U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report Nos. 50-275/91-02 and 50-323/91-02

License Nos. DPR-80 and DPR-82

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

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

Inspection at: Diablo Canyon Site, Seven miles north of Avila Beach, California

Inspection conducted: February 11-15, 1991

Inspected by: Mark W. Peranich for — 3-4-91
W. K. TenBrook, Radiation Specialist — Date Signed

Approved by: Mark W. Peranich — 3-4-91
Mark W. Peranich, Acting Chief — Date Signed
Reactor Radiological Protection Branch

Summary:

Areas Inspected: Routine unannounced inspection covering follow-up of open items and observation of radiation protection measures during the Unit One refueling outage. Inspection procedures 92701, 83726 and 83729 were addressed.

Results: Strengths were noted in the quality assurance department plan for surveillance of radiation protection activities during the outage, which had identified a potential violation. The ALARA program had been effective in achieving the licensee's collective exposure goals during the early stages of the outage and ALARA was well-implemented in work areas. Radiation protection technicians provided thorough coverage of general areas and specific jobs.

Weaknesses were observed in the personal conduct of steam generator maintenance workers and training and familiarity problems during staging of wash-down equipment at steam generator four, which contributed to exceeding the job dose estimate. Dose rate survey data from steam generators varied significantly due to the instrumentation and techniques employed. The ventilation balance in the residual heat removal pump room 1-2 caused minor contamination spread. No violations were identified.

DETAILS

1. Persons Contacted

Licensee Personnel

M. Angus, Assistant Plant Manager, Technical Services
J. Boots, Chemistry Manager
D. Cosgrove, Quality Control Specialist
W. Crockett, Instrumentation and Control Manager
R. Flohaug, Senior Quality Assurance Supervisor
B. Giffin, Assistant Plant Manager, Maintenance
R. Gray, Radiation Protection Manager
J. Griffin, Senior Regulatory Compliance Engineer
J. Hays, Radiation Protection General Foreman
J. Knemeyer, Senior Chemical Engineer
R. Kohout, Emergency and Safety Services Manager
J. Mellinger, Senior Planner
D. Miklush, Assistant Plant Manager, Operations
B. Nanninga, Senior Mechanical Maintenance Engineer
D. Oatley, Assistant Plant Manager, Support Services
W. Rapp, Onsite Safety Review Group Chairman
J. Shoulders, Onsite Project Engineer
M. Stabler, Quality Control Inspector
D. Taggart, Director, Quality Assurance
D. Unger, Chemical Engineer
A. Young, Senior Quality Assurance Supervisor

NRC

P. Galon, Inspector
K. Johnston, Resident Inspector
P. Narbut, Senior Resident Inspector
B. Olson, Project Inspector

The listed individuals attended the exit meeting held February 15, 1991. In addition, discussions were held with other members of the licensee's staff and contractor personnel.

2. Follow-up of Open Items (92701)

Open Item 50-275/88-33-01 (OPEN) This item concerned an NRC/licensee intercomparison of Fe-55 activity in liquid waste. Inspection Report 50-275/90-25 reported that the subject intercomparison did not agree, and documented a followup inspection at the licensee's offsite laboratory. The report concluded that the licensee's sampling and measurement techniques were fundamentally sound. However, differences remained in sample splitting and preservation techniques that could affect the measurements.

To resolve these concerns, representatives from the chemistry department and the licensee's offsite laboratory met with the inspector and developed an experiment to independently verify both the licensee and NRC analyses of a waste sample. A sample of processed waste receiver liquid waste was obtained and filtered to remove any fine particulate iron that could contribute to a nonhomogeneous split. Iron particles were visible on the filter. The filtered liquid was acidified and two aliquots were preserved for the licensee and NRC as "control" samples to provide the baseline result of Fe-55 activity in the sample. A portion of the remaining liquid was placed in a volumetric flask, spiked with a NRC-supplied Fe-55 concentrate solution, and diluted to the mark with sample liquid. The spiked liquid was split between the licensee and NRC and preserved as "treatment" samples. The inspector was the only party aware of the amount of Fe-55 added. Each laboratory's measurement of the "control" and "treatment" samples, and the difference between the measurements as compared with the known spike, will be evaluated to determine the accuracy of both licensee and NRC measurements. The results will be evaluated during a subsequent inspection.

Open Item 50-275/90-03-02 (Closed): This item concerned the logging of quality control checks for alpha-beta counters on control charts per regulatory guide 4.15, "Quality Assurance for Radiological Monitoring - Effluent Streams and the Environment." Control charts of source and background checks were specified in revisions to chemical analysis procedures CAP B-15, "Operation of the Liquid Scintillation Counter...," and CAP B-16, "Proportional Counter." The charts were maintained in the laboratories. The inspector had no further concerns in this matter.

Open Item 50-275/90-20-02 (Open): This item concerned high levels of Fe-55 in liquid radwaste, which caused the licensee to exceed their corporate curie release goal during the previous year. Inspection report 50-275/90-25, and the licensee's own intercomparison studies with other offsite laboratories, concluded that the licensee's measurements of Fe-55 in releases were generally sound, despite the analytical concerns addressed above. The inspector concluded that measurement inaccuracy did not account for the high measured Fe-55 levels.

The licensee had been aggressively reducing the size of micron filters throughout the plant, both in response to the high levels of Fe-55 and to reduce overall effluent levels and radiation dose rates due to particulate target material in the reactor coolant system. Chief among the staged decreases in filter size were the letdown filters, spent fuel pool filters and liquid radwaste treatment system filters. Most of these filters were one micron or less, absolute. The following total quarterly curies of Fe-55 had been released to date:

First Quarter, 1990:	9.3E-1 Ci
Second Quarter, 1990:	4.5E-1 Ci
Third Quarter, 1990:	9.7E-2 Ci
Fourth Quarter, 1990:	1.5E-1 Ci

The data show a reduction of one order of magnitude of total Fe-55 released per quarter. The licensee suspected that levels of iron would

be affected by forced oxygenation of the reactor coolant system prior to the Unit One refueling outage and unplanned trips of Unit Two during the first quarter of 1991. This item will be evaluated after data for the first quarter of 1991 are available.

3. Occupational Exposure During Outages; Contamination Control, Surveys and Monitoring (83729, 83726)

Radiation Worker Training

The inspector reviewed lesson plan series GRPA 400, for generic radiation protection training, and GRPD 650I, for site specific radiation protection procedures. The inspector observed that the materials thoroughly discussed external exposure, including the federal guidance for emergency exposure levels in excess of the limits of 10 CFR 20 and discussion of the recent risk data from the Biological Effects of Ionizing Radiation Committee Report V.

The inspector did not note a discussion of the conduct of radiation workers in the breaching of contaminated systems or containers of radioactive material, or in the movement of such material. The inspector inquired whether such a discussion was considered by training in light of a March 1990 incident where I&C contractors moved contaminated equipment to a sea-train without informing radiation protection, leading to personnel contaminations and contamination of the sea-train.

The licensee provided the inspector with Action Request A0184275, documenting the licensee's corrective actions for the incident. The action request documented tailboard meetings with I&C contractors to discuss the incident, but the issue had not been considered appropriate for general discussion. The licensee stated that general employee training discussed radiation work permit requirements, and radiation work permits, in turn, discussed specific requirements for radiation protection coverage during the breaching of systems. Also, the inspector learned that lesson GRPD 650I-7, "Radwaste Minimization," contained a discussion of tool control per administrative procedure D-55, including the requirement for radiation protection approval of tool storage locations.

The inspector concluded that general employee training and the specific requirements of radiation work permits provided adequate instructions for workers per 10 CFR 19.12.

Observation of Steam Generator Decontamination

The inspector observed the decontamination of unit one steam generator channel heads. Four technicians were assigned at each of the two steam generator access control points; one maintained radio contact and video surveillance of the work crew, one was stationed on the clean area of the step-off pad, another at the labyrinth entrance and a fourth technician accompanying the crew. The responsible radiation protection engineer was continuously involved as the job progressed.

Protective equipment, including air-fed suits and hoods, was properly donned. However, while contract workers waited to don protective equipment, the inspector observed some examples of poor conduct. A contract worker sportively shoved another worker against the bioshield wall repeatedly. Since the shoved worker did not wear their protective clothing in a manner consistent with procedure i.e., hood undone, the worker's outerclothing contacted the shoved worker's neck and chin. The responsible radiation protection technician and the contractor area coordinator were immediately informed. No personnel contamination resulted from the conduct and the inspector did not observe widespread instances of poor conduct in controlled areas.

The inspector observed two delays during the steam generator bowl decontamination. Workers at steam generators one and two were hampered by radio transmission difficulties. Workers at steam generators three and four appeared to misplace or misassemble components for the bowl wash-down, resulting in a delay of approximately one half hour during the transition from steam generator three to four. After obtaining assistance from the contractor's area coordinator, the bowl wash-down equipment was readied and work commenced. These delays contributed to the crews exceeding the estimated 2.5 person-rem for the job, accruing 4.3 person-rem.

The inspector reviewed survey data obtained before and after the steam generator bowl decontamination. Since the decontamination was intended to remove radioactive particles emitting high beta dose rates, the inspector did not expect a reduction in gamma dose rate. The inspector noted that tubesheet and divider plate post-decontamination dose rates on steam generator 1-1 and 1-2 ranged 30-50% higher than pre-decontamination dose rates. The inspector investigated these differences and found that compensated geiger-meuller detectors were used for the post-decontamination survey as opposed to the preferred ion chamber instruments used for the pre-decontamination survey. Geiger-Meuller instruments were substituted due to maintenance problems with the ion chamber instruments.

Data obtained for all four steam generators suggested a less severe variation overall, particularly since the same type of instrument was used for each survey of steam generators three and four. However, a +/- 33% variation remained. Since the four steam generator average dose rate increased after decontamination, and the average was used to calculate stay times for steam generator work, the inspector concluded that the post-decontamination survey conservatively predicted personnel exposure. However, the variation of survey techniques, and the resulting variation in dose rate averages, could affect evaluations of radiation field control methods.

The conduct of steam generator maintenance workers and their performance during staging of wash-down equipment at steam generator four suggested training weaknesses. Dose rate survey data in steam generators varied significantly due to the instrumentation and techniques employed, but personnel were adequately protected. No violations of radiation protection requirements were observed.

Removal of Residual Heat Removal Pump 1-2 Impeller

The inspector observed the removal of the residual heat removal system pump 1-2 impeller in preparation to remove the pump motor for maintenance. The impeller removal was covered by two radiation protection technicians, one inside the contaminated area and one at the step-off pad for support. The pump motor was hoisted to place the shaft in a vertical position, approximately two meters within the boundaries of contaminated area and high radiation area. A high-efficiency particulate air filter (HEPA) unit took suction across the impeller, away from the step-off pads. A breathing-zone air sample was in-progress and workers in the contaminated area wore respirators as a precaution during work with the highly contaminated impeller.

During the removal of the impeller, the inspector and the radiation protection technician at the step-off pad noted that the ventilation system was creating positive pressure within the room. A rush of air occurred each time the door was opened. The technician began a large area contamination survey of the step-off pad and entrance stairway, and initiated an air sample on the stairway. Direct frisk of the area wipes measured two hundred net counts per minute. The radiation protection foreman was informed and the step-off pad/surface contamination boundary was moved to the entrance to the room.

Shortly after, the impeller was removed from the shaft and stored in the contaminated area. The workers, technicians and the inspector performed a local frisk and passed through the personnel contamination monitors without incident. Later review of air sample data revealed 0.01 maximum permissible concentration (MPC) airborne activity on the entrance stairwell and 0.11 MPC at the clean area on the north end of the room. Natural airborne activity could have predominated in these samples, as neither sample met the licensee's 0.25 MPC criteria for gamma isotopic analysis.

The inspector noted that the design bases for the auxiliary building ventilation system, Final Safety Analysis Report section 9.4.2.1, state that the flow of air is always directed from areas of low potential contamination to areas of higher potential contamination. After investigating the conditions in the pump room, the radiation protection department informed the inspector that particular areas of the plant would not exhibit ideal ventilation flow during periods when ventilation systems were affected by outage maintenance. The licensee stated that room ventilation balance would be evaluated prior to reinstallation of the impeller.

The inspector concluded that the observed ventilation balance did not create an unanalyzed condition while the residual heat removal system was out of service, but the flow caused minor contamination spread. No violations were identified.

Quality Assurance

The inspector reviewed the quality assurance department's involvement in radiation protection activities since the prior inspection. The quality surveillance group had performed observation of several radiation protection activities, including cavity decontamination and temporary shielding installation.

During the inspection, the radiation protection manager informed the inspector of a quality finding from a February 12, 1991 surveillance of radiation protection activities in containment. Workers had entered the reactor coolant pump 1-3 cubicle via a route that avoided high radiation areas. Radiography was subsequently initiated near the cubicle 1-3 entrance, creating a high radiation area, so one worker was forced to exit to the opposite side of containment via a catwalk near the steam generators, also a posted high radiation area. The surveillant observed the worker exiting the posted high radiation area without an alarming dosimeter or a technician with a dose rate instrument, a potential violation of technical specification (TS) 6.12. Action Request A0217882 was initiated to track resolution of the observation, and further investigation revealed that the worker did not pass through any area that actually exceeded the 100 mR/hr dose rate specified in TS 6.12. The inspector had no further concerns and remanded the matter to the licensee.

The quality assurance department had established an effective plan for surveillance of radiation protection activities during the outage.

Keeping Dose As Low As Reasonably Achievable (ALARA)

The inspector performed dose rate measurements in controlled areas using ion chamber instrument NRC 015844. Boundary postings were consistent with 10 CFR 20.203. The inspector observed thorough radiation protection technician coverage of each containment elevation during tours of general areas. A checkpoint was set up at each elevation and no personnel were permitted without informing the on-duty technician. The balance of the elevation was covered by roving technicians or those assigned to continuous coverage.

The licensee's ALARA precautions in work areas were strong. The inspector observed workers staging equipment in a reactor coolant pump bat to sludge-lance steam generators, working quickly and efficiently to minimize exposure. "Cold areas" and localized radiation areas were conspicuously posted in containment. Workers were aware of measures available to minimize exposure.

The licensee's outage dose report demonstrated that the collective exposure accrued to date was tracking with corporate ALARA goals. The licensee was encouraged by the performance to date, as the 315 person-rem corporate goal was thought to be ambitious, given the outage scope. The inspector reviewed collective doses on individual radiation work permits and identified few instances where doses had exceeded those estimated. Among those permits that had exceeded their dose estimates, the steam generator bowl decontamination accounted for over half the total 3.3

person-rem excess, followed by the elimination of boron injection tank, 0.87 person-rem over estimate.

The inspector also examined steam generator channel head average dose rate data spanning all four unit one refueling outages. The average data compared favorably with charts of channel head dose rates at various plants versus operating time as presented in Electric Power Research Institute report NP-4505-SR, "Manual of Recent Techniques for LWR Radiation Field Control," demonstrating that historically good fuel integrity and measures to keep radiation fields ALARA were effective in reducing dose.

The inspector concluded that the licensee's ALARA program had been effective in achieving the licensee's goals during the early stages of the outage.

4. Exit Meeting

The inspector met with licensee management on February 15, 1991 to discuss the scope and findings of the inspection. The licensee acknowledged the inspector's observations.