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Report Nos.: 50-400/89-16

Licensee: Carolina Power and Light Company
P.O. Box1551
Raleigh NC 27602

Docket Nos.: 50-400 License Nos.: NPF-63

Facility Name: Harris 1

Inspection Conducted: July 31 - August 4, and August 14-18, 1989

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SUMMARY

Scope:

This special, announced inspection consisted of an in-depth team inspection of the maintenance program and its implementation. NRC Temporary Instruction 2515/97 issued November 3, 1988, was used as guidance for this inspection.

Results:

Overall, the maintenance program was judged to be GOOD with GOOD implementation. Areas of strength and weakness are highlighted in the Executive Summary with details provided in the report. No violations were identified.

One unresolved item was identified related to testing molded case circuit breakers in the safety-related 125 VDC power system (see section C.6).

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SECTION A

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Background

The Nuclear Regulatory Commission (NRC) considers effective maintenance of equipment and components a major aspect of ensuring safe nuclear plant operation and has made this area one of the NRC's highest priorities. In this regard, the Commission issued a Policy Statement dated 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 is undertaking a major program to inspect and evaluate the effectiveness of licensee maintenance activities. As part of this inspection activity, the current inspection was performed in accordance with guidance provided in NRC Temporary Instruction (TI) 2515/97, Maintenance Inspection, dated November 3, 1988. The TI includes a "Maintenance Inspection Tree" that identifies the major elements associated with effective maintenance. The tree was designed to ensure that all factors related to maintenance are evaluated.

Conduct of Inspection

The maintenance inspection at the Carolina Power and Light (CP&L) Shearon Harris Nuclear Power Plant (SHNPP) was initiated with a site meeting on July 10-12, 1989, where the inspection scope was discussed. In addition, a comprehensive package of material, as requested by NRC letter dated June 20, 1989, was provided for inspection preparation.

The inspection was conducted by a team consisting of a Team Leader and six inspectors. On July 31, 1989, the licensee presented to the inspection team an overview of the site maintenance program. The team spent two weeks, July 31 - August 4, and August 14-18, 1989, on site conducting the inspection.

The inspection was performance based, directed toward evaluation of equipment conditions; observation of in-process maintenance activities; review of equipment histories and records; and evaluation of performance indicators, maintenance control procedures and the overall maintenance program.

Maintenance activities were selected for detailed review by the team using the following criteria:

- Known industry problems
- Review of Licensee Event Reports (LERs) - site specific problems
- Review of NRC Bulletins and Notices
- Review of Plant Maintenance History

- Consultation with the Senior Resident Inspector
- Probabilistic Risk Assessment Analysis

Based on the above selection criteria, the following specific systems were selected for direct inspection effort:

Containment Spray System (CS)
Service Water System (SW)
Essential Services Chill Water System (ESCW)
6.9 KV AC Distribution System
Instrument Air System (IA)
125 Volt DC Distribution System

Results

The inspection results are presented in Figure 1 as the completed inspection tree. As indicated in the tree, three major areas of the licensee's maintenance program were evaluated: (1) Overall Plant Performance Related to Maintenance, (2) Management Support of Maintenance, and (3) Maintenance Implementation. Under each major area, a number of elements were evaluated, rated, and colored in accordance with the following guidelines:

"GOOD" Performance (Green)	-	Overall, better than adequate; shows more than minimal effort; can have a few minor areas that need improvement
"SATISFACTORY" Performance (Yellow)	-	Adequate, weaknesses may exist, could be strengthened
"POOR" Performance (Red)	-	Inadequate or missing
(Blue)	-	Not evaluated

In general, the top half of the box (element) was rated depending on how well the element had been specified programmatically and the bottom half was rated depending on how well the element was being implemented. As noted in the tree, overall, the Harris program for establishing an effective maintenance program was rated GOOD. The implementation of the program was rated GOOD. For the three major areas; (1) Overall Plant Performance was rated SATISFACTORY, (2) Management Support was rated GOOD for program and GOOD for implementation, (3) Maintenance implementation was rated GOOD for program and GOOD for implementation. These ratings were based on specific strengths and weaknesses identified in the issues section of the report. The following are the more significant strengths and weaknesses identified (see report for details):

Strengths:

1. General Housekeeping and Material Condition is considered above average to good (with the below indicated exception).

2. The Material Control system is considered to be a strength and contributes to the Maintenance Program.

3. The I&C Program is considered a strength.

4. The Automated Maintenance Management System (AMMS) is considered a strength.

5. The System Engineering Program is considered a strength.

6. Preventive Maintenance for Switch Gear and Motors is considered a strength.

7. Deficiency Identification system is considered a strength.

8. Feedback system is considered a strength.

Weaknesses:

1. Housekeeping and material condition in remote/low traffic areas is poor.

2. Vendor maintenance recommendations are not always addressed.

3. All ASME Code Section XI standby equipment is not included in the vibrational analysis predictive maintenance program.

4. Deficiencies related to the rotary air compressor: the absence of maintenance/surveillance procedures; lack of training; lack of main control board alarms; and frequent trips.

5. The lack of a formal process to consider risk in the maintenance process.

6. The licensee's program does not address the ASME Section XI subsection IWA 7220 suitability analysis requirements for non pressure retaining replacement parts, such a bearings, bushings, springs, stems, disks and shafts (items covered by ASME B & PV Code subsections IWP and IWV).

7. Lack of attention to work request and authorization status accuracy.

<u>NRC Concerns</u>

1. The lack of identification/specificity of consumables such as solvents, adhesives, and thread sealers in work packages.

2. The Quality Control (QC) staff size is marginally adequate. The potential exists for ineffective QC participation in day-to-day maintenance should the QC staff level be allowed to fall any lower than the current level.

S E C T I O N   B

I N S P E C T I O N

1. Service Water and Essential Services Chilled Water Systems

A. Service Water System

Background

The Service Water (SW) system consists of two separate systems, the Normal Service Water (NSW) system and the Emergency Service Water (ESW) system. The NSW system is normally operating to provide cooling to numerous plant auxiliary components. The ESW system is normally in a passive, standby status, ready to provide essential cooling from the ultimate heat sink during postulated accident conditions for safe shutdown of the reactor.

The NSW system consists of two pumps, each capable of supplying the required cooling for all NSW and ESW heat exchangers at 100% power operation. The NSW pumps take a suction on the cooling tower basin via a concrete conduit and provide the cooling water to the plant via a self cleaning strainer. During normal operation, the NSW flow provides cooling to the NSW system heat exchangers and, via a cross-connect, provides cooling to the ESW heat exchangers. Return flow is directed back to the cooling tower via the circulating water system.

The ESW system includes two intake structures and two pumps, each capable of supplying sufficient cooling to safely shutdown the reactor during postulated accident conditions. The ESW pumps are located in the emergency service water and cooling tower makeup (CTMU) water intake structure physically separate from the main plant. The ESW pumps can be aligned to draw suction from the main reservoir via traveling screens in the CTMU intake structure area or from the auxiliary reservoir via traveling screens in the ESW intake structure. Return from the ESW system is directed to the auxiliary reservoir via a return canal. The ESW system also provides a backup source of water to the Essential Chilled Water System, the Auxiliary Feedwater System and the Fire Protection System.

Inspection

The team's inspection of the SW system included a walkdown inspection of the emergency service water intake screening structure, the emergency service water and cooling tower makeup water intake structure, the NSW pumps, the ESW pumps, the SW booster pumps, major heat exchangers and valves. Also included was a review of the SW system historical maintenance data, the preventive maintenance program and the general condition of components.

The walkdown inspection revealed that areas which are physically separate from the main plant are not adequately monitored to ensure site housekeeping and material condition standards are maintained. These areas include the emergency service water and cooling tower makeup water intake structure, the emergency service water intake screening structure and the normal service water pump structure. Specific examples are included in section C of this report under Issue no. 5.

The general condition of SW system components is good. Components within the Reactor Auxiliary Building (RAB) are in particularly good condition in contrast to those in external or remote areas. For example, the coupling on the 'A' ESW pump was heavily corroded and two valves on the NSW pump structure were corroded to the point that much of the handwheels were gone. Similar to housekeeping problems, components located in remote areas do not receive the same level of attention as those in high traffic areas.

The preventive maintenance (PM) requirements for the SW system components are well documented in site procedures. A weakness noted in the PM program was the failure to incorporate vendor maintenance requirements. Several PM requirements specified by the ESW pump vendor were not included in the licensee's PM program. The licensee had apparently identified this error in May as part of a technical manual review program, but had not initiated corrective action at the conclusion of this inspection. (See section C, Issue no. 6.)

There was no direct observation of maintenance activities associated with the SW systems due to lack of scheduled maintenance on the SW systems. Historical maintenance data applicable to the SW system was reviewed by the team. Data was easily retrievable and provided a valuable record of maintenance actions on system components.

The licensee has established a procedure to test the performance of the component cooling water (CCW) heat exchangers, CCW Heat Exchanger Performance Test, PPP-212. In June 1988, the test procedure was run on both CCW heat exchangers. The results determined that the computer point values were not accurate enough to perform a heat balance on the CCW heat exchangers. While excellent initiative has been shown in the development of the performance test, action to effectively implement the procedure has been lacking.

B. Essential Services Chilled Water

<u>Background</u>

The Essential Services Chilled Water (ESCW) system provides chilled water to the cooling coils of air handling units which provide ventilation to vital equipment areas in the plant. The ESCW system is comprised of two loops, each having an R-12 water chiller, a pump and the air handling units. The air handling units in the ESCW system provide cooling to many vital areas in the plant.

Inspection

The team performed a detailed walkdown of the ESCW system which included both chillers, including chemical addition tanks and expansion tanks, pumps and twenty of the air handling units. The walkdown inspection noted the following:

- The air handling unit intake screens on all units observed were missing a majority of the wing nuts designed to hold them in place.
- Numerous ESCW system valves have packing leaks. Many of these had already been identified by the licensee.
- ESCW system valves are subject to heavy corrosion due to condensation. Painting and other methods to prevent corrosion have been unsuccessful.

The team also observed portions of the maintenance in progress for the following work request and authorizations (WR&A):

- 88-ASNA1, Repair a packing leak on 1CH-518
- 88-ASNB1, Repair a packing leak on 1CH-522
- 88-ASPL1, Repair a packing leak on 1CH-521
- 88-ASPM1, Repair a packing leak on 1CH-519
- 89-AEBA1, Repair a seat leak on 1CH-59
- 89-AGEN1, Bench test relief valve 1CH-50
- 89-AGEP1, Bench test relief valve 1CH-63

The packing leak repairs were observed in a piecemeal fashion, observing for short periods at various intervals. The work progressed smoothly with all four valves being completed over a two day period. The completed repairs appeared to have corrected the packing leaks. The valves were repacked using live-load packing to prevent recurrence of packing leak problems on these valves.

The relief valve bench tests received limited observation during the actual removal of the valves. No problems were noted.

The seat leak repair of 1CH-59 was observed in detail. The valve was reported to have a seat leak and upon disassembly and inspection, a small indentation was observed on the valve disc and on the seat, apparently due to impurities or corrosion in the system. Initial attempts to lap the seat proved futile. A special cutting tool was then used to cut the seat. Several cuts were made until a satisfactory blue check was received. A new stem and disc were used

and the valve was reassembled. The craftsmen were knowledgeable, skilled and experienced in the tasks performed as part of the valve repair.

Some problems were noted with the repair of 1CH-59. Several items, not listed in the procedure, were used in conducting the repair, specifically:

Silicon carbide - grade 1A, 320 grit abrasive compound
N-5000 nickel graphite anti-seize lubricant
Isopropyl alcohol

While these items are controlled under Plant Chemical Controls (AP-501), specific maintenance procedures should direct the conditions and use of such items. This is also discussed in section B.12. It was also noted, on August 18th, that the bonnet nut tack weld had not been completed, although the job had been signed off as complete, by the lead craftsman, and the welder, and was awaiting review by the crew foreman. The requirement to tack weld the bonnet nut was specified in the WR&A, the CM procedure Yarway Valves (2" and smaller) Disassembly and Maintenance, CM-M0031, and in the Yarway valve technical manual. This condition was corrected by the licensee and verified by the NRC Resident Inspector on August 21, 1989.

2. Containment Spray System

System Description

The primary purpose of the Containment Spray (CS) system is to limit offsite doses following a loss-of-coolant accident (LOCA) or a main steam line break (MSLB) by reducing the pressure of the post-accident containment and reducing the amount of airborne radioactive iodines inside containment. The system consists of two redundant trains and a common spray additive tank. Each train has a pump, a spray eductor, two 360 degree spray headers, and the required piping and valves. In the injection mode, the pumps take suction from the refueling water storage tank (RWST). Upon a low-low level in the RWST, pump suction is transferred to the recirculation sump (recirculation mode). A portion of flow from each pump discharges through the eductor where sodium hydroxide from the spray additive tank is drawn in and returned to the pump suction, thus introducing the sodium hydroxide into the spray water. During a LOCA, the water and sodium hydroxide mixture is sprayed into the containment atmosphere providing cooling and thus depressurization of the containment atmosphere. The sodium hydroxide improves the removal of radionuclides from the containment atmosphere by chemically absorbing gaseous iodine out of the atmosphere.

Inspection

The team evaluated maintenance relative to the CS system by performing a walkdown inspection of the system, observing maintenance activities, and reviewing maintenance history records.

During the walkdown inspections, general equipment condition and housekeeping in the various equipment spaces were examined. Pumps, valves (including operators), piping, supports, and foundations were inspected for general condition and cleanliness, leaks (water, oil, and grease), rust/preservation, lubrication, dirt/trash, etc.

The team observed preventive maintenance of CS pump 1CT-E005 in accordance with procedure MPT-0084 and WR&A 89NYZ324. Procedure compliance, work performance, and proper documentation were evaluated.

Maintenance history for the CS system was examined by reviewing a brief description of all WR&As issued for the system since June, 1988. In addition, through the Automated Maintenance Management System (AMMS) equipment history records, the complete maintenance history for the CS pumps and selected valves were reviewed. The team also reviewed in detail completed WR&As 88-AMNG1, 88-BBIE1, 89-AFZW1, 89-AMNS1, 88-BCRP1, 88-APJF1, 88-ASHH1, 88-AZXC1, 88-AZXJ1, 87-AXNF1, 87-AXNE1 and 88-AZXH1 for the CS system. These WR&As were reviewed for completeness and to assure that ASME Section XI required post maintenance tests were performed after maintenance.

The above inspections, observations, and record reviews revealed the following:

- In general, material condition was found to be good or above average. The team did note minor valve packing leaks (valves 1CT-47, 1CT-39, 1CT-26, and 1CT-71). The leaks on valves 1CT-39 and 1CT-26 had not been identified by the licensee. In addition, minor Limitorque operator leaks on valves 1CT-47 and 1CT-71 were identified by the team and had not been identified by the licensee. The fact that the leaks had not been identified by the licensee was not considered to be significant due to the minor nature of the leaks and the equipment records showing a history of the licensee identifying and correcting similar type problems. The licensee initiated deficiency tags and WR&As to correct the identified leaks.

- Housekeeping was found to be above average to good.

- The team noted that a large percentage of maintenance on the system had been to correct valve packing leaks. The licensee pointed out that they had a program in process to "live load" pack a large number of valves. Over 700 valves were "live load" packed during the last outage and approximately 70 valves have been identified for "live load" packing during the next outage. Although some of the CS system valves that have minor leaks have been "live load" packed and still have minor leaks, the licensee considers that "live load" packing will help minimize packing leaks.

- During the above inspections, the team evaluated the involvement of system engineers in the maintenance process. For the CS system, the assigned system engineer appeared to be involved in all aspects and was very knowledgeable of the system.

- The team also examined the predictive maintenance program. See paragraph C.1 for details of findings for this program.

3. 6.9 KV AC Distribution System

The purpose of the 6.9 KV Distribution System is to transmit power to the power plant auxiliary equipment. Portions of the system directly feed safety-related loads and, therefore, are safety-related as defined in Title Ten, Code of Federal Regulations. Equipment that performs key functions in the system includes transformers, nonsegregated bus duct, cable, motors, emergency generators and switchgear. Ancillary equipment such as instrument transformers, protective relays, meters, switches, etc. may be considered part of the system. Of this equipment, only motors, generators, switchgear and relays involve complex maintenance. Switchgear maintenance will be discussed in this section. Both 6.9 KV and 480 V motor maintenance is discussed in Section B.14. Since motors were seen as representative of the licensee's program for rotating electric machinery, the inspection did not specifically focus on generators. Relay maintenance is essentially a special case of an instrument calibration. The instrument calibration program in general is covered in Section B.8.

The 6.9 KV switchgear at SHNPP was manufactured by Siemens-Allis Co. It is 15 KV class indoor switchgear with air-magnetic circuit breakers rated at 7.2 KV at various ampere ratings. System design incorporates 85 circuit breakers.

Inspection

As a prelude to observing ongoing switchgear maintenance, the team discussed the PM program with cognizant electrical foremen and technicians. There are about 30 major PM steps that are typically recommended for medium voltage switchgear. SHNPP procedures included nearly all of these steps. The procedures did not call for a check of the anti-pump circuit nor an insulation resistance measurement across the open contacts. In response to the team's comments, an electrical maintenance engineer initiated a "feedback report" recommending addition of the two steps. The maintenance engineering supervisor signed the "feedback report" to indicate his concurrence. Therefore, the team expects the PM procedures to be updated eventually. At present, the program calls for performing preventive maintenance at every second refueling outage, or approximately half of the switchgear at each refueling outage. A small percentage of the circuit breakers may conveniently be PM'd while the unit is at power, and these are done at a biannual interval. Keeping in mind that circuit breakers are interchangeable between compartments of like rating, the tracking of individual circuit breakers was also discussed. The team was convinced that procedures and controls are implemented to assure that each circuit breaker is worked at the proper interval.

The team asked the electrical foremen and technicians if they were aware of any problems with the switchgear unique to their particular model. They related to the team two problems that came to light, and were corrected, during initial plant startup. One was that the secondary disconnect assembly did not provide proper electrical contact for circuit breakers at the first cubicle in a line-up. This was due to bulging of the side panel, and the solution was to install supplementary steel outside the switchgear. The second problem involved puffer tubes that needed additional support.

The team observed the complete performance of the PM procedure on a 1200 A, 6.9 KV circuit breaker (WR&A-89 AAF407). Two technicians worked together on the procedure. One was qualified by virtue of the fact he completed the relevant classroom and on-the-job training; the other was training to become qualified on switchgear. Through interviews, the team learned that the lead man did not have extensive experience with switchgear. Nevertheless, he performed well and moved through the procedure smoothly. He indicated that the manufacturer's technician, during site visits, had provided information that supplemented the CP&L training. The procedure called for several dimensional checks. Some adjustments were needed and easily made. Had the work being witnessed been on a safety-related circuit breaker, there would have been four quality control hold points. The switchgear room provided ample work space. Controlled copies of the manufacturer's instruction book were brought to the work place. The procedure was completed and the breaker was returned to its cubicle in the test position. Later the team confirmed with Operations that the breaker had passed the performance test.

The team performed a walkdown inspection of all 6.9 KV switchgear, accompanied by a maintenance engineer. Eight discrete switchgear lineups are located in three switchgear rooms. The switchgear and rooms were in good condition.

In addition, various documents related to 6.9 KV switchgear maintenance were reviewed:

a. Microfilm copies of three work requests, including data sheets for PM work selected at random from the refueling outage.

b. A summary report of corrective maintenance and special work on System 5165, "6.9 KV AC Distribution System." The report contained 49 entries and covered the period June 1988 - July 1989.

c. For 25 of the entries in the summary report, the computer printout of the work request was obtained and reviewed.

This documents review did not reveal any adverse trends or documentation deficiencies.

The team concluded that the program is strong. A nuclear quality procedure, supplemented by complete vendor instruction books, implemented good industry practice. Work is being done at a conservative interval. Engineers and foremen are involved in the work. While the technicians did not have extensive experience with switchgear, the team relied on observation of work in progress to conclude they were competent. Use of Quality Control (QC) hold points for safety-related circuit breakers is a plus. Documentation provided additional verification that the program is working. And finally, the switchgear appeared to be in good condition.

4. 125 Volt DC Distribution System

Background

The safety-related 125 Volt DC power systems provide a reliable source of continuous power for control, instrumentation, and emergency service. The systems consist of two redundant 125 VDC trains. Each train has one battery, two battery chargers, a ground detection system, and a switchgear load distribution center (panel). The distribution centers utilize molded case circuit breakers for feeder circuits to the battery chargers and 120 Volt AC inverters. All other feeder circuits are fed from fused switches.

Both batteries are the lead-acid type with lead-calcium grid construction. Each battery consists of sixty cells and is located in a separate battery room in the auxiliary building. The two battery chargers for each train are identical and redundant. Each charger is capable of suppling 100 percent of the load current.

The safety-related 125 VDC trains supply power to the 6.9 KV and 480 V AC switchgear control circuits, the safety-related diesel generators, auxiliary feedwater system isolation valves, solid state protection panels, safety-related instrumentation and controls and the 120 V AC vital inverters during loss of AC power. Power generation DC loads are supplied by nonsafety-related batteries, chargers, and inverters.

Inspection

The team conducted a walkdown inspection of the safety-related 125 VDC system. An effort was made to examine all system batteries, battery chargers, load distribution centers, and other control panels using 125 VDC for general cleanliness and material condition. The team also inspected numerous circuit breakers, fuses, switches, wiring connections, and cables. In addition, the four safety-related 120 VAC vital inverters were examined.

In general, system housekeeping was found to be satisfactory in all areas. The material condition of all equipment was exceptional, except for the 120 VAC vital inverters. The temperature of the transformers in the 120 VAC vital inverters appeared to be excessively high. Maintenance personnel informed the team all of these transformers have already been replaced.

During the walkdown, the team observed maintenance electricians troubleshooting a ground fault in the 125 VDC system train B. The electricians determined the quickest method to find a ground was to isolate each circuit and power it from the standby battery charger until the ground was found on the isolated circuit. This method has merit in locating ground(s) in an energized system without jeopardizing other circuits in the system.

The team observed the weekly surveillance tests for both safety-related 125 VDC batteries. The team requested additional specific gravity and voltage readings be performed. In all cases, the voltage and specific gravity for the various cells was found to be within specifications. The batteries were in good condition.

The team observed the weekly surveillance test for the diesel driven fire pump starting battery. The battery was found to be within specifications and in good condition. In addition, the team examined the associated control panel, 1-4A NNS, which contains the battery charger and control circuits for the diesel driven fire pump. This panel is outside and located at the emergency service water intake structure. The panel door was warped and the insulation was damaged preventing the panel from being either watertight or splashproof. The control fuses and electrical connections were corroded. The relays had open contacts which are subject to oxidation. The panel was extremely dirty and contained debris. The licensee issued WR&A 89-ANHA1 to clean the panel and make it weather proof. FBR 89-00778 was initiated to provide quarterly maintenance on the PM schedule and have engineering perform an evaluation for upgrading.

The team determined the licensee has a good maintenance program for the 125 VDC system. With the exception of panel 1-4A NNS, all the panels and batteries were found to be satisfactory. The team reviewed the test procedures for the batteries, chargers, and 120 VAC inverters and determined they were adequate. Work history was reviewed and the licensee was aware of the problems with the 120 VAC inverters (transformer replacement). The only other area of concern the team identified was with the molded case circuit breakers discussed in paragraphs C.4. and C.7. The molded case circuit breakers are not tested to verify they will perform their intended function. Page 18 in Section II of Gould-ITE Vendor Manual contains the field test procedure for thermal magnetic molded case breakers used in the 125 VDC system.

5. Instrument Air System

Background

The Compressed Air (CA) system at SHNPP provides air for two air subsystems: Service Air (SA), and Instrument Air/Breathing Air (IA/BA). The purpose of the SA system is to provide oil-free filtered air for operation of pneumatic tools, and service use. The purpose of the IA/BA system is to deliver dry, filtered air for operation of pneumatic instruments, controls, and valve operators, and to provide dry oil-free breathing air to work areas with potential or actual airborne contamination. The IA and BA systems share the same piping.

The CA system at SHNPP is considered nonsafety, and therefore, no credit is taken for operation of the CA system during an accident, however, there are three safety-related accumulators which allow their respective valves to operate upon loss of IA. The systems served by the accumulators are two containment vacuum breakers, and a single valve in the hydrogen purge system. Other safety-related valves and devices which rely on IA fail in the conservative direction on loss of IA.

Under the current configuration, air is provided to the system by a total of five oil-free air compressors; four two-stage reciprocating air compressors (1A, 1B, 1C, 1D), as described in the Final Safety Analysis Report (FSAR), and a self-contained rotary screw air compressor (RAC) and twin-tower desiccant air dryer package, which was recently added as a temporary modification to improve CA system reliability. The reciprocating compressors and the two air dryers described in the FSAR have proven themselves unreliable under continuous duty, and have required an inordinate amount of maintenance. At the time of the inspection, however, the RAC and its air dryer were not in the latest revision of the FSAR, and licensee management did not indicate any definite plans to incorporate this equipment in the FSAR.

Compressors 1A and 1C supply IA/BA, and these compressors discharge into their own twin tower desiccant air dryers, afterfilters, and air receivers. SHNPP has committed to -25 degrees F. or below for air dew point based on guidance given in American National Standards Institute (ANSI) MC 11.1-1976.

Compressors 1B and 1D supply the SA system, and the discharge of these compressors is only filtered. Each of the four reciprocating compressors are equipped with tube and shell intercoolers, and discharge aftercoolers. Service water is the cooling medium.

The RAC is a self-contained unit, and contains an air-to-air intercooler and aftercooler. The discharge of the RAC is piped directly to an additional aftercooler and then to its own twin-tower desiccant dryer unit, also capable of -25 degrees F. dewpoint at rated flow, and an afterfilter. The RAC and dryer package are powered from an offsite substation in Cary, NC. Since it is desirable to restore IA if offsite power is lost, it is possible to manually load reciprocating compressors 1A, and 1C (which supply IA/BA to the plant) onto safety related busses.

All four reciprocating compressors operating together deliver a maximum of 2108 standard cubic feet per minute (SCFM) at 100 to 110 pounds per square inch (psi). The RAC is rated at 1500 SCFM maximum, at 100 to 110 psi. At the time of the inspection, the RAC was operating, and the reciprocating compressors and their dryers were in standby. This has been the case since June, 1989. Typically, air demand at 100% power is 875 SCFM at 100 to 110 psi. Should IA/BA and SA pressure drop below 97.5 psi with the RAC

on line, the four reciprocating compressors are set to auto-start with no operator action required. The air dryers associated with the 1A and 1C compressors, however, would have to be energized and valved into service.

Air system trouble for the reciprocating compressors and the air dryers at the discharge of compressors 1A, and 1C is indicated locally, and on the main control board (MCB), and are as follows:

ALARM	FUNCTION
"Shift Failure"	Air dryer trouble
"Heater Failure"	Air dryer heater trouble, <125 deg. F
"High Dew Point"	On-line dryer tower depleted (>3½% RH)
"No Purge Flow"	Purge flow failure to tower in regeneration mode.

At the time of the inspection, alarms to the MCB were not connected to the RAC and its dryer, even though the equipment has been supplying all air to the plant on a steady basis since early June, 1989. Auxiliary Operators, however, make rounds at the RAC and its dryer twice per shift to check vital operating parameters, and to blow water out of the RAC intercooler and aftercooler.

Compressed air is delivered to the plant via a series of ring headers and branch lines to meet the IA, BA, and SA needs of the plant and yard areas. A single containment penetration is provided for IA/BA. Isolation of IA/BA is provided by a fail closed air-operated valve outside containment, and a check valve inside containment. Similarly, SA is provided to containment via a single penetration, and isolation is provided by a manual valve outside containment, which is locked closed during normal operations, and a check valve inside containment.

In accordance with a commitment to the NRC, CP&L has installed in-line filters directly upstream of safety-related components in the IA system. This is indicated in the CP&L response to NRC Generic Letter (GL) 88-14 "Instrument Air System Problems Affecting Safety-Related Equipment."

These filters ensure that particulates do not affect operability of these safety-related components.

Inspection

The team completed a general walkdown of selected portions of the CA system. The major components examined included all four reciprocating compressors, the RAC, all three air dryers, afterfilters, two safety-related accumulators and their check valves, and a number of filter-regulators and their associated end-use devices.

The team also conducted a review of selected documents, procedures, and work records for a number of CA system components, and conducted interviews with licensed operators, auxiliary operators (AO), and cognizant engineers. Further, the team conducted an in-depth review of the licensee's response to NRC GL 88-14 on instrument air. Pursuant to this review, the team examined records of licensee air quality checks, and obtained a list of all corrective maintenance performed on air operated equipment due to IA quality.

The general condition of the CA system components was observed to be good, and maintenance of the CA system was a strength based on the relatively small number of problems associated with air quality; only ten cases were recorded, the last in 1987. The team also found that air quality was very good; the CA system is blown down on a biweekly basis at selected locations, and the dewpoint, hydrocarbon, and particle size measurements were consistently well within specifications. This can be attributed to good maintenance, and the fact that CA system quality is given high priority by SHNPP management. The team consensus was that this indicates strength in the maintenance program. The team, however, noted that teflon tape was used on several IA components, and several discrepancies were identified related to the RAC package. These issues are discussed in paragraph C.2. In addition, an inline air filter did not receive required PM. This issue is discussed in paragraph C.6.

6. Maintenance Work Observation

In addition to the work observations detailed in Sections B.1 through B.5 above, the team observed the following in-process maintenance:

a. <u>Limitorque Inspection and Lubrication PMs</u>

The team observed inspection and lubrication of the Auxiliary Feedwater (AFW) system limitorque operators on the following valves:

- 1AF-5 - WR&A 89-RDR313
- 1AF-24 - WR&A 89-RDS313

The PMs were accomplished in accordance with procedure PM-M0014. Use of procedures, procedure compliance, work performance, level of knowledge of mechanics, use of correct materials, documentation, and general quality of maintenance were evaluated.

The team also observed housekeeping and general equipment conditions of the Motor Driven and Turbine Driven AFW Pumps and associated piping and valves.

These observations revealed quality maintenance being performed and documented in accordance with procedures, using qualified personnel and correct materials and tools. Material condition and housekeeping were found to be above average to good. The team identified one minor valve packing leak (valve 1CE-55) near the Turbine Driven AFW Pump. The mechanic performing the PMs took immediate action to hang a deficiency tag on the valve and initiate a WR&A.

b. General Maintenance on the Steam Generator Blowdown System

The team observed the following general maintenance on the Steam Generator Blowdown system:

- WR&A 89-AMXH1 - Repair Seat Leak on Valve 1BD-143
- WR&A 89-ANBF1 - Repair Manway Leak on Settling Tank 1BD-E016
- WR&A 89-ANBG1 - Repair Leak on Transfer Pump 1BD-E003 Supply Line

Use of procedures, procedure compliance, work performance, level of knowledge and qualification of mechanics, use of correct materials, calibration of tools, documentation, and general quality of maintenance were evaluated.

These inspections revealed quality maintenance being performed and documented in accordance with procedures, using qualified personnel and correct materials and tools. The team did identify one concern relative to lack of identification of allowable consumable materials such as solvents, adhesives, thread sealants, etc. in the work package. This concern is discussed further in paragraph B.12.

c. Valve Replacements in Moisture Separator/Reheater

The team observed valve changeout in accordance with PCR 3030 for the following valves:

- 3MW-662 - WR&A 88-BETK1
- 3MW-666 - WR&A 88-BETI1

General maintenance practices were observed and found to be good.

d. Motor Operated Valve Terminal Board Verification

An Environmental Qualification (EQ) verification was required for the terminal boards in the operator on motor operated valve (MOV) 1SW-276:002. In order to perform the the work, the Instrumentation and Control (I&C) craftsmen used the WR&A (89-ABJE1) and the referenced procedure, OST-1215. The work was conducted without difficulty, but the procedure covered numerous tasks on the MOV operator, of which very few were required for the terminal board verification. It was left up to the craftsmen to determine which steps needed to be accomplished to restore the MOV operator cover. While there was no confusion, the craftsmen did need to jump around within the procedure to find the steps that were applicable to their task. This issue is discussed further in Section B.12.

e. Bench Test of Relief Valve 1CC-381

Relief valve 1CC-381, the fuel pool heat exchanger 1 & 4A outlet relief valve, required a bench test verification per American Society of Mechanical Engineers (ASME) Section XI. After initial review of

the work and the WR&A (89-AGEJ1), the craftsmen determined that the only method available to drain the piping in order to remove the valve was to manually pull on the valve stem. This required the craftsmen to obtain a change in the procedure, which was done by hand carrying it to the required approval authorities. Although this valve had been worked on three previous occasions, (WR&As 87-BHBE1/2, 86-ACNY1, 86-AKJE1), the need for this abnormal step was not noted in previous WR&A's. The piping was eventually drained by clamping vise-grips onto the top of the valve stem and then prying up the stem using a screwdriver. The lines still required a couple of hours to drain. Since that only drained down to the valve discharge port, the remainder of the line had to be drained by breaking the flanged connection at the valve inlet. Since the system contains chromated water, the draining problem was somewhat more complicated. A design change to include a valve with a manual jack or installation of a drain line below the valve would alleviate these difficulties.

The valve was removed to the shop test stand for testing. Although cautioned in the procedure to maintain the valve in an upright position, little concern for this caution was evidenced. In the initial test attempt, pressure was raised rapidly causing the valve to relieve several times before pressure could be reduced. Since this occurred very rapidly, the set pressure was not noticed. At this point the valve would not reseat due to debris in the seat. After disassembly and cleaning, the valve was successfully reset to the required pressure and reinstalled in the system. No other problems were noted.

f. <u>Oil Change in the Diesel Generator Air Compressor</u>

The oil in diesel generator air compressor (1EA-E001) required changing due to moisture contamination of the oil. WR&A 89-AMIL1 was used to direct the work. The procedure was followed without problem and the work completed successfully. However, the procedure did not mention a solvent which the craftsmen used to clean the funnel prior to refilling the oil in the compressor. While this did not present a problem in this situation, such consumable items should be addressed in the procedures. This item is discussed further in Section B.12.

7. Material Control

<u>Background</u>

Materials, equipment, and supplies for support of maintenance are stored and issued from two warehouses: the bulk storage warehouse, and the parts and tool issue warehouse. Both warehouses are in the protected area, convenient to work areas in the Radiation Controlled Area (RCA). Large items, such as pipe, and heavy spools of cable are stored and issued out of the bulk storage warehouse. Smaller items, such as O-rings, and welding consumables are issued from the parts issue warehouse. Outside storage is also utilized, where appropriate. Receipt inspection and

Quality Assurance (QA) approval takes place outside the protected area. Stock which has received QA approval carries a green "QA APPROVED" sticker. Materials are stored according to guidelines in ANSI N45.2.2-1978, "Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power Plants." As in the ANSI standard, SHNPP categorizes storage levels as A, B, C, and D. Storage level A facilities are in the parts issue warehouse area only. Shelf life items are designated by green stickers on the bins with the expiration date printed on the sticker. Items with expired shelf life are stored in a separate area of the warehouse to prevent their being issued. Inventory is tracked on a data base which identifies item location, quantity on hand, supplier(s), cost, and WR&A application, among other things. Parts are issued out of warehouse stock with barcode scanners. The process captures the part number, its recipient, the WR&A, and is tied into the inventory control program. Welding consumables are issued from a separate locked, caged area in the parts issue warehouse. Stock is classified into "Q" and Non-"Q". The "Q" class stock is for safety-related applications, and is stored apart from the non "Q" stock.

Inspection

The team toured warehouse facilities at SHNPP to determine what the general storage conditions were, to specifically examine a random sample of parts in stock, and to examine computerized records, and documentation associated with stock, and records associated with maintenance of class A environmental conditions. The team also interviewed warehouse personnel to determine their knowledge of storage practices, and SHNPP warehouse procedures.

The team found that the licensee has established an effective materials control system. The team was especially impressed with the stock checkout and inventory control system. The team was able to locate a random sample of stock items in their respective warehouse bins, directly from the computer database. These items included a number of critical spare parts for CA system equipment, and determined that they were the proper parts per recommendations in vendor manuals, stocked in reasonably sufficient quantity, and properly stored and classified. Some of these parts included solenoid valve rebuild kits, O-rings, filter-regulator rebuild kits, and the afterfilters at the discharge of the IA air dryers. Many major spare parts from cancelled Units 2, 3 and 4 were also in stock, which shortens turnaround time for maintenance. The team also found that hazardous materials were stored properly.

Minor discrepancies noted by the team were confined to the bulk warehouse, and were as follows:

- A single can of 3/32" 7018 coated electrodes was found broken open (CP&L number 723-164-61). SHNPP procedures require disposal of coated electrodes if the container seal is broken, to prevent moisture pickup. In addition the welding consumable issue system, would not have allowed the subject electrodes to be issued.

- Two large lineshaft bearings (CP&L 723-888-79, 723-888-61) for the circulating water system, containing rubber inserts, were not identified as shelf life items. The team observed minor cracking in the rubber inserts. The licensee's response was that these bearings should have been identified as shelf life items, and indicated to the team that these items were being added to the shelf life list. The cracking in the rubber inserts was considered minor, and licensee technical support staff indicated that the operation of the bearings should not be affected. This was the only such case of stock sampled by the team, which was not identified properly and the team did not consider this to be a widespread problem.

- Locations 8PR, and 8PR5, containing Q-class stock were not identified as Q-class locations. The team sampled stock in these locations and did not find non-Q material on the "Q" shelves. The Licensee indicated that "Q"-class" signs were being hung on these locations.

With the exception of the minor discrepancies noted above, the team found that the licensee's material control system was a strength, and contributed to the maintenance program.

8. Instrument Calibration Program

The calibration and maintenance program for plant-installed instrumentation and Measuring and Test Equipment (M&TE) is the responsibility of the Instrumentation and Control (I&C) Group in the Maintenance Department. The calibration program and its implementation is primarily controlled by four procedures in Part 1, Volume 4 of the Plant Operating Manual. These procedures are MMM-004, MMM-005, MMM-006, and MMM-007. These procedures were reviewed to determine if the calibration program is adequate and meets NRC requirements and licensee's commitments.

The implementation of the calibration program is determined by technical specifications, commitments, safety classification, and NRC requirements. The plant-installed instrumentation calibration is specified in three areas by the following procedures: MMM-004, MMM-005, and MMM-007.

Surveillance tests (MST) are established to meet specific commitments in the Technical Specifications. Periodic tests (MPT) are established to meet FSAR and other commitments other than MST requirements. The Regulatory Compliance group is responsible for controlling and scheduling the MST and MPT programs. All other instrumentation, safety-related and balance of plant, is calibrated using the Process Instrument Calibration (PIC) and loop calibration (LC) procedures. Individual instruments such as transmitters, indicators, recorders, switches, etc. use PIC procedures. The LC procedures are used to calibrate two or more instruments within a common path. Instrumentation requiring calibration on a periodic basis using either the LC or PIC procedures are scheduled within the preventive maintenance (PM program.

The team conducted walkdowns and observed scheduled calibration tasks being performed. While observing this work, the team reviewed the work request, the calibration procedure, the data being taken, and discussed the work with the I&C technicians performing the calibrations. The instrument calibration or work, work requests, and procedures observed and reviewed are as follows:

Work Request	Procedure/Work	Equipment
89JQK267	LC-PD-5026B Calibrate differential pressure indicator loop	PDI-5026B
89KFL336	LC-F-3849 Calibrate flow transmitter loop	FT-3849
89DIH324	PIC-1600 Calibrate pressure transmitters	PT-7438-25A PT-015P-7438-25A
89JVB337	MPT-I0074 Perform ionization detector sensitivity test	FID-8602D01 FID-OIFP-8602D01
89FPB331	LC-M-3801 Calibrate moisture transmitter loop	MT-1WV-3801
89FOW332	LC-M-3803 Calibrate moisture transmitter loop	MT-1WV-3803
89FOX337	LC-M-3803 Calibrate signal amplifier	MY-1WV-3803
89APB51 89KGF327	CM-I0001 & LP-P-8752B Replace transmitter & calibrate loop	PT-8752B
89ADGA1	Repair Hydromotor hydraulic actuator SN8606B308552-05-001 per instructions on work request	

In all of the above examples, the instrumentation work was performed as required by the WR&As, the procedures were followed, and the I&C technicians were knowledgeable and acted in a professional manner. During these walkdowns, the team found the material condition of the instruments, panels, racks, and tubing to be in excellent condition.

The team reviewed the I&C PM schedule to determine the number and type of overdue instrumentation calibrations and work items. Thirteen items were found to be overdue. Eleven items were for cleaning and checking equipment. Two items were for overdue calibrations which do not involve safety-related instruments.

The team inspected the calibration lab to determine if measures specified in procedure MMM-006 were being met. These measures are the requirements for the control and calibration of M&TE under the control of the I&C group. The M&TE is used for the calibration, testing, and maintenance of plant equipment and systems. Various M&TE and the associated calibrations files were examined to verify the test equipment was properly calibrated. The calibration stickers for this M&TE, including the due date, were reviewed and compared against the equipment files. The following documentation and computer records were reviewed and compared with selected M&TE in the lab to assure accuracy: Master Controlled Tool List, Controlled Tool Recalibration Record, Calibration Data Form, Instrument History Record, Test Equipment Calibration Files, and Test Equipment Calibration Procedures. The licensee has an excellent computer system to maintain these records. In addition, the computer system has a bar code scanner which is used for checking M&TE in and out of the cal lab. Since most of the M&TE records are in computer memory, the team expressed concern for their loss if there was a computer failure. The licensee stated a backup hard disc memory would be added.

The cal lab was found to be neat and clean. The M&TE was properly stored. The documentation reviewed was found to be complete and neatly filed. The I&C technicians working in the lab were knowledgeable and acted in a professional manner. The calibration lab was well managed and had an excellent computer system for tracking M&TE. The limited size of the cal lab was the only weakness identified by the team.

The I&C calibration program has the following strengths: low backlog, the program is well managed, the supervisor and foremen are experienced and knowledgeable, the I&C technicians performed their work in a professional manner. The cal lab was found to meet all requirements and used an excellent computer tracking system, and the I&C technicians extensively use the Feedback Report System for the identification and resolution of problems.

The I&C calibration program had one weakness; the size of the cal lab limited the working area and storage space for M&TE. Although the M&TE was neatly stored, the storage space was cramped. Another problem identified with I&C not related to calibration is a large backlog of miscellaneous items which have been planned but not scheduled to be worked.

9. Health Physics

The team reviewed the licensee's radiological protection activities which included the licensee's As Low As Reasonably Achievable (ALARA) activities, external exposure controls, dosimetry and radiological surveys.

a. ALARA

The licensee's ALARA exposure goal for 1989 is 150 person-rem. As of August 10, 1989, the licensee had accumulated 12 person-rem which was six person-rem below the targeted 18 person-rem for that date. The licensee is scheduled to begin a 60-day refueling outage in October 1989. The licensee's outage ALARA goal is 100 person-rem.

The licensee's exposure goal for 1989 is considerably below the recent industry averages for similar facilities. However, lower dose totals for a relatively new facility are common and observation of licensee performance over several operating years will be required to demonstrate the real effectiveness of the licensee's ALARA program.

b. External Exposure Control

The team reviewed plant procedure HPP-20, Radiation Work Permits, which provided detailed instructions on the preparation and processing of RWP's.

The team reviewed selected RWP's for appropriateness of the radiation protection requirements based on work scope, location, and conditions. During the tours of the plant, the team reviewed the licensee's posting and control of radiation areas, high radiation areas, contaminated areas, radioactive material areas, and the labeling of radioactive material. The team found areas were posted conservatively. The team verified that posted high radiation areas were secured.

c. Surveys

The team made independent radiation and contamination surveys in the Fuel Handling, Radioactive Waste, and Auxiliary buildings; and reviewed the results of radiation and contamination surveys throughout the facility. The team noted that copies of recently completed surveys were removed from the Radiation Work Permit RWP issue station for review and were not always available for immediate use or reference. Licensee representatives reported that if the survey information was needed, it could be retrieved in a few minutes. Following a supervisor review of the survey information, the surveys are returned to the RWP issue station.

d. Maintenance Worker Interviews on Radiological Safety Program

The team selected maintenance workers from mechanical, electrical, and instrumentation work groups and asked each a series of questions concerning the radiological safety program. The interviews were made to evaluate communications between health physics (HP) and maintenance and determine the workers' impressions of support provided by the site radiological protection program. A summary of the interviews was discussed with the site Health Physicist.

Every maintenance worker interviewed reported strong support was provided from the HP unit. Each worker reported that the HP unit was timely in that support whenever possible. Generally, the workers (9 out of 10) reported that the HP technicians were helpful and professional in responding to questions concerning radiological hazards and radiological protection requirements. However, approximately fifty percent of the workers interviewed reported that the radiological protection requirements varied with the HP personnel in charge and, therefore, the HP group was not always consistent. Forty percent of the workers believed that the vendor HP personnel appeared to be more experienced than plant personnel. A few minor comments concerning protective clothing problems were also discussed.

As discussed above, the licensee's facility is relatively new and radiological hazards are generally minor with few high radiation and contaminated areas. In addition, the maintenance work activity in radiologically controlled areas has not been excessive. Together, these conditions have enabled the health physics group to provide extensive radiological protection job coverage during non-outage periods. All of the maintenance radiation workers interviewed by the inspector believed that the radiation protection staff provided adequate on-the-job coverage and about 30 percent of the radiation workers believed the HP job coverage was, at times, excessive or unnecessary.

The licensee's radiation protection management is aware that, during a high maintenance period such as an outage, the transition from full to selected radiation protection job coverage will be a challenge to the HP group and the maintenance worker.

Observation of Maintenance Activity

The team reviewed a routine changeout of filter elements on a vendor demineralization system. The vendor system was on a skid and temporarily connected to the licensee's liquid radioactive waste system on the 236-foot elevation of the radioactive waste processing building. The system had been in use for about six months and was being evaluated on a trial basis for one year, at which time the licensee may opt to purchase the equipment. The system was processing liquids from the laundry and hot shower drain tanks and the floor drain tanks. The activity of the water processed was typically 10^{-5} or 10^{-6} micro curie per milliliter.

The team reviewed the licensee's filter changeout procedure OP-120.09.05, Radioactive Liquid Processing Through Vendor Demineralization Skid. The team verified that the procedure utilized was current and properly reviewed by licensee management and the Plant Nuclear Safety Committee (PNSC). The procedure required system operators to notify HP when the need to change out a filter was determined and reminded operators to sign in on a RWP prepared for filter changeouts.

The team reviewed the radiation work permit 151, Changeout of Demin Skid Filters and Slucing of Resin, to be utilized by the operators in the filter changeout. The team observed the work and determined that the RWP requirements were adequate for the observed task. Upon completion of the work, the operators and HP technician cleaned up and decontaminated the work area.

Following the filter changeout, the team reviewed the licensee's filter changeout documentation and verified that the operations personnel were qualified to perform the filter changeout. The team also reviewed the licensee's design change documentation and the nuclear safety evaluation of the design change and verified that the necessary regulatory requirements for the installed equipment had been made.

10. Maintenance Facilities

Major maintenance facilities at SHNPP include the clean machine shop, the hot machine shop, a clean tool room, and a hot tool room. The clean machine shop, and tool issue room are on the ground level of the service building, inside the protected area, convenient to work areas, inside the RCA. The hot machine shop, and hot tool room are located in the RCA. The clean and hot machine shops were orderly, well-lit, and were equipped with adequate storage, bench space, and machine tools to perform most maintenance work on the site. In terms of equipment, The hot machine shop was similarly equipped, but had less floor space, and fewer machines than the clean shop. Space, however, was used wisely.

The hot shop also had an independent ventilation system, exhaust hoods over machinery to limit the spread of contamination, and area radiation monitors. The clean and hot shops both had adjacent welding areas in separate rooms. These welding areas were equipped for light to medium size jobs, and were also orderly, and well equipped. Mechanics receive a standard issue of basic hand tools. Any additional tools which are required for a particular WR&A are readily obtained from the tool issue room. Tools are issued for clean work, directly adjacent to the clean machine shop, from the clean tool issue room. Tools for hot work are issued from the hot tool room, in the RCA. Barcode scanners are used in both clean and hot tool rooms. The process records the mechanic's name, the WR&A number, and the tool serial number. With this system, it is possible to identify which WR&A's tools were applied to, which is useful if a calibrated tool is found to be out of tolerance to warrant investigation of individual WR&A's on which the tool was used. Tools, slings, and other equipment examined by the team were found to be of high quality, and in sufficient quantity to effect maintenance, however, calibrated tools, such as torque wrenches, or voltmeters were not available in the hot tool room. Calibrated tools must be hand carried into the RCA and after use, frisked out of the RCA, and returned to the clean tool room. The team consensus was that maintenance facilities were considered adequate.

11. Response to Industry Issues

The purpose of a "response to industry issues" program is to prevent or lessen the consequences of future incidents through an exchange of operating experience information. The NRC, Institute for Nuclear Power Operations (INPO), vendors, and member utilities distribute this information to identify problems, potential problems, and operating incidents that need to be evaluated for nuclear safety and reliability. The team inspected the licensee's responses to industry issues through a review of related programmatic requirements described in Administrative Procedure AP-031, Operational Experience Feedback. In addition, NRC Information Notices (INs), Nuclear Steam System Supplier (NSSS) vendor service bulletins, and the licensee response to INPO reports were examined.

The team examined the operating experience program (OEP) files to determine if the OEP information was reviewed in a timely manner by the Onsite Nuclear Safety group and corrective action implemented. The team inspected the licensee's computer tracking system for OEP to determine the information contained, the number of "open" and "closed" items, and how well the program worked to perform its intended function. The licensee was requested to provide computer lists of the existing "open" items and the "closed" items for the last twelve months for the team's review. The "closed" list contained 57 items where corrective action was implemented. The "open" list contained 16 items with only two items being past due by less than two weeks.

The team examined OEP files for 59 NRC INs, five INPO reports, six vendor service bulletins, and six 10 CFR 21 notifications. The items were satisfactorily reviewed and implemented as required by the licensee in a timely manner.

The team concluded that the licensee has an adequate program. The OEP files are complete and the use of the computer worked well. The implementation of reviewed OEP documentation was satisfactory. The Onsite Nuclear Safety group that is responsible for the OEP has an experienced staff that performs their work in a timely and professional manner.

12. Maintenance Work Management

Maintenance work management involves the initiation and control of WR&A's, equipment records, job planning, prioritization, scheduling, backlog controls, post maintenance testing (PMT), and review of completed work control documents.

The Maintenance Work Control Procedure (MMM-012) defines several of these activities as part of the Automated Maintenance Management System (AMMS).

AMMS provides an automated mechanism to process WR&A's. AMMS works well with the deficiency identification system. Any site personnel discovering a deficiency can hang a deficiency tag and initiate a WR&A. The deficiency identification system is functioning well in heavily travelled areas of the plant. Personnel are not reluctant to initiate a deficiency tag and are encouraged to do so by management. A WR&A can be initiated by entering some limited data into the system which identifies the component and the problem. AMMS will automatically generate a sequential serial number and date initiated and a list of all WR&A's outstanding for that component. The WR&A listing helps prevent the duplication of WR&A's for the same deficiency. Information is also requested on applicable craft, job priority and deficiency tag number. The WR&A's contain the necessary information for the conduct of the work including special instructions, post maintenance testing, required authorizations, description of problem, as found condition and work performed. Once initiated, the WR&A is electronically forwarded for initial reviews and planning. AMMS interfaces with the Equipment Data Base System (EDBS) to pull down specific information on the component needing work. Maintenance records are stored in AMMS and are readily accessed for use by the maintenance planners. AMMS is a powerful tool which is being effectively utilized to control and plan WR&A's. A drawback to the system is the inability to track component serial numbers to maintain a record for a single item which may be used in several different locations throughout its life. The licensee avoids using components in different locations, but acknowledged the need to manually track components when the case arises. An additional weakness of the equipment record system is in trending. While the system functions very well for trending of a single component, it is difficult to trend the same components across the entire plant. In order to obtain plant information, the planner must first identify all uses in the plant for the component in question. AMMS can readily perform that task. Then, the planner must individually call up each item to determine its failure history. Similarly, repetitive failures of identical components can go unrecognized unless specific effort is made to research all of the identical components for similar failures. See Section B.20 for more details on trending. A hardcopy printout of the data is maintained in case the computer system goes down and MMM-012 provides for the manual processing of WR&A's, if needed.

Once a WR&A has been initiated and reviewed, it is sent electronically to the maintenance planning staff. The planner reviews previous WR&A's written for that component and will generate supporting WR&A's where necessary to involve other crafts in the work. The planner will identify and reserve repair parts via an interface with the spare parts software system. The planner will also identify required special tools, procedures, technical manuals, QC hold points, applicable safety precautions and special instructions. The planner reviews the assigned priority and other data for accuracy and will enter estimated man-hours, clearance requirements and assign the work to a crew. WR&A's are planned based on priorities with an established goal of 45 days for the planning of any WR&A. An informal goal of 30 days has been set by the planning supervisor. Once planning is complete, the WR&A becomes part of the assigned maintenance foreman's backlog. The maintenance foreman must submit requests for applicable ALARA planning and clearances and submit the WR&A for scheduling. The late interface with ALARA planning activities is a potential weakness which may cause difficulties during outages when health physics personnel will be busy. This practice should be reviewed during a period of peak demand to determine whether or not it is a problem.

WR&A priorities are assigned in accordance with MMM-012 by the initiator. Assigned priorities are verified by the planners. The system of prioritization of WR&A's does not consider risk criteria. This is discussed in Section C, Issue no. 3. The prioritization system includes 17 different levels of priority and 8 different work condition codes. The prioritization system is unnecessarily cumbersome in that it includes considerations which do not relate directly to job priority. While one purpose of the relatively new, expanded levels of priority was to provide some differentiation in the work, many WR&A's remain grouped in 2 of the categories and the top several levels contain no entries. The priority system is not functioning to respond to several items which are listed as priority 4 (which indicates a regulatory requirement is being violated). The items are actually remnants of the old prioritization system which were not converted and should probably be a priority 18 or 26. See Section C, Issue No. 8 for more details.

The scheduling process receives input from the maintenance foremen and the system engineers. The Senior Control Room Operator in Maintenance Planning (SCOMP) reviews the proposed schedule and provides interface with the operations group and plant conditions. This strong operational support in the maintenance planning effort is a considerable strength and eliminates many coordination problems between maintenance and operations. Maintenance foremen input items from their backlog to scheduling based on priorities of the work, plant conditions to support the work, and available talent. System engineers provide an input to scheduling based on their overall knowledge of system status and requirements. Maintenance backlog is essentially controlled by the foremen and is discussed further in Section B.18.

Numerous maintenance procedures are maintained for corrective and preventive maintenance, surveillances and performance tests. In planning a job, the planner can typically reference the applicable corrective maintenance (CM) procedure. The craftsman will draw the procedure from document control and perform the applicable portions for the assigned task. A weakness in this process is that it allows the craftsman to determine which steps need to be accomplished and which do not. While some flexibility is desirable in some procedures, stricter control of the tasks should be strongly considered. An additional weakness was noted in procedures written for mechanical CM tasks in that they do not list solvents, cleaning fluids or other consumables in the procedure. The preventive maintenance procedures and the CM procedures for electrical and instrumentation and controls do list such items. There are many instances where substances may be incompatible with a particular use or environment.

By specifying the proper substances in the procedures, the possibility of error is significantly reduced. Post Maintenance Testing (MMM-019) describes the requirements to restore components to service. PMT is assigned by the planner and is discussed further in Section B.19.

The work control procedures direct the completion of WR&A's with a description of the work accomplished, a review by the maintenance foreman and entry into AMMS. AMMS also maintains a complete timekeeping record of individuals and time worked on each WR&A. A weakness in the system is the lack of sufficient detail and inconsistency in the work description. This diminishes the value of the maintenance record, particularly if the entry leaves doubt as to the conditions found and corrected. The Technical Support group has recognized this problem and issued examples for use in completing work descriptions. The problem could also be improved by review of completed WR&A's at a higher level. Currently, review of completed WR&A's is required at the foreman level. Significant or safety related maintenance items may warrant review at a higher level to ensure consistency and accuracy in record keeping.

13. Organization, Administration, Personnel Training, and The Qualification Process

The ultimate goal of organization, administration and personnel training is to maximize the efficiency and productivity of available human resources. Several factors may be used as indexes of how well the goal is being accomplished. These factors are discussed and evaluated in this section.

The SHNPP has a clearly established set of practical goals for the maintenance organization. Plant policy with regard to goals is documented in a procedure, and managers meet monthly to evaluate performance. In the NRC team's opinion, SHNPP could extract more benefit from the goals policy if organizational subunits had their own specific goals in addition to the goals set for the maintenance department as a whole. One goal is related to the minimization of dependence on overtime. Apparently, the intent of this goal was not always met. During previous inspections, the NRC identified a violation in the area of overtime control. The violation occurred during the 1988 refueling outage when Technical Specification (TS) limits on overtime were exceeded in at least 34 instances without the required authorization. The violation is documented in NRC Inspection Report No. 50-400/88-34. Implications derived from the inspection report details suggest that the plant should intensify their efforts in controlling overtime during outage periods.

Another factor considered by the team was organizational structure itself. At SHNPP, all maintenance management and supervisory positions are staffed with permanent utility personnel. The worker/supervisor ratio is appropriate. During normal operations, all work is performed by day shift crews except, of course, for emergency work. On any given day, two or three maintenance personnel are assigned to emergency crew duty on a standby basis. During outage periods, CP&L travelling work crews

supplement the regular forces. In the 1988 refueling outage, seven twelve-man mechanical crews and five twelve-man I&C crews were utilized. The travelling crews tend to be specialized on particular systems but, nevertheless, the travelling crew foremen report to the regular foremen.

A hallmark of a good maintenance organization is that high standards are set for individual performance and each individual understands what is expected. SHNPP's policy, according to the maintenance training supervisor, was to hire persons with a two-year technical degree for positions within the instrumentation and control crews; and persons with a high school diploma for positions within the electrical and mechanical crews. The team confirmed during interviews that each person receives regular performance appraisals. However, monetary incentives or other forms of recognition for outstanding performance are either not available or have not been used in the past at all levels. The I&C and Electrical Supervisor did not have a written job description and accountabilities in his possession. The job description for the Maintenance Manager furnished to the team was dated July 1982, further indicating that job descriptions may not be kept up-to-date. Policy on disciplinary actions was stated in the Supervisors Manual, but guidance in this area could be better defined. Periodic summary reports of actions taken were not distributed to supervisors so that areas of particular concern would be known by them.

One index the team attempted to measure was the strength of management's commitment to provide quality maintenance training. Training for nuclear power plant personnel is a corporate function at CP&L. It is under the direction of the Vice President of Operations Training and Technical Support. Corporate policies, technical programs and administrative procedures for training are well documented at both the corporate and plant levels. One facet of the program that is certainly well done is the computer based management system for training records and course scheduling. Foremen receive a printout for each crew member indicating a wealth of information about the person's training history, including upcoming required or suggested courses. It is the foreman's responsibility to actually enroll the employee in the course, and apprise him or her. Maintenance supervisors had, and continue to have, ample input to the training program.

In early 1980, the first wing of a corporate maintenance training center was built at a location near SHNPP. A second wing was added in 1983. The facility covers about 16,000 sq. ft., plus outdoor storage and work space. Office and classroom areas have first class architectural renditions. The corporate facility was inspected by the team, and discussions were held with the instructors concerning course content. On-site facilities comprise ten trailers: four used as office and library; and six used as classroom and laboratory. The on-site facilities were also toured by the team.

At present, six maintenance instructors work at the corporate training center: one electrical, two instrumentation, two mechanical and one welding. Three instructors work at the site: one electrical, one mechanical and one instrumentation. Vendor supplied training is paid out of the maintenance budget rather than the training budget. Record reviews did not indicate an abundance of vendor supplied training had taken place.

The team reviewed training records for eight foremen, a crew of nine people and a maintenance engineer. Some statistics that were compiled by the team from these records are:

a. The eight foremen received an average of 31 hours of technical and managerial training in 1988. Individuals' training hours ranged from 1.5 to 97.

b. The eight foremen had worked for CP&L for an average of 12 years; none less than five years.

c. The crew of nine people received an average of 46 hours of technical training in 1988. Individuals' training hours ranged from zero to 260.

d. The crew of nine people had worked for CP&L for an average of 8.7 years; none less than five years.

e. The maintenance engineer received 48 hours of technical training in 1988; and had worked for CP&L for 7.5 years.

SHNPP's qualification process was approved by INPO in December 1985. A novice craftsman would become fully qualified by completing ten defined steps. Each step represents a minimum of six months of experience, a pay increase, and a set of job factors. Some of the job factors are relatively simple while others represent the completion of a qualification card. A qualification card is a set of criteria and questions related to a maintenance task. Qualification cards are signed by a "qualifier" after the trainee has demonstrated ability in and knowledge of the task. In parallel with the job factors, the program calls for 900 hours of classroom training. Individual courses are prerequisites for particular qualification cards. The number of qualification cards in the program at the time of the inspection were: mechanic - 29; instrumentation and control technician - 28; electrician - 21. CP&L travelling crews are subject to the same program. Contract workers must furnish evidence of qualification. Requalification is required at two year intervals. For many craftsmen, the requirement to complete all or a percentage of the classroom training was waived in consideration of past experience and training. In the team's opinion, the program would be stronger if craftsmen had been required to pass a test or at least scheduled for refresher training as a condition for the waiver or "grandfathering." Another weakness the team saw in the licensee's program was the relatively small number of qualification cards together with the general nature of the criteria the cards represent. For example, there were no qualification cards for the hydrogen analyzer system nor the DC to AC inverters. To assign workers to perform testing, calibration or repair of equipment, the foreman relied upon his personal knowledge of the worker's ability. Such a program is difficult to audit, and does not have the rigid structure needed in the nuclear industry.

The current status of areas discussed in this section may be summarized as follows. The Maintenance Manager, the Mechanical Supervisor and the I&C and Electrical Supervisor are relatively new to those positions. For the past six months, most employees believed that a severe reduction in work force was imminent due to the announcement of a major reorganization, the details of which will be known in October 1989. This situation has affected morale of the whole maintenance department, although, to the team's knowledge, no workers have preemptively left SHNPP as a result. SHNPP will present its training and qualification program before the INPO reaccreditation board on August 24, 1989. Technical training scheduled for each craftsman in 1989 is: I&C - 70 hours; electrical - 46 hours and mechanical - 41 hours. This schedule was on track at the time of the inspection. The supervisors of maintenance training stated that the vast majority of craftsmen have completed the 10-step qualification program.

14. Motors

The team compared the licensee's electrical motor maintenance program to an objective published standard to form the basis for evaluation. The standard chosen was the "Work-in-Progress Report on Maintenance Good Practices for Motors in Nuclear Power Generating Stations - Parts 1 and 2," which was developed and published by the Institute of Electrical and Electronics Engineers. Again, the IEEE report was not considered a requirement; it was a useful yardstick with which to measure an actual program.

The team selected three safety-related motors to serve as representative examples: a 6.9 KV motor that runs approximately 1/3 of the normal unit operating time, a 6.9 KV standby motor and a 480 V standby motor. Data sheets (see Appendix 5) were prepared during the preparation phase of the inspection which listed all the recommendations made in the IEEE report. On-site inspection time was spent in gathering information to complete data sheets for each of the sample motors. Referring to the data sheets, one can see that they concisely summarize the licensee's program for motor maintenance. Motor data was obtained during plant walkdowns and from vendor supplied information. Program data was obtained from interviews, procedure reviews, the Equipment Data Base System; and verified by review of at least 70 work requests.

The licensee uses thermography as a tool of predictive maintenance on 6.9 KV motors. Semiannually, on all accessible running motors, temperature readings are made of the motor connection box, the motor frame and shaft. With the sophisticated equipment employed, high resolution and precision are possible. Experienced judgment is needed to interpret the results and once problems are identified, alternative courses of action must be evaluated.

When looking at the data sheet on the component cooling water pump motor, one can see that all the recommended maintenance elements are in place, which is indicative of a strong program. The auxiliary feedwater pump motor has essentially the same program except that the vibration monitoring is not done which is discussed further in Section C.1, Predictive Maintenance. The service water booster pump motor, a 480 V motor, receives much less attention than the latter two in the area of predictive maintenance. However, the basic inspection, cleaning and insulation resistance trending are done. In the inspection process of gathering the information on the data sheets, the team referred to a substantial amount of documents. The documents were all readily available and familiar to the maintenance engineers. The information contained in this section provides a wealth of positive evidence that the licensee has been doing a good job on motor maintenance. The team also believes that the program will improve in the future.

15. Quality Assurance/Quality Control (QA/QC) Involvement in Maintenance

The team examined QA/QC involvement in maintenance by: examining QC involvement in maintenance activities observed (paragraphs B.1 through B.6), reviewing completed WR&As, reviewing QA surveillances and audits, interviewing QA/QC personnel, and reviewing QA/QC control procedures.

The site QA/QC organization reports to the Director, Harris Operations QA/QC, who reports to the Corporate QA Manager. The site organization consists of 34 people, 14 in QA, 5 in QA Engineering, 12 in QC, and 3 in the QA/QC Director's office. QA is primarily responsible for performing QA surveillances of plant activities including maintenance. QA Engineering is primarily responsible for procurement specifications, contract assistance, review of modifications, and the Non Conformance Report (NCR) process. QC is responsible for review of WR&As prior to issue to ensure specification of proper hold points, QC inspection of hold points, random monitoring of work activities, procurement reviews, and receiving inspection. In addition to the above QA/QC activities related to maintenance, corporate QA audits maintenance activities annually.

The team inspected QC involvement in the in-process maintenance activities observed (paragraphs B.1 through B.6). In addition, the team reviewed the QA/QC procedures listed in Appendix 3. These procedures provide details of QA/QC requirements for audit, surveillance, and inspection of maintenance activities. Other procedures covering specific details of QC inspection activities related to maintenance are included in the Operations QA/QC Manual. Maintenance procedure MMM-001 specifies requirements for QC hold points on WR&As.

The following Surveillances and Audits were reviewed by the team:

Audit/Surv. No.	Subject
88-038	I&C Corrective Maintenance
88-055	Corrective Maintenance Program
88-083	Mech PM Observation
88-086	Corrective Maintenance - Mechanical
88-147	WR&A I&C Review
88-175	WR&A Review
89-016	Corrective Maintenance - Mechanical Observations
89-060	Predictive Maintenance
QAA/022-88-05	Maintenance Program
QAA/022-87-04	Operations

The team reviewed the qualification program for QC inspection personnel including qualification records for two plant QC inspectors and two contractor QC personnel.

The above reviews and inspections revealed the following:

- In general, QA/QC appeared to be adequately involved in the maintenance process. However, some areas of weakness/concern were identified by the team as identified below.

- The QA surveillances appeared to be well planned and implemented with substantive findings indicating an adequate surveillance program. The most recent corporate annual QA audit (September 1988) showed much improvement in detail and content over the previous annual audit (July 1987)

- The team noted the following weaknesses in procedure OQA-103 for qualification of QC inspectors:

  o In lieu of specifying education and experience requirements in accordance with ANSI N45-2.6 in a QA procedure, the procedure specifies education and experience as established for a job classification (personnel records). Although the education and experience requirements presently specified in the personnel job description for QC inspectors meets or exceeds ANSI N45-2.6, the requirements should be included in the QA procedure.

  o Because of the small size of the permanent QC staff, contract personnel supplement the permanent staff during outages. Rather than specify the education and experience requirements for temporary (contract) personnel, the procedure states that requirements will be determined by the Director QA/QC. The requirements should be specified in the procedure.

- The team noted that the number of permanent QC inspectors involved in inspecting maintenance was small (4 presently with one of the 4 planning to take maternity leave in the near future). The licensee pointed out that during outages extra QC inspectors are readily available from two contractors with standing contracts or other CP&L organizations (QA or Materials Quality Section). Interviews with QC inspectors revealed that during non-outage periods, the small QC staff can cover required inspections because of strong cooperation among the QC staff, willingness to change schedules and/or be on-call, and cross training between disciplines. The team learned that the licensee has plans to cut back/reassign some QC hold points to other organizations. The licensee pointed out that changes to procedures to reassign hold points had been placed on hold pending the imminent company reorganization and that if QC hold points are reassigned, only non-code or non-regulatory hold points will be reassigned. The team noted that the current distribution of QC hold points appeared to be about right and that the licensee should proceed with caution in reducing the number or reassigning QC hold points.

  Also, the team considered the size of the QC staff to be marginally adequate and expressed concern for potentially ineffective QC participation in day-to-day maintenance should the QC staff level be allowed to fall any lower than the current level.

16. Engineering Support for Maintenance

The maintenance department was found to have very good engineering support at the plant site. One of the significant strengths was in the system engineering program. The licensee has used the system engineering approach since January 1987 and this was smoothly transitioned from the construction engineers used during the construction period. The system engineers have typically been assigned since initial operation and due to minimal personnel turnover, have a thorough operating background for the plant. The system engineers maintain familiarity with their assigned systems and are instrumental in the implementation of modifications. They review all WR&A's initiated on their systems on a daily basis and provide an input to the scheduling process for those which should be worked. They are frequently involved in troubleshooting problems and are called by the control room operators for any questions or abnormalities in their systems. The system engineers are typically involved in root cause analysis. They receive data from the performance group for evaluation of system parameters. The key interface with the Nuclear Plant Reliability Data System (NPRDS) is the system engineer. They make a determination of what needs to be reported to NPRDS. In general though, any feedback of industry-wide NPRDS data is handled by the NPRDS coordinator. The system engineers typically perform frequent walkdowns of their systems, although more attention needs to be applied to the outlying and remote areas. See Section C, Issue No. 5 for more details.

The licensee maintains a formal feedback reporting system (MMM-026) to communicate problems internally. The system is applicable to the maintenance craftsmen who have a problem with a procedure, to the maintenance foremen that needs engineering support to resolve an issue or for any group to request assistance from another group. It was also found that informal lines of communication are open and readily used to resolve minor questions without resorting to the need for a formal request. The Plant Change Request (PCR) system (AP-600) functions effectively to implement more significant modifications. The open communications and teamwork displayed by site personnel is a significant strength to their maintenance program.

A weakness in engineering support was evident in the handling of T-drains in the motor end bell for limitorque valve operators. The licensee received a Severity Level IV violation on October 31, 1988 (50-400/88-27) for failure to install functional T-drains on at least two occasions. Based on the licensee response, full compliance was achieved as of April 30, 1989.

A weakness in engineering support involvement was noted in the handling of the cleaning of suction screens for the circulating water pumps. On April 14, 1987, the reactor and turbine were manually tripped due to the trip of a condensate pump on high condensate temperature and subsequent loss of a main feedwater train. The cause was attributed to cooling tower fill material in the main condenser, which got there due to problems in attempting to clean the circulating water pump suction screens. Although corrective actions were completed, a similar problem recurred on April 29, 1989. During cleaning of the suction screens for the circulating water pumps, cooling tower fill material entered the system and clogged the main condenser. The plant reduced power to 30% in order to clean the main condensers, during which three bushels of cooling tower fill material were removed. Currently, the licensee plans to wait until the next outage prior to cleaning circulating water pump suction screens. Adequate engineering involvement would have prevented the recurrence of this problem.

17. Historical Data Related To Maintenance

The team examined various data pertaining to the licensee's maintenance related activities. These included current internally generated data provided by the licensee, NRC Office of Analysis and Evaluation of Operating Data (AEOD) data and the NRC Licensed Operating Reactor Status Summary Report Data as of June 30, 1989. Overall, the team concluded that the SHNPP plant data indicated an average performance.

The licensee's tracking of maintenance backlog has demonstrated a steadily decreasing backlog of maintenance work over the last year.

AEOD data was obtained through the first quarter of 1989 and included automatic scrams while critical, safety system actuations, significant events, safety system failures, forced outage rate, and equipment forced outages/1000 critical hours. Industry averages used for comparison purposes were obtained from data from the first quarter of 1989.

In the first quarter of 1989, the licensee experienced five automatic scrams while critical, as compared to the industry average of 0.6 scrams for the same quarter. The SHNPP was the only unit in the nation with more than three scrams in this quarter. In the previous three quarters (the last three quarters of 1988) and the second quarter of 1989, the plant did not scram. The yearly average is five scrams as compared to the yearly industry average of 2.1 scrams.

Of the five scrams which occurred in the first quarter of 1989, three appear to be related to maintenance:

- Scram on 1/16/89 due to loss of condenser vacuum - caused by improper restoration of a clearance in that a vent valve was left open.

- Scram on 2/22/89 due steam flow/feed flow mismatch - caused by a faulty surveillance procedure.

- Scram on 3/14/89 on low-low steam generator level - caused by feed pump breaker trip when it was sprayed by water from a fire protection deluge system test.

In safety system actuations, the plant had two over the year ending with the first quarter in 1989 and reported none for the second quarter of 1989. This compares closely to the industry average of .46 for the first quarter of 1989.

Significant events reported over the year ending with the first quarter in 1989 was one, and none were reported in the second quarter of 1989. This is slightly better than the industry average of .36 for the first quarter of 1989.

Safety system failures for the year ending with the first quarter of 1989 was six, which is poorer than the industry average of .98 for the first quarter of 1989. Improvement in this area has been noted in that the last quarter of 1988, the first quarter of 1989 and the second quarter of 1989 have no safety system failures.

The forced outage rate for the first quarter of 1989 was 6% which was better than the 10% industry average for the same period.

The equipment forced outage rate for every 1000 hours of critical operation was 1.44 for the first quarter of 1989 as compared to the industry average of .6.

In addition, several potentially risk significant events occurred in the first quarter of 1989:

- On 1/16/89, an auxiliary feedwater pump tripped on electrical overload.

- On 1/16/89, a turbine driven pump tripped on overspeed due to condensation in the steam line resulting from leakage of an isolation valve.

- On 2/6/89, the 'A' feedwater pump shaft sheared causing a low-low steam generator level and a reactor scram.

Although the second quarter data has not been promulgated by AEOD yet, the data obtained from the licensee was factored into the teams evaluation of the area as satisfactory.

18. Backlog Control

The team reviewed licensee records and interviewed maintenance planning personnel to determine the extent and control of the maintenance backlog. Backlog is trended and controlled as part of the Performance Indicator program.

The licensee uses the following indicators to monitor maintenance performance: Weekly Work Schedule Completions; Initiated, Completed and Outstanding WR&As by Priority and Work Code; WR&As greater than 90 days Old; Planning Backlog; Maintenance Overtime, Overdue PMs; Ratio of PMs to Total WR&As; Rework Trend; Maintenance Violations; and Control Room Deficiency Tags.

The data is collected and trended weekly, monthly, or quarterly. Goals are set and the information is reviewed periodically by the Maintenance Manager and the Plant General Manager. At the time of the inspection, this process was not detailed as a formal procedure requirement. However, the licensee provided the team a draft of Rev. 1 to procedure PLP-603 which proceduralizes requirements for maintaining and trending performance indicators.

Review of data from the above performance indicators revealed the following backlog information:

- As of June 1989 only about 25 PMs were overdue. The team reviewed WR&As for these PMs and no significant PM work was found to be overdue. The licensee has detailed requirements in place for escalating deferred maintenance up the management chain for approval.

- The total number of outstanding non-outage WR&As was approximately 1500 as of June 1989. This number has trended down from 2500 in September 1988 and 1900 in January 1989. Of the 1500 outstanding non-outage WR&As in June 1989, approximately 450 were greater than 1 one year old and approximately 1050 were greater than 90 days old. Only 15 of the 450 and 58 of the 1050 were priority 1 through 4 WR&As. The licensee has a complex priority system consisting of 17 priorities and 8 work condition codes (See Paragraph B.12). Priorities 1 through 4 include the higher priority more important maintenance items.

- The team found the backlog difficult to evaluate because of the complex priority system and the method being used by the licensee to trend the backlog. Bar graphs covering all of the various work disciplines were sometimes difficult to interpret. Also, the licensee's practice of using more than 1 WR&A (a primary and any number of support WR&As) to accomplish a job severely inflats the total number of outstanding WR&As, making the backlog appear much larger than it actually is.

- Considering the above inflation of the total number of outstanding WR&As, the relatively small number of WR&As greater than 1 year and greater than 90 days old, and based on review of a sample of the outstanding WR&As, it appears that important maintenance is being performed in a timely manner and backlog control is fairly good. The total number of outstanding WR&As has shown significant improvement in 1989. Issue and implementation of Revision 1 to procedure PLP-603 should place additional emphasis on backlog control and continue to help to decrease the total number of outstanding WR&As.

- In review of the backlog, the team reviewed the 15 priority 1 through 4 WR&As greater than 1 year old and a sample of the 58 priority 1 through 4 WR&As greater than 90 days old. This review revealed problems with the accuracy of status and priority of WR&As. These problems are detailed in paragraph C.8 below.

19. Post Maintenance Testing

Background

Post maintenance testing requirements are defined in "Post Maintenance Test (PMT) Guide" MMM-019, Rev. 1. This procedure lists the post maintenance requirements for all equipment in the plant. Planners are responsible for referencing the requirement for PMT on WR&A's. The shift foremen are responsible for reviewing the PMT requirements, and have final responsibility for the results of the PMT prior to return of the equipment to service.

Inspection

The team reviewed a random sample of WR&A's to determine if PMT requirements were applied. These WR&A's were for various systems, including the CS, CA, SW and the containment vacuum breaker system. In each case, the requirement for PMT was on the WR&A, and signed by the responsible shift foreman. The team consensus was that PMT was adequate.

20. Maintenance Trending

The licensee's requirements for trending and failure analysis of equipment problems are covered in procedures TMM-109 and MMM-013. Procedure TMM-109 specifies techniques for trending and lists specific equipment to be trended. Procedure MMM-013 covers analyzing equipment work records for repeated failures of problems and trends to predict and initiate action to prevent further problems. By procedure, when component failure occurs, the work crew attempts to determine the cause of the failure and document the cause on the WR&A. If the crew cannot determine the cause, a failure analysis is requested using the Maintenance Feedback Report. Maintenance Engineering performs the failure analysis and documents the findings and resolution on a Breakdown/Repetitive Failure Investigation Report (BFIR). Also, each time a WR&A is initiated, the planner is to review the work history for the component (AMMS works well for this process) and determine if a repetitive failure or problem is indicated. If so, the WR&A is stamped "Repetitive Failure" and a BFIR is initiated. The Technical Support staff can be requested to determine if repetitive failures indicate a trend. "Repetitive Failures" are entered in the maintenance history record for the component. The BFIR documents repetitive failures, failure analysis, resolution, and assigns responsibilities for action.

The licensee also uses NPRDS to trend failures for equipment covered by NPRDS.

The team obtained a printout listing all BFIRs initiated since the beginning of 1988 and selected the following BFIRs for detailed review to evaluate the above trending and failure analysis program: 88-003, 89-126, 88-004, 89-160, 88-011, 89-138, 88-012, 89-032, 88-028 and 88-032.

In general, the tr nding and failure analysis program appeared to be adequate and worked fairly well. However, the following areas of weakness were identified and indicated the need for improvement:

- The system works well for trending failures of a single component. However it is cumbersome to trend the same component where the component is used in different applications. Unless, the planner just happens to be aware of other uses of the component and other failures, the planner must first identify all uses in the plant for the component in question (easily accomplished using AMMS). Then, he must individually call up each item to determine its failure history. Unless specific effort is made to research all identical components for similar failures, repetitive failures of identical components can go unrecognized. The licensee pointed out that this process is too cumbersome and time consuming to be used effectively. The licensee further pointed out that for NPRDS equipment, NPRDS trending will identify failures across systems and minimize the above weakness. However, the NPRDS is limited in scope to certain systems. The proposed revision to MMM-013 indicates that Reliability Engineering should investigate potential failure trends across system boundaries, but no details are provided.

- Procedure TMM-109 specifies trending only a few categories of equipment. This procedure could be expanded to include more equipment and more details.

- The definition of "repetitive failure" in procedure MMM-013 is not clear resulting in an excessive number of BFIRs. For 1988, 170 were issued and to date, 292 have been issued in 1989. This large number tends to diminish the effectiveness of the BFIR and failure analysis program by overloading the system. The licensee is in the process of revising procedure MMM-013 and is re-defining "repetitive failure" to improve this condition.

- BFIRs 88-011 and 88-012 were still open. The licensee could not locate copies of the BFIRs for the NRC even though the responsible engineer knew that the problems had been resolved. The licensee stated that these BFIRs would be re-issued to document the problems and resolutions. These lost documents indicated a problem with records management for the BFIR system. The problem is possibly related to the one above relative to the large number of BFIRs.

21. Industrial Safety

The licensee's safety program places most of the responsibility for safety on the individual worker with the company and supervisors providing resources and guidance. The licensee has seven Safety Councils on site. The Safety Councils are the primary organization utilized to implement the safety program. Each Council includes three elected officers and about twenty plant workers assigned to various committees. The licensee had no lost time accidents through the end of July 1989 and four doctor attended injuries.

The team selected maintenance workers from mechanical, electrical and instrumentation work crews and asked each a series of questions concerning this safety program. The interviews were conducted to determine the workers impression of the licensee's safety program as it related to their job. The team noted that the workers interviewed believed management was strongly committed to industrial safety (9 out of 10). Most workers knew where their department was ranked in accident frequencies and all workers interviewed reported access to sufficient industrial safety equipment. The inspector determined that the licensee holds required attendance safety meetings monthly and most workers (9 out of 10) reported individual work crews holds weekly safety meetings in their shops.

SECTION C

ISSUES

ISSUE NO. 1

PREDICTIVE MAINTENANCE

The licensee's predictive maintenance program is detailed in procedure MMM-018. In general, the program is comprehensive, and includes vibration analysis, oil analysis, shock pulse analysis, ultrasonic testing, and thermographic analysis. The following weaknesses were identified in the program:

- Vibration analysis - For safety related equipment, only continuously operated equipment, i.e., component cooling water and charging pumps and motors are being analyzed. Other safety-related pumps and motors that operate only during surveillances, normally performed on back shifts, are not being analyzed even though the equipment is included in the MMM-018 computer generated list of equipment to be tested and analyzed. The Licensee stated that intermittently operated safety related pumps are monitored and trended for vibration through the ASME Section XI program. If problems are identified by ISI, a work request is initiated and maintenance staff engineers obtain more detailed vibration analysis. The team does not consider the ASME Section XI vibrational surveillance a substitute for vibrational analysis performed as part of a good predictive maintenance program.

- Oil analysis - In general, oil analysis is not being used as a predictive maintenance tool for safety related equipment. Exceptions are Emergency Diesel Generators, Reactor Coolant Pumps, and Charging Pumps. Even though lubrication of safety-related equipment is a vital part of the licensee's PM program, the licensee has recognized the prudence of additional oil analysis as a predictive maintenance tool and has a revision to PM-M0074 in process to add additional equipment, including safety-related pumps and motors, to the oil analysis program.

- For identification of equipment to be included in the predictive maintenance program, paragraph 5.2.1 of procedure MMM-018 specifies that a list of equipment be drawn up and entered into the program in accordance with procedure MMM-003. The maintenance engineer responsible for the predictive maintenance program was not sure what this meant relative to generation and control of the list. Procedure MMM-003 covers the PM program. Based on discussions with the responsible maintenance engineer, the list of equipment included in the predictive maintenance program is a computer list generated solely by the responsible maintenance engineer. There is no formal management approval or control of what is included in the list.

- The predictive maintenance procedure for vibrational analysis does not specifically require initiation of immediate corrective actions in accordance with ASME Section XI if results are obtained that violate Section XI requirements. The licensee considered that the predictive maintenance program was intended to be totally separate from the Section XI program and that if results were outside the limits established by the predictive maintenance program, Section XI would become involved since a WR&A would be initiated that would require Section XI review. However, this would not necessarily ensure initiation of corrective action in accordance with Section XI requirements.

ISSUE NO. 2

QUALITY OF THE AIR SYSTEMS

As a result of interviews with licensee personnel, walkdown inspections, review of licensee documents, procedures, and the SHNPP FSAR, the team identified a number of concerns regarding the CA system at SHNPP. These concerns were the presence of Teflon tape at five locations in the RAB, missed PM's on a filter upstream of safety-related check valves, and several questions regarding the recently installed RAC and air dryer package. These concerns are listed under their general headings below.

Use of Teflon Tape on CAS Fittings

During a general walkdown of the IA/BA system, the team found Teflon tape used as joint sealing material on five IA components listed below located in the RAB. SHNPP procedures prohibit the use of Teflon tape in the entire CA System. These limitations are discussed in SHNPP "Chemical and Consumables Fact Sheet" AP-501 revision 3. The restriction is based on the chance that shreds of Teflon tape will carry over into solenoid valves, check valves, small orifices inside pneumatic controllers, or other such end use devices, and severely affect their operation.

Tag No.	System	Remarks
1PM-30	Potable Water	Teflon Tape found downstream of filter-regulator
1IA-135	Instrument Air	
1IA-127-11	Instrument Air	
1CH-125	Chilled Water	
1CH-126	Chilled Water	

The licensee indicated that some Teflon tape was used during construction. Walkdowns were conducted early in 1986 on the 236' level of the RAB, and 13 locations were found where Teflon tape was used. WR&A's were written for removal of the Teflon tape. The licensee also noted these most recent findings of Teflon tape listed above and has initiated two WR&A's to correct these discrepancies.

In-Line Air Filter PM Not Performed

The team found that the licensee did not perform required PM's on an in-line air filter directly upstream of two check valves in series, which are responsible for maintaining sufficient air volume in a safety-related accumulator. Containment vacuum breaker 1CB-6 relies on this accumulator, should it be required to function with a loss of IA.

Filters upstream of safety-related end-use components in the IA system are changed per the requirements of maintenance checklist CL-I0088, "Regulator Filter Replacement". This procedure requires removal of the old filter, blowdown of the air supply line, and installation of the new filter, among other things, every 18 months, for every filter on the CL-I0088 checklist. The filter unit for containment vacuum breaker valve 1CB-6 was not listed in checklist CL-I0088. Cognizant licensee personnel could not find documentation to show the subject filter had been changed at the required intervals. The identical filter for containment vacuum 1CB-2 breaker, however, was on checklist CL-I0088, and its filter was changed within the proper intervals. At the time of the inspection, the team noted that there are pressure indications for these accumulators locally, as well as on the MCB. The team noted that accumulator pressure for 1CB-6 displayed locally was at the proper pressure. The licensee's response to this item was to add the filter for 1CB-6 to maintenance checklist CL-I0088, and this filter is now scheduled for changeout during the second refueling outage in October 1989.

Concerns Related to Addition of Rotary Air Compressor Package to Compressed Air System

The RAC and its twin tower desiccant air dryer have been installed in the turbine building since early June, 1989. The discharge of the package ties into the existing CA system, upstream of valve 1SA-507, which was intended as a connection for a spare compressor. This package has been in continuous use since then, supplying 100% of the SA, and IA/BA to the plant with comfortable margin to spare. The output of the RAC package is high in quality, and the RAC package, by design, is a reliable alternative to the reciprocating compressors and dryers described in the FSAR; the reciprocating compressors and their dryers have required a great deal of corrective, as well as preventive maintenance when they were used as base load units. At the time of the inspection, the originally-installed reciprocating compressors and dryers described in the FSAR were in standby auto-start mode. The team considers the installation of the RAC package to be a sound move in the direction of improving CA system reliability, however, the team has the following concerns:

- Alarm indications for the RAC and its air dryer are not indicated on the MCB. Should the RAC trip, and/or the air dryer malfunction while the reciprocating compressors and their dryers are in standby, the only indication of this transient the control room operators would have are low pressure IA/BA and SA alarms. Further, if the RAC air dryer malfunctions in such a way that the required dewpoint is not maintained, the potential for introduction of excessive moisture into the entire IA/BA system exists. In contrast, the reciprocating compressors, and their air dryers which are in standby mode when the RAC is running, are fully alarmed on the MCB.

- The RAC and its dryer are powered from an unreliable offsite source, susceptible to loss during lightning storms. Since installation in June 1989, to July 27, 1989, the RAC has tripped nine times due to power supply transients. If power is interrupted, the required sequence of events to maintain requisite air quality requires that an AO be sent down to the turbine building to restart the RAC unit, and an I&C technician must reset the microprocessor which controls the new air dryer. If the RAC package is not restored prior to system pressure dropping to 97.5 psi, the reciprocating compressors auto-start, and the AO's must perform a valve lineup to align the old air dryers which are normally bypassed and deenergized while the RAC package is operating. In August 1987, the licensee reported a plant trip due to loss of IA. The cause of the event was due to personnel error while performing a valve lineup to restore IA dryer 1B to service following maintenance. This was reported to the NRC on LER 87-041-00.

- There were no formal PM, maintenance, operations, or surveillance procedures available for the RAC package, at the time of the inspection. A review of the RAC and air dryer vendor manuals indicated that both pieces of equipment are quite complex, and require regular PM. Furthermore, the RAC and its air dryer cannot be covered by existing PM, maintenance, or surveillance procedures already written for the old CA system components described in the FSAR.

- The team found that AO's responsible for checking vital operating parameters for the the RAC and the microprocessor-controlled air dryer at the discharge of the RAC, have not received formal training on this equipment. The AO's are required to check the RAC and the new dryer, among many other items on their rounds, every six hours.

- SHNPP management has not indicated their intention to incorporate the new RAC and dryer package into their FSAR, even though this system is in constant use; the originally-installed air compressors and dryers are now in standby mode, should the RAC fail.

Licensee management indicated to the team that the RAC and its air dryer were a "temporary" installation, even though the RAC unit rests on a poured concrete pad, the new dryers are lagged to the turbine building floor, and necessary service water connections are now considered permanent. Further, this package has supplied the base load for plant air, and the air supply package, described in the FSAR, has become a standby installation. The team considers the absence of maintenance/surveillance procedures, lack of training, lack of MCB alarms, and the frequent RAC trips to be a weaknesses associated with the RAC.

ISSUE NO. 3

CONSIDERATION OF RISK

The licensee has no formal process to evaluate and consider risk in the maintenance process. In discussions with the planning group, it was determined that some risk analysis had been done, but that the planning group did not use or consider the results in maintenance planning. In fact, the planning group did not have any risk data available. The planning group did give consideration to some common cause failure modes and repetitive failures are specifically addressed by plant procedures. Common cause failures are not routinely pursued, and repetitive failures are often not noted if different components are involved, unless the planner happens to recall the item from a previous WR&A. The methodology to evaluate repetitive failures of a type of component across the entire plant is time-consuming and is discussed in further detail in Sections B.12 and B.20.

The system engineers noted that the corporate nuclear safety (CNS) group had methodology and limited risk analysis but that no data had been made available for their use in the maintenance process. The system engineers have been involved in some common mode failure analysis, such as the problems noted with some Target Rock valves. The system engineers were also familiar with and involved in the repetitive failure identification effort, but their view is normally limited to the components within their system.

The safety significance of components is considered in the setting of priorities in the maintenance process, but it is an operational consideration and not a risk consideration.

ISSUE NO. 4

SUITABILITY ANALYSIS FOR REPLACEMENTS

American Society For Mechanical Engineers Boiler and Pressure Vessel (ASME B & PV) Code Section XI, Paragraph IWA 7220 requires the Owner to conduct an evaluation of the suitability of replacements, prior to authorizing the installation of those replacements. This requirement is implemented, by the licensee in Procedure PLP-605, Paragraph 5.8. The licensee informed the team that PLP-605 is applicable to pressure retaining components and their supports only (items covered by ASME B & PV Code Subsections IWB, IWC, IWD, and IWF). The licensee's program does not address the IWA 7220 suitability analysis requirements for non pressure retaining replacement parts, such as bearings, bushings, springs, stems, disks and shafts (items covered by ASME B & PV Code Subsections IWP and IWV). The licensee was unable to provide a single example where there was objective quality evidence attesting to the fact that a responsible individual had made a conscious decision that replacements "in kind" were suitable for the intended service.

The team concluded that a weakness exists in the licensee's program related to the implementation of the suitability analysis requirements of ASME B & PV Code Paragraph IWA 7220 for non pressure retaining components and for the documentation of suitability analysis for all first time replacements "in kind."

ISSUE NO. 5

HOUSEKEEPING AND MATERIAL CONDITION

During plant walkdowns, the general condition of the plant and the attention to housekeeping details is readily apparent in the heavily traveled areas of the power block. Clearly, management policy is being carried out by all personnel.

In contrast, the outlying or infrequently used/visited areas show little attention to housekeeping details. The areas of concern included the emergency service water and CTMU water intake structure, the emergency service water intake structure, the normal service water pump structure, and the 211 foot level in the waste processing building (WPB). Some of the specific deficiencies noted are listed below:

- Many panels and connection boxes are missing screws and cover keepers. Nearly all of these were corrected during the course of the inspection.

- 'A' ESW pump coupling is heavily corroded. The licensee initiated WR&A 89-ANJX1 to correct this item.

- Pressure instrument PI-01SC-8750AS has cables coming out of the guage that have been cut off and tied in a coil. Although these wires are for an unnecessary heating element within the instrument, they should be labelled and the bare wire ends protected.

- 'A' ESW pump strainer has a leak. This had already been identified by the licensee.

- Numerous articles (rope, hoses, ladder, screens) were left in vicinity of the CTMU pumps. This item was corrected during the course of the inspection.

- Many lights need replacment. Some of these were corrected during the course of the inspection.

- A temporary rig is used to redirect pump leak off from both ESW screen wash pumps. The licensee has no plans provide a permanent drain.

- Both fire pump valve pits contained excessive amounts of trash. These areas were cleaned during the course of the inspection.

- Many telephone box covers are left open when not in use. The Plant Manager issued a memorandum to supervisory personnel to reinforce the good practice of closing the telephone boxes that are exposed to the environment.

- Handwheels on instrument root valves in the vicinity of the CTMU pumps are severely corroded. The licensee initiated WR&A 89-APIQ1 to correct this item.

- Two valves on the NSW pump structure have handwheels corroded to the point where most of the handwheels are missing and the valves are probably inoperable. The licensee initiated WR&A 89-ANRS1 to replace the handwheels.

- Several of the rooms on the 211 foot elevation of the WPB, such as catalytic hydrogen recombiner room W374, were dirty and wet with ground water. Some of these rooms were empty and not utilized by the licensee.

- A radioactive materials storage area on the 211 foot elevation of the WPB had ground water crossing a radiological control boundary. The team requested the licensee survey the water and determined that the water was free of radioactive material. The licensee planned to move the storage area to a dry location.

Some items in the frequently traveled areas were also noted during walkdown inspections by the team:

- Panel B5315 in the diesel generator 1A building had notches in the top, defeating watertight integrity. This item was corrected during the course of the inspection.
- A face plate screw on guage TI-01CC-641CW had backed out and fallen inside the face cover. This condition appears to have existed for many weeks. The licensee initiated WR&A 89-ANSI1 to correct this item.

- Water is collecting on the floor behind switchgear 1-4A1 on the 236 foot level of the RAB. The licensee response was to mop up the water on a daily basis. Daily tours of the area by the team found that solution to be ineffective.

- The air handling unit intake screens on every unit observed are missing a majority of the wing nuts which hold them in place. The licensee is evaluating the benefit of removing the screens entirely. The exposed studs should be used or removed.

- Most safety chains, across ladders from elevated walkways, were not in use. Some were not operable due to broken hooks or insufficient length to reach across the opening. The licensee initiated WR&A 89-ANHL1 to correct these safety hazards.

The licensee initiated 28 WR&A's to correct deficiencies identified during the team's walkdowns.

A management walkdown of the Normal Service Water and Cooling Tower Basin areas was conducted as part of a periodic management walkdown program. About half the items identified during the management walkdown had already been identified during the inspection team's walkdown. These walkdowns are an effective management tool for communicating management standards of cleanliness and housekeeping to supervisory personnel. The frequency of management walkdowns in the remote and outlying areas should be increased.

The licensee has a very good deficiency identification system which is effectively implemented. The system functions well in high traffic, high visibility areas, but is weak in remote, outlying areas of the plant.

During a walkdown inspection, in the vicinity of condensate booster pump B, the team observed the recirculation line for this pump was vibrating to the extent that the insulation on the pipe was being damaged on adjacent pipe supports. The licensee indicated to the team that valve 1CE-261, the flow control valve for the subject recirculation line allowed condensate to leak by. The result was the hot condensate was flashing to steam, causing the recirculation line to vibrate. The team then asked to see the open WR&A's for the flow control valve, and licensee personnel indicated to the team that all WR&A's were completed and approved. Cognizant licensee personnel were aware of the leaking valve since early 1989, yet a WR&A was not opened to repair the valve. During the inspection, the licensee initiated a WR&A to repair to valve.

Housekeeping, in the remote areas of the plant, has been a continuing problem. NRC Inspection Report No. 50-400/88-20 dated August 4, 1988 had identified similar problems. The licensee corrected the problems at that time based on follow-up inspection by the NRC Resident Inspector. Since these concerns have developed again, the licensee should pay particular attention to the development of an adequate permanent solution.

ISSUE NO. 6

MAINTENANCE REQUIREMENTS

The following are examples of the licensee's failure to address and implement maintenance recommendations/requirements into the maintenance program:

a. ESW Pump

The vendor technical manual recommends the following maintenance requirements for the ESW pump:

Every three months for first year, every six months thereafter:

- Check alignment. If misalignment occurs frequently, check piping for settling by unbolting the suction and discharge piping and check fit.

- Check vibration at top of motor for deterioration.

- Check the packing and if necessary, replace.

Every two years:

- Remove rotating element and check parts for wear.
- Check the shaft for concentricity.

- Check unit for alignment.

- Replace bearings, sleeves, wear rings, if necessary.

- Check seismic support assemblies, i.e. bushings for wear. Replace if necessary. Inspect attachment plates, pins and transition piece for corrosion; replace if necessary.

- Repaint as necessary.

The licensee does have PM requirements to inspect seismic supports in the plant and to take vibration measurements per ASME Section XI. The team made no determination as to whether or not those PM's meet the vendor recommendations. The other recommended PM's are not planned by the licensee and there has been no formal justification for not following the vendor's recommendations. The licensee's procedure, Preventive Maintenance Program (MMM-003), specifically addresses evaluation of vendor recommendations in implementing PM requirements. The licensee had recognized this deficiency during a biannual technical manual review conducted on May 10, 1989, but had not instituted corrective action at the time of this inspection.

b. 125 VDC Molded Case Circuit Breakers

The team reviewed the original purchase order and technical specification file for the safety-related 125 Volt DC switchgear. These documents were examined to determine: how the equipment was qualified and the maintenance requirements for the molded case circuit breakers. Inspectors reviewed a document named the IEE 323-1974 Qualification and Test Summary Report for Class IE Switchboards, Gould SO #48-53382, Ebasco PO #NY-435138, prepared for the Shearon Harris plant by Gould Inc., Westminster, Maryland, in Report No. CC-323.74-45, Rev. 4. This report specifically states the following:

> The results of the test program demonstrated that the applicable equipment of Section 2.0 will satisfactorily perfoım their Class 1E functions during their qualified life in the environment specified, provided the following conditions are met by the user:
>
> 1. Adequate surveillance and maintenance programs are implemented. Reference Section 6.0 and Attachment F. Attachment F, entitled Field Testing of Standard 40° C Calibrated Thermal Magnetic Molded Case Breakers, states, "Field Testing of molded case circuit breakers is intended to enable qualified people to determine that a particular circuit breaker will perform its basic circuit protective function.... Field testing is aimed at assuring that the circuit breaker is functionally operable." Attachment F also contains the test procedure to be used. The licensee stated the safety-related 125 VDC molded case circuit breakers were not being tested. The licensee's intentions are to evaluate the requirements in the Qualification Summary Report to determine their position since these requirements were overlooked. The NRC will evaluate these requirements to determine if these circuit breakers are still qualified for Class IE service and safety-related use. This matter is identified as Unresolved Item 50-400/89-16-01: "Testing Molded Case Circuit Breakers in the Safety-Related 125 VDC Power System."

c. Filter for Valve 1CB-6

Filters upstream of enc-use components in the IA system are changed per the requirements maintenance checklist CL-I0088 "Regulator Filter Replacement." This procedure requires removal of the old filter, blowdown of the air supply line, and installation of the new filter, among other things. The filter unit for containment vacuum breaker valve 1CB-6 was not listed in checklist CL-I0088. This procedure lists all air filters upstream of safety-related valves which require regular PM changeout. The frequency for all filters on this checklist is 18 months. Since the subject filter was not listed in CL-I0088, the licensee could not substantiate that the filter had been changed since original installation.

The licensee's response to this issue was to add the filter to the maintenance checklist. The filter is now scheduled for changeout in October 1989, during refueling outage 2. The team considered this example to be an isolated instance, due to the fact that this was the only example of a filter missing from checklist CL-I0088 found by the team.

ISSUE NO. 7

BREAKERS

The resident inspector (RI) informed the team that containment cooling fan S-4 was out of service because the replacement (spare parts) molded case circuit breaker(s) installed in the 480 volt AC motor feeder circuit 1A-SA failed to operate as required. Nine different replacement breakers failed to hold the starting load current when each was installed. The team was requested to review this molded case circuit breaker problem and identify any NRC concerns for RI follow-up.

The existing problem identified to the team is that the replacement breakers are a different design than the breakers initially installed in the plant, although both use the same ITE model number, HE3B100. The original breakers manufactured by ITE/Gould are no longer available, which were rated at 600 volts AC with a 600-1000 ampere instantaneous trip rating. These 600 VAC breakers were qualified by Telemecanique Inc. as specified in Report No. CC-323.74-54, IEEE-1974 Qualification and Test Summary Report for Class 1E Motor Control Centers, dated September 4, 1985. The replacement breakers manufactured by ITE/Siemens (Siemens purchased ITE), are rated at 480 volts AC with a 1200-2000 ampere instantaneous trip rating. The licensee purchased these replacement breakers as commercial grade items for use in nonsafety and Class 1E service. The licensee was requested to furnish the specific qualification documentation, including the engineering analysis that upgraded the 480 VAC commercial grade replacement breakers for use in Class 1E service. The licensee did not furnish the specific documentation requested by the team. The team's first concern for follow-up is the 480 VAC breakers may not be qualified for seismic or Class 1E service.

The team held discussions with licensee personnel and reviewed documentation concerning the instantaneous current trip range. The licensee stated that two of the 480 VAC breakers were installed in a motor feeder circuit where the starting current was measured. The 480 VAC breakers tripped during motor starting currents of 360 and 636 amperes, respectively. This is much lower than the 1200-2000 amperes instantaneous trip range. The original 600 VAC qualified breakers did not trip when installed in the same circuit. The licensee submitted this information to Siemens Automated, Inc. in CP&L letter, File Number SHF/10-12020 dated August 10, 1989. This letter requested Siemens test three returned 480 VAC breakers and provide the root cause analysis of the failures with supporting documentation. The team's second concern for follow-up is that Siemen's 480 VAC molded case circuit breakers have a manufacturing or design deficiency with the instantaneous trip mechanism. In addition, there is a concern why factory testing did not detect this fault.

The team inspected the two M&TE circuit breaker test sets and reviewed their associated vendor manuals to determine if the equipment was adequate for testing circuit breakers. In addition, the M&TE calibration procedures were reviewed to verify the circuit breaker test sets were properly calibrated. The team found that the circuit breaker test sets did not use a high speed oscillographic type readout for the test current. It was determined that the circuit breaker test sets are properly calibrated and adequate for thermal (long term) trip testing. There is a concern that the test sets are not adequate for instantaneous trip testing since there is no high speed oscillographic current readout. The high speed oscillographic readout allows the first cycle of current to be displayed for an accurate reading. The licensee is in the process of evaluating new circuit breaker test with upgraded capabilities for instantaneous trip testing.

The team determined there are four concerns for the RI to follow-up regarding the 480 VAC ITE/siemens type HE molded case circuit breakers which are summarized as follows:

- The 480 VAC breakers may not have been qualified for seismic or Class 1E service.

- The 480 VAC breakers trip on instantaneous current well below the trip range. This may be a manufacturing or design deficiency.

- The factory testing was not performed or did not detect the fault with the instantaneous trip mechanism.

- The licensee's circuit breaker test sets do not use a high speed oscillographic type of readout to display the first cycle of current.

ISSUE NO. 8

ACCURACY OF PRIORITY AND STATUS OF WORK REQUESTS

As part of backlog evaluation, the team reviewed the 15 priority 1 through 4 non-outage WR&As greater than 1 year old. Thirteen of the 15 greater than 1 year old had one or more of the following problems relative to priority or work status:

- The work had been completed and the WR&A could not be readily found for closeout (1 WR&A).
- The WR&A had the wrong priority and should have been closed out as it was only issued to assist another craft.
- The WR&A had the wrong priority.
- The WR&A had been completed but the status had not been updated in the computer.
- Work was of a minor nature and was promptly completed after questioning by the NRC.

None of the work represented by these WR&As was of a significant nature and all work that was mis-prioritized was prioritized in the conservative direction. However, these discrepancies indicate the following weaknesses in the licensees program that should be investigated and corrective actions taken:

- The current priority system with 17 priorities and 8 work conditions has only been in effect a few months. The old priority system only had 5 priorities. Most of the WR&As with the wrong priority were prioritized under the old priority system. Work prioritized as 3 or 4 under the old system would be fairly low priority whereas under the new system it would be high priority. It appears the priorities have not been updated to the new system. This creates confusion and could bring into question the validity of the assigned priorities for older WR&As. It also makes it almost impossible to assess the true backlog of higher priority WR&As.
- The incorrect computer status and the failure to complete/closeout old WR&As that require little or no work indicates lack of attention by the licensee in keeping track of the status of WR&As. By the current system, the WR&As in question are prioritized as high priority, yet little effort was being made to complete and closeout the WR&As.

SECTION D

EVALUATION OF PLANT MAINTENANCE

INSPECTION TREE

EVALUATION OF PLANT MAINTENANCE

I. Overall Plant Performance Related To Maintenance

Rating: SATISFACTORY

Enough significance was attributed, by the team, to the walkdown deficiencies in remote and low traffic areas, and the relatively large number plant trips attributed to maintenance, to evaluate "Overall plant performance related to maintenance" as SATISFACTORY.

1.0 Direct Measures

Rating: SATISFACTORY

Findings/Observations:

The plant availability from the last year was close to the industry average. However, the number of scrams is well above the industry average of 2.1 for the last 12 months. Of the five scrams in the first quarter of 1989, three were attributed to questionable maintenance practices. The licensee's radiation exposure for the last year is well below the national average; however, this should be expected for a relatively new plant (B-17). General plant housekeeping, equipment and plant condition was considered very good; however, in remote and low traffic areas, housekeeping and equipment and plant conditions were considered poor. This circumstance was documented by the RIs in Report 50-400/88-20 issued in August 1988. The licensee performs regular walkdowns; however, the frequency in remote/low traffic areas appears inadequate. For all but low traffic areas the deficiency reporting methodology has been well implemented and is operating well. (C.S)

II. Management Support of Maintenance

Rating:

Program: GOOD

Implementation: GOOD

Management support of maintenance was examined by reviewing and evaluating (2.0) management commitment to and involvement in maintenance; (3.0) management organization and administration for both the corporate and plant level; and (4.0) technical support provided to the maintenance organization.

2.0 Management Commitment and Involvement

Rating:

Program: GOOD

Implementation: GOOD

Findings/Observations:

The rating of this section was based on application of industry initiatives and management's commitment to improvement of maintenance performance.

Evaluation of the licensee's application of industry initiatives indicated that CP&L: participates in the INPO Program; resolves NRC Notices in a timely mannor (B.11); has an effective system engineering program (B.16); has an INPO accredited training program (B.13); participates in TransAmerica DeLaval Owners Group; involved in the EPRI Check Valve Program; and they performed a maintenance self-assessment January 1988.

In evaluating management vigor and example, the team noted the following: management supports participation in industry initiative programs (B.11); management supports maintenance training; however, the quantity of annual training is low (B.13); lack of formal training for AOs related to RAC (C.2); feedback system is strongly supported by management (B.16); AMMS is an effective tool in management of the maintenance program (B.12).

3.0 Management Organization and Administration

Rating:

Program: GOOD

Implementation: GOOD

Findings/Observations:

Inspection in this area was accomplished by the review of procedures included in Appendix 3 of this report; interviews with all levels of management; sampling of selected systems and component WR&As; and observation of maintenance meetings and interface activities between Maintenance and Technical Support groups. The sampled WR&As are listed in Appendix 4 of this report.

Management has established maintenance goals; however, these goals are not effectively communicated in that goals are not broken down to lower levels of management and position descriptions are not available to the individual (B.13).

Review of the allocation of resources indicated the following: Unit 2 spares make immediate replacement possible (B.7); lack of control of maintenance overtime during the 1988 refueling outage (B.13).

Review of the licensee's specification of maintenance requirements revealed: the maintenance program implements EQ, preventive maintenance, ISI requirements, surveillance testing and diagnostic examination requirements; manufacturer maintenance requirements some time not addressed (C.6); the predictive maintenance program is in place though limited in scope and implementation (C.1); RAC maintenance requirements are not addressed (C.2); filter not included in maintenance program (C.6); diesel driven fire pump panel not included in maintenance program (B.4).

Review of the licensee's use of maintenance performance measurement indicated the following: effective feedback system (B.8); root cause analysis program implemented with minor weaknesses (B.20); maintenance performance indicators are established and implemented (B.20); maintenance performance is included in QA surveillances/audits (B.15).

The licensee has established and implemented a document control system for maintenance. Documents were retrievable, identifiable, well maintained and controlled.

4.0 Technical Support

Rating:

Program: GOOD

Implementation: SATISFACTORY

The purpose of this inspection was to evaluate the technical support received by the Maintenance organization from other plant organizations such as Engineering, Health Physics, Quality Control, Regulatory Compliance, and Onsite Nuclear Safety. Also of interest in this area was the level of communications between various organizations and the role of risk in the maintenance process.

Inspection in this area was accomplished by the review of procedures included in Appendix 3 of this report; interviews with supervisors and engineers in various Technical Support organizations; inspection of selected WR&As, and licensee followup of NRC Information Notices, NRC Bulletins and Generic Letters; and observation of ongoing maintenance activities.

Findings/Observations:

Evaluation of the licensee's technical support indicated: system engineers are a plus for the maintenance program (B.16); vibration, oil analysis and thermography programs have been developed for equipment outside of the envelope of ASME Section XI; feedback system is effective (B.8); vendor recommended maintenance not addressed in all cases (C.6); filter left out of the maintenance program (C.6); violation 50-400/88-27 related to the installation of "T" drain (B.16); engineering support input to post maintenance testing is considered acceptable (B.19); engineering is involved in the failure analysis process, and radiation exposure reduction.

The consideration of risk is not formally factored into the role of maintenance or implemented into the maintenance scheme (C.3).

Inspection of the role of QC revealed the following: criteria for audit/inspection have been adequately established and implemented; criteria established for hold points, education/experience requirements for QC personnel qualification are not contained in quality documents; and QC staff is considered small (B.15).

Radiological controls are well integrated into the maintenance program (B.9).

Safety review of maintenance activities indicated: maintenance personnel are integrated into the safety program (B.9); some inoperable safety chains were noted (C.5); and hazardous material storage/control was considered acceptable (B.10) (B.12).

III. Maintenance Implementation

Rating:

Program: GOOD

Implementation: GOOD

The purpose of this part of the inspection was to determine the quality of the established controls and, more importantly, the implementation of these controls. The four areas evaluated are (5.0) Work Control, (6.0) Plant Maintenance Organization, (7.0) Maintenance Facilities Equipment and Materials Controls, and (8.0) Personnel Control. The effectiveness was determined through a review of completed work orders, procedures, and other documentation associated with maintenance and training of maintenance personnel; physical observation of work in progress, tools in stock, and spare parts; and discussions with all levels of personnel.

5.0 Work Control

Rating:

Program: GOOD

Implementation: GOOD

Findings/Observation

Inspection in this area was accomplished by review of procedures included in Appendix 3; observation of the maintenance activities in progress and review of work orders included in Appendix 4.

Observation of maintenance in progress revealed the following: work orders were properly authorized, issued, and approved; procedures were followed; equipment was properly tagged out; tools were properly calibrated; correct parts identified; adequate management oversight; personnel were qualified (B.1, 2, 3, 4, 6, and 8).

The licensee has implemented the AMMS program which effectively controls the work order system (B.12).

The licensee has implemented the EDBS program which effectively maintains equipment data records, EDBS is an adjunct to the AMMS program which maintains work order history records (B.12). Historical records used to establish trending function very well for individual components but is cumbersome to establish trends across a generic item (B.20). The licensee makes effective use of NPRDS data and reports failures to NPRDS. Historical records are easily accessed and are used by planners and other site personnel. Some WR&As were found with inaccurate closeout status (B.18). Equipment data base tracks equipment/component by location in the system and not by serial number (B.12). Equipment records are used in root cause analysis (B.20).

Inspection of the conduct of job planning indicated the following: procedural controls were established and implemented; and WR&A interface with HP occurs after the job has been planned and scheduled and is initiated by the responsible foreman (B.12).

The team's evaluation of work prioritization revealed the following: work prioritization is based on a detailed and elaborate prioritization system. A disadvantage of the system is that factors not relating to job priority are included (B.12). Priorities not updated from the old prioritization system in some cases (C.8). The system appears to be unnecessarily cumbersome in that there are 17 priorities, but the majority of WR&As are contained in two categories (B.12); risk is not considered in the assignment of priority (C.3).

Review of the work scheduling process revealed the following: predictive, corrective, preventive maintenance, surveillances are scheduled; scheduling enhances the maintenance process and reduces backlog; the incorporation of the SCOMP into the maintenance scheduling process enhances and facilitates the identification of conflicts (B.12); and filter left out of the maintenance program (C.6).

Review of backlog controls revealed the following: backlog controls have been established and effectively implemented; deferred preventive maintenance is controlled and authorized; the number of overdue PMs are low and the ratio of PMs to CMs is monitored to control the ratio of PMs to CMs; and backlog manhours are tracked and shows a declining trend; there doesn't appear to be a strong effort to reduce the number of low priority WR&As (B.18).

Procedure format has been developed and consistently implemented. Procedures are periodically reviewed and changes are implemented. Procedures include cautions and warnings. Procedures are consistent, tested, and technically correct; there are no maintenance/operations/surveillance procedures for the RAC (C.2); procedure steps not specified when only a portion of a procedure is to be used (B.12); and solvents not specified in mechanical CM procedures (B.12).

Review of post maintenance testing (PMT) indicated: PMT is established, documented and implemented; PMT identifies acceptance criteria and for the tests reviewed assured operational readiness (B.2 and B.19).

Review of completed work documents revealed: WR&A are in general assembled, identified, stored, and retrievable; however, one lost WR&A was noted (B.18); description of as found condition and corrective action taken is often cryptic (B.12); some old WR&As have incorrect priorities indicated and WR&A status is not updated in the computer (B.18); and completed WR&As are reviewed for completeness.

6.0 Plant Maintenance Organization

Rating:

Program: GOOD

Implementation: GOOD

Finding/Observations

Inspection in this area was accomplished by observation of licensee's plant maintenance organization and how it responds to unusual events; how it supports maintenance activities; how it controls and implements maintenance activities; how it controls personnel; how it establishes documentation; and how it develops lines of communication between plant management and craft personnel. Inspection in this area included review of procedures included in Appendix 3 and review of WR&As included in Appendix 4.

Review of the controls on plant maintenance activities indicated: effective procedures have been developed and implemented for maintenance activities including identification of maintenance needs, system integrity, vendor tech manuals, tool control, material control, configuration control and accountability. Weaknesses were identified in training and qualification (B.13). A weakness was noted relating to: solvent control in mechanical corrective maintenance procedures (B.12); repair of valve 1CH-59 (B.1); lack of control of use of partial procedures (B.12). Generic problems with testing and application of molded case circuit breakers (C.7).

Evaluation of deficiency identification and control system indicated: the licensee has established a system to identify and control deficiencies which includes reporting, tagging, responsibility for deficiency identification, procedures for resolution and provides for review and approval before closeout (B.12). The team noted several unidentified deficient conditions (B.1, 4, 5, 6 and C.5).

Evaluation of maintenance trending revealed: maintenance trending has been established, implemented, and proceduralized; trending of spectrum analysis vibration is not performed on standby ASME Section XI pumps; trending of component failures is accomplished on specific (single tag no.) components, but not on generic components; the number of items in the trending procedure is small (B.20).

Review of the licensee's support interfaces revealed: an effective system of interfaces between maintenance and engineering, quality, operations and safety, that includes information transfer, problem resolution and willful support.

7.0 Maintenance Facilities, Equipment and Materials Control

Rating:

Program: GOOD

Implementation: GOOD

Findings/Observations

The inspection in this area was accomplished by general inspections within the maintenance shops, tool rooms, and training areas. A general inspection was made of warehouse storage conditions and specific details associated with problems in procurement of spare parts.

Maintenance facilities and equipment are considered adequate, well organized and accessible (B.10). Calibration lab is considered small (B.8).

The licensee has established an effective materials control program (B.7); a change in a vendor part without a change in vendor part number may not be identified by the licensee (C.7); poor storage practices and personnel training in the bulk warehouse (B.7); and excellent conditions in the parts issue warehouse (B.7). The licensee has established and implemented a good tool and equipment control program. Special tools and equipment which were necessary for the activities observed by the team were readily available. Tool control program electronically tracks measuring tool history.

The licensee has developed and implemented an effective program to control and calibrate M&TE. The use of electronic tracking of M&TE is extremely effective. The team noted that the physical size of the calibration facility is small.

8.0 Personnel Control

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

Findings/Observations

The purpose of this inspection area was to evaluate staffing controls, training, testing and qualification and to assess the current status. Inspection activities consisted of interviews with supervisors and craft personnel, observation of work activities in the field, and a review of some documents and records.

Inspection of staffing control indicated the following: sketchy guidance for disciplinary actions; no employee incentive program; position descriptions provided to the team were not up-to-date; back shift coverage is considered light; violation for overtime exceeding technical specification limits was cited during the 1988 refueling outage; and low turnover rate (B.13).

Review of training indicated: the size of maintenance training staff is small; little evidence of vendor supplied training; and craft and supervision maintenance/management training time is marginal (B.13).

Examination of the test and qualification process revealed the following: personnel qualifications are documented and traceable; format is approved and documented; few maintenance training card categories without sufficient specificity; and the criteria for grandfathering of maintenance training is considered quite liberal.

Assessment of the current personnel control status indicated the following: most craft personnel have completed their training and are in the requalification cycle; low turnover rate; pending organizational analysis has adversely affected morale (B.13).

SECTION E

FOLLOW-UP ON NRC NOTICE 87-44

AND

NRC BULLETIN 88-09

THIMBLE TUBE THINNING IN

WESTINGHOUSE REACTORS

(Closed) NRC Information Notice (NRCIN) 87-44, "Thimble Tube Thinning in Westinghouse Reactors"

This Notice issued September 16, 1987, alerted licensees to potential problems resulting from thinning of incore neutron monitoring system thimble tubes. NRC Information Notice (NRC IN) 87-44, Supplement 1, dated March 28, 1988, provided additional information. On July 26, 1988, NRC Bulletin (NRCB) 88-09, "Thimble Tube Thinning in Westinghouse Reactors," was issued requesting addressees to establish and implement an inspection program to periodically confirm incore neutron monitoring system thimble tube integrity. The licensee addressed NRCIN 87-44 on December 12, 1987, and NRCIN 87-44 Supplement 1 on April 21, 1988. Thimble tube inspection was performed during the August 1988 refueling outage. The licensee responded to NRCB 88-09 on November 10, 1988.

(Open) NRC Bulletin (NRCB) 88-09, "Thimble Tube Thinning in Westinghouse Reactors"

The team reviewed the licensee letter, dated November 10, 1988, and determined that the requested actions of the bulletin have been acceptably addressed. The team held discussions with responsible site personnel, reviewed supporting documentation, and observed representative samples of work to verify that the actions identified in the letter of response have been completed.

The team questioned the licensee, relating to the basis of the acceptance criteria for through-wall thinning and repositioning distance. The licensee indicated that the through-wall criteria was based on W Letter CQL-88-611 dated September 14, 1988 which stated "Typically, for a domestic Westinghouse Plant, it has been possible to justify leaving a thimble tube in service up to a wall loss of 60%.". The licensee could not demonstrate the suitability of the specific Harris plant configuration to the "Typical" criteria provided by W. The licensee indicated that the repositioning distance was based on what was typical for other utilities. The licensee apparently had not formally considered, wear scar length, or the operability of the instrumentation with a shortened thimble tube length, in their selection of repositioning distance acceptance criteria. The licensee indicated that they would generate a formal acceptance criteria basis document to support their thimble tube inspection program. Pending NRC review of the acceptance criteria basis document this bulletin will remain open.

SECTION F

FUEL TRANSFER FROM BRUNSWICK

The licensee is receiving spent fuel from the Brunswick Steam Electric Plant (BSEP) for storage in the facility's spent fuel pool. On August 17, 1989, the team determined that a lifting strap connected to a shipping cask lid broke on August 5, 1989, which could have damaged a cask seal. The cask lid was eventually secured that day and the cask and lid removed to the cask decon pit. On August 6, 1989, the cask was moved to the fuel pool and the lid removed. On August 8, 1989, the spent fuel from the shipping cask was removed for storage in the spent fuel pool. The licensee needed to do a hands-on inspection of the cask seal to inspect for any damage that may have resulted when the lid removal strap broke. The licensee determined that the radiation dose rate at the lid seal surface was three rem per hour (rem/hr). In order to keep the radiation exposures as low as reasonably achievable (ALARA), the licensee decided to remove the fuel support basket from the shipping cask prior to the cask inspection. Removing the fuel basket on August 9, 1989, reduced the dose rates to one rem/hr at the lid surface. However, the licensee experienced lifting clearance problems while moving the fuel cask basket out of the cask unloading pool into the Unit 2/3 transfer canal and was unable to complete the move until a third lift was made.

During the fuel basket movement, several personnel contaminations occurred on the 286-foot elevation of the fuel handling building (FHB). The contaminated radiation workers had clothing or skin contaminations which were less than 800 counts per minute (cpm) above background when measured with a thin window GM detector. The licensee was still examining and investigating the events associated with the fuel basket movement up to the inspection exit meeting on August 18, 1989. Consequently, the team was unable to sufficiently review the adequacy of the licensee's radiological controls and any subsequent corrective actions associated with the fuel basket movement. A review of the licensee's actions associated with the fuel basket movement will be made in a future inspection and identified as Inspector Follow-up Item 50-400/89-16-02: "Fuel Basket Removal on August 9, 1989."

SECTION G

EXIT INTERVIEW

F. Exit Interview

A preliminary inspection summary was conducted on August 18, 1989. A formal exit interview was conducted at the Harris site on September 27, 1989, with those persons indicated in Appendix 1. The team leader described the areas inspected and discussed in detail the inspection results listed below. Although reviewed during this inspection, proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

(Open) Unresolved Item 50-400/89-16-01: "Testing of Molded Case Circut Breakers in Safety-Related 125 VDC Power System" - Section C-6.

(Open) Inspector Follow-up Item 50-400/89-16-02: "Basket Removal on August 9, 1989" - Section F

APPENDIX 1

PERSONS CONTACTED

APPENDIX 1

PERSONS CONTACTED

N. Barlow, Control Operator - Radwaste
*B. Batts, Senior Engineer - Maintenance
*R. Biggerstaff, Project Engineer - Onsite Nuclear Safety
#J. Collins, Manager - Operations
B. Cooper, Senior Engineer - NSSS
C. Council, I&C Tech 1 - Nuclear
B. Cuthbertson, Senior Specialist - Mechanical
T. Dewees, Senior Engineering - BOP
*J. Eads, Project Engineer - Licensing
*G. Forehand, Manager - QA/QC
J. Floyd, Radiation Control Formen
C. Gentile, Senior Control Operator
#*C. Gibson, Director - Program/Procedures
J. Gunn, I&C Foreman
*P. Hadel, Project Specialist - Maintenance
T. Halker, Electrical Foreman
*L. Hancock, Administrative Supervisor - Training
R. Hearn, Mechanical Foreman - Nuclear
#*C. Hinnant, Plant General Manager
*K. Heffner, Senior Engineer - Maintenance
W. Holley, Senior Engineer - NSSS
C. Holt, Mechanic 1/C Nuclear
J. Jankens, Health Physics/Radiation Control Tech. 1
R. Johnson, Mechanic 1/C - Electrical
J. Kiser, Radiation Control Supervisor
D. Lake, Mechanic 1/C - Electrical
J. Leonard, Projhect Specialist - Radwaste
S. Mabe, Project Engineer - Maintenance
J. Martin, Auxiliary Operator A
*D. McCarthy, Principle Engineer - NED
#L. McKenzie, Manager - QA Engineering
G. Michie, Senior Engineer - BOP
B. Morgan, Senior Specialist - ALARA
B. Morris, Senior Engineer - BOP Electrical
*J. Morris, Senior Engineer - Maintenance
#*T. Morton, Manager - Maintenance
J. Neely, Engineering Assistant
*J. Ojala, Senior Engineering - Maintenance
*L. Olsen, Project Specialist - EDBS/Spare Part
R. Pasteur, Senior Specialist - Technical Training
*A. Poland, Project Specialist - Radiation Control
W. Ponder, Senior Engineer - Performance/EQ
D. Price, Senior Engineer - NSSS
M. Pugh, Project Specialist - ISI
V. Rascoe, Senior Specialist - BOP

#*R. Richey, Manager - Harris Nuclear Project
A. Roberts, Senior Specialist - Mechanical
M. Robinson, Control Operator - Radwaste
*D. Rodden, Engineering Tech 1 - Nuclear
*C. Rose, Jr. Manager QA
E. Royster, I&C Tech 1
J. Schaub, Senior Specialist - Mechanical
*J. Sipp, Manager - E&RC
W. Smith, Maintenance Pkinner/Analyst
E. Stevensen, Mechanic 1/C Nuclear
G. Stott, Senior Engineer - Performance/EQ
C. Strickland, Mechanic 1/C Nuclear
D. Terry, Shift Foreman Radwaste
C. Thomas, Senior Engineer - BOP
G. Thomas, Mechanical Foreman - Nuclear
#*D. Tibbitts, Director, Regulatory Compliance
#*B. Van Metre, Manager - Technical Support
#M. Wallace, Senior Specialist - Regulatory Compliance
#*E. Willet, Manager - Outages/Modifications
*L. Woods, Engineering Supervisor - Nuclear
J. Worley, Senior Mechanic - Nuclear
J. Yelverton, Materials Analyst
*G. Young, Engineering Tech 1 - Nuclear

Other organizations

*K. McCue, CRESAP, Managing Consultant
*G. Sala, CRESAP

*NRC Personnel

J. Blake, Section Chief, Engineering Branch, RII
W. Bradford, Senior Resident Inspector (SRI)
*C. Julian, Chief Engineering Branch RII
M. Shannon, Resident Inspector (RI)
*H. Dance, Project Section Chief RII

*Attended Inspection Summary August 18, 1989
#Attended Exit Interview September 27, 1989

#M. Jackson, Electrical/I&C Maintenance Supervisor
#B. Clark, Mechanical Maintenance Supervisor
#R. Gorganus, Group Staff Analyst - Nuclear Generation Group
#W. Hindman, Manager - Control and Administration

APPENDIX 2

ACRONYMS AND INITIALISMS

APPENDIX 2

ACRONYMS AND INITIALISMS

AEOD	Analysis and Evaluation of Operational Data
AFW	Auxiliary Feedwater
ALARA	As Low As Reasonably Achievable
AMMS	Automated Maintenance Management System
ANSI	American National Standards Institute
AO	Auxiliary Operator
AP	Administrative Procedure
ASME	American Society of Mechanical Engineers
BD	Blowdown
BFIR	Breakdown/Repetitive Failure Investigation Report
cal	Calibration
CAS	Compressed Air System
CCW	Component Cooling Water
CFR	Code of Federal Regulations
CM	Corrective Maintenance
CRESAP	Auditing Contractor
CS	Containment Spray
CW	Circulating Water
deg	Degree
EDBS	Equipment Data Base System
EPRI	Electronic Power Research Institute
EQ	Environmental Qualification
ESCW	Essential Service Chilled Water
ESW	Emergency Service Water
FSAR	Final Safety Analysis Report
HP	Health Physics
HVAC	Heating, Ventilating, and Air Conditioning
HX	Heat Exchanger
IEEE	Institute of Electrical and Electronic Engineers
INPO	Institute for Nuclear Power Operation
ISI	Inservice Inspection
KV	Kilo Volts
LC	Loop Calibration
LER	Licensee Event Report
LOCA	Loss of Coolant Accident
MOV	Motor Operated Valve
MPT	Maintenance Periodic Test
MST	Maintenance Surveillance Test
NCR	Nonconformation Report
NNS	Non-Nuclear Safety
NPRDS	Nuclear Plant Reliability Data System
NRC	Nuclear Regulatory Commission
NRCB	Nuclear Regulatory Commission Information Notice

NRCIN	Nuclear Regulatory Commission Information Notice
NSSS	Nuclear Steam System Supplier
NSW	Normal Service Water
P.E.	Professional Engineer
PI	Pressure Instrument
PIC	Process Instrument Calibration
PM	Preventive Maintenance
PNSCS	Plant Nuclear Safety Committee
PO	Purchase Order
psi	Pounds per Square Inch
PMT	Post Maintenance Test
PT	Performance Test
QA	Quality Assurance
QC	Quality Control
RAB	Reactor Auxiliary Building
RAC	Rotating Air Compressor
rem	Roentgen Equivalent Man
RWP	Radiation Work Permit
RWST	Refueling Water Storage Tank
SA	Service Air
SCFM	Standard Cubic Feet per Minute
SCOMP	Senior Control Room Operator in Maintenance Planning
SHNPP	Shearon Harris Nuclear Power Plant
TI	Technical Instruction
TS	Technical Specification
VAC	Volts Alternating Current
VDC	Volts Direct Current
WR&A	Work Request and Authorization

APPENDIX 3

PROCEDURES REVIEWED

APPENDIX 3

PROCEDURES REVIEWED

Identification	Title
CL-I-0088	Regulator filter replacement
PM-E0005	6.9 KV 1200/2000 Amp Air Circuit Breaker PM
PM-E0003	6.9 KV Bus and Cubicle
PM-E0040	6.9 KV Motor Cleaning and Trending,
MPT-E0008	Environmentally Qualified 6.9 KV Motor Electrical Inspection
PM-E0025	Electrical Preventive Maintenance for 6.9 KV Motors,
MPT-E0004	Environmentally Qualified 480 VAC Motor Electrical Inspection,
PM-M0009	Weekly Lubrication Schedule
PM-M0011	Annual Lubrication Schedule, Rev. 2, March 10, 1989
AP-003	General Plant Personnel Safety and Housekeeping
AP-019	Guidance for Voluntary LCOS
AP-020	Clearance Procedure
AP-021	Caution Tag Procedure
AP-024	Temporary Bypass, Jumper and Wire Removal Control
AP-031	Operational Experience Feedback
AP-032	Procedure to Obtain Non-Company Labor and Services
AP-038	Deficiency Tag Procedure
AP-501	Plant Chemical Controls
AP-510	Radiation Dose Budgeting
AP-514	ALARA Job Evaluations
AP-600	Plant Change Request Initiation

AP-608	Nuclear Network (Network) and Nuclear Plant Reliability Data System (NPRDS)
AP-610	Processing Vendor Manuals and Vendor Information
PLP-103	Surveillance and Periodic Test Program
PLP-602	Equipment Data Base
PGO-052	Guidelines for the Plan of the Day and Inputs to the Plant Work Schedule
PMC-001	Procurement and Cataloging of Parts, Material, Equipment and Services
PMC-005	Storage of Materials
OMM-003	Equipment Inoperable Record
OP-120.09.05	Radioactive Liquid Processing Through Vendor Demineralization Skid
OST-1015	Emergency Service Water System Operability Monthly Interval Modes 1-2-3-4
OST-1214	Emergency Service Water System Operability Train A Quarterly Interval Modes 1-2-3-4
OST-1215	Emergency Service Water System Operability Train B Quarterly Interval Modes 1-2-3-4
OPT-1512	Essential Chilled Water Turbopak Units Monthly Inspection/Checks Modes 1-6
MMM-001	Maintenance Conduct of Operations
MMM-002	Corrective Maintenance
MMM-003	Preventive Maintenance Program
MMM-004	Process Instrument Calibration (PIC)
MMM-005	Instrument Loop Calibration
MMM-006	Measuring and Test Equipment Calibration Program
MMM-007	Maintenance Surveillance and Periodic Test Program
MMM-011	Cleanliness and Housekeeping

MMM-012	Maintenance Work Control Procedure (Automated Maintenance Management System)
MMM-013	Maintenance History Records
MMM-018	Predictive Maintenance Program
MMM-019	Postmaintenance Testing
CM-M0031	Yarway Valves (2" and Smaller) Disassembly and Maintenance
CM-M0014	Hayward Tyler Vertical Turbine Pump - VS01 Disassembly and Maintenance
PM-M0001	Instrument Air Dryer Prefilter Element Replacement and Cleaning
PM-M0005	Annual Instrument Air Dryer Towers Dessicant Inspection
PM-M0007	Semiannual Lubrication Schedule
PM-M0008	Air Compressor Filter Silencer Inspection
PM-M0009	Weekly Lubrication Schedule
PM-M0011	Annual Lubrication Schedule
PM-M0013	Instrument Air Dryer Afterfilter Replacement and Cleaning
PM-M0014	Limitorque Inspection and Lubrication
PM-M0023	Ingersoll and PHE-2NL-2 Air Compressor Piston Rider Ring Wear Measurement Frequency: 8 Weeks
LP-P-8752A	Loop Calibration of Emergency Service Water Screen Wash Pressure Safety Channel A
MTE-002	Fluke 8022B/8021B Digital Multimeter Calibration Frequency - 1 year
MTE-010	MCD-400D Molded Case Breaker. Test Set Calibration/Calibration Check Frequeny 1 Year
MTE-013	W&T (Wallace and Tiernan) Pneumatic Calibrator Calibration Frequency - 6 Months Cancelled
MTE-018	Heise Digital Gauge and Pneumatic Calibrator Calibration Frequency - 6 Months

MTE-072	Ashcroft Digigauge Pressure and Differential Pressure Calibration Frequency - 6 Months
MTE-091	Fluke 8060A Digital Multimeter Calibration Frequency - 1 Year
MTE-509	Outside Micrometer with Fixed Anvil Calibration Frequency - 3 Months
MTE-510	Williams Micrometer Torque Wrench Calibration Frequency - 3 Months
MST-E0010	1E Battery Weekly Test
MST-E0011	1E Battery Quarterly Test
MST-E0012	1E Battery 18 Month Test
MST-E0013	1E Battery Performance Test
MST-0014	1E Battery Charger Capacity Test
MPT-I0074	Reactor Auxiliary Building Local Fire Detection Control Panel 1-LFDCP-3 Ionization Detector Sensitivity Test
MPT-M0084	Motor Lubrication, Westinghouse (Mechanical Environmental Qualification)
HPP-011	Job Recipes
HPP-015	Use of Temporary Shielding
CRC-218	Lubrication Oil Testing
TMM-100	Technical Support Conduct of Operations
TMM-102	Equipment Data Base System
TMM-109	Trending
TMM-400	Test Results Evaluation
TMM-402	Equipment Qualification Coordinator Responsibilities
SD-140	Traveling Screens and Screen Wash
SD-148	Essential Services Chilled Water System
SD-151	Compressed Air System

SD-156	Plant Electrical Distribution System
SD-112	Containment Spray System
SD-139	Service Water System
MOD-206	Temporary Modifications
PPP-100	Plant Performance Monitoring
PPP-212	Component Cooling Water Heat Exchanger Performance Test
ISI-202	Safety-related Component Support (Hangers and Snubbers) Examination and Testing
ISI-203	ASME Section XI Pump and Valve Program Plan
ISI-800	Inservice Testing of Pumps
ISI-801	Inservice Testing of Valves
PLP-603	Plant Performance Program
CQAD 80-01	Procedure for Corporate QA Audits
OQA-103	Personnel Indoctrination, Training, Qualification and Certification
OQA-501	Quality Assurance Engineering Document Review
OQA-202	Document Review

APPENDIX 4

WORK REQUEST AND AUTHORIZATIONS REVIEWED

(WR&A)

Appendix 4

WORK REQUEST AND AUTHORIZATIONS REVIEWED

WR&A	Work Description
86-BQGTI	Switch leaking at threaded connection
89-AEFZ1	Switch leaking at threaded connection
89-ADD313	Perform Weekly Bat MST-E0010 A&B
89-ADH313	Perform Weekly Bat MPT-E0019 D. Fire Pump
89-ABJE1	Terminal Board Verification in 1SW-276
88-AMRT1	Low DP on oil for "B" chiller
88-AMBN1	Service water strainer leak repair
89-ALFK1	Replace missing bonnet nut on 1CC-410
89-AGFJ1	Oil leak on WC-2 compressor "A" chiller
86-ANAU1	"A" ESW pump strainer clogged
86-ANAU2	"A" ESW pump strainer clogged
86-AWEM1	"A" ESW pump strainer cover gasket leak
88-AZTL1	"A" ESW pump strainer cover gasket leak
88-AZTL2	"A" ESW pump strainer cover gasket leak
88-AURA1	"A" ESW pump strainer cover gasket leak
89-AGEJ1	Relief valve testing of 1CC-38I
89-AMIL1	Oil change in diesel air compressor 1EA-E001
89-AMZI1	Trap stuck on inst. air aftercooler 1A
89-AMZI1	Trap stuck on inst. air aftercooler 1B
88-ASTS1	Change out filter in filter-regulator
89-NYZ324	Inspect oil in CS pump motor
89-RDS313	Inspect and lubricate valve operator (Valve 1AF-24)
89-RDR313	Inspect and lubricate valve operator (Valve 1AF-5)
88-BCRP1	Repair sent leak on valve 1CT-29
89-ANQZ1	Replace missing hardware in FHB
89-ANJU1	Screw broken off in 6.9 breaker cube
89-ANJW1	Replace missing hardware on 6.9 cubes
89-ANNB1	Rad monitor missing 2 clips and screws
89-ANNC1	E-19 and 20 missing covers
89-ANND1	HVAC panel missing 2 bolts and clips
89-ANNF1	Screws missing from main termination cable
89-ANNX1	Box 5044 has bad threads
89-ANIX1	Cover clamps and screws missing
89-ANIZ1	Rad monitor missing cover clamp
89-ANJA1	Box B5240 missing screw
89-ANJB1	Air handler junction box missing screw
89-ANQU1	B5222 screws cannot be tightened
89-ANQW1	Missing nameplate and screws
89-ANCK1	Position indicators missing
89-ANJY1	480 BBC switchgear has missing hardware
89-ANQP1	Replace missing screws in RAB
89-ANQT1	Replace missing screws at cooling tower
89-ANNZ1	Panel cover trim needs to be replaced

89-ANPB1	Door latch missing
89-ANPD1	Conduit defective
89-ANPF1	Panel missing 2 door latches
89-ANQI1	Replace missing hardware in WPB
89-ANIY1	Replace missing cover
89-ANJC1	Two cover clamps missing
89-ANKB1	Flex conduit loose
89-ANKG1	Door fastener broken
89-ANGT1	Door bent on power panel
88-AXWQ1	Perform OST-1801 on ICS-CSIPC
88-ASHH1	Repair packing leak on valve ICT-80
88-AZXC1	Repair packing leak on valve ICT-41
88-AZXJ1	Repair packing leak on valve ICT-77
88-AZXH1	Repair packing leak on valve ICT-75
88-BEKS1	Replace bearing in pump 1AF-E003
87-BFQF1	Repair seat leak on valve ISP-917
88-AFPJF1	Adjust packing on valve ICT-36
88-AMNG1	Replaced rotor on valve ICT-71
88-BBIE1	Adjust packing on valve ICT-71
89-AFZW1	Adjust packing on valve ICT-71
89-AMNS1	Valve ISW-270 will not shut automatically
88-ASNB1	Repack 1CH-522
88-ASPL1	Repack 1CH-521
88-ASPM1	Repack 1CH-519
89-AEBA1	Seat leak on 1CH-59
89-AGEN1	Verify setpoint of 1CH-50
89-AGEP1	Verify setpoint of 1CH-63
88-ASNA1	Repack 1CH-518
89-AMYK1	Open and inspect sw side of heat exchanger
89-AFCZ1	Open, inspect and clean condenser waterboxes
89-ANHL1	Safety chain repairs
88-ASTS1	Change out filter in filter-regulator 1IA-819
89-AMBU1	Inspect WPB CCW HX "B"
89-ALNS2	1B air dryer heater defective
89-AIRU1	Replace prefilter, DFD1A
88-AXIM1	Air leak from filter-regulator
WR 88ABU275	Bux 1B-SB inspection and cleaning
WR 88BAQ295	PM breaker for emergency service water pump 1B-SB
WR 88BAG275	PM incoming breaker for 1A-SA
WR 89AAF407	PM breaker bus 1B to 1C tie
88-ACUB1	Implement PCR 00651
87-BLTG1	Assist Computer Group Supervisor
87-AYDH1	Assist Foreman is establishing a card repair program
88-ASEH1	Check Thermocouple TE-2006B2
89-AEHI4	Rework instrument tubing
87-AHYS1	Repair Damaged Duct Work at RAB Vent Stack Inlet
88-ADNS1	Perform inspections per Bulletin 88-01
88-ARWB1	Assist System Engineer with removing transfer canal gate
88-ABNC1	Remove old grease and clean internals of value operator

88-ABLN1	Heat Tracing - ensure circuit 7 is operable
88-AAFN1	Training and timekeeping
88-AMAU1	Calibrate Cooling Tower Blowdown Integration
87-BTTW1	Fire Protection System - replace FUD-862 OA01
88-APQT1	Microwave Receiver - reset alarm
88-AREK1	Trouble shoot circuits associated with door 1173
88-ADEQ1	Closed circuit TV - trouble shoot
89-ACSC5	Failed seal on Cooling Tower Makeup System Pump
89-AHLW1	Assist operations in fully opening Cooling Tower valve
89-AHLU1	Assist operations in fully opening Cooling Tower valve
88-AYYJ1	Replace damaged flex conduit
89-ADSC1	Security lighting - trouble shoot
89-AFIB1	Temporary power for auxiliary sampler
89-AHNT1	Computer console troubleshoot
89-RDR313	Limitorque inspection and lubrication
89-RDS313	Limitorque inspection and lubrication
89-ANBG1	Leak on Transfer Pump 1BD-E003 supply line
89-ANBF1	Manway leak on Settling Tank 1BD-E016
89-AMXH1	Seat Leak on Valve 1BD-143
89-NYZ324	Westinghouse Motor Lubrication PM on Pump 1CT-E005

Auxiliary Feedwater Pump Motor 1B-SB Quarterly Meggering per MPT-E008: WR 87FD0281, WR 87MTM356, WR 87MTM486, WR 88MTM097, WR 88MTM175, WR 88MTM295

Auxiliary Feedwatewr Pump Motor 1B-SB Monthly Inspection per MPT-E008: WR 870A0441, WR 870A0481, WR 870A0511, WR 880A0034, WR 880A0087, WR 880A0126, WR 880A0167

Auxiliary Feedwater Pump Motor 1B-SB 550 day Inspection and Meggering per MPT-E008: WR 870AM513, WR 890AM104

Auxiliary Feedwater Pump Motor 1B-SB Monthly Bearing Oil Inspection per MPT-M0084: WR 87NZA467, WR 87NZA491, WR 87NZA524, WR 88NZA044, WR 88NZA087, WR 88NZA114, WR 88NZA157, WR 88NZA184, WR 88NZA227, WR 88NZA254, WR 88NZA297, WR 88NZA324, WR 88NZA365, WR 88NZA404, WR 88NZA442

Auxiliary Feedwater Pump Motor 1B-SB Semiannual Bearing Oil Change per MPT-M0084: WR 88NZJ107, WR 88NZJ281

Emergency Service Water Booster Pump Motor 1B-SB, Refueling Outage Cleaning and Inspection 480 V Motors per PM-E0009: WR 87GSJ445, WR 88GSJ275

Component Cooling Water Pump Motor 1B-SB, Refueling Outage Inspection per PM-E0025: WR 88AHC295

Component Cooling Water Pump Motor 1B-SB, Semiannual Bearing Oil Change per MPT-M0084: WR 88NZI107, WR 88NZI336, WR 89NZI042

Component Cooling Water Pump Motor 1B-SB, Refueling Outage Inspection per MPT-E008: WR 88PLS275

APPENDIX 5

MOTOR DATA SHEETS

Motor Preventive/Predictive Maintenance
Summary Sheet

Data

Load: component cooling water pump, direct coupled
Motor horsepower: 800 HP Motor voltage: 6600 V
Location: reactor auxiliary building, elevation 236 feet
Motor type: horizontal dripproof, WP-1
Motor cooling: air Motor running time: approximately 1/3
Stator RTD's: yes Space heater: yes
Bearings -- Type: sleeve Cooling: none Thermocouple: yes
Oil: Recommended, 200 SUS @ 100° F nominal
Used, Mobil 797 turbine oil 140-165 SUS
Maintenance required to maintain EQ status: not EQ
Manufacturer: Westinghouse Electric Corporation
Instruction book on file: yes

Program

*Power or current monitoring: quarterly per PM-E0040
*Winding temperature monitoring: quarterly per PM-E0040
*Bearing temperature monitoring: quarterly per PM-E0040
*Insulation resistance: polarization index, yearly
*Vibration monitoring: Fast Fourier Transform, radial and axial, monthly
Oil level check: weekly, per PM-M0009
Oil change: semiannually per MPT-M0084
Oil analysis: will be added in future
Variable trending: variables preceded by * are done on computer
Inspection: remove covers, air baffles, etc., 2nd R/O per PM-E0040
Cleaning: as required after inspection
Winding resistance: R/O per PM-E0025
Space heater check: R/O per PM-E0025
Thermography: semiannually per PIC-E039

Motor Preventive/Predictive Maintenance
Summary Sheet

Data

Load: auxiliary feedwater pump, direct coupled
Motor horsepower: 500 HP Motor voltage: 6600 V
Location: reactor auxiliary building, elevation 236 feet
Motor type: horizontal dripproof, WP-1
Motor cooling: air Motor runnning time: standby
Stator RTD's: chromel/constantan Space heater: yes
Bearings -- Type: split sleeve Cooling: none Thermocouple: yes
Oil: Recommended, 200 SUS @ 100° F
Used, Mobil 797 turbine oil 140-165 SUS
Maintenance required to maintain EQ status: not EQ
Manufacturer: Westinghouse Electric Corporation
Instruction book on file: yes

Program

*Power or current monitoring: quarterly, per PM-E0040
*Winding temperature monitoring: quarterly, per PM-E0040
*Bearing temperature monitoring: quarterly, per PM-E0040
*Insulation resistance: polarization index, yearly
Vibration monitoring: no
Oil level check: weekly, per PM-M0009
Oil analysis: will be added in future
Oil change: semiannual per MPT-M0084
Variable trending: Variables preceded by * are done on computer
Inspection: remove covers, air baffles, etc., 2nd R/O per PM-E0040
Cleaning: as required after inspection
Winding resistance: R/O per PM-E0025
Space heater check: R/O per PM-E0025
Thermography: when available per PIC-E039

Motor Preventive/Predictive Maintenance Summary Sheet

Data

Load: service water booster pump, direct coupled
Motor horsepower: 200 HP Motor voltage: 460 V
Location: reactor auxiliary building, elevation 236 feet
Motor type: horizontal 447TS
Motor cooling: air Motor running time: standby
Stator RTD's: no Space heater: yes
Bearings--Type: double shielded ball Cooling: none Thermocouple: no
Oil: Recommended, lithium soap base No. 2
250° F, class B, 300° F class F
Used, not added to double shielded bearing
Maintenance required to maintain EQ status: not EQ
Manufacturer: Siemens-Allis Type RGS
Instruction book on file: yes

Program

Power or current monitoring: no
Winding temperature monitoring: no
Bearing temperature monitoring: no
Insulation resistance: polarization index, yearly
Vibration monitoring: no
Oil level check: N/A
Oil change: N/A
Oil analysis: N/A
Variable trending: polarization index on computer
Inspection: R/O per PM-E0009
Cleaning: as required
Winding resistance: no
Space heater check: no
Thermography: no

MAINTENANCE INSPECTION TREE

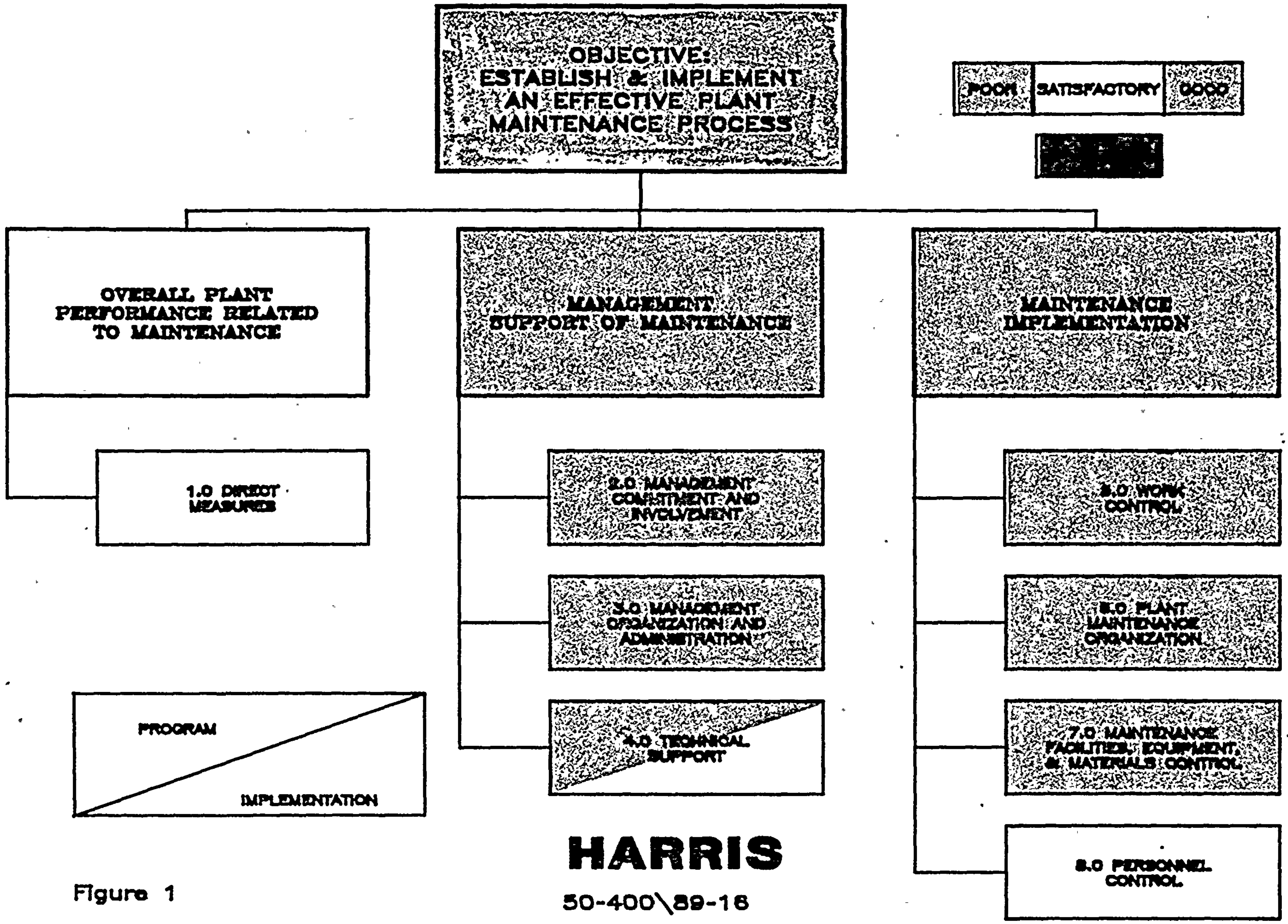

Figure 1

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