APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-275/94-26
50-323/94-26

Licenses: DPR-80
DPR-82

Licensee: Pacific Gas and Electric Company
77 Beale Street, Room 1451
P.O. Box 770000
San Francisco, California

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

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

Inspection Conducted: October 24-28, 1994

Inspector: W. L. Holley, Senior Radiation Specialist
Facilities Inspection Programs Branch

Approved: Blaine Murray 12/13/94
Blaine Murray, Chief, Facilities Inspection Programs Branch — Date

Inspection Summary

Areas Inspected (Units 1 and 2): Routine, announced inspection of radiation protection activities in support of the Unit 2 Refueling Outage 2R6 including: audits and appraisals, training and qualifications, as low as reasonably achievable (ALARA) program, worker awareness and incentive program, ALARA goals and results, facility inspections, high radiation areas, and the review of an iodine-132 event.

Results:

- Radiological Occurrence Reports were thorough, clear, and identified problems which were corrected in a timely manner (Section 2.1).
- Good procedures had been established for hiring and training of contract radiation protection personnel. Contract radiation protection technicians performed well (Section 2.2).
- Good outage training was provided which included mock-up training (Section 2.2).

- The as low as is reasonably achievable (ALARA) program received strong upper management support (Section 2.3).
- Good outage ALARA awareness and worker incentive programs were established (Section 2.3.1).
- The outage ALARA goals were achieved (Section 2.3.2).
- Good outage ALARA preplanning was accomplished. The planning was far enough in advance to include all aspects of the outage (Section 2.3.2).
- High quality ALARA outage packages were developed. Detailed post-job critiques were performed (Section 2.3.2).
- Good external exposure controls were established (Section 2.4).
- In general, good high radiation area controls and postings were maintained. A non-cited violation was identified by the licensee involving two entries into high radiation areas (Section 2.5).
- Iodine-132 airborne radioactivity was identified during steam generator work (Section 2.6).

Attachment:

- Attachment - Persons Contacted and Exit Meeting

DETAILS

1 PLANT STATUS

During the inspection, Unit 2 was in the process of completing Refueling Outage 2R6. Unit 1 was operating at 100 percent power.

2 OCCUPATIONAL EXPOSURES DURING EXTENDED OUTAGES (83729)

The radiation protection program implemented during Refueling Outage 2R6 was inspected to determine compliance with Technical Specifications and with the requirements of 10 CFR 19.12 and 20.1001-20.2401.

2.1 Radiological Occurrence Reports

The inspector reviewed most of the Radiological Occurrence Reports written by the radiation protection organization for the period October 1 through 22, 1994. The reports were thorough, clear, and identified problem areas and required corrective actions be implemented to prevent a recurrence of the problems. The corrective actions were completed in a timely manner.

2.2 Training and Qualifications

The qualifications and training program for contract radiation protection technicians hired to support Refueling Outage 2R6 were examined. It was determined that the contract radiation protection technicians met the qualification requirements specified in Technical Specifications 6.3, "Unit Staff Qualifications."

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

Each new contract radiation protection technician and returning radiation protection technician attended approximately 30 hours of site-specific training. Three written examinations were administered during the site-specific training. All radiation protection technicians were required to demonstrate their knowledge of the licensee's radiation protection procedures before being assigned to provide health physics duties. There were 110 contract radiation protection technicians employed for the outage. These technicians were ANSI/ANS-3.1 qualified. Ninety-three of the technicians were returnees from previous outages and were also senior radiation protection technicians. The remaining 17 technicians were junior technicians and were employed at the licensee's site for the first time.

The inspector interviewed the licensee's training representatives and determined that the training program for contract radiation protection

technicians emphasized lessons learned and management's expectations. The training organization assessed the performance of the contract radiation protection personnel during the outage from a training aspect and found that they performed well. The inspector verified this assessment from interviews with various organizations' personnel.

Mock-up training was provided for personnel working on the following jobs:

- Steam Generator Work
- Resistance Thermal Detectors (RTD) Bypass Elimination Mechanical Installation
- Reactor Coolant Pump Seal Replacement
- Reactor Head Work
- Steam Generator Jumps

2.3 ALARA Program

The ALARA program was examined for compliance with 10 CFR Part 20. Planning and preparation for Refueling Outage 2R6 was previously addressed in NRC Inspection Report 50-275/94-23; 50-323/94-23. This inspection (NRC Inspection Report 50-275/94-26; 50-323/94-26) focused on the implementation of the licensee's ALARA program.

The inspector noted that the ALARA program received strong support from upper management.

2.3.1 Worker Awareness and Incentive Program

A high level of ALARA awareness was present among licensee's management, supervision, and workers. The interface and working relationships between the various crafts and the radiation protection organization were excellent. The radiation protection job coverage was performed well, and the workers responded in a cooperative manner. 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 by the display of posters in appropriate locations during the outage.

Each worker had been provided with a refueling outage handbook. The handbook contained useful information such as: list of telephone contacts, diagrams of Unit 2, outage schedule, site layout diagram, emergency signals and responses, radwaste minimization program, ALARA program guidelines and goals, and other related information.

The licensee developed a formal worker awareness/recognition program for the outage. The objective of this program was to increase worker awareness by eliminating unnecessary radiation exposure and encouraging greater work efficiency. Incentive awards were given to those individuals who submitted ALARA suggestions that were adopted for implementation.

The inspector reviewed the refueling outage incentive program. The program provided workers with various awards for good performance. Workers were aware of the program and used good work practices to maintain their exposures ALARA.

2.3.2 ALARA Goals and Results

An ALARA goal of 270 person-rem was established for the Refueling Outage 2R6. As of October 26, 1994, day 33 of the outage, 190 person-rem had been expended. This was 74 person-rem under their expected goal for the October 26, 1994 date and 80 person-rem under the outage goal of 270 person-rem, with only 8 more days remaining in the schedule of 41 days. The licensee had projected the outage to last only 2 more days and a cumulative dose of less that 195 person-rem. Subsequently, the outage was completed after this inspection and had a duration of 34 days and 10 hours. The total cumulative dose for the outage was 194 person-rem, therefore the licensee was 76 person-rem under the outage ALARA goal.

ALARA post-job critiques for some of the high exposure jobs, such as, RTD removal and steam generator work had already been completed. A review of these critique packages disclosed that the licensee's staff was committed concerning their performance. Workers provided several useful comments which should prove useful in reducing person-rem the next time similar work is performed.

The licensee had 18 high impact teams for the major tasks of the outage. These high impact teams were responsible for all aspects of their respective job from planning to completion. These teams were composed of all disciplines involved with their specific task. Some of these teams met 6 months before the initiation of the outage to plan the tasks, and ALARA planning was always an important aspect of the teams' considerations. Each portion of the task had an ALARA goal in person-rem as well as the projected time involved. The outage work planning packages were of good quality.

During the outage, the licensee used video cameras, shielding, and hydrolyzing to reduce person-rem. The licensee used four video cameras focused at different areas of work on the steam generators. Discussions with licensee personnel revealed that the licensee was also considering utilizing robotics as a tool in reducing person-rem.

Workers were reminded by the training group, radiation protection, and supervision to stay in low-dose areas when they were not actively engaged in work and could not exit the area.

All training, including mock-up training, had ALARA emphasized so that the dose would be reduced. This focus on ALARA was found to be in all training and planning for the outage.

2.4 Facility Inspections

The inspector performed inspections of different areas of the plant including the spent fuel building, auxiliary building, and radioactive storage facility. During the inspections, the inspector observed work activities in progress,

radiological controls, and postings. Areas inspected were clean, but cluttered with material from the outage.

The inspector also observed the control of radioactive waste, contaminated tools and equipment, and radiation survey instrumentation response test, and calibration dates. All personnel observed in the radiological controlled areas by the inspector were equipped with proper dosimetry equipment.

The inspector verified that the 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). The portal monitors and frisking equipment were used properly and were in calibration. Survey instrumentation was in good supply, was in current calibration, and had been routinely response checked.

2.5 High Radiation Areas

Through a review of previous inspection reports, the inspector determined that the licensee had experienced problems during outages involving high radiation areas.

NRC Inspection Report 50-275/93-11; 50-323/93-11 included a Notice of Violation involving four occurrences in which personnel entered high radiation areas, between October 2 and March 22, 1993, without instrumentation, dosimetry, or radiation protection coverage as required by Technical Specification 6.12.1. NRC Inspection Report 50-275/94-12; 50-323/94-12 included a Notice of Violation which involved the failure to post a high radiation area. NRC Inspection Report 50-275/94-23; 50-323/94-23 contained licensee-identified high radiation area incidents in radiological occurrence reports of an event (No. A0331143) on March 10, 1994, in which a high radiation area was improperly posted around a filter cask and an event (No. A0332478) on March 21, 1994, in which an individual entered a high radiation area in Unit 1 without an alarming dosimeter.

As part of their corrective actions for the above violations, the licensee established a policy that an individual who enters a high radiation area without meeting the procedural and radiation work permit requirements will have his/her access placed in "hold" status and that it will require the approval of the vice president-operation/plant manager for the individual to return to work. During this inspection, the inspector noted that additional controls had been implemented for identification of high radiation areas. In addition to the normal required 10 CFR Part 20 postings for a high radiation area, the licensee had installed barriers at eye level and waist height across the entryway into high radiation areas. Attached to these barriers were "stop" sign shaped "hot pink" colored signs with added instructions and warnings.

At the beginning of this inspection, the director of radiation protection informed the inspector of two high radiation area incidents that occurred during Refueling Outage 2R6.

The first event occurred on October 1, 1994. At approximately 1:55 a.m., an auxiliary operator was observed in the Unit 2 penetration high radiation area without a properly marked personal electronic dosimeter. The marking indicates if the personal electronic dosimeter had been reset for use in a high radiation area. The operator was requested to leave the area immediately, which he did, and his radiation control area access was placed on hold. Upon exiting the radiation control area, it was determined he received 0 mrem for the entry.

This was identified as a worker performance problem, because the individual was aware of the requirements and that the area he was entering was posted but decided not to comply with the requirement to save time. The vice-president/plant manager came to the plant on the back shift to counsel the employee. The employee was given 1 day off and placed on probation for 1 year.

The second event occurred on October 22, 1994. At approximately 11:15 a.m., a contractor person was found in a posted high radiation area without an alarming dosimeter. He was approximately 3-4 feet inside the posted area of the 455-A cubicle of Unit 2 containment. The individual stated that he was trying to hear his coworker who was inside the cubicle and never intentionally entered an actual high radiation area. The actual highest dose rate the individual encountered was approximately 8-10 mr/hr.

The individual and his coworker did check in with the radiation protection technician at the radiation control area entry point on the 115 feet of Unit 2 containment and received a briefing on the area survey prior to entry. He did not obtain an alarming dosimeter, since he did not plan to enter high radiation area.

When the contractor was discovered in the high radiation area by the day shift outage radiation protection containment foreman, he had ducked under the eye level barrier and had the waist high barrier trailing in his hand. This individual was immediately terminated from employment.

The inspector concluded that the above two licensee-identified events were a violation of Technical Specification 6.12.1 which requires that high radiation areas in which the intensity of accessible whole-body radiation is greater than 100 millirem per hour (mrem/hr) but less than or equal to 1000 mrem/hr at 18 inches shall be barricaded and conspicuously posted at a high radiation area. Any individual or individuals permitted to enter such an area must have either: (1) a radiation dose rate survey meter or (2) an alarming dosimeter and prior knowledge of the area dose rates, or (3) accompaniment by an individual qualified in radiation protection procedures who carries a survey meter, provides positive control over activities in the area, and performs periodic radiation surveys.

The licensee had put into place good high radiation area controls and procedures, but the individuals deliberately chose to disregard them. The corrective actions taken by the licensee in response to these events were prompt and included substantial disciplinary action. This violation will not be subject to enforcement action because the licensee's efforts in identifying

and correcting the violation meet the criteria specified in Section VII.B.2 of Appendix C to 10 CFR Part 2.

2.6 Iodine-132

On days 10 and 11 of outage 2R6, the licensee detected the presence of iodine-132 for the first time. While performing steam generator nozzle dam work, workers were being detained when exiting the radiological control area, because the personnel contamination monitors were alarming. The personnel contaminations were distributed over the entire body and, although they were sufficient to alarm the personnel contamination monitors, the radioactivity could not be measured above 100 counts per minute with a hand-held frisker. Therefore, this contamination was not recorded as such, but the delay at the very sensitive personnel contamination monitors for a large number of people became a problem. After a short wait the workers could pass the personnel contamination monitors survey.

The licensee's investigation discovered airborne radioactivity around the steam generator platforms. Analyses of the radioactivity revealed it to be iodine-132, and iodine-132 had not been identified before.

Use of charcoal filtration for the air exhausted from the steam generators had been discontinued because historically only very small amounts of iodine had been identified from air samples taken in the duct upstream of the filters. It was still unknown why the licensee experienced this phenomenon during this Refueling Outage 2R6. The licensee immediately installed charcoal filtration, after the iodine-132 was identified, downstream of the blowers drawing suction on the steam generators and within a short time, the rate of the distributed contaminations were reduced and then stopped completely.

The licensee's analysis found that iodine-132 with a half life of 2.2 hours is a daughter of tellurium-132 that has a half life of 78 hours. Additionally, antimony-132 and tin-132 are parents, in ascending order, of tellurium-132 and these isotopes have fairly high fission yields. The tellurium-132 probably plated out on the steam generator tubes and its gaseous daughter, iodine-132, was released into containment via the steam generator ventilation.

No regulatory or procedural requirements were violated, and no significant exposure to personnel occurred.

2.7 Conclusions

Radiological Occurrence Reports were thorough, clear, and identified problems which were corrected in a timely manner.

Good procedures had been established for hiring and training of contract radiation protection personnel. Contract radiation protection technicians performed well.

Good outage training was provided which included mock-up training.

The as low as is reasonably achievable (ALARA) program received strong upper management support.

Good outage ALARA awareness and worker incentive programs were established.

The outage ALARA goals were achieved.

Good outage ALARA preplanning was accomplished. The planning was far enough in advance to include all aspects of the outage.

High quality ALARA outage packages were developed. Detailed post job critiques were performed.

Good external exposure controls were established.

In general, good high radiation area controls and postings were maintained. A violation was identified by the licensee involving two entries into high radiation areas.

Iodine-132 airborne radioactivity was identified during steam generator work.

ATTACHMENT

1 PERSONS CONTACTED

1.1 Licensee Personnel

J. Albers, Mechanical Maintenance Foreman
*T. Bast, Work Planning Supervisor/ALARA
G. Boiles, Dosimetry Supervisor
L. Broker, Maintenance Inspector
G. Drummond, Nuclear Operator
S. Ehrhardt, Radiation Protection Engineer
R. Etzler, Outage Director
*R. Flohaug, Site Quality Assurance Supervisor
H. Fong, Radiation Protection Engineer
M. Gibbons, Outage Containment Mechanical Maintenance Foreman
*R. Gray, Radiation Protection Director
K. Haddick, Nuclear Operator
*K. Hubbard, Regulatory Compliance Engineer
*T. Irving, Radiation Protection General Foreman
J. Knight, Radiation Protection Foreman
*D. Miklush, Operations Services Manager
F. Newall, Radiation Protection Instructor/Outage Work Planner
*W. Rising, Jr., Site Quality Assurance Auditor
R. Rogers, Radiation Protection Foreman
L. Sewell, Radiation Protection Engineer
T. Shelburne, I&C Foreman/Outage Reactor Head Removal
*R. Snyder, Chemistry/Radiation Protection Training Leader
*M. Somerville, Senior Radiation Protection Engineer
P. Stricker, I&C Foreman

*Denotes personnel that attended the exit meeting. In addition to the personnel listed, the inspector contacted other personnel during this inspection.

2 EXIT MEETING

An exit meeting was conducted on October 27, 1994. During this meeting, the inspector reviewed the scope and findings documented in this report. The licensee did not express a position on the inspection findings documented in this report. The licensee did not identify as proprietary, any information provided to, or reviewed by the inspector.