

**ENCLOSURE**

**U.S. NUCLEAR REGULATORY COMMISSION  
REGION IV**

Docket Nos.: 50-275; 50-323  
License Nos.: DPR-80; DPR-82  
Report No.: 50-275/98-01  
50-323/98-01  
Licensee: Pacific Gas and Electric Company  
Facility: Diablo Canyon Nuclear Power Plant, Units 1 and 2  
Location: 7 ½ miles NW of Avila Beach  
Avila Beach, California  
Dates: January 5-9, 1998  
Inspector: L. T. Ricketson, P. E., Senior Radiation Specialist  
Plant Support Branch  
Approved By: Blaine Murray, Chief, Plant Support Branch  
Division of Reactor Safety  
Attachment: Supplemental Information



## EXECUTIVE SUMMARY

Diablo Canyon Nuclear Power Plant, Units 1 and 2  
NRC Inspection Report 50-275/98-01; 50-323/98-01

This routine, announced inspection reviewed the program to maintain occupational radiation exposure as low as is reasonably achievable (ALARA), external exposure controls, surveying and monitoring, staff performance and knowledge, training and qualifications, organization and administration, and quality assurance in radiation protection activities.

### Plant Support

- An effective ALARA program produced good results. The licensee's 3-year average person-rem totals continued to decline. Although the 1995 and 1996 3-year averages were above the national PWR averages, it appeared that the 1997 3-year average will be near or below the national average (Section R1.1).
- Most external exposure controls were implemented properly (Section R1.2).
- A violation involving failures to follow radiation work permit instructions was identified because individuals entered the radiological controlled area without operable alarming dosimeters (Section R1.2).
- Proper neutron instrument calibration and neutron dosimetry programs were implemented. Radiation dose from neutrons was not significant (Section R1.3).
- Radiation protection technicians had good, basic knowledge of health physics practices and procedures (Section 4).
- The licensee had a highly qualified professional staff and a good continuing training program for supervisors, professionals, and radiation protection technicians. The licensee was moderately successful in promoting professional advancement of radiation protection technicians (Section R5).
- Staffing of the radiation protection organization was appropriate to ensure radiation safety (Section R6).
- Nuclear Quality Services provided good oversight of the radiation protection program. The radiation protection program was proactive in reviewing its activities through self-assessments and identifying and correcting problems within the program (Section R7).



Report Details

IV. Plant Support

R1 Radiological Protection and Chemistry (RP&C) Controls

R1.1 ALARA

a. Inspection Scope (83750)

The inspector interviewed radiation protection personnel and reviewed the following:

- ALARA committee activities
- ALARA Postjob reviews
- Hot spot tracking and trending
- Person-rem totals

b. Observations and Findings

ALARA Review Committee Activities

During the previous inspection of this program area, the inspector identified that the ALARA Review Committee had failed to execute its duties as outlined in procedural guidance. The inspector reviewed the minutes of the ALARA Review Committee since the previous inspection and concluded the licensee had corrected this problem and met expectations included in the ALARA Review Committee charter. However, the inspector noted that the outage services manager did not attend either of the two 1997 ALARA Review Committee meetings. While the failure to include the outage manager in the ALARA Review Committee was not a violation of regulatory requirements, it appeared to be inconsistent with optimum operation of the committee, because during these meetings, the ALARA Review Committee met to review and approve outage, radiation dose goals.

Licensee representatives stated that scheduling difficulties prevented all representatives from being able to meet together, but the outage services manager was kept informed of ALARA Review Committee activities and decisions.

ALARA Program Elements

During a review of elements of the ALARA program, the inspector noted that the licensee performed postjob reviews on more work activities than required by procedure. In some cases, even though the work activities accrued radiation doses less than the procedural threshold requiring a postjob review, the licensee reviewed the work activities and identified lessons-learned. The inspector also noted that the licensee appeared to be very successful in obtaining input from participating contractor personnel, as part of the postjob reviews. The reviews typically included numerous suggestions to improve work efficiency and to save radiation dose;



however, the suggestions were sometimes implicit because there was no standard format for the postjob reports. Overall, the post-job reviews were conducted and documented well.

An acceptable ALARA suggestion program was maintained. ALARA suggestions were submitted as part of a larger, sitewide suggestion program. Incentives for participating in the suggestion program were provided by the licensee. The suggestions dealing with radiation dose saving measures were assigned to radiation protection personnel for review. Approximately 10 legitimate suggestions were submitted in 1997. The suggestions were reviewed for viability by radiation protection personnel and handled appropriately.

The licensee implemented significant initiatives to reduce radiation dose. Refueling shutdown chemistry and cleanup were modified to maximize core crud removal. This resulted in a reduction of overall dose rates in containment. Licensee representatives estimated that this initiative may have saved 50 person-rems. Use of smaller crews for cavity decontamination (0.8 person-rem reduction) and scaffold work (4.1 person-rem reduction) also contributed to dose savings, as did the relocation of steam generator tube probe pushers (4.7 person-rem reduction). The results of some initiatives, such as high impact teams and remote monitoring devices, were not easily quantifiable.

#### ALARA Results

The licensee's person-rem totals are listed below:

	1995	1996	1997
Licensee Total/Unit Average	286/143	176/88	216/108
Three-year average per unit	193	175	113
National PWR Average	170	131	*

\*Not yet available

Person-rem totals rose slightly in 1997. The Unit 1 refueling outage was conducted in 1997. The Unit 2 refueling outage was conducted in 1996. Outage doses have been higher in Unit 1, historically. However, the 3-year person-rem average declined during 1995-1997.

#### c. Conclusions

An effective ALARA program produced good results. The licensee's 3-year average person-rem totals continued to decline. Although the 1995 and 1996 3-year averages were above the national PWR averages, it appeared that the 1997 3-year average will be near or below the national average.



R1.2 External Exposure Controls

a. Inspection Scope (83750)

- High radiation area controls
- Radiation area postings
- Access controls
- Dosimetry use

b. Observations and Findings

High radiation area controls

During tours of the radiological controlled area, the inspector determined that high radiation areas were properly controlled. The inspector noted the licensee was unable to control one area in which radiation dose rates were greater than 1 rem per hour, by use of a locked door or gate. The area was in the Unit 1 piping penetration room. The radiation dose rates in the area resulted from a hot spot in the residual heat removal piping located in an overhead area. The area was controlled by the use of a rope barrier and a flashing light, as allowed by Technical Specification 6.12.2. This means of control was not intended for long term use. Radiation protection representatives stated that the area had been controlled in this manner since the most recent refueling outage, which ended in June 1997. Attempts to flush away the source of radiation had failed, apparently because the source was located in a dead leg of piping. Radiation protection personnel also stated that they would attempt to remove the hot spot during the next refueling outage of Unit 1. Radiation protection personnel confirmed this was the only area with radiation dose rates greater than 1 rem per hour that was controlled in this manner.

Radiation Area Postings

The inspector conducted independent radiation measurements and randomly confirmed that areas within the radiological controlled area were posted properly.

Access Controls and Dosimetry Use

The inspector observed access and contamination controls at the radiological controlled area control point and concluded that radiation workers and radiation protection personnel performed appropriately.

At the start of the inspection, radiation protection representatives notified the inspector that they had identified examples of a violation involving individuals failing to follow radiation work permit instructions. A standard instruction on radiation work permits required radiation workers to have alarming dosimeters when inside the radiological controlled area. However, the licensee identified 50 examples, since January 1, 1997, in which radiation workers entered the radiological controlled area



without operable alarming dosimeters. Individuals entered without completing the access control computer log-in process, without completing the log-out process, or without having an alarming dosimeter. If individuals failed to complete the log-in process, the alarming dosimeter was not turned on. If individuals failed to complete the log-out process, the radiation dose was not assigned to the individual wearing the dosimeter.

Since identifying the problem during a self-assessment in May 1997, the licensee had taken actions intended to correct the problem. The events were discussed with radiation workers during outage meetings. Information was disseminated to plant workers by attaching notes to security badges. Involved radiation workers were counseled. Management expectations were emphasized to radiation protection technicians during special meetings. General employee training emphasized proper use of the alarming dosimeters. A human-factors specialist was assigned to review the events and participate in a root cause analysis. The root cause analysis results were not available by the end of the inspection.

Despite the licensee's efforts, corrective actions had not yet been successful in eliminating the problem. Another example of this problem was identified by the licensee during the week of the inspection. Licensee representatives acknowledged that the rate of occurrence of such problems had not declined, but they also pointed out that the rate of occurrence was very small. The licensee averaged approximately 10,000 entries per month into the radiological controlled area, during routine operations. More entries were made during outages.

Because broader corrective actions were needed to address the programmatic issue of individuals not following the special instructions of radiation work permits, the inspector identified this as a violation of Technical Specification 6.8, which requires the establishment, implementation, and maintenance of specified procedures (275/9801-01; 323/9801-01).

c. Conclusions

Most external exposure controls were implemented properly, but a violation involving failures to follow radiation work permit instructions was identified because individuals entered the radiological controlled area without operable alarming dosimeters.

R1.3 Surveying and Monitoring

a. Inspection Scope (83750)

- Neutron instrumentation calibration
- Personnel neutron dosimetry
- Personnel neutron doses



b. Observations and Findings

Licensee representatives stated that personnel entries into the containment building during reactor operations had increased during the past three years. A neutron spectral analysis conducted by a vendor, in 1984, determined that neutron energies inside reactor containment averaged between 34 and 114 keV. Neutron measuring instruments used during these power entries were calibrated onsite by the licensee. A 3.4 curie Americium-241/Beryllium source in a polyethylene shield was used for the calibration. According to vendor information, the calibration source produced neutrons with average energies of at least 580 keV and was capable of producing neutron dose equivalents of 6 and 87 millirems per hour. Instruments calibrated using this source over-respond when used in actual conditions in the reactor containment building. The inspector concluded this was a conservative calibration technique.

The licensee used neutron dosimeters with 2 lithium-borate elements and 2 calcium-sulphate elements to monitor all workers entering the containment building at power. No individual neutron radiation dose exceeded 20 millirems.

c. Conclusions

Proper neutron instrument calibration and neutron dosimetry programs were implemented. Radiation dose from neutrons was not significant.

R4 **Staff Knowledge and Performance**

Radiation protection technicians were interviewed randomly. The technicians were asked how they would handle hypothetical situations. The technicians provided appropriate answers and identified applicable guidance documents. The inspector concluded that radiation protection technicians had good, basic knowledge of health physics practices and procedures.

R5 **Staff Training and Qualification**

a. **Inspection Scope (83750)**

The inspector interviewed the radiation protection manager and reviewed the following:

- Qualifications of radiation protection supervisors and professionals
- Continuing training of radiation protection supervisors and professionals
- Radiation protection technician continuing training curriculum

b. Observations and Findings

The radiation protection staff included three certified health physicists and five individuals with advanced, educational degrees.



Twenty of 54 radiation protection technicians had completed the necessary requirement for registration by the National Registry of Radiation Protection Technologists. This was up slightly from the previous assessment period (37 percent versus 34 percent).

All supervisors and professionals were provided continuing training in their field of expertise through participation in professional meetings, offsite training, or peer reviews.

Two cycles of continuing training were presented to radiation protection technicians. Topics were reviewed by the inspector and found appropriate.

c. Conclusions

The licensee had a highly qualified professional staff and a good continuing training program for supervisors, professionals, and radiation protection technicians. The licensee was moderately successful in promoting professional advancement of radiation protection technicians.

R6 **RP&C Organization and Administration**

The radiation protection staff consisted of 86 positions. This was down from 88 positions at the end of the previous assessment period. Additionally, there were three contractors performing outage-related work. There were two vacancies at the time of inspection.

There was moderate turnover in staffing. The radiation protection organization lost 3 engineers, 3 utility workers, 1 health physicist, and 1 technician.

With no objective evidence to the contrary, the inspector concluded that staffing of the radiation protection organization continued to be appropriate to ensure radiation safety.

R7 **Quality Assurance in RP&C Activities**

a. Inspection Scope (83750)

The inspector reviewed the following:

- Nuclear quality audits and assessments of the radiation protection program
- Radiation protection self-assessments
- Corrective action documentation

b. Observations and Findings

The nuclear quality services audit team included several technical specialists. The results of the audit were presented clearly in a report format that followed the



format of 10 CFR Part 20. The inspector concluded from a review of the report that the quality assurance audit scope was comprehensive. The audit identified areas of program improvement and, the radiation protection organization addressed the findings in a timely manner.

In addition to performance assessments by the quality organization, numerous self-assessments were performed by the radiation protection organization. The inspector concluded that the self-assessments provided radiation protection management with meaningful information on the effectiveness of radiation protection activities.

The action request tracking system was used to document problems and track corrective actions. The inspector reviewed examples and concluded that problems were effectively identified and corrected, with the exception of the alarming dosimetry issue discussed in Section R1.2.

c. Conclusions

Nuclear Quality Services provided good oversight of the radiation protection program. The radiation program was proactive in reviewing its activities through self-assessments and identifying and correcting problems within the program.

R8 Miscellaneous RP&C Issues

R8.1 (Open) Inspection Followup Item 50-275; -323/9708-02: Air sample hose factor evaluation

This item involved the placement of air sample collectors. Licensee representatives stated that they will have to wait until the refueling outage for airborne radioactivity levels to be high enough to collect meaningful data for their evaluation.

R8.2 (Closed) Violation 50-275/9713-01; 50-323/9713-01 Issuance of the incorrect size respirator

The licensee committed to corrective actions before the inspection was completed and did not have to respond to the Notice of Violation. The inspector verified the corrective actions described in the inspection report were implemented. No similar problems were identified.

V. Management Meeting

X1 Exit Meeting Summary

The inspector presented the inspection results to members of licensee management at an exit meeting on January 9, 1998. The licensee acknowledged the findings presented. No proprietary information was identified.



ATTACHMENT

PARTIAL LIST OF PERSONS CONTACTED

Licensee

T. Bast, ALARA Planner, Radiation Protection  
H. Fong, Engineer, Radiation Protection  
R. Gray, Director, Radiation Protection  
T. Irving, General Foreman, Radiation Protection  
S. Ketelsen, Supervisor, Regulatory Services  
L. Moretti, Foreman, Radiation Protection  
R. Martin, Engineer, Regulatory Services  
G. Lutt, Engineer, Radiation Protection  
R. Lund, Foreman, Radiation Protection  
J. Molden, Manager, Operations Services  
L. Sewell, Engineer, Radiation Protection  
M. Somerville, Senior Engineer, Radiation Protection  
R. Snyder, Training Leader, Learning Services  
D. Taggart, Nuclear Quality Services, Acting Manager

NRC

D. Proulx, Senior Resident Inspector  
D. Allen, Resident Inspector

INSPECTION PROCEDURES USED

83750 Occupational Radiation Exposure

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

275/9801-01; VIO Failure to follow radiation work permit instructions  
323/9801-01

Closed

275/9713-01; VIO Issuance of incorrect respirator size  
323/9713-01

Discussed

275;323/9708-02 IFI Air sample hose factor evaluation



LIST OF ACRONYMS USED

ALARA	As low as is reasonably achievable
PWR	Pressurized water reactor

DOCUMENTS REVIEWED

ALARA

1R8 Exposure Summary  
2R8 Job Estimates and Comparisons  
ALARA Review Committee Meeting Minutes for October 21 and November 12, 1997

Audits and Assessments

Audit 962620172  
Radiation Protection Program (October 10, 1996 - August 5, 1997)  
STP Assessment During 1R8  
1R8 Assessment  
Respiratory Protection  
Dosimetry Laboratory  
Training Self-Assessment

Procedures

RP1	Radiation Protection, Revision OA
RP1.ID3	Respiratory Protection Program, Revision 2A
RP1.ID9	Radiation Work Permits, Revision 1

