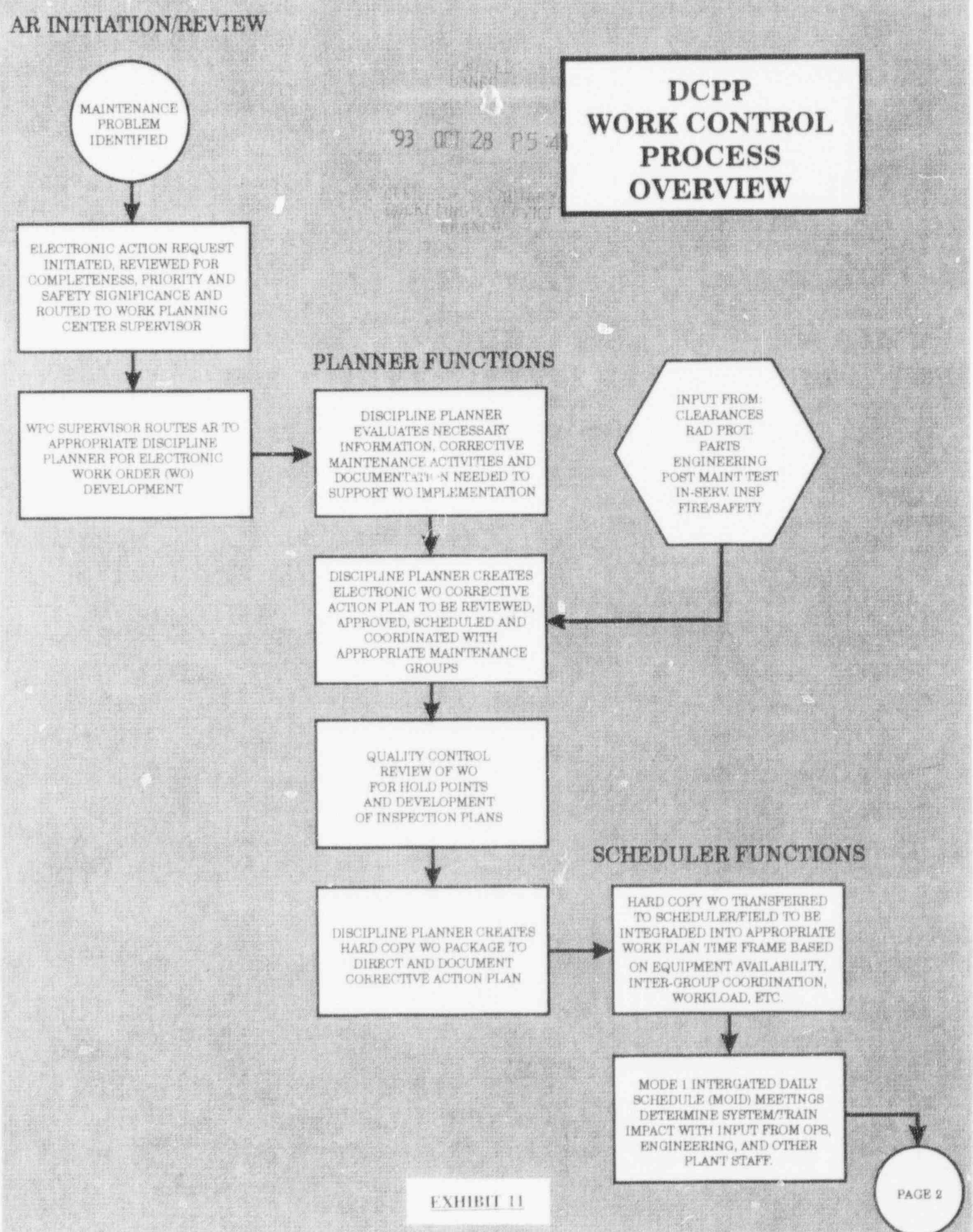
50-275/323-OLA-2 A-11 8/17/93



50-275/323-OLA-2 A-11 8/17/93

DCPP WORK CONTROL PROCESS OVERVIEW

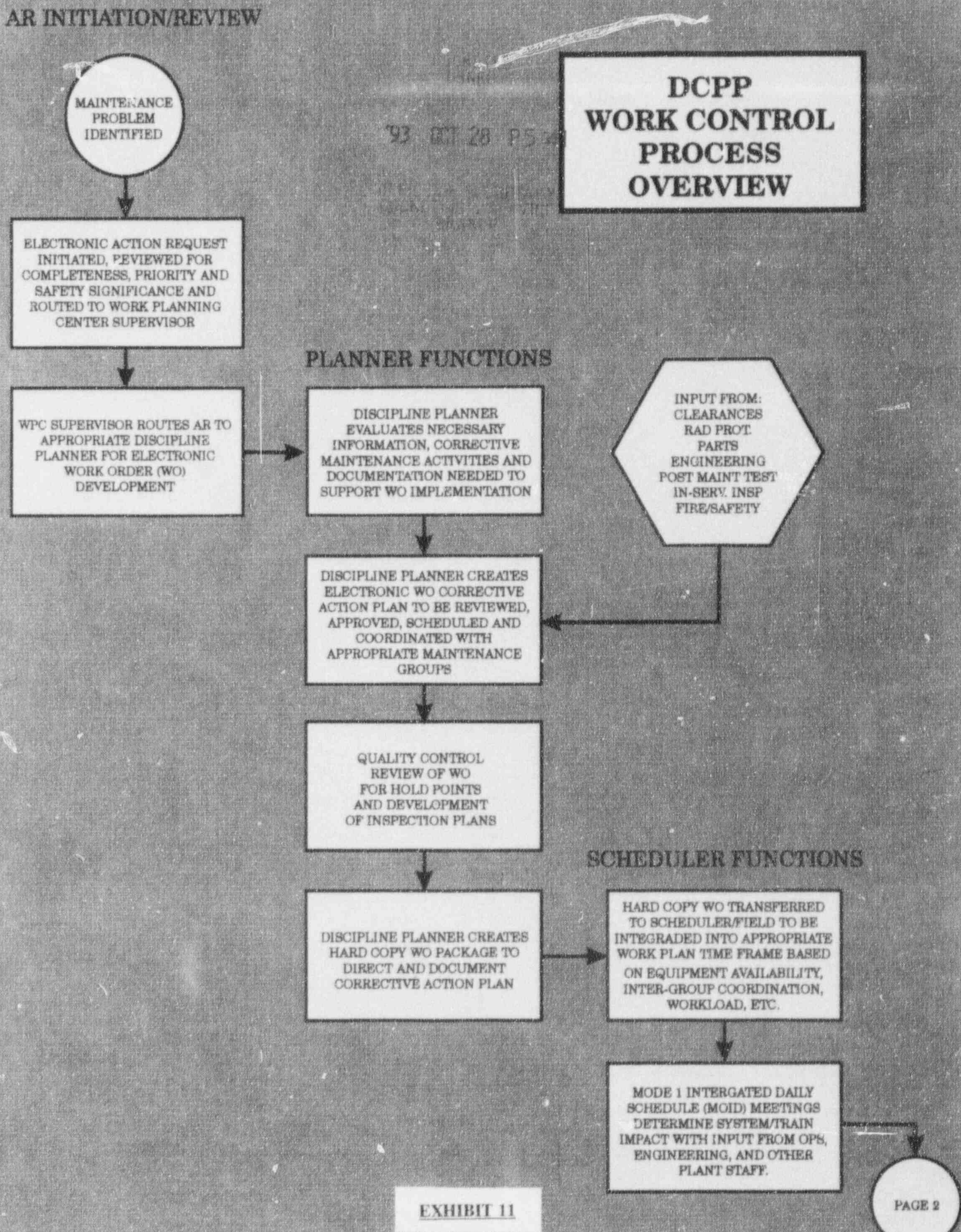


EXHIBIT 11

NUCLEAR REGULATORY COMMISSION

Docket No. 50-275-OLA Official Exh. No. 11

In the matter of PACIFIC GAS and ELECTRIC CO.

Staff ______ IDENTIFIED ✓

Applicant ✓ RECEIVED ✓

Intervenor ______ REJECTED ______

Cont'g Off'r ______

Contractor Ann Riley & Assoc's DATE 8-17-93

Other ______ Witness ______

Reporter Dollie Feigel

9311190095

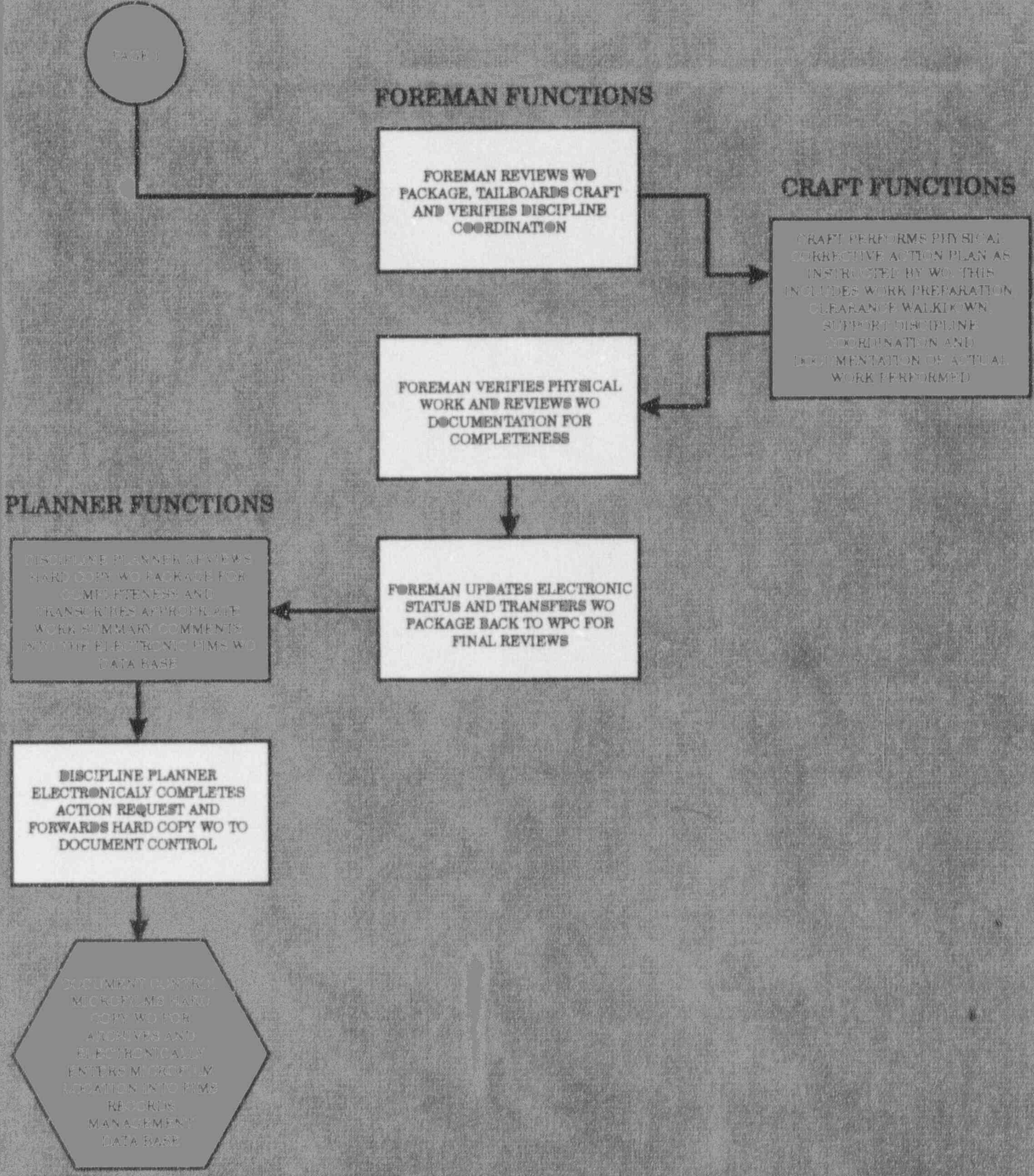

PAGE 1
FOREMAN FUNCTIONS
FOREMAN REVIEWS WO PACKAGE, TAILBOARDS CRAFT AND VERIFIES DISCIPLINE COORDINATION
CRAFT FUNCTIONS
CRAFT PERFORMS PHYSICAL CORRECTIVE ACTION PLAN AS INSTRUCTED BY WO. THIS INCLUDES WORK PREPARATION, CLEARANCE WALKDOWN, SUPPORT DISCIPLINE COORDINATION AND DOCUMENTATION OF ACTUAL WORK PERFORMED
FOREMAN VERIFIES PHYSICAL WORK AND REVIEWS WO DOCUMENTATION FOR COMPLETENESS
PLANNER FUNCTIONS
FOREMAN UPDATES ELECTRONIC STATUS AND TRANSFERS WO PACKAGE BACK TO WPC FOR FINAL REVIEWS
DISCIPLINE PLANNER REVIEWS HARD COPY WO PACKAGE FOR COMPLETENESS AND TRANSCRIBES APPROPRIATE WORK SUMMARY COMMENTS INTO THE ELECTRONIC PIMS WO DATA BASE
DISCIPLINE PLANNER ELECTRONICALY COMPLETES ACTION REQUEST AND FORWARDS HARD COPY WO TO DOCUMENT CONTROL
DOCUMENT CONTROL MICROFILMS HARD COPY WO FOR ARCHIVES AND ELECTRONICALLY ENTERS MICROFILM LOCATION INTO PIMS RECORDS MANAGEMENT DATA BASE

EXHIBIT 11

EXHIBIT 12

PROFESSIONAL QUALIFICATIONS

OF

TEDD A. DILLARD

RESUME

Tedd A. Dillard

- B.S., Mechanical Engineering, LeTourneau College, Longview Texas, 1969.
- Westinghouse, 1969 through 1973.
- Florida Power and Light, 1973 through present.
- Mechanical Maintenance Department Head, St. Lucie Nuclear Plant, 1972 through 1983.
- Superintendent of Maintenance, St. Lucie Nuclear Plant, 1983 through 1988.
- INPO Maintenance Assistance Visit, Peer Evaluator, Ft. Calhoun Plant, 1987.
- INPO Maintenance Assistance Visit, Corporate Evaluator, Turkey Point Nuclear Plant, 1987.
- NUMARC Advisory Committee on Industry Response to NRC Maintenance Policy, 1988 through 1989.
- NUMARC Advisory Committee on Industry Guideline for Maintenance Rule, 1991 through 1992.
- Supervisor, Component Programs, Nuclear Division, Florida Power & Light Company, 1992 through present.

EXHIBIT 13

PROFESSIONAL QUALIFICATIONS

OF

DAVID B. MIKLUSH

RESUME

MANAGER, OPERATION SERVICES

David B. Miklush

1. Birthdate - January 29, 1950

2. Citizenship - USA

3. Education

   a. B.S., Mechanical Engineering, University of California, Los Angeles, 1972.

   b. Registered Professional Engineer, Mechanical, California #18199.

4. Employment History - Joined PG&E in July 1982.

   a. September 1972 to April 1976 - General Atomic Company. Participated in the Technical Graduate Program at General Atomic with three 6-month assignments in manufacturing design engineering, and site startup at Fort St. Vrain from August 1974 to April 1976 in construction and operations.

   b. April 1976 to February 1978 - General Electric Company. Responsible Design Engineer for the BWR refueling, fuel handling, and auxiliary service bridges. Assignment consisted of verification of vendor hardware designs and initial design of the fuel grapple for BWR 6.

   c. February 1978 to June 1980 - PG&E at Diablo Canyon Power Plant. Power Production Engineer.

   d. June 1980 to August 1982 - Senior Power Production Engineer (Nuclear). Supervised 5 engineers in preparation of surveillance test procedures and conduct of plant equipment testing.

   e. August 1982 to August 1983 - Assistant Maintenance Supervisor.

   f. August 1983 to June 1988 - Maintenance Manager of Mechanical and Electrical Maintenance. Supervised department consisting of 15 engineers, 17 supervisors, and 130 journeymen.

   g. June 1988 to September 1989 - Assistant Plant Manager/Maintenance Services. Responsible for plant maintenance at Diablo Canyon consisting of mechanical, electrical, instrumentation and controls, maintenance workplanning center, and materials services.

h. September 1989 to July 1991 - Assistant Plant Manager/Operation Services. Responsible for plant operations at Diablo Canyon consisting of Operations, Radiation Protection, and Chemistry Departments.

i. July 1991 to Present - Manager, Operation Services (title change).

5. Nuclear Experience

a. Fort St. Vrain - Participated in initial core loading; shift operations engineer during low-power physics tests to 2 percent power.

b. General Electric - Design of nuclear fuel handling and servicing equipment.

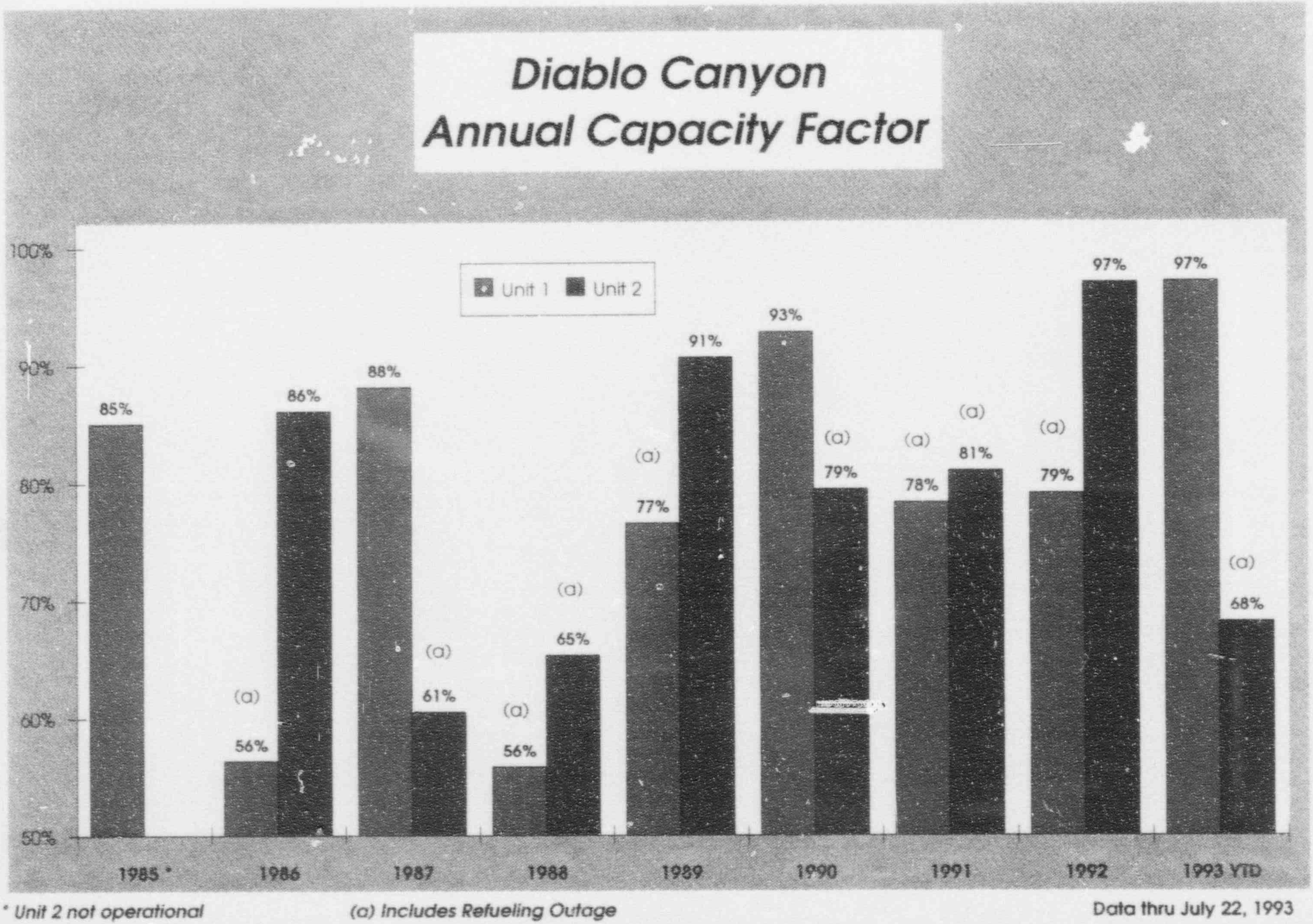
c. Diablo Canyon - Power Production Engineer (Nuclear) engaged in procedure preparation and startup testing of various plant systems and equipment.

d. Westinghouse Phase 2, three-month classroom training on SNUPP's plant. Westinghouse Phase 3, two-month simulator training on SNUPP's plant. Certified SRO with Westinghouse Training Center, August 1981.

e. Senior Reactor Operator's License, March 1982 to October 1988 (retired).

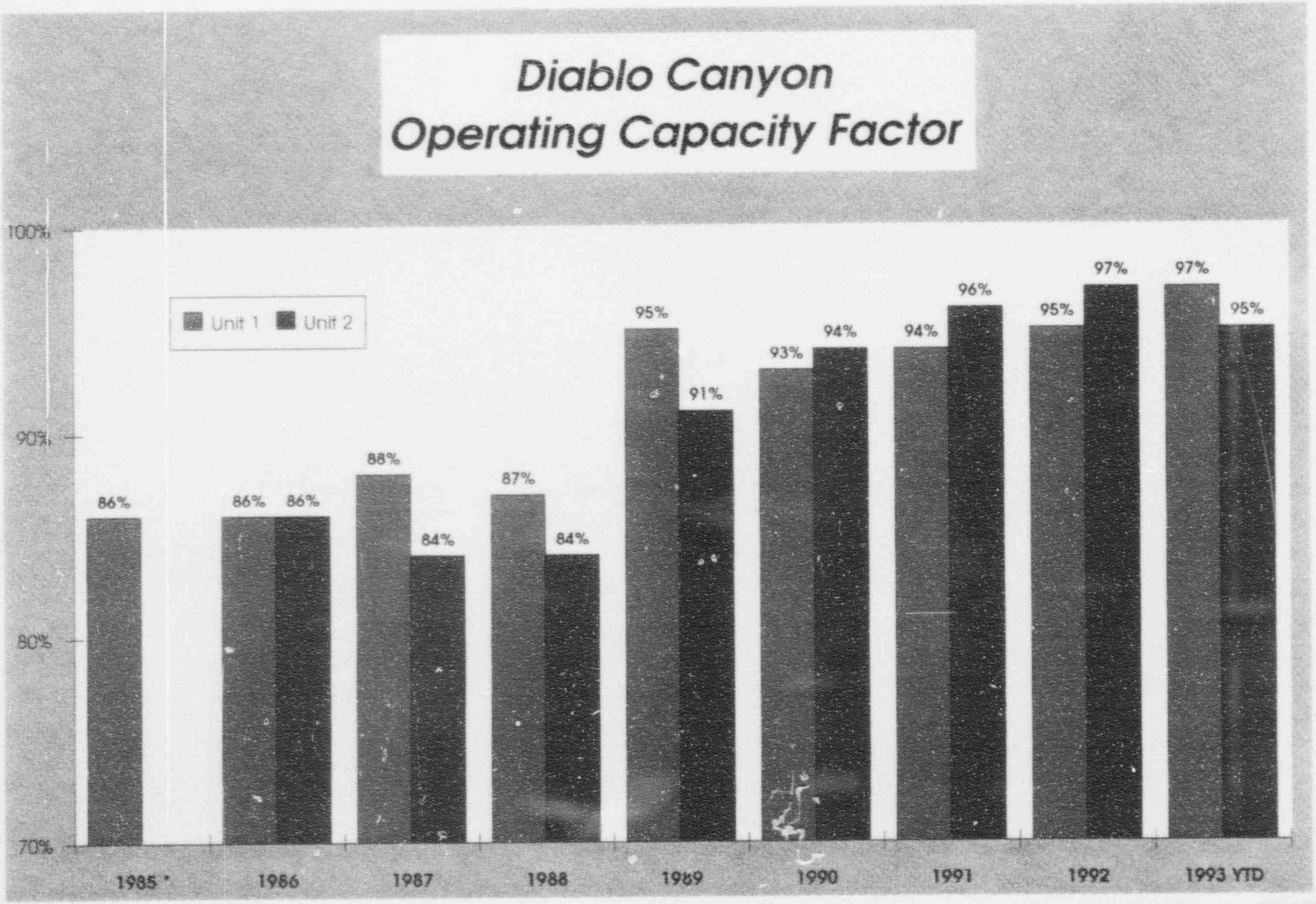
f. INPO Senior Nuclear Plant Manager's Course (5 weeks), March 1989.

EXHIBIT 14



Diablo Canyon
Annual Capacity Factor
Unit 1
Unit 2
100%
90%
80%
70%
60%
50%
85%
56%
86%
88%
61%
56%
65%
77%
91%
93%
79%
78%
81%
79%
97%
97%
68%
(a)
1985 *
1986
1987
1988
1989
1990
1991
1992
1993 YTD
* Unit 2 not operational
(a) Includes Refueling Outage
Data thru July 22, 1993

EXHIBIT 15



* Unit 2 not operational

Data thru July 22, 1993

EXHIBIT 16

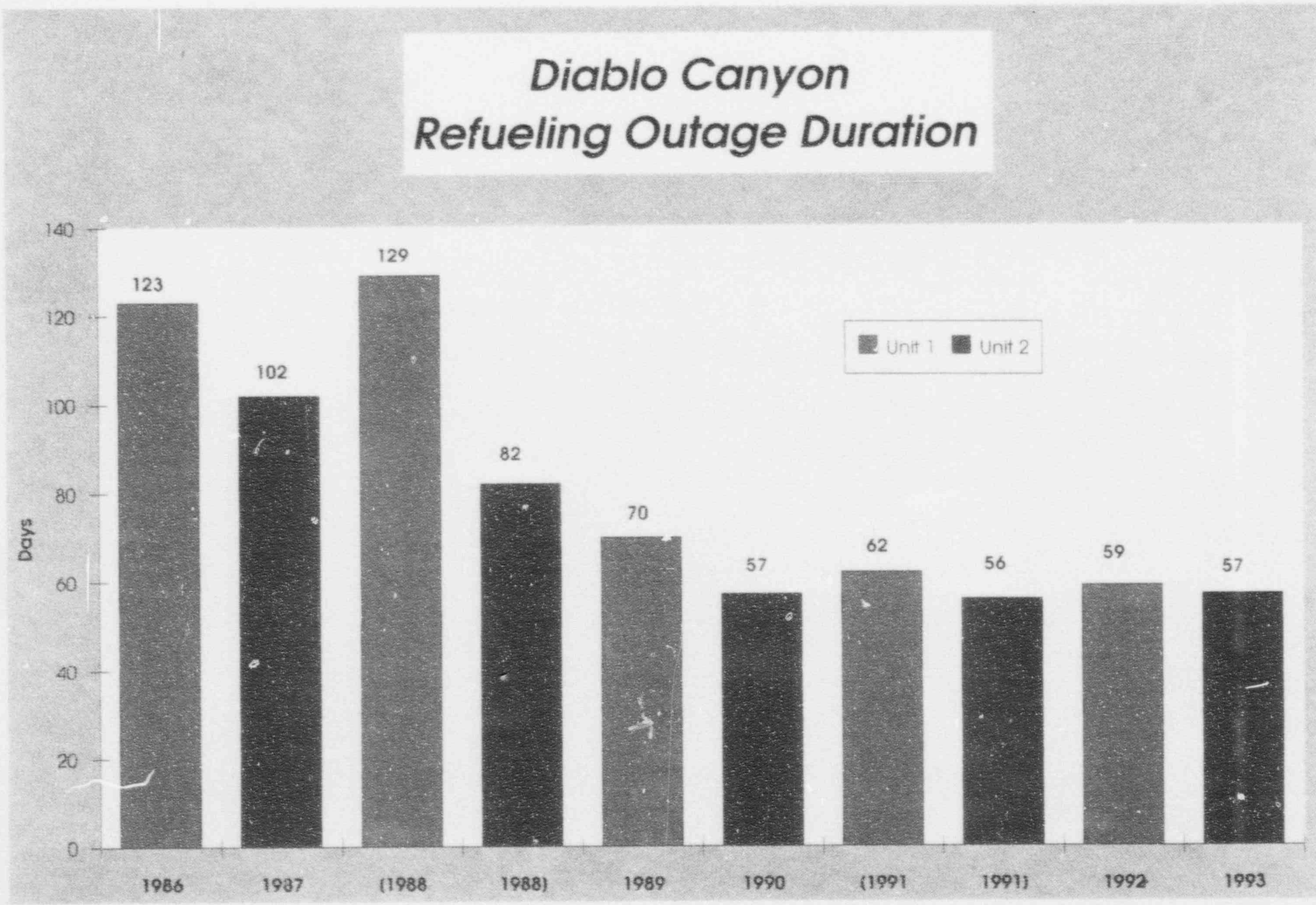
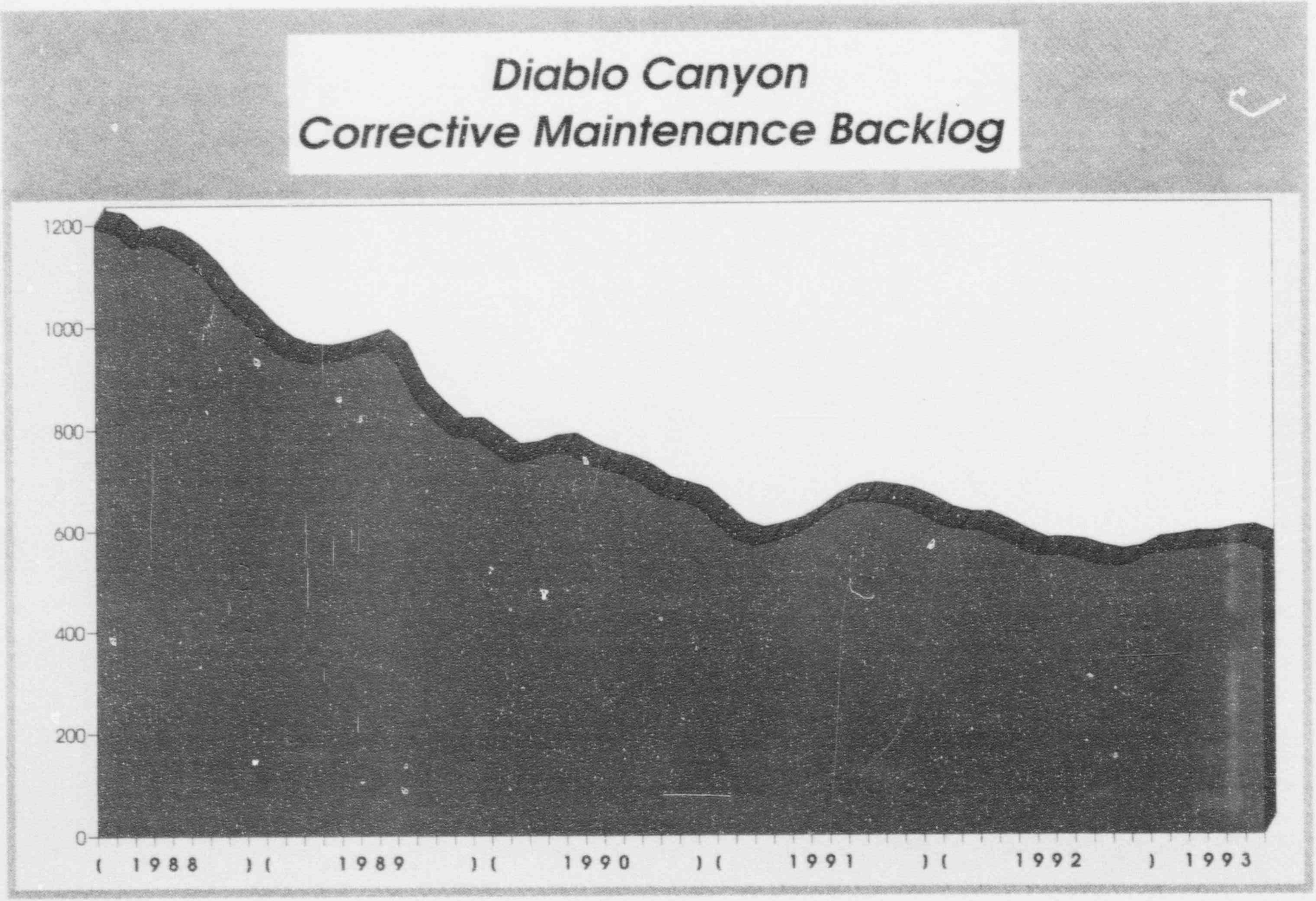
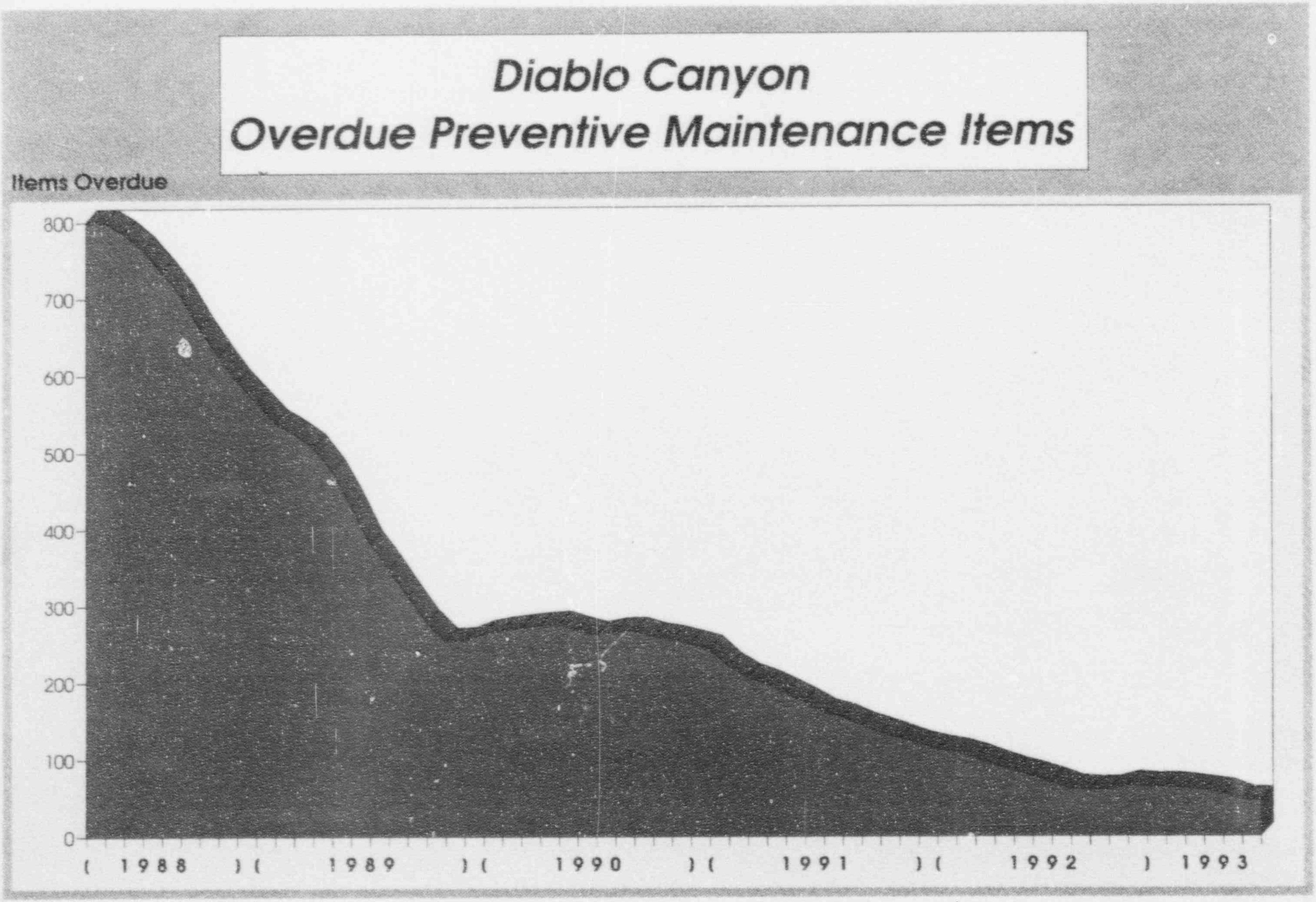

Diablo Canyon
Refueling Outage Duration
Days
140
120
100
80
60
40
20
0
123
102
129
82
70
57
62
56
59
57
Unit 1
Unit 2
1986
1987
(1988
1988)
1989
1990
(1991
1991)
1992
1993

EXHIBIT 17



Diablo Canyon
Corrective Maintenance Backlog
1200
1000
800
600
400
200
0
1988
1989
1990
1991
1992
1993

EXHIBIT 18



Diablo Canyon
Overdue Preventive Maintenance Items
Items Overdue
800
700
600
500
400
300
200
100
0
(1988)(1989)(1990)(1991)(1992) 1993

EXHIBIT 19

NRC COMMENDATION LETTERS

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUN 22 1993

Docket Nos. 50-275 & 50-323

Mr. Richard A. Clarke
Chairman of the Board and
Chief Executive Officer
Pacific Gas and Electric Company
77 Beale Street
San Francisco, California 94106

Dear Mr. Clarke:

On June 15-16, 1993, NRC senior managers met to evaluate the nuclear safety performance of operating reactors, fuel facilities, and other materials licensees. The NRC conducts this meeting semiannually to determine if the safety performance of the various licensees exhibits sufficient weaknesses to warrant increased NRC attention. In addition, at this meeting, senior managers identify specific plants that have demonstrated a level of safety performance that deserves formal NRC recognition. At the June 1993 Senior Management Meeting, the Diablo Canyon nuclear power plant (Units 1 and 2) was identified as having achieved a high level of safety performance and as a result met criteria for recognition of its performance. I am pleased to note that Diablo Canyon has again been identified as a good performer.

In identifying such plants, NRC senior managers perform an evaluation of performance in many areas including operational safety, self-assessment, problem resolution, and plant management organization and oversight.

The NRC recognizes that to achieve the level of performance demonstrated by the Diablo Canyon nuclear power plant, there must be management involvement in all phases of plant activities, the staff must be dedicated and knowledgeable and fully supportive of plant activities, and a commitment to safety must exist throughout the organization. We commend you and your staff for achieving this high level of safety performance. Your achievement is a positive example to the industry.

The greatest challenge that you now face is to maintain this level of performance and not to rest on past achievements. Continued management involvement and support, and dedicated efforts from your staff to identify and

promptly correct problems are necessary for you to continue to meet this difficult challenge.

Sincerely,

James M. Taylor
Executive Director
for Operations

cc: See next page

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

February 5, 1993

Docket Nos. 50-275 & 50-323

Mr. Richard A. Clarke
Chairman of the Board and
Chief Executive Officer
Pacific Gas and Electric Company
77 Beale Street
San Francisco, California 94106

Dear Mr. Clarke:

On January 26-28, 1993, NRC senior managers met to evaluate the nuclear safety performance of operating reactors, fuel facilities, and other materials licensees. The NRC conducts this meeting semiannually to determine if the safety performance of the various licensees exhibits sufficient weaknesses to warrant increased NRC attention. In addition, at this meeting, senior managers identify specific plants that have demonstrated a level of safety performance that deserves formal NRC recognition. At the January 1993 Senior Management Meeting, the Diablo Canyon nuclear power plant (Units 1 and 2) was identified as having achieved a high level of safety performance and as a result met criteria for recognition of its performance. I am pleased to note that Diablo Canyon has again been identified as a good performer.

In identifying such plants, NRC senior managers perform an evaluation of performance in many areas including operational safety, self-assessment, problem resolution, and plant management organization and oversight.

The NRC recognizes that to achieve the level of performance demonstrated by the Diablo Canyon nuclear power plant, there must be management involvement in all phases of plant activities, the staff must be dedicated and knowledgeable and fully supportive of plant activities, and a commitment to safety must exist throughout the organization. We commend you and your staff for achieving this high level of safety performance. Your achievement is a positive example to the industry.

The greatest challenge that you now face is to maintain this level of performance and not to rest on past achievements. Continued management involvement and support, and dedicated efforts from your staff to identify and

promptly correct problems are necessary for you to continue to meet this difficult challenge.

Sincerely,

James M. Taylor
Executive Director
for Operations

cc: See next page

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

June 30, 1992

Docket No. 50-275
Docket No. 50-323

Mr. Richard A. Clarke
Chairman of the Board and
Chief Executive Officer
Pacific Gas and Electric Company
77 Beale Street
San Francisco, California 94106

Dear Mr. Clarke:

On June 15 and 16, 1992, NRC senior managers met to evaluate the nuclear safety performance of operating reactors, fuel facilities, and other materials licensees. The NRC conducts this meeting semiannually to determine if the safety performance of the various licensees exhibits sufficient weaknesses to warrant increased NRC attention. In addition, at this meeting, senior managers identify specific plants that have demonstrated a level of safety performance that deserves formal NRC recognition. At the June 1992 Senior Management Meeting, the Diablo Canyon nuclear power plant was identified as having achieved a high level of safety performance and met criteria for recognition of its performance. I am pleased to note that Diablo Canyon has again been identified as a good performer, and I consider this a noteworthy accomplishment.

In identifying such plants, senior managers perform an evaluation of performance in many areas including operational safety, self-assessment, problem resolution, and plant management organization and oversight.

NRC senior management recognizes that management involvement in all phases of plant operation, the dedicated and knowledgeable staff that supports plant activities, and the commitment to safety throughout the organization are necessary to achieve the level of performance demonstrated by the Diablo Canyon nuclear power plant. We commend you and your staff for achieving a high level of safety performance. Your achievement is the result of dedicated efforts from your staff and is a positive example to the industry.

The greatest challenge that you now face is to maintain this level of performance and not to rest on past achievements. Continued management involvement and support, and dedicated efforts from your staff to identify and promptly correct problems, are necessary for you to continue to meet this difficult challenge.

Sincerely,

James M. Taylor
Executive Director
for Operations

cc: See next page

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

February 3, 1992

Docket No. 50-275
Docket No. 50-323

Mr. Richard A. Clarke
Chairman of the Board and
Chief Executive Officer
Pacific Gas and Electric Company
77 Beale Street
San Francisco, California 94106

Dear Mr. Clarke:

On January 14 and 15, 1992, NRC Senior managers met to evaluate the nuclear safety performance of operating reactors, fuel facilities, and other materials licensees. The NRC conducts this meeting semiannually to determine if the safety performance of the various licensees exhibits sufficient weaknesses to warrant increased NRC attention. In addition, at this meeting, senior managers identify specific plants that have demonstrated a level of safety performance that deserves formal NRC recognition. At the January 1992 Senior Management Meeting, the Diablo Canyon nuclear power plant was identified as having achieved a high level of safety performance and met criteria for recognition of its performance.

In identifying such plants, senior managers perform an evaluation of performance in many areas including operational safety, self-assessment, problem resolution, and plant management organization and oversight.

NRC senior management recognizes that management involvement in all phases of plant operation, the dedicated and knowledgeable staff that supports plant activities, and the commitment to safety throughout the organization are necessary to achieve the level of performance demonstrated by the Diablo Canyon nuclear power plant. We commend you and your staff for achieving a high level of safety performance. Your achievement is the result of dedicated efforts from your staff and is a positive example to the industry.

The greatest challenge that you now face is to maintain this level of performance and not to rest on past achievements. Continued management involvement and support, and dedicated efforts from your staff to identify and promptly correct problems, are necessary for you to continue to meet this difficult challenge.

Sincerely,

James M. Taylor
Executive Director
for Operations

cc: See next page

EXHIBIT 20

SALP REPORT

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION V
1450 MARIA LANE
WALNUT CREEK, CALIFORNIA 94596-5368

February 12, 1993

Docket Nos. 50-275 and 50-323

Pacific Gas and Electric Company
Nuclear Power Generation, B14A
77 Beale Street, Room 1451
P. O. Box 770000
San Francisco, California 94177

Attention: Mr. G. M. Rueger, Senior Vice President and General Manager
Nuclear Power Generation Business Unit

Subject: Systematic Assessment of Licensee Performance (SALP)
Report Nos. 50-275/92-34 and 50-323/92-34

The NRC's Systematic Assessment of Licensee Performance (SALP) Board has completed its periodic evaluation of the performance of your Diablo Canyon Nuclear Plant for the period July 1, 1991 through December 31, 1992. An Overview is provided as Section II.A of the enclosed Initial SALP Report.

The performance of Diablo Canyon was evaluated in the functional areas of Plant Operations, Radiological Controls, Maintenance/Surveillance, Emergency Preparedness, Security, Engineering/Technical Support, and Safety Assessment/Quality Verification. The criteria used in conducting this assessment and the SALP Board's evaluation of your performance in these functional areas are outlined in NRC Manual Chapter 0516, "Systematic Assessment of Licensee Performance," dated September 28, 1990.

Overall, the SALP Board found the performance of licensed activities at Diablo Canyon to be superior. The Security functional area was assessed by the SALP Board to be Category 2, improving, with all other functional areas evaluated Category 1. Based on the Board's assessment, we wish to recognize the overall performance of your management and staff in exhibiting an attitude clearly directed toward safe facility operation.

Based upon discussions with your staff, a management meeting to discuss the results of the SALP Board's assessment has been scheduled for February 25, 1993. Arrangements for this meeting will be discussed further with your staff in the near future.

In that no functional area was assessed as Category 3, a written response to the enclosed initial SALP report is not required. However, you may submit comments on the enclosed report, if desired, within 30 days after the February 25 meeting.

In accordance with Section 2.790 of the NRC's "Rules of Practice", Part 2, Title 10, Code of Federal Regulations, a copy of this letter and the enclosed Initial SALP report will be placed in the NRC's Public Document Room.

Should you have any questions concerning the SALP report, we will be pleased to discuss them with you.

Sincerely,

John B. Martin
Regional Administrator

Enclosure:
Initial SALP Report Nos. 50-275/92-34
50-323/92-34

cc: w/enclosure:
J. A. Sexton, PG&E
J. D. Townsend, Vice President/Plant Manager, PG&E
C. W. Warner, Esq., Attorney
D. A. Taggart, Director, Quality Support, PG&E
B. Thomas, News Services, PG&E
T. L. Grebel, Regulatory Compliance Supervisor, PG&E
State of California (Gordon K. Van Vleck)
Bob Hendrix, County Administrator
Sandra Silver
INPO

U. S. NUCLEAR REGULATORY COMMISSION

REGION V

SYSTEMATIC ASSESSMENT OF LICENSEE PERFORMANCE

SALP BOARD REPORT

Nos. 50-275/92-34 and 50-323/92-34

PACIFIC GAS & ELECTRIC COMPANY

DIABLO CANYON POWER PLANT

JULY 1, 1991 THROUGH DECEMBER 31, 1992

TABLE OF CONTENTS

I. INTRODUCTION

The Systematic Assessment of Licensee Performance (SALP) is an integrated NRC staff effort to collect available observations and data on a periodic basis and to evaluate licensee performance based on this information. The program is supplemental to normal regulatory processes used to ensure compliance with NRC rules and regulations. It is intended to be sufficiently diagnostic to provide a rational basis for allocating NRC resources and to provide meaningful feedback to licensee management regarding the NRC's assessment of their facility's performance in each functional area.

An NRC SALP Board, composed of the members listed below, met in the Region V office on January 21, 1993, to review observations and data on the licensee's performance in accordance with NRC Manual Chapter 0516, "Systematic Assessment of Licensee Performance."

This report is the NRC's assessment of the licensee's safety performance at Diablo Canyon Power Plant for the period July 1, 1991 through December 31, 1992.

The SALP Board meeting for Diablo Canyon was attended by:

Voting Members

K. Perkins, Director, Division of Reactor Safety and Projects, RV (SALP Board Chairman)
M. Virgilio, Assistant Director for Region IV & V Reactors, Division of Reactor Projects III, IV, V, NRR
R. Scarano, Director, Division of Radiation Safety and Safeguards, RV
L. Miller, Chief, Reactor Safety Branch, RV
P. Johnson, Chief, Reactor Projects Section 1, RV
S. Peterson, Project Manager, NRR
M. Miller, Senior Resident Inspector, Diablo Canyon

Other Attendees

J. Reese, Chief, Facilities Radiological Protection Branch, RV
R. Pate, Chief, Safeguards, Emergency Preparedness and Non-Power Reactor Branch, RV
D. Kirsch, Technical Assistant, RV
P. Morrill, Chief, Operations Section, RV
W. Ang, Chief, Engineering Section, RV
P. Narbut, Team Leader, RV
D. Schuster, Safeguards Inspector, RV
A. McQueen, Emergency Preparedness Analyst, RV
L. Norderhaug, Safeguards Inspector, RV
L. Coblentz, Radiation Specialist, RV
D. Corporandy, Project Inspector, RV
C. Myers, Reactor Inspector, RV

II. SUMMARY OF RESULTS

A. Overview

The licensee's overall performance level during this assessment period was good or superior in all areas. Examples of superior performance were demonstrated by relatively event-free operation, low occupational radiation exposure, awareness and training of personnel to minimize safety risks during outages, prompt and aggressive response to indications of cracking in feedwater piping nozzles, and aggressive and well focused insight into performance weaknesses by the Onsite Safety Review Group.

The strengths observed in the Operations, Radiological Controls, Engineering/Technical Support, Emergency Preparedness, and Safety Assessment/Quality Verification functional areas resulted in these areas being rated as Category 1. The board noted in the functional area of Maintenance/Surveillance that early in the SALP period there were a few problems involving prompt problem identification and resolution, and engineering involvement in maintenance issues. The board concluded, however, that the overall performance was superior based on strong corrective actions and very high quality performance throughout the remainder of the period.

While strengths were noted in the security area, security management did not appear to have conducted an adequately broad examination of their activities to assure a high standard of performance throughout the organization. The board discussed NRC-identified problems at length, particularly in comparison with the high level of performance seen in most of the security organization. While corrective actions were taken for specific problems identified by the NRC, it appeared that the requirements of the security organization had not been implemented with a consistent level of assurance of quality. Although management appeared to have corrected weaknesses noted during the previous SALP period, weak management involvement in maintaining high quality in all security program areas detracted from otherwise superior performance in this area.

B. Results of Board Assessment

Overall, the SALP Board found the performance of NRC licensed activities to be very effective and directed toward safe operation of Diablo Canyon. The SALP Board has made specific recommendations in most functional areas for licensee management consideration. The results of the Board's assessment of the licensee's performance in each functional area, along with the results from the previous period, are as follows:

Functional Area	Rating Last Period	Trend	Rating This Period	Trend
A. Plant Operations	1		1	
B. Radiological Controls	1		1	
C. Maintenance/Surveillance	2		1	
D. Emergency Preparedness	2		1	
E. Security	2	Improving	2	Improving

F. Engineering/Technical Support	1	1
G. Safety Assessment/ Quality Verification	1	1

III. PERFORMANCE ANALYSIS

The following is the Board's assessment of the licensee's performance in each of the functional areas, along with the Board's conclusion for each area and its recommendations with respect to licensee actions and management emphasis.

A. Plant Operations

1. Analysis

During the assessment period, the resident inspectors conducted frequent inspections involving observation of operations activities. Some engineering section and project inspector inspections also evaluated operations activities. Review of operations activities accounted for about 34 percent of the total inspection effort.

The last SALP assessment rated the licensee's performance in this area Category 1. Strengths were noted in relatively event-free operation, and in superior operator response to plant transients. Operations exhibited significant strength in conservative operational decisions. The previous SALP Board also noted weaknesses in occasional lack of timeliness in identifying and resolving problems and in issuing operability determinations.

During this SALP assessment period, the licensee continued to show superior performance in this area. Strengths were observed in the general high quality of the Operations staff's performance, and in relatively event-free and uncomplicated operations. Management involvement has been frequent and probing, assuring timeliness in identifying and resolving problems and in making operability determinations. Operations management has set high performance standards which have usually been met or exceeded.

Recovery from each event, regardless of cause, and the subsequent root cause investigation indicated significant strengths. This was due in part to a high level of skill and sense of ownership among the Operations staff, and to intensive management involvement at all levels of the organization.

During operations at power and during outages, the Operations staff showed strong awareness of overall plant safety system availability and the significance of evolutions relative to the risk to the plant. This appeared to have been a direct result of aggressive management commitment to plant safety and risk reductions. The licensee developed and implemented a comprehensive and effective outage plan that appropriately considered risk associated with plant shutdown evolutions. Operations staffing levels appeared to be appropriate, and operations staff qualifications were strong.

Other examples of significant strengths were as follows:

- Active Operations involvement with maintenance crews near sensitive equipment helped to avert events.

- Documentation of operability determinations was strong, timely and consistent. Also, a very low threshold was established for the level of equipment degradation which required an operability evaluation.

- Operations simulator training was challenging and effective, and critiques appeared to be appropriately critical and probing.

- Toward the end of the SALP period, Operations personnel were progressively more alert to anomalous plant conditions. For example, an operator's observation and followup of a failed fastener resulted in identification and repair of a degraded neutral connector to a main transformer, potentially averting a plant trip.

During this SALP period, two severity Level IV violations occurred in this area. One was a repeat violation, for operation in Modes 2 and 3 with one of two reactor cavity sump wide range level channels inoperable. The other violation involved inadequate instructions to operators for avoiding excessive piping vibration on loss of speed control to the positive displacement charging pump. Neither had an impact on safe plant operation, and each of these instances was promptly corrected.

During the first part of the SALP period, a few Licensee Event Reports (LERs) were issued as a result of personnel errors. Although this was not an unusually high rate, the concern was that it indicated an increasing trend. The personnel error rate was reduced later in the assessment period as a result of strong management involvement.

Four isolated instances of minor weakness were observed, either in following procedures or in coordination with other groups. The most significant involved an inadvertent chemical spill, which generated noxious fumes and prompted declaration of an Unusual Event. Another instance occurred as a result of unclear procedures, which allowed a condenser vacuum pump to be started before its seal water isolation valve was opened. This ultimately resulted in a reactor trip. In each of these cases, root cause evaluation and corrective actions were immediate and appeared appropriate.

In summary, the performance of Operations has been strong, and has continued to improve. Weaknesses have been minor, isolated and infrequent, and have been corrected promptly and appropriately.

2. <u>Performance Rating</u>

Performance Assessment: Category 1

3. Recommendations

None

B. Radiological Controls

1. Analysis

Radiological controls inspections during this SALP period found that the licensee continued to be aggressive in assuring quality. Radioactive effluents continued to decrease, and occupational dose was reduced in 1992 despite a demanding outage schedule. A continued strength was the licensee's innovative approaches to improving measures for personnel radiation protection. Minor weaknesses identified, related to radiological posting and labeling, were solved rapidly and thoroughly. Regional inspectors examining this functional area contributed approximately 5 percent of the total inspection effort during this assessment period.

The licensee's radiological controls performance during the previous SALP period was rated Category 1. The previous SALP Board recommended that management continue to fully support site and corporate initiatives for improving performance. The board also recommended added emphasis toward correcting minor weaknesses in controlling personnel contaminations, reducing the backlog of non-Technical Specification radiation monitoring equipment needing calibration, and training dosimetry clerks and radwaste handlers.

During this assessment period, management continued to be proactive in assuring quality. The ALARA awareness program, established to reward outstanding outage performance, continued to be an effective incentive toward meeting rigorous ALARA goals. The 1991 average occupational dose per reactor was 273 person-rem, and for 1992 was 214 person-rem. Liquid effluents continued to decrease. Gaseous effluents were also maintained at a small fraction of the Technical Specification limits.

Management support was evident in the elaborate remote monitoring capabilities used to support steam generator shot peening and eddy current testing during the 1R5 outage. Use of this equipment significantly reduced both the dose received and the radiological risk involved in conducting several complicated, high-dose tasks at once. In addition, corporate involvement and support was evident in continuing efforts associated with a major upgrade of radiation and effluent monitoring equipment.

The licensee's approach to resolving technical issues was conservative and timely, and demonstrated a clear understanding of the issues involved. In September 1992, the licensee voluntarily made a presentation to members of the NRC Region V staff concerning the status of radiation monitoring system upgrades. Detailed alternate monitoring methods had been analyzed, for use during interim periods while system upgrades were being performed, to ensure proper monitor ranges, efficiencies, and sensitivity to airborne radioactivity. Technical

improvements were observed in licensee programs for radwaste classification, the process control program, and radiological environmental monitoring. Technically sound judgment was also in evidence in the licensee's radiological controls preparations for potential high-dose outage tasks, such as steam generator shot peening, steam generator eddy current inspection, and core barrel inspection.

Licensee management support of training was demonstrated by the extensive efforts made in mock-up training prior to the 1R5 outage. The steam generator mock-up included a fully operational shot-peening apparatus. One weakness was observed involving failure to thoroughly train eddy current testing personnel on the impact that shot peening would have on steam generator airborne radioactivity hazards. A Severity Level IV violation was cited for the resulting hazard. The licensee took prompt corrective action to resolve this weakness.

The licensee's other training practices continued to exhibit excellence. Training and qualification programs made a positive contribution to the understanding of radiological controls issues and adherence to procedures. Staff members were kept abreast of industry knowledge and development through extensive participation in offsite owners' group meetings, Electric Power Research Institute (EPRI) conferences, and other opportunities for offsite involvement. An improvement was noticed in the licensee's training of radwaste handlers. Training on the new 10 CFR 20 requirements also continued for appropriate personnel.

The licensee's site and corporate radiological controls and chemistry groups continued to be well staffed. Key positions were generally filled on a priority basis. Authorities and responsibilities, both in the chemistry and radiation protection organizations, were well defined, and resulted in clear communications both within the groups and with other site organizations.

One voluntary Licensee Event Report (LER) was submitted relevant to radiological controls during this assessment period. The LER dealt with overexposures received by contract radiographers, due to personnel error by the radiographers while performing radiography on the licensee's site. Three Severity Level IV violations were identified in this functional area. Two resulted from inadequate posting and labeling, and one involved the failure to implement procedures to control airborne radioactivity from steam generator work. Neither the violations nor the LER indicated a programmatic breakdown of the radiation protection program. The licensee's root cause analyses and corrective actions were prompt and were effectively implemented.

2. Performance Rating

Performance Assessment: Category 1

3. Board Recommendation

None.

C. Maintenance/Surveillance

1. Analysis

During the assessment period, the resident inspectors conducted frequent inspections which included observation of maintenance and surveillance activities. Engineering inspections also evaluated maintenance and surveillance programs. Review of maintenance and surveillance activities accounted for about 10 percent of the total Diablo Canyon inspection effort.

The last SALP assessment rated the licensee's performance in this area Category 2. Strengths were noted in the initiation of a program for trending safety equipment out-of-service time, and in the use of probabilistic risk assessment to evaluate preventive maintenance programs. Weaknesses were noted in a lack of management aggressiveness in dealing with problem areas; occasional failure to follow procedures, resulting in safety significant events; and a tendency for personnel errors due to lack of self-verification. The licensee was encouraged to involve management in timely problem identification and root cause investigation, and to continue to support industry initiatives.

During this assessment period, the licensee generally displayed improved performance in this area. Virtually trouble-free plant operation evidenced a high quality of maintenance work in that no plant events and almost no equipment failures occurred as a result of improper maintenance. Strengths were observed in the general high quality of maintenance and surveillance work. Additionally, a high level of management involvement in scheduling and planning maintenance and surveillance work maximized safety system availability from a probabilistic risk standpoint, both at power and during outages. This resulted in a considerable benefit to plant safety.

Noteworthy strengths were as follows:

- Outage Management: The management of outages was marked by an overriding understanding and emphasis of the probabilistic risk of each job and evolution. Work crews and planners were trained and aware of the safety significance of the jobs and systems on which they worked at every stage of the outage.

- Qualifications: The training and qualification program for Maintenance personnel was strong. Well maintained training facilities and a dedicated training staff were significant factors in good performance, as was the sense of ownership shown by Maintenance personnel.

- Plant Safety: Maintenance personnel were trained and informed regarding overall plant safety system availability and the significance of their individually assigned work relative to its risk to the plant.

- Prioritization of Work: Outstanding work items were well prioritized, with safety-significant issues given high priority. The backlog of non-outage safety related work items was low.

- Root Cause Investigations: The routine involvement and leadership shown by the Plant Maintenance staff in root cause investigations was a significant strength, as was the routine integration of the Maintenance, Operations, and Engineering staffs in maintenance and surveillance operations.

- Reduction of Personnel Errors: A relatively high number of personnel errors were observed at the beginning of the SALP period. Several of these errors resulted in conditions which prompted a Licensee Event Report or Non-conformance Report. This number was reduced by about half during the remainder of the period due to a high level of management involvement throughout the organization.

- Response to Problems: Overall, the maintenance staff improved their response to problems by identifying, analyzing and correcting maintenance and surveillance problems promptly. This represented an improvement over the last assessment period. Examples of this improvement were the identification and correction of an incorrect reactor coolant system leakage surveillance; prompt, in-depth evaluation and compensatory action for problems with auxiliary feedwater pump steam admission valve FCV-95; and improvement of the clarity of some instrumentation and control surveillances.

Four Level IV violations were cited in this area, involving improper maintenance of containment fan cooler unit (CFCU) backdraft dampers, failure to perform a containment airlock surveillance, failure to identify inconsistencies in a pump vibration measurement procedure by writing an action request, and improper rigging of a cask. In some cases, as illustrated by the inoperable containment fan cooler unit backdraft dampers, Engineering involvement should have been more timely. Improper maintenance of CFCU dampers was significant in that the dampers were not functional, and only after additional analysis did the licensee determine that the CFCUs had been operable despite the improper maintenance. These concerns appear to have been isolated, although the CFCU issue was potentially significant to safety.

Other weaknesses were also observed. One example was the improper tightening of setscrews on some motor operated valve actuators, resulting in a common mode failure vulnerability. Additional, less significant weaknesses were observed. Most were identified by the licensee immediately upon occurrence. Management involvement was effective, and identified problems were promptly and appropriately corrected. Most of these examples occurred early in the SALP period. Since that time, significant improvement has been noted.

2. Performance Rating

Performance Assessment: Category 1

3. Board Recommendations

The Board encourages continued intrusive Engineering involvement in maintenance and surveillance issues, and focused management involvement to ensure continued low levels of personnel errors.

D. Emergency Preparedness

1. Analysis

Two routine emergency preparedness (EP) inspections and two annual emergency exercise team inspections were conducted during this assessment period. Review of the EP program accounted for approximately 6 percent of the Diablo Canyon inspection effort. A strength identified during the current assessment period was in making timely and appropriate classifications during most actual emergency events, exercises and drills. A weakness was noted regarding the making of protective action recommendations (PARs) to offsite agencies during the 1991 annual emergency exercise. Generally, licensee performance in the EP area appears to have improved over the assessment period.

The licensee's EP performance in the last SALP cycle was rated Category 2. The SALP board at that time indicated several recommendations: that management ensure the establishment and implementation of an effective corrective action plan for drill and exercise findings; that licensee management evaluate the adequacy of classroom training provided to emergency response personnel and ensure that personnel are given an adequate number of opportunities to practice their assigned tasks during periodic drills; that the additional dose assessment training provided to Control Room personnel continue; that the need to adhere to radiation protection procedures under simulated emergency conditions also be stressed during classroom training and drills; that administrative procedures be enhanced to ensure that drills and exercises consistently meet emergency plan requirements; and that simulation of sample collection during drills and exercises be avoided to enhance realism and increase the training value.

During the current assessment period, licensee management appeared actively involved in EP activities and demonstrated support by providing the necessary resources to the EP staff. Management took interest in correcting problems and responding to NRC findings which indicated a need for corrective action. During the assessment period, the licensee worked closely with the state, local county governments, and FEMA in resolving issues in offsite preparedness planning. Each of the recommendations from the previous SALP Board was addressed by the licensee during this assessment period. Corrective actions were evaluated by the NRC during routine inspections and observation of the two annual exercises, and improvement was noted in each area. Dose assessment and projection, in particular, were noted as strengths in response facilities during the 1991 and 1992 annual emergency exercises.

Licensee management's approach to the resolution of technical issues appeared generally timely and thorough. During the assessment

period, the licensee significantly upgraded the emergency warning siren system. The new primary system was completed, tested and turned over to the county with 100 percent activation in September 1992. The upgrade provided several new capabilities such as an activation system which allows selective sounding of individual or groups of sirens as opposed to the entire system, and a siren feedback system which provides input to the county when a "runaway siren" sounds without intended activation.

One EP exercise weakness was identified during the 1991 annual emergency exercise. The licensee's system for providing Protective Action Recommendations (PARs) appeared excessively complicated and caused delay in the issuance of PARs. The system was not based solely on plant conditions as would be appropriate, but included coordination of PARs with offsite agencies. This delayed and possibly biased the licensee's decision making. The appropriate emergency plan implementing procedure (EPIP) was revised to insure licensee independence in PAR decision making and was validated through training, drills and exercises. The system appeared to have been effectively implemented during the 1992 annual exercise.

There were no enforcement actions in the EP area during the assessment period. Notifications to the NRC and offsite agencies were consistent with regulatory requirements. The licensee reported nine unusual events to the NRC during the assessment period, including three earthquakes detected at the site. The other events were a reactor coolant system (RCS) leak, a grass and brush fire near the site, a turbine stop valve failure, a sulfuric acid spill, radiation overexposure of two contractor employees, and a temporary loss of communications with the California Office of Emergency Services. All events appear to have been properly identified and analyzed in accordance with regulatory requirements.

EP staffing was an apparent strength, and staff members appeared conscientious toward accomplishment of their assigned duties. No significant changes occurred in the composition of the emergency response organization (ERO) during the assessment period. The licensee had a system to ensure that new ERO personnel were properly trained prior to assignment to emergency organization positions. EP staff and emergency response positions were clearly identified; authorities and responsibilities appeared clearly defined; and key positions were filled as appropriate. Decision-making authority appeared properly delegated to ensure quick identification of and response to problems and changes. Emergency facilities continued to be appropriately maintained and appeared ready for rapid activation. The licensee provided adequate levels of dedicated staff to implement the programs and to interact appropriately with offsite agencies.

During the assessment period, the licensee implemented what appeared to be a substantial change to the EP training program. Previously, the site and corporate headquarters had separate EP training programs and responsibilities. The company-wide responsibility for EP training management and accomplishment was shifted entirely to the site. A system was established to ensure that required training is

conducted and that training due dates are not exceeded, by linking accomplishment of EP training requirements to unescorted access privileges. To supplement and reinforce routine annual training, a program of monthly integrated drills was conducted.

2. Performance Rating

Performance Assessment: Category 1

3. Board Recommendations

The licensee should strive to maintain a consistent level of management oversight to continue and improve on the program quality achieved during this assessment period.

E. Security

1. Analysis

During this SALP period, approximately 4 percent of direct inspection effort was applied to the licensee's physical security and fitness for duty programs. In addition to region based inspections, the resident inspectors also monitored implementation of this program as part of their routine inspection activities.

The previous SALP report rated the licensee's performance Category 2, Improving, for Security. Primary weaknesses identified in that report focused on personnel access control to vital areas and failures of compensatory security measures. These weaknesses were significantly reduced during the current assessment period. In the previous SALP report, the Board encouraged the licensee to resolve a longstanding weakness in the CCTV alarm assessment capability, initially identified during a 1986 Regulatory Effectiveness Review. A significant equipment upgrade to incorporate a video capture system was installed during the current assessment period and has largely eliminated this weakness. Some minor limitations remain with the video capture system and the licensee is actively exploring further equipment and/or procedural improvements.

The licensee's performance in the areas of physical security and fitness for duty appeared, on the basis of inspections conducted, event reports, and other observations and analysis, to be good in all assessment areas. Both program strengths (vital area barriers and armed response) and weaknesses (effectiveness of the audit program and the number of pending requests for security equipment modification or maintenance) have been noted during the assessment period.

Principal strengths in the licensee's security and fitness for duty programs included control of access to vital areas, the use of roving patrols dedicated to armed response (carrying carbines or shotguns, as appropriate, as well as side arms), and the availability of Employee Assistance Programs for contractor employees. A major program upgrade to establish a search train at the intake structure protected area was completed during the assessment period.

A principal program weakness was noted concerning the number of cited and non-cited violations that could have been identified and corrected by a stronger audit program. This indicated a need for increased management attention to upgrade the audit program and make it more effective.

Although the licensee has been aware of a large backlog of action requests for maintenance or modification to security equipment, little progress was seen in addressing this concern. This was also seen as a program weakness. Discounting action requests of an administrative nature or otherwise having no direct effect on security activities, approximately 90 requests were identified as being more than 90 days old, nearly half of which were more than a year old. A more effective audit program could have identified this weakness. This further demonstrated the need for increased management attention.

One Licensee Event Report dealing with safeguards matters (requiring prompt reporting pursuant to 10 CFR 73.71) was issued and adequately resolved during the SALP period. This report dealt with failure of circuit boards in the alarm annunciation system, and prompted a full replacement of the obsolescent components which is scheduled to be completed in the near future. However, technical issues discussed in two reports issued in January and December 1990, and dealing with backup power to communications equipment and vital equipment protected by compensatory measures, respectively, remain to be resolved.

Enforcement actions during the assessment period included four violations, which were resolved by appropriate corrective actions: one each related to access control at the main and intake structure protected areas, one violation related to protection of Safeguards Information, and one violation related to urinalysis testing of fitness for duty program personnel. Two weaknesses related to fitness for duty and four non-cited violations dealing with vital area access control, communications, lighting, and protection of Safeguards Information were promptly corrected by the licensee.

The licensee's loggable safeguards events were promptly and completely reviewed and reported as required. The root cause and trend analyses of these events determined that most of the events were related to aging equipment scheduled for replacement by major hardware upgrades then underway. The frequency of occurrence has exhibited a decreasing trend as those projects have been completed.

Licensee staffing appeared effective in most areas, although the identified long delays in resolving security related action requests may indicate a need for additional senior management support. Key positions have been identified and responsibilities are well defined. Decision making authority appears properly assigned to ensure prompt identification and response to program challenges. During the current assessment period, management implemented team development workshops for all staff. This training showed significant promise in improving staff communications and cohesiveness.

The licensee's guard training and qualification program was well defined and implemented with dedicated resources. During this SALP period, the licensee initiated sophisticated contingency drills incorporating diversionary tactics and covert penetrations.

2. Performance Rating

Performance assessment: Category 2, Improving

3. Board Recommendation

Licensee management is encouraged to more effectively identify and address weak areas. More attention should be given to improving the effectiveness of the audit program and to reducing the number and age of outstanding maintenance requests.

F. Engineering/Technical Support

1. Analysis

During the assessment period, NRC regional and Headquarters inspectors conducted a total of twelve inspections. Two of these inspections were team inspections which addressed motor operated valves and shutdown risk management. The other inspections involved facility modifications, design changes, inservice inspection and testing, erosion/corrosion monitoring, eddy current testing of steam generator tubes, and procurement of a new emergency diesel generator. The resident and project inspectors also conducted inspections in this area. Review of Engineering and Technical Support activities accounted for approximately 15 percent of the total Diablo Canyon inspection effort.

The last SALP assessment rated the licensee's performance in this functional area Category 1. Improvements were recognized in Engineering involvement in plant operations and modification work, design basis reviews, setpoint reverification, vendor interface, personnel qualification and training. A particular strength was found in the commercial grade dedication program. Some weaknesses were noted in incomplete technical work and untimely identification and resolution of problems due to a weak sense of ownership of plant problems. The Board recommended that the licensee provide emphasis on early identification, effective engineering involvement, and timely and thorough correction of plant problems. The licensee was encouraged to continue building a strong interface between corporate and plant engineering groups, with corporate engineering taking a leadership role in the resolution of plant problems. Continuation of innovative corporate engineering training programs was specifically encouraged.

During this SALP assessment period, the licensee showed continued high quality performance in this functional area. Strengths were observed in a generally aggressive and thorough engineering attitude in resolving technical problems, an extensive erosion/corrosion monitoring program, eddy current testing of steam generator tubes, assessment of probabilistic risks to the shutdown plant, and overall

engineering involvement in plant operational activities. The NRR staff observed excellent quality in the technical content and presentation of licensee submittals, which included documents in support of license amendment requests, corrective actions regarding operations and Licensee Event Reports, and responses to NRC bulletins and generic letters. Improvements were observed in timely problem identification, engineering involvement, and problem ownership. Minor weaknesses were noted related to procurement of the new emergency diesel generator (EDG) and certain inservice inspection and testing activities.

Engineering involvement in resolving safety issues was generally timely. The most significant exception was Engineering's assessment of problems with containment fan cooler unit (CFCU) backdraft dampers in early 1992. Additionally, resolution of Regulatory Guide 1.97 issues was delayed by inadequate tracking of engineering actions, but the licensee later identified this weakness and pursued resolution in an aggressive manner. Substantial improvement was displayed later in the SALP period in Engineering's timely resolution of CFCU damper blade cracking.

Strong Engineering performance and initiative were evidenced in Engineering's evaluation of setscrew loosening on motor operated valve (MOV) actuators and the licensee's decision to examine the steam generator feedwater nozzles in response to problems observed at another facility. The feedwater nozzle examinations were extensive and used state-of-the-art techniques. The Engineering staff's assessment of crack indications in both feedwater piping and in a safety injection tank penetration resulted in a conservative decision to replace affected piping segments.

Proactive Engineering involvement was observed in the development of an extensive erosion/corrosion monitoring program. Despite extensive involvement with the industry in the development of predictive analytical computer programs, poor correlation between the quantitative predictions and measured wear rates had been experienced by the licensee. The licensee's program exhibited a defense-in-depth approach to compensate for recognized limitations in the state of the art. Although a program weakness in the measurement of pipe wall thickness was noted, strong engineering ownership of the program compensated for this minor weakness.

Throughout the SALP review period, the licensee demonstrated an aggressive engineering attitude in technical problem resolution. For example, the licensee instituted a supplemental program that is the first surveillance program in a U. S. commercially operated reactor vessel to investigate the effect of annealing and reirradiation on its reactor vessel beltline materials.

Another example of aggressive engineering was resolution of the long-term seismic program. The licensee performed a detailed analysis to demonstrate that adequate seismic margins exist for the structures and equipment which could be affected by increased ground motion in certain frequency ranges at the Diablo Canyon site.

The licensee also developed and implemented an effective outage risk assessment plan which was found superior to other plants which were inspected. The technical support provided for the outage risk assessment plan was excellent.

The engineering program developed for eddy current testing (ECT) of steam generator tubes was observed to be a high quality program incorporating current technology and industry guidance. However, a weakness was noted in that engineering guidelines for ECT data analysis and defect acceptance criteria, although adequate, were not controlled through the use of formal plant procedures.

Specific strengths noted in engineering activities were as follows:

- The motor operated valve (MOV) program was found to be aggressive and conducted in a well integrated manner. A minor weakness was identified in the lack of timely determination of operability following testing, due to the complexity of the engineering evaluation required to evaluate the test data.

- A strong safety perspective was evident in the development of engineering programs to resolve emerging technical issues. The programs were implemented with priority on safety significance.

- Quality assurance involvement was evident in the implementation of engineering programs.

- Design change packages for the installation of a new emergency diesel generator were generally thorough and complete, although minor housekeeping and cleanliness deficiencies were observed.

Four Severity Level IV violations, one Level V violation and one non-cited violation were identified. The violations were minor in nature and did not evidence programmatic breakdowns.

The low number of engineers and lack of clear goals for the plant's System Engineering staff was a concern earlier in the SALP period. The licensee has since increased the staff and clarified the goals for this group, and some improvement has been observed.

The commercial grade dedication of the sixth emergency diesel generator (EDG) presented unique challenges to the licensee's engineering and procurement activities. The Region and NRR Vendor Branch identified weaknesses in the quality of the procurement and commercial grade dedication of the new emergency diesel generator. However, the licensee's root cause investigation was candid and thorough. Also, although most problems encountered during testing of the sixth EDG were found to have been documented and resolved, the test program did not require formal documentation of problems. This weakness was promptly corrected after identification by the NRC.

Inservice inspection and testing activities were found to comply with approved programs. Observed deficiencies in personnel qualifications

and procedural adherence indicated minor weaknesses in the inservice inspection program.

In conclusion, Engineering and Technical Support demonstrated high quality, with continued strong performance. Some weaknesses were observed, but these were minor in that they appeared isolated, of low significance, and were promptly and appropriately corrected.

2. Performance Rating

Performance Assessment: Category 1

3. Board Recommendation

The Board recommends that licensee management provide continued support for the development and long term integration of proactive engineering programs.

G. Safety Assessment/Quality Verification

1. Analysis

Evaluation of this area was based on both region-based and resident inspections. Review of Safety Assessment/Quality Verification activities accounted for about 26 percent of the total Diablo Canyon inspection effort.

The last SALP assessment rated the licensee's performance in this area Category 1. Strengths were noted in the implementati:n of Event Investigation Teams (EITs). Weaknesses were noted in resolving problems in a timely manner and in occasional lack of management aggressiveness in dealing with problem areas. The licensee was encouraged to provide more management involvement in timely problem identification and root cause investigation, particularly in the area of repeat problems.

During this SALP assessment period, the licensee generally showed improved performance in this area. Management was more aggressive and timely in dealing with problems than during the previous period, and Safety Assessment/Quality Verification performance by line and quality organizations showed continued improvement. A weakness was noted in the identification and correction of precursors of potentially significant problems.

A significant strength was the aggressive implementation of programs to improve control of safety system availability during operating and shutdown modes. These programs were implemented at all levels of the licensee's organization. Plant design changes were also implemented to reduce risk, resulting in improved safety performance and safety system availability.

Audits performed by the Quality Assurance organization were generally good. Lack of intrusive involvement by Quality Assurance in problems such as the improper maintenance of the containment fan cooler back-

draft dampers was a weakness. As discussed in Section III.E, a need for more effective audits was also noted in the Security area. In fact, a factor in several of the problems experienced during this SALP period was insufficient QA involvement. Some improvement was observed in the latter portion of the SALP period. Audits required by Technical Specifications were adequate and appropriate. Additional audits performed as Quality Assurance initiatives showed significant technical depth, and identified weaknesses in complex technical areas not typically reviewed by quality organizations. A noteworthy improvement in QA effectiveness was evidenced in the increased use of surveillances, which are brief audits in specific areas of concern. These audits have allowed rapid focus of QA oversight in problem areas, which resulted in more timely management attention, root cause evaluation, and corrective action.

Safety groups continued to be very strong in safety focus and depth of technical assessment. The Onsite Safety Review Group identified problems consistent with issues of higher safety significance. Management support of this group was adequate. The Nuclear Safety Oversight Committee improved during this assessment period as a result of focus on higher level concerns, and the addition of non-licensee members. The Plant Safety Review Committee continued to be very strong, providing significant safety insight and conservative decision making.

Nuclear Operations Support (NOS), which is not by charter a quality oversight group, performed several reviews and audits during this assessment period which were instrumental in identifying and correcting problems in interfaces between licensee organizations. These NOS reviews and audits resulted in several improvements in the overall implementation of plant safety functions.

During this assessment period the NRR staff reviewed a large number of safety analyses performed by the licensee. The licensee's submittals demonstrated a clear understanding of safety issues and a conservative approach to technical problem resolution. The submittals for license amendment requests were technically adequate and generally complete. Also, several of the licensee's submittals contained probabilistic risk assessment (PRA) analyses which were of high quality (the PRA technique requires considerable effort by the licensee, and when properly used, adds to the basis for approving proposed changes). The licensee's replies to NRC generic letters and bulletins were also timely, responsive and of generally high quality.

Throughout the SALP review period, the licensee consistently and systematically addressed operability concerns in an aggressive manner, and made appropriately conservative decisions until each concern was resolved. Licensee management kept the NRC well informed of initial concerns as well as their followup plans for resolution.

An increased number of personnel errors were observed in several functional areas at the beginning of the SALP period. This number was reduced by about half during the remainder of the period as a

result of an effective human performance enhancement program and aggressive management involvement at all levels of the organization.

The licensee's program for assessing industry events was strong. A few vulnerabilities were identified and corrected promptly. Several programs were enhanced as a result of implementation of lessons learned from the industry.

While the licensee typically has been aggressive in problem resolution, there have been isolated examples of insufficient aggressiveness in pursuing safety issues. For example, based on the review of licensing submittals requesting relief regarding pumps and valves, the licensee's approach to the resolution of inservice testing program issues required amplifying information and in some cases were not technically justified.

Five Severity Level IV violations were cited in this area, one for failure to correct reverse rotation of containment fan cooler units, and the others for failure to correct repeated problems of a lower safety significance in various functional areas.

A few weaknesses were observed. For example, in three cases, precursors of plant problems occurred without being identified as such. An example of one of these three instances was an unplanned turbine speed-up event, corrected by operators, which had two precursors which were not identified and corrected. In each case, the more significant problem occurred because the precursor had not been adequately addressed. Another weakness was that the guidelines used to trend root causes of problems were imprecise, in that root causes of problems could be assigned to more than one area.

In conclusion, the performance of the licensee's line organization is very strong in the assessment of safety and assurance of quality. Independent safety groups, although already strong, showed additional strength during this assessment period. The Quality assurance organization's performance was not as strong as the line organizations, but was above an adequate level.

2. <u>Performance Rating</u>

Performance Assessment: Category 1

3. <u>Board Recommendations</u>

The Board recommends continued management involvement in Safety Assessment/Quality Verification activities, and strongly encourages prompt identification of problems, timely corrective action, effective Quality Assurance audits and prevention of repeat problems.

IV. SUPPORTING DATA AND SUMMARIES

A. Licensee Activities

Unit 1

Diablo Canyon Unit 1 entered the assessment period at full power and operated nominally at full power during the SALP period, with occasional brief power curtailments for maintenance and testing activities, except as follows:

On July 5, 1991 an unplanned start of engineered safety features (ESF) equipment occurred when a licensed operator inadvertently actuated the wrong solid state protection system test switch. The control room operators promptly returned all actuated equipment to normal status.

On March 6, 1992 a plant trip occurred due to the loss of main feedwater pump 1-1. The cause of the trip was traced to a faulty fusible link in an inverter. Unit 1 was restarted on March 9, 1992 after a new inverter was installed for feedwater pump 1-1 and fusible links for feedwater pump 1-2 were inspected. Unit 1 reached 100% power on March 10, 1992.

On April 25, 1992, while conducting maintenance on main feedwater pump 1-1, vacuum in the condenser was lost, causing the main turbine and reactor to trip. The primary cause was attributed to inadequate instructions, which allowed a vacuum pump to be started before its seal water isolation valve was opened. Also, condenser vacuum pump suction line check valve CNC-1-747 was observed to leak excessively when the condenser vacuum pump suction valve was opened. Unit 1 was restarted on April 27, 1992 after evaluation of the event and correction of the cause of the trip. Full power was reached on April 28, 1992.

On July 24, 1992, after observing excessive flow noise from main turbine governor valve number 4, the licensee closed the valve, resulting in Unit 1 operating at 98% power.

On September 17, 1992, Unit 1 shut down for a scheduled 63-day refueling outage. The shutdown was complicated by spurious reopening of a main turbine stop valve and two governor valves, which caused the turbine to accelerate from 1100 RPM to 1870 RPM. A few hours later, during the cooldown, reactor coolant system (RCS) pressure rose above the 350 PSI setpoint. The system responded as expected, with the power operated relief valve opening and relieving pressure.

On November 9, 1992, Unit 1 completed its fifth refueling outage. The unit reached 100% power on November 11, 1992.

On December 23, 1992, an operator observed fragments of a fastening device on the ground. Followup investigation revealed a partially melted neutral line connector on a main transformer. The licensee curtailed power to 10% and separated from the grid, fixed the connector and inspected all similar connectors, and returned to 100% power.

Unit 2

Diablo Canyon Unit 2 entered the assessment period at full power and operated nominally at full power during the SALP period, with occasional brief power curtailments for maintenance and testing activities, except as follows:

On August 31, 1991 Unit 2 shut down for its fourth refueling outage about nine days early because of an unisolable leak in the charging system. The leak had been increasing since its discovery on August 13, 1991. The leak had not yet reached its Technical Specification limit at the time of shutdown. Unit 2's shutdown marked 482 days of continuous operation at power, a new world record.

On October 20, 1991, Unit 2 achieved criticality, marking the shortest refueling outage in Diablo Canyon history. Full power was reached on October 31, 1991.

On February 16, 1992, during a power curtailment to 50% for condenser cleaning, the Unit 2 reactor experienced an exaggerated quadrant power tilt ratio as a result of slightly different efficiencies of the secondary loops. The licensee decreased power below 50%, the level below which the quadrant power tilt action statement does not apply. The licensee also entered the action statement, as a conservative measure. During curtailment operations, the power tilt decreased due to xenon burnup, and did not recur until the following curtailment below 50% power for condenser cleaning on March 14, 1992. During this occurrence, the licensee repeated the earlier process, and entered the action statement. Upon power ascension, the power tilt decreased to normal, and the licensee exited the action statement.

On March 23, 1992, Unit 2 was shut down to investigate a failed turbine stop valve. The licensee disassembled the failed stop valve and found that the nut which secures the valve disk to the swing arm had disengaged, allowing the disk to separate and partially block main steam lead number 2. Unit 2 was returned to power on March 28, 1992 after the failed turbine stop valve was repaired and the other three Unit 2 turbine stop valves were verified to be properly assembled.

B. Inspection Activities

Fifty routine and special inspections were conducted during this assessment period (July 1991 through December 1992), as listed below.

1. Inspection Data

Inspection reports: 91-20, 91-22, 91-24 through 91-27, 91-29, 91-31, 91-32, 91-34 through 91-41, and 92-01 through 92-33. Six of these reports documented management meetings and one documented an enforcement conference.

2. Special Inspection Summary

Special inspections included the following:

91-39 October 21 - November 29, 1991: A review of the licensee's Generic Letter 89-10 program for safety related motor operated valves

92-09 March 10 - March 17, 1992: Review of the licensee's procurement activities for the 6th emergency diesel generator

92-17 March 17 - April 27, 1992: Review of the licensee's maintenance and inspection activities for the containment fan cooler units (CFCUs), as well as licensee operability assessments for the CFCUs

92-201 August 24 - October 30, 1992: Shutdown Risk Team Inspection

C. Enforcement Activity

Inspections during this period identified 19 cited violations. Of these, 18 were Severity Level IV and 1 was Severity Level V. No deviations were identified during this period.

D. Confirmatory Action Letters

None.

E. Licensee Event Reports

Unit 1 LERs

Unit 1 issued 40 LERs during this reporting period. The LERs were 83-39, 91-011 through 91-021, and 92-001 through 92-028. LERs 91-021, 92-003, 92-006, 92-010, 92-015, 92-016, and 92-022 were voluntary.

Unit 2 LERs

Unit 2 issued 18 LERs during this reporting period. The LERs were 91-001 through 91-012 and 92-001 through 92-006. LERs 91-002 and 91-008 were voluntary.

50-275/323-OLA

August 2, 1993

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of: Pacific Gas and Electric Company (Diablo Canyon Nuclear Power Plant, Units 1 and 2)	Docket Nos. 50-275-OLA 50-323-OLA (Construction Period Recovery)

TESTIMONY OF PACIFIC GAS AND ELECTRIC COMPANY
ADDRESSING CONTENTION I: MAINTENANCE AND SURVEILLANCE

PART 1: Bryant W. Giffin, William G. Crockett, Steve R. Ortore, David A. Vosburg

PART 2: Tedd A. Dillard

PART 3: Bryant W. Giffin, David B. Miklush

NUCLEAR REGULATORY COMMISSION

Docket No. 50-275-OLA Official Exh. No. ____
In the matter of PACIFIC GAS and ELECTRIC Co.
Staff ____ IDENTIFIED ✓
Applicant ✓ RECEIVED ✓
Intervenor ____ REJECTED ____
Cont's Off'r ____
Contractor Ann Riley & Assoc. DATE 8-17-93
Other ____ Witness ____
Reporter Dollie Feigel

TABLE OF CONTENTS

GLOSSARY

ACRONYM	DEFINITION
AFR	Audit Finding Report
AFW	Auxiliary feed water
ALARA	as low as reasonably achievable
ANS	American Nuclear Society
ANSI	American National Standards Institure
AR	Action Report
ASME B&PV	American Society of Mechanical Engineers Boiler and Pressure Vessel
BOP	Balance-of-Plant
CCPs	Centrifugal Charging Pumps
CFCU	Containment Fan Cooler Unit
CHUG	EPRI Erosion/corrosion users group
DCPP	Diablo Canyon Power Plant
E/C	Erosion/Corrosion
EDGs	Emergency Diesel Generators
EH	electro-hydraulic
EMF	Engineering Manager's Forum
EPRI	Electric Power Research Institute
EQ	Environmental Qualification
FHB	Fuel Handling Building
FME	Foreign Material Exclusion
FSAR	Final Safety Analysis Report
GVs	Governor Valves
HIT	High Impact Team
HPSI	High pressure safety injection
I&C	Instrumentation and Controls
IEEE	Institute of Electrical and Electronics Engineers
INPO	Institute for Nuclear Power Operations
IR	Inspection Report
ISI	Inservice Inspection
IST	Inservice Testing
LCM	Life Cycle Management
M&TE	Measurement and Test Equipment
MFP	San Luis Obispo Mothers for Peace
MM	Mechanical Maintenance
MOV	Motor Operated Valve
MQAs	Maintenance Quality Assessments
MVT	Modification Verification Tests
NCRs	Non Conformance Reports
NOV	Notice of Violation
NPG	Nuclear Power Generation Business Unit (PG&E)
NPRDS	Nuclear Plant Reliability Data System
NRC	Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
NUREG	Nuclear Regulatory Reports
OSRG	Onsite Safety Review Group

ACRONYM	DEFINITION
OVT	Operability Verification Tests
PDPs	Positive Displacement Pumps
PG&E	Pacific Gas and Electric Company
PIMS	Plant Information Management System
PM	Preventive Maintenance
PMT	post-modification testing
PSRC	Plant Staff Review Committee
PTS	Pressurized Thermal Shock
QA	Quality Assurance
QC	Quality Control
QEs	Quality Evaluations
RCM	reliability centered maintenance
RHR	Residual Heat Removal
RMS	Radiation Monitoring System
RPE	replacement part evaluation
RTD	resistance temperature detector
RVRLIS	Reactor Vessel Refueling Level Indication System
SALP	Systematic Assessment of Licensee Performance
SPDS	Safety Parameter Display System
SSCs	structures, systems and components
STP	surveillance test procedures
SVs	stop valves
TRG	Technical Review Group
WO	work order

GLOSSARY

ACRONYM	DEFINITION
AFR	Audit Finding Report
AFW	Auxiliary feed water
ALARA	as low as reasonably achievable
ANS	American Nuclear Society
ANSI	American National Standards Institure
AR	Action Report
ASME B&PV	American Society of Mechanical Engineers Boiler and Pressure Vessel
BOP	Balance-of-Plant
CCPs	Centrifugal Charging Pumps
CFCU	Containment Fan Cooler Unit
CHUG	EPRI Erosion/corrosion users group
DCPP	Diablo Canyon Power Plant
E/C	Erosion/Corrosion
EDGs	Emergency Diesel Generators
EH	electro-hydraulic
EMF	Engineering Manager's Forum
EPRI	Electric Power Research Institute
EQ	Environmental Qualification
FHB	Fuel Handling Building
FME	Foreign Material Exclusion
FSAR	Final Safety Analysis Report
GVs	Governor Valves
HIT	High Impact Team
HPSI	High pressure safety injection
I&C	Instrumentation and Controls
IEEE	Institute of Electrical and Electronics Engineers
INPO	Institute for Nuclear Power Operations
IR	Inspection Report
ISI	Inservice Inspection
IST	Inservice Testing
LCM	Life Cycle Management
M&TE	Measurement and Test Equipment
MFP	San Luis Obispo Mothers for Peace
MM	Mechanical Maintenance
MOV	Motor Operated Valve
MQAs	Maintenance Quality Assessments
MVT	Modification Verification Tests
NCRs	Non Conformance Reports
NOV	Notice of Violation
NPG	Nuclear Power Generation Business Unit (PG&E)
NPRDS	Nuclear Plant Reliability Data System
NRC	Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
NUREG	Nuclear Regulatory Reports
OSRG	Onsite Safety Review Group

ACRONYM	DEFINITION
OVT	Operability Verification Tests
PDPs	Positive Displacement Pumps
PG&E	Pacific Gas and Electric Company
PIMS	Plant Information Management System
PM	Preventive Maintenance
PMT	post-modification testing
PSRC	Plant Staff Review Committee
PTS	Pressurized Thermal Shock
QA	Quality Assurance
QC	Quality Control
QEs	Quality Evaluations
RCM	reliability centered maintenance
RHR	Residual Heat Removal
RMS	Radiation Monitoring System
RPE	replacement part evaluation
RTD	resistance temperature detector
RVRLIS	Reactor Vessel Refueling Level Indication System
SALP	Systematic Assessment of Licensee Performance
SPDS	Safety Parameter Display System
SSCs	structures, systems and components
STP	surveillance test procedures
SVs	stop valves
TRG	Technical Review Group
WO	work order

August 2, 1993

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of: Pacific Gas and Electric Company (Diablo Canyon Nuclear Power Plant, Units 1 and 2)	Docket Nos. 50-275-OLA 50-323-OLA (Construction Period Recovery)

TESTIMONY OF PACIFIC GAS AND ELECTRIC COMPANY
ADDRESSING CONTENTION I: MAINTENANCE AND SURVEILLANCE

PART 1: Bryant W. Giffin, William G. Crockett, Steve R. Ortore, David A. Vosburg

August 2, 1993

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of: Pacific Gas and Electric Company (Diablo Canyon Nuclear Power Plant, Units 1 and 2)	Docket Nos. 50-275-OLA 50-323-OLA (Construction Period Recovery)

TESTIMONY OF PACIFIC GAS AND ELECTRIC COMPANY
ADDRESSING CONTENTION I: MAINTENANCE AND SURVEILLANCE

I. INTRODUCTION

Q1 Please state your name, affiliation, qualifications and current job responsibilities.

A1 (Giffin) My name is Bryant W. Giffin. I am the Manager of Maintenance Services for Pacific Gas and Electric Company ("PG&E") at the Diablo Canyon Power Plant ("DCPP"). I am responsible for all maintenance and outage activities at DCPP. I have more than 25 years experience working in the nuclear industry; 12 years with PG&E and over 13 years as an officer in the United States Navy's nuclear power program. A summary of my professional qualifications and experience is provided in Exhibit 1.

(Crockett) My name is William G. Crockett. I am the Manager of Technical and Support Services for PG&E at DCPP. I am responsible for Engineering Support, including

System Engineering, Plant Engineering, Training, Security, and General Services. I oversee the development and evaluation of the DCPP surveillance testing program. I am the primary site interface with the Design Engineering section of the Nuclear Engineering Services Department, with PG&E's Computer Services Department, and with the Nuclear Regulatory Services Department. I have 16 years of nuclear power experience in operations, maintenance, and engineering, including 14 years at DCPP. I hold a Senior Reactor Operators ("SRO") license (inactive) for both units at DCPP. A summary of my professional qualifications and experience is provided in Exhibit 2.

(Vosburg) My name is David A. Vosburg. I am Director of the Work Planning Section in the Maintenance Services Department at DCPP. I am responsible for maintenance planning activities and for scheduling of maintenance, post-maintenance testing, and plant modification activities during normal and outage conditions. I have 16 years experience in the nuclear power industry, including 13 years at DCPP. In my 13 years at DCPP, I have worked in the Operations, Engineering, and Maintenance Departments. I maintained an SRO license for DCPP from 1982 to 1992. A summary of my professional qualifications and experience is provided in Exhibit 3.

(Ortore) My name is Steven R. Ortore. I am the Director of the Electrical Maintenance Section in the Maintenance Services Department at DCPP. I am responsible for maintenance of all electrical equipment at the plant.

I was formerly the Director of Material Services at DCPP, which included responsibility for procurement. I have 19 years of experience in the nuclear industry, of which 9 years have been at DCPP. A summary of my professional qualifications and experience is provided in Exhibit 4.

Q2 **What contention will the panel address?**

A2 (All) We will address the San Luis Obispo Mothers for Peace ("MFP") Contention I: Maintenance and Surveillance. MFP in the contention alleges that PG&E lacks a sufficiently effective and comprehensive maintenance and surveillance program to justify the operating license amendment here at issue. That amendment would extend the DCPP Unit 1 and Unit 2 operating licenses to the full 40-year term that was assumed in the original plant design. A copy of PG&E's license amendment application is provided as Exhibit 5.

Q3 **What is the purpose of your testimony?**

A3 (All) The purpose of our testimony is to provide a response to the above contention. This testimony will demonstrate that PG&E has implemented a comprehensive maintenance and surveillance program at DCPP. Maintenance and surveillance activities at DCPP address degradation of equipment, whether due to equipment aging or service wear, that has been experienced to date or that

is expected over a 40-year plant operating lifetime. This specifically includes any pre-operational equipment degradation. Contrary to MFP's claims, PG&E has implemented its maintenance and surveillance programs in an effective, and often outstanding, manner. PG&E recognizes the importance of maintenance and surveillance to efficient, reliable, and safe operation. PG&E has devoted considerable attention to this area and will continue to do so for the full 40 years of operation to be authorized by the proposed license amendment.

II. <u>OVERVIEW</u>

Q4 **What is the definition of "maintenance" as the term is used in your testimony?**

A4 (All) Maintenance as used in this testimony includes: those activities which are performed to assure that structures, systems and components ("SSCs") will continue to operate as designed, as well as those activities necessary to repair or replace SSCs that are degraded or cannot perform the intended function. Maintenance is considered to be the aggregate of actions at DCPP that (1) minimizes the degradation or failure of SSCs, and (2) promptly restores the intended function of SSCs if they experience operability or functional problems.

Q5 What is the definition of "surveillance" as used in your testimony?

A5 (All) Surveillance as used in this testimony is the aggregate of periodic tests and/or inspections that verify that SSCs continue to function in accordance with predetermined specifications or are in a state of readiness to perform their particular safety functions. Surveillance activities can trigger maintenance activities based upon the results of the particular tests or inspections.

Q6 What is the scope of issues raised in the contention and addressed by your testimony?

A6 (All) MFP in Contention I alleges that the maintenance and surveillance programs at DCPP are not comprehensive and effective. Our testimony will demonstrate that the overall maintenance and surveillance programs established at DCPP are comprehensive and effective in assuring the safe and reliable operation of DCPP. The programs meet all established requirements and are effective in identifying and rectifying potential and actual sources of equipment degradation. Moreover, as will be discussed in detail later in this testimony, the individual isolated items cited by MFP as bases for Contention I indicate that, contrary to MFP's claims, our maintenance and

surveillance programs are functioning well and as intended, in a comprehensive and effective manner.

Q7 **How do DCPP maintenance and surveillance programs address "aging" of equipment?**

A7 (Giffin, Crockett) Equipment aging management is a concept that is integral to the overall philosophy of an effective maintenance and surveillance program. PG&E recognizes that SSCs can deteriorate as service life increases due to "age-related degradation." "Age-related degradation," as defined by the Electric Power Research Institute ("EPRI"), is the gradual deterioration in the physical characteristics of an SSC due to aging mechanisms and which occurs with time or use and could impair the ability of the SSC to perform any of its design functions. An "aging mechanism" is a process that gradually changes the physical characteristics of an SSC with time or use. Some examples of aging mechanisms are fatigue, erosion, corrosion, radiation embrittlement, thermal embrittlement, and service wear.

In the case of certain critical components which are subject to complex aging mechanisms (e.g., the reactor vessel and steam generators), or components which may have limited life, special programs have been developed and implemented at DCPP to manage the aging process. These programs are discussed in more detail later in this testimony. For those components where special programs

have not been developed, normal maintenance and surveillance activities provide for and facilitate the management of aging mechanisms. DCPP's maintenance and surveillance programs are designed to (1) minimize deterioration through routine maintenance, (2) predict the rate of deterioration, and (3) detect the deterioration of equipment. Specific maintenance tasks respond to unacceptable SSC conditions either by equipment repair or replacement.

DCPP, like other nuclear power plants, was designed to operate for at least 40 years. In order to assure safe operation, a defense-in-depth philosophy was incorporated into the plant design, the plant operating programs, and the maintenance and surveillance programs. Specifically, design features have been incorporated to provide the ability to test, inspect, and perform preventive maintenance on SSCs. Furthermore, the plant was designed with redundant trains of safety-related equipment to be able to accommodate equipment failures that are random in time or location. The operators are also trained to recognize and respond to equipment problems, and the maintenance programs are established to assure that equipment problems, which are detected through routine surveillance and operating experience, are corrected.

As the NRC has recognized in issuing numerous 40-year operating licenses, and in issuing many license amendments similar to that at issue here, effective and comprehensive maintenance and surveillance programs assure that

detectable aging effects are addressed prior to their becoming a safety issue.

Q8 **What is the relationship between the specific, individual events alleged by MFP in their bases advanced in support of Contention I, and the effectiveness and comprehensiveness of DCPP's maintenance and surveillance program?**

A8 (Giffin) Our testimony will show that the specific examples MFP uses to support its contention that the maintenance and surveillance programs at DCPP are not effective or comprehensive do not, in fact, indicate a breakdown in the overall programs. None of the examples resulted in a situation with safety significance. Some are not maintenance-related and those that are do not prove an inadequacy in program scope or its overall implementation. Some of the examples are simply situations in which the maintenance and surveillance program has worked precisely as intended. In all cases, where specific equipment problems were identified or performance weaknesses were observed, corrective actions have been taken. PG&E believes that the examples cited by MFP illustrate a maintenance program that is working and reflect a strong commitment to continuous improvement.

MFP speculates that weaknesses in maintenance follow from the DCPP rate case settlement and the financial structure for DCPP rates. However, none of the examples

cited by MFP in the basis for Contention I supports this speculation. None of the examples involved delay in necessary corrective actions or repairs. In fact, necessary repairs were made while the plant was operating. Contrary to MFP, there are times when either unit of DCPP is curtailed at PG&E's discretion in order for prudent repairs or inspections to be performed. These curtailments evidence PG&E's commitment to safe operation as the highest goal for DCPP.

Q9 Could you give us a quantitative measure of the magnitude of the maintenance and surveillance program at DCPP?

A9 (Giffin, Vosburg) There are approximately 20,000 work activities which require a work order performed each year at DCPP. This includes 6,000 preventive and 7,000 corrective maintenance tasks. In addition, there are approximately 10,000 surveillances performed each year, 7,000 of which require a work order. Many of these work activities consist of a large number of sequential steps or elements. These are three year averages of the number of work orders performed. It is worth noting that the number of corrective maintenance tasks has decreased steadily for the past three years. In 1990, there were 9,000; in 1992, 6,000; and we estimate fewer than 5,000 this year.

In the context of these numbers, it must be recognized that the design of the plant; the checks and balances inherent in the maintenance and surveillance programs; state of the art tools, test equipment, and facilities; and the training and qualifications of the maintenance personnel all provide assurance that there will be a minimal number of errors made and that when errors are made or equipment degrades, there will be no safety significance.

III. DESCRIPTION OF DCPP MAINTENANCE AND SURVEILLANCE PROGRAMS

Q10 What programs at DCPP are included within the umbrella of "maintenance and surveillance" programs?

A10 (Giffin, Crockett) At DCPP, PG&E has established several programs or activities that addressing topic of maintenance and surveillance of safety-related equipment. These include:

- Technical Specification required surveillances;
- Numerous equipment surveillances not required by the operating license;
- Inservice Inspection ("ISI")/Inservice Testing ("IST") Programs;
- The Environmental Qualification ("EQ") Program; and
- The Maintenance Program.

These activities and programs collectively assure that any significant degradation of plant equipment will be

promptly identified and addressed throughout the proposed 40-year operating license terms.

Technical Specification Surveillances

Q11 **Please describe the role of Technical Specification surveillances?**

A11 (Crockett, Giffin) DCPP Technical Specifications are part of the plant NRC operating license and include numerous requirements for testing and/or assessment of safety-related SSCs. PG&E has adopted a surveillance and testing program in accordance with the industry standard ANSI N18.7-1976/ANS 3.2, "Administrative Controls and Quality Assurance for the Operation Phase of Nuclear Power Plants." In accordance with PG&E procedure NPAP-C3, "Conduct of Plant and Equipment Tests," the DCPP surveillance and testing program administratively controls the surveillance testing required by the Technical Specifications. A computerized master schedule is used to schedule and track the status of Technical Specification surveillance tests and to ensure that these tests are performed at the required intervals.

Over 10,000 Technical Specification-required surveillance tests are performed at DCPP each year. The actual number of SSCs tested is much higher because many surveillances actually test multiple components. If the results of a surveillance test are not within specific operability limits, the SSC is declared inoperable and the

Technical Specifications provisions are invoked. In these cases, PG&E initiates problem investigations and necessary maintenance activities to restore the SSC to its design condition in a timely fashion. Technical Specification surveillance testing provides assurance that safety-related equipment failures or substandard equipment performance will not remain undetected and that the required reliability and state of readiness of SSCs to function in accordance with predetermined specifications is maintained for the life of the plant.

<u>Other Surveillances</u>

Q12 **Are there routine surveillances of SSCs at DCPP other than Technical Specification surveillances?**

A12 (Crockett, Giffin) Yes. In a broad sense, there are many plant activities in addition to Technical Specification-required surveillance test procedures which result in surveillance information about equipment condition and performance. Examples of these activities are:

- Routine operator plant equipment inspections as required by Administrative Procedure DLAP OP1.DC3, "Auxiliary Operator Routine Plant Equipment Inspections;"
- Predictive maintenance program testing (e.g., vibration monitoring, oil analysis, and thermography)

as specified in Administrative Procedure C-751, "Predictive Maintenance Program;"

- Preventive maintenance program inspections (e.g., routine inspections of check valves) as required by Administrative Procedures C-750, "Maintenance Department Preventive Maintenance Program," and C-450, "Instrument and Controls Preventive Maintenance;"
- Procedure functional checks (e.g., turbine trip testing during startup);
- Performance tests of important equipment not controlled by the Technical Specifications (e.g., equipment controlled by Equipment Control Guidelines), as described in Administrative Procedure DLAP OP1.DC16, "Control of Plant Equipment Not Required by the Technical Specifications;"
- Inspections performed as part of the erosion/corrosion monitoring program required by Administrative Procedure D-300, "Monitoring of Erosion/Corrosion Induced Pipe Wall Thinning;"
- Testing performed after maintenance to verify that equipment performance has been restored to the required level as specified in Administrative Procedure C-6S3, "Post Maintenance Testing;" and
- System engineer quarterly equipment walkdowns in accordance with Administrative Procedure TS5.ID1, "System Engineering Program."

All of these different tests and inspections provide detailed, specific, on-going information about the current

condition of plant SSCs. These tests also provide thousands of data points on the performance of plant equipment, which are included and reviewed in the preventive and predictive maintenance programs. Based on this information, maintenance is scheduled and performed in a manner that maintains equipment performance at the required level for the life of the plant.

<u>ISI/IST Programs</u>

Q13 You listed in A10 above the ISI/IST Program. Please briefly describe this category of surveillance testing.

A13 (Crockett) The ISI and IST Programs were initiated in 1985 for Unit 1 and in 1986 for Unit 2, corresponding to the start of commercial operation of each unit. The ISI and IST Programs comply with the requirements of 10 CFR 50.55a(b)(2) and 50.55a(g), as well as the requirements in the Technical Specifications. The ISI and IST Programs include inspection, testing, and maintenance of pressure-retaining components (including their support structures) as required by the American Society of Mechanical Engineers Boiler and Pressure Vessel ("ASME B&PV") Code.

Components that are within the scope of the IST Program are designated pumps and valves that are required to perform a specific function in shutting down the reactor or mitigating the consequences of an accident. Periodic pump tests are performed in accordance with ASME Section XI, subsection IWP. Such tests measure

operational pump performance by observing, measuring and recording specific data such as pump/motor vibration, flow, and bearing temperatures. Also, periodic valve tests are performed in accordance with subsection IWV of Section XI. These tests measure the performance of power-operated valves, safety valves, and check valves. As applicable, depending on the valve type, these tests check stroke, stroke time, seat leakage, and relief setpoints. For both pump and valve tests, data are analyzed and compared to specific criteria for operability.

The ISI Program specifically includes nondestructive examinations such as visual, surface, and volumetric examinations. The surface examinations are done with liquid penetrant or magnetic particle methods. The volumetric examinations are done using ultrasonic or radiographic examination methods. The objective of these examinations is to:

- Identify any unexpected service-induced component degradation, which would be evidenced by surface cracks, wear, corrosion, or erosion;
- Locate any evidence of component leakage during system pressure or functional tests; and
- Verify operability of components and integrity of component supports.

10 CFR 50.55a(g) requires revision of the ISI and IST Programs as necessary to comply (to the extent practical within the limitations of design, geometry, and materials

for construction of components) with the edition of the ASME B&PV Code and Addenda in effect and adopted by the NRC twelve months prior to the start of each 10-year inspection interval. These programs ensure that pressure-retaining components will be adequately inspected, tested, and maintained throughout the proposed 40-year operating license terms.

EQ Program

Q14 **How does the EQ Program relate to maintaining plant material condition through the proposed 40-year operating term?**

A14 (Ortore) EQ is a rigorous program to confirm that electrical equipment which would be relied on in the event of an accident will be capable of performing its design safety function to assure safe shutdown of the reactor, despite exposure to the harsh environment postulated to result from an accident. The process of environmental qualification includes:

- determining which plant components are required to be operable in a harsh environment;
- defining the environmental conditions which each component may be exposed to, and for how long;
- using appropriate testing and/or analysis to demonstrate the component will operate in the harsh environment for the period of time;

- determining a "qualified life" based on the expected service conditions;
- identifying and implementing appropriate surveillance, maintenance and procurement requirements to assure the environmental qualification of the component is maintained;
- documenting all of the above.

The EQ Program for DCPP complies with the requirements of 10 CFR 50.49. As applied to DCPP, 10 CFR 50.49 requires that electric equipment important to safety and located in a harsh post-accident environment be environmentally qualified, at a minimum, in accordance with IEEE 323-1971 and the Category II positions in NUREG-0588, dated December 1979. In accordance with 10 CFR 50.49(l), replacement equipment (for equipment that is required to be environmentally qualified) is required to be qualified in accordance with IEEE Standard 323-1974 and the Category I positions in NUREG-0588, unless there are sound reasons to the contrary. The DCPP EQ program was evaluated and found by the NRC to be in conformance with applicable requirements in 1981 and 1985.

As described in detail later in this testimony, maintenance of EQ equipment is a formal program at DCPP. The master list of equipment required to be environmentally qualified is maintained as a controlled engineering drawing and is revised as plant design changes are implemented. Surveillance activities are performed to detect adverse trends in equipment performance or the

normal operating environment. Maintenance procedures assure that the qualified configuration of equipment is restored after maintenance and that appropriate maintenance activities are conducted to preserve the qualified status. Equipment that is not qualified for the entire 40-year operating license term is refurbished or replaced prior to exceeding its "qualified life."

Maintenance Program

Q15 **The major element relevant to MFP's contention under the maintenance and surveillance umbrella referenced in A10 is the Maintenance Program. Please describe this program generally.**

A15 (Giffin) As noted above, maintenance is the integrated means of maintaining the plant material condition throughout the plant's operating life by managing the effects of degradation and service wear on SSCs. The DCPP Maintenance Program was developed with the basic philosophy that it is necessary to have the requisite administrative and technical controls to ensure that maintenance is performed in a timely, controlled, and safe manner, consistent with applicable requirements, the license, and quality control criteria.

The DCPP Maintenance Program has been implemented through procedures which incorporate relevant information from the Technical Specifications, design basis criteria, industry standards, equipment vendor and manufacturer

recommendations, NRC Safety Evaluation Reports and PG&E maintenance experience at both nuclear and fossil plants. They provide the means to monitor, inspect, maintain, and test plant SSCs in a programmatic manner. The program includes maintenance tasks on both safety and non-safety-related SSCs.

As will be described further in this testimony, maintenance tasks are categorized as either preventive or corrective maintenance. Preventive and corrective maintenance tasks were initially identified and initiated during the plant construction phase. Maintenance activities have been conducted throughout the construction phase, the system turnover to plant staff, the period from operational testing through the start of commercial operation, and during commercial operation. This helps to assure that SSCs were not adversely affected during the period of plant construction. Additionally, Westinghouse was present onsite during the construction phase and has provided preventive maintenance information and guidelines for the Nuclear Steam Supply System ("NSSS") equipment it supplied. The Westinghouse guidelines also include recommended chemistry controls and system layup conditions.

In addition to procedural guidance on specific maintenance activities, maintenance procedures also provide for scheduling, implementing, and documenting activities covered by the Maintenance Program. PG&E installed a computer-based Plant Information Management

System ("PIMS") in 1985 to assist plant maintenance and engineering personnel in these activities. PG&E also committed additional resources to develop state-of-the-art machine shops, maintenance training facilities, spare parts inventories, and management systems. Staff resources and personnel training are provided to fully implement and use these support resources. All of these program elements are described in more detail later in this testimony.

Q16 **You mentioned PIMS. What is PIMS?**

A16 (Crockett) PIMS is a computer-based system that utilizes a mainframe computer system at DCPP. PIMS runs on a local area network and is available 24 hours a day to over 3,000 users. It functions to improve information flow, work planning, and productivity. It is regarded as one of the most comprehensive information systems in the nuclear industry.

PIMS specifically provides users with the ability to manage and obtain up-to-date information directly related to:

- Problem reporting and tracking
- Regulatory commitment management
- Plant component information and history
- Maintenance task instructions and history
- Measuring and test equipment calibration tracking
- Materials purchasing and processing

- Inventory control
- Radiation exposure tracking
- Personnel and training records
- Plant access management

A typical day will result in over 200,000 completed PIMS electronic transactions.

Q17 **What are the regulatory requirements for maintenance and surveillance programs?**

A17 (Giffin) The requirements for the implementation of maintenance and surveillance programs are found or referenced in several places. The DCPP Technical Specifications provide surveillance requirements for safety-related equipment and specify the requirements for the ISI/IST program as described above. The Code of Federal Regulations, 10 CFR Part 50, also provides certain specific requirements, such as the EQ requirements. These provisions, however, contain no explicit requirements for a maintenance program. PG&E has committed in the DCPP Final Safety Analysis Report Update ("FSAR") to follow the standards of ANSI 18.7-1976/ANS-3.2, "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants," as endorsed and modified by the NRC, in Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operation)." PG&E also has long been actively involved with establishing maintenance guidance for the nuclear industry. In 1971, a PG&E manager was the

chairman of the committee that authored ANSI 18.7/ANS 3.2. In 1976, one of our present executive officers coauthored the 1976 version which we committed to follow. This continuous involvement by PG&E demonstrates our management commitment to fostering comprehensive maintenance programs in the nuclear industry. These documents provide guidance concerning the maintenance and testing of safety-related SSCs. Accordingly, the maintenance program PG&E has established at DCPP is much broader in scope than required by any of these documents. For example, our program includes many maintenance activities for nonsafety-related and balance-of-plant ("BOP") equipment.

The NRC is implementing a new maintenance rule (10 CFR 50.65) which will become effective in 1996. Our preliminary assessment is that our existing programs meet the requirements of this new rule and that few changes to our programs will be required.

IV. <u>ELEMENTS OF AN EFFECTIVE AND COMPREHENSIVE MAINTENANCE PROGRAM</u>

Q18 **Focusing now on the DCPP Maintenance Program, is there any objective standard by which to judge the proper scope of such a program?**

A18 (Giffin) Yes. Maintenance is a very complex and interrelated program which includes (1) the identification of an equipment problem or potential equipment problem,

(2) the planning of the work activity intended to prevent a problem from occurring or to return the equipment to its design condition, (3) the preparation of a detailed procedure or work order defining the steps necessary to perform the work, (4) scheduling the work activity, (5) obtaining the parts which are necessary to complete the task, (6) assigning qualified personnel to actually perform the work, (7) performing the work, and (8) performing necessary testing at the completion of the work to ensure that the equipment is in operable condition. With this scope in mind, the nuclear industry and the NRC have generally agreed that the Institute of Nuclear Power Operations ("INPO") document 90-008, "Maintenance Programs in the Nuclear Power Industry," (Revision 1, March 1990), identifies the requisite elements for a comprehensive maintenance program. INPO 90-008 was recognized by the NRC in its Statement of Considerations for the Maintenance Rule, and the NRC expressly found that detailed recommendations for the conduct of maintenance, such as INPO 90-008, should be developed by the licensee, not the NRC. (See 56 Federal Register 31,313, July 10, 1991.) These elements are:

- A well-staffed and qualified organization that is provided with the tools and facilities necessary to perform tasks effectively and efficiently;
- A proper mix of corrective and preventive maintenance to provide assurance that equipment degradation is identified and corrected prior to failure;

- Accurate procedures or work instructions for craftsmen so that the work activities can be performed in a quality manner;
- Maintenance planning and scheduling to assure that all involved plant departments are aware of the activities and interferences are minimized;
- Post-maintenance testing to verify that the maintenance task was performed correctly and the equipment is ready to be returned to service;
- Availability of correct and qualified parts and material to support the repair and return to service of the component;
- Control of measuring and test equipment to ensure the accurate performance of instrumentation and equipment used for calibrations, testing, and repairs;
- A detailed root cause analysis program to understand the cause of equipment failures; and
- A maintenance history program to provide historical data for maintenance planning and to support trending analyses of equipment performance.

Similar but less-detailed elements are identified in ANSI 18.7-1976/ANS-3.2. The elements of INPO 90-008 have been addressed in the DCPP Maintenance Program and are explained in our Program Directive MA1 "Maintenance." The Program Directive is included with this testimony as Exhibit 6.

Maintenance Organization

Q19 The first element of a maintenance program is a well-staffed and qualified organization with necessary tools and facilities. Let us break this element into three sub-topics and address each: the maintenance organization, the training and qualifications of maintenance personnel, and maintenance facilities. First, please describe the maintenance organization for DCPP?

A19 (Giffin) The DCPP maintenance organization is clearly identified and has been communicated to personnel so that responsibilities, lines of communication, performance objectives, and mission are clearly understood. The DCPP Maintenance Services Department organization chart is included as Exhibit 7 to this testimony.

About four years ago, the DCPP maintenance functions were part of three different departments. A decision was made to arrange the plant organization along functional areas. Accordingly, the Maintenance Services Department was established and the sections having maintenance responsibilities were assigned to that department. The Maintenance Services Department now consists of six sections: Electrical Maintenance, Mechanical Maintenance, Instrumentation and Controls ("I&C"), Work Planning and Scheduling, Materials, and Outage Management. There are approximately 598 employees in the Maintenance Services Department, 300 union employees, 298 professionals. This

organization is well-staffed and well-suited to its purpose.

Q20 **Please describe each organization within the Maintenance Services Department individually, with the section responsibilities and the staffing.**

A20 (Giffin) The Mechanical Maintenance Section is responsible for maintaining and servicing all mechanical components at DCPP. This includes the supervision and programmatic controls needed to ensure that all components are monitored and maintained in reliable working condition. Engineering support within the section provides procedural guidance, troubleshooting, and technical direction. The Mechanical Maintenance Section consists of 157 employees.

The I&C Section is responsible for the maintenance and periodic testing of all plant instrumentation. Duties include the supervision and administration of the preventive and corrective maintenance programs for that equipment, and the implementation of the Technical Specification instrumentation surveillance program. Engineering support within the section is provided in the areas of problem troubleshooting, test reviews and direction, tracking and trending of component failures, design change scoping and installation sponsorship, plant computer systems maintenance and programming expertise, integrated communication interfaces, design engineering

support, and quality problem evaluations and reviews. The I&C Section consists of 123 employees.

The Electrical Maintenance Section is responsible for maintenance of all electrical plant equipment, including main generator and exciter, all motors, generators, switchgear, batteries, chargers, inverters and motor operated valves ("MOVs"). Engineering support is provided within the section. The Electrical Maintenance Section consists of 88 employees.

The Work Planning Center is comprised of two main functional groups: Work Planning and Work Scheduling. The overall responsibility of the Work Planning Section is to provide the plant maintenance sections with detailed working documents that reflect a safe, efficient work plan that is in compliance with all plant procedures, programs and regulatory requirements. The Work Scheduling Section is responsible for the coordination and scheduling of all plant work activities in a manner that maximizes efficient utilization of plant resources and enhances the safe and reliable operation of the plant. The Work Planning Center consists of 105 full time personnel.

The Outage Management Section is responsible for the planning, scheduling and direction of all activities associated with refueling outages and unscheduled outages of sufficient duration or complexity. The outages are directed from the Outage Control Center, utilizing a representative from each of the major disciplines on a seven day a week, 24 hour a day basis. Outage Management

is also responsible for the Lessons Learned program which captures items that worked well or things that need to be improved during outages. During non-outage periods, there are 6 people assigned to the outage management team. These people coordinate the efforts of schedulers and planners. During an outage, the maintenance services organization is augmented by about 400 engineers and craftsmen.

The Material Services Section has about 118 full time employees and is responsible for the procurement of material (equipment and parts), warehousing, issuance and repair of tools, and the calibration of measuring and test equipment. Procurement, within this section, also has responsibility for defining the technical and quality requirement of material requests.

Q21 **Are there examples of organizational methods utilized at DCPP, beyond what you have just described, to foster continued improvement?**

A21 (Giffin) Yes. As part of our commitment to continuous improvement in the maintenance organization, we have instituted the High Impact Team ("HIT") concept. A HIT is a multi-discipline team with members from a vertical slice of the organization who are selected based upon the particular maintenance issue or project involved. HITs are formed for complex outage tasks, to facilitate teamwork for new projects, or for other complicated multi-

discipline tasks. HITs are given the resources, abilities, and authority to implement actions and improvements so that tasks are accomplished in an excellent and improving manner. Industry and PG&E management have recognized the efficiency, quality, and productivity benefits of employee teams. The DCPP HIT teams have proven to be a very successful example. By having a management team which supports continuous improvement and employee involvement, coupled with HITs to look for and implement improvements, a working environment exists at DCPP where change for the better is expected.

<u>Training and Qualifications</u>

Q22 **Please describe the qualifications of the personnel involved in maintenance activities.**

A22 (Giffin, Crockett) PG&E has committed to the requirements of ANSI/ANS 3.1-1976, "For Selection and Training of Nuclear Power Plant Personnel." The qualifications of the DCPP maintenance staff are quite high, and exceed the ANSI/ANS 3.1-1976 requirements. Five of the seven section directors in the Maintenance Services Department have been either licensed or certified SROs, three have advanced technical degrees, and they all have over 15 years experience in the nuclear industry. The maintenance foremen and general foremen have, on average, 15 years of nuclear experience. The qualification of maintenance craftsmen who perform specific maintenance

tasks are ensured by a rigorous training program. In the NRC's last Systematic Assessment of Licensee Performance ("SALP") report on the Maintenance area at DCPP (February 12, 1993), the NRC listed as a noteworthy strength:

> "Qualifications: The training and qualification program for Maintenance personnel was strong. Well maintained training facilities and a dedicated training staff were significant factors in good performance, as was the sense of ownership shown by Maintenance personnel."

Maintenance training programs at DCPP have been accredited by INPO. These accredited training programs include Mechanical Maintenance, Electrical Maintenance, I&C, and Maintenance Supervisory Training. INPO accreditation is an ongoing process that is re-evaluated every four years. The maintenance training programs at DCPP were first accredited in 1988 and accreditation was renewed in 1992. As a result of obtaining and maintaining accreditation for all of the INPO identified programs, DCPP has been designated as a full member of the "National Academy for Nuclear Training."

In recognition of DCPP's commitment to training and the quality of its programs, DCPP's training director was selected to participate with INPO and the Department of Energy in a project to assist the Russian nuclear organizations with their training programs.

Q23 **How are maintenance personnel trained?**

A23 (Crockett, Giffin) DCPP training programs are designed to provide journeymen and foremen who will perform specific maintenance tasks with the skills and knowledge needed to successfully and safely complete their work. The training programs meet the requirements of ANSI/ANS 3.1, the state-approved apprenticeship program, and the INPO accreditation criteria.

The maintenance training programs are comprised of distinct components:

- Apprenticeship
- Basic (or Fundamental) Qualification for Journeyman
- Advanced (or Select) Qualification for Journeyman
- Supervisor Training
- Continuing Training

The apprenticeship program is State of California approved and is a negotiated contractual agreement with the International Brotherhood of Electrical Workers. Once in an apprenticeship, individuals are given two or three years of training and guidance in their chosen field. Examples are:

- Machinist (3 years)
- Electrician (3 years)
- Welder (3 years)
- Instrument Repairman (2 years)
- Control Technician (2 years - must have already completed either electrical or instrument repairman requirements).

When job vacancies for craftsmen occur, they are filled by graduates of the apprentice program. However, sometimes these vacancies are filled by journeymen from outside of the DCPP maintenance organization. These journeymen may come with a variety of backgrounds. Although they are considered to be journeymen, their specific skills, knowledge, and experience may be different than that specifically required for basic qualification at DCPP. Thus, all such personnel are tested upon entry into the Maintenance Services Department. The test results, along with interviews by supervision and review of previous work documentation, determine the initial training needed to meet the requirements for Basic (or Fundamental) Qualification for Journeyman.

The topics of the Basic qualification training program, and the amount of training available, are shown in Exhibit 8. Once an incoming journeyman satisfies the Basic (or Fundamental) qualifications, further advanced training on selected plant components is given based on need. Examples of advanced or plant-specific training, and the time available, are shown in Exhibit 9.

In addition to plant-specific training on components and equipment, all maintenance workers attend continuing training seminars on a quarterly basis, except during outage periods. These seminars are used to address plant and industry issues, changes recently made to the facilities or equipment, and recent "lessons learned."

These seminars also afford management an opportunity to stress areas of concern.

Q24 **How do you utilize "hands-on" training at DCPP?**

A24 (Crockett, Giffin) All aspects of DCPP maintenance training programs stress "hands-on" training activities. The majority of the classes are taught in a lab or shop facility and take advantage of plant-specific training aids. The classes consist of lectures with examples, coupled with actual hands-on experience on equipment utilizing actual plant procedures and work packages similar to those used to perform maintenance in the plant. Examples of plant specific equipment available in the training facilities are:

- Reactor Coolant Pump (seal and motor alignment portions)
- Steam Generator Channel Head and Tubesheet
- 10% Steam Dump Valve
- Limitorque Valves and Operators
- Reactor Trip Breaker
- Digital Feedwater Controls
- Nuclear Instrumentation and Protection Systems
- Diesel Engine

With the extensive training aids available in our training program, the majority of tasks requiring qualification can be fully accomplished in the training facilities. However, in some instances additional "on the

job" training in the plant is required prior to qualification. An individual's qualifications are tracked by a qualification matrix that identifies the tasks an individual is qualified to perform. The foremen makes use of this matrix when assigning work to assure that only qualified personnel are assigned to a job. When possible, workers are also given the opportunity to train on new equipment prior to its installation in the plant.

This extensive training program demonstrates a strong commitment to the development of the skills and knowledge of maintenance personnel. In the 1993 SALP report, the NRC recognized the strength of PG&E's training in the maintenance area noting:

> "Plant Safety: Maintenance personnel were trained and informed regarding overall plant safety system availability and the significance of their individually assigned work relative to its risk to the plant."

Maintenance Facilities

Q25 **What are the facilities that support the maintenance programs at DCPP?**

A25 (Giffin, Crockett) PG&E has provided excellent facilities for the performance of maintenance activities. State of the art training facilities, machine shops, calibration facilities, and warehouse storage areas are available to support the maintenance program and specific maintenance tasks. These facilities include:

- Maintenance Shops Building

- Warehouses
- Computer Center and Associated Equipment
- Machine Shops
- I&C Shop
- M&TE Lab

The Maintenance Shops Building is a $10 million facility, located adjacent to the plant protected area. In this building are laboratories, shops, and classrooms totaling 70,000 square feet of space devoted to the training of plant personnel. Within the mechanical, electrical, and instrumentation shops and laboratories are many of the same components and equipment installed and operating within the actual plant. These are used for the troubleshooting and repair training described above. When infrequent maintenance activities are planned, the equipment in this facility is also used to rehearse the activity and refresh the skill of the craftsmen before the activity is performed in the plant.

The main Warehouse is a $18 million facility with over 100,000 square feet of storage area with a material testing laboratory, a Quality Control inspection area, and an environmentally controlled storage room. In addition to the main Warehouse, there are several satellite warehouses to store specialized equipment, e.g., the spare generator storage building that houses one complete spare main generator, the spare rotor storage building that contains three low pressure turbine rotors, Warehouse A that is used to store components and materials that may be

radioactive, and Warehouse B that is used to store other large equipment and material to be surplused.

The Computer Center and associated facilities are located in the Administration Building at DCPP and occupy 25,000 square feet. The Center includes:

- A fully automated mainframe computer facility housing an IBM 3090 400J series machine.
- A network operating center housing over 30 network servers.
- A computer support and help desk facility.
- An information systems prototype and testing facility.
- The data communications hub internal to the plant and the gateway to external PG&E facilities.
- Applications maintenance, development, and administrative areas.
- A support staff of full time personnel

The cost to staff and operate the facility is approximately $12.5 million per year. This cost provides us with the capability to execute business transactions at the rate of 700-800 transactions per minute and to maintain over 130 gigabytes of plant information available for rapid on-line retrieval. Collectively, the staff and the facilities provide DCPP with state of the art information technology services.

There are four machine shops at DCPP. The first is the Cold Machine Shop Building located south of the Unit 2 Turbine Building. It is an $8 million facility consisting of 35,700 square feet and is shared by the Electrical and

Mechanical Maintenance Sections. The second is strategically located between both units in the Turbine Building. A third facility is located at the intake structure and consists of 2760 square feet at a cost of $720,000. These three "cold" machine shops are used to work on equipment that is not radiologically contaminated. Radiologically contaminated equipment is brought to a fourth facility, the "hot" machine shop, where special controls are in place to clean the equipment, prevent the spread of contamination, and protect the workers. All four machine shops have proper equipment, such as lathes and drill presses, with appropriate environmental conditions conducive to ensuring maintenance quality and work efficiency.

The I&C Shop is an $8 million facility with over 25,000 square feet of I&C repair shops (for repairs and instrument calibrations), telecommunication shops, a medical facility, and office area. The I&C shop was constructed to consolidate all I&C functions in one location to enhance communication and overall work efficiency.

Part of the I&C Shop is the Measuring and Test Equipment ("M&TE") calibration lab. Here, high accuracy calibration is performed on equipment that, in turn, is used to calibrate plant equipment. Over 700 pieces of M&TE are calibrated monthly during non-outage periods, and about 5,000 per month during outage periods.

In addition to these facilities, DCPP has various laydown areas, tool storage, repair and issue stations, and temporary facilities that are used during outages. Together, all of these facilities ensure the effective and efficient performance of maintenance activities.

Preventive and Corrective Maintenance

Q26 The next element is achieving a "proper mix" of preventive and corrective maintenance. How is this element satisfied at DCPP?

A26 (Ortore) Maintenance is generally defined as falling into two categories, preventive and corrective.

Preventive maintenance tasks are periodic, planned, or predictive actions taken to ensure that equipment continues to maintain its design function. Preventive maintenance tasks are normally performed on a predetermined scheduled basis prior to any equipment failure or degradation. Annually we perform about 14,000 preventive maintenance tasks at DCPP. These activities range from simple equipment inspections, replacement of limited life items such as lubricants, filters, wear rings, bearings, and diaphragms, to major equipment overhauls. Preventive maintenance tasks are selected so as to maintain equipment in a condition which will increase reliability and extend the life of equipment.

A Master Equipment List ("MEL") identifies and tracks the majority of plant equipment, both safety-related and

nonsafety-related. Starting with the MEL, the following equipment is selected to be included in the preventive maintenance program: (1) any installed equipment, either NSSS or BOP equipment, needed for safe and reliable plant operation, (2) any equipment requiring preventive maintenance based on PG&E commitments, (3) any equipment whose malfunction can cause direct personnel injury, and (4) any equipment where the implementation of preventive maintenance may cause a reduction in operating costs. There are about 17,500 components included in the DCPP preventive maintenance program.

A program of predictive maintenance has also been incorporated into our maintenance program at DCPP as a part of preventive maintenance. Predictive maintenance is the continuous or periodic monitoring and diagnosis of selected equipment parameters to provide early detection of equipment degradation prior to equipment failure. This is accomplished by gathering and analyzing information, predicting future degradation, and then taking action to limit the degradation before partial or complete failure occurs. For example, this could involve taking a lubricating oil sample from a piece of rotating equipment such as a pump or motor (which is a standard task), analyzing the sample for metal wear products and other particulates to determine the amount and type of wear occurring, and trending these findings to determine the degree of degradation that may have taken place. If necessary, we will then recommend specific maintenance

actions for equipment. Generally, DCPP utilizes a variety of nonintrusive equipment monitoring techniques including:

- Lubrication analysis (as just discussed)
- Vibration monitoring and diagnostics
- Air and motor operated valve diagnostic testing
- Acoustic analysis
- Infrared thermography
- Bearing temperature analysis
- Insulation resistance
- Non-destructive analysis
- Monitoring and trending of equipment data

The predictive maintenance program is described in procedure, AP C-751, "Predictive Maintenance Program."

Corrective maintenance consists of the repair and/or restoration of equipment. As discussed above, this is a normal and expected part of the maintenance program. Corrective maintenance is performed when equipment is not able to perform its intended function or is outside operating limits. The maintenance action will return the equipment to a specified performance level. For example, if a valve packing is leaking and needs to be tightened, that task would be listed as corrective maintenance. We perform on the average 7,000 corrective maintenance tasks at DCPP each year.

Q27 **How do we know that at DCPP we have achieved a "proper mix" of preventive and corrective maintenance?**

A27 (Giffin, Ortore) Within the nuclear industry, a high ratio of preventive maintenance (including surveillances) to total maintenance is indicative of an efficiently managed maintenance program which is effective in maintaining the plant in a safe and reliable condition. Obviously this is a very subjective assessment. It is in our interest to minimize corrective maintenance, to the extent practical, through preventive maintenance. However, preventive maintenance cannot avoid all corrective maintenance, nor would such a goal be practical from an operating perspective. INPO formerly monitored this parameter and had established 60 percent as the objective.

At DCPP, we monitor preventive maintenance tasks as a percentage of all maintenance tasks and strive to maintain the ratio above 60 percent. Over the past three years the number of corrective maintenances performed have decreased which can be attributed to the effectiveness of the preventive maintenance program. Based on this performance and the experience gained since we began monitoring this percentage, we believe that we are maintaining a proper mix. We believe also that the overall reliability of the plant to date, as measured by the plant availability and plant capacity factors, is a good indicator of a proper mix.

Maintenance Procedures

Q28 **The next element of a maintenance program includes the procedures and/or work instructions. Please describe how this works at DCPP.**

A28 (Vosburg) In order for maintenance activities to be performed in a consistently safe and efficient manner by the craftsmen, accurate procedures providing technical guidance and direction have to be in place. We have expended considerable effort at DCPP over the last several years in the preparation of state of the art maintenance procedures. There are currently about 6,000 written procedures which are used to conduct specific maintenance activities. Exhibit 10 to this testimony is a list of these maintenance and surveillance test procedures. These procedures are periodically reviewed and updated, as necessary. The procedures that the craftsmen use have been prepared with input from the workers and provide the necessary graphics and check lists. The relevant procedures for specific tasks are incorporated, as appropriate, into task-specific work packages described below.

Planning and Scheduling

Q29 **The next element concerns planning and scheduling of maintenance tasks. How is this accomplished at DCPP?**

A29 (Vosburg) With approximately 20,000 maintenance and surveillance work orders performed each year, it is extremely important to plan and schedule the activities correctly. This is one of the important functions of the Work Planning Section of the Maintenance Services Department and is part of a detailed, comprehensive work control process. The work control process provides the integrated mechanism under which plant maintenance activities and equipment problems (including both preventive and corrective maintenance tasks) are identified, reviewed, prioritized, planned, scheduled, performed, tested and closed out. The process ensures that plant maintenance activities are planned and performed in a safe, timely, efficient and controlled manner. The process is specifically designed to coordinate maintenance activities to minimize the time that safety-related equipment is out of service.

Q30 How are corrective maintenance activities identified for incorporation into the work control process?

A30 (Vosburg) A key objective in the overall maintenance program is to ensure that actual or potential plant equipment problems will be identified and documented in a timely manner. One facet of the surveillance testing and preventive maintenance programs is directed towards early identification of discrepant equipment conditions, with the desired goal of repairing/replacing equipment before

failure. Device calibrations also play a part in flagging trends which aid in early detection and repair. Maintenance tasks identified by these programs are scheduled and tracked through the work control process.

Any individual who discovers a problem in the plant is responsible for initiating an Action Request ("AR") or reporting the problem to a supervisor who must then initiate an AR in a timely manner. A significant factor which contributes to the effectiveness of the problem reporting system at DCPP is that all personnel working at the plant have access to the system, either directly or through their immediate supervisor. At the plant site alone, there are more than 1,800 computer terminals available where ARs may be initiated and at least as many plant personnel with direct access to the system. Since the AR system is used not only for documenting plant equipment problems but also for documenting administrative tasks, requesting design changes, requesting interdepartmental support, etc., there is a high level of familiarity with the problem reporting process throughout the plant staff.

Q31 **Once maintenance tasks are identified, what means exist to track the scheduling, planning, and completion of those tasks?**

A31 (Vosburg) The administrative controls for the work control process at DCPP are integrated into PIMS. Using

this system, all data entered at any one computer terminal during the process is immediately available at other computer terminals throughout the plant. This attribute makes the entire system highly responsive to plant maintenance needs. One advantage of PIMS is that the system itself assigns unique task numbers to new documents, thereby ensuring that none are inadvertently misplaced. Once an AR is created, it cannot be destroyed - even if it is taken to "rejected" status.

The ARs module within PIMS ensures that problems receive appropriate levels of review and are tracked through resolution. The AR is the key which electronically ties together all other modules which make up the maintenance process (equipment clearances, work orders, quality evaluations, post-maintenance test requirements, etc).

An overview of the DCPP work control process as it relates to a plant equipment problem is illustrated in Exhibit 11. In the sequencing of a typical maintenance work request, the key elements of the process are described below:

- Upon identification of a maintenance problem, the person who discovers it will initiate an AR at a convenient terminal. After filling in as much information as is available at that time, the AR is left in the "initiated" status and the individual's supervisor is notified.

- The supervisor reviews the AR for accuracy and assigns a priority to the AR in accordance with the plant work prioritization system. The supervisor is also responsible to ensure that Operations is immediately notified of any problem that is believed to have an impact on plant safety or equipment operability. This notification is documented on the AR. The AR is then taken to the "reviewed" status. This effectively makes the AR available to the Work Planning Center.
- The Work Planning Center routes the AR to the appropriate planner, who is then able to begin preparation of a work order, another electronic module document which is linked to the AR.
- As part of the work order preparation, the planner reviews the problem as documented on the AR and begins collecting information necessary to plan the maintenance activities. This may include (but is not limited to): a walkdown of the jobsite; identification of relevant procedures, drawings and vendor manuals; identification of special processes (such as welding); interviews with foreman and craft; identification of administrative limitations on the job sequence; and investigation of any salient information contained in the PIMS Component or Maintenance History Databases.
- The planner may use other specialized modules within PIMS to electronically research and order spare parts, flag quality-related aspects to the Quality Control group, request Radiation Work Permits for radiological

work, request any clearance (equipment isolation/tagout) which will be required in order to commence work, and notify other disciplines of the need for technical assistance.

- When the planner has all necessary information collected, he/she writes the work flow description directly into the electronic work order. Quality related work orders are reviewed by the Quality Control organization for the incorporation of needed inspection hold points which are inserted into the work order. The work package is then created which includes a copy of the work order, copies of maintenance procedures referenced by the work order, and other supporting documentation such as vendor manuals and applicable plant drawings. The work package is then assigned to the appropriate maintenance foreman.
- Another electronic link ties the work order to the on-site scheduling software. The job is integrated by the scheduling staff into the overall maintenance picture to ensure that it is performed in a time frame commensurate with its priority. It must be merged into the work stream along with other tasks to be scheduled, such as corrective or preventive maintenance activities and surveillance testing.
- The maintenance task is performed by the appropriate discipline, following which the work order is reviewed by the foreman. The package is then returned to the

Work Planning Center for closure. The planner transcribes the results of the maintenance action into the Component Maintenance History (another PIMS module which provides a running history of maintenance to aid in future planning efforts and/or research) and then forwards the completed work order to Document Control for archiving.

Q32 **What considerations go into planning the scope of work for specific maintenance tasks?**

A32 (Vosburg) Work planning creates the integrated work package based on the following considerations:

- Consistency and conformance to standards and requirements;
- Safety, reliability and effect on generation capability;
- The quality classification of the work, to assure that the plant quality organizations are integrated into the work planning process;
- Integration with work scheduling to maximize the efficiency of all work performed; and
- The safety and radiation protection of plant workers.

Q33 **Explain how maintenance tasks are scheduled.**

A33 (Vosburg) The overall objective of the work scheduling function is to coordinate and schedule plant work

activities in a manner that maximizes efficient utilization of plant resources and enhances the safe and reliable operation of the plant. To accomplish this we developed a computerized scheduling program which interfaces with PIMS. Periodic schedules identify when equipment maintenance, testing or inspection is required. These computer schedules are routed to appropriate sections for planning and performance of the work. The scheduling program allows for integration of all work activities into the schedule.

The framework for the scheduling of plant maintenance and surveillance activities is built around a process known as the Mode One Integrated Daily Schedule ("MOIDS"). This process uses a 12-week rolling matrix which identifies the required Technical Specification surveillance tests for plant equipment and reserves blocks of time within the base schedule for the performance of these tests. All other maintenance activities related to the equipment are then identified and incorporated into these maintenance windows. Typical activities to be included would be the routinely scheduled preventive maintenance activities and any necessary corrective maintenance activities. Using this method, both the number of times that equipment is removed from service and the amount of time that the equipment is unavailable are minimized. Using the MOIDS concept, plant schedulers along with senior licensed personnel from Operations meet twice a week to develop the schedule for the upcoming

week. All activities to be performed on safety-related equipment are reviewed by the group for plant safety impact. All preventive maintenance activities to be included are reviewed to assure that work necessary to enhance the reliability of the equipment is performed within the normal maintenance window and is not unnecessarily deferred.

An additional enhancement to the scheduling process has been the assignment of a licensed Operations representative to the scheduling group. This innovation has proven instrumental in the improvement of communication between the Planning, Scheduling, and Operations organizations. The Operations representative provides guidance to ensure that work is scheduled in a way that optimizes use of Operations and Maintenance manpower. He or she also provides input to the schedule from a risk assessment standpoint and reviews scheduled work to identify potential safety system interactions. This aids in the early identification and resolution of schedule conflicts and improves the overall efficiency and safety of the final schedules.

Q34 How do you monitor work to control the backlog of maintenance activities?

A34 (Vosburg) The work control system at DCPP provides the means for identifying, tracking, and controlling the maintenance backlog. The backlog of corrective and

preventive maintenance is tracked separately with specific goals for each as established by management at the beginning of each year, with the general intention of reducing each as low as practicable. Since all maintenance items at DCPP are individually tracked through PIMS, status reports can be generated quite readily and are available for management review.

Post-Maintenance Testing

Q35 **Please describe the DCPP post-maintenance and post-modification testing program.**

A35 (Crockett, Vosburg) Post-maintenance and post-modification testing ("PMT") is a key component to implementation of the plant maintenance program. The primary objective of PMT is to ensure that all plant equipment which has undergone maintenance or modification activities has been demonstrated to be fully functional or operable prior to return to service.

Technical Specifications specifically require that safety-related equipment be properly tested and any associated problems resolved following maintenance or modification prior to declaring the equipment operable. However, PMT at DCPP is not limited to Technical Specification equipment. From an overall plant safety and reliability standpoint, it is a good practice to perform PMT following maintenance or modification of plant equipment not required by the plant Technical

Specifications to ensure that the equipment will fulfill its design function prior to returning the equipment to service.

Generally, PMT requirements are specified in the work order and in each case will be commensurate with the maintenance or modification work completed and the importance of the equipment to plant safety and reliability. At DCPP, PMT consists of two different types of testing: Maintenance or Modification Verification Tests ("MVT") and Operability Verification Tests ("OVT"). MVTs are typically those tests, inspections, or verifications which are performed by the implementing organization without actually operating the equipment. For example, typical MVTs would include cleanliness checks, electrical continuity and megger checks, and instrument loop tests. OVTs are those tests specifically designed to prove Technical Specification operability. OVTs usually consist of performing the appropriate Technical Specification surveillance test.

Q36 **How is PMT planned, controlled, and tracked?**

A36 (Crockett, Vosburg) Identification and tracking of the necessary testing begins with the work planner during the development of the work package. Based on the scope of the work, the planner must decide prior to issuing the package to the field whether PMT is required and who is

responsible for identify'ng the required MVTs. Normally, to determine the MVTs, the planner routes the work package to the appropriate review group to identify any necessary in-process inspections, parts dedication tests, and static and dynamic tests specified in applicable industry codes, standards and vendor manuals. These tests and inspections are normally included in the work order created on PIMS. OVTs are also identified and tracked by the PMT module within PIMS.

Documented completion of the required PMT is an essential component of the equipment control process used by Operations when returning equipment to service. Prior to returning equipment to service, Operations will verify that all the work is completed and that the PMT has been successfully performed.

In total, the process for identification and tracking PMT is tied directly to the work performed and includes multiple cross-checks to ensure that adequate testing is accomplished.

<u>Procurement of Parts</u>

Q37 **The next element requires that correct and qualified parts be readily available to support maintenance. How is this achieved at DCPP?**

A37 (Ortore) In order to assure high reliability of operation, equipment downtime must be minimized. Accordingly, when a component is removed from service for

maintenance, it is important that any parts necessary to restore or repair the component be readily available. The DCPP Warehouse and parts ordering system provide a comprehensive and reliable means for accomplishing this goal.

When a work order is produced, any parts that are required for the work are identified and that information is electronically transmitted to the Warehouse. The parts are staged for the craft foreman prior to the start of the work so they are verified and ready for installation before removing a system from service. The computer system also orders any parts which have dropped below a preset limit. The onsite warehouses together have more than 200,000 square feet of storage space and contain about 59,600 different items (worth about $100 million) in spare parts inventory.

Q38 **How do you assure that replacement components and parts are procured in accordance with original design requirements so as to maintain the design basis?**

A38 (Ortore) To assure that replacement parts meet original design requirements, a quality assurance program, together with a careful engineering review of replacement parts is used. Many American manufacturers and suppliers of items to the nuclear industry have 10 CFR 50, Appendix B, quality assurance programs that are audited by PG&E. These manufacturers become our "qualified suppliers."

Safety-related components or parts purchased from qualified suppliers must be procured: (1) as the identical item, which is an exact duplicate of the original item with identical quality assurance, quality control, technical and documentation requirements, and purchased from the original supplier, or (2) a documented engineering evaluation (called a replacement part evaluation) must be performed to ensure the replacement part meets or exceeds the design requirements of the original component. In total, PG&E devotes considerable resources -- both in engineering time and money -- to assure that replacement components and parts are equivalent to or better than the original.

Q39 **How do you assure the item you ordered is the one received?**

A39 (Ortore) Receipt inspection is performed on all items delivered to DCPP from the supplier. Receipt inspections range from checking the model number and supplier documentation against the purchase order to a more detailed inspection by the Quality Control organization for safety-related and graded quality items. Any item not fully meeting the criteria established in the purchase documents is placed on hold, thus preventing its use in the plant until the discrepancy is resolved.

To assist in receipt inspection, DCPP has a material testing lab onsite that is used to test items. Equipment in the lab includes:

- a portable X-ray fluorescent spectrometer for metallic material identification;
- an optical emission spectrometer for metallic material identification;
- an infrared spectrometer for elastomer identification
- Rockwell hardness tester for determining metallic hardness tests; and
- Other equipment, including durometers, system scientific alloy analyzers, and normal lab facilities.

This lab is staffed with qualified quality control inspectors.

Q40 **How do you assure that the effects of age and environment on stored items do not adversely affect the quality of the item?**

A40 (Ortore) All items with shelf-life considerations have the shelf-life determined based on criteria from the manufacturer, industry standards [EPRI NP-6408, "Guidelines for Establishing, Maintaining and Extending the Shelf Life Capability of Limited Life Items" (NCIG-13)], or other sound engineering criteria. Material that has an expired shelf life is segregated and not released for issue without further documented evaluation. When a new part or item is installed in the plant,

preventive maintenance is appropriately scheduled to take into account any impact of shelf life on the design life of the part or item.

To reduce the effects of the environment on stored equipment, storage levels are established that correspond to the specifications in ANSI N45.2.2, "Packaging, Shipping, Receiving, Storage and Handling of Items for Nuclear Power Plants." Four storage levels are established, from level A through D, with the most stringent controls placed on Level A. For materials that are highly sensitive to environmental conditions such as electrical components, the material is stored in Level A storage. Level A storage provides temperature control between 60 and 90 degrees and humidity control between 30 and 60 percent. The ventilation system is filtered to provide an atmosphere free of dust. The main Warehouse at DCPP has an environmental room that meets or exceeds the Level A storage requirements. The remainder of the Warehouse is storage level B, which is indoors with temperature controls. (Storage level C is inside with no temperature controls and level D is outdoors. For shelf life consideration, a minimum of storage level B is used.)

To further reduce the effects of age and environment on stored items, in-storage maintenance is performed. In-storage maintenance is based on manufacturer recommendations, past experience, and the significance of the item to plant safety. In-storage maintenance can

involve visual examinations, cleanings, rotation of shafts, and application of preservatives.

Control of Measuring and Test Equipment

Q41 **Another aspect of maintenance is control of Measuring and Test Equipment ("M&TE"). How is this addressed at DCPP?**

A41 (Giffin) A program for the control and calibration of M&TE has been implemented to ensure that equipment, such as test meters and torque wrenches, is functional and accurate to support maintenance activities. The DCPP M&TE program is described in Administrative Procedure D-5, "Control of Mechanical, Electrical and Instrument & Controls Measurement, Test and Performance Monitoring Equipment." The DCPP M&TE program has been enhanced significantly over the past several years. We have invested in state of the art equipment and facilities for the calibration of this special equipment. PIMS is used to track and control M&TE. A highly trained and qualified staff is in place to manage and support the M&TE program. These elements have improved our performance in the M&TE area.

Root Cause Analysis Program

Q42 **Another element of maintenance is a detailed root cause analysis program. How does PG&E address this element especially in regard to equipment failure rates?**

A42 (Giffin) One of the very important components of an effective and comprehensive maintenance program is a program which provides for a systematic analysis of unplanned occurrences pertaining to maintenance. This analysis is designed to identify the root cause of an event. With a root cause, corrective actions can be implemented so that occurrences of the same type can be prevented. Root cause analysis at DCPP is controlled by Procedure NPAP C-26 "Root Cause Analysis." This procedure provides guidance in several analysis techniques such as cause and effect analysis, event and causal factors analysis, change analysis, barrier analysis, task analysis, and human factors surveys. The procedure is supplemented by training provided by both PG&E's Training Department and outside industry experts. We have made major investments in training our engineers and managers in effective root cause analysis techniques as part of our commitment to avoid repetitive problems.

Q43 **How are root cause determinations made for DCPP?**

A43 (Giffin) PG&E's root cause determinations have different levels depending on the occurrence being investigated. A root cause determination is required for all quality problems. These are classified as either Nonconformance Reports ("NCRs" - most significant) or Quality Evaluation ("QEs" - less significant

A Technical Review Group ("TRG") performs a root cause analysis for each NCR. A TRG is a multi-disciplined group established for each NCR and chaired by the DCPP department with the most responsibility for the issue. The TRG includes representatives from Quality Assurance, Quality Control, and all involved departments. Agreement on the root cause must be unanimous among the TRG members. Effective corrective actions are developed by the TRG only after the root cause of the event is determined and agreed upon. The Plant Staff Review Committee ("PSRC") reviews the root cause analysis for all NCRs. If the PSRC does not agree, the TRG reconvenes to resolve the differences. The PSRC also reviews the corrective actions recommended to ensure they are adequate to prevent recurrence.

A root cause determination is performed for all QEs by the responsible department. Corrective actions are established after the root cause is determined. Root cause determinations for all QEs are reviewed by the Quality Control Department.

Maintenance History/Failure Trending

Q44 **What does PG&E do in the area of component maintenance history and failure trending?**

A44 (Crockett) A major component of root cause analysis and component failure trending is the history of the components. Currently there are approximately 187,000 individual components in the DCPP Component Data Base,

each with its own maintenance history available in PIMS. The information is readily available on PIMS when a problem occurs with a particular component. For example, it is possible to determine the maintenance history of an individual valve, or all valves with the same model/manufacturer, or all valves in a system. Component experience is also available from an industry wide database, the Nuclear Plant Reliability Data System ("NPRDS"), maintained by INPO.

PG&E uses component history data for two systematic failure trending in several respects. First, all failures of components necessary for accident mitigation or whose loss of function could initiate significant plant transients are reported and included in NPRDS. The failure report contains extensive detail, including manufacturer, model number, serial number, supplier , application, failure mode, detection method, corrective actions, symptoms of failure, systems affected, narrative of the failure, and cause.

DCPP examines every component failure report in the NPRDS database that results in a major transient. If the same component is used at DCPP in a similar application, PG&E investigates the failure to determine if our application, maintenance practices, or surveillance testing assure we will not have the same transient. When corrective actions are required, the normal processes are used.

Second, DCPP design and maintenance departments routinely research failure rates in components as part of the design or parts replacement process. Any DCPP components failing at a rate higher rate than the industry average are evaluated and an appropriate evaluation is initiated.

Third, Nuclear Safety Engineering researches component failure rates using the DCPP component history. Failure rates are initially screened by computer using continuously upgraded evaluation techniques. Components that are identified in this process are then screened by engineers. This methodical evaluation process will detect failure trends occurring within systems by component type, manufacturer/model, and by other groupings. This is an approach designed to detect any aging failure mechanisms.

V. MAINTENANCE AND EQUIPMENT AGING MANAGEMENT AT DCPP

Maintenance and Surveillance Programs and Activities

Q45 How does maintenance and surveillance at DCPP address equipment aging?

A45 (Giffin) As described above, equipment aging management is inherent in maintenance and surveillance. PG&E has long recognized the benefits to be gained from initiatives to identify and address the effects of age-related degradation of SSCs. A commitment to aging management has existed since construction at DCPP began.

As a result, PG&E has many mature maintenance and surveillance programs and practices in place at DCPP that address equipment aging.

Some of the more significant programs and activities that assist in mitigating the effects of age-related degradation include:

- The preventive maintenance program provides the necessary inspection, testing, and monitoring activities and periodic equipment servicing and refurbishment to maintain the reliability of the equipment.
- The predictive maintenance program seeks to forecast the functional ability and necessary maintenance of SSCs.
- The corrective maintenance program addresses the repair of plant SSCs. Corrective maintenance can provide valuable input to the aging management program regarding potential aging effects.
- Surveillance test programs, including ISI/IST, help to detect any degradation that might affect SSC operability or reliability.
- Fatigue monitoring provides on-line fatigue cycle monitoring of sensitive components.
- The EQ program defines qualified life and service criteria for certain electrical equipment.
- A reactor vessel embrittlement management plan outlines PG&E's long term strategy to assure the

integrity and operational life of DCPP's reactor vessels.

- A Motor Operated Valve ("MOV") testing and evaluation program identifies and mitigates performance problems with safety-related MOVs through design reviews and testing activities.
- A steam generator Strategic Management Plan employs inspection results, industry experience, and engineering analyses to predict steam generator degradation trends and recommend aging mitigation strategies.
- Structural monitoring addresses the condition and integrity of important plant structures.
- An erosion/corrosion program addresses the aging effects of erosion/corrosion mechanisms in piping systems.

Each of these programs or activities produce specific results and corrective actions to maintain and/or restore equipment to its required performance level. These measures address aging effects regardless of whether the aging occurred prior to or during plant operation. In addition, results from these programs are used to develop new or enhanced strategies to improve maintenance and monitoring activities, highlight strategic issues, and increase understanding of aging mechanisms to insure that necessary actions are taken for mitigation.

Plant/Equipment Improvements to Date

Q46 **Since plant startup, has PG&E made or planned plant equipment modifications or replacements at DCPP which improve reliability or reduce the likelihood of future age-related degradation?**

A46 (Giffin) Yes. A number of major plant modifications designed to improve reliability or upgrade safety-related equipment have been made during the eight years since DCPP began operation. Several others are planned in the near future. Some of the more significant modifications include:

- *Copper Removal* - This project involved replacement of all feedwater heaters and retubing of all moisture separator reheaters. These changes resulted in the removal of essentially all copper from the secondary side of the plant to increase the life of the steam generators.
- *Condensate Polisher Addition* - To increase the life of the steam generators, a Condensate Polisher System was added to process secondary water by ion-exchange.
- *Ammonium Hydroxide Storage* - To regenerate condensate polisher resin, a 6,000 gallon bulk storage tank for ammonium hydroxide was added.
- *SG Blowdown Rate Increase* - To improve secondary water chemistry and thus increase the expected life of the steam generators, the blowdown rate has been increased.

- *Control Room Upgrade* - A detailed control room design review ("DCRDR") was performed in accordance with the requirements specified in Supplement 1 to NUREG-0737. Weaknesses in the man-machine interface between control room operators and equipment were identified in the DCRDR. Following review and approval by the NRC, control room equipment upgrades have been implemented.
- *High Density Spent Fuel Pool Racks* - The original fuel racks in each unit's spent fuel pool were replaced with high density racks, increasing the capacity in each spent fuel pool from 270 to 1324 fuel assemblies.
- *Improved Fuel Design* - The reactor fuel used in each unit is being replaced with an improved VANTAGE 5 Westinghouse design.
- *Boron Injection Tank ("BIT") Removal* - In response to industry experience and NRC recommendations, the BITs in both Diablo Canyon units were removed from service to reduce the potential for boric acid crystallization in the Emergency Core Cooling System ("ECCS") piping and valves which could potentially have degraded safety-related equipment operability.
- *Reduced Boric Acid Concentration* - The boron concentration in the Boric Acid System has been reduced from 12 to 4 weight percent to reduce the potential for boric acid crystallization in safety-related components.

- *Digital Feedwater Control System* - A digital feedwater control system was installed to improve feedwater control performance and reliability. The enhanced feedwater control features provided by this system reduces the likelihood of steam generator level-related reactor trips.
- *Computer Replacement* - The original plant process computer was replaced with one having improved man-machine interface, greater capacity, faster response time, improved print and report capability, improved retrieval of historical data, and complete redundancy to prevent loss of information due to single failure.
- *ATWS Mitigation System Actuation Circuitry ("AMSAC")* - The AMSAC System was installed in both Diablo Canyon units to ensure reactor protection during an anticipated transient without scram ("ATWS") event that results in the loss of the secondary side heat sink. AMSAC is designed to trip the main turbine, initiate auxiliary feedwater flow, and isolate steam generator blowdown and sample lines during an ATWS with a low steam generator level condition.
- *Chlorination System Modifications* - Modifications to the Chlorination System include (1) the use of liquid hypochlorite to control microbiofouling instead of gaseous chlorine, (2) implementation of continuous chlorination of the auxiliary saltwater system to control macrobiofouling (invertebrate marine life),

and (3) possible use of intermittent injection of a chlorine/bromine mixture to prevent macrofouling in the Circulating Water System.

- *Fatigue Monitoring* - PG&E has installed an on-line fatigue monitoring system at Diablo Canyon that will continuously analyze plant operational data to track fatigue usage of critical reactor coolant system components.
- *Additional Diesel Generator* - Addition of a sixth diesel generator will provide each unit with three dedicated diesel generators. This will enhance reliability of the onsite power distribution system by eliminating dependence on a swing diesel generator and the associated procedural complexities. Installation, testing, and tie-in of the sixth diesel was completed in April 1993.
- *Plant Process Protection System Upgrade* - This project will upgrade the Process Protection System by replacing the existing HAGEN 7100 equipment with a Westinghouse Eagle 21 system. New steamline break logic and steam generator low-low level trip time delay options will be included in the upgrade. These changes will improve the reliability and availability of the Process Protection System. The digital microprocessor-based system with computer-enhanced testing will also minimize the likelihood of personnel error during surveillance testing. System

installation is scheduled for the spring of 1994 for Unit 1 and the fall of 1994 for Unit 2.

- *RTD Bypass Elimination* - This project will replace the resistance temperature detector ("RTD") bypass loop piping with fast response RTDs installed in the hot and cold legs of the Reactor Coolant System. Plant downtime and radiation exposures will be reduced and numerous snubbers can be eliminated. Installation is scheduled for the spring of 1994 for Unit 1 and the fall of 1994 for Unit 2.
- *Radiation Monitoring System ("RMS") Upgrade* - This project will upgrade the present RMS to improve performance and reliability, and reduce required maintenance. Most of the work is scheduled to be completed by 1995.

Many of these major modifications, made subsequent to the issuance of the operating licenses for DCPP, constitute upgrades in plant equipment or operating systems which will help minimize the effects of age-related degradation on the plant over the remainder of the 40-year operating life contemplated by the license amendment request.

<u>Aging Management Program Directive</u>

Q47 **Has PG&E formalized its aging management efforts?**

A47 (Giffin, Crockett) Yes. The overall aging management program for DCPP was recently established pursuant to Program Directive TS1, "Plant Aging Management." This program encompasses and augments the many existing programs (listed in A45 above) that address age-related degradation over a 40-year operating life.

The DCPP aging management program collects data and utilizes input from many resources to insure that PG&E stays on the "cutting edge" of new developments and technologies for detecting and responding to age-related degradation. New research findings, industry operating experience, and information from the NRC, EPRI, Westinghouse, and other sources are considered for inclusion in appropriate programs. A process is also defined to integrate PG&E and industry experience into the existing DCPP maintenance and surveillance programs.

A major element of this enhanced aging management program involves increased emphasis on aggressive participation in activities that capture new technological advances and tools developed to improve nuclear plant life cycle management/aging management capabilities. As a result, during the first half of 1993 PG&E pursued this objective through the following initiatives:

- In January 1993, PG&E joined the EPRI Life Cycle Management ("LCM") subcommittee. EPRI is a recognized leader in research and development activities involving all aspects of the power industry. The LCM subcommittee has been established as a forum to

develop and/or assemble state of the art technical information , tools, and methodologies to assist nuclear power plant licensees in optimizing plant performance by identifying, evaluating, and mitigating the effects of plant aging to support continued safe, reliable long term nuclear plant operation.

- Acting on a PG&E initiative, the Region V Engineering Manager's Forum ("EMF"), consisting of representatives from Region V licensees, recently authorized the establishment of an aging management subcommittee. One of the primary objectives of this subcommittee is to share, collaborate, and disseminate information regarding issues and developments involving aging management.
- In February 1993, utility owners who are members of the Westinghouse Owners Group authorized an $8 million, five year project to manage nuclear plant life cycle management/license renewal issues facing the industry. One of the primary objectives of this program is to develop technical reports (based upon ongoing research, technical evaluations and plant experience) and other tools that guide member utilities in their efforts at managing aging in important plant components. PG&E has taken a leadership role in this effort by serving on a core project management team.

The above initiatives enhance the existing, ongoing PG&E efforts to identify, evaluate, and implement evolving aging technologies, tools, and methodologies.

Q48 **Are there other programs at DCPP to address aging/maintenance of specific equipment?**

A48 (Giffin) Yes. As we stated at the outset of this testimony in A7, for certain critical components subject to complex aging mechanisms, or for certain components with a limited life (e.g., some EQ equipment), special maintenance programs have been implemented at DCPP. Some of these mature programs are also listed in our response A45 listing existing programs that effectively address equipment aging. We will now describe a few in greater detail.

<u>Steam Generator Tube Degradation</u>

Q49 **How does PG&E address steam generator tube degradation?**

A49 (Giffin) At DCPP, steam generator tube degradation is monitored and managed by careful chemistry control during operation and by an extensive cleaning and inspection program during each refueling outage.

During plant operation, chemistry conditions in the condensate, feedwater, steam generators, makeup water, and other systems are monitored and controlled in accordance

with the chemistry guidelines published by EPRI (PWR Secondary Water Chemistry guidelines - Revision 3, May 1993). These guidelines reflect state-of-the-art industry thinking with respect to measures for reducing corrosion and for enhancing steam generator reliability.

During refueling outages the following techniques are used for tube cleaning and inspection:

- "Sludge lancing" to remove sludge accumulated during operation;
- "Pressure pulse cleaning" to aid in sludge removal in the upper area of the tube bundle; and
- Eddy current inspection to assess the condition of tubing (PG&E is actually inspecting by this technique a much larger scope than required by applicable guidelines to proactively assure detection of trends).

PG&E is also an active member of the EPRI Steam Generator Reliability Project. Participation in this and other industry groups helps keep PG&E aware of new developments related to steam generators. As new understanding of steam generator tube degradation emerges and new processes and recommendations for mitigation of age-related degradation are developed, PG&E has actively pursued prompt implementation of such initiatives. Examples of steam generator maintenance initiatives at DCPP are heat treatment of row 1 and 2 tube U-bends and "shotpeening" of all hot leg tube ends.

PG&E has also prepared a comprehensive Steam Generator Strategic Management Plan which compares the status of

DCPP steam generator tube degradation with that of other steam generators throughout the industry and predicts performance over time. Based on the current number of so-called "defective" tubes, DCPP compares well with the industry. Tubes are defined as "defective" with degradation equal to or greater than 40 percent through wall. Defective tubes are required to be repaired by either plugging or sleeving. Unit 1, with 43 tubes (0.3 percent of total tubes) plugged, is in the 20th percentile of the industry (i.e., 80 percent of plants have higher steam generator tube degradation rates); Unit 2, with 76 tubes (0.6 percent) plugged, falls just above the 50th percentile. If this level of performance continues, we predict that less than 10 percent of the tubes in each unit would require repair before the end of life based on license recapture (i.e., 2021 for Unit 1 and 2025 for Unit 2). It is also estimated that most of these tubes could be repaired by sleeving so that the overall effect on steam generation and plant performance would be minimal.

<u>Reactor Pressure Vessel Aging Management</u>

Q50 **How does PG&E address reactor pressure vessel embrittlement?**

A50 (Giffin) PG&E has and will continue to comply with NRC regulations governing Reactor Pressure Vessel ("RPV") surveillance and integrity codified at 10 CFR 50.61 and

Part 50, Appendix H. The DCPP Reactor Vessel Radiation Surveillance Program is designed to monitor changes in material/mechanical properties of the DCPP RPVs over the operating life of the plant to assure safe continued operation of the vessel. DCPP's surveillance program was designed to meet the requirements of ASTM E-185, "Standard Practice For Conducting Surveillance Tests For Light Water Cooled Nuclear Power Reactor Vessels."

Reactor vessel integrity is also evaluated through periodic 10-year in-service inspections which are required by ASME Section XI. The in-service inspections require volumetric inspection of all pressure retaining welds, and all full penetration nozzle welds; volumetric and surface inspection of all pressure retaining dissimilar metal welds and visual inspection of 25 percent of the partial penetration nozzle welds external surface. The first in-service inspection was successfully conducted on both units during the most recent outages, with no adverse findings.

Alternative fuel management strategies are also continually being evaluated to determine the most effective way to reduce reactor vessel exposure to neutron irradiation. To date these strategies have resulted in two fuel arrangement changes. DCPP implemented Phase 1 of the fuel management strategy in the first reload of each unit by incorporating a "low leakage" fuel loading pattern which yielded approximately a 30 percent flux reduction compared to standard loading patterns. A low leakage

loading pattern is achieved by loading relatively low enrichment fuel assemblies which have been previously burned in the preceding cycle in the core periphery to reduce the number of neutrons produced near the vessel wall. Phase 2 of the fuel management strategy was incorporated into the cycle 3 design which targets flux reduction measures in specific areas (i.e., the welds adjacent to the corner baffle locations).

PG&E has also recently implemented a comprehensive, state of the art Embrittlement Management Program which is designed to manage all of the issues relating to reactor vessel embrittlement.

Q51 **Has PG&E's regulatory compliance in this area been documented?**

A51 (Giffin, Crockett) Yes. Compliance with all NRC regulations governing vessel integrity has been documented in PG&E's response to Generic Letter 92-01 (PG&E Letter No. DCL-92-150, dated June 30, 1992). In addition, PG&E has calculated the Reference Temperature for Pressurized Thermal Shock ("PTS") for each weld metal and base metal in the DCPP beltline region for neutron fluences corresponding to 40 operating years. Since all materials meet the screening criterion in 10 CFR 50.61, neither additional flux reduction nor plant specific PTS analyses are required to comply with the PTS rule. Details of the

PTS evaluation were submitted to the NRC in 1992 (PG&E Letter No. DCL-92-056, dated March 6, 1992).

Erosion/Corrosion

Q52 **How does PG&E address piping erosion/corrosion concerns?**

A52 (Crockett) The term Erosion/Corrosion ("E/C") in the context of nuclear power plants refers to the process of wall thinning in susceptible piping or other pressure boundary components caused by the flow of water or wet steam. E/C is a normal part of the plant aging process; consequently, its management is an integral part of normal maintenance at DCPP. All DCPP secondary-side piping systems operating above 212°F, containing single or two-phase water (but not dry steam), are susceptible to the effects of E/C and are therefore included in a DCPP E/C Monitoring Program. Notably, safety-related piping which is fabricated of stainless steel is not susceptible to E/C degradation.

The rudiments of the DCPP E/C Monitoring Program were established in 1983, well before commercial operation was achieved. Later, in early 1987, PG&E formed a multi-discipline E/C Task Force. The Task Force is charged with developing and maintaining a broad-based perspective on E/C monitoring at DCPP. Rather than relying upon any single methodology for the prediction of E/C-susceptible locations, the Task Force has maintained a

defense-in-depth approach to address E/C at DCPP. PG&E's defense-in-depth philosophy includes monitoring E/C experience through a number of industry and NRC sources.

The DCPP E/C inspection scope incorporates approximately 160 components per unit in the most recent outage inspections. The most severe examples of E/C degradation found at DCPP are highly localized, and typically occur downstream of control valves and at reducing orifices in areas of extremely high fluid turbulence. Piping at all such locations has been or is in the process of being replaced with E/C-resistant material such as stainless steel or chrome-moly steel. These replacements are a permanent solution to the degradation problem, as proven by continued monitoring.

The next-fastest wearing piping occurs in the high pressure extraction steam piping exiting the high pressure turbine. The majority of this piping has already been replaced at DCPP with stainless or chrome-moly steel as a permanent solution, as proven by continued monitoring. The replacement of the remainder of this piping at DCPP is scheduled to be completed within the next several fuel cycles.

The DCPP E/C Monitoring Program was identified as an engineering strength in the 1992 NRC SALP Report. We believe the E/C program is an integral part of the PG&E corporate commitment to the safe, reliable operation of DCPP.

EQ Equipment

Q53 **How does PG&E maintain the continuing qualification of electrical equipment within the scope of the EQ program?**

A53 (Ortore) As discussed earlier, each item of EQ equipment has a calculated qualified life corresponding to the time the equipment can operate under its normal, installed operating conditions and still be considered qualified for the postulated post-accident harsh environment. For equipment whose qualified life is less than 40 years, replacements are scheduled and made before the end of the qualified life (in accordance with procedure AP D-756, "Maintenance and Surveillance of Electrical and I&C Environmentally Qualified (EQ) Equipment").

PG&E considers the anticipated effects of normal operating environmental conditions, including temperature, corrosion, dynamic interactions and radiation exposure, in the overall design of equipment utilized for safety-related service at DCPP. EQ equipment in particular is specified, designed, and fabricated for the anticipated service conditions. Required periodic inspections, tests, and surveillances provide assurance of continued equipment performance within these operating environments. To the extent EQ requirements dictate particular maintenance requirements (e.g., to preserve qualified life under normal conditions, or to simply preserve qualification such as by maintaining equipment

seals), these requirements are incorporated into the maintenance practices for the specific equipment. This process is also established by AP D-756.

Equipment qualified lives are specifically calculated based on the anticipated service environment. Environmental conditions which might have adverse effects on of these components are monitored by normal surveillance test procedures ("STPs") and periodic functional checks during routine operations and preventive maintenance. For example, DCPP procedures STP I-1A, "Routine Shift Checks Required by Licenses" and STP I-1B, "Routine Daily Checks Required by Licenses," specifically provide for the monitoring of outside and inside containment temperatures, respectively. These temperature measurements assure that Technical Specifications are met during plant operation for containment average air temperature monitoring (Technical Specification 3/4.6.1.5) and for important outside containment area temperature monitoring (Technical Specification 3/4.7.11). If the temperature recorded during these surveillances exceeds the limitations in the Technical Specifications, corrective measures are taken to restore the temperature within limits and an evaluation is performed by engineering to identify any necessary reduction to the qualified life of EQ equipment.

PG&E also has established a program for temperature monitoring in connection with maintenance of EQ equipment. Two maintenance procedures provide guidance:

- MP E-57.4, "Environmental Qualification Maintenance and Survey of Containment Penetrations, Cable and Splices": and
- MP E-57.8A, "Temperature Monitoring".

Procedure MP E-57.4 provides the necessary guidance for the visual inspection and insulation resistance testing of cable penetrations and splices in accordance with EQ requirements. MP E-57.8A provides guidance for the methods of specific device temperature monitoring to obtain qualitative temperature information. In accordance with these procedures, temperature indicating stickers are placed on various EQ devices to identify any equipment that may be exposed to temperature extremes higher than previously considered for qualified life purposes. These stickers identify momentary peaks and are sometimes augmented by continuous temperature recording devices. This program allows engineering to again consider whether local conditions cause any impact on the qualified life of equipment.

<u>Structures</u>

Q54 **How does PG&E maintain plant structures?**

A54 (Giffin) Maintenance of structures at DCPP has been based upon experience and proven practices that PG&E has employed over decades of operation at its generating facilities. Aging of passive, long-lived structural concrete and steel in particular is caused by processes

that are well understood and readily detected. Conditions such as spalling or cracking of concrete, corrosive or caustic attacks from leaks, spills or exposure to the environment, mechanical damage, and rust are routinely identified and reported by plant personnel (e.g., operators, firewatches, and security personnel) as they move about the plant. They are investigated and appropriate action taken. In addition, as noted previously, at DCPP system engineers conduct periodic walkdowns of their systems. During their inspections, they can observe signs of structural degradation.

For safety-related structures, functional surveillance requirements are specified in the Technical Specifications. This periodic surveillance testing verifies operability of these structures. For example, functional integrity of the DCPP containment structures must be routinely tested and documented by local and integrated leak rate surveillance test procedures. Containment coatings are also inspected under a special program.

VI. ISSUES RAISED BY MOTHERS FOR PEACE

Q55 Are you familiar with the Supplement to Petition to Intervene filed by the MFP on October 26, 1992 alleging certain problems with PG&E's maintenance and surveillance program for DCPP as specified in the bases for proposed Contentions I and IV?

A55 (All) Yes.

Q56 **Are you also familiar with MFPs Supplemental Response to First and Second Sets of Interrogatories and Request for Production of Documents Filed by PG&E which the MFP filed on June 21, 1993, and in particular Attachment C, which was MFPs unfiled "Reply to NRC and PG&E Responses to Petitioner's Supplement to Petition to Intervene dated December 10, 1992," relating to Contentions I and IV regarding alleged deficiencies in PG&E's maintenance and surveillance programs?**

A56 (All) Yes.

Q57 **In the original contention bases and the unfiled reply of December 10, 1992, MFP has identified a number of examples which they allege support their contention that the DCPP maintenance and surveillance programs are not sufficiently effective and comprehensive. Could you comment on these assertions?**

A57 (All) MFP in these documents has identified a number of specific events at DCPP which they allege demonstrate that DCPP's maintenance and surveillance programs are not sufficiently effective and comprehensive. Many of these events have been reported and documented in our extensive process of identifying problems, thoroughly investigating them, taking corrective action, and improving our

operations to prevent recurrence. Specific problems which have been identified and discussed by MFP in support of their contention which will be discussed in greater detail later in this testimony, involve containment fan cooler unit backdraft dampers, the positive displacement pumps operating procedures, steam generator feedwater nozzle indications, reactor cavity sump level indication, the motor operated valve program, debris found in the containment building, diesel generator turbo charger bellows bolting, diesel generator fuel oil piping corrosion, chemical volume and control system leakage, measuring and test equipment control deficiencies, emergency diesel generator surveillance test issues, fuel handling building ventilation leakage, residual heat removal ("RHR") recirculation sump screen deficiencies and turbine governor and stop valve malfunction.

Q58 **Can you characterize these examples in a general sense and put in perspective their nature, significance and relationship to the overall maintenance and surveillance program?**

A58 (All) The alleged problems are in some cases examples where something has fallen short of our expectations. However, these identified problems have been relatively minor, had no safety significance, have been thoroughly investigated and pursued, and have resulted in improvements to our maintenance and operations practices.

In most cases, the problems are examples of how effective and thorough PG&E's maintenance program has been in addressing isolated errors or omissions and aggressively following up to assure that we are continuously improving our performance.

It is also important to note at the outset that the number of problems identified by MFP is very small when compared to the very large number of tasks and individual actions which comprise our overall maintenance and surveillance programs. Over the past three years, PG&E estimates that there have been more than one million individual tasks and activities conducted during an operating cycle per unit in our maintenance and surveillance program. The relatively low rate of problem occurrence (e.g., reportable events, missed surveillances, nonconformances) indicates a well-functioning program, with an active and aggressive problem identification and resolution effort. Nonetheless, it is important that even a relatively small number of problems be properly identified, documented, resolved, and used to improve the overall effectiveness of the DCPP maintenance and surveillance program. These identified problems have been extensively reviewed, in accordance with DCPP's problem resolution program described earlier in this testimony. Root causes have been determined and measures taken to prevent recurrence.

Q59 Can you draw any additional conclusions about the specific events discussed by MFP (in the documents referenced in Q56) relative to any pervasive patterns or recurring events?

A59 (All) As we review these specific events, as well as the events characterized in the problem report documents referenced by the MFP, we see no pervasive or systematic problems that would indicate a programmatic weakness in our maintenance and surveillance programs. Rather, we see random occurrences or omissions that are typical of human shortcomings when engaged in a complex array of human activities. In some cases, a procedure was not sufficiently explicit. Other occurrences involved individual inattention to detail; while still others involved the exercise of judgment by an individual that some activity is acceptable, when a later, more thorough, review determines it to be unacceptable. We conclude that these are random problems of the type that one might normally anticipate to occur in the implementation of a nuclear plant maintenance and surveillance program. In addition, a defense-in-depth philosophy was incorporated into the plant design, the plant operating program, and the maintenance and surveillance programs at DCPP. This includes redundant trains of safety equipment, operator training to recognize and respond to problems, and surveillance and maintenance to identify and correct problems and potential problems. This defense-in -depth

assures that individual random equipment failures and personnel errors will have no effect on safe operation of the plant.

On the other hand, as we have previously stated, it is extremely important that we learn from these problems, investigate them and understand them fully, and continuously improve our maintenance and surveillance programs based on what we have learned. Each identified problem has its associated corrective action, which often includes improvements to procedures, training, work implementation, or work control. During this evaluation process, PG&E critically assesses how it conducts its activities. Thus, it should not be surprising that we identify mistakes and errors and use this information to formulate new and/or better ways to conduct our maintenance and surveillance activities.

Additionally, PG&E engages in a variety of self-critical evaluations and assessments which are designed to provide insight into and improve maintenance and surveillance at DCPP. This constant search for ways to improve is a hallmark of PG&E's and has contributed to the NRC placing DCPP on the "best plants" list for the past two years. Far from being an indication of programmatic weakness, PG&E's documented investigation and self-critical evaluation of the items cited by MFP, indicates that the overall maintenance and surveillance program is strong, effective and comprehensive.

Containment Fan Cooler Units Backdraft Dampers

Q60 For each of the specific events discussed by the MFP, please provide a very brief description of what went wrong and what was done about it. Let's begin with the Containment Fan Cooler Units Backdraft Dampers.

A60 (Giffin) Each of the DCPP units has five Containment Fan Cooler Units ("CFCUs") within the containment to provide ventilation and cooling during normal operation as well as postulated accident conditions. Each CFCU has a backdraft damper downstream of the fan. The backdraft damper is designed to close on reverse air flow and prevent the fans from rotating in a reverse direction. The design basis accident reverse flow could be caused by higher pressure in the discharge duct resulting from a postulated pipe rupture in the lower portion of the containment structure.

The problems with the backdraft dampers discussed, among other places, in NRC Inspection Report ("IR") 92-17, involved loose counterweights on the dampers and the incorrect assembly of certain linkages connecting the damper vanes caused by inadequate maintenance practices.

PG&E identified and evaluated these problems and determined that the CFCUs were operable in the as-found condition. Accordingly, there was no safety significance to the issue. The NRC found no programmatic deficiency or breakdown in PG&E's maintenance program and did not take any escalated enforcement action.

Nonetheless, because the inadequate maintenance practices fell short of our expectations PG&E formed a HIT team to assure adequate planning and coordination of maintenance on CFCUs. Our investigations revealed several areas for improvement in the maintenance and surveillance of the CFCUs, including improved procedures for damper linkage servicing and tightening of damper counterweights, improved procedures for post-maintenance inspection and testing, improved training, and additional emphasis on attention to detail when working on the plant ventilation systems.

In addition, we increased system engineering support for this type of ventilation system and improved our efforts in performing thorough and probing investigations of problems in ventilation systems. Later, as part of our increased inspection efforts on this system, small cracks were found in some of the damper vanes. By the end of the recent Unit 2 refueling outage, all of the damper vanes in both units had been replaced with material which is less susceptible to initiation of fatigue cracks.

Positive Displacement Pump Operating Procedures

Q61 **Please discuss the issues raised by MFP concerning the positive displacement pump operating procedures in the 1990-1992 period?**

A61 (Giffin) Each of the Diablo Canyon Units has one Positive Displacement (Charging) Pump (PDP) and two

full-capacity Centrifugal Charging Pumps ("CCPs") to maintain water level in the reactor coolant system pressurizer during normal operation. The CCPs have higher flow capacity and are also used to inject water into the primary system under certain postulated accident conditions. During normal operation, it is preferable to use the low flow PDP for charging. However, the industry has experienced hydraulic/mechanical vibration problems with this type of high pressure, low flow reciprocating pump for many years. At DCPP, the PDPs have required relatively high maintenance, and vibrations under certain operating conditions have caused pipe cracking in some of the associated small diameter piping system.

In August 1990, the PDPs for both units were placed in standby service status pending installation of in-line vibration dampening devices. In the interim, the CCPs are being used for this normal charging function in accordance with plant operating procedures.

In August 1992, PG&E received two notices of violation concerning the lack of appropriate procedures for operation of the PDPs as a backup to the CCPs in the unlikely event of a fire in the centrifugal charging pump room. Our own investigation concluded that there was a weakness in our procedures for using the PDPs as a backup under this postulated fire situation. However, neither the NOVs nor our own evaluation found any deficiency in maintenance or surveillance of the PDPs. In fact, the problems related to a lack of clear procedural guidance

provided by engineering and operations to the operating staff on use of the PDPs in response to a postulated fire involving both centrifugal charging pumps. Simply stated, this deficiency was not a maintenance-related issue.

The operators' procedures and instructions were clarified to better define the standby status of the PDPs pending the installation of the in-line vibration dampening equipment.

There was no safety significance due to placing the PDP in the backup mode while the vibration problem was investigated because the combustible loading in the area was limited, smoke detection and the wet-pipe sprinkler system were available, and an hourly fire watch was in place in the CCP rooms.

<u>Steam Generator Feedwater Nozzle Indications</u>

Q62 Could you address the MFP reference to indications of steam generator feedwater nozzle cracks in Unit 1 in 1992?

A62 (Crockett) The steam generator feedwater nozzle is a 20-inch diameter piping connection through which feedwater flows into each steam generator. These nozzles and the immediate upstream piping are susceptible to interior surface cracking as found at other nuclear power plants. This surface cracking results from nozzle metal temperature difference caused by certain relatively infrequent operating flow conditions during which cold water is flowing into the steam generator through a hot

nozzle. During a visit to another nuclear plant, a PG&E engineer observed a problem the plant had with feedwater nozzle cracking. When the engineer returned to DCPP, he recommended that as a prudent measure, inspections for similar cracking be performed at DCPP at the next scheduled refueling outage. As a result, during the fifth refueling outage for Unit 1, in September 1992, an ultrasonic inspection was performed which indicated some surface cracking indications in the steam generator feedwater nozzle connection welds at DCPP.

Based on these findings, a short piping section and the pipe-to-nozzle weld were replaced on all four steam generators in DCPP Unit 1. Later metallurgical investigations of the removed pipe and weld material, using sophisticated detection techniques, determined that the actual interior surface cracking was significantly smaller than indicated by the original ultrasonic evaluation. The ASME code allows such small surface cracking and, thus, we could have actually continued operation without repair. Our crack growth projection calculations demonstrated that crack growth would not have exceeded code allowables for at least another full cycle of operation.

Surface crack depth was determined to have been acceptable during the previous cycle operation, and repairs were not required for safety or code compliance reasons. Thus, there was no safety significance to this issue.

Nonetheless, to minimize future potential problems in this area, a design change is being developed to install a thermal sleeve device inside the pipe and nozzle connection to prevent contact between cold feedwater and the hot nozzle connection at this location during the relatively infrequent operating conditions of high temperature differential. In retrospect, this is an excellent example of the proper functioning of the DCPP maintenance and surveillance program, especially in assimilating industry experience and proactively initiating repairs even where existing standards do not require such repairs.

Reactor Cavity Sump Level Indication

Q63 **MFP has raised a question regarding alleged inadequate corrective action involving the Reactor Cavity Sump Pump Level Indication system. Could you address this question?**

A63 (Vosburg, Crockett) On November 6, 1990, it was discovered that both Wide Range Reactor Cavity Sump Level instrumentation channels were inoperable. Investigative actions subsequently determined that the instruments had been inoperable since August 21st of that year. The cause for the failure of one of the indicators was due to a blown fuse. However, due to the intermittent nature of the failure, our extensive investigation could not determine the exact cause for the failure of the other

channel. A suspect component was replaced and the instrument was tested and returned to service.

The delay in recognizing these failures was due to the fact that the instrumentation normally indicates zero percent sump level and the indicators had "failed low", thus giving approximately the same indication. Sump level is also displayed on the Safety Parameter Display System ("SPDS") which provides the plant operators with certain safety-related information. The SPDS provides an indication when questionable input values are detected. As a corrective action for this event, training was given to operations and maintenance personnel on interpreting the SPDS displays with respect to failed channel indications.

On October 22, 1991, another intermittent failure occurred in one of the two sump level indicators and investigation determined that the indicator had been out of service for approximately eight days. Again, the root cause for the instrument failure could not be found. After replacing the instrument and much of the interconnecting cable, the problem was resolved. The sump level instrumentation has operated normally since that time.

Since the failed instrument had been inoperable for approximately eight days prior to discovery, the effectiveness of the initial corrective action was reexamined. Additional corrective measures were taken to revise STP I-1B, "Routine Daily Checks Required By Licenses", to include a step for a member of the

Operations staff to check the SPDS display each shift. The STP now includes specific guidance with respect to SPDS indications of a questionable instrument channel and actions to be taken when channel problems are identified. As further corrective action, PG&E has reviewed all SPDS and control room indicators where a similar instrument failure might be difficult to detect from the control room and improved the procedure to cover these additional control room indicators.

This event is not indicative of a programmatic breakdown in the maintenance program. In each case, extensive investigative effort was expended to determine the specific cause of the instrument failures. However, in some cases involving intermittent failures it can be extremely difficult to pinpoint the exact cause for an equipment failure. The most likely causes of the problem are addressed, the equipment tested and/or replaced, and returned to service under increased surveillance. In this case, the initial actions taken to improve the capability to identify a degraded channel were not effective. When this was recognized, more comprehensive actions were taken to replace the faulty equipment and assure that any possible failures in the future would be promptly detected.

Motor Operated Valves

Q64 MFP has identified DCPP's response to Generic Letter 89-10, regarding motor operated valves, as being deficient. Could you discuss this issue and DCPP's response?

A64 (Ortore) An extensive MOV testing program is being implemented throughout the industry in response to NRC Generic Letter 89-10. In their Supplemental Petition, MFP refers to NRC Inspection Report 91-39, dated January 24, 1992, which identified certain weaknesses in PG&E's MOV testing program involving calculation methodology, selection criteria, verification parameters and trending.

MFP's reading of the inspection report is out of context. Notably, the NRC inspection report in fact concluded that PG&E appeared to be developing an "aggressive" and comprehensive Generic Letter 89-10 program. No deviations or violations of NRC requirements were found. The NRC inspection report comments regarding "weaknesses" are typical of NRC inspection activities in areas of development and improvement. The inspection report also commented that our MOV program was proceeding satisfactorily. Their comments and concerns were evaluated by PG&E and our program has been adjusted in specific areas to make further improvements.

PG&E believes that it has a good MOV program. PG&E is monitoring the development of the industry's response

through its participation on industry groups and committees. Again, nothing in the NRC IR cited by MFP supports the conclusion that this aspect of DCPP's maintenance and surveillance program is deficient.

<u>Debris Found in Containment Building</u>

Q65 **MFP has stated that DCPP had a problem with debris in the containment building. Could you discuss this issue?**

A65 (Crockett) The RHR recirculation sump in each containment building provides a collection point for water during a postulated accident, so that the water can be recirculated, cooled and returned to the system for accident mitigation. Housekeeping inside the containment building should assure that no loose debris (rags, papers, clothing, plastics, etc.) can be transported to the containment sump.

In October 1991, near the end of the Unit 2 fourth refueling outage, certain debris was found in the containment building during a PG&E Quality Control surveillance. The debris included a small plastic bag, some wipealls, a tool bag, a water jug and a tool bin. An engineering evaluation demonstrated that this small amount of debris would not have impacted the operability of the safety systems and, therefore, it did not represent a safety concern. Later, during the Unit 1 fifth refueling outage, although there was overall improvement, some further problems with control of debris were noted.

These problems with control of debris in the containment building caused PG&E to recognize that the program in effect to control material and housekeeping in containment during outages needed to be reorganized and strengthened to clarify responsibility for housekeeping and control of loose debris.

Corrective action has included the logging of all personnel in and out of containment at key times, logging and inspection of all jobs in progress every shift, periodic containment walkdowns, and a documented tailboard explaining the importance of housekeeping rules for all workers allowed in containment. The containment coordinator is now responsible for performing a housekeeping inspection of the accessible work areas of the containment during each shift to verify maintenance of housekeeping standards. PG&E believes that these corrective actions will prevent recurrence.

<u>Diesel Generator Turbo Charger Bellows Bolting</u>

Q66 **Could you discuss the problem with DCPP's expansion bellows during pre-operational installation of the new sixth emergency diesel generator?**

A66 (Vosburg) An expansion bellows is used on the turbo charger for each emergency diesel generator to connect the turbo charger to the exhaust piping. The issue cited by MFP and addressed in NRC IR 92-14 (June 5, 1992) involved insufficient written instructions for installing the lower

flange connecting the expansion bellows to the turbo charger during pre-startup installation of the new sixth diesel generator. The installation engineer verified the correct bolting and gasket material to be used, and the installation was completed. However, this action was not documented in accordance with DCPP procedures. Because the work was completed properly, the documentation deficiency had no safety significance.

This issue was not a maintenance or surveillance problem. It occurred during the installation of the new sixth diesel generator during the construction phase. At the time, the sixth diesel generator had not been turned over to the plant, and was not yet part of the plant's safety systems. The deficiency in documentation was corrected and the level of attention to such documentation was improved on the sixth diesel generator project.

Diesel Generator Fuel Oil Piping Corrosion

Q67 **Could you discuss the corrosion problem discovered by PG&E involving the diesel generator fuel piping?**

A67 (Crockett) The diesel generator fuel oil system is used to transfer fuel oil from underground storage tanks to the emergency diesel generators. This small diameter piping runs below ground in concrete trenches, on the seaward side of the turbine building and within the turbine building buttress area. The piping was installed in the 1970s and has experienced corrosion on its external

surfaces from the salt air environment. Over time, this environment corroded the piping's exterior surface in areas where the external coating on the piping had not been fully effective in preventing corrosion.

This problem, identified by PG&E in voluntary Licensee Event Report 1-92-006, was discovered during a PG&E inspection. Certain local repairs were made in the highly corroded areas. PG&E determined that the system's operability was not compromised even in the degraded condition. However, based on the general conditions of the piping and the environment in the trench area, it has been decided to replace the entire length of piping and to use improved coating techniques in the new installation.

Accordingly, this issue - identified and corrected by PG&E - does nothing to support MFP's contention. This type of problem and its resolution illustrates how the DCPP maintenance and surveillance program functioned properly to find the deteriorating piping and then to replace the piping with upgraded design materials or construction techniques.

<u>Chemical and Volume Control System Leakage</u>

Q68 **Describe the chemical and volume control system leakage issue raised by MFP regarding valve diaphragm degradation.**

A68 (Giffin) During normal plant operation, the primary function of the Chemical and Volume Control System

("CVCS") is to maintain reactor coolant system inventory. Parts of the system are heat-traced to keep concentrated boric acid in solution. During a postulated accident, portions of the system are used to recirculate and supply water to mitigate the accident.

In June 1992, during a routine radiation survey, leakage was noted from a CVCS valve bonnet in a heat-traced portion of the system. This leakage was determined to be outside the design basis for CVCS leakage. The leak was immediately stopped by tightening the valve body-to-bonnet nuts. The issue was identified by PG&E and reported in LER 1-92-009, Revision 1, dated January 11, 1993.

Our investigation revealed that the cause of the leakage was thermal degradation of the valve diaphragm due to a malfunctioning heat trace thermostat causing leakage through the body-to-bonnet joint. Corrective actions included lowering the heat trace temperature for the valve, reviewing every other valve in similar service in Units 1 and 2 to verify there were no other potential problems, reviewing the entire heat trace system for proper setpoints and installation, and improving our surveillance monitoring program.

A similar leak occurred in September 1991 due to a different root cause. In that instance, valve body-to-bonnet leakage was caused by an isolated case of the valve vendor recommendations (concerning bonnet nut torque and diaphragm replacement) not being adequately

included in the preventive maintenance program. The preventive maintenance program was reviewed and upgraded to address this issue. No similar problems were found.

The analysis of the as-found leakage in both events determined these events were not safety significant or programmatic.

Measuring and Test Equipment Control Deficiencies

Q69 Describe DCPP's response to measurement and test equipment control deficiencies identified in 1991.

(Giffin) An NRC inspection during February 1991 found deficiencies in the control of Measuring and Test Equipment ("M&TE") administrated by the Mechanical Maintenance ("MM") Department at DCPP. This inspection also found that PG&E's own Quality Control ("QC") and Quality Assurance ("QA") Departments had previously audited the MM M&TE program and found similar deficiencies which had not been aggressively corrected.

The identified deficiencies were reviewed in detail to determine the potential impact on plant equipment. The deficiencies involved calibration or use of torque wrenches and mechanical gauging devices. The application of the torque wrenches and gauging devices was found to have no effect on the plant equipment. The overall maintenance program controls for safety-related work (e.g., detailed work orders, post-maintenance operability

testing, etc.) were found to be adequate. Therefore, there was no safety significance to these deficiencies.

The corrective action for the deficiencies in the MM M&TE program included accelerating a previous management decision to transfer and consolidate all responsibility for MM M&TE equipment to the Instrument and Controls (I&C) Department M&TE program -- a program which was, and is, working effectively. Prior to the NRC inspection, PG&E had initiated a QA audit to verify and supplement information on the deficiencies found by PG&E's QC organization, but had not yet implemented improvement in a timely manner. Additional corrective action included improvement in the quality resolution process, better definition of management expectations concerning the resolution of quality audits, and improved training on M&TE requirements.

Emergency Diesel Generator Surveillance Test Issues

Q70 In their reply to PG&E's response to the proposed contention, MFP supplements the original basis of the proposed contention by citing "weaknesses" stated by the NRC in IR 92-01. The MFP state that these "weaknesses" challenge the maintenance and surveillance program. What is your reaction to this issue.

A70 (Crockett) During 1991, the NRC performed an extensive functional inspection on Diablo Canyon's electrical distribution system. The NRC issued IR 92-01 as a result

of this inspection. The specific "weaknesses" which were described on page 1 of this NRC report and discussed by MFP were attributed by the NRC to the Engineering Department. These weaknesses were not relevant to DCPP's maintenance and surveillance programs. Two Severity Level IV NOVs were issued but they were separate and apart from the NRC "weaknesses" discussed by MFP. Both NOVs related to specific surveillance procedures which have been corrected. The overall conclusion of the inspection was that DCPP's electrical systems were acceptable, no immediate safety or operability concerns were identified, and no broad scope programmatic breakdowns were noted.

Fuel Handling Building Ventilation Leakage

Q71 **Describe the DCPP fuel handling building ventilation leakage issue raised by MFP's Contention IV (age-related degradation).**

A71 (Crockett) The Fuel Handling Building ("FHB") ventilation system for each unit is designed to maintain a slight negative pressure inside the building. This design is accomplished by removing more air (with the exhaust fans) than what is supplied to the FHB (by the supply fan). Thus, air leakages will be inward and all potential releases from the spent fuel pool are exhausted through filters. This functional capability is required to be verified by a surveillance test procedure every 18 months. On September 1989, this surveillance was performed and

fully met the specific requirements for negative pressures. The next required test was performed on January 18, 1992. Although the measured pressure was negative, it did not meet the specific operability requirement. PG&E conservatively assumed that the FHB ventilation system was inoperable at the time of fuel movement during the Unit 1 third refueling outage in October 1989. Prompt action was initiated in accordance with our problem resolution procedure to investigate the situation, determine a root cause and implement corrective action.

Our investigation determined that the cause of system inoperability was the existence of small leakage paths into the building due to building and seal degradation. Corrective action included sealing the leaks. Both FHBs have also been re-sided. The new siding is the best available on the market with an expected life of greater than 25 years.

Analysis of the event showed that because of conservatism in the ventilation system design, sufficient negative pressure was maintained at the surface of the spent fuel pool throughout the event and there was no safety significance.

RHR Recirculation Sump Screens

Q72 **MFP has stated that DCPP had a problem with gaps in the containment building recirculation sump screens and debris inside the sumps. Could you discuss these issues?**

A72 (Crockett) Yes. RHR recirculation sumps are surrounded by debris screens. In February 1990, the NRC issued Enforcement Action 89-241 citing PG&E for three violations related to the RHR recirculation sump screens. One of the violations involved inadequate engineering and construction completion, which resulted in unacceptable gaps in the screen structure. The second involved operational control that allowed an unattended open access hatch in the screens. Neither of these two violations bears any relation to maintenance or surveillance. Both were corrected. The third violation included a reference to poor performance of a visual surveillance of the sumps, which resulted in unidentified debris remaining in the sumps. This deficiency was an isolated personnel error -- an individual failed to implement an otherwise clear procedure. This does not indicate a program problem. As a corrective action, PG&E clarified requirements for inspection of the sumps.

Turbine Governor and Stop Valve Malfunction

Q73 **Describe the DCPP turbine governor and stop valve malfunction cited by MFP.**

A73 (Vosburg) The main turbine speed is controlled by four governor valves ("GVs") during startup, operation and shutdown. Four additional stop valves ("SVs"), located in line with the GVs, are used to trip and isolate the turbine during overspeed and other conditions. All eight

valves are controlled by an electro-hydraulic ("EH") system.

In September 1992 during a Unit 1 shutdown, simultaneous circumstances occurred which resulted in a steam flow path being created through the SVs and GVs after the turbine had been tripped, thereby causing the turbine to accelerate. The operators controlling the evolution immediately tripped the turbine. No reactor or turbine limits were exceeded.

Our investigation into this event found the cause to be a combination of factors, including a sticking pressure switch, low EH system pressure and steam leakage. Corrective actions included replacing and upgrading the pressure switch, correcting several conditions in the EH system and revising our shutdown procedures to add additional verification of EH system control parameters during turbine shutdown.

Two other previous related events merit discussion. In August 1991, a problem with the Unit 2 turbine control system resulted in a spurious GV opening. Rigorous investigative testing could not determine the root cause. The problem was intermittent and could not be reproduced. The most likely cause was thought to be a sticking pressure switch, similar to the switch which contributed to the September 1992 Unit 1 event. The switch was replaced. In March 1992, a spurious SV opening occurred on Unit 1 due to suspected steam leakage. The SVs were

operable and, therefore, no corrective action was necessary.

PG&E believes that its investigation and corrective actions for these two events were comprehensive and thorough. In retrospect, operations personnel should have implemented more positive interim compensatory action (such as changes to the operating procedure or additional training) which may have prevented the third, September 1992, event. As part of our corrective action for the third event we upgraded our use of interim compensatory measures.

No operating limits were exceeded during any of the three events. This equipment is not safety-related. None of the events was safety significant.

4kV/12kV Cable Problems

Q74 **MFP has raised an issue regarding maintenance of the 4kV and 12kV underground cables between the turbine building and the intake structure. Please discuss the recent problems experienced by DCPP involving these cables.**

A74 (Ortore) DCPP has experienced three failures of 4kV cables -- two safety-related and one nonsafety-related. Two of these failures were random in nature and time of occurrence. One of the failures was detected by PG&E during post-maintenance High-Potential ("Hi-Pot") testing. Additionally, there were two area-specific failures of

non-safety 12kV cables. Both types of cable are contained in conduits located in underground duct banks routed between the turbine building and the intake structure. The safety-related and non-safety related 4kV cables supply electrical power to safety related cooling water pumps and a non-safety related load center transformer, respectively. The nonsafety-related 12kV cables supply electrical power to the main circulating water pumps.

The failures which occurred in the 12kV nonsafety-related cables were caused by exposure to a contaminant which was present in the underground conduits in a localized area between the turbine building and the intake structure and which caused severe cable jacket and insulation degradation. Both of these failures were detected with the ground detection system, allowing operator action to isolate the cable before complete failure of the cable.

Neither of the two safety-related 4kV cable problems involved actual in-service failures. One involved a momentary alarm indication signaling a potential ground fault. When this occurred, the redundant cooling water pump was started and the cable with the potential fault was isolated. The second case occurred during routine "Hi-Pot" testing while the cable was out of service during a refueling outage. One of the two safety-related 4kV cables was in a location remote from the more recent 12kV cable failures. Moreover, the 4kV cable jackets did not exhibit any physical degradation as did the 12kV cable

jacket. These differences would suggest that there was no imminent common-mode cable failure mechanism involved with these occurrences .

After failures occurred to the 4kV and 12kV cables, the failed cable sections were replaced. Reviews of the original design, installation, quality assurance and/or quality control audits for the failed cables were conducted. These reviews have concluded that the installed cables are of acceptable quality and design for their specific applications and service conditions (wet or dry). However, as a prudent measure, additional sections of unfailed 4kV and 12kV cables have been replaced.

A contributory cause of the 12kV failures was believed to be water carrying contaminants into the cable conduits. While sump pumps are provided in the vaults, they were not at that time part of the formal maintenance program and, accordingly, were not maintained in an adequate manner. After rains, the vaults would fill with water and flood the conduits. The sump pumps have been repaired and are now included in our preventive maintenance program.

PG&E believes that the maintenance activities with regard to these underground cables are adequate, particularly given the installations involved. To the extent our continuing analysis of these issues suggests the need for further maintenance activities, they will be included in our program.

Q75 **Are there other issues raised by the MFP in their supplemental filing of December 10, 1992 regarding Contention I, that were not maintenance and surveillance issues? If yes, would you please comment on them.**

A75 (Giffin) Yes, there are several issues raised by the MFP in the document that are not maintenance issues. The major issues are as follows:

- CCW, AFW, and Fuel Oil Transfer Pump Vault Drain (NRC Enforcement Action 89-85, May 5, 1989)
  - These problems involved design or design basis issues, not the maintenance and surveillance programs. They were corrected by revisions to operating procedures, reclassification of equipment, or upgrading design basis documentation.
- Feedwater Pump - Control System Power Supply Failure (Management Meeting of April 2, 1992).
  - This problem was a design issue involving a particular electrical circuit design for redundant power supplies, and it was not a maintenance or surveillance issue. A complete reassessment of this design to enhance the capability to withstand local component failures was performed and modifications to the electrical circuit were implemented.

* Residual Heat Removal ("RHR") System Operational Problems (NRC Enforcement Action 87-131, dated August 7, 1987 and NRC NUREG 1269, "Loss of Residual Heat Removal System, Diablo Canyon Unit 2")
  - The loss of RHR occurred during mid-loop operating conditions. The causes of this event were related to inadequate control of system operation during this infrequent and abnormal operating condition. The event resulted in extensive investigative and corrective action. The enforcement action cited deficiencies in the operating procedure control, the quality control inspection, and a safety evaluation. These were not maintenance or surveillance issues. Corrective actions included several operating procedure changes, upgrading of operator training, and improvement of the temporary level indicating systems used during refueling outages.

In summary, none of these matters related to any programmatic deficiency or breakdown in DCPP's maintenance or surveillance programs.

VII. CONCLUSION

Q76 Do any of the problems cited by MFP and described above indicate a pervasive concern relative to lack of

timeliness in resolution of problems or a lack of proper attention?

A76 (Giffin) No. In the vast majority of cases we consider our response to have been timely. In applying resources to address issues, we consider safety significance, operational necessity, and the time it takes to perform a comprehensive assessment of the issue. For the kinds of issues identified by MFP, we believe that thorough investigation and thoughtful corrective action are very important aspects. We also believe that we have emphasized the need for thorough responses, and that the extensiveness of our corrective actions reflects our desire to promote significant improvements to our maintenance and surveillance program.

Q77 **Do these issues of events indicate a programmatic deficiency or breakdown in PG&E's maintenance and surveillance programs at DCPP? Why or why not?**

A77 (Giffin) No. The issues or events described above do not in any way represent a programmatic deficiency or programmatic breakdown in PG&E's maintenance and surveillance programs at DCPP. These issues or events represent a relatively few random and isolated occurrences that are inevitable in any large and complex program of human activities. They are not concentrated in any one aspect of the program. Rather, they have involved

different equipment, systems, procedures, locations, or operating conditions. Furthermore, they have occurred at random times and in a random manner, without a particular pattern relating to organization staffing or supervision.

Moreover, I want to re-emphasize that the maintenance-related problems that have occurred at DCPP represent only a small number of occurrences relative to the very large number of maintenance activities, surveillances, and individual steps in maintenance work orders. We perform more than a million individual maintenance and surveillance tasks and activities at each unit during each refueling cycle. These problems and issues have been aggressively handled and thoroughly documented in a clear, self-critical manner.

Q78 **Are you aware of events or documents, other than those cited by MFP as a basis for Contention I and discussed above, that relate to maintenance and surveillance at DCPP?**

A78 (Giffin) Yes. Based on information provided to MFP by PG&E during discovery in this case, MFP has identified other documents which it intends to rely upon in this proceeding. Some of these relate to plant maintenance and surveillance activities.

Q79 **How would you characterize these documents?**

A79 (Giffin) These documents generally are part of our normal processes. As we have discussed elsewhere in this testimony, when issues or problems are identified at the plant, they are documented and thoroughly investigated to prevent recurrence. A process is in place to track these matters to resolution. We believe that a program of aggressively finding and documenting problems, thoroughly investigating them, and continually improving our operations is essential to a complete and comprehensive approach to plant maintenance.

In addition, as a means to foster continuous improvement, we do perform from time to time candid self assessments of our programs. In this context, the existence of deficiency reports, critical self-assessments, and the like are not evidence of a faulty maintenance program. Rather, they evidence a properly functioning program.

Q80 Does this conclude your testimony?

A80 (Crockett, Ortore, Vosburg) Yes.

August 2, 1993

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	Docket Nos. 50-275-OLA
	)	50-323-OLA
Pacific Gas and Electric Company	)	
	)	(Construction Period
(Diablo Canyon Nuclear Power	)	Recovery)
Plant, Units 1 and 2)	)	
	)	

TESTIMONY OF PACIFIC GAS AND ELECTRIC COMPANY
ADDRESSING CONTENTION I: MAINTENANCE AND SURVEILLANCE

PART 2: Tedd A. Dillard

August 2, 1993

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	Docket Nos. 50-275-OLA
	)	50-323-OLA
Pacific Gas and Electric Company	)	
	)	(Construction Period
(Diablo Canyon Nuclear Power	)	Recovery)
Plant, Units 1 and 2)	)	
	)	

TESTIMONY OF TEDD A. DILLARD ON BEHALF OF
PACIFIC GAS AND ELECTRIC COMPANY
ADDRESSING CONTENTION I: MAINTENANCE AND SURVEILLANCE

Q1 **Please state your name, affiliation, and current job responsibilities.**

A1 My name is Tedd Dillard. I am the Supervisor of Component Programs for the Nuclear Division of Florida Power & Light Company ("FPL"). I was the Manager of Maintenance at the St. Lucie Nuclear Power Plant from May 1983 until November 1988. Prior to that, I was the Mechanical Maintenance department head at St. Lucie for eight years. My current responsibilities include supervising the efforts of a group of engineers responsible for the FPL Nuclear Division's technical expertise for major plant components at both FPL nuclear facilities. I am also responsible for developing FPL's implementation plan for the Maintenance Rule, 10 CFR 50.65.

Q2 **What other qualifications do you have in the area of nuclear power plant maintenance?**

A2 In addition to my maintenance experience at FPL, I have had an opportunity during the past six years to visit a number of nuclear power plants and participate in several industry maintenance assessment efforts. I was corporate evaluator on an Institute of Nuclear Power Operations ("INPO") maintenance assistance review team evaluation of our Turkey Point Plant. I was a peer evaluator on an INPO maintenance assistance review team at the Ft. Calhoun Nuclear Plant. I was a member of one of several teams who visited the Mihama Nuclear Plant of Kansai Electric Company in Japan in conjunction with our quality improvement efforts. I served on the Nuclear Management and Resources Council ("NUMARC") Ad Hoc Committee that developed the industry response to the proposed Nuclear Regulatory Commission ("NRC") Maintenance Rule. I also served on one of four committees that developed the implementation guidance document for NUMARC that the NRC has endorsed with the regulatory guide for the NRC Maintenance Rule.

I have more than 23 years of experience in United States commercial nuclear power plants, the last 20 of which has been with FPL.

A copy of my professional qualifications is provided in Exhibit 12.

Q3 **What contention will you address?**

A3 I will address San Luis Obispo Mothers for Peace ("MFP") Contention I, which is:

> "The San Luis Obispo Mothers for Peace contends that Pacific Gas & Electric Company's (PG&E) proposal to extend the life of the Diablo Canyon Nuclear Power Plant for more than 13 years (Unit 1) and almost 15 years (Unit 2) should be denied because PG&E lacks a sufficiently effective and comprehensive surveillance and maintenance program."

Q4 **What is the purpose of your testimony?**

A4 The purpose of my testimony is to provide my opinion as to whether PG&E has implemented a comprehensive and effective maintenance program at the Diablo Canyon Nuclear Power Plant ("Diablo Canyon"). PG&E specifically requested that I visit Diablo Canyon and review the maintenance program, procedures, and program implementation at the plant in light of my experience with maintenance at St. Lucie and in observing and evaluating other nuclear power plants. It is my understanding that PG&E solicited my views, in part, based on the fact that St. Lucie has been given Category 1 ratings by the NRC in the maintenance area in Systematic Assessment of Licensee Performance ("SALP") evaluations. St. Lucie is also one of the plants singled out by the NRC for distinction on its "Best Plants" list.

Q5 **What were your overall impressions of the Diablo Canyon maintenance program?**

A5 Based on my review of the program and procedures, my interviews with maintenance personnel, and my visit to the plant, it appears to me that PG&E has implemented a comprehensive and effective program. I observed no significant weaknesses. In the time available to me, I did not, of course, review all details of the program. However, I should add also -- and I will spell this out in more detail below -- that based on my experience, I believe I can spot quite readily a well-maintained plant or a poorly-maintained plant based on some important indicators. Diablo Canyon appeared to me to be very well maintained by a very professional and knowledgeable staff.

Q6 **In general, explain the criteria you applied in evaluating Diablo Canyon.**

A6 I will use as a guide the elements contained in INPO Document 90-008, Maintenance Programs in the Nuclear Power Industry. This document is a compilation of the performance objectives and criteria used by INPO in evaluating nuclear power plants. I believe that the objectives and criteria are comprehensive and that if an organization effectively implements them the resulting performance will be good, and more

importantly, will continue to improve over time. Like many plants, Diablo Canyon has a maintenance program that meets the elements contained in INPO 90-008. I would like to point out that INPO 90-008 is not an organization chart or structure, but is a list, in no particular order, of elements or functions of maintenance that have been shown to be important to the effective operation of a nuclear power plant.

I note also that in one of the prehearing conference orders in this case, the Licensing Board observed that the existence of adequate programs on paper does not constitute proof of effectiveness, but that "the implementation of these programs is the only real gauge of their effectiveness." Given my operating background, I could not agree more. When I look at a plant, Diablo Canyon included, I specifically look at how paper programs are implemented.

In addition to an overview of the programs in place at Diablo Canyon, I have, therefore, tried to make specific personal observations at the plant. It is not the purpose of my testimony to respond in detail to any of the specific examples cited by MFP in the bases for their contention. However, I have tried to use observations closely related to their examples. There are thirty INPO elements, but I am addressing the eighteen that I believe are most relevant to the contention.

Q7 Please address your criteria one-by-one and provide your observations regarding Diablo Canyon. The first concerns Management Assessment.

A7

- <u>Management Assessment</u>

  Performance Objective: Management and supervisory personnel should monitor and assess station activities to improve all aspects of station performance.

  Criteria: Line managers and supervisors are responsible for and personally take part in monitoring and assessing station activities. Assessments by other independent groups, such as Quality Assurance, are used by line managers and supervisors as a management tool to assist them in assessing station performance.

It is my observation that this element of the program is in place. Specific examples are:

- The housekeeping throughout the plant was excellent.
- There were only about twenty action tags hanging on equipment in the secondary part of the plant.
- The condition of both operating and standby equipment was very good.
- Compliance with industrial safety work practices was excellent. Everywhere I went people wore their hard hats, eye glasses, and hearing protectors.
- People were careful to ensure that fire and security doors locked properly behind them.
- Supervisors and managers that I talked to were readily able to discuss the condition of

equipment, and were very responsive to questions about the trends in performance and condition in their area.

It is my conclusion that the conditions that I have listed (and there are many more) would not be true unless the managers and supervisors are doing an excellent job in assessing plant conditions.

Q8 **The next criterion is Quality Programs. Please describe your observations in this area.**

A8 • <u>Quality Programs</u>

Performance Objective: Quality programs should effectively monitor activities that affect safe and reliable plant operation, provide feedback to line management on quality of performance, and contribute to improved performance.

Criteria: Quality programs reinforce and support the line functions of managers and supervisors. Line managers and supervisors are responsible for and held accountable for the quality of work performed within their area of responsibility.

There were a number of indications that quality programs are healthy at Diablo Canyon. Some examples follow:

- One of the best examples that the attitude toward quality programs is good is the comprehensive plant aging management document, "Aging Management Program," dated June 30, 1992, generated at a very high level in the organization. This shows a strong commitment to the issue. This is being

addressed as a high level business objective. It is a very comprehensive document and includes all aspects of plant aging. It addresses how to define terms and how to apply the programs. It discusses different age-related degradations and mechanisms. But most importantly, it outlines the relationship of the many activities, organizations, and outside factors that bear on the issue. It also assigns responsibility for the implementation. I believe this document indicates that PG&E is clearly aware of the importance of managing this issue and has taken action to do so.

- Examples of quality programs in place that I observed are:
  - Hot work permits
  - Equipment clearance tagging
  - Scaffold tagging

  These examples demonstrate that quality programs are in place and are working.

Q9 **The next criterion is Maintenance Organization and Administration. Please address this.**

A9

- <u>Maintenance Organization and Administration</u>

  Performance Objective: The maintenance organization and administration should ensure effective implementation and control of maintenance activities.

  Criteria: Administrative controls are employed in the conduct of maintenance

activities that affect safe and reliable plant operation. Examples of such activities include scheduling of preventive maintenance, use of special tools and lifting equipment, and use of measuring and test equipment.

In my tour of the plant and discussions with plant staff, it was clear that the maintenance organization and administration are being effectively implemented. Observations are:

- In all discussions with plant staff, they had a ready answer for who was responsible for various aspects of what was being discussed. For example, when talking to technical support people about the Inservice Testing ("IST") program, they had a clear understanding of how the check valve inspection program in maintenance fits in.
- The Work Planning Department plans and coordinates the work of all three maintenance disciplines with the Operations Department. This is a free-standing organization that must effectively coordinate the activities of many different departments. They are responsible for daily work and outage activities, too. The efficient outages that Diablo Canyon has had show how effective PG&E has been, as this is a major effort coordinating several thousand activities in a sixty-day period.
- Significant work has been done at the intake structure over the past couple years. The scope and volume of this work was substantial and required a coordinated effort from many groups to

be successful. The success of the improvements in the intake structure is an excellent example of organizational effectiveness.

- An interdepartmental administrative procedure was developed to improve the implementation of the plant's response to Generic Letter ("GL") 89-10 regarding motor-operated valves ("MOVs"). This document outlines the actions and accountabilities of eight different plant organizations that play a role in effectively responding to the requirements of GL 89-10. The NRC noted in their inspection of this area that "the inspection findings indicated that you appear to be developing an aggressive, well-integrated program for assuring MOV reliability. Program strengths were found in the area of program scope and your high impact team (HIT) approach to integrating the multi-disciplined activities required for the 89-10 program."

These examples show, in my opinion, that the maintenance organization is properly defined and that proper administrative controls are in place. From what I have seen, the organization appears to be effective.

Q10 **Next, please address the Plant Material Condition at Diablo Canyon.**

A10 • Plant Material Condition

Performance Objective: The material condition of the plant is maintained to support safe and reliable plant operation.

Criteria:

- Systems and equipment are in good working order; examples of this include the following:

  a. Fluid system leaks are minimized.
  b. Equipment is appropriately protected from adverse environmental conditions.
  c. Instruments, controls, and associated indicators are calibrated, as required.
  d. Good lubrication practices are evident.
  e. Fasteners and supports are properly installed.
  f. Equipment, structures, and systems are properly preserved and insulated.

- Material deficiencies are identified and are in the work control system.
- Temporary repairs are minimized and permanent requires are made when conditions permit.
- Temporary environmental protection (e.g., dust, humidity, freeze, shock) is provided for plant equipment when needed to support construction, outage, or maintenance activities.
- Newly installed or modified systems/equipment are verified to be in good working order prior to operational acceptance by the plant staff.

Plant material condition is one of most visible examples of maintenance effectiveness. The condition of the equipment is the end to which all programs and efforts point. While visual appearance alone is not a guarantee of reliability, it is a very good indicator of equipment condition. Diablo Canyon has an excellent

plant material condition. Some of the many examples are noted below:

- I toured two of the six emergency diesel generator rooms. The rooms were very clean with no dust or trash anywhere. There were no equipment or tools left anywhere in either of the rooms. There were only two action request tags hanging in both spaces. The air start air supply system was very leak-tight as the compressors never cycled in the ten minutes we were in the rooms.
- The 4kV switch gear rooms were in excellent condition. There were no cross-under pipe manway cover leaks. It has been my experience that they are next to impossible to consistently make up leak tight.
- The piping rack area, which includes the auxiliary feedwater ("AFW") piping, was in very good condition. The valves, pipe hangers and pipe snubbers were all in good condition.
- The feedwater heater level control stations were in excellent shape. They were leak-free, clean, the lights behind the level site glasses were lit and were in about as good a condition as any I have ever seen. It has been my experience that the level site glasses are difficult to prevent from leaking. The insulation on the feedwater heaters was very clean and neat.

- The main feedwater pump and drive turbines were in very good shape. These types of turbines have a low pressure control oil system and usually have a number of small leaks on the reservoir and bearing pedestals, in my experience. These particular ones were very clean and dry. The turbine platforms were clean and free of any debris.
- The condensate pumps, the condensate booster pumps, and the heater drain pumps were all clean and leak-free.
- Diablo Canyon uses a large vacuum pump to draw vacuum and a stream jet to maintain vacuum, so the pump is in standby mode most of the time. It was in excellent condition.
- The condenser wells were in very good condition with no evidence of leaks down in the well area. The wells were very clean. There were no materials or tools stored down in the wells.
- The intake area, both top-side where the screen drives are and below where the pumps and motors are, was in excellent condition. This area has had a large effort directed at improving its condition in the last year. Large areas of concrete have been chipped out and replaced. They are about complete with this effort and the results are outstanding.
- The intake screens are being replaced with new stainless steel all welded units.

There are many other specific observations I could make but I believe the examples provided demonstrate that the equipment at Diablo Canyon is in very good condition. This is one of the very best plants that I have seen. There is no doubt is my mind that a plant could not be kept in this condition and not have an effective maintenance program.

Q11 **What were your observations regarding the Work Control System?**

A11 • <u>Work Control System</u>

Performance Objective: The control of maintenance work should support the completion of tasks in a safe, timely, and efficient manner such that safe and reliable plant operation is optimized.

Criteria:

- The work control system provides management with an accurate status of maintenance planning and outstanding maintenance work.

- Work planning includes considerations such as material, tool, and manpower requirements; interdepartmental coordination; safety considerations; radiological protection requirements; and quality control requirements. Maintenance history records and NPRDS information are considered where appropriate.

- Advance planning is performed and routinely updated for scheduled outages. Considerations such as work priority, work procedures and instructions, plant/system conditions, length of outage required, prestaging of documents and material, and coordination of support activities are included.

Some of my observations follow:

- Diablo Canyon has a work planning department that has the responsibility of planning all of the work done by the Maintenance Department and scheduling all of the work performed on site. They do this on a daily basis as well as for outages. Every morning they meet with the representatives of all operating departments to go over the schedule for the next few days. They meet on Friday afternoon to review the plan for the weekend and again on Tuesday to factor in what happened over the weekend. This process is very tightly controlled as a great effort is given to coordinate all the activities necessary to accomplish a given job. Jobs brought in late to this process must be important in order to be included. The effort put into the efficient planning and scheduling pays off in reduced manhours and equipment out of service time. To do it well is the mark of a strong organization, in my opinion, as it is difficult to bring all different groups and activities together on the dozens of jobs that are done on any given day.
- The maintenance action requests ("ARs") are part of the maintenance equipment history, and the number and age of action requests are tracked by department. The division directors are

responsible for the control of the backlog and age of the action request in their areas.

- The excellent overall housekeeping condition of the plant is an indicator of an effective work control system.
- The posting of hot work permits, equipment clearances, and scaffold tags are also indications of an effective work control system.

I believe that these examples show that the work control system at Diablo Canyon is well conceived.

Q12 **Please address the Conduct of Maintenance at Diablo Canyon.**

A12

- Conduct of Maintenance

  Performance Objective: Maintenance should be conducted in a safe and efficient manner to support plant operation.

  Criteria:

  - Personnel exhibit professionalism and competency in performing assigned tasks that results in quality workmanship.
  - Maintenance personnel are attentive to identifying and are responsive to correcting plant deficiencies with a goal of maintaining equipment/systems in an optimum material condition.
  - Managers and supervisors routinely observe maintenance activities to identify and correct problems and to ensure adherence to station policies and procedures including industrial safety and radiation protection.

This is an important aspect of maintenance performance. The conduct of maintenance is not as

visible as the plant material condition, but is an important indicator of the way that the results are obtained. Some examples of my observations on the conduct of maintenance at Diablo Canyon follow:

- Everyone that I observed out in the plant was very conscious of industrial safety work practices. They all wore their safety equipment and were careful that all security and fire doors were secured behind them. This showed me that the habit of doing things right is a part of their daily work. It has been my experience that it is very difficult to get hundreds of people to do all these small daily activities consistently well.
- During my tours of the plant, I noted many times that supervisors were out in the field. In two cases, I saw the mechanical department head inspecting equipment in the plant at different locations and times. In my discussions with him he displayed a good knowledge of the plant and the equipment in it.
- During my tour of the intake area, I was impressed with the area foreman's knowledge of and commitment to the intake area. He was obviously very enthusiastic about his work. He readily answered all of my questions, and in many cases anticipated where I was leading to and volunteered much more information. An example of this was on a question I had about the intake crane. He not

only answered my questions, but told me what the plans were for future work on the crane. He discussed experience they had on the cables, the plans to replace the cables with stainless, and the schedule for non-destructive examination of the hook. The crane had recently been included in a plant-wide crane inspection program. Such knowledge and enthusiasm is a clear example, in my mind, of a very healthy commitment to the effective conduct of maintenance. Such outstanding examples would not exist, I believe, unless a strong culture exists at the plant to support it.

- During my tour of the high voltage switchgear rooms, I noted a significant work activity where large steel beams were being added to stiffen the walls. This was in response to a seismic upgrade. This work involved cutting, welding, grinding, painting, and chipping in the relatively small space between the switchgear cabinets and the walls. The area had been very effectively controlled by the manner in which the scaffolding had been erected, and clear, yellow plastic was draped to prevent arc flashes from harming people and dust from escaping from the work area. This is a good example of effective conduct of maintenance.

I believe these are examples wherein the maintenance program is being implemented very well at Diablo Canyon.

Q13 **Did you observe a Preventive Maintenance Program at Diablo Canyon?**

A13 • <u>Preventive Maintenance</u>

Performance Objective: Preventive maintenance should contribute to optimum performance and reliability of plant systems and equipment.

Criteria:

- A preventive maintenance program is effectively implemented and includes systems and equipment that affect safe and reliable plant operation.
- Preventive maintenance, including predictive maintenance activities, are performed at appropriate intervals. These intervals maximize equipment availability. Considerations such as operational experience, vendor recommendations, engineering analysis, and cost/benefit analysis are used as a basis to establish preventive maintenance tasks and intervals.
- Preventive and maintenance activities are scheduled and performed within established intervals. Preventive maintenance is waived or deferred only with management approval.

Yes. Some observations related to preventive maintenance made during my plant tour follow:

• The implementation of activities for preventive maintenance are done by the respective maintenance organizations. The development and coordination of specific preventive maintenance activities is the responsibility of the Preventive Maintenance

Engineering Group. They are responsible for the technical aspect of preventive maintenance activities and for determining the proper frequency of the activities. The Group includes representatives from the maintenance disciplines. The Group reviews vendor recommendations, technical manuals, data provided by Reliability Engineering, and equipment history files which include all action requests for that piece of equipment. This appeared to be a comprehensive and effective process and the overall plant equipment condition reinforces this view.

- Diablo Canyon is implementing a reliability centered maintenance ("RCM") project. This is an ongoing effort, the results of which are available plant-wide on their computer-based information management system (known as "PIMS"). The basis of why an activity is or is not recommended is documented and can be referred to in the future to support why a certain activity is recommended. Factors included are:
  - why it is a critical component
  - what the RCM analysis results are
  - what the system engineer analysis was
  - what the vendor recommendations are

  This RCM project is an effort by the maintenance organization to improve the performance of the plant equipment. This project appears to receive

high levels of commitment from management as it was mentioned by several management-level people in discussions with them. This is an example, in my view, of an organization that is looking for ways to constantly improve its performance.

- The preventive maintenance program also ties in with the Inservice Inspection/Inservice Testing and performance monitoring activities at the plant.

It is my conclusion that the preventive maintenance program at Diablo Canyon is in place to improve equipment performance.

Q14 **Please address your next criterion, Maintenance Procedures and Documentation.**

A14

- Maintenance Procedures and Documentation

  Performance Objective: Maintenance procedures and other work-related documents should provide appropriate directions for work and should be used to ensure that maintenance is performed safety and efficiently.

  Criteria:

  - The preparation, review, approval, and revision of procedures and other work-related documents are properly controlled.

  - Documents used in lieu of procedures (such as excerpts from vendor manuals) receive the same review and approval as procedures.

  - Procedures and other work-related documents such as vendor manuals,

drawings, reference materials, and posted job performance aids used in support of maintenance are technically accurate and up-to-date.

Specific examples I observed wherein this element is being effectively implemented at Diablo Canyon are:

- My review of selected procedures satisfied me that procedures are in place for effective control of maintenance activities. I did not review all procedures. However, the procedures I did review were comprehensive, clear, and in general what would be expected of effective procedures.
- Specific procedures examined include:
  - MA1, Maintenance (which is a program overview document and shows how all of the maintenance elements within the plant work together)
  - OM7, Problem Resolution
  - OM7 ID1, Problem Identification and Resolution Action Request
  - AP C-250, Preventive Maintenance Program (electrical)
  - AP C-450, Preventive Maintenance Program (I&C)
  - NPAP C-3, Conduct of Plant and Equipment Tests
  - AP C-62, Preventive Maintenance Living Program
  - AP C-352, Surveillance Testing and Inspection

Q15 **Does PG&E compile and evaluate Maintenance Histories?**

A15 • <u>Maintenance History</u>

Performance Objective: Maintenance history should be used to support maintenance activities, upgrade maintenance programs, optimize equipment performance, and improve equipment reliability.

Criteria: Maintenance history records are maintained for systems, equipment, and components that affect safe and reliable plant operations.

Yes. Based on my discussion with maintenance personnel, reliability engineering personnel, preventive maintenance engineering, as well as some system engineering personnel, and upon my procedure review, I believe it is reasonable to conclude that Diablo Canyon has an effective maintenance history program. Some of my observations are:

- All of the action requests for a piece of equipment are permanently added to the computerized history file. This aids in the determination of equipment performance and evaluation of the effectiveness of preventive maintenance activities.
- The reliability centered maintenance project information is entered into equipment history.
- The trending of equipment performance by the reliability engineering group is an effective use of equipment history.

- Outage management utilizes historical performance as a base for current outage planning.

Q16 **Please address your next criterion, Maintenance Facilities and Equipment.**

A16
- <u>Maintenance Facilities and Equipment</u>

  Performance Objective: Facilities and equipment should effectively support the performance of maintenance activities.

  Criteria:

  - Maintenance facilities size and arrangement promote the safe and effective completion of work.

  - Measuring and test equipment (M&TE) is calibrated and controlled to provide accuracy and traceability. Out-of-tolerance test equipment is removed from service. Plant equipment calibrated with out-of-tolerance test equipment is evaluated in a timely manner for operability, and is recalibrated as necessary.

Diablo Canyon has excellent facilities. The plant as a whole has excellent facilities and the maintenance facilities are outstanding. During my tour of the plant, I had an opportunity to see most of the maintenance facilities, as well as the training facilities. Some specific examples follow:

- There is a very good light machine shop and mechanical facility between the units in the turbine building. This shop was very spacious and very well equipped. There were four lathes, two milling machines, and several smaller power tools

such as drill presses and grinders. It was also equipped with a nice overhead crane.

- The intake structure has its own free-standing workshop area that is almost as large and well-equipped as the maintenance shop described above. They also have an office and break/lunch building. They have many special tools used in the repair of intake equipment.
- The I&C shop was very spacious and well-equipped for a large number of I&C workers (I think I counted about 80 benches).
- The M&TE calibration shop was the best I have ever seen. PG&E has the capability at Diablo Canyon to calibrate most equipment used in the plant; the shop acts as a common calibration shop for all M&TE equipment on site including health physics. The calibration equipment was all in excellent shape and the storage of calibrated equipment was also excellent. PG&E separates the uncalibrated instruments from the calibrated instruments, and the history of individual calibrations is kept in a computer history program. All jobs that an instrument was used on are kept in this history, so if an instrument is found out of calibration the work that was done with it is immediately known. The individual that took me through the shop was quick to point out the many strengths in this shop and demonstrated them to me. This is

another example of a very knowledgeable person readily able to demonstrate the effectiveness of the work they do. Highlights pointed out to me included the optical scanner used to identify both the M&TE equipment as well as the individual who checks it out.

- The training facilities were also very good. I will discuss them more in the element on training.

In summary, I believe that Diablo Canyon's facilities would compare favorably to any nuclear facility in the United States.

Q17 **Please address Maintenance Personnel Knowledge and Performance.**

A17
- <u>Maintenance Personnel Knowledge and Performance</u>

  Performance Objective: Maintenance personnel knowledge and performance should support safe and reliable plant operations.

  Criteria:

  - Maintenance is performed by or under the direct supervision of personnel who have completed applicable formal qualification associated with the tasks to be performed.

  - Maintenance personnel knowledge is evidenced by an appropriate understanding of areas such as the following:

    a. maintenance policies and procedures
    b. general plant layout
    c. purpose and importance of plant/systems and equipment
    d. effect of work on plant systems

e. industrial safety, including hazards associated with work on specific equipment/systems
f. radiological protection and as low as reasonably achievable ("ALARA") principles
g. job-specific work practice
h. cleanliness and housekeeping practices

During my inspection of the plant, and in discussions with plant personnel as part of my review of the maintenance program, I had many opportunities to observe the knowledge and performance of maintenance personnel. Some of my observations are as follows:

- My discussion and tour with the Mechanical Department head revealed that he was very knowledgeable about the plant equipment and the programs and processes used to maintain the equipment.
- The Electrical Department supervisor, who discussed Generic Letter 89-10 activities with me, was very knowledgeable about the program and equipment related to motor operated valves.
- As I indicated in my comments on the M&TE shop, the people who were associated with M&TE were extremely knowledgeable of that program and how it fits in with the rest of the plant activities.
- I will discuss this more later, but the training supervisor for Maintenance demonstrated a strong knowledge of the training aspect of maintenance, as well as knowledge of how some of the training

facilities are used to do maintenance on equipment from the plant.

- The area foreman for the intake area was extremely knowledgeable about this area. I covered this in the element on plant material condition, but it is a very good example of personnel knowledge and bears repeating.
- I observed discussions between the foreman and some of the crew members related to work at the intake structure. Based on the comments and detail of the discussions, I would say that the journeymen were very knowledgeable about the work being performed.

I conclude that this element is being effectively implemented at Diablo Canyon.

Q18 **Please describe what you observed regarding the Technical Support Organization and Administration Performance Objective.**

A18
- Technical Support Organization and Administration

Performance Objective: Technical support organization and administration should ensure effective implementation and control of technical support.

Criteria:

- The organizational structure is clearly defined.
- Staffing and resources are sufficient to accomplish assigned tasks.
- Responsibilities and authority for each management, supervisory, and

- professional position are clearly defined and understood.
- Interfaces with support groups, including corporate groups and contract services, are clearly defined and understood.
- Technical support personnel have sufficient expertise regarding plant systems, components, and operations to effectively investigate and resolve plant problems.

My discussions with plant staff and my review of plant and corporate procedures show that the technical support function is well established at Diablo Canyon. Some specific observations follow:

- The data trending of equipment performance done by the Reliability Engineering group is analyzed and the results forwarded to preventive maintenance engineering. This is a good example of technical support.
- The tie between the several department organizations needed to implement ISI, IST, and equipment qualification is generally clear and well understood by the individuals involved.
- The motor operated valve activities are covered by a program plan document that formalizes the plant efforts to comply with GL 89-10.
- The corporate level aging document mentioned earlier is also an example of effective technical support.

I believe these examples show that this element is clearly in place and is being implemented well.

Q19 **Please address the Surveillance Testing Programs**

A19 • Surveillance Testing Programs

Performance Objective: Surveillance inspection and testing activities should provide assurance that equipment needed for safe and reliable plant operation will perform within required limits.

Criteria:

- Administrative systems and controls ensure timely completion and review of required surveillances.
- Surveillance testing programs result in a high degree of reliability of equipment needed for safe and reliable plant operations.
- Procedures used for surveillance testing contain sufficient detail to ensure safe plant operation during testing and provide for consistent test performance and accurate results. Procedures simulate, as near as practical, the actual conditions under which the system must operate on demand.

In assessing the effectiveness of this element, I interviewed a number of plant personnel and made specific observations of equipment and work being performed:

- The IST program appears to be well-defined. The supervisor of this program was very knowledgeable about the requirements of IST. He pointed out to me that they have a program document that clearly states the relationships of the many activities involved in completing the IST program requirements. We discussed in detail how this program relates to check valve inspections performed by Mechanical Maintenance. This area is

often one that is not well integrated and leaves room for some problems. I believe that Diablo Canyon has done an adequate job of ensuring good compliance of these two programs.

- The implementation of the ISI program appears to be very good.
- The implementation of environmental qualification by the different maintenance departments is also very good.
- The implementation of the motor-operated valve program is very strong. As I mentioned earlier, PG&E has a program plan document that shows the relationship of the different organizations that must coordinate well in the compliance to GL 89-10.

Q20 **Does PG&E address Performance Monitoring?**

A20

- <u>Plant Performance Monitoring</u>

  Performance Objective: Performance monitoring activities should optimize plant reliability and efficiency.

  Criteria:

  - Programs are implemented to routinely monitor, collect, trend, and analyze performance data (including thermal, hydraulic, electrical, acoustical, and mechanical data) for equipment, systems and components important to plant reliability and efficiency.
  - Approved procedures or guidelines and knowledgeable personnel are used to conduct performance

> monitoring functions. Tests are conducted consistently to aid in analyzing results.

Discussions with plant staff and inspection of equipment provided me with the following examples for this element:

- The gathering, trending, and analyzing of data done by Reliability Engineering is a good example of this element.
- The RCM/preventive maintenance activities also support plant performance monitoring.
- The IST and ISI programs contribute to plant performance monitoring very well.
- The actual valve testing of motor operated valves is a part of performance monitoring.
- I believe that NRC SALP assessments, while not a direct measure of plant performance, are a very good indication of the plant performance. A review of the most recent SALP for Diablo Canyon satisfied me that PG&E is performing its licensed responsibilities very well.

Q21 **What were your observations regarding Maintenance Personnel Training and Qualification?**

A21
- <u>Maintenance Personnel Training and Qualification</u>

> *Performance Objective*: The maintenance personnel training and qualification program should develop and improve the knowledge and skills necessary to perform assigned job functions.

Criteria: Programs are established and implemented for initial and continuing training.

A significant contributor to maintenance strength is training. A key indicator to the health of this relationship is the attitude that maintenance has for training and that training has for maintenance. I observed a number of things that show me Diablo Canyon has a very healthy relationship:

- I got very clear feedback from the maintenance manager that he is a strong supporter of training. I also heard from at least two of his division directors that he is a strong supporter of training.
- The maintenance training supervisor attends the Maintenance Department's morning meeting each day instead of his own training division morning meeting.
- On a tour of the maintenance training facilities, it was clear that training was well supported with equipment and mock-ups. Some specific examples are:
  - The reactor coolant pump/seal mock-up was about as realistic as it could be. It is full-scale and is made of the actual materials. This provides for a very realistic training aid. Reactor coolant pump seal performance and change out of seals is a

very important part of plant reliability, outage activities, and radiation exposure.

- They have a full-sized, real emergency diesel engine in training.
- The electrical training area has a wide variety of motor operated valve operators. This would provide very important training in the proper maintenance of MOVs.
- The I&C Lab was exceptional in my experience. They have one channel of the reactor protection system with all of the components, including actual control rod drive motors and drive shafts and rod position indication. This facility is so realistic that they bring electronic circuit boards from the plant and troubleshoot them on the training aid.
- There were classes going on in all three disciplines during my tour.
- About one-third of the training staff go to other plant departments during refuelings to perform outage-related work. This is an excellent way to keep the training staff up-to-date on plant activities and to strengthen the personal ties.

Q22 Does PG&E effectively use industry reliability data?

A22 • <u>Nuclear Plant Reliability Data System ("NPRDS")</u>

Performance Objective: The NPRDS should be effectively used to improve equipment reliability and to report component failure information to the industry.

Criteria: NPRDS engineering data is maintained up-to-date and in accordance with program guidance.

Discussions with plant personnel indicated that the use of the NRPDS is effective. The RCM project utilizes this information. The system engineers seem to be using it as well. The Preventive Maintenance Engineering group utilizes NPRDS data in determining the recommendations on preventive maintenance activities.

Q23 **How does PG&E address the element of maintenance related to operating experience reviews?**

A23 • <u>In-House Operating Experience Review</u>

Performance Objective: In-house operating experience should be evaluated, and appropriate actions should be undertaken to improve safety and reliability.

Criteria:
- In-house events are screened for significance and prioritized for evaluation.
- Rigorous investigation is performed on significant in-house events to determine root causes, generic implications, and necessary corrective actions to prevent recurrence.

Several examples of effective use of in-house operating experience were evident to me:

- The plant-wide use of computerized action request ("AR") forms seems to strengthen the availability of in-house information. All AR forms are trackable via computer, so any issue can be tracked to see if it is being responded to properly.
- The AR is a permanent part of equipment maintenance history and figures in on the schedule of work to be done and the tracking and trending of repetitive failures.
- An interesting aspect to ARs for me is that they can be for any type of problem. They do not have to be for equipment deficiencies, but can be for program and process problems. This allows for a very wide range of issues to be identified. This seems to me to be an indication of an organization that is not afraid of criticism and change for the better.
- While it is not clear who has accountability for root cause analysis (a situation also true at other facilities), it seems to be because <u>everybody</u> has accountability for it. Every time I asked, "Who had accountability for root cause?," the answer was, "I do," or "we do," or "here's how it works," with a ready explanation. Significant problems are addressed with an officially formed team dedicated to whatever the problem is.

I believe that Diablo Canyon has a very effective use of in-house experience.

Q24 Did you observe any system for Industry Operating Experience review?

A24

- **Industry Operating Experience Review**

  Performance Objective: Significant industry operating experiences should be evaluated, and appropriate actions should be undertaken to improve safety and reliability.

  Criteria:

  - A comprehensive evaluation is performed on applicable, significant industry operating experience, and appropriate corrective action is completed in a timely manner.
  - Sources of significant industry experience information reviewed for applicability include the following:

    a. INPO Significant Operating Experiences Reports ("SOERs")
    b. Significant Event Reports ("SERs")
    c. Significant by Others ("SO") notifications
    d. INPO Significant Event Notifications ("SENs")
    e. NRC letters, bulletins, and information notices
    f. Supplier and architect/engineer reports

Most of the examples I provided for in-house operating experience also apply to industry experience. However, several additional observations are warranted:

- The success that Diablo Canyon has had with respect to the MOV/GL 89-10 issue is an indication that they are effectively in touch with the rest of the industry.

- Changes to the IST program reflect a strong tie with industry issues.
- The check valve program is one that has effectively responded to industry activities.
- Diablo Canyon performs a self-evaluation prior to their INPO evaluation. They utilize the help of peer evaluators from other plants to do this. This evaluation appears to be more rigorous to me than the actual INPO evaluation. They have about 28 people working for three weeks looking at all areas. From the number of findings and the detail involved, it is clear to me that the intent is to find the weaknesses themselves and to strengthen the performance from self-identified issues. This is an indication of a very healthy organization.

Q25 What do you conclude overall from your review?

A25 Based upon my review, I am satisfied that Diablo Canyon does in fact have a comprehensive and effective maintenance program. While there may be individual deficiencies in the implementation of the programs, the overall strength of the programs provides for corrective action and continued improvement.

Q26 **In raising Contention I, MFP cited a number of incidents and reports that they believe show the Diablo Canyon maintenance program to be less than adequate, or at least less than adequately implemented. Do these citations affect your view of the Diablo Canyon program?**

A26 I have not reviewed all of these incidents and citations in detail. However, I am familiar with the types of incidents and reports referenced. These do not change my overall conclusions.

From my experience, it is unreasonable to expect, given the complexity of a commercial nuclear power plant, that there will not occasionally arise a confluence of events that creates an unsatisfactory condition. This is not to minimize the role that nuclear safety must play in operating a nuclear power plant. Nuclear safety must be paramount. Eliminating safety problems is of the utmost importance. It must be the first consideration given to any situation. It is extremely important that great initiative is given to anticipating and preventing safety problems. In my opinion, a healthy organization is one that is self-examining by nature, does not obscure the facts of a situation, is ready to take responsibility for problems, and initiates quick, effective corrective action. During my observations at Diablo Canyon, I found many instances to show that Diablo Canyon is such

a healthy organization and found no condition, word, or deed to suggest otherwise.

Being alert to potential problems, ensuring that problems are identified, making sure that problems are entered on the proper tracking list, and taking timely, effective corrective action on those problems are all signs of a healthy environment. Indeed, to suggest that the identification of a problem was a weakness would reduce the probability of correcting it.

Q27 **MFP also speculates in their contention that PG&E is guilty of putting off necessary maintenance to keep the plant running and to maximize profits. Did you see any evidence of this occurring at Diablo Canyon?**

A27 No. Furthermore, the speculation seems to me to be completely unrealistic. It assumes that you can run a nuclear power plant just because you want to. If all it took was a high level manager saying "you are going to run," all nuclear power plants would have 100 percent capacity factors. It is not that easy! It is very difficult to keep the equipment running reliably. It takes a strong commitment at a high level, as well as a great deal of effort and experience. It has been my observation that only a very strong organization with a resolute commitment to success can keep a

nuclear power plant running at a high capacity factor over a long time.

Being able to maintain a high capacity factor demonstrates in my mind the existence of strong programs. Once you have an organization that does things well in one area, they tend to try to do things well in all areas. I believe that the existence of a consistently high capacity factor is the mark of a well-run and well-maintained plant and, therefore, the mark of a safely-run plant.

Q28 **Do you have any additional observations?**

A28 Let me make some final general observations. One of the examples that I have referred to in my testimony is the scaffold tagging program. It is my direct observation that this is an effective program at Diablo Canyon. I believe that this observation has more significance than just a good scaffold program.

Some factors relating to scaffold tagging follow:

- It is relatively low on the priority list of important things done at a nuclear power plant.
- If you were going to cut corners, it would be a place to do it.
- It takes a while, in my experience, for an organization to recognize that controlling scaffold tagging is necessary.

- It is a fairly cumbersome process, as there are at least five areas that are important and need to be addressed in the process:
  - Fir~ (as a transient fire load)
  - Chemical (as a hydrogen release agent in containment)
  - Seismic (as a missile or attachment to adjacent equipment)
  - Ventilation (flow blockage to equipment)
  - Industrial safety (slips, falls, dropped objects, and blocked exits)
- It is difficult to control as many different people build and use scaffolds in many areas of the plant. In most cases, there is nothing to physically prevent them from building and using a scaffold.
- It takes a while for an organization to figure out how to effectively control scaffold use.
- It takes a while longer, and some considerable effort, to make it work.

There are several conclusions that I believe can rightfully be drawn from having an effective scaffold control program:

- You are not cutting corners. If you are doing something like this well, you are probably also doing more important work well too.
- You have been paying attention to problems in your organization.

- You can develop and administer a relatively cumbersome process.
- Your people can tell that you think it is important and therefore other things are important too.

In this light, my observations of the scaffolding program at Diablo Canyon increase my confidence regarding the overall effectiveness of the maintenance program and the organization.

I believe that the same general conclusion can be drawn from other programs by my direct observation:

- Equipment clearances
- Equipment tagging
- Hot work permits
- Attention to personnel safety
- Attention to fire and security doors

From my observations, PG&E appears to be effective in these areas as well.

Finally, I want to reiterate that the plant is in excellent overall condition. The operating performance at Diablo Canyon has also been among the best in the nation. The SALP ratings are just about as good as they can be. Maintenance/Surveillance was a SALP 1 for the most recent period, and I know that this is not an easy thing to do. This plant is also on the NRC's "Best Plants" list, which also is a very difficult achievement. I believe these general assessments alone

demonstrate that the maintenance programs are in place and that they are being implemented very well.

Q29 **Does this conclude your testimony?**

A29 Yes.

August 2, 1993

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	Docket Nos. 50-275-OLA 50-323-OLA
Pacific Gas and Electric Company	
(Diablo Canyon Nuclear Power Plant, Units 1 and 2)	(Construction Period Recovery)

TESTIMONY OF PACIFIC GAS AND ELECTRIC COMPANY
ADDRESSING CONTENTION I: MAINTENANCE AND SURVEILLANCE

PART 3: Bryant W. Giffin, David B. Miklush

August 2, 1993

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	Docket Nos. 50-275-OLA
	)	50-323-OLA
Pacific Gas and Electric Company	)	
	)	(Construction Period Recovery)
(Diablo Canyon Nuclear Power Plant, Units 1 and 2)	)	

TESTIMONY OF PACIFIC GAS AND ELECTRIC COMPANY
ADDRESSING CONTENTION I: MAINTENANCE AND SURVEILLANCE

I. INTRODUCTION

Q1 **Please state your name, affiliation, qualifications and current job responsibilities.**

A1 (Giffin) My name is Bryant W. Giffin. I am the Manager of Maintenance Services for Pacific Gas and Electric Company ("PG&E") at the Diablo Canyon Power Plant ("DCPP"). I am responsible for all maintenance and outage activities at DCPP. I have more than 25 years experience working in the nuclear industry; 12 years with PG&E and over 13 years as an officer in the United States Navy's nuclear power program. A summary of my professional qualifications and experience is provided in Exhibit 1.

(Miklush) My name is David B. Miklush. I am the Manager of Operational Services for PG&E at DCPP. I am

responsible for Operations, Chemistry, and Environmental Engineering. I have more than 20 years experience in the nuclear industry, and have been working at DCPP for more than 15 years. I maintained an SRO license at DCPP from 1982 to 1988. A summary of my qualifications and experience is provided in Exhibit 13.

II. PERFORMANCE EVALUATION OF DCPP'S MAINTENANCE AND SURVEILLANCE PROGRAMS

Introduction

Q2 **What performance measures does PG&E use to determine the effectiveness of the DCPP maintenance and surveillance programs? How have the DCPP maintenance and surveillance programs performed under each of these performance measures over the last two SALP periods?**

A2 (All) One of PG&E's most important corporate goals is to "Operate the Diablo Canyon Nuclear Power Plant at the highest level of safety, reliability, and performance." In order to meet this goal, the Nuclear Power Generation Business Unit ("NPG"), which includes DCPP, has defined its goals and objectives in Program Directive OM2, "Management Goals and Objectives." NPG's goals are prepared annually and are formulated in the following categories:

- Safety and Quality of Operations
- Energy Production

- Cost Management
- Continuous Improvement

Maintenance activities have a large impact on how NPG performs in meeting its goals. Maintenance effectiveness is not merely a function of day-to-day, individual preventive and corrective maintenance tasks. A well maintained plant exhibits long, uneventful runs between refueling outages with plant generation at a high percentage of generating capacity. Uneventful runs mean minimal plant transients. High operating capacity factors (percentage of maximum generation capability actually delivered between outages) result in efficient delivery of energy to customers. Thus, in a programmatic sense, the effectiveness of maintenance is demonstrated by the overall safe and reliable operation of the plant over time.

With this in mind, NPG uses three broad performance measures to evaluate the comprehensiveness and effectiveness of the DCPP maintenance program in meeting PG&E's corporate goal for DCPP. These performance measures include:

- Plant Operating Performance,
- Maintenance Services Department Goals and Objectives, and
- Regulatory Performance

Each of these performance measures will be discussed below.

Plant Operating Performance

Q3 **How does plant operating performance demonstrate the effectiveness of DCPP's maintenance and surveillance programs?**

A3 (All) Experience has demonstrated that nuclear plants with consistently high capacity factors, long continuous operation, and short refueling outages are also the best maintained plants. This is because reliable and continuous operation at high capacity factors between scheduled refueling outages and across many operating cycles simply cannot be sustained unless plant equipment and facilities are maintained in a superb condition. In turn, reliable, event-free operation results in fewer challenges to plant safety systems and less wear and tear on safety equipment. Thus, good maintenance practices are not only evidenced by reliable plant operation, but reliable plant operation itself reduces the wear and tear that can lead to increased maintenance.

Diablo Canyon's operating history provides ample evidence of the effectiveness of the DCPP maintenance program. The combined lifetime capacity factor for both Diablo Canyon units since Unit 1 began commercial generation in 1985 through July 1993 is 78 percent including refuelings. In this respect, the Diablo Canyon units are among the best operating nuclear units in the nation. DCPP's capacity factor has steadily improved from year to year over its operating history. Over the last

three years (1990-1992), the combined capacity factor for both Diablo units has been 85 percent. See Exhibit 14. Among all nuclear plants worldwide, Diablo's performance consistently ranks among the best.

Q4 **What measures are there of operating performance?**

A4 (All) A plant's overall operating performance is defined by two components: (1) capacity factor between refuelings, and (2) duration of its refueling outages. A commonly used measure of performance for the first is "operating capacity factor," the percent of maximum generation that is achieved from the time the breakers are closed at the end of a refueling outage, to the time power production ends when the breakers are opened again at the next refueling outage.

Q5 **Please address DCPP's performance in terms of capacity factor.**

A5 (All) For a plant like Diablo Canyon with constant temperature ocean cooling, a 100 percent operating capacity factor is not attainable since the plant goes through a period of power ascension testing coming out of an outage. Moreover, ocean-cooled plants like DCPP need to conduct periodic scraping of the intake tunnels at reduced power to remove barnacles and other sea life.

Diablo Canyon's operating capacity factor has averaged 95 percent over the last three years, has been over 92 percent each year over the last five years including 1993 year-to-date, and reached over 96 percent in 1992. See Exhibit 15. This is the best among similar plants in the United States, and consistently among the very best of all nuclear plants worldwide. In 1991, Unit 2 set a world record for length of continuous run, 481 days at power, breaker-to-breaker between refueling outages. World class performance like this is not achieved without a superb maintenance program. This is a further indication that PG&E's preventive maintenance program has been effective in precluding equipment failure and forced outages across multiple operating cycles.

Another, and perhaps more subtle, reason that our excellent plant operating capacity factor is indicative of an effective maintenance program has to do with the numerous Technical Specification surveillance tests which are required to be performed during operation on the thousands of SSCs important to safety. All of these surveillances have Technical Specification mandated "ACTION STATEMENTS" which are required to be initiated if an SSC is not operable because the surveillance result is not satisfactory in every respect. This includes all supporting equipment, administrative requirements and test results. The great majority of these "ACTION STATEMENTS" require the plant to begin reducing power toward shutdown if the problem is not fully resolved within a limited

period of time. To achieve a consistently high plant operating capacity factor, the plant's maintenance program must maintain and test SSCs in a well coordinated manner at a very high level of performance to avoid "ACTION STATEMENT" power reduction or unit shut-down.

Q6 **How is DCPP's performance of maintenance reflected in the duration of planned refueling outages?**

A6 (Giffin) Certain periodic maintenance activities are performed every refueling outage, and the duration of the outage (along with event-free post-outage operation) is an indicator of how efficiently outage maintenance activities are planned, scheduled and performed by a skilled, highly-trained workforce. Since DCPP began operation in 1985, refueling outage times have been cut in half. See Exhibit 16. DCPP refueling outages are now consistently among the shortest in the industry. In 1992, even with the additional scope of DCPP's ten-year ISI and reactor vessel steam generator shotpeening work, the Unit 1 fifth refueling outage took only 59 days, a record for the unit. In 1993, Unit 2 completed a similar scope refueling outage in 57 days. This performance set a United States record for Westinghouse and Combustion Engineering plants undergoing a 10-year ISI refueling outage. These short outage durations reflect the comprehensive training of DCPP maintenance personnel and thorough planning of maintenance activities necessary to perform outage

maintenance tasks. The quality of the work performed has a been demonstrated by the reliable, event-free operation of both units since the outages were completed. Once again, DCPP's consistency and quality are the hallmarks of a top-flight maintenance program.

Maintenance Goals and Objectives

Q7 **How do DCPP's internal goals and objectives measure the effectiveness of the DCPP maintenance program?**

A7 (Giffin) As discussed previously, PG&E uses a formalized set of goals and objectives for managing DCPP. The objectives established for the Maintenance Services Department are a subset of DCPP's overall goals, and provide constant feedback to the workforce and to senior management concerning overall effectiveness in the key areas of maintenance activities. Each of these internal indicators provides a different view of the process to a specific organizational level or group. Some are quantitative reports generated from PIMS records and some are based on qualitative assessments. A comprehensive analysis of maintenance performance is dependent on a review of all available data at any given point in time. The primary Maintenance Services Department objectives include:

- Industrial Safety
- Radiation Exposure
- Personnel Contamination

- Personnel Error Reduction
- Refueling Outages
- Corrective Maintenance Backlog
- Overdue Preventive Maintenance Items
- Ratio of Preventive Maintenance to Total Maintenance

DCPP's performance in each area is discussed below.

1. Industrial Safety

Q8 **How has DCPP performed relative to its industrial safety goal in the maintenance area?**

A8 (All) DCPP's industrial safety accident rate overall has been 0.22 per 200,000 man-hours, substantially better than the U.S. nuclear industry median of 0.77 and the U.S. best quartile of 0.27 per 200,000 man-hours. A culture which stresses attention to detail to produce safe working conditions also promotes professionalism and quality overall.

The Maintenance Services Department experienced four industrial injuries in 1990, zero in 1991, and one in 1992. So far in 1993, there has been only one injury. Even though Maintenance Services has not met its stated objective of reducing industrial accidents to zero, the Department is performing at a rate better than NPG's goal of 0.5 per 200,000 manhours. DCPP's performance in this area has usually been the best safety record in PG&E.

2. <u>Radiation Exposure</u>

Q9 **How has DCPP performed relative to its goal for minimizing radiation exposure in the maintenance area?**

A9 (All) PG&E establishes a goal each year designed to minimize the radiation exposure that employees receive. It has always been PG&E's philosophy to keep the dose as-low-as-reasonably-achievable ("ALARA").

DCPP maintenance personnel achieved a collective dose of 95 manrem in 1992 compared to our internal objective of 96 manrem. This year our objective for similar scope of work is 91 manrem and we are projecting a dose of about 60 manrem. During 1992, the majority of the dose, as in any year, was received during the refueling outage. The dose received in the 1992 Unit 1 outage was higher than we had targeted. Consequently, in order to reduce the dose for 1993, we formed a High Impact Team ("HIT") with the responsibility to understand the reasons for the increased dose and to implement improvements.

Due in a large part to these HIT team efforts, we were able to reduce the dose received in the 1993 Unit 2 fifth refueling outage by about 30 percent. This reduction is also being seen in Maintenance Services personnel dose. The improvement was an outstanding effort. We did as much work in the 1993 refueling outage with fewer people and received less exposure.

3. Personnel Contamination

Q10 How has DCPP performed relative to its goal for minimizing personnel contamination in the maintenance area?

A10 (All) In 1991 and 1992, Maintenance Services Department personnel incurred 107 and 87 personnel radioactive material contaminations, respectively. This year, we estimate that the number will be about 55. Again, the improvements that we have experienced in this area have been due to the efforts of the plant staff. By carefully planning work, taking time and being observant, it is possible to reduce the number of instances of contaminations to almost zero. PG&E has expended substantial effort in developing and providing a training program to provide workers with the knowledge necessary to reduce the potential for contamination.

4. Personnel Error Reduction

Q11 How has DCPP performed on its personnel error reduction goal in the maintenance area?

A11 (All) We have established goals to reduce the number of personnel errors which cause a plant transient or a formal report to a regulatory agency. The goal for 1993 is 3 for each 1,000,000 hours worked at the plant. So far this year there have been two instances of personnel

errors which fall into this category (one in maintenance) which equals approximately 1.7 per 1,000,000 hours worked.

We have seen a continuous decrease in the number of personnel errors since 1989. This is based on a reduction in such events identified in LERs, Quality Evaluations, and Nonconformance Reports. We will continue to devote attention to this area with the ultimate goal of reducing personnel errors to zero.

5. <u>Refueling Outages</u>

Q12 **How has DCPP performed on its goals for refueling outages in the maintenance area?**

A12 (Giffin) During a refueling outage, over a million man hours of work and several thousand work activities are scheduled. Our performance in outage duration, radiation exposure, and accident rate during refueling outages has continued to improve. As discussed above, a key indicator related to outage performance is the low level of equipment problems experienced during subsequent operation. The duration of outages at DCPP has been reduced by almost 50 percent in the past five years. In addition, the fact that we were able to reduce the radiation dose by 30 percent in the recent Unit 2 fifth refueling outage is outstanding.

6. Corrective Maintenance Backlog

Q13 How has DCPP performed on its goal for corrective maintenance backlog?

A13 (Giffin) PG&E tracks the number of outstanding corrective maintenance work requests at DCPP. The objective of this goal is to provide an overall indication of the condition of the maintenance program.

DCPP has consistently improved its performance on corrective maintenance backlog over the last five years, even while DCPP management has continuously raised the "stretch" goal set for this indicator. As Exhibit 17 indicates, the corrective maintenance backlog has been reduced from about 1,200 items prior to 1989 to about 600 items as of the end of July, 1993. Since DCPP performs over 7,000 corrective maintenance work orders on an annual basis, this backlog indicator demonstrates an excellent and continuously improving trend in overall backlog management.

7. Overdue Preventive Maintenance Items

Q14 How has DCPP performed relative to its goal for minimizing overdue preventive maintenance items?

A14 (Giffin) This indicator provides an overall measure of the timeliness of DCPP's Preventive Maintenance ("PM") program. We monitor the number of PM tasks overdue. This number has continued to be reduced because of an

aggressive effort by the maintenance engineers and craftsmen. See Exhibit 18. What is important is the overall trend, which at DCPP has been positive, i.e., decreasing. Again, the curve has a consistently decreasing number of overdue PM tasks for the past five years. At the beginning of 1992 there were 137 overdue PM tasks; this was reduced to 56 by the end of the year, and PG&E's goal is to reduce that number to 35 by the end of this year.

8. <u>Ratio of Preventive Maintenance to Total Maintenance</u>

Q15 **How has DCPP performed relative to its goal for the ratio of preventive maintenance to total maintenance?**

A15 (Giffin) The purpose of the ratio of preventive to total maintenance indicator is to monitor progress in achieving and maintaining a proactive maintenance program.

DCPP's trend has been steady and positive, and we have achieved the long-term objective of a 60 percent ratio of preventive to corrective maintenance over the past three years. This year we have averaged about 68 percent.

<u>Qualitative Evaluations and Self-Assessments</u>

Q16 **Please describe the self-evaluations performed by DCPP prior to INPO evaluations.**

A16 (Giffin) DCPP conducts a performance-based review of the maintenance program once every INPO evaluation period. This self-evaluation provides for a qualitative assessment of maintenance effectiveness, rather than a quantitative score as is generated from the INPO evaluation itself. A final report (Summary of Findings) is produced at the conclusion of each assessment period. This report lists the assessment group's findings (both strengths and weaknesses) and recommendations for improvement. This program is viewed as one means of assessing the administrative structure, programmatic controls and working environment in the maintenance organization. PG&E uses the report as a tool for continuously identifying areas for further improvement in our maintenance and other programs.

The most recent two self-evaluations were conducted in 1990 and 1993. In the maintenance and surveillance areas, as would be expected in these types of self-critical assessments, the evaluations concluded that there were areas which could be improved. Action plans were prepared and implemented for the 1990 evaluation, and they are being prepared and implemented for the draft evaluation which was distributed in preliminary form in July 1993. (The 1993 evaluation will be finalized prior to the next INPO evaluation in October 1993.) PG&E management requires that each finding in these self-evaluations be formally tracked, responded to, and corrected. In the case of the specific findings of the 1990 and 1993 self-

evaluations, the overall corrective actions that need to be addressed are to improve maintenance personnel's attention to detail on routine plant evolutions. The Maintenance Services Department is responding to these issues by using continuous improvement techniques with employee involvement. Even though areas for improvement were identified in these self-assessments, there was no indication of any programmatic breakdown in maintenance.

<u>Maintenance Quality Assessment</u>

Q17 **How has PG&E's Quality Assurance program assessed the DCPP maintenance program?**

A17 (Giffin) Maintenance Quality Assessments ("MQA"), conducted under the DCPP Quality Assurance Program, audit multiple areas of outage related maintenance and evaluate the operational readiness of selected plant systems.

The most recent MQA issued May, 1993, included maintenance activities during the Unit 2 fifth refueling outage. The assessment concluded that each of the audited activities had been effectively implemented. The report also stated that the overall quality of maintenance and technical support demonstrated by each organization provides confidence in the operational readiness of DCPP's systems. Specifically, the audit noted that the steam generator shotpeening had exceeded all expectations. The planning and coordination led to a well-executed evolution and the work was performed on time and with significantly

less radiation exposure than anticipated. Also especially effective, according to the audit, was the Generic Letter 89-10 MOV Testing. Field support by the foremen and Electrical Maintenance engineers facilitated problem solving and helped keep the work moving smoothly. The audit found some areas for improvement, and these areas have been documented on quality problem reports.

There were four Audit Finding Reports issued, three of which were not maintenance-related but addressed design documentation problems (associated with four air operated valves) which were discovered in the course of the assessment. The fourth finding was for incorrect torquing of feedwater regulating valve capscrews to 16 ft-lbs rather than the required 19 ft-lbs. These deficiencies did not indicate a lack of programmatic control or overall effectiveness. They are currently being resolved and responded to in accordance with DCPP's required procedures.

In December 1992, an MQA was issued for the Unit One fifth refueling outage. This audit also concluded that the maintenance program, technical support of maintenance and technical specification surveillance had been effectively implemented. Specifically cited as effective were diesel generator maintenance and installation, and calibration and placement into service of the Reactor Vessel Refueling Level Indication System ("RVRLIS").

Some deficiencies were noted and resulted in six Audit Finding Reports relating to specific issues, such as an

incorrect radiographic test; procedural noncompliance regarding reactor vessel water level during reactor head removal maintenance; incorporation of design criteria memoranda requirements into certain surveillance test procedures; procedural noncompliance in control of some M&TE; airborne radioactive contamination during steam generator shotpeening; and a replacement parts evaluation deficiency for a diesel engine fuel oil switch. DCPP has responded with root cause analysis and corrective actions identified for five of the six findings, and corrective actions for three of these already have been completed. The sixth, an incorrect radiographic test, is still under investigation to determine if deficiencies exist.

Again, these findings did not indicate any programmatic problems, but did provide important feedback to the DCPP maintenance program.

Continuous Program Improvement

Q19 **What are some examples of "continuous improvement" initiatives involving the DCPP maintenance and surveillance programs?**

A19 (Giffin) PG&E's operating and maintenance strategy for DCPP is focused on continuous improvement. Over the past few years, PG&E has conducted a number of internal reviews of the maintenance program as part of its continuous improvement strategy. Although these reviews are specifically targeted at improving the efficiency of

the maintenance process, they provide a mechanism for evaluating the quality of the maintenance organization in terms of its internal processes. Examples of these continuous improvement initiatives include:

1. <u>Maintenance Process Improvement Project</u>

In February 1992, DCPP initiated the Maintenance Process Improvement Project. The Project consisted of a task force made up of employees from all levels of the organization representing the DCPP maintenance process and other related departments and sections. This task force used continuous improvement techniques to identify opportunities for improved efficiency in the maintenance process. The Project was completed in December 1992, and identified four specific recommendations with action plans and eleven other recommendations worthy of further evaluation. The four specific recommendations are:

- Establish integrated maintenance teams aligned by plant "systems";
- Establish a combined consumables, tools and equipment group;
- Modify the work priority system to provide an integrated priority system for DCPP maintenance, engineering and procurement personnel;
- Modify the minor maintenance program to improve its utilization.

Each of these recommended improvements, along with necessary computer enhancements, is being implemented and

will add substantial efficiencies to DCPP's overall maintenance process.

2. Reliability Centered Maintenance

PG&E has an active process in place at DCPP to incorporate reliability centered maintenance ("RCM") improvements into DCPP's preventive maintenance programs. RCM is a reliability-based methodology for optimizing preventive maintenance by analyzing the failure modes and safety significance of equipment on a system-by-system basis, and then improving condition-monitoring programs for those systems to reflect the insights gained from the analysis. PG&E has completed the first phase of its RCM Program by completing a rigorous system analysis of the DCPP feedwater system and developing preventive maintenance program administrative procedures to reflect the RCM process. The second phase of the program is well underway at the plant, and involves analysis of 12 additional safety-related systems. Currently, the project is nearing completion of the fifth and sixth systems (CCW and 4kV). If the second phase produces positive results, a third phase will perform generic analyses of additional systems and components, and incorporate the insights into DCPP's "Living Preventive Maintenance Program."

3. Procurement Task Force

In 1991, PG&E completed a multi-disciplinary review of the procurement process at DCPP. The purpose of this review was to reduce overlap and duplication among various departments, and to improve the reliability and timeliness

of procurement of parts and equipment to support DCPP maintenance and operations. The recommendations of the Task Force have been implemented, and the DCPP procurement organization has achieved a higher level of efficiency and timeliness in meeting maintenance needs.

Regulatory Performance

1. NRC Programmatic Assessments

Q20 **Please discuss examples of NRC assessments of the DCPP maintenance and surveillance programs.**

A20 (All) As discussed above, the overall operating performance of DCPP, as well as the numerous self-critical evaluations conducted by PG&E, are indicators which PG&E uses to monitor, assess and continuously improve the performance of the DCPP maintenance and surveillance programs. These measures demonstrate that the DCPP maintenance and surveillance programs are comprehensive, effective and superior. In addition, inspection, enforcement and assessment activities by regulators such as the NRC also provide PG&E with important information concerning the overall performance of all its programs, including maintenance and surveillance. These NRC activities are discussed below.

a. NRC "Best Plants" List

Q21 DCPP is on the NRC "best plants" list. How does this relate to effectiveness of maintenance and surveillance at DCPP?

A21 PG&E's excellent overall safety performance in operating and maintaining DCPP has been recognized by the NRC numerous times since issuance of the initial operating licenses for the plant. Most importantly, four consecutive times over the last two years, the NRC has commended PG&E's outstanding safety record as part of the Commission's semi-annual review of licensee performance - in February and June 1992, and again in February and June 1993. These commendations, typically referred to as the NRC's "best plants" list, are among the select few awarded to NRC licensees nationwide. DCPP's commendations specifically reference the excellent performance of PG&E personnel and programs, and recognize DCPP as being one of the best operated nuclear plants in the nation. These NRC commendations of DCPP's overall safety performance are strong indicators that DCPP's regulatory performance in all areas - including maintenance and surveillance - has attained a level of excellence among the highest in the United States. Copies of each of the four NRC letters commending DCPP are attached as Exhibit 19.

b. SALP Ratings

Q23 What have been the NRC SALP ratings of the DCPP maintenance and surveillance programs?

A23 (Giffin) The NRC periodically assesses the programmatic performance of DCPP in key functional areas such as maintenance and surveillance through the Systematic Assessment of Licensee Performance ("SALP") program. According to NRC SECY 90-189 (May 25, 1990), the SALP program is an integrated NRC staff effort to consolidate available information to support a periodic evaluation of a licensee's overall performance. The SALP process is a means of expressing NRC senior management's observations and judgments on licensee performance. SALP reviews are conducted by a SALP Board which is multidisciplinary in nature. SALP reviews are intended to result in an integrated assessment of licensee performance. SALP Board members consist of a mixture of NRC regional and headquarters personnel.

NRC Manual Chapter 0516 dated September 28, 1990 establishes the specific performance criteria applicable to each functional area, and defines the maintenance/surveillance functional area as including:

> "...[A]ll activities associated with either diagnostic, predictive, preventive or corrective maintenance of plant structures, systems, and components; procurement, control, and storage of components, including qualification controls; installation of plant modifications; and maintenance of the plant physical condition. It includes conduct of all surveillance (diagnostic) testing activities as well as all inservice inspection and testing

activities. Examples of activities included are instrument calibrations; equipment operability tests; post-maintenance, post-modification, and post-outage testing; containment leak rate tests; special tests; inservice inspection and performance tests of pumps and valves; and all other inservice inspection activities."

Thus, the SALP report provides PG&E - as well as the NRC - with an integrated, multidisciplinary, programmatic evaluation of the effectiveness of a licensee's performance in key functional areas, including maintenance and surveillance.

NRC's SALP ratings have recognized the high quality and effective performance of DCPP's maintenance and surveillance programs. For the most recent SALP review period, July 1, 1991 through December 31, 1992, the NRC rated PG&E's performance with six "1" ratings and one "2 and improving" rating. The NRC rated Maintenance/Surveillance at DCPP as Category 1, the highest possible rating. Category 1 is defined as a "superior level of performance" based on licensee management attention and involvement in licensed activities (NRC Manual Chapter 0516, Section 08.a). More specifically, the SALP report cited the following bases for its "Category 1" rating of DCPP maintenance and surveillance:

- Virtually trouble-free plant operation evidenced a high quality of maintenance work;
- The high-level of management involvement in scheduling and planning maintenance and surveillance work maximized safety system availability;

- Maintenance and surveillance work was generally of high quality;
- The training and qualification program for maintenance personnel was strong;
- Management of outages was marked by an overriding understanding and emphasis of the risk of each job. Work crews and planners were trained and aware of the safety significance of the jobs and systems on which they worked;
- Work items were well prioritized, with safety-significant issues given high priority. Backlog of non-outage safety related work was low;
- The involvement and leadership shown by maintenance staff in root cause investigations was a significant strength, as was the integration of maintenance, operations and engineering staff in maintenance and surveillance activities;
- The number of personnel errors was reduced due to the high level of management involvement throughout the organization; and
- The maintenance staff overall improved their response to problems by identifying, analyzing and correcting maintenance and surveillance problems promptly.

The SALP report cited four Level IV violations that had occurred in the maintenance/surveillance area, but concluded that the concerns associated with each appeared to have been isolated. Some additional minor weaknesses were noted as having occurred early in the SALP assessment

period. However, the SALP report stated that most had been identified by PG&E immediately upon occurrence, and PG&E management involvement was effective in promptly and appropriately correcting the problems. A copy of the SALP report is attached as Exhibit 20.

Previous SALP evaluations also have recognized the effectiveness of DCPP's maintenance and surveillance programs from an overall perspective. The NRC judged DCPP's performance in maintenance/surveillance to be Category 2 (a "good level of performance") in each of the three SALP assessment periods spanning August 1987 through June 1991. It is important to note that every SALP evaluation, including those in which PG&E's maintenance/surveillance programs have been rated "good" or "superior," contains qualitative assessments of various individual weaknesses and strengths exhibited within the particular functional area during the assessment period. This "feedback" from the regulators is subject to the same formal followup evaluation and corrective action by PG&E management as internal problem reports. PG&E maintenance and surveillance management track each item to closure to assure that corrective actions have been implemented in response to the SALP findings.

The SALP ratings and NRC "best plants" list also must be considered in the context of the entire nuclear industry. DCPP's current SALP "1" rating in maintenance/surveillance places it high among current licensees in that functional area. DCPP is one of only

five plants nationwide which was commended by the NRC in June 1993 for its overall superior safety performance. This indicates that, in terms of overall regulatory performance, DCPP's maintenance and surveillance program is at a very high level when "benchmarked" against its peers in the industry.

2. <u>NRC Inspection and Enforcement Activities</u>

Q24 **Please discuss how NRC inspection and enforcement activities evaluate DCPP's maintenance and surveillance programs?**

A24 (Giffin) Routine and special NRC inspections provide continuous information to PG&E on specific aspects of the DCPP maintenance and surveillance programs. For example, NRC inspectors routinely review DCPP LERs and other plant events. Open items on such events are identified in monthly NRC inspection reports, and PG&E's response to each open item is evaluated in a subsequent NRC inspection report. Each LER event is fully evaluated by PG&E through root cause analysis, corrective actions and/or program improvements.

Other NRC inspections and reviews provide PG&E with in-depth NRC evaluations of important maintenance and surveillance activities and programs. Examples include:

- NRC Inspection Report ("IR") 93-08, in which the NRC reviewed the DCPP 10-year In-service Inspection ("ISI") performed during the Unit 2 fifth refueling

outage, and concluded that PG&E was implementing a comprehensive ISI program in accordance with Technical Specification, ASME Code and other NRC and industry requirements;

- IR 91-39, concluding that PG&E was developing an aggressive, well-integrated program for assuring safety-related MOV reliability under Generic Letter 89-10, and at the same time noting certain areas requiring further development;
- IR 92-201, concluding that PG&E was implementing a strong program for evaluating and minimizing safety risks associated with maintenance activities performed while certain safety systems are unavailable during refueling outages;
- NRC Safety Evaluation (TAC No. M83285), dated September 4, 1992, concluding that PG&E's supplemental reactor vessel surveillance program meets NRC requirements.

Other NRC inspections may identify isolated areas in PG&E's maintenance and surveillance programs which need to be addressed. PG&E evaluates the safety significance of major items, performs a formal root cause analysis, and implements corrective actions to avoid recurrence.

Based on a review of thousands of hours of NRC inspection and enforcement activities, and hundreds of pages of NRC inspection reports issued over the last two SALP assessment periods, PG&E believes that the regulatory

performance of DCPP's maintenance and surveillance programs has been excellent.

III. CONCLUSION

Q25 Based on the content, performance and history of PG&E's maintenance and surveillance programs for DCPP, are the programs sufficiently effective and comprehensive to assure that the public health and safety is protected if PG&E is granted a full 40-year operating license for DCPP as requested by the license amendment at issue in this proceeding?

A25 (All) Yes.

Q26 Does this conclude your testimony?

A26 (All) Yes.