UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
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ARLINGTON, TEXAS 76011-8064

JUL 15 1999

See Reports

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Nuclear Power Generation Bus. Unit
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Nuclear Power Generation, B32
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San Francisco, California 94177

SUBJECT: SUMMARY OF PUBLIC MEETING HELD ON JULY 1, 1999, TO DISCUSS ACTIVITIES COMPLETED DURING DIABLO CANYON UNIT 1 REFUELING OUTAGE

Dear Mr. Rueger:

This refers to the meeting conducted in the Region IV office on July 1, 1999. This meeting related to discussions of performance of the different groups during Refueling Outage 1R9 and your plans for continued performance improvement. The discussions of the results of your outage assessments were frank and informative. Copies of the self-assessment report and the overhead slides used by your staff during the meeting are enclosed.

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 will be placed in the NRC's Public Document Room.

Should you have any questions concerning this matter, we will be pleased to discuss them with you.

Sincerely,

Linda Joy Smith

Linda Joy Smith, Chief
Project Branch E
Division of Reactor Projects

Docket Nos.: 50-275
50-323
License Nos.: DPR-80
DPR-82

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1. Attendance List
2. Licensee Presentation

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Enclosure 1

Attendance List

Licensee

Jim Becker, Manager, Operations Services
Chuck Belmont, Director, Nuclear Quality Services
Amy Calloway, Clerical, Regulatory Services
Russ Gray, Director, Radiation Protection
Dave Miklush, Manager, Engineering Services
Pat Nugent, Licensing Supervisor, Regulatory Services
David Oatley, Vice President, Operations
Greg Rueger, Senior Vice President and General Manager
Jim Tomkins, Manager, Nuclear Safety Assessment and Licensing
Bob Waltos, Manager, Maintenance Services

NRC

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Bill Johnson, Deputy Director, Division of Reactor Projects (DRP)
Bill Jones, Senior Reactor Analyst, DRS
Ellis Merschoff, Regional Administrator, Region IV
David Proulx, Senior Resident Inspector, Project Branch E, DRP
Larry Ricketson, Senior Radiation Specialist, DRS
Linda Smith, Chief, Project Branch E, DRP

ENCLOSURE 2

Self-Assessment Report
Diablo Canyon Unit 1 Refueling Outage 1R9

Table of Contents

I. Executive Summary

This report provides an overall self assessment of organizational performance during the Diablo Canyon Power Plant (DCPP) Unit 1 ninth refueling outage (1R9).

Overall 1R9 performance was satisfactory. Performance was improved in several key areas including: industrial safety, clearances, Operations and Security human performance, and the Corrective Action Program. While performance overall is considered acceptable, there were several areas that warranted prompt immediate corrective actions and subsequent investigation to identify causes and long-term corrective actions: operational events such as the loss of residual heat removal (RHR) cooling and the loss of spent fuel pool (SFP) cooling, the high chlorides during reactor coolant system (RCS) shutdown cleanup, poor radiation work practices, and a decline in human performance within Maintenance. The most significant unresolved issue is the cause of the high dose rates experienced during 1R9.

Based on the relative number of declining and improving trends for several indicators compared to the previous two DCPP refueling outages, 1R9 performance is considered better than either. However, some negative performance trends and areas for improvement were identified. All issues, events, and negative trends have been included in the Corrective Action Program.

Operations: Overall, performance during 1R9 was good. However, several significant events occurred and some areas for improvement were identified.

Maintenance: Performance was considered good during 1R9 considering the significant reorganization that occurred prior to the outage in which all department functional areas were realigned into multidiscipline asset teams. However, several issues or events occurred that required immediate corrective actions and investigations were required in some cases to ascertain the causes and identify long term corrective actions.

Engineering: In summary, Engineering continued to protect the design and licensing basis of the plant while still supporting operational flexibility during 1R9. The identified weaknesses (interdepartmental information handoffs, preoutage preparation, and personnel experience levels) can be partially attributed to the reorganization of both the Maintenance and Engineering organizations over the last year. Significant Engineering organization and responsibility changes occurred as a result of the pre-1R9 closure of the Nuclear Power Generation (NPG) Engineering office in San Francisco.

C&EO: Overall, performance was very good during 1R9. While there were areas for improvement identified which included taking ownership for two significant plant system challenges, specifically the RCS high dose rates and the RCS high chlorides, the group continues to be a learning organization.

Radiation Protection: A slight decline in overall performance occurred in 1R9. However, some decline had been anticipated based on significant program changes implemented prior to the outage. As such, monitoring was performed throughout the outage to assess these changes and identify areas for improvement.

Security: Security provided a level of support to the plant during 1R9 that was consistent with past outages. Efforts in planning and coordination resulted in a reduction of security-related events, action requests, and associated costs.

Numerous work process and personnel responsibility changes occurred relative to previous outages due to two significant organization changes: 1) multidiscipline asset teams, divided up by physical plant area, were utilized for the first time and 2) the NPG Engineering office in San Francisco was closed in September 1998. Minor performance declines in some areas had been anticipated in affected departments due to these changes.

II. Introduction

This report is based on department self-assessment reports and 1R9 information in the First Period 1999 (1P99) Quality Performance Assessment Report (QPAR) issued by Nuclear Quality Services (NQS). The QPARs associated with the two previous refueling outages, 2R8 and 1R8, were also used for trending purposes.

Section III provides an overall assessment of 1R9 performance based on positive and negative issues and events trends for 1R9 compared to 2R8 and 1R8. The individual department self-assessment reports and the independent NQS 1P99 QPAR, all of which are presented in the appendices, provide detailed information regarding each department's 1R9 strengths, areas for improvement, trends, and issues and events. These aspects are summarized in Section IV of this report. The individual department self-assessment reports also provide the specific corrective actions, problem resolution document references, causal information and other details, as applicable, for each of the issues, events, and negative trends.

III. Overall 1R9 Performance

The following table compares 1R9 performance in several key areas with the two previous DCPP scheduled refueling outages. The eighth refueling outage for Unit 2 (2R8) occurred in Spring 1998 and the eighth refueling outage for Unit 1 (1R8) occurred in Spring 1997. The table information is based on the individual department self-assessment reports and NQS QPARs associated with each of the outages.

Trend Issue	1R9 Total	2R8 Total	1R8 Total	1R9 Trend
Human error rate (per 10,000 man-hours)	~1.4	~1.4	~1.6	Steady
Overtime (% over normal baseload work)	37	31	44	Steady
Clearance errors - total	17	63	116	Improving
high significance	1	3	7	Improving
moderate significance	4	15	35	Improving
low significance	12	45	74	Improving
Maintenance backlog (increase in total number of CM ARs during the outage)	10	82	196	Improving
Rework errors (ETRs)	37	78	*	Improving
Foreign material exclusion events	26	16	12	Declining
Liquid radioactive waste curie discharge	0.05	0.3	*	Improving
Personnel contaminations - outside SCAs	29	46	24	Improving
Personnel contaminations - inside SCAs	181	112	69	Declining
Respirator issuance errors	2	5	*	Improving
PED logging errors (per 10,000 RCA entries)	1.5	2.0	2.3	Improving
Lost TLDs	31	28	*	Steady
Total exposure (REM)	313.5	158	193	Declining
High radiation area TS violations	2	1	1	Declining
Security logged events	38	67	61	Improving

* - denotes no data

The overall human error rate in 1R9 was comparable to the previous outages. Improving trends occurred in clearance errors, maintenance backlog, rework errors, liquid radioactive waste curie discharge, personnel contamination events outside surface contamination areas (SCA), respirator issuance errors, personal electronic dosimeter (PED) logging errors, and security logged events. Declining trends occurred in foreign material exclusion (FME) events, personnel contamination events inside SCAs, total radiation exposure, and high radiation area Technical Specification (TS) violations. Based on the relative number of declining and improving trends for several indicators compared to the previous two refueling outages, overall 1R9 performance is considered better than either.

Plant wide overall performance in 1R9 (with comparisons as applicable to 2R8 and 1R8) for some of the more significant areas listed above and in other areas are as follows:

- Clearance and tagging performance has improved significantly since 1R8 as demonstrated by fewer total and significant errors.
- Total 1R9 overtime for all personnel (base staff and temporary additionals) increased slightly from 2R8. However, base staff overtime of 27 percent for 1R9 was comparable to the 26 percent total for 2R8 and substantially less than the 39 percent total for 1R8.
- The total number of significant loss of configuration control events (five to six) in 1R9 is similar to the totals in 2R8 and 1R8. Although the 1R9 events do not appear to be repeats from the previous outages, the human performance aspects of these events show that there is room for improvement in this area.
- The increase in maintenance backlog during 1R9 was substantially less than the increase in 2R8 and 1R8. Maintaining the near constant backlog during 1R9 was the result of increased dedicated maintenance resources to the operating unit during the outage.
- The total number of rework items decreased in 1R9 but the number of significant items has not decreased.
- Immediate corrective actions were ineffective for implementation of the controls required to prevent items with unqualified coatings from being installed in containment.
- FME events have significantly increased from 2R8 and 1R8 levels. However, improvement in this area was noted during the latter part (Window 3) of 1R9.
- Personnel contamination events, high radiation area violations, and total radiation exposure all increased during 1R9. Although 1R9 dose rates were significantly higher than expected and were the major contributor to overall exposure, a number of poor radiological/ALARA work practices contributed to this increase.
- The number of logged security events due to human factors in 1R9 was only about one half of the number that occurred in 2R8 and in 1R8. This was the first outage in which the goal (45 events for 1R9) in this area was met.
- The number of security events associated with untimely notifications of employee terminations increased during 1R9.
- The industrial safety record for 1R9 represents the best performance of any outage to date with only one disabling injury and three recordable injuries.

As noted above, refer to applicable appendices for actions being taken to address each negative trend.

IV. Individual Department Performance

Operations

Overall, Operations performance during 1R9 was good. However, several significant events occurred and some areas for improvement were identified.

Operations created a new work control process for 1R9 which utilized the Operations Support Center (OSC) and work window managers (WWMs). The OSC dealt with Operations work activities to support the outage and included a work authorization shift foreman, clearance coordinators, task coordinators, and WWMs. WWMs are shift foreman assigned to the asset teams to improve outage planning and coordination. Transferring approval of work activities from the control room to the WWMs allowed control room personnel to stay focused on plant operations. The new work control process was well planned and executed as there were few problems as a result of the change.

Operations utilized simulator training prior to the outage for shutdown and midloop operations. This resulted in a well planned and executed shutdown. It also allowed preplanning and coordination issues to be resolved on the simulator. The use of the simulator allowed for midloop casualty response and refresher training in the use of shutdown casualty procedures. This aided both midloop evolutions in being well executed and controlled.

The clearance process was changed prior to 1R9. This resulted in significant improvement in the clearance process as compared to past outages. In reviewing the decreasing number and significance of clearance errors, it can be concluded that there is an improving trend in clearance performance.

The outage safety plan and safety schedule effectively maintained appropriate outage safety levels by ensuring the proper availability scheduling of the systems, structures, and components needed to provide defense in depth for the various 1R9 plant conditions.

- Based on an outage risk assessment and management (ORAM) risk profile generated for the upcoming 2R9 outage using core damage frequency as the figure of merit, the cumulative risk anticipated during 2R9 is about the same as the actual cumulative risk from either 1R9 or 2R8. All three outages are characterized by two midloop operations, with the risk being the highest during those evolutions (Note: 1R8 was not included in the comparison since it contained only one midloop operation). These results are consistent with industry risk insights experienced during refueling outages.

- Any proposed changes to the outage safety schedule were effectively evaluated to ensure appropriate outage safety levels. For example, prior to the start of 1R9, ORAM indicated a one time higher risk period which would occur due to a proposed safety schedule change to perform a ventilation system damper seal replacement. Although this work was planned for 1R9, it was reevaluated prior to the outage and deferred to 1R10.
- Contingency plans were in place throughout 1R9 to ensure outage safety plan implementation: 1) an unannounced containment closure drill was executed within the allowable time, and 2) additional midloop operations contingency plans included additional management oversight during the evolution, contingency plan information in the "Plan of the Day" memo, midloop coordinators at the 140 ft. and 85 ft. RCA access points, reviews of the outage schedule and work in containment by experienced Operations personnel, additional walkdowns of the auxiliary and containment buildings, hourly announcements over the plant public address system, and special operator training.

There are five areas Operations could improve. These areas include (1) communication between the OSC and the control room, (2) understanding the effect of setting the plant process computer select alarm on the midloop trouble alarm, (3) ensuring that the results of surveillance tests are not accepted with conditions outside of the acceptance criteria, (4) improving the role of midloop coordinators, and (5) more equally apportioning the radiation dose received amongst the individuals of the department.

There were several significant events that occurred in 1R9. These events were (1) bypassing two trains of reactor protection at the same time, (2) unanticipated transfer of electrical busses (resulting in temporary loss of RHR cooling), (3) a loss of SFP cooling caused by relay replacement, and (4) controlling RCS level while restoring nitrogen to the pressurizer relief tank.

All issues, events, and negative trends have been included in the Corrective Action Program. The majority of the identified corrective actions involve changes to operating procedures and training. With the exception of the installation of a diverse loss of SFP cooling alarm, all corrective actions will be completed prior to 2R9. Refer to Appendix A for specific corrective actions, problem resolution document references, causal information and other details, as applicable, for each of the issues, events, and negative trends discussed above.

Maintenance

Maintenance performance was good during 1R9 considering the significant reorganization that occurred prior to the outage in which all department functional areas were realigned into multidiscipline asset teams. However, several issues or events occurred that required immediate corrective actions and investigations were required in some cases to ascertain the causes and identify long term corrective actions.

Modifications implemented during 1R9 were performed well with few exceptions. The new asset teams performed well although a number of human performance-related events occurred. Communication between the asset teams, the OSC and the outage control center were significantly improved. Clearance performance was significantly improved over previous outages both in significance and number. Changes in the schedule or sequence of work activities were effectively reviewed for impact on the outage safety plan and other organizations to ensure that the changes were prudent and were in the interest of all affected departments. The quality of tailboards was an outage focus area and reflected improvement as evidenced by improved work quality and reduction in significant rework.

Several issues and events that occurred during 1R9 were dealt with immediately to ensure that plant and personnel safety were always maintained. Each issue and event was appropriately documented in the Corrective Action Program and, as warranted, received timely investigation to ascertain causes and identify appropriate corrective actions. The issues and events included (1) several instances of equipment being installed in containment without qualified coatings, (2) improper torque applied to reactor vessel level instrumentation system tubing cavity side bellows, (3) improper orientation of "T" drains (drain holes) in some motor operated valve operator switch compartment covers, (4) forklift accident resulted in personnel injury and damage to safety-related equipment, (5) rigging problem resulted in a gang box being dropped during the removal of material from containment, (6) three significant clearance errors - an Operations man-on-line clearance tag was bypassed, an incorrect valve was unpacked, and removal of a main steam safety valve was begun without reporting onto a clearance, (7) relay maintenance caused a loss of power to the operating SFP cooling pump, (8) higher than normal steam generator (SG) nozzle dam leakage occurred, and 9) improper maintenance performed on the main generator motor operated disconnect switch resulted in significant damage to the switch.

All issues, events, and negative trends have been included in the Corrective Action Program. All corrective actions will be completed prior to 2R9. Refer to Appendix B for specific corrective actions, problem resolution document references, causal information and other details, as applicable, for each of the issues, events, and negative trends discussed above.

Engineering

Engineering continued to protect the design and licensing basis of the plant while still supporting operational flexibility during the outage. The identified weaknesses (interdepartmental information handoffs, preoutage preparation, and personnel experience levels) can be partially attributed to the reorganization of both the Maintenance and Engineering organizations over the last year. The weakness are being appropriately addressed by the Corrective Action Program and existing process improvement initiatives.

Engineering exhibited strong teamwork during 1R9 as reflected by Engineering sections providing additional personnel to the Engineering Fix-It-Now (EFIN) team during 1R9 such that EFIN could effectively function as the engineering first point of contact. The additional personnel allowed continuous coverage to aggressively address and resolve emergent outage issues. Engineering also filled gaps in the asset teams when required to lead and support emergent work. Engineering organizations loaned more people out to other organizations during 1R9 than at any time in the past while still keeping within the Engineering overtime budget and keeping base load work on track.

Overall, Engineering provided timely information, support, and input to both scheduled and emergent issues during 1R9. EFIN was on top of issues throughout the outage and in many cases provided same-shift resolutions to difficult emergent problems.

Excellent communication and information exchange was demonstrated by Engineering as status, successes, and problems needing resolution were effectively communicated up and down the chain of command and across to other plant organizations and outside contractors.

As noted by NQS in the 1P99 QPAR, sound engineering judgment was demonstrated in the following actions:

- Engineering required the rework of the improper bus terminations for SFP Pump 1-1 circuit beaker.
- Engineering required the proper plunger to auxiliary switch gap be verified for the Auxiliary Saltwater Pump 1-2 circuit breaker prior to Mode 4.
- Engineering did not allow paper that was for establishing welding purge boundaries to satisfy containment closure requirements.
- Engineering identified a generic concern with "T" drains on Limitorque motor operator limit switch covers.

Timely notification to the rest of the organization did not occur for some project scope changes, activities requiring increased support requirements, and issues with regulatory significance. This was an issue that crossed many activities including some which were considered overall successes.

Preoutage planning was identified as an area needing improvement. In some instances, this issue arose because many Engineering activities are not scheduled since physical work is not involved, but the activities are required for task completion.

Experience level was an issue as experienced personnel were not distributed to support a 7 days a week, 24 hours a day schedule. For example, the test team had many new members in 1R9 and the most experienced members for a given test were not always available when the test was being performed.

Several issues and events involving Engineering personnel occurred in 1R9. These included (1) the emergent repair of the canopy seal welds having a negative impact on overall project duration, cost, and radiation exposure, (2) the containment fire stop/sump evaluation issues, (3) the time to rated voltage and frequency for the diesel generators not recorded as required by STP M-15, "Surveillance Test Procedure," (4) a manual containment isolation valve left open and unattended, and (5) the emergency core cooling system voiding issue.

As noted in the 1P99 QPAR, Engineering developed an operability evaluation (OE) in lieu of using the design change process to upgrade the alternate low temperature over-pressure protection pressure transmitters for use in Mode 4. This application was an improper use of the OE process, and was contrary to the applicable procedural and regulatory requirements associated with design control.

All issues, events, and negative trends have been included in the Corrective Action Program. Corrective actions for outage issues will be completed prior to 2R9. Refer to Appendix C for specific corrective actions, problem resolution document references, causal information and other details, as applicable, for each of the issues, events, and negative trends discussed above.

Chemistry

Overall, performance of Chemistry and Environmental Operations (C&EO) was very good during 1R9. While there were areas for improvement identified which included taking ownership for two significant plant system challenges, specifically the RCS high dose rates and the RCS high chlorides, the group continues to be a learning organization.

The use of formal written turnovers between shifts was implemented in 1R9 and resulted in better communication and continuity of information. This helped minimize

the chemistry effects of the high RCS chloride event due to prompt and complete corrective actions.

Liquid radioactive waste discharge curie content was very good during 1R9. In comparison to 2R8, curie content was significantly reduced.

As a result of emerging work and an especially busy time of the year just prior to the outage, the corrective action process within C&EO slowed as indicated by an increasing average age and quantity of action requests. Recovery in this area has been slower than anticipated.

During outage recovery, condenser saltwater leaks were not successfully repaired, at least in part due to communication problems.

The control room experienced nuisance alarms on SG blowdown radiation monitors during heatup. The radiation monitors had been set to a higher level during the outage to support SG maintenance associated with SG tube removal, but were prematurely reset back to the original values.

The plant experienced high RCS chloride levels at the beginning of the outage. While this was caused by the inadvertent introduction of a chloride-based demineralizer resin into the primary system, C&EO missed an opportunity to identify this error due to poor communications with Operations and poor program guidance for sampling demineralizers when placing the demineralizer bed in service.

Investigation continues into the reasons behind the higher-than-anticipated dose rates that were experienced during 1R9. Actions in an attempt to determine causes include evaluation by consultants as well as interdepartment and interplant meetings as part of the NCR process.

The number of hazardous material labeling deficiencies, per the DCPP Green Label Program, increased during the outage. This result was not unexpected due to the increase in the number of temporary personnel who are unfamiliar with the requirements of the Green Label Program.

All issues, events, and negative trends have been included in the Corrective Action Program. All corrective actions will be completed prior to 2R9 (although final resolution of the high dose rate issue may not occur until after 2R9). Refer to Appendix D for specific corrective actions, problem resolution document references, causal information and other details, as applicable, for each of the issues, events, and negative trends discussed above.

Radiation Protection

Overall, a slight decline in Radiation Protection (RP) performance occurred in 1R9. However, some decline had been anticipated based on significant program changes implemented prior to the outage. As such, monitoring was performed throughout the outage to assess these changes and identify areas for improvement.

Documentation of surveys required by radiation work permits improved significantly in 1R9. This is a significant accomplishment as changes to simplify survey guidance and documentation helped RP to manage workloads with even fewer outage technicians and improve survey documentation.

During 1R9, the 29 incidents of personnel contamination outside posted surface contamination areas were significantly less than the 46 that occurred during 2R8. Additional focus in the area of radioactive tool control combined with less work in the auxiliary building contributed to this low number.

The frequency of PED RCA log in and log out errors continued the downward trend during 1R9. There were 9 entries into the RCA without an operable PED, which was a continued low rate of 1.5 events per 10,000 entries. This was a reduction from 2.0 events per 10,000 entries for 2R8 and 2.3 events per 10,000 entries during 1R8.

Personal contamination incidents (PCIs) occurring in surface contamination areas increased by 50 percent compared to 2R8. The number of 1R9 PCIs was 2.5 times the number that occurred during 1R8.

Changing the ALARA responsibilities, performed by the former RP work planning group, resulted in many good practices. However, some administrative management expectations were not met, including (1) in process job reviews, (2) job specific dose tracking, and (3) job implementation responsibilities.

There was an increase in the number of events involving poor contamination control practices, some of which resulted in a spread of contamination and multiple personnel contamination events.

The number of high radiation area boundary events increased during 1R9: (1) A TS violation occurred when a worker entered a high radiation area without a PED, and (2) contrary to the TS and the radiation work permit requirements, a worker entered a high radiation area located on top of the reactor head.

Poor ALARA practices resulted in some unnecessary exposure during several work activities.

The 1P99 QPAR concluded that RP technicians failed to actively promote desired radiological protection behaviors from outage personnel, and overall, RP management

failed to provide adequate oversight of RP technician interface with workers. Some technicians had ALARA and RP work practice standards that were inconsistent with management expectations and, as such, technicians did not actively seek to coach workers in the best ALARA practices.

As noted in the 1P99 QPAR, the number of lost thermoluminescent dosimeters increased from 28 in 2R8 to 31 in 1R9.

Unexpected high dose rates were experienced during 1R9. Some work in affected areas was delayed for up to several days. Elevated dose rates were noted at shutdown and later increased significantly during the forced oxygenation. As noted above, investigation continues into the causes of the higher than anticipated dose rates, including evaluation by consultants in addition to interdepartment and interplant meetings as part of the NCR process.

All issues, events, and negative trends have been included in the Corrective Action Program. All corrective actions will be completed prior to 2R9. Refer to Appendix E for specific corrective actions, problem resolution document references, causal information and other details, as applicable, for each of the issues, events, and negative trends discussed above.

Security

Security provided a level of support to the plant during 1R9 that was consistent with past outages with a reduction of security events, action requests, and associated costs through planning and coordination.

A total of 38 security human factor events occurred during 1R9. This represented a marked improvement over 2R8 in which 67 security human factor events occurred.

During 1R9, there was an increase in the trend for security events associated with untimely notifications of employee terminations.

The identified negative trend has been included in the Corrective Action Program. All corrective actions will be completed prior to 2R9. Refer to Appendix F for specific corrective actions, problem resolution document references, causal information and other details, as applicable, for the identified negative trend.

V. Appendices

A. Operations Self-Assessment
B. Maintenance Self-Assessment
C. Engineering Self-Assessment
D. Chemistry Self-Assessment
E. Radiation Protection Self-Assessment
F. Security Self-Assessment
G. NQS 1P99 Quality Performance Assessment Report

1R9 SELF-ASSESSMENT

OPERATIONS

1R9 SELF-ASSESSMENT
OPERATIONS

EXECUTIVE SUMMARY

Overall, Operations performance during the outage was good. However, several significant events occurred and some areas for improvement were identified.

Operations created a new work control process for 1R9, with the operations support center (OSC) and work window managers (WWM). The OSC dealt with Operations' work activities to support the outage. It included a work authorization shift foreman (SFM), clearance coordination, task coordinators, and WWMs. WWMs are SFM assigned to the asset teams to improve outage planning and coordination. This removed approval of work activities from the control room and allowed the control room to stay focused on plant operations. The new work control process was well planned and executed as there were few problems as a result of the change.

Operations utilized simulator training prior to the outage for shutdown and midloop operations. This resulted in a well planned and executed shutdown. It also allowed preplanning and coordination issues to be resolved on the simulator. The use of the simulator allowed for midloop casualty response and refresher training in the use of shutdown casualty procedures. This aided both midloop evolutions in being well executed and controlled.

The clearance process was changed prior to 1R9. This resulted in significant improvement in the clearance process as compared to past outages. Looking at the decreasing number and significance of clearance errors, it can be concluded there is an improving trend in clearance performance.

There are five areas Operations could improve. These areas include (1) communication between the OSC and the control room, (2) understanding the effect of setting the plant process computer (PPC) select alarm on the midloop trouble alarm, (3) a surveillance test procedure (STP) was accepted with conditions outside of the acceptance criteria, (4) improve the role of midloop coordinators, and (5) equalizing the radiation dose received amongst the individuals of the department.

There were several significant events that occurred in 1R9. These events were (1) bypassing two trains of reactor protection at the same time, (2) unanticipated transfer of electrical busses (resulting in temporary loss of residual heat (RHR) removal cooling), (3) a loss of spent fuel pool (SFP) cooling caused by relay replacement, (4) controlling reactor coolant system (RCS) level while restoring nitrogen (N_2) to the pressurizer relief tank (PRT).

All events have been captured in the Corrective Action Program. Identified corrective actions primarily include changes to operating procedures and training. All corrective actions will be completed prior to 2R9.

STRENGTHS

1. **Creation of the OSC**
   For 1R9, Operations undertook a new approach to the control of work activities by establishing the OSC. Most of the Operations' activities to support work for the outage were coordinated at this facility. This resulted in (1) reduced traffic in the control room, promoting a quiet, professional atmosphere, (2) increased efficiency by offering a single point of contact for control room personnel and asset teams, and (3) smoother clearance coordination by having the clearance process in one room.

2. **Creation of WWMs**
   The creation of WWMs allowed Operations a greater influence in planning the outage. The Turbine Building, Control Room Electrical, and NSSS Asset Teams had a full time SFM assigned, to help in planning the outage. This resulted in better planning and coordination of outage activities. This continued through the outage as the WWM helped resolve schedule problems as they arose in the outage. WWMs also acted as the contact between the control room and asset teams. This facilitated communication between Operations and the asset teams and resulted in timely resolution of problems.

3. **Simulator training prior to the outage**
   Both control room crews involved in the plant shutdown for the outage practiced the shutdown on the simulator. The simulator session was run for 24 hours and included crew turnover. The test team and Maintenance were also involved to work out the coordination of testing as the plant was shut down. This resulted in identifying problems in the shutdown on the simulator and solving them prior to the actual plant shutdown. It also allowed assignments of job functions and tailboards to be conducted on the simulator. This resulted in a smooth, controlled, and well executed shutdown.

   Operations received midloop training prior to the outage. This training included failures while at midloop. This also required the use of shutdown casualty procedures and was a good refresher as these procedures are only used in Mode 5 (Cold Shutdown) or below.

4. **Control room operations**
   Observations during the plant shutdown, draining to hot midloop, and draining to midloop with the reactor defueled and the reactor vessel cover installed, were rated as excellent performances. This was demonstrated by (1) effective use of updates (attention to all operators and a quick update of some information), (2) thorough and informative tailboards, (3) good peer checking for all board manipulations, (4) increased sensitivity to the critical nature of the task, (5) diligent management oversight, and (6) attentive board observations by operators. The addition of updates showed great benefit in the outage. It allowed a quick and simple way of keeping all of the control room personnel informed of new information.

AREAS FOR IMPROVEMENT

1. **Communication between OSC and control room**
   There were some problems with communications between the OSC and the control room. This was more evident on day shift. A daily 10:00 meeting was instituted between the OSC, SFM, and the shift supervisor (SS) to resolve this problem. An understanding of what is to be communicated to the control room and when, will be better defined before 2R9. (Refer to Action Request (AR) A0485196.)

2. **Midloop alarm function transferred from the midloop trouble alarm to the PPC select alarm**
   Per Operating Procedure OP A-2:III, "Reactor Vessel - Draining to Half Loop/Half Loop Operations with Fuel in Vessel," the narrow range reactor vessel refueling level instrumentation system (RVRLIS) alarm is enabled while draining to 112 ft. in the reactor vessel. This was accomplished by the Control Room Electrical Asset Team enabling the alarm. The procedure also states that the operators should setup the PPC operator select alarm. However, a feature of the PPC exists such that if a PPC-driven address is used to drive the "PPC Operator select" window, it will defeat the alarm for an existing widow. In this case, the operators set new alarm values for the high RVRLIS level alarm (the high alarm value was changed from 108 ft. to 107 ft. 10 in.) on the PPC select alarm. This resulted in the alarm function transferring to the PPC select alarm and disabling the "midloop trouble" alarm. The alarm value can only be set in a conservative direction when setting the PPC select alarm.

   There was some confusion with the shift operating crews about the way the PPC select alarm functioned. Personnel did not understand that setting the PPC select alarm caused the alarm function to transfer from the midloop trouble alarm window to the PPC select alarm window of the annunciator system.

The operating procedure is written such that it can be interpreted differently as to what alarms are to be enabled. It also does not adequately address the fact that when the PPC select alarm is used it transfers the alarm window from the midloop trouble alarm window to the PPC select alarm window. OP A-2:III has been clarified to prevent reoccurrence of this problem. An article is to be written for the Operations newsletter to ensure all operators understand the way the PPC select alarm functions. These actions should resolve operator understanding of how the alarms function and improve the guidance in the procedure. (Refer to AR A0486456)

3. **STP M-54 accepted with conditions outside the acceptance criteria**
On 3/13/99, STP M-54, "Verification of RCP Seal Injection Flow by Resistance Measurement," was performed as required due to a possible change in the line resistance of the charging system, due to transferring reactor coolant pump seal injection filters. STP M-54 requires total seal injection flow to be less than 36.6 gpm to meet the Technical Specification (TS) limit of 40 gpm (controlled leakage per TS 3.4.6.2). The difference between the two values is instrument inaccuracies. The measured flow rate was 37.82 gpm. STP M-54 was reviewed as acceptable with the out of tolerance reading due to misreading a less than sign. Mode changes from Mode 3 (Hot Standby) to Mode 2 (Startup) and from Mode 2 to Mode 1 (Power Operation) were made with this out of tolerance reading.

   The out of tolerance reading was discovered on 3/15/99 through a secondary review of this STP. A new test was run on 3/15/99 and the seal injection throttle valves were adjusted to satisfy the acceptance criteria. When the error was brought to the SFM's attention, he entered TS 4.0.3 thinking that this was a missed surveillance and not a failed surveillance because the calculation for the seal line resistance was also done incorrectly. At the time the Shift Technical Advisor (STA) found the test failure, TS 3.4.6.2, Action b, should have been entered. There were 5 hours and 3 minutes between when the STA found the STP did not meet the acceptance criteria and when the SFM accepted the subsequent STP. The subsequent STP M-54 was not started and reviewed in a timely manner because of the TS misinterpretation.

   The acceptance requirements are based on the most limiting instrument inaccuracies between Unit 1 and 2. This allows one STP to be written for both units. The Unit 2 instruments are the most limiting. Review of the data and the use of Unit 1 inaccuracies resulted in an acceptable value for Unit 1 of 39.87 gpm (refer to Chron 236159). Thus, the initial STP M-54 results were determined to be acceptable and TS 4.4.6.2 was not violated.

This problem and a similar problem have been combined into Quality Evaluation (QE) Q0012135. The root cause and corrective actions required are to be completed by 07/27/99. The individuals involved were counseled on the inappropriate review of the STP and the entry into the incorrect TS.

4. **Midloop coordinators**
   Operations utilized senior reactor operator (SRO) licensed individuals as midloop coordinators. This position was staffed while the RCS was below 112 ft. (reduced RCS inventory). They were stationed at access points to the auxiliary building and containment. They were responsible for ensuring the activities of each worker were acceptable to be performed during reduced inventory operations. They utilized a list of work that was preauthorized to be performed while at reduced RCS inventory. If an item was not on the list, it required a second SRO to approve the work before it was allowed to commence.

   This is a good position, but it is not as effective as it could be. It was not adequately communicated to plant personnel what this position's function is and its importance. This resulted in problems at the control points, as some people became irritated and attempted to bypass this position. A second person had to be stationed with the midloop coordinator to prevent people from bypassing them. Plant-wide communication will be completed prior to 2R9, to ensure the function of the midloop coordinators is understood and personnel understand management's expectations for cooperating with the midloop coordinators (Refer to AR A0485197).

   Guidance will be improved for equipment that is required to remain in service for midloop operations. Guidance for midloop coordinators will include what to consider prior to allowing work that is not preapproved. This will aid midloop coordinators and the second SRO approving work while at midloop. A complete package of information will be created for the midloop coordinators prior to 2R9 (Refer to AR A0485198).

5. **ALARA, Operations needs to equalize the dose amongst its personnel**
   The average dose received by operators in February was 45.29 mrem. Fifteen operators received between 100 and 314 mrem with an average of 170 mrem. The difference between the average and the highs for the department is high. Five of these operators continued to receive higher doses during March. While most of Operations' jobs are low dose jobs and very few are high dose jobs, it is understandable that there is disparity in the dose received. The fact that five of the operators continued to receive higher dose than the average is of concern. Part of ALARA is to keep each individual's dose as low as reasonably achievable.

The manner in which jobs are assigned during 2R9 will consider the dose each individual has received for the purpose of dose equalization in the department. Task coordinators will consider an individual's dose prior to assigning a high dose job to an individual in 2R9. (Refer to AR A0485199)

6. **Risk assessment for an inoperable boric acid storage tank**
Operations performed a flush of the RHR system at power to bring the systems boron concentration to the refueling boron concentration. Operations allowed the boric acid storage tanks (BASTs) to go below the individual tank limit, this was preplanned. While the BASTs themselves are not risk significant, and are therefore not part of the on line maintenance (OLM) risk assessment computer program, a total inventory of at least one full BAST is required in the safety function assessment trees (SFAT) for subcriticality in the OLM risk assessment procedure, Department Level Administrative Procedure AD7.DC6, "On Line Maintenance Risk Assessment." The operating crew did not understand that this is assumed in the OLM computer program. Since at least one full BAST worth of boric acid was still available, the SFAT was satisfied and no revision of the risk assessment was required. Just in time, training was conducted with all SSs, SFM, and STAs to ensure the SFAT assumptions are understood when performing risk assessments using the OLM computer program.

TRENDS

- **Clearance issues have been significantly reduced**
A dramatic reduction in clearance-related, documented problems has occurred - from 116 total events in 1R8, to 63 total events in 2R8, to 17 total events in 1R9. More significantly, there were 7 events in 1R8 that were deemed to be significant versus only 1 event deemed significant in 1R9. Of those events deemed to be of moderate significance, the reduction is equally dramatic at 35 events for 1R8, 15 events for 2R8, and 4 events for 1R9.

  With the rewriting of the clearance procedure between 2R8 and 1R9, the number of report off for test (ROFT) related events has dropped off considerably. Prior to the change, a significant portion of the moderate events were ROFT-related. During 1R9, only two events were due to ROFT problems.

  Based on the decreasing numbers and significance of clearance-related events over the past three outages, it can be concluded that DCPP in general, and Operations in particular, have an improving trend in clearance performance.

ISSUES AND EVENTS

1. **Bypassing two channels of reactor protection at the same time**
   Unit 1 entered TS 3.3.1, action 6, for an inoperable reactor protection system RCS Loop 1 temperature channel due to a time response problem requiring troubleshooting. Because of this problem, the bistables were tripped for this channel. As part of power ascension testing following the 1R9, STP R-41, "Reactor Coolant System Temperature Instrumentation Data," was to be performed and an adjustment of the RCS temperature instrumentation was to be performed as a result. The SFM was informed that in order to perform the temperature adjustment, the Loop 1 bistables would have to be placed in the bypassed condition (an out of service condition allowed by the TS). However, the SFM did not understand that each of the other three loop temperature channels would have to be placed in the bypass condition one at a time in order to adjust the temperature instruments. This resulted in three separate times that two channels of protection were in bypass at the same time and TS do not allow this condition. With two channels in bypass at the same time, the unit is placed in TS 3.0.3 which was also not realized by the SFM. The "channel in bypass" alarm occurred each time a channel was placed in bypass, but neither the SFM nor control operator realized that there were two concurrent alarms at any given time. However, since the total time the unit was in this condition was less than 1 hour, the action requirements of TS 3.0.3 were not violated (Refer to Licensee Event Report 1-1999-02).

   The annunciator response procedure for "channel in bypass" is being revised to make it clear that placing two channels in bypass at the same time is not allowed. A generic procedure is to be written for Westinghouse Eagle 21 protection system testing to check bistable status prior to commencing the testing. The procedure will provide guidance on how to proceed if any bistable is in other than the normal condition. These changes should prevent this problem from occurring again and are being tracked by NCR N0002093.

2. **Unanticipated transfer of electrical busses to start-up power**
   While restoring the oil system to the main turbine generator, a thrust bearing wear trip via the turbine protection system resulted in a transfer of electrical busses to start-up (SU) power. Testing was in progress on vital 4kv Bus G at the time that blocked the transfer to SU power (SU feeder breaker was in the test position). This resulted in transferring Bus G to its diesel generator (DG). The bus transfer caused all loads on the bus to strip prior to loading on the DG. RHR Pump 1-1, which was being used to recirculate and cool the RCS at the time, was one of the loads stripped. This condition was recognized immediately and RHR Pump 1-1 was restarted within 39 seconds (Refer to LER 1-99-01).

When the 500 kV main transformers were returned to service in accordance with OP J-2:I, "Main and Aux Transformer Return to Services," and aligned to supply the plant's power, the main generator thrust bearing trip was left cut in. The operating crew did not realize there were two separate procedures to restore the main bank and backfeed the unit. The backfeed procedure OP J-2:V, "Backfeeding the Unit from the 500kV System," cuts out the thrust bearing wear trip. There was no reference in the main bank restoration procedure to the backfeed procedure.

The main bank restoration procedure and 13 other operating procedures that reference backfeeding have been modified to refer to the backfeed procedure. STP M-13 series, "Manual & Auto Transfer of 4kv Vital Busses Off-site Power Sources," and M-15 series, "Integrated Test of Engineered Safeguards and Diesel Generators," are to be reviewed and ensure the appropriate equipment line-ups are performed prior to placing the SU feeder breaker in the test position. These actions are being tracked via NCR N0002089.

3. **Relay replacement caused the SFP cooling pump to trip.**
The control room received a high temperature alarm of 125 degrees on the SFP. Investigation found no SFP cooling pump running. SFP Pump 1-2 was immediately restarted and SFP temperature returned to normal. Investigation also revealed this was due to the replacement of a containment isolation Phase A actuation relay. One of the functions of this relay is to stop SFP Pump 1-2 when it actuates. Removing this relay from the system was the same as the relay contacts opening and resulted in SFP Pump 1-2 stopping. The aspect of how this contact worked was not understood by the clearance coordination group and it was not identified in the work order.

   The clearance coordination group has been trained on the way this feature acts for all relays. OP B-8DS1, "Core Unloading," was modified to require monitoring of SFP temperature every 2 hours while the reactor core is not fully loaded in the reactor vessel. A diverse alarm is to be installed to alert the operators that SFP cooling has been lost. These actions should provide additional warning of a loss of SFP cooling and are being tracked by QE Q0012110. The diverse alarms are expected to be installed prior to 1R10 and 2R10 in Unit 1 and Unit 2, respectively. For 2R9, verifying SFP temperature every 2 hours is considered to be sufficient interim action until the 2R10 alarm installation.

4. **Effects of restoring N_2 to the PRT on the RCS.**
While lowering RCS level from 25 percent pressurizer cold calibration level to 112 ft. in accordance with OP A-2:II, "Reactor Vessel - Draining the RCS to the Vessel Flange - With Fuel in Vessel," to allow reactor head removal, an issue arose because N_2 had been isolated to the PRT. This resulted in unstable readings in RVRLIS as some water from the voided steam generator (SG) U-tubes transferred

into the RCS. These effects were because the pressurizer and the reactor head were vented to the PRT via RVRLIS and N_2 acts as a cover gas on the RCS. The reduction in N_2 pressure on the RCS caused water to sluice from the voided SG U-tubes to the RCS. The crew stopped reducing RCS level when the discrepancy between RVRLIS indications was discovered.

An investigation into the discrepancies between RVRLIS instrumentation identified that nitrogen was isolated to the PRT and was the probable cause. The crew decided to restore N_2 to the PRT. When N_2 was restored, RCS level decreased and the crew had to charge to the RCS to maintain level above 112 ft. (approximately 400 gallons). The decrease in RCS level was due to sluicing water from the RCS back into the voided SG U-tubes. Although the control room expected RCS level to drop when restoring N_2, they did not understand where the water would go. Operations controlled the evolution by setting a limit of 112 ft. in the RCS and would not go below 112 ft. by any indication. N_2 was to be restored slowly; however, restoring N_2 caused RCS level to drop by 2 ft. and should have been accomplished in a more controlled manner (either slower or stopping to allow the system to settle out prior to continuing).

Training is to be held on the effects of changing pressure (N_2 or via ventilation system) on the RCS and RVRLIS while at reduced inventory. Isolation of N_2 to the PRT was correctly scheduled but was performed earlier without appropriate reviews. Work instructions have been revised to require WWM review of all clearances prior to implementation (AR A0476823)

Appendix B

1R9 SELF-ASSESSMENT

MAINTENANCE SERVICES

1R9 SELF-ASSESSMENT
MAINTENANCE SERVICES

EXECUTIVE SUMMARY

A postoutage assessment of 1R9 maintenance and modification activities was performed to determine the overall performance of the Maintenance organization in completing the outage. This assessment specifically identified the activities that were successfully planned and performed, the areas needing improvement, and what significant events that occurred. The assessment included reviewing shift turnover results, 1R9 outage reports, action requests (ARs), event trend records, quality evaluations (QEs), nonconformance reports (NCRs), management observations, and work control documents.

1R9 maintenance was performed this outage for the first time utilizing the asset teams. The outage duration and costs were the best Unit 1 has achieved. Although schedule adherence and control of emergent work helped to minimize the outage impacts, a number of emergent items contributed to the delays. Including the reactor vessel level indication system (RVLIS) capillary fill work, residual heat removal Sump LT-940/941 operability issue and poor schedule adherence on reactor coolant pump motor and seal work. More effective use of the 30 minute rule, and better coordination of handoffs would also have lessened schedule impact. There were both successes and room for improvement during performance of maintenance. Modifications performed during 1R9 were performed well with few exceptions. Maintenance Services had several issues and events that required immediate corrective actions and in some cases an investigation to determine the cause and identify long term corrective actions.

In summary, the quality of work performed by the new asset teams was generally good in the area of human performance. Communication between teams, the outage support center and OCC helped the asset teams with timely and accurate communication. The concept of having the Operations Department support personnel in an area separate from the control room created closer communication between Maintenance and Operations personnel resulting in a reduced impact of traffic in the control room. Changes in the schedule or sequence of work performed were reviewed against the outage safety plan and impact on all organizations to assure the changes were prudent and were in the interest of all affected departments. Issues, events, and areas for improvement were dealt with immediately to assure plant and personnel safety was maintained first, then long term corrective actions were addressed. Examples include the valve motor operation "T" drain issue for both the outage and operating unit, the investigation into finding the spent fuel pool (SFP) cooling pump not running, and the unit trip signal due to a thrust bearing wear device causing the start of the Emergency Diesel Generator 1-2.

STRENGTHS

1. **Projects**
   Examples of projects that went well were the emergency core cooling system pressure reducing orifice project and the condensate storage tank repairs. Both projects were well coordinated and the quality of the results of both projects was excellent.

2. **Work completion documentation**
   Work completion documentation was significantly improved over previous outages. Work orders were kept current with the work activity and issues identified during maintenance were properly identified. Changes to work plans were documented in a timely manner.

3. **Clearance performance**
   Clearance performance was significantly improved over previous outages both in significance and number. Changes to improve the clearance process after 2R8 appeared to have been communicated adequately to support success. Nuclear Power Generation had 63 clearance-related issues in 2R8 and just 17 in 1R9.

4. **Tailboards**
   The quality of tailboards had been a focus area and reflected improvement. This was evidenced by the quality of work and a reduction in significant rework. A tailboard checklist was implemented prior to the outage.

5. **Industrial safety**
   Industrial safety was excellent. A preoutage safety stand-down was held by each asset team addressing safety issues, performance expectations, and outage content.

6. **Turbine generator work**
   The turbine generator work was an example of a large task that was well planned, coordinated, and performed. This was reflected in the quality of work, schedule adherence, and safety performance.

7. **Documentation of human performance errors**
   The self-identification and documentation of human performance errors increased during the outage. This was in part due to the increased awareness of human performance issues by Maintenance Services. The number of management observations increased and a willingness to document low level errors supported this awareness. This is considered a necessary step in improving human performance in Maintenance Services.

AREAS FOR IMPROVEMENT

The assessment identified several areas that needed evaluation for improvements prior to 2R9. Corrective actions for these areas will be tracked through the corrective action process. The areas with an "*" following the description are considered part of the increase in human performance errors that will be addressed in NCR N0002083.

1. **Foreign material exclusion issues**
   During 1R9, the reactor cavity foreign material exclusion (FME) controls were changed from previous outages due to the split pin replacement task. The area was configured differently to accommodate the temporary reactor cover and different personnel were involved in the task. This resulted in an increase in the number of FME events. Every event was investigated and lessons learned were implemented as issues were identified. (Refer to AR A0477521) *

2. **Radiation exposure**
   DCPP had very high radiation exposure during 1R9. This was a result of unplanned events occurring during the shutdown of the reactor coolant system which created higher than expected dose rates. Poor radiation work practices, and a lack of awareness of higher than normal doses by radiation workers contributed to the accumulated dose. The cause of the higher than expected dose rates is still being investigated by C&EO and is discussed in Appendix D. (Refer to NCR N0002091) *

3. **Contamination events**
   The split pin replacement task caused excessive contamination for the personnel working on the tool platform. This was a new process and a better understanding of the job conditions would have helped preclude this level of contamination. Poor radiation worker practices contributed to an increase in contamination events. (Refer to RP Self-Assessment Report, Appendix E, for corrective actions and tracking documents.)

4. **Unqualified coatings in containment**
   Several instances of equipment being installed in containment without qualified coatings occurred. Several causes were identified and corrective actions will be completed prior to 2R9. The primary cause was that the direction for when and where to inspect for qualified coatings was not clear or understood by the planners and craft. All conditions identified were rectified or assessed for impact on the containment sump. (Refer to QE Q0012107) *

5. **RVLIS capillary fill**
   A very lengthy and resource intensive capillary fill of RVLIS tubing was required as a result of improper torquing of the cavity side bellows during past work. This was attributed to inadequate procedure guidance. (Refer to QE Q0012116) *

TRENDS

1. **Human performance errors**
   A negative trend was identified in human performance errors (some of which are part of this report and are identified with an "*" following the text). These issues were added to NCR N0002083 issued prior to 1R9 to address a negative trend in Maintenance Services human performance errors.

2. **Hazardous waste**
   Several incidents of improper disposal of hazardous waste occurred in 1R9 and were documented in individual action requests. QE Q0012103 was issued to address these incidents and any programmatic implications.

ISSUES AND EVENTS

As part of the overall performance assessment, issues or events that appeared significant were identified to assure the correct level of cause was performed, immediate corrective actions were adequate, and that there was a plan for long-term corrective action to preclude recurrence. The following issues and events were determined to fit that category.

1. **Improperly installed "T" drains**
   There was a failure to orient "T" drains or drain holes in some Limitorque motor operated valve (MOV) switch compartment covers in a manner that would allow proper drainage of moisture. This finding initiated an immediate inspection of all environmentally qualified MOVs in both units to assure that there were not any current of past operability issues. The operating unit was found to be in compliance. It was determined that all of the valves would have performed their intended safety function. The cause of the error was inadequate procedure guidance and a lack of understanding the design bases function of the drain by the personnel installing the actuators. The valves that needed to be corrected were immediately modified, changes to the MOV program procedure are in process, and permanent training enhancements to MOV training were completed. (Refer to NCR N0002087) *

2. **Forklift incident**
   A forklift accident resulted in personnel injury and damage to safety-related equipment. A forklift driver fell off the forklift while it was in motion. This resulted in injury to the driver and damage to a support on the boric acid storage tank. Although the personnel injury and equipment damage were not significant, the event itself could have led to significant equipment damage and more serious personnel injury. The accident was caused by the forklift operator leaning too far sideways to look around the load he was carrying. The seatbelt became

disengaged, and the operator fell off. An inspection of the seatbelt did not reveal any cause for it disengaging. The accident severity was mitigated by another person stopping the forklift. (Refer to AR A0478215) *

3. **Rigging problem**
   A gang box was dropped during the removal of material from containment. It was dropped through the hatch in the auxiliary building. It appears that the box caught on the lip of the hatch while being lowered and, because of being loaded unevenly, it slid off the slings and dropped. Rigging practices for this kind of lift are being reviewed. (Refer to AR A0479787) *

4. **Clearance errors**
   One clearance error characterized as significant occurred during 1R9:

   - Removal of a main steam safety valve was started without reporting onto a clearance. A master clearance was in place to protect the workers but they did not report onto the subclearance. The assistant team leader had performed this task under a master clearance in previous outages and did not remember that the new practice was to have individual subclearances for each activity under that master clearance. (Refer to AR A0476557) *

   Two clearance errors characterized as moderately significant also occurred during 1R9:

   - During the initial turbine generator work, a contract employee bypassed a man-on-line tag and operated the turbine building crane. The procedure controls were reviewed and determined to be adequate. This was determined to be a human performance issue. The employee involved was interviewed and released due to the procedure noncompliance and the potential for personnel injury. (Refer to QE Q0012101) *

   - A Maintenance Services person unpacked the wrong valve. The correct valve and the one that was inadvertently unpacked were side by side but the craftsperson did not self-verify the tag verses the valve identified in his work order. The valves had the same numbers but the suffix letter designation was different. The program controlling these activities was reviewed and determined to be adequate. This was addressed as an individual human performance error. (Refer to AR A0477781) *

5. **SFP pump found not running**
   A temperature alarm from the SFP led to the discovery that the SFP was off. The cause was that the planning process did not identify the fact that associated relay maintenance would cause a loss of power to the pump circuit. Operations had just performed rounds and did not notice the power loss until the high temperature alarm came in on the control board. An operations procedure for core unloading will be revised and a low flow alarm installed prior to 1R10/2R10. (Refer to QE Q0012110)

6. **Nozzle dam leakage**
   Maintenance experienced higher than normal nozzle dam leakage during 1R9. This created an impact on Operations and Maintenance to mitigate the flow of water in containment. This is being reviewed for lessons learned to implement during 2R9. The cause evaluation has not been completed. (Refer to QE Q0012104)

7. **Main generator motor operated disconnect switch damaged**
   Improper maintenance was performed on the main generator motor operated disconnect switch which resulted in significant damage during subsequent operation and required major rework of the switch. (Refer to QE Q0012102) *

Appendix C

1R9 SELF-ASSESSMENT

ENGINEERING

1R9 SELF ASSESSMENT
ENGINEERING

EXECUTIVE SUMMARY

After the completion of 1R9, Engineering formed a self-evaluation team to assess the department's performance during the refueling outage. The team was led by the Engineering night shift representative to the outage coordination center (OCC) and included engineers from the systems group, civil design, electrical components, and the engineering fix it now (EFIN) team. They performed the assessment by establishing criteria, obtaining input from management, soliciting feedback from clients (asset teams and outage director), and obtaining input from the Engineering supervisors. The team also reviewed various Nuclear Quality Services' (NQS) assessments of the outage, action requests (ARs) and action evaluations (AEs), and quality problems related to 1R9. The results of this assessment are documented in this report. Subsequent to this effort, some additional assessments were performed by Engineering individuals and groups and these are also documented in the report.

The team determined that Engineering had demonstrated four strengths and three areas for improvement during 1R9. The noted strengths were in teamwork, timeliness, communication, and professional attitude. The areas for improvement consisted of a lack of adequate forewarning to other groups, lapses in preoutage preparedness, and the inadequate experience levels of some personnel for specific functions. The areas for improvement are being addressed by the appropriate groups within Engineering and are expected to be corrected prior to 2R9 in September 1999.

Also documented in the report are some significant issues and events involving Engineering that arose during 1R9. Specific issues and events included are the core exit thermocouple nozzle assembly (CETNA) weld repair; containment fire stop/sump evaluation; Surveillance Test Procedure M-15, "Integrated Test of Engineered Safeguards and Diesel Generators"; missed data, LT-940 and 941 power supply failure, manual containment isolation Valve SI-8964 left open, reactor vessel level indication systems (RVLIS) capillary fill, the emergency core cooling system (ECCS) voiding issue, plant operability assessment (POA)/operability evaluation (OE) process and the impact of closure of the San Francisco Engineering office. Any identified weaknesses in these areas are being addressed by the Corrective Action Program, specific Nuclear Technical Services actions, or have been submitted to the outage lessons learned program for resolution.

In summary, Engineering continued to protect the design and licensing basis of the plant while still supporting operational flexibility during the outage. The identified weaknesses can be partially attributed to the reorganization of both the maintenance

and engineering organizations over the last year and are being appropriately addressed by the Corrective Action Program and existing process improvement initiatives.

STRENGTHS

Four strengths were consistently demonstrated by Engineering personnel in the support of 1R9. These strengths were in the areas of teamwork, timeliness, communication, and professional attitude. Each of these strengths are discussed below.

1. **Teamwork**
   This strength was reflected in the Engineering organization's willingness to help each other and other organizations during 1R9. Many Engineering sections provided additional personnel to the EFIN team during 1R9 such that it could effectively function as the first point of contact and resolution of most Engineering outage issues 24 hours a day. Various Engineering sections also provided Sunday coverage for EFIN such that the team could have that day off during 1R9 even when the schedule slipped and work was scheduled for Sunday. Engineering also filled gaps in the asset teams when required to lead and support emergent work such as the weld repair of the leaking CETNA, containment debris/fire stop removal, reactor stud tensioner failure evaluation, Valves 8010 B & C fit up resolution, and the RVLIS capillary fill evaluation. Engineering supported the asset teams in resolution of valve issues during the residual heat removal (RHR) window, resolution of crane and fuel handling equipment problems, resolution of the LT-940 and 941 issue, and issuance of design changes. Personnel from Engineering took on many more outage assignments outside of their normal engineering roles in 1R9. This included working on asset teams, serving as containment coordinators, night shift projects lead, test team, scheduling support, etc.

2. **Timeliness**
   Engineering provided timely information, support, and input to both scheduled and emergent issues during 1R9. EFIN was on top of issues throughout the outage and in many cases provided same shift resolutions to difficult emergent problems. An example of this was providing a resolution and procedure change within a few hours to resolve the issue of the startup transformer tap changer remaining in manual while on startup power. Other examples are providing resolution of the auxiliary transformer oil leak before the end of the shift in which it was discovered, solution to RHR pump leakage issue, and continuous support to the ASUP Welding Team. Civil Engineering also performed the containment seismic gap walk down prior to shutdown such that any problems could be resolved without impacting the outage schedule. Engineering personnel provided prompt scaffolding, shielding, and floor loading evaluations to the requesting organizations. Design changes, both before and during the outage, were issued in time to support the outage schedule and allow time for required procedure changes. Timely notification of emergent issues was provided to the OCC and the rest of the organization to minimize impact on

schedule. This included items like RVLIS, testing issues, recirculation sump issues, and fuel handling equipment problems.

3. **Communication**
Communication and information exchange are critical to a successful outage. Engineering demonstrated a strength in this area that went from top management and the Engineering OCC representatives down to the individual contributor level. Status, successes, and problems needing resolution were communicated up and down the chain of command and across to other plant organizations and outside contractors. This was accomplished by written turnover reports, status turnover meetings, and frequent status updates from the field to the OCC and Engineering management. Specific communications strengths consisted of (1) keeping the OCC and asset teams informed of the status of emergent work items such as the containment debris/fire stop removal progress, (2) obtaining support from outside contractors for the fire stop, CETNA, and RVLIS issues, and (3) coordinating the required support and outputs to minimize outage impact, provide test status updates to the OCC and asset teams to facilitate smooth handoffs, and having the inservice inspection (ISI) group stay on top of the schedule to provide timely support. Engineering also kept the organization informed of the status of major design changes such as the split pin replacement project and out-of-step protection modifications. The steam generator (SG) group kept all parties informed of status and emergent issues via turnover reports, tailboards, and face-to-face reports to the OCC which facilitated teamwork and work scheduling. Directors and supervisors kept the Engineering OCC representatives informed of their personnel on shift and personnel on call for emergent work, especially on weekends. The Engineering OCC representatives not only did a good job of presenting items in the OCC meetings, they also kept the outage director apprised of critical work status changes between meetings. During the readiness for restart process, Engineering personnel continuously kept the outage organization updated on the status of Engineering restart items and ensured they were completed in a timely manner.

4. **Professional attitude**
Engineering personnel demonstrated a high level of professionalism prior to and during the outage by always being ready to support the outage and Nuclear Power Generation (NPG) goals. Engineering organizations loaned more people out to other organizations during 1R9 than at any time in the past and did this while still staying within the Engineering overtime budget and keeping base load work on track. Personnel rearranged their time off schedules to support outage tasks without using or increasing overtime usage. When emergent issues required additional maintenance support, Engineering personnel were always there and ready to serve. Some notable examples of this were in providing leadership and personnel for the CETNA repair, containment debris/fire stop issue resolution, stud tensioner failure evaluation, LT-940/941problem resolution, and RVLIS problem resolution. Another example of the professional attitude of Engineering was in the

performance of the ECCS orifice project in which all the lessons learned from 2R8 were incorporated into the 1R9 project such that this project was almost invisible to the outage organization. This was also true of the local leak rate test and ISI programs during 1R9. Off shift personnel were also professional in wearing their pagers off site and responding to pages and phone calls for support in a timely manner. As noted in the 1999 Quality Assessment Performance Report, Engineering maintained the plant's licensing and design basis while providing technical support for emerging issues during 1R9. Specific examples included (1) requiring rework of improper bus terminations for the SFP pump circuit breaker, (2) requiring that the proper plunger to auxiliary switch gap be verified for the auxiliary salt water pump circuit breaker prior to Mode 4 (Hot Shutdown), (3) identifying a generic concern with T-drain orientation on Limitorque limit switch covers (Nonconformance Report (NCR) N0002087), (4) and not allowing the use of purge dam paper to satisfy containment closure requirements. All of this was done in a cooperative and professional manner.

AREAS FOR IMPROVEMENT

The Engineering Self-Assessment Team identified three areas for improvement by Engineering personnel in the support of 1R9. These areas for improvement were adequate forewarning, preoutage preparedness, and experience level. Each of these areas for improvement are discussed below.

1. **Adequate forewarning**

   Adequate forewarning was an issue that crossed many activities, and showed up even in areas which were considered overall successes. As an example, the handling of the containment debris/fire stop issue was seen as a success by those who were informed early, but was not seen as such by the asset teams that had to do the removal work since they did not get a heads up during the initial planning stage. Another area of weakness was in the notification for boric acid leaks found during the performance of STP R-8A, "Reactor Coolant System Leakage Test." Engineering did a good job of finding the leaks, but surprised the outage organization with the number of ARs written and delays in writing them after the inspection. The outage director did not know that Engineering was using a new computer program for flux map analysis during 1R9 and that there was not a backup available. This caused several hours delay during the outage. Some other changes in plans, such as the fix for the auxiliary transformer oil leak and the clearance for the main transformer, were not communicated early enough to meet asset team needs. Another area of lack of forewarning was noted in that the asset teams did not always know in advance what support Engineering needed for testing activities since there were no AEs written for this support. Actions being taken to address this issue for 2R9 include having Engineering write AR/AEs to define required Maintenance support for surveillance testing, valve inspections/testing, etc. The Engineering manager will also reinforce the need to provide timely notification to the

rest of the organization of increases in scope, additional support required, etc. in all hands meetings prior to the outage. Another lesson learned from the outage was the need to be proactive regarding potential issues that may arise during a refueling outage. Regulatory Services is performing a review of generic industry issues, such as containment sump issues that currently exist to determine the potential probability of action being required during a refueling outage. Regulatory Services is also considering what contingency actions can be taken to mitigate the impact of these issues on the refueling outage.

2. **Preoutage preparedness**
Preoutage planning was identified as an item needing improvement prior to 2R9. Numerous individual items identified this as a problem, but the biggest issue is that many Engineering activities are not scheduled, because they don't involve physical plant work even though these tasks must be done before the work can be called complete. As a result, the outage schedule only counted the time to perform the physical work and became optimistic, then people were perturbed when the required Engineering evaluations appeared to be "holding up the outage." There were also some logistic problems in getting ready to reload the core in that there was not a clear understanding by all parties of all the prerequisite actions. Engineering will meet with Operations to review the fuel handling program in general, to improve the process. Another issue in this area was the apparent lack of schedule review for the logic and duration required for STP R-6, "Low Power Reload Physics Test," in relation to resetting the power range. The outage director would have also benefited by having a list of scheduled post-maintenance tests and STPs at the beginning of the outage rather than just prior to Mode 4. This would have provided better focus on these tasks. During the schedule review for 2R9, Engineering will provide input to the schedule for the above items to ensure they are adequately accounted for in 2R9. Also, as stated above, AR/AEs are being written for support required by Engineering during 2R9.

3. **Experience level**
Experience level was an issue with the test team and night shift rotating machinery support. The issue was not so much that Engineering lacked the needed experience, but rather that the experience was not distributed to support a 7 day a week, 24 hour a day outage. The test team had many new members in 1R9 and the most experienced members for a given test were not always available when the test was being run. In most cases this was not a problem, but it did have significant impact at times. The missed data for STP M-15 is partially attributable to having new people performing parts of this test. Originally there was an experienced rotating equipment specialist on night shift, but the person was switched to day shift due to emergent work in other areas. This resulted in not having an experienced rotating equipment engineer available from midnight until approximately 6:00 a.m. each day. Again this was not normally a problem, but did at times delay Engineering's response or follow up to some equipment problems. Engineering is

reevaluating coverage for 2R9 in order to reduce or eliminate this weakness. Also, since many Engineering personnel gained valuable experience in new areas during 1R9, we should be better able to support 2R9 with experienced personnel.

ISSUES AND EVENTS

1. **CETNA weld repair**
   On February 17th ISI performed routine inspections of the reactor head control rod drive mechanism (CRDM) canopy seal welds looking for signs of reactor coolant system (RCS) leakage in accordance with ISI procedure STP X-CRDM. During the course, if this inspection evidence of RCS leakage was observed at core exit thermocouple locations A-5 and E-15. Engineering was immediately requested to evaluate the leakage and to provide repair options to the NSSS Asset Team. The next day, during a breakout meeting with all of the affected parties, the decision was made to repair the seal welds using a weld overlay process. The weld repair was to be performed by an outside welding contractor experienced in this type of repair work. In less than 6 days time the procurement request was issued; contractor was mobilized; design change package was issued; reactor head was prepared for welding; contractors were trained and badged; work orders written, reviewed, and approved; all contractor procedures, equipment, and processes were reviewed and approved for use at DCPP. The weld repair of the first location began on February 24th and the second weld repair finished on February 27th. The reactor head weld repair project completed approximately 10 days following the discovery of the canopy seal weld leaks.

   Although the emergent repair of the canopy seal welds was completed without impacting the outage duration, several issues have been self-identified which were determined to have had an impact on the overall project duration, cost, and radiation exposure. The issues are listed below:

   a. Higher than normal RCS radiation levels during plant shutdown for 1R9 resulted in significant personnel exposures for this repair. This is being addressed by Operations, C&EO, and Radiation Protection (RP) via NCR N0002091 for 2R9.

   b. Due to the magnitude of this project, different groups/asset teams were required to perform their specific job scope. This hampered project communication, continuity, and ownership. This issue was submitted to the Outage Lessons Learned Program.

   c. The unavailability of "escorted radworker" keycard status resulted in significant delays. This access status had been deleted by the badging department. Badging is now reevaluating this keycard status.

d. Continuous dedicated RP support during the actual repair work was key to the success of the project. However, the project lacked the same level of support during equipment removal and decon efforts. This resulted in increased project costs as a result of holding one crew over 1 day to complete the equipment removal process. This issue was submitted to the Outage Lessons Learned Program.

e. Crews assigned to disassemble and reassemble the reactor head CRDM assembly were inexperienced. This resulted in additional exposures and project delays. This issue was submitted to the Outage Lessons Learned Program.

2. **Containment fire stop/sump evaluation**

INPO Operating Experience 93-07, "Fibrous Material in Containment," describes the removal or disposition of several sources of potential recirculation sump debris. One of these sources is an electrical cable tray fire stop damming material called "Fiberfrax." Although Fiberfrax is not installed at DCPP, other fibrous fire barrier materials are used, such as Kaowool M board, Kaowool blanket, mineral wool, and marinite.

During 1R9, high energy line break (HELB) locations inside containment were walked down to determine whether cable trays were located in the HELB zones of influence and, if so; whether the cable trays contained fibrous fire barrier material. Several cable trays were identified to be in HELB zone of influence locations inside the crane wall on the 117 ft. elevation.

The project initiated three concurrent activities:

a. Evaluate and characterize the insulation material for impact to the recirculation sump. Assistance was sought from Innovative Technology Solutions (ITS) which was provided with several samples of DCPP fibrous materials. ITS performed scanning electron microscope (SEM) and energy dispersive spectrometer (EDS) analysis of the insulation samples. High magnification SEM analysis measured fiber diameters within each sample and EDS analysis identified the elemental constituents of the fibers. This information was used to derive fiber specific values that were input to Calculation M-591 (sump blockage calculation).

b. Remove as much of the fibrous material as possible with minimal impact to the outage and organization. Many hurdles were encountered during this part of the project, including high dose rate areas and limited scaffolding and resources. In the end, however, a significant amount of material was removed from Unit 1 and the overall results show we are in good shape with respect to our containment sump screens post loss of coolant accident.

c. Revise existing calculations and evaluate related design and licensing documents. Significant manhours were spent evaluating complicated calculations that required revision in an expeditious manner. Other Engineering groups were enlisted to evaluate the impact of fire stop materials on the DCPP design and licensing basis documents.

Overall, there was good team effort and the fire stop removal project was managed well. The emergent scope, while very involved, was completed with little impact to the outage duration. In retrospect, however, several issues were self identified:

a. DCPP did not take advantage of the two forced outages in December 1998 to perform walkdowns to address the fire stop issues needing validation to determine its impact on operability status sooner.

b. Engineering did not initiate an AR in a timely manner to address fibrous materials in Unit 2. (Refer to AR A0477669.)

c. Initial review of Operability Evaluation 93-07 concluded that the material specified in the OE was not installed in containment; however, additional related issues were not considered. (Refer to NCR N0002085.)

d. As discussed earlier, management of this issue was seen as a success by those who were informed early, but was not seen as such by the asset teams that had to remove the material, since they did not get a heads up during the initial planning stage.

3. **STP M-15 missed data**

Test team engineers performed STP M-15 on 5/4/99. The primary reviewer of the completed STP discovered that the time to rated voltage and frequency for the diesel generators was not recorded. This prevented him from verifying that all test acceptance criteria were satisfied. He attempted to obtain this data from other STPs performed coincidentally with M-15, but the data were not available. His shift ended before he resolved this issue, so he left it as a turnover item for the next shift. The next shift could not find this data, so the engineer wrote AR A0479523. Day shift supervision determined that the diesel start portion of M-15 should be reperformed and the data recorded. Diesel starts using the solid state protection system start (accomplished using STP M-16, "Safeguards Active Component Operation By Slave Relay Operation") portion of STP M-9A, "Diesel engine Generator Routine Surveillance Test," were performed and the required data to complete M-15 were obtained.

STP M-15 did not require recording diesel times to achieve rated voltage and frequency; the time to voltage for one diesel was verified and the time to frequency for a different diesel was verified. No times were verified for the third diesel. No

times were recorded; therefore, acceptance criteria could not be independently verified. In this regard, test performance did not meet expectations or requirements. The test review process worked as it is expected to work—the failure to perform the test correctly was identified and corrective actions were taken. The review personnel demonstrated the proper questioning attitude. Supervision/management directed the proper actions by correcting the error through additional testing and documenting the problem on an AR with the attendant quality paper (QE Q0012112). Corrective actions include directing the procedure be revised prior to the next performance to require recording of the start time data. Additional corrective actions to improve pretest tailboards for integrated system tests are being implemented for 2R9.

4. **LT-940/941 power supply failure**
The RHR recirculation sump level indication Channels LT-940 & LT-941 are heated element resistance temperature detector type sensors, which rely on the heat dissipation from the sensing elements to detect water level in the sump. The instruments were installed in the 1991 time frame, and have a calibration frequency corresponding to unit refueling outages. The routine calibrations in 1R9 noted significant drift from previous calibrations. In accordance with an established I&C policy, a ">3x OOT" (greater than three times out of tolerance (OOT)) AR was written to Instrument and Controls Component Engineering (ICE) to evaluate the conditions that might have been contributing to the OOT, prior to performing any further maintenance on the channels. As this calibration was taking place late in the outage schedule, it had a good chance of affecting the final completion of the outage.

Discussions among asset team technicians, planners, and ICE confirmed that the methods and test setup being used were satisfactory. The ICE engineers performing the evaluation had been involved with the original installation of the instruments, and therefore had historical files and knowledge of the instrument characteristics. The results of the discussions were documented on the 3x OOT AR and troubleshooting continued by the craft. It was determined that the internal power supplies in the transmitters were significantly degraded due to the condition of the electrolytic capacitors. (Refer to AR A0479760 and A0479885.) Replacement capacitors were procured from the vendor and installed in the transmitters, and the calibrations completed satisfactorily. ICE was consulted frequently throughout the evolution and tasked with evaluating performance criteria for the Unit 1 channels and developing action plans to troubleshoot the Unit 2 channels. Several write-ups were generated by ICE, for planning purposes (Plant Safety Review Committee review) and for inclusion on INPO Nuclear Network, as well as for support of System Engineering evaluations. Engineering provided timely and comprehensive support to Maintenance and Operations in resolving this issue with minimal impact to the outage and the operating unit.

5. **STP V-5 valve SI-8964 left open**
Test personnel left Valve SI-8964 open and unattended during shift turnover while making the transition from STP V-5C to V-5A2. This valve is currently identified as a manual containment isolation valve for Containment Penetration 51B. It is normally sealed closed during Modes 1 through 4 (Power Operation through Hot Shutdown). Technical Specification (TS) 3.6.3 provides that locked or sealed closed manual isolation valves may be opened on an intermittent basis under administrative control. The administrative control includes continual attendance by a person in communication with the control room while the valve is open. However, it was concluded that TS 3.6.3, action d, was met so this event was not reported.

The shift foreman briefed day shift personnel on the administrative controls required for opening the valve. The test did not finish on that shift. The night shift personnel relieving the day shift did not receive the communication of the administrative requirements. When turnover to day shift arrived, the night shift personnel left the valve unattended (for approximately 1 to 1.5 hours). Day shift personnel discovered the error and sent an engineer to attend the valve as an immediate corrective action. Supervision wrote an AR to document this problem, and NCR N0002090 was issued. The technical review group responsible for this NCR is evaluating further corrective actions. These include revising STP V-5C to include specific directions that SI-8964 requires continual attendance when opened. Improved tailboards for this type of test will be implemented in 2R9 and the future. A corrective action of consolidating containment design/isolation descriptions and requirements in a single document, possibly the Final Safety Analysis Report is also being considered.

6. **RVLIS capillary fill**
RVLIS train B transmitter calibration was attempted during the normal 1R9 outage window, where it was identified that the as found readings were significantly shifted with a nonlinear output. AR A0477636 was written, and ICE was tasked with assisting with troubleshooting the system. After several pressure tests, and the help of Westinghouse, the reactor head capillary line was determined to contain a 20 in. air bubble. This condition normally requires a full system or partial refill, which takes approximately a week to perform.

In parallel with refill preparations, an analysis path was pursued which may have allowed operation through the next operating cycle, with a refill of the capillary line in 1R10. The analysis involved determining the effects of the air bubble on system accuracy during normal and accident conditions. The analysis path was exhausted when it was determined that major changes to the design and licensing bases would need to occur to allow this particular condition to exist throughout the cycle.

At that point, the decision was made to pursue the refill operation during 1R9 to restore the system to required specifications. Westinghouse was contacted to provide technical assistance with the refill operation and ICE was assigned the project lead. Once the reactor pit was drained and access was possible, the refill operation proceeded. Significant refill findings included:

a. The original sensing bellows was found loose, which was deemed to be the root cause of the air bubble.

b. The second bellows was determined to be defective after the refill operation, which required the operation to be restarted with a loss of 4 days of outage time.

c. Expedited evacuation techniques incurred a delay of 1 day when ice formation prevented sufficient vacuum retention.

The system was eventually refilled, balanced, recalibrated, and returned to service during Mode 4. AR A0481375 and QE Q0012116 were written to track the above noted root cause and corrective actions for the loss of RVLIS capillary fill.

During this time period, with the RVLIS capillary refill operation in progress, the normal low temperature over pressure (LTOP) transmitters were unavailable for service. The alternate LTOP transmitters can be used in their place, but they are only qualified for Modes 5 (Cold shutdown) and 6 (Refueling) service. To alleviate the requirement to halt plant startup to wait for the normal LTOP, an evaluation was performed to qualify the alternate LTOP transmitters for Mode 4 service. This evaluation was documented in OE 99-02. NQS identified a concern in AR A0480392 regarding the appropriateness of using an OE for this purpose. This issue is being investigated by QE AFR Q0012113 and will be resolved prior to 2R9.

7. **ECCS voiding**

In the past, gas voids have been found in both units' ECCS crosstie piping between the discharge of the RHR pumps and the suctions of the safety injection pumps (SIPs) and centrifugal charging pumps (CCPs). During switchover from safety injection to cold leg recirculation, a gas void could be flushed to the suction of either both SIPs or both CCPs. If the void were large enough (i.e., if the suction fluid contained greater than a 5 percent void fraction), operability of the SIPs and CCPs could not be assured.

In October 1998, Engineering Calculation STA-089 was issued to determine the allowable accumulated gas volume in the SIP/CCP suction crosstie piping. Shortly thereafter, STP M-89A, Rev. 0, was issued to monitor the ECCS suction crosstie piping, a known accumulation point. This surveillance is currently performed weekly to ensure that acceptable void volume limits are met.

Due to the current piping configuration in both units, some voids cannot be completely vented. NCR N0002076 was initiated to determine the root cause of the voids, i.e., how they are generated and where they come from. As part of the NCR investigation, jumpers were installed in Unit 1 prior to 1R9 to monitor certain piping locations. One jumper was installed between the suction of the CCPs and the tee toward ECCS suction crosstie valves SI-1-8807A/B to observe if bubbles were migrating toward the high point. This jumper recorded flow through the piping so that any bubbles noted might be correlated to a plant evolution. Another jumper was installed near SI-1-8807A/B to monitor void growth at the known gas accumulation point.

It was believed, and confirmed by ultrasonic testing (the jumpers), that the gas voids are formed during outage activities which introduce air into the ECCS, such as: (a) Swapping CCPs, (b) Stroking valves, and (c) Bumping reactor cooling pumps

Inadequate fill and vent of the ECCS was also identified as a contributing cause, and Engineering is working with Operations to modify the appropriate fill and vent procedures.

Although there has been good team effort and cooperation in monitoring and addressing this problem, the following issues have been identified:

a. While control room personnel and Operations management understood that monitoring was being performed to watch for void growth, this was not adequately communicated to the nuclear operators (auxiliary building watch). (Refer to QE Q0012130.)

b. A potential violation of TS 6.8.1 existed when a void in excess of STP M-89A acceptance criteria was detected by Operations, but actions to vent the void were not taken for approximately 23 hours.

8. **1R9 POA/OE**

At the start of 1R9 there were 19 open POAs and all but 2 of those were related to Unit 1 or common to both units. All but 2 of the 17 issues related to Unit 1 were closed during the outage and 1 additional POA was also closed that was written against Unit 1 at the beginning of the outage. The 2 POAs that were not closed during the outage were on fire protection issues and had been open for less than nine months. They both required outside support or parts for closure and did not involve outage work. Licensing basis impact evaluation screens were performed for these 2 issues prior to the end of the outage and they were closed in the month following the 1R9 outage. At the end of 1R9, there were only 6 open POAs on both units and there are now only 5 that remain open. All currently open POAs are scheduled to be closed by the end of 2R9.

During 2R9, Regulatory Services processed 17 OEs. This includes closing 6 OEs entirely, closing 1 OE for Unit 1, revised and screening 2 OEs, screening only 6 OEs, and issuing 2 new OEs. All OE work was completed on time and without impacting the outage schedule.

In summary, Engineering worked aggressively to resolve operability concerns during 1R9. Very few of these issues remained open at the end of the outage and those that did were approved by management and screened to ensure no unreviewed safety questions existed.

9. **Impact of San Francisco office closure**

1R9 was the first refueling outage after the closure of the NPG Engineering office in San Francisco in September, 1998. In previous outages, the SF engineering groups provided on-site support for major design changes and also provided manpower to some maintenance and on-site engineering groups. The SF engineering staff was also a resource that was utilized to address emergent issues during previous outages. Since this resource no longer existed, the DCPP site organization had to handle all outage work requests and emergent issues. This was effectively accomplished by preplanning work, ensuring that all Engineering personnel were fully utilized, variable work schedules, and utilization of Altran personnel for some planned and emergent work. The Altran consultant option had been set up to specifically reduce the impact of the closing of the San Francisco office by retaining some DCPP experienced personnel at one firm in the SF Bay area. As in any refueling outage, some Engineering sections were more heavily loaded than others and this was taken into account in preplanning of engineering support for 1R9. Personnel were shifted from their normal assignments to outage assignments to better support the heavily loaded areas. Everyone was encouraged to take on an outage job to support 1R9. The test team, SG team, EFIN, etc. were

staffed with additional personnel from other sections during 1R9. Prior to the outage, it was determined that the civil group would require additional resources to complete the seismic gap evaluations during 1R9 and Altran was contracted to supply these additional personnel. Most emergent issues were handled by DCPP personnel, but several, including the fire barrier debris/sump issue, RVLIS, and the CETNA repair, required additional resources from outside contractors. Altran supplied personnel to support resolution of the fire barrier debris/sump issue, Westinghouse supported the RVLIS cap fill, and outside welding support was brought in by Engineering for the CETNA repair. Altran was also available and utilized to provide expert advice and opinion on various issues raised during 1R9. Based on the overall performance of Engineering during 1R9, the closure of the SF Engineering office had minimal affect on Engineering's capability to support the outage or operating unit during 1R9.

Appendix D

1R9 Self-Assessment

Chemistry & Environmental Operations

1R9 SELF-ASSESSMENT
CHEMISTRY & ENVIRONMENTAL OPERATIONS

EXECUTIVE SUMMARY

Overall, performance of Chemistry and Environmental Operations (C&EO) was very good during 1R9. While there were areas for improvement identified which included taking ownership for two significant plant system challenges, specifically the reactor coolant system (RCS) high dose rates and the RCS high chlorides, the group continues to be a learning organization.

One improvement instituted this outage was the use of formal written turnovers between shifts. This resulted in good communication and continuity of information. This helped minimize the chemistry effects of the high RCS chloride event due to prompt and complete corrective actions. In addition, communication both before and during the outage helped heighten the awareness of plant personnel surrounding the need for careful treatment of the liquid radwaste system. This helped avoid system challenges which resulted in increased curie discharges during the previous outage.

As a result of emerging work and an especially busy time of the year just prior to the outage, the corrective action process within C&EO slowed as indicated by an increasing average age and quantity of action requests (ARs). Recovery in this area has been slower than anticipated. This can be at least partially attributed to the loaning of personnel to other organizations for the outage and a reduction in overtime during the outage in an effort to support the 1R9 goal of 30 days duration with $30 million in expenditures (30/30 goal).

During outage recovery, condenser saltwater leaks were not successfully repaired, at least in part due to communication problems. This communication breakdown was identified and actions are being taken to prevent recurrence. In addition, an abnormally excessive amount of mussels on the intake traveling screens combined with an ineffective cleaning process during the outage caused a short curtailment within days of startup. This resulted in an unplanned capability loss factor of 2.37 percent.

The control room experienced nuisance alarms on SG blowdown radiation monitors during heatup. The rad monitors had been reset to a higher level during the outage to support steam generator maintenance associated with tube removal. Unfortunately the monitors were reset back to original values too soon and had to be reset again to avoid these nuisance alarms.

The plant experienced a high RCS chloride level at the beginning of the outage. While this was caused by the inadvertent introduction of a chloride based demineralizer resin into the primary system, C&EO missed an opportunity to identify this error due to poor communications with Operations and poor program guidance for sampling demineralizers when placing the demineralizer bed in service. Operations missed an opportunity to identify the error when they did not pursue sample completion as indicated by their procedure.

Investigation continues into the reasons behind the higher than anticipated radiation dose rates that were experienced during 1R9. Actions in an attempt to determine causes include evaluation by consultants as well as interdepartment and interplant meetings as part of the nonconformance report (NCR) process. DCPP hosted a 2-day meeting with key consultants, EPRI, and four other plants to evaluate shutdown chemistry and the high dose rate issue.

STRENGTHS

1. **Formal turnovers**
   Formal written turnovers between C&EO shifts were used this outage. This enhanced communications between shifts and provided access to this information by other personnel. This was noted as a significant improvement in the turnover process, especially by C&EO management.

2. **C&EO response to the RCS chloride event**
   C&EO actions to help resolve the high chlorides in the RCS were very good. The problem was identified promptly and investigated with good follow up by supervision. C&EO management has been leading the technical review group (TRG) on this issue. To date extensive efforts have been placed in the TRG process to identify the primary causes and all contributing causes in an effort to prevent recurrence. While it is unfortunate that this event had to happen, lessons are being learned that can be carried over to other aspects of daily operation.

3. **RCS cleanup**
   RCS cleanup is evaluated each outage by the primary C&EO engineer. At the time of this assessment, this report was in the draft stage for 1R9. Because DCPP experienced high dose rates in some areas of the RCS but not others during 1R9, an NCR was initiated to address this issue. This NCR is designed to help understand the mechanisms and answer the question as to why this happened. In addition, several consultants have been hired to provide independent analyses of the data from 1R9 and this information is being evaluated for development of corrective actions.

A considerable amount of energy has gone into this process following 1R9 as has gone into previous outages. It can be identified as a strength that the primary C&EO engineer evaluates the cleanup each outage in an effort to help improve the process and especially the level of effort that is being put into 1R9 due to the anomalies that were seen. Final review of this process for 1R9 will be performed as part of the NCR and the issuance of this report.

AREAS FOR IMPROVEMENT

1. **Timeliness of corrective actions**
   As a result of reduced staffing prior to and during 1R9, as well as emerging issues during these periods, all combined with an especially busy period during the two months leading up to the outage which included two forced outages, corrective actions for preexisting problems within C&EO slowed prior to and during 1R9. This was seen as a slow climb in the average age of ARs as well as an increased number of open ARs. This was self-identified by C&EO just after the outage. Actions are currently being taken to reverse this trend and resolve this problem while maintaining an appropriate priority on all issues. To a certain extent, this issue was anticipated; however, the recovery period following the outage has been much longer than expected. To ensure the corrective action process moves at an acceptable rate for the remainder of the year, C&EO is currently planning to have the quality coordinator remain in C&EO and not transfer to Radiation Protection (RP) for the outage or work on preoutage activities for RP as was done during 1R9.

2. **Condenser saltwater leak resolution**
   Prior to 1R9, Unit 1 had a small condenser leak resulting in increased sodium concentration in the steam generators. Plans were made to look for leaks after the outage during the startup period. This was put on the outage schedule in advance of the outage. During startup, C&EO was asked how the salt leaks were looking. With a vacuum but at zero power, the message was relayed that everything looked acceptable at that point. This was taken by outage management to mean there were no salt leaks and they could proceed. Further leak searches were removed from the outage schedule. As power increased and condenser delta temperatures changed, C&EO started detecting leaks. Due to a variety of communication issues for a number of reasons, no leak detection activities took place until near the end of the 50 percent power hold. At this time due to limited time available, leak detection efforts were only applied to half the condenser and leaks were not found. Leak search is now on the forced outage schedule.

   Prior to the outage, System Engineering usually took the lead on leak search issues with the help of C&EO and Operations. Primary ownership appears to have been transferred over to the asset team during this past year. However, the leak issues

weren't communicated very well to the asset team during the outage recovery period and this was part of the reason for limited leak search efforts. C&EO has taken the lead to open communication with the asset team in this area and future leak search efforts should be better communicated. Evidence of this was seen during the most recent scheduled curtailment of Unit 2 in April for tunnel scraping. Better scheduling and communication with the asset team resulted in 60 percent of the condenser leaks being identified and fixed during this short curtailment. C&EO is also considering possible alternatives at this time, such as eddy current testing of condensers during outages.

3. **Cleaning of traveling screens during 1R9**
Within a few days of startup, Unit 1 needed to curtail to 50 percent for a short period of time to perform a pick and dredge due to rising condenser differential pressures (DPs). This resulted in an unplanned capability loss factor of 2.37 percent. On 3/23/99, condenser DPs were at 9.3 at 0930 (low tide) and at 10.7 psid at 1540 (near high tide). Unit 1 began ramp down at 2100 so the 1-2 circulating water pump (CWP) could be cleared by 0000. The 1-2 CWP was shut down at about 0000 on 3/24/99. Pick and dredge proceeded as planned. Three full bags of material - about 1.5 to 2 cubic yards was removed. The debris was about 95 percent dead mussel shells (recently dead) and about 3 percent kelp and algae. The remainder was a mixture of small amounts of jingle shells and a few barnacle shells. After the pick and dredge, DPs were both at 4.1 psid.

This issue is being resolved by AR A0481449 and quality evaluation (QE) Q0012119. The QE cause analysis identified the cause to be inadequate cleaning of the traveling screen frame and baskets during dewatered bay maintenance. It was believed that, the internal portions of the traveling screen had died off during the dewatered bay period of the outage. These mussels were not readily visible without rotating the traveling screens. Rotating traveling screens is not a normal activity due to potential damage that may occur to the foot shaft bearing since these bearings are water lubricated. However, an abnormal excessive amount of mussels must have been in the interior of the screen. These mussels were washed from the screen to the main condenser upon starting CWP 1-2. These mussels caused the DP on the east condenser to increase.

As recorded in the QE, the recurring task work orders (WOs) for dewatered bay traveling screen maintenance for the outages will be revised to include steps to ensure the internal portions of the traveling screen assembly get inspected for debris that may become dislodged. This debris will be removed. Rotating the traveling screen during this time may need to occur to ensure adequate inspection and cleaning. The asset team leader will perform a final walk down inspection and document acceptance of the final walk down on the summary comments of the WO.

4. **RE-23 high alarm setpoint**
Normally, the high alarm setpoint (HASP) for the SG blowdown liquid overboard monitor, 1-RM-23, is set based upon a primary-to-secondary leak rate scenario. During 1R9, the HASP had to be increased to accommodate higher than normal isotopic activity resulting from SG secondary side outage work. Periodic control room alarms and blowdown isolation was occurring. The HASP was increased using radioactive effluent discharge limits as its basis. Toward the end of the outage, the HASP was changed back to its original setting (based upon a leak rate scenario). Unfortunately, when the SGs were drained just prior to heating up, and during initial blowdown, the need for the higher HASP still existed. The HASP was raised again to keep nuisance alarms and blowdown isolation from occurring.

As part of future outage plans, the RM-23 HASP should routinely be raised from the normal leak rate setting to a radioactive effluent based setting just prior to the beginning of the outage when Maintenance Services may have more time to make the change. The HASP should not be changed back to the leak rate setting until soon after the outage when time restraints are not as critical.

C&EO recommended to outage management as part of the formal lessons learned process that the HASP change be made part of the outage preparation schedule so that C&EO and Maintenance Services both have it as part of their schedules to prepare the set point change documentation and schedule technician and engineering time to implement it. The implementation activity could include cutting ARs or Action Evaluations to the same groups to change the HASP back after the outage.

5. **Outage staffing**
To help the plant achieve the 30/30 goal for 1R9, C&EO loaned several personnel to other organizations during 1R9 and reduced overtime of the management personnel that remained in C&EO. Assessment activities for 1R9 with the primary purpose of assessing were only performed after the fact with the intent of learning lessons and making improvements for future outages. No formal self-assessments were conducted during the outage. Normal informal self-assessment activities such as supervisory reviews and observations of work were performed as usual and Nuclear Quality Services did review and report on C&EO activities during various outage windows. In addition, a total of 18 formally documented supervisor observations of tasks took place during 1R9. At the end of 1R9, the plant decided to compile a plant wide self assessment of 1R9 activities. This assessment would have been more meaningful if it had been anticipated and based on assessments that had been performed during the outage. Prior to future outages we will need to decide the appropriate balance between any anticipated postoutage processes and relocation of staff during the outage.

TRENDS

1. **Hazardous material labeling**
   The number of hazardous material labeling deficiencies, per the DCPP Green Label Program, increased during the outage. This result was not unexpected due to the increase in the number of temporary personnel who are unfamiliar with the requirements of the DCPP program. However, the total number of discrepancies found during the April walkdown following 1R9 was 11, the lowest ever recorded during a monthly walkdown.

   The current goals for this program need to be evaluated. The reason is that we continue to exceed the goal of 12 identification discrepancies and 60 storage discrepancies per year that are found on the monthly walkdowns. DCPP is recognized by outside groups such as INPO on the excellence of the program. The goal may need adjusting or additional emphasis needs to be placed on this program by management. (Refer to AR A0486131.)

2. **Liquid radwaste discharge**
   Liquid radwaste discharge curie content was very good during 1R9. In comparison to 2R8, curie content was significantly reduced. This was mostly due to a lack of system challenges that were experienced during 2R8 due to chemical contamination of the radwaste system. However, this lack of challenges can be at least partially attributed to good communication efforts that took place both before and during the outage to encourage personnel to be careful during work to avoid chemical contamination of these systems.

ISSUES AND EVENTS

1. **High RCS chlorides**
   At the very beginning of the outage a new demineralizer bed was placed in service in preparation for RCS cleanup activities. Shortly after the bed was placed in service, RCS chloride levels began to rise. Chlorides went from a normal of about 1 parts per billion (ppb) to over 1000 ppb in a short period of time. Highest recorded value was 1070 ppb on 2/8/99 at 12:00. Levels had dropped to less than 150 ppb by 2/10/99 at 08:00. Immediate actions included removing the suspected bed from service and placing another bed in service to effect cleanup, meeting the equipment control guideline requirements, increasing sampling requirements, and performing an evaluation to determine the effect of RCS cleanup activities that were planned. Since it was suspected that chloride base resin had been used in the demineralizer reload, remaining resin was also removed from the radiologically controlled area. The NCR process is being used to investigate and resolve this issue. The TRG is currently meeting and progress is being made to determine all of the causes so that measures can be put in place to prevent recurrence. (Refer to NCR N0002084.)

A preliminary cause analysis for this event indicates there was a broken barrier in communication between Operations and C&EO in addition to the several other factors that either directly caused or contributed to this event. The broken barrier meant to prevent this type of occurrence was in the form of a tailboard that was supposed to occur between Operations and C&EO as part of Operations Procedure OP B-1A:XIII prior to placing a new bed in service. Since Operations had been in contact with regarding this issue during the planning phase in the several weeks leading up to the outage, they believed this requirement had been met but did not pursue sample completion as indicated by their procedure. This perception was enhanced as a result of informal communication and turnovers on the subject in both organizations. Since C&EO personnel were not aware of this Operations requirement, and lacking any formal guidance in C&EO procedures for placing the bed in service, they allowed the bed to be placed in service without a sample. C&EO personnel made this decision because the primary concern appeared to be effects on reactivity instead of contamination and there were no barriers in place within the C&EO procedures to redirect this thought process.

2. **High dose rates**
Coincident with the RCS chloride problems, increasing dose rates in the RCS were observed. This would not be unexpected for the conditions in the RCS at the time. However, dose rates continued to remain high in some sections of the RCS, primarily the residual heat removal system and reactor head, even after cleanup was initiated. Investigation during and after the outage showed that several areas of the RCS actually experienced decreased dose rates, such as the RCS piping and SG bowls, while other sections remained high. This contributed to high personnel doses for some jobs and contributed to an overall outage dose that was higher than expected or normal for this point of plant maturity. The NCR process is being used to investigate and resolve this issue. The TRG is currently meeting and progress is being made in an attempt to determine all of the causes so that measures can be put in place to prevent recurrence. Recently, DCPP hosted a 2-day meeting with members of several utilities in an effort to better understand the mechanisms that contributed to this issue and this is being used as input for the NCR. (NCR N0002091)

1R9 SELF-ASSESSMENT

RADIATION PROTECTION

1R9 SELF-ASSESSMENT
RADIATION PROTECTION

EXECUTIVE SUMMARY

Radiation Protection (RP) has improved performance in a number of targeted areas during 1R9. These areas included: (1) better documentation of radiological surveys, (2) issuance of correct size respirators to personnel, and (3) a decrease in the number of personnel contaminations occurring outside posted surface contamination areas. In addition, the frequency of human errors associated with the use of personal electronic dosimetry (PED) remained at a low rate for radiological controlled area (RCA) log-in. It was also at the lowest rate ever for RCA log-out. These were focus areas for RP and desired results were achieved.

Before 1R9, RP focused on streamlining radiation work permits, the job coverage process, and radiation worker and craft supervisor ownership of the RP program. This was done to continue excellent performance while reducing RP labor costs during the outage. Additional changes affecting the RP program included the move of plant maintenance activities to the asset teams and the dissolution of the RP work planning group. The RP work planning organization had previously implemented a significant portion of our As Low As Is Reasonably Achievable (ALARA) Program. That portion of the ALARA Program was shifted into the roles and responsibilities of the RP foremen and technicians.

Since these changes were significant, a slight decline in performance was not unexpected by RP. As part of this change process, RP monitored for possible effects these changes could have on the RP Program. Performance was reviewed during and after the outage. Two postoutage critiques were held by RP personnel in the area of dosimetry and operational RP. Critique participants included RP supervisors, RP engineers, decontamination specialists, RP technicians, the RP director, and a facilitator from the SPARK Team. Self-assessments of 1R9 personal contamination incidents and lost/damaged thermoluminescent dosimeters were performed by RP. This assessment also reviewed event trends, action requests (ARs), and Nuclear Quality Services (NQS) observations, many of which were focused on areas that could be affected by the changes.

The results of this performance review indicated three primary areas requiring improvement (1) the ALARA Program, (2) the number of personal contamination incidents (PCIs), and (3) radiation work practices. RP is aggressively pursing improvements in these areas prior to 2R9. The RP ALARA coordinator is reviewing outage exposures. Correlations between historical exposure for specific work task/maintenance in comparison to 1R9 exposure activities based on elevated dose rates have been identified. Although worker practices contributed to higher doses,

current comparisons suggest that the higher outage plant exposure was primarily due to the higher source term.

There is no indication that shift in ALARA responsibilities from RP work planning to the RP foremen and technicians contributed significantly to the higher doses. However, RP management is concerned that this shift did not result in a strong ALARA Program. To strengthen the ALARA Program to meet RP management expectations, a team consisting of two RP Foremen, two RP technicians, the RP coordinator, NSSS Maintenance, and the ALARA coordinator was formed after 1R9. These positions are tasked with developing and managing a program that supports and works within organizational changes.

During 1R9, there was an apparent decline in the quality of radiological work practices as evidenced by event trend data, personnel contamination data, and radiological occurrence reports. Interviews with some RP technicians, plant maintenance personnel, and the RP general foreman indicated a perception that this decline was the result of using the same work practices that were allowed in previous outages with more consequential radiological conditions and a reduced presence of RP technicians to coach workers. Interviews with other plant individuals indicated a perception that practices and standards declined during the course of particular work, namely split pin repair and at the equipment hatch during containment off-load. RP has identified significant issues to assist the plant in attaining excellent performance in radiological work practices. Special teams consisting of RP management and technicians have been formed specifically to address these issues.

To ensure that plant needs are being identified and addressed, the RP director and RP foremen have begun monthly meetings with asset team leaders and assistant asset team leaders. The RP general foreman and ALARA coordinator attended asset team safety meetings to hear directly from the craft their concerns and what we need to better implement good radiological work practices. Additionally, at the request of the plant manager and RP management, interviews of plant personnel were conducted to provide a well-rounded perspective of radiological work practices and needs. Interviews of RP, Maintenance, and Operations personnel are being performed jointly by the NQS human performance coordinator and a member of RP. Results of these interviews will be communicated to the plant manager and RP management.

INTRODUCTION

Before 1R9, a number of significant changes occurred within DCPP that affected the way the RP Program and RP personnel interfaced with radiological workers. These changes included:

1. Process modifications as a result of the RP cost and performance projects to maintain excellent performance with reduced RP outage staffing.

2. The move of the Maintenance organization to asset teams.

3. The dissolution of the RP work planning group and subsequent integration of work planning and ALARA functions into the RP foreman and RP technician roles.

4. Relying on radiological workers and their supervisors to own and successfully implement the RP Program with less guidance and coaching by RP.

This assessment was performed at the request of RP management to help identify the potential effects these changes may have had on the RP Program and to assess overall RP performance for 1R9.

STRENGTHS

1. **Survey documentation**
   During the previous refueling outage, a self-assessment identified that 30-50 percent of work performed did not have all the surveys documented that were required by radiation work permits. A similar problem also resulted in a Level IV violation during 1997. RP performed a formal cause analysis and determined that workload management was a major contributor to the problem. Before the outage, RP completed a project to improve performance. This project included providing one consistent instruction for survey requirements where the same survey requirements apply to similar work instead of having survey requirements located in individual radiation work permits. Additionally, documentation requirements for minor surveys was simplified by providing guidance for documenting multiple one line surveys on "the minor survey form." Performance in this area was reviewed by NQS during 1R9. NQS reviewed surveys and found that documentation of surveys required by radiation work permits improved significantly. There were no instances of missing survey documentation observed by NQS during 1R9. This is a significant accomplishment as it helped us manage workloads with even fewer outage technicians by providing a means of simple survey guidance and documentation.

2. **Personnel contamination incidents occurring outside surface contamination areas**
   During 1997, an INPO assessment resulted in a finding in the area of contamination controls. INPO identified that we experienced more personnel contamination outside posted surface contamination areas (SCAs) than the best plants. During 1R9, these events were almost one half the number that occurred during 2R8. It was also the second lowest number in an outage (1R8 = 24, 2R8 = 46, 1R9 = 29). Additional focus in the area of radioactive tool control combined with less work in the auxillary building contributed to this low number.

3. **PED logging errors**
During 1R9, RP trended the frequency of PED log in errors. This was done to identify compliance with RP requirements with less staffing and as a continuing follow-up to the effectiveness of our corrective actions to reduce log in errors. In 1998, the NRC issued a Level IV notice of violation for entries into the radiological controlled area (RCA) without an operable personal electronic dosimeter, which at the time, was required for RCA entry. At the peak, these events occurred at a rate of 7 per 10,000 RCA entries. The frequency of PED RCA log-in and log-out errors continued the downward trend during 1R9. There were 9 entries into the RCA without an operable PED, which was a continued low rate of 1.5 events per 10,000 entries. This was a reduction from 2.3 events per 10,000 entries during 1R8 and 2.0 events per 10,000 entries for 2R8. (Total events for each outage: 1R8 = 19, 2R8 = 14, 1R9 = 9). PED log-out errors occurred at the lowest frequency ever during this outage. Log-out errors were reduced from 4 per 10,000 entries during 2R8, to about 1 per 10,000 entries in 1R9.

AREAS FOR IMPROVEMENT

1. **Personnel contamination incidents[1] occurring in SCAs**
The number of personal contamination incidents that occurred in SCAs during 1R9 were fifty percent greater than those that occurred during 2R8 and two and one half times the number that occurred during 1R8. 1R8 was our best outage for PCIs and 2R8 was our second best. Poor work practices as well as higher than normal levels of contamination found in the reactor cavity and during system breaches contributed to the increased number of events. Split pin repair was one evolution that experienced a high number of personnel contaminations. The general foreman stated that repeated discussions concerning poor practices did not result in improved performance. In the future, the general foreman stated that RP would consider stopping work as a tool to correct poor radiological work practices.

An RP foreman has performed a comprehensive 1R9 PCI assessment. Recommendations to reduce events will be addressed by RP management in June of 1999. AR A0486429 was initiated by RP to address these recommendations.

2. **ALARA Program management expectations were not met**
During 1R9 RP, management realized that shifting the ALARA responsibilities, previously performed by the former RP work planning group, posed a greater challenge than initially thought. Many good practices and some administrative management expectations were not met including (1) in process job reviews, (2) job specific dose tracking, and (3) confusion concerning responsibilities for implementation.

[1] >100 ncpm at ½" from the surface of skin or personal clothing

A cursory review of thirty radiation work permits was performed by the assessor. With one exception, ALARA codes had been assigned appropriately and ALARA codes were revised in accordance with applicable procedures. AR A0477613 was initiated by RP to document one instance where this did not occur.

The RP ALARA coordinator is reviewing outage exposures. He has identified correlations between historical exposure for specific work task/maintenance in comparison to 1R9 exposures activities based on elevated dose rates. Although worker practices contributed to higher doses, current comparisons suggest that the higher outage plant exposure was primarily due to the higher source term.

There is no indication that shift in ALARA responsibilities from RP work planning to the RP foremen and technicians contributed significantly to the higher doses. However, RP management is concerned that this shift did not result in a strong ALARA Program. To strengthen the ALARA Program to meet RP management expectations, a team consisting of two RP foremen, two RP technicians, the RP coordinator, NSSS Maintenance, and the ALARA coordinator was formed after 1R9. These positions are tasked with developing and managing a program that supports and works within organizational changes.

3. **The quality of radiological worker practices need improvement**
During 1R9, RP identified an adverse trend in the quality of radiation work practices. AR A0484208 was initiated by RP to identify this adverse trend and to develop and track corrective actions.

Interviews with some technicians, plant personnel, and the general foreman indicated a perception that some of this decline was actually the result of using the same work practices that were allowed in previous outages with more consequential radiological conditions and a reduced presence of RP technicians to coach workers. Interviews with other plant individuals indicated a perception that practices and standards declined during the course of particular work, namely split pin repair and at the equipment hatch during containment off-load. RP takes this seriously and is taking aggressive actions to lead the plant in improving radiation work practices.

RP identified significant issues to focus on for improvement during their postoutage critique and discussions with plant personnel will help provide radiation worker perspective. These insights will be used by RP to help improve radiation work practices.

4. **Postoutage RP critiques issues**
Following the outage the RP held two outage critiques, one in the area of operational RP, the other in the area of dosimetry in processing. This was conducted to identify specific areas of the RP Program for improvement. An emphasis was placed on areas affected by changes that occurred before the outage. Together these critiques were attended by over fifty RP personnel including the director, the general foreman, technicians, engineers, supervisors, clerks, and decontamination specialists. The operational RP critique was facilitated by a member of the DCPP SPARK Team.

Nine general categories were identified for improvement during these critiques.

- Accountability
- ALARA
- Coordination
- Manpower
- Preoutage planning
- Training
- Worker practices
- Other
- Dosimetry

To resolve significant issues in each category, teams consisting of management and bargaining unit personnel were formed. RP initiated ARs A0482049 and A0482290 to document and track the resolution of the significant issues. These teams are currently working on the issues to support 2R9.

5. **Addressing the needs of radiation workers**
To ensure that plant needs are being identified and addressed, RP has begun monthly meetings with asset team leaders and assistant asset team leaders. The RP general foreman and ALARA coordinator now attend asset team safety meetings to hear directly from the craft their concerns and what they need to better implement the RP Program. Additionally, at the request of the plant manager and RP management, the human performance coordinator and a member of RP are jointly conducting interviews of RP, Maintenance, and Operations personnel to provide a well-rounded perspective of radiological worker practices and needs. Results of these interviews will be communicated to the plant manager and RP management.

TRENDS

1. **Decline in the quality of radiological worker performance**
   The following event trends were identified by RP using the event trend database. Individually, each event does not indicate a pronounced decline in any one area. However, RP believes that collectively these event trends indicate a decline in the quality of radiological worker performance during 1R9. Discussions with the general foreman indicated that he believed this was due to multiple causes. One cause was because of more significant radiological conditions, the same work practices used in previous outages resulted in contaminations and additional exposure during 1R9. The other cause was because the reduced presence of RP technicians did not result in coaching in the field to the level that occurred during past outages. AR A0484208 was initiated by RP to identify this adverse trend and develop and track corrective actions.

   a) **Increase in the number of poor contamination control practices**
      There was an increase in the number of poor contamination control practices events, some of which resulted in a spread of contamination and multiple personnel contaminations. The following ARs were initiated by RP during the outage.

      - Maintenance Services workers tracked contamination from a posted surface contamination area to a noncontaminated area of the RCA (Refer to AR A0479529).

      - During one event, approximately 30 radioactive particles were found outside the 140 ft. RCA. One particle was found in the turbine building. This was discovered during routine contamination surveys. The suspected cause was a combination of (1) windy conditions outside containment and (2) an open containment equipment and personnel hatch (Refer to AR A0479773).

      - An individual entered the RCA without the required PED and exited the RCA without going through a personal contamination monitor (Refer to AR A0479819).

      - Contaminated equipment was discovered outside the posted SCA inside the RCA (Refer to ETR V0017584).

      - Operations disconnected a vent hose without RP presence to evaluate radiological conditions. This was a radiation work permit violation (Refer to AR A0476861).

- Poor radiological work practices involving breaching the liquid radwaste system without RP and without proper contamination controls resulted in four personnel contaminations (Refer to AR A00478029).

- Contrary to entry requirements, a worker was observed drinking coffee in the RCA. Additionally the worker was performing work on an improper radiation work permit (Refer to AR A0478248).

b) **Increase in the number of high radiation area boundary events**
The number of high radiation area boundary events increased during 1R9. The following ARs were initiated by RP. In each instance individuals involved were counseled by their supervisor.

- Two Technical Specification (TS) violations occurred during 1R9 compared to one during 2R8 and 1R8.

  A TS violation occurred when an operator entered a high radiation area without a PED. This violated the special work permit, which required a PED that is set to alarm at a predetermined accumulated dose for entry into a high radiation area (Refer to AR A0480044).

  An NSSS maintenance worker entered a high radiation area located on top of the reactor head. Contrary to TS and the radiation work permit requirements for entry into a high radiation area, he was not knowledgeable of the dose rates in the areas and he was not wearing a PED set to alarm at a predetermined accumulated dose (Refer to AR A0478984).

- Two other events involving high radiation areas were not TS violations. However, RP management felt that good practices were not followed. This was, in part, attributed to poor communication between the worker and RP technician. Expectations for good communication for important evolutions was emphasized to technicians by RP management. Some RP personnel believed that one of the individuals involved intentionally miscommunicated his intentions. However, a discussion with the individual by the RP foreman supervising the floor led the supervisor to believe that ineffective communication was the cause and that the individual's main focus was on not holding up work. RP is working to develop a method to identify and address repeat poor performers. Although described in separate ARs, the two events described below happened together.

  An engineer removed a temporarily installed shield plug located at the secondary side steam generator (SG) hand-hole without

contacting RP. This caused an increase in general area dose rates due to radiation streaming from the SG U-tubes (Refer to AR A0478772).

An individual entered a high radiation area without an RP brief. He entered the area to assist the engineer who removed a temporarily installed secondary side SG hand-hole shield plug. Although he was aware of dose rates, he entered the area without an RP brief (Refer to AR A0478631).

c) Unnecessary exposure due to poor ALARA practices

Poor ALARA practices resulted in some unnecessary exposure. The following issues were addressed by RP.

- Not performing operational checks on staged SG bowl pumps resulted in added exposure (approximately 500 mrem) when primary side SG nozzle dams leaked (Refer to AR A0478620).

- The inservice inspection reactor pressure vessel outlet nozzle inspection tool was initially constructed in the wrong location. Disassembly and reassembly cost additional exposure (Refer to AR A0477898).

Coatings application rework on Unit 1 containment 91 ft. component cooling water piping resulted in expending approximately 600 additional mrem (Refer to AR A0477852).

Leaking nozzle dams caused additional radiation exposure (approximately 3 mrem). Nozzle dam leakage also resulted in additional exposure in 2R8. A quality evaluation (QE) was initiated by plant engineering to investigate the cause the leaks in 1R9 and to determine and take corrective actions to prevent recurrence. The cause analysis is ongoing (Refer to AR A0478620 and QE Q0012104).

Lack of planning for scaffolding needs during reactor head canopy seal and shroud work resulted in expending an additional 185 mrem (Refer to AR A0479519).

2. Issuance of proper size respirators

A Level IV notice of violation was received in September 1997 for numerous instances in which the wrong size respirators were issued to personnel during 2R7. This occurred because the software used to issue and verify qualification did not check for size. The need to manually check the respirator was communicated to technicians in a morning tailboard and numerous e-mails. This expectation was to be temporary until the software program was repaired. The repair request was

turned down by AART. During the 1998 annual RP audit, NQS identified that corrective action for this problem did not result in acceptable performance. Respirator issue logs between the dates of January 1998 and August 1998 were reviewed by NQS. They found five instances in which either the wrong size or type of respirators was issued to personnel. The majority of these events occurred during 2R8.

A formal cause analysis was performed and the analyst recommended that the issue process be either electronic or manual or that the electronic process cues the issuer that the wearers respirator qualification card must be checked for size and type. RP management made the decision to use the electronic process to issue the respirators with the requirement that the technician is to check the individuals respiratory card for correct size and type. These expectations were reemphasized to permanent RP technicians through procedures, a foreman expectation, tailboards, and e-mails. This expectation was also emphasized heavily during temporary additional RP technician training prior to 1R9. We also put in a request to action request review team to fix the software so it will check for size and type. This request is pending approval of funds.

NQS reviewed the effectiveness of the corrective actions taken this outage. There was only one event in which two wrong size respirators were issued during 1R9 compared to five during 2R8. This is an improvement. RP investigated this event and concluded that the event was due to a personnel performance problem rather than a programmatic problem. The RP technician who issued the respirator received positive discipline. RP currently issues the respirators manually. Once the PIMs software module is repaired we should have an effective barrier to prevent this from happening.

3. **Promotion by RP technicians of desired RP behaviors**

The 1P99 Quality Performance Assessment Report concluded that RP technicians failed to actively promote desired radiological protection behaviors from outage personnel, and overall, RP management failed to provide adequate oversight of RP technician interface with workers. Some technicians had ALARA and RP work practice standards that were inconsistent with management expectations and, as such, technicians did not actively seek to coach workers in the best ALARA practices. At the request of the plant manager and the RP director, interviews with RP and craft personnel were conducted by RP and the human performance coordinator. Interview results suggested that both craft and RP technicians did not have a clear understanding of how the changes affected their work. RP supervisors will continue to shape the behavior of RP technicians and radiation workers through discussion and coaching during supervisor field observations. Additionally, the RP radiological worker practice team is developing printed material entitled "How to be a Good Radworker," which further clarifies expectations. Arrangements have been made with general employee training (GET) to (1) cover this material during initial

GET and the "current issues" portion of continuing GET, and (2) include this material in the package sent to newly hired personnel.

ISSUES AND EVENTS

1. **High dose rates and high accumulated exposures during 1R9**
   Unexpected high dose rates were experienced during 1R9. Some work in affected areas was delayed for up to several days. Elevated dose rates were noted at shutdown and later increased significantly during the forced oxygenation. Although a significant amount of activity in the reactor coolant system had been removed by the fifth day of the outage, dose rates in areas affected by residual heat removal and letdown systems were about two to four times higher than had been expected. Dose rates were no longer trending downward, and further delays would have significantly impacted the outage. Work was allowed to continue with the concurrence of the director of RP. The following is a list of actions taken to minimize accumulated dose from the higher than expected dose rates:

   - Radiation shielding in the form of 82,000 pounds of lead was used to reduce dose rates during 1R9. Additional shielding was installed at the following locations (1) at the entry into the containment 140 ft. directional shield wall to reduce the dose rates from the reactor head when the head is in the stand, (2) on the 91 ft. elevation of containment to provide additional platform and piping shielding for emergency core cooling system orifice modification work, (3) to provide additional shielding to support split pin activities on the work platform, and (4) upper reactor head. The RP ALARA coordinator stated that the estimated savings for shielding was 58 person rem, 18 person rem of which were realized from the additional application of shielding.

   - Radiation work permits were reviewed and revised according to dose rates in the areas.

   - Exclusion of work for extended periods of time from the 91 ft. and 115 ft. elevations of containment.

   - An ALARA committee review was conducted for the first time in the middle of the outage. The reviewed addressed awareness of elevated dose rates and the potential impact to work scope and schedule delays. The plant manager and managers were members of the review committee.

   - The outage control center evaluated work stoppage and work go aheads, frequent periodic reviews were held by outage management, C&EO, and RP about work in specific areas

- Warning signs for no loitering and signs to identify cold areas were used to inform individuals.

- Outage exposures and areas of concern were published in the Plan of the Day to provide information to plant personnel.

A total accumulated dose of 313.5 person rem (estimated) was expended during 1R9. This is much higher than the initial and the revised goals of 184 and 261 rem respectively. The RP ALARA coordinator stated that he is reviewing permits to determine how much dose was expended due to high dose rates, poor ALARA practices, and/or expanded work scopes. He expects to have this review complete by the end of June 1999.

C&EO initiated a nonconformance report and a technical review group was convened to evaluate the cause of the high dose rates. Additionally, RP initiated AR A0477282 to evaluate and provide recommendations to plant management for a contingency plan for scheduling and planning should high dose rates occur again in future outages.

Appendix F .

1R9 SELF-ASSESSMENT

SECURITY

329 for 2R8). The planning and coordination via a process known as SECSCHED literally reduced the number of personnel entries into, and out of, the power block. Anytime the in-plant population is reduced, a commensurate level of security logged event reductions occur.

Lastly, the reduced maintenance scope at the intake during 1R9, minimized overall security costs while increasing plant support elsewhere. The intake has statistically been a heavy hitter with respect to security events due to many detailed maintenance evolutions that require direct security involvement. Coordination and planning by outage management and the sub Intake Asset Team rewarded us with fewer associated events.

AREAS FOR IMPROVEMENT

- **Increased security events specifically relating to the untimely notification of employee terminations**
  During 1R9, there was an increase in the trend for security events associated with untimely notifications of employee terminations. The likely cause for these events is the manner in which personnel changes in staff, supervision, and plant employees communicate with each other and the access and badging organization as compared to previous outages. The manner in which an employee termination is communicated to the access and badging organization is currently being examined and corrective measures will be taken accordingly. (Refer to QE Q0012117)

TRENDS

- **A recent history trend reveals a decrease in security events**
  A review of the data surrounding the past three refueling outages indicates a trend for decreased security events occurring "breaker-to-breaker."

Nuclear Power Generation

Quality Performance Assessment Report (QPAR)
First Period 1999
(January 1 to March 31)

Signature on Original

William G. Crockett
Manager, Nuclear Quality Services
April 23, 1999

NPG Quality Performance Assessment Report
1st Period 1999

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NPG 1P99 QPAR

Background Information

Introduction

The Quality Performance Assessment Report (QPAR) summarizes Nuclear Quality Services' (NQS) view of quality within NPG and is based upon assessments, inspections, audits, Independent Technical Reviews, NQS section level meetings, Quality Problem Report (QPR) trend data and other feedback. **The Manager - NQS requests a written response to annotated weaknesses and other items identified in each respective section of the QPAR within 30 days of issue. This response should include planned corrective actions and progress made.**

Definitions

Strength
A strength is an activity that adds significant value to plant performance. Strengths include the following key elements:
- clear and direct enhancement of personnel or plant performance
- successful implementation
- efficient utilization of section resources
- can serve as a model for use by other sections, and
- high standard of performance relative to industry standards.

Weakness
A weakness refers to deficiencies such as the following:
- one or more Quality Plan objectives are not fully met
- personnel or plant performance needs are not met, or
- conditions exist that will adversely impact future personnel or plant performance.

Trend
A trend refers to improving or declining performance in one or more of the areas normally associated with strengths and weaknesses, but does not add significant value to plant performance and is not a deficiency as noted above.

Issue
An issue refers to items specific to individual departments that may not be considered a weakness or a strength.

Operational Focus
Operational Focus at DCPP describes activities that support a high level of plant performance and promote a climate of professionalism that affirms a high regard for nuclear safety and plant reliability.

Focus Area
Focus areas are problems that are:
- inter-departmental
- repetitive
- significant, and which require additional management attention or focus for resolution.

Overall Performance Assessment

Overall Performance Assessment

Satisfactory

Diablo Canyon Power Plant performance was satisfactory during the first quarter of 1999. Most activities centered around the Unit One refueling outage. Performance was improved in several key areas including, Industrial Safety, Clearances, Operations Human Performance, Corrective Action Program implementation and Security Human Performance events. While performance overall is considered good, there were several areas that need attention. Examples include: several undesirable operational events during 1R9 (e.g. the loss of RHR cooling, the loss of Spent Fuel Pool cooling), the high chlorides during RCS shutdown cleaning, poor radiation work practices, and the need for improved Human Performance within Maintenance Services. The most significant unresolved issue is the cause of the high dose rates experienced during 1R9.

Strength

Operations Performance

Operations implemented several new processes that enhanced personnel and plant performance including the implementation of "Supercrews" and the Operations Support Center (OSC). Operations also achieved significant improvement in the area of Human Performance/error reduction. Refer to page 10.

Weakness

Radiation Work Practices

There were signs during 1R9 that there was a decline in good RP work practices including an increase in personnel contaminations and violations of high radiation area boundaries. Although dose rates in 1R9 were significantly higher than expected, NQS observed a number of poor radiological work practices that are sure to have contributed to the overall exposure. Refer to page 18.

Trends and Issues

Clearances

Although there were three significant clearance errors, 1R9 clearance performance was much improved from previous outages. Refer to pages 11 and 25.

Industrial Safety

During 1R9 there were three recordable injuries and one disabling injury. None of these injuries were considered significant. This was the best safety performance of any outage to date.

Continued on next page

Overall Performance Assessment, Continued

Trends and Issues (continued)

Security Related Human Performance Events
Security results were outstanding during 1R9. For the first time, an outage security goal was attained. The goal of limiting the total number of logged events due to human factors (which was established as 45) was met with 34 events. This is an accomplishment for the entire plant staff. Refer to page 26.

Corrective Action Program
NPG is continuing to demonstrate positive performance in the area of Corrective Action Program implementation and ownership. NPG is currently meeting all Corrective Action Program performance goals. Currently the average age of quality problems is: NCRs: 164 days, QEs: 172 days, and "A" type ARs: 156 days. Problems are continuing to be identified at the Event Trend Record (ETR) and Action Request (AR) levels. There were 939 ETR's generated this quarter.

The Action Request Review Team (ARRT), in concert with the rest of the DCPP organization, has played an important role in the success of the Corrective Action Program. ARRT's conservative approach and willingness to elevate issues is considered a strength. As a result of this approach, there were 11 NCRs, 20 QEs and 390 "A" type ARs generated this quarter.

The statistics presented above indicate that the organization identifies and resolves problems in a timely manner.

Human Performance in Maintenance
Maintenance Services continues to experience human performance errors at an unacceptable rate. Two significant examples are the incorrect accumulator channel being removed from service and the significant amount of rework required on a Control Rod Drive Motor Generator set.

Undesirable Operational Events
Several unexpected events occurred during 1R9 that may have resulted from poor planning and attention to detail:

- A procedural inadequacy resulted in a unit trip and a total loss of power which in turn resulted in a loss of Residual Heat Removal system cooling.
- A work process related error caused a loss of Spent Fuel Cooling.
- A series of errors allowed a chloride form resin to be used during the RCS shut-down cleaning, which in turn resulted in high RCS chloride concentration. The delays in placing the correct resin bed in service may have exacerbated the high dose rate issue.

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Focus Areas and Focus Area Follow-Up Issues

Focus Areas and Follow-Up Issues	There are no Focus Areas or Focus Area Follow-up Issues this period.

NPG 1P99 QPAR

Human Performance

Overall Performance Assessment

Satisfactory

Due to the high volume of activities during the 1R9 Refueling Outage, the number of errors during this period was higher. When compared to a similar outage period in 1998, the results are mixed. While significant improvement was noted in Operations' performance, similar improvements were not noted in Maintenance Services.

The following Human Performance improvement efforts have taken place during the first period:

- Introduction of the new Event Free Days performance indicator.
- Initiation of a Non-Conformance Report to address Maintenance Services Human Performance issues.
- Closure of the Operations Human Performance Non-Conformance Report.

First Quarter Assessment

Operations Section

NQS believes Operations was very successful in the area of Human Performance improvement during the first period of 1999. NQS noted a strong emphasis on performing operations correctly the first time, using the desired self-verification techniques. Errors, such as securing the Fuel Handling Building Ventilation on the wrong unit, did occur however.

NQS noted the following good practices during the 1R9 Refueling Outage that assisted in the management of human performance issues:

- A daily meeting was held to discuss events of the previous day. This allowed a proactive approach to any human performance errors that may have occurred.
- The STAR trainer was used as a remedial tool to reinforce self-verification.
- Errors of all types were documented at a low threshold through the use of the Event Trend Record (ETR) and Action Request (AR) systems.

NQS believes that continuing these practices during non-outage times will provide ongoing improvement in the human performance area.

Continued on next page

Human Performance, Continued

First Quarter Assessment (continued)

Maintenance Services

Observations during NQS assessments noted improvements in the area of tailboards, however, there is still substantial room for improvement. MS failed to meet its management expectations for use of subject matter experts in multi-discipline teams. When tailboards cover topics outside the supervisor's area of expertise, subject matter experts should be used. A second expectation that was not consistently met was discussions on the required procedure level of use.

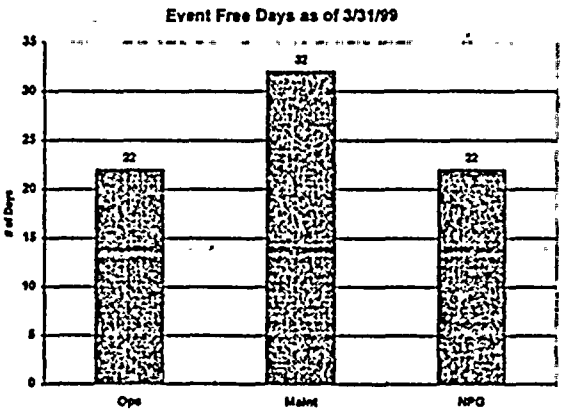
A review of Action Request (AR) and Event Trend Record (ETR) data shows the number and type of human performance related errors this period were similar to the same period in 1998, during the 2R8 Refueling Outage. Several significant errors occurred this quarter including:

- An incorrect accumulator pressure channel was removed from service.
- A crane circuit breaker was closed with a Man-On-Line Tag attached (an action performed by a contractor).
- A rigged load was dropped.
- An incorrect valve was unpacked.
- A Control Rod Drive motor generator set required significant rework.

At the beginning of this period, Maintenance Services issued a Non-Conformance Report to address Human Performance issues. With the outage complete, MS recognizes renewed attention is needed to determine effective corrective actions and provide sustainable improvement in this area.

Event Free Days Indicator

Effective January 1, Diablo Canyon introduced a new performance indicator entitled "Event Free Days." For the purpose of this indicator, a Plant Event is a consequential event caused by inadequate human performance, which results in significant, adverse impact on nuclear or personnel safety, plant operation or regulatory position. The indicator measures the number of days that pass without a plant event.



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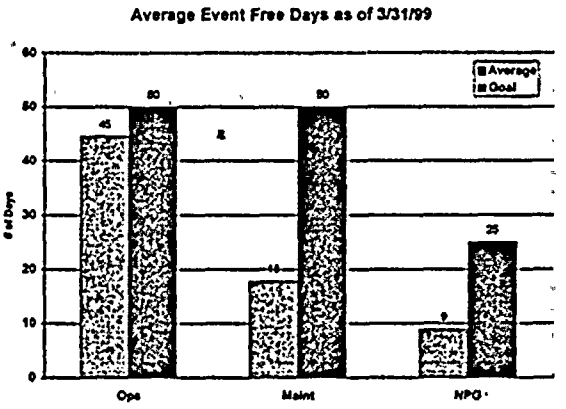
Human Performance, Continued

Event Free Days Indicator (continued)

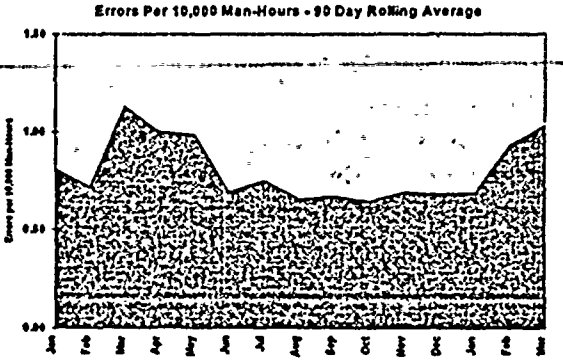
A second indicator, average event free days, measures the average number of days between plant events based on a 12-month rolling average.



The purpose of these indicators is to reduce the number of human performance related errors through increased personnel awareness. Event free day goals have been established and included in the Performance Plans for the Operations, Chemistry and Radiation Protection Sections and Maintenance Services.

Error Rate

According to the Human Error Rate Trending Database maintained by NQS, the overall error rate for the first quarter of 1999 is comparable to 1998. The number of active errors reported in first quarter Action Requests decreased slightly from 123 in 1998 to 117 in 1999. Taking into account the fewer man-hours worked, the rate is essentially unchanged. The graph below represents total NPG Human Errors per 10,000 man-hours worked.



There are some changes of interest in the distribution of errors and the significance of the events being reported. One explanation for the stagnant error rate is due in part to the apparent lowering in the threshold at which line organizations document problems in ARs. Minor infractions of administrative requirements are increasingly being reported in ARs. The line organizations are to be commended for this, as it indicates an increasing desire to be self-critical and report minor issues. This allows identification and intervention of problems prior to the occurrence of more significant events.

Continued on next page

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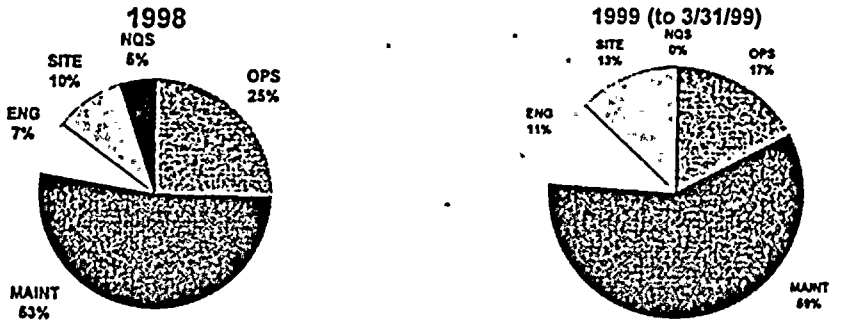
Human Performance, Continued

The distribution of errors also appears to be shifting, indicating some level of success in error reduction by the Operations Department. The charts below compare 1998 to 1999 departmental contributions to the overall error rate.



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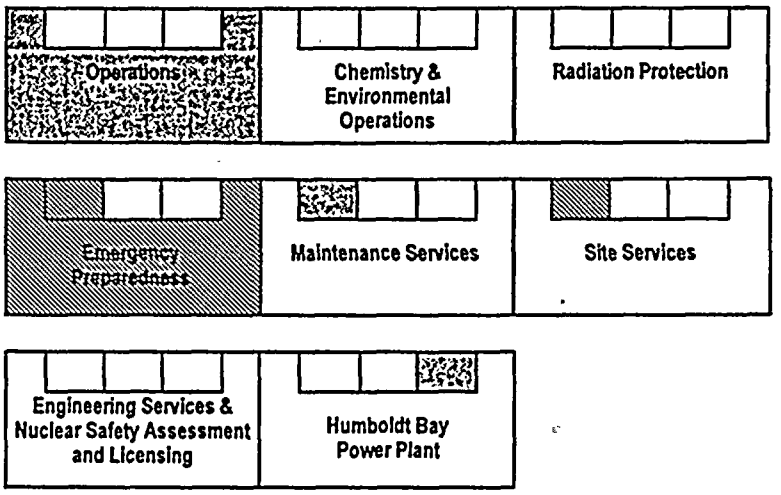
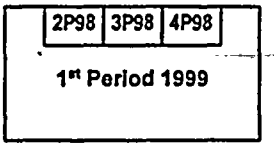
Department Summary Panel

Department Performance



Legend

The summary panels above should be interpreted with the legend below.



⇒ Noteworthy Performance (significant strengths)
⇒ Satisfactory Performance (few areas of weakness exist)
⇒ Performance Needs Improvement (several areas of weakness)
⇒ Unsatisfactory Performance (significant weaknesses)
⇒ Not Evaluated During This Period

Operations

Overall Performance Assessment

Noteworthy

Operations demonstrated noteworthy performance during the first period of 1999. This is based, in part, on several positive observations and two identified strengths noted during 1R9. During this period, Operations implemented several new processes that clearly enhanced personnel and plant performance, and better utilized department resources including implementation of "Supercrews" and the Operations Support Center (OSC). NQS also noted increased awareness of Human Performance issues and behaviors that promote a positive safety culture. Examples include both teamwork and a willingness to identify problems at a low level. The following strengths were identified this period:

- Operations ownership of plant activities
- Use of "Supercrews"

Other observations included:

- Significant reduction in the number of errors in general as well as clearance related errors during 1R9.
- Efficient coordination of work through the OSC.
- Good verification practices and effective 3-way communications.
- Maintenance on a containment isolation relay resulted in a loss of Spent Fuel Pool cooling for several hours.
- A unit trip, resulting in a loss of auxiliary power and Residual Heat Removal occurred due to procedural inadequacies. Operations' response to the event was judged to be very good.

Operational Focus

As noted in previous QPARs, Operations continues to demonstrate several elements of a strong Operational Focus. Examples this period include:

- Well controlled shutdown and startup activities with good management oversight.
- Thorough, effective tailboards included good use of Industry Operating Experience and an emphasis on "expecting success but planning for failure."
- Good control of work activities through the use of the OSC.

Daily meetings by Operations management to address clearance and human performance related issues.

Continued on next page

Operations, Continued

Strengths

Operations Ownership

During observations of the 1R9 Refueling Outage, NQS noted a high sense of ownership and awareness displayed by Operations personnel during many evolutions. The use of the OSC and the Work Window Managers provided good control of work activities and effective operations oversight. A questioning attitude was clearly evident, both in the Control Room and in the field.

Although most of the major testing activities were under the direction of an Engineering Test Team member, the Shift Foreman clearly maintained command and control and the Control Room operators provided a high level of oversight. In some cases, operations personnel, assumed responsibility for the testing evolution to ensure the successful completion of the activity.

"Supercrews"

For 2R8, Operations began the use of "Supercrews" with management personnel. During 1R9, this was expanded to include all operators. NQS believes this was a strength and contributed to the noteworthy performance by the Operations Section.

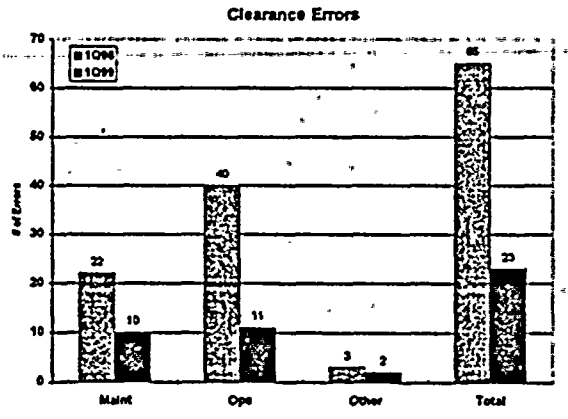
NQS noted the following positive observations with respect to "Supercrews":

- Consistent enforcement of management expectations.
- Extra manpower assigned to the control room provided better watchstation continuity and allowed for improved focus and awareness of plant activities.
- Additional manpower was available to meet all operational requirements.

Trends and Issues

Clearances

NQS believes that field observations of clearance processing, along with a review of Event Trend Record (ETR) and Action Request (AR) data, clearly indicate successful implementation of corrective actions in the clearance process. When compared to a similar period in 1998, the number of clearance errors for Operations is significantly lower. Additionally, a similar reduction is evident in the rest of the organization which reflects, in part, the success of improvements in the overall clearance process.



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Operations, Continued

Trends and Issues (continued)

Clearances (Continued)

Most of the clearance errors identified for Operations during this period were minor administrative errors with no consequences. One error of greater significance occurred when operators mistakenly removed Man-On-Line tags from several active clearance points before being stopped by a Red Tag. Fortunately, no clearance points were repositioned so the consequences were minimal. Examples of minor errors include:

- Clearance taken to history prior to tags being pulled.
- Removal of the wrong Control Board Caution Tag during a ROFT.
- Man-On-Line Tag hung on the incorrect switch on a breaker cubicle.

Although errors continue to occur, NQS believes the significant reduction in both the number and severity of the errors demonstrates the success of efforts to simplify the clearance process. This, combined with the ongoing initiatives in human performance, should provide continued improvements in this area.

Operations Support Center

For 1R9, Operations undertook a new approach to the control of work activities by establishing an Operations Support Center (OSC). Most activities to support the Asset Teams were coordinated from this facility. The Operations' Task Coordinators and manpower pool were also located in the OSC which facilitated support of all work activities which required Operations' support.

Positive observations of the OSC include:

- Reduced extraneous "traffic" in the control room promoting a quiet, professional atmosphere.
- Increased efficiency by offering a "single contact" for Control Room personnel.
- Smoother clearance coordination, i.e. approval, logging, hanging and removal.

Due to the remote authorization of work, some issues arose related to coordination and communication of work activities to the Control Room. Examples include:

- Isolation of the Pressurizer Relief Tank nitrogen supply, which contributed to inaccuracies in the Reactor Vessel Refueling Level Indication System during drain-down of the Reactor Coolant System.
- Clearing the Control Room position indication for the steam dumps during drain and refill of steam generators necessitated local observation of the 10% steam dumps.

Continued on next page

Operations, Continued

Trends and Issues (continued)

Operations Support Center (Continued)

Although there are areas for improvement in the OSC, overall performance was very good. NQS believes the OSC will continue to play an important role in performing outages safely and efficiently.

Loss of Spent Fuel Pool Cooling

As a result of maintenance on a containment isolation relay, spent fuel pool cooling was lost for several hours while the core was offloaded when a wire was lifted. The lifted wire de-energized the control circuit for Spent Fuel Pool (SFP) Cooling Pump 1-2. This was not identified until the SFP high temperature alarm was received in the Control Room.

As a result of this incident, Operations has revised their procedure to require increased surveillance of the SFP during core offload. They have also requested installation of a low flow alarm to provide additional warning for this type of incident.

Unit Trip and Loss of Shutdown Cooling

A unit trip, caused by a main turbine thrust bearing trip, resulted in a loss of Aux power and a transfer to Startup power. The thrust bearing trip, which is normally cut out when backfeeding, was left cut in, due to a procedural inadequacy, when the main transformers were returned to service.

Additionally, Startup power was unavailable to 4kV Bus G due to testing that was in progress. This resulted in a loss of the running Residual Heat Removal pump for a short period of time. Good command and control was exhibited by the Shift Foreman and the overall response to this event was very good. Corrective actions for this event are being tracked on a Non-Conformance Report.

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Chemistry and Environmental Operations

Overall Performance Assessment

Satisfactory

Chemistry and Environmental Operations' (C&EO's) overall performance for this period was satisfactory, but declining. This conclusion is based on the following information:

- Chemistry preparations and communications were excellent during 1R9.
- Chemistry has taken aggressive actions to determine the cause of higher dose rates in the RHR system and various other locations in the plant during 1R9.
- Chemistry performed well during the 1R9 Steam Generator scale softening effort. Procedures and safety practices were followed, and studies continue to determine the effect on heat transfer efficiencies.
- The number of Curies of radioactivity discharged as liquid radwaste to date is very low.
- A chloride-form resin bed was placed into service instead of a hydroxide-form bed, resulting in out-of-specification chloride levels in the Reactor Coolant System. This incident was associated with a number of broken barriers attributed to several departments.
- Continuing problems were identified with Environmental Operations' implementation of the graded QA program as prescribed in Program Directive (PD) EV1. This was particularly apparent in the area of the 316(b) entrainment studies.

Operational Focus

Steam Generator Scale Conditioning

During 1R9, a chemical conditioning agent was added to two of the four Steam Generators to evaluate its ability to soften scale buildup. Approximately 400 pounds of sludge was removed from each of the generators that underwent this process, while only 30 - 60 pounds of sludge was removed from each of the non-treated generators. While this is a marked increase, it did not produce the anticipated 1000 pounds removed per generator. Over the next few months, Chemistry will evaluate whether heat transfer efficiencies were improved by the conditioning process. NQS observed the initial chemical addition process and found procedures to be followed, including stopping work to process an On-The-Spot-Change, good communication between Chemistry and Operations, and adequate safety practices.

Continued on next page

Chemistry and Environmental Operations, Continued

Operational Focus (continued)

1R9 Shutdown Chemistry and Forced Oxygenation of the RCS
Upon cooldown of Unit 1, dose rates in the primary system increased dramatically. During the clean-up process, a chloride-form resin bed was accidentally placed in service instead of the hydroxide form. This was attributed to a number of broken barriers spanning several departments. Use of this bed created a chloride excursion in the RCS, with chloride levels in excess of 1500 ppb. Once the bed was replaced, forced oxygenation was performed. After the final clean-up, dose rates continued to be elevated in certain sections of the RHR, while Steam Generator bowl and RCS legs experienced lower than usual dose rates. Chemistry believes that zinc injection contributed to the lower dose rates. Chemistry sampled extensively during the outage and is working with three outside organizations to evaluate many factors pertaining to the elevated dose rates. Some of these include:

- Whether the flush of the RHR with oxygenated water (RWST) during the December 1998 shutdown contributed to increased corrosion product build-up and plate-out in the RHR.
- Whether the 1R9 cool-down was too fast, affecting the kinetics and thermodynamics of corrosion products.
- Whether the time without clean-up while the chloride resin bed was being replaced may have provided the increased activity time to plate out, which in turn created continued elevated dose rates after the clean-up.

In all, 155 Curies of Co-60 were removed from the Steam Generators during 1R9, along with 40 Ci during the 12/98 shutdown, compared to an average 40-45 Ci in previous outages. This is being attributed to the effectiveness of zinc injection.

Weakness

Environmental Operations *
NQS performed the 1999 Environmental Protection Plan (EPP) audit during this period. The audit team concluded that although DCPP is in compliance with all Central Coast Regional Water Quality Control Board requirements relating to ongoing Receiving Water studies, and that the technical aspects of the EPP are being effectively implemented, the appropriate graded QA program elements required to be utilized for all EPP and NPDES activities by PD EV1 are not being implemented.

* **The Manager - NQS requests a written response to this item within 30 days of issue. See Page 1.**

Continued on next page

Chemistry and Environmental Operations, Continued

Weakness (continued)

Environmental Operations (continued)

This problem is particularly apparent in the area of the 316(b) study activities (Intake entrainment and impingement studies) which are being repeated by Tenera. These include:

- AD1 and AD3, procedures processing and control,
- AD10, records maintenance,
- OM7, problem resolution

In some instances, NQS also found that Environmental Operations is not following DCPP procedures for the routing and storage of regulatory submittals and correspondence as required in EV1 and XI1. In one case, a submittal had not been routed to the NRC as required. Other submittals had not been routed to the EPA in the time required. Some submittals, incoming regulatory correspondence and Receiving Water sampling data sheets, had not been entered into RMS or the NPG library as appropriate.

National Pollutant Discharge Elimination System (NPDES) activities (sampling, analysis, lab QC) conducted by C&EO's Chemistry group were observed to be well managed and performed by well-qualified technicians.

C&EO has created a master corrective action plan for these issues, and has assigned responsibilities and dues dates for each action. NQS will monitor the corrective actions and will perform a follow-up assessment later in the year.

Trends and Issues

1R9 Chemistry Turnovers

Chemistry continued to perform effective turnovers throughout 1R9. Both pre-outage and mid-outage meetings were held to discuss the shut-down sequence and start-up sequence, respectively. During the outage, both oral and written communications were utilized by the foremen to communicate and coordinate work, and shiftly e-mails were more widely distributed by the Outage Coordination Center (OCC) representatives.

Continued on next page

Chemistry and Environmental Operations, Continued

Trends and Issues (continued)

Radioactive Effluents

During 1R9, 0.05 Curies of radioactive liquid effluents were discharged. This compares favorably to the 0.3 Curies released during 2R8. The 1998 total was 0.54 Curies, while the year-to-date for 1999 is only 0.06Ci. Chemistry attributes this in part to good communication with the plant about radwaste minimization.

Self-Assessments

A self-assessment was performed during the first quarter which focused on the status of corrective actions from the problems identified during the pre-INPO assessment, EPP audit findings, and other miscellaneous events. The assessment concluded that, due to variables such as two forced outages in December, 1998 and 1R9 preparation and performance, corrective actions have not always been timely, and in some cases have not yet been implemented. NQS will be following-up on the EPP audit findings and encourages C&EO to provide an action plan for the other activities prior to INPO's arrival.

C&EO also participated in the NTS sponsored self assessment of the Steam Generator Program. See page 34 for additional details on this assessment.

Action Requests (ARs) / Trending / Event Trend Records (ETRs)

No negative trends were identified for Chemistry and Environmental Operations. However, only two ETRs were initiated by Chemistry that were not required by ARs, and none were initiated by Environmental Operations. NQS suggests that C&EO increase the awareness of this program and make additional use of it.

Radiation Protection

Overall Performance Assessment

Performance Needs Improvement

The overall performance of the Radiation Protection (RP) program for this quarter has declined. Although problem reporting and trending of the associated performance data by RP has been good and RP has been highly self-critical of events occurring in 1R9, a number of negative trends overshadow this positive performance. The strongest negative concerns deal with observed poor radiological work practices by radiation workers, and the lack of consistent intervention by RP personnel during 1R9.

There are a number of programs, such as clearances where a single department has responsibility to implement a site-wide program. Likewise, RP has the overall responsibility to assure that radiation workers exhibit the appropriate behaviors while in the radiologically controlled areas of the plant. More importantly, each radiation worker has the ultimate responsibility for demonstrating these appropriate radiological work practices.

Dose rates in 1R9 were significantly higher than expected. The issues surrounding these dose rates are being investigated by an industry team. Regardless of the causes of the increased dose rates, and the portion of the workforce dose attributed to them, NQS observed a number of poor radiological work practices that are sure to have contributed to the overall exposure. RP is reviewing and analyzing the data collected during the outage to better identify and understand the detailed causes of this problem.

Based on its observations, NQS has identified one possible cause as the management of the RP change initiative. The initiative called for the implementation of significant changes in the way radiological work is monitored by RP. The initiative, and the changes it entailed, were communicated to DCPP personnel prior to the outage. Despite these efforts, outage performance in the area of radiological work practices did not meet expectations in that workers and line supervision are still relying on RP to provide close oversight of radiological work practices.

Based on interviews with RP staff and line management, NQS believes that DCPP management of the change was not fully effective. NQS recommends that management review this transition for lessons learned, especially with respect to what contingencies were anticipated and the steps taken to "plan for failure." NQS also recommends that RP management assure that RP technicians expect radiation workers to demonstrate the best radiation and ALARA work practices, and provide the appropriate coaching when these standards are not met.

Continued on next page

Radiation Protection, Continued

Operational Focus

The following examples demonstrate the RP Section's Operational Focus in the first quarter, and particularly 1R9:

- The Radioactive Waste Group provided continued support for Chemical and Volume Control System and Refueling Water Purification filter replacements, facilitating Reactor Coolant System and refueling water cleanup.
- The new Radiation Work Permit (RWP) format, with one page of need-to-know information, was put into place.
- Self monitoring training for operators was provided to allow high radiation area access without direct interaction with RP.

Weaknesses

Radiological Work Practices*

The change initiative implemented by RP to reduce the number of RP technicians appears to have been ineffective in its goal of maintaining radiological performance consistent with previous outages. This failure manifested itself in the form of poor radiological work practices by 1R9 workers and is supported by the following indicators and observations:

- **ALARA**
  Based on preliminary information, exceeding the revised ALARA goal may be due, in part, to the poor ALARA work practices observed by NQS and management during the outage.
- **High Radiation Area Boundary Violations**
  There were four violations of high radiation area boundaries in 1R9. This is an increase over the past two outages. Two of the four violations involved miscommunications and could have been avoided with 3-way communication. DCPP previously received an NOV in this area for four events in 1993.
- **Lost Dosimetry**
  Based on a recommendation of an NQS assessment, RP set a goal to reduce instances of lost dosimetry to be less than 1 per month. In the first three months of 1999, a total of 37 TLDs were lost (31 during 1R9), requiring dose evaluations to estimate individual dose. This is a negative trend compared to 28 lost TLDs during 2R8, and an average of 2 per month non-outage.

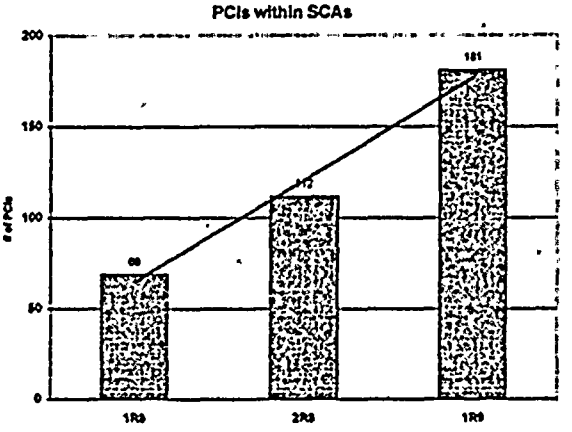
Continued on next page

* The Manager - NQS requests a written response to this item within 30 days of issue. See Page 1.

Radiation Protection, Continued

Weaknesses (continued)

- **1R9 Personnel Contamination Incidents (PCIs) within Surface Contamination Areas (SCAs)**
  1R9 PCIs within SCAs were noticeably higher and indicate a negative trend as compared to the previous two outages. . NQS believes that PCIs inside of SCAs is DCPP's best indicator of poor radiological work practices. Examples of poor practices observed by NQS are listed below.



  - The interior of the containment structure is posted as an SCA. Many workers were observed engaging in behaviors inappropriate for an SCA, such as scratching their heads and faces.
  - In higher risk SCAs, such as over the refueling cavity, workers did not engage in preventive behaviors, such as changing gloves or wiping equipment, as frequently as expected or desired.

  RP is analyzing the data acquired during the outage to better understand the cause(s) of this issue.

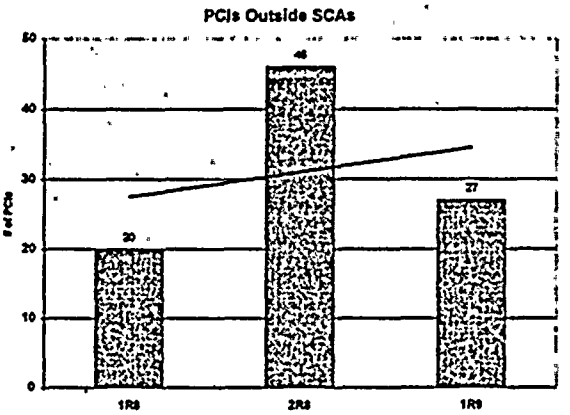
- **Oversight of RP Technician Standards**
  During 1R9, NQS observed that, in general, RP technicians failed to actively promote the desired behaviors from outage personnel. NQS believes that overall, RP management failed to provide adequate oversight of RP technician interaction with workers during the outage. Some technicians interviewed had standards for both ALARA and RP work practices that did not meet management expectations. As such, many technicians did not actively seek to coach workers in the best ALARA practices, nor did they appear to have a questioning attitude. An example of this was that RP allowed three nozzle dam workers dressed in bubble suits to remain in a 10 mr/hr area for about an hour, when an extra 50 ft of hose would have allowed them to wait in an area less than 1 mr/hr. NQS believes that RP technicians did not understand that they were expected to continue to coach workers on excellent RP practices and that closer supervision by RP management would have allowed early detection and remediation of the problem.

Continued on next page

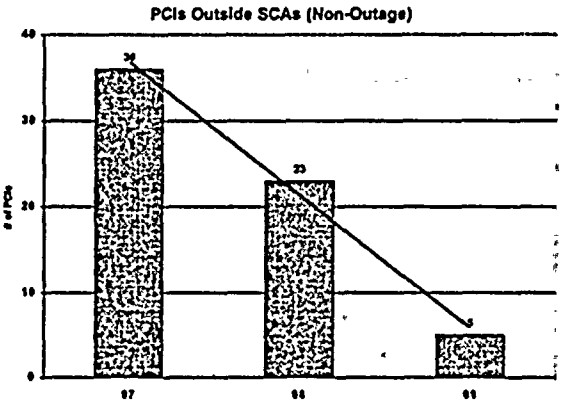
Radiation Protection, Continued

Trends and Issues

1R9 Outage PCIs outside of SCAs
1R9 Outage PCIs outside of SCAs were noticeably lower than 2R8, which is a positive trend. They were only slightly higher than 1R8 which was the best ever at DCPP. NQS believes this performance results from a greater RP focus on monitoring SCA boundaries as well as better tool control.



Non-outage PCIs outside SCAs
Non-outage PCIs outside SCAs indicated a continued positive trend over the previous two years and continues toward a positive trend in 1999.



Corrective Actions

Overall, RP has been timely in resolving problems. The average age of Quality Problem Action Requests is 80 days with 100% of them current as of 3/24/99.

Self-Assessments

RP is currently involved in self-assessments in the areas of lost dosimetry, contamination incidents, and radiological work practices. The General Foreman held a "lessons learned" open forum with key players in the outage to capture areas in need of improvement for 2R9. Over two hundred items have been identified and categorized into areas of concern which have been assigned to key RP supervisors for investigation and resolution.

Continued on next page

Radiation Protection, Continued

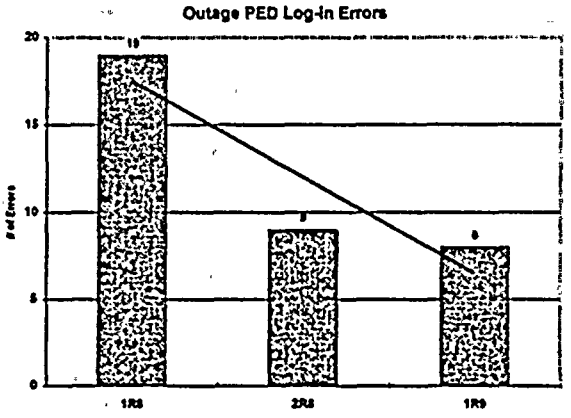
Trends and Issues (continued)

Wrong Size Respirators Issued (Follow-up)

During a follow-up assessment, NQS found one instance of issuing two respirators of the wrong size. This has become an NQS Watch List item since it is the third instance of this recurring problem, initially identified by an NRC inspection in 1997. This NRC finding resulted in a Level 4 NOV. Based on interviews with technicians, including the person who issued the incorrect respirators, NQS believes this was an isolated incident and not due to ineffective corrective actions to prevent recurrence. The technician admitted to taking the word of the respirator users rather than checking their respirator cards for size, contrary to the procedural requirement and management's communications to do so. NQS will continue to monitor this area.

PED Log-in Errors

Outage log-in errors (forgetting to pick up a PED from the rack, leaving the PED in the reader, or entering the RCA with the PED "off") have continued on a positive trend. RP's close monitoring of personnel at the 140' access control the first week of the outage has contributed to this success.



NPG 1P99 QPAR

Maintenance Services

Overall Performance Assessment

Satisfactory

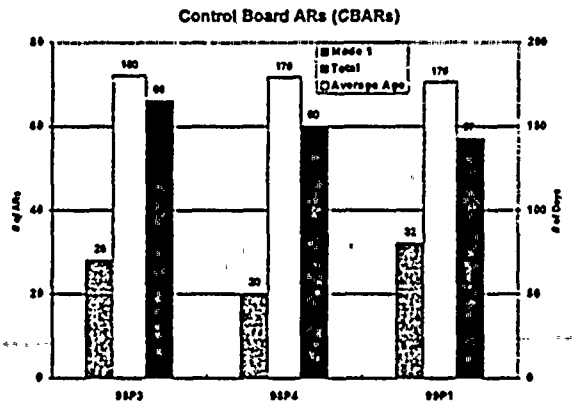
Maintenance Services' (MS) performance this period was satisfactory. This conclusion is supported by the following observations:

- During 1R9, there were no quality problems directly attributable to the MS reorganization. Overall performance of the Asset Teams during the outage was acceptable.
- A negative trend in Reactor Cavity Foreign Material Exclusion (FME) was observed during the early stages of the outage. Improvements were noted during Window 3.
- An NQS assessment of the Outside Asset Team was performed this quarter. The Outside Asset Team is effectively implementing the Quality Assurance Program.
- Weaknesses in corrective action effectiveness by MS have been noted.
- Control Board A/Rs (CBARs) continue to be adequately managed.

Operational Focus

Control Board Action Requests (CBARs)

Overall, MS's continues to adequately manage the CBAR backlog. Exceptions include a single Mode 1 CBAR which is over two years old. The resolution of this CBAR cannot be considered timely. As shown in the graph to the right, the number and average age of CBARs has remained essentially unchanged over the last three quarters.



Strengths

Emergency Core Cooling System (ECCS) Pressure Reducing Orifice (PRO) Project

The ECCS PRO project was well-planned and executed, performance similar to that observed during 2R8. There were few weld rejections, and the use of the automatic orbital welding machine was consistent with ALARA practices.

Continued on next page

Maintenance Services, Continued

Strengths (continued)

Condensate Storage Tank Piping Repairs
Prior to the outage, leaks were discovered on the Unit 1 Condensate Storage Tank (CST) level transmitter piping. Repair plans and design changes were implemented quickly for these repairs to both unit's CSTs. Excellent coordination took place between several departments including OPS, Engineering, ASUP Welding Crew, NQS and Testing personnel. Repairs were performed on both units quickly with no impact on the operating unit.

Trends and Issues

Corrective Action
Although the effectiveness of corrective actions reviewed during the assessment of the Outside Asset Team were effective, the MS Corrective Action Program showed weaknesses in other areas this quarter.

Immediate corrective actions were ineffective for the following two areas:

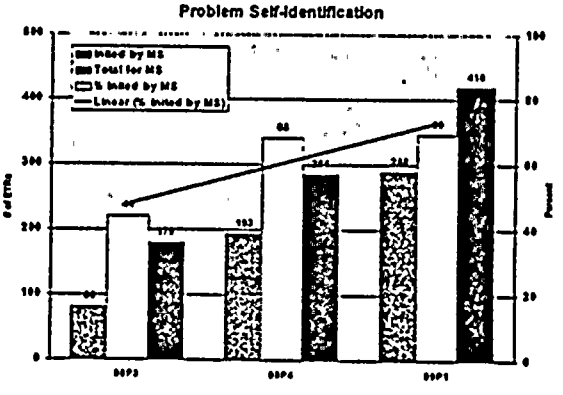
- The Non-Conformance Report (NCR) for the Maintenance and testing of doors important to safety, and
- implementation of the controls required to prevent items with unqualified coatings from being installed in containment.

Adherence to work control requirements and implementation of the immediate corrective actions for the NCR on doors has been problematic for MS. NQS has communicated its concerns about this recurring problem.

Several quality problem Action Requests (ARs) were completed without the appropriate documentation demonstrating that the problem had been resolved. NQS discussed this with MS management. A quality problem AR was initiated to track the resolution of this concern.

MS is effectively managing the number and average age of their quality problem backlog.

Self-Identification of Low-Level Problems
MS continues to improve in the area of self-identification of low-level problems not associated with an A/R. Efforts by MS to improve in this area have produced good results as seen in the accompanying graph.



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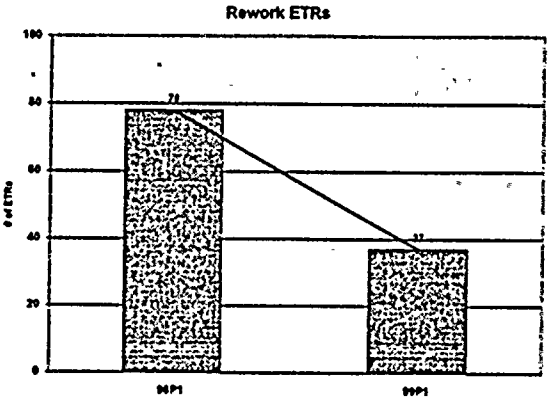
Maintenance Services, Continued

Trends and Issues (continued)

Rework

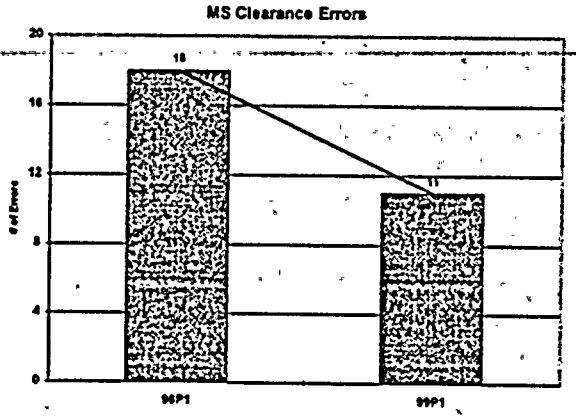
The number of documented rework ETRs dropped significantly compared to the previous outage period. Note that the numbers indicated in the graph are approximate, and include only those events that required physical rework. Based on severity, the number of more significant rework events has not diminished. Examples include:



- Improper reassembly of a Control Rod Drive Motor Generator set necessitated extensive rework.
- A relay installed during the outage for FCV-95 was incorrectly wired resulting in the failure of the valve to remain closed.
- Coatings applied to containment piping were removed the next day resulting in additional radiation exposure. The coatings were removed because they would have affected cables running over the pipes which were in place for outage Steam Generator work.
- Maintenance on a Motor Operated Disconnect resulted in damage necessitating extensive repairs. The rework was the result of a deficient procedure.

Clearances

The number of documented clearance events decreased compared to the last outage (2R8) quarter. The number of significant errors is similar to that period:



- A contract worker closed a breaker with a Man-On-Line tag.
- Work began on a Main Steam Safety Valve without an active clearance.
- A valve was unpacked without a clearance assigned for that work

NQS assessments during this period noted good clearance performance for those activities assessed. This included an assessment of the Outside Asset Team in January, and various outage assessments.

Site Services - Security

Overall Performance Assessment

Satisfactory

Security Services performance for the first period was satisfactory however, improvements are needed for timely access termination and positive control of Security Safeguards Information.

- For the first time, the outage security goal was attained. The goal of limiting the total number of logged events due to human factors (which was established as 45) was met with 34 events. This is an accomplishment for the entire plant staff.
- Security continues to maintain a 100% success rate for search train self-assessments. A self-assessment of the package search activities at the warehouse found activities in compliance with Security Plan requirements.
- Security made a 1-hour report to the NRC this period due to discovery of a faulty microwave transceiver. A compensatory measure was provided upon discovery however, it was later determined to have been out of service for several days.
- A negative trend has been identified for positive control of Security Safeguards Information.
- The adverse trend associated with untimely access terminations (first identified in the 4P98 QPAR) continues. Previous corrective actions remain ineffective.
- Process activities for granting access authorization to 1R9 personnel were verified to be satisfactorily conducted.

Weaknesses

Control of Security Safeguards Information (SSI)

Although Security has no 1999 goal related to SSI control, the 1998 annual goal was three or fewer events involving a loss of control of SSI. There were 4 such events in 1998 and 2 in 1997. There have been 4 events during this period. This weakness has been identified as a negative trend and corrective actions will be implemented via a Quality Evaluation (QE).

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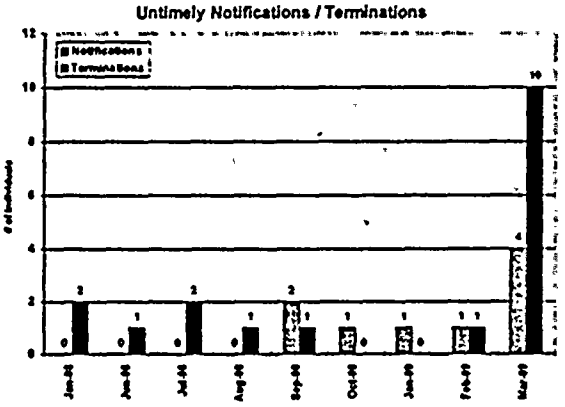
Site Services - Security, Continued

Weaknesses (continued)

Access Authorization - Untimely Terminations

The Access Group revised OM11.ID1, "DCPP Site Access Process", as a corrective action for the negative trend of untimely terminations in October, 1998. Since the procedure was revised, there have been 6 untimely notifications and 11 untimely terminations of individuals. Corrective actions for this weakness have not been effective and as a result, Security has agreed to address the late notification aspect through a QE. Untimely terminations due to errors made on the part of the Access Group will continue to be tracked on ARs.



Trends and Issues

Search Train Drills/Self-Assessments

Security has maintained the 100% success rate for contraband identification during search train drills which was achieved last period. This is a great improvement over the earlier periods in 1998.

Access Authorization

The following access errors were documented this period:

- NQS performed an assessment of the Access Group's processes and activities required to grant unescorted access for 1R9. These activities were conducted satisfactorily.
- The Radiation Protection Section continues to resolve the problems associated with health physics exposure data not transferring from PIMS to the Personnel Access Data System (PADS).

Perimeter Intrusion Detection System Testing

Two procedural adherence incidents involving functional testing of the microwave Perimeter Intrusion Detection System occurred during this period. The most recent incident resulted in a 1-hour report to the NRC. A root cause analysis is being performed to identify potential corrective actions to improve the performance of these tests.

Continued on next page

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Site Services - Procurement

Overall Performance Assessment

Satisfactory

In general, Procurement Services provided effective support in terms of parts and services required for 1R9. The assignment of "Procurement Advocates" and "Foreman's Assistants" to Asset Teams, the parts delivery process, and processing of Returns to Stock were all positives.

The Performance Plan is in place with appropriate areas selected for focus and self-assessment. Performance Indicator results for the first quarter show that most goals were met.

Operational Focus

The following examples demonstrate a commitment to an Operational Focus:

- Procurement Services quickly adjusted the hours during which the warehouse would be staffed in response to requests for additional support.
- Procurement Services was successful in locating parts needed to support emergent work. However, the inventory stocking policy should be reviewed for parts that became emergent in 1R9 to determine if they should be stocked in the future.

Weakness

Deficient Material Issued*

During 1R9, the Main Feedwater Pump (MFWP) was replaced. The pump shaft on the pump issued from the Warehouse was chrome plated, which is not desired because the vibration monitor proximity probes do not read correctly with a chrome plated shaft. Procurement Services was advised via e-mail in 1997 that the MFWP shafts should not be chrome plated, but this did not result in correcting the pump in inventory, which had been purchased in 1993.

Other instances of deficient material issued were identified including:

- The issuance of incorrect parts, e.g. torque switch limit plates, an Eagle 21 analog input board, flexible conduit, a conductivity monitor, etc.
- The issuance of parts with workmanship issues, e.g. a voltage regulator board, a throttle bushing, a "u-bolt", a forged elbow, a relief valve, etc.

Trends and Issues

Material Putaway

A number of examples were identified where material was located incorrectly, becoming temporarily or permanently lost. Examples included the temporary reactor head gasket, cable, orifice plates, and two examples of material assigned to undefined locations.

* **The Manager - NQS requests a written response to this item within 30 days of issue.** **See Page 1.**

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Site Services - Procurement, Continued

Trends and Issues (continued)

Corrective Action

There were several examples during this period where corrective actions have been incomplete or too narrowly focused. Examples are corrective actions on stub ends, which did not correct all the affected Stock Codes or preclude repeated configuration deficiencies, and corrective actions on Grinnell "u-bolts" which did not address all the applicable Stock Codes.

Few standalone Event Trend Records were initiated by Procurement Services.

Resolution of Action Requests has been timely.

Repetitive Supplier Deficiencies

NQS receipt inspection identified nine suppliers who repeatedly shipped rejectable material during the period. The problems were resolved at receipt inspection, however actions should be taken with these suppliers to improve future performance.

480V Pressurizer Heater breakers have experienced failures as reported in a number of Action Requests (ARs) during this period. The procurement process for new spare breakers of this model is considering this recent operating experience.

A cracked weld on a Bettis actuator spring cartridge was identified during this period. An NQS review of previous ARs has determined that this same weld has cracked several times previously on other spring cartridges.

Contracts

Programmatic and procedure problems were identified with the contract process. There were also two examples of difficulties with Procurement Requests that are used to initiate contracts. A quality evaluation has been initiated to determine the cause and corrective actions. Increased future oversight is planned by Procurement Services and NQS to follow-up on resolution of these issues.

Replacement Part Evaluations (RPEs)

An RPE for carbon steel stub ends on stainless steel valves was unclear and allowed an end use application which was not appropriate. Also, a power supply was issued that is not a like-for-like replacement and was not evaluated for equivalency as required. NQS will perform a follow-up assessment on the RPE process during the second quarter of 1999.

Engineering Services & Nuclear Safety Assessment and Licensing

Overall Performance Assessment

Satisfactory

The overall performance of Engineering Services (ES) & Nuclear Safety Assessment and Licensing (NSAL) for the first period of 1999 was satisfactory. With the exception of the weaknesses noted below, NTS continued to provide strong technical support to operation and maintenance while protecting DCPP's licensing and design basis.

Operational Focus

Maintenance of Design Basis

During 1R9, Engineering was noted to have maintained the DCPP's licensing and design basis. Sound engineering judgment was noted in the following ES actions:

- ES required rework of the improper bus terminations for Spent Fuel Pool Pump 1-1 circuit beaker.
- ES required the proper plunger to auxiliary switch gap be verified for the Auxiliary Salt Water Pump 1-2 circuit breaker prior to Mode 4.
- ES did not allow the use of purge dam paper to satisfy containment closure requirements.
- ES Identifyed a generic concern with drain holes/T-drains on Limitorque limit switch covers.

Strengths

Strengths were noted by NQS in the following areas:

- Maintenance of the Plant's licensing and design basis, while providing technical support for emerging issues during the 1R9 Refueling outage.
- Resolution of the containment debris/fire stop issue during the 1R9 Refueling outage.
- Project management of the Emergency Core Cooling System (ECCS) Pressure Reducing Orifice (PRO) and Condensate Storage Tank piping repair projects.

Weaknesses

Weaknesses were noted by NQS in the following areas:

Operability Evaluations (OEs) in lieu of Design Changes

Developing an Operability Evaluation in lieu of using the design change process to upgrade the alternate Low Temperature Over-pressure Protection (LTOP) pressure transmitters for use in Mode 4.

Continued on next page

Engineering Services & Nuclear Safety Assessment and Licensing, Continued

Weaknesses (continued)

Operability Evaluations (OEs) in lieu of Design Changes (Continued)

This application was an improper use of the OE process, and was contrary to the applicable procedural and regulatory requirements associated with design control. The use of PT-403A and PT-405A in Mode 4 required a design change as it necessitates changing the currently specified safety function and design bases for these transmitters. When brought to the attention of the ES Manager, a design change was immediately initiated to address this issue. No further response is necessary.

Maintenance Rule Goal Setting*

A number of program implementation inadequacies were identified in the Maintenance Rule Goal Setting activities. Problems were identified relevant to:

- the review of industry operating experience;
- establishment of monitoring periods; and
- the review and reconciliation or revision of established goals and monitoring periods when subsequent System, Structure, or Component (SSC) failures occur or corrective actions are determined to be inadequate.

Additionally, it was identified that no corrective actions, goals, or monitoring period had been established for one of the SSCs in (a)(1) status.

Verification/closure activities for the Non-Conformance Report on Maintenance Rule Issues identified a significant number of deficiencies in regards to the technical adequacy of the Maintenance Rule Technical Bases Document (MRTBD) changes made in response to the NCR. The number and significance of the deficiencies identified indicates that an independent technical review (ITR) process may be warranted relevant to future MRTBD revisions.

Trends and Issues

Event Trend Record (ETR) Trend Analysis

No trends were identified that were not already being appropriately addressed. It was noted that three ETRs were written by the POA process owner for documentation/processing discrepancies. This is not perceived by NQS as an adverse trend, but is an area for performance improvement.

* **The Manager - NQS requests a written response to this item within 30 days of issue. See Page 1.**

Continued on next page

Engineering Services & Nuclear Safety Assessment and Licensing, Continued

Trends and Issues (continued)

CFCU 1-5 Issues
A third failure of CFCU 1-5 to start on demand occurred during 1R9. An aggressive testing plan has been initiated, however, an extensive cause analysis of the repeat failure was not performed until prompted by NQS.

Containment Recirculation Sump Debris/Fire Stops
Engineering's resolution of the potential debris blockage issue of the Residual Heat Removal recirculation sump, as a result of the fibrous material from cable tray fire stops following a design basis loss of coolant accident, was thorough and timely. Although the design change Licensing Basis Impact Evaluation (LBIE) concluded that credited cable tray fire stops would not be impacted by the removal of non-credited cable tray fire stops, DCPP's defense in depth for the overall fire protection program was degraded as a result of fire stop removal. Although there was no decrease in the Fire Protection licensing basis, this degradation is being addressed by the fire protection engineers who are working on a new design for cable tray fire stops to replace those removed from the Unit 1 containment.

Engineering Support Personnel (ESP) Training Program Self-Assessment - (Follow-up)
Currently, new ESP qualification tasks have been approved, new qualifications cards are waiting for final approval, the ESP Training Program procedure has been revised. An ES engineer was assigned to Learning Services from November, 1998, through mid-January, 1999, to assist with these efforts. A follow-up review conducted in January, 1999, found good progress had been made towards resolving deficiencies identified during the 1998 Engineering Support Personnel (ESP) Training Program Self-Assessment and implementing ACAD 98-004.

Containment Seismic Gap Issues
To address / close an Operability Evaluation (OE), Civil Engineering completed extensive walkdowns of the containment liner looking for insufficient seismic gaps and commodities spanning the seismic gap. Numerous deficiencies were identified, including one for which a Prompt Operability Assessment (POA) was written. All conditions were either corrected or documented on the appropriate calculation and engineering accepted prior to Mode 4. The walkdowns and resolution of identified conditions were well coordinated.

Continued on next page

Engineering Services & Nuclear Safety Assessment and Licensing, Continued

Trends and Issues (continued)

Emergency Diesel Generator (EDG) 1-1
There was good engineering response to the repeat failure of EDG 1-1 to reach rated voltage during 1R9. The failure was properly classified as a maintenance rule functional failure and vendor analysis of the suspected part has been requested.. A Quality Evaluation was initiated and an aggressive testing plan has been established.

Readiness For Restart (RFR) Evaluation
A review of pre-outage quality problems, quality problems identified during the outage, CM work orders removed from the schedule after the outage started, Operability Evaluations, and POAs identified no instances of a degraded or non-conforming condition not being appropriately addressed. The RFR process, coordinated by the Design Change Coordination Group, was initiated shortly after the outage started, and the restart list was updated regularly. Action Requests were reviewed routinely by the Action Request Review Team for outage constraints, and added to the RFR list when warranted. The process was found to be sound.

A review of selected design changes implemented during the outage found the changes were appropriately implemented prior to the modified SSC being returned to service. However, "Positive control" over the return-to-service of a modified SSC was not always being met as intended by design procedures. Good oversight by Engineering and Document Services of Control Room drawings requiring update for design changes was observed, and extremely quick engineering issuance of final drawings was noted for several changes.

Self-Assessments
The following self-assessments were performed by NTS this period:

- **Year 2000 Project**
  A Y2K Region IV Peer Audit was performed. The audit noted several strengths and weaknesses. The strengths included contingency planning, plant staff awareness, and project team leadership. Documentation for application compliance, remediation, and testing were cited as requiring improvement. Engineering generates much of this documentation and will be required to review previously closed packages to improve compliance and testing information in the packages. Additional resources are being expended to rework certification packages.

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Engineering Services & Nuclear Safety Assessment and Licensing, Continued

Self-Assessments (Continued)

- **Steam Generator Program**
  In January 1999, NTS sponsored a self-assessment of the Steam Generator Program. The Program was assessed against the requirements of NEI 97-06, and to identify any areas necessary to support 1R9. The Team was multidisciplined with individuals from NTS, NQS, Chemistry, as well as external industry experts. No quality problems were identified during this assessment. Several weaknesses with potential effect on 1R9 were immediately corrected.

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Humboldt Bay Power Plant

Overall Performance Assessment

Satisfactory

The performance of Humboldt Bay Power Plant (HBPP) was satisfactory in the first period. This conclusion is based on the results of audits of the Corrective Action Program, the Fire Protection Program, the Technical Specifications and License Conditions, and the Stack Replacement Project. Activities for the Stack Replacement Project were completed this period and further progress was made toward an HBPP Independent Spent Fuel Storage Installation.

Trends and Issues

Fire Protection Program

A modest decline in performance was noted, although NQS concludes that the program is still being effectively implemented. The Fire Marshall's role in the program was noted to be a strength. One problem with completing vendor's maintenance on the No. 2 Diesel Fire Pump resulted in a Non-Conformance Report (NCR). One program weakness pertaining to resolution of test failures in equipment without Technical Specification operability requirements was also identified, although it did not reduce the effectiveness of the fire protection program. Three examples were identified where test failures had not had timely follow-up. An NQS recommendation to increase management attention in this area resulted in prompt corrective actions.

Technical Specifications & License Conditions

Improvements were noted in previously identified audit problems. Maintenance activities were successfully rolled over from AMPPS to SAP and improvements were implemented. Deferred maintenance was properly identified and controlled. Improvements were noted in the control of modifications and the backlog of design changes. Although NQS concludes the program was effectively implemented, one moderately significant problem was identified in administrative controls for implementing Surveillance Requirements from the Offsite Dose Calculation Manual (ODCM).

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Humboldt Bay Power Plant, Continued

Trends and Issues (continued)

Corrective Action Program

The Corrective Action Program is being effectively implemented. One quality problem was identified for a lack of timely resolution to a 1997 NCR, "Radiological Survey Findings." The issues identified in this management discretion NCR date back to site contamination that occurred before SAFSTOR. NQS noted that Plant Management had taken appropriate actions to determine the issue had low safety significance and was not reportable, and then made a conscious decision to defer additional action until after completion of the Stack Replacement Project.

The backlog of open quality problems exceeded the pre-established goal of 50 for two months during the period, and is an early indicator of a decline in performance. One new non-conformance was initiated during the period, although the overall NCR population remained low (three open NCR's). This was good performance.

Stack Replacement Project

The remaining activities for the Stack Replacement Project were completed late this period. They included decontamination and long-term lay-up of the remaining stack pedestal, and additional modifications to the plant ventilation system ducting. This work was performed safely and in accordance with project procedures and design change packages. Plant personnel closely controlled the activities of contractors and no significant problems were identified. An overall Stack Replacement Project Audit report will be issued by NQS and the highlights will be included in the next QPAR.

Independent Spent Fuel Storage Installation (ISFSI)

HBPP ISFSI activities continued this period with on-site geological boring to evaluate the soil conditions at several prospective site locations. NQS observed and evaluated these activities that were conducted by contract personnel. Soil sample analysis is presently underway at an independent laboratory and NQS will issue an assessment of the project upon completion. HBPP ISFSI Project Management also developed an ISFSI License Submittal Process procedure this period.

DIABLO CANYON POWER PLANT

Self-Assessment
Diablo Canyon Unit 1
Refueling Outage 1R9

PG&E Meeting with the NRC
Arlington, TX
July 1, 1999

Introduction

- Introductions
- Self-assessment
  - 1R9 was a successful outage when measured against "areas of focus"
  - ALARA performance was the one key exception in "focus" areas
  - Many 1R9 "innovations" were successful
  - Several key issues/events occurred which require corrective actions and improvement prior to future outages

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Agenda

- Overview
- 1R9 focus areas
- ALARA analysis
- Key changes / strengths
- Specific issues / events
- Conclusions

Overview

Trend Issue	1R9 Total	2R8 Total	1R8 Total	1R9 Trend
Human error rate (per 10,000 man-hours)	~1.4	~1.4	~1.6	Steady
Overtime (% over normal baseload work)	37	31	44	Steady
Clearance errors - total	18	63	116	Improving
high significance	2	3	7	Improving
Industrial safety	4	11	11	Improving
Maintenance backlog (increase in total number of CM ARs during the outage)	10	82	196	Improving
Rework errors (ETRs)	37	78	*	Improving
Foreign material exclusion events	26	16	12	Declining
Liquid radioactive waste curie discharge	0.05	0.3	*	Improving
Personnel contaminations - outside SCAs	29	46	24	Improving
Personnel contaminations - inside SCAs	181	112	69	Declining
Respirator issuance errors	2	5	*	Improving
PED logging errors (per 10,000 RCA entries)	1.5	2.0	2.3	Improving
Lost TLDs	31	28	*	Steady
Total exposure (REM)	313.5	158	193	Declining
High radiation area TS violations	2	1	1	Declining
Security logged events	38	67	61	Improving

* - denotes no data

1R9 Focus Areas

- Industrial safety
- Duration
- Cost
- Security
- Clearances
- ALARA

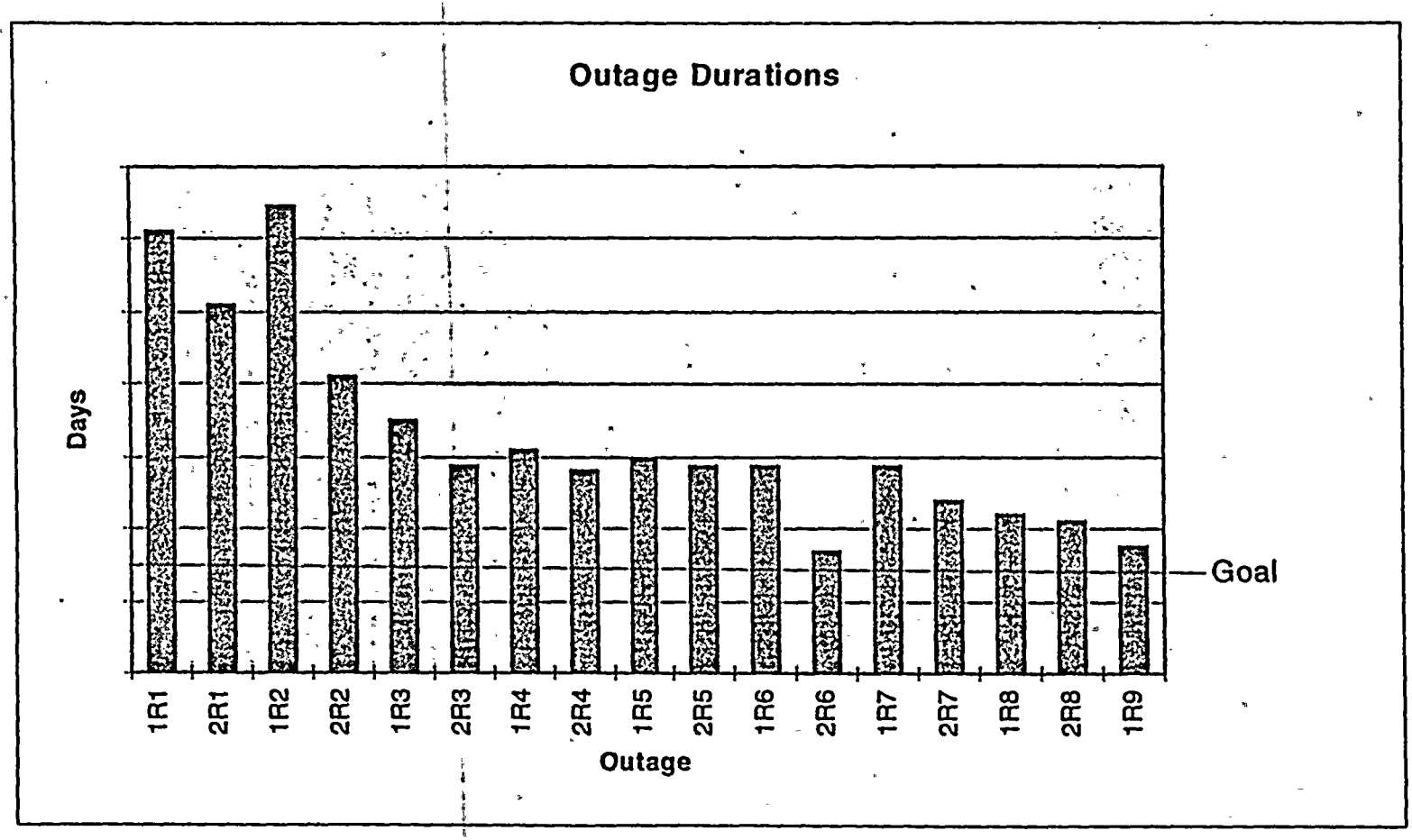
Industrial Safety

- Industrial safety accidents decreased sharply in 1R9
  - Lost time and recordable injuries
    - 1R9 - 4 (2 were contractors)
    - 1R8 - 11 (6 were contractors)
    - 2R8 - 11 (7 were contractors)
  - Preoutage stand-down held by each maintenance asset team which focused on safety and error-free performance
  - 1R9 continued accident reduction trend from mid-1998
  - PG&E "CEO focus" on industrial safety

Duration

- Goal: duration not to exceed 30 days; scheduled (no contingency) for 27.5 days
  - Completed in 35 days - shortest Unit 1 outage
  - Reduction of 9 days from previous Unit 1 best
  - Matched corporate budget, which was based on 35 days

Duration (cont)



Cost

- Goal: costs not to exceed $30m (direct)
  - Total cost was $31m
  - Reduction of $4m from previous best
  - Goal is still above industry average

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Security Outage Human Factor Logged Events

	1R9 (35 Days)	2R8 (42 Days)	1R8 (44 Days)
Unsecured Doors	6	23	10
Lost Key Card	13	15	17
Not Logged Into PA/VA	7	9	22
Misc.	8	13	12
Total	34	60	61
Avg. Events Per Day	.97	1.42	1.38

Clearance Errors

	Significance			
Refueling Outage	High	Moderate	Low	Total
1R9	1	4	12	17
2R8	3	15	45	63
1R8	7	35	74	116

ALARA

ALARA Analysis

- Goal was 184 man-Rem
  - Actual dose was 313 man-Rem
  - Main contributor was unexpected high source term in majority of plant
  - Cleanup sequence
  - Immediate corrective actions
- DCPP hosted a 2-day meeting with EPRI, consultants, and several utilities to better understand issue of high source term
- No single cause identified but contributors included:
  - December forced outage
  - Plate-out of activity when RHR was placed in service
  - Other factors

ALARA Analysis (cont)

- Currently planned corrective actions:
  - Boration prior to cooldown
  - RCS temperature when initiating RHR
  - Lower pH to 7.3 EOC
  - Improved training on shutdown chemistry
  - Lower zinc concentration sooner before 2R9
  - Reestablish 325°F hold prior to RHR initiation
  - More extensive data collection

KEY CHANGES / STRENGTHS

Major Changes

- Success - creation of the Operations Support Center
  - Reduced traffic in control room
  - Single point of contact for control room and asset teams personnel
  - Improved clearance coordination
- Success - creation of work window managers
  - Better planning and coordination of outage activities
  - Facilitated communication between Operations and asset teams

Major Changes (cont)

- Success - First use of asset teams in outage
  - Significant organization change
  - Multiple personnel in new jobs
  - Stable or improved performance in critical areas (e.g. clearances, human performance, rework, etc.)
- Area for Improvement - Split pin replacement
  - Refueling pool FME controls configured differently to accommodate work contributed to increased FME events
  - Use of temporary reactor vessel cover caused nozzle dam leakage
  - Significant contributor to ALARA and PCI

Major Changes (cont)

- Success - Closure of SF Engineering
  - First time site organization alone had to respond to significant issues
  - Issues resolved in a timely and effective manner

Strengths

- Simulator training prior to outage
  - Resulted in a smooth, controlled, and well executed shutdown
- Control room operations
  - Effective use of updates
  - Thorough and informative tailboards
  - Good peer checking
  - Diligent management oversight
  - Attentive board observations by operators
- PED log-in errors were reduced from 4 per 10,000 to 1 per 10,000

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SPECIFIC ISSUES / EVENTS

Issues / Events

- Loss of RHR
- SFP cooling pump not running
- Containment fire stop / material removal
- Midloop level indicator
- Demineralizer bed
- Personnel contamination incidents
- ECCS gas voids
- Other issues

Loss of RHR

- Inadvertent main turbine thrust bearing wear trip caused a transfer of electrical busses to SU power and momentary loss of RHR
- Corrective action:
  - Main bank restoration and 13 other operating procedures have been modified to assure thrust bearing wear trip cut-out before auxiliary power is returned to service
  - Test procedures have been revised regarding RHR pump configuration

SFP Cooling Pump Not Running

- SFP cooling pump shut down during replacement of relay due to misunderstanding by clearance coordination of relay function and failure to identify it in work order
- Corrective actions:
  - Clearance coordination group has been trained
  - SFP temperature will be verified every 2 hours during future outages when core in pool
  - Another alarm will be installed in control room prior to 1R10 and 2R10

Containment Fire Stop/Material Removal

- D.C. Cook finding reported to industry in October 1998
- Required inspection scope detailed and extensive
  - HELB jet impingement maps reviewed
  - Target fire barriers identified (in plant walkdown)
  - Material inventory; type, quantity, and location
  - Test of material characteristics (none available)
- Appropriately chose to wait
- Performed action plan in 1R9, results satisfactory, revised sump screen plugging calcs
- Operability Evaluation written for Unit 2
- Unit 2 action plan in 2R9

Midloop Level Indication

- Midloop trouble annunciator unintentionally defeated
- N_2 was isolated to the PRT resulting in unstable readings in RVRLIS
- Corrective actions:
  - Procedure revision and training on midloop alarm
  - Training to be held on N_2 isolation event
  - Work instructions have been revised to require work window manager review of all clearances prior to implementation

Demineralizer Bed

- High RCS chloride level when demineralizer bed placed in service with incorrect resin
  - Not sampled prior to use
- Corrective actions:
  - Delayed clean-up (but not a significant player in dose rates)
  - Bed removed from service
  - ECG was entered and action statements met
  - Chloride sample frequency increased from 72 to 2 hours
  - Performed evaluation of impact on RCS
  - Suspect resins were removed from RCA and returned to warehouse

Personnel Contamination Incidents Inside SCAs

- 50% greater than during 2R8 due to:
  - Higher than normal levels of contamination in reactor cavity and during system breaches
  - Radworker practices
- Corrective actions:
  - Accountability database
  - GET & RP training
  - Meeting with NSSS Team
  - Radworker handbook
  - Hiring and coverage

ECCS Gas Voids

- Continuous U.T. during fill and vent for restart
- Outage activities such as swapping CCPs, stroke testing valves, and RCS fill and vent contributed to voids
- Operational monitoring revealed valve testing moved void into charging header during Mode 1
- Current program:
  - Reviewing all responses to IE Notice 88-23 and revisions
  - Reevaluating high point vents for effectiveness
  - Fill & vent procedures will be revised

ECCS Gas Voids (cont)

- Some vents will be relocated (8804B Unit 2, 8807A/B both Units)
- More extensive U.T. during and after restart to confirm stable "fill" conditions
- Acceptable void sizes at suction high points to be determined

- Plan on having future management meeting on issue

Other Issues

- STP M-54 acceptance criteria
- Two OTΔT channels bypassed
- Containment isolation vent valve SI-8964

Major Plant Enhancements

- Replaced feedwater pump
- Installed ECCS pressure reducing orifices
- Replaced split pins
- Repaired/replaced all CFCU motors
- Installed out-of-step relay
- Steam generator (2 of 4) upper bundle hydraulic cleaning

Conclusions

- Outage was successful
  - Improvements made in safety, clearances, cost, and duration
  - Plant has operated for 108 days with minimal equipment related problems
- Additional improvements can be made
  - High dose rates were not anticipated
    - Required changes in schedules
    - Still resulted in higher dose to plant personnel
  - Must plan and prepare better to prevent events