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Inspection Team: John D. Wilcox, Team Leader, NRR
Ronald D. Gibbs, Region II
Peter S. Koltay, NRR
Melanie A. Miller, Assistant Team Leader, NRR
Terrence Reis, Region IV
Darrell J. Roberts, NRR
Francis X. Talbot, NRR

NRC Consultants: Donald A. Beckman, Parameter, Inc.
R. David Butler, Parameter, Inc.
Gary G. Rhoads, Parameter, Inc.
David B. Waters, Parameter, Inc.

Prepared by: Melanie A. Miller — 1/3/91

Melanie A. Miller, Assistant Team Leader — Date
Team Inspection Development Section C
Special Inspection Branch
Division of Reactor Inspection and Safeguards
Office of Nuclear Reactor Regulation

Reviewed by: Robert A Gramm — 1/3/91

Robert A. Gramm, Chief — Date
Team Inspection Development Section C
Special Inspection Branch
Division of Reactor Inspection and Safeguards
Office of Nuclear Reactor Regulation

Approved by: Robert A Gramm for/ — 1/3/91

Wayne D. Lanning, Chief — Date
Special Inspection Branch
Division of Reactor Inspection and Safeguards
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

The U.S. Nuclear Regulatory Commission's Special Inspection Branch performed a team inspection of the maintenance program and its implementation at Catawba Nuclear Station, Units 1 and 2, November 12 through 16 and November 26 through 30, 1990. The inspection included detailed observations of maintenance work in progress, plant area and system walkdown inspections, and a review of maintenance records and documented program requirements. The team followed NRC Maintenance Inspection Guidance, dated September 1988, and Temporary Instruction 2515/97, dated September 22, 1989, for this inspection.

When considering all aspects of a maintenance program as defined by the Maintenance Inspection Tree, the Catawba maintenance program and performance are judged to be adequate. However, areas for improvement and areas requiring increased management attention were identified in most areas inspected. The inspection team evaluated three major areas corresponding to three segments of the Maintenance Inspection Tree: (1) overall plant performance related to maintenance, (2) management support of maintenance, and (3) maintenance program implementation. The three major areas encompass the eight elements of the Maintenance Inspection Tree.

The inspection team judged the area of overall plant performance related to maintenance satisfactory, although they identified numerous deficiencies in general housekeeping and the material condition of the plant, usually in out-of-the-way plant locations. Site programs have not been fully effective in identifying and resolving these concerns.

Overall, management support of maintenance, which includes the elements of "Management Commitment and Involvement," "Management Organization and Administration," and "Technical Support," was judged to be satisfactory. Particularly noteworthy was the industrial safety program and the productive interaction between the maintenance crafts and support groups, including Maintenance Engineering Services. Although Nuclear Production Department goals were in place, goals for the maintenance area were not formally established, and maintenance goals were not communicated throughout the organization. Although management vigor was evident in many areas, the level of management visibility was low. In addition, the team found several instances in which proper document control was not exercised.

Maintenance implementation, which includes the elements of "Work Control," "Plant Maintenance Organization," "Maintenance Facilities, Equipment, and Materials Control," and "Personnel Control," was adequate. The licensee's recent improvements in the post-maintenance testing program were evident, and the calibration and standards laboratory was outstanding. The area of personnel control, including staffing, training, and current status, was a strength. However, the team identified numerous significant weaknesses regarding (1) work in progress and the failure of mechanical maintenance and contracted personnel to follow procedures, (2) administrative and technical procedures, (3) the control of contracted maintenance, (4) the deficiency identification system, and (5) control of material shelf-life. The number of these findings, particularly regarding work in progress, was significant because of the operational status of the plant and the associated relatively low level of maintenance activity. The quality of training and the high experience level of the craft personnel lessened the effect of the procedural problems. However, the team was concerned that the capabilities of craft personnel were being overly relied upon in lieu of identifying problems with, and improving, procedures currently in use.

In summary, of most significant concern were the lack of procedural adherence by mechanical maintenance and contractor personnel, inadequate technical and administrative procedures, and ineffective licensee oversight of contractor personnel.

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1.0 INTRODUCTION

The U.S Nuclear Regulatory Commission (NRC) considers the effective maintenance of equipment and components to be very important in ensuring safe nuclear plant operations. The Commission issued a Policy Statement on March 23, 1988, that states:

> It is the objective of the Commission that all components, systems, and structures of nuclear power plants be maintained so that plant equipment will perform its intended function when required. To accomplish this objective, each licensee should develop and implement a maintenance program which provides for the periodic evaluation and prompt repair of plant components, systems, and structures to ensure their availability.

To ensure effective implementation of the Commission's maintenance policy, the NRC staff developed a major program to inspect and evaluate the effectiveness of licensee maintenance activities. This inspection was one of a series of inspections being performed by the NRC to evaluate the effectiveness of maintenance activities at licensed power reactors. The inspection was conducted in accordance with the guidance provided in NRC Temporary Instruction 2515/97 and the NRC Maintenance Inspection Guidance.

The onsite inspection focused on maintenance work in progress and on licensee activities supporting this work, which included support provided by the engineering and training organizations. Maintenance activities were selected for inspection on the basis of the scope of work in progress during the inspection, recent failures of safety-related equipment, special items of interest, and NRC inspection experience.

The NRC team leader held daily meetings with plant management to summarize the inspection team's findings and to identify areas requiring additional information. A summary of the inspection team's findings, including a presentation of the Maintenance Inspection Tree, was discussed with the licensee's representatives at the exit meeting on November 30, 1990.

The Maintenance Inspection Tree (see Appendix C) is divided into three major areas: I, "Overall Plant Performance Related to Maintenance," II, "Management Support of Maintenance," and III, "Maintenance Implementation." The major sections of this report (2.0, 3.0, and 4.0) parallel the three tree areas. Each of these major tree areas is composed of one or more elements. Each element in turn is divided into two to ten subelements. The element and subelement boxes (except Element 1.0) are split in half diagonally; the upper left triangle represents the programmatic components of a given maintenance area, while the lower right triangle represents the implementation of the program. The upper and lower portions of a subelement are evaluated separately. The team evaluated each element and subelement and assigned a rating to each of good, adequate, or inadequate. Appendix C contains the completed Maintenance Inspection Tree.

The elements and subelements of the Maintenance Inspection Tree are structured to address all aspects of a maintenance program at a nuclear power plant. In order to thoroughly accomplish this, some areas of one element may overlap areas of another element. As a result, certain inspection items may appear in several sections of the report, and based on the significance of the examples, may contribute to good or inadequate findings in more than one area. For example, the deficiencies identified during the performance of mechanical maintenance contributed to the inadequate findings in "Review of Maintenance in Progress" (Section 4.1.1) and "Mechanical Maintenance" (Section 4.2.1). Conversely, the positive role of Maintenance Engineering Services (MES) supports good evaluations in both "Internal/Corporate Communication" (Section 3.3.1) and "Support Interfaces" (Section 4.2.6).

2.0 OVERALL PLANT PERFORMANCE RELATED TO MAINTENANCE

This part of the inspection, which included Element 1.0 of the Maintenance Inspection Tree, assessed overall plant maintenance. The maintenance inspection team conducted plant systems walkdown inspections and direct inspections of completed work, plant housekeeping, and the material condition of the plant. The team reviewed historical plant data to assess the effect that maintenance had on plant availability, operability, and reliability.

2.1 Historic Data

Element 1.0, "Direct Measures," relates historical data and direct observation of the material condition of the plant to maintenance activities. The historical data indicate that Catawba has had a good operating record. The forced outage rates for Units 1 and 2 were consistent with the industry average (although Unit 2 was slightly worse than average) and showed an improving trend.

However, numerous events had occurred related to maintenance or surveillance activities or equipment malfunction. Of 47 licensee event reports (LERs) that were submitted since January 1990, 22 were related to maintenance or surveillance activities. Of these 22 LERs, 7 were shutdowns or initiations of shutdown required by the Technical Specifications (TSs). Ten others were TS violations while two LERs were engineered safety feature actuations. Repeated maintenance problems have occurred involving the control room and the auxiliary building ventilation systems.

The licensee's performance indicators for the six quarters ending May 1990 showed Catawba Units 1 and 2 to be worse than the industry average with regard to safety system actuations, safety system failures, and equipment forced outage rates. Additionally, Unit 2 was slightly below the industry average in its forced outage rate and had more than the average number of significant events.

The performance indicators and the number of LERs attributable to maintenance indicated that some plant performance problems were directly attributable to the manner in which maintenance activities were conducted.

2.2 Plant Walkdown Inspection

The well-traveled areas of the plant were generally adequately maintained; however, numerous examples of poor housekeeping and deficient material conditions in other areas of the plant were noted. Plant programs were ineffective for identifying and correcting these types of problems. Examples of these problems are given below.

(1) The auxiliary building room 425 had many housekeeping problems. This area was a high-radiation area, and the door was kept locked. The major problem was the amount of material on the floor, including anti-contamination material, wrenches, trash, and other items.

(2) The auxiliary building 522-foot level had anti-contamination clothing stuffed behind wall supports, and loose bolts and brackets were left on the floor.

(3) The Unit 2 condenser circulating water pump area had many housekeeping problems around a CCW motor repair area.

(4) A pipe clamp and loose nuts and washers were laying in the Unit 1 turbine-driven auxiliary feedwater (AFW) pump pit. In several instances tape had been left wrapped around pump inlet and outlet piping from previous maintenance activities.

(5) The safe shutdown facility (SSF) switchgear room had loose nuts and bolts on a handy-lift platform with no evidence of work in progress.

(6) The emergency diesel generator (EDG) rooms had the following problems:

- Lube oil was leaking heavily at the EDG 1A crankcase #8L explosion door.

- Many oil- and cleaner-soaked rags were scattered around air compressors and in the engine pedestal gutters in the EDG 2B room.

- The overhead trolley crane hooks, chains, and pendants in all of the EDG rooms were not secured and were swinging freely, which could cause potential damage to instrumentation tubing and equipment.

- The EDG 1A lube oil pit was excessively oily and dirty and needed to be cleaned.

(7) The cable raceway area of the switchgear room of the SSF contained substantial fumes, and water and oil were found in the power cable pit behind the switchgear control panels.

(8) Containment spray pump room 1B had an improperly erected scaffold. The scaffolding, no. 41932, erected on October 15, 1990, blocked the manual operator of motor-operated valve MOVINS03B. This valve isolates pump suction for the refueling water storage tank. Additionally, the electrical power cables to the valve motor operator were routed between the scaffolding platform and the valve handwheel, leaving insufficient clearance for scaffold movement during a seismic event. This condition was not in accordance with the licensee's procedure 0/B/7650/115, "Building/Erection and Removal of Scaffolding," section 11.6.8, which stated that scaffolding should not be placed within 2 feet of items that

could be damaged if a scaffold moves during a seismic event. This example of failure to follow procedures is included in Appendix A, Unresolved Item 90-201-03.

(9) Uncontrolled operator aids were identified on remote control/annunciator panels. Panel 1CMPDCP had "Information Only" prints taped to the inside door and marked-up control prints (dated 1985) were found in the panel's door pockets. The door to panel 2ELP0019 was open, various notes and data were written directly on the door, terminal strip covers inside the cabinet were not secured, and calculations had been written on the front of the instrumentation control panel. Poor housekeeping practices were noted inside control panel 1ELCP0019.

These problems were pointed out to the licensee as they were discovered, and the licensee corrected many of them before the end of the inspection. Although the material condition of the plant was satisfactory, a number of specific areas required attention and improvement.

3.0 MANAGEMENT SUPPORT OF MAINTENANCE

This part of the inspection (Elements 2.0, 3.0, and 4.0 of the Maintenance Inspection Tree) assessed site and corporate management's support of the establishment and implementation of an effective maintenance program. The team evaluated management involvement in the organization and administration, resource allocation, and technical support provided to the maintenance organization, as well as cooperation between the maintenance organization and other onsite and offsite organizations. To provide a basis for its assessment, the team evaluated the maintenance plan documentation, self-assessment measures, definition of maintenance requirements, and accountability.

3.1 Management Commitment and Involvement

The team interviewed personnel, reviewed applicable documentation, and assessed management involvement in activities that ensure an effective maintenance program, such as self-assessment, training, and program review.

3.1.1 Application of Industry Initiatives

The licensee had established a procedure to ensure that industry initiatives applicable to the nuclear power plants were received, evaluated, and incorporated into the maintenance program.

The Nuclear Production Department (NPD) Directive 4.8.1(1), Revision 1, "Operating Experience Program Description," provided controls for the receipt, screening, distribution, and tracking of operating experience information. This information included Institute of Nuclear Power Operations (INPO) documents, vendor information letters, and such utility-initiated operating experience programs as problem investigation reports (PIRs) and licensee event reports (LERs). The procedure was comprehensive and established responsibilities and accountabilities.

A draft Regulatory Compliance procedure entitled "Bulletins, Generic Letters and Other NRC Requests for Action/Information" provided the criteria for required actions and responses to NRC documents and was scheduled to be issued by the end of 1990.

The team verified that corporate and site managers took an interest in industry initiatives and routinely participated in industry-sponsored programs such as Electric Power Research Institute (EPRI) and INPO workshops.

The team concluded that corporate management was committed to the evaluation of industry events and initiatives and to the dissemination of pertinent information to the plant.

3.1.2 Management Vigor and Example

Corporate and plant managers demonstrated a strong commitment to plant maintenance. However, several important management tools that would strengthen the ability of management to assess program implementation and compliance were neither proceduralized nor uniformly applied by the various maintenance department managers.

The audits conducted by the Catawba Safety Review Group were generally initiated following significant operational events and were concentrated in the areas of system/component availability and reliability, operations personnel, and equipment surveillance. The six evaluations conducted in 1990 did not assess the conduct of the maintenance department or the implementation and management of the maintenance program. Another method of auditing was the Nuclear Safety Review Board reviews of two operational activities per year. Again, no comprehensive assessment of the maintenance department was included in the reviews. Another audit tool available to the licensee, the Self-Initiated Technical Audit, was scheduled to be performed every 18 months. The one report prepared for Catawba addressed the operational readiness of shared motor control centers.

In summary, the audits reviewed had a narrow scope. It appeared that the existing licensee audit programs were designed to conduct in-depth evaluations of operational events when so requested by station management.

All department managers articulated an interest in establishing performance indicators, setting departmental goals, and initiating new programs. However, there was a lack of formality and consistency among the departments in implementing and tracking such indicators, goals, and initiatives. For example, although managers agreed that maintenance procedures should contain enough detail to accomplish a job and workers should adhere to such procedures, the team noted that some procedures were inadequate and some maintenance personnel did not adhere to procedures as discussed in Section 4.1.7 of this report.

No formalized mechanisms existed to provide adequate feedback to the managers regarding the implementation of several of their programs, such as post-maintenance cleanup, procedural adequacy, and general housekeeping. Managers and superintendents had not scheduled nor conducted periodic plant tours to assess plant material conditions or observe ongoing routine maintenance activities. Impromptu management tours were conducted but were neither documented nor followed up to ensure that corrective action was taken.

Management had committed resources to initiate several programs to increase system and equipment reliability and to strengthen preventive maintenance programs. For example, the licensee completed a reliability-centered maintenance (RCM) pilot program which evaluated the emergency diesel generators. Two additional systems were scheduled for an RCM review in 1991. Also, Technical Support Documents were being developed to provide relevant guidance for 180 components and maintenance activities. At the time of the inspection, this program was 50 percent completed and was expected to be fully implemented in 1991. Further, the licensee developed and implemented a comprehensive testing and maintenance program for motor-operated valves. The licensee also planned to implement a computerized maintenance data base system, the Work Management System, starting in December 1990.

Although management vigor was evident in many areas, the level of management visibility in the field was low. Existing periodic audits met the requirements of the Technical Specifications for evaluating designated activities and for the review of plant operating experiences. However, the existing program did not appear to be effective in assessing maintenance activities in a manner that would prevent the programmatic problems identified during the inspection.

3.2 Management Organization and Administration

To evaluate the effectiveness of the management organization in the administration of the maintenance program, the team reviewed the maintenance program; maintenance policy, goals and objectives; allocation of resources; identification and definition of maintenance requirements; performance measurements; the document control system; and the maintenance decision process.

3.2.1 Program Coverage for Maintenance

The maintenance philosophy and organizational responsibilities were delineated in the Station Directives and the Maintenance Manual. The 3.3 series of the Station Directives discussed maintenance program requirements and responsibilities, including such major maintenance activities as work request preparation, equipment qualification, and preventive maintenance. The Maintenance Manual contained the detailed administrative-type procedures related to the conduct of maintenance organization activities.

Although there were weaknesses with the licensee's performance of required reviews of Station Directives and in some of the individual administrative procedures as discussed in Section 4.1.7(2), the program coverage was adequate.

3.2.2 Policy, Goals, and Objectives for Maintenance

The NPD 5-year business plan contained high standards with regard to corporate incentive goals and NPD visions and goals for 1990. The primary nuclear department vision was to be the "best operators of nuclear plants in the world and recognized as such." However, no formal program existed for establishing goals and objectives at the maintenance department level. Personnel stated that many managers and supervisors saw the monthly performance indicators as their "goals."

Many of the performance indicators used by the licensee were either directly or indirectly related to the maintenance department. Such items as material condition of the plant, work request backlog, specific system unavailability rates, and the ratio between preventive maintenance and total maintenance were tracked and published on a monthly basis. In addition, some supervisors and managers had informally established their own goals, such as limiting the amount of valve rework being performed.

The informality of the goal program at the supervisor and manager level did not provide individual supervisors and managers with sufficient goals or objectives to monitor their performance. However, the overall direction and thrust of this area was adequate.

3.2.3 Allocation of Resources

The maintenance department had a staff of approximately 580 people to perform maintenance and to provide the necessary maintenance support and engineering functions. The turnover rate in the maintenance department was low. The maintenance organization did not routinely use full-time contractor personnel. Such personnel were used during outage periods and to perform specific activities, but the majority of work was performed by in-house employees. The establishment and implementation of the maintenance engineering services (MES) group was considered a strength (see Section 3.3.2 for further discussion).

Station Directive 3.0.8, "Control of Overtime Hours," dated January 14, 1990, discussed the method for controlling overtime within the guidelines established by the NRC in Generic Letter 82-02, "Commission Policy on Overtime," dated February 8, 1982 and Catawba Technical Specification 6.2.2. This program appeared to be properly implemented and overtime work in excess of the licensee's guidelines was being properly approved. However, more than 175 overtime extensions had been approved thus far in 1990, and many of these actions included approval for several people.

Although the team felt that the amount of approved overtime extensions was more than expected in a maintenance organization, the overall allocation of resources for maintenance, including maintenance staffing, was adequate.

3.2.4 Maintenance Requirements Defined

Maintenance requirements were controlled by the procedures contained in the Maintenance Manual. All maintenance programs, such as those for preventive maintenance, equipment qualification, and lubrication also were delineated in maintenance manual procedures. Maintenance requirements of safety significance were covered by the procedures, with the exception of those discussed in Sections 4.1.7(2) and 4.1.7(3) of this report.

The overall program and its translation into working procedures were adequate.

3.2.5 Performance Measurements

The licensee's performance indicators provided maintenance and plant management with information on some critical maintenance parameters. Although these parameters were not widely disseminated, most personnel questioned appeared to be aware of the indicators and the status of the performance. The use of the performance indicators was adequate.

3.2.6 Document Control System for Maintenance

Numerous examples of problems existed in the document control program. The major problems are addressed below.

(1) In one instance a red-lined, control room drawing had not been updated in accordance with the latest drawing revision. Drawing CN-1553-1.0, Revision 15, a reactor coolant system flow diagram, had changes associated with nuclear station modifications (NSMs) 10753 and 11103 red-lined on the drawing located in the control room area stick files. However, the associated drawing aperture card located in the tagging center revealed a later revision of the drawing, which incorporated one of the NSMs. Document control had issued revised drawings incorporating both modifications, but these later drawings had not been sent to the control room stick files or the tagging center files. The deficiency was not considered safety significant because the control room drawing information was consistent with the revised as-built drawing.

An audit of the control room drawings conducted in August 1990 by the responsible operations support group had identified this problem. However, corrective action was not taken for more than 3 months, contrary to step 9.5 of Operations Management Procedure (OMP) 2-10, "Control Room Drawing Maintenance," Revision 1. This is an example of inadequate corrective action (see Appendix A, Unresolved Item 90-201-04).

(2) As previously identified in Section 2.2, various remote control/annunciator panels contained "Information Only" and marked up control prints dated 1985. Various notes and data were written inside the back door of panels, and calculations were written directly on the face of the panel next to control and recording instrumentation. These practices were not consistent with good document control.

(3) An uncontrolled operator aid was located on the incore instrumentation control panel, 2INIC0001. A yellow "Post-it note" with a precaution regarding detector B insertion was found adjacent to the control switches. Subsequent discussions with performance section personnel indicated that these directions did not exist in any formal procedure and were not intended to be part of normal operating practices.

(4) During the bearing replacement on the control room area HVAC air-handling unit, the craft personnel had used an unapproved procedure (i.e., an unapproved vendor manual) to perform maintenance activities (see Section 4.1.1 for further discussion). This is an example of failure to follow procedures (see Appendix A, Unresolved Item 90-201-03).

(5) Maintenance personnel used an uncontrolled circuit print located inside the air-handling unit 1TD-AHU-3 control panel while performing work request 543870PS because they could not locate a controlled drawing of the electrical circuit. This is an example of failure to follow procedures (see Appendix A, Unresolved Item 90-201-03).

Based on the above identified deficiencies, the site document control program implementation was lacking.

3.2.7 Maintenance Decision Process

The Nuclear Production Department 5-year business plan indicated that modification projects were being identified and prioritized for future action. Further, corporate personnel were involved in the industry efforts presently under way regarding plant aging. However, because of the relatively young age of the facility, most site personnel were not familiar with these efforts. Because the team found no deficiencies, this area was judged to be satisfactory.

3.3 Technical Support

The team evaluated the extent of technical support for maintenance, including establishment of internal and corporate communications channels, engineering support, the role of risk assessment in the maintenance process, the role of quality control, integration of radiological controls into the maintenance process, safety review of maintenance activities, and integration of operating experience and regulatory documents into the maintenance process.

3.3.1 Internal/Corporate Communication

The primary formal means for communicating and resolving identified technical issues between groups was the problem investigation report (PIR) process as described in Station Directive 2.8.1, "Problem Investigation Process and Regulatory Reporting." Anyone could initiate a PIR; once initiated, the PIR was tracked by the technical services' compliance section. If maintenance personnel initiated the PIR, they interacted as necessary through the evaluation and resolution phase with other licensee organizations. Participation and agreement with proposed actions was documented on the PIR form. The PIR process is discussed further in Section 3.3.4, and identified deficiencies associated with the PIR process are discussed in Section 4.2.4 of this report.

Modification requests, initiated on station problem reports and processed using variation notices for minor modifications, or NSM forms for major identifications, were another formal means for interaction between maintenance and the onsite and offsite organizations that performed a design engineering function such as project services and design engineering.

Many informal communication channels existed between the maintenance organization, including MES, and other organizations. Maintenance personnel felt free to contact other groups to consult on technical issues and solicit assistance. Especially noteworthy was the willingness exhibited by the craft personnel to contact MES engineers with questions or requests for assistance. The support provided by MES was a strength.

The licensee's internal and corporate communications programs were adequate, and implementation of these programs was a strength.

3.3.2 Engineering Support

The licensee had two onsite engineering organizations providing support for plant maintenance and modifications. The first organization was MES, one of five groups within the maintenance department. The types of support MES gave maintenance craft personnel included, but was not limited to, trending and failure analysis, troubleshooting, qualifying and procuring parts and components, and procedure development and periodic review. The other onsite engineering organization was project services, one of five groups reporting to the superintendent of integrated scheduling. Project services produced the documentation to support variation notices (the process to handle evaluation of minor modifications). The work packages and documentation that were reviewed, and that supported completed variation notice packages, were thorough and well prepared. The design engineering group in the corporate offices in Charlotte, North Carolina also supported the maintenance function. This organization was responsible for evaluating and developing documentation to support major modifications outside the scope of the project services group.

Both onsite engineering organizations were developing manuals to strengthen their functional capabilities. MES had completed approximately 50 percent of its Technical Support Documents. This set of documents included a variety of component and system information to aid MES engineers, including component descriptions, design-basis information, applicable commitments, preventive maintenance effectiveness and schedule, and as-low-as-reasonably-achievable (ALARA) responsibilities. The Project Services Manual documented administrative policies and described processes associated with such items as various types of modifications, variation notices, station problem reports, and fabrication work requests. Both manuals were worthwhile undertakings anticipated to be complete in 1991.

The lack of a failure determination and analysis program was a weakness in engineering support. Station Directive 3.3.14, "Station Work Management System Failure Analysis and Trending Program," was no longer used, but had not been replaced. The lack of a programmatic procedure resulted in occasional cases where detailed analyses should have been considered and initiated, if necessary, but were not. One example was the multiple control rod drive shaft failures over three outages beginning on Unit 2 in May 1989. The team concluded that this series of failures could have been identified as a potential failure analysis topic earlier had the appropriate criteria been available.

The failure analyses performed by engineers in MES ranged in formality: Some were detailed, formal reports addressing such items as event description, equipment teardown findings, vibration data, system investigation and corrective actions; others were informal internal office communications transmitted by computer. The formal failure analysis reports were complete and well documented. However, the failure analysis program did not provide (1) criteria for determining when a particular type of failure analysis is needed, (2) the items that need to be considered, and (3) a means for maintaining such information for future reference.

The system engineering function was divided between the system engineers in the performance section and the engineers in MES. The performance system engineers focused on system surveillance tests and overall system knowledge while MES engineers focused on components, trending, preventive maintenance, and troubleshooting. However, the large turnover and limited experience of the performance system engineers was a weakness in engineering support. This contributed to a low level of plant familiarization displayed by the performance section system engineers.

Although the programs and implementation associated with engineering support were adequate, weaknesses were associated with the lack of a rigorous failure analysis program and the level of knowledge and experience among performance system engineers.

3.3.3 Role of Risk Assessment in the Maintenance Process

Risk assessment was not a formal part of the licensee's planning, prioritization, and scheduling of maintenance work. The licensee, however, was sensitive to technical-specifications-type considerations associated with equipment removed from service. OMP 2-29, "Technical Specifications Action Item Log," included detailed information and tables to define situations when major equipment is inoperable and when supporting systems are required for system operability. The Technical Specification Interpretation Manual discussed such topics as safety system unavailability. OMP 2-18, "Tagout Removal and Restoration Procedure," included guidance associated with equipment removed from service.

The licensee had developed a Level III probabilistic risk assessment (PRA) in August 1987 and planned to update it in 1991 to comply with the NRC's individual plant examination requirements. The licensee had begun to take steps to incorporate component and system significant information obtained from PRA analyses into its maintenance program. A pilot reliability-centered maintenance (RCM) program was initiated in 1989; a consultant evaluated the diesel generator and its support systems and provided data and recommendations supporting an optimized maintenance program to maximize diesel availability. The licensee planned to combine this information with that obtained from the 5-year diesel teardown to support future surveillance and maintenance requirement revisions. The licensee planned to utilize consultants to continue the RCM program in 1991 and to evaluate two additional safety-significant systems. The licensee's intent was to assign one MES engineer full time to the effort to expand in-house RCM capabilities.

The licensee's process for prioritizing work dealt with risk in a broad sense. The unit manager's group, a support staff for operations which prioritized work requests and interfaced regularly with the integrated scheduling and planning group to prioritize planned and unplanned work, was aware of broad risk considerations (e.g., simultaneous train A/train B maintenance and initiation of safety system maintenance during plant coastdown to an outage). The Unit 2 unit manager indicated that these broad risk assessments were considered routinely although not proceduralized for the unit manager's engineers.

The licensee had begun to implement initiatives that could improve the risk component of the maintenance function. In addition to the RCM program, another recent initiative included a steering committee formed in October 1990 that would evaluate and recommend ways to reduce unavailability of select safety systems, including the emergency diesel generator, auxiliary feedwater, nuclear service water, and emergency core cooling systems. The committee's activities should help reduce risk exposure.

Although no formal risk assessment program existed, the application of risk assessment was adequate because of the licensee's general consideration of risk and positive initiatives in this area.

3.3.4 Role of Quality Control

Chapter 17 of the Final Safety Analysis Report (FSAR) and the Quality Assurance Program Administrative Procedure Manual controlled the identification, evaluation, and correction of deficiencies. Procedure QA-150, "Nonconformance/Problem Investigation Report Trend Analysis," identified the PIR process as the primary means for the quality assurance/quality control (QA/QC) organization to identify nonconformances. This procedure required that safety problems and potentially reportable items be identified on a PIR. The PIR process was coordinated and maintained by the technical services' compliance section. Although QA/QC did not track directly those PIRs that members of their organization identified, QA/QC was required to review and approve the proposed resolution as well as verify the completed corrective action. See Sections 3.3.1 and 4.2.4 for additional discussion on the PIR process.

Unlike the PIR process, the corrective action report (CAR) system was a QA/QC-controlled system throughout the initiation, resolution, tracking, escalation (as needed), and corrective action. The QA/QC surveillance group was responsible for identifying CARs; CAR description and status (corrected or uncorrected) was reported in a quarterly report to the station manager. Procedure QA-122, "Corrective Action Escalation Policy," provided a means to identify and escalate to higher management those CARs that had not been adequately resolved by the responsible organization. Although not frequently used, this was an effective corrective action tool.

The QA/QC group had two additional mechanisms to inform appropriate management of identified deficiencies. The first was a work request problem report that was provided monthly to MES or the job sponsor. The report documented deficiencies identified during QA/QC's review of completed work packages. The second was the monthly inspection results/reject rate report that summarized the number of rejected activities and explained the substance of each, giving maintenance management some insights into the problem that needed to be corrected.

Based upon inspection activities, QA/QC involvement in maintenance was adequate. However, the team was somewhat concerned that either QA/QC had not identified previously procedural adequacy and adherence problems and/or station management had not adequately addressed such QA/QC findings when identified in the past.

3.3.5 Integrate Radiological Controls into the Maintenance Process

The radiological controls program was implemented in accordance with the Systems Health Physics Manual, Maintenance Manual Procedure 1.9 ("ALARA Planning"), and such station directives (SDs) as 3.8.1 ("ALARA Program"), 3.8.2

("Respiratory Protection Program"), 3.8.3 ("Contamination, Prevention, Control and Decontamination Responsibilities"), 3.8.5 ("Exposure Extensions and/or Exposure Limit Reductions"), and 3.8.8 ("Radiological Work Practices").

The radiological controls were adequately implemented into the maintenance process, and the health physics (HP) group gave satisfactory support to maintenance activities. Specifically, HP conducted pre-job briefings for maintenance work as required. Additionally, informal communications between HP and maintenance and between HP and the planning group effectively aided the maintenance process.

However, some weaknesses were identified in site radiological controls. Positive control over both the issuance of dosimetry and the dose card system was lacking. Both rely heavily on the individual: first, to select and return the correct dosimetry from open access bins and second, to accurately fill out and return the dose card. Also, SD 3.8.8, step 5.17.3.4, which required that all personnel entering the single-point access, or radiation-controlled area, contact HP or be enroute to the HP office, was not being implemented.

The as-low-as-reasonably-achievable (ALARA) reporting and feedback mechanisms, such as ALARA problem reports, ALARA improvement notices, ALARA job observation reports, and ALARA post-job critiques, were comprehensive; they were, however, only used in a limited sense. Only 3 ALARA improvement notices were issued in 1984, 4 in 1989, and 10 in 1990 as of September 29. Of these 17 notices, 10 remained unresolved. Also, a 38-percent midyear increase in site dose projection had been identified. However, no ALARA committee meetings had been held since November 1, 1989, and there were no immediate plans to hold any meetings.

The incorporation of radiological controls into the maintenance process was adequate, although attention is required to address identified programmatic weaknesses and lack of ALARA committee involvement.

3.3.6 Safety Review of Maintenance Activities

A highly visible program existed in industrial safety and fire protection as defined in Sections 2.11, "Personnel Safety," and 2.12, "Fire Protection," of the Station Directives. The industrial safety organization had a staff of seven, including supervisors, which functioned as "safety partners" to the individual craft groups; that is, one was dedicated to mechanical maintenance (MM), another to instrumentation and electrical (IAE), and so forth. One of the individuals was a professional industrial hygienist, and the others had extensive training in industrial hygiene and requirements of the Occupational Safety and Health Administration. The three people in fire protection were state-certified fire protection instructors.

For 1990 through November, the licensee had only 2 lost-workday cases per 2,118,061 hours worked and was meeting the goal for recordable injuries.

Programmatically, industrial safety and fire protection was a strength; however, there were several examples of failure to implement the programs. On August 16, 1990, a fire occurred at EDG 2B, which was caused by spilled fuel oil that had not been cleaned up. Emergency eye wash stations were in unusable conditions. Several inches of diesel fuel and water were found in the safe shutdown facility (SSF) power cable pit. In addition, there were numerous examples of failure to clean up work areas as described in Section 2.2.

Although the industrial safety and fire protection programs were viewed as strengths, program implementation was lacking.

3.3.7 Integrate Regulatory Documents

The integration of operating experience information into the maintenance process is discussed in detail in Section 3.1.1. The licensee's incorporation of amendments to the FSAR and Technical Specifications into the maintenance process was controlled by Station Directive 2.1.7, "FSAR and Technical Specification Amendment Processing and Interpretation." This procedure described the process for reviewing and implementing changes to the FSAR and Technical Specifications into procedures or administrative policies by various station groups. The procedure included implementation provisions to ensure compliance by the effective date.

The licensee's program for incorporating operating experience information and changes to regulatory documents into the maintenance program was adequate, no deficiencies were identified, and the licensee appeared to be implementing the process appropriately.

4.0 MAINTENANCE IMPLEMENTATION

This part of the inspection (Maintenance Inspection Tree Elements 5.0, 6.0, 7.0, and 8.0) determined the effectiveness of the established maintenance controls, as well as assessed the quality of work performed. The team evaluated the controls established for work; the plant maintenance organization; the maintenance facilities, equipment, and material; and personnel. The effectiveness of the controls was assessed through (1) observation of work in progress; (2) review of completed work orders, procedures, and other documentation associated with the training of maintenance personnel and the maintenance of tools in stock and spare parts; and (3) discussions held with all levels of personnel.

4.1 Work Control

The effectiveness of the licensee's maintenance work controls and the quality of work in progress were evaluated by performance-based inspection and review of work order documentation, equipment history, planning and scheduling, and work load management.

4.1.1 Review of Maintenance in Progress

The team extensivel observed work in the two primary maintenance disciplines, mechanical and instrumentation and electrical, including work control measures instituted by the licensee and its contractors. The team reviewed maintenance in progress to ensure that (1) appropriate pre-work authorization had been obtained, (2) the administrative and work procedures were properly approved and were adhered to, (3) qualified test equipment and tools were used, (4) correct parts and material were used, (5) discrepancies were identified and corrected, (6) management oversight was adequate, (7) personnel were qualified, and (8) ALARA principles were applied.

Several good practices and performance-related strengths were identified during IAE maintenance activities. In the performance of work request (WR) 54387OPS, which obtained thermography information for breaker 1MXBF07E, a power source for air-handling unit 1TB-AHU-3, the field supervisor provided a detailed pre-job briefing, and craft personnel displayed good work safety practices. The safety practices employed were considered to be a strength.

During the course of work observations, the team identified a number of discrepancies related to poor procedural guidance or failure to follow procedures. The specific instances of poor procedural guidance are covered in Section 4.1.7. The instances of failure to follow procedures were found to be concentrated in the areas of mechanical maintenance and with work performed by contractor personnel, as discussed below.

Control Room Area Heating, Ventilation, and Air Conditioning (HVAC) Air-Handling Unit Repair

The team observed replacement of the driven end bearing on the control room area HVAC air-handling unit in accordance with WR 3725MES and MP/0/A/7450/26, "Westinghouse 8000 Series Fans Corrective Maintenance," Change 1. Numerous problems were noted with the maintenance procedure resulting from inadequate implementation of requirements and recommendations contained in the vendor manual (see Sections 4.1.7(2) and (3)). As a result, the work was subsequently stopped by the job supervisor and procedural changes were issued. Despite this effort, the work was completed incorrectly (because MES and the mechanical procedure writing group misinterpreted the vendor manual requirements), and the bearing clearances were set incorrectly. As a result, the unit was declared conditionally operable based on an engineering evaluation until the bearing could be reworked. PIR 0-C90-330 was generated to evaluate the deficiencies and corrective action associated with this job.

During this process, the team discovered that both bearings on this unit had been worked on approximately 2 weeks earlier in accordance with WR 1490PMP. Investigation of this job revealed that the same procedure (MP/0/A/7450/26) had been used to accomplish the work. The problems with the procedure had not, however, been discovered at that time. It was also determined that craft personnel had used an unapproved copy of a vendor manual, which was received in the replacement bearing box, as an aid to accomplish the work. Because the unapproved vendor manual contained unclear instructions, the bearing clearances had been set improperly. Also, the unapproved vendor manual did not contain torquing values, and thus, the bearing cap fasteners had not been torqued to the level required in the approved vendor manual. The licensee was notified of this problem, and the operability of the non-driven end bearing was evaluated. Both bearings on this unit had to be reworked in accordance with the resolution to PIR 0-C90-330. This is considered a failure to follow procedures (see Appendix A, Unresolved Item 90-201-03).

Chemical Cleaning of the Nuclear Service Water System Motor and Pump Components

The team observed the chemical cleaning of the nuclear service water (NSW) system motor and pump components. This work was performed under WRs 007238SWR and 007240SWR using a vendor procedure entitled "DSI (Vendor)." As discussed in Section 4.1.7(2), one problem was noted with the vendor's procedure approval. In addition, several discrepancies were noted during the implementation of the work request.

(1) Vendor procedure step B.1 required that each component be flushed at a rate of 1 gallon every 5 minutes. There were no flow measurement devices installed on the flushing system to ensure that this requirement was satisfactorily accomplished. The step also required that a total of 25 gallons of fluid be supplied to each component being cleaned; similarly the flushing system had no measuring method to verify that this requirement was being accomplished.

(2) Vendor procedure steps B.1 and C.1 required that pump shafts be rotated by hand while flushing and rinsing. These steps were not performed.

(3) Vendor procedure step C required the temperature of the rinse water to be 125°F. The maximum rinse water temperature observed by the team was 102°F.

(4) The licensee had erected barriers over a certain portion of the work area and had classified this area as Housekeeping Zone III. MMP 1.6, "Housekeeping Requirements During Maintenance Activities on Open Systems and Components," stated that for Housekeeping Zone III, "entry will be controlled by a responsible monitor who will maintain a materials and personnel log." Contrary to this requirement, no log had been established and craft personnel routinely brought such small items as socket wrenches, pens, and cigarettes into the Housekeeping Zone III area.

(5) The licensee did not appear to be monitoring vendor personnel. Although not explicitly required by procedure, this was a weakness. A work crew was assigned to the vendor to hook up hoses, but the crew was not responsible for monitoring the vendor work activities.

The licensee stated that the vendor procedure would be incorporated into a station procedure and that separate signoffs for vendor and licensee personnel would be incorporated into this station procedure for critical steps.

These failures to follow procedures have been identified in Appendix A as Unresolved Item 90-201-03.

Cleaning of the Component Cooling Water Heat Exchanger

The team witnessed the cleaning of the Unit 1 train A component cooling water (CCW) heat exchanger procedure MP/0/A/7650/88, "Heat Exchanger Corrective Maintenance," and WR 009183SWR. Overall, the documentation of the work package prepared for this job was generally comprehensive and easily followed, but the implementation was lacking.

Procedure step 11.3.1.1 required signoff by the maintenance representative and independent verifier to record the number of brushes installed in the heat exchanger tubes. The team observed that work had proceeded beyond this signoff step without positive verification of the number of brushes installed.

Additionally, procedure step 11.2 included a note stating that "parts shall be bagged and tagged as removed." This was not being done.

The failures to follow procedures have been identified in Appendix A as Unresolved Item 90-201-03.

On-Line Leak Repair Process

The licensee had a comprehensive on-line leak sealing program as part of the Technical Support Documents. The program was used routinely for repairing process fluid system leaks in both safety-related and nonsafety-related components. It required the licensee to initiate the temporary or urgent modification process in order to seal leaks in safety-related components. For all applications, safety-related and nonsafety-related, the program required safety evaluations pursuant to 10 CFR 50.59.

The leak repair process was executed through procedure MP/0/A/7650/63, "On-Line Leak Repair Corrective Maintenance." The team reviewed work packages or directly observed work on the following leak repairs: WR 535460PS-1, WR 530210PS-1, WR 533830PS-1, WR 470330PS-1, WR 003109MES, and WR 542390PS-1. The team noted instances where the procedure in use lacked the necessary details and the contractor personnel performing the work were inadequately trained on the process.

For example, in one case the contractor did not drill a hole less than the minimum wall thickness (0.300 inch) for the packing gland area of valve 1SP-0097 (WR 35460PS-1). The procedure did not clearly state that this minimum wall thickness should not be exceeded. Initial drilling should be within this minimum wall thickness to ensure that a non-isolable leak does not result at this point. The team watched the contractor personnel drill to a depth of 0.350 inch without using a mechanical stop. A non-isolable leak did not occur only because the actual wall thickness was greater than 0.350 inch.

As part of the leak repair covered by this same work request, contractor personnel tried to measure thread engagement. Craft personnel were unfamiliar with the measurement technique because they made three attempts before obtaining satisfactory values. In addition, there was no signoff in the procedure for the contractor personnel to verify that minimum thread engagement had been achieved. Finally, the hand pump used for sealant injection on this task was not treated as measuring and test equipment (M&TE); therefore, the volume of sealant injected could not be positively controlled.

Procedure MP/0/A/7650/63 was based on the Electric Power Research Institute (EPRI) document, "NMAC: On Line Leak Repairing." There was a discrepancy noted between the EPRI document and the licensee's program with regard to injection pressure of the sealant. The EPRI document stated that injection pressures should in most cases be less than system pressures to positively prevent extrusion into the line. In all on-line leak activities observed or reviewed, the injection pressure significantly exceeded the system pressure. The discrepancy between the EPRI document and the site procedure is considered an unresolved item (see Appendix A, Unresolved Item 90-201-08).

The licensee specified in its procedure (MP/0/A/7650/63) the maximum pressure to which the component can be subjected from the injection process. This pressure was defined as the "maximum allowable dead head pressure." The licensee stated that the "maximum allowable dead head pressure" should always be equal to or less than the component design pressure. The pressure indicated by the injection pump gauge routinely exceeded the "maximum allowable dead head pressure." For example, the actual injection pressure for the repair of valve 2CA-191 was recorded as 3400 psig while the "maximum allowable dead head pressure" was 2400 psig. When questioned, the licensee stated that the maximum allowable pump gauge pressure was the sum of the "maximum allowable dead head pressure" and the "static pressure." The licensee indicated that the "static pressure" was obtained prior to connecting the sealant pump fitting to the temporary valve fitting and was the pump gauge pressure required to initiate movement of the sealant. The "static pressure," which is a function of the particular sealant chosen, is not defined in the procedure nor is its value specified in the procedure. The procedure also did not direct the craft personnel to subtract the "static pressure" from the maximum gauge reading to obtain the actual injection pressure. Further, as observed during the leak repair of valve 1SP-0097, the craft personnel understood the maximum pressure gauge reading to include the system pressure prior to injection contrary to the licensee's definition of "static pressure." The licensee maintained that during the process the cavity being filled does not experience pressures in excess of the "maximum allowable dead head pressure." The licensee has not adequately demonstrated that the injection pressure as read at the injection pump gauge did not result in component internal pressures greater than the "maximum allowable dead head pressure" and/or their design ratings (see Appendix A, Unresolved Item 90-201-08).

During the review of documentation for the on-line leak repair of valve 2CA-191, the auxiliary feedwater system flow tempering check valve (WR 542390PS-1), Data Sheet step 6.4 of MP/0/A/7650/63 implied that the system design pressure was 1400 psig, but step 6.4.2 stated that the "maximum allowable dead head pressure" was 2400 psig. The procedure was not clear in stating that the 2400 psig was based on the component design pressure rather than the system design pressure.

Additionally, the on-line leak repair procedure was inadequate because it (1) lacked clear instructions not to exceed the minimum wall thickness provided, (2) lacked instructions on how to obtain and verify thread engagement for the injection valve, (3) failed to treat the injection pump as measuring and test equipment, (4) failed to clearly distinguish between system and component design pressures, and (5) lacked instructions for determining the actual injection pressure. These procedural inadequacies are included in Appendix A, Unresolved Item 90-201-01.

Independent Verification

During the review of investigation and repair of the subcooling margin alert control room annunciator (WR 475030PS), the team observed technicians performing independent verification on four separate procedures in a manner that did not correspond with instructions for independent verification contained in those procedures. A similar situation occurred involving inadequate independent verification regarding the procedure for WR 003778SWR.

The independent verification for WR 475030PS was not performed in an independent manner nor was the independent verification performed at the point of task completion as required. The technicians were observed performing the independent verification in conjunction with the performance of the procedural steps.

The methods employed to accomplish the work on both WRs also did not appear to meet the intent of NPD Directive 3.1.1, "Independent Verification Requirements," Revision 4, and Station Directive 4.2.2, "Independent Verification Requirements," Revision 2. These failures to perform independent verification as required are identified in Appendix A as Unresolved Item 90-201-06.

Operations procedures OMP 2-18, "Tagout Removal and Restoration (R&R) Procedure," Revision 24, paragraph 6.3.N, and OMP 1-5, "Independent Verification," Revision 14, provided similar guidance and expanded on the methods to perform independent verification. Interviews with operators, however, indicated that operators usually work together during restoration activities and that requirements regarding independence (separated by space and time) of activities was not generally applied.

Performance of the five work activities was poorly controlled on the basis of inadequacies in procedures and their implementation.

4.1.2 Work Order Control

The licensee controlled the scope and authorization of maintenance activities by MMP 1.0, "Work Request Preparation," Revision 28. Work requests were used for corrective maintenance, and standing work requests were used for recurring preventive maintenance and surveillance activities. The work orders were tracked by computer in accordance with MMP 1.7, "Work Request Status System," Revision 4. However, the work requests were prepared largely by hand, limiting the data available for electronic processing (as further discussed in Section 4.1.3). The licensee planned to implement a computerized work request system in early 1991.

The team reviewed in-process and completed work request packages for the EDGs, the radiation monitoring system, the residual heat removal system, the ventilation systems, the auxiliary feedwater (AFW) system, the electrical distribution systems, the containment spray system, and for various generic components such as check valves and motor-operated valves. An instance in which work was not properly prioritized was identified. Potential work order control problems were found in the percentage of work accomplished using "inspect and repair" WRs and the closeout of voided work requests.

The team noted that 6 days after WR 545150PS had been issued, for the failure of the blue pen that indicated steam generator level on the steam generator 1B recorder, that the item had not been repaired. The team discussed the importance of this indication during transient or accident situations with operations personnel. On the basis of the indication's importance, the WR was immediately sent to the planning section as a Priority 2 work request that required, if possible, a repair within 24 hours. This indicated a weakness in the operations review and disposition of control room instrumentation work requests because such delays could hinder the timely and safe operators response to transients and accidents. This is an example of inadequate corrective action (see Appendix A, Unresolved Item 90-201-04).

Computer printouts of work requests initiated during the past 12 months showed that approximately 55 to 60 percent of all work requests contain the instructions "I/R [inspect/repair]." The team concluded that this type of instruction on the work request placed additional job planning responsibilities on the craft personnel since formal work instructions were not provided on the WR and troubleshooting activities would define the resulting work operations. The team was concerned that review of such activities may not be conducted prior to their execution. However, no specific instances of inadequate review were identified.

MMP 1.0 established a procedure to void work requests. In some instances, voided work requests did not provide a means to identify how these work requests were closed. This demonstrated a poor work order control practice (see Section 4.1.9 for further discussion).

Given the minor significance of these weaknesses, the licensee's program for and implementation of work order control was determined to be functioning satisfactorily.

4.1.3 Equipment Records and History

Equipment history information was available through several computerized and manual retrieval methods. None of the methods were integrated for easy review of data for failure analyses or trending. For example, the current procedures and practices did not identify unsuccessful repairs that had to be reworked. The principal resources were the nuclear maintenance data base (NMDB) for work request information, the equipment qualification data base (EQDB) for component data, the standing work request tracking program, and the microfilm records of completed activities. The licensee had developed a new integrated work management system (WMS) to improve the origination, planning, scheduling, execution, and documentation of completion of work activities. Implementation of the WMS was scheduled to begin in December 1990. That MES did not have a procedure for its trending program was considered a weakness (see Section 4.2.5 for further discussion). In addition, there was one instance associated with PIR 0-C90-0074 in which a complete equipment history was not available for a rotating element of the AFW turbine-driven pump because initial site inspection information had not been retained.

Although sometimes difficult to use, the equipment histories were generally complete and available; thus, this area is judged to be adequate.

4.1.4 Job Planning

Job planning was administered under several procedures, including MMP 1.0 ("Work Request Preparation"), MMP 1.7 ("Work Request Status System"), MMP 1.9 ("ALARA Planning"), and MMP 1.12 ("Post-Maintenance Testing"). Planning activities conducted by planners included considerations for work order initiation and prioritization; specification of job requirements for security, radiological and chemical control, industrial safety, cleanliness, and other similar considerations; identification and pre-staging of spare parts; safety tagging requirements; post-maintenance functional and operability testing; and availability of work instructions. Some of these considerations were proceduralized, but they were contained in several MMPs and other plant procedures without a central planner's guide or planning procedure. In the absence of consolidated guidance, the success of the planning process depended heavily on the experienced planning staff. A secondary factor which contributed to the success of the planning and work control processes was that WP instructions were generally limited to task sequencing and coordination, with detailed work instructions generally provided by formal technical work procedures. This approach was considered a strength.

Although centralized guidance for the planning activities would be desirable, the program for job planning and its implementation were adequate.

4.1.5 Work Prioritization and Maintenance Work Scheduling

Initial prioritization of work requests was established by MMP 1.0, section 4.2.1. Priorities were based on nuclear and personnel safety significance, the impact on electrical output, and the value of the work request as it pertained to plant improvement. The integrated scheduling group (ISG) scheduled daily operation and maintenance activities in accordance with ISG Manual procedure 6.0, "Operating Schedules," Revision 0. Outage management and schedules were controlled by ISG Manual procedures 2.0, "Unit Forced Outage/Trip Lists," Revision 4, and 3.0, "Outage Management Planning." Several specific cases were identified in which, once the initial priorities had been assigned, changing situations such as the availability of parts and procedures significantly delayed important repairs.

(1) Numerous battery pack emergency lighting units required by 10 CFR Part 50, Appendix R, and Catawba FSAR Section 9.5.3.2, were found inoperable between July and November 1990, during annual and monthly testing. Work requests had been issued for repairs, but on November 27, 1990, about 33 percent of the lights required by the FSAR remained out of service. Some repairs were delayed because parts were unavailable or because repairs were scheduled as low-priority work. Nevertheless, the repairs had not received adequate attention until the team identified them (see Section 4.1.7(3) for further discussion). This is an example of a failure to promptly correct a deficiency (see Appendix A, Unresolved Item 90-201-04).

(2) The Unit 2 train A auxiliary shutdown panel (ASP) ventilation system had been inoperable since August 25, 1990, because a spare cooling unit was unavailable. With this supply train inoperable, the ventilation system in the auxiliary building must provide backup ventilation. Despite the fact that this task had been identified as an unplanned work priority by the unit manager's group, the needed parts had not been procured or identified on a priority procurement parts list. Similarly, the Unit 1 train B ASP ventilation supply unit had been inoperable since September 8, 1990, and the unit's train A ASP ventilation supply unit was declared inoperable on November 25, 1990.

With the exception of the emergency lighting and the ASP ventilation system work, work prioritization and scheduling were being adequately controlled and implemented for the instances examined by the team.

4.1.6 Work Backlog Control

MMP 1.0 ("Work Request Preparation"), MMP 3.0 ("Preventive Maintenance Program"), and the ISG Manual provide the basic program for control of work deferral, prioritization, and work backlog tracking. Routine monthly reports provide both a numerical and graphical status of backlog information. The licensee employed INPO guidance as an informal goal to minimize the backlog and to control preventive maintenance (PM) deferral. Any maintenance activity, including such minor jobs as replacing indicator light bulbs and fuses, and nonessential system work, required a work request. At the time of the inspection, about 4500 work requests were outstanding for both units. Of these, about 1700 did not require an outage before they could be implemented. The licensee had not specifically identified safety-related work requests in plant statistics or tracking. About 1000 of the 1700 work requests for both units were designated as "plant production-related" and involved safety-related items, important-to-safety items, or items that could have an indirect (balance-of-plant) effect on safety. The remaining 700 involved work of no safety significance.

The level of the backlog was acceptable on the basis of the significance of backlogged work requests and the usual proper identification of significant work. The current data and backlog trends indicated that the licensee's program for control of backlog functioned satisfactorily.

4.1.7 Maintenance Procedures

The licensee had established an upgrade program for both mechanical maintenance (MM) and instrumentation and electrical maintenance (IAE) procedures. This program began in the mid-1980s and had evolved to state-of-the-industry standards as reflected by the station and departmental procedure guides and standards. The new format of the procedures provided reasonable levels of detail and human factors considerations typical of current industry maintenance procedures. At the time of this inspection, about 75 percent of 1944 IAE procedures were reported as upgraded and approved for use and the remainder were in various stages of development. Similarly, about 65 percent of the 473 mechanical maintenance procedures were upgraded and approved. The procedures were prioritized by safety importance and were being tracked by the procedures groups. Interviews indicated that both the MM and IAE programs historically slipped their schedules. At the end of the inspection, both programs were behind their desired completion dates for high-priority and low-priority safety procedures.

In general, the licensee's procedure programs included appropriate requirements for review and approval, technical content and correctness, cautions and warnings, document control, and revision. Significant weaknesses were identified in three aspects of the licensee's procedures and their implementation: (1) excessive handwritten changes had not been incorporated into procedures in a timely manner, (2) some administrative procedure requirements and/or implementation were weak, and (3) some technical procedures were weak or inadequate.

(1) Handwritten Changes

Many work procedures contained excessive handwritten changes that made the procedures difficult to use. Some of these changes had existed up to seven years without having been incorporated. Station Directive 4.2.1, "Development, Approval and Use of Station Procedures," dated

February 18, 1990, and the individual departmental procedure programs had no requirements for incorporating handwritten changes on any regular basis. Although the licensee had tracked unincorporated changes by computer tabulation and indicated that changes had been progressively incorporated as procedures were being upgraded, the overall extent of the unincorporated changes was unsatisfactory. The procedures identified with excessive handwritten changes were (a) procedure IP/0/A/3817/12, "Calibration Procedure for Barton Model 763, 764, and 386A Pressure Transmitters," last revised January 6, 1983; (b) procedure IP/0/A/3820-02A, "MOVATS Testing of Rotork Valve Actuators," last revised July 1987; (c) procedure IP/0/A/3870-09, "Removal, Replacement, and Field Setup of Rotork Actuators," last revised July 1987; (d) procedure IP/0/A/3710/15, "Batteries Periodic Inspection," last revised July 1984; and (e) procedure IP/0/A/3710/08, "Vital Battery and Terminal Post Inspection," last revised July 1984.

(2) Inadequate or Weak Administrative Procedures

A number of administrative procedures were weak. The team was concerned that the multiple examples of less-than-adequate administrative procedures provided erroneous direction to plant staff.

(a) The team noted numerous procedures in the Station Directives Manual affecting quality that appeared to be outdated. Station Directive 4.2.1, "Development, Approval and Use of Station Procedures," stated that "a comprehensive periodic review of all station procedures shall be performed at intervals not to exceed 2 years for safety-related procedures." In addition, the licensee was committed to American National Standards Institute (ANSI) N18.7-1976 through TS 6.8.1. Section 5.2.15 of ANSI N18.7-1976 states that documents which prescribe activities affecting safety-related structures, systems or components such as operating and special orders, operating procedures, test procedures, equipment control procedures, maintenance or modification procedures, and refueling and material control procedures shall be reviewed every two years.

The team determined that most Station Directives should receive a 2-year review in accordance with Section 5.2.15 of ANSI N18.7-1976. The licensee had not performed this review as required. The lack of periodic review of Station Directives has been identified in Appendix A as Unresolved Item 90-201-07.

(b) As a result of the deficiencies concerning vendor manual implementation discussed in Section 4.1.1 of this report, the team reviewed the vendor manual program. The program document (Station Directive 2.1.4, "Control of Vendor Manuals," Revision 1) did not specify how vendor manual requirements were implemented or incorporated into site procedures (see Appendix A, Unresolved Item 90-201-01). Key personnel in the maintenance department (i.e., procedure writers for the mechanical and the IAE maintenance groups, personnel from MES and document control) were unable to adequately explain the vendor manual implementation program. Later discussions with the projects services staff determined that implementation of vendor requirements took place through the design change process.

(c) The team performed a comparative review of Nuclear Production Department Directive (NPDD) 3.1.1 and Station Directive (SD) 4.2.2 regarding independent verification (IV) and found the following nonconservative Station Directive requirements that provided evidence that corporate level requirements regarding IV had not been translated into the site program. This example of inadequate procedures is identified in Appendix A as Unresolved Item 90-201-01.

- NPDD 3.1.1, Step 2.2.d, applied IV to key control; SD 4.2.2 did not.
- NPDD 3.1.1, Step 3.2.1.i, applied IV to temporary procedures; SD 4.2.2 did not.
- NPDD 3.1.1, Step 4.10, implied mandatory training for visual means of verification; SD 4.2.2 used "should."
- NPDD 3.1.1, Step 8.1, used a dose limit of 50 mrem for an exception to performing IV; SD 4.2.2 used 10 mrem.
- NPDD 3.1.1, Step 8.1, required documentation of a waiver of IV for dose considerations; SD 4.2.2 did not.
- NPDD 3.1.1, Step 8.5, provided guidance on exceptions for certain vent and drain valves; SD 4.2.2 did not.

(d) Station Directive 4.2.1, "Development, Approval and Use of Station Procedures," section 6.0, stated that "maintenance, operating, and testing activities performed by interfacing individuals and organizations shall be conducted in accordance with written approved procedures. These procedures shall receive the same level of review and approval as station procedures used at Catawba, including qualified review, 10 CFR 50.59 evaluation, and approval by station management." No 10 CFR 50.59 evaluation had been performed (as is required) before the vendor's chemical flushing procedures were used. This is an example of failure to follow procedures (see Appendix A, Unresolved Item 90-201-03).

(e) Adjacent to the packing area of the NSW pumps, clear plastic splashguards had been affixed with clamps. The shields prevented packing runoff from wetting down the surrounding area and were installed per Fabrication Work Request 393PJT. The fabrication work request system was employed for fabrication of minor items that were not considered plant modifications. Accordingly, no 10 CFR 50.59 evaluation was performed. The addition of the splashguards was a modification of safety-related equipment as described in the FSAR, and therefore the performance of a 10 CFR 50.59 evaluation would have been appropriate.

(f) Station Directive 3.8.8, "Radiological Work Practices," step 5.17.3.4, required that all personnel entering the single-point access to the radiation-controlled area call the health physics work unit or be enroute to the HP office. This requirement was not being practiced (see Appendix A, Unresolved Item 90-201-03).

(g) Station Directive 3.3.14, "Station Work Management System Failure Analysis and Trending Program," August 22, 1988, was obsolete. It was based on an integrated computerized work management system that had not been adopted by the plant. Further failure analysis is discussed in Section 3.3.2.

(h) Weaknesses were found in corporate and plant administrative procedures for material control that contributed to the issuance of expired shelf-life material to the field. These weaknesses are discussed in more detail in Section 4.3.2 and are identified in Appendix A as Unresolved Item 90-201-05.

(i) There were no requirements in procedure MMP 1.0, "Work Request Preparation," Revision 28, for an operability determination on issued work requests. Operability reviews on work requests were conducted even though the procedure did not require that this be done. This is an example of an inadequate procedure (see Appendix A, Unresolved Item 90-201-01).

(3) Inadequate or Weak Technical Procedures

The team's review of completed work requests and observation of work in progress noted a number of technical procedure weaknesses, some of which led to field performance problems, as described below.

(a) During work on the control room area HVAC air-handling unit (WR 3725MES), several inadequacies were noted in the maintenance procedure (MP/0/A/7450/26, "Westinghouse 8000 Series Fans Corrective Maintenance," Change 1) associated with this work request. These deficiencies concerned the failure of the procedure to incorporate numerous requirements and/or recommendations of the controlled vendor manual (CNM-1211.00.0319, "CRA Engineered Safeguards Large Capacity Air Handling Units") manuals as listed below.

- ° torque requirements for the fasteners that secure the bearing cap to the bearing base *
- ° a requirement to measure the fan shaft diameter and acceptance criteria for minimum shaft size
- ° requirements for tightening of the bearings so that the required clearance is obtained between the rollers and the outer ring raceway *
- ° a specific method for checking the drive belt tension and specific deflection criteria and torque in inch-pounds *
- ° requirements for lubrication of the bearings during installation

*Specifically addressed by change 2 to the procedure which was issued during the performance of the work

- a requirement that the bearing cap and base be match marked
- a requirement to disassemble the cap from the base using jacking screws in the dowel holes and specifically prohibiting the use of a pry wedge at the split line
- a requirement for the use of a lubricant to install the adaptor sleeve and also to lubricate the inside face of the locknut *
- a specific method for tightening the bearing to relieve the stress on the nut and to ensure proper tightening
- requirements for locking the lockwasher or lockplate *
- requirements for the installation of felt seals between the bearing cap and base, or as an alternative, the use of a non-hardening gasket compound between the cap and the base
- instructions for troubleshooting excessive vibration

(b) WR 003228SWR required the performance of procedure PT/O/A/4971/12/R, "Routine Test Procedure: RIS Type 90634-100 Undervoltage Sensor with C-H M300 Auxiliary Relay." The procedure did not provide sufficient guidance for obtaining input voltage and control voltage and did not provide adequate instructions concerning installation of the test setup. Craft personnel had to perform actions not delineated in the procedure to satisfactorily complete the maintenance activities.

(c) Deficiencies in procedure IP/O/A/3680/08, "EQC System Time Delay Relays and Undervoltage Relays Calibration," appear to have contributed to improper test equipment installation and blown fuses in the EDG sequencer cabinet power supply during performance of WR 010359SWR (see Section 4.2.4). The procedure gave only general instructions for installing the equipment and relied heavily on the knowledge and experience of the technician to make the correct connections.

(d) IAE technicians performed procedure IP/O/B/3314/15, "Radiation Monitoring System Flow Calibration," section 10.4, with inadequate instructions on manipulating auxiliary ventilation sample line equipment. IAE technicians were able to complete the procedure because of the technician's previous work experience operating radiation monitor sample line equipment. However, the procedure did not provide information to identify major unlabeled system components: a flow schematic for sample line components and flow path and sample point flow units with tolerance limits for adjusting sample point gauge levels.

*Specifically addressed by change 2 to the procedure which was issued during the performance of the work

(e) In February 1990, QA audit NP-90-05(CN) and PIR 0-C90-0052 indicated that procedure IP/0/B/3450/02, "DC Emergency Lighting (ELD) System Periodic Maintenance and Testing Procedure," Changes 0-9, was deficient. Because the procedure did not provide for adequate testing and preventive maintenance, it contributed to chronic inoperability of emergency lighting. The PIR was resolved in March 1990 but as of the end of this inspection, the procedure had not been revised to include the testing and maintenance improvements proposed. The problems with emergency lights persisted as discussed in Section 4.1.5.

The procedural inadequacies identified in (a) through (e) above are included in Appendix A as Unresolved Item 90-201-01.

(f) Procedure TN/1/B/2488/CE/01A, "Implementation Procedure for CEVN CE-2488, Work Unit 01," gave instructions for a modification that delayed the radiation monitor alarm time in the control room during normal backflush cycles and also delayed pump restart following backflushes to allow the pump to stop its backward rotation before restarting. Control room verification as part of steps 8.17 through 8.19 needed to occur up to 90 seconds and again at 115 seconds after stopping the turbine building sump pump to verify successful implementation of the modification. However, the need to establish control room communications was not clearly indicated in the notes preceding step 8.17. During implementation the crews did not establish communications early enough and thought that the light came on earlier than required, thereby bringing into question the adequacy of the modification. Resolution of the problem resulted in several hours of print and logic diagram review that did not address the actual cause of the problem.

The licensee's procedural coverage of the maintenance program was adequate. However, deficiencies in technical procedures discussed in this section and in Section 4.1.1 led the team to conclude that administrative and technical procedure implementation was a weakness requiring additional management attention.

4.1.8 Post-Maintenance Testing

The licensee controlled post-maintenance testing (PMT) in accordance with Station Directive 3.2.1, "Post Maintenance Testing," Revision 0, and MMP 1.12, "Post Maintenance Test Program," Revision 4. The licensee controls included requirements for performance of such functional verification testing as stroking valves, calibrating instruments, cycling dampers, operating pumps and breakers, and testing interlocks, as well as for performing such operability testing as surveillance tests. The use of test requirement matrices and an extensive retest manual containing equipment-specific requirements provided a good basis for development of PMT specifications.

The licensee also established a program in the Integrated Scheduling Group Manual procedure (ISGMP) 3.3, "Plant Condition and Mode Change Requirements," Revision 1, to administer the post-maintenance testing for all work activities that may be prerequisites for plant condition or operational mode changes involved in outage recovery. The team reviewed the application of this procedure to WRs and NSMs implemented during the last Unit 1 outage. Particular attention was paid to those items which required that testing be deferred until hot shutdown or hot standby plant modes.

These PMT and plant condition and mode change programs had been significantly improved in response to problems that the NRC and the licensee found during the 1990 outages. Both programs were considered a strength, and performance was improving in these areas.

4.1.9 Review of Completed Work Control Documents

The team reviewed completed work packages and reviewed licensee programs to determine whether post-work reviews were described by procedures, properly documented, and effective in identifying work-related problems. Identified problems included:

(1) MMP 1.0, "Work Request Preparation," Revision 28, gave instructions on voiding work requests. These instructions required that the word "void" be followed by an explanation, and that the signature of the person voiding the work request and the date be entered in Section 5 of the work request. In a number of cases the explanation for voiding was inadequate. Such entries as "not required" or "not a problem" did not describe how someone verified that the problem no longer existed. Additionally, some work requests had been voided based on the fact that the work would be done under another work request or by another group. The voided work request did not provide specific reference to the documentation substantiating proper work completion. Specific examples of this deficiency were noted on WRs 11287IAF, 7350PRF, 530620PS, 530610PS, 530600PS, 454850PS, 466090PS, 469540PS, 469830PS, 275700PS, and 2326MES. This is an example of failure to follow procedures (see Appendix A, Unresolved Item 90-201-03).

(2) Review of 22 completed corrective maintenance work requests showed that approximately 25 percent did not specify whether deficiency tags were hung in accordance with MMP 1.0, "Work Request Preparation." The incomplete work requests were 7361PRF, 519900PS, 7355PRF, 3672PLN, 1490PMP, and 003725MES. No examples were found where tags remained when work was finished. This is an example of failure to follow procedures (see Appendix A, Unresolved Item 90-201-03).

(3) MMP 1.0 did not explicitly require obtaining additional work authorizations if the work scope increased. In one case, WR 1650MES authorized a maintenance break-in run of EDG 1B to include various inspection and operating checks. Conditions identified during the run resulted in drill-out and re-tapping of a 2L cam door bolt, replacement of the 4L cylinder head, and overhaul of the 8R fuel injector and pump. This work was adequately documented in the "Action Taken" and PMT portions of the work request, but was not reflected in the work request authorization or the job planning sequence. Interviews revealed that proper authorizations had been given but not documented. The planning and materials manager

stated that a requirement for more discrete authorization and documentation of work request scope increases was being considered before this inspection. Further, the new work management system will permit more reliable retrieval of such information.

The completion and review of work control documents were being adequately implemented and controlled when considering the total program in comparison to the identified problems.

4.2 Plant Maintenance Organization

The maintenance organization was evaluated with regard to control of its activities, personnel, documentation, and communications. In this portion of the inspection, the team interviewed personnel, extensively observed ongoing work in progress, and reviewed procedures and other work documents. The evaluation of maintenance control over the mechanical and the instrumentation and electrical maintenance groups included contracted maintenance work activities.

4.2.1 Mechanical Maintenance

The team noted a significant number of serious deficiencies when it inspected mechanical maintenance. The team reviewed work activities and documentation concerning the replacement of the control room area air-handling unit bearings and noted significant differences between the licensee's procedures and the vendor manual requirements for bearing replacement. Additionally, this work was incorrectly completed so that an operability determination and eventual rework of the bearings were required subsequently. Observation of the NSW system flushes and cleaning of the component cooling water heat exchanger noted several examples of failure of licensee personnel and contractor personnel to follow approved site procedures. Review of documentation and observation of the on-line leak repair area noted several serious deficiencies concerning inadequate procedures to control the sealant pressures and a general lack of licensee control over this process. Instances of inadequate procedures and failure to follow procedures where prevalent in nearly all work activities observed by the team. These deficiencies are discussed in more detail in Section 4.1.1 of this report.

Work procedures and practices were inadequately implemented in the mechanical maintenance area.

4.2.2 Instrumentation and Electrical (I&E) Maintenance

Although several minor deficiencies were observed in the I&E maintenance area, they lacked safety significance and the licensee responded to them acceptably:

(1) Various panels in the vicinity of air-handling unit 1TB-AHU-3 were missing covers, screws, and bolts (WR 543870PS).

(2) Electrical terminal cover plates on various remote control/annunciator panels were unsecured. This item, previously mentioned in Section 2.2, item (i), has the potential for equipment malfunction and for presenting a safety hazard to personnel.

(3) During observation of work, under procedure PT/0/A/4971/12/R, "Routine Test Procedure: RIS Type 90634-100 Undervoltage Sensor with C-H M300 Auxiliary Relay" (WR 003228SWR), craft personnel performed actions not delineated in the procedure. Insufficient steps were provided to instruct craft personnel on how and where input voltage and control voltage should be obtained. This item was previously discussed in Section 4.1.7(3).

IAE maintenance activities were generally adequately controlled and implemented.

4.2.3 Control of Contracted Maintenance

In general, the licensee did not rely on contractors to perform maintenance activities. However, the station directive relative to control of contractor activities (Station Directive 2.7.1, "Control of Non-assigned Individuals and Organizations Performing Work or Directing Activities in the Station") contained the necessary elements to ensure the contractors were qualified to perform tasks, were trained appropriately, and were reliable.

The team observed several activities including the nuclear service water (NSW) system flush, on-line leak repair of valve 1SP-0097, and a videotape of a core exit thermocouple valve assembly repair. Several instances of failure to properly control contractor work activities were identified. No plant employee was present to monitor the contractor's performance when the NSW system was flushed. The number of deficiencies identified by the team (see Section 4.1.1) concerning this NSW flush indicated that oversight was required to adequately control the activity. The licensee monitored the contractor's repair of valve 1SP-0097, but the oversight was ineffective because deficiencies were not identified and remedied by the licensee. A videotape of the attempt to repair a core exit thermocouple valve assembly showed that the contractor craft personnel did not positively verify required thread engagement which possibly resulted in a primary coolant release. Licensee oversight for this task was not evident.

Because oversight problems were identified in each activity observed involving contracted personnel, the implementation of the contracted maintenance program was an area of weakness.

4.2.4 Deficiency Identification and Control System

Review of the licensee's programs for identifying and controlling deficiencies in MMP 1.0, "Work Request Preparation," Revision 28, and NPD Directive 2.1.8, "Problem Investigation Process," Revision 5, determined that the programs were adequate for the areas covered. However, on several occasions, the licensee failed to initiate deficiency reports, failed to initiate reports in a timely manner, and failed to properly report items to the NRC as required by 10 CFR 50.73. In addition, the licensee did not have a system in place to convey to appropriate levels of management those items not encompassed by either the WR or PIR systems.

Examples of failure to initiate deficiency reports at all and failure to initiate deficiency reports in a timely manner follow. These deficiencies have been identified as Unresolved Item 90-201-04 in Appendix A.

(1) On October 17, 1990, during the performance of procedure PT/1/A/4200/52A, "Partial Stroke Test 1FW28," a significant spill occurred because a valve was out of position. No PIR was written.

(2) On August 16, 1990, a fire occurred at EDG 2B during surveillance testing. No PIR or fire report were written.

(3) On August 25, 1990, 20 to 30 gallons of water were spilled from the containment spray ring as a result of engineered safeguard features testing. No PIR was written.

(4) On September 7, 1990, during reactor coolant system heatup, the 25V-1-S/G 2D power-operated relief valve lifted prematurely at 1020 psig resulting in a 5°F cooldown as steam pressure dropped to 960 psig. No PIR was written.

(5) The uncontrolled operator aid problem noted with the incore instrumentation control panel (as previously discussed in Section 3.2.6) had not been documented on a WR, although performance section personnel were aware of the problem for approximately 18 months.

(6) During its review of WR 115971AE, the team noted that fuses had blown during relay testing performed under an earlier work request (WR 010359SWR). A review of the relay calibration test indicated inadequate guidance for craft personnel to follow, resulting in the blown fuses that were not identified until the subsequent troubleshooting associated with WR 115971AE. No PIR was written to document that a deficient procedure resulted in blown fuses.

(7) On November 12, 1990, the team found several inches of diesel fuel/water on top of the SSF power cable pit and reported this condition to the licensee. A PIR was not written until November 26, 1990.

(8) On October 11, 1990, there were two valid diesel generator failures. A PIR was not written until November 8, 1990.

Examples of deficiencies identified regarding the licensee's reporting of items to the NRC are given below. These deficiencies have been identified as Unresolved Item 90-201-02 in Appendix A.

(1) The review of PIR 0-C90-0036 revealed a violation of Technical Specification (TS) Table 3.3-4, Item 10.b concerning 4-kV bus undervoltage-grid degraded voltage instrumentation that had occurred in November 1989. An LER was not submitted until March 2, 1990 to address the concern that undervoltage relay test acceptance criteria did not agree with the TS (LER 90-012-00 and changed to LER 90-007-01 on March 12, 1990). A review of this LER indicated that licensee personnel had known of the TS violation as early as November 8, 1989. Also, other departments were told of the concern on or about November 21, 1989 and December 7, 1989.

(2) PIR 0-C89-0359 was written in December 1989 to address a problem regarding AFW check valve testing. The PIR stated that the valves in question had been added to the licensee's inservice testing program in May 1989, but

that the procedures had not been changed to include the test requirements. The PIR evaluation concluded that the item was not reportable in accordance with 10 CFR 50.72 or 50.73. The team questioned whether this determination was adequate because it appeared that the event as described in the PIR was a violation of Technical Specification 4.0.5 which required testing in accordance with the requirements of the American Society of Mechanical Engineers (ASME) Code Section XI. The licensee reviewed the reportability determination and wrote a new PIR (0-C90-0340) to address this missed report.

The team was concerned that items which do not merit generation of a PIR (based on operability and NRC reportability criteria) might not be escalated to appropriate management attention. These could include inadequate procedures, procedural implementation difficulties, and surveillance or test errors. Such items would typically be corrected at the lower levels of the organization, but no mechanism existed to inform higher levels of station management to assess the need for broader resolution. The team noted instances where plant management was not aware of plant problems including the issues concerning the blown fuse and the uncontrolled operator aid discussed in Section 4.2.4 plus numerous procedural inadequacies discussed in Sections 4.1.1 and 4.1.7.

Deficiency reports had not always been generated when required and the overall threshold for identifying problems to management was considered by the team to be too high. Also, the areas of deficiency identification timeliness and implementation of NRC reportability requirements needed improvement. On the basis of the above, the licensee's implementation of deficiency identification was judged less than satisfactory.

4.2.5 Maintenance Trending

Catawba personnel supported fully the Nuclear Plant Reliability Data System program by providing input and utilizing the data to periodically assess plant equipment. Maintenance Engineering Services (MES) conducted a semiannual review of component failures that exceeded the industry average. Additionally, MES utilized several different data bases to continually monitor equipment performance and analyze failures. These data were used primarily by the responsible engineer; however, periodic reports of trending and associated actions were not given to management. MES took some actions in response to unsatisfactory trends, but such actions had not been integrated into the overall maintenance process. One weakness identified in this area was that MES had not yet developed a procedure which described the trending program in detail.

The licensee was judged to have an adequate trending program because some level of trending was being accomplished despite the lack of a systematic trending program.

4.2.6 Support Interfaces

Communications and teamwork between the maintenance department and other site organizations was better than average. Of specific note is the positive interaction between MES and craft personnel in both the mechanical maintenance and IAE groups. The working relationship between maintenance and the site industrial safety group was also very supportive and exhibited a cooperative approach to meeting site safety goals.

The support interfaces employed by the licensee represent a strength.

4.3 Maintenance Facilities, Equipment, and Materials Control

The following areas were evaluated during this inspection: provision of maintenance facilities and equipment, establishment of materials controls, establishment of maintenance tool and equipment controls, and control and calibration of measuring and test equipment.

4.3.1 Maintenance Facilities and Equipment

The mechanical shop areas were large and contained adequate amounts of machinery to enable most repair and fabrication jobs to be performed on site, greatly reducing reliance on offsite job shops. The licensee identified planned acquisitions of equipment to enable improved job quality and reduced time for job performance, such as valve seat machining and repair. Dedicated machinist positions were used rather than relying on the machining capabilities of general mechanical maintenance personnel. The nonradiological shop was in close proximity to maintenance crew and supervisor areas.

The IAE shop areas were located in another part of the plant, well separated from interference with mechanical maintenance activities. The implementation of planned renovations will expand the IAE shops inside the power block and will provide better integration of the IAE maintenance organization. The shop areas and equipment were neat, and good housekeeping practices prevailed.

The areas from which stock and nonradiological tools were issued were located outside the power block, requiring a fair amount of travel time to assemble additional tools and parts for the conduct of work activities.

A rack containing miscellaneous pipe, rod, plate, and other materials was in the railroad bay outside the nonradiological mechanical maintenance shop. There were scrap pieces of previously certified materials on the rack. The rack was not identified as containing only nonsafety-related material. In response to the team's observation, the licensee put up a sign to identify that the material was nonsafety-related.

The maintenance facilities and equipment were satisfactory and planned improvements were being implemented.

4.3.2 Material Controls

Corporate guidance on handling material was generally incorporated into the station's Materials Manual, which contained the material handling procedures (MHPs). The lack of procedural guidance for the practice of marking subdivided cartons or boxes of material was an example of the need to strengthen procedures to incorporate observed good handling practices and ensure consistency of these practices over time. Corporate and site administrative procedures did not contain any reference to control materials with an expired shelf-life. MHP 3.2, "Shelf-life Program," Revision 6, provided a controlled system to monitor shelf-life material condition of stock items in storage through a computer program. However, the procedure did not contain guidance to material control personnel to ensure that materials with an expired shelf-life were controlled and that an engineering evaluation would be initiated, when necessary, for issues of expired stock. MHP 5.1, "Issuing and Returning Materials," Revision 18, also did not contain information requiring that shelf-life material expiration dates be checked before these materials are issued.

The team asked the licensee to review the QA-related parts listed on the latest report (October 1990) of expired shelf-life materials that were still on the shelf awaiting replacement to determine if any material had been issued beyond the expiration date. Of the 15 part numbers reviewed, there were 21 issuances of expired material associated with P/N 1126-00568N (transmitter cover O-ring) and 1 issuance of expired material associated with P/N 21710811N (Limitorque cover gasket). The licensee initiated PIR 0-C90-0333 to evaluate the consequences of operating with the expired materials installed in the affected safety-related plant components. The licensee determined that operability was not compromised because the shelf-life of the O-rings could be justifiably extended to 14 years instead of the previously assumed 6-year life. An operability determination for the cover gasket had not been provided to the team by the close of the inspection. Also, the licensee reviewed 71 QA and non-QA parts whose shelf-life had expired since May 1990 and found no additional issuances of expired shelf-life material. The licensee initiated action to instruct materials personnel to specifically identify and tag materials with expired shelf-life and ensure that these materials were not issued improperly. The licensee was preparing procedure enhancements at the close of the inspection to strengthen the shelf-life material control program. The failure to properly control certain shelf-life material is an unresolved item (see Appendix A, Unresolved Item 90-201-05).

In addition, a location in the QA storage warehouse contained epoxy material (P/N 842664) with an expiration date of 1985. This material was not listed on the expired shelf-life program because of its status as a "special stock" item. The licensee took the epoxy off the storage shelf and planned to review the special stock items for other instances of expired shelf-life material. The engineering evaluations and justifications for extension of expired shelf-life materials were not always formally conducted with proper reviews and documentation provided. No procedures to perform these evaluations were provided to onsite engineering organizations. However, site engineering personnel believed that the evaluations performed by the design engineering group in Charlotte, North Carolina were properly performed. In contrast, onsite evaluations often consisted of informal justifications based on telephone conversations.

Instances of unattached tags were observed in storage locations. For example, a bin location in the QA material warehouse had certified stud material segregated by various lengths and diameters, but stud material number 1007B/ASIC 0B010050 was missing the associated QA green acceptance tag. The tags to other materials were lying in open locations and were not attached to the material.

The bar-code issue system for QA material was a strength. It appeared to be a very effective way to control stock issues and returns, identify materials used in maintenance activities and minimize errors in stock control. The issue of QA materials was documented by a manual log entry in accordance with MHP 5.1. Other good practices were storage of printed circuit cards in anti-static pouches and aluminum parts cabinets, controls on returned parts not needed in the maintenance activity, segregation of QA and non-QA parts storage, warehouse physical condition and general cleanliness, and storage controls. The subdivision and marking of steel plate, pipe, all-thread and related materials was acceptable in the warehouse areas during material issue and in the shop areas when further subdividing was required.

Based on the significance of the weaknesses identified in relation to the total program, the material control program was judged to be adequate. Implementation of the program, however, was found lacking. Of particular concern was the licensee's implementation of its shelf-life program.

4.3.3 Maintenance Tool and Equipment Control

Plant maintenance work areas appeared to have adequate tools and equipment for work activities. Tool issues were adequately recorded for traceability to work requests and tool users. Lifting cables, straps, hoists, and extension cords were periodically inspected for material conditions. Lifting slings were appropriately inspected, and weld rod control and storage were acceptable.

A good practice was applied to the storage and control of special tools and equipment: Books containing photographs of special equipment and associated storage locations were available for use by the tool issue clerks and tool requestors to assist in identification of the correct equipment.

The control of maintenance tools and equipment was adequate.

4.3.4 Control and Calibration of Measuring and Test Equipment

The team inspected the licensee's measuring and test equipment (M&TE) facilities to review calibration methods and the calibration history of test equipment used by maintenance personnel during observed repair, surveillance, and troubleshooting activities.

The facilities for onsite calibration of mechanical and instrumentation and electrical (IAE) equipment were good, and proper consideration was given to climate control and maintenance of calibration equipment. Although the IAE laboratory was located within the Unit 2 turbine building area and was subject to vibration and noise, calibrations observed did not appear to be adversely affected. Nonetheless, the licensee was considering establishing a calibration facility outside the power block.

The issuance and return of calibrated equipment was well controlled. The control of IAE equipment in particular was a strength. A computerized database was used to log the user and job identification, to restrict issuance of equipment that would exceed the calibration due date before the expected return, and to issue late return reports and tool usage reports. Control was applied to the issuance of radiological and nonradiological equipment. Each item of calibrated equipment was uniquely identified. The calibration labels also identified where the last calibration was performed.

Approximately 60 percent of the IAE and more than 90 percent of the mechanical calibrated equipment was calibrated on site. Procedures for calibration and calibration results provided for traceability of as-found conditions and review of tool usage if out-of-calibration equipment was found. The remainder of the equipment, along with equipment used on site to perform calibrations, was calibrated at the licensee's standards laboratory at the McGuire site. The control of equipment sent off site for calibration was acceptable. The capabilities of the standards laboratory were a significant strength in the M&TE program. The laboratory was designed with tight controls on temperature and humidity and isolation from induced vibration and electrical interferences, allowing a high accuracy of measurements. Extensive capability was provided for equipment repair, and calibration standards were referenced to the National Institute for Standards Technology (NIST), where necessary. The laboratory employed many primary standards such as the triple point of water, WWVB frequency (the NIST radio frequency) and time standards, and zinc and tin melting temperatures. The standards laboratory also provided calibration services for nuclear and fossil plants outside the licensee's system, government facilities and other industries.

The licensee's program for control and calibration of M&TE was judged to be very strong.

4.4 Personnel Control

The inspection objective of this area was to evaluate the licensee's ability to effectively staff, train, and qualify maintenance personnel. The team evaluated the aspects of staffing control, employee training, testing and qualification, and the overall current status. The team's evaluation was based on interviews, reviews of documents and records, examination of station directives and policy guidelines, inspection of training facilities, and field observation of on-the-job training (OJT) in progress. Interviews were conducted with personnel management, training and qualifications management, station department managers, maintenance superintendents, field work supervisors, and craft personnel.

4.4.1 Staffing Control

The licensee's administrative policy manual was controlled by the station's personnel management department and contained directives relative to staffing control. The manual also contained baseline guidance and qualifications for staffing various station positions (administrative and technical).

The management procedures manual provided guidance to management personnel in such areas as fitness for duty, promotions, disciplinary actions, absences, and terminations. The fitness-for-duty program was a strength with a special manual to provide detailed guidance for administration of the program.

Organizational charts clearly identified the structures of and relationships among various departments, were readily accessible, and were updated on a quarterly basis. Formal job descriptions of all salaried staffing slots included the basic position functions, the staffing dimensions, principal accountabilities and responsibilities, and identification of incumbent personnel.

Worker morale was a strength. The licensee had recently instituted new programs in the areas of alternative work schedules and job transfers/promotions. Additionally, a new policy allowing workers increased work hour flexibility had been drafted and was intended to be implemented during 1991. These items were prime factors of the relatively low turnover rate. However, there had been a higher than normal turnover rate in the performance section. As a result of this turnover, a number of systems engineers had very limited experience in some positions (see also Section 3.3.2).

The worker-to-supervisor ratio averaged approximately eight to one for the maintenance department, and a full complement of maintenance personnel were available for continuous shift coverage.

The team concluded that staff control was a strength.

4.4.2 Personnel Training

The licensee maintained an INPO-accredited training program and had recently been evaluated for continued accreditation. Technical training centers for both mechanical and IAE maintenance disciplines were shared by Catawba and other licensee facilities. Maintenance personnel received basic technical training at these facilities before station assignment. Station familiarization, fundamentals, general employee training, and radiation worker training were provided to the employee before on-the-job training (OJT) was initiated.

Procedures and job descriptions had been developed for the training department that described the responsibilities of training managers, training requirements, initiation of training, continuing training practices, and control of training records. Procedures also described the requirements and methods of implementing departmental training.

Craft specialty training was assigned on an as-needed basis which was determined by maintenance supervision. Workers typically were assigned primary systems and/or components and were required to maintain qualifications in those areas. Maintenance supervision and training management jointly determined minimum qualification tasks that were required for work completion. Craft personnel were tested and qualified against these basic tasks. Advanced specialty training and vendor training also were considered in the training and requalification program.

The program to integrate certain station working procedures with hands-on instruction and classroom training was considered a strength.

The requirements and implementation of an overall good training program were evident. The training program implementation was especially strong.

4.4.3 Test and Qualification Process

The qualification criteria were defined in various training procedures and guidelines. Maintenance craft personnel were required to have and maintain a theoretical knowledge of their respective discipline and exhibit competence in hands-on application. Training and qualification records were continuously updated and maintained via the licensee's on-line data base, and a hard-copy backup was supplied to supervisors in order to control field activities. Adequate traceability measures of employee qualifications were in place, and personnel performing maintenance activities were found to be appropriately qualified.

Overall, the licensee's program in this area was adequate while its implementation was an identified strength.

4.4.4 Assessment of Current Status

The training and qualification programs were adequate with above average implementation. The fitness-for-duty program appeared to be working well with no instances of substance abuse problems identified by the licensee or the team. The turnover rate for Catawba was currently low, and adequate measures were in place to maintain this performance level.

Strengths were noted in the areas of OJT, specialized system training, high experience levels, and an overall departmental commitment to training. The current status of staffing also was a strength.

5.0 CONCLUSION

The licensee was implementing a generally satisfactory maintenance program; however, needs for improvement were identified in a number of areas. Specific areas of weakness were procedural adherence during mechanical maintenance work activities; control of contracted maintenance; identification, evaluation and correction of deficient conditions; adequacy of procedures; control of shelf-life materials; and document control. Of most significance were the inadequate technical and administrative procedures that lacked sufficient detail and clarity and the lack of procedural adherence. The licensee's control of activities performed by contractors also needed improvement. The team also identified weaknesses concerning lack of established maintenance organization goals. Housekeeping needed improvement in less-travelled plant locations, and plant management visibility in the plant was low.

The team found strengths in areas such as communication and interface between maintenance and support groups; Maintenance Engineering Services; the calibration facility at McGuire Nuclear Station; the industrial safety program; the post-maintenance test program; and the personnel control and training program. In particular, the calibration facility was outstanding, and the quality and experience level of personnel was evident.

6.0 UNRESOLVED ITEMS

Unresolved items are matters which require more information to determine whether they are acceptable, deviations, or violations. Unresolved items identified are listed in Appendix A of this report.

7.0 EXIT MEETING

On November 30, 1990, the team conducted an exit meeting at the Catawba site. Licensee and NRC representatives attending this meeting are listed in Appendix B. During the exit meeting, the team summarized the scope and findings of the inspection. An evaluated Maintenance Inspection Tree was presented and discussed with the licensee's representatives. A copy of the final evaluated Maintenance Inspection Tree is contained in Appendix C of this report.

APPENDIX A

SUMMARY OF INSPECTION FINDINGS

UNRESOLVED ITEM 90-201-01

FINDING TITLE: Inadequate Procedures

DESCRIPTION OF CONDITION:

(1) The program document for vendor manual control, Station Directive 2.1.4, Revision 1, did not provide instructions on the incorporation of vendor manual maintenance specifications into applicable site maintenance procedures. This resulted in the licensee's failure to include vendor manual requirements in maintenance procedure MP/0/A/7450/26, "Westinghouse 8000 Series Fans Corrective Maintenance." The procedure lacked detail on torquing requirements, acceptance criteria for shaft size, bearing clearance requirements, and belt tension criteria.

(2) Additionally, the following procedures were deemed to contain inadequate detail to accomplish the intended tasks.

- Procedure IP/0/B/3314/15, "Radiation Monitoring System Flow Calibration," lacked information on how to manipulate and identify ventilation sample line equipment.

- Procedure PT/0/A/4971/12/R, "Routine Test Procedure: RIS Type 90634-100 Undervoltage Sensor with C-H M300 Auxiliary Relay," failed to provide detail on obtaining input and control voltage, as well as adequate instructions concerning installation of the test setup.

- MMP 1.0, "Work Request Preparation," Revision 28, did not instruct the licensee to conduct operability determinations of work requests. These reviews were accomplished even though the procedure does not require them.

- Procedure IP/0/A/3680/08, "EQC System Time Delay Relays and Undervoltage Relay Calibration," lacked the necessary detail to install equipment, resulting in improper installation and subsequently blown fuses in the emergency diesel generator sequencer cabinet.

(3) The team performed a comparative review of Nuclear Production Department Directive (NPDD) 3.1.3 and Station Directive (SD) 4.2.2 regarding independent verification (IV) and found the following nonconservative SD requirements.

(a) NPDD 3.1.1, step 2.2.d, applied IV key control; SD 4.2.2 did not.
(b) NPDD 3.1.1, step 3.2.1.i, applied IV to temporary procedures; SD 4.2.2 did not.
(c) NPDD 3.1.1, step 4.10, implied mandatory training for visual means of verification; SD 4.2.2 used "should."

(d) NPDD 3.1.1, step 8.1, used a dose limit of 50 mrem for an exception to performing IV; SD 4.2.2 used 10 mrem.
(e) NPDD 3.1.1, step 8.1, required documentation of a waiver of IV for dose considerations; SD 4.2.2 did not.
(f) NPDD 3.1.1, step 8.5, provided guidance on exceptions for certain vent and drain valves; SD 4.2.2 did not.

(4) The on-line leak repair procedure (MP/0/A/7650/63, "On-Line Leak Repair Corrective Maintenance") was inadequate because it (1) lacked clear instructions not to exceed the minimum wall thickness provided, (2) lacked instructions on how to obtain and verify thread engagement for the injection valve, (3) failed to treat the injection pump as measuring and test equipment, (4) failed to clearly distinguish between system and component design pressures, and (5) lacked instructions for determining the actual injection pressure.

(5) Procedure IP/0/B/3450/02, "DC Emergency Lighting (ELD) System Periodic Maintenance and Testing Procedure," Changes 0-9, was deficient because it did not provide for adequate testing and preventive maintenance.

REQUIREMENT:

10 CFR Part 50, Appendix B, Criterion V requires that activities affecting quality shall be prescribed by documented instructions or procedures appropriate to the circumstances and they shall include appropriate quantitative or qualitative acceptance criteria.

REFERENCES:

1. CNM-1211.00.0319, "CRA Engineered Safeguards Large Capacity Air Handling Units."
2. WR 003228SWR.
3. WR 010359SWR.

UNRESOLVED ITEM 90-201-02

FINDING TITLE: Failure to Identify Reportable Occurrences to the NRC

DESCRIPTION OF CONDITION:

(1) Certain auxiliary feedwater check valves were added to the Catawba inservice testing program in May 1989 but procedures had not been changed to include test requirements. This item was determined to be not reportable to the NRC until questioned by the team at which point the licensee initiated a reevaluation of the reportability aspects.

(2) A violation of Technical Specification Table 3.3-4, Item 10.b concerning 4kV bus undervoltage-grid degraded voltage instrumentation had occurred in November 1989. However, LER 90-012-00 was not written until March 2, 1990 (changed to LER 90-007-01 on March 12, 1990). Personnel knew of the violation as early as November 8, 1989.

REQUIREMENTS:

(1) Technical Specification 4.0.5 requires testing in accordance with the requirements of the ASME Code Section XI. 10 CFR 50.73(a)(2)(i)(B) requires that the licensee report via a Licensee Event Report (LER) any operation or condition prohibited by the plant's Technical Specifications which includes missed surveillance or testing requirements.

(2) 10 CFR 50.73(a)(1) requires that LERs be submitted within 30 days of the discovery of the event.

REFERENCES:

For Item (1) above:
1. PIR 0-C89-0359.
2. PIR 0-C90-0340.

For Item (2) above:
3. PIR 0-C90-0036.

UNRESOLVED ITEM 90-201-03

FINDING TITLE: Failure to Follow Procedures

DESCRIPTION OF CONDITION:

The team noted several instances where licensee personnel or licensee contractor personnel failed to follow approved procedures during the performance of work as follows:

(1) Discrepancies were noted during the chemical cleaning of the nuclear service water system motor and pump components in accordance with WRs 007238SWR and 007240SWR and an associated vendor procedure ("DSI (Vendor)").

(a) Vendor procedure step B.1 required flushing each component at a rate of 1 gallon every five minutes, but no flow measurement devices were installed on the flushing system. The step also required that 25 gallons of fluid be supplied to each component being cleaned, but the flushing system had no measuring method to accomplish this.

(b) Procedure steps B.1 and C.1 which required rotating pump shafts by hand while flushing and rinsing were not performed.

(c) Procedure step C required the temperature of the rinse water to be 125°F. The maximum temperature observed by the team during rinsing was 102°F.

(d) MMP 1.6, "Housekeeping Requirements During Maintenance Activities on Open Systems and Components," requirements for Housekeeping Zone III controls were not adhered to regarding a materials and personnel log.

(2) Problems were noted with the cleaning of component cooling water (CCW) heat exchanger in accordance with WR 009183SWR for the Unit 1 train A CCW heat exchanger and procedure MP/0/A/7650/88, "Heat Exchanger Corrective Maintenance."

(a) Procedure step 11.3.1.1 required signoff by the maintenance representative and independent verifier to record the number of brushes installed in the heat exchanger tubes. Work proceeded without this verification being recorded.

(b) Procedure step 11.2 included a note stating that "Parts shall be bagged and tagged as removed." This action was not being accomplished.

(3) During the bearing replacement on the control room area HVAC air-handling unit, craft personnel utilized an unapproved procedure (i.e., manufacturer's instructions enclosed with the part) to accomplish the maintenance activities.

(4) During observation of work request 543870PS, maintenance personnel used an uncontrolled drawing of the control circuit located inside of the air-handling unit 1TB-AHU-3 control panel. Maintenance personnel could not locate a controlled copy.

(5) MMP 1.0, "Work Request Preparation," Revision 28 provided instructions for voiding of work requests. These instructions required that the word "void" be followed by an explanation and that the signature of the person voiding the WR and the date be entered in Section 5 of the WR. A number of instances were identified where the explanation for voiding the WR was inadequate. Additionally, some WRs were voided stating that the work would be done on another WR or by another group without providing specific traceability to the documentation which substantiated proper work completion. Specific examples of this deficiency were noted on WRs 112871AE, 7350PRF, 530620PS, 530610PS, 530600PS, 454850PS, 406090PS, 469540PS, 469830PS, 275700PS, and 2326MES.

(6) The team noted an improperly erected scaffold in the containment spray pump 1B room. The scaffolding, no. 41932, erected on October 15, 1990, blocked the manual operator of motored-operated valve MOV1NS03B. Additionally, insufficient clearance for scaffold movement during a seismic event had been provided to ensure that the operator electrical cables could not be damaged.

(7) The instruction for placement of deficiency tags contained in MMP 1.0, "Work Request Preparation," Revision 28, directed the preparer of the WR to check "yes" in the appropriate yes/no block if a deficiency tag was hung. Specific instructions were included in MMP 1.0 regarding the assurance that tags were hung where possible on deficient equipment and that they were cleared once work was completed. Review of 22 completed corrective maintenance work requests showed that approximately 25 percent did not have this block completed on the WR form. The subject WRs were 7361PRF, 519900PS, 7355PRF, 3572PLN, 1490PMF and 003725MES. No field examples were found where tags remained in place following completion of work.

(8) Station Directives 4.2.1, "Development, Approval and Use of Station Procedures," required that 10 CFR 50.59 evaluations be performed on maintenance procedures. No such review was performed for the vendor's (Dowell Schulmberger) chemical flushing procedure ("Formic/ Sulfuric Acid Cleaning Procedure for Nuclear Service Water System").

(9) Station Directive 3.8.8, "Radiological Work Practices," step 5.17.3.4, required all personnel entering the single-point access to the radiation-controlled area call the health physics work unit or be enroute to the HP office. This requirement was not being practiced.

REQUIREMENTS:

10 CFR Part 50, Appendix B, Criterion V requires that activities affecting quality shall be accomplished in accordance with appropriate instructions or procedures.

10 CFR Part 50, Appendix B, Criterion VI, in part, requires that measures shall be established to control the issuance of drawings which prescribe all activities affecting quality, and these measures shall assure that documents are distributed to and used at the location where the prescribed activity is performed.

REFERENCES:

1. PIR 0-C90-330.
2. WR 3725MES.
3. MP/0/A/7450/26, "Westinghouse 8000 Series Fans Corrective Maintenance," Change 1.

UNRESOLVED ITEM 90-201-04

FINDING TITLE: Failure to Promptly Identify and Correct Deficiencies

DESCRIPTION OF CONDITION:

Review of maintenance activities and control room operator logs noted several cases where licensee personnel failed to initiate deficiency reports (work requests or problem investigation reports) when conditions adverse to quality occurred. Examples include:

(a) On October 17, 1990, during the performance of procedure PT/1/A/4200/52A, "Partial Stroke Test 1FW28," a significant spill occurred because a valve was out of position. No PIR was written.

(b) On August 16, 1990, a fire occurred at EDG 2B during surveillance testing. No PIR or fire report was written.

(c) On August 25, 1990, 20 to 30 gallons of water were spilled from the containment spray ring as a result of engineered safeguard features testing. No PIR was written.

(d) On September 7, 1990, during reactor coolant system heatup, the 25V-1-S/G 2D power-operated relief valve lifted prematurely at 1020 psig resulting in a 5°F cooldown as steam pressure dropped to 960 psig. No PIR was written.

(e) A deficiency with the incore instrumentation was not documented on a work request, although performance section personnel were aware of the problem for approximately 18 months.

(f) Troubleshooting under WR 11597IAE identified that blown fuses were the result of relay testing performed under a prior work request (WR 010359SWR). No PIR was written to address the cause of the blown fuses.

(g) On November 12, 1990, the team found several inches of diesel fuel/water on top of the safe shutdown facility power cable pit and reported this condition to the licensee. No PIR was written until November 26, 1990.

(h) On October 11, 1990, there were two valid diesel generator failures. A PIR was not written until November 8, 1990.

Additionally, examples of untimely corrective action were identified:

(a) Numerous battery pack emergency lighting units required by 10 CFR Part 50, Appendix R, and Catawba FSAR Section 9.5.3.2, were found inoperable in July through November 1990, during annual and monthly testing. Work requests had been issued for repairs, but on November 27, 1990, about 33 percent of the FSAR-required lights remained out of service. Some repairs were delayed because parts were unavailable or because repairs were scheduled as low-priority work. The repairs had not received expedited attention until the team identified them.

(b) An audit of control room drawings conducted in August 1990 identified an improperly updated control room drawing. However, corrective action was not taken for more than 3 months, contrary to step 9.5 of OMP 2-10, "Control Room Drawing Maintenance," Revision 1.

(c) The team noted that 6 days after WR 54515OPS had been issued, for the failure of the blue pen that indicated steam generator level on the steam generator 1B recorder, that the work had not been performed. On the basis of identifying the indication's importance, the WR was immediately sent to the planning work unit as a Priority 2 work request that required, if possible, a repair within 24 hours.

REQUIREMENTS:

10 CFR Part 50, Appendix B, Criterion XVI requires that measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected. In the case of significant conditions adverse to quality, the cause of the condition shall be determined and corrective action taken to preclude repetition. For significant conditions adverse to quality both the cause of the condition, and the corrective action taken shall be documented and reported to appropriate levels of management.

Licensee Conditions 2.C.(6) and 2.C.(6) for Catawba Units 1 and 2, respectively, requires the licensee to maintain in effect all provisions of the approved fire protection program, including emergency lighting, as described in the Final Safety Analysis Report and as approved in the Safety Evaluation Report through Supplement 6.

REFERENCES:

None

UNRESOLVED ITEM 90-201-05

FINDING TITLE: Issuance of Expired Shelf-Life Material

DESCRIPTION OF CONDITION:

Licensee procedures governing the shelf-life program for stock parts and the issuance of parts for use in safety-related equipment did not contain adequate instructions for expired shelf-life material control and handling. Expired stock could be issued without an engineering evaluation.

Review of expired shelf-life material that was still on the shelf awaiting receipt of replacement material revealed 21 expired material issuances of QA-related O-rings used in environmentally sealing electronic transmitter covers and one expired material issuance of a QA-related gasket used in environmentally sealing Limitorque housing covers. The licensee performed an operability determination to ensure no adverse consequences on safe plant operations from the use of the O-rings and needed to complete the operability determination for the gasket.

REQUIREMENTS:

10 CFR Part 50, Appendix B, Criterion VIII, states that measures shall be established for the identification and control of materials, parts and components to prevent the use of incorrect or defective material, parts, and components.

10 CFR Part 50, Appendix B, Criterion XV, states that measures shall be established to control materials, parts or components which do not conform to requirements in order to prevent their inadvertent use or installation. These measures shall include, as appropriate, procedures for identification, documentation, segregation, disposition, and notification to affected organizations. Nonconforming items shall be reviewed and accepted, rejected, repaired or reworked in accordance with documented procedures.

REFERENCES:

1. MHP 3.2, "Shelf Life Program," Revision 6.
2. MHP 5.1, "Issuing and Returning Materials," Revision 18.
3. PIR 0-C90-0333.

UNRESOLVED ITEM 90-201-06

DEFICIENCY TITLE: Failure to Perform Independent Verification

DESCRIPTION OF CONDITION:

Technicians conducting tasks described in the following instrumentation procedures failed to adhere to the independent verification requirements detailed in each of the procedures.

- IP/0/A/3890/01, "Controlling Procedure for Troubleshooting and Corrective Maintenance," paragraph 5.1.3.
- IP/2/A/3222/55A, "RCS Pressure (Wide Range) Channel 4 Loop PT-403 (2NCPT5140)," paragraph 5.1.2.
- IP/2/A/3122/01B, "Inadequate Core Cooling Monitor System (ICCM-86) Walkdown Checklist Train B," paragraph 5.1.2.
- IP/2/A/3122/03B, "Inadequate Core Cooling Monitor (ICCM-86) Analog/Digital Internal Loop Calibration Train B," paragraph 5.1.3.

Each of the above procedures stated:

"A. Before action is performed, two individuals acting independently will verify that component on which action is to be taken is correct. This will be done by comparing work requests, procedure, and equipment identification.

B. After action is performed, an individual, acting independently of person that performed action, will verify action has been completed correctly."

The close coordination between technicians in accomplishing their tasks precluded their conformance to the independent verification requirements.

Similar failures to follow independent verification requirements were identified with performance of procedure IP/1/A/3240/041, "Calibration Procedure for Power Range N-42 Analog Channel Operability Test."

REQUIREMENT:

10 CFR Part 50, Appendix B, Criterion V requires that activities affecting quality shall be accomplished in accordance with appropriate instructions and procedures.

REFERENCES:

1. Nuclear Production Department Directive 3.1.1, "Independent Verification Requirements," Revision 4.
2. Catawba Nuclear Station Directive 4.2.2, "Independent Verification Requirements," Revision 2.
3. NUREG-0737, Item I.C.6, "Guidance and Procedures for Verifying Correct Performance of Operating Activities."
4. IE Information Notice 84-51, "Independent Verification," June 26, 1984.
5. WR 475030PS.
6. WR 003778SWR.

UNRESOLVED ITEM 90-201-07

FINDING TITLE: Failure to Conduct Periodic Procedure Reviews

DESCRIPTION OF CONDITION:

Station Directives affecting quality appeared to be outdated with no indication of periodic review as required by the Technical Specifications. For example, Station Directive 2.4.3, "Control of Materials, Parts and Components," and Station Directive 3.3.12, "Equipment Qualification Program," had not received periodic reviews. The majority of Station Directives should receive a periodic 2-year review.

REQUIREMENTS:

Technical Specification Section 6.8.2 requires that applicable procedures identified in Appendix A to Regulatory Guide 1.33, Revision 2, shall be reviewed periodically.

Station Directive 4.2.1, "Development, Approval and Use of Station Procedures," requires that all station procedures shall be reviewed at intervals not exceeding two years.

REFERENCES:

1. ANSI N18.7-1976, "Administrative Controls and Quality Assurance Program for the Operational Phase of Nuclear Pow Plants."

UNRESOLVED ITEM 90-201-08

FINDING TITLE: On-Line Leak Repair Process

DESCRIPTION OF CONDITION:

The on-line leak repair process was executed through procedure MP/0/A/7650/63, "On-Line Leak Repair Corrective Maintenance," which was based on the Electric Power Research Institute (EPRI) document, "NMAC: On Line Leak Repairing."

The team noted a discrepancy between the EPRI document and the licensee's program with regard to injection pressure of the sealant. The EPRI document stated that injection pressures should in most cases be less than system pressures to positively prevent extrusion into the line. In all on-line leak activities observed or reviewed, the injection pressure significantly exceeded the pressure of the system under repair.

The licensee specified in its procedure (MP/0/A/7650/63) the maximum pressure to which the component can be subjected from the injection process and defined this pressure as the "maximum allowable dead head pressure." The licensee stated that the "maximum allowable dead head pressure" should always be equal to or less than the component design pressure. The pressure indicated by the injection pump gauge routinely exceeded the "maximum allowable dead head pressure." For example, the actual injection pressure for the repair of valve 2CA-191 was recorded as 3400 psig while the "maximum allowable dead head pressure" was 2400 psig. When questioned, the licensee stated that the maximum allowable pump gauge pressure was the sum of the "maximum allowable dead head pressure" and the "static pressure." The licensee indicated that the "static pressure" was obtained prior to connecting the sealant pump fitting to the temporary valve fitting and was the pump gauge pressure required to initiate movement of the sealant. The "static pressure," which is a function of the particular sealant chosen, is not defined in the procedure nor is its value specified in the procedure. The procedure also did not direct the craft personnel to subtract the "static pressure" from the maximum gauge reading to obtain the actual injection pressure. Further, as observed during the leak repair of valve 1SP-0097, the craft personnel understood the maximum pressure gauge reading to include the system pressure prior to injection contrary to the licensee's definition of "static pressure." The licensee maintained that during the process the cavity being filled does not experience pressures in excess of the "maximum allowable dead head pressure." The licensee has not adequately demonstrated that the injection pressure as read at the injection pump gauge did not result in component internal pressures greater than the "maximum allowable dead head pressure" and/or their design ratings.

REQUIREMENTS:

10 CFR Part 50, Appendix B, Criterion V requires that activities affecting quality shall be prescribed by documented instructions or procedures of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings. Instructions, procedures, or

drawings shall include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished.

REFERENCES:

None

CATAWBA MAINTENANCE INSPECTION TREE