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101 MARIETTA STREET, N.W.
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Licensee: Carolina Power and Light Company
P.O. Box 1551
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Facility Name: H.B. Robinson

Inspection Conducted: May 21-25, June 4-8, 25-29, and July 13, 1990

Inspectors: for E. H. Girard, Team Leader — August 2, 1990 Date Signed

Team Members: P. Fillion, M. Glasman, T. Keck, W. Kleinsorge, J. Mathis, R. Shortridge

Approved by: J. J. Blake, Chief — Aug 7, 1990 Date Signed
Materials and Processes Section
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SUMMARY

Scope:

This special, announced inspection consisted of an indepth team inspection of the maintenance program and its implementation. NRC Temporary Instruction 2515/97 issued September 22, 1989, was used as guidance for this inspection.

Results:

Overall, the maintenance program and its implementation were judged to be marginally SATISFACTORY. The more significant areas of strength and weakness are highlighted in the Executive Summary, with details provided in the report.

No violations or deviations were identified.

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EXECUTIVE SUMMARY

This NRC maintenance inspection rated the H. B. Robinson's maintenance program and its implementation marginally SATISFACTORY. The SATISFACTORY rating indicates adequate development and implementation of the important elements of a maintenance program, with the areas of weakness being approximately offset by strengths in other areas. In the case of Robinson, the weaknesses identified were numerous and appear only "marginally" offset by strengths.

The more significant areas of weakness identified, those whose correction the team judged would be of greatest benefit to the maintenance process, were the following:

Weaknesses:

- System engineering (inadequately defined program, high personnel turnover, personnel training/capabilities requirements not determined, routine assessments of completed maintenance not being performed, no periodic system status reporting, etc. - report Section 3.a)

- Post maintenance testing (lack of guidance for determining test requirements, examples of testing that failed to assure corrective maintenance was effective, and inadequate system engineer involvement in reviews of completed work requests - report Section 3.c)

- Maintenance shop (location outside secured area limiting access to work, insufficient mockups, inadequate lighting, etc. - report Section 3.e)

- Allocation of resources (substandard maintenance shop, failure to promptly respond to industry check valve concerns, insufficient QC inspectors, incomplete equipment database, etc. - report Section 3.i)

- Quality control (inadequate program definition regarding hold points and insufficient staffing - report Section 3.d)

- Maintenance trending (lack of programmatic standards and controls - report Section 3.f)

- Backlog assessment (inadequate program to understand and control backlog - report Section 3.f)

- Lack of upper management presence at the site of maintenance activities (to communicate their interest in and support for the maintenance process - report Section 3.h)

- Preventive maintenance procedures for electrical equipment (weak procedures and the extensive use very simple checklist - report Section 3.j)

The NRC team also noted many other weaknesses that were not considered as serious as those above but that do require attention. Examples are: failures to hang deficiency tags on deficient equipment, insufficiently documented work history, inadequate equipment identification tagging, etc. These are enumerated in Section 4 of this report.

Some of the more significant areas of licensee strength identified were as follows:

Strengths:

- Housekeeping and materiel conditions in most areas (report Sections 2.a and 4.a(1))

- Radiological controls (report Section 2.j)

- Well-qualified and capable maintenance staff (report Section 4.c(4))

- Actions taken to reduce valve packing leaks and provide a lubrication program (report Sections 3.i and 4.b(3))

The inspection was performed by a seven-man team during May and June 1990. The maintenance performed while the team was on site was limited in significance and complexity, therefore, direct assessment of work activities can not be considered as representative. The plant was in operation at the time and a refueling outage was planned for September 1990.

The inspection and the rating process were conducted in accordance with guidance provided in NRC Temporary Instruction 2515/97. A principal feature of this instruction is a maintenance inspection logic tree used to collate and present the maintenance inspection findings. The tree prepared by the NRC from inspection of maintenance at Robinson is presented as Appendix 3 to this report. It depicts the ratings determined for individual maintenance elements and the overall satisfactory rating. The findings used in determining the ratings are summarized in report Section 4.

1. INTRODUCTION

This inspection was conducted to assess the effectiveness of maintenance at H. B. Robinson Unit 2 utilizing guidance given in NRC Temporary Instruction 2515/97. It was performed by an seven-man team during May and June 1990. At the time Robinson 2 was operating and was approaching a refueling outage scheduled for September 1990. During the period the maintenance inspection team was on site no particularly significant or complex maintenance was being undertaken.

The Robinson plant site is shared by one nuclear unit (Unit 2) and one fossil fuel unit (Unit 1). Robinson Unit 2, a 665 MWe (net) Westinghouse PWR, is one of the region's older plants. It began commercial operation in March 1971. The plant was rated SALP Category 2 by the NRC in the maintenance or maintenance/surveillance areas for the last three appraisal periods.

The inspection findings and conclusions are described in report Sections 2 through 4. Section 2, Inspection Details, describes the conduct of the inspection and the majority of the findings obtained. Section 3, Issues, highlights the more outstanding maintenance weaknesses identified in the inspection. Section 4, Evaluation of Plant Maintenance, summarizes all of the findings and logic which culminate in the overall rating of maintenance effectiveness at Robinson 2. It includes some findings not described in Sections 2 and 3, findings which were either obtained as separate assessments (e. g., of historical data) or involved findings that were noted incidental to, but outside the inspection described in Section 2.

A special maintenance inspection logic tree developed for the NRC was utilized to aide in collating inspection findings, obtaining assessments for individual elements of maintenance, and summing the individual element assessments into an overall rating of maintenance. It is discussed in Section 4 and presented in Appendix 3.

The last section of the report, Section 5, summarizes the exit interview held with the licensee following the inspection.

2. INSPECTION DETAILS

This inspection was performance based and included:

- Plant walkdowns to observe and assess materiel condition and housekeeping.

- Detailed examination and assessment of the adequacy of maintenance and maintenance-related work performed on selected systems and components. This was accomplished by observing the materiel condition of the systems and components, observing maintenance in progress, reviewing documentation and interviewing personnel.

- Maintenance-related topics especially examined because of their importance to the overall assessment (e.g., work control, post maintenance testing, root cause analysis, known industry problems, etc.). These were typically examined as part of the system and component maintenance assessments, but in a few instances they were examined separately (e. g., historic data) and are only addressed in Section 4 of this report.

- Selected miscellaneous in-progress maintenance work observed to increase the sample of direct maintenance observations.

- Radiological controls in their relation to maintenance.

The inspection findings for systems and components, radiological controls, and for miscellaneous maintenance work observed are described below. All findings of importance to the evaluation are included in Section 4.

2.a. Service Water (SW) System

The team's inspection of the SW System included a walkdown of the majority of SW system outside the containment; observation of vibration and bearing temperature testing of "A" Service Water Booster Pump conducted on Work Request (WR) 90ALC262; detailed review of 16 completed WRs related to the SW system, review of the root cause analysis of the HVH 1-4 heat exchanger flow failure conducted under Engineering Evaluation 89-113; and examination of system engineering practices. In addition to these activities specific to the SW system, the team evaluated the following general maintenance areas while inspecting the SW system: prioritization; consideration of risk in the maintenance process; trending; and backlog controls. The team's findings regarding the licensee's trending and backlog controls are described in issue Section 3.f. Findings relative to consideration of risk in the maintenance process are described as an issue in Sections 3.g. The findings for each of the other areas inspected, except system engineering, are described below. The team's combined findings for system engineering are discussed in issue Section 3.a.

System Walkdown

In general, materiel condition and housekeeping throughout the plant were good, however, some poor conditions, as detailed below and in Section 2.e, were noted. Although these conditions indicated a need for improvement in some areas, they were minor compared with the generally good condition of other areas observed.

Examples of the unsatisfactory housekeeping and materiel conditions noted during the walkdown included minor items such as threaded fasteners loose or missing (e. g., on "C" SW pump causing the motor conduit to be loose) and, of more significance, a large amount of boric acid crystals on both RHR pumps (observed while inspecting SW piping in the RHR Pit). The latter reflected the presence of a long term leak. Discolored boric acid, possibly indicating wastage, was observed on some of the RHR pump studs and nuts.

The team noted approximately 35 small valves and a similar number of instruments, that were uniquely identified on Piping and Instrumentation Diagrams but were not labeled (identified) in the plant. The licensee indicated that the majority of the unlabeled SW valves observed by the team and a few of the instruments were known to them. They stated that they had determined that their labeling problems included: the lack of a labeling standard for items outside of the control room; many missing labels; conflicting and inconsistent label information; inconsistencies in label abbreviations and format; illegibility (due to the small size and lack of contrast on many labels); and labeling information on control room controls and instruments that differed from that on the items in the field. Labeling had not been the responsibility of a single group but belonged to the Operations Department, the Maintenance Department, or the Modifications organization depending on location. This was recognized as the cause of many of the labeling inconsistencies. A plant labeling committee had been identified and tasked with providing management with a unified labeling program by September 1990. The team noted that the NRC identified labeling deficiencies at Robinson during inspection 261/89-11, conducted in July 1989, and that the problem remains incompletely corrected.

As a result of the team's walkdown findings the licensee issued approximately 20 WRs associated with the SW system.

Through their discussions with licensee personnel, the team found that tours were the responsibility of all levels of management and were strongly encouraged by the plant manager. However, the team determined that the tours were not as effective in controlling housekeeping/materiel conditions in remote/low traffic areas as they were in the general plant areas - based on their observations in the RHR Pit and other areas that appeared to be toured infrequently (e. g., the Containment and the RHR Heat Exchanger Room, as discussed in Section 2.e)

Observation of Work

The work observed involved preventive maintenance vibration and bearing temperature tests on SW Booster Pump A. It was properly performed in a professional manner. One test specified by the controlling work request could not be accomplished because of equipment status. The craftsman so noted and informed appropriate personnel.

Review of Completed Work Requests

Preliminary to their review of work requests the team reviewed the controlling Maintenance Management Manual procedure for work requests, MMM-003. It appeared to lack detail in some areas. It did not sufficiently specify or reference requirements for QC hold point or post maintenance testing instruction entries. It did not even contain an example of either a blank or a completed work request form.

The team's review of 30 completed WRs, about one-half each from the SW and the HVAC Systems, found various deficiencies. Only two or three of the WRs examined specified any post maintenance testing. Three of the WRs contained work instructions rather than a description of the trouble in the WR field labeled "NATURE OF TROUBLE, HOW FOUND, LOCATION", thus limiting the usefulness of the data in this field for future use. Repair instructions were almost uniformly sketchy leaving a great deal to the "skill of the craft" Two examples were noted which were outside the definition of "skill of the craft" as specified by the licensee in Procedure PLP-013, "Maintenance Program". The first, WR 88-AMMX1, covered the removal of a damaged plug in a Limitorque gear casing without providing any instructions for the protection of the gear lubricant from metal chips. The other, 89-AFQG1, specified a Belzona Repair of leaking tubes without any details. For most of the WRs the field labeled "CAUSE OF TROUBLE, CONDITION FOUND" contained only as found information, again limiting the usefulness of WRs as a source of historical data. Three repairs were noted for which followup actions to preclude recurrence appeared desirable but none was indicated in the WRs - repair of cracked nipple on WR 89-AHXX1, cracked duct on 89-AALN1, and trash found in piping on 89-AJTF1. The "CORRECTIVE ACTION TAKEN" field on the WRs reviewed by the team was found to contain very limited information, usually only indicating that the trouble had been corrected and the equipment was "left in a satisfactory condition". There was little or no detail as to what actions were taken to correct the conditions found and no indication as to what actions were taken to assure that the equipment was "left in a satisfactory condition". This was observed, for example, on WRs 88-AMKN1, which replaced a broken pin in a valve; 90-ACYK1, which re-set a low temperature alarm; and 88-ACAM1, which replaced a section of pipe. Materials used were not always identified on the WRs, as in the case of the pin in 88-AMKN1 and the nipple in 89-AHXX1. Based on the above findings, the team considers that the licensee's review of completed WRs was not adequate to assure that they provide a useful record of equipment condition and history. In the team's experience such reviews are typically the responsibility of the foremen and/or system engineers.

Review of Root Cause Analysis

The root cause analysis reviewed appeared to be a thorough and accurate assessment.

Prioritization

The licensee established a new work request (WR) prioritization system effective on the first day of this inspection. The team reviewed all five of the Priority 1 WRs (by inference requiring expeditious action) in the backlog. One dated back to March 3, 1989 (over 15 months) and had yet to be started. Each of these WRs had been prioritized under the previous program. With the assistance of a senior member of the licensee's Planning staff the team determined that all five WRs were inappropriately prioritized. The licensee had determined that previous program was not effective, which was the driving force for the development of the new program. The team noted that the new program appeared to provide well thought out guidance for prioritization but it was silent in the area of the urgency of the commencement and completion of work (e. g., in requiring Priority 1 WRs to be started with in 24 hours of the completion of planning and worked until completion). As the new program implementation was in its infancy, its effectiveness could not be determined.

2.b. Heating Ventilating and Air Conditioning (HVAC) System

The team's inspection of the HVAC System included a walkdown of the majority of the system outside the containment, observation of the cleaning of air handling equipment conducted on work request (WR) 90AFDH1, detailed review of 14 completed WRs, review of the root cause analysis of the HVE-6 fan hub failure conducted under SCR 88-016, and examination of system engineering practices. In addition to the above, the team expanded its inspection beyond the HVAC System to include a general examination of the preventive maintenance program (including predictive maintenance) and of maintenance personnel goals. The team's findings with regard to the licensee's HVAC System work requests are described in combination with those for the SW System in Section 2.a above. The findings for each of the other areas inspected, except system engineering, are described below. The team's combined findings for system engineering are discussed in issue Section 3.a.

System Walkdown

In general, the materiel condition and housekeeping observed were good. Some unsatisfactory conditions were noted but their number and significance were considered minor in comparison with the total.

Examples of the unsatisfactory housekeeping and materiel conditions noted during the walkdown included trash in air handling units HVE-50 and HVS-5; door handles broken on air handling units HVE-14 and HVS-4; holes in flex joints HVE-3 and HVE-5; damaged insulation on HVE-15; door on air handling unit HVE-1 not sealing properly; sampling holes in ducting not properly sealed (e. g., on HVE-5); many instruments not identified (e. g., PI-775A and FI-934); three of eight bolts supporting HVE-19 fan were 3/8"x7/8" vice 1/2"x1" required by the manufacturer; and numerous missing fasteners from panel covers, light fixtures, and fan housings. The unidentified instruments referred to above are another example of the labeling problems already described under the walkdown heading in Section 2.a. The licensee issued in excess of 20 WRs to correct the above conditions.

During the inspection of heaters in the Station Battery Room, the team noted a thermometer was left in cells 13 and 49 of the A and B batteries respectively. This is of concern because, with the thermometers left in cells, the cell flame arresters are defeated. In addition cell numbers 58 and 59 in the A Battery and cell number 49 in the B Battery were filled with electrolyte above the high fill level, indicating a lack of attention to detail on the part of the personnel maintaining the station batteries.

During the walkdown of the HVAC system, the team noted several instances where equipment was disassembled with the parts and or tools abandoned in place. The licensee indicated that the general practice in the area of tool and dissembled equipment parts control is to rope off a working area, but there is no firm rule (documented procedural control). The concern in this area is that lost parts cause delays due to procurement of replacements and may result in unauthorized replacements (see bolts associated with HVE-19 above) and lost tools can also cause delays.

In walkdowns of the HVAC and other systems the team noted many deficient items that had not been deficiency tagged. They subsequently found that most of the deficiencies had already been identified by the licensee. In response to questioning regarding the absence of deficiency tags on these items one of the system engineers stated that he never used deficiency tags on deficiencies that he identified. The team reviewed the licensee's Deficiency Tagging Program, which was found to be implemented through Procedure MMM-014. This procedure indicates that deficiency tags are to be used to visually identify all equipment found deficient except in the control room - where small blue stickers are used. However, the procedure prefaces virtually all responsibilities for performance of deficiency tagging with permissive "shoulds", such that they may be ignored as requirements. Page 8 of the procedure alone contains six "shoulds" and one "may" in responsibility steps. Based on its review the team concluded that the licensee's identification of deficiencies was satisfactory overall, but the deficiency tagging procedure and its implementation were unsatisfactory.

Observation of Work

From the observation of work activities the team noted the following:

- The craftsmen obtained the necessary clearances, performed their task in a workmanlike manner, followed procedural requirements, and properly resolved discrepancies when encountered.

- Discussions with craft personnel, indicated that senior maintenance and plant managers were infrequently at the site of active maintenance activities. However, the senior managers were frequently in attendance during plant operability crises. Additionally the team was informed that the managers toured the plant off-shift - observing, identifying and obtaining correction of unsatisfactory plant conditions

Examination of Preventive Maintenance

The team's review of the licensee's predictive maintenance program revealed the following:

- The licensee had established an informal (not proceduralized) vibration analysis program for approximately 100 pieces of both safety-related and non-safety-related equipment. This program was found to use a sophisticated technique which evaluates both the velocity and displacement of vibration. It included both balance-of-plant and safety-related equipment that was in full time operation (e. g., Service Water, Charging, and Component Cooling Water Pumps). The stand-by safety-related pumps (Safety Injection, Containment Spray, Auxiliary Feedwater, etc.) were not regularly monitored by this program. The stand-by pump vibration monitoring was being accomplished by a less sophisticated and less sensitive displacement analysis technique specified in ASME Section XI. Working hour conflicts and lack of training, were the reasons given for the use of the less sophisticated and less sensitive vibration technique in monitoring the very important stand-by pumps.

- The licensee's lube oil analysis program was procedurally defined and appeared to be functioning well, based on discussions with involved system engineering personnel.

- The licensee currently has no thermography program; however, they are in the process of formulating a program and evaluating equipment.

The team's comparison of preventive maintenance recommendations given in approximately ten vendor technical manuals with the preventive maintenance specified for the associated equipment by the licensee's preventive maintenance (PM) program revealed the following:

- The Buffalo Forge vendor manual for the motors on non-safety-related air handling units HVE-7, 8A, 8B, and 22 recommended oil lubrication, with periodicity of one to five years depending on service. These motors were not included in the licensee's lubrication program. Records did not indicate any previous lubrication of these motors.

- The American Air Filter Company manual for safety-related evaporative air coolers HVS-5 and 6, recommended the reservoir be cleaned at least twice a year, and the ball float valve assembly be inspected for proper operation. Only the fan motors and the fiber pads for HVS-5 and 6 were included in the preventive maintenance program.

- The Honeywell Company vendor manual for the safety-related side mounted pneumatic positioners for EAC-1, 2, and 3 louvers, recommended periodic lubrication of the end of stroke adjusting pin. These positioners were not included in the preventive maintenance program.

Review of lubrication basis documentation for selected HVAC and SW components revealed the following:

- Many of the basis documents stated "THE LUBRICATION PROGRAM IS NOT AWARE OF A SPECIFIC OR GENERIC RECOMMENDATION FROM THE EQUIPMENT MANUFACTURER." and "THE LUBRICATION PROGRAM IS NOT AWARE OF A SPECIFIC APPLICATION FREQUENCY RECOMMENDED BY THE EQUIPMENT MANUFACTURER." The team's review of equipment vendor manuals provided by the licensee indicated that this statement was incorrect in many cases. The following are some examples where the vendor manuals made specific lubricant and/or lubrication frequency recommendations and the basis document denied any knowledge of recommendations: A and B SW Booster Pumps, HVE-5A & B pillow block bearings, HVE-19 pillow block bearing, HVH-1, 2, 3, and 4 motors

- Westinghouse Electric Corporation manuals for centrifugal fans HVH-5 and 9, and American Standard Co. manuals for axial fans HVE-5A, 5B, 7, and 19, recommended periodic lubrication with specified lubricants. Fans HVH-9 and HVE-7 were not in the lubrication or preventive maintenance program.

The above examples are indicative of poor engineering support and poor definition/identification of maintenance requirements. The licensee was found to be in the process of reviewing the equipment in the HVAC system to determine appropriate preventive maintenance needs.

In reviewing lubrication-related preventive maintenance activities, the team found that the licensee had taken the positive step of having their lubricant vendor develop lubrication requirements for most of their equipment.

Maintenance Personnel Goals

The licensee had established both corporate commercial goals (customer satisfaction, employee safety, continuity of service, nuclear production, financial strength, etc.) and maintenance goals (i. e.,. overtime, work started as scheduled, ratio of preventive to total maintenance, etc.). The corporate commercial goals are conspicuously posted about the plant in attractive chart form updated monthly as "Employee Incentive Goals". The team could find no indication that the working level employee understood their role in those goals. The maintenance goals are contained in a monthly "Performance Monitoring Report" sent to upper plant management and the maintenance foremen only. The maintenance goals and the performance indicators related to those goals are not promulgated to the working level employee thus leaving them out of the improvement loop.

2.c. Instrument Air System

The team's inspection of the Instrument Air (IA) System included a walkdown of most of the system outside the containment. Most major components and many end-use devices were included in the walkdown inspection. In general, materiel condition was good. The licensee's response to NRC Generic Letter (GL) 88-14 "Instrument Air System Supply System Problems Affecting Safety-Related Equipment" was also reviewed. Pursuant to this review, the team examined records of air quality checks, selected corrective maintenance records (to determine the extent of maintenance work performed as a result of air quality), and test records for IA accumulator check valves. The team also reviewed preventative maintenance for equipment in the IA system.

Preventive Maintenance

The team found that there was no preventative maintenance (PM) established for the refrigerant air drier at the discharge of the "C" IA compressor. These units are relied on as the primary source of IA for the site. The vendor manual suggests that the condenser coil be cleaned on a regular basis, among other things, to ensure efficient operation of the unit. The team found that the coil was clogged with dust and one of two fan motors was not operating. The licensee did not indicate whether this was normal. A review of maintenance records for the unit did not indicate PM was ever performed since installation in 1986. In addition, vendor requirements for the "C" IA compressor were not incorporated in the established PM procedure for this piece of equipment. The vendor manual indicated that the importance of establishing a wear rate for the teflon wear and seal rings "cannot be overemphasized". The consequences of worn rings are a loss of compressor efficiency, and if allowed to wear enough, contact between the piston and the cylinder occurs, which results in immediate, expensive damage to the finely honed cylinder(s). Further, the "C" IA compressor and its air drier were not listed on the outside Auxiliary Operator (AO) log sheet. Interviews with AOs indicated that they do check the "C" IA compressor and drier, however, the NRC resident inspector indicated to the team that the actual checks and duties performed can differ between AOs; for instance, some blow moisture traps down, while others do not. Note that the Primary air compressor is listed on the AO log sheet even though it is no longer used as the base load unit. The team concluded that not incorporating vendor manual requirements into PM for the "C" air compressor and air drier was a weakness in the maintenance program.

NRC Generic Letter 88-14

Per Generic Letter 88-14, the licensee verified air quality requirements for individual components served by the IA system, and verified IA quality by determining hydrocarbon content, dewpoint, and particulate content. The initial air quality tests were performed by an outside laboratory, and stated hydrocarbon, moisture content, and particulate content in the IA system at various sampling locations. Review of this report by the team indicated that the test for particulate content was not appropriate. The report stated that particulates content was determined by passing a known volume of air to be tested through filter media and measuring the weight increase of the filter media. The team considered this test unsatisfactory because particle size and distribution were not determined. Particulate size in the IA system is important because air quality for end-use devices is frequently expressed in the maximum particle size permissible. In addition, attached to the laboratory report furnished by the laboratory was a specification (Commodity Specification for Air G-7.1, Compressed Gas Association, Incorporated, 1984) which stated that the method of determining particulate content using filter paper was not appropriate for gaseous air. It should be noted that the licensee's Harris site used a laser scanner instrument to characterize particulate content of air samples for their response to Generic Letter 88-14. The IA system engineer indicated to the team that he was not aware of how Harris determined particulate content, or that the Harris site had such an instrument. It should be noted, however, that at Robinson each IA end-use device is preceded by an in-line filter-regulator and the filter-regulators have been placed on a refueling outage filter changeout schedule to help assure against introduction of undesirable particles. The first round of filter changes has been scheduled for the upcoming September, 1990, outage.

At the time of the inspection, the licensee indicated that regular dewpoint checks were conducted by the IA system engineer, and that hydrocarbon and particulate checks were to be performed on a refueling outage basis. The team observed the IA system engineer perform dewpoint checks at four locations with a portable instrument. The indications were well within requirements stated in the Updated Final Safety Analysis Report. However, the dewpoint instrument he was using was observed not to be calibrated. Failure to properly test for particulate content of the IA as well as the lack of communications between counterparts within the corporate system, especially when considering a response to a Generic Letter was considered a weakness in the maintenance program.

The Main Steam Isolation Valves (MSIVs) are safety-related components and IA pressure is required to keep them in the open position. Upon loss of instrument air, the MSIVs fail closed with spring force. However, IA assist is required to maintain them in a closed position. The MSIVs are equipped with accumulators and check valves to ensure adequate IA remains to hold the valves closed or cycle them upon loss of IA. The team examined the MSIVs, accumulators, and check valves, and found no visibly discrepant conditions. However, they found the licensee did not include the three check valves in their ASME Section XI program and test them to assure they functioned correctly. Also, the team found that the check valves were not shown on appropriate plant drawings. At the time of the inspection, the licensee indicated to the team that these valves were being added to the Section XI program and that plant drawings were being revised to include the check valves. The team found that the licensee provided functional tests of these check valves under procedure OST-702. The procedure, however, tested rapid closure of the valves and not the the ability of the check valves to seat and seal under conditions of slow loss of IA, a more realistic scenario of IA failure.

2.d. Check Valves

The manner in which the licensee performed check valve maintenance, and their response to the industry concerns that had resulted in issuance of INPO SOER 86-03 were reviewed by the team. To assess check valve maintenance, the team visually examined accessible check valves, interviewed engineers and craftsmen, and reviewed procedures and maintenance records. A total of 14 check valves were chosen for review in the Service Water System, Main Steam System, and the Safety Injection System. These valves were chosen based on service and environmental considerations such as severity of service, frequency of position changes and if the valve was at a boundary between the high-pressure Reactor Coolant System and a low-pressure system.

The valves selected for review were as follows:

Valve	Description
SI-875A,B,C	Low Head Safety Injection and RHR Check
SI-876A,B,C	SI Accumulator Outlet Check
SW-560	SW Booster Pump A Discharge Check
SW-561	SW Booster Pump B Discharge Check
MS-261A,B,C	Main Steam Check
IA-3742	MSIV IA Accumulator Check
IA-3743	MSIV IA Accumulator Check
IA-3744	MSIV IA Accumulator Check

The team reviewed the work history for the above valves and found no major discrepancies, except there were no work history records for check valves IA-3742, IA-3743, and IA-3744, nor were these valves in the licensee's ASME Section XI program. Additional details regarding these valves may be found in the section on the Instrument Air System, Section 2.c. Procedures in effect at the time of the team's inspection lacked acceptance criteria for inspection of check valve internals for wear and degradation and, for some valves, craftsmen performing inspections needed to refer to other procedures to complete the work. For instance, Engineering Surveillance Test Procedure EST-096, Revision 2, covered disassembly and inspection of valve internals but required craftsmen to refer to Corrective Maintenance Procedure CM-120 for reassembly of the same valves. This results in an added documentation burden for craftsmen working in a difficult environment, while making procedure preparation easier. The team also found that the licensee did not have a surveillance or PM program for check valves. Check valves did not receive attention unless the valve was in a degraded condition, or testing/disassembly was required by Section XI.

At the time of the inspection, the licensee had implemented the Managed Valve Maintenance Program (MVMP). The MVMP, as described in Plant Procedure PLP-014 Revision 0, addresses industry-wide motor operated valve and check valve issues to ensure long term operability of these components. The team found that existing procedures were being improved, new procedures were being written, post-maintenance test requirements were being defined, and check valves applications were being evaluated based on industry experience.

Specific guidance for engineering evaluation of check valve applications was covered in Technical Support Management Manual Procedure TMM-008, Revision 0. This procedure was primarily based on guidance in EPRI Report NP-5479, Application Guidelines for Check Valves in Nuclear Power Plants. The NRC team found that the MVMP was technically strong and comprehensive; however, the licensee did not devote sufficient resources to the program, and the licensee was far behind the industry in its actions to address industry check valve concerns. One contract engineer hired in June, 1989, was primarily responsible for completion of the MVMP check valve action items. His responsibilities included engineering evaluation of 55 Priority 1 check valves, writing 12 new corrective maintenance procedures, and revision of three existing procedures. At the time of the NRC maintenance inspection, 40 check valves had undergone engineering evaluation, and none of the procedures had been through final approval. These procedures were needed for planned check valve maintenance to be conducted during the September, 1990 outage.

Also required for the September, 1990, outage were spare parts for check valve maintenance. The licensee provided an Outage Materials Status Listing to the team which listed the spare parts required for the planned check valve maintenance during the outage; purchase orders for only 16 valves had been issued as of the end of of the inspection. Many of the items that had not been ordered had lead times as long as 26 weeks making it unlikely they could be obtained to meet the outage schedule.

The lack of sufficient dedication of resources to implement the MVMP, as well as its untimely implementation, and the spare parts shortage for upcoming check valve maintenance were considered a weakness in the licensee's maintenance program.

2.e. Residual Heat Removal System

The team's inspection of the Residual Heat Removal (RHR) System included an extensive walkdown of the system, review of actions to correct deficiencies in the performance of valves HCV-758 and FCV-605 and examination of system engineering practices relative to the system. In addition, work request records for RHR and associated Safety Injection System valves were reviewed for post maintenance testing, the tagout program for maintenance equipment and examples of tagouts were checked, and discussions were held with planners relative to their capabilities and the control on their activities. The team's findings for the areas inspected, except system engineering and post maintenance testing, are described below. The team's findings for system engineering and post maintenance testing are discussed in issue Sections 3.a and 3.c, respectively.

System Walkdown

In a walkdown of the Residual Heat Removal (RHR) System with the responsible system engineer, the team observed licensee tags identifying various equipment deficiencies. Examples included excessive leaks at valve SI-863B, motor for RHR-744A leaking grease and various Limitorque operator problems. Most plant areas exhibited good housekeeping and materiel conditions. Exceptions which appeared in need of improvement included the following:

Containment - Unremoved trash was present in the containment. This was a problem previously identified in NRC Resident Inspector and licensee QA Audit Reports. Valves RHR-751 and RHR-744A exhibited corrosion around packing nuts and an oil leak, respectively. In one area of the containment ladders were stored improperly. The team noticed a number of blown light bulbs inside containment.

- RHR Heat Exchanger Room - Damaged insulation had fallen onto the platform and there were boric acid buildups around the packing for valves RHR-759 and HCV-758.

- RHR Pump Pit - Boric acid buildups were observed around the packing for valves RHR-756A, RHR-767A, RHR-767B, and RHR-766C. The RHR pumps exhibited extensive boric acid build-ups (with possible wastage indicated on bolting, as noted in Section 2.a above) and the materiel condition for these pumps appeared substandard. The licensee had identified this discrepancy prior to the walkdown and had issued a work request to correct the leak by replacing the pump seal cartridges during the next refueling outage.

In general, the team observed that areas not frequented by plant management were in need of improvement both in housekeeping and materiel condition.

<u>Review of Corrective Actions for Valves HCV-758 and FCV-605</u>

The team examined the licensee's actions to address serious ongoing problems with leakage through RHR valves HCV-758 and FCV-605. Leakage through these valves had caused operational difficulties in heat up and cool down and had been identified as a possible detriment to the RHR System safety function. The problem was selected for examination by the team in a review of the Significant Condition Report Log. It appeared to represent a good "case study" for use in assessment of various licensee maintenance actions, as it involved important technical and managerial decisions and maintenance work.

The licensee's Operations personnel identified that, as a result of the leakage past valves HCV 758 and FCV 605, there existed the potential of RHR pump runout. In addition, due to this leakage the plant had experienced an automatic actuation of the LTOPP (Low Temperature Overpressure Protection) System while in cold shutdown with the RHR System in service for decay heat removal. Based on conversations with Operations Maintenance personnel, the team found that the problem of HCV-758 leak-by had been tolerated historically since 1982. Plant Internal Requests (PIRs) 85-330/00 and 86-103/00 were initiated for replacement of the RHR valves FCV-605 and HVC-758.

This was resolved by valve replacement-in-kind per WR 86-ALYC1 and Engineering Evaluation (EE) 86-034 during the 1987 Refueling Outage. During the plant's 1989 refueling outage Operations re-identified leakage past these valves as a problem. Maintenance inspected HCV-758 in response to WRs 89-AEKS1 and 89-AERH1, but failed to initiate followup action to correct the leak-by condition of the valve when Operations would not approve a clearance on the valve or allow valve cycling. Due to their location, the valves cannot be disassembled while fuel is in the reactor and at the time of the work the plant was at 100% power.

The team feels that the failure by management to satisfactorily provide for root cause determination and correction of the leakage past HCV-758 is indicative of inadequate root-cause determination. The historical documentation associated with maintenance repair and design reviews for valve HCV-758 indicate a minimal management priority and assignment of resources for this equipment-related problem while not ensuring adequate evaluation of consequences and compensatory actions.

Operations and Maintenance had two potential opportunities in 1989 to communicate on the HCV-758 leak-by status and to ensure appropriate compensatory and long-term corrective action. The first opportunity occurred during closeout of Maintenance troubleshooting on May 10, 1989, and the second, during return to RHR operation prior to the LTOPP actuation on October 16, 1989. In both instances the valve leak-by status was accepted without proper coordination of a near-term and permanent corrective action program, including the involvement of Technical Support. This is a contributing factor to the problem not being resolved in a timely manner.

Review of Tagout Program and Examples

The team reviewed the tagout program implemented at the H. B. Robinson site. Procedures OMM-005, Clearance and Test Request, and OST-913, Local Clearance and Test Request (LCTR), Caution Tag, and Temporary Modification Log Audit, provided instructions to perform tagouts and periodic checks for equipment tagout. The team randomly selected two tagouts of equipment to verify whether the components were in the required protected position. There were no discrepancies identified during the verification of tagouts by the team. The licensee verifies, on a quarterly basis, that all components (valves, switches, breakers, etc...) listed on each of the LCTRs are properly tagged and correctly positioned per the LCTR, caution tag log, or the temporary modification tag log.

Job Planning

Discussions held with planners revealed that there is no formalized training program in place to provide guidance to planners as to preparing a work request. However, there is a work request planning check list that serves as an aid to the planners in work request preparation. The check list includes guidance as to whether the problem is stated clearly, required parts have been identified, special tools are required and determining if it is a repetitive failure. Overall, the planners appeared to be knowledgeable on work request preparation. Several of the planners had previously worked as foremen. All planners were observed to be capable of retrieving information from the various databases (i.e. AMMS, EDBS...etc..).

2.f. 480 Volt AC Distribution System

Review of Procedures

Review of preventive maintenance procedures for 480 volt switchgear led to the team's conclusion that a significant weakness exist in the area of preventive maintenance procedures for electrical equipment in general. Refer to Section 3.j for an explanation of this finding.

Observation of Work

The team found that Preventive Maintenance Procedure PM-402 was being performed on all safety-related switchgear at each refueling outage, as confirmed by a review of work requests. This is considered a conservative interval. Actual performance of PM-402 on one type DB circuit breaker was requested and witnessed by the team. Probably attributable to effective on-site training, the craftsman was able to fill in the lack of detail of the checklist type procedure. For example, the main contacts were found out of adjustment, and the appropriate adjustments were easily made. The craftsman was selected at random by the team from among those holding Qualification Cards for low voltage switchgear, which adds credibility to a conclusion that the licensee's training process was effective.

Review of Records

The team's review of maintenance history for the safety-related 480 volt switchgear, covering a recent 18 month period, found there had been five maintenance-related circuit breaker failures. The work requests involved, the problems and the causes are tabulated below.

WR	PROBLEMS	CAUSE
89-AHDX1	Bkr fail to close	Safety latch bent
90-AAYC1	Bkr fail to close	Secondary contacts
90-ADNL1	Bkr fail to close	Blown fuse, cause unknown
89-AIQB1	Spurious trip	Cause unknown
90-ACMB1	Bkr fail to close	Lost control power

This translates to 0.11 failures per breaker-year for the sample and period selected, which is significantly higher than the industry wide failure rate. Referring to IEEE Standard 493-1980, Recommended Practice for Design of Reliable Industrial and Commercial Power Systems, Table 11, page 38, the failure rate for drawout type switchgear (circuit breakers) 0-600 volts is 0.0027 failures per unit-year. This suggests that the licensee's maintenance has been insufficiently effective.

Training and qualification records for nine individuals who had worked on 480 volt safety-related switchgear were reviewed by the team. Records showed that four of the individuals held Qualification Cards corresponding to this task. It appeared to the team that the number of qualified personnel had been sufficient to properly accomplish the subject work. Three of the "qualified" individuals had received refresher training on 480 volt switchgear maintenance within the last year. The team's review found that qualification records of site personnel were generally readily retrievable. Although no record could be produced for one individual, it was thought that this was due to his having been borrowed from another of the licensee's sites during an outage. The team found that the licensee required periodic requalification of personnel.

Review of Root Cause Analysis Program and Examples

Preliminary to a review of examples of licensee analyses of electrical equipment failures, the licensee's program for Root Cause Analysis was discussed with engineers, the Corrective Action Coordinator, and the Manager of Regulatory Compliance. The Corrective Action Program (PLP-26) had been in existence since November 1988. PLP-26 gave a set of criteria for determining when a root cause analysis was required to be carried out. Actual implementation of a root cause analysis was found to be based on case-by-case management directive and the training manual. The Corrective Action Coordinator develops an ad hoc plan of action and the Plant Manager sets a due date. Individuals carrying out a root cause analysis are guided by techniques contained in the training manual. The team identified four areas of improvement for the root cause analysis program:

(a) Improve the track record on meeting completion dates (already identified by licensee)

(b) Standardize the action plans corresponding to various "levels" of root cause analysis

(c) Lower the threshold for requiring a root cause analysis to be carried out. The lower threshold should result in five times more lowest level analyses than being performed at present.

(d) Trend types of root causes (already identified by licensee)

Four examples of root cause analysis related to electrical/I&C were reviewed, and found satisfactory.

The team concluded that the licensee had a root cause analysis program that was effective but in need of improvement.

Review of Responses to NRC Information Notices

On-site Nuclear Safety was found to be responsible for carrying out most of the analysis and coordinating related actions in response to NRC Information Notices. An analysis and action status file was maintained for each Information Notice. Seven files dealing with electrical systems were selected by the team and reviewed. In each case the analysis was technically correct and timely. However, in the team's opinion two of the analyses should have been expanded to address broader generic implications beyond the specifics stated in the Notice. The review of generic communications related to motor operated valves was identified as a strength at H. B. Robinson during an inspection conducted by NRR in NRC inspection report 89-200.

2.g 480 Volt AC Motors

The team compared the licensee's electrical motor maintenance to an objective published standard to form a 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 (IEEE). The IEEE report was not considered a requirement; but it was a useful yardstick with which to measure an actual program.

The team selected three safety-related motors to serve as representative examples: two which were frequently run - the Service Water Pump A and Service Water Booster Pump A motors and a standby motor - the motor for Safety Injection Pump A. The team found that approximately half the recommended good preventive practices were not being performed by the licensee. Examples not performed on any of the three motors included power or current monitoring, winding temperature monitoring, bearing temperature monitoring, and thermography. Two of the motors had space heaters and in neither case were they being checked. There was no inspection or trending of variables for the Safety Injection Pump motors. Examples of practices that were being performed included insulation and winding resistance checks at refueling outages and vibration monitoring (sophisticated method used monthly on two and less sophisticated method used quarterly on the other). The team's assessment was that the licensee's program for predictive and preventive motor maintenance was satisfactory with considerable room for improvement.

2.h. Instrument Calibration

The team's inspection of instrument calibration included a walkdown of the plant to generally observe housekeeping and equipment (especially instrumentation) conditions, observation of seven jobs involving instrument calibration work, review of calibration records, and examination of measuring and test equipment controls. The team's findings for each of the areas inspected are described below.

Plant Walkdown

Of 80 balance-of-plant (BOP) instruments inspected during the walkdown, 21 did not have identification labels attached to the instrument isolation valves. In order to identify 7 pressure indicators, it was necessary to verify the identification of the associated root isolation valve. The instrument low isolation valve for Steam Generator Blowdown D/P indicator DPI-1328A was missing it's identification label. Of 51 safety related instruments inspected by the team, only 3 instrument isolation manifolds located in the safety injection pump room did not have identification tags attached.

The team inspected 14 instrument cabinets/panels and found 2 contained loose debris. Within one unit it was observed that 10 level control switches were missing 3 of 6 access cover screws. They apparently had been omitted by maintenance personnel because they were in such close proximity to a wireway that installation or removal would be very difficult. One wireway was missing the wireway cover. The lack of identification labels on 2 instrument panels contributed to the inadvertent running of the wrong pump during the performance of maintenance surveillance test 451, which was observed by the team as described under the observation of work heading below.

The PASS instrument panel had a temporary power isolation switch installed in the power lead to the boron indicator. A review of the PASS Boron Meter on Stream Calibration and Temperature Compensation procedure revision 0 dated 7/6/84 indicated that this isolation switch had been present since installation testing of the panel.

The A Steam Generator Blowdown Heat Exchanger had a flange leak. Valve SGB 158C was missing the handwheel. The handwheel for valve SGB 158B was loose and vibrating.

On the A Main Feedwater Pump, the glycerine damped Filter Inlet Pressure Gauge was only 1/3 full. On the B Main Feedwater Pump, the glycerine damped Filter Inlet Pressure Gauge was below visual range.

Observation of Work

The team observed 7 activities involving calibrations being performed by the Instrumentation and Controls (I&C) group in the maintenance department. The types of work observed by the team were as follows:

Maintenance Surveillance Test Procedures (MST)

MST-007 - Reactor Coolant Low-Temperature Overpressure Protection System Test

MST-901 - Radiation Monitoring System

MST-552 - Turbine Redundant Overspeed Trip System Testing

MST-451 - Level Channels 182, 183, 603, 604, 605, and 948

MST-013 - Steam Generator Water Level Protection Channel Testing

Process Instrument Calibration Procedures (PIC)

PIC-705 - PASS Boron Meter on Stream Calibration and Temperature Compensation

PIC-301 - Laundry and Hot Shower Tank Level Instruments

During the performance of MST-451 (Level Channels 182, 183, 603, 604, 605 and 948), the team observed that the technicians were not getting the indication expected for step 7.4.14. The technicians returned the system to normal and proceeded to investigate the problem. It was found that insufficient panel descriptions in steps 7.4.5, 7.4.6, 7.4.8 and the lack of identification labels on the referenced panels caused the technicians to install a set of jumpers in the wrong panel. This led to the starting and running of the wrong pump for a short period of time. The panel referenced in step 7.4.10 did not exist. The licensee wrote a Nonconformance Report (NCR) 90-020 on the procedure errors and NCR 90-21 on the lack of panel identification labels.

During the performance of PIC-705 (Boron Meter on Stream Calibration and Temperature Compensation), the team observed within the Post Accident Sample System (PASS) instrument panel a temporary toggle switch installed in the power circuit to the boron indicator. A review of the PIC-705 procedure, Revision 0, dated 7/6/84, indicated that this temporary installation was made prior to the writing of the procedure. The temporary modification had existed without being made permanent for at least six years.

The team concluded that the performances of the MSTs and PICs witnessed by the team were performed properly with the exception of MST-451, in which deficiencies resulted from a lack of identification labeling and inadequate procedural description of the equipment involved. The I&C maintenance activities were accomplished by highly skilled, conscientious maintenance technicians.

As a check on the licensee's control of drawing changes, the team verified that pen and ink changes observed on a set of diesel generator wiring drawings were incorporated into the latest drawing revisions. They were confirmed to have been correctly incorporated.

Review of Calibration Records

The team reviewed 167 completed instrument calibration data sheets for calibration checks performed in 1990. The data sheets were reviewed for proper data entries, evaluations and review signatures. No discrepancies were observed.

Examination of the Control of Measuring and Test Equipment

During the performance of MST 007 (Reactor Coolant Low-Temperature Overpressure Protection System Test), the team observed the sign out and return of Measuring and Test Equipment (M&TE). The team reviewed the control, storage and issuance of M&TE assigned to the I&C department. The team considered the control of M&TE to be good, in that they observed that defective, damaged, or "calibration due" instruments were stored in an identified separate area from the instruments that were in calibration. M&TE requiring calibration were being sent to an off-site contracted calibration facility. The M&TE were stored in a locked room and the calibrated instruments were kept in cabinets identified as certified instrument storage to insure separation from non-certified instruments.

The team observed that each piece of M&TE was identified with a unique identifier. The date calibrated and date due were identified on the instrument and in record files. Selected calibration records reviewed by the team were found traceable to the national standards and the organizations performing the calibrations were documented.

2.i. Miscellaneous Maintenance Work Observations

One of the maintenance activities observed by the team was performance of work request 90-AHYR1 to check filters at the "B" fuel oil transfer pump on the "A" Emergency Diesel Generator Day Tank. A surveillance test had identified low flow and it was believed that the reduced flow might have been due to clogged filters. The team verified that the system was tagged out of service and that the work had been properly authorized to start by Operations. The work instruction required the mechanic to remove the plug from the filter/strainer and inspect it for trash that could be blocking flow. The team noted the tools required by the work request specified two 14-inch pipe wrenches. The mechanics brought a socket wrench to the job location. The socket was a 15/16 and twice the mechanic returned to the shop to get the right size socket, 7/8. After checking the filter/strainer and finding no debris the mechanic returned to the shop with the work package to discuss further troubleshooting. Following a review of the problem by the mechanic, system engineer and responsible foreman, check valve FO-21B was disassembled and examined as a possible source of the flow obstruction. It appeared that this was a questionable selection, as the check valve was located down stream of a pressure indicator which had shown no indication of the increased pressure that should have been present if the check valve had caused the apparent blockage. The appropriate work steps were added to the work package to perform this task. No obstruction was found in the check valve. The valve was reassembled and its cover bolts were torqued to 45 ft/lbs. QC verified the proper torquing of the check valve cover bolting and the package was returned to the shop for discussion a second time. Steps were then added to the WR to examine a relief valve as a possible source of loss of flow. The relief valve was found to have an unacceptability low set pressure (43 versus a required 50) but it did not appear to have been the source of the low flow. The valve setpoint was adjusted to the correct setting. QC was present to verify the new lift setpoint was within tolerance. The team considered that this maintenance activity indicated poor planning and root cause determination of the problem. In addition, the WR was not descriptive enough of the nature of the problem. The licensee used a whole day to troubleshoot the problem without resolving the issue.

2.j. Maintenance/Radiation Protection Interface

The team's scope for this element of the assessment was to determine the extent to which radiological controls were integrated into the maintenance process. Based on a review of 20 key maintenance and radiation protection procedures, interviews with approximately 15 maintenance and radiation protection personnel, observation of work, and a review of maintenance related data, the team determined that radiological controls were adequately integrated into the maintenance process. The team also determined that good lines of communication existed between groups.

The licensee's work control database for maintenance, the automated maintenance management system (AMMS) is computerized and has a base of five years of maintenance job histories. Licensee representatives stated that as jobs are identified and planned, the AMMS is frequently utilized to identify specific procedures, tooling and other related requirements needed to perform the job. Maintenance planners have a goal to perform walkdowns of 60 to 70 percent of all jobs and to complete checkoff lists to ensure planning for the specific work is complete. The team observed that the checkoff list used by the maintenance planners did not include any specific items to assist in maintaining worker dose as low as reasonably achievable (ALARA). Also, that the maintenance planners had not received any training in ALARA concepts other than that given in General Employee Training. Licensee management acknowledged that identification of measures to reduce dose early in the maintenance planning process would be of help to the ALARA group and to work coordinators. During outages radiation protection personnel work closely with maintenance planning, and scheduling to provide dose reduction methods to all jobs estimated to be over one person rem. The team reviewed the process of implementing ALARA into the maintenance work and found that pre-job briefings were comprehensive and that the majority of jobs were given realistic job dose estimates and were within those dose estimates at completion.

The licensee provides training for maintenance personnel both onsite and at their energy center located in Raleigh, North Carolina. Most training on site is classroom training with most hands-on training conducted at the energy center. The team noted that continuing training for maintenance personnel was provided at the site on a quarterly basis and annually at the energy center for hands-on training. Also, that radiological training was provided on site using a mockup (approximately 50 feet of piping) resembling piping and valves in the plant. Workers were required to perform functions on the mockup under simulated plant conditions without coaching to successfully complete the practical factors training. During a review of 1987 and 1988 refueling outage reports the team noted that unnecessary dose was required on manway stud detensioning, pneumaseal installation, and shielding that better training would have precluded. In discussions with licensee management it was acknowledged that for these operations a dedicated crew, use of a stud detensioning mockup, or better use of videotapes would have reduced dose acquired during the operation. The licensee state that consideration would be given to correcting the problems identified in the 1987 and 1988 refueling outage reports.

The team found the licensee's program to control contamination at its source to be excellent. The licensee's radiologically controlled area of the plant was 86,896 square feet. Only 1130 square feet was maintained as contaminated which allows most work to be performed in minimal or no protective clothing. Maintenance personnel were observed to support this program as well as general housekeeping. The team noted that there were overall very few radioactive leaks from systems and that the overall materiel condition of the plant was excellent.

The team reviewed 20 key job-related maintenance procedures to determine the extent of radiological controls incorporated. Maintenance procedures reviewed did not contain specific radiological instructions, however, did reference radiological documents and radiation work permits. Maintenance personnel stated that the majority of the time operations were conducted with radiological controls on the radiation work permit and with intermittent or direct radiological coverage. In reviewing 1987 and 1988 post refueling outage reports the team noted that problems were encountered with the installation of a seal on the reactor vessel closure head for the two successive outages. The Maintenance Manager stated that additional instructions were being considered for this operation to reduce personnel dose. Also, the need for a specific procedure to contain cobalt particles when performing maintenance on valves containing Stellite was identified. Maintenance personnel pointed out that they performed very little maintenance on Stellite seated valves and that the plant had not experienced problems with hot particle personnel contaminations.

In interviews with approximately 15 maintenance workers regarding radiological controls the team determined that the workers were knowledgeable of methods to reduce collective dose, their department annual dose goal, their personal dose, and were supportive of the plant ALARA program. The plant and department managers appeared to be actively managing plant collective dose and supportive of the ALARA program. The team did not find any major weaknesses in the integration of the radiological controls into the maintenance process.

3. ISSUES

3.a. System Engineering

The NRC team observed significant weaknesses in the licensee's system engineering. Although the licensee had about 30 system engineers there was no documented program for the support provided by system engineers. Training/capabilities needs for systems engineers had not been defined. The licensee had been experiencing significant losses of their more experienced system engineers (six in the last two years with more currently indicating their plans to leave). The engineers had not been sufficiently involved in review of completed work requests to assure appropriate historical data was entered and post maintenance testing was performed and to assess equipment failures. The NRC team found this indicated by the work request entry deficiencies described in Section 2.a and the post maintenance test deficiencies noted in Section 3.c. System status reports were not prepared and issued periodically. Some equipment vendor preventive maintenance recommendations did not appear to have been properly considered and implemented - (understood to be a system engineer responsibility). Attitudes of several system engineers were poor - for example, one stated he did not hang deficiency tags on the deficiencies he identified and another noted that apparently excessive packing gland leakage on a non-safety related pump was unimportant unless it became a housekeeping or personnel safety problem. Licensee management indicated they were already taking actions to address the lack of a system engineering program and the high system engineering personnel turnover rate.

From a positive standpoint, the team found that system engineers were generally knowledgeable of their systems and and the work being conducted on them. Also, they appeared to be utilized well in reactive situations. Another apparently positive step taken by the licensee utilizing system engineers was their development of system teams involving system engineers, maintenance personnel, operations personnel, etc. The NRC team thought this was a potentially good concept but, as yet, there did not appear to be sufficient results to evaluate its effectiveness. One system engineer informed the team of difficulties assembling the teams for periodic meetings, suggesting there might be a need for stronger management support if the concept is to work.

3.b. Check Valves

The NRC team found a weakness in the licensee's response to check valve concerns expressed by the industry, as described in detail in Section 2.d above. Industry guidance released in draft form in mid-1987 and formally issued as EPRI Report NP-5479 in February 1988, had not been utilized in a timely manner. The licensee appeared well-behind most of the industry in responding. An important aspect of the guidance is disassembly and inspection of check valves selected in an engineering evaluation. Typically the inspections are performed in a refueling outage. For many check valves the inspection can only practically be performed in a refueling outage because of operability considerations. The licensee indicated plans to begin disassemblies and inspections of check valves in accordance with the EPRI guidance in the upcoming September 1990 refueling outage. The team found that the required engineering evaluation was not complete, inspection procedures were in preparation but none had been approved, and parts had not been ordered for many of the examinations planned for the check valves.

In addition to the above, the team noted two other check valve problems. The MSIV accumulator check valves were not being adequately tested to assure they performed their design safety function and they did not even appear on the licensee's drawings.

3.c. Post Maintenance Testing

The team's assessment of the licensee's post maintenance testing program identified weaknesses in the program and its implementation. The program was considered weak in that there did not exist a formalized procedure to provide appropriate post maintenance testing selection criteria. The weaknesses observed in implementation consisted of failures to perform tests to verify that the identified deficient conditions were corrected by the maintenance performed. The team reviewed approximately 15 completed work requests performed prior to this inspection. The work requests covered a period extending back 18 months. The following work requests exemplified inadequate post maintenance testing:

- Work requests 88-AGlDl, 88-AHIL1 and 88-ADKU1 required work to be performed on leaking valves SI-853B, SI-853C and SI-855 respectively. The internals were inspected and damaged parts were replaced for all three job tasks. However, no post maintenance testing was performed to leak test the valves.

- Work requests 88-AFYB1, 89-ACCG1 and 89-ACWQ1 involved work preformed on valve SI-853A due to leakage and being unable to open/close the valve from the reactor turbine control board. A new plug, seat and cage were installed under work request 89-ACCG1 and 89-ACWQ1. The post maintenance testing performed was inadequate in that documentation reviewed by the team indicated the valves were not leak tested in either instance.

- Continued problems on RHR valves HCV-758 and FCV-605, as described in Section 2.e above, would have been recognized and highlighted sooner had the valves been properly post maintenance tested following replacement.

The licensee was aware of the weaknesses associated with their post maintenance testing program and in response to NRC Inspection 50-261/90-03 they had committed to develop appropriate post maintenance testing selection criteria. A plan to formulate the actions necessary to implement the procedures was being developed and was expected to be completed by June 30, 1990.

3.d. Quality Control

The team observed apparent weakness in the licensee's Quality Control (QC) in that the program was inadequately defined with regard to hold points and there appeared to be insufficient QC personnel. Additionally, one minor NRC identified discrepancy and a more significant licensee identified discrepancy involving QC receipt inspection personnel were noted during the NRC team's on site inspection period.

During observation of the performance of an MST 007, which requires the lifting of leads, it was observed that a Quality Control (QC) inspector was present and initialed the steps requiring the lifting and replacement of leads. The procedure did not contain hold points for QC to observe and initial that the leads had been properly replaced. Upon questioning the QC inspector, the team was informed that most procedures not revised by the procedure upgrade program, do not contain QC hold points. The QC inspector referenced an undated memorandum, serial RNPD/89-4097, from the Maintenance Manager to all maintenance personnel, as guidance for notifying QC of possible QC hold points. Upon consulting with the NRC Resident Inspector, the team was informed that the memorandum was the result of the Resident questioning QC's program on hold points. The team considered that the use of an undated memorandum to determine hold points, in lieu of a formally documented and approved program, was a weakness. The team was informed that the memorandum had been issued the previous year.

In reviewing electrical maintenance, the team determined that there was no QC involvement in some important electrical work. The licensee's preventive maintenance procedure for all safety-related and Dedicated Shutdown System switchgear did not call for any QC involvement. The licensee's hold point memo, referred to above, did not specify any hold points for QC inspections of switchgear work.

There appeared to be insufficient QC personnel. Licensee personnel indicated this had delayed maintenance work, especially during extended forced outages. During two months of a forced outage that occurred late in 1989, QC overtime was reported as 60 and 68%. Overtime averaged over 25% for 1989 and has exceeded 25% for the most recently reported months of 1990. This was more than twice the licensee's reported overtime goal for QC, which at the time of the NRC team's inspection was a limit of 10%.

Discussions held with the 4 QC inspectors performing inspections within the plant indicated that due to the limited number of inspectors, an inspector might perform a large number of various types of inspections within any given day. Each assignment required time to review the procedure/work order to insure that the inspector knew what was required of him. At times this delayed completion of maintenance.

The team noted two incidents during their inspection that reflected adversely on the licensee's receipt inspection. The most significant was licensee identified. A feedwater regulating valve developed an excessive leak during the period and it was necessary for the licensee to take the plant off-line to accomplish its repair. The leak was found to have been due to the use of an incorrect thickness gasket in the last reassembly of the valve. The gasket had been accepted as the correct thickness by the licensee's receipt inspection. The other incident consisted of the team's discovery that receipt inspection personnel had been using an uncalibrated caliper.

Based on the above, the team considered that the licensee's QC program and their actual performance of some QC functions contained significant weaknesses. From a positive standpoint the team also noted that the QC inspectors they observed appeared knowledgeable, conscientious and performed their assigned inspections correctly.

3.e. Maintenance Shop

The maintenance shop and an associated stockroom are located in one building, just outside the protected area. It is shared with Unit 1 maintenance workers who report to different supervision. The NRC team found it small, and not well equipped. Lacking was machining equipment, bench space, good lighting, valve test stands, mockups for training and pre-job briefings, etc. The location of the shop outside the protected area requires security checks of all equipment and tools to be taken inside the protected area, encumbering the movement of personnel and tools to work locations. Interviews with licensee personnel indicated that most machining work must be performed off-site by a local vendor. Foremen offices are located directly adjacent to the work area, and a maintenance library is located in a trailer next to the shop building. In contrast to the maintenance shop, the licensee's hot machine shop contained more machine tools and space was ample for staging and laydown. The licensee indicated to the team that a new Unit 2 maintenance shop inside the protected area had been included in the budget several years ago, but was subsequently removed.

Mechanical MT&E are issued from a stockroom in the maintenance shop. Good A level storage conditions were maintained for sensitive stock, however, the team found that several pieces of mechanical M&TE were covered with rust, and no attempts to control corrosion were made.

The lack of an adequate maintenance shop, especially with regard to its location, was considered a weakness by the team. The Robinson shop was considered substandard by comparison to other nuclear plant maintenance shops the team has observed.

3.f. Trending and Backlog Controls

The team examined licensee maintenance-related trending activities which included application of Nuclear Plant Reliability Data System information, identification of repeat failures of individual components, and the trending of QA deficiency reports, equipment performance data, maintenance performance indicators and maintenance backlog. While examining the licensee's trending of backlog, the team considered whether the trended data indicated adequate control of backlog. They concluded that the licensee did not have an adequately defined trending program and that their program for assessing maintenance backlog was also deficient. The findings that led to these conclusions are described below.

The licensee did not have a documented maintenance trending program and the team found that in many instances maintenance-related trending appeared performed without procedural controls. The types of performance data to be trended or examined for trends, qualifications for personnel who performed trending and aided in interpretating the trends, and standards and controls to assure consistency were not established programmatically.

The industry-supported Nuclear Plant Reliability Data System (NPRDS) was utilized by the licensee to assess important failures for evidence of trends. The entry of failure data into and retrieval of data from NPRDS was covered by a recently issued procedure (dated February 26, 1990). The team found that the licensee's use of NPRDS was hampered by a lack of assigned identification numbers for approximately a quarter of the plant items entered in the database; failure to update the database entries to reflect current plant conditions; and deficiencies in the plant's Equipment Data Base System (EDBS). (The equipment information in EDBS was incomplete, its accuracy had not been verified and the licensee stated that its development had been suspended with the intent of funding a better system). In attempting to obtain further understanding of the licensee's difficulties in use of NPRDS, the team found that only one individual, the NPRDS Coordinator, appeared to have an adequate understanding of its use and in his absence the team was unable to obtain replies to even basic questions regarding the difficulties which had resulted from lack of equipment identification numbers. This suggested inadequate staffing.

The Quality Assurance (QA) organization trends quality deficiencies (nonconformance reports). The licensee indicated that the QA quality deficiency report was used with other sources of deficient condition information to identify significant trends. Examples of adverse conditions stated to have been identified by the quality deficiency trending were torquing and equipment identification issues. The team was informed that this process was controlled by procedure.

The licensee's Automated Maintenance Management System (AMMS) identifies repeat failures occurring within an 18 month period by component tag number. These failures are reviewed to determine and implement any necessary corrective action. The licensee does not identify multiple failures of components that are identical except for tag number. The team was informed that AMMS has the capability of identifying such generic failures but that this capability had not yet been implemented. Management indicated implementation would be delayed until more experience had been gained with the application of AMMS in identification of repeat failures of components with the same tag number.

Equipment performance data trended included ASME Section XI inservice testing results and approximately 80 equipment performance data points from predictive maintenance (e g., oil usage trended on motor driven fire pumps). The trending of ASME data was controlled by procedure whereas the trending of the other equipment data was not.

The maintenance organization had, as of January 1990, established approximately 30 tabulations or plots depicting changes in maintenance-related performance data with time. These performance indicators were used to monitor the maintenance program performance on a monthly basis. Eight of these indicators included goals. Related to the goals the team noted the following. The goal for primary system leak rate and overtime appeared inappropriate in that actual performance was approximately ten percent of the goal for leak rate and 20% for overtime. The number of "Blue Dots" (equipment deficiencies) for the control room were 75% above the goal and increasing. The indicator goals appeared useful to management for monitoring their performance but neither these nor any other meaningful performance indicators and goals had been posted for craftsmen to monitor their performance.

Since January 1990, the maintenance organization trended a variety of maintenance backlog data on both a weekly and monthly basis. The performance indicators referred to in the previous paragraph included backlog. The team found that data for previous years, which would be helpful in analyzing and detecting trends, was difficult to obtain. The licensee experienced great difficulty in retrieving backlog data older than 22 months. There was no documented program to control or assess the maintenance backlog. Maintenance backlog management was based on the limited trending data and managerial experience and judgement. The trending data for outage WRs was currently found to be increasing, as would be expected with an outage approaching. However, there had also been an increasing trend in non-outage WRs since September 1989. The licensee indicated that the increasing trend of non-outage WRs could be partially attributed to the following: the addition of the painters and pipe coverers work load to the AMMS; audits - NRC, INPO, and Corporate Quality Assurance; and newly instituted management plant tours. When asked whether the increasing backlog could be attributed to insufficient maintenance staffing levels, the maintenance planning staff indicated that there was insufficient data to make that determination. The generally good materiel appearance of the plant and an apparent lack of significant equipment corrective maintenance demands suggested that there was no seriously increasing corrective maintenance backlog. From a positive standpoint, there was apparently no preventive maintenance backlog.

3.g. Acknowledgement of Risk Significance in the Maintenance Process

The team found that the licensee had no formal process to evaluate and consider risk in the maintenance process. In discussions with the planning and maintenance staffs, it was determined that risk was considered only in the distinction between Technical Specification equipment versus non-Technical Specification equipment and safety-related equipment versus non-safety-related equipment, for prioritization. It should be noted that this distinction is primarily for operations/operability considerations.

3.h. Presence of Upper Management at Maintenance Work

The team found that upper management was infrequently observed at the site of routine maintenance work. As a consequence, there was little direct evidence to maintenance personnel of any management interest in improving the maintenance process. Management's failure to monitor the maintenance process and communicate with maintenance personnel by being present at the performance of maintenance work was considered an important weakness by the NRC maintenance team. To management's credit, the team found that they did tour the plant during off-shift hours and these tours aided in assuring the generally good plant housekeeping and materiel conditions. As mentioned in Section 2.a, however, remote areas that were apparently not toured by plant management had poorer conditions. Also to the credit of management, interviews with craft indicated they typically were present when there were operability crises.

3.i. Allocation of Resources

The team noted that in many instances the licensee appeared to have been deficient in allocating resources to correct unsatisfactory or substandard plant equipment, facilities, etc. and the team considers this to be a significant weakness. Examples, which lead the team to this conclusion are as follows:

- The maintenance shop and associated facilities are "spartan" and substandard by comparison to other plants. (See Section 3.e)

- The number of QC personnel appeared insufficient based on overtime figures. (See Section 3.d)

- Sufficient funds had not been allocated to development of the equipment database which was incomplete and contained data that had not been validated (The Maintenance Manager informed the team that it had been recognized that development of this database had been inadequately funded and that an appropriately funded program was being developed.)

- The licensee's incompletely defined and implemented vibration analysis program. (See Section 2.b)

- RHR Valve HCV-758 uncorrected leak-by has been a continual concern over much of the plant lifetime. The historical documentation associated with maintenance repair and design reviews for this valve indicated a minimal management priority and allocation of resources for this equipment-related problem while not ensuring adequate evaluation of the consequences and compensatory actions. (See Section 2.e)

- Tardiness in developing and implementing a program to respond to industry check valve concerns. (See Sections 2.d and 3.b)

- Failure to develop a trending program. (See Section 3.f)

- Lack of an on-site backshift maintenance crew.

While the team considered that overall the licensee had been deficient in allocating resources at Robinson, they did observe several examples of positive actions in this area:

- Valve packing improvements that appeared to have significantly reduced radioactive valve leaks.

- Efforts to maintain good plant housekeeping and materiel condition and, especially, to maintain the amount of contaminated floor space small. (See Section 2.a, b, e, and j)

- Contracted development of a lubrication program for most plant equipment

3.j. Preventive Maintenance Procedures for Electrical Equipment

Most of the 480 volt switchgear at Robinson is solenoid operated Westinghouse type DB switchgear although the Dedicated Shutdown System utilizes type DS, which has stored energy closing type circuit breakers. One procedure (PM-402) defines the preventive maintenance program for the safety-related and Dedicated Shutdown System switchgear. In the team's opinion the quality of PM-402 was poor in comparison to similar procedures used throughout the nuclear industry. It lacked sufficient detail, omitted several typical steps and did not call for QC involvement. For example, the procedure did not describe how to check critical dimensions of the primary contacts nor state how to adjust the contacts if necessary. The procedure did not call for operating the breaker electrically from the test stand, checking brushes for charging motors for the DS breakers, checking open/close response time nor contact resistance measurements etc. These comments were discussed in detail with one of the foremen and in general terms with the Maintenance Manager. They concurred with the comments.

Due to the weaknesses noted in PM-402, the team expanded its procedure review to other types of electrical equipment. For many of these items, both safety-related and important-to-safety, extremely brief checklists were found used in lieu of procedures in carrying out preventive maintenance work. An example was the checklist used for 4160 volt switchgear maintenance. The omission of important precautions, information, and control of work steps which occurs when such documents are used may result in unplanned actions and increase the potential for unsatisfactory maintenance and equipment failures. Too much responsibility for control of the maintenance process may be exercised by the craftsmen rather than the engineers and managers. The Maintenance Manager indicated that the above comments were valid, but no specific statement was made as to how the situation would be resolved.

Effort in the area of providing preventive maintenance procedures was considered a weakness. The team was told that a Procedure Update Program had been in existence since September 1988, but very few if any of the electrical preventive maintenance procedures or checklists had been through the program.

4. Evaluation of Maintenance

Summary Rating of Maintenance Process:

Program: SATISFACTORY

Implementation: SATISFACTORY

The evaluation completed by the NRC team rated the Robinson 2 maintenance program and its implementation marginally SATISFACTORY. The SATISFACTORY rating was considered "marginal" because of the overall large number of weaknesses identified which appeared largely offset only by good personnel performance rather than by strong programs and procedures. In particular, the team noted the potential for reduced performance due to the ongoing losses of experienced systems engineers - especially significant to an aging plant such as Robinson. The licensee was found to have recognized the importance of correction for many of their weaknesses and had initiated improvements. The team was concerned, however, that the licensee had been slow to respond with sufficient resources to fund such improvements in the past.

The maintenance rating was obtained by collating and assessing the maintenance team inspection findings in a special maintenance inspection logic tree. The tree completed for Robinson maintenance inspection is depicted in Appendix 3. The tree divides maintenance evaluation into three "parts" (I, II, and III). The parts are divided into eight "areas" (1.0 through 8.0) and the areas into individual maintenance topics or "elements" (1.1, 1.2, 2.1, etc.). Based on their inspection findings (negative and positive), the team established ratings for most of the elements. Subsequently, area ratings were determined based on associated element ratings; part ratings based on the associated area ratings; and, finally, a total maintenance rating was determined from the ratings for the parts. The team did not weight all findings or ratings equally.

Four rating categories were used and a color was assigned to each to aide in displaying the ratings on the maintenance inspection tree. The rating categories were as follows:

"Good" Performance (Green)	-	Overall, better than adequate, shows more than minimal effort; can have a few minor areas that need improvement
"Satisfactory" or "Adequate" Performance (Yellow)	-	Adequate, weaknesses approximately offset by strengths
"Poor" Performance (Red)	-	Inadequate or missing
(Blue)	-	Not evaluated or insufficient information to evaluate

Each part, area and element, as well as overall maintenance, is represented by a block on the tree. Most of the blocks are split into two parts with the upper portion representing program or process and the lower half representing implementation. The exception is for the part I blocks which are not considered to have separate programs or implementation.

The parts and areas of the maintenance inspection tree are described below. The inspection findings that contributed to the ratings are also given. Individual element ratings are not described but are shown in Appendix 3.

The team's assessment of maintenance at Robinson was somewhat impaired by the unavailability of any especially significant or complex maintenance for observation while the team was on site. It is recommended that this assessment be supplemented by an additional future inspection of the licensee's maintenance during a period of importance such as during a refueling or forced outage.

4.a. Overall Plant Performance Related to Maintenance (Tree Part I)

Rating: Satisfactory

This part of the tree is an overall assessment and rating of maintenance through direct measures: Its rating was based on the SATISFACTORY rating determined for "direct" measures below.

4.a(1) Direct Measures (Tree Area 1.0)

Rating: SATISFACTORY

The direct measures used to assess this area are the examination of plant historic performance data (tree element 1.1) and observations of housekeeping and materiel conditions observed in walkdown inspections (element 1.2). The historic data examined by the team consisted primarily of the seven performance indicators tracked and trended by the NRC, and the licensee's maintenance backlog data. The team also checked to determine if the licensee was participating in the INPO industry-wide assessment of plant performance indicators. The team's walkdown inspections and detailed examples of their observations are described in report Sections 2.a, b, and e above. The historic data and walkdown findings considered by the team in determining the rating for this area were as follows:

<u>General Observations</u>

Of seven plant performance indicators compiled and trended by the NRC:

Five (automatic scrams while critical, safety system actuations, significant events, safety system failures, and equipment forced outages/1000 hours critical) had values that did not differ significantly from industry averages, which are typically low.

One of the other two, radiation exposure, appeared be in an improving trend from poor performance of several years ago. Recent indicator values suggested that good performance had been achieved. However, the period of apparent improvement was insufficient for confirmation solely from the indicator data. Current dose reduction practices appeared good, supporting a conclusion of good performance.

The final indicator, forced outage rate, was above the usual industry average of about 10% in 1988 and increased to almost 45% in 1989. The large increase in forced outage rate appeared to be primarily due to the need correct deficiencies identified in their Design Basis Reconstitution. However, a significant but not accurately quantifiable portion appeared due to maintenance-related discrepancies. The longest forced outage in

1989, was lengthened significantly as a result of maintenance or maintenance support-related deficiencies discovered during the outage. Examples included repairs required on the motor driven Auxiliary Feedwater pumps (stemming from a lack of past periodic maintenance inspections) and cleaning/flushing of the Service Water System required to remove debris introduced during piping replacement activities performed in a previous outage. A brief outage to correct a maintenance-related problem was instituted during the course of the NRC team's inspection period, but at a time when they were not on site. A feedwater regulating valve was repaired to correct a leak that had resulted due to the use of an incorrect thickness gasket during previous maintenance. To the licensee's credit, a temporary repair might have been accomplished on the valve without taking the plant off-line but they elected to assure proper correction and avoid the potential for more serious damage to the valve.

The team determined that the licensee participated in the industry-wide plant performance indicator program. The licensee's data for the last three years was examined for a sample of seven of the indicators. A sharp adverse increase was noted in one of the indicators for the first quarter of 1990. This indicator, out-of-service control room instruments, was questioned by the team. Licensee personnel responded that previously they had failed to determine the number in accordance with the criteria specified by INPO and that the increase represented properly determined values rather than a serious adverse trend.

The Maintenance Department appeared to have no backlog of preventive maintenance overdue. The team was unable to fully assess the the licensee's corrective maintenance backlog due to insufficient data. Details regarding the team's inspection and findings regarding the licensee's maintenance backlog are described in Section 3.f of this report.

Strength

General plant housekeeping and materiel condition very good. (See Sections 2.a, b, c, and e)

Weaknesses

Housekeeping and materiel condition unsatisfactory in remote locations (RHR Pit and Heat Exchanger Room and Containment). (See Sections 2.a and e)

Deficiencies identified but not tagged. (See Section 2.a and b)

Uncontrolled parts and tools. (See Section 2.b)

Many items with no identification labels (no major safety related item noted). (See Sections 2.a, b and h)

4.b Management Support of Maintenance (Tree Part II)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This part of the tree is an assessment and rating of areas of the tree which represent management's support of maintenance through their commitment and involvement, organization and administration, and provision of technical support for the maintenance process.

4.b(1) Management Commitment and Involvement (Tree Area 2.0)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This area consists of upper management's direct encouragement and promotion of improvements in maintenance. The rating of the program and implementation was based on the following findings:

Strengths

INPO accredited training had been provided.

Generally, good databases had been provided.

Managers were frequently present when there were operability crises. (See Section 2.b)

Managers directly monitored plant housekeeping and material conditions in most areas and took actions to assure they were properly maintained. (See Section 2.b)

Weaknesses

Some important industry initiatives were not well-supported (e. g., regarding check valves). (See Section 3.i)

The maintenance shop had been recognized to be substandard but the condition had not been corrected. (See Section 3.i)

Lack of meaningful goals for maintenance craft. (See Section 2.b)

Some databases had serious deficiencies - the Equipment Database System was a notable example. (See Section 3.f)

Upper management was very infrequently at the site of routine maintenance activities and thus, did not indicate their interest in the improvement of maintenance. (See Section 3.h)

4.b(2) Management Organization and Administration (Tree Area 3.0)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This area consists of management's support of and involvement in the control of maintenance through developing and implementing a maintenance plan, setting goals and policies, allocating resources, defining maintenance requirements, monitoring performance, providing document control and determining the need for improvements to plant materiel condition. The rating of program and implementation was based on the following findings:

Strengths

Performance indicators and goals had been established that were, generally, useful to management in monitoring and controlling the maintenance process. (See Section 3.f)

Management had generally established good standards of plant housekeeping and materiel condition through their tours to observe the conditions and the actions they had taken to maintain good conditions. (See Section 3.h)

Good radiological controls had been established. (See Section 2.j)

Weaknesses

Due to the lack of a documented program, system engineers did not have adequately defined goals and responsibilities. (See Section 3.a)

A loss of experienced system engineers was in progress. (See Section 3.a)

Based on overtime data and discussions with involved personnel, insufficient QC personnel had been provided. (See Section 3.d)

Management had been tardy in responding to industry check valve concerns. (See Section 3.b)

The maintenance shop had been recognized to be substandard but this had not been corrected. (See Section 3.e)

There was no routine maintenance backshift coverage

Deficiencies in the preventive maintenance program (e. g., insufficiently defined and supported vibration analysis, bases for some preventive maintenance requirements not correctly documented, and vendor recommended preventive maintenance not provided for some important equipment). (See Section 2.b)

Inadequate specification of post maintenance testing requirements. (See Section 3.c)

Deficiencies in procedures containing maintenance administrative or programmatic requirements, such as procedures for deficiency tagging and for work control

4.b(3) Technical Support (Tree Area 4.0)

Rating:

Program: POOR

Implementation: SATISFACTORY

This area encompasses the various elements of technical support that are needed for maintenance to function effectively (e.g., engineering support, health physics, QC, risk assessment, etc.). The rating of this area was based on the following findings, which collectively represent maintenance strengths and weaknesses.

Strengths

System engineers were knowledgeable of there systems and of the work being conducted on the systems, they appeared to make a positive impact on the resolution of reactive problems. (See Section 3.a)

System teams had been instituted involving system engineers, maintenance and operations personnel etc., which offered the potential for improved communications and application of expertise to resolution of equipment problems. (See Section 3.a)

Equipment lubrication program developed for most equipment by lubricant vendor. (See Section 3.i)

NRC Information Notices issues properly resolved. (See Section 2.f)

Good radiological controls. (See Section 2.j)

Good safety practices.

Good root cause analysis started (but could use improvement - as for example in the timeliness of completion). (See Section 2.f)

Valve packing improvements had been instituted and was having a positive effect in reducing leakage.

Weaknesses

No documented program for the support provided by system engineers. (See Section 3.a)

Insufficient/inadequate routine reviews of work requests by system engineers to assure appropriate work history entries, post maintenance testing and low level review of equipment failures. (See Section 3.a)

Inadequate communications, root cause analysis, specification of post maintenance testing, etc. in resolution of ongoing problems with RHR Valves HCV-758 and FCV-605. (See Sections 2.e and 3.c)

High loss rate for experienced system engineers. (See Section 3.a)

Industry initiative on check valve concerns has not been promptly or completely addressed. (See Section 3.b)

Deficiencies in preventive maintenance involving insufficiently supported vibration analysis program, inadequately documented basis for some preventive maintenance requirements, and omission of some vendor recommended preventive maintenance for important equipment. (See Sections 2.b and 2.g)

Inadequate program for consideration of risk in setting maintenance priorities. (See Section 3.g)

Inadequate and insufficient specification of QC hold points and insufficient QC personnel. (See Section 3.d)

4.c. Maintenance Implementation (Tree Part III)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This part of the tree is an assessment and rating of the work, organizational, hardware and personnel controls necessary to proper implementation of maintenance.

4.c(1) Work Control (Tree Area 5.0)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This area encompasses assessment of important elements of work control through evaluation of maintenance in progress, work order control, planning, scheduling, prioritizing, etc. Its rating was based on the following findings:

General Observations

Repeat failures were identified and analyzed for the same tag number component, but not for like components or for parts that differed in tag number. (See Section 3.f)

Work generally appeared to be performed in an appropriate priority. There was a new priority system which had not been in place sufficient time for assessment but generally appeared satisfactory. The previous prioritization system had apparently not been effective. (See Section 2.a)

There was no preventive maintenance backlog. It appeared the corrective maintenance backlog was trending high but there was insufficient data for adequate assessment. (See Section 3.f)

Strengths

QC and foreman involvement appeared appropriate for I&C work observed. (See Section 2.h)

Routine maintenance observed was generally performed properly - appropriate tagout authorizations and documentation were obtained, work was understood and instructions and procedures were followed, lifting of leads was properly performed (except in one instance, involving procedure and equipment labeling deficiencies), craftsmen appeared capable and qualified, and test equipment was of the appropriate type and was used correctly. (See Sections 2.a, b, e, f and h)

Equipment history record documents were generally readily retrievable through their databases.

Personnel radiation exposure estimates were accurate. (See Section 2.j)

Examples of periodic maintenance review appeared properly scheduled.

Examples were noted where maintenance was scheduled to aid in maintaining exposures ALARA.

Weaknesses

The work request procedure lacked adequate detail. It did not adequately specify or reference requirements for QC hold points, post maintenance testing, details of work history to be documented, problem description, cause identification or review of work request entries for completion. It did not even contain an example of the work request form. As an apparent consequence the team saw many work requests that were insufficiently documented. (See Section 2.a)

There were limited guidelines for maintenance planning. (See Section 2.e)

The equipment database was incomplete and unvalidated. (See Section 3.f)

Planning for troubleshooting fuel oil transfer system low flow was deficient in identifying tools and selecting potential failure cause. (See Section 2.i)

The tie between scheduling and priority was not adequately defined. (See Section 2.a)

Use of the Nuclear Plant Reliability Data System appeared hampered by having no identification numbers for many plant items, deficiencies in the Equipment Data Base System, and possibly by insufficient staff. (See Section 3.f)

Risk significance was not formally considered in establishing priorities. (See Section 3.g)

The licensee did not have a good program to assess maintenance backlog and as a result did not have a good understanding of the current backlog. (See Section 3.f)

Many of the maintenance procedures were lacking in detail. Examples included general maintenance procedures (as for deficiency tagging and work requests) and work procedures (480 V and 4160 V switch gear maintenance). (See Sections 2.b, f, and h)

Insufficient documented guidance, engineering involvement and actual performance of post maintenance testing. (See Section 3.c)

Insufficient system engineer and foreman involvement in assuring adequate historical entries in work requests. (See Section 2.a)

4.c(2) Plant Maintenance Organization
(Tree Area 6.0)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This area encompasses the processes used by the maintenance organization to control, support and direct maintenance activities. Its rating was based on the following findings which, assessed together, indicate apparent strengths and weaknesses:

General Observations

Capabilities to trend and analyze multiple failures as tag number component being used but capability to trend generic failures had not been implemented. (See Section 3.f)

Strengths

Personnel correctly trained and qualified. (See Sections 2.f and h)

Tagouts obtained where appropriate. (See Section 2.e)

Controls assured return of equipment to proper configuration for operation. (See Sections 2.e and h)

Meetings functioned well in providing interfaces. (See Section 2.h)

Support interfaces between Radiation Protection and Maintenance functioned well. (See Section 2.j)

Systems groups had been formed that appeared to offer potential for good interfacing. (See Section 3.a)

The electronic mailbox database aided interfacing among managers and supervisors.

Weaknesses

Lack of meaningful goals and performance indicators for craft. (See Section 3.f)

Instance of mechanical maintenance troubleshooting not well-planned. (See Section 2.i)

Instance of minor unincorporated temporary modification. (See Section 2.h)

Electrical maintenance appeared to omit some appropriate QC inspections. (See Section 2.f)

Failure to use deficiency tags. (See Section 2.a and b)

Missing identification labels which in one instance contributed to actuation of a wrong pump. (See Section 2.h)

Corrective actions not promptly implemented for Containment housekeeping and missing identification labels. (See Sections 2.a and e)

Lack of a well-defined trending program. (See Section 3.f)

Incomplete/inadequate entries of work history data. (See Section 2.a)

4.c(3) Maintenance Facilities, Equipment and Material Controls (Tree Area 7.0)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This area encompasses the plant maintenance facilities, equipment and material controls with regard to the part they play in supporting the maintenance process. The findings upon which the rating of this area was based are listed below.

Strengths

Proper control of issue and return of measuring and test equipment. (See Section 2.h)

Mechanical calibrated tools were calibrated both on issue and on return.

Weaknesses

Substandard maintenance shop (outside secured area, few mockups, insufficient lighting, etc. (See Section 3.e)

Need bagging and tagging of tools and parts to assure against loss. (See Section 2.b)

Parts not ordered for check valve work scheduled for upcoming outage. (See Section 3.b)

Recent licensee identified example of receipt inspection acceptance of incorrect gasket leading to serious valve leakage. (See Section 3.d)

Uncalibrated calipers used in receipt inspection. (See Section 3.d)

Uncalibrated dewpoint tester used by IA System engineer. (See Section 2.c)

4.c(4) Personnel Control (Tree Area 8.0)

Rating:

Program: SATISFACTORY

Implementation: SATISFACTORY

This area encompasses staffing controls (personnel policies, turnover minimization, shift coverage, etc.), training, testing and qualification and the overall current status of personnel (actual turnover rate, extent of personnel trained and qualified, drug problems, etc.). The above rating was based on the following findings:

Strengths

Training was INPO accredited and included both general and specific training.

Based on interviews with personnel and observations of their work, the team concluded that they were well-qualified. (See Sections 2.a, b, f and h)

The foreman to worker ratio appeared about appropriate at about six or seven to one. (Based on the team's experience and data from the licensee's organization chart)

The overtime goal for maintenance craft was low and was currently being met.

Maintenance personnel indicated that they had inputs to determining their training needs.

Waivers of training and grandfathering for maintenance had been permitted in only a small number of cases.

Qualifications of craftsmen were readily traceable. (See Section 2.f)

Almost all maintenance personnel had completed the qualification program.

Periodic requalification of craft was required. (See Section 2.f)

The turnover rate of maintenance personnel was not high. (Based on two year data provided to the team by the licensee)

Weaknesses

The turnover rate for system engineers was high and included highly experienced personnel. (See Section 3.a)

System engineer training needs appeared inadequately assessed. (See Section 3.a)

There were insufficient mockups and training devices at the site for pre-work training/briefings. (See Section 3.e)

There was normally no backshift maintenance coverage on site.

5. Exit Interview

The inspection scope and results were summarized on July 13, 1990, with those persons indicated in Appendix 1. The team leader described the areas inspected and discussed in detail the strengths and weaknesses identified in the report. The licensee did not identify as proprietary any of the material provided to or used by the inspectors during this inspection. Dissenting comments were not received from the licensee.

APPENDIX 1

PERSONS CONTACTED

Licensee Employees

* R. Barnett, Manager, Outages and Modifications
* S. Billings, Technical Aide, Regulatory Compliance
* R. Crook, Senior Specialist, Regulatory Compliance
* C. Dietz, Manager, Robinson Nuclear Project Department
* J. Eaddy, Environmental and Radiation Control Support
* R. Elmore, Instrumentation and Control (I&C) Foreman
* K. Enzor, Manager, Corporate Nuclear Maintenance
* E. Harris, Manager, Onsite Nuclear Safety
* J. Huntley, Project Specialist, Maintenance
* J. Kloosterman, Director, Regulatory Compliance
* R. Morgan, Plant General Manager
* P. Odom, Project Specialist, Maintenance Support
* L. Smith, Manager, Technical Training
* R. Smith, Manager, Maintenance
* M. Page, Manager, Technical Support
* W. Powell, Senior Specialist, Nuclear Engineering Division
* J. Waldorf, Manager, Corporate Nuclear Technical Support
* W. Watts, I&C Foreman
* H. Young, Manager, QA/QC

NRC Personnel

* E. Adensam, Project Director, Office of Nuclear Reactor Regulation
* G. Bagchi, Acting Deputy Division Director, Division of Reactor Safety, Region II
* J. Blake, Section Chief, Division of Reactor Safety, Region II
* L. Garner, Senior Resident Inspector
* K. Jury, Resident Inspector

Attended Exit Interview on July 13, 1990

APPENDIX 2

ACRONYMS AND INITIALISMS

ALARA	As Low As Reasonably Achievable
AMMS	Automated Maintenance Management System
AO	Auxiliary Operator
ASME	American Society of Mechinical Engineers
Bkr	Breaker
EDBS	Equipment Data Base System
EE	Engineering Evaluation
EPRI	Electric Power Research Institute
FI	Flow Indicator
ft	Foot
GL	Generic Letter
HVAC	Heating, Ventilating, and Air Conditioning System
IEEE	Institute of Electrical and Electronic Engineers
INPO	Institute for Nuclear Power Operations
I&C	Instrumentation and Controls
lbs	Pounds
LCTR	Local Clearance and Test Request
LTOPP	Low Temperature Overpressure Protection
MSIV	Main Steam Isolation Valve
MST	Maintenance Surveillance Test
MVMP	Managed Valve Maintenance Program
MWe	Megawatts Electric
M&TE	Metering and Test Equipment
NCR	Nonconformance Report
NPRDS	Nuclear Plant Reliability Data System
NRC	Nuclear Regulatory Commision
PI	Pressure Indicator
PIC	Process Instrument Calibration
PIR	Plant Internal Request
PM	Preventive Maintenance
PWR	Pressurized Water Reactor
QA	Quality Assurance
QC	Quality Control
rem	Radiation Equivalent Man
RHR	Residual Heat Removal
SALP	Systemic Assessment of Licensee Performance
SCR	Significant Condition Report
SI	Safety Injection
SOER	Significant Operating Event Report
SW	Service Water
WR	Work Request

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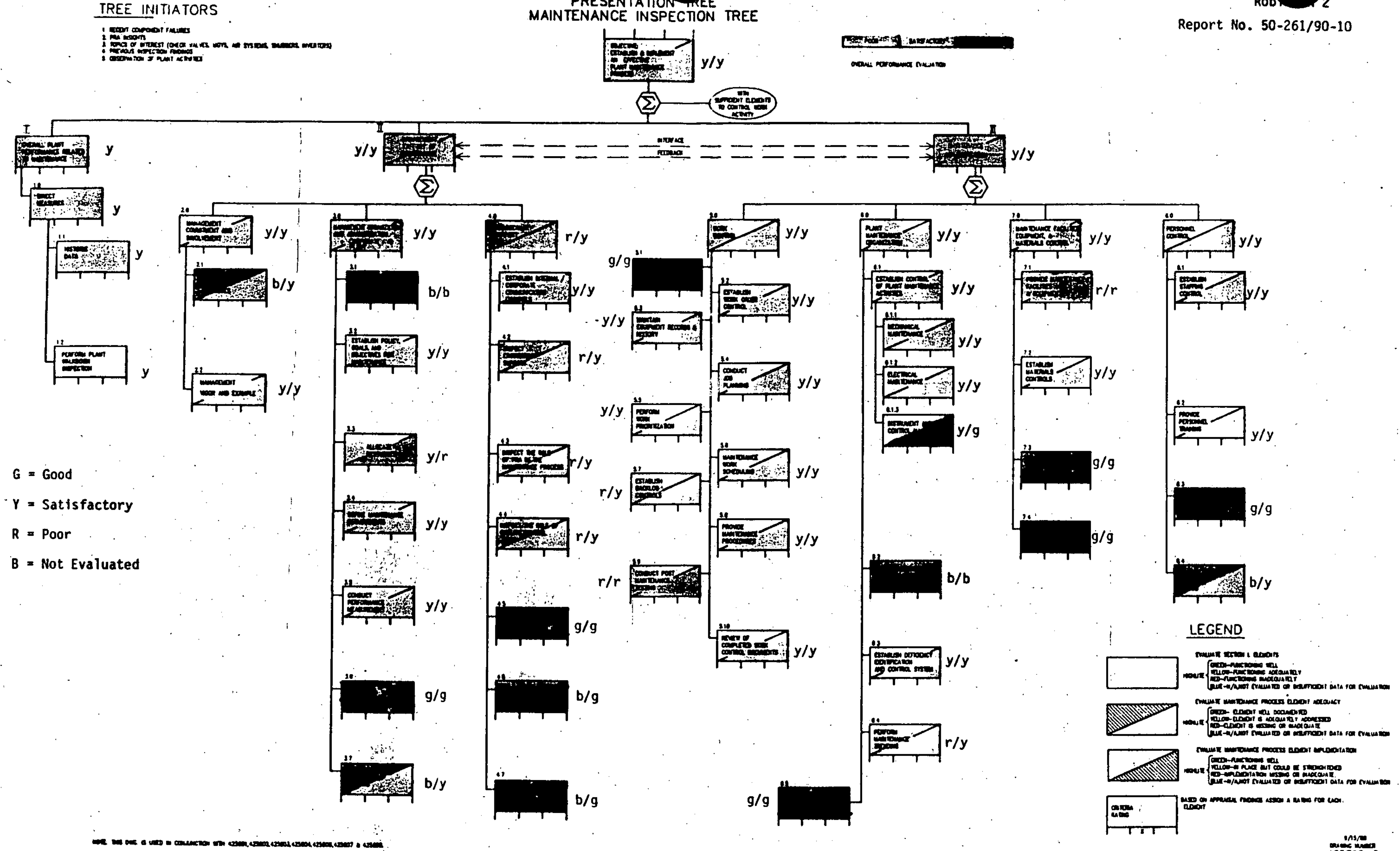
Report No. 50-261/90-10

PRESENTATION TREE
MAINTENANCE INSPECTION TREE



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