

APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report No.: 50-498/93-49
50-499/93-49

Licenses: NPF-76
NPF-80

Licensee: Houston Lighting & Power Company
P.O. Box 289
Wadsworth, Texas 77483

Facility Name: South Texas Project Electric Generating Station (STP),
Units 1 and 2

Inspection At: Region IV Office, Arlington, Texas

Inspection Conducted: October 12, 1993, through March 18, 1994

Inspectors: M. A. Satorius, Project Engineer, Project Branch A
Division of Reactor Projects

W. C. Sifre, Reactor Engineer, Technical Support Staff
Division of Reactor Projects

Approved: W.D. Johnson
W. D. Johnson, Chief, Project Branch A

3/30/94
Date

Inspection Summary

Areas Inspected: Routine in-office inspection of the Maintenance and Testing issues contained in the Diagnostic Evaluation Team (DET) Report.

Results:

- The Maintenance and Testing section of the DET report was reviewed. Based on this review, issues that the NRC considers necessary to be addressed which do not pertain to the restart of either unit were identified.
- Items identified in the review of the DET report related to nonrestart issues were assigned as inspection followup items (IFIs) in order to facilitate tracking and eventual closure.

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Summary of Inspection Findings:

- The following IFIs were opened:
498;499/9349-07, -13, -14, -15, -16, -17, -24, -25, and -27.
- The following IFIs were opened, but were subsequently closed by referencing other NRC inspection reports:
498;499/9349-01, -02, -03, -04, -05, -06, -08, -09, -10, -11, -12, -18, -19, -20, -21, -22, -23, -26, -28, -29, -30, -31, -32, -33, -34, -35, -36, -37, -38, and -39.

Attachment:

- Persons Contacted and Exit Meeting

DETAILS

1 BACKGROUND

Both units at STP were shut down in early February 1993 and remained shut down as a result of numerous broad-scope problems identified by the NRC and the licensee.

The NRC Office for Analysis and Evaluation of Operational Data conducted a Diagnostic Evaluation of STP during the period March 29 to April 30, 1993. The findings of this evaluation were forwarded to the licensee on June 10, 1993. Numerous items were documented in this report, including a number of issues that NRC considered of sufficient scope and safety significance to require resolution prior to either unit being restarted.

In an effort to identify the Maintenance and Testing issues that NRC did not consider necessary to address prior to restart, a review was conducted of the DET report. As a result of this review, the issues in the following sections were identified.

2 DIAGNOSTIC EVALUATION TEAM NONRESTART ITEMS RELATED TO MAINTENANCE AND TESTING

This section was structured to address the issues in Section 2.1, "Maintenance and Testing," of the DET Report. The introductory section was not addressed because the issues addressed in the introduction were also determined to be identified in the detailed portion of the corresponding section of the report. In addition, the positive observations and Restart Issues were not addressed because these issues were determined to be not applicable or addressed in other NRC inspections.

2.1 IFIs Identified in Paragraph 2.2 of the DET Inspection Report

2.1.1 (Closed) IFI 498/499/9349-01: Preventive maintenance weaknesses resulted from the lack of appropriate scope and incorrect implementing procedures.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-38; 50-499/93-38, 50-498/93-42; 50-499/93-42, 50-498/93-53; 50-499/93-53, 50-498/94-04; 50-499/94-04, and 50-498/94-08; 50-499/94-08.

2.1.2 (Closed) IFI 498/499/9349-02: Craft performance suffered from numerous training deficiencies.

Based on the licensee's focus of improving maintenance training they were removed from a probationary status by an industry organization's assessment of their maintenance training. In addition, based on a sample of maintenance training initiatives, as documented in NRC Inspection Reports 50-498/93-38;

50-499/93-38 and 50-498/94-04; 50-499/94-04, the licensee has improved the quantity and quality of their maintenance training.

2.1.3 (Closed) IFI 498;499/9349-03: Senior managers did not consistently reinforce quality performance.

This item was closed based on the action taken by the licensee and documented in NRC Inspection Reports 50-498/93-37; 50-499/93-37, 50-498/93-38; 50-499/93-38, 50-498/93-40; 50-499/93-40, 50-498/93-41; 50-499/93-41, 50-498/93-42; 50-499/93-42, 50-498/93-43; 50-499/93-43, 50-498/93-44; 50-499/93-44, 50-498/93-45; 50-499/93-45, 50-498/93-46; 50-499/93-46, 50-498/93-47; 50-499/93-47, 50-498/93-53; 50-499/93-53, 50-498/93-54; 50-499/93-54, 50-498/94-04; 50-499/94-04, and 50-498/94-08; 50-499/94-08.

2.1.4 (Closed) IFI 498;499/9349-04: The size of the maintenance staff and the amount of emergent work resulting from equipment failures limited the time that the maintenance personnel could spend on balance-of-plant corrective maintenance.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-53; 50-499/93-53 and 50-498/94-08; 50-499/94-08.

2.1.5 (Closed) IFI 498;499/9349-05: The inefficient work control system, the added workload of a three-train plant, and long-standing design deficiencies also detracted from the amount of balance-of-plant corrective maintenance.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-40; 50-499/93-40, 50-498/93-41; 50-499/93-41, 50-498/93-44; 50-499/93-44, 50-498/93-45; 50-499/93-45, 50-498/93-53; 50-499/93-53, 50-498/94-06; 50-499/94-06, and 50-498/94-08; 50-499/94-08.

2.1.6 (Closed) IFI 498;499/9349-06: Postmaintenance testing weaknesses resulted from a poor reference document and the lack of training to compensate for this document.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-46; 50-499/93-46 and 50-498/93-54; 50-499/93-54.

2.1.7 (Open) IFI 498;499/9349-07: The surveillance testing procedures did not contain all required Technical Specification attributes. Other contributors to the maintenance and testing weaknesses were poor communications and coordination, the quality of the management information system, and the limited staffing to perform vibration analysis for predictive maintenance.

2.2 IFIs Identified in Paragraph 2.2.1 of the DET Inspection Report

2.2.1 (Closed) IFI 498;499/9349-08: Ineffective corrective maintenance, caused by poor root cause analysis, poor prioritization of work, and poor craft performance, adversely affected safety-related equipment performance.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-38; 50-499/93-38, 50-498/93-40; 50-499/93-40, 50-498/93-41; 50-499/93-41, 50-498/93-42; 50-499/93-42, 50-498/93-53; 50-499/93-53, 50-498/94-04; 50-499/94-04, and 50-498/94-08; 50-499/94-08.

2.2.2 (Closed) IFI 498;499/9349-09: The licensee had established a program to determine the root cause of events and major equipment failures but the identification and evaluation of maintenance issues did not always occur. This resulted in the ineffective or untimely resolution of equipment problems.

This item was closed based on this issue being addressed in IFI 498;499/9331-08.

2.2.3 (Closed) IFI 498;499/9349-10: Craft personnel occasionally made mistakes during corrective maintenance.

This item was closed based on this issue being addressed in IFI 498;499/9331-08.

2.2.4 (Closed) IFI 498;499/9349-11: The following was an example of poor root cause determination and poor maintenance efforts:

- A standby diesel generator (SDG) jacket water leak took four attempts to correct. The first two repair efforts were unsuccessful because maintenance personnel installed the wrong size of gasket. In a third repair attempt, the gaskets were made on site with material not suited for that application.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Report 50-498/93-44; 50-499/93-44.

2.2.5 (Closed) IFI 498;499/9349-12: Untimely corrective maintenance and poor prioritization resulted in delays in restoring equipment to an operable status, allowed degraded equipment to deteriorate until it was incapable of performing its intended safety function, and resulted in site personnel being forced to work around the failed and degraded equipment.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-38; 50-499/93-38, 50-498/93-40; 50-499/93-40, 50-498/93-41; 50-499/93-41, 50-498/93-42; 50-499/93-42, 50-498/93-53; 50-499/93-53, 50-498/94-04; 50-499/94-04, and 50-498/94-08; 50-499/94-08.

2.3 IFIs Identified in Paragraph 2.2.2 of the DET Inspection Report

2.3.1 (Open) IFI 498;499/9349-13: Weaknesses in the scope and implementation procedures for the preventative maintenance (PM) program contributed to poor equipment performance. These weaknesses could be attributed in part to poor development of the PM program in terms of scope and procedure accuracy that were not properly addressed.

2.3.2 (Open) IFI 498;499/9349-14: As a result of not performing inactive PM tasks, the following preventable events, equipment failures, and instances of poor assurance of operability (mostly dealing with instrument calibrations) occurred: (1) an uncalibrated lubricating oil pressure switch contributed to a startup feed pump not starting on demand following a reactor trip; (2) a feedwater booster pump was damaged partly because of an uncalibrated lube oil pressure switch; (3) the technical support center chillers failed, resulting in high temperature conditions and corresponding alarms on the plant computer. Only inactive PMs were associated with the technical support center chiller; (4) temperature indicators used to determine the operability of safety-related chillers were not periodically calibrated; and (5) an uncalibrated level switch in the component cooling water system contributed to an engineered safety feature actuation.

2.3.3 (Open) IFI 498;499/9349-15: Appropriate PM tasks were not developed or included in the PM program for some important equipment in the SDGs and support systems. Relay failures in the voltage-regulating circuit caused inoperable SDGs on two different occasions. The relays that failed had been installed beyond their 10-year service life but had never been replaced nor scheduled to be replaced.

2.3.4 (Open) IFI 498;499/9349-16: Main control board meters used during SDG testing and SDG monitoring were not in the PM program and had not been calibrated since startup.

2.3.5 (Open) IFI 498;499/9349-17: In reviewing the issue of noncalibrated SDG meters, the licensee identified approximately 150 additional main control board instruments that were not in the PM program. Some of these instruments monitored important parameters for the 125 VDC batteries and the battery chargers.

2.4 IFIs Identified in Paragraph 2.2.3 of the DET Inspection Report

2.4.1 (Closed) IFI 498;499/9349-18: The training program established for maintenance craft personnel was deficient. This contributed to numerous instances of ineffective maintenance and poor equipment performance.

This item was closed due to this issue being addressed in IFI 498;499/9349-02.

2.4.2 (Closed) IFI 498;499/9349-19: Key maintenance support personnel such as maintenance planners and procedure writers only received limited formal technical training.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Report 50-498/93-39; 50-499/93-39.

2.4.3 (Closed) IFI 498;499/9349-20: An industry organization determined that the licensee's basic maintenance craft skills training program was deficient. In response, the licensee established a recertification testing program for journeyman in the three disciplines. To allow continuation of work, craft qualification matrices were established. Each matrix listed individual craftsmen and the tasks in which they were currently "qualified," such as breaker maintenance. To compensate for a lack of "qualified" individuals, a supervisor or qualified journeyman continuously observed the work of the unqualified personnel. This decreased the supervisor's freedom to observe work activities under his cognizance and to select workers for particular tasks. The poorly trained work force and the obstacles associated with the matrix further reduced the effectiveness of the maintenance program.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-40; 50-499/93-40, 50-498/93-41; 50-499/93-41, 50-498/93-45; 50-499/93-45, 50-498/93-53; 50-499/93-53, and 50-498/94-08; 50-499/94-08.

2.4.4 (Closed) IFI 498;499/9349-21: The training for molded case circuit breakers did not include the correct method for determining the breaker settings based on the values (amperes) provided in the setpoint document.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Report 50-498/93-45; 50-499/93-45.

2.4.5 (Closed) IFI 498;499/9349-22: Instrumentation and control technicians introduced air into essential chillers and flooded a control panel with oil due to a lack of understanding of how the chillers function under vacuum.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Report 50-498/94-04; 50-499/94-04.

2.4.6 (Closed) IFI 498;499/9349-23: The mechanical maintenance staff was not trained to maintain the turbine-driven auxiliary feedwater pump (TDAFWP) governor or the TDAFWP overspeed trip mechanism. This contributed to the numerous unsuccessful attempts to resolve problems on TDAFWPs.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Report 50-498/93-38; 50-499/93-38.

2.4.7 (Open) IFI 498;499/9349-24: Training for reactor coolant pump motors was based on a generic 2000 horsepower motor and did not include the unique features of these motors. Training on the SDGs did not include the governor or voltage regulator. Instrumentation and control technicians assigned to work on the security system were not trained on certain aspects of that system. Three of the five designated technicians had not received specific

security system related training and the other technicians received only limited training.

2.5 IFIs Identified in Paragraph 2.2.4 of the DET Inspection Report

2.5.1 (Open) IFI 498;499/9349-25: The team found numerous deficiencies in the spare parts system, including the lack of parts and the use of wrong parts. These deficiencies contributed to inefficient use of maintenance resources and negatively impacted equipment operability.

2.5.2 (Closed) IFI 498;499/9349-26: Examples of unavailable parts which adversely impacted equipment performance included:

- In December 1992, during maintenance to repair an auxiliary feedwater turbine trip throttle valve, a replacement disc and seat were not available in the warehouse. The valve was reassembled and the system declared operable. This leaking valve contributed to numerous overspeed turbine trips in January and February of 1993.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Report 50-498/93-38; 50-499/93-38.

- The lack of parts contributed to valves within the primary containment being inoperable for a year. During the 1991 refuel outage, "T" drains were not available for installation into some new valve motors. Without the "T" drains installed, moisture could not drain from the motors and could damage the components after an accident. A failure of the work control system later resulted in the "T" drains not being installed in a timely manner.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-35; 50-499/93-35 and 50-498/93-45; 50-499/93-45.

- The Unit 2 secondary side Power-Operated Relief Valve B was inoperable because of an internal hydraulic leak that caused premature failure of a pressure switch. The internal leak caused the hydraulic pump to cycle frequently and eventually resulted in the high pressure switch failing low. The hydraulic pump ran continuously until its thermal overloads tripped. The switch was replaced but the leak was not fixed because of a lack of parts.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Report 50-498/93-45; 50-499/93-45.

- Previously, several switches on the chilled water system failed and were replaced. However, if they had failed again no replacements were in the warehouse or on order when the inventories were reviewed by the team.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-54; 50-499/93-54 and 50-498/94-04; 50-499/94-04.

2.5.3 (Open) IFI 498;499/9349-27: The process to determine the correct replacement part was extremely difficult and cumbersome. The computerized parts reference system consisted of two databases requiring the viewing of multiple screens. Numerous part numbers were "flagged" for revision because of the large engineering document backlog. Sometimes part numbers, as in some Rockwell valve components, were wrong.

2.5.4 (Closed) IFI 498;499/9349-28: When computer information regarding spare parts was questionable, such as being flagged, design and purchase documents had to be used. However, a number of these documents had unincorporated revisions due to the large engineering backlog. The overall process was prone to error and was time consuming. Examples of attempts to install incorrect parts follow:

- During repair activities to stop a jacket water leak on the inlet header of an SDG, the discharge header gasket was installed. This occurred twice before the mechanics recognized that the gasket was not the correct size.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Report 50-498/93-44; 50-499/93-44.

- During repair activities to return an essential chiller to service, the correct type of pressure switch was installed but was not qualified as safety-related. The switch was replaced before the chiller was placed back into service.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-54; 50-499/93-54 and 50-498/94-04; 50-499/94-04.

2.6 IFIs Identified in Paragraph 2.2.5 of the DET Inspection Report

2.6.1 (Closed) IFI 498;499/9349-29: Maintenance department senior supervisors provided limited reinforcement of expected quality performance standards. Their time was dominated by preparation for meetings, attending meetings, and performing administrative tasks.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Report 50-498/94-06; 50-499/94-06.

2.6.2 (Closed) IFI 498;499/9349-30: The staff size was insufficient to accomplish corrective maintenance given the productivity achieved using the existing system, the unique three-train design of the facility, and the untimely resolution of design deficiencies.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-40; 50-499/93-40, 50-498/93-41; 50-499/93-41, 50-498/93-46; 50-499/93-46, 50-498/93-53; 50-499/93-53, and 50-498/94-08; 50-499/94-08.

2.6.3 (Closed) IFI 498;499/9349-31: The balance-of-plant corrective maintenance effort suffered mostly due to the lack of personnel resources.

- From the end of the Unit 2 refuel outage (December 1991) until the beginning of the Unit 1 refuel outage (September 1992), both units were essentially operating at power. However, during these 9 months, the backlog of nonoutage service requests increased by 1600, an increase of approximately 50 percent. Three-fourths of the service requests were on balance-of-plant systems. The more significant percentage of these were on systems such as feedwater, condensate polishers, and fire protection which were in poor material condition.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-53; 50-499/93-53 and 50-498/94-08; 50-499/94-08.

- Recognized design deficiencies for numerous equipment had not been resolved. Examples included:

- (1) the Brown Boveri breakers for the technical support center diesel generator,

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Report 50-498/93-45; 50-499/93-45.

- (2) the obsolete fire protection computer system,

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-35; 50-499/93-35 and 50-498/93-45; 50-499/93-45.

- (3) water intrusion into the startup feedwater pump's lubrication system,

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Report 50-498/93-55; 50-499/93-55.

- (4) refrigerant and oil contamination mitigation devices had not been permanently installed on essential chillers even though air and moisture intrusion had reduced their reliability.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Report 50-498/94-04; 50-499/94-04.

2.6.4 (Closed) IFI 498;499/9349-32: In an outage condition, substantial, routine use of overtime was used to try to accomplish the scheduled tasks.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-40; 50-499/93-40, 50-498/93-41; 50-499/93-41, and 50-498/93-45; 50-499/93-45.

2.6.5 (Closed) IFI 498;499/9349-33: In some instances, Technical Specification overtime guidelines were exceeded without appropriate management review and approval.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-40; 50-499/93-40 and 50-498/93-41; 50-499/93-41.

2.6.6 (Closed) IFI 498;499/9349-34: Staffing limitations impaired the amount of vibration monitoring accomplished under the predictive maintenance program. Only one technician was assigned to routine vibration monitoring of rotating equipment.

This item was closed due to this issue being addressed in IFI 498;499/9349-07.

2.7 IFIs Identified in Paragraph 2.2.6 of the DET Inspection Report

2.7.1 (Closed) IFI 498;499/9349-35: The work control process was inefficient and manpower intensive. This resulted in the inefficient use of staff, which contributed to the poor material condition of the plant and the completion of only high priority work.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-45; 50-499/93-45, 50-498/93-53; 50-499/93-53, 50-498/94-06; 50-499/94-06, and 50-498/94-08; 50-499/94-08.

2.7.2 (Closed) IFI 498;499/9349-36: The high maintenance backlog significantly stressed the maintenance department in the form of emergent work, rendering the process more inefficient. Multiple barriers to an efficient work control process existed within the planning, preparation, scheduling, and execution of work.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-45; 50-499/93-45, 50-498/93-53; 50-499/93-53, 50-498/94-06; 50-499/94-06, and 50-498/94-08; 50-499/94-08.

2.7.3 (Closed) IFI 498;499/9349-37: The large amount of emergent work significantly contributed to the inefficient work control process. This was due, in part, to the large corrective maintenance backlog which inhibited the timely repair of deficiencies before their condition degraded.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-45; 50-499/93-45, 50-498/93-53; 50-499/93-53, 50-498/94-06; 50-499/94-06, and 50-498/94-08; 50-499/94-08.

2.7.4 (Closed) IFI 498;499/9349-38: The excessive emergent work prompted the staff to postpone previously planned or partially planned jobs, adding to the backlog.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-45; 50-499/93-45, 50-498/93-53; 50-499/93-53, 50-498/94-06; 50-499/94-06, and 50-498/94-08; 50-499/94-08.

2.8 IFI Identified in Paragraph 2.2.7 of the DET Inspection Report

(Closed) IFI 498;499/9349-39: The planners lacked appropriate training, experience, and guidance in selecting the appropriate postmodification testing (PMT) following maintenance activities. This resulted in planners listing all possible PMT that might be necessary and specifying the PMTs to be performed as "if required." This required the already heavily burdened shift supervisor to review the scope of work completed in order to specify the appropriate postmaintenance test to be performed. Periodically, the shift supervisor selected inappropriate PMT.

This item was closed based on the action taken by the licensee and as documented in NRC Inspection Reports 50-498/93-45; 50-499/93-45 and 50-498/93-53;499/93-53.

ATTACHMENT

1 PERSONS CONTACTED

1.1 Licensee Personnel

J. Sheppard, General Manager, Nuclear Licensing
M. Coughlin, Senior Licensing Engineer
other members of the licensee's staff

1.2 NRC Personnel

W. Johnson, Chief, Project Branch A, Division of Reactor Projects
M. Satorius, Project Engineer, Project Branch A, Division of Reactor Projects

2 EXIT MEETING

A telephonic exit meeting was conducted on February 22, 1994. During this meeting, the inspectors reviewed the scope and findings of this report. The licensee did not take exception to any of the inspection findings nor identify as proprietary any information provided to, or reviewed by, the inspectors.