

U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report Numbers: 50-275/93-01 and 50-323/93-01

Docket Numbers: 50-275 and 50-323

License Numbers: DPR-80 and DPR-82

Licensee: Pacific Gas and Electric Company
Nuclear Power Generation, B14A
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Facility Name: Diablo Canyon Units 1 and 2

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

Inspection Date: January 19 through January 29, 1993

Inspectors: D. Acker, Reactor Inspector
F. Gee, Reactor Inspector

Approved By:

W. P. Ang
W. P. Ang, Chief,
Engineering Section

2-17-93
Date Signed

Summary:

Inspection from January 19 through January 29, 1993 (Report Nos. 50-275/93-01 and 50-323/93-01)

Areas Inspected:

The areas inspected in this routine engineering inspection included the teardown inspection of the new emergency diesel generator (EDG) 2-3 in Unit 2 and follow-up of previously identified items. Construction Modules 50073, 70300, 70729; Inspection Procedures 37700, 92700, 92701 and 92702; and Temporary Instruction 2515/111, "Electrical Distributional Functional Inspection Followup," were used as guidance for this inspection.



Results:General Conclusions and Specific Findings:

The licensee's testing and inspections of EDG 2-3 was comprehensive. However, some inspection findings, e.g. worn starting motor gear teeth, could have been identified during earlier commercial grade dedication inspections. The following were also observed:

- EDG 2-3 inspections were being performed per procedure requirements.
- EDG 2-3 material and cleanliness controls were adequate.
- EDG 2-3 air start motor turning gears were found to have been damaged.

Significant Safety Matters:

None

Summary of Violations:

None

Open Items Summary:

The inspectors closed three open items and opened one followup item (Section 2.f). All electrical distribution system functional inspection open items have now been closed. Therefore, Temporary Instruction 2515/111, "Electrical Distributional Functional Inspection Followup," is closed.



DETAILS

1. Persons Contacted

Pacific Gas and Electric Company

- *J. Townsend, Vice President, Plant Manager
- *D. Miklush, Manager, Operations Services
- *R. Powers, Manager, Support Services
- *R. Russell, Director, Nuclear Safety Assessment
- *M. Burgess, Director, System Engineering
- *W. Rapp, Chairman, Onsite Review Group
- *M. Tresler, Project Engineer, Nuclear Engineering and Construction Services
- *R. Hess, Assistant Project Engineer, Nuclear Engineering and Construction Services
- U. Faradj, Diesel Group Leader, Nuclear Engineering and Construction Services
- *L. Cossette, Supervisor, Plant Engineering
- *T. Grebel, Supervisor, Regulatory Compliance
- B. Goelzer, System Engineer
- *R. Theirry, Senior Compliance Engineer
- *J. Portney, System Engineer
- *C. Groff, Technical Services
- *E. Chaloupka, Plant Engineer
- *P. Lang, Senior Quality Control Engineer
- *T. Moulin, Assistant to the Vice President
- G. LeBlanc, Quality Control Specialist
- *J. Galle, System Engineer

*Denotes those attending the exit meeting on January 28, 1993.

Nuclear Regulatory Commission

- *M. Miller, Senior Resident Inspector
- *B. Olson, Resident Inspector

The inspectors also held discussions with other licensee personnel during the course of the inspection.

2. Design Changes, New Emergency Diesel Generator 2-3 (37700)

a. Background

A number of issues had been previously identified by the NRC staff during previous inspections of procurement activities associated with installation of the new emergency diesel generator (EDG) 2-3. The licensee decided to resolve those issues by performance of a 200 hour endurance test, and subsequent teardown inspection of EDG 2-3.



b. Purpose

The purpose of this inspection was to verify licensee EDG inspection data accuracy, independently inspect EDG parts and components, review the extent of licensee quality control, review problems noted by the licensee and their resolution, and verify the licensee's ability to properly reassemble the EDG.

During the inspection the licensee committed to summarize the results of the teardown inspection in a letter to the NRC. This letter will address each of the NRC issues concerning commercial grade procurement.

Prior to, during, and after the endurance test, the licensee documented observations with Action Requests (ARs). In general, these ARs fell into two categories, vibrations and leakages.

c. Licensee Inspections of EDG 2-3

Diesel Engine

The licensee performed teardown, inspection and reassembly of the EDG using a number of procedures including Post-modification Test (PMT) 21.16, Revision 0, "Diesel Generator 2-3 Pre-operational Endurance Test," Maintenance Procedure (MP) M-21.30B, Revision 0, "DEG 2-3 Power Assembly Inspection, MP M-21-31, Revision 0, "Main Bearing Inspection," and associated attachments, MPs, and work orders. The licensee used two technical representatives from the diesel manufacturer (ALCO) to assist with the inspections.

Quality Control Inspection (QCI) Plan Number 93-0121, Revision 0, contained the licensee's plan for quality control verification for PMT 21.16 and associated MPs.

After completion of the endurance run the licensee performed a fibroscopic examination of all the cylinder heads. Based on engine analyzer pressure test data and fiberscope inspection results, the licensee chose to remove five cylinder headers (2R, 6R, 8R, 2L, and 8L) and four pistons (2R, 8R, 2L, and 8L) for initial examination. The licensee then selected five heads for teardown inspection. The licensee video taped the inspections and provided a copy to the inspectors for review.

Piston Rings and Valve Seats

Based on inspections of the pistons removed from the four selected cylinders, the licensee found some of the piston compression rings were installed upside down. The licensee also found that the piston rings were all installed with their gaps in the same position, in lieu of the required orientation of reversing each ring's gap 180 degrees. The improper arrangement allowed more than normal amounts of lube oil to enter the compression area. The licensee noted that



the lube oil had caused more carbonization on the valves than normally would have been expected.

Based on the improper ring installations on the four pistons chosen for removal, the licensee decided to remove all the pistons. No liners were removed.

The licensee installed new rings in the correct orientation on all the pistons. The licensee cleaned the valve sealing surfaces and concluded that the valves and seats were satisfactory. The licensee concluded that the improper ring installation had not damaged the engine. The licensee further concluded that had the improper ring orientation not been found, that no immediate damage would have occurred.

Generator

The licensee removed the end bell from the generator and inspected the stator, rotor, slip rings, bearing and associated bearing bracket bore. The licensee did not identify any problems with these components and assemblies and concluded that the generator was satisfactory.

d. Inspectors' Actions, Discussions, and Conclusions

Diesel Engine

The inspectors witnessed cylinder head disassembly, blue checks of seating surfaces, and measurements of piston dimensions. The inspectors did not identify any problems.

The inspectors independently inspected cylinder liner surfaces, pistons, and head components. The inspectors found conditions consistent with those recorded by the licensee in PMT 21.16 and associated MPs.

The inspectors reviewed the video tape of fiberscoping all eighteen cylinders and observed no equipment abnormality.

Piston Rings/Valve Seats

The inspectors inspected the valve and valve seats. The inspectors concurred with the licensee that the valve seats had not been damaged. The inspectors inspected the pistons and rings and observed that the pistons did not appear to have been damaged by the improper ring installation.

Generator

The inspectors witnessed the licensee's generator inspection and independently inspected the generator. The inspectors observations were similar to the licensee's observations.



The inspectors witnessed performance of Temporary Procedure TD-9209, Revision 0, "Diesel Generator Rotor Pole AC Voltage Drop Test." This test checked the rotor for shorted turns. The performance of the test and the test results appeared to be satisfactory.

Main Bearing Clearance Measurements

The inspectors observed the performance of main bearing clearance measurements, Appendix 8.2 of MP M-21.31, "Main Bearing Inspection," Revision 0. Nine main bearing clearances were within the acceptance criteria. The licensee had difficulty in obtaining the reading of the tenth bearing. The licensee used a hoist to relieve the weight of the generator, and was able to obtain the bearing clearance within the acceptance criteria. The licensee also performed a visual inspection of the bearing and found no abnormality. The inspectors reviewed QCI 93-0121 and witnessed quality control oversight of EDG work. The inspectors reviewed the main bearing clearance measurements and considered the measurements to be adequate.

e. Other Inspections

The inspectors concluded that QCI 93-0121 included appropriate quality verification of important measurements and that the quality control was being performed as required.

The inspectors reviewed the labeling of parts removed from the EDG, control and temporary storage of the parts, and control of EDG room cleanliness. The licensee had tagged all removed parts and stored them in laydown areas with appropriate boundaries. The inspectors did not identify any cleanliness problems in the EDG room and shop work area. The inspectors concluded that material control and cleanliness were adequate.

The inspectors reviewed the action requests associated with the EDG. The inspectors concluded that the licensee's action request system was satisfactory for tracking resolution of all the reported potential problems with EDG 2-3. The inspectors also concluded that the majority of the ARs, vibrations and leakages, were normal occurrences encountered during start-up and not indicative of the engine performance.

f. EDG 2-3 Conditions Not Associated with Endurance Testing

During a walkdown of EDG 2-3, the inspectors observed partially chipped teeth on the diesel ring gear. The ring gear is where the air motors engage the engine and turn the engine during start-up of the diesel. The inspectors identified at least ten consecutive partially chipped teeth on one side of the ring gear and a couple of chipped teeth on the diametrically opposite side. The licensee initiated Action Request A0291363 to evaluate the impact of the partially chipped teeth on future starts of the diesel engine.



The licensee informed the inspectors that the ring gear teeth had been damaged during factory testing by inadvertently engaging the air motors while the gear was moving. The licensee did not know the engine speed at the time of this occurrence. The inspectors sighted the air start motors and noted that damage had occurred on the backside of the motor gears. The inspectors concluded that the damage was indicative of trying to engage the air motors with the ring gear rotating in excess of the air start motors capability to properly engage. The inspectors considered that the licensee's commercial grade dedication inspections should have identified and resolved the damaged gear. Commercial grade dedication of the EDG will be further reviewed by NRR staff.

The inspectors noted that prior to the endurance test the licensee had identified that an insulator under the generator slip rings had a crack. The crack extended approximately 60 percent of the width of the insulator. The inspectors also noted that the licensee was planning to perform a megger check of this insulator using a 500 volt megger. The vendor (NEI Peebles) manual for the generator stated to check this insulator with a 2500 volt megger.

The inspectors were concerned that dirt could enter the crack and short circuit the slip rings. The inspectors discussed this issue with the licensee, including the apparent differences in megger criteria. The licensee agreed to contact the vendor concerning the crack and the appropriate megger voltage.

The staff's review of the licensee's completion of the action requests associated with EDG 2-3 endurance test, review of the evaluation and repair of the air start motor and ring gears, and review of the evaluation of the slip ring insulator crack, will be accomplished as a followup item (Item Number 50-323/93-01-01).

g. Diesel Generator 2-3 Multiple Start Tests

The licensee performed PMT-21.11, "Diesel Generator 2-3 Multiple Start Tests," Revision 0, to verify the multiple start capability of the emergency diesel generator 2-3. The acceptance criterion of the test was that each starting air receiver should be capable of providing three consecutive fifteen second cranking cycles without recharging the receiver, which was consistent with the UFSAR Section 8.3.1.1.13.2.

With the air compressors disabled, the licensee devised the following test configurations and obtained following test results:

1. With both air receivers and the turbo air receiver at full capacity, the air system was capable for twenty-four successful starts. Successful start was defined as a start when the engine achieved the rated speed of 900 revolutions per minute in less than fifteen seconds.



2. With or without the turbo air receiver isolated and with air receiver 2-3A isolated, the air capacity of air receiver 2-3B was capable of fifteen successful starts without recharging.
3. With or without the turbo air receiver isolated and with air receiver 2-3B isolated, the air capacity of air receiver 2-3A was capable of sixteen successful starts without recharging.
4. With the turbo air receiver isolated, each of the two air receivers was capable of providing three consecutive fifteen second cranking cycles without recharging.

The inspectors reviewed the test data of PMT-21.11 and concluded that the test results met the acceptance criteria of the test. Although each run of the tests, which started with air receivers at full capacity, was not conservative, the inspectors concluded that the test results indicated sufficient air capacity was present for multiple starts below the low alarm setpoint (210 psig) of the air receiver.

No violations or deviations from NRC requirements were noted in the areas inspected.

3. Onsite Followup of Written Reports (92700)

- a. (Closed) 50-275, 50-323 Licensee Event Report 83-39, Revision 1, - Control Room Ventilation System Outside Design Basis

Reported Problem

Licensee Event Report (LER) 83-39, Revision 1, reported that failure of one of the redundant booster fans or booster fan dampers could potentially cause the control room ventilation system to be outside its design basis.

The licensee further determined that failure of an operating booster fan, or fan damper would not cause an alarm nor start the redundant unit. Failure of the operating booster fan could allow unfiltered air to enter the control room via recirculation ducting. The licensee determined in 1991 that this condition had existed since 1983.

The licensee investigated the cause of this design problem and concluded that the primary cause was personnel error.

Corrective Action

The licensee issued an operations night order that discussed the possible failure of a booster fan or fan damper.

The licensee committed to make design changes which would start the redundant fan upon loss of an operating fan.



As an interim corrective action the licensee installed streamers on the control room ventilation recirculation ducts. The licensee revised emergency procedure (EP) E-0, "Loss of Reactor or Secondary Coolant," to include instructions to operators to confirm proper control room ventilation.

Inspectors' Review

The inspectors reviewed LER 83-39, Revision 1. The inspectors reviewed EP E-0 with the control room supervisor. The inspectors sighted the streamers.

Based on the above review, the inspectors concluded that EP E-0 and the streamers would provide the operators sufficient information to alert them to unfiltered reverse ventilation flow via the recirculation ducts. The inspectors also concluded that the proposed design modification would resolve the problem.

Based on the licensee's interim corrective actions and committed design change, LER 83-39, Revision 1 was closed.

No violations or deviations from NRC requirements were identified in the areas inspected.

4. Previously Identified Open Items (92701)

- a. (Closed) Unresolved Item 50-275, 50-323/91-07-05: High Emergency Diesel Generator Jacket Water and Lube Oil Temperatures

Original NRC Open Item

The electrical distribution system functional inspection team identified that it might be necessary to open east room doors to ensure that emergency diesel generator (EDG) temperatures were not exceeded under design basis conditions. The team identified that EDG high temperature annunciator response procedures did not include opening the east doors.

The team also identified that a test of EDG 1-1 on November 16, 1989, showed that both high lube oil and jacket water alarms occurred with a room temperature of 92 degrees Fahrenheit (F). Since the design basis temperature for the room was 123 degrees F, the team questioned the cause of the high temperatures and the potential effects of these high temperatures on the EDG. The team also considered that the licensee needed to perform or obtain calculations to establish maximum EDG jacket water and lube oil temperatures under maximum design ambient temperatures to ensure that vendor established limits would be met.



Licensee's Actions in Response to the Open Item

The licensee modified annunciator response procedures to include opening the east doors.

The licensee determined that the EDG 1-1 high lube oil and jacket water temperatures which occurred on November 16, 1989, were apparently caused by an equipment failure and were not representative of design basis temperatures. The licensee concluded that the most likely failures were misoperation of the jacket water temperature control valve or recirculation of the EDG radiator exhaust into the radiator intake. The licensee noted that recirculation of the EDG radiator exhaust into the radiator intake could be precluded by opening the east doors. The licensee replaced the jacket water temperature control valve and added it to 36 month maintenance procedures. The licensee also concluded that EDG 1-1 was not damaged by the high temperatures noted on November 16, 1989.

The licensee determined that vendor calculations did not specifically exist to establish maximum EDG jacket water and lube oil temperatures at design ambient temperatures. However, sufficient design information existed for the licensee to determine that EDG temperatures would not be exceeded by design ambient air temperature (78 degrees F) or maximum ambient temperature (91 degrees F). This conclusion was based on vendor data and licensee calculations.

Inspectors' Action During the Present Inspection

The inspectors reviewed sample EDG alarm response procedures with the control room supervisor. The inspectors reviewed the licensee's calculations and evaluation of EDG design basis temperatures and their conclusion that the high temperatures for EDG 1-1 on November 16, 1989, were due to equipment failure.

Discussion and Conclusion

The inspectors determined that annunciator response procedure (AR) PK16-08, Revision 6, "Diesel [Number] Cooling System," and similar procedures included opening the east door.

The inspectors noted that the design ambient air temperature of 78 degrees F was based on not exceeding this value for more than 9 hours a year, and was based on actual temperature data. The inspectors determined that the basis for satisfactory operation of the EDG was based on calculations using 90 degrees F ambient air. The licensee had then extrapolated the data to 91 degrees F, to account for maximum site temperature. Since the maximum site temperature occurs for very limited times the inspectors considered this approach acceptable.

The inspectors considered that the licensee's calculations and



evaluation provided reasonable assurance that EDG temperatures would not be exceeded during operation at maximum ambient temperatures.

The inspectors concluded that the licensee's evaluation and corrective actions for the EDG 1-1 high temperatures which occurred on November 16, 1989, were technically valid.

This item was closed.

b. (Open) Other Followup/Enforcement Items

The licensee listed the following open items as completed, but review of these items was not completed during this inspection. The staff will review these items during future inspections.

Open Item 50-275, 50-323/90-16-01 (MOV Spring Packs)
 Open Item 50-275, 50-323/91-01-01 (Audit Deficiencies)
 Open Item 50-275, 50-323/91-39-01 (MOV Switch Sizing)

The inspectors requested information on the following items and noted that the licensee's actions were not complete. The staff will review these items during future inspections.

Open Item 50-275, 50-323/91-39-02 (MOV Capability)
 Open Item 50-275, 50-323/91-39-03 (MOV Trending)
 Enforcement Item 50-323/92-09-01 (Failure to Follow Procedures)
 Enforcement Item 50-323/92-09-02 (Corrective Actions)

No violations or deviations from NRC requirements were identified in the areas inspected.

5. Previously Identified Enforcement Items (92702)

(Closed) Violation 50-275, 50-323/91-07-07: Inadequate Implementation of Emergency Diesel Generator Technical Specification Requirements

Original NRC Open Item

The electrical distribution system functional inspection team identified that the licensee's procedures did not adequately implement Technical Specification 6.8.1.a for testing EDGs.

Licensee's Actions in Response to the Open Item

The licensee updated their EDG testing procedures.

Inspectors' Action During the Present Inspection

The inspectors reviewed the revised procedures, including surveillance test procedure (STP) V-302, Revision 4, "Exercising Valves DEG-214, 225, 236, 247, 258 and 269, Diesel Starting Air Compressor Discharge Check," and STP M-91, Revision 5, "Diesel Generator Testing Frequency



Determination."

Discussion and Conclusion

The inspectors concluded that the procedure changes adequately resolved the original item. This item is closed.

No violations or deviations from NRC requirements were identified in the areas inspected.

6. Exit Meeting

The inspectors conducted an exit meeting on January 28, 1993, with members of the licensee staff as indicated in Section 1. During this meeting, the inspectors summarized the scope of the inspection activities and reviewed the inspection findings as described in this report. The licensee acknowledged the concerns identified in the report. During this inspection, the licensee did not identify as proprietary any of the materials provided to or reviewed by the inspectors.

