U.S. NUCLEAR REGULATORY COMMISSION

REGION V

Report Nos: 50-275/93-36 and 50-323/93-36

Docket Nos: 50-275 and 50-323

License Nos: DPR-80 and DPR-82

Licensee: Pacific Gas and Electric Company
Nuclear Power Generation, B14A
77 Beale Street, Room 1451
P. O. Box 770000
San Francisco, California 94177

Facility Name: Diablo Canyon Units 1 and 2

Inspection at: Diablo Canyon Site, San Luis Obispo County, California

Inspection Conducted: December 13 through 17, 1993

Inspectors: P.P. Narbut, Regional Team Leader

Approved by: C. A. VanDenburgh — 1/12/94 Date Signed
Acting Deputy Director
Division of Reactor Safety & Projects

Summary:

Inspection from December 13 through 17, 1993 (Report Nos. 50-275/93-36 and 50-323/93-36)

Areas Inspected: Routine, announced, regional inspection of PG&E's activities performed in response to Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment," issued on July 18, 1989. Temporary Instruction (TI) 2515/118 and Inspection Procedure 40500 were used as guidance during this inspection.

Safety Issues Management System (SIMS) Items: None

Results:

General Conclusions on Strengths and Weaknesses:

Strengths:

- The QA organization performed a surveillance to determine if the licensee's program and commitments for Generic Letter 89-13 were being properly implemented. The QA effort was performed in technical depth and had significant findings which paralleled the inspection findings. (Paragraph 3)

Weaknesses:

- The engineering organization's technical response to the service water issues raised in Generic Letter 89-13 was not performed in sufficient technical depth to identify significant operability issues which were subsequently raised by the QA organization and this inspection. (Paragraph 2.b.3)

- The engineering organization's response to the service water issues raised by the QA surveillance of May 1993 was not timely. The issues had not been resolved at the time of inspection in December 1993 (Paragraph 3.a)

- The licensee's response to Generic Letter 89-13 regarding heat exchanger testing results and the existence of a routine ASW piping system inspection program apparently contained incomplete information (Paragraphs 2.b.2 and 2.c.1).

Significant Safety Matters: The operability of the CCW heat exchangers was not clearly established by the licensee's 1991 heat exchanger performance testing, nor by the licensee's program for heat exchanger preventative maintenance, trending, inspection, and flow testing. The licensee performed an operability evaluation which stated that it considered the heat exchangers at least temporarily operable due to the low winter ocean temperatures. The licensee further determined that the heat exchangers may not have been operable in the past.

Summary of Violations and Deviations:

None.

DETAILS

1. Persons Contacted

Pacific Gas and Electric Company

*J. D. Townsend, Vice President and Plant Manager, Diablo Canyon Operations
*D. H. Behnke, Senior Engineer, Regulatory Compliance
R. P. Powers, Manager, Nuclear Quality Services
*G. M. Burgess, Director, Systems Engineering
*W. G. Crockett, Manager, Technical and Support Services
S. R. Fridley, Director, Operations
J. R. Hinds, Director, Nuclear Safety Engineering
*K. A. Hubbard, Engineer, Regulatory Compliance
M. E. Leppke, Assistant Manager, Technical Services
*C. M. Seward, Sr. Engineer, Mechanical Maintenance
*J. R. del Mazo, Group Supervisor, Nuclear Engineering Services
*D. G. Howland, Mechanical Engineer, Nuclear Engineering Services
*M. L. Da Re, System Engineer
*D. A. Taggert, Director, Site Quality Assurance
*S. C. Ketelsen, Auditor, Nuclear Quality Services
*D. B. Miklush, Manager Operations Services
*G. W. Gurley, Power Production Engineer
*V. R. Foster, Senior Power Production Engineer
K. S. Smith, Mechanical Engineer, Nuclear Engineering Services
F. L. Steinert, Senior Scientist, Aquatic Systems Inc.
J. E. Anastasio, Power Production Engineer

U. S. Nuclear Regulatory Commission

M. H. Miller, Senior Resident Inspector

*Denotes those attending the exit interview on December 17, 1993.

The inspector interviewed other licensee employees including operators, maintenance personnel, engineers, and quality assurance personnel.

2. Examination of PG&E's Actions for Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment."

Background

The NRC issued Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment," on July 18, 1989. The generic letter described recurring industry problems with the service water systems at nuclear power plants. Service water systems are important to plant safety as the ultimate heat sink following a design basis event. The generic letter recommended certain actions to be taken by licensees and required that each licensee advise the NRC of the programs to be implemented in response to the generic letter recommendations. PG&E Letter No. DCL-90-027, dated January 26, 1990, provided PG&E's response to the generic letter and committed to perform certain actions. PG&E Letter No. DCL-91-286, dated November 25, 1991, provided a supplemental response to the generic letter and reported the completion of the initial program actions.

Scope of Inspection

The inspection reviewed the licensee's actions described in the two PG&E letters discussed above and reviewed the licensee's implementing procedures for those actions. The inspector conducted a walkdown of the system with the system engineers from the site and from the design offices. The inspector reviewed selected records of licensee tests and inspections including videotape of an inspection of piping internals. The inspector also examined the internals of CCW Heat Exchanger 2-1 when it was opened for cleaning. In addition, after independently making several findings, the inspector was apprised of, and reviewed, a Quality Assurance surveillance which contained many of the same findings.

Overview

The inspector concluded that the licensee had implemented a number of actions in response to the generic letter. Some of the actions had resulted in improved performance. Examples of improved performance included continuous chlorination of the Auxiliary Salt Water (ASW) system which resulted in a greatly decreased frequency of system cleaning due to macrofouling. (Macrofouling refers to piping and heat exchanger fouling due to marine organisms such as mussels and barnacles. Microfouling refers to the growth of algae or other micro-organisms.) Another example of improved performance was the accelerated repair program for rusting reinforcing bar and spalling concrete in the intake structure.

The inspector found that the licensee's heat exchanger test results showed that one heat exchanger did not meet the acceptance standards for minimum heat transfer capacity established by the system design requirements. This raised a concern regarding the operability of the ASW system which the licensee subsequently determined to be temporarily acceptable due to the cold winter sea temperatures. Additionally, the test data appeared to contradict the licensee's statements to the NRC in their November 25, 1991, letter to the NRC regarding the acceptability of the test results.

In addition, the inspector found that the licensee had not assured that the ASW system maintenance and surveillance controls were sufficient to assure system operability. Specifically, the licensee had high differential pressure limits on the heat exchangers which allowed macrofouling to a degree that would exceed the manufacturer's tube plugging limit and significantly reduce the heat removal capacity. This concern also affected the operability of the ASW system which the licensee subsequently determined to be temporarily acceptable due to the cold winter sea temperatures.

The inspector also found that the licensee had not fulfilled all of the commitments made to the NRC. Specifically, the licensee had not established procedures for a routine inspection for ASW piping.

In general, the inspector concluded that the licensee had not developed a good engineering understanding of the effects microfouling, macrofouling, and heat exchanger differential pressure and had not implemented operational controls to ensure system operability. This was considered a

significant failing due to the high safety significance of the system and the number of opportunities the licensee had to address the issues. NRC concerns regarding system operability due to differential pressure had been previously raised in Inspection Report 50-275/88-11. The licensee responded to those concerns with assurances that the differential pressures were acceptable. Generic Letter 89-13 again focused attention on the issue of heat exchanger performance. The failed heat exchanger capacity test in 1991 should have initiated additional analysis and understanding, but did not. Finally, a QA surveillance in May 1993 raised the same heat exchanger performance issues, but did not result in an adequate technical response from the engineering organization. These multiple missed opportunities indicate ineffective engineering involvement in the issues.

Inspection Details

a. Biofouling Controls

Generic Letter 89-13 recommended an ongoing program of surveillance and control techniques to reduce the incidence of flow blockage problems as a result of biofouling. In letters DCL-90-027, dated January 26, 1990, and DCL-91-286, dated November 25, 1991, the licensee explained that they would visually inspect the ASW intake structure once per refueling outage, that they would install a continuous chlorination system, and that they would continue their existing program for monthly system flow testing.

Intake Inspection - The inspector reviewed the licensee's actions for the intake. The actions were described in a series of computerized, recurring, work order tasks. The inspection requirements for the intake structure appeared to be implemented as described to the NRC.

Chlorination Program - The licensee implemented a continuous chlorination program which appeared to be very effective and eventually resulted in a significant reduction in the frequency of heat exchanger outages for cleaning. However, the inspector noted that during the initial chlorination periods during 1992 the frequency of cleaning was greatly increased due to mussel kills. For several months the heat exchangers were taken out of service every few days for cleaning. During this period, the licensee temporarily allowed the heat exchangers to exceed their operational differential pressure limit of 140 inches, be declared inoperable and left in service until a limit of 200 inches was reached.

System Flow Testing - The licensee continued to perform monthly flow tests of the ASW system using temporary test instrumentation. The ASW system at Diablo Canyon does not have installed flow instrumentation available to the operators. Operators infer adequate flow from the differential pressure across the heat exchanger and from the ASW pump motor currents. The inspector observed that the monthly test was performed in accordance with procedure STP M-26, Revision 11, "ASW System Flow Testing." The test acceptance values did not include a simple value for minimum

flow, but provided a series of curves dependent on the ocean and Component Cooling Water temperatures. The licensee stated the acceptance values are from a study done in 1992 by Westinghouse. The study is WCAP-12526, Revision 1, "Auxiliary Salt Water and Component Cooling Water Flow and Temperature Study for Diablo Canyon Units 1 and 2" dated June 1992. The study is one of three different design bases described in the licensee's design criteria memorandum, DCM No. S-17B Revision 2.3, "Auxiliary Saltwater System." The licensee stated that the revised design bases had not been reviewed by the NRC technical branches. The acceptability of the licensee's revised design bases is considered an open item. (Followup item 50-275/93-36-01)

b. Heat Exchanger Capacity Test

Generic Letter 89-13 requested that licensees conduct a test program to verify the heat transfer capability of all safety-related heat exchangers. The generic letter allowed for an alternative program such as frequent regular maintenance of the heat exchanger.

In letter DCL-90-027, dated January 26, 1990, the licensee explained that they would perform a one-time heat exchanger performance test to confirm the baseline heat transfer capability of the heat exchangers. The letter further explained that the licensee would implement an alternative program to verify the system would remain capable of maintaining design basis capability. The letter stated that the licensee would implement a monitoring program which combined flow testing, trending, inspection, and frequent preventative maintenance. The letter stated these actions would be completed by the end of the 1991 fourth refueling outage of each unit.

In letter DCL-91-286, dated November 25, 1991, the licensee reported that they had performed the heat exchanger capacity test and stated that: "...the computer model predicted that the heat exchanger would remove the design basis heat load at design conditions." The letter also stated that the licensee had implemented the alternate monitoring program.

The inspector reviewed the results of the one-time heat exchanger test. The test methods and results are described in Field Test Report 420DC-91.1156, "Diablo Canyon Power Plant CCW Heat Exchanger Performance Tests Units 1 and 2," dated November 22, 1991. The test was not performed by plant personnel but by personnel from the licensee's Technical and Ecological Services Division in San Ramon, California. The inspector had the following observations and findings:

(1) Non Conservative Testing Due to Inadequate Initial Test Conditions

The inspector found that several important initial conditions were not established for the test. The missing initial conditions were:

- An assessment of the amount of microfouling and macrofouling present in the heat exchanger. The lack of this information precludes assessing the acceptability of the microfouling and macrofouling found in the licensee's regular monitoring program. The lack of this information also resulted in the test result projections to design conditions not accounting for the maximum allowed fouling. This approach was not conservative.

- The recording of the amount of differential pressure present in the heat exchanger. The operators use the differential pressure as an assessment of the degree of macrofouling. The failure to record differential pressure precluded the use of the test data as an assessment of the adequacy of the operator's differential pressure limits.

- A measurement of the outlet water box water level. The outlet water box operates at a negative pressure and does not run full at Diablo Canyon. This information is based on an informal test performed by the system engineer in 1988. The water level in the outlet water box apparently varies with the tide according to operators. This additional variable also affects the measurement of differential pressure across the heat exchanger.

(2) Inaccurate and Incomplete Information

The licensee's letter DCL-91-286, dated November 25, 1991, stated that: "...the computer model predicted that the heat exchanger would remove the design basis heat load at design conditions." The inspector's review of Field Test Report 420DC-91.1156 showed that the computer prediction for Unit 1 heat exchanger CCW 1-2 did not show that the heat exchanger would remove the design basis heat load. Rather, the test results showed the heat exchanger capacity to be at 98.7 percent of design. The inspector also determined that the differential pressure across the heat exchanger was probably at only 101-104 inches based on informal records. Therefore, the heat removal capacity would have been less if the licensee had accounted for the maximum allowed differential pressure of 140 inches.

In response to the inspector's finding, and in accordance with their procedures, the licensee initiated a Prompt Operability Assessment (POA) for the heat exchanger test failure. The licensee concluded that the heat exchanger was operable under the existing conditions of cold winter ocean temperatures. The licensee also initiated a more complete long term operability assessment which was to be completed in 7 days.

The apparent failure to provide complete and accurate information to the NRC in regards to the CCW 1-2 heat exchanger's ability to meet the design basis heat load is

considered an unresolved item pending further examination of the circumstances of the omission. (Unresolved item 50-275/93-36-02).

(3) Inadequate Preventative Maintenance Limits

The inspector observed that the heat exchangers were taken out of service for cleaning of macrofouling accumulations when the differential pressure across the heat exchanger approached 140 inches of water. The alarm setpoint for the differential pressure alarm was set at 140 inches and this was used by the operators as the limit for system operability. The inspector examined the basis document for the alarm setpoint to determine the technical basis for the 140 inch limit. The setpoint basis document stated that the setpoint was based on engineering judgement, but did not provide a technical basis for this judgement.

In order to make an independent engineering judgement, the inspector examined CCW Heat Exchanger 2-1 which had been taken out of service at a differential pressure of about 125 inches per the shift foreman. The heat exchanger had been taken out of service in November for cleaning, was getting a high differential pressure much sooner than the other heat exchangers and was expected to have less macrofouling than the other CCW heat exchangers would at the same differential pressure. Heat exchanger CCW 2-1 was more sensitive than the other heat exchangers due to a known buildup of calcification on the outlet end. The key point was that the other heat exchangers would show more macrofouling than CCW 2-1 at a given differential pressure.

In CCW 2-1, the inspector noted that 10 tubes were permanently plugged due to tube wear problems. Fifteen tubes were plugged with mussels and barnacles. Three crabs were in the head which would have represented at least another 3 tubes being blocked in service. Therefore, the inspector estimated a total of 28 blocked tubes. Since heat exchanger CCW 2-1 was taken out of service with only 125 inches of differential pressure, the inspector estimated that the amount of macrofouling and the number of plugged tubes at 140 inches would have been much higher. Also, because CCW 2-1 was running at a higher initial differential pressure after cleaning due to its greater calcification, the amount of macrofouling and plugged tubes in the other heat exchangers (CCW 1-1, CCW 1-2, and CCW 2-2) would be even more severe than the macrofouling in CCW 2-1 for any given differential pressure. Therefore, the inspector concluded that any of the heat exchangers would have significantly more than 28 tubes plugged with a differential pressure of 140 inches.

The licensee stated that their tube plugging limit was 2 percent of the total tubes or 24 plugable tubes total. This limit was provided to the licensee on March 30, 1993, by a

facsimile memorandum from Yuba Heat Transfer Division. The memorandum stated that: "There is an inherent factor of safety in the heat transfer formulas such that the heat exchangers should achieve the design heat transfer rate with as many as 2 percent of the tubes plugged."

Based on the above information, the inspector's technical judgement was that the differential pressure limit of 140 inches was excessive and that the heat exchangers may have been inoperable during conditions of warmer ocean temperatures.

In response to the inspector's finding, and in accordance with their procedures, the licensee included this issue in the Prompt Operability Assessment (POA) written for the heat exchanger test failure. The licensee concluded that the heat exchanger was operable under the existing conditions of cold winter ocean temperatures. The licensee also initiated a more complete long-term operability assessment which was to be completed in 7 days. This operability evaluation was completed on December 30, 1993, as discussed in Section 3.d. of this inspection report.

This issue is a significant item due to the high safety significance of the system and the number of opportunities the licensee had to address the issue. System operability concerns due to differential pressure had been raised in Inspection Report 50-275/88-11 and the licensee responded to those concerns with assurances that the differential pressures were acceptable. Generic Letter 89-13 again focused attention on the issue of heat exchanger performance and maintenance practices. The failed heat exchanger capacity test in 1991 should have triggered investigative actions but did not. Finally, a QA surveillance in May 1993 (discussed in Section 3 of this report) raised the specific issue of the adequacy of the differential pressure setpoint, but did not elicit a studied response from the engineering organization. These multiple missed opportunities indicate that engineering was ineffective.

The apparent failure to establish adequate differential pressure limits to ensure CCW heat exchanger operability is an unresolved item pending the licensee's assessment of operability and the inspector's review of that assessment. (Unresolved item 50-275/93-36-03)

c. Inspection and Maintenance of the ASW System Piping

Generic Letter 89-13 recommended that a routine inspection and maintenance program for the service water system piping and components be established so that corrosion, erosion, coating failure, silting, and biofouling would not degrade the performance of the system. In letter DCL-90-027, dated January 26, 1990, the licensee stated that they would develop a program and that procedures to establish a routine inspection and maintenance program

for the ASW system would be established by the 1991 fourth refueling outages of Units 1 and 2. In letter DCL-91-286, dated November 25, 1991, the licensee stated that they had established a routine inspection and maintenance program.

(1) Lack of a Piping Inspection Program

The inspector examined a sample of the licensee's program and procedures for the inspection and maintenance of the ASW system. The inspector found that the licensee had not established a routine inspection program or procedures to inspect the ASW piping.

During the Unit 1 fourth refueling outage in March of 1991, the licensee inspected 1790 feet (about 50 percent) of the Unit 1 piping using a temporary procedure which utilized a television camera. Unit 2 was inspected in a similar manner in October 1991. Both inspections did not reveal significant problems, although two small areas of damaged coating and localized corrosion were observed. The two areas required weld repair to restore minimum wall. However, subsequent to the initial inspection the licensee did not establish a program defining the amount or period of any additional inspections to be conducted. No additional inspections were done in the fifth refueling outages of Units 1 or 2. Responsible engineers stated that there were no plans for an inspection during the sixth refueling outages in 1994. The licensee had an open action request (AR) No. A0221696, dated March 6, 1991, which requested that the temporary inspection procedure be made a permanent plant procedure and that a regular period be established. However, those actions had not been completed.

The apparent failure to develop a routine inspection program for the ASW system piping by the end of the 1991 fourth refueling outages of Units 1 and 2, as committed to in letter DCL-90-027 dated January 26, 1990, and the apparent failure to provide accurate implementation status of the piping inspection program in letter DCL-91-286, dated November 25, 1991, are considered unresolved pending further inspection of the circumstances involved. (Unresolved item 50-275/93-36-04)

d. Confirmation of the Licensing Basis of the ASW System

Generic Letter 89-13 requested that licensees confirm that the service water system can perform its intended function in accordance with the licensing basis for the plant. In letters DCL-90-027 dated January 26, 1990, and DCL-91-286, dated November 25, 1991, the licensee explained that they had completed the development of Design Criteria Memorandums (DCMs) in 1990 and that no significant design deficiencies were identified confirming that the ASW system would perform its intended function in accordance with the licensing basis.

Although the inspector did not examine the licensee's actions for confirming that the ASW system would perform its intended design function, the inspection results discussed in Section 2.b. of this report regarding a lack of engineering understanding of the validity of the operational controls for microfouling, macrofouling, and heat exchanger differential pressure suggest that the licensee's actions were not sufficient. Likewise, there were significant technical findings in the licensee's QA surveillance of the licensee's commitments for Generic Letter 89-13 discussed in Section 3 of this report. The QA findings suggest that engineering controls on operational configurations were not sufficient to preclude pump runout conditions in certain situations.

The licensee's DCM for the ASW system, DCM No.S-17B, addresses some of these issues but only in a general manner such as "...useful heat transfer area is dependent upon heat exchanger maintenance. Assuming the CCW heat exchanger is maintained per standard practices the selection of a conservative fouling factor can be made." and "This heat exchanger high differential alarm is provided as a diagnostic tool which operations/maintenance personnel use to determine when cleaning is required to assure that significant fouling and/or blockage of the heat exchanger does not occur." As stated in Section 2.b, the only basis for the alarm setpoint in the licensee's setpoint basis document is described as judgement.

In addition, the issue of the adequacy of the 140 inch differential pressure limit was specifically questioned in NRC Inspection Report 50-275/88-11. The licensee responded to the issue in letter DCL-88-215, dated September 13, 1988. This response was also general in nature and stated, "...a heat exchanger high differential alarm was provided as a diagnostic tool which operations/maintenance personnel use to determine when cleaning is required to assure that significant fouling and/or blockage of the heat exchanger does not occur."

The inspector concluded that the licensee's review of their design basis to verify that the ASW system would perform its intended design function did not identify several important design basis issues. An assessment of the need to reperform an assessment of the adequacy of their design basis for the ASW system is a followup item. (Followup item 50-275/93-36-05)

d. Licensee Operability Evaluations

On December 30, 1993, the licensee made a 10 CFR 50.72 report to the NRC which concluded that on August 23, 1990, and perhaps dates prior to and subsequent to that date, the CCW heat exchangers for both units may have had sufficient fouling to have precluded the systems from meeting their design bases. Also on December 30, 1993, the licensee performed, and the Plant Safety Review Committee (PSRC) approved, an operability evaluation and concluded that the ASW system was operable since the initiation of the continuous chlorination program in October 1992.

3. Review of QA Involvement

The inspector reviewed the licensee's QA surveillance report SQA-93-0031, dated July 28, 1993. The licensee conducted the audit from March 5 to May 7, 1993. The report raised many of the same issues as were raised by the inspector and other issues not identified by the inspector. The inspector noted that the surveillance was an in depth examination of not only the commitments made to the NRC, but also the underlying technical bases involved with the commitments. The inspector further noted that the QA personnel had not only raised the issues but also critically reviewed the responses of engineering and rejected the answers when appropriate. Although the issues were formally identified to engineering in May of 1993 by action requests, the issues had not been resolved at the time of the inspection.

Examples of issues identified by the inspector and QA report included:

- The failure of CCW Heat Exchanger 1-2 to pass its performance test. The QA report requested engineering to provide a written evaluation of the results in Action Request (AR) A0306715. The engineering response to the AR was not accepted by QA and a reevaluation was requested on August 12, 1993. Engineering had not responded to the request for a revaluation at the time of the inspection.

- The concern with the 140 inch differential pressure setpoint for the CCW heat exchangers. Likewise, the issue had not been resolved at the time of the inspection.

Additional excellent technical issues were identified by the QA report. Examples of these issues included:

- A concern regarding the fact that test results showed that the ASW system flow was reduced by much more than was concluded by licensee calculations for the condition where system flow was aligned through the pump cross-tie. This problem was identified in AR A0309356 dated June 11, 1993.

- A concern regarding the lack of operational limits for protecting the system from high flow rates under 1 pump and 2 heat exchanger configurations.

The inspector considered the number, importance, and technical depth of the QA surveillance findings to be a licensee strength. The QA evaluation and rejection of poor engineering responses to the QA findings was also considered a strength. The failure to resolve the QA findings in a timely manner was considered a weakness.

a. Failure to take Timely Action

CCW Heat Exchanger 1-2 failed to meet its test acceptance criteria in a test conducted on February 2, 1991. The test failure was documented in Field Test Report 420DC-91.1156, "Diablo Canyon Power Plant CCW Heat Exchanger Performance Tests Units 1 and 2," dated November 22, 1991. The test failure was identified again during a

QA surveillance and documented on Action Request No. A03066715 dated May 10, 1993. As of the end of the inspection on December 17, 1993, the effect of the test failure on ASW system operability had not been resolved.

The apparent failure to promptly resolve conditions adverse to quality is considered an unresolved item pending further review of the circumstances involved. (Unresolved item 50-275/93-36-06)

4. Other Observations

a. Use of a Computer Code that had not been Validated

When reviewing the CCW heat exchanger capacity tests previously discussed, the inspector noted that the test report, Field Test Report 420DC-91.1156, "Diablo Canyon Power Plant CCW Heat Exchanger Performance Tests Units 1 and 2," performed by the licensee's Technical and Ecological Services Division, described the use of a computer code to project design basis heat transfer capacity. The computer code was described as not having been validated for accuracy. The failure to use a validated computer code is considered an unresolved item pending further review of the details involved. (Unresolved item 50-275/93-36-07)

b. Calcification of Heat Exchanger Tubes

The inspector learned that calcification had been observed on the inner diameter of the CCW heat exchanger tubes. The calcification was located only at the outlet end of the heat exchanger in the tube sheet area. The system engineer stated that the cause of the calcification was deposits from seawater caused by the impressed voltage system for cathodic protection of the ASW piping. The system engineer further stated that the calcification was of a short length and would not affect the available heat transfer area or tube fouling factor. The inspector expressed the concern that since the buildup was not being trended for rate of buildup, and since the inlet of the tubes had a reduced diameter, the calcification could cause the tubes to plug at the outlet end which would not be detected by the periodic cleaning and inspection of the inlet end. The effect of the calcification on the heat exchanger capacity and the potential effect of undetected tube plugging is a followup item. (Followup item 50-275/93-36-08)

c. Trending not Performed

The inspector inquired as to whether the system engineer was trending the amount of macrofouling found in each CCW heat exchanger and the consequent amount of tube plugging. The system engineer stated that macrofouling was trended by the biologists. However, the biologists only trended amount and species but did not count tubes plugged. Further discussion with the system engineer disclosed that system availability was no longer trended. System availability had been previously trended and the information had

been used to update the licensee's Probabilistic Risk Assessment (PRA).

Although there is no regulatory requirement to trend system performance, the inspector's observation was provided to licensee management at the exit interview for information.

d. Lack of ASW Flow Instruments for Operator Information

The inspector noted that the operators do not have ASW flow information available in the control room. A flow instrument installed at the intake structure does not indicate accurately according to the system engineer. The operators infer flow from the differential pressure across the heat exchanger and by observing the electrical current to the ASW pump motors. Although, there is no regulatory requirement for flow instrumentation, this matter was discussed with the licensee at the exit interview.

5. Exit Meeting

An exit meeting was conducted on December 17, 1993, with the licensee representatives identified in Paragraph 1. The inspector summarized the scope and findings of the inspection as described in this report.

The licensee did not identify as proprietary any of the materials reviewed by or discussed with the inspectors during this inspection.