APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-361/94-15
50-362/94-15

Licenses: NPF-10
NPF-15

Licensee: Southern California Edison Co.
23 Parker Street
Irvine, California

Facility Name: San Onofre Nuclear Generating Station, Units 2 and 3

Inspection At: San Onofre Site, San Clemente, California

Inspection Conducted: April 25-29, 1994

Inspectors: C. Myers, Reactor Inspector, Engineering Branch
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Approved: T. F. Westerman 6-3-94
T. F. Westerman, Chief, Engineering Branch Date
Division of Reactor Safety

Inspection Summary

Areas Inspected (Units 2 and 3): Special, announced inspection of the implementation of the licensee's program to meet commitments to Generic Letter 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," and to followup on open inspection followup items and the licensee's corrective actions for a previous deviation and two violations.

Results (Units 2 and 3):

- Additional test acceptance criteria for limit seated motor-operated valves were required to assure valve closure and sealing (Section 1.3.2).

- The licensee's method for extrapolating thrust requirements from dynamic testing was nonconservative for some motor-operated valves and considered a program weakness (Section 1.3.3).

- Additional consideration of design basis DC motor speed was required in the evaluation of motor-operated valve stroke time (Section 1.3.4).

- Flow effects were not yet analytically justified (Section 1.3.5).

- The licensee's program was generally effective in establishing assurance of design basis capability for the sampled motor-operated valves (Section 1.6).

- The licensee was implementing a program consistent with their commitments to Generic Letter 89-10 (Section 1.6).

- Evaluation of the potential for pressure locking and thermal binding was not complete (Section 3).

Summary of Inspection Findings:

- Violation 361;362/9327-01 was closed (Section 2.4).
- Violation 361;362/9327-03 was closed (Section 2.3).
- Deviation 361;362/9336-01 was closed (Section 2.5).
- Inspection Followup Item 361;362/9317-01 was closed (Section 2.1).
- Inspection Followup Item 361;362/9331-02 will remain open (Section 2.2).
- Inspection Followup Item 361;362/9317-02 was closed (Section 3).
- Inspection Followup Item 361;362/9415-01 was opened (Section 1.1.1).
- Inspection Followup Item 361;362/9415-02 was opened (Section 1.3.2).
- Inspection Followup Item 361;362/9415-03 was opened (Section 1.3.3).
- Inspection Followup Item 361;362/9415-04 was opened (Section 1.3.4).
- Inspection Followup Item 361;362/9415-05 was opened (Section 1.3.5).
- Inspection Followup Item 361;362/9415-06 was opened (Section 3).

Attachment:

Attachment - Persons Contacted and Exit Meeting

DETAILS

1 GENERIC LETTER (GL) 89-10, "SAFETY-RELATED MOTOR-OPERATED VALVE TESTING AND SURVEILLANCE" (2515/109)

On June 28, 1989, the NRC issued GL 89-10, which requested licensees to establish a program to ensure that switch settings for safety-related motor-operated valves (MOVs) were selected, set, and maintained properly. Subsequently, six supplements to GL 89-10 have been issued. NRC inspections of licensee actions implementing commitments to GL 89-10 and its supplements have been conducted based on guidance provided in Temporary Instruction 2515/109, "Inspection Requirements for Generic Letter 89-10, Safety-Related Motor-Operated Valve Testing and Surveillance." Temporary Instruction 2515/109 is divided into Part 1, "Program Review," and Part 2, "Verification of Program Implementation."

The inspection documented by this report was the second inspection at San Onofre Nuclear Generating Station, Units 2 and 3, under Part 2 of Temporary Instruction 2515/109. The inspection focused on verification of program implementation for selected valves. Programmatic issues were addressed during this inspection as followup from previous inspection open items and in the context of issues that developed in the course of the inspection.

The following MOVs were selected for review:

3HV6367 Emergency Cooling Unit CCW Outlet Isolation Valve,
3HV8152 Shutdown Cooling Heat Exchanger Inlet Valve,
3TV9267 Letdown Heat Exchanger Outlet Valve, and
3HV5686 Fire Water to Containment Isolation Valve.

The selected MOVs were configured as shown below:

Valve	Actuator Model	Valve Type and Vendor	Closure Control
3HV6367	SB-00S	10"x8"x10" WKM- Split Disc Gate	Torque
3HV8152	SMB-1	12" Aloyco-Flex Wedge Gate	Torque
3TV9267	SB-00	3" Westinghouse-Flex Wedge Gate	Limit
3HV5686	SMB-000	4"X3"X4" WKM-Split Disc Gate	Torque

For each MOV selected, the inspectors reviewed the design basis calculation of flow, temperature, and the maximum expected differential pressure (MEDP); the sizing and switch setting calculation; the diagnostic test data package; and the diagnostic traces using MOVATS 3000 software.

In addition the inspectors sampled portions of the diagnostic testing for other valves.

1.1 Design-Basis Reviews

The inspectors reviewed the licensee's MOV program document Procedure MS-123-125, "GL 89-10 MOV Valve Program Design Standard," Revision A, to determine the worst case design basis conditions for each sampled MOV. The design basis calculations for each of the sampled valves appeared to adequately evaluate the design basis conditions consistent with licensee commitments in response to GL 89-10.

1.1.1 Consideration of Single Failure Criteria

During review of Valve 3HV5686, the inspectors noted that the MEDP for closing had been revised from an original value of 160 psid to 0 psid. The licensee had revised the MEDP based on a reassessment of the susceptibility of the valve to mispositioning and the sequence of valve movements that would take place during a design basis event. According to the licensee, Valve 3HV5686 can only be operated from the control room by simultaneously depressing two control board handswitches. The licensee considered it unlikely that inadvertent remote closure could result from such a design feature. The licensee's evaluation stated that in the design basis event for this valve, the valve must be closed to isolate the line during a fire. By procedure, the outboard fire isolation valve would be isolated first, thereby, creating a zero differential pressure (d/p) across the inboard Valve 3HV5686. Although the licensee's evaluation method considered single equipment failures within the design basis for determining MEDP, the inspectors were concerned that a failure of the outboard fire isolation valve to close did not appear to be considered in the licensee's MEDP determination for the inboard isolation valve. In response to the inspectors' concern, the licensee stated that they would reevaluate the MEDP for Valve 3HV5686 and other valves for consistent application of single failure criteria. The licensee stated that this evaluation would be completed in 90 days. This issue was identified as an inspection followup item (361;362/9415-01).

1.2 MOV Sizing and Switch Setting Calculations

The inspectors reviewed Procedure MS-123-125, Revision A, for calculating MOV sizing and switch settings. This document provided guidance for performing valve population verifications; calculations of operational basis, degraded voltage, weak link, and setpoints; test data reconciliation; and changes to calculations. The inspectors considered this document to be a high quality product that appeared to incorporate the recommendations of GL 89-10. The inspectors reviewed the sizing and setpoint calculations for the sampled valves. The licensee's calculations for the sampled valves appeared to be adequate.

1.3 Testing and Data Analysis

The inspectors reviewed Procedure MS-123-125, Revision A, for performance of testing and data analysis. The licensee used this procedure to evaluate the results of their dynamic testing under d/p conditions. The procedure included the determination of apparent valve factor, stem factor, and load sensitive behavior for both the opening and closing direction. The inspectors observed that instrument inaccuracies were included in the determination of valve factor and stem factor.

1.3.1 Design-Basis Capability

The inspectors reviewed the design basis calculations and test packages for the selected valves. The selected valves were dynamically tested under the following conditions.

VALVE	CLOSE MAX D/P	CLOSE TEST D/P	% MAX D/P
3HV6367	87 psid	N/A	N/A
3HV8152	0 psid	>0 psid	>100
3TV9267	2505 psid	1930 psid	77
3HV5686	0 psid	>0 psid	>100

1.3.2 Lack of Indication of Hard Seat Contact

The inspectors noted that Valve 3TV9267 did not appear to completely close under the test d/p conditions. Although flow was stopped during the closing stroke, the inspectors noted a lack of indication of hard seat contact following flow isolation in the diagnostic test trace. After further review, the inspectors concluded that the valve had only marginally closed during the test. However, since Valve 3TV9267 was a Category A containment isolation valve requiring leak tightness, the inspectors were concerned that the valve may not be able to satisfy the specified leakage limit following closure under design basis conditions. The inspectors noted that the valve was tested at only 77 percent of the design basis d/p and 28 percent of the design basis flow rate.

Valve 3TV9267 was a flexible wedge gate valve with an SB-00 actuator. The licensee used "limit seating" rather than "torque seating" to control the closing stroke of this valve. Under the licensee's limit seating method, when the valve had reached the closed position, power to the actuator motor was interrupted by a limit switch in the actuator. The limit switch was manually set to actuate when the valve disk contacted the valve seat.

The inspectors noted that the static test diagnostic traces of Valve 3TV9267, which had been performed prior to the d/p test, indicated that the limit switch trip was properly set with the valve achieving hard seat contact before

the limit switch tripped. However, during the closing d/p stroke, the diagnostic thrust trace did not indicate that hard seat contact had occurred either before or after limit switch trip. The inspectors considered that two explanations were possible for the valve being able to reach the hard seat under static but not under d/p conditions. First, less inertia was available under d/p conditions with the valve stem travelling slower under load at motor cutoff. Stem ejection load due to system test pressure acting on the area of the valve stem also increases resistance to stem movement during dynamic testing. Second, the compensator spring of the SB model actuator may compress under d/p loading conditions prior to hard seat contact. Compression of the compensator spring prior to hard seat contact will introduce an error in limit switch setting. The error would cause the limit switch to actuate prior to the valve being fully closed. After that point, available inertia would be relied on to coast the valve to its final position.

Based solely on evaluation of the closing stroke diagnostic signature, the licensee acknowledged that Valve 3TV9267 may have failed to achieve hard seat contact during the d/p stroke. The licensee considered that the valve had successfully closed because a disk pullout peak was evident on the subsequent opening stroke diagnostic thrust trace. Additionally, the upstream and downstream pressure trace data indicated that flow was isolated approximately 1.7 seconds prior to the cessation of valve movement.

The inspectors considered that period of time after flow cutoff for the valve to continue to stroke and yet not contact the hard seat was unusually long. The licensee attributed this anomaly to the fact that this valve had a very wide seat (2.62 inches inner diameter, 3.75 inches outer diameter).

To address the inspectors' concern that the compensator spring may have compressed prematurely, the licensee contacted Limitorque and was able to confirm that the compensator spring installed in Valve 3TV9267 was a heavy model spring having a spring constant of 43,000 pounds per inch of compression. The preload on the spring appeared to be approximately 4000 pounds, based on review of the diagnostic traces. Since the d/p closing stroke stem thrust reached approximately 5500 pounds prior to limit switch trip, the compression of the compensator spring could account for 0.035 inch error in the limit switch setting causing premature actuation. The inspectors considered that, although only a small amount of error, this displacement coupled with decreased inertia prevented the valve from achieving positive indication of hard seat contact during the dynamic test. The inspectors concluded that the licensee's demonstration of design basis capability for Valve 3TV9267 appeared to be marginally adequate.

In addition to concern for the lack of hard seat contact, the inspectors were concerned that the licensee's testing did not address valve leakage requirements. The inspectors noted that the licensee did not require the local leak rate test leakage requirements of 10 CFR Part 50, Appendix J, to be verified after closure under dynamic conditions. The licensee stated local leak rate test testing under static closure conditions was the accepted method of assuring adequate leak tightness. The inspectors considered that the

adequacy of the local leak rate test testing appeared to be based on the assumption that static closure conditions were reasonably representative of design basis closure conditions. In response to the inspectors' concern, the licensee contacted the valve vendor (Westinghouse). According to the licensee, Westinghouse recommended that a sealing load of approximately 8000 to 11000 pounds should be applied after valve closure for controlling leakage. The licensee stated that a sealing load had not been previously specified by Westinghouse. The licensee stated that the switch settings of Valve 3TV9267 would be modified to achieve the recommended sealing force under static conditions and to achieve positive indication of hard seat contact under dynamic conditions. The licensee further stated that similar conditions would be verified for all wedge-type gate valves (whether limit or torque closed) that must meet safety-related leakage requirements. The inspectors found the proposed licensee actions to be adequate. The review of the completion of licensee actions was identified as an inspection followup item (361;362/9415-02).

1.3.3 Nonconservative Extrapolation Method

The inspectors identified a concern related to the licensee's method of extrapolating d/p closing thrust data. The inspectors found that the licensee's method for extrapolation of d/p thrust requirements incorporated on a combination of d/p test thrust data, static test thrust data and calculated thrust values, in an attempt to accurately extrapolate only the d/p dependent component of thrust. The inspectors were concerned that the licensee's method may not be conservative in all cases.

To determine the thrust required to close an MOV, the licensee's analysis consisted of the following six-step method.

(1) The maximum dynamic throttling thrust (i.e., the maximum stem load before seat contact) was obtained from the d/p test trace.

(2) The average running load, obtained from a previous static test trace, was subtracted to isolate the pressure dependent component of the thrust.

(3) A calculated stem rejection load based on the upstream pressure at flow isolation was subtracted to isolate the d/p dependent component of thrust.

(4) The d/p component of thrust was then extrapolated to the MEDP.

(5) The average static running load was added to the extrapolated d/p thrust.

(6) A calculated stem rejection load based on the maximum design basis pressure was added to derive the thrust requirement for closure under design basis conditions.

The inspectors noted that the licensee's extrapolation method was nonconservative for the sampled Valve 3TV9267. The inspectors observed that the d/p thrust evident directly in the dynamic test trace appeared to be greater than that derived by the licensee. This appeared to result from the average running load in the d/p test being less than assumed in the licensee's method. When extrapolated to MEDP, this larger d/p thrust would predict a higher thrust requirement for design basis conditions. Due to available excess capability, the inspectors concluded that Valve 3TV9267 was adequately sized despite the nonconservative extrapolation. The inspectors concluded that the licensee had not verified that the d/p test data was consistent with the assumptions in their standard extrapolation methodology.

In response to the inspectors' concerns, the licensee recalculated the required closing thrust loads for all 16 MOVs, which were d/p tested during the Cycle 6 outage. The licensee determined that in only two cases (Valves 3TV9267 and 2HV8161) was their method nonconservative. Neither case resulted in an operability concern. For the other 14 MOVs, the licensee stated that their method was more conservative than the method used by the inspectors. While acknowledging the licensee's finding, the inspectors reemphasized the licensee's lack of recognition of the inconsistency between the d/p data and calculated values used in extrapolating the data for Valve 3TV9267. The licensee stated that it would reevaluate the thrust data for Valve 3TV9267 to determine the reasons for the mismatch between assumptions and test results. Further, the licensee stated that it would perform a review to determine if the existing extrapolation methodology should be revised and review of the completion of licensee actions was identified as an inspection followup item (361;362/9415-03).

1.3.4 DC Motor Speed

The inspectors found that the licensee evaluated the adequacy of dc MOV stroke time during d/p testing. However, the licensee did not consider the effects of design basis d/p load and degraded voltage in their evaluation of the stroke time. The licensee committed to revise their Design Standard S123-25 to incorporate specific information for evaluating dc MOV stroke time under design basis load and degraded voltage. Review of the licensee actions to address design basis dc MOV stroke time will be inspection followup item (361;361/9415-04).

1.3.5 Flow Effects

Based on tabulated MOV test information provided by the licensee, the inspectors noted numerous examples where MOVs were tested at a high percentage of the MEDP but at a low percentage of the maximum expected flow. Since the MEDP was calculated as the difference between static pressure upstream and downstream of the MOV following closure (not computed in a real-time sense

from the pressure traces), the inspectors were concerned that the licensee was taking credit for test conditions that did not adequately mimic the dynamic forces that would exist in a design basis event. The licensee had performed some testing to sort out the relative contributions of d/p and flow on MOV thrust requirements and had tentatively concluded that d/p effects were predominant to an extent that flow effects appeared inconsequential. The inspectors noted that the licensee's position was based on testing of a limited sample of MOVs and that no analytic basis for the findings had been developed. The licensee agreed that additional effort was needed to justify its current practice of not accounting for flow rates in the extrapolation of MOV test data. This issue was identified as an inspection followup item (361;362/9415-05).

1.3.6 Extrapolation of Low DP Test Results

For MOVs that undergo partial d/p testing (under conditions less than design d/p and flow), the inspectors noted that the licensee had not established criteria to differentiate between one-stage and two-stage MOVs as defined in GL 89-10. According to its program, the licensee planned to demonstrate design basis capability for all valves within their program without relying on testing being conducted by the Electric Power Research Institute. The inspectors were not able to identify MOVs considered complete under the GL from those that require additional review. Extrapolation of low d/p test data had previously been considered too unreliable to predict MOV performance at design conditions. However, recent test data has indicated that extrapolation of low d/p test data is typically conservative because apparent valve factors tend to be higher during lightly loaded than fully loaded strokes. The inspectors observed that the licensee's test data was consistent with this recent industry data. The licensee stated that they are incorporating industry experience in establishing justification for their method of extrapolation of low d/p test data. The inspectors found the licensee's actions to be acceptable at this time.

1.3.7 Group Performance Assessment

The inspectors noted that the licensee had incorporated the group performance evaluation from its Cycle 8 outage into the setpoints for the remaining MOVs to be tested. The inspectors found the licensee's generic evaluation and feedback of group test results to be adequate.

1.4 Periodic Verification of MOV Capability

Every other refueling outage, the licensee conducts static diagnostic testing of each MOV. Each refueling outage preventative maintenance is performed, including stem lubrication and grease inspection. Every fourth refueling outage, each actuator is refurbished and static tested. The licensee plans to conduct selected periodic d/p testing as part of their periodic verification.

The inspectors found that the licensee had not yet identified the periodic d/p testing to be performed. The inspectors found that the licensee had implemented preventative maintenance tasks to periodically perform static testing.

1.5 Walkdown

During a tour of the plant, the inspectors observed the material condition of the following MOVs: 2HV-4713, 2HV-4716, 2HV-6495, and 2HV-6497. The inspectors found the external condition of the MOVs and general housekeeping in the areas to be adequate.

1.6 Overall Conclusions

- As an overall assessment, the inspectors concluded that the licensee's MOV program was generally capable of demonstrating the operability of MOVs subject to GL 89-10. The program was thorough and was being implemented in a manner consistent with the licensee's commitments to the GL.

- The licensee's program was generally effective in establishing assurance of design basis capability for the sampled motor-operated valves.

- The licensee was implementing a program consistent with their commitments to Generic Letter 89-10.

- Additional test acceptance criteria for limit seated motor-operated valves were required to assure valve closure and sealing.

- The licensee's method for extrapolating thrust requirements from dynamic testing was nonconservative for some motor-operated valves and considered a program weakness.

- Flow effects were not yet analytically justified.

- Additional consideration of design basis DC motor speed was required in the evaluation of motor-operated valve stroke time.

- Evaluation of the potential for pressure locking and thermal binding was not complete.

2 FOLLOWUP - ENGINEERING (92903)

2.1 (Closed) Violation 50-362/9317-01: Inadequate Documentation of MOV Test Signature Anomalies

This violation concerned indications of improper MOV operation during a March 23, 1992, diagnostic test of the Auxiliary Feedwater Control Valve 3HV-4705 which were not documented or promptly corrected. Indications

of improper MOV operation in the March 1992 diagnostic test signature showing cyclic thrust loads were not documented and corrected until August 1993. Auxiliary Feedwater Flow Control Valve 3HV-4705 failed to open during a routine test in May 1993. While no single root cause was identified, the licensee concluded that the probable cause of the failure was misalignment of the actuator on the valve and internal degradation of the actuator.

NRC Inspection Report 50-361;50-362/93-36 discussed this violation. The licensee had identified that 53 of the 75 MOVs tested during Cycle 6 displayed anomalies in the diagnostic thrust signatures. The inspectors were concerned that the licensee had not addressed the generic implications of the numerous apparent deficiencies in the condition of the MOVs tested.

The inspectors reviewed Engineering Procedure S023-V-3.50, TCN 0-2, "Technical Guidelines for Evaluating MOV Data." The inspectors found that the procedure required documentation of unusual characteristics observed in MOV diagnostic signatures. The licensee used this procedure to evaluate the abnormal traces. The assessment included a review to ensure that no operability concerns existed. The review was performed from December 1993 to February 1994. During the review, Valve 3HV-9203 was found to have torque switch hammering in the open to close direction. Nonconformance Report (NCR) 93110053 was prepared which contained an operability assessment determining the valve was operable for the interim since the hammering was limited and was within the thrust rating of the actuator. In addition, the inspectors reviewed a number of NCRs generated from MOV diagnostic tests. The NCRs were all after June of 1993.

The inspectors concluded that the licensee had documented and reviewed the 53 anomalies in the diagnostic thrust signatures from Cycle 6. In addition, from a review of the NCRs, the inspectors concluded that the licensee's current practice was to document and review discrepancies as they occurred.

2.2 (Open) Inspection Followup Item 50-361/9331-02: Auxiliary Feedwater (AFW) Trip/Throttle Valve Failure to Close

In August 1993, during an inservice test of the Unit 2 turbine driven AFW pump, the trip and throttle valve, 2HV-4716, failed to close when an operator attempted to close the valve from the control room. The licensee determined the failure was caused by dirty relay closing contacts. The licensee was able to duplicate the failure and replaced the contacts.

In October 1993, while attempting to shut down the AFW pump after a subsequent test, the valve again did not close. After the second failure, the licensee could not determine the root cause. The licensee replaced the torque switch and closing relay.

During a previous NRC inspection (NRC Inspection Report 50-361;362/93-31), the licensee had committed to complete their root cause evaluation of the failure of Valve 2HV-4716. As part of its initial evaluation, the licensee determined that the preventive maintenance (PM) program for electrical relays did not

include the direct current relays. The licensee committed to revise the PM program to include these relays. In addition, the licensee committed to inspect the relay contacts which had not been previously included in the routine PM procedure.

During this inspection, the inspectors reviewed the licensee's root cause analysis. The licensee stated that the remainder of the corrective actions previously identified had not yet been completed.

As part of their root cause evaluation, the licensee tested the torque switch to determine if it was faulty and could have contributed to the valve failure to close. In March 1994, the torque switch was tested by cycling it more than 50 times. A visual examination was also conducted which revealed no evidence of wear or damage.

The inspectors reviewed the root cause analysis portion of NCR 93080087, "Root Cause Evaluation of Auxiliary Contacts." The auxiliary contact blocks and the closing contractor were removed from the valve control circuitry for laboratory analysis. An examination of the closing contractor and the auxiliary blocks was performed visually and utilizing a scanning electronic microscope. In addition, analysis of the contact materials and contaminants was performed. The results of the examination revealed that mild contamination was present on most of the silver contacts. The root cause evaluation concluded that some of the contamination on the contacts could have caused the failure of the valve to close.

The inspectors concluded that the licensee had completed its root cause evaluation portion of this followup item, but the recommended correction had not been implemented.

Recommended corrective actions resulting from the root cause analysis included removing contamination on the contractor contacts and auxiliary block contacts by light burnishing of the contact surface areas with the equivalent to 600 grit sand paper and not using any chemical cleaning. The recommended frequency for burnishing was once per refueling outage.

Implementation of the recommended corrective action from the root cause evaluation including assurance that burnishing does not degrade the contacts, revision to the PM program and inspection of the affected relays remained open.

2.3 (Closed) Violation 361;362/9327-03: Verification of Work not Personally Performed

During a previous NRC inspection, the inspectors identified that licensee personnel had not followed Administrative Procedure SO123-VI-0.9, "Author's Guide for the Preparation of Orders, Procedures, and Instructions," Revision 3. Attachment 7 of this procedure required that verification signatures be the individuals who personally conducted the operation identified by the document. For verification of a procedural step as

performed, Procedure S0123-VI-0.9 required the signature of the individual who personally performed the verification. While performing Maintenance Procedure S023-I-5.4, TCN 4-3, "Pumps - Saltwater Cooling Pump Disassembly, Inspection and Assembly," a maintenance supervisor signed step 6.7.19 of the procedure when he had not personally performed the step. The licensee stated that the reason for the violation was a personnel error in correctly documenting work performed.

The inspectors reviewed the licensee's corrective actions. The licensee counselled the individuals involved on the need to adhere to documentation requirements. In addition, the inspectors reviewed Maintenance Procedure S0123-I-1.3, TCN 3-1, "Maintenance Documentation." This revision added a new Section 6.6 which gave specific instructions for signatures or initials on procedure steps. The inspectors concluded that the licensee's corrective actions were adequate.

2.4 (Closed) Violation 361;362/9327-01: Five Examples of the Failure to Follow Procedures

During a previous NRC inspection, the inspectors identified five examples where the licensee's personnel failed to follow procedures.

Maintenance Procedure S023-I-5.4, TCN 4-3, "Pumps - Saltwater Cooling Pump Disassembly, Inspection and Assembly," required that the coupling adjustment nut had satisfactory clearance to the motor coupling to allow rotation without contact. However, the activity was not accomplished in accordance with the procedure in October 1993 and the required verification was not performed. During this inspection, the inspectors reviewed the documentation of the licensee's corrective actions. The corrective actions included taking disciplinary action against the supervisor involved and counselling the individual on the requirement to follow procedural and equipment clearance verification requirements. In addition, on January 18, 1994, the maintenance manager met with the maintenance supervisors and cautioned them about proper documentation requirements as well as the Notice of Violation response.

Maintenance Procedure S023-I-5.31, "Pumps - Centrifugal Pump Packing Adjustment and Replacement," required adjustment of the diesel fuel oil transfer pump packing leakage to a specific leak-off rate. However, the activity was not accomplished in accordance with the procedure. In July 1993, the leak-off rate was recorded in the procedure at less than the minimum leak-off rate specified. The licensee's corrective actions included counselling the individual involved. In addition, the licensee relocated the packing leak-off instructions to a more appropriate procedure. During this inspection, the inspectors reviewed Procedure S023-I-5.23, TCN 2-8, "Diesel Fuel Oil Transfer Pump Maintenance," and found the procedure contained direction and acceptance criteria for packing adjustment and leak-off.

Procedure S03-XXVI-9.6818.0.1, "Emergency Diesels Starting Air System Compressors Performance Test," Revision 0, required that the dewpoint indicator used have an accuracy of plus or minus one degree Fahrenheit.

However, the dewpoint indicator used between November 1991 and February 1992 had an accuracy of plus or minus four degrees Celsius. During this inspection, the inspectors reviewed the corrective action which consisted of training conducted on November 18, 1993. The training consisted of the need to verify measure and test equipment accuracy in accordance with procedure SO123-II-1, "Calibration and Control of Measure and Test Equipment," Revision 3.

Procedure SO123-III-6.5, "Oil Sampling and Analysis Program," Revision 0, required that a sample be drawn and analyzed annually from the Unit 2 turbine driven AFW pump turbine outboard bearing housing. However, activities were not accomplished in accordance with the procedure. In October 1993, the licensee did not maintain a file copy of the oil sample test results. During this inspection, the inspectors reviewed TCN 1-1 to Procedure SO123-III-6.5 and determined that the procedure had been revised to reflect the correct oil sampling frequency and sampling locations. The associated procedures were also revised to reflect the correct frequency.

Procedure SO23-V-3.25, TCN 0-2, "Component Cooling Water Heat Exchanger Testing," required verification signatures for a number of steps. When the procedure was completed in January 1992, verification signatures were missing from three of the steps. During this inspection, the inspectors reviewed the documentation of the licensee's corrective actions. The licensee counselled the supervisor involved. In addition, training on verbatim compliance was given on March 21, 1994, to the station technical engineers.

The inspectors concluded that the licensee had completed adequate corrective actions.

2.5 (Closed) Deviation 361;362/9336-01: Degraded Voltage Capability of DC MOVs

Based on additional information and corrective actions identified by the licensee in their response to the Notice of Deviation, this deviation was withdrawn. Corrective actions identified by the licensee in their response were found to be adequate.

During this inspection, the inspectors found that the licensee had revised Design Standard MS-123-125, Revision A, to adopt the manufacturer's (Limitorque) method for determining actuator capability under degraded dc voltage conditions. The inspectors found the licensee corrective actions to be adequate.

3 FOLLOWUP (92701)

(Closed) Inspection Followup Item 50-361;362/9317-02: Pressure Locking and Thermal Binding of MOVs

During a previous NRC inspection, the inspectors identified that the licensee's evaluation of pressure locking and thermal binding of MOVs was

incomplete and a potential program weakness. The licensee had evaluated the potential for pressure locking and thermal binding of gate valves and identified 27 valves, which met their screening criteria for being susceptible. The licensee's preliminary analysis had indicated that the operability of all of the susceptible MOVs could be justified by analysis. The licensee had planned no hardware modifications. The licensee planned to issue their evaluation in Technical Paper TP-9 in Appendix XIII of their Design Standard MS-123-125.

During this inspection, the inspectors reviewed MOV Technical Paper 009, "Thermal Binding and Pressure Locking," Revision 0. The purpose of the Technical Paper was to develop an evaluation criteria for identification of safety-related gate valves in the GL 89-10 MOV program which might be susceptible to pressure locking or thermal binding. Eighty six valves were included in the review including 55 WKM split disc gate valves, 14 Target Rock parallel disc gate valves which the licensee analyzed for pressure locking. The remaining valves were ALOYCO and Westinghouse wedge gate valves. The Westinghouse valves were analyzed for both thermal binding and pressure locking and the ALOYCO valves for thermal binding only.

The licensee considered that WKM valves were not likely to become pressure bound because the valve design included an internal pressure relief valve to vent the bonnet cavity to the upstream side of the disc. Since the setpoint of the relief valve was 250 ± 50 psig, the licensee analyzed the capability of the valves to open with a 300 psig bonnet pressure in excess of a the upstream pressure.

The licensee considered a valve to be susceptible to thermal binding if (a) the system temperature could exceed 200°F, (b) the valve would close while hot, and (c) the valve would subsequently cool down 100°F prior to opening. If the valve was susceptible to thermal binding, an operability assessment would be made.

For valves with internal bonnet pressure relief devices, the licensee evaluated the MOV capability to open under degraded voltage conditions at the relief valve setpoint. Valves without any bonnet pressure relief capability were evaluated to determine if the worst case thrust requirements under pressure locked conditions were less than the available actuator output thrust under degraded voltage conditions.

The licensee's preliminary Calculation A-94-NM-MOV-PL/TB-001, "Pressure Locking and Thermal Binding for SONGS GL 89-10," was reviewed by the inspectors. This calculation used the guidelines specified in Technical Paper TP-009 for analyzing valves for pressure locking or thermal binding.

The inspectors noted that many of the valves were justified as acceptable and not degraded based on the actuator being capable of opening the valve against pressure lock or thermal binding. The licensee stated that this calculation and all evaluations would be completed by August 1, 1994. The inspectors identified the review of the completed calculation and any corrective actions due to the results of the calculation as Inspection Followup Item 361;362/9415-06.

ATTACHMENT

1 PERSONS CONTACTED

1.1 Licensee Personnel

*D. Axline, Engineer, Onsite Nuclear Licensing
*M. Anderson, Supervisor, Nuclear Engineering Design Organization
*D. Bradford, Engineer, Nuclear Engineering Design Organization
*C. Brandt, Engineer, Quality Assurance
*D. Brieg, Manager, Station Technical
*C. Cash, Manager, Nuclear Maintenance
*J. Curran, Generic Letter 89-10 Project Manager, Nuclear Engineering Design Organization
*E. David, Lead Engineer, MOV Group, Nuclear Engineering Design Organization
*G. Gibson, Supervisor, Onsite Nuclear Licensing
*D. Herbst, Manager, Site Quality Assurance
*M. Herschthal, Manager, Nuclear Systems Engineering
*B. Joyce, Maintenance Manager, Units 2 and 3
*J. Leavitt, MOVATS Supervisor, Maintenance
W. Marsh, Manager, Onsite Nuclear Licensing
*R. McPherson, Engineer, Maintenance Engineering
*D. Niebruegge, Motor-Operated Valve Group, Supervising Engineer, Station Technical
*G. Plumlee, III, Lead Engineer, Onsite Nuclear Licensing
*J. Reilly, Manager, Nuclear Engineering and Construction
*M. Wharton, Manager, Nuclear Engineering Design Organization
*T. Yackle, Manager, Nuclear Mechanical, Nuclear Engineering Design Organization
*R. Zbavitel, Engineer, Station Technical

1.2 NRC Personnel

*J. Russell, Resident Inspector

The inspectors also held discussions with other licensee and contractor personnel during the course of the inspection.

*Denotes those attending the exit meeting.

2 EXIT MEETING

An exit meeting was conducted on April 29, 1994. During this meeting, the inspectors reviewed the scope and findings of the report. The licensee acknowledged the inspection findings documented in this report. The licensee did not identify as proprietary any information provided to or reviewed by the inspectors.