ENCLOSURE 2

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

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Licensee:	Southern California Edison Co.
Facility:	San Onofre Nuclear Generating Station, Units 2 and 3
Location:	5000 S. Pacific Coast Hwy. San Clemente, California
Dates:	December 1-5, 1997, with in-office inspection continuing until February 2, 1998
Inspection Team Leader:	John E. Whittemore, Senior Reactor Inspector, Maintenance Branch
Inspectors:	Ramon V. Azua, Project Engineer, Project Branch B Peter A. Balmain, Operations Engineer, Office of Nuclear Reactor Regulation Clifford A. Clark, Reactor Inspector, Maintenance Branch Paul C. Gage, Senior Reactor Inspector, Maintenance Branch Claude E. Johnson, Senior Reactor Inspector, Maintenance Branch William M. McNeill, Reactor Inspector, Maintenance Branch
Accompanying Personnel:	Robert M. Latta, Senior Operations Engineer, Office of Nuclear Reactor Regulation Dr. S. Wong, PRA Consultant, Brookhaven National Laboratory
Approved By:	Dr. Dale A. Powers, Chief, Maintenance Branch Division of Reactor Safety

ATTACHMENT: Supplemental Information

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EXECUTIVE SUMMARY

San Onofre Nuclear Generating Station, Units 2 and 3
NRC Inspection Report 50-361/97-22; 50-362/97-22

The licensee had developed and implemented a program in accordance with 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," with a few exceptions noted. The team found that the program was adequate; however, the program, which made extensive use of other programs and documentation, was fragmented across an extensive site-wide data base and could be difficult to use by personnel without overall program responsibility. The team observed that without the knowledge and insight of the current key employees, personnel would find it difficult to implement the program in a manner consistent with the intent of 10 CFR 50.65.

Supplemental information from the licensee was provided to the NRC on January 2, 1998. That Supplemental information has been docketed.

Operations

- Operations personnel were well versed in the use of the safety monitor, which was well integrated into the work control process. This had resulted in the risk control of changing plant configurations being effectively managed (Section O4.1).

Maintenance

- The failure to include the nonsafety-related nonradioactive sumps in scope of the Maintenance Rule Program was a violation and demonstrated an example of the incomplete scope of the Maintenance Rule program (Section M1.1).

- The frequent involvement and valuable contributions by probabilistic risk assessment personnel in expert panel deliberations and the panel's conservative, consensus judgment decision-making process were programmatic strengths (Section M1.2).

- The overall quality of the licensee's periodic evaluation was good because the documented assessments were thorough and provided good insight for specific areas that could be improved (Section M1.3).

- The licensee's method of balancing reliability and unavailability provided a reasonable approach to meet the intent of 10 CFR 50.65(a)(3).

- The licensee's process for removing equipment from service for maintenance and the shutdown risk assessment methodology were good (Section M1.5).

- The failure to initially monitor the polar crane function of lifting and moving heavy loads over radioactive fuel and safety-related equipment was a noncited violation and demonstrated a weakness in the execution of the program for controlling the lifting of heavy loads (Section M1.6).

- The failure to adequately monitor the adequacy of the preventive maintenance program to demonstrate the reliability of the containment isolation pseudo system and the instrument air system was a violation and demonstrated a weakness in the execution of the preventive maintenance program (Section M1.6).

- The identification of structure, system, and component (SSC) functions, quantifiable limits to assess the validity of functions, and program documentation could be difficult for personnel without overall program responsibility because of the licensee's method of documenting program information (Section M1.6).

- The quality of the licensee's most recent self-assessment was good because the licensee's use of personnel from industry sources to supplement the composition and knowledge level of this assessment team was beneficial (Section M7.1).

Engineering

- Engineering personnel with Maintenance Rule Program responsibilities were sufficiently trained and experienced to carry out their responsibilities (Section E4.1).

Report Details

Summary of Plant Status

During the inspection week, Units 2 and 3 operated at or near full power.

According to licensee representatives, the San Onofre Nuclear Generating Station (SONGS) had implemented a Maintenance Rule Program that endorsed the guidance of Regulatory Guide 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," and NUMARC 93-01 "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."

I. Operations

O4 Operator Knowledge and Performance

O4.1 Operator Knowledge of the Maintenance Rule

a. Inspection Scope (62706)

During the inspection, the team interviewed a sample of licensed plant operators to determine if they were familiar with the general requirements of the Maintenance Rule, aware of probabilistic risk assessment (PRA) insights, and understood their particular duties and responsibilities for Maintenance Rule implementation.

b. Observations and Findings

The operator tasks associated with the Maintenance Rule included the documentation of SSCs that were out-of-service, evaluating priorities for restoration of SSCs, and evaluating plant configurations to determine if work authorization created unacceptable risk levels.

Overall, the operators interviewed understood the philosophy of the Maintenance Rule and their responsibilities associated with it. All operators understood the need to restore equipment to operating condition and minimize SSC unavailabilities. The licensee had implemented the use of a safety monitor in the form of an electronic calculator. The safety monitor would provide a quantification of the risk associated with changes to the plant configuration based on the real or presumed availability of specific equipment. The operators interviewed were familiar with the use of the safety monitor as an advisory tool for risk assessment of plant configuration changes.

c. Conclusions

Overall, operations personnel interviewed clearly understood the philosophy of the Maintenance Rule and their specific responsibilities for implementation of the Rule. These personnel were familiar with the use and limitations of the safety monitor in support of work control. The use of the safety monitor was well integrated into the work control process, and resulted in the risk control of changing plant configurations being effectively managed.

II. Maintenance

M1 Conduct of Maintenance

M1.1 Scope of the System, Structure, and Component Functions Included Within the Maintenance Rule

a. Inspection Scope (62706)

The team reviewed the licensee procedure for initial scoping, the San Onofre Units 2 and 3 updated final safety analysis report, and emergency operating instructions. The team developed an independent list of SSCs that they determined should be included in the scope of the licensee's Maintenance Rule Program in accordance with the scoping criteria in 10 CFR 50.65(b). The team used this list to determine if the licensee had adequately identified the scope of SSCs or functions that should have been included in the scope of the Maintenance Rule Program.

b. Observations and Findings

The team verified that the licensee had identified the total population of SSCs available for inclusion in the scope of the Maintenance Rule Program. The sources referenced by the licensee included: the updated final safety analysis report, the design drawings, the design basis documentation, the systems list maintained by nuclear engineering design organization, and the nuclear plant reliability data system. The licensee's scoping process was delineated in Section 6.0 of Procedure SO123-XIV-5.3.1, "Scoping for the Maintenance Rule," Revision 0, and the results documented in Procedures TS-SO123-2001, "Maintenance Rule Scoping Summary Matrix," Revision 1.

Early in the inspection, Procedure SO123-XV-5.3, "Maintenance Rule Program Implementation," Revision 1, was issued in an expeditious manner to correct a team observed deficiency that changes in the emergency operating instructions were not required to be reviewed for potential changes to Maintenance Rule Program scope. Applicable licensee personnel reviewed prior changes and verified that the Maintenance Rule Program scope had not been impacted.

In accordance with Procedure STS-SO123-2001, the scoping matrix was prepared and presented to the expert panel for review and approval as the basis for final determination. The team noted that documentation of the bases for some scoping decisions was not always sufficiently detailed. After discussions with members of the licensee's staff, the inspectors concluded that all but two of the justifications were acceptable.

The inspectors found that the turbine building heating, ventilation, and air conditioning (HVAC) and nonradioactive sumps systems were manipulated in the steam generator tube rupture section of the emergency operating instructions, and that these systems had not been placed in the scope of the licensee's Maintenance Rule Program, since July 10, 1996, the effective date of the Maintenance Rule. The licensee's basis for not including these systems were that, no functions associated with these systems were determined to be called for in the emergency operating instructions.

The inspectors held discussions with licensee personnel and noted that Section 6.6.2 of Procedure SO123-XIV-5.3.1 stated that a system, structure, or component must add value to the mitigation function of the emergency operating instruction by providing the total or substantial fraction of the total functional ability required to mitigate core damage or radioactive release. Licensee personnel stated that the turbine building HVAC and the nonradioactive sumps systems were excluded from the scope based upon their minor contribution to the successful execution of the emergency operating instructions.

The team noted that Document SO23-14-4, "Steam Generator Tube Rupture Procedure Bases and Deviations Justification," Revision 2, stated that the bases for including turbine building HVAC and nonradioactive sumps within the emergency operational instruction was to minimize radiological releases and spreading of contaminated water. The document further stated that these steps were required to evaluate the full radiological effect of the event so that subsequent contingency actions of establishing appropriate restricted area boundaries can be performed. The team noted that these systems were of such significance to be addressed in the emergency operating instructions for minimizing radioactive releases, but no specific documentation or evaluation provided an assessment of the significance associated with their contribution of release mitigation if the turbine building HVAC and nonradioactive sump systems failed to function. Additionally, the licensee's program did not define significant contribution or significance.

The team found the justification for exclusion of these systems from the scope of the program to be unacceptable because 10 CFR 50.65(b) requires that SSCs used in the emergency operating procedures for mitigating accidents or transients be monitored by the licensee's Maintenance Rule Program. Without monitoring, there was decreased assurance of system performance during emergency events. Therefore, failure to include the two systems within the scope of the licensee's program was initially identified as two examples of a violation of 10 CFR 50.65(b).

Following the onsite portion of the inspection, the licensee submitted additional information related to these findings, by its letter dated January 2, 1998. The inspectors reviewed this information, which indicated that in order for the turbine building HVAC system to perform its mitigating function, it had to be stopped. The licensee also indicated that failure to stop the turbine building HVAC system during a release of radioactivity due to a steam generator tube rupture event would not affect the amount of radioactivity released, but merely its local onsite deposition. Therefore, the team determined that the turbine building HVAC system did not meet the requirements for inclusion into the scope of the Maintenance Rule Program, and was not included as an example to the violation above.

The licensee made a similar statement regarding the nonradioactive sump system. However, the team determined the plant operators' failure to make the required manipulations to direct the radioactive discharge from the sumps to the liquid radioactive waste system would affect the amount of radioactivity released to the environment. The licensee's letter further asserted that any release to the outfall would be monitored. The release would occur in the turbine building instead of the circulating water system outfall because an alarming radiation monitor would isolate the sump discharge to the circulating water system outfall. Without a discharge path, the sump would overflow to the turbine building floor. Therefore, there would be a release to the environment because the SONGS turbine buildings are open to the environment. Therefore, failure to include the nonradioactive sump system in the scope of the licensee's Maintenance Rule Program constituted a violation of 10 CFR 50.65(b) (50-361;-362/9722-01).

c. Conclusions

The licensee acted quickly to revise a procedure to correct a program deficiency identified by the inspection team. The inspectors concluded that the licensee's scoping effort was generally conservative and thorough, and had resulted in the proper identification of all but one SSC, including related functions that were required to be within the scope of the Maintenance Rule Program. The failure to include the nonradioactive sumps system in the scope of the Maintenance Rule Program was a violation of 10 CFR 50.65(b).

M1.2 Safety or Risk Determination

a. Inspection Scope (62706)

The team reviewed the methods and calculations that the licensee had established for making the required safety determinations for those systems that were reviewed. Additionally, the team reviewed the safety determinations for the functions that were

reviewed in detail during this inspection. The team also verified the adequacy of the determination of performance criteria. As part of the inspection team's review, expert panel members were interviewed and minutes of all panel meetings from January 1995 - November 1997 were reviewed. Finally, the team reviewed a sample of low safety-significant (LSS) SSCs to determine if the licensee had adequately established safety significance.

b. Observations and Findings

b.1 Safety or Risk Determination Methodology and Results

The teams' review of a sample of SSCs within the scope of the Rule categorized as LSS found that the expert panel had properly determined the safety significance of those SSCs. In general, the team found that the expert panel had properly categorized the safety significance of SSCs and documented the basis for their conclusions. The team noted that the frequent involvement and valuable contributions by PRA personnel in panel deliberations on SSC safety significance and performance criteria were a strength.

The expert panel determined the risk significance of SSCs based on the combined results from PRA and deterministic considerations, using a consensus judgment decision-making process. The SONGS PRA provided information on PRA importance measures used for risk ranking of SSCs. The importance measures used were risk reduction worth, risk achievement worth, and cutsets that contributed to 90 percent of core damage frequency (CDF). The establishment of the importance measures was consistent with industry guidance. All SSCs, which had met at least one of the quantitative criteria for high safety significance (HSS), were classified in the HSS category by the expert panel. The 120Vac inverters and engineered safety features switchgear room emergency HVAC system, were reclassified more conservatively as HSS by expert panel judgment. Upgrading the safety significance of the two SSCs indicated conservatism within the expert panel's deliberations and judgments. The team did not identify any SSCs that had been improperly ranked.

The information used for risk ranking SSCs was based on the PRA model developed to support the 1993 individual plant examination (IPE) and 1995 IPE for external events (IPEEE) studies submitted to the NRC. Generic failure data and plant-specific data for component failures and unavailabilities from 1984 to 1991 were used in the PRA calculations. The licensee had updated the associated PRA models and established a living PRA database of basic event failure rates and unavailabilities in support of the use of the safety monitor. In addition to the major updates of the living PRA database for each refueling cycle (18 months), component functional failure (FF) data contained in the Maintenance Rule monthly and quarterly reports were used to update the PRA database. The cutsets generated from the PRA model in the safety monitor were the basis for Maintenance Rule evaluations. The PRA model contained cutsets of accident sequences initiated by internal events (e.g., loss of offsite power), as well as, fires, floods, and seismic event-initiated sequences.

A truncation level of 1E-10 was used to quantify the PRA results used for risk ranking. This truncation limit was five orders of magnitude less than the overall CDF estimate of 5E-5 per reactor-year. This limit was considered to be reasonable to ensure that risk significant SSCs were not omitted from risk ranking considerations. The team judged that the licensee's process was satisfactory to perform the risk ranking of SSCs within the scope of the Maintenance Rule.

b.2 Performance Criteria

The team reviewed Nuclear Safety Group Report NSG-97-007, "SONGS Maintenance Rule High Safety Significant SSC Availability Performance Criteria," dated October 17, 1997. This document presented the licensee's methodology for establishing availability limits using PRA assumptions based on Electric Power Research Institute (EPRI) guidance. The method to determine the appropriate unavailability criteria for HSS SSCs was based on using the PRA assumptions as the minimum of the acceptable range, and any change to the PRA assumptions that would result in an acceptable increase in core damage and large early release risk as the maximum of the acceptable range. Thus, unavailability limits were based on any given system's unavailability, which would result in less than an allowable increase of the average CDF value or of the average large early release frequency (LERF) value determined by using the EPRI guidance.

The licensee performed sensitivity analysis to show that increases in CDF and LERF values were within their allowable limits when the unavailability for any given risk-significant SSC was assumed to be at its allowable value. The team noted that the unavailability criteria for the risk-significant SSCs were based on a rolling 12-month monitoring period. Based on insights from the sensitivity analyses, the team considered that the unavailability goal over a 12-month interval would be a sensitive trigger for monitoring degraded SSC performance.

The licensee's program used reliability performance criteria that counted FFs at the system and train levels. Failures were assessed to determine if SSC functions were affected, but not if the failures were maintenance preventable. The licensee's methodology for establishing reliability performance criteria was presented in the Nuclear Safety Group Report NSG-97-008, "SONGS Maintenance Rule High Safety Significance SSC Reliability Performance Criteria," dated October 17, 1997. The approach for establishing the reliability performance criteria was based on a reasonable estimate of SSC demands and accumulated operational time over the monitoring interval of 36 months. The acceptable limit on FFs varied from one to six FFs per 12 quarters (36 months) at the system or train level, depending on the availability limits in accordance with the PRA assumptions and margin based on EPRI guidance. The team verified that the licensee had performed sensitivity analyses to demonstrate that the selected reliability performance criteria would not have a significant impact on the plant CDF and LERF values. The sensitivity analysis results showed that increases in CDF and LERF values were within their allowable limits when the unreliability for any given risk-significant SSC was assumed at its selected value.

The team considered that the licensee's approach to setting unavailability and reliability performance criteria was acceptable.

b.3 Expert Panel

The licensee's expert panel determined which SSCs were within the scope of the Maintenance Rule Program, evaluated the risk significance ranking of SSCs, and established the performance criteria of SSCs. Members of the expert panel included representatives and designated alternates from station technical, operations, maintenance, design engineering, site technical services, and the PRA group. The team noted that the expert panel members who did not have a strong PRA background had received PRA training.

The team reviewed the licensee's process and procedures for establishment of an expert panel. It was determined that the licensee had established an expert panel in accordance with the guidance provided in NUMARC 93-01. Site Technical Services General Procedure SO123-XV-5.3, "Maintenance Rule Program Implementation," Revision 0, contained the guidance regarding expert panel activities and responsibilities.

The team determined that expert panel meetings were convened on a weekly basis, and participation of the PRA personnel provided strong input into the decision making on risk ranking and performance criteria of HSS SSCs. The team interviewed panel members on previous decisions and aspects of panel responsibilities. The expert panel members interviewed had an adequate working knowledge of their responsibilities with respect to the Maintenance Rule implementation.

c. Conclusions

The licensee's overall approach to performing risk ranking of SSCs for the Maintenance Rule Program was satisfactory. The licensee's performance criteria for reliability and unavailability of SSCs was commensurate with assumptions in the PRA for the sampled systems. The frequent involvement and valuable contribution by PRA personnel in expert panel deliberations and the panel's conservative consensus judgment, decision-making process were programmatic strengths. The PRA truncation limit was reasonable and low enough to ensure that risk-significant SSCs were not omitted for risk ranking purposes.

M1.3 Periodic Evaluation

a. Inspection Scope (62706)

The team reviewed the licensee's completed periodic evaluation (dated November 26, 1997) of the Maintenance Rule Program applicable to Units 2 and 3. The evaluation covered the period July 1, 1996, through March 31, 1997, and was performed in accordance with the requirement of 10 CFR 50.65(a)(3).

b. Observations and Findings

The team verified that the licensee's Maintenance Rule Program established requirements to perform a periodic assessment at least once per refueling cycle. The current refueling cycle length assures that this will be performed at intervals of less than 24 months. The evaluation was performed as a combined assessment for Units 2 and 3 and also Unit 1 SCCs within the scope of the Maintenance Rule. Topics covered by this assessment included performance criteria, goal setting and monitoring, balancing availability and reliability, equipment removal from service, scoping and risk significant determinations, expert panel, and corrective actions.

The team observed that the report contained a thorough assessment of each area reviewed and suggested improvements for areas where weaknesses were identified. Information provided in the periodic evaluation included details and summaries of results on the topics suggested by NUMARC 93-01, Section 13.5, "Documentation of the Periodic Assessment."

c. Conclusions

The licensee's program requirements for periodic evaluation met the requirements of the Maintenance Rule. The overall quality of the licensee's periodic evaluation was good as the assessments provided in the report were thorough and provided good insight for specific areas that could be improved.

M1.4 Balancing Reliability and Unavailability

a. Inspection Scope (62706)

Regulation 10 CFR 50.65(a)(3) requires that adjustments be made where necessary to assure that the objective of preventing failures through the performance of preventive maintenance is appropriately balanced against the objective of minimizing unavailability due to monitoring or preventive maintenance. The team reviewed plans and procedures and then met with the Maintenance Rule coordinator, system engineers, reliability engineers, and representatives of the expert panel to discuss the licensee's methodology for balancing reliability and unavailability.

b. Observations and Findings

The team reviewed the licensee's approach to balancing system reliability and unavailability for HSS SSCs to achieve an optimum condition. The requirements for balancing reliability and unavailability were discussed in Procedure SO123-XV-5.3. The Maintenance Rule coordinator was responsible for collecting the data and implementing the balancing process for HSS SSCs during periodic system evaluations. Reliability engineers were responsible for generating the data by continuously monitoring and trending system performance.

The approach to balancing equipment reliability and unavailability was addressed in the Maintenance Rule Evaluation (MRE) Guideline, Revision 0. The MRE desktop guide had been written to provide specific instructions for reliability engineers on how to balance SSC availability and reliability during the MRE process. This balancing consisted of establishing goals and/or performance criteria for the appropriate SSCs and functions, and then monitoring the performance of the affected equipment. An implicit assumption was made that if appropriate goals and criteria were set and if such goals and criteria were met, then an appropriate balance between unavailability and reliability would be achieved. The team determined that such an approach should provide a reasonable balance, provided that appropriate goals and performance criteria were always established.

c. Conclusions

The team concluded that the licensee's method of balancing reliability and unavailability provided a reasonable approach to meet the intent of Section (a)(3) of the Rule.

M1.5 Plant Safety Assessments Before Taking Equipment Out of Service

a. Inspection Scope (62706)

The team reviewed the licensee's procedures and discussed the process with applicable licensee personnel for assessing the change in overall risk associated with the removal of equipment from service due to failure or to support maintenance activities. The team discussed the process with a PRA representative, plant operators, operations management, a work week manager, schedulers, and equipment control senior reactor operators. A sample of plant configuration changes that resulted from schedule revisions and equipment failures was identified and then reviewed to evaluate the licensee assessments of the change in risk that resulted.

b. Observations and Findings

The licensee's process for removing equipment from service with a unit at power was documented in Procedure SO123-XX-4WPM-607, "SONGS Work Scheduling and Coordination Process," Revision 2, and Maintenance Policy Guideline MPG-SO123-G-31, "Utilization of the Safety Monitor in Support of Work Control," Revision 1.

During power operation, the safety monitor was used by schedulers and work week managers to evaluate plant risk for various equipment-outage configurations. A 12-week rolling schedule was used for planning surveillance and preventive maintenance of plant equipment. The work week manager and equipment control senior reactor operators stated that the safety monitor was used for evaluating emergent work situations. For combinations of equipment outages not considered in the safety monitor, a "Component Risk Reduction List" was used to determine whether minor components were related to

components of PRA significance. Otherwise, a duty PRA engineer was requested to perform a detailed risk evaluation. The use of the safety monitor by the operations and maintenance staff for work planning resulted in the risk associated with changing plant configurations being effectively managed.

Shutdown risk was managed by use of the Outage Management Division Procedure, "Shutdown Nuclear Safety Program," Revision 0. The PRA group performed outage risk assessments using a shutdown PRA model. The outage management group used the EPRI outage risk assessment monitor (ORAM) software for evaluating defense-in-depth requirements to maintain the respective shutdown safety functions. Insights from the outage risk assessments were evaluated by the outage management division. The PRA group was involved in the risk assessment of emergent activities during the outage to evaluate risk significance of the activities and potential compensatory measures.

From the control room logs for the period September 1 through October 31, 1997, for SONGS, Unit 2 and 3, the team identified three risk significant "time windows" in which several SSCs were concurrently out-of-service. The windows occurred in Unit 2 on September 5, October 13, and October 22, 1997, where configurations of more than three SSCs were out-of-service due to planned maintenance and surveillance activities. The licensee was requested to evaluate the risk impact of the three equipment-outage configurations in terms of CDF and LERF estimates. The resulting risk evaluations did not identify any unacceptable risk due to the changed configurations. Core damage probability estimates of the configurations were less than 1E-6, which was an acceptable risk impact threshold.

c. Conclusions

The licensee's process for removing equipment from service for maintenance and the shutdown risk assessment methodology were good. The users of the safety monitor were aware of the limitations of the safety monitor for risk assessment of equipment-outage configurations. The use of the safety monitor was well integrated into the work control process, and resulted in the risk control of changing plant configurations being effectively managed.

M1.6 Goal Setting and Monitoring and Preventive Maintenance

a. Inspection Scope (62706)

The team reviewed program documents and records in order to evaluate the process that was in place to establish performance criteria, set goals, and monitor under Category (a)(1) to meet goals, or to verify that preventive maintenance was effective under Category (a)(2) of the Maintenance Rule. The team also discussed the program with the Maintenance Rule coordinator, expert panel members, reliability engineers, system engineers, plant operators, and schedulers.

The team reviewed in detail the systems described below to verify: that goals or performance criteria were established with safety taken into consideration; that industry-wide operating experience was considered where practical; that appropriate monitoring and trending were being performed; and that corrective action was taken when an SSC function failed to meet its goal or performance criteria, or when an SSC function experienced an FF.

Auxiliary Feedwater System
* Chemical, Volume and Control System
Component Cooling Water System
Containment Isolation (Pseudo) System
Emergency Diesel Generators
* Fire Protection (Water)
Instrument Air System
Low Pressure Safety Injection System
Main Feedwater System
* Main Steam System
* Plant Protection System
Qualified Safety Parameter Display System
* Radiation Monitors
* Salt Water Cooling System
Site Structures
Switchgear HVAC
Turbine Governor Controls

(* indicates Category (a)(1) monitoring)

The team also conducted a limited general review of the licensee's Maintenance Rule Program treatment of equipment for lifting heavy loads, specifically containment polar cranes.

b. Observations and Findings

Although the team was provided inspection preparation documentation, and once on site, given read only access to the data base, they were unable to obtain the specific information concerning systems in goal setting. The information pertaining to the status of the Maintenance Category (a)(1) SSCs was fragmented throughout the data base. Therefore, the team requested a status summary of systems in Category (a)(1) at the start of the inspection. The licensee provided the summary which indicated that 9 systems were in Category (a)(1) and monitoring against goals of 21 trains, channels, or components within the 9 systems, was being performed.

The team noted that the auxiliary feedwater, component cooling water, emergency diesel generators, fire protection (water), low pressure safety injection, main feedwater, plant protection, qualified parameter display, radiation monitoring, salt water cooling, structures, switchgear HVAC, and turbine governor control systems' performances were such that the SSCs were being monitored in accordance with 10 CFR 50.65(a)(1) or (a)(2), as appropriate. Performance criteria were appropriate in all cases. The team found that appropriate corrective actions had been taken to address the causes of any unacceptable performance. The team did not identify any inadequate goal setting or performance monitoring for the subject systems.

Chemical and Volume Control System

The chemical and volume control system (CVCS) was a HSS system with the Unit 2 system monitored under Category (a)(1). The performance criteria were less than 4 FFs in 3 years, less than two repeat FFs in 3 years, and less than 1.5 percent unavailability in 1 year. The pumps in this system were monitored separately against an unavailability criterion of less than 25 percent per year. According to licensee personnel, this monitoring technique prevented masking of degraded pump performance.

Unit 2 was placed in Category (a)(1) because of documented unavailability associated with the failure and replacement of charging loop check valves, MU020 and MU021. These valves failed to fully open and provide required flow during testing conducted for support of the licensee's in-service testing program. The licensee took corrective action to replace the valves with a superior design in both units, and correct an inadequate testing process.

Unit 3 remained in Category (a)(2) as SSC unavailability hours did not accrue because the modification to replace the valves was implemented during the unit refueling outage, when the flow paths containing these valves were not required to be available.

The team considered the licensee's action to address the check valve failures to be adequate, with respect to the Maintenance Rule, Another NRC inspection was addressing the adequacy of the licensee's in-service testing program, related to these valves.

Containment Polar Cranes

The team reviewed the licensee's program for assuring the effectiveness of maintenance on the polar cranes. The licensee's program monitored the performance of all safety-significant handling equipment periodic surveillance and testing as a single SSC function for lifting and moving heavy loads. The structural support function for the polar cranes was monitored within the licensee's structures monitoring program. Failure to meet any two surveillance requirements within the group of monitored equipment (fuel handling cranes, spent fuel cranes, polar cranes, etc.) over 36 months would require placing all lifting equipment in Category (a)(1).

The team determined that the method of Maintenance Rule Program monitoring of lifting equipment was adequate. However, this monitoring practice was new and had been in place only for the previous 2 months. Prior to October 1997, only the support function of the polar cranes was monitored within the licensee's program for monitoring structures. The function of lifting and transporting heavy loads over radioactive fuel and safety-related equipment was not monitored.

This inadequate monitoring was identified and corrected by the licensee in October 1997. The team verified the adequacy of the licensee's current Maintenance Rule Program to appropriately monitor the function of lifting and moving heavy loads over radioactive fuel and safety-related equipment. The team identified that the previous practice of only monitoring the effectiveness of maintenance on the function of supporting the lifting equipment was a violation of 10 CFR 50.65(a)(2). This self-identified and corrected violation that resulted from implementing corrective actions associated with previous enforcement, will be treated as a noncited violation consistent with Section VII.B.1 of the NRC Enforcement Policy (50-361;-362/97022-02).

Containment Isolation System

The containment isolation system was an HSS system that was being monitored under Category (a)(1). Upon initial Maintenance Rule Program implementation, the licensee monitored the containment isolation function within each individual system having isolable containment penetrations. Later, the licensee changed the individual system function monitoring scheme by creating a containment isolation pseudo system and defined a separate overall containment isolation function.

The licensee issued Procedure STS-S023-1004, "Containment Isolation System, System Analysis Report," Revision 0, on November 7, 1997, and placed the containment isolation system in Category (a)(1) to determine if goal setting was required. A review of failures from July 10, 1993, to the present was initiated and in progress during the inspection. Procedure STS-SO23-1004 established performance criteria of less than 10 FFs in 3 years, less than two repetitive FFs in 3 years, and less than 6 percent unavailability in 1 year.

The licensee's definition of a FF appeared to be inconsistent. At different times, conflicting information was provided by licensee personnel about a FF being defined as individual or multiple valve leakage exceeding the regulatory limit of $0.6L_a$ for Type B and C valves as defined in 10 CFR Part 50, Appendix J. The additional information stated that when a valve leaked at such a high rate that the leakage could not be measured, then it would be considered a FF regardless of the status of the companion outboard or inboard valve.

The team reviewed the Unit 3 Refueling Outage 9 Appendix J testing results and found the following:

- Valve HV 5686 failed its "as found" leakage testing. After the completion of two flushing and testing cycles, the valve passed the leakage test.

- Valve HV 7512 failed the leakage testing for Generic Letter 89-10 testing. The valve passed leakage testing after being repacked and retested three times.

- Valve HV 9420 failed "as found" leakage testing. The observed leakage was 1087 sccm/minute. The corrective action was to increase the valve's administrative leakage limit from 500 sccm/minute to 2,000 sccm/minute. A licensee representative stated that the limit was changed because of the high radiation exposure involved with repairing the valve.

None of these events, which reflected unsuccessful maintenance activities were considered FFs and, as such, were not in the Maintenance Rule data base.

Prior to rule implementation, the licensee had established a testing program to meet the requirements of Appendix J. The program required that corrective action be initiated for valve leakage reaching an Appendix J administrative limit. The administrative limits employed by the licensee for the Appendix J testing program were dependent on the valve and varied from 0 to 10,000 sccm/minute. In order for a valve to exceed the reliability performance criterion established for the Maintenance Rule, its leakage would have to exceed 0.6 L_a, 130,287 sccm/minute, for one or each valve in a process penetration. Therefore, the effectiveness of preventive maintenance was not evaluated until a limit of Technical Specification 3.6.1 was reached or exceeded by either one or multiple valves. Technical Specification 3.6.1 defined containment operability in terms of Appendix J allowed leakage. As a result of using this excessively high performance criterion, it was not demonstrated that the performance or condition of containment isolation valves was being assured through the performance of appropriate preventive maintenance. This was identified as an example of a violation of 10 CFR 50.65(a)(2) (50-361;-362/97022-03).

Following the inspection, the licensee submitted additional information dated January 2, 1998. This information stated that the team was concerned about the performance criteria of 10 FFs being too high. The team was not concerned about the number of FFs, but rather, the amount of leakage to determine if an FF occurred. The additional information addressed the performance criteria in terms of number of FFs allowed, as well as, how inboard and outboard valves were considered. The concern of the inspectors was that the definition of a failure was excessive and that a technical specification limit would have to be reached or exceeded for a failure to be recognized. Licensee management stated a view point that they met the Maintenance Rule. The additional information did not convince the team that a violation had not occurred. However, the licensee's stated intent to enhance the criteria by using a fraction of the technical specification limit and the licensee-determined Appendix J administrative

leakage limit to define failure, satisfactorily addressed the needed corrective action. Therefore, it is not necessary for the licensee to respond to this example of the violation. Although the team's concern was fully addressed by the licensee's performance criteria enhancement, the team concluded that the containment isolation system Maintenance Rule Program performance criteria were needlessly complicated.

Instrument Air System

During a review of the LSS instrument air system documentation, the team noted the following:

- The instrument air system Maintenance Rule Program function was to provide an adequate, reliable, continuous supply of filtered, dry, and essentially oil-free air/nitrogen to plant loads via the instrument air compressors or the backup (upon loss of normal instrument air supply) low pressure nitrogen system.

- There had been several FFs of the three instrument air compressors over the past 2 years. At one time, a temporary air compressor was used on site to supplement the existing instrument air compressors.

- While several functional failures of the instrument compressors were documented over the past 2 years, the existing performance criteria were not challenged and did not affect how the system was monitored, i.e., Category (a)(1) or (a)(2).

The team further noted the instrument air system was monitored at the plant level and the performance criteria were:

- "Less than one (1) scram per 7,000 hours critical."

- "An Unplanned Capability Loss Factory below two percent (2%) for a three (3) year average."

As defined, the plant level performance criteria for the instrument air system was inadequate for monitoring the equipment performance to assess the effectiveness of maintenance for the instrument air compressors. For example, Action Request 970700930 noted that during the rotation of Instrument Air Compressor SA2417MC001, the compressor failed to run and load in the lead mode. Although the compressor did not function, the failure was not identified or tracked in the licensee's Maintenance Rule Program because the performance criteria were not challenged.

The guidance provided in NUMARC 93-01, Section 9.3.2, indicates that plant level criteria may not be adequate to monitor some LSS SSCs, and that for those SSCs performance criteria should be established, as appropriate. The occurrence noted above, where it was necessary to perform a temporary system modification by

installing a temporary air compressor to keep the system functional, indicated that the performance criteria required enhancement to address the compressor failures. The team found that the failure to establish performance criteria that would demonstrate that preventive maintenance assured the reliability of the instrument air compressor performance, was an example of a violation of 10 CFR 50.65(a)(2) (50-361;-362/97022-03).

During the inspection, the licensee's representative stated that the corrective action program had provided corrective actions to address the latest instrument air compressor failures, in Action Request 961001395 ("Instrument Air Spool Piece Mods") and Action Request 961100275 ("Instrument Air Control Modification"). Following the onsite portion of the inspection, the licensee submitted additional information dated January 2, 1998, which reiterated that the corrective action program was effective in maintaining the air compressor function. Further, licensee representatives stated an opinion that a violation had not occurred because the corrective action system was effective. This information did not address the adequacy of the system performance criteria to identify problems related to the effectiveness of maintenance for the air compressors. However, the licensee stated an intent to enhance Maintenance Rule Program monitoring of the instrument air system monitoring. According to the licensee, a minor program enhancement implemented an additional performance criterion of 10 percent unavailability over four quarters for each instrument air compressor. The team determined that this enhancement served to provide adequate performance criteria for monitoring the effectiveness of maintenance on the air compressors. Therefore, it was not necessary to respond to this example of the violation.

General

The team identified a number of other observations about the licensee's program. None of these issues constituted violations of regulatory requirements.

- The SSC functions were not consistently identified or documented. LSS SSC functions were documented in LSS systems reports and HSS functions were found in system analysis reports. The team noted that some important functions were not considered by the Maintenance Rule Program. For example, the alarm function of the qualified safety parameter display system (QSPDS) was not monitored. The radiological barrier and leakage detection functions of the component cooling water (CCW) system that were described in the Updated Final Safety Analysis Report, Section 9.2.2.1, were not monitored by the program. According to a licensee representative, SSC Maintenance Rule functions were still being developed.

- Within the licensee' program, certain definitions of FFs did not have quantitative limits, for example, the QSPDS reference document did not address a number of isolations that could be lost and still retain the function. The licensee reported in Action Requests 940900022, 941100042, and 950100003 that the charging

pumps in the CVCS had experienced gas binding because of a leaking suction check valves. The resulting temporary low flow rates did not result in FFs. The monitoring category of the system would not have changed if these occurrences had been identified as FFs.

- The program information for SSCs was fragmented throughout a site-wide database. In order to retrieve some Maintenance Rule information, it was necessary to access the corrective action and work control data bases. This method of documenting information caused difficulty in integrating and assessing specific SSC performance. Further, this approach encumbered a central focus on the current or emerging conditions. For example, using this data base, the team was unable to identify which SSCs were in Category (a)(1), and what goals had been implemented. This could have required extensive searching in the corrective action data base.

c. Conclusions

The team concluded that, in general, the licensee: properly established goals and performance criteria; performed appropriate monitoring and trending; and took appropriate corrective actions when required. The failure to initially monitor the polar crane function of lifting and moving heavy loads over radioactive fuel and safety-related equipment was a noncited violation. In addition, the failure to adequately monitor the adequacy of preventive maintenance program to demonstrate the reliability of the containment isolation pseudo system and the instrument air system was a violation. Finally, the identification of SSC functions, quantifiable limits to assess validity of functions, and program documentation could be difficult for personnel without overall program responsibility because of to the licensee's method of documenting program information.

M2 **Maintenance and Material Condition of Facilities and Equipment**

a. Inspection Scope (62706)

In the course of verifying the implementation of the Maintenance Rule, the team performed in-plant walkdowns to examine the material condition of the following systems:

- Auxiliary feedwater system
- Chemical and volume control system
- Component cooling water system
- Fire protection - water system
- Instrument air system

- Low pressure safety injection
- Main steam system
- Saltwater cooling system (Unit 2 and Unit 3 pump rooms)
- HVAC switchgear system (Unit 2, Unit 3 ac units, and switchgear rooms)
- Main turbine governor control system (Unit 3 governor and stop valves)
- Radiation monitoring system (various Unit 2 radiation monitors and control room panels)

b. Observations and Findings

The team found that the SSCs observed were visually free of large areas of corrosion. There were some minor oil and water leaks; however, based on their external condition, the SSCs appeared to receive the required maintenance. The licensee was aware of all observations made by the team and was planning corrective action. There was some improvement noted in the preservation of equipment in the saltwater cooling pump rooms.

c. Conclusions

In general, the material condition of those systems inspected was adequate.

M7 Quality Assurance in Maintenance Activities

M7.1 Licensee Self-Assessment

a. Inspection Scope (62706)

The team reviewed a total of five self-assessments, listed in the attachment, that had been performed on the licensee's Maintenance Rule Program between May 1995 and November 1997.

b. Observations and Findings

The first two assessments were performed by consultants and industry peer group representatives during the initial phases of Maintenance Rule implementation at SONGS. The remaining three assessments were performed by the licensee's nuclear oversight division. Personnel from other utilities were used to supplement the last two assessments.

The team observed that the most recent assessment report dated November 1997 was thorough and comprehensive. This assessment identified problems with the timeliness of completing corrective actions from previous assessments. The team reviewed corrective action documentation which addressed this problem, held discussions with the assessment leader regarding resolution of these issues, and determined that the licensee obtained the appropriate management attention and completed the outstanding corrective actions.

c. Conclusions

The team concluded that the quality of the licensee's most recent self-assessment was good because use of personnel from industry sources to supplement the composition and knowledge level of this assessment team was beneficial. The licensee's self-assessments of the Maintenance Rule Program prior to 1997 were not as effective as the latest assessment.

M8 *Miscellaneous Maintenance Issues*

M8.1 (Closed) Inspection Followup Item 50-361;-362/9614-01: Followup and assess the adequacy of licensee-established goals for Category (a)(1) systems. The team verified that the licensee had established adequate goals for the systems in Category (a)(1).

M8.2 (Closed) Violation 50-361;-362/9614-02: Failure to monitor the performance of the control room smoke exhaust system. The team verified that the licensee had established adequate performance criteria and was monitoring the system performance against the criteria.

M8.3 (Closed) Inspection Followup Item 50-361;-362/9614-03: Followup licensee action to evaluate adequacy of plant level performance criteria for control room smoke evacuation and containment purge systems. The licensee had evaluated the adequacy of the original performance criteria, found it lacking for monitoring the effectiveness of maintenance, and implemented more stringent criteria that were adequate.

M8.4 (Closed) Violation 50-361;-362/9614-04: Failure to provide adequate technical basis for the reliability performance criteria implemented for HSS systems. The team verified that the licensee checked the reliability performance criteria against the assumed performance of systems modeled in the individual plant examination (IPE) and validated that the reliability performance criteria for modeled systems were bounded by the assumptions in the IPE.

III. Engineering

E4 Engineering Staff Knowledge and Performance

E4.1 Engineer Knowledge of Maintenance Rule

a. Inspection Scope (62706)

The team interviewed cognizant station technical, system engineering, and technical services reliability engineering personnel to assess their understanding of the Maintenance Rule and associated responsibilities. The team also reviewed procedures to determine responsibilities.

b. Observations and Findings

The team determined that the cognizant system engineers had the following responsibilities:

- Reviewing and approving the data used to establish the criteria for the SSCs within the scope of the Maintenance Rule.
- Performing cause analysis, as required by the action request process.
- Participating in the development and approval of all goal setting activities.
- Developing proposed corrective actions taken to improve SSC performance under their area of cognizance.

System engineers had minimal responsibilities associated with Maintenance Rule activities, Most had adequate knowledge of Maintenance Rule activities and terms related to scoping, risk-significance, performance criteria, monitoring periods, or goal setting. Generally, system engineering personnel were trained sufficiently to implement their assigned Maintenance Rule responsibilities.

Site technical service reliability engineering personnel were assigned the majority of the responsibility for implementation of the Maintenance Rule Program. The team determined that these personnel were fully capable of carrying out their assigned Maintenance Rule Program responsibilities.

c. Conclusions

All groups of engineering personnel with Maintenance Rule Program responsibilities were sufficiently trained and experienced to carry out those responsibilities.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors discussed the progress of the inspection on a daily basis and presented the inspection results to members of licensee management at the conclusion of the onsite inspection on December 5, 1997. In addition, a supplemental telephonic exit was held on February 2, 1997 to discuss the enforcement findings from the inspection. During this meeting, the NRC informed licensee personnel that the proposed violation for not including the turbine building ventilation system in the scope of the Maintenance Rule program was withdrawn after review of the additional information submitted on January 2, 1998. The licensee personnel acknowledged the findings presented, but voiced disagreement with the violation for failure to include the nonradioactive sumps in the program scope.

The inspectors asked the licensee staff and management whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

ATTACHMENT

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

Licensee

R. Allen, Supervisor, Reliability Engineering
D. Axline, Compliance Engineer
R. Clark, Manager, Quality Engineering
K. Flynn, Supervisor, Technical Services
T. Hook, Supervisor, Nuclear Safety
R. Krieger, Vice President, Nuclear Generation
D. Nunn, Vice President, Engineering and Technical Services
M. Short, Manager, Technical Services
K. Slagle, Manager, Oversight
M. Wharton, Manager, Engineering Design
L. Wright, Supervisor, Technical Services

NRC

S. C. Black, Chief, Special Inspection, Quality Assurance, and Maintenance Branch, NRR
D. A. Powers, Chief Maintenance Branch, Division of Reactor Safety
J. A. Sloan, Senior Resident Inspector

INSPECTION PROCEDURES USED

IP 62706	Maintenance Rule

ITEMS OPENED AND CLOSED

Opened

50-361;-362/9722-01	NOV	Failure to include the nonradioactive sumps within the Maintenance Rule Program scope
50-361;-362/9722-02	NCV	Failure to adequately monitor the polar cranes
50-361;-362/9722-03	NOV	Failure to demonstrate that preventive maintenance would assure the reliability of the containment isolation and the instrument air systems

Closed

50-361;-362/9614-01	IFI	Followup and assess adequacy of licensee-established goals for Category (a)(1) systems (Section M8)
50-361;-362/9614-02	NOV	Failure to monitor the performance of the control room smoke exhaust system (Section M8)
50-361;-362/9614-03	IFI	Followup licensee action to evaluate adequacy of plant level performance criteria for control room smoke evacuation and containment purge systems (Section M8)
50-361;-362/9614-04	NOV	Failure to provide adequate technical basis for the reliability performance criteria implemented for high safety-significant systems (Section M8)
50-361;-362/9722-02	NCV	Failure to adequately monitor the polar cranes

LIST OF PROCEDURES REVIEWED

SO123-XV-5.3	Maintenance Rule Program Implementation, Revision 0
SO123-XIV-5.3.1	Scoping for the Maintenance Rule, Revision 0
SO123-XIV-5.3.2	Determination of Maintenance Rule Performance Criteria, Revision 0
SO123-XIV-5.3.3	Preparation of Maintenance Rule System Analysis Reports, Revision 0
SO123-XIV-5.3.4	Maintenance Rule Expert Panel, Revision 0
SO123-XIV-5.3.5	Maintenance Rule Risk-Significant SSCs, Revision 0
SO123-XIV-5.3.6	Goal Setting for the Maintenance Rule, Revision 0
SO123-XIV-5.3.7	Maintenance Rule Periodic Assessment, Revision 0
SO123-XXIV-20.2	Maintenance Rule for Structures, Revision 0
SO23-12-4	Emergency Operating Instruction, SG Tube Rupture, Revision 13
MPG-SO123-G-31	Utilization of the Safety Monitor in Support of Work Control, Revision 1 (Guidance Document)

SO123-XX-4-WPM-607	SONGS Work Scheduling and Coordination Process, Revision 2
	Outage Management Division Procedure, "Shutdown Nuclear Safety Program," Revision 0

LIST OF DOCUMENTS REVIEWED

STS-SO123-2001	Maintenance Rule Scoping Summary Matrix
SO23-14-4	Steam Generator Tube Rupture Procedure, Basis and Deviation Justification, Revision 2
	San Onofre Nuclear Generating Station Units 2/3 Individual Plant Examination (IPE), May 4, 1993
NSG-97-007	"SONGS Maintenance Rule High Safety Significant SSC Availability Performance Criteria," October 17, 1997
NSG-97-008	"SONGS Maintenance Rule High Safety Significant SSC Reliability Performance Criteria," October 17, 1997
NSG-97-010	"SONGS PRA Analysis Support for Maintenance Rule Sensitivity Study," November 24, 1997

Action Requests/Maintenance Rule Program Evaluations

90021280	93080050	94020062	94031557
94060936	95029090	95030808	95051819
95060799	95120312	96010526	96020268
96033887	960700160	960700895	960700894
960601362	960601201	961000951	960601337-01
960601338-01	960601359-02	960700066-02	961000979-01
970101806-01	971100374-01	971100373-01	970601605-01
970601604-01	970101806-01	970601604-01	971100372-01
971100375-01	961000946-01	970900036-01	970101807-01
971100376-01	970401185-01	970601607-01	971000432-01
970101805	97050063	941100042	950100003
960300147	960511160	961201026	970500461
970500563	970501676	970600187	970701234
970800432	970800937	970900139	970900193
971001617	971100379	971101106	970700930
940900022	961001395	961100275	

System Analysis Reports

STS-S023-1020, "Saltwater Cooling System," Revision 1
STS-S023-1014, "ESF Switchgear Room Normal HVAC System," Revision 1
STS-S023-1002, "Component Cooling Water," Revision 1
STS-S023-1004, "Containment Isolation System," Revision 0
STS-S023-1007, "Chemical and Volume Control System," Revision 1

Expert Panel Meeting Minutes

All meetings during the period January 10, 1995 - November 29, 1997

Miscellaneous

Turbine-Governor System Basis Report
State of The System Reports for 3rd Quarter 1997

Audits and Assessments

N/A	Periodic Evaluation of the San Onofre Nuclear Generating Station's Maintenance Rule Program for the Period July 1996 through March 1997, dated November 26, 1997
N/A	Maintenance Rule Assessment Performed by Quadrex Energy Services, May 12, 1995
N/A	Nuclear Energy Institute Assist Visit Report, January 23, 1996
SCES-613-96	Nuclear Oversight Division, Site Quality Assurance Audit Report SCES-613-96, Maintenance Rule, June 24, 1996
SEA 96-008	Nuclear Oversight Division, Quality Engineering Maintenance Rule Program Assessment Report SEA 96-008, October 18, 1996
SEA 97-005	Nuclear Oversight Division, Quality Engineering Maintenance Rule Program Assessment Report SEA 97-005, Revision 1, November 7, 1997