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

Report No.: 50-395/92-02

Licensee: South Carolina Electric & Gas Company
Columbia, SC 29218

Docket No.: 50-395 License No.: NPF-12

Facility Name: Summer

Inspection Conducted: January 27-31, 1992

Inspectors: C. Smith, Lead Reactor Inspector — Date Signed 3/3/92

for L. Keller, Resident Inspector, Summer — Date Signed 2/28/92

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SUMMARY

Scope:

This special, announced inspection examined the program developed in response to NRC Generic Letter (GL) 89-10, "Safety-Related Motor Operated Valve Testing and Surveillance." The inspection was the first of two or more that will be conducted for each nuclear plant in accordance with NRC Temporary Instruction 2515/109, issued January 14, 1991.

Results:

The inspectors determined that a basic program had been developed which addressed most of the generic letter recommendations. Concerns were identified in some areas; strengths were also noted.

TABLE OF CONTENTS

A written response is requested for two concerns. One is a concern related to the PORV block valves having their torque switches bypassed and the valve close operation being controlled by the close limit switch. The other is the generic letter program, as currently structured, to perform differential pressure tests where practicable does not include all testable valves. Some valves are excluded by grouping. The concerns and strengths identified are listed below, with the concerns separated into those for which a written response is requested and those for which no response is requested.

Concerns - Written Response Requested

(1) The licensee has identified 35 groups of MOVs based on similarity in design, functional characteristics, and operating conditions. This grouping methodology takes credit for equivalent group of MOVs based on successful differential pressure testing of the least capable MOV within a group. Implementation of this methodology will not result in performing a differential pressure test where practicable, as recommended in the generic letter. The licensee does not have a verifiable basis for the assumptions used for the grouping methodology. The omission of differential pressure testing on MOVs where practicable is contrary to the generic letter 89-10 recommendations and the licensee's commitment to comply with the generic letter. [Reference Section 3.d]

(2) The licensee has bypassed the torque limit switch for the PORV block valves and used the close limit switch for de-energizing the motor during MOV close operation. This practice is not recommended by Limitorque. Additionally, industry experience has shown that these MOVs have had difficulty closing under highly loaded conditions. The licensee needs to justify use of the above practice. [Reference Section 3.c]

Concerns - No Written Response Requested

(1) Inconsistencies were noted in the licensee's draft design basis review documents. Further engineering review of these documents will be required to ensure that the licensee's generic letter MOV torque switches are set appropriately. [Reference Section 3.b]

(2) Licensee's generic letter 89-10 program does not make provision for evaluating the effects of high ambient temperature on motor developed torque. [Reference Section 3.b]

(3) Licensee's use of 0.3 valve factor in calculating thrust requirements for gate valves is non-conservative. The licensee needs to validate this value of valve factor via dynamic tests or develop specific justification for its use. [Reference 3.c]

(4) The generic letter program does not make provision for evaluating differential pressure test results in order to determine available thrust margin. Test results are not reviewed to validate assumptions used in thrust equations. [Reference 3.c]

(5) The generic letter program needs to clearly identify the margin, related to lubricant aging effects, that is applied to required thrust numbers. Additionally, the licensee needs to evaluate MOV test results to identify the "rate of loading" effects on load sensitive MOVs. [Reference 3.c]

(6) Limit seating MOVs, that have leakage criteria, requires a switch setting that ensures adequate leak tightness without exceeding the valve or actuator rating. [Reference 3.c]

(7) Inconsistencies were noted in the licensee's draft thrust calculation documents. Further review of these documents will be required to ensure that the licensee's generic letter MOV torque switches are set appropriately. [Reference 3.c]

(8) The licensee needs to review differential pressure test results, to the extent necessary, to ensure operability of an MOV prior to returning the system to operation. [Reference 3.d]

(9) The program did not justify the use of static tests to periodically verify MOV capability in accordance with the generic letter recommendations. [Reference 3.e]

(10) Use of a thrust measuring device to measure thrust during dynamic tests will affect the licensee's ability to detect load sensitive MOV behavior. [Reference 3.1]

(11) Calculating maximum expected differential pressure using design values for upstream pressure could result in overly conservative assumptions. Achievement of the identified worst case conditions during differential pressure test may not be possible. [Reference 3.b]

Strengths

(1) The licensee has devoted considerable resources to the generic letter program. The personnel assigned were knowledgeable regarding the issues and were actively involved in implementing the program. [Reference 3.h]

(2) The licensee's training facility, including the laboratory, was identified as a strength. [Reference 3.j]

(3) The capability of the Corrective Action Program to implement significant corrective actions for generic letter MOVs has resulted in plant safety enhancements. [Reference 3.k]

(4) Post maintenance test requirements have been fully specified for various maintenance activities performed on generic letter MOVs. [Reference 3.e]

No violations or deviations were identified.

REPORT DETAILS

NRC Inspection of the Program Developed in Response to Generic Letter 89-10 at the V. C. Summer Plant

1. Background

On June 28, 1989, the NRC issued Generic Letter (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 are selected, set and maintained properly. The staff held public workshops to discuss the generic letter and to answer questions regarding its implementation. On June 13, 1990, the staff 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 staff 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 staff 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 staff 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 generic letter program.

In GL 89-10 the NRC staff requested licensees to submit a response to the generic letter by December 28, 1989. South Carolina Electric and Gas Company (SCE&G) submitted a response to the generic letter for its Summer facility on December 22, 1989 and indicated it would comply with the recommendations of the generic letter, including its five year schedule. In a letter dated September 28, 1990, SCE&G requested an extension of the implementation time frame for the generic letter because of scheduling constraints related to differential pressure testing of MOVs. The NRC granted this extension which added one outage or approximately five months to the original time schedule allowed by the generic letter.

2. Inspection Plan

The NRC inspectors followed Temporary Instruction (TI) 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 TI which involves a review of the program being established by the licensee in response to GL 89-10. Part 2 of the TI, which involves a detailed review of program implementation, was not performed. Implementation was examined only where this aided in evaluating the program.

3. Program Areas Inspected and Findings

3.a. Scope of Generic Letter Program

GL 89-10 states that all safety-related MOVs and other MOVs that are position-changeable should be included within the program. The inspectors reviewed and discussed the scope of the GL 89-10 program with SCE&G personnel. The program includes 133 MOVs and the screening criteria used is within the conditions stated within GL 89-10. The criteria were described in CALC No. 0980-077-SC-001, Scope. MOVs that are non-active, locked out of service or do not perform a safety-related function were excluded from the program. The basis for each MOV that was excluded was given in the above calculation. System drawings were inspected to verify that MOVs were included in the program. The following systems were reviewed to verify that their applicable MOVs were included in the licensee's program:

- High Head Safety Injection
- Low Head Safety Injection
- CVCS
- Component Cooling Water
- Essential Chill Water

Also, a walkdown of selected plant systems, available during power operation, was performed to verify the program scope.

Several EOPs were reviewed and any valve listed was checked against the program scope. No valves were identified that had been improperly excluded or not included in the program.

No concerns were identified in this area.

3.b. Design-Basis Reviews

In recommended action a of GL 89-10, the NRC staff requested the review and documentation of the design-basis for the operation of each MOV within the generic letter program to determine the maximum differential pressure and flow (and other factors) expected for both normal operations and abnormal conditions. VCSNS committed to comply (with exceptions) with the recommendations of GL 89-10 in a letter to the NRC dated December 22, 1989.

Accordingly, the inspectors examined the VCSNS GL 89-10 Program Description documents to determine that the review methodology and criteria were consistent with the recommendations of GL 89-10 and

Supplement 1. The documents reviewed were (1) "Station Administrative Procedure SAP-1250, Motor Operated Valve Program, Rev. 0, (2) Design Engineering's "MOV Program Description," dated December 26, 1990, (3) ABB Impell Instruction 0980-077-PI-001, "Maximum Design Basis Differential Pressure Determination," Rev. 1, and a sample of draft design-basis review calculations, 0980-077-DP-001, Safety Injection, 0980-077-DP-002, Charging System, and 0980-077-DP-004, Service Water.

VCSNS had identified 133 MOVs to be in their GL 89-10 program. At the time of the inspection, the licensee was incorporating contractor-performed differential pressure calculations into their generic letter program. The licensee's draft calculations were in the process of final review.

The licensee's method of determining a MOV differential pressure consisted of performing a calculation to determine the maximum expected differential pressure for each MOV during opening and closing for both normal and abnormal events, and valve mispositioning conditions. In most cases, design numbers were used for upstream pressure. Downstream pressure was typically assumed to be zero psig. The inspectors were concerned that use of design numbers could lead to overly conservative assumptions that make it difficult to achieve the identified worst case conditions as part of the differential pressure test program.

The inspectors noted that VCSNS' analyses had determined only differential pressure and did not consider design flow effects and other factors discussed in the staff response to Question 16 of Supplement 1 to GL 89-10. To determine the conditions under which the MOV must perform its safety function, the generic letter recommended that licensees consider all relevant factors that may affect the capability of the MOV to perform its function. The licensee's calculations documented the fluid phase, but did not identify fluid temperatures. VCSNS' MOV design basis test program intends to account for flow by establishing MOV test conditions using existing system pumps to achieve the maximum flowrate attainable.

During review of the licensee's draft design basis review documents, the inspectors noted inconsistencies between text portions of the analysis and the summaries that existed at the end of each section. Licensee personnel indicated that technical review of the documents had been completed. Further engineering review of design basis documents will be necessary to ensure that the licensee's generic letter MOV torque switches are set appropriately.

The methodology used by the licensee for calculating minimum MOV terminal voltage was described in technical instruction number 0980-077-PI-077, MOV Electrical Design Basis Review, Revision 1. The inspectors reviewed this technical instructions and verified that the methodology included the effects of TOL resistance, feeder cable

impedance, and motor impedance, all temperature corrected for high ambient temperature. The motor locked rotor current at an assumed power factor of 0.40 was also used as inputs into the voltage drop calculations. The inspectors did not identify any deficiencies with the licensee's methodology.

Values of minimum MOV terminal voltages were documented in calculation number 0980-077-EV-001, Minimum MOV Terminal Voltages, Revision 0. The inspectors reviewed this calculation and verified that the specified minimum MCCs bus voltages, for normal and accident temperature conditions, were based on a degraded voltage condition consistent with the degraded voltage relay setpoint contained in TS Table 3.3-4. Calculated values of MCCs steady state bus voltages under degraded voltage conditions were contained in calculation of record number DC-820-001, "ESF Undervoltage Relay Logic Settings and Transformer Tap Settings," Revision 11. This calculation was reviewed by the inspectors who conducted interviews with licensee's engineering personnel concerning recent hardware changes made to the degraded voltage relay via a plant modification. The inspectors were informed that the degraded voltage relay on the 7.2 kv Emergency Bus had been replaced by a model having closer setpoint tolerance. The degraded voltage relay setpoint, however, had not been changed at this time. Any future change to the setpoint specified in TS Table 3.3-4 will require the approval of the NRC. Additionally, the electrical design basis information for MOVs within the scope of GL 80-10 will have to be re-evaluated to determine the impact of this change on the MOV degraded voltage capability. The calculated values of minimum MOV terminal voltages were not determined for DC operated MOVs. The inspectors were informed that DC operated MOVs were not included in the GL 89-10 Program. The inspectors did not identify any deficiencies with the licensee's degraded voltage calculations.

The effect of high ambient temperature caused by DBA upon motor developed torque was discussed with licensee's engineering personnel. Licensee management is aware of the study being done by Limitorque concerning the effect of high ambient temperature on motor developed torque. Upon completion of this study an evaluation of the temperature effects on motor performance will be performed by the Licensee. Additional inspection in this area will be completed during future NRC inspections.

3.c. MOV Switch Settings

In recommended action b of Generic Letter 89-10, the NRC staff requested licensees to review, and to revise as necessary, the methods for selecting and setting all MOV switches.

The inspectors reviewed the licensee's VCSNS GL 89-10 Program Description documents consisting of the following: "Station Administrative Procedure SAP-1250, Motor Operated Valve Program," Rev. 0, Design Engineering's "MOV Program Description," dated

December 26, 1990, ABB Impell Instruction 0980-077-PI-002, "Minimum Seat Thrust Determination," Rev. 2, and Impell Instruction 0980-077-PI-006, "MOV Design Review and Capability," Rev. 3, and a sample of draft MOV thrust calculations (0980-077-TH-001, Charging System, 0980-077-TH-002, Safety Injection, 0980-077-TH-004, Service Water, and 0980-077-TH-007, Reactor Coolant). The inspectors also discussed the process for sizing MOVs and setting their switches with VCSNS personnel.

VCSNS had draft sizing and switch setting calculations for 113 gate, globe, and butterfly valves. A standard industry equation was used for determining the required minimum thrust for gate and globe valves. The worst case differential pressures identified in each MOV's design-basis calculation were applied in sizing and setting the MOVs for opening and closing capability. A 0.60 valve factor was identified for Westinghouse and Borg Warner gate valves. However, the licensee was using a non-conservative 0.3 valve factor for other gate valves, such as Anchor Darling, without a test-based justification. All calculations used orifice diameter to determine the disk area term. Valve factors for globe valves ranged from 1.15 for valves 2 inch and larger to 1.50 for valves smaller then 2 inch.

Thrust requirements based on a 0.30 valve factor for flex wedge gate valves have been shown to yield non-conservative results in some analytical thrust determinations. The inspectors indicated that the use of low valve factors places a special emphasis on the performance of design basis testing of MOVs in situ in order to verify the licensee's methodology for sizing MOVs and their switches. Where it is not practicable to test an MOV under worst case differential pressure and flow conditions, VCSNS will need to develop specific justification. The licensee will need to be prepared to evaluate its methodology, including appropriate consideration of MOV operability, when results of design basis testing are obtained. The licensee's use of a 0.30 valve factor will be reviewed during future inspections.

In light of the above concerns, the inspectors noted that VCSNS' generic letter program did not identify a feedback process where an evaluation of differential pressure test results would be used to determine available thrust margins. Differential pressure test results should be used to validate assumptions used in VCSNS' thrust equations to ensure that design basis thrust requirements used for MOV baseline setup remain valid. The licensee's use of differential pressure test results will be reviewed during future inspections.

VCSNS' methodology for baseline setup of MOV torque switches included the use of diagnostics to set torque switches above the minimum required thrust and below the maximum allowable thrust, as calculated by engineering. The required thrust numbers were used to develop a "window" that included margins to account for diagnostic equipment inaccuracies. VCSNS was also using a margin that was originally

designed to account for lubricant aging effects and assigning it to account for load sensitive MOV behavior otherwise known as "rate of loading." Load sensitive MOV behavior can reduce the thrust delivered by the motor operator under high differential pressure and flow conditions from the amount delivered under static conditions. The licensee must review test results to ensure that this approach is adequate to account for load sensitive MOV behavior. If adjustment is found to be necessary, then this adjustment should be applied uniformly to all MOVs that are not practicable to test at design basis conditions. In addition, the licensee's program should be clarified to identify that this margin was assigned to address lubricant degradation and load sensitive MOV behavior.

The licensee assumes a stem friction coefficient of 0.20. The calculated minimum required thrust is multiplied by the stem factor (based on a 0.20 stem friction coefficient) to determine the equivalent minimum required actuator torque. Because baseline setup of the MOV will typically occur when the stem has been recently lubricated, VCSNS decided to adjust upward the minimum required thrust limit to ensure sufficient thrust would be produced under degraded lubricant conditions. This was done by taking the minimum required actuator torque (as calculated above) and dividing it by a stem factor based on a 0.15 stem friction coefficient. The end result of this process was a more conservative minimum required thrust limit. The inspectors' only concern was that the licensee later decided to use this margin to also cover possible load sensitive MOV behavior without specific justification. VCSNS will need to evaluate as-found test data to ensure that worst-case lubricant conditions are identified and review differential pressure test results (as outlined in the above paragraph) to ensure that this margin is adequate to account for degradation in stem lubricant and load sensitive MOV behavior. The licensee's method of accounting for the stem friction coefficient and load sensitive MOV behavior will be reviewed during future inspections.

The inspectors noted that the licensee had several MOVs (mostly Limitorque SB actuators) which had minimum thrust requirements that exceeded the results of Limitorque's standard equation for the calculation of actuator output under degraded voltage conditions. To offset this condition, the torque switches for these MOVs were bypassed and were controlled by the closed limit switch. This places heavy emphasis on the stall capability of the actuator's motor and is not a recommended practice by Limitorque. The licensee's justification was that these MOVs had utilized this control method from the time the plant was built. Of particular concern was that the PORV block valves, which have had difficulty closing under highly loaded conditions at other nuclear facilities, were included in this group. The inspectors considered this to be a response item in that VCSNS needs to identify what actions will be taken to ensure that these MOVs will function under all worst-case conditions including degraded voltage.

As identified above, VCSNS is controlling many MOVs with the closed limit switch, some of which have leakage criteria associated with them. Limit seating MOVs makes it difficult to set the closed limit switch in such a manner that ensures adequate leak tightness without exceeding the valve or actuator ratings. The basis for the limit switch set-points needs to be justified by the licensee.

During review of the licensee's draft thrust calculation documents, the inspectors noted inconsistencies between the values listed in the input data summary (at the top of the data sheet) and the calculations (at the bottom of the data sheet). For example, the stem diameter for XVG-1002-EF was listed in the summary as 1.00 inch, but the thrust calculations used a value of 1.25 inch. As with the design basis review documents, licensee personnel indicated that technical review of these documents had been completed. Further engineering review of thrust calculations will be necessary to ensure that the licensee's generic letter MOV torque switches are set appropriately.

The licensee accounted for degraded voltage conditions through the use of an undervoltage factor that is part of the motor actuator capability calculation. This factor was determined for each MOV based on the minimum value of terminal voltage that would exist at the motor under degraded voltage conditions. The inspectors reviewed the design input voltage ratios used in the actuator capability calculation and did not identify any concerns.

3.d. Design-Basis Differential Pressure and Flow Testing

In recommended action c of the generic letter, the NRC staff requests licensees to test MOVs within the generic letter 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 suggests 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 generic letter.

The inspectors reviewed VCSNS' program documents, test procedures, draft 0980-077-GR-001, "Groups," and ABB Impell Instruction 0980-077-PI-005, "Generic Letter 89-10 Valve Population and Grouping," Rev. 1, to evaluate the licensee's generic letter program for differential pressure testing. The inspectors also conducted discussions with licensee personnel.

VCSNS intends to utilize a grouping methodology that groups MOVs based on similarity in design, functional characteristics, and operating conditions. The licensee had identified 35 groups in Attachment 1 of CGSS-01-2604-NO, "DP Testing Groupings for Generic Letter 89-10." VCSNS' grouping methodology had a premise that credit can be taken for the equivalent group of valves based on successful demonstration that the one MOV in the group with the least capability passes its differential pressure test. As outlined in Supplement 1 of the generic letter, grouping is one possible alternative for addressing MOVs that are not practicable to test and would be considered the first stage of a two stage approach. In light of industry test results to the contrary, the licensee's premise was considered unjustified. The licensee did not have a test-based justification for their assumption. The inspectors considered the VCSNS' position on including testable MOVs in their grouping families for the purpose of reducing the population of MOVs requiring differential pressure tests to be contrary to their commitment to the generic letter to test where practicable. The inspectors considered this to be a response item.

The inspectors reviewed a sample of the licensee's test procedures and noted that the MOV test program's acceptance criteria did not include an evaluation of test results to determine available thrust margins. Differential pressure test acceptance criteria should ensure operability under all conditions including degraded voltage. In addition, differential pressure test results should be used to validate assumptions used in VCSNS' thrust equations to ensure that design basis thrust requirements used for MOV baseline setup remain valid. Further, VCSNS should review differential pressure test results to the extent necessary to ensure the operability of an MOV prior to returning the system to operation. This issue will be reviewed during future inspections.

3.e. Periodic Verification of MOV Capability

In recommended action d of the generic letter, the NRC staff requested that licensees prepare or revise procedures to ensure that adequate MOV switch settings are determined and maintained throughout the life of the plant. In Section j of the generic letter, the staff 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 five years or three 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 are not representative of the MOV.

The licensee's upper-tier program document SAP-1250, Motor Operated Valve Program, Revision 0, paragraph 6.34, established requirements for performing periodic diagnostic testing and trending of MOVs to identify degradations. Site level procedure ES-424, MOV Program

Implementation, paragraph 6.7.1.B, implements these requirements and specified a periodicity of five years or three RFO for performing these diagnostic tests. The surveillance interval may, however, be adjusted by the MOV Coordinator based upon written justifications.

Discussions with licensee engineering personnel revealed that static diagnostic testing would be performed periodically to reverify design basis capability of the MOVs within GL 89-10 program scope. The inspectors informed licensee management that the use of static testing to verify continued capability of an MOV to operate under worst case differential pressure and flow conditions was not considered adequate at this time. The reason given was the unknown relationship between the performance of an MOV under static conditions and under design basis conditions. The licensee will be expected to provide a technical justification for whatever method is used for periodic verification of MOVs capabilities. Additional NRC inspection of this area will be required in order to evaluate the verification method used.

The licensee's GL 89-10 MOV Program has established requirements for post maintenance activities to be performed on MOVs following any type of maintenance on the operator or valve. Preventive maintenance activities for these MOVs were specified in procedure SAP-143, Preventive Maintenance Program, Revision 6. Additionally, scheduling of PM activities were accomplished via a computerized system, CHAMPS, on a frequency that had been established for the PM task. The inspectors reviewed the "Requests for PM Sheets," prepared for MOVs that had completed baseline testing and verified that these MOVs had been incorporated into the CHAMPS data base with a maintenance frequency consistent with program requirements. The bases for PM activities, including lubrication requirements, were discussed with Licensee's engineering personnel. The inspectors determined that these bases were derived from Vendor Technical Manuals, Plant Lubrication Manual and Equipment Qualification Manuals. Post maintenance test requirements for MOVs within the scope of the GL 89-10 program were delineated on test matrices for typical work activities associated with a MOV. The inspectors identified the specified PMTRs as a program strength based on guidance provided on Enclosures 6.6 and 6.7 of procedure SAP-143.

The licensee had committed to the requirements of Regulatory Guide 1.106, regulatory position 1.b, by providing a bypass of the TOL protection of safety related MOVs upon receipt of an ESF signal. Technical Specification, Table 3.8.2, provided a listing of those MOVs that have had their TOL protection bypassed. The inspectors determined that periodic tests associated with these MOVs were performed on a frequency specified in T.S. Section 3.8.4.2, and were not scheduled in accordance with any requirements of the GL 89-10 program.

3.f. MOV Failures, Corrective Actions, and Trending

In recommended action h of the generic letter, the staff 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 also suggests that the material be periodically examined (every two years 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 periodically adequate MOV capability. The generic letter indicates that a well-structured and component-oriented system is necessary to track, capture, and share equipment history data.

The inspectors reviewed the following material concerning this subject:

SAP-1250, Motor Operated Valve Program, Rev. 0

EMP-445.008, Motor Operated Valve Data, Rev. 5

ES-424, MOV Program Implementation, Rev. 0

EMP-445.001, Limitorque Preventative Maintenance, Rev. 7

EMP-445.002, Operator Maintenance, Rev. 9

EMP-445.004, Rotork Maintenance, Rev. 3

SAP-1141, Nonconformance Control Program, Rev. 0

The emphasis of this inspection was program review. The licensee's program for accomplishing the disposition and documentation of equipment failures is the Nonconformance Control Program (SAP-1141). The specific program for accomplishing the above reviews, trends, justifications, etc. for MOVs was titled, MOV Program Implementation (ES-424). ES-424 appeared to be adequate to meet the requirements of GL 89-10.

In the area of MOV failures and corrective action, the inspectors reviewed the licensee's files of nonconformance notices (NCNs) for MOVs. With one exception, the NCNs reviewed were dispositioned properly.

Incomplete root cause failure analysis of a failure of XVG-3103B SW (Service Water) during generic letter differential pressure testing caused the licensee to not consider the assumptions used in the required thrust calculation as a possible source of the failure.

VCSNS determined that the test in the closing direction was conducted under flow conditions that resulted in a differential pressure that was too high. The MOV would only experience this level of differential pressure during a mispositioning scenario. Because the licensee's thrust calculation used the design basis differential pressure value (which was approximately 33 psid greater than was present during the second successful test) and the results of this calculation showed that the valve was capable, the test differential pressure should not have caused the problem. The failure appears to have been caused by the use of a nonconservative valve factor assumption in the thrust calculation for this gate valve, thereby underpredicting the required thrust. This test indicates that the licensee's assumption for valve factor may be nonconservative for this, and other, Anchor Darling flex wedge gate valves. This issue will be re-evaluated during future NRC inspections.

3.g. Schedule

The NRC staff, in GL 89-10, requested that licensees complete all design-basis reviews, analyses, verifications, tests, and inspections by June 28, 1994 or three refueling outages after December 28, 1989, whichever is later.

SCE&G accepted this schedule in the December 22, 1989 response, but due to scheduling constraints, an extension was requested by letter, dated September 28, 1990. The NRC staff reviewed the request and granted an extension by letter dated October 29, 1990. Accordingly the licensee has prepared a schedule to complete the GL implementation during refueling 8, which is scheduled for the second quarter of 1994. During discussions of the schedule with licensee management it was noted that if additional MOVs require dynamic testing the schedule may need to be reevaluated. Licensee management indicated that their commitment tracking program is under review and the NRC would be notified in advance when a scheduled commitment appears to be difficult to complete.

3.h. Overall Administration of MOV Activities

Overall administration of the GL 89-10 program is described in procedures ES-424, MOV Program Implementation and SAP-1250, MOV Program. These documents contain detailed guidance regarding program activities and assign the responsibility for ensuring proper implementation. Discussions with plant personnel revealed that they were very knowledgeable of the issues involved in GL 89-10 and were actively addressing the issues toward an acceptable solution.

An MOV coordinator has been selected to have overall control of the program. This coordinator has available the necessary resources and assistance to enable the job to be acceptably completed.

An MOV steering group meets periodically to review and direct the program. It includes personnel from Operations, Nuclear Licensing, Mechanical and Electrical Maintenance with the MOV coordinator as the primary contact.

The licensee has developed an interface with the industry groups working toward resolving MOV concerns. For example, the licensee participates in the MOV Users Group (MUG) and the Electric Power Research Institute activities related to MOV Performance.

The inspectors concluded that the licensee has devoted considerable resources to the GL 89-10 program. The necessary engineering expertise to facilitate program implementation was provided on site. When necessary, contract personnel was utilized. The personnel assigned were very knowledgeable regarding the issues and were found to be actively involved in implementation of the program. This was considered a strength in the licensee's program.

3.i. MOV Setpoint Control

The inspector reviewed procedure EMP-445.008, Motor Operated Valve Data, Revision 5 and determined that approved values of MOV actuator thrust were listed on Enclosure 10.1. These maximum and minimum torque switch setpoints were calculated based on maximum and minimum design requirements determined from design basis reviews. They were issued as approved design outputs contained in MCN No. 21745 C and were prepared, reviewed and approved in accordance with the design control program requirements. Site level procedures delineating the requirements of the MOV Baseline Tests are used to ensure that MOV torque switches are set per the values listed on Enclosure 10.1. Values for limit switch settings were determined to be specified on the B-208 drawing series, and procedural controls have been established to ensure that geared limit switches are set in accordance with these requirements.

The inspectors concluded that setpoint changes to design basis information, involving torque switches, limit switches, and TOLs, are performed under design controls specified in procedure ES-416, Design Modification Change Process and Control, Revision 5. These changes will require a 10 CFR 50.59 Safety Review to be performed. Additionally, for MOVs that have been modified to the extent that existing test results are no longer representative of the MOV operation, post modification test will require in situ differential pressure test, if necessary.

The inspectors did not identify any deficiencies in this area.

3.j. Training

The inspectors reviewed training procedures, course outlines, toured the training facility, and discussed the training program with

licensee personnel. The licensee conducts a eight hour training course for electrical maintenance personnel titled, "Limitorque Valve Operators", using lesson plan AEC 23-001. Upon completion of this lesson plan, the trainee completes a written exam and then completes eight hours of lab training using lesson plan LEC 23-001. The Lab training consists of conducting maintenance activities on MOVs. Mechanical maintenance personnel receive forty hours of classroom training (AMC 10-001). The licensee also conducts sixteen hours of laboratory training on the MOVATS 2150 system for personnel involved in testing MOVs. The MOVATS instructors are plant personnel that attend onsite training at MOVATS and then conduct training courses at the plant site for plant personnel. The methods used by the licensee to ensure the adequacy of this training will be assessed in the NRC inspection of GL 89-10 program implementation.

Refresher training is performed for mechanics every three years and for electricians every four years. A refresher training schedule for MOVATS test group personnel was not established. The licensee stated that as information updates become available, they will be incorporated into the training program and future refresher classes. 100 percent of all personnel authorized to perform maintenance or testing of MOVs had received all required training. The inspectors noted that the licensee's training facility was a strength.

3.k. Industry Experience and Vendor Information

The inspectors found that the licensee had a good system for collecting industry experience and vendor information and ensuring that it was distributed, communicated, and tracked until resolved. Under the Technical Oversight Procedure titled, "Operating Experience Review", (TO-301) the Senior Operating Engineer from the Operating Experience Group receives incoming NRC documents, INPO information, and vendor documents. He then assigns these items to the appropriate engineer or technical specialist for disposition. These issues were tracked on the licensee's regulatory tracking system database.

Engineering Services procedure, ES-414, provided guidance for accepting inputs from individuals personally receiving information from vendors, etc. An example is technical manual revisions which were mailed directly to the appropriate engineer/technical contact, who in turn sent them to the Manager, Design Engineering for review and subsequent distribution in accordance with ES 414.

The inspectors reviewed the handling of the following industry experience items and 10 CFR 21 reports received by the plant:

- Westinghouse Technical Bulletin NSID-TB-88-01, "Spring Compensator Housings on Limitorque Valve Operators"

  This technical bulletin recommends replacing all cast iron housings on SB-00 actuators, having serial number 222711 or

lower, with ductile iron housings. VCSNS had 18 actuators fitting this description. Seven have been replaced. The rest are scheduled to be replaced at the time of preventive maintenance on each actuator. Completion is scheduled by the end of RF7.

- NRC Information Notice 88-84, "Defective Motor Shaft Keys in Limitorque Motor Operators"

  This notice reports that a total of eleven Limitorque Model SMB-0-25 motor operators have experienced either sheared or deformed motor shaft keys, all of which were made of material inferior to the AISI Type 1018 steel that was specified.

  Although VCSNS does not employ SMB-0-25 operators, they did have eight SMB-2 operators that were in the population described in the notice that could potentially experience failures if the keys are of the non-specified key materials. The Operating Experience evaluation concluded that the motor shaft keys on the eight identified operators should be replaced with keys made from warehouse stock material which is the specified Type 1018 steel.

  MWRs 90E0027 thru 90E0034 were written to replace the motor shaft keys. Three operators have not had their keys replaced. Completion of the task will coincide with the next MOVATS baseline for each of the operators.

- Limitorque Part 21 Notification, "SMB 000, 00 Torque Switch Failures"

  This notification states that the use of fiber spacers under the contact bridge of SMB 000 and 00 can-type torque switches has resulted in three switch failures.

  This notification does not apply to the size 00 operators at VCSNS because they do not use can-type torque switches.

  Any of the VCNS size 000 operators may have been received with fiber spacers, according to the notification. All but one of Summer's safety related size 000 operators have had their torque switches changed. Procurement Quality has verified that all safety related replacement size 000 torque switches that were purchased were exempt from the concern involving fiber spaces, according to the notification guidelines. VCSNS does not have any spare non-safety size 000 torques switches onsite.

  The one corrective action resulting from this issue is the inspection of the final size 000 operator having an original torque switch which is scheduled for the 7th refueling outage.

- Limitorque Potential Part 21: "SMB 00 Torque Switch Roll Pin Failures"

  Limitorque reported the torque switch (TS) design used in size 00 actuators having serial numbers greater than 233218 can experience roll pin failure leading to actuator inoperability. Limitorque has established the root cause to be manual operation after having shut the valve electrically. This shift to manual operation suddenly releases the energy stored in the spring pack, causing TS roll pin failure.

  The Operating Experience evaluation determined this issue to be applicable to VCSNS and that they have had roll pin failures on two sister valves. NCN dispositions had installed stronger groove pins (Spring, 1990) and no failures have occurred since. The evaluation requested Design Engineering to obtain the stronger TS's recommended by Limitorque and install them in all size 00 actuators at VCSNS.

  Design Engineering is in process of purchasing size 00 TS's that meet the new Limitorque design standards, for all SMB 00 actuators at VCSNS. Maintenance is in process of replacing size 00 TS's for 34 actuators in the safety related serial number greater than 233218 category. Seventeen of this population were replaced in RF6; the rest will be replaced by the end of RF7. Non-safety applications will be replaced at time of actuator MOVATS baseline.

- NRC IN 90-40, Results of NRC-Sponsored Testing of Motor-Operated Valves, processed under IN 90-40. Corrective action completed.

- NRC IN 89-90, Recent NRC-Sponsored Testing of MOVs, processed under IN 89-90. Corrective action completed.

- NRC IN 89-61, Failure of Borg-Warner Gate Valves to Close Against Differential Pressure, processed under IN 89-61. Corrective action completed.

- NRC IN 90-72, Testing of Parellel-Disk Gate Valves in Europe, processed under IN 90-72. Corrective action completed.

- Limitorque P21 letter dated March 18, 1988, H3BC Cracked Worm Gears, processed under VEN 900038. Corrective action in progress.

- Limitorque P21 letter dated November 3, 1988, Temperature Effects on RH Insulated DC Motors, processed under VEN 880039. Corrective action completed.

- Limitorque P21 letter dated March 20, 1990, Motor Pinion Keyway Depth, processed under VEN 900024. Corrective action completed.

- Limitorque Maintenance Update 88-1 dated August 17, 1988, processed under NOE 88-03. Corrective action completed.

- Limitorque Maintenance Update 88-2, processed under SER 87-20. Corrective action completed.

Significant corrective actions have been initiated by this program, resulting in safety enhancements in the plant. This area was identified as a strength.

3.1. Use of Diagnostics

VCSNS had been using MOVATS diagnostic equipment to provide a measurement of thrust delivered by motor operators for rising-stem valves. In the past, the licensee had used the thrust measuring device (TMD) for determining actuator output thrust. In light of the concerns over using the TMD to measure thrust, the licensee was adding the torque thrust cell (TTC) to its diagnostic equipment to provide direct measurement of available thrust. Discussions with licensee personnel revealed that the licensee intended to use the TTC and TMD during baseline setup of their MOVs while the TMD alone was to be used for measurement of thrust during differential pressure testing. The inspectors were concerned that the TMD exhibits its worst performance for measurement of thrust when a highly loaded dynamic test is performed. Use of the TMD alone during differential pressure testing will affect VCSNS' ability to detect load sensitive MOV behavior. Combined use of the TTC and TMD allows for assessment of actuator output thrust under all load conditions. This issue will be reviewed during future inspections.

The licensee had not reviewed the preliminary report addressing the MOV Users' Group (MUG) testing of diagnostic equipment. The inspectors stated that, during this time period when the results of the diagnostic testing are being finalized and distributed by MUG, the licensee will need to evaluate each MOV to determine which diagnostic equipment had been used to establish the switch settings. The final MUG report was scheduled to be released in February 1992. The licensee will need to take prompt action in response to the MUG findings to make appropriate operability determinations, and to reset MOV switches or make hardware modifications, as necessary.

4. Conclusions

The licensee had developed a basic program which adequately addressed most of the generic letter program recommendations. The inspectors identified both strengths and concerns in various program areas. A written response is requested for two concerns. One of the concerns involves testing where practicable. The other concern involves a licensee practice that could impact the capability of the PORV block valves to perform their design functions. All of the concerns will be examined further during subsequent NRC inspection of program implementation.

5. Exit Interview

The inspection scope and results were summarized on January 30, 1992, with those persons indicated in the Appendix. The inspectors described the areas inspected and discussed in detail the concerns listed in the "Summary". Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

APPENDIX 1

PERSONS CONTACTED

Licensee Employees

*J. Skolds, Vice President, Nuclear Operations
*G. Soult, General Manager, Nuclear Power Operations
*M. Browne, Manager, Design-Engineering
*C. McKinney, Nuclear Licensing
*A. Koon, Jr., Manager, Nuclear Licensing
*L. Cunningham, Quality Assurance
*C. Bowman, Manager, Maintenance Services
*M. McMillian, Electrical Supervisor
*B. Norcuyy, Electrical Maintenance
*C. Price, Engineering Services
*F. Zander, Nuclear Operations
*C. McGee, Technical Specialist
*C. Osier, Acting Manager, Systems and Performance Engineering
*R. Fowlkes, Associate Manager, Shift Engineering
*S. Reese, Licensing Specialist
*W. Higgins, Supervisor, Regulatory Compliance
*R. White, South Carolina Public Service Agency
*G. Taylor, Manager, Operations
*S. Hunt, Manager, Quality Control
*G. Loignon, Jr., Test Unit Supervisor

*Attended Exit Interview

APPENDIX 2

ACRONYMS AND INITIALISMS

NRC	Nuclear Regulatory Commission
PORV	Power Operated Relief Valve
MOV	Motor Operated Valve
CVCS	Chemical Volume and Control System
EOP	Emergency Operating Procedure
VCSNS	V. C. Summer Nuclear Station
RFO	Refueling Outage
CHAMP	Computerized History and Maintenance Planning System
PM	Preventive Maintenance
PMTR	Post Maintenance Test Requirements
TOL	Thermal Over-Load
T.S.	Technical Specification
NCN	Nonconformance Notice
SCE&G	South Carolina Electric and Gas
MOVAT	Motor Operated Valve Analysis and Test System
INPO	Institute of Nuclear Power Operations
MWR	Maintenance Work Request
TMD	Thrust Measuring Device
TTC	Torque Thrust Cell