SERVICE WATER SYSTEM

OPERATIONAL PERFORMANCE INSPECTION

(SWSOPI)

COOK NUCLEAR PLANT

SELF-ASSESSMENT REPORT

MAY 5, 1995

Ray Siada for

PREPARED BY: Robert Stanley, GP/Cygna DATE: May 5, 95

APPROVED BY: [signature] DATE: 5/5/95

9505180505 950512
PDR ADOCK 05000315
G PDR

TABLE OF CONTENTS

EXECUTIVE SUMMARY

American Electric Power Nuclear Organization (AEPNO) conducted a Service Water System Operational Performance Inspection (SWSOPI) at the Cook Nuclear Plant from February 27, 1995 to March 31, 1995. This self-assessment was an AEPNO initiative led by the Nuclear Engineering Department and consisted of a team of ten reviewers from AEPNO's corporate office, Cook Nuclear Plant, and General Physics/Cygna Energy Services (GP/Cygna).

A full scale SWSOPI methodology was utilized for the self-assessment using NRC Temporary Instruction 2515/118, "Service Water System Operational Performance Inspection (SWSOPI)," as a guideline. The self-assessment was also conducted under the "Licensee Self-Assessment Related to Area-of-Emphasis Inspection," which is promoted by the NRC in Administrative Letter 94-03. In order to perform a self-assessment of this type NRC approval is required. The NRC performs an oversight of the self-assessment process, and then conducts a short inspection after the self-assessment report is issued. This review and oversight was conducted in accordance with Inspection Procedure 40501.

The NRC's SWSOPI requirements and objectives were incorporated into the self-assessment plan and the inspection was conducted accordingly. The objective was to assess the operational readiness of the Essential Service Water (ESW) System, placing emphasis on actions in response to Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment."

The ESW system was determined to be capable of fulfilling its thermal and hydraulic performance requirements and found to be operated consistent with its design basis. Operational controls, maintenance, surveillance, testing, and personnel training were found satisfactory, thus ensuring the ESW system will perform its safety related functions.

There were several programmatic strengths identified during the self-assessment. These were; overall operations, the zebra mussel program, the forebay inspection and cleaning program, and the self-betterment program in the Nuclear Engineering Department I&C Section.

However, there is need for improvement in some areas; specifically issues relating to Generic Letter 89-13. As a result of the inspection, fifteen condition reports (CRs) were issued for processing in accordance with GP 16.1/PMI-7030. No operability or reportability concerns were identified.

FINDINGS

The primary findings of this inspection are the following:

- Small margins exist in the flows to the containment spray (CTS) heat exchangers during the flow balancing operation. (CR 95-0510)
- Few pipe inspections are being conducted on the ESW system for microbiological induced corrosion (MIC) or fouling. (CR 95-0509)
- Acceptance criteria for inspecting safety-related heat exchangers are insufficient. (CR 95-0511)
- The heat transfer analyses of the component cooling water (CCW) heat exchanger tests do not meet Generic Letter 89-13 requirements to calculate the heat transfer at the design conditions after obtaining the fouling factors from the test data. Flow and temperature measurements need to be improved. (CR 95-0512)
- At times, a vacuum exists on the shell side (ESW side) of the CTS heat exchanger. During the post-LOCA recirculation mode, steam formation and reduced flow through the heat exchanger could result. (CR 95-0513)
- A partial summary report was not issued for RFC-3076 which would have assured that OP drawings and procedures were revised in a timely manner. It does not appear that there was adequate configuration/operational control for these valves. (CR 95-0421)
- Emergency diesel AB south combustion air aftercooler temperature indicator 2-XTI-301 is in disrepair and was reattached to its mounting with masking tape. (CR 95-0475)
- 12-RFC-2935 and 12-MM-227 upgraded the ESW pump's parts from bronze to stainless steel. Both design changes were closed out after all engineering work was completed, but prior to implementation at Cook Nuclear Plant. (CR 95-0476)
- Insufficient training has been conducted on Generic Letter 89-13 issues. Interviews with maintenance personnel indicate that understanding of MIC, silt accumulation, and corrosion is weak. (CR 95-0507)

Attachment B lists all CRs associated with this inspection. Attachment D lists the summary of the implementation of the five actions of Generic Letter 89-13.

RECOMMENDATIONS

To maintain the ESW system and to retain its capability to perform its safety related functions, the following actions are recommended:

R1 Evaluate the CCW heat exchanger supply piping for silt accumulation and reconfirm the flow instrumentation. If silt accumulations show potential impact on indicated flow, reperform the flow balance, i.e., if the actual flows in the line are found to be higher than previously thought. This extra flow to the CCW heat exchanger takes flow away from the CTS heat exchanger. (Ref: Plan Item 1.8)

R2 Continue development of the computer model for hydraulic analysis of the ESW system. Evaluate the flow balance for LOCA conditions when two pumps per train (one in Unit 1 and one in Unit 2) are expected to be running. Confirm that the flow balance valve lineup is valid under the operating case of the open train cross-tie valves (between units) with the other unit in each of its possible configurations. (Ref: Plan Item 1.1)

R3 Develop a heat exchanger heat transfer test program for testing and analyzing CCW heat exchangers which includes a basis for test requirements for the following:

- type of instrumentation
- number of each type
- sensor location

Test data analysis methodology should also include; source references for the equations used, sample calculations, and a calculation which supports the design data sheet. Verification should be completed for the analysis methodology. (Ref: Plan Items 1.19 and 4.13)

R4 Establish the flow rates in the flow balance at values close to the required flow rates. Currently, excess flow rates are established to the Emergency Diesel Generator (EDG) and CCW heat exchangers which contribute to low flow to the CTS heat exchangers. (Ref: Plan Item 1.8)

R5 Develop a pipe inspection program. The program should focus on the key Generic Letter 89-13 issues of silt accumulation, mussels, MIC, and corrosion and should include a timeline for completion. Inspection of the embedded piping in the turbine building foundation should be included. (Ref: Plan Item 3.7)

R6 Change the test flow rate for the IST pump test. The ESW pump is tested at a flow rate of 7,000 gpm. The accident flow rates in the flow balance are 9,126 gpm plus up to 80 gpm for the control room air conditioning (CRAC). Therefore, the test flow rate should be on the order of 9,200 gpm. (Ref: Plan Item 1.8)

R7 Since silt accumulation has been a historical condition at Cook Nuclear Plant, the ESW System piping should be radiographed at key locations to determine the extent of silt accumulation. These locations should include the following:

- the low points in the line to the CTS heat exchanger,
- the upstream and downstream piping adjacent to the flow orifices monitoring the CTS and CCW heat exchanger flows,
- and the 12" piping upstream of the 3" takeoff to the CRAC.

Cook Nuclear Plant has been in operation for over twenty years; therefore, silt accumulation could be significant at these low point and low flow condition locations in the ESW Sytem piping. (Ref: Plan Item 3.4)

R8 Develop inspection criteria for components in the ESW system which include quantifiable parameters. (Ref: Plan Item 3.4)

R9 Implement additional training for the maintenance supervisors and mechanics including topics such as silt accumulation, MIC, mussels, and corrosion (pipe wall loss). (Ref: Plan Item 3.13)

R10 Review implementation of significantly delayed modification packages to ensure the information is current from a technical and administrative aspect. (Ref: Plan Items 4.7 and 6.5)

Attachment E lists all the recommendations associated with this inspection.

1.0 INTRODUCTION

A SWSOPI self-assessment was conducted at the Cook Nuclear Plant and corporate offices by the American Electric Power Nuclear Organization (AEPNO) and General Physics/Cygna Energy Services (GP/Cygna). The self-assessment was conducted between February 27, 1995 and March 31, 1995, and was conducted by a team comprised of ten reviewers from AEPNO corporate office, Cook Nuclear Plant, and GP/Cygna.

The self-assessment team was comprised of the following members:

Team Leader:	David Powell, AEPSC - NED
Mechanical:	Robert Stanley, GP/Cygna Gregory Hines, AEPSC - NED
Operations:	Alan Tattersall, GP/Cygna Pat O'Neil, I&M - Operations
Maintenance:	Jeffrey Haverly, GP/Cygna Curtis Hehl, I&M - Maintenance
Surveillance and Testing:	James Olson, GP/Cygna Walter McCrory, I&M - Plant Engineering
Electrical and I&C:	Donald Kosack, GP/Cygna

The self-assessment methodology utilized for this effort was a full scale SWSOPI using NRC Temporary Instruction 2515/118 titled, "Service Water System Operational Performance Inspection (SWSOPI)," as a guideline. The self-assessment was also conducted as a "Licensee Self-Assessment Related to Area-of-Emphasis Inspections" promoted by the NRC in Administrative Letter 94-03. In order to perform a self-assessment of this type, NRC approval is required and the NRC performs an oversight of the self assessment process. This review and oversight is conducted by the NRC through Inspection Procedure 40501.

The NRC's SWSOPI requirements and objectives were incorporated into the SWSOPI Self-Assessment Plan. The self-assessment was then conducted in accordance with the plan. The plan covered the following areas; Mechanical Design, Operations, Maintenance, Surveillance and Testing, Quality Assurance

and Corrective Actions, and Electrical and I&C. The plan is included in Attachment A.

The objective of the SWSOPI was to assess the operational readiness of the ESW system, with emphasis on AEP's actions in response to Generic Letter 89-13 (GL 89-13), "Service Water System Problems Affecting Safety-Related Equipment."

<u>Assessment Objectives</u>

The objectives of the SWSOPI procedure are:

- assess the licensee's planned or completed actions in response to GL 89-13,

- verify that the service water system is capable of fulfilling its thermal and hydraulic performance requirements and is operated consistently with its design basis, and

- assess the operational controls, maintenance, surveillance and other testing, and personnel training to ensure that the service water system is operated and maintained such that it can perform its safety related functions.

The scope of GL 89-13 requests licensees to perform the following tasks:

1. Implement and maintain an ongoing program of surveillance and control techniques to significantly reduce the incidence of flow blockage problems as a result of biofouling in open-cycle service water systems.

2. Conduct a test program to verify the heat exchanger capability of all safety-related heat exchangers cooled by service water. The total test program should consist of an initial and periodic test programs and should include heat exchangers connected to or cooled by one or more open-cycle systems.

3. Establish a routine inspection and maintenance program for open-cycle service water system piping and components to ensure that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade performance of the safety-related systems supplied by service water.

4. Confirm that the service water system will perform its intended function in accordance with the licensing basis.

5. Confirm that maintenance practices, normal and emergency operating procedures, and training are adequate to ensure that safety-related equipment

cooled by the service water system will function as intended and that operators of this equipment will perform effectively. Confirmation should include review of practices, procedures, and training modules.

The Self-Assessment Plan contained topics which were evaluated by team members. Starting with Section 3.0 in this report, the individual topics from the plan are stated, and the inspection assessment is provided for the topic.

During the self-assessment, Requests for Information (RFI) were generated. The RFIs are listed in Attachment F. Assessment records were also used by each team member to record findings and observations for each assessment plan item. These assessment records are not included in this report, but are available in NED files for review.

2.0 GENERAL SYSTEM DESCRIPTION

The Essential Service Water (ESW) System at Cook Nuclear Plant is comprised of two supply headers (east and west) in each unit. Each header is cross-tied to a header in the other unit (i.e., 1E header is cross-tied to 2W header). Two isolation valves, which are normally open and do not automatically close, separate the headers between the units.

The east header in one unit, together with the west header in the other unit, (1E and 2W, 2E and 1W) is considered a train. Two ESW pumps (1E and 2W, 2E and 1W) supply water to each train.

Each ESW header in a unit supplies the following components:

- component cooling water (CCW) heat exchanger,
- containment spray (CTS) heat exchanger,
- control room air conditioning (CRAC) system,
- a primary supply to one of the Emergency Diesel Generators (EDGs) on the unit,
- an alternate supply to the other EDG on the unit, and
- emergency supply to auxiliary feedwater (AFW) pump(s) (one or two depending on the header)

A duplex strainer is located on the discharge of each pump, which will automatically backwash once a day from a timer signal. It also automatically backwashes on high differential pressure. The strainer is a duplex basket (when one basket is in service the other can be backwashed).

ESW pumps are located in the intake structure, which is a seismically designed structure and are located between each unit's circulating water (CW) pumps and behind the CW traveling screens. Water is drawn into the intake structure via pipelines which are 2,285' into Lake Michigan. A crib is provided at the entrance to each pipeline. The ESW discharge line returns water to the lake just downstream from the CW discharge tunnels and upstream of the CW discharge pipes, which extend 1,150' into the lake. The ESW discharge location is just downstream from the roller gate, which is closed to permit CW recirculation during winter operation.

During normal operation, water is supplied only to the CCW heat exchanger and the CRAC. Cook Nuclear Plant operators provide flow to the EDGs during winter, when ESW system flows are low due to low lake temperatures, to maintain minimum flow requirements.

If loss of power occurs, the EDG starts and the associated ESW pump is sequenced on. The EDG's ESW supply water valves are environmentally qualified and are located in a tunnel along with the steam line to the AFW turbine. In the event of a steam line break, the motor operators and controls can withstand harsh environmental conditions.

There are two safeguard actuation trains in each unit (A and B). In the event of a loss of coolant accident (LOCA), the solid state protection system (SSPS) will provide a start signal to all four ESW pumps (i.e., the Train A signal starts two Train A pumps (1E and 2W), and the Train B signal starts two Train B pumps (1W and 2E)).

The safety injection (SI) signal will also position the outlet valve on the CCW heat exchanger to provide 5,500 gpm. After the refueling water storage tank is depleted in the injection phase and if there is a permissive from the containment sump outlet valves, the SSPS automatically opens the outlet valves on the CTS heat exchanger to permit a minimum flow of 2,400 gpm.

Radiation monitors are provided on the ESW outlet of the CTS heat exchanger to detect a leak between CTS and ESW; otherwise, a leak would result in an unmonitored radioactive discharge to the environment during an accident.

The CRAC unit is non-seismic and non-safety related. An ESW cross-tie to the control room air handler is provided to supply ESW directly to the air handling cooling coil in the event that the CRAC is unavailable for service and cooling is required. Cross-tie valving must be performed manually. In an SI event, flow to the CRAC system remains aligned.

ESW provides a back-up supply to the AFW pumps in the event normal AFW system supplies are not available. Manual operation is required to initiate back-up flow to AFW.

3.0 MECHANICAL SYSTEMS ENGINEERING DESIGN REVIEW

Plan Item 1.1 - Review the design-bases, and other design documents such as calculations and analyses for the SWS, and determine the functional requirements for the SWS and each active component during accident or abnormal conditions.

The design basis is clearly stated in the Design Basis Document (DBD). Supporting information is identified in the System Description, Final Safety Analysis Report (FSAR), and Westinghouse analyses (WCAPS). FSAR Table 9.8-5 identifies the ESW system flow requirements.

The functional requirement for ESW system is to provide sufficient flow to the various components to remove the design heat loads. The component should be designed to operate in the expected environment, able to operate in the event of a single active failure, and designed to operate following an earthquake. Functional requirements for specific active components are:

- establish 5,500 gpm to the CCW heat exchanger in the event of a LOCA by positioning its outlet valve,
- establish 2,400 gpm to the CTS heat exchanger during the recirculation mode,
- establish flow to the diesel generators when they are started, and
- start the ESW pumps on either a loss of power condition or an SI signal.

The pump head requirement was determined in several calculations. Calculation HXP841106 began the series and was supplemented by HXP900626AF and others. A new computerized flow model, which is almost complete, is in development and provides a good evaluation of the hydraulic conditions. It is not yet modeled for all the design basis scenarios.

Various operating procedures were reviewed for correlation to calculations or other engineering output. Seven operating procedures were reviewed, and none contained requirements for ESW flow excluding minimum pump flow requirements. Comparison between PMSO.111 and the system operating procedure revealed different values (87.5°F versus 90°F) for maximum allowable

lake temperature. Procedure change request (PCR) 95-0259 was issued to rectify this discrepancy.

Plan Item 1.2 - Review the SWS configuration drawings for consistency with applicable design documents, NRC requirements, and licensing commitments.

The configuration drawings, test procedures, and vendor manuals were found to be consistent with design documents, NRC requirements, and licensing commitments. A flow balance test was performed to confirm valve positioning for an SI signal. The CCW heat exchanger is heat transfer tested for GL 89-13 requirements. ESW pumps are in-service tested (IST) in accordance with ASME Section XI requirements.

With the exception of a line size discrepancy on the CTS heat exchanger vent found during a walkdown, the flow diagrams matched Cook Nuclear Plant configuration.

Plan Item 1.3 - Review the SWS operation as compared to design documents.

Based on discussions with the system engineer and members of the inspection team and a review of plant documents, operation of the ESW system was found to be in accordance with design documents.

The system is flow balanced, as required; ESW strainer operates, as required; pump flows are within both minimum and maximum limits; and diesel generator heat exchangers are placed in operation when lake temperatures are low to assure that minimum pump flow requirements are met.

Surveillance tests for Train A and Train B SI signals are performed to start the associated ESW pumps. During normal configuration, one pump is operated on a combined pipe header to keep each train pressurized.

The procedures and observed operation of the ESW system conform to the design basis.

Plan Item 1.4 - Evaluate single active failure vulnerabilities of the system and the resulting impact on interfacing system components. Also, examine potential common mode failures from fouling of common intakes or traveling screens.

The single active failure review, which was performed for GL 89-13, was limited to a review of UFSAR Table 9.8-6, "Essential Service Water System Malfunction Analysis." Each unit is provided with two trains or headers throughout Cook Nuclear Plant, which is acceptable from a mechanical perspective.

The control system was reviewed, in particular the configuration for a train SI signal. Both Train A and Train B SI signals start two pumps on one header, which is acceptable since two pumps on a common pipe header provide the flows required for two unit operation.

The ESW pumps are located downstream from the CW traveling screens. The common ESW structure is downstream from the screens. While this provides a potential common mode failure (clogging of all screens), the remaining open area of the screens and the associated low flow rates as circulating water pumps are shut down would not prevent the ESW pumps from receiving lake water and thus being able to perform their safety function. The flow rate for the ESW pumps is very small compared to total circulating water flow.

Plan Item 1.5 - Review the effectiveness of design features installed to minimize silting and biofouling of the piping and components.

The general arrangement of the intake minimizes massive silt intrusions to Cook Nuclear Plant. Intake pipes take suction from a crib 2,285' into the lake. The water then flows to the intake structure. The bottom elevation of the intake structure is lower than the lake bottom and the west wall of the intake structure precludes silt movement into the intake. However, some silt does enter the system at the crib. Most of this is silt which is in suspension in the lake. Additionally, the ESW pumps are set back in the intake, which has low velocity areas where silt settles to the bottom, with a wall in front of the pump cells.

Intermittent chlorination has been less than completely effective in preventing veliger settlement and colonization in the service water system. Continuous chlorination is scheduled to begin May 1, 1995, pending expected approval by the Michigan Department of Natural Resources. A draft chlorination study is in the approval stages. Clamtrol treatment has been effective in killing mussels that colonize in the systems.

Plan Item 1.6 - Verify if features are provided for the timely detection of flow degradation and if flow balancing has been conducted during various system operating modes.

A flow balance is performed to verify that, for the valves which position automatically, the flows which are achieved exceed those flows required during the LOCA recirculation phase. System flow balances and component inspections provide timely detection of flow degradation. Additionally, the CTS loop is tested monthly at high flow rates to flush out silt accumulation. These are based on Recurring Tasks 18086 through 18089.

The Operations Department performs surveillances on the ESW system to determine whether the pumps and valves are operable per ASME Section XI valve & pump program requirements, which provide an assessment of pump and valve condition.

During the respective unit outages performance testing of heat exchangers and EDG coolers provides a satisfactory indication of potential flow degradation. These performance tests and associated results are discussed in more detail under Plan Items 1.11 and 4.12.

Plan Item 1.7 - Verify that pump run-out conditions are not present with minimum number of pumps operating with worst case alignment of non-safety related loads.

Computer flow analyses results were reviewed and indicated that the pump run-out condition is acceptable. The CRAC system is the only non-safety related load in the system and it is not automatically isolated for loss of power or LOCA scenarios. In the event it cannot perform its air conditioning function, there is a safety related capability provided. The ESW system can also provide water directly to the control room air handler cooling coil. Procedures are in place to manually start ESW flow to the coil and to isolate the flow to the non-safety related CRAC unit. Flow requirements for the CRAC or air handler coil are approximately the same.

Plan Item 1.8 - Verify that system flow balance data is consistent with key design assumptions.

Flow balance procedures for Units 1 and 2 were reviewed. Requirements in the flow balance test procedures and in test data were found to be consistent with the design assumptions which are listed in the DBD and UFSAR.

The results associated with these procedures, which were performed during the last three outages, were also reviewed. The flow balance satisfactorily demonstrated that the required flow during a design basis event would be delivered to the respective heat exchangers and coolers. However, the procedure does not verify design flow to the CRAC units. The flow to the CRAC is recorded. However, this data is taken with the temperature control valves (1, 2-WRV-711, 712) regulating flow to the chiller package condensers so that the maximum required flow cannot be achieved. Commitments relating to flow balancing were more associated with confirming the valve positioning, which automatically changes, than with confirming the actual system flow balance.

The flow balance results also show that the outlet valve on Unit 2 west CTS heat exchanger has to be fully open to deliver the required flow. Flow rates achieved for the three different tests reviewed were marginally above the required minimum flow. Additionally, the outlet valves for the other CTS heat exchangers were also found to be open more than 80% with achieved flows only marginally above requirements.

While design flows are achieved, there is minimal flow margin to the CTS heat exchanger. The individual flows achieved for each of the other components is appreciably higher than the values required in the flow balance procedure. Additionally, silt accumulation in the ESW supply lines to the CCW heat exchanger, upstream of the flow orifice, could cause false low flow readings. The ESW portion of the thermal balance in the heat transfer test has shown consistent low values, which may be due to errant flow readings. In addition, the results of the IST on the ESW pumps show the pumps are operating below their curves. This results in the operating point on the pump curve being significantly past the desired operating point. As a result the pump pressure is lower than expected.

The total effect of the three conditions (higher actual flows to the CCW heat exchanger due to silt accumulation flow errors, use of higher flow rates in the flow balance (resulting in the flow rate being past the pump design point), and degraded pump performance) could be the root cause of the reduced pressure, and thus flow, to the CTS heat exchanger.

The above conditions were modeled into both a computer simulation of the system and the computer flow analysis for the ESW system. The results showed that with higher flows to the CCW heat exchanger, lower pump total developed head, and higher flows to the EDGs the pressure at the CTS heat exchanger was reduced and the outlet valve in the model needed to be full open to achieve the required flows.

Item 1.9 - Check whether design features are provided to mitigate the effects of flooding caused by SWS leaks. Review NUREG 1275, Volume 3, Section 3.3, for information on SWS events involving actual or potential flooding.

Mitigation of flooding events appears to have been adequately addressed. Two additional manually-actuated flood protection pumps (approximately 200 gpm each) were added to the heater drain room sump pits in the early 1990s under PM 12-1187. Provisions were made for draining the ESW pipe tunnel by adding a 4" connection through the pipe tunnel wall, which drains water from the tunnel to the heater drain pump room, where it would be removed by the flood protection pumps. Combined capacity of the two pumps (400 gpm) is exceeded

by the flow rate from the postulated crack in the pipe (706 gpm). However, the time to flood-up to the ESW cross-tie valves (89 minutes) is sufficient to allow operator action to isolate the leak.

Annunciator response procedures 1/2 OHP4024.118/218, Drop 84, indicate that the operator is to check the level of water in the ESW pipe tunnel, by attaching a tygon hose to the tell-tale valve upstream of the tunnel drain valve, prior to opening the door.

As part of the seismic review, the consequences of failure of the non-seismic CRAC chiller was determined. Floor drains would direct the expected flow (75 gpm) to the turbine room sump. Sealing of floor penetrations, which was performed for fire protection reasons, would prevent water intrusion into the control room. This issue has been adequately addressed.

Plan Item 1.10 - Review the safety-related portion of the system for seismic qualification and verify that non-safety related portions can be isolated in accordance with the provisions specified in the system design bases.

Flow diagrams 1-5113 and 2-5113 were reviewed to identify interfaces with non-safety related equipment or piping. Consequences of failure of the non-safety related CRAC, which is located above the control room, is addressed under Plan Item 1.9.

Seismic aspects of the non-safety related CRAC system have been reviewed. The CRAC system and components were evaluated under the SQUG program and were found acceptable.

Automatic vent valves on top of the CTS heat exchanger are outside the in-service inspection (ISI) code class boundary and are thus non-safety related. This is confirmed by the classification in the facility data base (FDB). The design was reviewed and the vent valve and upstream piping were found to be mounted and supported seismically.

The CW system intake pipes are non-safety related, and Cook Nuclear Plant probablistic risk assessment (PRA) considers their failure as non-credible. In the remote possibility that the intake pipes do fail, sluice gates WMO-17 and WMO-27, between the forebay and the discharge pipe, allow recirculation of the ESW system, thus maintaining the heat sink. The annunciator response procedure for extreme low forebay level directs the sluice gates to be opened and then to "continue efforts to restore circulating water." Other actions, such as temporary makeup from the lake with portable pumps, could maintain heat sink requirements and should be listed in the response procedure.

Plan Item 1.11 - Review the program for monitoring system degradation.

No formal system exists to monitor system degradation other than ASME Section XI IST pump and valve testing. The system flow balance and heat transfer test results from sequential tests can be compared as a form of system degradation monitoring.

The as-found flow balance data has shown that changes between tests and corrections to throttle valve positions have been made as a result of the findings.

Existing heat transfer test results appear to be inadequate to assess degradation because discrepancies exist in the test data. The test can demonstrate that the heat exchanger is adequate, but good trend data has not been developed.

Plan Item 1.12 - Review the setpoints for alarms and actuations to ensure they are consistent with the design bases and assumptions.

Actual versus required submergence of ESW pumps was reviewed. Required net positive suction head (NPSH) at 13,600 gpm is 38.5' (5.5' submergence). The setpoint for forebay extreme low alarm (XPS-813, -823) is 565' elevation. The pump is located at elevation 547', so a worst case submergence is 18', at runout flow, which is acceptable.

There are no formal documented calculations for non-safety related process setpoints or instrument setpoints. A review of the various process instruments indicated that calculations which would otherwise be performed under the engineering control procedure are not prepared for non-safety related instruments. There are no uncertainty setpoint analyses expected to be prepared for the ESW system. See also Plan Item 6.1.

Plan Item 1.13 - Review the system design bases to ensure that the functions required are met.

System design bases were compared to drawings and procedures and found to be acceptable. The functions required by the design bases (pump start on SI signal, flow established to the CCW heat exchanger on an SI signal, flow established to the CTS heat exchanger upon entering recirculation mode, required flow rates established to the components, environmental qualification of the valves to the EDGs, ESW pump start following a blackout, and cleaning of the strainers) were all satisfactory.

Plan Item 1.14 - Evaluate the adequacy and consistency of the existing system/component with respect to the design bases.

Information on major components of the ESW system was reviewed (pump manual, heat exchanger manuals, heat exchanger data sheet, pump specification). The data in the documents was found to be consistent with the information in the DBDs.

During a walkdown on March 8, 1995, the mounting feet of the CCW heat exchangers were examined. It was expected that some provision to allow expansion would be evident. However, no such provision was seen. Review of the vendor information also indicated that elongated holes were provided in the mounting feet to allow for thermal expansion of the shell.

This condition was previously examined under Problem Report (PR) 92-316 as a result of a QA audit. Review of the PR file showed that the shell mounting was not installed properly and that expansion was restrained, which placed additional stress on the mounts, causing cracks in the grout and/or concrete. This condition was evaluated by Structural Design personnel who concluded that the damage was minor, no additional damage was occurring, and the mounts were structurally sound.

Plan Item 1.15 - Assure availability of power circuits under all operating and design bases conditions.

A review of the availability of IE power circuits under various postulated operating and design bases conditions was performed. Circuit availability was determined to be acceptable.

Plan Item 1.16 - Review instrumentation for range and accessibility.

The calibration procedures and calibration data sheets associated with the ESW system were reviewed to ensure that the range associated with the installed instrumentation was consistent with both the DBD and supported the various operating and surveillance procedures. A walkdown of the ESW system was performed to verify accessibility of the instrumentation for performing required calibrations and also for supporting local operations/data gathering during performance of surveillances or emergency operations. There were no areas of concern noted with either the range or accessibility of the installed instrumentation.

Plan Item 1.17 - Verify the adequacy of system/component controls and protection logic.

Review of the design drawings and associated elementary diagrams indicated that the system/component controls and the protection logic associated with the ESW system are satisfactory. The interlocks associated with operation of the outlet valves of both the CCW and CTS heat exchangers, auto-start of the ESW pumps upon receipt of either a low header pressure signal or safety injection signal, automatic operation of the ESW backwash strainers, and diesel load sequencing associated with tripping and loading of the ESW pumps were reviewed and found satisfactory.

Plan Item 1.18 - Review all modifications to the SWS and select at least three significant modifications for a detailed review.

Modification packages 12-MM-227 and RFC 12-2935 were reviewed. They both concerned a material change for pump parts. Material specification for the impellers and wear rings was changed from bronze to stainless steel.

New components were ordered for two pump assemblies and both were delivered. Neither assembly was installed in the plant. Both assemblies were found in the warehouse.

The modification packages required the vendor to test the assemblies; therefore, the pumps were tested, and the test curves were found to be acceptable. Since there are no modified pumps currently installed in the plant, there have been no in-plant tests of the new assemblies.

The modification packages were closed-out prior to installing the pumps. CR 95-0476 was initiated to assess whether the procedures were properly used to close the modification packages prior to installation of the equipment.

The tie-in of modification RFC 12-3076 to the ESW system is discussed in Plan Item 2.1.

Plan Item 1.19 - Evaluate the Cook Nuclear Plant assessment to Action IV of Generic Letter 89-13.

The GL 89-13 response indicated that a review of the FSAR was performed as the single failure review for ESW and was found to be acceptable. This review was based on UFSAR Table 9.8-6, "Malfunction Analysis." However, it was found to be incomplete because the table is exclusively for mechanical equipment.

The team reviewed the SSPS interface and identified that each train's SI signal starts two pumps (one pump per unit, each on the same train). The single failure of this design was found to be acceptable.

The GL 89-13 response did not address a design review. However, a DBD was recently written for the ESW system, and the team found that the development and review of the DBD serves as a design review for GL 89-13 purposes. This is judged to be acceptable.

4.0 OPERATIONS

Plan Item 2.1 - Perform an in-depth system walkdown. Review the SWS configuration for consistency with design drawings.

Comparison of the design documents to the operating procedures and the system walkdown verified, with the exception of minor deficiencies, that the design and operating documents agree; as-built configuration is as shown in the drawings and described in the procedures; and Technical Specification surveillance requirements are adequately implemented through the surveillance test procedures (STP).

During comparison of the OP and OHP, the following discrepancies were identified:

- valves listed in the OHP, but excluded from the OP, or
- inconsistent component designations

These discrepancies were addressed in PCR 95-0246.

During the walkdown, Unit 1 and 2 were identified as being in the process of implementing RFC 12-3076 which installs a radiation monitor sampling of the ESW return header to the CW discharge header. The valves (1 or 2-ESW-283E/W) that isolate the ESW header and the new radiation monitors are installed, and the connecting piping appears to be complete. These valves are not included in the OHP valve line-up sheets for either Unit 1 or 2. The valves for Unit 1 are shown on the OP, but the valves for Unit 2 are not. OP drawings and OHP valve line-up sheets had not been revised and a partial status report was not completed in a timely manner. Proper completion of these actions would have resulted in the valves being appropriately turned over to Operations and consequently controlled as the boundary isolation valves. CR 95-0241 was written to document this issue for evaluation and corrective action.

During the walkdown, discrepancies in the valve line-up attachments to 12-OHP-4021.019.001 were identified which consisted of incorrect locations and component designations. PCR 95-0258 was written to correct these discrepancies.

Performance of Surveillance Test 01-OHP 4030.STP.022E was observed on March 29, 1995. A five-minute flush of the CTS heat exchanger was performed to ensure that the previously observed sludge build-up does not reoccur. No issues were raised as a result of the observation of this surveillance.

During a walkdown of the vent line to/from 2-QP-56W, on the CTS heat exchanger, it was determined that the line is 1/2", yet OP-2-5113-42 shows this line to be 1". CR 95-435 was written to evaluate and resolve this issue.

This area is acceptable.

Plan Item 2.2 - Review the SWS alarm response procedures and operating procedures for normal, abnormal, and emergency system operations.

During review of Unit 1 and 2 annunciator response procedures, it was noted that the drops for the auto ESW pump start on low header pressure (40 psig) did not make reference to low intake levels as a possible cause. The emergency recirculation valve WMO-17/27 would have to be opened to correct for this problem. PCRs 95-0278 and 95-0279 were issued to resolve this item.

The operations procedure group supervisor was interviewed regarding how Operations procedure changes are communicated to the on-shift Operations personnel.

During this review, it was determined that the annunciator response procedures refer to different transfer switch positions than shown on the wiring diagram, which are also engraved on the instrument bezel. PCRs 95-0290 and 95-0291 were issued to resolve this item.

PMSO-111, Rev. 1, dated October 20, 1992, stated that the maximum allowable CW (ESW inlet) temperature is 87.5°F. The ESW operating procedure, 12-OHP 4021.019.001, states in Step 2.11, "Do not operate either unit with circ water temperature ... above 90°F." PCR 95-0259 was issued to resolve this item.

This area is acceptable.

Plan Item 2.3 - Review operating logs to determine the adequacy of temperature and flow monitoring.

Temperatures logged on the tour sheets are for systems cooled by ESW (e.g., EDG jacket water and EDG lube oil). There are no local temperatures or flows for ESW monitored or recorded on the tour sheets.

Temperatures recorded in the control room are the CW inlet and ESW return header temperatures. The only action required is based on a high temperature alarm on the ESW return header temperature (92°F) when the operator is directed to increase flows. The ESW system flow is normally varied to maintain CCW temperature within specified limits (i.e., 60 to 95°F).

There are no ESW flows recorded in the control room. Flow monitoring is done to assure that the ESW pump's minimum flow requirements (2,000/3,000 gpm) are met. No reasonable scenario exists under normal operating conditions that could lead to pump run out.

This area is acceptable.

Plan Item 2.4 - Review operator training for the SWS, ensuring that the lesson plans reflect the system modifications and that the licensed operators have been trained on these modifications.

PMP 5040 requires the Training Department to evaluate the impact of modifications on training. This requirement is implemented through a normally scheduled weekly meeting, when necessary, that is attended by the Plant Engineering, Operations Training, and Training Departments. Action items resulting from this meeting are tracked by the Operations training specialist and Training Departments to insure closure. The same process applies to the management and technical staff (M&TS) training programs at the plant.

M&TS personnel at Cook Nuclear Plant and the engineering support personnel (ESP) in Columbus have orientation and continuing training on ESW using the same lesson plans. However, the lesson plans are modified for the ESP in order to more appropriately cover material for the Columbus departments. M&TS instructors are SRO certified and participate in the Operator Requalification Training Program (Requal). They facilitate the transfer of material on plant modifications or procedure changes from the Requal program to the continuing program for M&TS. Content of the continuing program for ESP is determined by appropriate section managers. Both programs have covered microbiologically induced corrosion (MIC) within the past two years.

A recent modification, MM-454, to the ESW system impacted operations which changed two motor operated valves (MOVs) and has been incorporated into the training material. Plant modifications incorporated into lesson plans are noted on the cover sheet of the lesson plan.

This area is considered good.

Plan Item 2.5 - Review the proper implementation of procedures for verifying periodic and post-maintenance alignments of valves in the SWS, especially those valves that isolate flow to safety-related components.

The clearances for various job orders (JOs) were reviewed, and no discrepancies were noted. Equipment was declared operable and returned to service based upon satisfactory completion of the required surveillance test (OHP 4030.STP. 022W). There are additional strict controls on the performance and completion of work (PMSO 122) that requires Cook Nuclear Plant to voluntarily enter an action statement.

No issues were raised during the review of PMSO 122 and PMSO 154.

This area is acceptable.

Plan Item 2.6 - Verify that required accident condition flow is not degraded during normal system operation valve alignments.

This review was completed during Plan Item 2.2. All issues are identified in that section.

The system valves are adjusted for temperature control purposes at the outlet of the CCW heat exchanger as discussed in Plan Item 2.7. While these adjustments change flow rates, the valves are automatically repositioned in response to SI signal requirements. Therefore, operations changes do not degrade the system alignments.

Plan Item 2.7 - Review control of SWS heat exchanger flow variations due to changing climate (temperature) conditions.

Procedures that cover operation of the CW system to increase the forebay temperatures for zebra mussel chemical injection or for placing the de-icing system into operation have limits on forebay level. The limits specified ensure that there is an adequate height of water above the ESW pump suction to meet NPSH requirements. A concern was noted regarding the reason why these limits

were not also specified in the normal operating procedure for CW. PCR 95-0311 has been written to address this issue.

None of the CW procedures take exception to the temperature limits on ESW supply temperature as stated in OHP. 4021.019.001.Compliance with the limitations for maximum CW inlet temperature to ESW stated in OHP 4021.019.001 ensures that the ESW system is operable from the standpoint of temperature.

The only flow variations normally initiated from the control room involve adjusting the ESW flow to the CCW heat exchangers for CCW temperature control or opening/closing the MOVs to the EDGs to insure that minimum flow requirements for the ESW pumps are maintained. These manipulations do not affect the ability of the ESW system to meet its design requirements.

None of these evolutions affect the ability of the ESW system to meet its design heat removal requirements.

This area is acceptable.

Plan item 2.8 - Walk through the system operating procedures and the system piping and instrument diagrams with engineering and operations staff, as appropriate. Verify that the procedures can be performed and that components and equipment are accessible for normal and emergency operation.

The ESW operating procedure and the system flow diagrams were used to walk through removal and return to service of the ESW loops. During this walkthrough, it was determined that vent valve 2-ESW-213 is practically inaccessible and would be very difficult to operate to vent the system as required by the procedure. PCR 95-0286 was written to correct this issue.

In order to determine whether this valve had been operated previously, station records and Cook Nuclear Plant archives were researched. The last time this procedure attachment had been completed was December 22, 1993. At this time, the operator noted in the procedure that 2-ESW-213 was not operated and the procedure was annotated to say, "Not required to be vented."

The completed valve line-up attachments to OHP 4021.019.001 were reviewed back to 1992 to see how the inaccessible valves found on this "walkthrough" were annotated. ESW-236/237, the two valves in question, were noted as being inaccessible in these valve line-ups.

This area is acceptable.

Plan Item 2.9 - Verify that the operators' knowledge of equipment location and operation is adequate.

Operations personnel were questioned on the following topics:

- Describe how to manually shift ESW strainers.
- How do you determine the position of the slide gates locally?
- What is the normal indicated differential pressure across the strainers?
- What are the actions if there is a sump level alarm in the pipe tunnel?
- Where are the ESW MOVs that supply the EDGs located?
- How many valves are located there?
- Where are the ESW outlet valves from the CTS heat exchangers located?
- What is the effect of zebra mussel infestations in the ESW system?
- Where and how do you align ESW to supply makeup to the motor driven/turbine driven auxiliary feedwater pumps?

All operators correctly answered the questions or demonstrated an understanding of the question and gave the correct reference where the detailed information could be found.

The licensed operator replacement class in the simulator was observed during the performance of a scenario involving an ESW rupture. Although this class is not composed of operators who have been working together for an extended period of time, the crew's interactions were clear and understandable. Communications were properly acknowledged, and the crew successfully responded to the symptoms using the correct procedures.

This area is good.

Plan Item 2.10 - Interview the operators to determine the adequacy of their technical knowledge of such items as the operation of the system, its role in accident mitigation, technical specification surveillance requirements, and determination of operability.

Licensed and non-licensed operators were questioned on the following topics:

- How do you determine the operability of the ESW system when relieving the watch?

- What are the system's normal indicated flow rates and pressures in the winter/summer?

- What are the system temperature limits?

- What temperatures and flows are used to control ESW?

- Describe the ESW system response to safety injection actuation, containment spray actuation, loss of offsite power.

- Describe actions taken to transfer from RWST to cold leg recirculation.

- What methods are used to control the infestation and growth of zebra mussels?

- Describe the possible indications in the control room due to zebra mussel growth in the ESW system.

All operators correctly answered the questions or demonstrated an understanding of the question and gave the correct reference where the detailed information could be found.

This area is good.

Plan Item 2.11 - Review the local operation of equipment. Determine if the indication available to operate the equipment is in accordance with applicable operating procedures and instructions. Verify that the environmental conditions, such as expected room temperature, emergency lighting, and steam, assumed under accident conditions are adequate for remote operation of equipment.

This activity was performed in conjunction with Plan Item 2.8. Equipment required to be operated during a fire (Appendix R) is accessible and specifically designated Appendix R emergency lighting is available to allow operation of the equipment.

This area is acceptable.

Plan Item 2.12 - Assess operational controls for traveling screens and circulating water pumps to preclude excessive drawdown of the intake bay, with associated loss of SWS pump suction head, as a result of clogging the traveling screens. Assess operational requirements for the sliding sluice gates.

During review of procedure 01 or 02-OHP 4021.057.002, "Placing In/Removing From Service of the Circulating Water De-Icing System", it was noted that Precaution 4.5 included a table for required forebay level as referenced to lake level for normal and de-ice operation. This table states the maximum deviation of forebay level allowed from normal lake level, assumed to be the average lake level of 578', based on the number of CW pumps in service. The precaution states that the table shall be used to verify that the intake structure is operating normally. This information is not included in the normal operating procedure 01/02-OHP 4021.057.001 for the CW system. PCR 95-0313 was written to correct this issue.

This area is acceptable.

Plan Item 2.13 - Assess the effectiveness of the OE Program.

A review was performed of completed SERs, SOERs and CRs. The following SERs and SOERs were relevant to ESW:

- 84-15, "Low Water Level in the Intake Bay due to Ice";
- 84-16, "Diesel Generator Coolers Plugged with Asiatic Clams";
- 84-73, "Microbiologically Induced Corrosion (MIC) Wolf Creek/Palo Verde";
- 86-36, "ESW Pump Failure due to Suction Recirculation and Erosion"; and
- 88-7, "Flooding of the Service Water Bay."

Records of the five SERs selected showed that each had been evaluated and that the appropriate action was taken. In each case, the evaluation was reviewed and approved by the STA supervisor who, at that time, was responsible for this activity.

Four CRs, which dispositioned OE events from INPO Nuclear Network (94-0255,94-0256,95-0081,95-0168), were reviewed and found to be satisfactory.

This area is acceptable.

5.0 MAINTENANCE

Plan Item 3.1 - Conduct an in-depth system walkdown to review the as-configured system for material condition.

Material condition inspections of the ESW system structures, systems and components were performed, which included:

- assessing material condition of ESW components and related areas,
- assessing plant housekeeping,
- assessing and recording of AR tags for later validation,
- obtaining a sample of ESW component nameplate data for later validation,
- system familiarization,
- observing work/modifications in progress, and
- observing work controls for work in progress.

The following conditions were found:

- Flexible conduit and conduit fittings were loose and ill fitted. Instances in which excessive "slack" existed in power and/or instrument cable/conduit were identified for the following components: 1-PP-7W, 12-HV-ESW-5 and 2-PP-7E (power and instrumentation/heater cables). AR 91600 was issued.
- Loose grease fittings with grease leakage were found on the 1-PP-7W Farval grease unit. AR 91599 was issued.

- AR tag #55460 was found hung on valve 1-WRV-767. Further investigation discovered JO C19606, to repair the deficiency, was completed October 1993. The tag was stated as being removed during close-out, but was not. An open CR 95-137 already existed so a new one was not initiated.

- The junction box for 2-WMO-738 was found with its fire wrap removed (during maintenance) and its cover hanging partially open in an unsecured manner. A fire watch was in place due to the removed fire wrap. AR 91643 was issued.

- Radiation monitor WRA-713 has a power lead to the monitor, with a length of over 6', to travel a distance of 1-2'. The cable found lying on the floor, whichpresented a tripping hazard, was wrapped through the handrail. The safety representative corrected the safety hazard condition.

- Temperature gage 2-XTI-301 was found hanging by its bimetallic wire. AR 79935 was identified for this component; however, no AR tag was found at the location.

- The ESW system outlet piping downstream from CCW heat exchanger HE-15W was found to have a hold down nut missing from its pipe support. CR 95-0382 was initiated.

- A pipe cap was missing on 1-WTX-737W and was later replaced.

Generally, Cook Nuclear Plant is clean and equipment is properly stowed.

Plan Item 3.2 - If possible, witness maintenance performed on the selected system. Review maintenance package preparation and observe quality control involvement.

Paperwork for job C28546 was reviewed (perform infrared inspection of power lead connections) with no discrepancies noted.

Paperwork for R0041744 was reviewed, and the job performance was discussed with maintenance personnel. The package appropriately specified the quality and torque requirements. The CTS heat exchanger vent valve was replaced, and the lines to the valve (from connection flanges) were cleaned. The vent valve was inspected following removal from the system. Rust, corrosion, and evidence of MIC existed in the valve.

In regard to identification of equipment deficiencies, the following related to R0041744:

- The repetitive task initiated by RCM did not include any reference to inspecting open systems for evidence of corrosion.

- The task did not include any activity to call in the system engineer to perform inspections for MIC or other corrosion mechanisms, as could be considered appropriate when the ESW system is opened.

- The performing maintenance mechanic did not have any of the training on GL 89-13 issues from the upgraded lesson plans as committed to in the GL 89-13 responses.

- The inspection of the vent valve demonstrated that corrosion mechanisms are deteriorating the vent valves. While 1-QP-56E was been changed out in March of 1993, similar tasks do not exist for either 1-QP-56W or 2-QP-56E.

In general, maintenance appears to be performed in accordance with written JOs; JOs appear to have adequate detail to ensure safe and accurate job performance; and awareness of requirements related to job cleanliness and control of asbestos appears good.

Plan Item 3.3 - Review maintenance procedures for technical adequacy.

Procedure 12MHP.5021.001.154 deals with rubber expansion joints and shows minimum/maximum face-to-face dimensions for each joint. It includes a drawing showing minimum/maximum stops on a typical joint. The XJ-54 expansion joints (ESW to the EDGs) are in the procedure; however, non-safety related expansion joints in the ESW pipe tunnel (XJ-56) are not. Preventive Maintenance Change Request #396 was initiated to add the XJ-56s to the preventive maintenance (PM) program to be replaced with the same frequency as the XJ-54s.

Procedure 12MHP.5021.019.022 makes reference (step 6.2.7) to setting of "stretch bolts." To determine the proper "stretch bolt" adjustment, this procedure should reference the procedure previously discussed which lists the various joints with their allowable maximum/minimum face-to-face dimension. The maximum extension and compression are restrained by adjusting the "stretch bolts" (called "control rods" in that procedure). These two procedures should reference each other and use consistent terminology. Inspection of some of the joints in the pipe tunnel indicates that some do not have limits installed to prevent over-compression of the joint.

Maintenance procedure **12MHP5021.019.001, "Essential Service Water Pump," has an acceptable level of detail to properly guide pump installation and

removal. The procedure reflects vendor recommendations. Pump performance and system availability reflect the performance of proper maintenance.

The Limitorque and MOV testing procedures were obtained and reviewed only as they apply to ESW system MOV/EQ components. Maintenance procedures are in place for ESW EQ valves WMO-721 through 728. The MOV and EQ procedures were discussed with the MOV engineer. No issues were identified.

Several ESW component maintenance procedures used on ESW system components were reviewed. No other issues were identified other than those discussed in Plan Items 3.4, 3.5, and 3.7.

Other than for EDG aftercoolers, no procedures exist to provide guidance for performance of heat exchanger maintenance. JOs were randomly reviewed on NPM. The following inspection JOs were evaluated in hard copy: R25622 (1-15W), R27105, (2-15W) and R25623 (1-15E). These address both inspection and cleaning.

As related to cleaning of CCW heat exchangers, JO R0025623 states (Activity 4, Step 2), "Thoroughly clean the interior of heat exchanger including tubes. Refer to VICS #700, Sect. 4 pg 12 E-4.31 'Cleaning Tubes'," where that vendor manual provides options for cleaning heat exchangers including: 1) use of hot wash oil or light distillate, 2) use of available chemical cleaning compounds, etc. Further procedural guidance should be provided which specifies the cleaning technique to be used and when the cleaning should be performed. Additional procedural steps should delineate the cleaning processes to be considered and/or utilized.

Additional guidance is needed in the instructions for performing cleaning of heat exchangers, particularly in those JOs for cleaning of CCW heat exchangers.

No other technical deficiencies were identified.

Plan Item 3.4 - Determine if maintenance procedures are sufficient to perform the maintenance tasks and provide for identification of equipment deficiencies.

In addition to the on-screen review of corrective maintenance JOs on NPM and a hard copy review of many specific completed JOs, maintenance procedures were also reviewed.

No maintenance procedures could be identified which provide guidance for maintenance on the following components:

- ESW pump duplex strainers - Maintenance has not been performed on the strainers for at least six years. Per JOs 723483 and A12536, an incident of strainer inspection and necessary rework appears to have been necessary in May 1989 and June 1989. Using a procedure to guide the performance of strainer refurbishment could have prevented such rework.

- Valves WRV-721 through 728, Robertshaw ESW flow control valves to EDG air aftercoolers.

- Valves WMO-733, 734, 737, 738, CCW heat exchanger outlet valves. These valves have recently been replaced. The modification package states that no maintenance procedures are to be developed even though spare parts are being procured..

No procedures exist to provide guidance during the performance of tube plugging.

Procedure **12MHP5021.019.001, "Essential Service Water Pump," was reviewed. Other than the issues discussed in Plan Item 3.5, no deficiencies were noted. Recording requirements for as-found and as-left measurements, equipment calibration verifications, and QC hold points is considered a strength.

The maintenance planning procedure requirements ensure that JO completion remarks are recorded and undergo a supervisory review during JO review and close-out, thus identifying equipment deficiencies during maintenance performance. The completion remarks were reviewed on a number of work orders, both on-screen NPM and in hard copy. These remarks are extensively recorded and additionally entered into the NPM recorded copy of each JO during close-out.

Plan Item 3.5 - Compare maintenance procedures to vendor manuals to identify any vendor recommendations not incorporated into the procedures.

The ESW pump vendor manual includes site specific guidance for removal and re-installation of the ESW pumps which is not included in the procedure. Vendor technical data VTD-JOHN-0002 includes OTH-00119 which does not appear to have been incorporated into the maintenance procedure. See Plan Item 3.6.

NRC Information Notice 94-45, "Failure of Service Water Pump at Grand Gulf," was evaluated for thoroughness of review, applicability, and implementation of any corrective actions at the Cook Nuclear Plant. This evaluation included reviews of both the applicable vendor manual for ESW pumps, VTM-JOHN-

0001, and applicable corrective maintenance procedures. No issues were identified.

An evaluation was performed of the maintenance procedure against the vendor manual. Technical specifications of the vendor manual were validated against the procedure. The vendor manual has site specific guidance for removal and re-installation of the ESW pumps which is not included in the procedure.

The CCW heat exchanger vendor manual was reviewed against those Corrective Job Orders (CJOs) for CCW heat exchanger inspection and cleaning tasks. No discrepancies were identified.

The CTS vendor manual was reviewed against those CJOs for CTS heat exchanger inspection tasks. No discrepancies were identified.

Regarding the strainer vendor manual, no maintenance procedure exists for performing maintenance on the ESW pump duplex strainers. No maintenance requiring the opening of those strainers for inspection has occurred since 1989.

The EDG maintenance procedure was reviewed against the vendor manual. Very little maintenance related guidance was identified within the vendor manual. No discrepancies were noted.

Plan Item 3.6 - Determine if vendor manuals are available and maintained current.

The vendor manuals and the procedure for control of vendor documents were reviewed. Vendor manuals were found to be available to address those ESW components considered in the review. Cook Nuclear Plant has embarked upon a vendor manual improvement program. Manuals that have been processed through the program have been significantly improved.

The overall vendor manual upgrade program has made significant improvements in the quality of manuals processed through the program and implementation of INPO's recommendations.

The vendor manual upgrade program appears to allow the incorporation of vendor-related information into newly approved vendor manuals without receiving engineering review regarding its authenticity, origin, and/or appropriateness to the components addressed in the manual.

Review of VTM-JOHN-0001, "Vendor Technical Manual for Johnston Pumps," identified an issue relating to maintenance related information that has been

incorporated into the manual. Section VTD-JOHN-0002 includes two specific source documents that have been incorporated into the manual which do not appear to have been processed through an engineering review. Documents OTH-00119 & OTH-00123 do not show any reference regarding the origin of the documents, the engineering review and approval of the documents, or the applicability of the information to these specific components. Inclusion in this manual could allow referencing this information when performing safety related maintenance.

Procedure 12 PMP 2030 VICS.001, Attachment 13.1, provides guidance for identifying source documents as category "OTH." Per discussions with the VTM specialist, these OTH documents included in the upgraded manuals appear not to have been processed through a validating engineering review. CR 95-0508 was issued to address this item.

No other issues were identified.

Plan Item 3.7 - Review the periodic inspection program used to detect corrosion, erosion, protective coating failure, silting and biofouling.

Forebay Inspections:

The intake forebay and intake piping inspections are performed in accordance with the commitments. Procedure 12THP6020ENV.101, "Mollusk Biofouler Sampling and Analysis," describes the processes and requirements for inspection and sampling of these locations, and for the presence of macroscopic biological fouling mechanisms, corrosion products, and debris. Inspections and sampling are performed once per refueling cycle. Sand and debris are removed and multiple samples are taken and analyzed from specified locations, including sediment samples and substrate location points. Sampling and inspections are performed during the warmer months when high mollusk growth is expected. Beach walks are also performed. No issues were identified in this area.

Regarding corrosion, one of the diver inspections noted the "clean galvanized metal" appearance and the absence of rust on the intake pipe. There are no other known applications of protective coating used in the service water system.

The maintenance supervisor who is responsible for removing zebra mussels and cleaning intakes and the forebay was asked how much silt typically accumulates in the forebay. He reported that 6" to 12" of silt and sand is found in the low-flow areas (e.g., corners) of the forebay during inspections. This material is removed by using the equipment for removing dead zebra mussels.

The environmental engineer stated that intake inspections are performed as time and plant conditions permit. Cleaning is performed based on previous inspections and availability of funds. This philosophy appears to be adequate based on Cook Nuclear Plant operating experience as noted above.

The forebay inspection program was found to be a strength.

Various other program documents, JOs and technical references were assessed. Validation of the inspection program for commitment compliance and technical adequacy was performed.

The following was identified:

- ESW system heat exchanger inspections have been implemented without standardized inspection criteria. Approved procedures have not been used for performance of the inspections. No trending or comparative analysis of inspection data which could be used to demonstrate heat exchanger improvements has been performed. Records of inspections have not been formally controlled.

- ESW pump discharge strainers are not routinely inspected. No recurring tasks exist to ensure that such inspections are performed.

- A piping inspection program that addresses GL 89-13 biofouling, silt buildup, erosion, and corrosion issues is not in place.

- Implementation of ESW system inspections at all opportunities that the system is opened for maintenance can form the basis for a piping inspection program.

The GL 89-13 commitments related to the performance of periodic inspection programs to detect corrosion, erosion, silting and biofouling were identified and evaluated. The review of the periodic inspection program included the following activities and results:

Heat Exchanger Inspections:

CCW Heat Exchangers - CCW heat exchangers are addressed through performance testing and inspections. CCW heat exchanger inspections have been performed during each of the last three refueling outages and the results have been recorded.

CTS Heat Exchangers - CTS heat exchangers are addressed through flow testing and inspections. CTS heat exchanger inspections have been performed during each of the last three refueling outages and the results have been recorded.

For both the CCW and CTS heat exchangers, no procedures exist to provide guidance for the performance of these inspections. No guidance detailing criteria for measuring and recording the inspection results was routinely provided. There is no evidence demonstrating that trending of the inspection results was performed. Results were frequently not stated as part of the JO completion remarks and, therefore, are not archived accordingly. Inspection results are informally recorded in the GL 89-13 system book by the system engineer.

Based upon the results of those inspections, the program for further inspections is currently under development.

EDG Heat Exchangers - EDG heat exchangers are addressed through flow testing and inspections. Based upon the JO sampling performed, EDG heat exchanger inspections for air aftercoolers, lube oil coolers, and jacket water coolers have been performed during each of the last three refueling outages. Results from the 1990 Unit 1 AB diesel north air aftercooler inspection, performed under JO A15204, November 1990, are not included in the system engineer GL 89-13 book.

No procedures exist to provide guidance for performing these inspections. Generally, the inspection program for the EDG air aftercoolers found little evidence of fouling and/or corrosion over the three refueling outage inspection program and the program appears adequate.

No inspections are performed on the CRAC heat exchangers, as discussed in AEP:NRC:1104 and 1104A NRC correspondence.

ESW Pumps - No inspections have been performed on these components. A review of Artemis shows overhauls on all four pumps in 1988-1991. An inspection is performed when the pumps are overhauled at the vendor's shop.

ESW Pumps Discharge Strainers - Unit 1 E strainer was last inspected in 88/89 per 723483. No JOs could be found for inspecting the west strainer (back through 1987). Unit 2 strainers were last inspected in 88/89. No internal inspection recurring task exists for these components.

Piping Inspections:

As discussed in AEP:NRC:1104A for Action III, erosion/corrosion (E/C) monitoring of the service water system was incorporated into Cook Nuclear Plant's E/C program. Nondestructive examinations for the E/C program are performed per procedures 12 SHP 5050 NDE.008, "Ultrasonic Inspection for Thickness Measurements," and 12 SHP 5050 NDE.014, "Grid Layout for Erosion/Corrosion Examinations." This inspection was essentially limited to the piping on the discharge of the CCW heat exchanger. The plan is to cease this E/C inspection in the future.

No inspection program currently exists for either small or large bore piping within the ESW system, for corrosion mechanisms including: biofouling, MIC, silt, debris buildup or E/C. This is true even though there is reoccurring evidence that such is present. This is discussed below and in the heat exchanger inspections. CR 95-0509 was issued concerning this issue.

AEP's original response was that inspections would be performed through the E/C program. The criteria in this program is more appropriate for condensate quality water/steam systems. The ESW system experiences other types of fouling as described above.

Program Issues:

During reviews for inspection program and MIC program implementation and review and evaluation of many JOs on ESW valve maintenance, opportunities were identified where ESW system internal inspections could have been performed. The table in Attachment C shows examples within the completion remarks section of the JO when evidence of corrosion and, in some instances, MIC were recorded. If inspected and recorded in accordance with standardized criteria, these instances would provide a cost effective process to collect a great deal of valuable GL 89-13 corrosion data. The system engineer should take advantage of these opportunities to collect data.

Processes should be implemented to effectively and consistently obtain this data, which will be a significant part of the piping and MIC inspection program.

Plan Item 3.8 - Review the maintenance program for removal and repair of SWS piping and interface system components due to silting, biofouling, corrosion, erosion, and failure of protective coatings.

Review of the piping and component maintenance activities addressing corrosion, erosion, protective coating failure, silting, and biofouling included the following activities and results:

Heat Exchanger Maintenance:

CCW Heat Exchangers - No procedures exist to provide guidance for performing heat exchanger maintenance. Inspection and cleaning issues are discussed in Plan Item 3.3.

CTS Heat Exchangers - Chemical cleaning of the CTS heat exchangers was performed in December 1993. JOs and CR 93-1761 were reviewed. No issues were identified relating to the performance of the cleaning activities. Review of the CR and related information shows that continued flushing may have provided similar results to the performance of a chemical cleaning.

Chemistry Program - The chemistry procedures and inspection results were reviewed, and the program was evaluated against the GL 89-13 guidelines and industry standards. The program appears to be a satisfactory approach for reducing biofouling organisms. No issues were identified.

Piping Maintenance Program - There has been minimal piping maintenance for repair of ESW piping. The outlet pipe from the CCW heat exchanger was replaced several times before it was changed out with a stainless steel spool piece.

EDG Heat Exchangers - The EDG vendor manual was reviewed. The maintenance procedure appears adequate to clean and maintain the EDG air aftercoolers.

No other issues were identified.

Plan Item 3.9 - Determine if the SWS components are being adequately maintained to ensure their operability under all accident conditions.

Evaluation of the ESW components and determination whether the components are being maintained to ensure their operability under all accident conditions was performed. Maintenance documents were reviewed and evaluated as part of this review. The RCM developed recurring tasks appear to be sound. Primary

maintenance program attributes included in this evaluation were the PM program, awareness of material condition, and implementation of appropriate PM activities.

The following issues were identified:

- The system engineering program is not being fully implemented to ensure awareness of system and component conditions (awareness of JO completion and removal of tags, and component and piping inspections at all opportunities).

- Scheduling administrative procedures conflict with PMI 2291 regarding assignment of priority 37 items. Failed components were prioritized as priority 37, which is not in accordance with procedures.

- Maintenance procedures do not exist for all critical components.

PM Program:

The RCM and maintenance rule implementation programs have been reviewed. No related issues or other issues related to the PM program were identified.

<u>1-PP-7W,E & 2-PP-7W,E Pump Motors</u> - The recurring tasks for these components were reviewed. The tasks developed as part of the RCM and maintenance rule program upgrades seem appropriate. An issue was identified related to scheduling and performing the PM task for oil sampling and analysis for these components. Currently, no oil sampling/analysis is performed on the ESW pump motors. Tasks R35761, 35762, 35763, and 35764 have been eliminated. Currently, a modification is under development to permit sampling of oil in the motor reservoirs.

Additionally, NRC inspection reports 50-315/94018 (DRP) and 50-316/94018 (DRP) (dated October 20, 1994) identified that no oil samples are currently analyzed for the ESW pump motors. Inspectors were informed during that inspection, that JOs were initiated to implement the oil sampling program for these components.

<u>ESW Pump Discharge Duplex Strainers</u> - No PM exists to ensure that these components undergo periodic inspections. Based on the grass matting seen on the CCW heat exchanger tubesheet, it appears that the strainer should be periodically inspected. This inspection would also confirm the condition of the strainer baskets.

Awareness of Material Conditions/Prioritization - While performing the system material condition walkdowns (as discussed in Plan Item 3.1), a number of material discrepancies were identified. One particular AR tag, found in place, AR Tag #55460 for valve 1-WRV-767, addressed the failure of the component to open during backwash. Further evaluation on NPM showed that the JO to correct this deficiency was completed in October 1993 and identified that the tag was removed. The AR tag was removed on March 13, 1995. CRs 94-1653 and 95-0137 were referenced as documenting similar past events which will specifically handle preventive actions to preclude recurrence.

Since the AR tag in question had hung on the component for over fifteen months past the work completion date, system engineering procedures/programs were reviewed to ascertain if requirements existed which should have ensured that the tag be removed at some point. The system engineering program, revision 6, was reviewed to assess the requirements for the system engineer to be aware of the system and the component's material condition. The following requirements were identified:

- Section 5.1, "System Engineer Functional Areas of Responsibility," Subsection 5.1.2.1(b), Walkdowns, requires that the system engineer identify problems with systems.

- Subsection 5.1.2.4(a), Monitoring, requires the system engineer to maintain cognizance of engineering and maintenance work performed on assigned systems.

- Subsection 5.1.3.4(d), Maintenance, requires that the system engineer review action requests and maintain cognizance of outstanding action requests on assigned systems.

It is recognized that this program is currently in revision. Failure of this program to ensure that AR tags do not remain hung for 15 months following work performance indicates a failure in program implementation.

ARs & Prioritization - Temperature gauge 2-XTI-301 (EDG Intake Air Manifold Temperature) was found hanging by its bimetallic wire. AR 79935 was identified for this component; however, no AR tag was found at the location. Additionally, the description on this AR states that the component has no fasteners to secure it. Masking tape had been used to secure the indicator. CR 95-0475 was written on this unauthorized "repair" outside the work control process.

The current maintenance JO prioritization is priority 37, which is for material condition issues. The initial question was whether the component had, in fact, failed and whether prioritization should have been 30 versus 37. Discussions with the system engineer on March 28, 1995 confirm that he still considered the XTI to be functional. Per SAM 5.14, only when components have failed to perform their function, are they prioritized as priority 30. Based upon the system engineer's determination that the component is functional, this priority appears appropriate.

SAM 5.14 states that the Scheduling Department handles priority 30 and priority 37 items in an identical fashion. However, priority 37 items, which are considered primarily to be material condition issues, are not included in the maintenance backlog managed by management; are not tracked as a performance indicator; and, in the future, will not be an integral measure as part of the maintenance rule implementation.

It should be noted that XTI-301 was reading 65°F and XTI-302 (other side of the engine) was reading 80°F while both were at ambient temperature. Additionally, the system engineer does not concern himself with differences in prioritization between 30 and 37 since these work items are scheduled and planned with equivalent weighing.

During this review it was identified that guidance in procedure PMI-2291, "Work Control Process," and SAM 5.14 both relate to priority 37 criteria. The PMI states that priority 37s are limited to PMs while SAM permits priority 37s to be assigned to "material condition-related corrective maintenance items." Failed components, which are defined as being unable to accomplish their functions, are to be prioritized as 30.

AR 87197 to replace XTC-301 and 302, states; "We are unable to properly control air inlet temperature on the 1AB engine." While the assessment team interprets this statement to indicate a failure of the component to function as designed, scheduling has prioritized this AR as a 37 (material condition). Discussions with the scheduler identified that the basis for the 37 prioritization is that the AR additionally states that EDG operability is not impacted by this failure. No procedure could be identified that permits priority level 37 assignment to a failed component corrective JO based upon lack of impact on major component operability.

<u>Review of ESW Expansion Joints</u> - Failures of ESW expansion joints occurred in 1989/1990. CRs were developed to determine the root cause(s) of the expansion joint failures and to determine corrective actions to prevent reoccurrence. Actions have been initiated, and all expansion joints, except an

XJ-56 expansion joint, on the ESW system have been inspected/replaced. Recurring tasks have been developed to replace the ESW expansion joints on a seven-year frequency. No issues were identified.

Availability of Maintenance Procedures - No maintenance procedures could be identified which provide guidance for maintenance on the following components:

- ESW pump duplex strainers
- Valves WRV-721 through 728, Robertshaw ESW flow control valves to EDG air aftercoolers
- Valves WMO-733, 734, 737, 738, CCW heat exchanger outlet valves. These valves have recently been replaced. The modification package states that no maintenance procedures are to be developed even though spare parts are being procured.

Based on the performance of various heat exchangers, system pumps, valves, and improvements with maintenance on the expansion joints, the components are adequately maintained to ensure their operability under all accident conditions.

Plan Item 3.10 - Review the maintenance history for the selected components of the SWS for the past two operating cycles (minimum of two years) or longer if necessary. Look for recurring equipment problems and determine if any trends exist.

Repetitive problems associated with the EDG air aftercooler temperature controllers and Robertshaw control valves have existed and no overall plan exists to determine the problem root cause(s) and to implement the appropriate actions. No maintenance has been performed on these valves since 1991. Based upon the number of ARs on the EDG aftercooler air temperature controllers and the current ARs to replace the controller units (being performed as a preventive maintenance item due to their age), an overall problem root cause analysis may be appropriate.

The root cause analysis included in CR 93-1761 appears to have overlooked information that would have allowed a definitive root cause determination. As part of the assessment of GL 89-13 implementation of the heat exchanger inspection and flushing program, a review of CR 93-1761 was performed. This CR states the description of the condition as, "Data collected during the as-found ESW Differential Pressure Test indicates the U1-E CTS Heat exchanger pressure drop had significantly increased over the last fuel cycle. Initial as-found data was 65 psid @ 3200 gpm." The CR concludes that the investigation was not

sufficient to determine the root cause of the problem and that no preventive actions were taken to preclude recurrence.

The CR states that a contributing factor for the fouling of the 1E CTS Heat exchanger was the leaking outlet valve (1-WMO-713). In actuality, a review of ARs shows that this valve had been identified as leaking in April 1991 per Artemis AR A58519 and subsequently identified on ARs 496, 45624, 22638, 45526 & 52268. In effect, this valve had been leaking at some low flow condition, either intermittently or continuously, for a period of over 32 months prior to the cleaning. This low flow condition, along with the vertical flow path over the baffle of the heat exchanger, could be considered a likely cause for the sediment build-up and resultant pressure drop increase. Failure to effectively address the valve WMO 713 leakage is a potential root cause. The CR evaluation of the cause of the degraded CTS performance appears to have additionally been deficient in the following manners:

- No samples of the CTS sludge build-up were taken and/or evaluated of the as-found condition. The only samples taken were of the post-cleaning residue, and they were contaminated by the cleaning process and chemicals.

- The CR inappropriately considered that the sludge appeared to be a result of the Bentonite clay compound used as a part of the Clamtrol (zebra mussel/biofouling) treatment. In actuality, such treatments were used only over a twelve-hour period, once per year, at a concentration of 15 ppm. Such a treatment would not significantly contribute to the buildup found in the CTS heat exchanger. The buildup, most likely, came from the low flow (sediment trap) conditions created by the long term existence of the leaking WMO-713.

Review of the referenced maintenance history data showed no other recurring trends for like ESW components. Trends relating to common conditions such as the silt and corrosion buildup are discussed in Plan Item 3.7.

Plan Item 3.11 - Review several completed maintenance activities for technical adequacy, performance of appropriate post-maintenance testing and satisfactory demonstration of equipment operability.

The maintenance activity and post-maintenance activity (when identified), for those JOs reviewed, were evaluated for technical adequacy and appropriate restoration of the component's operability.

No deficiencies were identified.

During plant walkdowns, the position and material condition of fire doors were monitored. Fire door 12-DR-SRV 258 was found on Mach 15, 1995, to be propped open to allow ventilation for the maintenance offices. Further evaluation found that the roving fire watch was established since March 13, 1995.

Plan Item 3.12 - Determine the adequacy of the maintenance program from an overview perspective. Of importance here is a determination that the maintenance work order system ensures that the plant, system and component design bases are adequately maintained.

Procedure PMI-2291, "Work Control Process," and SAMs 5.14 & 5.11 provide conflicting guidance for the prioritization of JOs at priority level 37. This discrepancy should be corrected.

The maintenance work processes and work controls appear to be a program strength as supported by the low re-work percentage.

Scheduling:

Procedure PMI-2291, "Work Control Process," was reviewed. An objective of the procedure is to provide mechanisms by which identified work is reviewed for adequacy/completeness, prioritization, and coordination. Attachment 1, page 4 of 5, describes priority 37 JOs as being:

- PM/testing activities not meeting the definition of priority 17 or 27, and
- PM/testing activities to be scheduled into FEG intervals.

No reference is made to prioritization of CMs at priority 37. This becomes increasingly important when one acknowledges that priority 37 JOs are not considered as high priority as priority 30, and are not as closely tracked against work order backlog by management.

Contrary to this procedure guidance, approximately 20 open CM JOs pertaining to ESW were identified as priority 37. SAMs 5.14 and 5.11 were provided which detail the authorized prioritization of CM JOs at priority 37. The basis for this prioritization is provided and was understood by the assessment team. This discrepancy should be corrected.

From the originally identified twenty items suspected to be wrongly prioritized, the following ESW system ARs were reprioritized by scheduling: A0070722, A0068426, A0070724.

Work Processes:

The material condition work items were evaluated. The program appears to be an appropriate way to further reduce the maintenance backlog for material condition items. During review of the scheduling and planning activities, it was identified that FEG related NOI (non-outage, in-service) work items are also scheduled to be worked during FEG cycles. To ensure that the shop personnel work efficiently, it is suggested that such items be continually planned and available to further reduce maintenance backlogs.

Plan Item 3.13 - Determine if maintenance personnel receive adequate training pertaining to the SWS and if the degree of training provided is consistent with the amount of technical detail in the procedures.

Lesson plan EM-C-F228 has been revised as committed in the GL 89-13 response. Training on that lesson plan has not been provided to the mechanical maintenance personnel who are most likely to be exposed to the GL issues. Cleanliness training is provided to all maintenance personnel; however, it does not include all GL 89-13 issues. Interviews with maintenance personnel have shown that understanding of GL 89-13 issues is weak.

In the GL 89-13 response, response V states that a specific lesson plan emphasizing the function and importance of the ESW system has been part of the maintenance training program since 1986. AEP:NRC:1104A, response V, program implementation summary states that maintenance practices for the service water system have been included in lesson plan EM-C-F228. This lesson plan was revised to include information and concerns addressed in GL 89-13.

A review of EM-C-F228 was performed. This lesson plan was found to adequately address the issues identified in GL 89-13. This lesson plan is primarily used for training electricians. IC-C-0618 and training records of the I&C Department were reviewed. The latest revisions to these lesson plans included information on MIC and biofouling, and how to recognize them, and appear adequate. Training records were reviewed and demonstrated that electricians and I&C personnel were trained on this lesson plan; however, while not all were trained on the latest revision which included the GL 89-13 information.

Mechanics and welders who are most likely to open ESW systems did not receive training on the revised EM procedures. Eleven mechanical maintenance personnel were found to have been trained on the EM procedure in 1988, prior to incorporation of the information on GL 89-13. No mechanical maintenance personnel had been trained on this lesson plan following the GL 89-13 revision.

ESW systems training has not been provided to all maintenance personnel. Systems training has been suspended for a period of time and is in the process of being re-initiated.

Lesson plan SK-C-S700, "Cleanliness Inspection," includes a discussion on MIC and how to recognize it. This training has been provided to all maintenance personnel.

Plan Item 3.14 - Conduct detailed interviews with the maintenance personnel to determine their technical knowledge of how components are maintained.

Interviews were held with six maintenance employees in the mechanical and welding groups. Questions were asked to gauge their understanding and familiarity with:

- mechanical work activities,
- ESW system awareness, and
- GL 89-13 issues.

The following issues were identified:

- Technical maintenance expertise appears appropriate (supported by maintenance performance and low rework percentage).

- ESW system understanding and training is a weakness.

- GL 89-13 issue understanding is a weakness

- Awareness of the need to interface with maintenance/systems engineers based upon component maintenance problems and component inspection results is adequate.

ESW system training has not been held for most maintenance personnel.

Plan Item 3.15 - Assess the degree of assessment of industry component/system specific failures and/or maintenance issues.

Practices and processes governing implementation of the NPRDS system were reviewed. No issues were noted.

Status of the maintenance rule program implementation was reviewed. A recent program implementation status report was obtained and reviewed. No issues were noted.

6.0 SURVEILLANCE AND TESTING

Plan Item 4.1 - Review and evaluate the technical adequacy and accuracy of the technical specification surveillance procedures and inservice test procedures performed in the past two operating cycles (minimum of two years) for the SWS.

The surveillance procedures reviewed were found to satisfy the Technical Specification requirements for ESW system operability, and were also found to be in agreement with Cook Nuclear Plant's design and licensing basis, as identified in the UFSAR and the DBD. Past surveillance results were reviewed and no issues were identified.

A comparison was performed on the operational procedures against the ASME Section XI Valve & Pump Program. The Technical Specification surveillance required on the pumps is being met through the performance of operations procedure 4030 STP.002 E&W. Operating procedures for the testing of power operated valves, manual valves, check valves and safety valves were reviewed along with test results for these procedures. These procedures and test results were compared to the ASME Section XI valve program. All of the valves in the program to be tested were tested by the performance of three different operating procedures: OHP 4030 STP.002 E&W, OHP 4030 STP.002 CS, and OHP 4030.STP.011.

Additionally, the technical data books associated with ISI requirements for valve stroke times and pump performance were reviewed. Both the valve stroke times and pump alarm and alert limits were reviewed in the applicable surveillance procedures and associated test results to ensure consistency. Further details associated with the ISI pump and valve program are discussed in Plan Item 4.8.

Plan Item 4.2 - Review the SWS design and licensing bases.

A review of the DBD, UFSAR, and Technical Specifications was performed and compared to the various surveillance and performance test procedures associated with the ESW system. The flow balance satisfactorily demonstrated that the required flow during an event, as identified in the UFSAR, would be delivered to the respective heat exchangers and coolers. The exception is that the procedure does not verify flow to either the CRAC units or the auxiliary feed pumps, both of which would require the manual manipulation of valves located at the respective component. This concern was previously discussed in Plan Item 1.8.

Plan Item 4.3 - Verify that test acceptance criteria are consistent with the design bases to ensure the SWS testing adequately demonstrates that the SWS will operate as designed.

Applicable procedures and associated test results were reviewed to verify that test acceptance criteria were consistent with the design bases to ensure that ESW testing adequately demonstrated that the ESW system will operate as designed. The surveillance procedures were found to contain acceptance criteria consistent with design basis documents and the ISI Pump and Valve Program.

However, the procedure associated with heat transfer testing of the CCW heat exchangers does not contain any acceptance criteria. The test data is forwarded to Columbus for engineering review to determine acceptability of the test.

This appears to be a weakness in the program. Since there is no identified acceptance criteria in the procedure, Cook Nuclear Plant has no way of telling if the heat exchangers are performing as designed. This would be acceptable if the test data was reviewed in a timely manner; however, the results are not submitted in a timely manner or attached to the surveillance test package. The test results need to be in a form that will allow trending of the data. For example, fouling factors for the heat exchangers could be calculated for the CCW heat exchangers and could be compared to the fouling factors used during design of the heat exchangers.

IST for the ESW pumps is conducted at a flow point of 7,000 gpm. While there is no strict requirement in ASME Section XI for the test point, a test point near the flow rates for the LOCA recirculation would provide higher assurance that the pumps are operating properly.

Plan Item 4.4 - Review indicators of SWS performance to identify if any testing inadequacies exist or if testing frequency is appropriate.

Analysis of test data for the heat exchanger heat transfer tests indicate that there are difficulties in obtaining good test data. While the heat exchangers appear to be performing properly, there are deficiencies on the order of 15% in the thermal balance data for shell and tube side heat loads. See Plan Items 1.11 and 4.12 for additional information.

STPs were reviewed to determine if any inadequacies existed with applicable procedure steps or if testing frequencies were appropriate. Various procedure results were generally found to satisfy the requirements for determining performance of the ESW system. The surveillance test procedures provide a good indication of the performance of the related pumps and valves (ISI). The

flow balance procedures assure that flow requirements can be met, with a few exceptions, and the performance testing indicates generally satisfactory results for heat exchanger performance testing. Calibration procedure results were also reviewed to verify that the calibration intervals were acceptable. Based on these results, no concerns were noted with the exception of 2-WPS-702, which appeared to have drifted in the high conservative direction. This concern was identified to I&C personnel who initiated an AR to calibrate the switch.

After reviewing the special procedures performed by Operations to support testing of MOVs for the GL89-10 program, a concern was noted associated with minimum flow requirements. The ESW DBD identifies the minimum pump flow rate as 2,000 gpm. The procedures for high differential pressure MOV testing, 01-OHPSP.102 and 02-OHPSP.106, under Precautions and Limitations, require establishing a minimum flow path of 2,000 gpm prior to placing the ESW pump in service. However, a review of past test results indicates that the minimum flow requirements are not being followed. The flows recorded in the procedures for initial conditions ranged from 1,400 gpm to the minimum flow requirement of 2,000 gpm. CR 95-0389 was generated to both review and address the concerns associated with not adhering to the precautions and limitations for minimum pump flow identified in the procedure.

Plan Item 4.5 - Determine if surveillance test procedures comprehensively address required SWS responses.

Flow balancing is performed to verify that the required flows can be met during the LOCA recirculation phase. It satisfactorily demonstrated that the required flow during an event, as identified in the UFSAR, would be delivered to the respective heat exchangers and coolers.

The Operations Department performs surveillances on the ESW system to determine that the pumps and valves required to meet ASME Section XI requirements are operable per the requirements of the ASME Section XI Valve & Pump Program. As part of these tests, stroke times of the valves are confirmed to ensure that the valves will perform as required to support operation of the ESW system during the identified design basis events. A review of test results indicates that the stroke times of these valves are being monitored and requirements followed.

A review of the procedures for EDG loading and ESF time response testing was performed and indicated that the time response requirements identified in the UFSAR are satisfactory.

Plan Item 4.6 - Review results from pre-operational testing to determine whether the SWS capabilities and limitations were appropriately demonstrated.

Both units' pre-operational tests were reviewed. Flow requirements were the same for both units. The flow requirements at that time (3,300 gpm, 5,900 gpm and 610 gpm for CTS, CCW, and EDG, respectively) were greater than and thus envelope the flows currently required.

Problems were encountered in keeping the CTS heat exchangers at a positive pressure with design flow on the system. Pressure at the CTS outlet (e.g., WPX-714) was noted to be -3.0 psig or 3 psi vacuum.

Elevation of the CTS outlet pressure gauge is lower than the top of the heat exchanger so the top of the heat exchanger will be at a greater vacuum (mitigated somewhat due to the back pressure developed in the "downstream" part of the shell). This calls in question the operation of the automatic vent valve QP-56, which is a simple float valve. When a vacuum exists in the CTS heat exchanger, air will be drawn into the system.

The automatic vent valve was not installed until 1983 under RFC 12-1753. At that time the check valve, which was installed in the continuous vent line sometime after the Unit 1 pre-op test (1974) under RDR #276, was removed. Removal of the check valve, and installation of the auto vent valve, introduced the new possibility of air being drawn INTO the system. The check valve would have precluded the entry of air into the system which would otherwise occur due to the vacuum.

It appears that the vacuum condition was considered when the RDR was installed but not when the RFC was installed. Review of a memo in the RFC package indicates that the vacuum condition was not considered in the design. The memo states that "the rupture or break of this [vent] line would not affect the performance of the containment spray or the essential service water systems." This same memo states that "air that might be released from the cooling water (ESW) into the heat exchanger shell . . . would blanket the heat exchanger tubes, [thus] reducing their effectiveness."

It was noted that the CCW heat exchanger outlet valve had to be throttled to increase flow to the CTS heat exchanger to allow for venting of the heat exchanger and to allow for the continuation and completion of the remainder of the pre-op test. The vacuum condition will be investigated further by CR 95-0513.

Plan Item 4.7 - Evaluate the support systems and plant modifications selected for review by the engineering team to ensure that surveillance and testing has been properly performed.

Plant modification 12-MM-237 was reviewed to ensure that satisfactory post work testing was performed and that the acceptance criteria were consistent with the modification package. No concerns were identified with the post work testing results associated with this modification.

Minor Modification 12-MM-237 was performed to replace the existing Lonergan LCT-20 safety valves installed in the ESW system with Consolidated/Dresser safety valves. Two of these valves in the package were reviewed to ensure that sufficient post work testing was performed prior to installation of the new safety valves. The JOs, procedure, and the procedure results associated with the bench testing of these valves were reviewed. Both the leak test and setpoint of the valves were found to be satisfactory.

Plan Item 4.8 - Review the inservice test records for valves and pumps in the SWS.

The ISI/IST program was reviewed against the requirements identified in the ASME Section XI code 1983 edition and Summer of 1983 Addenda. The flow diagrams for Unit 1 and 2 ESW systems were reviewed to ensure all valves were included in the program. The OPS surveillance procedures were reviewed against the ISI program to ensure that all the valves in the ISI program were being tested. Safety valves are bench tested by the Maintenance Department per procedure **12MHP5021.001.034, Safety Valve Bench Testing. Test results on the MOVs and safety valves were reviewed, and no problems were found.

Plan Item 4.9 - Review how specific SWS instruments are calibrated and tested.

Instrumentation calibration procedures and associated calibration results for instrumentation utilized in the ESW system were reviewed. The calibration results revealed that, in most cases, the instrument's as-found results were within acceptable tolerances. A majority of the instrumentation in the ESW system is calibrated using the generic calibration procedure, 12-IHP6030.IMP.066. Selected instrument calibration data sheets associated with the generic calibration procedure were reviewed to determine as-found/as-left tolerances criteria. The calibration data sheets indicate that an acceptable as-left tolerance is being utilized during the calibration. However, calibration data sheets for WPS-701, 702, 705, and 706 did not identify any as-found tolerances for the pressure switches. Results of these calibrations indicated that the as-found setpoints of the pressure switches would not have prevented the instruments

from providing the auto-start initiation signal to their respective ESW pump. The calibration data sheets should contain as-found acceptance criteria to determine if the instrument was capable of performing its function within acceptable performance specifications.

During the walkdown of the system, it was observed that one of the low pressure ESW auto-start pressure switches (2-WPS-702) was out of calibration. This was determined by observing the location of the pointer for the lower setpoint on the scale plate of the instrument. After a discussion with the I&C system engineers, an action request (AR A92496) was generated and given a seven-day priority to verify calibration of the pressure switch.

Plan Item 4.10 - Verify that the tolerance used for instrument accuracy is acceptable.

The instrument accuracy for as-left values utilized in the calibration procedures and the calibration data sheets was +/-0.5%. There was no basis identified for this tolerance. No instrument accuracy calculations exist for the ESW instrumentation. However, the use of the +/-0.5% tolerance for the as-left value of the respective instrumentation was judged to be acceptable. See also Plan Items 1.12 and 6.1.

Plan Item 4.11 - If possible, witness post-maintenance, surveillance, and inservice tests performed on the SWS.

Surveillance procedure **1-OHP4030.STP.022E, "East Essential Service Water System Test," was observed during the inspection. Several team members witnessed the test from the control room while two members witnessed the test from the pump room. The review team witnessed the pump start, operation of the backwash strainers, and vibration measurement readings on the pump. Additionally, members witnessed the initiation of flow through the CTS heat exchangers. There were no concerns identified during this evolution.

During the performance of the quarterly surveillance test, local instrumentation was observed throughout the entire surveillance evolution. All instrumentation observed during the test operated within the anticipated ranges associated with the various valve lineups and cutting in and out of the related heat exchangers. No concerns were observed with the instrumentation during performance of this surveillance.

Plan Item 4.12 - Review procedures for periodic testing of safety related heat exchanger heat transfer capability and the trending of such results.

Procedures and test results for the CCW heat exchanger heat transfer tests were reviewed. The heat transfer test is a recording of flow and temperature measurements.

There are many discrepancies in the test data. In the 1994 tests, heat balance between shell and tube side data for the 1W unit were significantly different. The tube side heat gained was calculated to be as low as 82% of the shell side heat loss. The calculated tube side heat removed by ESW ranged between 82% and 89% of the heat given up by CCW. For the 1E unit, data was better with a range of 92.5% to 95.4%.

Test instrumentation used in the heat transfer test is probably not sufficiently accurate to obtain good test data. Improvements are possible for both temperature and flow measurements.

Some improvements have been made for temperature measurement. (See QAVP 92-02 regarding use of RTDs for temperature measurement.) The RTDs can measure temperature to a tenth of a degree, and the loop accuracy could be as low as 0.5°F.

However, temperature measurements in a heat exchanger performance test are critical. ASME Power Test Code PTC 19.1, Instruments and Apparatus Part 1 Measurement Uncertainty, recommends several measurements to reduce uncertainty. The accuracy assessment can be improved with multiple readings. In the analysis portion of the assessment, an assumed accuracy of 1°F is used for the temperatures. Two degrees are subtracted from the differential temperature to compensate for accuracy (one degree for the inlet measurement and one degree for the outlet measurement). Since the differential temperatures can be on the order of 20 to 30 °F, this 2° can represent up to a 10% loss of actual measurement when the conservative analysis methodology is used.

Apparently, little was done to improve flow measurement capabilities. There has been no check of the pipeline condition. The ESW pipeline to the CCW heat exchanger is very susceptible to silt buildup which could cause flow measurement errors.

An instrument accuracy calculation was performed for the ESW flow orifice in 1992. It is part of the file for the flow balance.

The 1994 testing of the Unit 2 CCW heat exchangers produced data which was not meaningful enough to perform analysis because the heat loads were too low. The heat transfer test must be performed early during Cook Nuclear Plant cooldown when there is sufficient heat available to obtain good test data.

Plan Item 4.13 - For the two previous operating cycles (two years minimum) preceding the inspection, ascertain the system, train, pumps, or significant component unavailability during power and shutdown conditions. Assess the degree to which the licensee has input accurate unavailability data into the IPE.

A review was performed of various CRs and maintenance JOs associated with the ESW system and was compared to the Cook Nuclear Plant PRA analysis. The PRA ESW system notebook; loss of ESW event tree, which models the behavior of Cook Nuclear Plant following postulated loss of ESW cooling; and Table 3.1-14, Loss of ESW System Success Criteria, were reviewed to ensure consistency with the existing system operating procedures and the previously identified CRs and maintenance JOs. There were no concerns noted or observed with this review.

Plan Item 4.14 - Verify that the installed SWS components are tested to ensure the components will perform in accordance with their design bases.

Procedures and associated test results were reviewed to verify that testing is consistent with the design bases and to ensure that ESW testing adequately demonstrated that the ESW system will operate as designed. The surveillance procedures were found to contain acceptance criteria consistent with design basis documents and the ISI pump and valve program. Performance testing associated with heat transfer testing of the CCW heat exchangers is discussed in 1.8 and 4.2.

Plan Item 4.15 - Review the implementation of the periodic inspection program to detect flow blockage from biofouling in other systems.

The stator cooling water, diesel generator jacket water and control room systems are analyzed for MIC every six months. This action results from a November 1991 commitment to INPO.

Plan Item 4.16 - Review testing on one air-to-water heat exchanger served by the SWS to ensure proper heat transfer. Examine the air side for fouling.

AEP's commitment for air-to-water heat exchangers was that there would be no heat transfer testing since the only air-to-water heat exchangers were the EDG aftercoolers and the control room air handler. The air handler utilizes

demineralized water in the system and would not be tested because clean water is used. An INPO commitment was made, and the water was sampled to assure that there was no intrusion of the ESW system water into the coil. The emergency diesel air aftercoolers are inspected to ensure the ESW side of the aftercooler is acceptable.

7.0 QUALITY ASSURANCE AND CORRECTIVE ACTIONS

Plan Item 5.1 - Review the meeting minutes of the plant onsite safety review committee and the offsite safety review committee for the past six months for items pertaining to the SWS.

The off-site review meeting minutes were reviewed. Meeting 139 noted the use of biocide treatment for zebra mussels. Meeting 136 noted a power reduction on September 9 for Clamtrol activities. Meeting 132 contained a presentation on the blockage in the ESW line to the AFW pumps. Also discussed was the special service water inspection exit meeting on the line blockage. Meeting 134 discussed the zebra mussel program and modification to change the fire protection system to a clean water system to preclude zebra mussel problems. The operations presentation included information on zebra mussels found in plant components. Meeting 135 discussed the trip of Unit 2 on August 15 because of zebra mussels in the circulating water system.

The off-site meetings contained sufficient information on the SWS over the past six months. Significant attention was given to zebra mussels and the line restriction to the AFW system.

The on-site Plant Nuclear Safety Review Committee minutes of meetings 2836 through 2854, November 14, 1994 through February 9, 1995 were reviewed.

Of particular note was meeting 2853 which discussed CR 93-1761 that documented changes in the CTS heat exchanger differential pressure resulting from the presence of a gray sludge-like substance. Discussions were held regarding the short term corrective action of flushing the CTS heat exchanger monthly and the long term corrective action of a design change.

Plan Item 5.2 - Review the operational history of the SWS.

In general the ESW system was found to have operated efficiently since commercial operation. However, there were historical problems found regarding zebra mussels, line blockage, and silt accumulation.

High differential pressures occurred across the CTS heat exchangers on at least two occasions. These heat exchangers have already been chemically cleaned twice. New recurring task JOs require monthly operation of ESW through the CTS heat exchangers to flush out accumulated silt.

Similarly, the flows to the CTS heat exchangers have declined over time. CTS outlet valves are now either in the full open position or are very close to the full open position.

Obtaining good test data for the heat transfer tests on the CCW heat exchangers is difficult.

There needs to be heightened awareness in evaluating and prioritizing equipment performance problems, not only in terms of component/system safety function, but also in terms of MIC intrusion (CR 93-41).

Compared to other plants, MIC and biofouling are not significant problems at Cook Nuclear Plant because of water quality and control strategies.

The following significant events in the operational history of the ESW system were considered:

- CTS heat exchangers experienced degraded flow in 1986.
- Live freshwater shrimp were found in the Unit 2 West CTS heat exchanger during the 1990 refueling outage.
- Corrosion rate monitoring was added to the system engineering program in June 1991.
- Live zebra mussels were found in the Unit 2 West CTS heat exchanger in April 1992 during the refueling outage.
- The ESW outlet elbows from the CCW heat exchangers have had a repetitive history of replacement and rework due to cavitation caused by throttling the outlet flow control valves (PR 92-492).
- Dead zebra mussel shells were found during a flush of the 4" ESW line to the Unit 2 East motor driven auxiliary feedwater pump (CR 93-1076).
- Very high as-found differential pressures were noted across the CTS heat exchanger before chemical cleaning (CR 93-1761).

- The supply and discharge piping of the Unit 1 AB EDG main lube oil coolers and supply piping to the jacket water cooler were inspected in February 1994 and found to be clean and free of carbuncles. Inspection of the Unit 1 AB EDG supply and discharge piping of both the north and south air aftercoolers revealed dormant MIC, indicating that the continuous/intermittent chlorination has been effective.

- The ESW emergency supply lines to the auxiliary feedwater pumps were found partially blocked with silt in March 1994. Remote video inspection, hydrolasing, and installation of large bore flushing connections were performed to assess and relieve this condition.

Plan Item 5.3 - Compare the results of the team's assessment of the areas inspected for the SWS with the results of applicable licensee quality verification activities in the same areas. Determine why quality verification activities did not uncover significant issues identified by the team.

There were no significant findings from this assessment that were not identified by previous quality verification activities. Findings related to the need for improved heat exchanger test methods and pipe inspections had been previously identified in both QAVP 92-02 and the containment spray SSFI.

Review of previous audits indicated there were no QA audit or surveillance topics directed specifically at the ESW system and that there were only two surveillance findings related to service water components during the period from 1991 through 1994. During unannounced and scheduled work in progress surveillances, the following service water activities were witnessed: two ESW pump replacements, ESW MOV testing and refurbishment for GL 89-10, ESW piping modification, and EDG aftercooler cleaning, inspection, assembly, and post-maintenance testing. In addition, the QA audit on chemistry/radiochemistry reviewed NTS to ensure that:

- diesel jacket water and CRAC are analyzed for corrosion and MIC every six months;

- audits on Technical Specifications included observation of the ESW liquid process monitor surveillance testing, CCW loop testing and pump and heat exchanger inspection, and ESW MOV repairs and testing; and

- audit on system cleanliness included inspection of 2-HE-15W and 2-ESW-102W.

In general, Cook Nuclear Plant's quality verification activities are judged to be acceptable. Although there are no specific audit topics related to the SWS, there is evidence that the Quality Assurance Department recognizes the importance of these issues and that they have received an appropriate level of attention in the audit and surveillance program.

Plan Item 5.4 - Review the timeliness and technical adequacy of licensee resolution of findings from its self-assessments. Review the open item tracking system items pertaining to the SWS for adequate tracking and closure of identified deficiencies.

QAVP 92-02 resulted in three problem reports and six recommendations, which were reviewed for timeliness and technical accuracy of the resolution. PR 92-316 involved cracking at the CCW heat exchanger foundation's pedestal. The PR evaluation concludes that the cracks are not significant and will not propagate. The timeliness and technical accuracy of this evaluation is judged to be acceptable.

PR 92-492 covered inadequate resolution of piping elbow erosion, instrumentation adequacy, and excessive fan cycling and reverse rotation. Review of the problem report investigation documented that appropriate design changes were in progress to reduce the throttling on the CCW heat exchanger outlet valves to eliminate cavitation damage downstream. The issue on ESW return header instrumentation was resolved by disabling the alarms under PM-676, removing MPA-703, -704, -707 and -708 under MM-513, and relying on alternate indications (temperature). This approach was reviewed during the self-assessment and determined to be acceptable. Cycling of the ESW pump room fans was resolved by RFC-3063 by installing of snap action temperature switches with a wide enough deadband to prevent excessive cycling. The timeliness and effectiveness of the corrective and preventive action for PR 92-492 was determined to be acceptable.

PR 92-493 covered inadequate record keeping requirements when a calculation performed by a non-nuclear support organization for Cook Nuclear Plant was not microfilmed. This item was resolved by NEP 6.4, "Calculations," revision 2, change sheet 1 to clarify microfilming of calculations by interfacing sections. The timeliness and technical accuracy of this problem report resolution was determined to be acceptable.

The actions taken in response to violations from the NRC System Based Instrumentation and Control Inspection (SBICI) were reviewed. Evidence of the scope of training, attendees, and effectiveness of the course training in response to the audit findings was reviewed and found to be acceptable.

The I&C engineering discipline has been very proactive in performing self-assessments, particularly since these audits were neither regulatory nor QA driven. Findings of the internal and external audits have resulted in an I&C

"Betterment Program" which will enhance the I&C engineering product by reducing the potential for making errors and increasing the efficiency of I&C personnel.

Plan Item 5.5 - Evaluate the interface between engineering and technical support (E&TS) and plant operations regarding corrective actions to resolve operational problems.

A random sample of twenty-one system engineer monthly reports from the last three years was reviewed for evidence of interface between Engineering and Technical Support and Plant Operations on corrective actions to resolve plant operational problems. These reports cover essential and non-essential SWSs, but are judged to be typical of the level of engineering involvement in resolution of operational problems.

Review of these reports revealed several examples of Plant Engineering and AEPSC Nuclear Engineering involvement in resolving operational problems. Significant involvement was noted on zebra mussel issues and heat exchanger performance testing, as well as specific component problems on 1-WRV-970, 2-N and 1-S NESW pumps, 2-WMO-714, 1-WMO-707, 2-SV-14W; an NESW expansion joint failure; and blockage found in the ESW emergency supply lines to the auxiliary feedwater pumps. Extensive engineering involvement was also noted in the following areas:

- development of corrective/preventive action strategies on replacement of the CCW heat exchanger outlet and CCW cross-tie valves;
- expansion joint replacement;
- ESW pump differential pressure trend;
- CTS heat exchanger pressure drop; and
- evaluation of anti-cavitation coating for the ESW elbows downstream of the CCW heat exchanger.

In addition to operational issues at Cook Nuclear Plant, the system engineer monthly reports documented reviews of at least eighteen industry operating experience reports for applicability to Cook Nuclear Plant. The number of open

action requests on the service water systems was tracked on a rolling three month window, and system engineer involvement was noted in the review of several design changes.

In order to determine the level of corporate Nuclear Engineering direct involvement with plant on-site activities, the number of man-days on site was reviewed. The records showed there were 1,479 corporate Nuclear Engineering man-days on site in 1993 (317 managerial, 1,162 engineers/techs/admin.), 2,026 man-days in 1994 (302 managerial, 1,724 engineers/techs/admin.), and 323 man-days through the first two months of 1995 (38 managerial, 285 engineers/techs/admin.). Given that the Nuclear Engineering Department-Columbus staffing as of mid-March, 1995, was roughly 170, this indicates a good level of corporate involvement at Cook Nuclear Plant.

The conclusion of this audit topic is that there is an appropriate level of plant system engineering and corporate nuclear engineering involvement on corrective actions to resolve operational problems.

8.0 ELECTRICAL AND I&C

Plan Item 6.1 - Review the design-basis, and other design documents such as calculations and analyses for the electrical and instrumentation components and systems supporting the SWS and each active component during accident or abnormal conditions.

- Calculation HXP900622JRR, which had been prepared to justify the 40 psig instrument setpoint for low ESW cross-tie header pressure at the highest accident flow conditions, was reviewed. The calculation determined the pressure at the centerline of the cross-tie header piping. Elevation differences between the centerline of the piping and the instrument location (head correction) were not considered when determining the instrument setpoint. Allowances for instrument and process uncertainties were not included in the calculation.

  The calculation was presented as simply a check of the margin between the expected lowest header pressure and the pressure where the instrument would start the standby pump. The calculation was not intended to be a setpoint calculation. However, Cook Nuclear Plant issued CR 95-0372 to address the head correction concern.

- 220V MCC Control Circuits Not Electrically Protected

  220V control circuits for MCCs are not grounded, nor do the control transformers have primary or secondary fuses. Most circuits do not employ a ground detection scheme. The present position appears to be more flexible than in recent years and allows different circuit configurations, depending upon the particular installation. For example, fuses are installed on the secondary side of control and miscellaneous transformers in selected 600V MCCs as directed by Design Guide 102.3, "Guide for Circuit Protection of Miscellaneous Transformers." This philosophy is used to preclude a fire from occurring in a breaker compartment and disabling the entire MCC due to a short circuit on the control transformer secondary side. In addition, it has been found through testing that control transformers of NEMA size 1 starters are susceptible to damage when a short exists on the secondary side. Therefore, aluminum barriers have been installed between the control transformers and associated circuit breakers. These positions have been captured in DBD DB-12-ELEC, "Electrical Control and Protective Circuit Philosophy," revision 0.

- Setpoint Methodology Review and Project Calculation Scope

  EG-IC-004, "Instrument Setpoint/Uncertainty," was reviewed. The error analysis methodologies contained in the guide were equivalent to updated versions of methodologies previously utilized at Cook Nuclear Plant by Westinghouse. The methodology was considered to be an acceptable response to the requirements of R.G. 1.105 and ISA S67.04. The scope of the instrument setpoint analysis program is expected to include setpoint analysis for Technical Specifications, EOP, R.G. 1.97 Category 1 and 2 parameters and selected setpoints considered important to safety. No uncertainty setpoint analyses are expected to be prepared for the ESW system.

- Fuse Control Program

  The initial phase of the Cook Nuclear Plant fuse control program consisted of a design basis reconstitution program for all safety related fuse applications at Cook Nuclear Plant. The design basis was documented in electrical power system's design input summary, DISPS-FUSE-001. However, plant procedure PMP 6065.FUS.001, "Plant Fuse Control Program," presently makes no reference to the DBD but rather to use an in-kind replacement fuse. In the future, the tie between the DIS and PMP will be accomplished via the Cook Nuclear Plant's Facility Data Base (FDB) which is in the process of loading data. The data fields for each fuse appears adequate to ensure proper selection of replacement fuses.

- Component Classification

When components are no longer in stock, have become obsolete, and are no longer in production, engineering is required to specify a new component manufacturer and model number. The FDB determines whether a component is safety related. However, the design basis for being classified as safety related is not captured in any document or data base and must be reconstituted prior to procurement of each component. The Nuclear Engineering Department is aware of this inefficiency, and a data base is being developed.

Pertinent procurement information such as safety related, pressure boundary only, 1E application, Appendix R component, R.G. 1.97 component, seismic requirements, etc., are expected to be part of the data base which will facilitate component classification for various plant uses.

- Bus Tie Breakers

Bus tie breakers are provided between buses 11A and 11C and buses 11B and 11D so that a 2,000 KVA transformer can feed two adjacent 600V buses in the event of one transformer failure. Two concerns are associated with this arrangement:

  - Separation - Bus bar is run from each train to the stabs located at the back of each breaker. The upper and lower stabs are approximately 2" apart and are powered from their respective train. The main contacts of the breaker are approximately 1-3/4" apart, and each side of the contact is also live with power from its respective train.

  - Single Failure - In an aspect similar to the separation criteria, a description of how the tie breakers meet the single failure criteria was requested. Specifically, during a loss of off-site power with the diesel generator running, a hot short could be postulated between the fuse of the control circuit and the closing coil. The two trains would then be tied together, with a very high probability of being out of synchronization with each other.

    The response regarding the above was that safeguard loads are distributed among the buses such that buses 11A and 11B form one redundant source, and buses 11C and 11D form the other redundant source. In addition, the safeguard loads of bus 11A are duplicated on 11D, and the safeguard loads of bus 11B are duplicated on bus 11C. In the event of a failure of a 600 volt bus section during an abnormal

condition when one of the bus tie circuit breakers was closed, one set of the safeguard loads would be served by the remaining two bus sections.

Plan Item 6.2 - Evaluate the design criteria including the requirements for layout, redundancy and diversity, electrical separation, seismic, EQ, safe shutdown, containment isolation, and electrical and I&C safety-related functions.

CR 94-2138 details an unexpected closure of an ESW pump breaker during the execution of an I&C procedure which was testing the low pressure auto start permissive circuit. To prevent an auto pump start, the transfer switch at the hot shutdown panel (HSD) was placed in the control room position, with the control switch in the "auto" mode. The control switch at the HSD was placed in the "closed" position. When this was performed, the west ESW pump started.

Disposition of the CR was that the circuit worked as designed since it was developed to prevent operation of the breaker by sabotage and, therefore, meets that criteria. A procedure change was subsequently performed by I&C to ensure that the switch lineup would not again be aligned in this manner.

The team reviewed the circuit and concluded a "sneak circuit" existed which allowed the breaker to be operated at the HSD with the transfer switch in the "control room" position. The ESW transfer switch operation appears to be a unique design with no other breaker control scheme in Cook Nuclear Plant having this same design condition. The team was concerned that a procedure change was used to correct a design deficiency.

In addition, the Nuclear Engineering Department I&C response to this CR did not receive any second or independent I&C review. Only the I&C memo preparer signed the response.

Design criteria associated with the I&C and electrical disciplines were evaluated and found to be acceptable. Dissimilar metals were observed on numerous tubing runs; however, the Nuclear Engineering Department's position was that these installations were acceptable from a galvanic corrosion aspect since the fluid medium within the sensing lines is not corrosive.

Plan Item 6.3 - Evaluate single active failure vulnerabilities of the system and the resulting impact on interfacing system components.

Results of the single failure criteria review is addressed in Plan Item 6.1.

Plan Item 6.4 - Evaluate the adequacy of I&C to support the control room operators during normal, abnormal, and emergency conditions.

The adequacy of the I&C/electrical components available to the operators during normal, abnormal, and emergency conditions was found to be acceptable.

Plan Item 6.5 - Review several design modification packages to ensure that all related issues were addressed adequately.

A number of modification packages were reviewed with only minor concerns regarding the technical aspects of the package. One aspect of the design change process should be given further consideration. Minor Modification 12-MM-513 was accepted by the Plant Nuclear Safety Review Committee on March 17, 1994. Implementation of the MM will not be performed until one and a half to two years, or longer, after plant acceptance of the package. Pre-installation walkdowns of the package are performed. However, a formal review of the entire modification package is not performed which would ensure that recent plant changes, such as circuit changes, raceway loading, or other plant changes not detectable during a walkdown, would not impact the signed-off modification package. A review of the implementation of significantly delayed modification packages is strongly recommended to ensure that the information in the package is current from a technical and administrative aspect.

Plan Item 6.6 - Perform a " Human Factors" evaluation to verify the ease of operation of the system and review control room and equipment layouts.

A review of the control room for "human factors" considerations was performed and found to be adequate. A related "human factors" concern is addressed in Plan Item 6.2.

Plan Item 6.7 - Review how specific SWS instruments are calibrated and tested.

Refer to Plan Item 4.9 for a discussion associated with this topic.

9.0 PERSONS CONTACTED

The following persons were contacted during the course of the SWSOPI:

A. Feliciano - AEPSC, NED
C. Golden - Cook Nuclear Plant, Plant Engineering
R. Smith - Cook Nuclear Plant, Plant Engineering
C. Lin - AEPSC, TAS

H. Young - AEPSC, NED
S. Hover - AEPSC, NOD
V. Vanderburg - AEPSC, NOD
W. MacRae - AEPSC, NOD
B. Gerwe - AEPSC, NED
R. Kalinowski - AEPSC, QA
S. Farlow - AEPSC, NED
B. Shramko - AEPSC, NED
M. Finissi - AEPSC, NED
N. Farr - AEPSC, NED
B. Bastian - AEPSC, NED
J. Kingseed - AEPSC, NOD
S. Parsons - AEPSC, NED
J. Anderson - AEPSC, NED
R. Roman - AEPSC, NED
B. Bentley - AEPSC, NED
D. Hunsicker - Cook Nuclear Plant
R. Peterson - Cook Nuclear Plant, Project Engineering
T. Slavens - Cook Nuclear Plant, Project Engineering
E. Abshagen - Cook Nuclear Plant, Project Engineering
T. Conrad - Cook Nuclear Plant
R. Harrah - Cook Nuclear Plant
B. Halfacre - Cook Nuclear Plant
J. Buursma - Cook Nuclear Plant
D. Kamradt - Cook Nuclear Plant
D. Dolby - Cook Nuclear Plant, SRO
M. Fish - Cook Nuclear Plant, SRO
G. Zielde - Cook Nuclear Plant, NRO
C. Allee - Cook Nuclear Plant, NRO
B. Hamilton - AEPSC, S&A
K. Blackwell - AEPSC, NED
R. Reynnells - Cook Nuclear Plant
R. Perrine - Cook Nuclear Plant
W. Riggs - AEPSC, NOD
A. Barker - AEPSC, NOD
R. Simms - AEPSC, NED
M. Gumns - Cook Nuclear Plant, S&A
D. Sorrell - AEPSC, QA
J. Sankey - Cook Nuclear Plant
M. Roth - Cook Nuclear Plant
E. Oman - Cook Nuclear Plant
A. Gort - Cook Nuclear Plant, Plant Engineering
E. Mallen - Cook Nuclear Plant, Environmental

E. Anderson - Cook Nuclear Plant, Plant Engineering
C. Powell - Cook Nuclear Plant
J. Schwark - Cook Nuclear Plant
E. Schmimmel - Cook Nuclear Plant, S&A
G. Van Bladeren - Cook Nuclear Plant, Plant Engineering
L. Ormson - Cook Nuclear Plant, Plant Engineering
M. Horvath - AEPSC, QA
B. Rarrick - AEPSC, QA
R. Papps - AEPSC, NED
J. Carlson - Cook Nuclear Plant

ATTACHMENT A

SELF-ASSESSMENT PLAN

SERVICE WATER SYSTEM OPERATIONAL PERFORMANCE INSPECTION (SWSOPI)

SELF-ASSESSMENT PLAN

PREPARED BY:	Robert T. Stanley NAME	3/7/95 DATE
REVIEWED BY:	Ray S. Siada NAME	3/8/95 DATE
APPROVED BY:	[signature] SWSOPI TEAM LEADER	3/8/95 DATE

AMERICAN ELECTRIC POWER NUCLEAR ORGANIZATION

1.0 INTRODUCTION

This procedure is to perform a Service Water System Operational Performance Inspection (SWSOPI) at the Cook Nuclear Plant.

The inspection methodology to be utilized for this work will be that for a full scale SWSOPI using NRC Temporary Instruction TI 2515/118 titled, "Service Water System Operational Performance Inspection (SWSOPI)", as a guideline. The Inspection requirements and objectives have been incorporated into the Service Water System Operational Performance Inspection (SWSOPI) Self Assessment Plan.

2.0 SCOPE OF WORK

The scope of work is as follows:

Assessment Objectives

The objective of the Service Water System Operational Performance Inspection is to assess the operational readiness of the Essential Service Water System by determining whether:

1. The system is capable of performing the safety functions required by the design basis.

2. Testing is adequate to demonstrate that the system would perform all of the safety functions required.

3. System maintenance (with emphasis on pumps and valves) is adequate to ensure system operability under postulated accident conditions.

4. Operator and maintenance technician training is adequate to ensure proper operation and maintenance of the system.

5. Human factors considerations relating to the selected system (e.g., accessibility and labeling of valves) and the supporting systems for those systems are adequate to ensure proper system operation under normal and accident conditions.

Assessment Guidelines

Assessment guidelines consist of:

1. Review of design-basis requirements and determination of operating conditions under which each active component functions under accident or normal conditions.

2. Review of the design of the system as installed in the plant. This shall include

assessing the cumulative effects of design changes.

3. Review of the maintenance and test records.

4. A walkdown of the system.

5. Review of abnormal, emergency, and normal operating procedures, maintenance procedures and surveillance procedures.

6. Review of the operational experience of the system.

To accomplish the inspection objectives, the SWSOPI will be conducted using USNRC Inspection Procedure 93801, "Safety System Functional Inspection (SSFI)", and Temporary Instruction 2515, Rev. 1, "Service Water System Operational Performance Inspection (SWSOPI)", as a basis for the review. The objectives of the USNRC SWSOPI Procedure are to:

1. Assess the licensee's planned or completed actions in response to Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"

2. Verify the Service Water System is capable of fulfilling its thermal and hydraulic performance requirements and is operated consistent with its design basis.

3. Assess the operational controls, maintenance, surveillance, and other testing and personnel training to ensure the Service Water System is operated and maintained so as to perform its safety related functions.

The scope of Generic Letter 89-13 "Service Water System Problems Affecting Safety-Related Equipment", requires the licensees to perform the following tasks:

1. Implement and maintain an ongoing program of surveillance and control techniques to significantly reduce the incidence of flow blockage problems as a result of biofouling in open-cycle service water systems.

2. Conduct a test program to verify the heat exchanger capability of all safety-related heat exchangers cooled by service water. The total test program should consist of an initial test program and a periodic test program. Both the initial test program and the periodic retest program should include heat exchangers connected to or cooled by one or more open-cycle systems.

3. Ensure, by establishing a routine inspection and maintenance program for open-cycle service water system piping and components, that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade the performance of the safety-related systems supplied by service water.

4. Confirm that the service water system will perform its intended function in accordance with the licensing basis for the plant.

5. Confirm that maintenance practices, normal and emergency operating procedures, and training that involve the service water system are adequate to ensure that safety-related equipment cooled by the service water system will function as intended and that operators of this equipment will perform effectively. This confirmation should include reviews of practices, procedures, and training modules.

3.0 SCHEDULE

The project schedule and major milestones for the project are:

Training and Data Gather	February 27, 1995
Entrance Meeting	March 3, 1995
Complete initial review	March 17, 1995
Columbus Office Review	March 20, 1995
Start Final Review Week	March 27, 1995
Exit Meeting	March 31, 1995
Issue Final Report	May 1, 1995

4.0 PROJECT APPROACH

The Inspection will be conducted in several tasks as follows:

Task 1:	Project Initiation
Task 2:	Data/Design Bases Acquisition
Task 3:	Execution of the Review Plan
Task 4:	Preparation of Draft Report
Task 5:	Preparation of Final Report

Task 1: Project Initiation

Team orientation and site access training to the extent required, will be conducted during the first week of the SWSOPI. During this week, a formal entrance meeting with plant personnel will be held.

During this project initiation task, the Self-Assessment Plan will be finalized to address the pertinent elements of the Cook Nuclear Plant Essential Service Water System. The particular elements of the Self-Assessment Plan will be finalized with consideration of:

- particular system components
- industry experience, lessons learned and NRC identified problems on the particular system (I&E notices, NRC initiated SWSOPIs, etc.)
- points of focus (i.e., GL 89-13 issues, EPRI identified issues, MOV issues, etc.)

The organizational composition of the review team is as follows:

- o Team Leader
- o Functional Reviewers

  Design Inspectors (electrical, mechanical, I&C, civil/structural)
  Plant Activities Reviewers (operations, maintenance, and surveillance and test)

The responsibilities associated with each position are as follows:

- o <u>Team Leader</u> - Responsible for the overall direction of the technical, administrative, and schedule aspects of the project to ensure that all project criteria are met. He will provide daily summaries of SWSOPI progress, daily activities, plan-of-the-day/week summaries, and will identify interface requirements. He will coordinate site interviews and walkdowns and conduct daily exit meetings. He will also direct the preparation of the draft and final report.

- o <u>Functional Reviewers</u> - Responsible for refinement and the implementation of the Self-Assessment Plan in their specific area of expertise (i.e., design, operations, and maintenance, etc.). They will ensure that all owner specific design details, past NRC and SWSOPI system and process related issues as well as all industry identified system related points of focus are identified within the Self-Assessment Plan. They are responsible for implementation of the plan and for the observation documentation completion on the Assessment Record and draft document development input in each area of responsibility. They are also responsible for identifying any specific issues requiring technical expert support and the bringing in of such experts.

<u>Task 2: Data/Design Bases Acquisition</u>

A data list will be developed of the available design related and design basis information inventory for the Essential Service Water System. Input will be solicited from Cook Nuclear Plant site and home office personnel in the data identification phase. The objective will be to obtain and assess all documents supporting implementation of the Self-Assessment Plan. These would include, but would not be limited to, the following:

- Design Basis Documents (as available)
- Original Equipment Purchase Specifications
- Flow Diagrams
- Logic Diagrams
- Loop Schematics
- Elementary Wiring Diagrams
- Original Pre-Operational Test Procedures and Reports
- Licensing Letters
- Operating and System Procedures
- Abnormal, Emergency, and Alarm Response Procedures
- Surveillance and Test Procedures and Reports
- Corrective and Preventive Maintenance Procedures

- Training Lesson Plans
- Instrument and Control Setpoint Calculations
- Calibration Procedures and Reports
- Maintenance Job Orders
- Non-Conformance Reports
- SALP and INPO Evaluations
- Condition Reports

Task 3: Execution of the Self-Assessment Plan

The SWSOPI is implemented by the review team utilizing the attached Self-Assessment Plan. The plan will be customized to incorporate system specific areas of attention, including trouble spots and problem areas that are identified during the initial discussions with Cook Nuclear Plant personnel. This will aid in focusing the reviews from the start. The data gathering and design bases review tasks provide the review team with the necessary baseline operational and functional information to evaluate during the execution of the plan. The plan is designed to be a guide for the detailed system review and provide a means to standardize the fundamental review process and ensure thoroughness. The plan provides the minimum set of items to be reviewed for each major area based on the overall objectives of the NRC SWSOPI program and previous experience. It is stressed that the review team members are expected to add to and refine the inspection plans based on the direction and findings of the assessment. The plan addresses the following inspection areas:

- Design (including system design bases and design changes and modifications)

- Operations (including procedures, human factors, training, surveillance and testing in electrical, mechanical and I&C)

- Maintenance (vendor manuals, maintenance procedures, work prioritization, planning, procurement, inspections, completed Job Orders, maintenance training)

Review meetings will be conducted at the conclusion of each day's activities while on site. The meetings allow for cross-discipline review and discussion of potential trouble areas. The meetings, conducted by the team leader, allow for complete "system" basis conclusions and findings.

The execution of the plan will be accomplished per the schedule in Section 3. The SWSOPI review will follow the requirements of the NRC Temporary Instruction.

Interviews with appropriate Cook Nuclear Plant personnel (operations, maintenance, training, etc.) will be conducted along with general research into potential problems or trouble spots. General questioning is directed toward system improvement. "What can go wrong?" and "How do we make it work better?"

The project team will utilize the strategy described below:

1. Each Functional Reviewer will be responsible to execute their respective part of the Self-Assessment Plan. The Team Leader will oversee and guide the team to ensure a thorough and focused effort.

2. Interviews with appropriate utility personnel (design, operations, maintenance, training, etc.) will be conducted along with general research into potential problems or trouble spots. Interviews aid in identifying potential problem areas very early in the SWSOPI process, thus allowing in-depth system investigation.

3. Three (3) assessment mechanisms will be utilized in the project performance:

   a) plant data assessment,
   b) personnel interviews, and
   c) field inspections.

Each assessment performed will be documented on the Assessment Record (AR) form. AR forms are included as Attachment A:

When there is a need for additional information or identification of a potential problem is made, then the SWSOPI Request for Information Form (RFI) will be used. RFI forms are included as Attachment B. The request will be evaluated whether a concern exists. All RFIs identified as a Concern shall be initialed by the Team Leader or a designee. Each RFI will be numbered to track the status of the RFIs.

The Plant Response Team will obtain the requested information or evaluate the identified potential problem. The response team will evaluate all RFIs categorized as a concern. The response team will document the evaluation on the SWSOPI Concern Form. Concern Forms are included as Attachment C. These will be categorized as follows:

Category A - Condition Report Number generated
Category B - Further investigation required
Category C - Response obtained and submitted to Inspection Team

Through usage of these forms, every stage of SWSOPI assessment can be recorded. The primary objectives of using these forms are listed below:

- A clear path of observation development can be maintained.

- Controls are in place to document implementation of each Self-Assessment criterion.

- Flags are implemented for Team Leader review approvals as well as to focus related inspection areas by other reviewers.

- Potential safety implications receive automatic and immediate attention and prioritization with regard to operability and reportability determinations.

These Assessment Records and Request for information Forms will form the basis of the SWSOPI report development. All observations and issues can therefore be tracked from identification to closeout.

Upon completion of the final on-site inspection week, an exit meeting will be conducted with utility management. During this meeting, the overall performance of the SWSOPI will be summarized along with the identification of observations and findings.

<u>Task 4: Preparation of the Draft Report</u>

A draft report will be prepared and reviewed by the assessment team.

<u>Task 5: Preparation of the Final Report</u>

The final SWSOPI report will then be developed and submitted to the NRC. Documents which are used during the course of the project will be comprehensively logged. Those that are used to directly support the findings and conclusions of the SWSOPI will also be referenced in the final report.

1.0 Mechanical Systems Engineering Design Review and Configuration Control

1.1 Review the design-bases, and other design documents such as calculations and analyses for the SWS, and determine the functional requirements for the SWS and each active component during accident or abnormal conditions.

1.2 Review the SWS configuration drawings for consistency with applicable design documents, NRC requirements, and licensing commitments.

1.3 Review the SWS operation as compared to design documents.

1.4 Evaluate single active failure vulnerabilities of the system and the resulting impact on interfacing system components. Also, examine potential common mode failures from fouling of common intakes or traveling screens.

1.5 Review the effectiveness of design features installed to minimize silting and biofouling of the piping and components.

1.6 Verify if features are provided for the timely detection of flow degradation and if flow balancing has been conducted during various system operating modes.

1.7 Verify that pump run out conditions are not present with minimum number of pumps operating with worst case alignment of non-safety related loads.

1.8 Verify that system flow balance data is consistent with key design assumptions.

1.9 Check whether design features are provided to mitigate the effects of flooding caused by SWS leaks. Review NUREG 1275, Volume 3, Section 3.3 for information on SWS events involving actual or potential flooding.

1.10 Review the safety-related portion of the system for seismic qualification and verify that non-safety related portions can be isolated in accordance with the provisions specified in the system design bases.

1.11 Review the program for monitoring system degradation.

1.12 Review the setpoints for alarms and actuations to ensure they are consistent with the design bases and assumptions.

1.13 Review the system design bases to ensure that the functions required are met.

1.14 Evaluate the adequacy and consistency of the existing system/component with respect to the design bases.

1.15 Assure availability of power circuits under all operating and design bases conditions.

1.16 Review instrumentation for range and accessibility.

1.17 Verify the adequacy of system/component controls and protection logic.

1.18 Review all modification to the SWS and select at least three significant modifications for a detailed review.

1.19 Evaluate the Cook Nuclear Plant assessment to Action IV of Generic Letter 89-13.

2.0 Operations

2.1 Perform an in-depth system walkdown. Review the SWS configuration for consistency with design drawings.

2.2 Review the SWS alarm response procedures and operating procedures for normal, abnormal, and emergency system operations.

2.3 Review operating logs to determine the adequacy of temperature and flow monitoring.

2.4 Review operator training for the SWS, ensuring that the lesson plans reflect the system modifications and that the licensed operators have been trained on these modifications.

2.5 Review the proper implementation of procedures for verifying periodic and post-maintenance alignments of valves in the SWS, especially those valves that isolate flow to safety-related components.

2.6 Verify that required accident condition flow is not degraded during normal system operation valve alignments.

2.7 Review control of SWS heat exchanger flow variations due to changing climate (temperature) conditions.

2.8 Walk through the system operating procedures and the system piping and instrument diagrams with engineering and operations staff, as appropriate. Verify that the procedures can be performed and that components and equipment are accessible for normal and emergency operation.

2.9 Verify that the operators' knowledge of equipment location and operation is adequate.

2.10 Interview the operators to determine the adequacy of their technical knowledge of such items as the operation of the system, its role in accident mitigation, technical specification surveillance requirements, and determination of operability.

2.11 Review the local operation of equipment. Determine if the indication available to operate the equipment is in accordance with applicable operating procedures and instructions. Verify that the environmental conditions, such as expected room temperature, emergency lighting, and steam, assumed under accident conditions are adequate for remote operation of equipment.

2.12 Assess operational controls for traveling screens and circulating water pumps to preclude excessive drawdown of the intake bay, with associated loss of SWS pump suction head, as a result of clogging the traveling screens. Assess operational requirements for the sliding sluice gates.

2.13 Assess the effectiveness of the OE Program.

3.0 Maintenance

3.1 Conduct an in-depth system walkdown to review the as-configured system for material condition.

3.2 If possible, witness maintenance performed on the selected system. Review maintenance package preparation and observe quality control involvement.

3.3 Review maintenance procedures for technical adequacy.

3.4 Determine if maintenance procedures are sufficient to perform the maintenance tasks and provide for identification of equipment deficiencies..

3.5 Compare maintenance procedures to vendor manuals to identify any vendor recommendations not incorporated into the procedures.

3.6 . Determine if vendor manuals are available and maintained current.

3.7 Review the periodic inspection program used to detect corrosion, erosion, protective coating failure, silting, and biofouling.

3.8 Review the maintenance program for removal and repair of SWS piping and interface system components due to silting, biofouling, corrosion, erosion, and failure of protective coatings.

3.9 Determine if the SWS components are being adequately maintained to ensure their operability under all accident conditions.

3.10 Review the maintenance history for the selected components of the SWS for the past two operating cycles (minimum of two years) or longer if necessary. Look for recurring equipment problems and determine if any trends exist.

3.11 Review several completed maintenance activities for technical adequacy, performance of appropriate post-maintenance testing and satisfactory demonstration of equipment operability.

3.12 Determine the adequacy of the maintenance program from an overview perspective. Of importance here is a determination that the maintenance work order system ensures that the plant, system and component design bases are adequately maintained.

3.13 Determine if maintenance personnel receive adequate training pertaining to the SWS and if the degree of training provided is consistent with the amount of technical detail in the procedures.

3.14 Conduct detailed interviews with the maintenance personnel to determine their technical knowledge of how components are maintained.

3.15 Assess the degree of assessment of industry - component/system specific failures and/or maintenance issues.

4.0 Surveillance and Testing

4.1 Review and evaluate the technical adequacy and accuracy of the technical specification surveillance procedures and inservice test procedures performed in the past two operating cycles (minimum of two years) for the SWS.

4.2 Review the SWS design and licensing bases.

4.3 Verify that test acceptance criteria are consistent with the design bases to ensure the SWS testing adequately demonstrates that the SWS will operate as designed.

4.4 Review indicators of SWS performance to identify if any testing inadequacies exist or if testing frequency is appropriate.

4.5 Determine if surveillance test procedures comprehensively address required SWS responses.

4.6 Review results from preoperational testing to determine whether the SWS capabilities and limitations were appropriately demonstrated. Determine whether appropriate controls were established to avoid unacceptable system or component operating regimes.

4.7 Evaluate the support systems and plant modifications selected for review by the

engineering team to ensure that surveillance and testing has been properly performed.

4.8 Review the inservice test records for valves and pumps in the SWS.

4.9 Review how specific SWS instruments are calibrated and tested.

4.10 Verify that the tolerance used for instrument accuracy is acceptable.

4.11 If possible, witness post-maintenance, surveillance, and inservice tests performed on the SWS.

4.12 Review procedures for periodic testing of safety-related heat exchanger heat transfer capability and the trending of such results.

4.13 For the two previous operating cycles (two years minimum) preceding the inspection, ascertain the system, train, pumps, or significant component unavailability during power and shutdown conditions. Assess the degree to which the licensee has input accurate unavailability data into the IPE.

4.14 Verify that the installed SWS components are tested to ensure the components will perform in accordance with their design bases.

4.15 Review the implementation of the periodic inspection program to detect flow blockage from biofouling in other systems.

4.16 Review testing on one air-to-water heat exchanger served by the SWS to ensure proper heat transfer. Examine the air side for fouling.

5.0 Quality Assurance and Corrective Actions

5.1 Review the meeting minutes of the plant onsite safety review committee and the offsite safety review committee for the past six months for items pertaining to the SWS.

5.2 Review the operational history of the SWS.

5.3 Compare the results of the team's assessment of the areas inspected for the SWS with the results of applicable licensee quality verification activities in the same areas. Determine why quality verification activities did not uncover significant issues identified by the team.

5.4 Review the timeliness and technical adequacy of licensee resolution of findings from its self-assessments. Review the open item tracking system items pertaining to the SWS for adequate tracking and closure of identified deficiencies.

5.5 Evaluate the interface between engineering and technical support (E&TS) and plant operations, regarding corrective actions to resolve operational problems.

6.0 Electrical and I&C

6.1 Review the design-basis, and other design documents such as calculations and analyses for the electrical and instrumentation components and systems supporting the SWS and each active component during accident or abnormal conditions.

6.2 Evaluate the design criteria including the requirements for layout, redundancy and diversity, electrical separation, seismic, EQ, safe shutdown, containment isolation, and electrical and I&C safety-related functions.

6.3 Evaluate single active failure vulnerabilities of the system and the resulting impact on interfacing system components.

6.4 Evaluate the adequacy of I&C to support the control room operators during normal, abnormal, and emergency conditions.

6.5 Review several design modifications packages to ensure that all related issues were addressed adequately.

6.6 Perform a " Human Factors" evaluation to verify the ease of operation of the system and review control room and equipment layouts.

6.7 Review how specific SWS instruments are calibrated and tested.

ATTACHMENT A

ASSESSMENT RECORD FORM

SERVICE WATER SYSTEM OPERATIONAL PERFORMANCE INSPECTION		
ASSESSMENT RECORD		
TOPIC:		TOPIC NO. ___
REFERENCES/REF.NO.:		
INTERVIEWEES:	NAME	DATE
ACTIVITY WITNESSED:	ACTIVITY	DATE
OBSERVATIONS: Deficiencies: Weaknesses: Strengths:		
ASSESSMENT:		

SERVICE WATER SYSTEM OPERATIONAL PERFORMANCE INSPECTION

ASSESSMENT RECORD

ASSESSMENT (continued):

ATTACHMENT B

SWSOPI REQUEST FOR INFORMATION FORM

(RFI)

SWSOPI REQUEST FOR INFORMATION FORM (RFI)	
INSPECTOR:	DATE:
QUESTION:	
CONCERN: YES____ NO____	
RELATED PLAN SECTION #:	
TL/ATL APPROVAL:	RFI #:
RESPONSE:	
CLOSED BY:	DATE:
RESPONSE TL:	DATE:

ATTACHMENT C

SWSOPI CONCERNS FORM

SWSOPI CONCERNS	
RFI #: CONCERN #:	DATE:
DESCRIPTION:	
PRELIMINARY INVESTIGATION:	
CATEGORY (A, B, C): ________	
INVESTIGATED BY:	
RESPONSE TL APPROVAL:	DATE:
(CAT.C) SUBMIT RESPONSE:	DATE:
(CAT.B) FURTHER INVESTIGATION BY:	DATE ASSIGNED: DATE DUE:
(CAT.A) CONDITION REPORT #:	DATE ISSUED:

ATTACHMENT B

CONDITION REPORTS

CONDITION REPORTS

CR 95-0372

No instrument uncertainties or head corrections were considered for calculation of the ESW low header pressure pump start switch setpoint.

Assigned to S. Farlow. Due April 20, 1995. Closed April 13, 1995.

CR 95-0382

Hanger nut missing on ESW pipe support.

Assigned to G. Weber. Due May 12, 1995.

CR 95-0389

ESW pumps operated at flow rates less than the minimum recommended flow.

Assigned to W. Nichols. Due May 12, 1995.

CR 95-0421

Partial summary report not issued for RFC 12-3076.

Assigned to L. Van Ginhoven. Due June 2, 1995.

CR 95-0435

Piping to and from 2-QP-56W is 1/2" vs. 1" on OP flow diagram.

Assigned to A. Lotfi. Due April 20, 1995. Closed April 17, 1995.

CR 95-0475

EDG aftercooler temperature indicator attached by masking tape.

Assigned to T. Beilman. Due April 30, 1995. Closed April 27, 1995.

CR-0476

ESW pump impeller upgrades.

Assigned to L. Van Ginhoven. Due May 14, 1995.

CR-0506

Tracking of various procedure change requests.

Assigned to W. Nichols. Due May 24, 1995.

CR-0507

Training of maintenance personnel on GL 89-13 issues.

Assigned to P. Carteaux. Due May 24, 1995.

CR-0508

Additions to vendor documents (OTH) without engineering approval.

Assigned to W. Burgess. Due June 8, 1995.

CR-0509

No formal program for capturing inspection data when system components are opened for maintenance.

Assigned to G. Weber. Due June 8, 1995.

CR-0510

Small margins in flow to CTS heat exchangers during flow balancing.

Assigned to D. Powell. Due May 10, 1995.

CR-0511

Insufficient proceduralized acceptance criteria for inspection of safety-related heat exchangers.

Assigned to D. Powell. Due May 10, 1995.

CR-0512

Testing and analysis of heat exchanger performance do not meet the requirement of GL 89-13 to calculate the heat transfer at design conditions after obtaining the fouling factors from the test data.

Assigned to D. Powell. Due MAy 10, 1995.

CR 95-0513

Evaluate whether there are potentially adverse effects due to the vacuum condition in the CTS heat exchanger.

Assigned to D. Powell. Due May 10, 1995.

ATTACHMENT C

ESW JOB ORDER SUMMARY - GL 89-13 CORROSION MONITORING

ESW JOB ORDER SUMMARY - GL 89-13 CORROSION MONITORING

Examples of ESW Component Job Orders Reflecting Corrosion and/or Silt Build-Up

COMPONENT	JOB ORDER	DATE	NOTED CORROSION	COMMENTS
1-ESW-101E	R20791	3/94	Pitting/corrosion on piping flanges and valve discs.	No history on 1-ESW-101W.
2-ESW-102W	C442	4/92	Pitting noted on flange.	No history on 2-ESW-102E, RT A52455, no JOA, 5 RFOs.
1-QP-56E	C14554	3/93	Found valve "full of rust and corrosion."	1-QP-56W, A52815, no JOA, 5 year.
2-QP-56W	R41744	3/95	Corrosion & MIC evident. Rodded out vent inlet and outlet piping.	2-QP-56E, A52815, no JOA for 5 years.
1-T-131-1	C4539	3/93	Replaced trap due to internal rust/ corrosion.	A10880 written 12/91 from Artemis AR files. RT A52064 established RCM 2 RFOs.
1-T-131-3	C1966	7/93	Replaced due to corrosion.	A4784 written 9/21. References Artemis JOA 17272.
2-T-131-2	C17419	11/93	Replaced trap.	A44780, 5/93 leaks by. No RT for periodic inspections on Unit 2 traps.
2-T-131-1	C9346	3/93	Trap in "bad" condition; suggest replacement.	A14861, 2/92, leaks by.
WMOs-744, 753, 754				Both units, no history on NPM.

COMPONENT	JOB ORDER	DATE	NOTED CORROSION	COMMENTS
WRVs 721-728				Both units, no history on NPM.
OME-34E(W)				Both units, no history on NPM.
2-SV-14W	C1280	5/92	SV internals badly pitted, coated with "red clay-like substance."	
1-SV-14E	R21374	3/94	Internals found "muddy."	
1-SV-16CD	C1500	7/92	Buildup on seats.	
2-SV-14W	C8292	5/92	Stuck open from dirt and trash.	
2-SV-14W	C14562	2/93	Stuck open from small abrasive particles.	

ATTACHMENT D

GENERIC LETTER 89-13 ACTIONS SUMMARY

GENERIC LETTER 89-13 ACTIONS SUMMARY

ACTION I - BIOFOULING CONTROL AND SURVEILLANCE TECHNIQUES

Action I of GL 89-13 requested implementation of an ongoing program of surveillance and control techniques to significantly reduce incidence of flow blockage problems as a result of biofouling.

The SWS has experienced blockage and silt accumulation in the past, and zebra mussels have been found in the ESW system. Inspections of the intake for biofouling control meet the requirements. The chlorination treatment program and application of clamtrol have been reasonably effective.

Occasionally in the past, the as-found flow balance did not meet the requirements. The CTS heat exchanger has had high differential pressures and subsequently was chemically cleaned twice.

The most recent flow balances have had CTS outlet valves positioned in the full or almost full open position. While design flows are achieved, there is minimal flow margin to the CTS heat exchanger. Silt accumulation in the ESW lines to the CCW heat exchanger upstream of the flow orifice could be the cause of false low flow readings. Higher actual flows to the CCW heat exchanger; higher flow balance settings; and degraded pump performance in conjunction with a test flow rate beyond the design point could be the root cause of the reduced measured flow to the CTS heat exchanger.

ACTION II - MONITORING SAFETY RELATED HEAT EXCHANGER PERFORMANCE

Action II requested implementation of test programs to periodically verify the heat transfer capability of all safety related heat exchangers cooled by service water.

The test program for heat exchangers meets commitments but is incomplete since all previous test data have not been analyzed on the CCW heat exchangers. Analytical results from the Unit 1 outage have not been finalized. The 1994 Unit 2 CCW data did not yield meaningful results. Analysis results have not been submitted to Cook Nuclear Plant for the Unit 1W CCW heat exchanger.

Heat transfer testing of the CCW heat exchanger has experienced difficulties. Even with errant data, it appears that the CCW heat exchangers are performing in accordance with the design specification. Improved test data for ESW flow measurements and CCW and ESW temperature measurements is needed.

Operating data indicates that performance of the diesel generator coolers is acceptable. Diesel generator heat exchangers are inspected each outage.

There is no formal trending of performance test results.

ACTION III - ROUTINE INSPECTION AND MAINTENANCE

Action III requested implementation of routine inspection and maintenance programs for open-cycle SWS piping and components to ensure that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade performance of the safety related systems supplied by service water.

Inspection and maintenance of components relating to MIC and biofouling meet commitments but are deficient. Maintenance personnel are not fully cognizant of microbiological induced corrosion.

Silt has accumulated in various components including the CCW and CTS heat exchangers. No programmatic inspection of the ESW piping has been scheduled. The SWS strainers have not been opened for inspection and cleaning for at least six years.

Acceptance criteria for component inspections are not provided. Records of inspection are informal and, in some cases, not in agreement with photographs of inspected components. Improved quantification of the inspection findings is required. There is no formal trending of inspection data.

ACTION IV - DESIGN FUNCTION VERIFICATION AND SINGLE FAILURE ANALYSIS

Action IV requested confirmation that the service water system will perform its intended function in accordance with the licensed basis for Cook Nuclear Plant.

The single failure analysis review performed for the GL 89-13 response did not cover the SI signal to the ESW pumps but was analyzed and found acceptable during the assessment. A design function verification was not documented in the GL 89-13 submittal. A DBD was recently completed for the ESW system. DBD development was found to be an acceptable method for design verification of the ESW system.

ACTION V - TRAINING

Action V requested confirmation than maintenance practices, operating and emergency procedures, and training involving the SWS were adequate to ensure the safety related equipment cooled by the service water system will function as intended and that operators of this equipment will perform effectively.

Management and technical staff are trained regarding the impact of MIC, corrosion, biofouling, and mitigating features (chemical treatment). Training was found to be satisfactory.

Training of maintenance personnel on awareness of MIC could be improved. Operator training on the ESW system and associated procedures was found to be acceptable.

ATTACHMENT E

RECOMMENDATIONS

RECOMMENDATIONS

To maintain the ESW system and to retain its capability to perform its safety related functions, the following actions are recommended:

R1 Evaluate the CCW heat exchanger supply piping for silt accumulation and reconfirm the flow instrumentation. If silt accumulations show potential impact on indicated flow, reperform the flow balance, i.e., if the actual flows in the line are found to be higher than previously thought. This extra flow to the CCW heat exchanger takes flow away from the CTS heat exchanger. (Ref: Plan Item 1.8)

R2 Continue development of the computer model for hydraulic analysis of the ESW system. Evaluate the flow balance for LOCA conditions when two pumps per train (one in Unit 1 and one in Unit 2) are expected to be running. Confirm that the flow balance valve lineup is valid under the operating case of the open train cross-tie valves (between units) with the other unit in each of its possible configurations. (Ref: Plan Item 1.1)

R3 Develop a heat exchanger heat transfer test program for testing and analyzing CCW heat exchangers which includes a basis for test requirements for the following:

- type of instrumentation
- number of each type
- sensor location

Test data analysis methodology should also include; source references for the equations used, sample calculations, and a calculation which supports the design data sheet. Verification should be completed for the analysis methodology. (Ref: Plan Items 1.19 and 4.13)

R4 Establish the flow rates in the flow balance at values close to the required flow rates. Currently, excess flow rates are established to the Emergency Diesel Generator (EDG) and CCW heat exchangers which contribute to low flow to the CTS heat exchangers. (Ref: Plan Item 1.8)

R5 Develop a pipe inspection program. The program should focus on the key Generic Letter 89-13 issues of silt accumulation, mussels, MIC, and corrosion and should include a timeline for completion. Inspection of the embedded piping in the turbine building foundation should be included. (Ref: Plan Item 3.7)

R6 Change the test flow rate for the IST Pump Test. The pump is tested at a flow rate of 7,000 gpm. The accident flow rates in the flow balance are 9,126 gpm plus up to 80 gpm for the control room air conditioning (CRAC). Therefore, the test flow rate should be on the order of 9,200 gpm. (Ref: Plan Item 4.1)

R7 Since silt accumulation has been a historical condition at Cook Nuclear Plant, the piping should be radiographed at key locations to determine the extent of silt accumulation. These locations should include the following:

- the low points in the line to the CTS heat exchanger,
- the upstream and downstream piping adjacent to the flow orifices monitoring the CTS and CCW heat exchanger flows,
- and the 12" piping upstream of the 3" takeoff to the CRAC.

Cook Nuclear Plant has been in operation for over twenty years; therefore, silt accumulation could be significant at these low point and low flow condition locations in the piping. (Ref: Plan Item 3.4)

R8 Develop inspection criteria for components in the ESW system which include quantifiable parameters. (Ref: Plan Item 3.4)

R9 Implement additional training for the maintenance supervisors and mechanics including topics such as silt accumulation, MIC, mussels, and corrosion (pipe wall loss). (Ref: Plan Item 3.13)

R10 Review implementation of significantly delayed modification packages to ensure the information is current from a technical and administrative aspect. (Ref: Plan Items 4.7 and 6.5)

R11 Add guidance to the annunciator response procedure for low forebay level on how to establish alternate means to restore the heat sink, in addition to the existing guidance on restoring the ESW flow path by opening the sluice gates WMO-17/27, if circulating water is lost. (Ref: Plan Item 1.10)

R12 Ensure that maintenance procedures for rubber expansion joints (12MHP.5021.001.154 and 12MHP.5021.019.022) reference each other and use consistent terminology. Inspect all expansion joints in the ESW pipe tunnel to ensure that maximum/minimum travel stops are installed and properly adjusted for the particular joint. Attachment 1 of 12MHP.5021.001.154 should be reviewed against the uncontrolled list of expansion joints (provided under RFI 033) to include those not shown in the procedure attachment. (Ref: Plan Item 3.3)

R13 Provide additional guidance in the instructions for performing cleaning of heat exchangers to specify the cleaning processes to be used. (Ref: Plan Item 3.3)

R14 Develop maintenance procedures for:

a) ESW pump discharge strainers,
b) ESW control valves to EDG aftercoolers,
c) CCW heat exchanger outlet valves, and
d) plugging of heat exchanger tubes. (Ref: Plan Item 3.4)

R15 Include information available in vendor document for ESW pump into the maintenance procedure. (Ref: Plan Item 3.5)

R16 Resolve the apparent discrepancy between PMI-2291 and SAM 5.14 regarding use of priority 37 classification. (Ref: Plan Items 3.9 and 3.12)

R17 Complete the implementation of the material changeout for the ESW pumps from aluminum-bronze to stainless steel as soon as possible.

R18 Several parts of the DBD require clarification or additional input, or correction. See the listing of comments on the DBD provided separately.

R19 Improve the settings for the flow balance tests. The as-left values are significantly above the required values in the procedures. As a result of existing practices, the pump operates further out on its curve than desired. The lower pressure and additional flows result in reduced pressure available at the CTS heat exchanger. (Ref: Plan Item 1.8)

R20 During the reviews for Inspection Program and MIC Program implementation and the review and evaluation of the many job orders on ESW valve maintenance, many opportunities were identified during which ESW system internal inspections could have been performed. These instances, if inspected and recorded in accordance with standardized criteria, would provide a cost effective process to collect a great deal of valuable GL 89-13 corrosion data. The Systems Engineer should take advantage of the opportunities to collect such data. Processes should be implemented to effectively and consistently obtain this data and become part of the piping and MIC inspection program.

R21 The ESW Strainers have not been manually inspected or cleaned since about 1989. Based on the grass matting seen on the CCW heat exchanger tubesheet, it appears the ESW Strainers should be periodically inspected and manually cleaned. This inspection should also confirm the condition of the strainer baskets themselves.

ATTACHMENT F

REQUESTS FOR INFORMATION

REQUESTS FOR INFORMATION

NO.	TOPIC	REV'R	RETN'D	NOTES
1	TEN YEAR HYDRO PLAN	JMO	X	PROVIDED
2	OP/OHP INSTRUMENT DISCREPANCIES	AT/JPO	X	PCR 95-0246 ISSUED
3	OP/OHP VALVE DISCREPANCIES	JPO/AT	X	PCR 95-0246 ISSUED
4	LOOSE GREASE SUPPLY FITTING	JH/CH	X	AR 91599 ISSUED
5	U1 E&W UNSEALED PENETRATION, NO DAMPER	JH/CH	X	RESPONSE ACCEPTABLE
6	LOOSE CONDUIT FITTINGS TO FOUR COMPONENTS	JH/CH	X	AR 91600 ISSUED
7	REQUEST FOR VARIOUS CALCULATIONS	RTS	X	PROVIDED
8	HEAT EXCHANGER TUBE SHEET MAPS	GH	X	RESPONSE ACCEPTABLE
9	HEAT REMOVAL CAPABILITIES DURING RECIRCULATION THROUGH SLUICE GATES	GH	X	RESPONSE PROVIDED, RFI 35 ISSUED
10	ASME SECTION XI TEST RESULTS REQUEST	JO/WM	X	PROVIDED
11	INTAKE INSPECTION REPORT	GH	X	PROVIDED
12	REQUEST FOR FSAR 9.8-5 SUPPORTING CALCULATION	GH	X	PROVIDED
13	PLUGGING ALLOWANCE ON HX CALCULATIONS	GH	X	RESPONSE ACCEPTABLE
14	LOOSE THERMOLAG, CCHX ESW OUTLET VALVE CONTROL BOX	JH/CH	X	AR A91643 ISSUED
15	SAFETY VALVE TESTING INFORMATION	WM	X	PROVIDED
16	CHECK VALVE PROGRAM INFORMATION	WM	X	PROVIDED
17	PUMP MATERIAL CHANGE INFORMATION	RTS	X	PROVIDED
18	CR 94-2138: CONTROL CIRCUIT DESIGN	DEK	X	RESPONSE PROVIDED

NO.	TOPIC	REV'R	RETN'D	NOTES
19	WPS-701 MERCOID NUCLEAR CERTIFICATION	DEK	X	PROVIDED
20	WRA-713 POWER CABLE STOWAGE	JH	X	RESPONSE PROVIDED RFI 59 ISSUED
21	X-TIE HEADER PRESSURE CALC/HEAD CORRECTION	DEK	X	CONDITION REPORT 95-372 ISSUED
22	REQUEST FOR VARIOUS CR'S AND PR'S	RTS	X	PROVIDED
23	REQUEST FOR VARIOUS DRAWINGS & RFC 3076	RTS	X	PROVIDED
24	ESW PUMP BYPASS & INOPERABLE ALARM	DEK	X	RESPONSE PROVIDED
25	FSAR VS DBD FLOW REQUIREMENTS	GH	X	RESPONSE PROVIDED
26	REQUEST FOR COPY OF DAILY POD	DP	X	PROVIDED
27	HX15W OUTLET PIPE SUPPORT MISSING NUT	RTS	X	CONDITION REPORT 95-382 ISSUED AR 91654 ISSUED
28	ESW EXPANSION JOINT INSTALLATION DEFICIENCIES	RTS	X	RESPONSE PROVIDED
29	SETPOINT CALC/ECP FOR VARIOUS INSTRUMENTS	GH	X	PROVIDED
30	INTAKE/FOREBAY INSPECTION RESULTS	JH/CH	X	PROVIDED
31	PROVIDE CCW HX VENDOR MANUAL	JH/CH	X	PROVIDED
32	CALC TO SUPPORT EDG FLOW REDUCTION 610/540	GH	X	RESPONSE PROVIDED
33	XJ INSTALLATION PROCEDURE, INSPECTION RESULTS	GH	X	PROVIDED
34	1st TEN YEAR HYDRO RESULTS, DRAFT 95/96 PROCEDURE	JMO	X	PROVIDED

NO.	TOPIC	REV'R	RETN'D	NOTES
35	FOLLOW UP ON RFI 009, RE/MAINT/TEST OF SLUICE GATES	GH	X	RESPONSE PROVIDED
36	DIFFERENT MAX TEMP LIMITS PMSO.111 VS. OHP	GH	X	PCR 95-0259 ISSUED
37	10/93 J.O. COMPLETE ON WRV-767, TAG NOT CLEARED	JH/CH	X	CR 95-137 PREVIOUSLY ISSUED
38	PROGRAM FOR S.E. NOTIFICATION OF AR TAGS	JH/CH	X	RESPONSE ACCEPTABLE
39	COPY OF NRC VIOLATION/RESPONSE RE:AR TAGS	JH/CH	X	PROVIDED
40	COPY OF NUREG-1275, VOL. 3	GH	X	PROVIDED
41	PIPE CAP MISSING ON 1-WTX-737W	AT/JPO	X	CAP WAS INSTALLED
42	WALKDOWN DISCREPANCIES VS. OHP	AT/JPO	X	PCR 95-258 WAS ISSUED
43	J.O. DOCUMENTATION FOR DG A/C INSPECTION	JH	X	INFORMATION WAS PROVIDED
44	CONFIRM CCW HX BOLTING/MOUNTING PER VICS	GH	X	RESPONSE ACCEPTABLE
45	ADEQUATE CONTROL OF RFC BOUNDARY VALVES	AT/JPO	X	RESPONSE PROVIDED CR95-0241 ISSUED
46	COPY OF MM-454, SCEW V06	DEK	X	PROVIDED
47	SAFETY CLASS INCONSISTENCY MM513 VS 503	DEK	X	RESPONSE ACCEPTABLE
48	HANDLING OF ISSUED DESIGN CHANGE FOR WHICH IMPLEMENTATION IS SUBSEQUENTLY DELAYED	DEK	X	RESPONSE PROVIDED
49	REQUEST FOR THE EQUIVALENCY PROCEDURE	GH	X	PROVIDED

NO.	TOPIC	REV'R	RETN'D	NOTES
50	PROCEDURE FOR CALC DISTRIBUTION/REVIEW VS DBD	GH	X	ACCEPTABLE RESPONSE
51	COPIES OF 3 PR'S	DP	X	PROVIDED
52	ESW PUMP TEMPERATURE MEASUREMENT LOCATION	RTS	X	RESPONSE PROVIDED
53	COPIES OF SOER 85-5, PM-1187, MM-235	GH	X	PROVIDED
54	ADHERENCE TO PUMP MINIMUM FLOW REQUIREMENTS	JMO	X	CONDITION REPORT 95-389 ISSUED
55	PROVIDE COPY OF HVAC CALC REFERENCE	RTS	X	PROVIDED
56	FAILURE OF S.C. III CRAC CONDENSER	GH	X	ACCEPTABLE RESPONSE
57	PROVIDE ACCEPTANCE DOCUMENTATION FOR ESW HYDRO	JMO	X	PROVIDED
58	TRAINING PER 89-13 V NOT CONDUCTED	CH/JH	X	RESPONSE PROVIDED
59	CABLE ROUTING FOLLOW-UP TO RFI-20	JH/CH	X	ACCEPTABLE RESPONSE
60	NO REFERENCE TO WMO-17/27 OPENING ON PUMP START ALARM	AT/JPO	X	PCR'S 95-0278 & 95-0279 ISSUED
61	PROVIDE DBD REFERENCES ON STRAINER BACKWASH	AT	X	PROVIDED
62	PROVIDE RESPONSE ON L.S. NON-QUALIFIED WIRE NRC BULLETIN	DEK	X	PROVIDED
63	JUSTIFY SEISMIC MOUNTING ON INSTRUMENT TUBING WITH FRICTION MOUNTS	DEK	X	ACCEPTABLE RESPONSE
64	PROVIDE INSTRUMENT SETPOINT METHODOLOGY	DEK	X	PROVIDED
65	TRAINING RECORDS FOR CHC602 AND MAINT/MECH	JH	X	PROVIDED

NO.	TOPIC	REV'R	RETN'D	NOTES
66	HX EVALUATION METHODOLOGY FOR CCW AND DG AND THE INSPECTION CRITERIA FOR THE CTS.	RTS	X	PROVIDED
67	PROCEDURE FOR HANDLING OPERATING EXPERIENCE	AT	X	PROVIDED
68	COPY OF PR-90-619	DP	X	PROVIDED
69	ES 1.3 DOES NOT STATE TO CLOSE WMO-717/715	AT	X	ACCEPTABLE RESPONSE
70	PROVIDE UPDATED SWS EXPANSION JOINT DATA BASE	CH	X	PROVIDED
71	PROCEDURE FOR HX INSPECTIONS, CRITERIA, CORRECTIVE ACTIONS	JH/CH	X	RESPONSE PROVIDED
72	METHODOLOGY OF EDG FLOW REDUCTION CALCULATION	RTS	X	RFI 103 ISSUED
73	SYSTEM DESCRIPTION INSTRUMENT DISCREPANCIES	GH	X	ACCEPTABLE RESPONSE
74	COPY OF APP R SAFE SHUTDOWN COMPLIANCE ANALYSIS	JH	X	PROVIDED
75	YEARLY/TOTAL RUN TIMES ON ESW PUMP/MOTOR	JH	X	RESPONSE PROVIDED
76	DISSIMILAR METAL CONNECTIONS ON TUBING	DEK	X	ACCEPTABLE RESPONSE
77	COPY OF EPRI NP-4582 "MIC AT NUKES"	JH	X	COPY PROVIDED
78	COPY OF SINGLE ACTIVE FAILURE REVIEW FOR 89-13	RTS	X	RESPONSE PROVIDED
79	DIFFICULTY READING 1000 GPM ON WFI-735 IN CONTROL ROOM	DEK	X	ACCEPTABLE RESPONSE
80	ESW PUMP ROOM INSTRUMENT RACK ACCESSIBILITY	DEK	X	ACCEPTABLE RESPONSE

NO.	TOPIC	REV'R	RETN'D	NOTES
81	2-ESW-213 PRACTICALLY INACCESSIBLE FOR VENTING	AT/JPO	X	RESPONSE ACCEPTABLE
82	COPY OF CR 94-1622/LER 94-005	AT/JPO	X	PROVIDED
83	ELIMINATION OF PM TASK TO SAMPLE ESW PUMP OIL	JH	X	SEE RFI 112
84	ARTEMIS HISTORY ON DUPLEX STRAINER JO'S	CH/JH	X	PROVIDED
85	VENDOR MANUAL FOR QP-56E,W	JH	X	PROVIDED
86	DP RESULTS DURING WMO-713,714,716,718 MOV TESTS	JO/WM	X	PROVIDED
87	THP 4030 STP.241 FLOW BALANCE REFS TO DBD/FSAR	JMO	X	ACCEPTABLE RESPONSE
88	RESULTS OF R002081 HX 47-CDS CLEAN/INSPECTION/MIC	JH	X	PROVIDED
89	INCOMPLETE DOCUMENTATION HX15E CLEAN/INSPECTION	JH	X	RESPONSE PROVIDED
90	HXP841106 FLOW CALC CLARIFICATION	RTS	X	PROVIDED
91	HXP900626AF SUCTION LIFT/HEAD DIFFERENTIAL	RTS	X	PROVIDED
92	BASIS FOR E/C STATEMENTS IN AEP/NRC:1104A	JH	X	RESPONSE PROVIDED
93	TESTING FOR FSAR MIN FLOWS ON AFW AND CRAC	WM	X	RESPONSE PROVIDED
94	PR 92-316 REVIEW OF HX CONNECTION DETAIL	DP	X	ACCEPTABLE RESPONSE
95	CR 94-546 FLOW DISCREPANCY WITH FSAR	WM	X	RESPONSE PROVIDED
96	UNGROUNDED 220V CONTROL CIRCUITS ANALYSIS	DEK	X	RESPONSE PROVIDED

NO.	TOPIC	REV'R	RETN'D	NOTES
97	PROVIDE AR 77901, IC-004, CR 94-2138 COMMITMENT	DEK	X	PROVIDED
98	JUSTIFY PRIORITY 37 FOR 2-XTI-301	JH/CH	X	SEE RFI 115 & 159
99	FOCUS REPORT ON PAST 2 YEARS PMS	JH/CH	X	PROVIDED
100	JUSTIFY PRIORITY 37 FOR XTCI-301, 302	JH/CH	X	SEE RFI 115 & 159
101	PROVIDE DCC PV301/302 QCS SPECS	JH/CH	X	PROVIDED
102	PROVIDE SYSTEM ENGINEER PROGRAM	JH/CH	X	PROVIDED
103	CLARIFY FLOW REQUIREMENT IN HXP9500531AF	RTS	X	PROVIDED
104	VACUUM CONDITION IN THE CTS HX	GH	X	RESPONSE PROVIDED
105	CIRTS PRINTOUT OF OPEN/UNRESOLVED NRC ITEMS	DP	X	PROVIDED
106	PROVIDE FIRE ZONE ROUTING FOR 4ESW PUMP CONTROL	DEK	X	PROVIDED
107	PROVIDE MM-429	JH/CH	X	PROVIDED
108	PROVIDE AR TAGS FROM CR 95-137, 94-1653	JH/CH	X	PROVIDED
109	LOCAL/NORMAL VS HSD/CONTROL ROOM	AT/JPO	X	PCR 95-0290 & 95-0291 ISSUED
110	PR 492, 493 LETTER FROM QVAP 92-2	DP	X	PROVIDED
111	EDG FLOW REQUIREMENTS FOR 90°F LAKE	RTS	X	PROVIDED
112	PROVIDE COPY OF AR'S FROM RFI-83	JH/CH	X	PROVIDED
113	1/2" INSTALLED PIPING @ QP-56W, DWG SHOWS 1" PIPE	JH/CH	X	CONDITION REPORT 95-435 ISSUED
114	NO MIC INSPECTION WHEN 2-QP-56W WAS REMOVED	JH/CH	X	RESPONSE PROVIDED

NO.	TOPIC	REV'R	RETN'D	NOTES
115	JOB ORDER PRIORITIZATION, FOLLOW RFI'S 98 & 100	JH/CH	X	SEE RFI 159
116	PROVIDE COPY OF ROBERT SHAW VALVE PROCEDURE	JH/CH	X	PROVIDED
117	SEISMIC CLASSIFICATION OF PIPE TUNNEL	RTS	X	PROVIDED
118	INSPECTION CRITERIA GUIDELINES	CH/JH	X	PROVIDED
119	PROVIDE CR'S RELATIVE CTS HX CHEMICAL CLEANING	JH	X	PROVIDED
120	FUSE CONTROL PROGRAM	DEK	X	PROVIDED
121	IMPELLER REPLACEMENT J.O. DOCUMENTATION	JH	X	PROVIDED
122	PROVIDE A COPY OF AEP:NRC 90205	JH	X	PROVIDED
123	DESIGN TEMPERATURE OF ESW PIPE ON CTS HX OUTLET	RTS	X	PROVIDED
124	ESW PUMP START LOGIC ON SI	RTS	X	PROVIDED
125	ESW PUMP AUTOSTART FLOW POINT	RTS	X	PROVIDED
126	PROVIDE I&C DRAWINGS AND STANDARDS	DEK	X	PROVIDED
127	SETPOINT CONTROL AND FUSE TEST PROGRAMS	DEK	X	PROVIDED
128	COPY OF JOHNSON VTM "OTH" DOCUMENTS	JH	X	PROVIDED
129	REFERENCE TO AIR AFTERCOOLER IN VICS MANUAL	JH	X	PROVIDED
130	PROVIDE CALC AND WCAPS	RTS	X	PROVIDED
131	OHP-4021-028-014 STEPS REGARDING ISOLATING CRACS	AT	X	RESPONSE PROVIDED

NO.	TOPIC	REV'R	RETN'D	NOTES
132	PROVIDE TEST DATA ON 4 CCW HX	RTS	X	PROVIDED
133	SEISMIC CLASS OF CTS HX VENT VALVE	GDH	X	RESPONSE PROVIDED
134	COPY OF DG 102.3	DEK	X	PROVIDED
135	STATUS OF SQUG ACTIVITIES	GDH	X	PROVIDED
136	PROVIDE SBICI VIOLATION RESPONSE RE:TRAINING	DEK	X	PROVIDED
137	PROVIDE QAVP 92-02 RECOMMENDATION/DOCUMENT ON CCW HX TESTING I.E. ACCURACIES	DFP	X	PROVIDED
138	LINK FROM PS-FUSE-001 TO PMP 6065-FUS-001	DEK	X	RESPONSE PROVIDED
139	COMMITMENT CLOSEOUT FOR 8 CIRTS ITEMS	DFP	X	PROVIDED
140	LACK OF PRECAUTION IN 12OHP 4021.057.001	AT	X	PCR 95-0311 ISSUED
141	SAFETY CLASSIFICATION OF I&C EQUIPMENT	DEK	X	RESPONSE PROVIDED
142	INSTRUMENT CALIBRATION HISTORY	WEM	X	PROVIDED
143	CLASSIFICATION OF WRV-711	RTS	X	PROVIDED
144	VERIFICATION OF CALC N931001	RTS	X	ACCEPTABLE RESPONSE
145	IEEE-384 FUSE TESTING FOR NON-1E ISOLATION	DEK	X	RESPONSE PROVIDED
146	SINGLE FAILURE OF TRIP COIL DURING LOOP	DEK	X	RESPONSE PROVIDED
147	CABLE SEPARATION OF 11AC, 11BD BREAKERS	DEK	X	RESPONSE PROVIDED

NO.	TOPIC	REV'R	RETN'D	NOTES
148	SAFETY CLASS DOCUMENTATION FOR RFC-1753	GDH	X	PROVIDED
149	FLOW ELEMENT SIZING CALC FOR WFA-702, 705	JMO	X	PROVIDED
150	PRESSURE SWITCHES REVERSED IN OHP 4024.104	JMO	X	PCR 95-0317 ISSUED
151	3 RFO HX INSPECTIONS - FUTURE PLANS	JH	X	RESPONSE PROVIDED
152	INSPECTION OF ESW PIPING TO THE CRAC	JH	X	RESPONSE PROVIDED
153	PURPOSE OF DP ACROSS JW COOLER IN THP 6040.PER.002 EDG	JMO	X	ACCEPTABLE RESPONSE
154	JUSTIFY HOW RESPONSE TO RFI-17 COMPLIES WITH APPLICABLE PROCEDURES	DFP	X	RESPONSE PROVIDED CR 95-476 ISSUED
155	COPIES OF COMPLETED CR'S	AT	X	PROVIDED
156	FLOW RESTRICTION IN CTS HX PIPING	RTS	X	RESPONSE PROVIDED
157	ACCEPTANCE CRITERIA CURVES FOR CCW HX	RTS	X	RESPONSE PROVIDED
158	PROVIDE NED MAN-DAYS AT PLANT	DFP	X	PROVIDED
159	XTI-301, XTC-301/302 FUNCTIONALITY, EDG OPERABILITY	JH	X	RESPONSE PROVIDED
160	HEAT TRANSFER ACROSS CTS WITH AIR INTRUSION	GH	X	RESPONSE PROVIDED