

U. S. NUCLEAR REGULATORY COMMISSION
REGION V

Report No. 50-275/84-06

Docket No. 50-275

License No. DPR-76

Licensee: Pacific Gas and Electric Company
77 Beale Street, Room 1435
San Francisco, CA 94106

Facility Name: Diablo Canyon Unit 1

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

Inspectors: Harvey S. Canter for 4-27-84
M. M. Mendonca, Sr. Resident Inspector Date Signed

Harvey S. Canter for 4-27-84
M. L. Padovan, Resident Inspector Date Signed

H.S. Canter 4-27-84
H. L. Canter, Chief, Reactor Projects Date Signed
Section 3

Summary: Inspection from April 7, through April 17, 1984
(Report No. 50-275/84-06)

Areas Inspected: Special, unannounced inspection of Unit 1 operational event involving the inoperability of an ECCS flow path for both centrifugal charging pumps. This inspection involved 42 inspection hours on Unit 1 by two NRC Resident Inspectors.

Results: Enforcement action taken as a result of this inspection is to be the subject of separate correspondence.

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DETAILS

1. PERSONS CONTACTED

- *J. Boots, Supervisor of Chemistry and Radiation Protection
 - J. Becker, Shift, Technical Advisor
 - L. Collins, Shift Foreman
 - W. Crockett, Senior Power Production Engineer
- *M. Dobrzensky, Quality Assurance Engineer
- *C. Eldridge, Quality Control Manager
- *R. Fisher, Acting Manager of Operations
- *B. Giffin, Instrumentation and Control Manager
- *T. Haueter, Acting Supervisor of the Work Planning Center
- *J. Hinds, Regulatory Compliance Engineer
 - D. Koehler, Control Operator
 - M. Lenke, Control Operator
- *R. Patterson, Plant Superintendent
- *D. Miklush, Supervisor of Maintenance
 - T. Nahay, Shift Advisor
 - M. Price, Clearance Coordinator
- *W. Raymond, Assistant Manager of Nuclear Plant Operations
 - M. Rhodes, Shift Foreman
- *R. Thornberry, Plant Manager
- *B. Tinkle, Project Team General Construction, Field Engineer
- *L. Womack, Senior Power Plant Engineer

The inspectors interviewed several other licensee employees, including shift supervisors, reactor and auxiliary operators, maintenance personnel, plant technicians and engineers, quality assurance personnel and general construction personnel.

*Denoted those attending the exit interview on April 17, 1984.

2. INOPERABILITY OF EMERGENCY CORE COOLING SYSTEMS (ECCS) FLOWPATH FORM THE CENTRIFUGAL CHARGING PUMPS

a. Summary of Events and Findings

On April 6, 1984 while the facility was in Mode 3, the Boron Injection Tank (BIT) was valved out of service and electrical power was removed from the valve operators to permit recharging of the tank to increase the boron concentration. The activity was performed in accordance with approved procedures. The action, however, violated the facility technical specification provisions that require the charging pumps to be operable and capable of injecting coolant through the BIT and into the Reactor Coolant System (RCS) upon actuation of a safety injection signal whenever the reactor is being operated in Modes 1, 2 or 3.

Contrary to Technical Specification (TS) 3.5.2 and 3.0.3, between April 6, 1984 and April 7, 1984 (for about 15 hours) the inlet and outlet valves to the BIT were closed and disabled by securing the electrical power to the valve operators. This action blocked and rendered inoperable the flow path between the centrifugal charging pumps (CCP) and the RCS for both Emergency Core Cooling subsystems. The reactor was in mode 3 during the entire period. (Note: An ECCS subsystem as defined in the TS, consists of a centrifugal charging pump (CCP), a safety injection (SI) pump, a Residual Heat Removal (RHR) pump, a RHR heat exchanger, and the components in the flow paths from the Refueling Water Storage Tank (RWST) to the RCS for each of the pumps.) (84-06-01)

b. Documentation Reviewed

The inspectors reviewed the following documents to determine the sequence of events, and to assess underlying causes of the event:

- . Technical Specification 3.5.2, "ECCS Subsystems - TAVG greater than or equal to 350°F"
- . Technical Specification 3.0.3, Untitled
- . Operating Procedure B-1C:II, "12% Boric Acid System - Place In Service"
- . Operating Procedure B-1C:III, "12% Boric Acid System - Shutdown and Clearing"
- . Operating Procedure B-1C, "12% Boric Acid System"
- . Emergency Operating Procedure OP-0, "Reactor Trip With Safety Injection"
- . INPO "Notepad" Report dated 6-20-83, "Operating Plant Experiences"
- . Clearance Request and Job Assignment Sheet #9-2954-84
- . Diablo Canyon Final Safety Analysis Report
- . ANSI N18.7-1976, "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants"
- . Administrative Procedure NPAP C-6S1, "Clearance Request/Job Assignment/Special Work Permit Request Procedure"
- . Temporary Procedure TP-TO-8401, "Responsibilities and Duties of the Shift Advisor"
- . Shift Foreman Log/Turnover Checklist dated 4/6/84 and 4/7/84
- . Control Operator Log dated 4/6/84 and 4/7/84
- . Nuclear Plant Problem Report #DCI-84-OP-P0762
- . Nonconformance Report #DCI-84-OP-N066

c. Detailed Description

As a result of a Safety Injection (SI) on April 6, 1984, the contents of the Boron Injection Tank (BIT) (containing borated water at a nominal concentration of approximately 21,000 ppm boron) had been injected into the RCS. The contents of the BIT were injected into the RCS by the centrifugal charging pumps (CCP) thus forcing water from the Refueling Water Storage Tank (RWST) (containing borated water at approximately 2,000 ppm boron) into the BIT. The BIT then contained a borated water solution of less than the minimum TS requirement of 20,000 ppm boron.

Accordingly, on the same day, a clearance request was prepared by a Senior Reactor Operator (SRO), to drain and refill the BIT with a 12% boric acid solution (this is equivalent to approximately 21,000 ppm boron). This clearance request was approved by the Shift Foreman, a licensed SRO. Operating Procedures (OP) B-1C:II "12% Boric Acid System - Place In Service" and OP B-1C:III "12% Boric Acid System - Shutdown and Clearing" were specified in the clearance request as the applicable procedures to drain and refill the BIT. The "Prerequisites" section of OP B-1C:III specified that procedure OP B-1C "12% Boric Acid System" should be reviewed prior to using OP B-1C:III. OP B-1C lists six TS which are applicable to the procedure. However, OP B-1C did not reference TS 3.5.2, which specifies restrictions on ECCS subsystems for Modes 1 through 3, nor did it reference TS 3.5.3, which restricts operation of the ECCS subsystems for Mode 4.

In accordance with the previously mentioned procedures, at approximately 7:10 p.m. on April 6, 1984, BIT inlet valves 8803A and 8803B, and BIT outlet valves 8801A and 8801B, were closed, and the electrical breakers to the valve operators were opened. As a result of the TS information supplied in OP B-1C and on the clearance request, the operators were under the impression that the BIT valve lineup could remain in this configuration for up to 7 days without exceeding TS 3.5.4.1 for the BIT. However, by isolating the BIT and removing electrical power to the valve motor operators, the flow path from the RWST, through the two charging pumps and the BIT to the RCS, was made inoperable. With this flowpath inoperable, on receipt of a safety injection signal, both centrifugal charging pumps in the ECCS would not have been able to automatically perform their intended safety function. Since both charging pumps were isolated from the RCS, both ECCS subsystems were inoperable. As the ACTION statement for TS 3.5.2.a only defines the action to be taken with one ECCS subsystem inoperable, the provisions of TS 3.0.3 apply. TS 3.0.3 specifies that with the plant in a Mode 3 condition, if a TS cannot be met (even if relying upon ACTION statements) then the licensee must, within 1 hour, initiate actions to place the unit in a hot shutdown (mode 4) condition within the following 6 hours. The licensee failed to recognize this TS restriction for a period of 15 hours.

At 9:30 a.m. on April 7, 1984, the dayshift shift foreman (SFM), examining the Unit 1 control board, recognized that the ECCS was inoperable, and that the plant was outside the ACTION statement requirements of TS 3.5.2. The SFM declared that the provisions of TS 3.0.3 were applicable to the Unit 1 facility, and at 10:10 a.m. the electrical breakers to the BIT isolation valves were closed. At this time, the charging pump flow path through the BIT was available, and the ECCS was declared operable.

d. Factors Contributing to the Event

Several factors contributed to this event. These include (1) a procedural deficiency, (2) inadequate review of documentation, and (3) preoccupation of control room personnel. Each of these items is addressed further below.

(1) Procedural Deficiency

As previously discussed, OP B-1C lists six TS which are applicable to the procedure. However, no reference to TS 3.5.2 is provided in OP B-1C. In response to this disclosure, the licensee has 1) initiated action to revise OP B-1C, 2) instituted a program to review their operating procedures for similar omissions of TS references, and 3) is developing a method to cross-reference applicable TS requirements with each safety related plant component. These corrective actions will be followed as open items 84-06-02, 84-06-03, and 84-06-04, respectively.

(2) Inadequate Review of Documentation

The first problem dealt with the fact that OP B-1C:II had been recently revised to reference OP B-1C:III. OP B-1C:III specifies that, when draining and refilling the BIT, electrical power should be removed from the closed BIT inlet and outlet valves. However, OP B-1C:II was revised, reviewed and approved by SROs and plant management, including the Plant Staff Review Committee (PSRC), without the licensee identifying that the specified valve configuration in OP B-1C:III would result in ECCS inoperability if complied with, and that OP B-1C:III should not be used in Modes 1 through 4. A description of the circumstances leading to the procedures revision is provided below.

Plant management realized that, during an inadvertent safety injection (SI), if the control operator terminated the charging flow as early as possible, after the SI reset block relays time out, the contents of the BIT (a heat traced tank) might not be completely discharged into the RCS. In this situation, the 12% boron concentration solution could conceivably precipitate and potentially plug the non-heat traced injection lines to the RCS. To avert this potential problem, Emergency Operating Procedure (EP) OP-0 "Reactor Trip with Safety Injection" was revised to specify flushing of the cold leg ECCS injection lines after recovery from a inadvertent SI. Also, EP OP-0 was revised to specify that the BIT was to be drained and refilled in accordance with OP B-1C.

While revising EP OP-0, licensee personnel recalled an operating experience at the North Anna Power Station regarding inadequate BIT procedures. A report from INPO's "NOTEPAD" service indicated that the high head safety injection pumps (similar to the Diablo Canyon ECCS centrifugal charging pumps) possibly experienced "pump runout" (overspeed) as a result of an inadequate procedure for refilling the BIT. The North Anna procedure specified that the BIT was to be isolated by use of motor operated valves (which open on a SI

signal). As a result of a previous SI at the North Anna Power Station, the BIT contained a boric acid solution less than the required TS value. Accordingly, the BIT was to be drained of its lower-than-required boric acid solution by opening the BIT drain and vent valves. While the drain and vent valves were open on the BIT, a second SI signal occurred, which started the high head safety injection (HHSI) pumps and resulted in RWST water being pumped out of the ECCS piping through the open valves. The North Anna report indicated that these open flow paths could affect the HHSI flow to the RCS, and possibly cause HHSI pump runout. As one possible corrective measure, the report suggested that the SI signal to the BIT isolation valves could be disarmed during BIT refill.

In response to this report, Diablo Canyon personnel reviewed and revised OP B-1C:II to assure that once the BIT is discharged, it would be cleared and drained in accordance with OP B-1C:III before refilling. OP B-1C:III specifies that the electrical breakers for the motor operators on the BIT inlet and outlet valves are to be "racked out". With electrical power removed from the BIT isolation valves, the valves would then not open on an SI signal, and RWST water would not be lost through the open BIT drain and vent valves.

Apparently, the licensee accepted procedural changes suggested by Notepad at face value, and incorporated them into the Diablo Canyon OPs, without thoroughly assessing the applicability of the suggested changes to the plant.

The second problem of inadequate review of documentation dealt with clearance request (No. 9-2954-84) for draining and refilling the BIT. This request was prepared by a licensed operator, and approved by a SFM, without proper consideration of the operability of redundant equipment. In Chapter 17 of the Diablo Canyon Final Safety Analysis Report (FSAR), Table 17.2, the licensee has committed to ANSI N18.7-1976 "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants". Section 5.2.6 "Equipment Control" specifies that prior to granting permission to release equipment or systems for maintenance, "such operating personnel shall verify that the equipment or system can be released.... Attention shall be given to the potentially degraded degree of protection when one subsystem of a redundant safety system has been removed for maintenance.... Conditions to be considered... include shutdown margin, method of emergency core cooling...." In PG&E's Administrative Procedure NPAP C-6SI, Rev.5, "Clearance Request/Job Assignment/Special Work Permit Procedure" Item A.4 specifies that "if the equipment to be cleared is covered by the TS, the operability of redundant equipment must be verified prior to approving the clearance".

The licensee should have realized that isolating the BIT would prohibit the redundant CCPs from performing their intended function. Accordingly, in issuing the subject clearance, the licensee did not comply with provisions of the Administrative Procedures and Quality Assurance Program. Corrective action will be followed as open item 84-06-05.

(3) Preoccupation of Control Room Personnel

The closed position of the BIT isolation valves, and the absence of electrical power to the valve motor operators, were indicated in the control room. Valve position was indicated by the valve control switches being tagged in the closed position. The absence of the electrical power source to the valve operators was indicated by lack of illumination of a "closed" or "open" indicator (light bulb) on the valve position control. A SFM, STA, Shift Advisor, Senior Control Operator and Control Operator were present in the control room during this event. With the indications available to be control room personnel, the inoperability of the ECCS should have been identified shortly after it occurred.

In discussions between each of the above personnel and the resident inspector, the licensee's personnel indicated that failure to identify the ECCS inoperability in a timely manner could be attributed to a preoccupation with control rod system testing, which was being performed concurrently. The control room personnel indicated that, had they been free to review the control board status, the inoperability of the ECCS would probably have been quickly identified. While this explanation is very plausible, in one instance, an individual indicated that he had thought the valve lineup to be incorrect, but in reviewing OP B-1C:II and III, he found that the procedures had been approved by the PSRC, and he therefore assumed that the valve alignment was acceptable, and returned to evaluate control rod system testing.

3. OTHER CORRECTIVE ACTION

The licensee has instituted corrective action to assure that there is a proper management overview of plant operations. Specifically, the licensee has placed management on shift to monitor and evaluate plant operations during low power testing. In a memorandum from the Plant Manager to the Manager of Nuclear Plant Operations, dated April 17, 1984, the responsibilities of these on shift management personnel are stated to include:

- a. Monitor safety-related plant activities, including the startup program, surveillance, and maintenance.
- b. Review SFM duties to eliminate extraneous, non-plant operations oriented duties. Monitor shift turnovers and briefings with suggestions geared to improved effectiveness.
- c. Assist the SFM in controlling access to the control room. Assist the SFM in maintaining a highly professional, business-oriented atmosphere in the control room.
- d. Assist the SFM in reviewing all planned operational activities to insure that all TS requirements and license conditions are met.

- e. Approve all jumpers to assure they are required.
- f. Review all procedures not routinely completed or not previously run to insure that the procedure is adequate to complete the job in a safe efficient manner.
- g. Insure that the jumper log is filled out properly and that all jumpers are removed when the equipment is returned to service.
- h. Review clearance and tagging operations for safety-related equipment to insure that they are properly completed.
- i. Assist SFM in coordinating the activities of the STA and Shift Advisor.
- j. Provide independent advice to the SFM on potentially reportable events.
- k. Work with PG&E News Bureau on draft press releases.
- l. Interface with NRC personnel present at the plant for the purpose of apprising them of the status of the startup test program.

In addition, the licensee has instituted a program to visit other Region V facilities and review operational methods and control at other facilities within Region V. The licensee has also instituted an extensive walk-down verification system to provide screening for operators on safety system alignments and technical specifications requirements.

The effectiveness of these programs will be monitored under open item 84-06-06.

4. EXIT MEETING

On April 17, 1984, an exit meeting was conducted with licensee representatives identified in paragraph 1. The inspectors summarized the scope and findings of the inspection as described above. Finally, the inspectors indicated that the licensee should anticipate further discussion with senior level NRC management on the current inspection findings and enforcement considerations.