment period was operator performance discussed in committee minutes when considering restart from a reactor trip. Following the March 1995 reactivity event, although a number of members were consulted prior to continuation of startup physics testing, an onsite committee meeting was not convened. Evaluation of the "fast" shutdown and shortened crud burst cleanup time for the shutdown of Unit 1 for the 1995 refuel outage was not rigorous. Consequently, an opportunity to recognize deficiencies in these plans was missed. Conversely, Offsite Review Committee evaluations were well focused, especially beginning midway through the assessment period, with consistent emphasis on the degrading safety-related service water system. The committee appeared to be using substantial amount of external reviews with limited consideration of internal self or independent performance assessments. By the end of the assessment period, the Offsite Review Committee emphasized the internal assessment process as needing improvement.

The team recognized that the licensee was moving forward with a number of new initiatives in this element that appeared viable. However, the initiatives had yet to be implemented or had only been recently implemented, rendering an assessment by the team highly questionable. Therefore, this element is recommended for increased inspection. The increased inspection should focus on onsite review committee activities, Problem Investigation Process (PIP) improvements and root cause analysis changes. Inclusive in the inspections should be periodic evaluations that operational matters were receiving appropriate multi-disciplined review. Special emphasis should be applied to organizational and process changes. Routinely, the status of licensee's initiates for improving the PIP trending, proper cause coding and analysis of human performance should be monitored. Periodically PIP trends such be evaluated and key managers interviewed on how useful the information is. Periodic evaluation of what receives a root cause analysis should be performed.

7.3 Problem Resolution

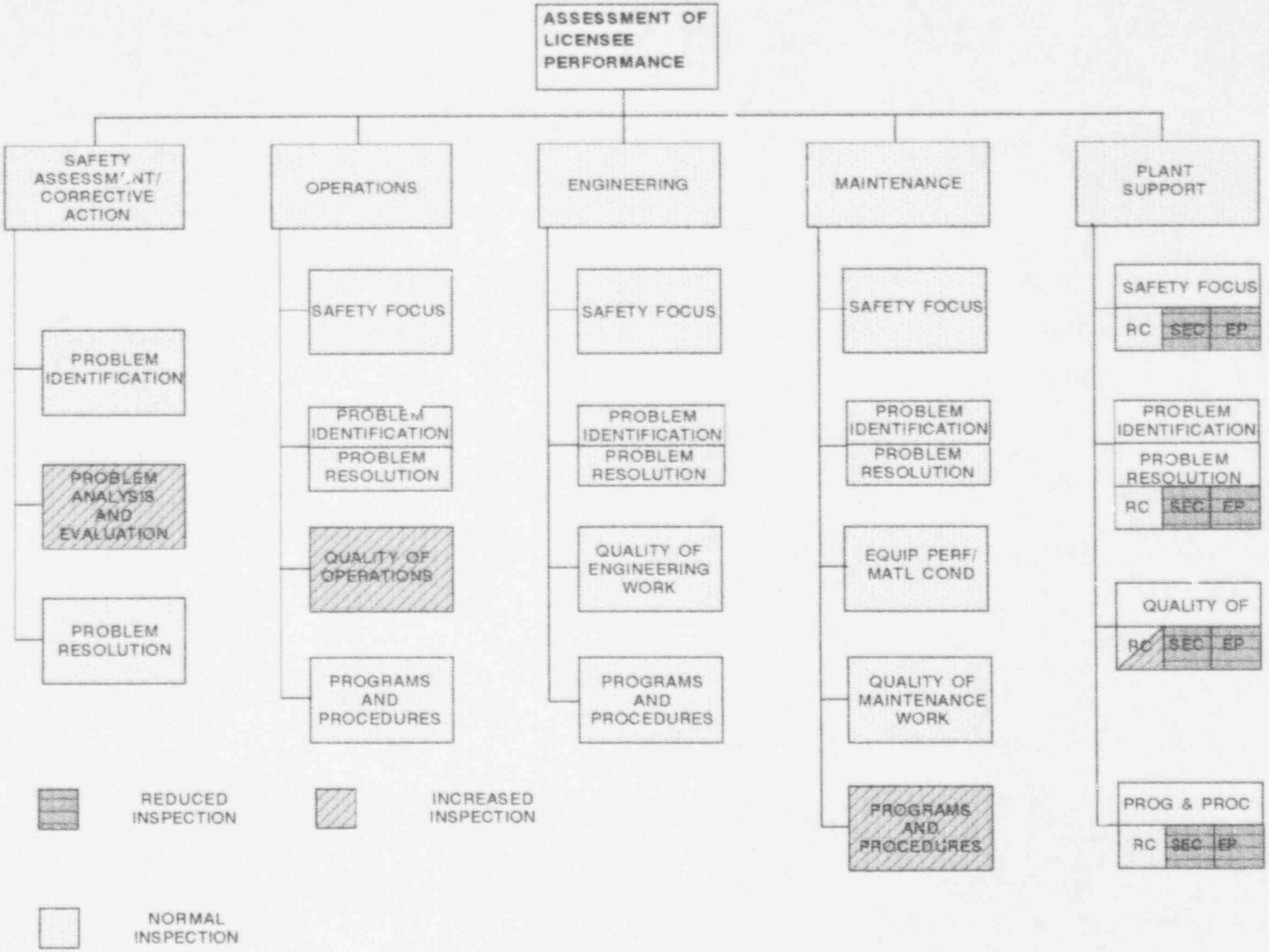
Problem resolution timeliness was poor at the beginning of the assessment period and significantly improved by the end of the assessment period. The average time to complete problem investigation process corrective actions reduced by almost one half from 237 days at the beginning of the assessment period to 134 days at the end. Corrective action effectiveness was mixed throughout the assessment period. Management emphasis areas associated with valve mispositionings and corrective actions showed improving performance throughout the assessment period. However, management was slow to take comprehensive corrective actions associated with missed surveillances, and mechanical maintenance during refuel outages. Also, human performance problems such as procedural adherence and seismically securing transient equipment have yet to be fully resolved. Corrective actions to event identified issues were normally good as evidenced by the corrective actions following the 1995 loss of RHR event and the reactivity event. Strong actions were taken to improve the modification process and extensive reactivity management assessments were performed. Although normally good, there were instances where licensee responsiveness to external initiatives were weak such as not trending the performance of a particular motor operated valve manufacturer or not completing electrical calculations supporting station blackout mitigation in a timely manner.

Due primarily to the significant improvement in the timeliness of implementing corrective actions in the problem investigation process, normal inspection is recommended.

8.0 EXIT INTERVIEW

At the conclusion of the site visit on August 18, 1995, the team met with representatives of the plant staff listed in Appendix B to discuss the results of the inspection. The licensee did not identify as proprietary any material provided to, or reviewed by the inspectors. The licensee did not express any dissenting comments.

CATAWBA
PERFORMANCE ASSESSMENT/INSPECTION PLANNING TREE



Enclosure, Appendix A

CATAWBA IPAP EXIT INTERVIEW
ATTENDEES LIST

LICENSEE PERSONNEL

G. Addis	Training Manager
A. Bhatnagar	Electrical System/Equipment Manager
C. Boyd	Modification Engineering Manager
B. Bright	Mech/Civil Eng. Equipment Manager
T. Byers	Security Manager
D. Cameron	North Carolina Municipal Power Agency
R. Casler	Operational Assessment Manager
S. Christopher	Emergency Preparedness
J. Cox	Engineering Supervisor, ESE, Powell
S. Coy	Radiation Protection Manager
P. Deal	ESS Customer Support Manager
W. Funderburke	Work Control Superintendent
T. Harrall	Maintenance Manager
J. Huddle	Business Management
J. Kammer	Mechanical System Engineer
W. McCollum	Site Vice President
W. Miller	Operations Superintendent
K. Nicholson	Regulatory Compliance
P. Pappas	North Carolina Electric Member Corporation
G. Peterson	Station Manager
J. Proffitt	Nuclear Engr TVA-Sequoyah
R. Propst	Chemistry Manager
D. Rogers	Maintenance Superintendent
J. Snyder	McGuire Nuclear Station
M. Tuckman	Senior Vice-President
R. Vigor	ESS-Maintenance Manager

NRC PERSONNEL

P. Balmain	Resident Inspector, Catawba
K. Barr	Acting Branch Chief, NRC, RII
H. Berkow	NRR Director PDII-2
N. Economos	Reactor Inspector
R. Freudenberger	Senior Resident Inspector, Catawba
J. Johnson	Deputy Director, DRP
R. Martin	NRR PDII-2
P. Prescott	Reactor Inspector
W. Rogers	Team Leader
S. Tingen	Reactor Inspector
G. Tracy	EDO Staff
R. Watkins	Resident Inspector, Catawba
F. Wright	Radiation Specialist