APPENDIX B

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report Nos. 50-498/92-06
50-499/92-06

Operating License Nos. NPF-76
NPF-80

Licensee: Houston Lighting & Power Company
P.O. Box 1700
Houston, Texas 77251

Facility Name: South Texas Project (STP), Units 1 and 2

Inspection At: STP, Matagorda County, Texas

Inspection Conducted: February 24-28 and March 19, 1992

Inspectors: M. Runyan, Reactor Inspector, Plant Systems Section
Division of Reactor Safety

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Approved: Samuel Axum 4/10/92
T. F. Westerman, Chief, Plant Systems Section Date
Division of Reactor Safety

Inspection Summary

Inspection Conducted February 24-28, 1992 (Report 50-498/92-06; 50-499/92-06)

Areas Inspected: Special, announced inspection of the licensee's program for implementing commitments to Generic Letter (GL) 89-10.

Results: The licensee had initiated a comprehensive program for motor-operated valves (MOVs) that generally met your commitments to GL 89-10.

The operability of some valves is considered unresolved pending staff review of the test data utilized by Westinghouse and Limitorque to provide operability criteria specific to your facility - Unresolved Item 498; 499/9206-01 (paragraphs 2.3.2, 2.3.3 and 2.3.5).

A violation was identified for inadequate corrective action evaluation relative to MOVs subject to over-thrust conditions - Violation 498; 499/9206-02 (paragraph 2.3.5). -

Three issues requiring additional information were identified. The licensee committed to provide responses to the three items within 90 days of receipt of this report. The response items are as follows and will be tracked as Inspection Followup Item 498; 499/9206-03:

Response Item 1 - paragraph 2.3.3

> The licensee was requested to provide the methodology they plan to utilize for extrapolating diagnostic test results from test conditions to design basis conditions and in particular in order to estimate the thrust and torque required to operate the valve at 100 percent differential pressure and flow. This is to include a review of previous dynamic test results to identify and document any operability concerns.

Response Item 2 - paragraph 2.3.3

> The licensee was requested to provide their long-term plans for all MOVs which were left in a condition where total thrust may exceed 110 percent of the actuator ratings.

Response Item 3 - paragraph 2.3.3

> The licensee was requested to justify the apparent conflict between the recent "Limitorque Technical Update #92-01" recommended housing cover and actuator base fastener minimum torque levels, including manufacturer plant-specific seismic considerations, and the previous information provided by the licensee based on their discussions with Limitorque and Westinghouse.

During the programmatic review, weaknesses were identified regarding the timing of program development (paragraph 2.4.1), and the lack of a back calculation process to validate original design assumptions (paragraph 2.3.3).

Strengths were identified regarding an excellent self-assessment of the MOV program (paragraph 2.4.1), conservative and complete scoping of valves to be included in the program (paragraph 2.3.1), good design basis reviews (paragraph 2.3.2), the high percentage of MOVs being tested at or near design basis conditions (paragraph 2.3.3), the planned use of dynamic periodic testing (paragraph 2.3.4), and the purchase of stem load sensors to augment the diagnostic capability of the MOVATS equipment (paragraph 2.4.6).

DETAILS

1. PERSONS CONTACTED

HP&L PERSONNEL

*P. Appleby, Training Manager
*C. Ayala, Supervising Engineer, Licensing
*M. Berg, Division Manager, Design Engineering
*W. Blair, Manager, Staff Training
*J. Blevins, Supervisor
*M. Chakrarvsky, Executive Director Nuclear Safety Review Board
*M. Coppinger, Manager Mechanical Maintenance
*J. Garcia, Electrical Maintenance
*D. Hall, Group Vice President
*R. Hernandez, Manager, Design Engineering
*T. Jordan, General Manager Nuclear Assurance
*W. Jump, Manager, Nuclear Licensing
*D. Leazar, Manager, Plant Engineering
*T. Lucas, Electrical Maintenance Representative
*M. McGehearty, Staff Engineer
*G. Manasco, Consultant Engineer
*S. Phillips, Licensing Engineer
*R. Rehkugler, Director, Quality Assurance
*K. Richards, Division Manager, Electrical
*C. Rowland, Consultant Engineer
*D. Sanchez, Director, maintenance
*G. Schinzel, Supervising Engineer, Plant Engineering
*R. Tennant, Manager, NPMM
*T. Underwood, Director, ISEG
*M. Wisenburg, Plant Manager

NRC

*A. Dummer, Reactor Inspector (Intern)
*J. Tapia, Senior Resident Inspector
*T. Westerman, Chief, Plant Systems Section, Region IV

*Denotes persons present at the February 28, 1992, exit interview.

The inspectors also contacted other licensee personnel during the course of the inspection.

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

2.1 Background

On June 28, 1989, the NRC issued GL 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," which requested licensees and construction permit holders to establish a program to ensure that switch settings for safety-related motor-operated valves (MOVs) and certain other MOVs in safety-related systems were selected, set, and maintained properly. The NRC held public workshops to discuss the GL and to answer questions regarding its implementation. On June 13, 1990, the NRC issued Supplement 1 to GL 89-10 to provide the results of those public workshops. In Supplement 2 to GL 89-10 (August 3, 1990), the NRC stated that inspections of programs developed in response to GL 89-10 would not begin until January 1, 1991. In response to concerns raised by the results of NRC-sponsored MOV tests, the NRC issued Supplement 3 to GL 89-10 on October 25, 1990, which requested that boiling water reactor licensees evaluate the capability of MOVs used for containment isolation in several systems. In Supplement 3, the NRC indicated that all licensees and construction permit holders should consider the applicability of the information obtained from the NRC-sponsored tests to other MOVs within the scope of GL 89-10 and should consider this information in the development of priorities for implementing the GL program.

In GL 89-10, the NRC requested licensees to submit a response to the GL by December 28, 1989. HL&P submitted a response to the GL on December 28, 1989, stating that it would meet the recommendations and schedule of the GL. In this letter, the licensee stated that it would inform the NRC of any significant changes to its commitment of compliance to the GL.

2.2 Inspection Plan

The inspectors followed Temporary Instruction 2515/109 (January 14, 1991), "Inspection Requirements for Generic Letter 89-10, Safety-Related Motor-Operated Valve Testing and Surveillance," in performing this inspection. The inspection focused on Part 1 of the temporary instruction (TI) which involves a review of the program being established by the licensee in response to GL 89-10. The inspectors addressed some items of Part 2 of the TI because the licensee had implemented a significant percentage of the GL 89-10 program.

2.3 Generic Letter 89-10 Areas

As required by Section 04.01 of the TI, the inspectors reviewed the licensee commitments to the GL. The inspectors reviewed the licensee's GL 89-10 MOV Program Procedure OPGP03-ZE-0037, Revision 1, February 24, 1992, and supporting documentation. In addition, the inspectors discussed the program in detail with licensee personnel.

As required by Section 04.02 of the TI, the inspectors reviewed each aspect of GL 89-10. The inspection findings are described below.

2.3.1 Scope of the Generic Letter Program

The NRC staff position is that the scope of GL 89-10 includes all safety-related MOVs and other MOVs that are position-changeable in safety-related piping systems. Through Supplement 1 to the GL, the staff defined "position-changeable" as any MOV in a safety-related piping system that is not blocked from inadvertent operation from the control room. The licensee's response to GL 89-10 committed to the scope of the program as recommended in GL 89-10.

The inspectors reviewed the licensee's program plan, "South Texas Project Motor-Operated Valve Program," OPGP03-ZE-0037, Revision 1, dated February 24, 1992, for determining scope and noted that the plan required valves which served a safety function and those which were "position-changeable" as defined in GL 89-10 to be included within the scope of their program. The licensee identified 164 MOVs in Unit 1 and 164 MOVs in Unit 2 to be included in their program for a total of 328 MOVs. The inspectors reviewed piping and instrumentation drawings for several Unit 2 plant systems as a sample check of the scope of the licensee's program. The systems selected for this review were residual heat removal (RHR), safety injection (SI), and containment spray (CS). Six valves from the RHR system, N1RHMOV0067A, -0067B, -0067C, N2RHMOV0067A, -0067B, and -0067C, had been deleted but were reinstated in the program because of an emergency operating procedure specifying the use of a RHR train. The inspectors did not find any discrepancies in the licensee's GL 89-10 scope. The MOVs which the licensee had excluded from their program were appropriately justified.

The licensee's Program Procedure OPGP03-ZE-0037, Revision 1, Addendum 2, documented the justification for removal of motor-operated valves from the GL 89-10 valve list. However, in this addendum, the inspectors found MOVs which were being included in the licensee's program. The licensee stated this addendum was a history of valve additions and removal. The licensee stated that they will clarify the heading for this addendum.

2.3.2 Design-Basis Reviews and MOV Switch Settings

In recommended action "a" of GL 89-10, the staff requested the review and documentation of the design basis for the operation of each MOV within the GL program to determine the maximum differential pressure and flow (and other factors) expected for both normal operations and abnormal conditions. In recommended action "b" of GL 89-10, the staff requested licensees to review, and to revise as necessary, the methods for selecting and setting all MOV switches.

The licensee contracted outside engineering consultants to perform their design-basis reviews. These design packages were then reviewed by STP engineering personnel to ensure that they were correct. These design-basis review packages were received by the licensee just prior to the outage in which the subject valves were scheduled for design-basis testing.

The inspectors reviewed the contracts supplied to Westinghouse Electric Corporation and ABB (Asea, Brown, and Boveri) Impell Corporation (see Attachment). The inspectors also reviewed the "South Texas Project Motor-Operated Valve Program," Procedure OPGP03-0037, Revision 1, dated February 24, 1992, as it pertained to design-basis reviews.

The licensee addressed the design-basis conditions of worst-case flow, design-line pressure, and maximum-differential pressure in both the open and closed direction to determine the maximum-expected differential pressure (MEDP). The licensee performed a review of these MEDPs using the Safety Analysis Report (SAR), Design Basis Documents (DBD), and plant normal, abnormal, and emergency operating procedures to ensure the MEDP was accurate and plant specific and to ensure that valve mispositioning was taken into account. System fluid temperature is monitored during design-basis in-situ tests. If the fluid temperature is not near basis temperature for flex-wedge gate valves, the licensee requires a retest at design-basis conditions and temperature or this particular valve test will be considered the first phase of a two phase approach similar to the two-stage approach outlined in GL 89-10.

The licensee performed a probabilistic risk assessment (PRA) concerning the effects to MOVs due to a seismic occurrence. The licensee did not consider a seismic event occurring during valve seating/unseating to be a credible event and it is, therefore, not included in the design-basis reviews.

The licensee assumed a degraded voltage condition at the motor terminal based on a nominal 80 percent terminal voltage at the valve motor for all GL 89-10 MOVs. On a case-by-case basis, actual motor-terminal degraded voltages based on an electrical distribution study were used.

During an engineering review, STP identified several MOVs as having the potential for the motor to stall at a degraded-voltage condition prior to control switch trip. A Station Problem Report (SPR) was written which requested the evaluation of all MOVs at degraded-voltage conditions. This evaluation was completed using a power factor of 0.60, cable impedance/reactance (at an elevated temperature of 90 degrees centigrade), overload heater resistances, cable lengths, and locked-rotor currents.

The inspectors questioned licensee personnel if they had considered the effects of high-ambient temperature on AC-motor torque output. The licensee had not considered this effect. The inspectors informed the licensee that Limitorque is conducting research on this effect and would, in the future, publish their results. The licensee stated they would review and incorporate the results of the Limitorque research when available and as applicable to their plant.

The inspectors considered the licensee to have adequately addressed the area of design-basis reviews consistent with the recommendations of GL 89-10.

The inspectors reviewed the licensee's documents for MOV sizing and switch settings (see Attachment). Further, the inspectors reviewed several calculations for accuracy and completeness.

The licensee's contract personnel, Westinghouse Electric Corporation and ABB Impell Corporation performed the MOV sizing and switch setting calculations supplied in groups specified by the licensee. These calculation packages addressed the valves which will be design-basis in-situ tested during the upcoming outage. These packages were reviewed by the licensee for appropriate data and precision of calculations. Calculations supplied by ABB Impell Corporation use the standard industry equation for determining minimum required valve thrust for non-Westinghouse valves. ABB Impell uses a coefficient of thread friction of 0.20 based on Limitorque guidelines and a valve disc factor of 0.40 to 0.50 for gate valves depending on valve type, service conditions, and current industry data. ABB Impell uses a valve disc factor of 1.1 for globe valves. Westinghouse Electric Corporation uses the standard industry equation for determining minimum required valve thrust with the exception that the disc area term was based on a seating surface diameter that was larger than the commonly used valve orifice diameter. Westinghouse Electric Corporation uses a coefficient of thread friction of 0.15 for valves supplied to the licensee and a valve factor of 0.40 to 0.50 for gate valves and 1.1 for globe valves.

The licensee's review process should ensure that the values received from their contractors are applicable to site-specific valves. The use of a less conservative coefficient of thread friction of 0.15 for Westinghouse valves may not be valid unless specific maintenance and lubrication requirements and frequencies are implemented to ensure continued high efficiency of torque to thrust conversion. The licensee's program should use test results to verify the assumed coefficient of thread friction.

Of the 328 valves in the licensee's program, approximately 124 valves are butterfly valves. These valves had a minimum required valve thrust calculation performed with the stem located on one side of the disc and then another calculation performed with the stem in the opposite orientation. The licensee was using the largest value of these two calculations where possible to establish torque switch settings. Where the motor size was in question, the licensee performed a design-basis in-situ test to ensure valve operability. To date, the licensee has not found any butterfly valves to be inoperable.

The inspectors noted that the licensee bypassed their thermal overloads for the Class 1E power supplied valves in their program. However, the licensee had not reviewed thermal overload settings for non-1E power supplied valves which may be included in STP's program as position-changeable valves. Licensee personnel stated that they will search for any non-1E valves with thermal overloads and review their thermal overload setting.

The licensee leaves limiter plates installed if possible. When it is necessary to increase the setting greater than the vendor recommended maximum

and remove the limiter plate, a design change notice (DCN) is issued and an appropriate engineering analysis is performed.

The calculations performed for the licensee by Westinghouse and ABB Impell only supply the minimum required valve thrust (the bottom point for the target thrust window), the maximum allowable thrust (the top point for the target thrust window), based on a weak-link analysis, and the unit-operator capabilities. Other issues, such as diagnostic equipment uncertainties, torque switch repeatability, and rate of loading (ROL) are incorporated into the thrust window calculations by the licensee's engineering personnel. The licensee was using ITI MOVATS as their diagnostic vendor. The licensee was using ITI MOVATS Equipment Accuracy Summary, ER 5.0, Revision 3, dated October 25, 1991, for determining torque-switch repeatability, diagnostic equipment uncertainties, and rate of loading. The licensee was a member of the MOV users group (MUG) and they were aware of the current discussion about ITI MOVATS equipment uncertainties resulting from the MUG diagnostic validation test results. The inspectors informed the licensee that, when the published results are available, any changes in diagnostic uncertainties, torque switch repeatability, etc., will need to be reviewed for applicability.

The licensee set all 328 GL 89-10 MOVs to open on limit switch setting and 146 of these valves to close on torque switch setting. The valves which utilize the torque switch in the close direction have their torque switches bypassed for 90 to 95 percent of travel and then the torque switch is placed in the circuit for the last 5 to 10 percent of valve travel to ensure seating. The remaining 182 MOVs utilize the closed limit switch setting to stop MOV operation. The inspectors questioned the licensee whether any of their valves which limit-close also have specified criteria for leakage. The licensee responded that they did have some limit-close valves which have specified leakage criteria. However, the licensee stated that all valves that limit-close and have a specified leakage criteria have an SB actuator which uses a compensating spring. The licensee further stated that no valves with specified leakage rates will be set to limit-close an SB actuator and a compensating spring.

The inspectors found several valves whose calculations indicated that the present actuator was undersized. The most notable of these valves were the two PORV block valves on each unit, A1RCMOV0001A, C1RCMOV0001B, A2RCMOV0001A, and C2RCMOV0001B. These valves were controlled by the close-limit switch setting. A stall-thrust value at 80 percent degraded voltage was supplied to STP by Westinghouse Electric Corporation. Based on this stall-thrust value, and setting the valve to limit-close, the licensee felt these valves to be operable under design-basis conditions. The inspectors questioned the applicability of the Westinghouse supplied 80 percent stall-thrust values and how they were obtained. South Texas Project received a one paragraph communication from Westinghouse stating that these 80 percent stall-thrust values were based on valve-specific testing. The basis for the licensee operability determination is considered to be an unresolved item (498;499/9206-01) pending NRC staff review of the Westinghouse test data.

2.3.3 Design-Basis Differential Pressure and Flow Testing

In recommended action "c" of the GL, the staff requested licensees to test MOVs within the GL program in-situ under their design-basis differential pressure and flow conditions. If testing in-situ under those conditions is not practicable, the staff allows alternate methods to be used to demonstrate the capability of the MOV. The staff suggested a two-stage approach for a situation where design-basis testing in-situ is not practicable and, at this time, an alternate method of demonstrating MOV capability cannot be justified. With the two-stage approach, a licensee would evaluate the capability of the MOV using the best data available and then would work to obtain applicable test data within the schedule of the GL.

The licensee had completed static diagnostic tests on 197 MOVs. Of these, 166 MOVs had also been tested under differential pressure and flow conditions. The licensee had established by procedure that in order for a dynamic test to fully qualify the MOV to GL 89-10 requirements and be considered a "Phase 1" valve, three conditions must be met: the test differential pressure must be at least 80 percent of the design-basis differential pressure, the test flow rate must be commensurate with the design flow rate, and the test temperature must be close to normal operating temperatures (for flex-wedge gate valves only). Of the 166 dynamic tests performed to date, approximately 66 could not achieve the test condition criteria specified above. These valves along with the 31 valves that could be tested only under static conditions were tentatively designated as "Phase 2" valves and would be qualified under the two-stage approach described in the GL.

The licensee's approach to dynamic testing was considered aggressive and proactive. A high percentage of MOVs had been tested at dynamic conditions and the licensee had taken the approach of testing valves at the highest achievable differential pressure and flow even if beforehand it was realized that test conditions could not meet the requirements for a "Phase 1" valve. The licensee intended to incorporate test results measured under partial design conditions into its two-stage qualification process. This approach to testing was identified as a strength in the program.

Based on a review of several valve-specific and diagnostic test procedures, the inspectors concluded that the licensee had acceptably proceduralized the testing process. Problems were noted, however, in the evaluation of test results. Procedure EI-4.05, "Test Acceptance Criteria for Safety-Related MOVs in GNL89-10," Revision 0, had recently been issued to formally proceduralize the methodology of determining the acceptability of MOV test results. Essentially, the same analyses had been performed in the past but this process had not previously been proceduralized. The inspectors identified several editorial errors each of which the licensee corrected prior to the exit meeting.

A weakness identified was a conceptual error, which may impact on the validity of previous test package acceptability determinations. For those MOVs tested at between 80 and 100 percent of the design-basis differential pressure,

Procedure EI-4.05 did not include a necessary step to extrapolate the measured valve thrust necessary to close (or open) the valve during the test to that thrust, which would have been necessary to close (or open) the valve at 100 percent of design conditions. Although most of the rate of loading phenomenon is realized at 80 percent differential pressure, a major factor of the required thrust is directly proportional to system differential pressure. The licensee's program should show that the valve, actuator, and motor are capable of producing the estimated thrust requirements at 100 percent design differential pressure and under degraded voltage conditions. Approximately 60-70 MOVs are affected. This is a 90-day response item (Response Item 1).

Another weakness identified related to the review of test data and the lack of an analytical feedback loop to validate or justify the original design assumptions. Of specific importance is a back-calculation to determine whether the stem friction and valve coefficients and rate of loading assumed in the design calculations and two-stage approach dispositions are valid. This information is needed to ensure the operability of those MOVs which can not be tested under conditions approximating the design basis. The licensee stated that it intends to initiate this type of back-calculation effort in the near future.

Based on review of several test packages and discussions with the licensee, it appeared that a large number of MOVs (approximately 45 overall) were marginally sized such that in order to meet the minimum thrust required to close the valve, the maximum thrust allowed (usually based on the actuator rating) was exceeded. Limitorque permits an overthrust of 110 percent of actuator-rated thrust. Approximately 40 of the MOVs were left with torque or limit (about [illegible] were limit-closed valves) switches set such that the maximum-closing thrust anticipated (including allowances for diagnostic measurement uncertainty) fell into the range of 110 to 140 percent. Five additional MOVs were in the range of 141 to 161 percent. The inspectors questioned the operability of these MOVs.

Prior to the exit meeting, the licensee was able to establish an interim basis for concluding that the valves were operable. For those MOVs in the 110 to 140 overthrust range the licensee referenced a January 24, 1992, letter from Limitorque stating that thrust ratings for SMB-000, SMB-00, SMB-0, and SMB-1 actuators at South Texas may be increased to 140 percent of the currently published actuator ratings. Limitorque placed certain conditions on this updating and the licensee was able to establish a rationale for meeting these conditions. For those MOVs left in the 141 to 161 percent thrust range, the licensee referenced a telecopy message they had received from Westinghouse dated February 22, 1992. This message listed 4 of the 5 MOVs in the 141 to 161 percent overthrust range and qualified them for an additional 6 cycles. The excluded MOV was bounded by its sister valve in the other unit since it had a lower (as left) closing load. Westinghouse qualified these actuators (all SMB-00) based on testing performed for them by Limitorque. The licensee is requested to provide their long-term plans for all MOVs which were left in a condition where total thrust may exceed 110 percent of the actuator ratings (Response Item 2). The inspectors considered the referenced letters to

satisfactorily resolve the interim operability for these MOVs. Nevertheless, the operability of these valves is considered unresolved pending NRC staff review of the test data utilized by Westinghouse and Limitorque and the basis of the operability criteria provided for STP (498;499/9206-01).

The inspectors noted that subsequent to completion of the inspection, Limitorque Corporation issued a Limitorque Technical Update No. 92-01, which is similar to the January 24, 1992, Limitorque letter. Recommendation 5 states that, "The Limitorque housing cover and actuator base fasteners should be torqued to the minimum specified levels shown in the accompanying figures (Figures 5.1 through 5.4). The actual torque levels for actuator base fasteners should also; meet the valve manufacturer's requirements, including plant-specific seismic considerations." The licensee indicated at the time of the inspection that Limitorque and Westinghouse had verbally indicated that torque values for fasteners were not required. The licensee is requested to provide justification for the apparent conflict in torquing criteria (Response Item 3).

Other overthrust events occurred during the testing process. Some MOVs were overthrust to greater than 200 percent of the actuator rating. In each case, the licensee stated that the recommendations of Limitorque were followed to determine if any damage occurred. The operators were inspected and the diagnostic traces were examined for any sign of damage. The licensee stated that no sign of damage was detected in any of the MOVs experiencing overthrust.

The licensee was using ITI MOVATS diagnostic equipment and was using diagnostic-uncertainty values published in Engineering Report 5.0, "ITI MOVATS Incorporated Equipment Accuracy Summary." The accuracy values typically ranged from about 6 to 17 percent with a 5 percent allowance for closed versus open thrust when using the load cell in the open direction. The inspectors alerted the licensee of potential changes to the published uncertainties that may require the licensee to take contingency actions to demonstrate the continued operability of previously-tested MOVs.

2.3.4 Periodic Verification of MOV Capability

In recommended action "d" of the GL, the NRC requested that licensees prepare or revise procedures to ensure that adequate MOV switch settings were determined and maintained throughout the life of the plant. In paragraph j of the GL, the NRC recommended that the surveillance interval be based on the safety importance of the MOV as well as its maintenance and performance history, but that the interval not exceed 5 years or 3 refueling outages. Further, the capability of the MOV will need to be verified if the MOV is replaced, modified, or overhauled to an extent that the existing test results would not be representative of the MOV.

The inspectors discussed the periodic verification of MOV capability with licensee personnel and reviewed the Program Plan Procedure OPGP03-ZE-0037, Revision 1, "Motor-operated Valve Program." The program plan stated that

dynamic as well as static testing will be performed initially on a 5-year interval or three refueling outages, whichever is longer. The plan also stated that the trending program will be used to adjust the periodic testing intervals. The planned use of dynamic testing to periodically confirm valve performance is considered a strength.

The licensee's Procedure No. OPMP05-ZE-0312, Revision 1, "Limitorque MOV Actuator Lubrication," and preventative maintenance work orders controlled the performance of periodic preventive maintenance and stem lubrication for each MOV in the GL 89-10 program. The licensee's frequency for lubricating the valve stem and sampling grease was 78 weeks, which is in accordance with Limitorque recommendations. The inspectors walked down some of the valves in the GL 89-10 program and found the stems were well lubricated and the valves appeared to be well maintained.

2.3.5 MOV Failures, Corrective Actions, and Trending

In recommended action "h" of the GL, the NRC requested that licensees analyze or justify each MOV failure and corrective actions. 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 was also suggested that the material be periodically examined (every 2 years or after each refueling outage after program implementation) as part of the monitoring and feedback effort to establish trends of MOV operability. These trends could provide the basis for a licensee revision of the testing frequency established to verify adequate MOV capability on a periodic basis. The GL indicated that a well-structured and component-oriented system would be necessary to track, capture, and share equipment history data.

The licensee's MOV program plan stated that a tracking and trending program would be established for the MOVs and would provide a means for reviewing MOV data at least every 2 years. A draft of the implementing procedure for tracking and trending was reviewed by the inspectors and appeared to meet the requirements of the GL. However, the program was not yet in place and will be a review item for a future inspection. Currently, the design engineering department maintains its own data base which contains design data and test data on each MOV, and plant engineering maintains the data package for each valve.

A review of the licensee's disposition of MOV-performance data identified a significant weakness in the licensee's corrective action program. The inspectors reviewed a number of Request for Action (RFAs) for MOVs that had been found to be in an overthrust condition during testing or had been left in an overthrust condition after testing. As discussed in Section 2.3.3, the licensee has a current basis for declaring the as-left overthrust MOVs operable. However, prior to receiving this 1992 information from Limitorque and Westinghouse, the licensee justified the operability of the valves in 1990 and 1991 for thrust ratings exceeding 110 percent with information that did

not in all cases provide a valid basis for disposition. The information used to justify the operability of the valves consisted of a March 6, 1990, letter from Limitorque to South Carolina Electric & Gas Company stating that thrust ratings for SMB-00 actuators could be increased to 18,900 (approximately 135 percent) on an interim basis, a summary of notes from the MOV Users Group 1991 summer meeting where Kalsi Engineering presented a paper on MOV overthrust test results for specific actuators, and undocumented telephone conversations with Westinghouse to justify the applicability of other actuators. Of these sources, the inspectors found the interim updating of SMB-00 actuators by the March 6, 1990 Limitorque letter to be the only valid, site-specific documented basis for exceeding the currently published actuator thrust ratings.

Examples of the RFAs reviewed were RFA No. 91-1801 dated December 3, 1991, RFA No. 91-1941 dated November 21, 1991, RFA No. 91-1846 dated December 3, 1991, and RFA No. 91-1596 dated October 22, 1991. The inspectors noted that these RFAs reference the Kalsi Engineering paper presented at the motor-operated valve users group (MUG) in July 1991 as the basis for justifying the over-thrust conditions. The inspectors concluded that a site-specific documented evaluation of the Kalsi test data had not been performed at the date of the issuance of the RFAs referenced above and that the referenced test data was not on site. Therefore, prior to 1992, the inspectors did not find that the RFA use-as-is dispositions for the SMB-00 actuators exceeding 18,900 pounds thrust and the SB-0, SB-1, and SB-2 actuators exceeding 110 percent of the thrust ratings had a valid documented bases.

The failure to take measures to initiate adequate corrective action to promptly evaluate and disposition the overthrust conditions is considered to be an apparent violation of 10 CFR Part 50, Appendix B, Criterion XVI (498; 499/9206-02).

It is recognized that the licensee has reopened all previously closed RFAs for as-left actuator thrust values that exceed the 110 percent thrust rating of the actuator in two summary RFAs. Corrective action for these two RFAs was not complete at the time of the inspection.

2.3.6 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 GL recommended actions by June 28, 1994, or 3 refueling outages after December 28, 1989, whichever was later.

The licensee has three refueling outages remaining prior to the June 1994 deadline, two on Unit 1 and one on Unit 2. The greatest challenge to meeting the GL schedule will be on Unit 2 where approximately 60 MOVs remain to be tested. The licensee expressed confidence that the GL 89-10 schedule will be met.

2.4 Other MOV Areas Addressed

Section 04.03 of the TI lists certain aspects of the licensee's overall program that should be reviewed by the inspector, as appropriate.

2.4.1 Plan, Scope, and Oversight of the MOV Program

The licensee had a dedicated MOV design engineer and a test engineer to coordinate the GL 89-10 program. Additionally, in November 1991, the Mechanical Division Manager had been assigned as head of an MOV task group to ensure that all commitments would be met. Overall, the staff assembled to execute the program appeared sufficient in number, knowledge, and expertise to successfully complete the program.

Between April and June 1991, a Nuclear Assurance team conducted an assessment of the MOV program. The inspectors considered this assessment to be commendable in its depth, scope, and technical findings. The licensee was tracking and in most cases meeting its corrective action commitments to resolve the assessment findings. The self-assessment process represented by this assessment was considered a strength.

In spite of the knowledgeable personnel and the strong self-assessment process, the licensee's MOV program was still in a state of flux. Many of the procedures reviewed had only been recently issued. The inspectors considered that the formulation of the program was not as far along as it should have been considering that over half of the diagnostic testing was complete. This was considered a weakness.

2.4.2 Control of MOV Switch Settings

The licensee maintained control of their switch settings by placing them in a controlled data base. These settings were established in accordance with the licensee's procedures. Modifications to any valve or actuator must go through plant procedures which incorporate the changes into the controlled data base to show the new switch settings. Changes can only be made as approved by engineering utilizing the plant approved procedures. The controlled data base contained all switch settings for MOVs, past and present. The inspectors found it difficult to determine which was the most current setting for a given MOV. The licensee stated that they wanted to maintain a complete record of past and present data for the MOV, but would reorganize their data to make it less confusing and less open for errors. The inspectors found no instances of incorrect data and considered the licensee's control of MOV switch settings to be in accordance with the recommendations of the GL.

2.4.3 Training

The inspectors discussed the licensee's training program with licensee personnel, reviewed training lesson plans and examinations, and toured the training facility. The MOV training consisted of a 40-hour course in mechanical or electrical maintenance for maintenance technicians. The course

consisted of both classroom and hands-on training in the laboratory followed by a written examination and a practical examination. The maintenance technician is qualified by the maintenance supervisor upon passing the course and having sufficient on-the-job training. The MOV qualification applies for 4 years.

At the end of the 4-year period, the division manager will evaluate the maintenance personnel individually to determine if qualification should be continued or if additional training is required. The qualifications records are maintained by the maintenance department.

The licensee was contracting with ITI-MOVATS to provide a 2-week training program for MOV testing activities. The course consisted of 7 days of diagnostic testing methods and 3 days of analysis of test results followed by examinations on both portions of the course.

2.4.4 Industry Experience and Vendor Information

The inspectors reviewed the licensee's responses to various industry and vendor communications including 10 CFR Part 21 reports, Limitorque maintenance updates, and NRC Information Notices pertaining to MOVs. In all cases, the licensee had received, reviewed, and evaluated the information; determined plant-specific applicability; and taken appropriate actions as necessary. Based on the documentation reviewed, these actions were timely and comprehensive.

2.4.5 Use of Diagnostics

The licensee utilized ITI-MOVATS 3000 as a diagnostic tool to examine the capabilities and characteristics of its MOVs. Several transducers may be used with this equipment independently or in various combinations to enhance the diagnostic capabilities. Along with the traditional thrust measuring device (TMD) (used to measure spring pack displacement) and load cell (used to calibrate TMD-measured valve-stem thrust in the open direction) the licensee had purchased a stem-strain transducer (SST) and stem-strain ring (SSR). The licensee stated that the SST and SSR provide a means of directly measuring stem thrust but neither is capable of providing full-stroke diagnostics in the closed direction under dynamic conditions. To address this limitation, the licensee purchased a set of stem-load sensors (SLS) which it intends to use on most of the remaining tests. The SLS will help provide a direct measure of rate of loading. The upgrading of the licensee's diagnostic capabilities with the purchase of the SLS is considered a strength. For MOVs where precise measurement is needed to demonstrate functionality (a valve with little margin), the licensee intends to mount strain gages directly on the valve stem.

2.5 Walkdown

The inspectors conducted a walkdown of several MOVs including four MOVs with the switch compartment cover removed. All valve stems that could be inspected

appeared to be well lubricated. All MOV components were clean and rust free. No lubrication leakages were identified.

2.6 Conclusions

The inspectors considered the licensee to have made a good beginning in developing a program in accordance with its commitments to GL 89-10. The inspectors concluded that the licensee's program would meet the intent of GL 89-10 upon completion of corrective actions and development of certain portions of its program identified during the inspection. The areas of the licensee's GL 89-10 program not currently developed will be reviewed during a subsequent inspection of the implementation of the licensee's program. The inspectors considered the licensee's schedule for completion of the GL 89-10 program to be ambitious. Continued management support will be necessary to achieve the schedule.

3. EXIT INTERVIEW

An exit meeting was held with those persons denoted in paragraph 1 on February 28, 1992. The scope and findings of the inspection were summarized. Licensee personnel acknowledged the inspection findings and agreed to respond to the areas of weakness denoted as "Response Items" in the report within 90 days of receipt of the report. The licensee did not identify as proprietary any of the materials provided to, or reviewed by, the inspectors during this inspection.

ATTACHMENT

Documents Reviewed

Contracts

Westinghouse Electric Corporation, "MOV Program Engineering Services, Westinghouse Valves, ST-400088, Supplement No. 11, Appendix A, Scope of Work and Schedule of Performance," dated December 14, 1989

ABB Impell Corporation, "MOV Program Engineering Services, Non-Westinghouse Valves, ST-400149, Supplement No. 42, Appendix A, Scope of Work and Schedule of Performance," dated November 16, 1989

Motor-Operated Sizing and Switch Settings

Westinghouse Electric Corporation, "MOV Program Engineering Services, Westinghouse Valves, ST-400088, Supplement No. 11, Appendix A, Scope of Work and Schedule of Performance," dated December 14, 1989

ABB Impell Corporation "MOV Program Engineering Services, Non-Westinghouse Valves, ST-400149, Supplement No. 42, Appendix A, Scope of Work and Schedule of Performance," dated November 16, 1989

Procedure OPGP03-0037, Revision 1, "South Texas Project Motor-operated Valve Program," dated February 24, 1992.

Calculations

Calculation 3L481MC6224 for MOV 1CC0068, "Component-Cooling Water"

Calculation ST400088-U0094-AWN for MOV C2CVMOV0023, "Letdown-Line Containment Isolation"

Calculation 3L481-MC-6308 for MOV A2CCMOV0772, "Component-Cooling Water"

Calculation 3L481MC6258 for MOV B2EDMOV0064, "Isolation of Containment Sump from Floor-Drain Tank"

Calculation 3L481MC-6190 for MOV 2CV0014, "Letdown-Line Orifice Valve"

Calculation ST400088-00081-AWN for MOV A2SIMOV0004A, "Safety Injection"

Calculation ST400088-00026-AWN for MOV A2RCMOV0001A, "Reactor Coolant System (RCS) Power-Operated Relief Valve (PORV)