U.S. NUCLEAR REGULATORY COMMISSION

REGION V

Report No. 50-344/90-34

License No. NPF-1

Licensee: Portland General Electric Company
121 S. W. Salmon Street
Portland, Oregon 97204

Facility Name: Trojan Nuclear Plant

Inspection at: Trojan Nuclear Plant; Prescott, Oregon

Inspection Conducted: November 26, 1990 through January 8, 1991

Inspectors: K. Johnston, Resident Inspector
M. Miller, Reactor Inspector
B. Olson, Project Inspector

Approved By: D.F. Kirsch for Forrest R. Huey, Chief, Engineering Section, DRS&P/RSB, Region V — 1/29/91 Date Signed

Summary:

Inspection during the period November 26, 1990 through January 8, 1991 (Report No. 50-344/90-34)

Areas Inspected: The team performed a special announced inspection of the maintenance program and implementation of related activities. The objective of this team inspection was to examine the scope and effectiveness of corrective actions taken by the licensee in response to the findings of the October 1988 Maintenance Team Inspection (Inspection Report IR 50-344/88-30) and to arrive at an assessment of the status of the licensee's maintenance program in those areas previously characterized as weak. Temporary Instruction procedures TI 2515/108, TI 2515/97, and associated maintenance inspection procedures were used for guidance in this inspection.

Results:

General Conclusions and Specific Findings:

Areas of Strength:

The team concluded was that many improvements have taken place since the maintenance team assessment was conducted in 1988. Notable improvements included the following:

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- o A Maintenance Improvement Program (MIP) was established which tracked the resolution of problems and issues discussed in the 1987 maintenance self assessment, the 1988 maintenance team inspection, and subsequent internal and external audits. The MIP itself had been audited by Maintenance and Quality Assurance (QA), resulting in additional actions.

- o QA had become more involved in the review of maintenance activities. Recent audits in the maintenance area identified programmatic weaknesses in a number of areas, such as the preventative maintenance program.

- o The control of maintenance work packages had improved. The work control center was able to promptly locate all work packages requested by the team.

- o The licensee had recently established and staffed a work control center, providing a centralized work planning and scheduling group.

- o The control of overtime was found to be well established.

Areas of Weakness:

The team identified weaknesses in some significant areas, including areas which had previously been identified as weak in the 1988 Maintenance Team Inspection. The issues are characterized as follows:

Implementation of the Plant Design Basis Requirements Through the Maintenance Process: The team found several examples where the licensee had failed to establish adequate controls to assure that work maintained the design basis. The examples included:

1. Some design quality classification lists were not available to job planners, and those lists that were available had apparent inconsistencies and inaccuracies.

2. Numerous issues related to the maintenance of heat tracing and heating systems for safety related equipment had been identified by the NRC and the licensee; however, comprehensive action had not been taken to resolve the overall concern.

3. Although instrumentation calibration data sheets, which implement design requirements, had not been adequately controlled until October 1990, corrective actions to address their control did not include the need to establish their accuracy.

With respect to each of these problem areas, it was noted that a less than adequate involvement of plant and design engineering in the maintenance process appeared to be a significant contributor to the incomplete problem resolution.

Adequacy and Implementation of Procedures: The team had several concerns with the adequacy and implementation of maintenance procedures and instructions. These concerns resulted in a more severe rating of the maintenance procedures category than was arrived at during the 1988 Maintenance Team Inspection.

1. It was apparent that no guidance had been provided to maintenance planners and craft as to the minimum level of detail required for procedures and instructions for safety related work.

2. As a result of the above, in some instances, procedures and instructions were not explicit. As a result, craftsmen developed, without formal review, the steps necessary to complete work.

3. The Plant Manager's policy to limit solid waste generation by limiting the amount of materials brought into the radiation controls area was misinterpreted to include "unnecessary" portions of maintenance work packages; for example, work packages were excluded from entry.

4. The team observed one example where a procedure was not followed and other instances where ambiguous procedures were extensively interpreted by the workmen, indicating a need for continuing management attention to procedural compliance.

Work Prioritization: The team found that there had been little change in the implementation of establishing priorities for corrective maintenance activities and work associated with Non-Conformance Reports, even though this was an area rated as "poor" in the 1988 Maintenance Team Inspection.

Significant Safety Matters:

None

Summary of Violations and Deviations:

None

Open Items Summary:

Five items were opened for future followup action.

DETAILS

1. <u>PERSONS CONTACTED</u>

<u>Portland General Electric Company</u>

+ J. Cross, Vice President, Nuclear
+*W. Robinson, General Manager, Trojan Plant
*D. Hicks, General Manager, Plant Support
+*T. Walt, General Manager, Technical Functions
+*C. Seaman, General Manager, Quality Assurance
+*J. Whelan, Manager, Maintenance
*M. Lackey, Manager, Planning and Control
*J. Lentsch, Manager, Personnel Protection
+*M. Hoffmann, Manager, Nuclear Safety and Regulation
+*W. Peabody, Manager, Nuclear Plant Engineering
+*S. Bauer, Branch Manager, Nuclear Regulation
+ M. Singh, Manager, Plant Modifications
*A. Ankrum, Manager, Nuclear Security
*J. Mody, Branch Manager, System Engineering
*J. Reynolds, Branch Manager, Work Control
*E. Petersen, Branch Manager, Maintenance
*D. Nordstrom, Branch Manager, Quality Operations
D. Swanson, Branch Manager, Nuclear Safety
*R. Fowler, Supervisor, Maintenance Support
*M. Cooksey, Supervisor, Electrical Maintenance
*M. Malmros, Supervisor, I&C Maintenance
*O. Scheel, Supervisor, Mechanical Maintenance
+*R. Rupe, Supervisor, Work Control Development
*G. Bladeren, Unit Supervisor, Mechanical Maintenance Engineering
P. Johnson, Supervisor, Planning
G. Bennett, Unit Supervisor, I&C
G. Hill, Unit Supervisor, I&C
K. Benguiat, PM Supervisor
+*W. Williams, Regulatory Compliance Engineer
*K. Hukari, Service Water System Engineer, PSE
T. Gasser, Engineer, NPRDS Program
M. Zessin, Work Control Center

<u>Oregon State Department of Energy</u>

*H. Moomey, Manager, Reactor Safety
*A. Bless, Resident Inspector

<u>NRC Staff</u>

*D. Kirsch, Region V, Chief, Reactor Safety Branch
*W. Russell, NRR, Associate Director for Inspection and Technical Assessment
+*K. Johnston, Region V, Resident Inspector (Diablo Canyon)
+*M. Miller, Region V, Reactor Inspector
+*B. Olson, Region V, Project Inspector (Trojan)
+ F. Huey, Region V, Section Chief, Engineering

*Identifies individuals who attended the exit meeting on November 26, 1990.

+Identifies individuals who attended a telephone conference call on January 8, 1991, to discuss the team's evaluation of the maintenance tree elements.

2. INSPECTION OBJECTIVES

The objective of this team inspection was to examine the scope and effectiveness of corrective actions taken by the licensee in response to the findings of the October 1988 Maintenance Team Inspection (1988 MTI, Inspection Report IR 50-344/88-30) and to arrive at an assessment of the status of the licensee's maintenance program in those areas previously characterized as weak.

3. INSPECTION APPROACH

To accomplish the objective, the inspectors focused efforts on areas identified as weaknesses in IR 50-344/88-30. This included the following sections of the "maintenance tree" described in NRC Inspection Procedure TI 2515/97;

3.6 Document Control System for Maintenance
5.1 Review of Maintenance in Progress
5.3 Maintenance of Equipment Records and History
5.5 Performance of Work Prioritization
5.7 Establishment of Backlog Controls
5.8 Maintenance Procedures
5.10 Review of Completed Work Control Documents
6.3 Establishment of Deficiency Identification and Control System
6.4 Performance of Maintenance Trending

Inspection of these maintenance program attributes was accomplished by performing a review of the program improvement actions taken by the licensee in response to the 1988 MTI and observing the implementation of the program in the field. The program review was accomplished during the preparation week preceding the inspection, a meeting with plant management on the first day of the inspection, and in subsequent meetings with various licensee personnel. The inspection of the licensee's implementation of these attributes was performed by observing the planning and performance of work, and by reviewing actions taken to address problems previously identified with the service water system and the instrument air system.

4. GENERAL ASSESSMENT FINDINGS

In general, the team found that the licensee had made efforts in maintenance areas, and several program improvements were noted. This section summarizes improvements noted by the team. Additionally, the team noted some areas which had not received the attention warranted. These are discussed in Section 5.

a. Maintenance Improvement/Excellence Program

The 1988 MTI noted that although an extensive maintenance program self-assessment had been completed in 1987, no formal program existed to address the weaknesses it identified. In 1989, the licensee established the Maintenance Improvement Program (MIP). The program established an action plan to address weaknesses identified in the maintenance self assessment, the 1988 MTI, subsequent NRC findings, INPO audit, the NRC SALP reports, and further problems identified by the licensee.

At the time of the inspection, the majority of the 240 MIP items had been closed. The licensee had identified a follow up program, the Maintenance Excellence Program (MEP), which included outstanding MIP items. It was observed that the licensee had made efforts to gauge the effectiveness of the MIP by both internal and QA audits.

Although the MIP was seen as a positive step, the team noted that some of MIP action items had not been adequately addressed. Specifically, action to consolidate various qualification lists and action to review the accuracy I&C calibration data sheets appeared to have been inappropriately deferred. These problems are discussed in more detail in Section 5. The licensee was encouraged to remain self critical with respect to the implementation of the numerous maintenance program improvements.

b. Effectiveness of Quality Assurance

The team reviewed three QA audit reports of maintenance related activities:

- Maintenance and Work Control Center, issued November 2, 1990
- Electrical/Instrument and Control, issued January 4, 1990
- Mechanical Maintenance Activities, issued April 6, 1989

The team also discussed the involvement of QA in maintenance activities with QA management. In general, the team found that QA is more involved in maintenance activities than was found during the 1988 MTI. Of particular note were the extensive findings of the November 2, 1990 audit of preventative maintenance. Findings included;

- Numerous overdue PMs with an inadequate PM deferment process.
- A large backlog of Preventive Maintenance Change Requests (PMCRs)
- A weak PM planning process.
- I&C calibration data forms which were not receiving appropriate review.

The team discussed the findings of the QA audit with maintenance management and were encouraged to find that work had begun to address the QA concerns. The team took as an inspection sample the finding regarding the I&C calibration data forms. As discussed in the ISSUES section of the report, although QA identified a concern with the appropriate review of I&C calibration data forms, the licensee had only partially addressed the concern. The current accuracy of the forms did not appear to have been adequately addressed.

The team also noted that QA had performed audits of the MIP to evaluate the effective completion of actions items.

c. Outage Planning and Work Control

The topic of outage planning and work control was discussed with outage planning management. The licensee stated that the following measures had been taken and were expected to improve the scheduling and performance of outage activities.

- An experienced manager was hired in August to manage the Planning and Control organization.
- The Planning and Control group staff has been increased, including an SRO qualified branch manager.
- Outage coordinators have been assigned as plant area coordinators to improve the monitoring and performance of outage work.
- A detailed outage work schedule has been prepared which identifies all outage work and uses the system window concept for work scheduling. The schedule is resource loaded and provides for plant condition prerequisites.
- Maintenance requests are loaded into system windows.
- Critical path work has been defined and scheduled on a separate chart to enable close tracking.
- Additional redundancies are being provided during mid-loop operation in recognition of the additional vulnerabilities which arise in that condition.
- A milestone schedule has been prepared to better manage and control the outage preparation and outage work.
- Outage maintenance requests have been identified and are scheduled to be written and approved before the outage begins. The bulk of the MRs have been written and approved; only a few remain.
- The scope of outage corrective maintenance was scheduled to be closed on December 28, 1990.
- Materials needed for outage work have been identified and loaded into the inventory control and procurement system. All purchase orders are scheduled to be issued by mid-December 1990. Materials in inventory are reserved for specific MRs.

During the November 30, 1990, exit meeting, the NRC (Mr. Kirsch) observed that the planning for the 1991 outage appeared to be much improved compared with past outages. However, he cautioned that the increased level of attention should be maintained in order to preclude a recurrence of problems experienced during the 1990 outage. The Plant General Manager agreed and stated his intentions to conduct a well managed and coordinated 1991 refueling outage.

d. Control of Overtime in Accordance with Technical Specification Limits

The 1988 MTI noted that the overtime hours of key maintenance personnel were not administratively controlled and sometimes exceeded the limits allowed by Technical Specifications. The team reviewed time control program records and observed that the licensee appeared to have established administrative controls which ensured that the hours worked by maintenance personnel and maintenance contractors were evaluated on a daily basis to determine if individuals were approaching overtime limits. The team observed that the management of this system appeared to be appropriate and to have resolved the concern identified by the earlier maintenance team inspection.

e. Service Water System

The 1988 MTI identified a number of concerns with the maintenance of the Service Water System (SWS). Among the concerns was that the licensee had failed to take timely action to address repeated instances of SWS fouling due to silt and clams.

Preceding this team inspection, during the most recent outage, the licensee had again been surprised with the extent of SWS system fouling. In response to NRC Generic Letter 89-13, the licensee inspected 53 SWS supplied heat exchangers and coolers. Of the 53 heat exchangers, only 9 had been previously inspected. The licensee found that to some extent all were fouled. In some instances the fouling reduced heat exchanger efficiency below that assumed in the design basis. This was documented in a Licensee Event Report.

The licensee's corrective actions, discussed in the LER, were found to be appropriate. The licensee was also confident that the scope of the fouling problems is currently understood.

During a walkdown of the SWS intake area, the team identified 15 maintenance tags. Of the 15, active maintenance requests (MRs) were identified for 11 tags. Of the four tags not associated with MRs, three were duplicate tags, and one was associated with a cancelled MR. The licensee's program for tag removal following completed work, cancelled work, or duplicate identification was not always successfully implemented.

In a review of the backlog of work, the team noted that a high number of non-outage, corrective maintenance activities (108) were associated with the SWS. As discussed in the ISSUES section regarding work priority, the team found that work on safety related systems, such as the SWS, was not given priority over non-safety related work.

f. Documentation Control System for Maintenance

The maintenance team inspection in 1988 noted significant discrepancies in the system for tracking work records from issuance to quality record storage.

The team noted that the licensee now tracks the location of MRs using a computer system. The tracking system assigns accountability by name, and appeared to update status of the MR daily or more frequently. The system included MRs from several years ago and was able to call up MRs associated with equipment identification numbers, dates, and other criteria. All active MRs requested by the team were tracked and located within a few minutes. Completed MRs were located within minutes or hours, and completed equipment maintenance records reviewed by the team were available in files sorted by equipment number. The licensee stated that effort had been made to obtain equipment records back to 1984.

g. Maintenance Failure Trending and Analysis

A weakness noted by the NRC during the 1988 maintenance team inspection was that data entered into the NPRDS was not being adequately reviewed to ensure the actual root cause for equipment failures was identified. The team also noted limited use of the NPRDS.

Since 1988, the licensee had improved use of the NPRDS. A dedicated engineer had been assigned to use the system, the number of backlog entries had been reduced, the number of terminals for system access had been increased, and the number of requests for NPRDS information had increased. In 1990, the NPRDS engineer began preparing Component Failure Analysis Reports (CFARs) on a quarterly basis. The CFARs compared failure rates of licensee components with those seen in the industry. The CFAR recommended action based on the results of the comparisons, but root cause analysis of the failures was not required.

The licensee was implementing the Maintenance Evaluation and Trending System (METS) which, as stated by the licensee, would identify, track, and trend equipment failures. The system would automatically generate a report if an abnormal failure rate was detected. The reports would then be screened to determine when root cause evaluations would be required. The licensee had loaded the system with information of past component failures so that trending could be performed. The METS coordinator indicated that the system would generate about 1000 reports a year based on generating a report if more than one corrective maintenance request was written against a component in a year.

The team noted that the effectiveness of this program could not be assessed, because the program was not yet implemented. Overall, it appeared that the NPRDS data was not being reviewed to determine whether root cause evaluations should be performed until after CFARs were issued in 1990. It was noted that CFARs recommended, instead of required, root cause evaluations. The licensee stated that implementation of the METS would provide for root cause evaluation of component failures. However, the team noted that a backlog of evaluations would be likely to develop.

5. SIGNIFICANT ISSUES IDENTIFIED DURING INSPECTION

The inspection team identified weaknesses in some significant areas, including areas which had previously been identified as weak in the 1988 MTI. The issues are described below.

a. Implementation of the Design Basis

The team found several examples, as discussed below, where the licensee had failed to establish adequate controls to ensure that plant work maintained the plant design basis. The examples include:

- The availability and use of design classification lists.
- The control of heating equipment to ensure the operability of safety related equipment.
- The accuracy of I&C calibration data sheets.

To some extent, all of the above issues had been previously identified as problems by the licensee. However, the implications of these problems, with respect to their effect on the licensee's ability to maintain the plant design basis through the maintenance program, were not fully realized by the licensee. As a result, the team found that corrective actions appeared to be limited in scope.

With respect to each of these problem areas, it was noted that a lack of plant and design engineering involvement in the maintenance process appeared to be a significant contributor. Because each of these findings is related to the implementation of the design basis, the licensee's engineering staff needs to have greater involvement in these areas.

- Engineering had been aware of inaccuracies and inconsistencies in the equipment classification lists since 1985. Action had been minimal, and no attention was focused on how the inaccurate lists could affect the design basis in the maintenance process, one of the main functions of these lists.
- Engineering had addressed heating and heat tracing issues on a problem-by-problem basis, without addressing the generic concern.

o Engineering had been made aware that there had been a lack of control of I&C calibration data sheets which are used by the plant to implement plant design criteria. However, the licensee appeared to have given little consideration to the potential inaccuracies in the I&C-4 forms (and, therefore, in the plant) which may have resulted from this lack of engineering control.

(1) Availability and Use of Design Classification Lists

The team reviewed the implementation of the newly established Work Control Center (WCC). The team found that equipment lists to be used by job planners in the WCC were incomplete, unavailable, or contained conflicts. Further, the team found, as discussed below, that problems with equipment classification lists had been previously identified by the licensee. Corrective actions had come to a standstill with due dates "to be determined." Ultimately, job planners were required to make decisions regarding the application of plant requirements on an item-by-item basis and sometimes without the benefit of accurate engineering documents.

The licensee implemented the Work Control Center (WCC) in March, 1990. Through the WCC, Maintenance Requests (MRs) were prepared, planned, and scheduled. Administrative Order (AO) 3-9 established the administrative controls for initiating, planning, and scheduling MRs. After an MR was requested, approved by a supervisor, and assigned a number, the MR was provided to a job planner. In accordance with section 4.6.1.b of AO 3-9, the job planner designated the applicable quality classification of the component. Proper classification of the component ensured appropriate elements of the Quality Assurance (QA) program were applied during performance of the MR. Some of the quality classifications that could be applied included: Safety Related, Trojan Technical Specification (TTS) Listed, Environmental Technical Specification (ETS), Environmental Qualification, Fire Protection, and Security. As discussed below, the team found that equipment lists to be used by job planners in the WCC were incomplete, unavailable, and contradictory.

Safety Related List: The Safety Related List included those structures, systems or components relied upon to remain functional during and following design basis events. In accordance with Section 2.2.5 of the Trojan Nuclear Quality Assurance Manual (PGE-8010), the Safety Related List is to be prepared, approved, and maintained by the Nuclear Safety and Regulation Department (NSRD). The team confirmed that a copy of the Safety Related List was available in the WCC for use by the job planners. The completeness of this list, however, was questioned.

In October 1985, Nonconforming Activity Report (NCAR) #85-73 was written to indicate that the list did not reflect all of the components that were safety related. As a result of the NCAR, action was taken to include all safety related components in one listing. The new list was approved for use in December 1987. In 1988 the licensee identified that approximately 900 individual components were still undergoing evaluation for inclusion in the list. Additionally, in 1989, the licensee planned to evaluate electrical components inside vendor supplied panels. This effort was expected to involve the addition of several thousand electrical components to the Safety Related List.

On October 31, 1989, in response to a request for additional information pertaining to NRC Generic Letter 83-28, the licensee submitted a letter to the NRC indicating that there were possible conflicts between subordinate documents and the Safety Related List. Conflicts included components appearing on more than one list, and the component safety classification being different on different lists. To avoid possible conflicts, the licensee stated that all subordinate documents would conform to the Safety Related List by December 31, 1990.

To date, the evaluation of electrical components inside vendor supplied panels had not occurred. Approximately 100 items were added to the list of 900 components known to require evaluation. To date, about 400 of the 1000 evaluations had been performed. The effort to make subordinate lists conform to the Safety Related List by December 31, 1990 was on hold. In a discussion with the Branch Manager of Nuclear Safety, NSRD, the inspectors learned that consolidation of lists and evaluation of components would be performed as part of an effort to integrate all plant information into one computer system. The system, called the Trojan Information System (TIS), was scheduled to be in service in 1992.

<u>TTS/ETS Lists</u>: Components in TTS and ETS lists are those items used to implement Trojan Technical Specifications or Environmental Technical Specifications. In accordance with Section 2.2.5 of PGE-8010, the TTS/ETS Equipments Lists were prepared, approved, and maintained by NSRD. The team asked a WCC Planning Supervisor if the TTS/ETS lists were available for job planners. The Supervisor indicated that he was unaware of the existence of TTS/ETS lists. A job planner, overhearing the conversation, indicated that the lists were available in the WCC. The job planner produced a copy of the lists marked "Information Only". The planner stated that he obtained the lists by copying them from ones held by Plant System Engineering. The "Information Only" copy had been in the WCC for approximately three weeks. The TTS portion of the copy had been last revised in 1988, and the ETS portion of the copy had been last revised in 1981. NSRD was contacted to determine what section was cognizant of the TTS/ETS lists. While NSRD had a copy of the TTS/ETS lists, no NSRD section claimed responsibility for the lists.

Other Lists: Planners had other resources available to them in determining the classification of components, but these resources were considered by planners to provide conflicting information. Planners used a computer program, the Trojan Scheduling System (TSS), to display information regarding a component. The following conflicts were noted:

- The team questioned the Planning Supervisor if Level Indicator (LI)-3480 was quality related. LI-3480 provided indication of the water level of the cooling tower basin and was used to ensure that TTS 3.7.5.1.a was satisfied. Using the licensee's definition, LI-3480 should have been quality related. The Planning Supervisor, using TSS, found that the indicator was not quality related. An I&C planner, using a computer to view the calibration data sheet for LI-3480, found that the component was listed as quality related on the data sheet. The Nuclear Plant Instrument Index, J-900, did not list LI-3480 as quality related.

- The team observed the calibration of Pressure Indicator (PI)-3072A. The indicator provided suction pressure information for the safety related steam driven auxiliary feedwater pump. The MR indicated the component was safety related, TTS related, and, thus, quality related. The calibration data sheet for PI-3072A, which was attached to the MR, indicated that the component was not quality related.

- A conflict with component numbering was observed when the TSS showed component C-101 to be both a steam packing exhauster and the west end diesel generator control exciter panel.

Planners indicated that proper equipment classification required significant time and effort and was considered a "challenge" as a result of incomplete, unavailable, or conflicting lists. Such problems could result in maintenance being performed on equipment without appropriate QA controls. As currently planned, one equipment list that provides all attributes for component classification would not be available until 1992. Although action to create a comprehensive list was included on the MIP, its due date was listed as "to be determined."

At the exit meeting, the licensee committed to provide the most recent classification lists to the job planners.

In summary, although the licensee had been aware of inadequacies of classifications lists since 1985, corrective actions have been slow. As a result, the end users, those required to make decisions regarding the application of design requirements based on the information which should be provided by these lists, have not had accurate engineering documents.

The lack of accurate engineering documents could result in the use of an unacceptable part or the lack of a quality program overview. Pending a review of the licensee's corrective actions to establish the accuracy of classification lists and provide them to the job planners, this is an Open Item (50-344/90-34-01).

(2) <u>Inadequate Control of Heating Equipment to Ensure Operability of Safety Related Equipment</u>

The team performed walkdowns of the indoor and outdoor piping associated with several safety related fluid systems to determine the status and control of components required to maintain the system fluids above precipitation and freezing temperatures. The licensee used both heat tracing and room heating systems to ensure that fluid systems would not freeze and, for systems with high boron concentrations, that precipitation would not occur. The team found weaknesses in the licensee's maintenance program for this equipment.

<u>Heat Tracing</u>:

The licensee used heat tracing on the piping and instrument lines of several safety related systems. The heat tracing was used for freeze protection and to maintain boric acid in solution for systems with high boron concentrations. These systems included the Auxiliary Feed Water (AFW) system, the Reactor Vessel Level Indication (RVLIS) systems, the Refueling Water Storage Tank (RWST), and the boric acid injection system.

Two types of heat tracing systems were used. The first used a thermostatic device placed on the piping to control power to the heat trace. For these heat trace circuits there are three indication lights: power on, low temperature, and high temperature. The second type of heat trace was self-limiting with temperature. As the heat trace temperature increased, its resistance increased, limiting current to zero. For this type of heat trace, the power breaker remained closed. The thermostatically controlled type discussed first was used exclusively during plant construction. However, due to continuing reliability problems, the licensee had replaced, rather than repaired, the thermostatically controlled heat trace with the self-limiting type.

It was not apparent from the team's review that either type of heat trace was adequately controlled or monitored to establish that the heat trace had been performing its function.

- The thermostatic devices had not been calibrated since plant startup due to the effort required to remove pipe lagging, remove the devices, and calibrate the devices in a temperature bath.

- It appea that only a limited amount of heat tracing was monitored in a programmatic manner. Monitoring included the periodic walkdown of control cabinets, and the monitoring of temperature instrumentation.

- It appeared that not all heat tracing on safety related systems was listed as quality related.

The lack of adequate monitoring of heat tracing could allow inoperable heat tracing to go undetected and result in system inoperability and system damage.

Control of Temperature of the Emergency Boration Flow Path During Modes 5 and 6:

NRC inspection report 90-32 stated that the emergency boration flow path from the boric acid storage tanks to the boric acid blender room did not have appropriate control of temperature. The boric acid in the system, with concentrations between 7000 and 7700 ppm as required by TTS, must be kept at a temperature of greater than 65 degrees F to ensure boric acid does not solidify. The licensee had initiated CAR C90-1070 to address this issue prior to the team inspection. As compensatory action, the piping and room temperatures were being monitored to ensure appropriate temperature control.

During a walkdown inspection, the team identified a concern that the flow path downstream of the blender room to the inlet of the centrifugal charging pumps did not appear to have temperature controls. The licensee stated that the piping downstream of the blender room passed through the RHR pipe chase, the overhead area of the 25 foot level, and into the centrifugal charging pump room. These rooms appear to have a 50 degree F minimum temperature limit, which was below the minimum temperature required by Technical Specifications for operability of the emergency boration flow path. The licensee stated that this piping did not require temperature controls since the volume control tank (VCT) supplied continuous flow through the line which would warm and dilute the boric acid solution in the event of an emergency boration. The inspector identified that the normal flow of hot water from the VCT was not available during modes 5 and 6. Technical Specification 3.1.2.7 required a borated water source during Modes 5 and 6. Without adequate heating on the line there might not be adequate protection to prevent this section of pipe from dropping below the required temperature and causing boron to solidify.

Control of Room Heaters Required to Maintain Temperatures Above Design Minimums:

Several examples have been identified which indicate that room heaters, which are relied on to maintain rooms above design minimum temperatures, had not been adequately controlled or maintained.

- CAR C90-1070 noted that the heaters used to maintain the Auxiliary Building above a minimum of 50 degrees F (VE-301 A&B) were not operable while inlet air was approximately 40 degrees F. Records searched by the licensee showed that these heaters had experienced repeated problems which had not been addressed. Corrective action was limited to an evaluation of the heater fuse size.

- During a walkdown of room heaters required to maintain boration flow path above the Technical Specification minimum of 65 degrees, five of eight heaters were found to be either inoperable or turned off. This was discussed in CAR C90-1070. Corrective action was limited to the repair of the heaters and the installation of additional temperature monitors.

- CAR C90-1070 indicated that room heaters had been turned on and off in an uncontrolled manner by plant personnel, affecting the ability of the equipment to maintain design basis room temperatures. Corrective actions appeared to be limited to a memorandum from the plant general manager to all employees to not adjust heater controls.

- CAR C90-5407 was initiated by the licensee following discussions with the team to address the control of temperature in the diesel fire pump battery room. The licensee stated the room's minimum temperature according to Equipment Qualification lists was 70°F. However, during a surveillance, the battery cell temperature was measured at 64°F. The safety significance of this finding appears to be minimal, since the licensee stated that the fire pump, diesel, and starting battery were sized at temperatures below 60°F. The inspectors also noted that no acceptance criteria for temperature were included in the surveillance procedure.

Based on the above, it appeared that the licensee has addressed each of the heater concerns on an individual basis without pursuing potential generic considerations such as identifying all heaters required to maintain plant temperatures within design limits, establishing a monitoring and control program which would ensure that the heaters perform their function, and including acceptance criteria for temperatures in surveillance procedures.

<u>Summary</u>: Based on the above, it was apparent that while the licensee had addressed heating issues on a case-by-case basis, they had not addressed the generic concern. It was not clear that the licensee had demonstrated that equipment used to maintain system temperatures within design limits was adequately controlled and monitored to ensure that equipment

could perform the design function, if required. This is an Open Item (50-344/90-34-02).

(3) Accuracy of I&C Calibration Data Sheets

In 1989, the QA department found that instrument calibration data sheets had not been adequately controlled as engineering documents. Although corrective action was taken to ensure that the future data sheets will receive appropriate engineering review, the team found that the licensee had not taken action to verify that the data sheets, which had been changed in the past, still maintained that plant design basis.

I&C technicians used data sheets designated as Form I&C-4 when performing instrument calibrations. The I&C-4 forms were generated by a computer and were provided in the MR packages prepared by the WCC. The forms provided background information about the component including vendor, applicable technical manual, physical location, calibration interval, and quality designation. The I&C-4 also provided the input/output and setpoint data required for the calibration. When a calibration was performed, the I&C-4 was filled out to document "as found" and, if instrument adjustments were made, "as left" conditions.

Originally, the data was maintained on hard cards and was later transferred to a computer database for use as the I&C-4. The I&C department was responsible for the input/output and setpoint data. I&C Department personnel developed the data and would perform necessary calculations to make changes if components were replaced. Changes to the data were approved by an I&C supervisor but were not reviewed or approved by engineering groups.

The QA organization had identified concerns with the process of reviewing and approving changes to the forms. In audits issued in January 1990, and in November 1990, QA indicated that I&C-4 forms should have been treated as procedures, including the appropriate reviews and approvals. As a result of QA's persistent efforts, I&C prepared a revision to Maintenance Procedure (MP) 2-0, which was used for I&C-4 changes. The revision, which at the time of the inspection was in the approval process, would require that two engineering organizations review and approve changes to the forms.

The team questioned the method used to transfer the data from the original hard cards to the computer database. The team was told that data was transferred by clerks, and the database was independently checked against the hard card. The I&C Maintenance Supervisor stated that prior to initially using an I&C-4, the technician also checked the data on the form against the data on the hard card. The team asked if the process to transfer and check the data was formal and if records existed to show that all the forms had been checked. The Supervisor indicated that the process was practiced but was not specified by procedure. He added that no records were developed to verify validation of the data on the forms.

The team noted that while future changes to calibration data sheets would be reviewed by engineering, past changes had not been reviewed. The team could find no licensee action or program which was chartered with establishing the validity of the data contained in the I&C-4 forms. The I&C Maintenance Supervisor was asked if the calculations used to make changes to I&C-4 forms had been retained. The Supervisor indicated that the calculations were not retained, but the calculations could be verified. The Supervisor indicated that a verification program by engineering could possibly check the calculations.

The team contacted the I&C Engineering Supervisor in Nuclear Plant Engineering. The Supervisor described the Technical Specification Verification Program. The program, fully implemented in 1990, was to verify that parameters listed in TTS included instrument uncertainties. Approximately 120 parameters were being verified. For setpoints, verification involved performing calculations to account for the uncertainties of all the instruments in the loop. For parameters listed in TTS Limiting Conditions of Operation, the verification usually just involved ensuring that the uncertainty of a single instrument had been accounted for. The Supervisor stated that the program could result in changes to TTS. Of the 120 parameters that were being verified, 14 were completed. The goal for program completion was 1992. The Supervisor also described the Design Basis Document Program. The team verified that neither program would result in verifying that the data on the I&C-4 forms was correct.

Subsequent to the team's onsite review, it was noted that MEP action item E.4. stated; "conduct a verification of all I&C form 4 data." The item was assigned to the I&C Supervisor with a due date of December 1991. Discussion with the I&C supervisor indicated that he was not aware of the action item and that no action had yet been initiated.

The team was told that there were approximately 10,000 I&C-4 forms. Through the efforts of QA, the process for future changes to the data on the forms would require independent engineering review. It appeared that the licensee had not addressed the need to assess whether past changes to the forms should be reviewed.

The team expressed concern that I&C-4 forms had not been treated as controlled engineering design documents and had been changed in a manner involving less control and documentation than had been used for other documents that implement the plant design basis. The potential exists for discrepancies between the design basis and the documents which implement the design basis. This is an Open Item (50-344/90-34-03).

b. Procedures and Procedure Compliance

In the entrance meeting, licensee management stressed their commitment to improving the quality of procedures and their commitment to procedural adherence. Regarding the improvement of procedures, the licensee had pursued a maintenance procedures upgrade program. Regarding procedural compliance, licensee management had taken several steps including a stop work order during the 1990 refueling outage following a number of problems resulting from a failure to follow procedures.

During the inspection the team found that while the efforts of licensee management were evident, the concepts of procedure adequacy and procedure adherence had not been implemented to an appropriate level. The team found the following weaknesses:

- o Workers were not aware of requirements for a minimal level of instruction detail needed to perform work.
- o As a result of the above, workers had a tendency to improvise when using inadequate procedures.
- o At times workers considered the MR package to be nonessential and created their own instructions.
- o There was evidence that procedural adherence was still a problem.

Based on these findings, the team recommended that the licensee continue to focus significant attention on the principles of procedure adequacy and procedural adherence, particularly regarding the level of detail.

Examples of work observed, described below, illustrate the team's concerns.

(1) Minimum Level of Instruction Detail Not Provided

It appeared that workers were not aware of requirements for a minimum level of instruction detail adequate to perform work. It appeared that, regardless of the lack of detail provided in work packages, the workers understood that they were expected to do appropriate maintenance or troubleshooting work to ensure both the completion of work and satisfactory equipment operation. It appeared that, as a result of the their skill level, familiarity with the equipment, and sense of pride and ownership, workers voluntarily learned functional and design details and requirements as necessary for the job scope, and provided the additional level of detail needed in informal or memorized instructions.

Because work control should be accomplished with adequate detail in formal work instructions, workers should be provided with standards and examples of what constitutes adequate detail. These standards did not appear to have been provided. Additionally, workers need to be encouraged to seek procedure changes when instructions do not meet the minimum level of detail. During discussions, the licensee stated that work stoppages may occur if a sudden increase in the level of work instruction detail was required. The team considers that the licensee should determine standards for the minimum level of detail in work control documents and provide these standards

to technicians and planners to ensure formal control of maintenance. This is an Open Item (50-344/90-34-04).

The licensee has been engaged in a procedures improvement program. The team considers that continued attention is warranted in this area.

(2) Work Packages in the Radiation Controls Area (RCA)

The team observed that maintenance workers sometimes failed to bring applicable work packages with them into the RCA. When questioned by inspectors, the workers stated that earlier concerns to minimize the paper and materials brought into the RCA had resulted in health physics personnel requesting that extraneous paper be kept out of the RCA.

A memorandum, dated October 30, 1990, from the Plant General Manager, to all plant personnel, requested personnel to bring only necessary material into the RCA. Examples of unnecessary material described in the memorandum included cardboard containers, extra paper packaging, and absorbent waste material. Additionally, all hand carried items were to be evaluated by Radiation Protection personnel prior to entry into the RCA.

The team found that the memorandum had been interpreted by some plant personnel to include "unnecessary" portions of work packages. Two examples of this are discussed below. Following the inspection, on December 10, 1990, the Plant General Manager issued a revised memorandum which stated "This restriction is not intended to limit workers from taking the necessary procedures or work packages into the RCA. The work group is the final authority as to what is required to perform the work."

(3) Digital Rod Position Indication Troubleshooting

On November 29,1990, the team reviewed MR 90-11001 for troubleshooting of the Digital Rod Position Indication System (DRPI) as a result of alarms received for rod N-9. The MR indicated that troubleshooting was to be in accordance with the guidelines of Administrative Procedure (AP) 3-3, and replacement of an encoder card was authorized. The MR package included a Troubleshooting Conclusion Report, system drawings, and bench test data for the replacement card. The work was to be performed inside containment while the Unit was at power.

The team questioned the I&C technician assigned the work regarding the troubleshooting plan. The technician described the steps he intended to accomplish, and the results he expected to obtain. The technician was asked how the plan was developed since the MR did not contain any details, and AP 3-3 only provided general guidelines. The plan had been developed in the I&C shop through discussion with various technicians. It was noted that system engineering had not concurred with the troubleshooting plan, and the plan was not specified in writing. After completing the review of the MR, the team asked what portion of the MR package would be taken into containment. The technician indicated that none of the MR package would be brought into containment because Radiation Protection had a policy of minimizing the amount of paper that was allowed in controlled areas. The team was shown two pages from the DRPI technical manual that the technician intended to take with him during the work. The pages, not part of the MR package, depicted the encoder card authorized for replacement and provided normal voltages measured by the card. The technician wrote additional information on the pages such as the rod number, N-9.

The Oregon Department of Energy (ODOE) Resident Inspector accompanied the technician into containment to observe the troubleshooting actions. The ODOE Resident confirmed that the technician used the two pages from the technical manual to assist in his work. The ODOE Resident also reported that the informal troubleshooting plan was modified as the first expected result was not obtained. Modification of the plan occurred by phone conversations between individuals in the I&C shop and the technician inside containment.

The description above illustrated weaknesses in the development of procedures, the MR process, and work inside Radiological Controlled Areas (RCAs). In this instance, the troubleshooting plan was not formal, did not contain contingencies, and was not discussed with the system engineers. The technician chose to use a portion of the technical manual because he considered it more useful than the MR package. Finally, the MR package prepared for the job was not taken to the job site in order to minimize the amount of paper inside the RCA.

(4) Lifted Leads Log

On November 29, 1990, the team observed calibration of pressure indicator PI-3072A using Maintenance Request (MR) 90-10778. To perform the calibration a lead was lifted from the indicator, and test equipment was connected. The team observed the I&C technician document his action on a lifted lead form. Independent verification of the lifted lead was performed, and the form was signed by a second technician. The team questioned the technician as to how he knew what lead to lift since the form did not designate the lead. The technician replied that the lifting of leads was within the skill of the craft, and he had reviewed a schematic to verify what lead needed to be lifted. After completing the calibration, the form was signed to verify the landing of the lead.

The team contacted the I&C Maintenance Supervisor and discussed the need to designate leads that are required to be lifted. The Supervisor stated that for complex procedures or large maintenance jobs, the leads that are to be lifted are designated in the procedure or MR. He added that for less complex evolutions, the technician was responsible for designating the leads, a practice considered to be within the skill of the craft. The team asked if procedures defined when leads needed to be designated, and if procedures defined when an evolution was complex. The Supervisor stated that procedures did not provide the definitions.

The team also observed that lifted leads were not specified in the work package for work performed on a boric acid storage tank area room heater. Additionally, craft did not bring a lifted leads form into the RCA, in accordance with the interpretation of the requirement to minimize radioactive waste (see Section 5b(2)). Instead, the lifted leads were documented on the back of the MR and then copied onto the appropriate form when the craft returned from the field. The lifted lead process was allowed by licensee administrative procedures, and by minimization of paper in the RCA.

The practice of not designating the leads to be lifted was considered to be a weakness. Instead of engineering designation/review of which designated lead was correct, the technicians determined what leads to lift. This action could result in errors. Additionally, work planners were not provided with procedures to define when a task was considered complex enough to require designation of leads. This is an Open Item (50-344/90-34-05).

(5) Weekly Battery Testing

The team noted several instances in maintenance or surveillance procedures in which one step of the procedure required several discreet actions, and cases in which data sheets associated with the procedure did not have designated blanks or spaces to record relevant data. The inspectors observed that technicians recorded the information on the data sheets in the margins or blank areas. It is a noteworthy strength that they appeared to understand that the information should be recorded, although recording was not required by the procedure, and space was not provided for it on the data sheet.

An example of this was observed during the weekly diesel fire pump battery surveillance controlled by procedure MP-12-8, "Fire Pump Diesel Engine." Step III.A.2 stated, "Record the battery charging current to the nearest milliamp by using the installed current test jacks provided in C211." Without comment from the team, the technicians performed the following actions to complete the above step:

a. Connected a shunt resistor in parallel with the charger current path (not specified in the procedure, but required to obtain the information),

b. Recorded the calibration and equipment identification data for the shunt, although there was no space designated on the data sheet, and recording this data was not required by the procedure.

c. Obtained the voltage reading across the shunt using a digital voltmeter (the technicians had already recorded the voltmeter calibration and identification on the data sheet for other purposes required by the surveillance),

d. Recorded the voltage value on the data sheet, although there was no space designated for reccrding the value,

e. Detached the shunt, continued with the surveillance according to procedure and returned to the office to complete the calculations,

f. Recorded the shunt conversion standard (volts to amps) on the data sheet, although no space was provided on the data sheet,

g. Performed the conversion calculation, and recorded the calculation on the data sheet, although no space had been provided for the calculation.

h. Recorded the resulting milliamps value for the battery charging current in the appropriate space designated on the data sheet.

The team noted that, to perform the one step, actions a. through h. were required. The technicians performed all the steps noted above, however the procedure and data sheet did not appear to have enough detail to control the work.

The original surveillance data sheet discussed above was incorporated in the work package for review by electrical maintenance. At the end of the review process, the team noted that the data sheet in the package was not the original data sheet, because the data on the review package data sheet was recorded in different areas from the original data sheet used in the field. In comparison of a photocopy of the data sheet prepared at the job site, the team noted that the numerical values appeared to be identical between the original and rewritten data sheets. The licensee stated that maintenance and surveillance data sheets were often rewritten in the office if the data had been recorded in a disorganized or messy fashion, and the original data sheet discarded. Based on further discussion with the licensee, rewriting of data sheets and discarding the original sheet appeared to be done routinely to provide the quality records program with neat, organized quality records.

The team's concern is that, although rewriting the data sheet may be necessary to provide legible, clear information as a convenience and as an aid to understanding the job progression; the original log of the maintenance work is also a quality record for that job, as defined in ANSI N 45.2.9; "a record which furnishes documentary evidence of the quality of items and of activities affecting quality", because the information was recorded as it was obtained. Therefore, this original data sheet should be included with the quality records.

During discussions of this particular issue, the licensee stated that this surveillance procedure (among many others) was being revised as part of the licensee commitment to improve procedures. The team reviewed the data sheet of the new procedure still under licensee review. The new procedure had deleted an unnecessary space to record hydrometer calibration data, and had provided space for the shunt readings. However, no space for calculations had been provided. The new procedure was still under review, and the licensee stated that the inadequacies of the data sheet would be corrected.

(6) Lubrication of Safety Injection Pump Lube Oil Cooler Studs

The team observed the monthly inspection of the safety injection pump lube oil cooler (MR 90-12587). The inspection was done to monitor the accumulation of silt and clam fragments.

With one exception, the job was performed in accordance with the MR. Step 3.03 of the MR stated "clean and lubricate threads of studs and nuts with N-5000 or Neo-lube." In follow-up questioning, the team asked the mechanic where he had procured the grease. The mechanic stated that the stud and nuts were found adequately greased and did not require further attention. This was later documented by the mechanic in the "work performed" section of the MR.

The team also noted that this repetitive, safety related task had not been developed into an established preventative maintenance procedure.

c. Establishing Work Priorities

The 1988 MTI identified that the licensee's implementation of work prioritization was poor and that the backlog of maintenance requests was large and not well understood. As part of the scope of this inspection, the progress in this area was assessed.

The team found that while some improvements had been made in this area, the status of work prioritization and backlog control had not progressed as far as would have been expected. The majority of MRs, of all quality classes, were still categorized as "routine", the fourth of four prioritization categories. Additionally, the majority of the backlog of MRs associated with Non-Conformance Reports (NCRs) were categorized as routine, and as a result, were not differentiated from the rest of the backlog of MRs.

(1) Maintenance Request Prioritization System

The priority system, established in procedure AO 3-9, specified four priorities, "Urgent", "Priority 1", "Priority 2", and "Routine". At the time of the inspection, the majority of work was categorized as routine (greater than 85%). MRs in the routine category were not further differentiated into other categories such as safety related and non-safety related.

At the time of the inspection, the licensee had drafted a new procedure (TPP 10-11) entitled "Trojan Nuclear Plant Work Prioritization. The new procedure split the work which would have previously been categorized as routine into two main categories with several subcategories. The new procedure, if implemented, would appear to address the concerns regarding the prioritization of work.

(2) Non-Conformance Report Prioritization

Non-Conformance Reports (NCRs) were used by the licensee until February 1990 to document equipment problems with quality related equipment. These types of problems are now covered in the CAR program. Unlike the CAR program, the NCR program did not require a due date. Although due dates have subsequently been established for most NCRs, as of November 7, 1990, half of the due dates had passed. In a review of some of the open NCRs the team found the following:

- NCR due dates were not being followed or maintained.
- Corrective actions were deferred repetitively without review or justification.
- The review process was long and recommendations of simple corrective actions were not being addressed.
- Priorities were not established for NCRs.

Examples of these problems are discussed below.

(3) Auxiliary Feedwater Valve MS-0143

On July 17, 1987, NCR 87-317 was initiated when it was discovered that isolation valve MS-0143 was found with a cracked seat. MS-0143 is a manual isolation valve upstream of the Loop A auxiliary feedwater (AFW) turbine driven pump steam supply automatic isolation valve. MS-0143 is sealed open during power operation. It was found to be leaking during a hydrostatic test.

The disposition of the NCR was to grind out the crack in the valve's stellite seat to prevent crack propagation and use the valve "as is" until the next refueling outage, when the valve could be repaired or replaced. Since the valve was to be sealed open, it would not impact operations unless it was needed to be closed to perform repairs on the automatic isolation valve.

On November 29, 1990, three outages following the initiation of the NCR, the team observed that NCR 87-317 was still open and that isolation valve MS-0143 had not been repaired or replaced. The monthly NCR report issued November 7, 1990 listed this NCR as having a June 15, 1990 due date. MR 90-3078 had been written on March 6, 1990 so that the valve could be replaced during the 1990 refueling outage. The MR was deferred to the 1991 due to outage scheduling problems.

On November 30, 1990, the automatic isolation valve for the Loop B AFW turbine driven pump steam supply failed its periodic inservice testing and the upstream isolation valve was closed to allow repairs. Had this occurred on the A loop, it is likely the licensee would have had to shut down the plant to perform repairs.

(4) Service Water System Pressure Switches

On February 7, 1990, NCR 90-030 was initiated to document problems with service water system pressure switches PS 3745B and PS 3701A. The glass face plate for PS 3745B had fallen inside the switch and the cover screws for PS 3701A had degraded, allowing the cover to fall out. Both switches perform safety related control functions.

During a walkdown on November 27, 1990, the inspector found the switches in the condition described on the NCR. Although three spare switches of the same make were found in stock in the warehouse, no MR had been written to repair or replace PS 3745B or PS 3701A.

The NCR root cause in both cases was determined to be "...moisture intrusion from a highly humid environment." NCR corrective action was limited to replacing the face plate cover (PS 3745B) and tapping a new hole (PS 3701A). The NCR did not include corrective actions to address "...moisture intrusion from a highly humid environment" such as an inspection of other similar switches in the same environment or the need to upgrade the switch to a model less susceptible to moisture intrusion.

Although the root cause and corrective actions identified were simple, the review and approval was not completed until August 19, 1990. Additionally, it overlooked expedient solutions such as replacing the installed switches with those in stock and then subsequently repairing the removed switches.

(5) Component Cooling Water Pump Gaskets

NCR 86-194 was initiated in 1986 when it was recognized that the Component Cooling Water (CCW) pumps had asbestos pump gaskets. The disposition of the NCR was to replace the gaskets with flexitallic gaskets at the next convenience. Although an MR had been written, when asked, the licensee did not know if parts were in stock. Additionally, the planner for the CCW system did not know of this NCR or the commitment to replace the gaskets.

d. Predictive Trending

A strength noted by the NRC during the 1988 maintenance team inspection was that the licensee was developing diagnostic and predictive maintenance activities such as vibration and oil analysis of components. The status of these activities was discussed with the Preventive Maintenance (PM) Supervisor. Trending was performed when vibration measurements or oil samples were obtained from components. The program to perform predictive trending was not formal. That is, no procedure documented program requirements. The PM Supervisor indicated that he evaluated the results of the analysis and notified plant system engineers when unfavorable trends developed.

The PM Supervisor indicated that his goal was to expand the use of predictive trending. Plant system engineering would be involved to establish both the component parameters to be measured and the criteria for acceptable or unacceptable results. Trending reports would then be routinely sent to the system engineers for their evaluation. The goal to expand the use of predictive trending was not part of Trojan's Maintenance Excellence Program. While some predictive trending was performed, the overall program did not appear to have matured since 1988.

6. GENERAL INSPECTION FINDINGS

The following section of the report presents the team reassessment of the areas of the Maintenance Inspection Tree (provided as part of the NRC Temporary Inspection Procedure TI-2515/97) on which this inspection focused.

Following the site inspection, the team developed a consensus judgement of a rating for each element, considering both the progress in the area since the 1988 MTI and the performance observed during this inspection. A revised summary presentation of the team ratings, superimposed with the ratings of the 1988 MTI, is provided.

In general, the following criteria were used as a rating standard for the blocks reviewed:

Good: More than minimal efforts have been made in this area, and this area has desirable qualities with only a few minor areas requiring improvement.

Satisfactory: Applicable requirements of this element have been developed, documented and effectively implemented. Areas requiring improvement are approximately offset by better performance in other areas.

Poor: Inadequate or no effort has been made in this specific area.

A measure of how well the licensee maintenance program has described and documented the requirements of the element:

Good: The element was determined to be fully included in the licensee maintenance program.

Satisfactory: The element was determined to be adequately addressed in the licensee maintenance program.

Poor: The element was determined to be missing or inadequately addressed in the licensee maintenance program.

A measure of how well the licensee maintenance process has implemented the requirements of the element.

Good: The element was determined to be functioning and functioning adequately.

Satisfactory: The element was determined to be in place, but could be strengthened.

Poor: The element was determined to be missing or inadequate.

Several issues should be considered when comparing the reassessment ratings with those made in 1988. In most cases, ratings improved, especially with respect to element implementation. This indicates the licensee's overall commitment to maintenance improvement has had positive effects.

In some instances, such as maintenance procedures, the ratings arrived at by this team were more severe than in the previous team. However, the team found in their review that the licensee's performance in the category had in fact stayed the same or improved. The apparent disparity between the declining rating and unchanged or improving performance indicates a difference in the inspection sample selection and the severity of problems observed.

The following subparagraphs, numbered to correspond to individual blocks of the Inspection Tree, summarize the basis for individual ratings discussed above. For each category addressed in the reassessment, the weaknesses noted in the 1988 MTI are listed, in addition to progress/strengths and weaknesses noted during this 1990 inspection. To assist the licensee to explore perceived weaknesses, details of such items have been more fully developed in Section 5 of this report "Significant Issues Identified During the Inspection." Where an item has been so developed, it has been identified by the notation "See Issues."

3.6 Documentation Control System for Maintenance

1988 MTI Evaluation Summary:

Program: Satisfactory
Implementation: Poor

- The Trojan document control system failed to recover 10% of the MRs requested by the team.
- Post work operability verification signatures were not always provided.
- Supporting data to verify correct tool utilization on MRs was not always provided.

1990 Maintenance Reassessment:

Reassessment:

Program: Satisfactory
Implementation: Satisfactory

The Progress and Strengths noted in this area included:

- All MRs requested by the team were easily recovered. Responsible personnel and departments were identified.
- Maintenance tags associated with MRs were also tracked, providing a documented trail from a field deficiency to the current job status.
- All MRs sampled contained tool verification data.

The Weaknesses identified in this area included:

- Microfilm records were sometimes complicated to retrieve. A simple cross-reference index would help.
- Maintenance documentation completed prior to 1984 was difficult to retrieve.
- Several obsolete maintenance tags were found on service water system equipment.

5.1 Review of Maintenance in Progress

1988 MTI Evaluation Summary:

Program: Satisfactory
Implementation: Satisfactory

- o During the performance of maintenance controlled by a procedure, the procedure was not followed.
- o Maintenance personnel were failing to acquire the proper signatures for work package completion.
- o The work packages were not being generated in accordance with the appropriate procedure.
- o Maintenance personnel were not identifying, or were incorrectly identifying the work order when withdrawing materials and tools.
- o Post-maintenance testing was not being conducted or attested to as required by procedure.

1990 Maintenance Reassessment:

Reassessment:

Program: Satisfactory
Implementation: Satisfactory

The Progress and Strengths noted in this area include:

- o The team observed an improvement in craft awareness of procedural compliance requirements.
- o The team observed that an Electrical Maintenance worker stopped work and obtained a revision to an inadequate procedure.
- o Plant workers performed the majority of plant maintenance observed in a satisfactory manner.

The Weaknesses identified in this area include:

- o A policy instituted by the Plant General Manager to minimize the amount of material brought into the RCA to reduce solid waste was misinterpreted. To implement this policy, Radiation Protection routinely did not allow workers to carry work packages into the RCA.
- o In some instances, inadequate procedures were implemented without a procedure change (See Issues).
- o A mechanic did not follow work instructions while performing the Safety Injection pump lube oil cooler inspection (See Issues).
- o Field data was routinely discarded after transposing it onto "clean" forms following work (See Issues).

5.3 Maintenance of Equipment Records and History

1988 MTI Evaluation Summary:

Program: Satisfactory
Implementation: Poor

- o Historical records were not used for trending
- o The data entered into the Nuclear Plant Reliability Data System (NPRDS) was not adequately reviewed to ensure that the actual root cause for equipment failures was identified.
- o The maintenance equipment records were not being kept current because of the untimely review of completed work packages.

1990 Maintenance Reassessment:

Reassessment:

Program: Satisfactory
Implementation: Satisfactory

The Progress and Strengths noted in this area included:

- o The maintenance request tracking system allowed for quick location of maintenance requests, determination of outstanding requests, and provided records for equipment repair time and outage time.
- o There was an engineer assigned to the NPRDS, the backlog of NPRDS entries had been reduced, and the system was being used to generate Component Failure Analysis Reports (CFARs).
- o The proposed Maintenance Evaluation and Trending Program would identify, track, and trend equipment failures. Root cause analysis would be required for some failures.

The Weaknesses identified in this area included:

- o Equipment quality classification lists used by work planners were incomplete, unavailable, or provided conflicting information (See Issues).
- o Predictive trending had not significantly changed since 1988. Oil and vibration analysis was performed, but no formal program had been established (See Issues).

5.5 Performance of Work Prioritization

1988 MTI Evaluation Summary:

Program: Satisfactory
Implementation: Poor

- o No probabilistic risk assessment (PRA) techniques were used in the prioritization of work
- o Safety related (SR) work was not adequately prioritized

1990 Maintenance Reassessment:

Reassessment:

Program: Satisfactory
Implementation: Poor

The Progress and Strengths noted in this area included:

- o A new priority system, with more priority categories and detail, had been drafted but not yet implemented.
- o A better understanding of the maintenance backlog existed. Priority could be and had been given to perceived areas of weakness.

The Weaknesses identified in this area included:

- o The existing maintenance work priority program had not changed since 1988, when it was found to be weak.
- o The majority of work was categorized as routine, without differentiation made between safety related and non-safety related work.
- o Because priority had recently been given to outage planning, "routine" corrective maintenance was not being planned for completion unless it became highly visible to plant management, such as control board MRs.
- o Most MRs associated with backlogged NCRs were given a routine priority and did not have completion due dates assigned (See Issues).
- o The backlog of corrective maintenance MRs was still large.
- o Work scheduling still does not consider probabilistic risk techniques or other methods to review the cumulative affects on plant safety of removing from service multiple components at the same time.

5.7 Establishment of Backlog Controls

1988 MTI Evaluation Summary:

Program: Poor
Implementation: Poor

- o The backlog of MRs was tracked, but not reviewed to address outstanding items.
- o The licensee had not established threshold values or goals for backlog numbers (i.e. older than a month, three months and average days old).
- o The backlog of MRs was not characterized (i.e. waiting parts, outage related, established priority).
- o Some backlogged MRs could not be found.

1990 Maintenance Reassessment:

Reassessment:

Program: Good
Implementation: Satisfactory

The Progress and Strengths noted in this area included:

- o An elaborate program existed to monitor the backlog of MRs. MRs could be differentiated by priority, system, time to completion, outage/non outage, and responsible group.

- o Management and planning staff received weekly updates of maintenance backlogs.
- o The licensee could quickly identify who was responsible for MRs and establish MR locations.
- o The backlog of corrective maintenance work was decreasing.

The Weaknesses identified in this area included:

- o Although most corrective maintenance was characterized as "routine", including work on safety related components, there was no formal prioritization of routine work and there was no time constraint placed on completion.
- o The team found that some safety related corrective maintenance could be worked, but was on hold due to a lack of established priorities (See Issues).

5.8 Maintenance Procedures

1988 MTI Evaluation Summary:

Program: Satisfactory
Implementation: Satisfactory

- o The maintenance procedures were not consistent in format or content.
- o Review and approval of some maintenance instructions, which were incorporated in MRs, did not appear to require the same approval as maintenance procedures. Some instructions of this type had contributed to inadvertent plant trips.
- o The review of maintenance procedures did not consistently demonstrate that the procedures were technically correct for the work being performed nor did they appear to have been updated as the systems or components changed.

1990 Maintenance Reassessment:

Reassessment:

Program: Satisfactory
Implementation: Poor

The Progress and Strengths noted in this area included:

- o The licensee had committed significant resources to procedure improvement.
- o Procedures appeared to have improved.
- o Maintenance procedures appeared consistent within discipline areas, e.g. I&C, electrical, and mechanical.
- o Procedures had been updated to be consistent with some plant changes.

The Weaknesses identified in this area included:

- o Many maintenance procedures did not include enough detail to control work in a step by step fashion (See Issues).

- o No administrative requirements appeared to exist which required maintenance procedures, particularly troubleshooting procedures, to be written with enough detail to control work step by step (See Issues).
- o Work instructions did not always specify the electrical leads that were to be lifted and landed. This was allowed by plant administrative procedures (See Issues).
- o I&C calibration data sheets, which implemented plant design requirements, were allowed to be changed without engineering approval (See Issues).
- o The team observed that inadequacies with one maintenance procedure had not been corrected in the procedure upgrade program. Although the revised procedure had not been issued, the problems with the procedure were of a technical nature not likely to have been addressed by management review.
- o The Resident Inspectors had identified numerous examples of surveillance procedures which failed to implement Technical Specification surveillance requirements (Inspection Report 90-29).
- o Inadequate maintenance procedures for non-safety related work had contributed to a number of recent plant transients (Inspection Report 90-29). This included the installation of condenser tube plugs, the setting of the main feedwater pump wear detectors, and maintenance of the field generator output breaker.

5.10 Review of Completed Work Control Documents

1988 MTI Evaluation Summary:

Program: Satisfactory
Implementation: Poor

- o The program did not specify review completion times. Consequently, there were plant modifications, which had been competed for extended periods of time, that still had not had their associated work packages reviewed for adequacy and completeness.
- o Work packages that had been partially completed during a refueling outage had not received appropriate temporary closure including post maintenance testing. The team had identified several cases where equipment had been returned to service without appropriate post maintenance testing.

1990 Maintenance Reassessment:

Reassessment:

Program: Satisfactory
Implementation: Satisfactory

The Progress and Strengths noted in this area included:

- o The licensee had established and implemented an effective program for the timely completion of maintenance work document reviews.
- o The team had observed that reviews were conducted to adequate detail.

The Weaknesses identified in this area included:

- o The team found that in many instances the final work order package did not include the data sheets used in the field, but included only redrafted copies of the original data sheets created by workers following completion of the work (See Issues).

6.3 Establishment of Deficiency Identification and Control Systems

1988 MTI Evaluation Summary:

Program: Good
Implementation: Poor

- o Several of the uncorrected and/or recurring problems discussed in the Issues section of the 1988 MTI report demonstrated that the deficiency identification and control program had not been fully implemented.
- o In 1988, the licensee had not established a program to address the findings of their maintenance self assessment.

1990 Maintenance Reassessment:

Reassessment:

Program: Satisfactory
Implementation: Satisfactory

The Progress and Strengths noted in this area included:

- o In early 1989, the licensee established a Maintenance Improvement Program (MIP) containing over 200 action items. The MIP (redesigned the Maintenance Excellence Program (MEP)) action items were tracked, trended, and audited.
- o The diffuse corrective action programs were centralized under a new system (Corrective Action Requests or CARs). This system required that due dates be established and escalated management review be required for due date extension.
- o All CARs received management attention within a week of issuance (MCAC).
- o The licensee had established a site root cause assessment technique and had established a training program to implement it.
- o QA involvement in the identification and tracking of problems had increased significantly.
- o QA findings appeared to have been credible to the Maintenance Department and the response had been adequate.

The Weaknesses identified in this area included:

- o Although the MIP recognized a need for a centralized equipment classification list, the team found little progress on this document (See Issues).
- o Although QA recognized that I&C calibration data sheets had not been properly controlled (I&C was allowed to make changes without

engineering review), corrective actions did not include a review of the accuracy of current I&C calibration documents (See Issues).

- CAR evaluators were not required to have root cause evaluation training. However, the licensee was providing training and indicated that root cause training would be a future requirement for evaluators.
- NCRs which were produced under the old system were not given priorities, were not required to have due dates, and the due dates, when established, were not enforced (See Issues).
- Management programs, although required to be reviewed monthly, were not subject to QA review and assessment when due dates slipped (See Issues).

6.4 Performance of Maintenance Trending

1988 MTI Evaluation Summary:

Program: Satisfactory
Implementation: Poor

- Trends were not recognized (e.g. service water system. fouling, silt in instrumentation, out of calibration flow gages).
- Trending was not performed for instrumentation calibration problems.
- Inadequate root cause analysis was performed.

1990 Maintenance Reassessment

Reassessment:

Program: Satisfactory
Implementation: Satisfactory

The Progress and Strengths noted in this area included:

- Maintenance Evaluation and Trending Program (METs) has been online and was expected to provide a valuable equipment data base.
- The licensee had established an effective trending program for corrective maintenance backlog.
- The licensee had established deficiency trending. Periodic reports which established deficiency trends were available and used by plant management.
- The METS Program would require root cause evaluation of component failures.
- The maintenance request tracking system provided trending of outstanding maintenance items and provided the time equipment was out of service.

7. EXIT MEETINGS

On November 30, 1990, the team conducted an exit meeting at the Trojan Nuclear Plant with plant management. The meeting focused primarily on the issues identified during the inspection. On January 8, 1991, the team conducted a telephone conference call with senior plant management to present and discuss the reassessment of maintenance program elements as described in Section 6 of this report. Attendees of both meetings are listed in Section 1 of this report.