



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
ATLANTA, GEORGIA 30323-0199

Report No.: 50-261/94-06

Licensee: Carolina Power and Light Company
P. O. Box 1551
Raleigh, NC 27602

Docket No.: 50-261

License No.: DPR-23

Facility Name: H. B. Robinson

Inspection Conducted: March 28 - April 1, 1994

Lead Inspector: E. H. Girard 4/28/94
E. Girard Date Signed

Other Inspectors: M. Hunt
M. Miller

Other Personnel: R. Cain, Consultant (EG&G Idaho, Incorporated)

Approved by: C. Casto May 9, 94
C. Casto, Chief Date Signed
Test Programs Section
Engineering Branch
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SUMMARY

Scope:

This special, announced inspection examined the implementation of the licensee's motor-operated valve (MOV) program to meet commitments in response to Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance." The inspectors utilized the guidance provided in Temporary Instruction (TI) 2515/109 (Part 2), "Inspection Requirements for Generic Letter 89-10; Safety-Related Motor-Operated Valve Testing and Surveillance." As delineated in Part 2 of TI 2515/109, this inspection was the initial review of the licensee's MOV program implementation in response to GL 89-10.

The inspectors reviewed the GL 89-10 design calculations, test packages, and diagnostic signature traces for a selected sample of 14 MOVs. They also examined the licensee's actions in response to related previously identified open items and a violation.

Results:

Based on the evaluation completed, the inspectors concluded the licensee was implementing a satisfactory GL 89-10 MOV program. However, program implementation had not been completed and additional NRC evaluation will be required. The inspection described in this report identified the following inspector followup items (IFIs) that require further evaluation:

- (Open) IFI 50-261/94-06-01, Margin for Load Sensitive Behavior. (Section 2.2)
- (Open) IFI 50-261/94-06-02, Correction of Maximum Settings for Torque Switch Repeatability. (Section 2.2)
- (Open) IFI 50-261/94-06-03, Actions to Ensure Capabilities of RHR-744 Valves. (Section 2.2)
- (Open) IFI 50-261/94-06-04, Revision of Design Criteria Assumptions Based on Test Data. (Section 2.3)
- (Open) IFI 50-261/94-06-05, Adequacy of Periodic Verification Methods. (Section 2.4)
- (Open) IFI 50-261/94-06-06, MOV Post Maintenance Testing. (Section 2.3)
- (Open) IFI 50-261/94-06-07, Mispositioning. (Section 2.10.c)
- (Open) IFI 50-261/94-06-08, Setting Closed-to-Open Bypass Switch Limit. (Section 2.10.e)

A previously identified violation and ten other open items were closed.

- (Closed) Violation 50-261/92-19-01, Inadequate Design Control Involving Unverified Assumptions Related to DP for Valves FW-2V-6A, B, and C. (Section 2.10.a)
- (Closed) Open Item 50-261/91-201-01, Determination of Design Basis Flow Rate. (Section 2.10.b)
- (Closed) Open Item 50-261/91-201-02, Failure to Review Mispositionable Valves. (Section 2.10.c)
- (Closed) Open Item 50-261/91-201-03, Undersized Actuators for Valves FW-V2-6A, 6B, and 6C. (Section 2.10.d)
- (Closed) Open Item 50-261/91-201-04, Setting of Closed-to-Open Bypass Limit. (Section 2.10.e)
- (Closed) Open Item 50-261/91-201-05, Procedures for Controlling Design-Basis Testing. (Section 2.10.f)

- (Closed) Open Item 50-261/91-201-06, Periodic Verification of MOV Operability. (Section 2.10.g)
- (Closed) Open Item 50-261/91-201-07, Inadequate Documentation and Corrective Action for MOV Deficiencies. (Section 2.10.h)
- (Closed) Open Item 50-261/91-201-08, MOV Setpoint Document Control of Switch Settings. (Section 2.10.i)
- (Closed) Open Item 50-261/91-201-09, MOV Post Maintenance Testing. (Section 2.10.j)
- (Closed) Open Item 50-261/91-201-10, Failure to Periodically Test Thermal Overloads. (Section 2.10.k)

Strengths

The following strengths were noted during the inspection:

Trending program

All valves practicable to test were tested in accordance with GL 89-10

Tests were well-documented

No violations or deviations were identified in this inspection.

REPORT DETAILS

1.0 Persons Contacted

- *A. Canterbury, Manager, Component Engineering
- W. Clark, Manager, Maintenance
- *S. Farmer, Manager, Inservice Inspection
- *D. Gudger, Regulatory Affairs
- C. Hinnant, Vice President, Robinson Plant
- G. Hoffman, Clerk
- *K. Jury, Manager, Licensing/Regulatory Programs
- *R. Krich, Manager, Regulatory Affairs
- *S. McCutcheon, MOV Component Specialist
- M. McDaniel, MOV Mechanical Engineer (NED)
- W. McGoun, Senior Engineer (NED)
- M. Murdock, MOV Engineer (NED)
- B. Nauhria, MOV Engineer (RNP NED)
- A. Nguyen, Component Engineer
- C. Olexik, Manager, Plant Assessment Section
- M. Page, Manager, Mechanical Engineering (RNP NED)
- E. Paine, Mechanical Evaluation and Analysis Subunit
- M. Pearson, Plant Manager
- A. Redpath, Engineer, Harris Engineering Support Section
- S. Roberts, MOV Electrical Engineer (NED)
- R. Steele, Manager, Maintenance Programs
- R. Wehage, Manager, Mechanical Subunit (RNP NED)
- *R. Williamson, MOV Component Specialist

NRC Personnel

- *W. Orders, Senior Resident Inspector
- *B. Mozafari, Project Manager, Office of Nuclear Reactor Regulation

*Denotes personnel that attended the exit meeting.

Acronyms and initialisms used throughout this report are listed in the last paragraph.

2.0 GENERIC LETTER (GL) 89-10 "SAFETY-RELATED MOTOR-OPERATED VALVE [MOV] TESTING AND SURVEILLANCE" (2515/109)

On June 28, 1989, the NRC issued GL 89-10, which requested licensees and construction permit holders to establish a program to ensure that switch settings for safety-related MOVs were selected, set, and maintained properly. Subsequently, six supplements to the GL 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 (TI) 2515/109, "Inspection Requirements for Generic Letter 89-10, Safety-Related Motor-Operated Valve Testing and Surveillance." TI 2515/109 is divided into Part 1, "Program Review," and Part 2, "Verification of Program Implementation."

The current inspection is the initial TI 2515/109 Part 2 program implementation inspection. The TI 2515/109 Part 1 program review for Robinson was conducted June 10 through 14, 1991; and was documented in NRC Inspection Report 50-261/91-201, dated July 25, 1991.

The principal focus of this inspection was to evaluate in depth the implementation of GL 89-10 for a sample of MOVs selected from the licensee's program. The MOV sample was chosen from a list of valves that had received differential pressure (DP) testing. The majority of the valves selected were gate valves with high design-basis DP (DBDP) operating requirements. The MOVs in the sample were as follows:

<u>Valve No.</u>	<u>MOV Function, Size, and Type</u>
AFW-V2-14A	SDAFW Pump Discharge Valve to Steam Generator A 4 inch double disc gate
AFW-V2-16A	AFW Header Discharge Valve to Steam Generator A 4 inch double disc gate
CC-749B	RHR Heat Exchanger B Cooling Water Isolation Valve 16 inch solid wedge gate
FW-V2-6A	Feedwater Header Section Valve 16 inch solid wedge gate
MS-V1-8A	Steam Admission Valve to SDAFW Turbine 2 inch double disc gate
RHR-744A	RHR Loop to RCS Cold Leg Valve 10 inch flex wedge gate
RHR-744B	RHR Loop to RCS Cold Leg Valve 10 inch flex wedge gate
RHR-759B	RHR HX B Outlet Isolation Valve 10 inch solid wedge gate
SI-845B	CV Spray Additive Tank Discharge Valve 2 inch globe
SI-866A	Loop 3 Hot Leg Injection Valve 2 inch globe
SI-869	Loop 2 and 3 Hot Leg Injection Shutoff Valve 3 inch double disc gate
SI-870A	Boron Injection Tank Outlet Isolation Valve 3 inch double disc gate
SI-880C	CV Spray Pump B Discharge Isolation Valve 6 inch double disc gate

V6-16B

SW to Turbine Building Isolation Valve
16 inch butterfly

This inspection also evaluated actions which the licensee had taken to correct a related violation and weaknesses identified in previous inspections, as described in Section 3.0 of this report.

Based on the evaluation completed during this inspection, the inspectors concluded that the licensee was implementing an acceptable MOV program in response to GL 89-10. Additional NRC evaluation is planned to complete the evaluation of some areas and to address specific findings identified as followup items below. Details of the inspection and the findings are provided in the following sections of this report.

2.1 Design-Basis Reviews

The inspectors reviewed the licensee's Design Basis Differential Pressure Reports and their referenced documentation together with applicable operational procedures, system flow drawings, pump curves, the System Description Procedure, and the Design-Basis Documents and verified that the maximum flow and differential pressure were determined. The calculations of differential pressure, electrical degraded grid voltage, flow, and temperature were reviewed and verified to be complete and correct. Calculations of thrust and torque were verified to use appropriate inputs of design DP, degraded voltage, and temperature corrected motor torque capabilities. The inspectors verified that the licensee completed the DBDP Reports for all the safety-related systems and addressed flow. The design-basis fluid flow rate was included in the "Assumptions Section" of the thrust calculations for each MOV. These thrust calculations were titled "Mechanical Analysis and Calculation for [Valve No]."

The licensee had been notified of the effects of elevated temperature on motor torque through a Potential 10 CFR Part 21 Notice dated May 13, 1993 and Technical Update 93-03 (March 1993) issued by Limatorque Corporation. The inspectors examined Design Guide DG-V.67, "Electrical Evaluation of AC Powered Motor-Operated Valves," and Calculation EE107-CS-58, "AC MOV Calculated Available Torques for Various Voltage Scenarios," and verified that the effects of elevated temperature were properly addressed for the licensee's MOVs.

The inspectors concluded the licensee had adequately implemented the design-basis recommendations of GL 89-10 for design-basis reviews.

2.2 MOV Sizing and Switch Setting

The inspectors reviewed the licensee's Design Guide DG-I.11, "Design Guide for Limatorque Motor-Operated Valve Mechanical Evaluations," Revision 6, dated July 27, 1993, which specified the use of a standard industry equation for calculating thrust for gate and globe valves. Except in the case of valves provided by Westinghouse, the licensee used a valve factor of 0.40 for gate valves and 1.10 for globe valves for

development of the initial thrust setting window. For Westinghouse valves, the licensee used data provided by the valve manufacturer, where available, or assumed a valve factor of 0.55 in the opening and closing direction. The valve's mean seat diameter was used to calculate the valve disc seat area. Further, a stem friction coefficient of 0.20 was used to calculate the minimum required torque. The minimum required thrust was increased for diagnostic equipment inaccuracies and torque switch repeatability by adding the values of these error factors.

During review of the licensee's thrust calculations, it was noted that a margin was not included for load sensitive behavior (also known as "rate of loading"). Licensee personnel stated that their evaluation of test data did not indicate an appropriate amount of margin to be set aside for load sensitive behavior. They stated that the previously mentioned additions of the diagnostic and torque switch repeatability accuracies (rather than using the square root of the sum of the squares method) to the calculated minimum thrust requirement increased the conservatism of their minimum required thrust settings and would account for load sensitive behavior. The licensee's justification that this margin will be adequate for MOVs that cannot be tested at or near design-basis differential pressure is to be evaluated in a subsequent NRC inspection and is identified as Inspector Followup Item 50-261/94-06-01, Margin for Load Sensitive Behavior.

The inspectors noted that the calculated maximum thrust limit was not reduced for torque switch repeatability. However, the limit did include a 10 percent safety margin. This margin would be adequate to address torque switch repeatability except at numerical switch settings of 1, where the repeatability error may be as great as 20 percent (Reference Limitorque Maintenance Update 92-2 for repeatability error). At the end of this inspection, the licensee initiated a procedural change to provide for the repeatability error. The matter will be evaluated further in a subsequent NRC inspection and is identified as Inspector Followup Item 50-261/94-06-02, Correction of Maximum Settings for Torque Switch Repeatability.

In reviewing the licensee's calculations, the inspectors found that the motor torque provided for valves RHR-744A and B was marginal and that 744A had recently failed to open during a surveillance test. When the licensee had re-evaluated motor torque as a result the Part 21 report and Limitorque Technical Update referred to in Section 2.1 above, they initially determined that RHR-744A and B did not have adequate torque in the opening direction. The licensee recalculated the minimum available torque for the opening stroke per Limitorque Technical Update 93-03 and found the torque marginally adequate under degraded voltage conditions. A check of Adverse Condition Reports (ACRs) by the inspectors found that valve RHR-744A had failed to open during surveillance test OST-252, conducted February 1, 1994, during a plant outage. The inspectors reviewed the licensee's identification and disposition of this event documented in ACR 94-00249. The operators on shift during the event had attempted to reset the breaker and thermal overloads before an investigation of the failure, possibly removing evidence of the root

cause. The shift log indicated the valve was actuated and correctly opened following the resetting. The valve operated properly in troubleshooting performed following the failure and documented on Work Request 94-ACMG1 completed February 7, 1994. The cause was not identified in the ACR. The inspectors were informed that the open torque switch setting had been found at a setting that had been acceptable previously, but that no longer applied. The setting was raised to the current requirement, which was the maximum allowed by the limiter plate, as specified in the Electronic Database System (EDBS). The inspectors verified that the EDBS specified this setting and that Work Request 94-ACMG1 documented this as-left setting. Considering the failure experienced on valve RHR-744A and the marginal capabilities of both RHR-744 valves, the inspectors questioned whether additional actions were being taken to ensure the valves remained operable. In response, licensee personnel provided copies of Plant Improvement Requests 94-019/00 and 93-059/00. The former was for replacement of the motor feeder cables, which would result in increased motor torque margin. The latter increased the range of open torque switch bypass, which would aid in assuring that the maximum actuator torque would be available for opening. The inspectors considered these appropriate actions. The licensee's completion of actions to ensure the capabilities of the valves is identified as Inspector Followup Item 50-261/94-06-03, Actions to Ensure Capabilities of RHR-744 Valves.

From the evaluation completed, the inspectors concluded that the licensee had satisfactorily implemented sizing and switch settings for the valves with diagnostic thrust measured near DBDP. The adequacy of sizing and switch settings for other valves will be determined after the licensee has completed program implementation. Two followup items (-01 and -02) were identified which appeared to represent weaknesses in the licensee's sizing and switch setting criteria and require further evaluation. A third followup item was identified for confirmation of the licensee's action to correct the marginal capabilities of valves RHR-744A and B.

2.3 Design-Basis Capability

The licensee had identified 64 MOVs within its GL 89-10 program. The inspectors were informed that all of the valves had been set and design-basis DP tests had been performed for those valves where it was practicable (48 valves).

The inspectors reviewed the licensee's test procedures, completed test packages, and VOTES diagnostic static and dynamic test traces for the MOVs listed in Section 2.0, except valves CC-749B, RHR-744B, and SI-880C. Independent calculations were performed by the inspectors, using the licensee's test results, to assess MOV capabilities and determine if the licensee's assumptions were justified. The results of these reviews are discussed in the following paragraphs.

Valve factors obtained from the test data were examined by the inspectors. The closing gate valve factors ranged up to 0.7 (Valve MS-VI-8A). Based on this, the valve factor assumptions which the licensee

used in calculating thrust settings for gate valves was not always bounding. In the initial valve setups a valve factor of 0.40 had often been used by the licensee. The inspectors' review suggested this was too low. Licensee personnel agreed that a valve factor greater than 0.40 would be appropriate if an initial setup was required in the future for a new valve or replacement. It was the inspectors' understanding that Design Guideline DG-I.11 would be revised to include the best available data for valve factors. The inspectors considered the feedback of best available data for valve factor into the licensee's Design Guideline important and identified this as Inspector Followup Item 50-261/94-06-04, Revision of Design Criteria Assumptions Based on Test Data.

The inspectors verified that the operability reviews were performed on MOVs prior to returning them to service after differential pressure testing. The review requirement was documented in TMM-035, Attachment 6.1, "Analysis of MOV Diagnostic Data." In accordance with the procedure, site engineering personnel determined the valve stem thrust at flow cut-off (adjusted for running loads) from diagnostic test results and calculated a valve factor. This valve factor was used to calculate design-basis thrust requirements. The design-basis thrust requirements were then compared to the thrust measured at torque switch trip to verify a satisfactory margin and confirm operability. At a later date valve factor, load sensitive behavior, and stem factor were calculated by the licensee's Nuclear Engineering Department (NED) and then compiled into a complete package for each tested MOV.

In examining the operability reviews described in the previous paragraph the inspectors found that design-basis thrust in the open direction had not been determined for valves AFW-V2-14A, RHR-759B, and MS-V1-8A, which had active safety functions in the opening and closing directions. Calculations of opening requirements performed by the inspectors using the licensee's data demonstrated that these valves had adequate opening capabilities for design-basis conditions and that there was no operability concern. Further, the inspectors noted that adequate post return to service determinations were performed later by NED which adequately evaluated design-basis performance in the open direction. To ensure that any future site operability reviews of diagnostic test results included valve opening requirements, the licensee initiated a change to their procedure TMM-035. The inspectors reviewed the revised procedure (Rev. 6) and found that it appeared adequate.

Summary information on all valves in the licensee's test program indicated that adequate diagnostic thrust measurements could not be obtained for 13 of the 48 valves dynamically tested. The tests on these 13 valves were performed at or near design-basis differential pressure. Licensee personnel indicated they were developing justifications for setup of these valves as-well-as for the MOVs that were not practicable to test at or near design-basis DP. The justifications will be addressed in a subsequent NRC inspection of the licensee's program implementation. The justifications will be addressed in a subsequent NRC inspection of the licensee's program implementation. The licensee's prompt analysis and feedback of the results of testing to ensure the operability of

valves that could not be adequately tested will be evaluated in that inspection.

Based on the review and evaluation completed, the inspectors concluded that the licensee had adequately implemented design-basis testing in accordance with GL 89-10. A followup item (-04) was identified to verify that the licensee appropriately revises the valve factors assumed in its design criteria, based on testing results. Additional NRC evaluation of the licensee's implementation of actions to assure the design-basis capabilities of MOVs is planned. The evaluation will include actions for valves that could not be adequately tested to demonstrate design-basis capabilities, such as valves that were not practicable to test at or near full DP and valves that were tested at less than DBDP without thrust measurements.

2.4 Periodic Verification of MOV Capability

Recommended action "d" of the generic letter requests the preparation or revision of procedures to ensure that adequate MOV switch settings are determined and maintained throughout the life of the plant. Section "j" of the generic letter recommends surveillance to confirm the adequacy of the settings. The interval of the surveillance was to be based on the safety importance of the MOV as well as its maintenance and performance history, but was recommended not to exceed five years or three refueling outages. Further, GL 89-10 recommended that the capability of the MOV be verified if the MOV was replaced, modified, or overhauled to an extent that the existing test results are not representative of the MOV.

The licensee's MOV coordinator stated that static diagnostic tests were to be used to periodically verify MOV capabilities as follows:

The periodic verification is to begin Refueling Outage (RFO) 16 (one outage following completion of all design-basis differential pressure testing).

Scheduling is controlled through the licensee's AMMS database, with the static diagnostic test to be performed in association with Preventive Maintenance Procedure PM-423 (electrical inspection).

The period between verifications is now set at two RFOs but may be changed.

Capabilities of valves that cannot be statically diagnostic tested due to sensor problems (e.g., reversal) will be verified by partial diagnostic testing using the calibrator as auxiliary sensor and measuring motor current. For Accumulator discharge MOVs even the calibrators cannot be practically mounted and only motor current will be checked (Note: Removal of these valves from the program is being evaluated by the licensee).

The capabilities of only a portion of the valves will be verified during RFO 16. The remaining valves will be verified either RFO 17

or 18. The valves to be verified during each of these outages has not been fully established.

The inspectors viewed the AMMS for valve AFW-V2-16A and confirmed that this GL 89-10 MOV was scheduled for static diagnostic testing as preventive maintenance at a two RFO frequency. They informed the licensee that the adequacy of static diagnostic testing and other methods involving less than design-basis conditions for periodic verification of MOV capabilities had not been established but is an industry issue recognized by the NRC. The adequacy of the methods used by the licensee for periodic verification of valve capabilities is identified as Inspector Followup Item 50-261/94-06-05, Adequacy of Periodic Verification Methods.

The inspectors reviewed the requirements that would apply to maintenance operations, which were specified in Appendix A of Procedure MMM-003, Rev. 39, Maintenance Work Requests. The inspectors found that static diagnostic testing was specified to verify required thrust following limit switch removal or replacement (for limit closed rising stem valves), operator overhaul, packing maintenance, and valve overhaul or replacement. The inspectors indicated the adequacy of static testing to verify thrust was not adequately justified for valve replacement or overhaul. The inspectors were informed that the licensee plans to revise MMM-003, Appendix A. The licensee was informed that the adequacy of the revisions to post maintenance testing requirements would be identified as Inspector Followup Item 50-261/94-06-06, MOV Post Maintenance Testing.

The inspectors were informed that post modification testing would be specified for a given modification consistent with post maintenance test requirements. They reviewed the requirements specified by the licensee's Nuclear Plant Modification Program, Rev. 4, and found that it contained rather general criteria for testing all components. Licensee personnel stated that proper post modification testing would be assured by requiring that the Nuclear Engineering Department MOV group review significant design changes involving safety-related MOVs. The inspectors verified that a memo, dated February 16, 1993, had been issued to clarify that the MOV group was to review design changes that could effect MOV capabilities. The memo specifically referenced the licensee's commitment to establishing and maintaining a design basis meeting GL 89-10 recommendations.

The licensee's implementation of GL 89-10 recommendations in this area will require further evaluation to assure adequate post maintenance testing is specified and to assure that the methodology specified for periodic verification is adequate. The issues will be examined in a subsequent inspection and are identified above as inspector followup items.

2.5 MOV Failures, Corrective Actions, and Trending

Recommended action "h" of the generic letter requests that licensees analyze and justify each MOV failure and corrective action. The

documentation should include the results and history of each as-found deteriorated condition, malfunction, test, inspection, analysis, repair, or alteration. All documentation should be retained and reported in accordance with plant requirements. It is also suggested that the material be periodically examined (every two years or after each refueling outage after program implementation) as part of the monitoring and feedback effort to establish trends of MOV operability.

The inspectors reviewed the four Adverse Condition Reports (ACR) related to MOV problems listed below:

ACR No.	CONDITION
93-168	<p>During DP Test SP 1181, SI-866A failed to close against SI pump pressure. SI-866A is required to open to perform its safety function.</p> <p><u>Corrective Action:</u> A burr was found in the yoke area of the anti-rotation device and removed. The anti-rotation device was replaced. The MOV was retested and met all test requirements.</p>
93-175	<p>When SI-845B was tested after refueling maintenance had been performed, the valve would not operate due to a locked motor.</p> <p><u>Corrective Action:</u> Residue grease from the original greases used in the operators had leaked into the motor due to a cracked bearing seal. The motor was replaced and the valve tested. The corrective actions were satisfactory.</p>
93-194	<p>An operability determination concern related to RHR-744A was not processed properly by operations personnel.</p> <p><u>Corrective Action:</u> There was no fuel in the vessel at the time and no operability determination was required at the time. A review of this ACR was conducted with the personnel involved, stressing the importance of communication and followup.</p>
93-290	<p>Feedwater block valves had dual indication when they were tested per the Special Procedure 1178 (DP Testing of V2-6A, B, & C). The valves did not completely close even though they were set per the calculated values.</p> <p><u>Corrective Action:</u> Due to the effects of an increased valve factor caused by "rate of loading", the valves only closed to 95 percent. To overcome this condition the torque switch bypass in the close direction was installed to assure closure under design conditions.</p>

The inspector reviewed four MOV Failure Trending Reports that covered the period from January 1, 1991, to December 31, 1993. The reports were developed from information contained in Work Requests and were intended to identify common mode MOV failures and provide tracking information for future MOV performance evaluations. These reports divided information regarding the identified MOV failures into coded failure categories. The reports included tables and charts that provided information for

comparison of failures of MOVs included in the GL 89-10 program to those that are not part of the program.

The program for trending appeared to be a thorough well planned effort that providing useful information to support the GL 89-10 program. The trending program was considered a strength.

Based on the documents reviewed and discussions with the personnel involved in activities that support corrective actions and trending, the inspectors concluded that the licensee has an acceptable method for correcting and tracking MOV failures and deficiencies.

2.6 Schedule

In GL 89-10, the NRC requested that licensees complete all design-basis reviews, analyses, verifications, tests, and inspections that were initiated in order to satisfy the generic letter recommendations by June 28, 1994, or three refueling outages after December 28, 1989, whichever is later. The licensee committed to the generic letter schedule and, as three refueling outages have already occurred, the June 28, 1994, completion date applies.

The licensee identified 48 valves in the GL 89-10 program that were determined practicable to DP test. The inspectors were informed that all of these valves had been tested, that preliminary analyses of all test results had been performed, and that remaining final analyses were in process. The completion of testing and preliminary analyses was verified by the inspectors for their selected sample of MOVs. Based on their review for the sample and their discussions with licensee personnel, the inspectors believe the licensee is progressing satisfactorily to meet the specified completion schedule.

2.7 Pressure Locking and Thermal Binding

The Office for Analysis and Evaluation of Operational Data has completed a study of pressure locking and thermal binding of gate valves. It concluded that licensees have not taken sufficient action to provide assurance that pressure locking and thermal binding will not prevent a gate valve from performing its safety function. The NRC regulations require that licensees design safety-related systems to provide assurance that those systems can perform their safety functions. In GL 89-10, the staff requested licensees to review the design basis of their safety-related MOVs.

The licensee submitted a Licensee Event Report 82-011 which identified the pressure locking phenomenon which occurred August 11, 1982 during RHR. System Component tests. Motor-operated valve SI-861A would not fully open. Valves SI 861-A and B were modified by drilling a 3/8 inch hole in the high pressure discs as directed by Modification No. 677. A study that followed identified 12 other valves that required modifications to prevent disc warpage caused by the effect of pressure locking. These

modifications were performed during the steam generator replacement outage under Modification No. 792.

Thermal binding was identified on three feedwater block valves in the late 1980s. Operating procedures were changed to require the manual cycling of these valves during cool down of the system. The licensee reports that no further problems with thermal binding have been experienced.

The licensee's evaluation of INPO SOER 84-07 determined that the modifications to the Safety Injection valves to overcome pressure locking agreed with the INPO recommendation. Review of Information Notice 92-016 by the licensee determined that no further corrective actions were required. The NRC will issue additional recommendations regarding pressure locking and thermal binding in the future.

2.8 Motor Brakes

The licensee had identified ten MOVs that were equipped with brake mechanisms. The engineering evaluations (EEs) for the continued operation of these MOVs was reviewed by the inspectors. These engineering evaluation reports are listed as follows:

<u>EE No.</u>	<u>Valve No.</u>
93-160	SI-865A, B, and C, Safety Injection Accumulator A, B, and C Discharge Isolation Valves
93-161	SI-880A, B, C, and D Containment Spray Pump A and B Discharge Isolation Valves
93-162	CC-716 A and B RC Pump Cooling Water Inlet Isolation Valves, and CC-730 RC Pump Cooling Water Return Isolation Valve

In EE-93-160 valves SI-865A, B, and C were determined to be capable of performing their intended safety function based on the fact that the valves are open under normal operating conditions and are therefore ready to allow the accumulators to discharge into the RC system if needed.

EE-93-161 and EE-93-162 contained the necessary evaluations to determine that the brakes will function after a seismic event and are electrically acceptable for operation at degraded voltages. The degraded voltage operation acceptance was based partly on the testing performed at Northeast Utilities, Millstone Unit One.

The inspectors found that the above evaluations appeared to be complete in that all aspects of the brake mechanism were considered and evaluated for possible failure modes and the impact the failure would have on the operation of the MOV.

2.9 Quality Assurance Program Implementation

The inspectors reviewed MOV Program Assessment Report No. R-SP-92-08 which was performed during April 20-23, 1992, which was an assessment of the effectiveness of the MOV program. The assessment result indicated a need for increased management commitment and attention to the MOV program. These findings were based on the incomplete resolution of nine weaknesses identified during the NRC Part 1 inspection.

Engineering and Technical Support Assessment Report No. R-ES-93-01 conducted September 15-27, 1993, identified two weaknesses regarding the MOV program with regard to evaluation of test data prior to returning valves to service and independent verification causing delays in MOV testing. This report also included resolution of findings identified in Report No. R-SP-92-08.

Both reports identified strengths in addition to the weaknesses and appeared to be in depth audits that were performed by knowledgeable personnel. The audits addressed the weaknesses to the organizations responsible to bring attention to the finding and get the proper solutions. The inspectors concluded that the assessments were adequate and a contributor to the MOV program improvement.

2.10 Followup of Previous Inspection Findings

The inspectors reviewed the status of open findings identified in the previous GL 89-10, Part 1 inspections. These findings included a violation and 10 "open items". The licensee had provided written responses to the violation and open items in letters to the NRC dated August 20, 1992, and September 23, 1991, respectively. The results of the inspectors' review are described below:

- a. (Closed) Violation 50-261/92-19-01, Inadequate Design Control Involving Unverified Assumptions Related to DP for Valves FW-2V-6A, B, and C.

The licensee's August 20, 1992, letter acknowledged the violation, described the corrective actions taken, and stated the steps taken to avoid further violations. The inspectors verified that new thrust values had been calculated as the result of the identified higher differential pressures and that the torque switch setting had been increased to meet the high thrust requirements. The inspectors reviewed differential pressure calculations and examined the assumptions used to determine the DP values. New larger electrical cables were installed which resulted in a higher motor torque. These valves were identified as being subject to thermal binding as discussed in Section 2.7 of this report. General Procedure GP-007, Plant Cooldown From Hot Shutdown to Cold Shutdown, directs that these valves be cycled at three different intervals during cool down of the plant. The licensee has taken adequate corrective actions for this violation. This item is closed.

- b. (Closed) Item 50-261/91-201-01, Determination of Design Basis Flow Rate.

This item identified the licensee's failure to consider the effects of flow in either the design-basis review or the in the testing. GL 89-10 recommended the evaluation of factors such as flow.

In its September 23, 1991, letter responding this item, the licensee indicated that design flow was not an important consideration, since it did not have a quantifiable effect. The inspectors agreed that there was no currently quantifiable effect but noted that flow has been observed to effect required thrust and should be considered in testing and evaluations. In particular, it is important to have significant flow to simulate design-basis conditions adequately in the testing. The inspectors' current review found that the licensee had determined and added the design-basis flow rate to the assumption Section of the "Mechanical Analysis and Calculation" in the thrust calculation package for each MOV. Additionally, the licensee had used substantial system flows in the MOV tests. The inspectors concluded that this adequately addressed the issue.

- c. (Closed) Item 50-261/91-201-02, Failure to Review Mispositionable Valves.

This item identified that the licensee had determined that it was not necessary to review the capability of mispositioned valves to be repositioned to their safety position, if redundant valves or systems existed. This was contrary to a recommendation of GL 89-10.

As indicated in its response letter, the licensee's determination is consistent with an owner's group position. The matter is currently under evaluation by the NRC and, pending an NRC decision, this issue remains open. The original open item will be closed and re-identified as Inspector Followup Item 50-261/94-06-07, Mispositioning, for tracking by NRC Region II.

- d. (Closed) Item 50-261/91-201-03, Undersized Actuators for Valves FW-V2-6A, 6B, and 6C.

This item is closed based on the information reviewed by NRC inspectors during the close out of Violation 50-261/92-19-01.

- e. (Closed) Item 50-261/91-201-04, Setting of Closed-to-Open Bypass Limit.

This item questioned the licensee's practice of setting closed-to-open torque bypass limit switches at 5 percent of the valve opening stroke, as this might not adequately encompass the unseating of some valves. Additionally, concern was expressed regarding the licensee's failure to balance torque switches (to assure actuation at similar opening and closing torques) and its use of torque wrenches for setting the torque switches.

The licensee's response to this finding indicated that diagnostic data obtained during MOV testing would be reviewed to ensure the open torque switch bypass limit was set appropriately to allow proper functioning of the valve. It further stated that new installations would require torque switch balancing and that the need for routine balancing would be considered.

The inspectors found that the licensee had issued Plant Improvement Request 93-059100 (dated April 30, 1993) which recommended increasing the closed-to-open bypass from 5 percent to 95 percent. Therefore, the torque switch would be bypassed for 95 percent of the valve's opening stroke and be placed back into the circuit for the remaining 5 percent of the opening stroke. This change in open torque switch control was not fully implemented.

The inspectors had previously observed a demonstration of the licensee's use of torque wrenches to set torque switches at the licensee's Harris facility. The practice applied by the licensee was found to be acceptable.

Further NRC review of the licensee's torque bypass changes and torque switch balancing practices will be conducted in a subsequent inspection. The original open item will be closed and re-opened as Inspector Followup Item 50-261/94-06-08, Setting Closed-to-Open Bypass Switch Limit, for tracking by NRC Region II.

- f. (Closed) Item 50-261/91-201-05, Procedures for Controlling Design-Basis Testing.

This item identified the following apparent deficiencies in the procedures used to control design-basis testing:

- (1) Dynamic diagnostic testing had been performed without accompanying static testing.
- (2) Test results had not been fully assessed almost three months after the tests had been completed.
- (3) Test flow and differential pressure were not recorded in a way that was readily available to the test results evaluator.

In their review of design-basis testing during this inspection the inspectors determined that the apparent deficiencies identified through this open item had been adequately addressed by the licensee. Timely operability reviews had been documented, static diagnostic testing accompanied dynamic testing, and recorded test parameters were readily available. This item is closed.

- g. (Closed) Item 50-261/91-201-06, Periodic Verification of MOV Operability.

This item questioned the licensee's planned lubrication and cleaning of MOVs before periodic testing. This practice would preclude evaluation of the as-found valve condition.

The licensee's response letter stated that Preventive Maintenance Procedure PM-420 had been revised to require lubrication only prior to baseline testing. Additionally, the inspectors were informed that the AMMS database which initiates the lubrication requires that the MOV coordinator be contacted to assure that testing is performed prior to the lubrication and cleaning. The inspectors verified the above corrective actions through a review of PM-420, Rev. 9, and the AMMS database requirement for the lubrication. The issue is resolved.

- h. (Closed) Item 50-261/91-201-07, Inadequate Documentation and Corrective Action for MOV Deficiencies.

This item identified two cases in which deficient conditions appeared inadequately documented and evaluated. The first case involved tightening the packing of valve RHR-744B from 46 to 138 foot pounds without an engineering review or post modification test and failing to adequately evaluate the reported movement of this valve during actuation. The second case involved inadequate evaluation of stem galling on valve V2-6A.

The licensee's response letter stated that Maintenance Work Request 91-AIDQ1 provided testing (June 14, 1991) that verified the packing adjustment on valve RHR-744B had not significantly increased actuator loading. In addition, the response stated that the valve had been observed during stroking and did not exhibit any abnormal movement. The inspectors reviewed and verified the above Work Request, which contained the results of current traces performed on the valve. They also interviewed the licensee's MOV coordinator, who indicated that he had observed the valve in operation and saw no abnormal movement. Finally, the inspectors verified that the licensee had conducted design-basis DP testing of the valve and found that it operated satisfactorily. On this basis the original finding is considered closed. However, this valve and valve RHR-744A, were identified as marginal valves as described in Section 2.2 above and further licensee actions to ensure that these valves perform satisfactorily are to be verified in a subsequent NRC inspection.

- i. (Closed) Item 50-261/91-201-08, MOV Setpoint Document Control of Switch Settings.

This item identified that procedure CM-111 did not provide torque switch, limit switch, or thrust settings for numerous MOVs. The technicians who set MOVs were obtaining the values to be used verbally from the MOV coordinator.

The licensee's response stated that MOV switch settings and thrust values would be controlled through its automated Equipment Database System (EDBS), eliminating the need for the verbal transfer of information. The inspectors verified that the EDBS contained the setting entries and that procedure CM-111, Rev. 21, directed use of the EDBS for the settings. This resolves the finding.

- j. (Closed) Item 50-261/91-201-09, MOV Post Maintenance Testing.

The licensee's procedure did not require that thrust margin be verified following maintenance that could affect MOV performance.

The licensee's response letter indicated that using thrust data to verify performance was under review. In the current inspection the inspectors found that post maintenance testing requirement guidance was specified by Appendix A of procedure MMM-003, Rev. 9. Thrust verification appeared satisfactorily controlled except where significant valve maintenance was performed. For example, static (no DP) thrust testing was specified following packing maintenance, valve overhaul or replacement, and operator overhaul. For valve overhaul or replacement use of static testing may not be adequate. As discussed in Section 2.4 above, the adequacy of post maintenance testing will require further NRC review and has been designated Inspector Followup Item 50-261/94-06-06, replacing Open Item 50-261/91-201-09.

- k. (Closed) Item 50-261/91-201-10, Failure to Periodically Test Thermal Overloads.

This item identified that there was no periodic testing to verify proper setting of the thermal overloads on MOV circuits.

The licensee's response letter indicated this issue was under advisement.

The licensee tested all the TOLRs for 94 safety related MOVs. The TOLRs for six MOVs were replaced due to failures. Three of the failures were determined to be opening at a value greater than the range of the TOLR. Three others were borderline when the tolerance was taken into account could have been out of range. These were replaced as a conservative action. The licensee had not determined the interval that will be used for TOLR testing but plans some form of testing in the future.

3.0 EXIT INTERVIEW

The inspection scope and findings were summarized on April 1, 1994, with those persons indicated in Section 1. The inspectors described the areas inspected and discussed in detail the inspection results. Proprietary information is not contained in this report. No dissenting comments were received from the licensee. Eight inspector followup items were identified. These items are listed in the summary at the beginning of this report, which gives the status of all items inspected.

4.0 ACRONYMS AND INITIALISMS

AC	Alternating Current
ACR	Adverse Condition Report
AFW	Auxiliary Feedwater
AMMS	Automated Maintenance Management System
CC	Component Cooling System
CFR	Code of Federal Regulations
CS	Charging System
CST	Control Switch Trip
CV	Containment Volume
DBDP	Design Basis Differential Pressure
DP	Differential Pressure
EDBS	Electronic Database System
EE	Engineering Evaluation
FW	Feedwater
GL	Generic Letter
HX	Heat Exchanger
IFI	Inspector Followup Item
INPO	Institute for Nuclear Power Operations
MOV	Motor-Operated Valve
MS	Main Steam System
NED	Nuclear Engineering Department
NRC	Nuclear Regulatory Commission
RC	Reactor Coolant
RCS	Reactor Coolant System
RFO	Refueling Outage
RHR	Residual Heat Removal System
RNP	Robinson Nuclear Plant
SDAFW	Steam Driven Auxiliary Feedwater (Turbine)
SI	Safety Injection
SOER	Significant Operating Event Report
TI	Temporary Instruction
TOLR	Thermal Overload Relay
VOTES	Valve Operation Test and Evaluation System