

ENCLOSURE 2

U.S. NUCLEAR REGULATORY COMMISSION  
REGION IV

Docket Nos.: 50-275  
50-323

License Nos.: DPR-80  
DPR-82

Report No.: 50-275/98-10  
50-323/98-10

Licensee: Pacific Gas and Electric Company

Facility: Diablo Canyon Nuclear Power Plant, Units 1 and 2

Location: 7 1/2 miles NW of Avila Beach  
Avila Beach, California

Dates: May 10 through June 20, 1998

Inspectors: D. L. Proulx, Senior Resident Inspector  
D. B. Allen, Resident Inspector  
D. G. Acker, Resident Inspector

Approved By: Howard J. Wong, Chief, Reactor Project Branch E

Attachment : Supplemental Information

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## EXECUTIVE SUMMARY

Diablo Canyon Nuclear Power Plant, Units 1 and 2  
NRC Inspection Report 50-275/98-10; 50-323/98-10

This inspection included aspects of licensee operations, maintenance, engineering, and plant support. The report covers a 6-week period of resident inspection.

### Operations

- Routine operations were conducted in a professional manner, with self-checking and effective three-way communications (Section O1.1).

### Maintenance

- The maintenance mechanics demonstrated good maintenance practices in replacing the shuttle valves on the main feedwater Pump 1-1 stop valves. Engineering provided good onsite assistance and assisted in determining the proper wiring of the new shuttle valves. Performance of the functional test confirmed proper operation prior to returning the main feedwater pump to service (Section M1.1).
- Maintenance personnel demonstrated poor self-verification that, combined with an inadequate briefing and self-imposed time pressure, resulted in a violation of Technical Specification (TS) 6.8.1.a for failure to implement instructions for performing maintenance, in that two auxiliary feedwater (AFW) pumps were simultaneously rendered inoperable because oil was drained from the wrong pump. In addition, licensee personnel failed to take adequate immediate corrective actions in that they: (1) failed to notify the control room in a timely manner; (2) continued to work on the wrong component without work authorization or a clearance; (3) failed to make timely log entries in the control operator's log; and (4) could have decided to perform a postmaintenance test in a more timely manner. The safety significance of this event was mitigated by the relatively short period of time with two AFW pumps inoperable (Section M1.3).

### Engineering

- Temporary modifications were performed, controlled, and tracked properly. 10 CFR 50.59 safety evaluations for these temporary modifications provided good justification as to why no unreviewed safety question existed (Section E1.1).

### Plant Support

- Housekeeping was excellent throughout safety-related areas (Section O2.1).



## Report Details

### Summary of Plant Status

Unit 1 began this inspection period at 100 percent power. On May 15, Unit 1 power was reduced to 50 percent to test the control oil valves for the main feedwater pump stop valves. The unit was returned to 100 percent power on May 16. On June 20, Unit 1 power was reduced to 50 percent to replace certain control oil valves on main feedwater Pump 1-1. The unit was returned to 100 percent power and continued to operate at essentially 100 percent power until the end of this inspection period.

Unit 2 began this inspection period at 100 percent power. On June 6, Unit 2 power was reduced to 50 percent to close steam generator blowdown sample stop Valve MS-2-1048 and install a bypass line to isolate a body-to-bonnet leak. The unit was returned to 100 percent power and continued to operate at essentially 100 percent power until the end of this inspection period.

## I. Operations

### **O1 Conduct of Operations**

#### **O1.1 General Comments (71707)**

The inspectors visited the control room and toured the plant on a frequent basis when on site, including periodic backshift inspections. In general, the performance of plant operators was professional and reflected a focus on safety. The utilization of three-way communications continued to improve, with operators requiring three-way communications from nonoperations personnel. Operator responses to alarms were observed to be prompt and appropriate to the circumstances.

### **O2 Operational Status of Facilities and Equipment**

#### **O2.1 General Comments (71707)**

The inspectors toured the facility on a frequent basis to determine if conditions in the facility impacted the operability of safety-related equipment. The inspectors determined that housekeeping was excellent throughout the safety-related areas and no adverse conditions existed that impacted the operability of safety-related equipment.



## II. Maintenance

### M1 **Conduct of Maintenance**

#### M1.1 Replacement of Shuttle Valves on the Main Feedwater Pump 1-1 Stop Valves

##### a. Inspection Scope (62707)

The inspectors observed maintenance personnel replace the Racine (shuttle) valves on the main feedwater Pump 1-1 high pressure and low pressure stop valves. The following documents were reviewed:

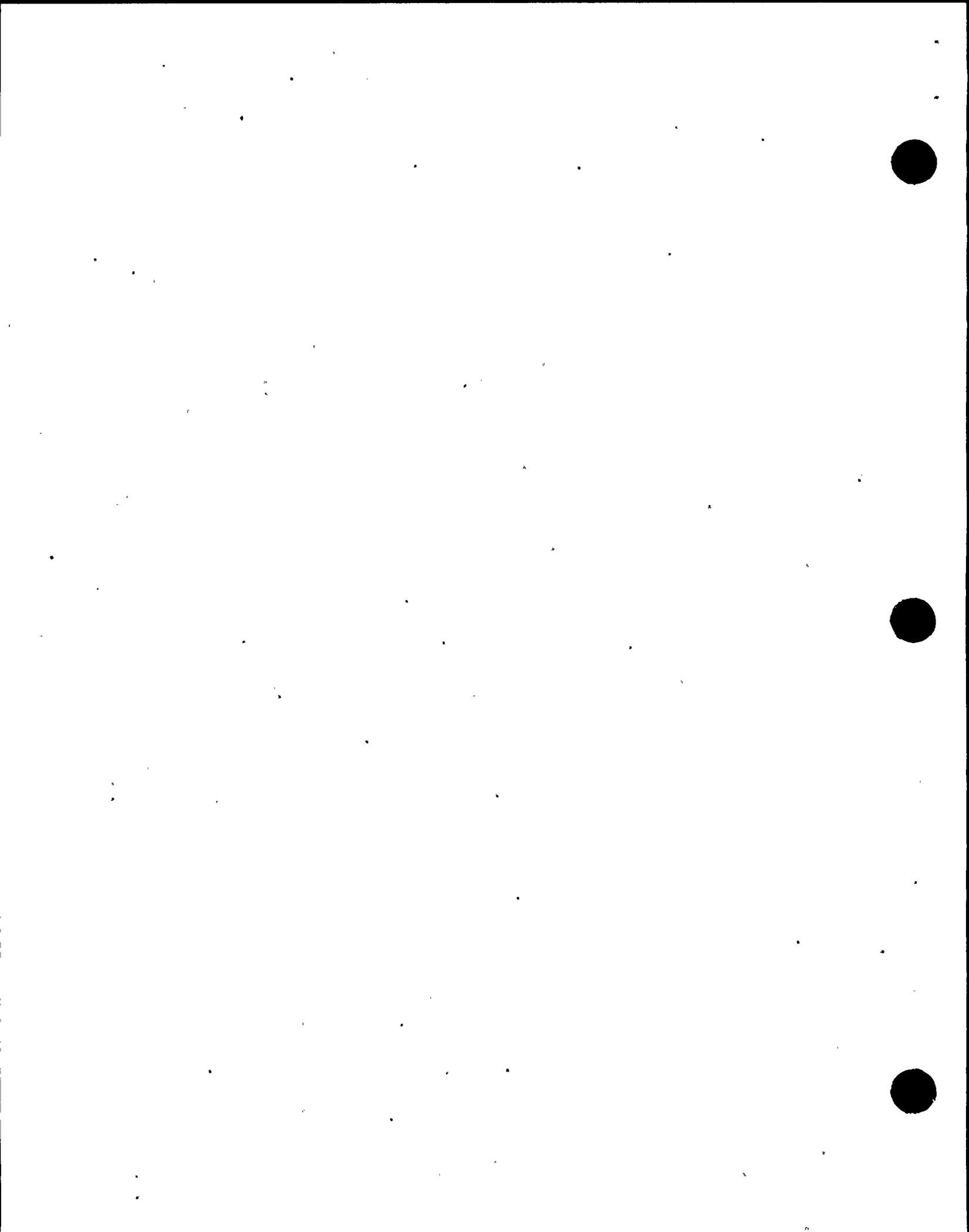
- WO C0155937, Feedwater Pump 1-1, Install New Racine Valves, Implement AT-MM A0444397
- AT-MM A0444397, Unit 1 - Low Pressure/High Pressure Racine Stop Valves: Replacement
- Clearance Number 00058606-001, Main Feedwater Pump 1-1 Racine Valve Replacement
- Maintenance Procedure MP I-2.31-1, Revision 9, Functional Check of Main Feedwater Pump 1-1 Controls

##### b. Observations and Findings

This maintenance activity was scheduled after it was identified that the Racine valve associated with the low pressure stop valve would not close during testing the previous weekend. The inspectors found the work performed under these activities to be accomplished in accordance with procedures. All work observed was performed with the work package present and in active use. The maintenance mechanics were familiar with the equipment and competent at the required tasks. The new Racine valves' wiring configuration was different from the previous model and the inspectors observed an engineer at the job site assisting in the resolution of this issue. The functional test revealed the wiring connections were reversed on one valve. This was corrected and the test was completed successfully.

##### c. Conclusions

The maintenance mechanics demonstrated good maintenance practices in replacing the shuttle valves on the main feedwater Pump 1-1 stop valves. Engineering provided good onsite assistance and assisted in determining the proper wiring of the new shuttle valves. Performance of the functional test confirmed proper operation prior to returning the main feedwater pump to service.



M1.2 Surveillance Observations.

a. Inspection Scope (61726)

Selected surveillance tests required to be performed by the TS were reviewed on a sampling basis to verify that: (1) the surveillance tests were correctly included on the facility schedule, (2) a technically adequate procedure existed for the performance of the surveillance tests, (3) the surveillance tests had been performed at a frequency specified in the TS, and (4) test results satisfied acceptance criteria or were properly dispositioned.

The inspectors observed all or portions of the following surveillances:

- STP I-36-S2R10      Protection Set II, Rack 10 Channels Operational Test, Revision 6
- STP M-21C            Main Turbine Valve Testing, Revision 27

b. Observations and Findings

On June 17, the inspectors observed the performance of surveillance test Procedure (STP) I-36-S2R10, "Protection Set II, Rack 10 Channels Operational Test," Revision 6, on Unit 1. This test satisfied TS requirements for channel operational test for pressurizer pressure Channel P-456, pressurizer level Channel L-460, and reactor coolant loop flow Channels F-415, F-425, F-435, and F-445. The procedure allowed the calibration of test points to be performed manually (user enters the voltage values measured by the meter via a screen keypad) or automatically (meter would be connected to the rack and information entered automatically). The test was performed using the manual calibration of test points and the test meter was within its calibration frequency. The inspectors observed the pretest briefing, which covered the prerequisites, precautions and limitations, effects on the channels under test, expected alarms in the control room, and the necessary communications and actions of the control room operator. The test procedure was technically adequate, the test was performed in accordance with the procedure, and the test results satisfied the acceptance criteria.

On June 20, the inspectors observed portions of the STP M-21C, "Main Turbine Valve Testing," Revision 27, performed on Unit 1. The pretest briefing covered the necessary prerequisites, precautions and limitations, coordination of personnel, sequence of testing to allow maintenance on a valve, and the potential use of the modification to the hydraulic line, which isolated the trip pilot valve. During the performance of the test, stop Valve FCV-1-143 did not reopen. The operators performed the on-the-spot change



per Appendix 7.1, which used the trip pilot valve isolation modification and successfully reopened the stop valve. The procedure was technically adequate, the test was performed in accordance with the procedure, and the test results satisfied the acceptance criteria.

c. Conclusions

The inspectors found that the surveillances observed were being scheduled and performed at the required frequency. The procedures governing the surveillance tests were technically adequate and, in general, personnel performing the surveillance demonstrated an adequate level of knowledge. The inspectors noted that test results appeared to have been appropriately dispositioned.

M1.3 Oil Removed From Wrong AFW Pump

a. Inspection Scope (61726, 92902)

The inspectors evaluated the licensee's response to Quality Evaluation Q0012042 and associated Action Request A0461604 that described an event in which mechanics removed the lubricating oil from an incorrect AFW pump.

b. Observations and Findings

On May 14, 1998, mechanics prepared to perform Work Order (WO) R0180120 for preventive maintenance on AFW Pump 1-2, one of the Unit 1 motor driven AFW pumps. One mechanic was assigned to verify the clearance, another to obtain replacement oil, and the third to obtain sample bottles from the chemistry laboratory. Only the mechanic assigned to verify the clearance received a prejob briefing from the foreman. The mechanics agreed to meet at the job site following their initial assignments before work was to commence. Operators correctly cleared AFW Pump 1-2, and entered the 72 hour TS action statement of TS 3.7.1.2 since AFW Pump 1-2 was no longer capable of automatic initiation.

The mechanic assigned to obtain the sample bottles believed that he could save time by immediately proceeding to drain the oil from AFW Pump 1-1, as soon as he arrived at the job site. This was done despite the clearance walkdown not being completed by the first mechanic. Because the mechanic assigned to retrieve the sample containers only had previous experience in performing preventive maintenance on turbine-driven AFW Pump 1-1, he assumed that the AFW pump maintenance performed on May 14, 1998, was also associated with AFW Pump 1-1. The mechanic assigned to perform the clearance walkdown had the WO in hand, so the mechanic assigned to obtain the sample bottles could not self-check that he was working on the correct pump. Therefore, he proceeded to drain the oil from turbine-driven AFW Pump 1-1, rather than motor-driven AFW Pump 1-2.



Approximately 10 minutes later, a second mechanic arrived at the job site and immediately noted that oil had been drained from the incorrect pump. Instead of notifying the control room immediately so action could be taken to preclude automatic initiation of AFW Pump 1-1, the mechanics returned the oil to AFW Pump 1-1. AFW Pump 1-1 was without lubricating oil for approximately 10 - 20 minutes. After this was complete, the mechanics went to the shop to inform their acting foreman. The acting foreman had difficulty in attempting to notify the regular foreman of this incident. Following contact of the regular foreman, the mechanics wrote an AR to document the occurrence and then called the control room. Approximately 2 hours elapsed before control room operators were made aware of the incident.

#### Operator Response

When notified of the occurrence, the shift supervisor contacted engineering personnel on the need for a postmaintenance test for AFW Pump 1-1, given that maintenance was inadvertently performed. Engineering took the position that draining and refilling of pump oil was such minor maintenance that a post-maintenance test was unnecessary. The shift supervisor agreed with this assessment and the turbine-driven AFW pump was considered fully operable. The control operator did not make a log entry for this event until approximately 7 hours later.

On May 15, 1998, approximately 12 hours later, when the next shift assumed the watch, the new shift supervisor questioned the decision of the previous shift with respect to postmaintenance testing. The new shift supervisor determined that performing a postmaintenance test was prudent. Turbine-driven AFW Pump 1-1 was started manually and ran for several minutes successfully. Licensee management subsequently stated that the postmaintenance test was conservative, but not a necessary action. Therefore, licensee management determined that the timeliness of the postmaintenance test was not an issue. Considering that a mistake had been made, that the mechanics did not notify the control room until 2 hours after the event, and that work continued on the pumps, the inspectors concluded the postmaintenance test was appropriate. Based on the safety significance of two auxiliary feedwater pumps inoperable simultaneously, the decision to perform the postmaintenance test could have been more timely.

#### Barriers Broken

The inspectors noted that a number of barriers were broken that led to this event. Additional errors were made upon discovery.

#### Prior to the Incident

- Personnel failed to follow Procedure OP2.ID1 "Clearances and Administrative Tagouts," Revision 8, Section 5.2.2, in that work commenced prior to the maintenance walkdown of the clearance, or reporting on the clearance for work.



- Personnel failed to have the WO at the job site while work was in progress, which did not meet management's expectations.
- Personnel failed to self-check prior to work commencement, which did not meet managements' expectations.
- Personnel failed to follow WO R0180120 that directed the user to drain the oil from AFW Pump 1-2.

#### Upon Discovery

- Personnel did not inform the control room in a timely manner that the oil had been drained from AFW Pump 1-1 so that operators could take action to preclude automatic initiation of the pump to prevent possible damage.
- Upon recognizing that the oil had been drained from the wrong pump, mechanics refilled the oil; however, this was an unauthorized maintenance activity on AFW Pump 1-1, done without a clearance required by Procedure OP1.DC18, "Authorization for Equipment Operation and Maintenance," Revision 3. Section 5.3 of Procedure OP1.DC18, states that whenever plant equipment is removed from service for maintenance, written authorization from the Unit shift foreman shall be obtained prior to removal from service.
- When informed of the incident, the operator failed to log the event in the control operator's log until 7 hours later.
- Licensee management was not informed of the event until the next day.
- Postmaintenance testing could have been performed in a more timely manner.

The licensee's failures to: (1) implement WO R0180120; (2) implement the clearance procedure; and (3) perform work on safety-related components without proper authorization are three examples of the failure to follow procedures as specified by TS 6.8.1.a (Violation 50-275/98010-01).

Although this violation was discovered by the licensee, the immediate corrective actions upon discovery were inadequate, resulted in further violation of procedures, and could have resulted in equipment damage. Therefore, the inspectors concluded that enforcement discretion was not warranted.

#### Safety Significance

AFW pumps were credited in the licensee's safety analysis for removal of decay heat during several design basis scenarios. The turbine-driven AFW pump was designed to remove 200 percent of the postulated decay heat following a reactor trip and design basis accident. The turbine-driven AFW pump discharges to all four steam generators.



Each motor-driven pump was capable of removing 100 percent of the postulated decay heat. Each motor-driven AFW pump discharges to two of four steam generators. Because one motor-driven pump was available throughout this incident, the inspectors concluded that the licensee had adequate means to remove decay heat.

The licensee also evaluated this incident with respect to overall risk. The instantaneous risk of having one motor-driven and the turbine-driven AFW pumps inoperable simultaneously would result in an approximate increase in core damage frequency of 3000 percent (if both pumps were inoperable for the entire year). However, this risk was mitigated by the fact that both pumps were inoperable for only a short period of time. Therefore, the increase in core damage frequency per reactor year was increased on the order of  $1 \text{ E-}8$ , a minimal increase. The inspectors reviewed the licensee's risk assessment and agreed that this incident was potentially risk significant, but was mitigated by the fact that the configuration lasted a short period of time.

In addition, the licensee complied with the TS Action Statement because the TS required 6 hours to be in hot standby with 2 AFW pumps inoperable.

#### Cause Analysis

The licensee's analysis concluded the causes of the event was attributable to human error with the following factors present:

- A mind set that AFW Pump 1-1 was the component to be sampled caused the wrong component error. The mechanic had only worked on Pump 1-1 previously and assumed it was the pump to be sampled. This error could have been prevented by self-verification that was not properly executed.
- Time pressure, which was self-imposed, to complete the task expediently for the purpose of minimizing critical component outage time caused the mechanic to rush the job and commence work prior to the work package being available at the job site.
- The pretask briefing by the maintenance foreman did not sufficiently identify each mechanic's role and responsibilities related to the task at hand.

#### Subsequent Corrective Actions

The issues related to this event were reviewed with mechanical maintenance personnel during weekly safety meetings on May 19 and on May 26. The first issue was the selection of the wrong component for oil sampling. The second issue was the fact that one mechanic verified the clearance while another started work on the component without positive confirmation that the component was cleared. The third issue was not notifying the control room in a timely manner. Management's expectations for each of these issues was discussed and emphasized. The need to be self-critical as an organization and learn from others' mistakes was also emphasized.



DCPP Case Study 66 was developed from this event and reviewed with essentially all maintenance services personnel. The lessons learned discussed in the case study included: (1) the importance of good pretask briefings; (2) time pressure can result in unnecessary hurry or short cuts; (3) self checking to verify the right unit, train and component should be used prior to work on any component and requires the work documentation be in hand; (4) mind set can be an incorrect preconceived idea; (5) assuming everything is OK, in this case that the component was cleared, can have an adverse safety impact; and (6) the necessity for timely reporting to operations. These reviews were completed by June 23 and completed the planned corrective actions for this event and actions to prevent recurrence.

c. Conclusions

Maintenance personnel demonstrated poor self-verification which, combined with an inadequate briefing and self-imposed time pressure, resulted in a violation of TS 6.8.1.a for failure to implement instructions for performing maintenance. This resulted in two AFW pumps simultaneously rendered inoperable because oil was drained from the wrong pump. In addition, licensee personnel failed to take adequate immediate corrective actions in that they: (1) failed to notify the control room in a timely manner; (2) continued to work on the wrong component without work authorization or a clearance; (3) failed to make timely log entries in the control operator's log; and (4) could have decided to perform a postmaintenance test in a more timely manner. The safety significance of this event was mitigated by the relatively short period of time with two AFW pumps inoperable.

The inspectors' review of the licensee's reason for the violation and subsequent corrective actions determined they were adequate.

**M8 Miscellaneous Maintenance Issues (92700)**

M8.1 (Closed) Licensee Event Report (LER) 50-275:323/95008-02: Control Room Ventilation System was outside of its design basis due to a programmatic deficiency in the operation and maintenance of the filters and charcoal adsorber system. This LER described situations in which both trains of the control room ventilation system were rendered inoperable because of maintenance activities. On four occasions, from 1986 to 1990, the charcoal adsorbers were removed and replaced without isolation. Because there was no isolation provided for these replacements, the boundary of the control room envelope was breached. For corrective actions, the licensee proposed to: (1) provide a local operator aid to alert personnel not to perform work on the filter units unless the filter units are properly isolated, (2) a shift order was provided to the operators to ensure that the control room ventilation system is properly cleared prior to work, (3) the design criteria memorandum associated with the control room ventilation system was revised to alert personnel to concerns with breaches of the envelope, and (4) revise procedures associated with maintenance and operation of the control room ventilation system. These corrective actions were previously reviewed during closeout of Revisions 0 and 1 of this LER. Revision 2 changed the safety analysis to note that



the total dose to the operators following a design basis event would not exceed the limits of 10 CFR Part 50, Appendix A, General Design Criterion 19. The inspectors reviewed the licensee's corrective actions and new safety analysis and determined them to be satisfactory. This item is closed.

### III. Engineering

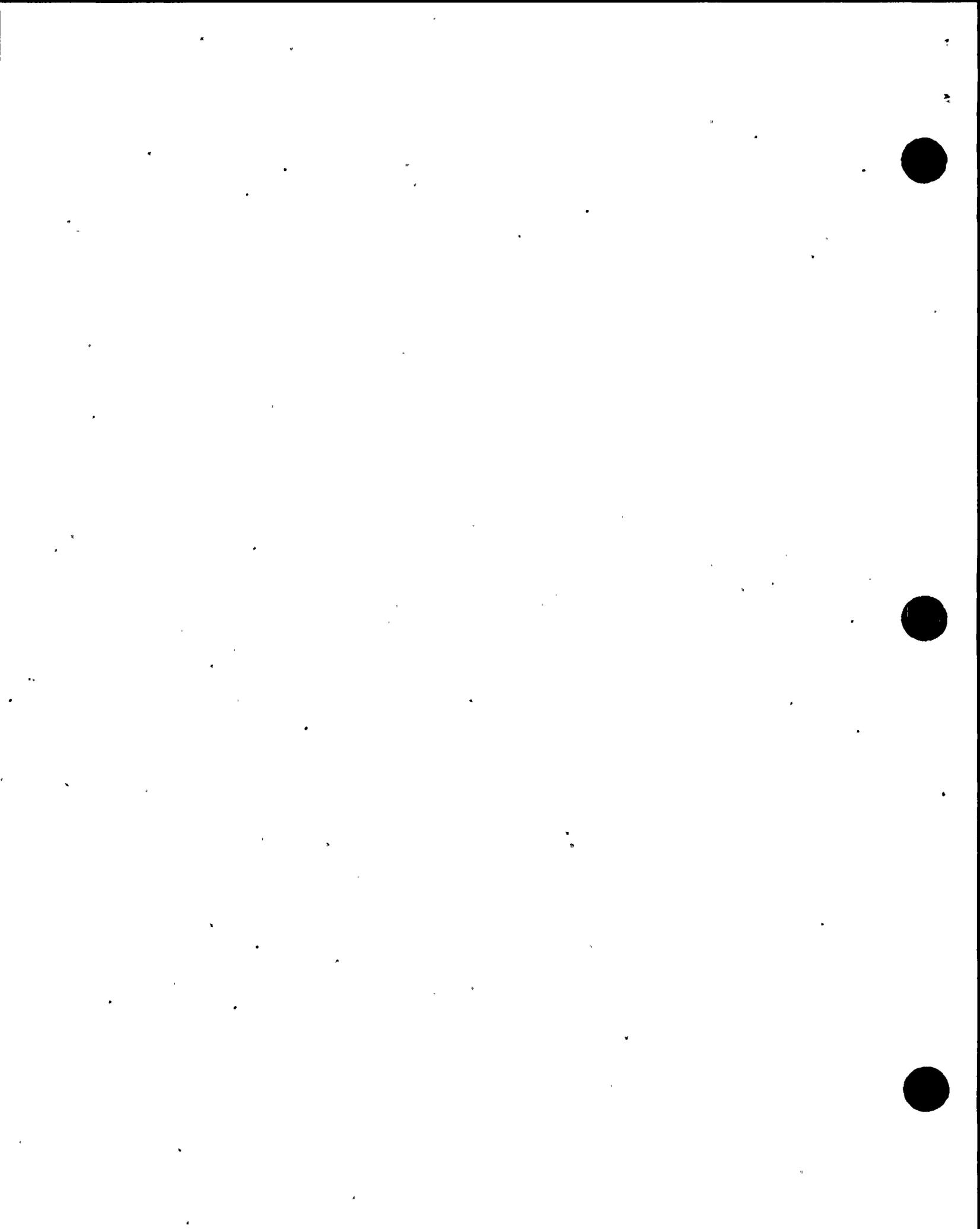
#### E1 **Conduct of Engineering**

##### E1.1 Temporary Modifications (37551)

The inspectors reviewed the temporary modifications log for Unit 1. The inspectors noted that each temporary modification was properly installed and independently verified. The inspectors also reviewed the 10 CFR 50.59 evaluations and screenings and determined that these evaluations appeared to be satisfactory. None of the modifications were in place for an excessive period of time.

#### E8 **Miscellaneous Engineering Issues (92700)**

E8.1 (Closed) LER 50-275/96006-00: Basler BE1-50/51B overcurrent relays failed to meet instantaneous current pickup acceptance criteria during preinstallation testing. On March 8, 1996, the licensee determined that approximately 40 percent (37 out of 94) of the relays (purchased commercial grade and dedicated to allow wholesale changeout of the relays in the vital 4 kV system) failed to meet the instantaneous current acceptance criteria during preinstallation testing. Discussions with the manufacturer revealed the manufacturer knew of the problem and recommended replacement with a newer model, Revision "K". Relays with the same revision as the failed relays (primarily Revision "H") were returned to the vendor. The dedication process for these relays was revised to incorporate lessons learned from this event. An INPO network entry was made to provide this information to the industry. The licensee determined that the root cause of this event was manufacturing/design error in that the relays were manufactured and sold with a high probability of random failures when used in the higher end of the current range advertised as being satisfactory for this relay. Procedures controlling preinstallation testing discovered the high failure rate before any relays were installed in the plant. A review of records by the licensee indicated that there were no Revision "H" relays installed in either unit. The inspectors performed an onsite review of the corrective actions and found them to be appropriate. This item is closed.



#### IV. Plant Support

##### **R1 Radiological Protection and Chemistry Controls**

###### **R1.1 General Comments (71750)**

The inspectors evaluated radiation protection practices during plant tours and work observation. The inspectors determined that personnel donned protective clothing and dosimetry properly, and that radiological barriers were properly posted.

##### **P1 Conduct of Emergency Planning Activities**

The inspectors conducted a tour of the technical support center. The inspectors determined that the technical support center was in an adequate state of readiness for response to emergencies.

##### **S1 Conduct of Security and Safeguards Activities**

###### **S1.1 General Comments (71750)**

During routine tours, the inspectors noted that the security officers were alert at their posts, security boundaries were being maintained properly, and screening processes at the Primary Access Point were performed well. During backshift inspections, the inspectors noted that the protected area was properly illuminated, especially in areas where temporary equipment was brought in.

#### V. Management Meetings

##### **X1 Exit Meeting Summary**

The inspectors presented the inspection results to members of licensee management at the conclusion of the inspection on July 1, 1998. The licensee acknowledged the findings presented. The licensee stated that they were very concerned about the draining of oil from the wrong AFW pump, and recognized the potential safety significance. However, while the postmaintenance test was performed, they did not believe that it was required due to the small amount of oil that was removed. The management's expectation for notification was that the event was not significant enough for a call in the middle of the night and could wait until the beginning of the next day shift. The inspectors acknowledged the licensee's comments.

The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.



ATTACHMENT

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

Licensee

W. G. Garrett, Director, Operations  
M. A. Crockett, Manager, Nuclear Quality Services  
R. D. Gray, Director, Radiation Protection  
T. L. Grebel, Director, Regulatory Services  
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J. P. Molden, Manager, Operations Services  
D. R. Oatley, Manager, Maintenance Services  
R. P. Powers, Vice President and Plant Manager  
L. F. Womack, Vice President, Nuclear Technical Services

INSPECTION PROCEDURES (IP) USED

|          |   |
|----------|---|
| IP 37551 | Onsite Engineering  |
| IP 61726 | Surveillance Observations   |
| IP 62707 | Maintenance Observation   |
| IP 71707 | Plant Operations  |
| IP 71750 | Plant Support Activities  |
| IP 92700 | Onsite Followup of Written Reports of Nonroutine Events at Power Reactor Facilities |
| IP 92902 | Followup - Maintenance  |



ITEMS OPENED AND CLOSED

Opened

|                 |     |  |
|-----------------|-----|--|
| 50-275/98010-01 | VIO | Mechanics drained oil from wrong AFW Pump (Section M1.3) |
|-----------------|-----|--|

Closed

|                         |     |   |
|-------------------------|-----|---|
| 50-275;323/<br>95008-02 | LER | Control Room Ventilation System Outside of Design Basis (Section M8.1). |
|-------------------------|-----|---|

|                 |     |  |
|-----------------|-----|--|
| 50-275/96006-00 | LER | Basler BE1-50/51B overcurrent relays failed to meet instantaneous current pickup acceptance criteria during preinstallation testing (Section E8.1) |
|-----------------|-----|--|

Opened and Closed

None

