APPENDIX B

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-275/94-12
50-323/94-12

Licenses: DPR-80
DPR-82

Licensee: Pacific Gas and Electric Company (PG&E)
77 Beale Street
San Francisco, California 94106

Facility: Diablo Canyon Power Plant, Units 1 and 2

Inspection At: San Francisco, San Luis Obispo County, California

Inspection Conducted: April 11-15, 1994

Inspector: Michael Cillis, Senior Radiation Specialist
Facilities Inspection Programs Branch

Approved: Blaine Murray 5/26/94
Blaine Murray, Chief
Reactor Inspection Branch
Date

Summary:

Areas Inspected: Routine, announced inspection of the radiation protection program including: audits and appraisals; changes; training and qualifications of personnel; external exposure control; internal exposure control, control of radioactive materials and contamination, surveys, and monitoring, maintaining occupational exposures as-low-as-is-reasonably-achievable (ALARA); and tours of the licensee's facilities.

Results:

- No major changes in the Radiation Protection Program had been made since the previous inspection (Section 1.1).
- Very good surveillances of radiation protection activities were performed (Section 1.2).
- Contract radiation protection technicians were qualified and trained appropriately (Section 1.3).
- An excellent ALARA program, ALARA awareness and incentive program, ALARA mock-up training program, and an aggressive ALARA goal program were implemented for Refueling Outage 1R6 (Sections 1.4, 1.4.1, 1.4.2, and 1.4.3).

- Good external exposure controls were implemented (Section 1.5).
- Good internal exposure controls were implemented (Section 1.6).
- Respirator usage during the refueling outage were significantly reduced (Section 1.6).
- Increases in personnel contamination events were noted during the refueling outage (Section 1.7).
- Control of radioactive materials and contamination, surveys, and monitoring were generally good (Section 1.7).
- Housekeeping was generally good (Section 1.8).
- A poor ALARA practice in the auxiliary building, a poor OSHA safety practice in the reactor containment building, and poor ALARA practice in the reactor containment building were observed (Section 1.8).
- A violation was identified for failure to post a high radiation area (Section 1.9).

Inspection Findings:

Violation 50-275/9412-01: 50-323/9412-01 was opened (Section 1.9).

Attachment:

Attachment - Persons Contacted and Exit Meeting

DETAILS

1 OCCUPATIONAL EXPOSURES DURING EXTENDED OUTAGES (83729)

The radiation protection program implemented during Refueling Outage 1R6 was inspected to determine compliance with Technical Specifications and with the requirements of 10 CFR 19.12 and 20.1001-20.2401.

1.1 Changes

No major changes in the licensee's facilities and organization had occurred since the previous inspection. The inspector reviewed numerous changes in procedures that were made since the previous inspection. The changes should result in program improvements.

1.2 Audits and Appraisals

The inspector reviewed the licensee's quality assurance schedule of radiation protection related audits and appraisals for Unit 1, Refueling Outage 1R6. At the time of this inspection, quality assurance had just initiated an Audit 940117I to verify that the radiation protection and dosimetry processing programs were being effectively implemented and to provide for the evaluation of radiation hazards and protection of workers.

No quality assurance surveillances of outage activities had been conducted; however, one surveillance activity was conducted in December of 1993 (Surveillance Report SQA-93-0063) to verify the licensee's readiness for implementation of 10 CFR 20.1001-20.2401.

The inspector noted that supervisory and management oversight of work activities were frequently conducted during the outage. The licensee's management staff expects their first line supervision and foremen to monitor the performance of work activities. Licensee Action Requests generated as a result of supervisory, foreman, and management surveillances were reviewed. The surveillances were of good quality and generally focused in on procedure compliance issues.

Radiological Occurrence Reports written by the Radiation Protection Branch for the period of January 1 through March 31, 1994, were reviewed. The reports identified problem areas and required corrective actions be implemented to prevent a recurrence of the problems.

1.3 Training and Qualifications

The qualifications and training program for contract radiation protection technicians who were hired in support of Refueling Outage 1R6 were examined. Selected resumes and training records were reviewed by the inspector. It was determined that the contract radiation protection technicians met the qualification requirements specified in Technical Specifications 6.3, "Unit Staff Qualifications."

A standardized screening examination was used by the licensee's radiation protection staff for the selection of returning radiation protection technicians and contract radiation protection technicians who had not previously worked at the site. First time contract radiation protection technicians were required to demonstrate their knowledge of health physics by taking a written entrance examination. The licensee's screening process was effective in ensuring that the selection of radiation protection technicians was in compliance with the Technical Specification.

Each new hire radiation protection technician and returning radiation protection technician attended 4 days of site-specific training. Four written examinations were administered during the site-specific training that was provided. All of the radiation protection technicians were required to demonstrate their knowledge of the licensee's procedures before being assigned to support the outage. Most of the 100 senior radiation protection technicians and 10 junior radiation protection technicians who were hired for the outage were returnees. Approximately 25 radiation protection technicians were new hires.

The inspector interviewed the licensee's training representatives and radiation protection staff and determined that the training program for contract radiation protection technicians emphasized lessons learned and management's expectations.

1.4 ALARA Program

The licensee's program for maintaining personnel exposures ALARA was examined for compliance with 10 CFR Part 20. Planning and preparation for Refueling Outage 1R6 was previously addressed in NRC Inspection Report 50-275/93-35; 50-323/93-35.

This inspection focused in on the implementation of licensee's ALARA program. The scheduled 57-day outage started on March 12, 1994, and was approximately 4-5 days behind schedule at the conclusion of this inspection.

The inspector noted that the ALARA program received direct attention and strong support of upper management. Similar comments were expressed to the inspector by the licensee's staff and contract workers during the inspection. The licensee's staff and workers were encouraged by observed periodic management tours of work activities in the radiological controlled area during the outage.

1.4.1 Worker Awareness and Incentive Program

A high level of ALARA awareness was present among licensee's management, supervision, and workers interviewed during facility tours. Workers were well aware of the ALARA goals that were established for the outage. Workers were continually made aware of the progress being made towards achieving the ALARA goals. This was accomplished by displaying posters in appropriate locations, through plan-of-day meetings, craft group meetings, and by supervision.

Each worker had been provided with a refueling outage handbook. The handbook contained useful information such as: list of telephone contacts, diagrams of Unit 1, outage schedule, site layout diagram, emergency signals and responses, radwaste minimization program, ALARA program guidelines and goals, and a list of other useful information.

The licensee developed a formal worker awareness/recognition program for the outage. The objective of this program was to increase their competitive edge and enhance the quality of worker awareness by eliminating excessive radiation exposure and encouraging greater efficiency. The strategy of the program was to stimulate worker awareness of the ALARA program and to recognize ALARA suggestions. Approximately 25 ALARA suggestions were under review at the time of this inspection. Incentive awards were given to those individual who submitted suggestions that are adopted for implementation.

The inspector reviewed the sixth refueling outage incentive program described in a Pacific Gas and Electric Company memorandum dated March 28, 1994. The memorandum described the awards that all workers (e.g., contractors and permanent staff) could receive for completing the outage under schedule and also for completing the outage under the person-rem goals that were established for the outage. The program provides workers with awards (e.g., material goods, meal tickets, and monetary awards) for good performance. Workers interviewed during the inspection were aware of the program and used good ALARA work practices to maintain their exposures as low as possible so that they could avail themselves of the incentive awards.

Except for the isolated observations discussed in Section 1.8, work practices observed during the inspection appeared to be consistent with the ALARA concept.

1.4.2 Mock-up Training

During the outage, the licensee used mock-up training as a tool to reduce person-rem. The following mock-up training was provided in support of the outage:

- Steam Generator Manway Cover Removal
- Reactor Coolant Pump seal Removal
- Steam Generator Nozzle Dam Removal and Installation
- Resistance Temperature Detector Modifications
- Steam Generator Sludge Lance
- Reactor Head Bolt Inspection

The inspector observed steam generator nozzle dam removal mock-up training which was provided on April 12, 1994. The quality of the training was good.

1.4.3 ALARA Goals and Results

At the beginning of the outage, an ALARA goal of 350 person-rem was established for the Outage 1R6. As of April 13, 1994, the licensee expended approximately 280 person-rem. This was 26 person-rem under their expected

goal for the April 13, 1994 date and 75 person-rem under the outage goal of 350 person-rem, with only 2 more weeks remaining in the schedule.

ALARA in-progress reviews for high exposure jobs, such as, for the resistance temperature detector bypass piping modifications had already been completed. A review of the debrief package disclosed that the licensee's staff was very self critical with their performance. Many useful comments for improvements should prove to be useful in reducing person-rem the next time similar work is scheduled.

During the outage, the licensee used video cameras, shielding, and hydrolyzing to reduce person-rem. ALARA prejob briefings were a common practice used by the licensee to reduce person-rem. Discussions with the ALARA coordinator disclosed that the licensee was considering the purchase of a surrogate travel technology program. The program has been used with great success at other nuclear power plants as a tool in reducing person-rem. By using an interactive videodisc system areas of the plant that are normally inaccessible can be viewed without entering the plant.

Low-dose areas were posted throughout the plant for workers to spend their time when they were not actively engaged in productive work. Workers were reminded by the training group, radiation protection, and supervision to stay in a low-dose area when they were not actively engaged in work and can not exit the area.

1.5 External Exposure Control

The inspector toured the radiological controlled areas, reviewed area postings, and performed independent radiation measurements. All postings except for the event discussed in Section 1.9 were correct and easy to understand. It was determined that high radiation areas and locked high radiation area controls were in compliance with Technical Specification 6.12, "High Radiation Area," and 10 CFR 20.1902(c).

All personnel observed in the radiological controlled area by the inspector were equipped with proper dosimetry equipment. The inspector also reviewed personnel exposure records for the period of January 1993 through March 1994. The review disclosed that personnel exposure levels were well below the occupational exposure limits established in licensee procedures and 10 CFR Part 20.

1.6 Internal Exposure Control

The licensee's respiratory protection program was examined for compliance with 10 CFR Part 20 requirements and consistency with the recommendations of Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection"; NUREG 0041, "Manual of Respiratory Protection Against Airborne Radioactive Materials"; and American National Standards Institute (ANSI) Z88.2, "Practices for Respiratory Protection."

The examination included a review of the training program provided to users of respiratory protection equipment, medical examination requirements, and

respirator fit-up testing program for respiratory equipment users. Applicable respiratory protection program implementing procedures, an inspection of the respirator issuing facility, and various emergency use respirator storage locations were also performed.

The inspector verified that the routine monthly inspections of several self-contained breathing apparatus had been performed within the past 31 days. The control and issue of respiratory equipment were determined to be consistent with implementing procedures and the documents referenced above. Respiratory usage during Refueling Outage 1R6 had decreased by approximately 82 percent. The decrease was attributed to the implementation of the new 10 CFR Part 20 regulations on January 1, 1994.

The licensee's respiratory protection program was determined to be consistent with regulatory requirements and the other documents referenced above.

The licensee's air sampling program was examined and determined to be in compliance with 10 CFR Part 20 and Licensee Procedure RCP D-420, "Sampling and Measurement of Airborne Radioactivity." The inspector observed that air sampling of work evolutions being performed during the inspection were representative of the workers' breathing zone.

1.7 Control of Radioactive Material and Contamination, Surveying, and Monitoring

The inspector observed entrance and exit access control at the radiological controlled areas and found them to be good.

Selected radiation and contamination surveys for 1994 were reviewed for completeness, use of appropriate survey instruments, and timely management review. Survey results were documented properly.

Records of clothing and skin contamination events were examined for thoroughness. Timely decontamination, trending, and followup actions of the events appeared to be appropriate. As of April 14, 1994, a total of 226 clothing and skin contamination events were reported during the Refueling Outage 1R6. This represents an increase from personnel contamination events that occurred during the Refueling Outage 2R5. Clothing contaminations outnumbered skin contamination events by a 6:1 ratio. Each event receives a detailed review for possible dose assessment, probable cause, and corrective actions. The inspector verified that none of the personnel contamination events reported during Refueling Outage 1R6 resulted in a significant internal or external exposure.

During the tours of the Auxiliary Building and Reactor Containment, portal monitors and frisking equipment appeared to be used properly and were in current calibration. In addition, the inspector noted that monitoring instrumentation was in good supply and was in current calibration and had been routinely performance checked.

Individuals exiting the radiological controlled areas were required to pass through both gamma and beta sensitive personnel contamination monitor. All

tools and equipment removed from the radiological controlled areas were surveyed for release by a qualified radiation protection technician. Tool monitors were also used to survey equipment. In general, surveys, monitoring, and releases of potentially contaminated materials to unrestricted areas were good.

The licensee's surveillance program for verifying accountability and leak checks of sealed sources was examined and was found to be in compliance with Licensee Procedure RCP D-620, "Control of Radioactive Sources"; and Technical Specifications 3/4.7.8, "Sealed Source Contamination." The licensee had completed its most recent sealed source surveillance on January 12, 1994. All of the sources were accounted for and no leaking sources were identified.

1.8 Facility Tour

Tours of the licensee's facilities were conducted by the inspector. Areas toured included the Spent Fuel Building, Auxiliary Building, Reactor Containment, and Radioactive Storage Facility. Work evolutions observed included:

- Core reload (Spent Fuel Building and Reactor Containment)
- Radioactive waste compaction
- Steam Generator - manway cover inspection
- Charging system - hydrostatic testing
- Reactor Coolant Pump restoration
- Valve refurbishment
- Hot machine shop activities
- Preparation of a radwaste shipment
- Feed Water Pump overhaul
- Other miscellaneous activities

Areas toured were clean but were cluttered with material from the outage. Except as noted below, personnel interviewed knew their assigned tasks and for the most part, used good ALARA work practices. All workers interviewed had signed in on the appropriate radiation work permit. Additional observations by the inspectors include the following:

- On April 11, 1994, six workers were observed performing a hydrostatic test of the charging system on the 100-level of the Auxiliary Building. It appeared that the work could have easily been conducted by three workers. Radiation level in the work area ranged from 2 to 3 mrem/hr. The observation was brought to the attention of the lead mechanic and radiation protection who instructed the workers to move to a lower dose area.

- On April 14, 1994, core reload workers in the Reactor Containment were observed walking along the edge of the cavity without donning a life jacket and/or a life-line as required by the licensee's safety manual.

- On April 14, 1994, a contract worker was observed picking up an alarming dosimeter from a tool box located adjacent to Reactor Coolant Pump 1-2 on the 115-foot level of the Reactor Containment. Discussions held with

the individual revealed that the individual had signed in on Radiation Work Permit 94 01050 02 which provided the radiological control requirements for performing reactor coolant pump maintenance activities. The radiation work permit required an alarming dosimeter if entry into a high radiation area was expected. As a precautionary measure, the mechanic signed out for an alarming dosimeter even though he did not expect to enter a high radiation area. The worker also had a thermoluminescent dosimeter and a low range pocket ion chamber which were required by the radiation work permit.

The worker stated that he placed the alarming dosimeter in the tool box, because he was afraid that it would fall off his person when he climbed on some piping that was adjacent to the tool box. The worker added that he had not actually entered a high radiation area.

Radiation measurements taken in the area by the inspector indicated levels of approximately 10 mrem/hr by the tool box and approximately 30 mrem/hr where the worker was seen climbing off the piping. These dose rates were subsequently verified by the licensee's radiation protection staff.

The observation was brought to the attention of the radiation protection staff who implemented appropriate corrective action.

- On April 14, 1994, the inspector observed a situation that did not agree with good ALARA practices. A contract quality control inspector, who had signed in on Radiation Work Permit 94 01006 00, was observed to be lying down flat on his back. The quality control inspector stated that he was providing support for a welding operation that was being performed on the 91-foot level of the Reactor Containment. The worker had his feet propped up against a stairwell structure, and his eyes were closed. The worker appeared to be in an extremely restful position when observed by the inspector.

  The worker jumped up immediately when he heard the inspector talking to the welders working nearby. Radiation measurements in the area were approximately 2-3 mrem/hr. The welders stated that they still had approximately 20-30 minutes of welding to be performed before they would need the services of the quality control inspector.

  The observation was reported to the lead radiation protection technician who instructed the worker to move to a low-dose area. The radiation protection technician subsequently instructed the worker to exit the Reactor Containment.

  Subsequent corrective action taken by the individual's supervisor appeared to be satisfactory.

1.9 Unit 1 Letdown System Hot Spot Event

At approximately 2:50 a.m. Pacific daylight time (PDT) on April 11, 1994, the radiation protection staff was informed that the operations group intended to

fill and vent the let down line and the volume control tank. The radiation protection group was informed that radiation levels could change because of this planned activity and that the dose rates may even go down. Approximately 20 minutes earlier, at 2:30 a.m. (PDT) on April 11, 1994, radiation protection had just completed a daily survey of the let down header area on the 100-foot elevation of the Auxiliary Building. Results of this survey indicated the expected normal dose rate of approximately 0.2 mr/hr to 0.5 mr/hr adjacent to the let down header area. The next survey of the area was scheduled to be accomplished 24 hours later on the morning of April 12, 1994.

The vent and fill operation was performed between the hours of 2:58 a.m. and 4:03 a.m. (PDT) on the morning of April 11, 1994. Radiation surveys were not performed during the evolution, because radiation protection expected the same or possibly that the radiation levels would go down.

At approximately 4 p.m. (PDT) on April 11, 1994, a contractor junior radiation protection technician while performing routine work activities noted that her Eberline Model RO-2 dose rate meter pegged on the low range (e.g., 0-5 mr/hr) as she was walking adjacent to the let down header area located on the 100-foot level of the auxiliary building. The junior radiation protection technician notified her supervisor and took immediate action to assess the problem and assigned personnel to guard the area to prevent inadvertent entry.

The radiation protection staff responded immediately. A radiation survey of the area was conducted. The results of this survey indicated that there was a 5 R/hr hot spot on the let down header piping and dose rates at 30 cm ranged from 1 R/hr to 1.5 R/hr. Dose rates of 350 mr/hr at a meter were also detected. The area was immediately posted in accordance with Technical Specification, Section 6.12, requirements and a licensee's investigation was started.

The licensee quickly determined that the probable cause for the elevated radiation levels was associated with the vent fill operation of the liquid hold up tank and volume control tank that had taken place approximately 12 hours earlier. Increased radiation levels were also noted on the volume control tank and piping adjacent to Residual Heat Removal RHR-1-8804A. These areas were isolated from normal traffic.

The vent and fill lines in question were flushed, and the radiation levels were returned back to normal approximately 2 hours after the unposted high radiation area was discovered. It was determined that the unposted high radiation went undetected for about a 12-hour period. Indications from a continuous air sampler confirmed this assumption. The air sampler indicated a rise in the general area background during this time period. During this period of time, personnel who had logged into the radiological controlled area had no appreciable dose indicated on their pocket ionization chambers. It was also determined that no work had been performed in the area during the 12-hour period, and any new jobs would have required the completion of a prejob radiation survey. This substantiates the licensee's belief that no one was overexposed. The inspector agreed with the licensee's assumption that no one was overexposed but concluded that this was a readily accessible area and that

a potential for an overexposure did exist for the 12-hour period that the elevated dose rates went undetected.

A review of Emergency Procedure EP G-1, "Accident Classification and Emergency Plan Activation" was conducted by the Manager of Operations Services and Director of Radiation Protection to determine reportability. Attachment 7.1 of Emergency Procedure EP G-1 stated that passageways, occupied areas, accessible areas <100 mR/hr, outside boundaries of radiological controlled areas in which unplanned or unanticipated increase of 1 R/hr or greater is encountered is reportable as an Alert. This event was not reported as such based on information found in NUREG 0654, MUMARC/NESP-007, Regulatory Guide 1.101 and Emergency Procedure EP G-1. The rational for reaching this decision was discussed during a conference call held by the Vice President/Plant Manager and his staff with the NRC's staff on April 14, 1994. The NRC staff determined that licensee's decision to not declare an Alert was appropriate under the circumstances; however, Emergency Procedure EP G-1 needed to be clarified.

The licensee initiated Nonconformance Report DC1-94-HP-N017, Revision 0, on April 12, 1994. The Nonconformance Report described that an unexpected high radiation areas was found on the west end of the 100-foot elevation hallway of the Unit Auxiliary Building. The Manager of Operations Services assigned his staff to perform a thorough investigation of the event to determine why the vent and fill operation resulted in unexpected high radiation levels. The Operations Services Manager identified the following areas that were in need of improvement:

- Communications between operations and radiation protection
- Emergency Procedure EP G-1 needed to be clarified
- A better method for surveying future vent and fill operations needed to be developed by the radiation protection group. The possibility of utilizing a remote monitoring system was discussed.

The licensee's investigation indicated that the hot spots appeared to occur when the flow was diverted to LHUT 1-1 for a period of 1 to 2 minutes. The 0.2 micron letdown filter was subsequently found to be ruptured. The NRC Senior Resident Inspector will examine the operational aspects of the vent and fill operation that was performed on the morning of April 11, 1994. The results of this examination will be addressed in NRC Inspection Report 50-275/94-11.

The failure to post a high radiation area is a violation of 10 CFR Part 20.1902(b) (VIO 275/9412-01; 323/9412-01).

1.10 Conclusions

Very good radiological control surveillances were performed. No significant changes in the licensee's organization or facilities had been made since the previous inspection.

The selection, training, and qualification program for contractor radiation protection technicians hired in support of the refueling outage was excellent.

The licensee's overall performance during Refueling Outage 1R6 appeared to be good. Reduction in outage exposures was excellent.

The licensee's program for controlling occupational exposure in the aspects reviewed appeared to be good in accomplishing the licensee's safety objectives and in achieving the aggressive ALARA exposure goals. Both external and internal radiation exposure controls were generally good. An excellent job of reducing respirator use during the outage was performed.

Control and labeling of radioactive materials were consistent with 10 CFR Part 20 requirements. Surveys and monitoring were generally good. However, personnel contamination events had increased and was an area that was in need of improvement.

Several poor health physics work practices and one poor safety practice were noted during the tours. The licensee took prompt corrective action in each event.

In general, posting of work areas was good. A violation was identified concerning the failure to post a high radiation area. A potential for an overexposure existed for the period of time that the high radiation area was undetected.

ATTACHMENT

1 PERSONS CONTACTED

1.1 Licensee Personnel

J. Townsend, Vice President/Plant Manager
*D. Miklush, Manager, Operations Services
*D. Taggart, Director Quality Assurance
*K. Hubbard, Engineer, Regulatory Compliance
*M. Somerville, Senior Engineer, Radiation Protection (RP)
*S. Ehrhart, Engineer, Radiation Protection
*C. Helmen, Engineer, Radiation Protection
R. Gray, Director, Radiation Protection
*R. Rogers, Foreman, Radiation Protection
*W. Rising, Auditor, Site Quality Assurance
*R. Flohaug, Supervisor, Site Quality Assurance
*T. Bast, Director, Work Planning
*M. Persky, Instructor, Training
*G. Boiles, Dosimetry Supervisor
*R. Snyder, Chemistry/Radiation Protection Training Supervisor
T. Grebel, Supervisor, Regulatory Compliance
M. Lemke, Shift Supervisor
*J. Hays, Director, Quality Control

1.2 NRC Personnel

M. Tschiltz, Resident Inspector
M. Miller, Senior Resident Inspector

*Denotes personnel that attended the exit meeting. The inspector met and held discussions with additional members of the licensee's staff during the inspection.

2 EXIT MEETING

An exit meeting was held on April 15, 1994. During this meeting, the inspector reviewed the scope and findings of the report. The licensee did not identify as proprietary, any information provided to, or reviewed by the inspector.