U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report Nos: 50-275/89-16 and 50-323/89-16

Docket Nos: 50-275 and 50-323

License Nos: DPR-80 and DPR-82

Licensee: Pacific Gas and Electric Company
77 Beale Street, Room 1451
San Francisco, California 94106

Facility Name: Diablo Canyon Units 1 and 2

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

Inspection Conducted: June 4 through July 29, 1989

K. E. Johnston, Resident Inspector

P. P. Narbut, Senior Resident Inspector

Approved by: M. M. Mendonca — 8/17/89
M. M. Mendonca, Chief, Reactor Projects Section 1 — Date Signed

Summary:

Inspection from June 4 through July 29, 1989 (Report Nos. 50-275/89-16 and 50-323/89-16)

Areas Inspected: The inspection included routine inspections of plant operations, maintenance and surveillance activities, follow-up of on-site events, open items, and licensee event reports (LERs), as well as selected independent inspection activities. Inspection Procedures 30702, 30703, 35702, 40500, 61726, 62703, 71707, 90712, 92701, 92702, and 93702 were used as guidance during this inspection.

Results of Inspection: No violations or deviations were identified.

Areas of Strength: The licensee's actions subsequent to a condensate saltwater intrusion and manual reactor trip on July 16, 1989, were formally conducted, used their event investigation methodology, and comprehensive in the follow-up of identified problems including the diesel generator start and the investigation of mismachined air operated valves (see paragraph 4.e.).

The licensee Quality Assurance audit of the reactor supplier conducted in June was noted to be a innovative performance based inspection utilizing extensive resources. The audit identified meaningful findings which are not typically identified by the compliance/programmatic audits ordinarily performed by utilities on their reactor suppliers.

Areas of Weakness: The licensee's actions dealing with a malfunctioning boric acid flow indicator were not aggressive. The problem was not elevated to management attention and properly dealt with until elevated by the NRC.

DETAILS

1. Persons Contacted

*J. D. Townsend, Plant Manager
D. B. Miklush, Assistant Plant Manager, Maintenance Services
*L. F. Womack, Assistant Plant Manager, Operations Services
*B. W. Giffin, Assistant Plant Manager, Technical Services
W. T. Rapp, Onsite Safety Review Group Chairman
*C. L. Eldridge, Quality Control Manager
K. C. Doss, Onsite Safety Review Group
R. G. Todaro, Security Supervisor
T. A. Bennett, Maintenance Manager
D. A. Taggert, Director Quality Support
W. G. Crockett, Instrumentation and Control Maintenance Manager
J. V. Boots, Chemistry and Radiation Protection Manager
*T. L. Grebel, Regulatory Compliance Supervisor
J. A. Shoulders, Onsite Project Engineering Group Manager
M. E. Leppke, Engineering Manager
S. R. Fridley, Operations Manager
R. P. Powers, Radiation Protection Manager

The inspectors interviewed several other licensee employees including shift foremen (SFM), reactor and auxiliary operators, maintenance personnel, plant technicians and engineers, quality assurance personnel and general construction/startup personnel.

*Denotes those attending the exit interview on August 8, 1989 .

2. Operational Status of Diablo Canyon Units 1 and 2

Unit 1 and Unit 2 continued at power operations for the reporting period. Unit 1 achieved a national record for continuous days at power for a Westinghouse four loop design reactor. On July 7, 1989, the record was set at 308 continuous days. Unit 2 was manually tripped on July 16, 1989, from about 40% reactor power due to a severe chloride intrusion into the condensate system, in turn due to a failed condenser tube sheet plug. The unit restarted on July 22, 1989, the delay in restart was due to investigative and corrective work done to air operated valves with potentially mismachined parts.

3. Operational Safety Verification (71707)

a. General

During the inspection period, the inspectors observed and examined activities to verify the operational safety of the licensee's facility. The observations and examinations of those activities were conducted on a daily, weekly or monthly basis.

On a daily basis, the inspectors observed control room activities to verify compliance with selected Limiting Conditions for Operations

(LCOs) as prescribed in the facility Technical Specifications (TS). Logs, instrumentation, recorder traces, and other operational records were examined to obtain information on plant conditions, and trends were reviewed for compliance with regulatory requirements. Shift turnovers were observed on a sample basis to verify that all pertinent information of plant status was relayed. During each week, the inspectors toured the accessible areas of the facility to observe the following:

(a) General plant and equipment conditions,

(b) Fire hazards and fire fighting equipment,

(c) Radiation protection controls,

(d) Conduct of selected activities for compliance with the licensee's administrative controls and approved procedures,

(e) Interiors of electrical and control panels,

(f) Implementation of selected portions of the licensee's physical security plan,

(g) Plant housekeeping and cleanliness,

(h) Engineered safety feature equipment alignment and conditions, and

(i) Storage of pressurized gas bottles.

The inspectors talked with operators in the control room, and other plant personnel. The discussions centered on pertinent topics of general plant conditions, procedures, security, training, and other aspects of the involved work activities.

No violations or deviations were identified.

4. Onsite Event Follow-up (93702)

a. Cracked Weld in Letdown Line

On June 19, 1989, the licensee discovered a cracked and leaking weld on the letdown line in the Unit 2 containment. The total leakage had been determined to be about 0.1 gpm and first indications were noted on June 7, 1989. On June 17 containment radiation levels had increased by a level of three as determined by trending.

The licensee performed repairs while at power utilizing excess letdown as an alternative.

The licensee removed the entire weld and a section of pipe in order to perform metallagraphic examination of the failed weld. During the work a QC inspector discovered an adjacent pipe hanger had also broken and dislodged. The nature of the hanger strap break

indicated that it was an old break and had not been due to overstress but cyclic fatigue. The licensee was investigating several possible root causes including water hammer, vibration, and thermal cyclic fatigue. The metallagraphic analysis planned was expected to provide greater insight. The licensee did not put much credence in the water hammer theory due to the absence of signs of rapid pipe movement.

Subsequent to repair, the line was monitored in service for any signs of undue vibration in various letdown modes. No abnormal operating characteristics were noted.

The inspector will follow-up the licensee's root cause analysis in the normal course of inspection through the nonconformance report (NCR) written on the subject, NCR DC2-89-MM-N064.

The licensee is also exploring certain operational situation in which water hammer can be induced for operational improvements.

b. Unit 1 Power Reduction for Valve Repair

On June 24, 1989, Unit 1 reduced power to 24% to allow maintenance on feedwater isolation valve FCV 530. This was a repeat of a similar power reduction and maintenance to valve FCV 530 on May 5, 1989. The licensee plans additional investigative actions including valve disassembly during the upcoming refueling outage in October 1989.

c. High Temperatures in 480 Volt Bus Rooms

On July 5, 1989, both units had high ambient temperatures in the 480 volt bus rooms due to relatively high environmental, daytime temperatures. The inspector monitored licensee actions and found them to be acceptable.

d. Moderator Temperature Coefficient Testing

On July 6, 1989, in accordance with technical specification requirements the licensee performed a surveillance test in Unit 1 to determine the moderator temperature coefficient of reactivity within 7 days of having achieved an equilibrium boron concentration of 300 ppm.

The test was performed utilizing a new test method for Diablo Canyon which involved keeping the plant power stable and not diluting boron concentration for 48 hours, and measuring the amount that Tave had dropped (to provide the assessment of reactivity worth).

The results from his first test showed the moderator temperature coefficient to be more negative than allowed by technical specification. The maximum technical specification limit for this test is 3.0 x 10 E-4 delta k/degree F. The licensee measured -3.05 pcm requiring the licensee to reperform the test every 14 days to ensure the shutdown limit of -3.9 pcm was not reached.

The licensee performed a second test using the rod worth measurement method as determined by a reactivity computer and got very different results, specifically, -1.4 pcm.

The licensee performed a third test utilizing a third method, a boration then dilution and got results which were close to the predicted value. The results were -2.15 pcm whereas predicted was -2.5 pcm.

The licensee had discussions with Westinghouse, the reactor supplier. The discussions indicated a greater confidence in the third test based on the experience with other plants tests and results. The licensee also revisited their second test method using rod worth curves versus the reactivity computer method and obtained good agreement with the expected value.

Licensee management had not determined the final resolution of the measurement. There was general confidence that the first tests indication of a very negative moderator temperature coefficient was not accurate. The first test measurement was taken with an induced temperature swings of about 2 degrees F, whereas subsequent tests were done with induced temperature swings of about 4 degrees F giving greater accuracy

The inspector discussed the relative accuracies of the measurements with licensee engineering. The licensee representatives could not provide absolute error band estimates but considered, in their judgement and after discussion with Westinghouse, that the last method used was more accurate due to improvements made in chemical analysis accuracies. Licensee engineering assessed the precision of the boron concentration measurements to be within + 1 ppm for the change of about 12 ppm in an overall solution of about 250 ppm boron.

The licensee management determined, during the week of August 1, that additional testing would be performed during the week of August 7, 1989. The results of that testing, conducted after the close of this inspection report, did not confirm the repeatability of the boron dilution methodology. The inspector will continue to follow licensee actions on this matter.

e. Unit 2 Condenser Leak and Manual Reactor Trip

On July 16, 1989, Unit 2 developed a seawater leak into the condenser and subsequently manually tripped the reactor from about 40% power to avoid excessive chloride intrusions into the steam generator.

Prior to the event, the Unit was at 50% power performing condenser cleaning. The chloride leak occurred after completion of cleaning of the east half of the condenser and upon its return to service. Operators noted the leak through conductivity alarms and reduced condenser vacuum. A power reduction to 40% had been initiated due to the vacuum reduction.

The reactor was manually tripped in accordance with the abnormal operating procedure AP-20 when feedwater conductivity downstream of the condensate polishers was noted to be increasing. Subsequent to the reactor trip all systems responded normally with the exception that diesel generator 2-2 started. The diesel start was not expected, but was not detrimental. Subsequent investigation revealed that a diesel sometimes starts during electrical transfer from auxiliary to startup. The licensee has experienced this occurrence before, and has readjusted voltage settings to a degree. The licensee plans include changes to undervoltage relay setpoints (50 relays) from a setpoint of 100 volts to 98 volts. The licensee also plans to "beef-up" the taps on the auxiliary power transformers to decrease the likelihood of reduced voltage situations. These changes have been coordinated with the licensee's engineering organization to reduce the number of unnecessary diesel generator starts. The licensee plans to implement these changes during the next outage.

Post trip investigation revealed that the cause of the seawater leak was a failed condenser tube sheet plug. As corrective action all such plugs in both the east and west halves of the condenser were re-verified to be installed properly.

The licensee's chemistry personnel noted hotwell chlorides achieved 13,000 ppb. Steam generator samples, although slightly elevated in chlorides, indicated that the generator had been protected by the condensate polishers to reasonable levels (but above the normal levels of 1 to 3 ppb).

As part of the normal routine in preparation for return to service the licensee proceeded to perform valve grooming of the steam dump valves. One valve, PCV-22, did not respond to testing. Investigation revealed that an internal bolt in the valves air operator had failed causing inoperability. The bolt failed due to overload. The bolt had been improperly modified, by machining, which greatly reduced its effective cross section. The licensee launched a comprehensive investigation. The licensee determined that the modification occurred prior to plant startup in conjunction with a design change performed at that time. The licensee also compiled a list of all other valves which might have received the same modification and verified that no other improper modifications had been performed. The verification was performed by visual inspection or radiographic examination of each valve.

The inspector noted that the licensee's response (to both the salt intrusion and to the improperly modified steam dump valve) appeared comprehensive, formally structured, and sound. All problems were acceptably resolved prior to the reactor restart on July 22, 1989.

f. Primary Relief Tank Pressurization and Spill

On July 18, 1989, while in Mode 3 the licensee noted an increase in the Unit 2 containment sump level. Level rose then stopped. Subsequent containment entry revealed the rupture disk on the

primary relief tank had ruptured and what was estimated to be about 300 gallons of water had spilled in the surge of depressurization.

The licensee's review of events over the previous shift indicated that letdown isolation had occurred. When letdown was restored the letdown relief valve had lifted and remained lifted for about 1/2 hour. That discharge and subsequent leakage led to the primary relief tank pressurization and rupture disk failure. The pressurization of the relief tank had not been noted on the previous shift since the pressure and level instruments had been taken out of service for calibration. Operators had checked the relief tank temperature, which was functional, at the time of the relief lift and noted no abnormally high temperature.

The events leading to letdown isolation started the evening before when I&C personnel were authorized to perform position indicator work on FCV 143, a main turbine stop valve. This work requires latching and unlatching the turbine which puts a light steam load on plant. When this work was complete and the turbine was relatched, the steam dumps which had to open slightly to compensate, overshot causing an RCS cooldown to 17% pressurizer level which automatically causes letdown isolation.

Operators noted the letdown isolation and proceeded after assessing the cause to reestablish letdown. However the reestablishment of letdown did not reduce header pressure low enough to prevent the blowdown setting of the relief valve to be reached. The relief valve stayed open as noted by operators in observing letdown flow rate until operators reduced the letdown flow pressure setting low enough to allow the relief valve to reseat.

The licensee prepared a event report on the matter and defined four corrective actions. The licensee has issued a Quality Evaluation (QE) to determine root cause. The inspectors will follow-up the licensee's root cause analysis and corrective action in the normal course of future inspection.

g. Security Event

On July 18, 1989, the licensee made a one hour security event report regarding alarm malfunctions due to failed fuses in security computer components.

h. Heater Drip Pump Bearing Failure

On July 22, 1989, Unit 2 reduced power to 70% due to high vibrations on the heater drip pump caused by bearing failure. The Unit returned to full power on July 26, 1989, after repairs.

5. Maintenance (62703)

The inspectors observed portions of, and reviewed records on, selected maintenance activities to assure compliance with approved procedures, technical specifications, and appropriate industry codes and standards.

Furthermore, the inspectors verified maintenance activities were performed by qualified personnel, in accordance with fire protection and housekeeping controls, and replacement parts were appropriately certified.

Selected maintenance activities were examined as described in Section 4 of this report including maintenance work related to the operational occurrences described in paragraph 4a, 4b, 4e, 4f, and 4h. Additionally, the inspector observed selected portions of the replacement of auxiliary feedwater supply control valve, LCV-115, operator. The inspector observed that the work package was complete. The inspector also noted that the last the work activity that had been performed had not yet been marked complete by the technician. Upon notification by the inspector, the electrical maintenance foreman for this work activity instructed the technician to mark the specific step. The inspector concluded that this was acceptable corrective action and that no further action was needed as the work was still in progress and the documentation would probably have been completed prior to the next step in the work package. The inspector also determined that mechanical maintenance had found a problem with the fit up of the valve operator to the valve body; and that mechanical maintenance appropriately obtained plant engineering involvement in the resolution of this problem.

No violations or deviations were identified.

6. Surveillance (61726)

By direct observation and record review of selected surveillance testing, the inspectors assured compliance with selected technical specification requirements and plant procedures. The inspectors verified that test equipment was calibrated, and acceptance criteria were met or appropriately dispositioned.

The inspectors examined selected aspects of surveillance testing for the operational occurrences described in paragraphs 4a, (post maintenance hydro testing), 4c, and 4d.

Additionally the inspector examined the following:

- On July 6, 1989, the licensee conducted a special test in Unit 1 to determine the cause of occasional water hammer concurrent with the Unit 1 start of the Residual Heat Removal (RHR) System. As previously discussed in NRC report 88-31 (Follow-up item 88-31-01) the severity of the water hammer is not sufficient to cause system damage. The inspector observed the licensee's setup for the test which included accelerometers, pressure detectors and time trace equipment. The licensee's test did not produce the expected results in regards to the source of the water hammer. Licensee actions to reduce and understand the data and devise another approach will continue.

- On July 25, 1989, the inspector examined licensee actions in performance of Surveillance Test STP R20 dealing with measurements of the boric acid inventory primarily conducted by chemistry

personnel. The inspector noted that an action request had been written on June 22, 1989, the boric acid flow indicator FIC-949 which was not functioning properly as determined during an operations surveillance test STP M-16B.

The flow transmitter, used to verify recirculation flow through the boron injection tank (BIT) was hung up and would not alarm when BIT flow was reduced to zero. When tapped, the indicator did reduce to zero and alarm. When BIT flow was restarted the indicator responded and the alarm properly cleared.

Several aspects of the licensee's handling of this occurrence did not appear to be handled adequately by the licensee.

The problem was identified on June 22, 1989, but not raised to sufficient action levels until July 25, 1989.

The initial evaluation by I&C on June 29, 1989, evaluated indication as performing no safety function. QC concurred on July 6, 1989.

I&C could not repair the item due to parts unavailability and recommended a design change on July 14, 1989. Again the action was not elevated to management attention.

In regards to technical specification requirements the licensee was meeting requirements for weekly testing of BIT flow and concentration but in a less than exemplary manner. Tests were conducted by tapping the gage to induce a proper reading in flow verification. The gage was not tagged and chemistry personnel (whose procedure requires flow verification were not aware they were reading a stuck gage).

The licensee subsequently issued a temporary procedure to verify BIT flow for the weekly tests using a transfer scheme from one Boric Acid Tank to another (through the BIT) and verifying a volume change.

This example of a need to elevate important problems quickly was discussed with licensee management at the exit interview. Licensee management indicated that they were aware of the problem and would identify actions to prevent recurrence.

No violations or deviations were identified.

7. Evaluation of Licensee Self Assessment Capability (IP 40500)

The inspectors performed an evaluation of the effectiveness of the licensee's self assessment programs including the licensee's programs to monitor performance, identify problems, and effect necessary corrective actions.

Although this effort has been an ongoing evaluation reflected in the residents monthly inspection reports, specifically in the identification of licensee strengths and weakness and in inspection report cover letter

issues, the inspectors arranged for a contract study performed by Idaho National Engineering Laboratory (INEL) to perform an independent assessment.

Two INEL engineers conducted an examination for two separate two week periods in March and April 1989. Their report published July 25, 1989, is attached as an Attachment to this report.

The INEL contractors were furnished with specific information in the form of all nonconformance reports and all audit finding reports for the year 1988 and were instructed to perform an analysis of the effectiveness of the licensee's self assessment programs both from the ability to recognize problem areas and to adequately resolve them in a reasonable time frame. The NRC contractors were also requested to review the functioning of the licensee oversight groups including the Technical Review Groups (TRG), the Onsite Safety Review Group (OSRG), the the General Office Nuclear Plant Review and Audit Committee (GONPRAC). Additionally, since the INEL contractors had expertise in the electrical and instrumentation and controls areas, they were requested to review a sampling of the licensee's technical resolutions in depth.

In the conduct of this examination, the INEL engineers met daily with licensee representatives and were under the supervision of the NRC residents.

As described in the attached report, the INEL engineer found that the licensee had acceptable procedures and staffing for their self assessment activities.

The INEL engineers described the fact that the licensee has experienced self identified and NRC identified difficulties with root cause analysis since 1987. The INEL engineers recognized the licensee's significant and continuing actions to improve both the root cause process and the timeliness of corrective actions.

The INEL engineer's judgement was that overall, the licensee's self assessment program was "marginally satisfactory" based on the continuance of certain problem attributes from 1987 to 1989.

The INEL engineers also concluded that the licensee was slow in resolving nonconformances as was recognized by licensee upper management and is being dealt with.

The NRC inspector concluded pursuant to the results of the INEL study, the ongoing evaluations performed by the residents and a root cause program analysis conducted by senior Region V management personnel, that the licensee's programs for root cause analysis have shown continuing improvement and problem areas are being dealt with responsibly.

Likewise, the program with timely resolution of nonconformance reports and audit findings reports has been identified by licensee management. The problem area has been tracked and trended and reported regularly to upper managements attention. The licensee has taken aggressive measures to improve performance in this area. The inspectors concluded that the

licensee has properly recognized the problem and is dealing with the problem responsibly.

No violations or deviations were identified.

8. Radiological Protection (71707)

The inspectors periodically observed radiological protection practices to determine whether the licensee's program was being implemented in conformance with facility policies and procedures and in compliance with regulatory requirements. The inspectors verified that health physics supervisors and professionals conducted frequent plant tours to observe activities in progress and were generally aware of significant plant activities, particularly those related to radiological conditions and/or challenges. ALARA consideration was found to be an integral part of each RWP (Radiation Work Permit).

No violations or deviations were identified.

9. Physical Security (71707)

Security activities were observed for conformance with regulatory requirements, implementation of the site security plan, and administrative procedures including vehicle and personnel access screening, personnel badging, site security force manning, compensatory measures, and protected and vital area integrity. Exterior lighting was checked during backshift inspections.

No violations or deviations were identified.

10. Licensee Event Report Follow-up (92700)

a. Status of LERs

The LERs identified below were closed out after review and follow-up inspections were performed by the inspectors to verify licensee corrective actions:

Unit 1: 84-41, 86-24, 88-33, 89-04, and 89-05.

Unit 2: 88-20, 88-02 Rev 1, 88-17, 88-26, 89-03, and 89-05.

b. LERS related to events subject to enforcement action EA 89-85

The following LERs described events which were subject to enforcement actions (EA 89-85):

2-88-24 Inoperable auxiliary feedwater pump due to an improperly open vent valve (January 30, 1989).

2-89-02 Auxiliary feedwater pump overspeed trip linkage to stop valve failed to operate properly (April 21, 1989).

These events were discussed in detail in reports 50-275/89-02, 50-275/89-05, and 50-275/89-13. The inspectors will review the adequacy of the licensee's corrective actions in conjunction with their response to the enforcement action. Based on the above, the review of these LERs is closed.

No violations or deviations were identified.

11. Open Item Follow-up (92703, 92702)

a. Follow-up Item 50-275/88-32-01, Flow Transmitters Inaccurate in Seismic Qualifications (Closed)

This item dealt with the Barton 288 flow Transmitters used in the residual heat removal (RHR) recirculation system.

The residents had been notified of the problem through the Trojan resident inspectors. Follow-up revealed that Westinghouse had not notified Diablo Canyon of the problem.

Subsequent actions included a justification for continued operation prepared by the licensee with Westinghouse input, a redefinition of accuracy and setpoints required, and implementation of setpoints changes by a design change and field implementation.

The licensee completed the above action in July 1989. One resultant problem remains. Specifically, the RHR low flow alarm now remains annunciated when the RHR pump is on recirculation flow. This problem occurred due to insufficient licensee engineering understanding of the alarm function according to licensee management personnel.

The licensee has analyzed the current alarm setpoint has made plans for its correction and has provided operations personnel with orders for additional actions in the interim.

In addition to the above actions, the licensee Quality Assurance Organization utilized the Barton 288 indicator problem and others to conduct a performance based audit of Westinghouse. The concept of the audit and the resources allocated were unique to such an audit which has been typically performed as a compliance audit of vendor programs.

The results of the QA audit identified meaningful areas for correction including the communication errors leading to the failure to notify PG&E of the Barton 288 seismic qualification problem.

This open item is considered closed.

b. TI-15-00 Proper Receipt Storage and Handling of Diesel Generator Fuel Oil (Closed)

The inspector examined the licensee's actions in regards to the handling, sampling, and testing of emergency diesel generator fuel oil. The licensee's actions were found to be acceptable.

This temporary instruction was prompted in part by biofouling in diesel fuel oil at Diablo Canyon in May 1988 and previously discussed at that time in the resident inspector reports.

This item is considered closed for Units 1 and 2.

c. Unresolved Item 50-323/87-15-01, Records review for Regenerative Heat Exchanger (Closed)

This item was identified during an independent NRC non destructive examination inspection conducted in 1987.

The NRC non destructive examiner had hoped to review the radiographic films of a heat exchanger produced by a certain manufacturer.

The film records which were retained by the manufacturer had only been retained for seven years in accordance with the manufacturing code requirements at that time.

The resident inspector discussed this matter with the NRC non destructive examiner in June 1989. It was agreed that this item should be closed.

d. Unresolved Item 50-323/88-19-01, I&C Procedures not Revised (Closed)

This item dealt with I&C procedures not being revised in a timely way, even when I&C technicians had identified important changes which needed to be made.

This item is closed based on licensee actions which included the addition of procedure writing staff and procedure changes for all important identified changes.

12. Exit (30703)

On August 8, 1989, an exit meeting was conducted with the licensee's representatives identified in paragraph 1. The inspectors summarized the scope and findings of the inspection as described in this report.