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Docket No. 50-272
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License No. DPR-70
DPR-75

Licensee: Public Service Electric and Gas Company
P.O. Box 236
Hancocks Bridge, New Jersey 08038

Facility Name: Salem Nuclear Generating Station Units 1 and 2

Inspection At: Hancocks Bridge, New Jersey

Inspection Conducted: May 4 - 8, 1992 and May 20, 1992

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Inspection Summary: See the Executive Summary.

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EXECUTIVE SUMMARY

The Nuclear Regulatory Commission (NRC) conducted a team inspection at the Salem Nuclear Generating Station on May 4 - 8, 1992 to assess the programs developed by the licensee in response to NRC Generic Letter 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance." This team inspection was accomplished in accordance with NRC Temporary Instruction (TI) 2515/109, "Inspection Requirements for Generic Letter 89-10, Safety-Related Motor-Operated Valve Testing and Surveillance." The generic letter and its Supplements (1, 2, 3 and 4) provided recommendations to the licensees for the development of adequate programs to ensure operability of safety-related motor-operated valves (MOVs) during design basis conditions.

The team concluded that the licensee has developed an MOV program description which meets the intent of Generic Letter 89-10. With the exception of analyzing, establishing corrective actions for and trending MOV failures, the licensee was taking satisfactory corrective actions to resolve various MOV program weaknesses identified during the MOV inspection at the Hope Creek facility in July, 1991. The licensee has established a project team with a good mix of experienced engineering, contractor and maintenance personnel to develop and implement the program. The various documents, such as the MOV program appendices and position papers, supporting the MOV program description were of good quality with a few areas needing minor improvement. A good MOV training program is in place. MOV maintenance was identified by the NRC team as an area requiring further improvements as the failure trending and procedure revisions were not completed to address all the concerns of Generic Letter 89-10.

The licensee has recently completed initial design-basis testing of 4 MOVs. The Valve Operation Test and Evaluation System, which the licensee recently adopted as the primary diagnostic equipment for MOVs at Salem and Hope Creek, was used during this testing. The licensee expects to perform the design-basis testing of approximately 50 percent of the MOVs for Salem 1 and 2. All aspects of the licensee's MOV program are expected to be implemented by mid-1994.

There were no violations or deviations identified during this inspection. The team concluded that, with few a exceptions, the licensee has developed a good motor operated valve program consistent with the recommendations in Generic Letter 89-10.

1.0 INTRODUCTION

On June 28, 1989, the NRC staff issued Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," which requested that licensees and construction permit holders establish a program to ensure that switch settings for motor-operated valves (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 Generic Letter 89-10 to provide the results of the public workshops. In Supplement 2 (issued on August 3, 1990) to Generic Letter 89-10, the staff stated that inspections of programs developed in response to the generic letter would not begin until January 1, 1991. In response to concerns raised by the results of NRC-sponsored motor-operated valve tests, the staff issued Supplement 3 to Generic Letter 89-10 on October 25, 1990, which requested that boiling water reactor licensees evaluate the capability of motor-operated valves used for containment isolation in the steam lines to the high pressure coolant injection system and reactor core isolation cooling system, in the supply line to the reactor water cleanup system, and in the lines to the isolation condenser as applicable. On February 12, 1992 the staff issued Supplement 4 to Generic Letter 89-10 excluding considerations be made for inadvertent operation of MOVs from the scope of Generic Letter 89-10 for Boiling Water Reactors. The generic letter also recommended that each licensee with an operating license complete all design-basis reviews, analyses, verifications, tests and inspections that have been instituted within 5 years or three refueling outages, whichever is later, of the date of the generic letter (June 28, 1989).

The NRC inspection team used Temporary Instruction (TI) 2515/109 (dated January 14, 1991), "Inspection Requirements for Generic Letter 89-10, Safety-Related Motor-Operated Valve Testing and Surveillance," to perform 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 Generic Letter 89-10.

2.0 THE LICENSEE'S GENERIC LETTER 89-10 PROGRAM

In a previous inspection of the Generic Letter 89-10 Program at Hope Creek, as documented in Inspection Report 50-354/91-80, Public Service Electric and Gas (PSE&G) had not established an approved program description. This issue was determined to be a deviation from a prior commitment, PSE&G letter (NLR-N90179) dated August 31, 1990, in response to Generic Letter 89-10. PSE&G provided their corrective actions in response to this deviation in their letter (NLR-N91189) dated November 8, 1991. The team reviewed these corrective actions and determined them to be satisfactory except for weaknesses still present in analyzing MOV failures, establishing corrective actions, and trending MOV operability. The inspection results related to each aspect of Generic Letter (GL) 89-10 are described below.

2.1 Scope and Administration of the Program

The program administration was reviewed to assure that the licensee has an adequate program plan and has delineated responsibilities to complete the Generic Letter 89-10 program commitments.

PSE&G has developed an MOV program description which meets the intent of GL 89-10. This document was issued on October 28, 1991 as Programmatic Standard NC.DE-AP.ZZ-0033(Q) titled, "Motor Operated Valve Program." The team reviewed Revision 1 dated April 24, 1992 and other documents, such as MOV Program appendices, MOV project scope/plans and MOV Program position papers, that support NC.DE-PS.ZZ-0033(Q). The team noted that the MOV program description did not specifically refer to Salem's QA program for basic requirements for corrective action. The licensee noted that this was an oversight which would be corrected.

PSE&G has established a specific project team to develop and implement the MOV Program, thereby addressing the concerns of GL 89-10. The project team uses personnel from existing PSE&G groups in addition to certain contractor personnel employed specifically for the project. The team is headed by a project manager who coordinates the efforts of the various engineering, contractor, licensing, maintenance, and administrative personnel. The MOV project scope document describes the specific responsibilities for the various project personnel.

Piping and instrumentation diagrams, emergency operating procedures, technical specifications, and the updated final safety analysis report were reviewed to verify that MOV's in safety related systems were included in PSE&G's MOV Program. The inspectors verified on a sampling basis that the safety related MOV's in the residual heat removal, safety injection, containment spray, component cooling water, and service water systems had been included in the program. Currently all MOVs installed in safety related systems at Salem 1 and 2 are included in Appendix 1 of the MOV Program, MOV Program Valve Population. This included 100 MOVs for each unit. Appendix 1 provides criteria for including or excluding MOVs from the program.

2.2 Design-Basis Reviews

The licensee's response to the recommendations in GL 89-10 was reviewed to understand the design basis for the operation of MOVs within the licensee's GL 89-10 program. The inspectors reviewed the following documents:

1. PSE&G Nuclear Department Engineering and Plant Betterment Programmatic Standard NC.DE-PS.ZZ-0033(Q), Motor Operated Valve Program, Rev. 1, April 24, 1992 (hereinafter MOV Program Document 0033);

2. Appendix 4 (Rev. 1, April 24, 1992), MOV Program Operating Condition Evaluation, of MOV Program Document 0033;

3. PSE&G Document EE: A-O-ZZ-MEE-0609 Position Paper 3 (Rev. 0, October 25, 1991), Differential Pressure Analysis;

4. PSE&G Position Paper 17 (Rev. 1, April 24, 1992), Valve Mispositioning; and

5. The design basis reviews for several MOVs.

In the MOV Program Document 0033, the licensee states that, for each valve operation, the licensee will determine functional requirements, system pressure, fluid temperature, flow rate, and maximum differential pressure. The MOV Program Document 0033 also states that the Updated Final Safety Analysis Report, plant Technical Specifications, plant procedures (including emergency operating procedures), and other licensee documents will be reviewed in determining these design basis parameters. In Appendix 4, MOV Program Operating Condition Evaluation, of MOV Program Document 0033, the licensee provides requirements for its determination and documentation of maximum differential pressure for the operation of MOVs in its GL 89-10 program.

Position Paper 3, Differential Pressure Analysis, discusses use of the utility owners' group reports for differential pressure evaluations. The licensee stated that the applicability of the analyses in those owners' group reports is being evaluated as part of the design basis reviews. The position paper said that the pressure setpoint tolerances for relief valves were not considered. However, the licensee stated that these tolerances were included for MOVs interfacing with the reactor coolant system. For example, the inspectors noted that the design basis review for the PORV block valves included consideration of the safety relief valve setpoint tolerance in determining the maximum differential pressure for MOV operation.

Although the licensee indicates in the MOV Program Document 0033 that various design basis parameters will be considered, only the determination of maximum differential pressure is described in detail. The licensee notes other design basis parameters such as flow and ambient temperature in its documents. However, the available documents did not include details to demonstrate that flow, ambient temperature and other design parameters were addressed in these evaluations. The licensee agreed to review this matter for resolution.

Position Paper 17 states that the licensee is withholding consideration of the capability of MOVs to respond to inadvertent MOV operations until the NRC staff completes its review of the need to address inadvertent MOV operation as part of GL 89-10 programs at pressurized water reactor plants.

2.3 Diagnostics Systems

The purpose of diagnostic testing is to verify MOV operability and performance and to verify diagnostic information for tracking and trending of MOV performance. MOV diagnostic testing systems from a number of vendors were tested with oversight from the MOV user's group. The testing raised concerns regarding equipment accuracy and application. In reviewing the final report from the MOV user's group regarding diagnostic test equipment accuracy validation, and the unresolved accuracy concerns of PSE&G's previous diagnostic equipment, PSE&G is using the Valve Operation Test and Evaluation System (VOTES) as their primary diagnostic tool for motor operated valves. The overall accuracy of the VOTES system is said to be 9.2% for measuring stem thrust. This accuracy is based upon a standard "two-sigma" criteria, which implies that 95 out of 100 values will be within the stated accuracy of the true value.

Procedure SC.MD-EU.ZZ-0012(Q) is being developed to provide instructions for acquiring and analyzing diagnostic data to support: 1) baseline testing, 2) testing following preventative maintenance or corrective maintenance activity, 3) packing adjustments/replacements, 4) thrust verification, and 5) troubleshooting. This procedure will also support differential pressure (dp) testing of MOV's as part of the station response to Generic Letter 89-10 for first time testing of motor operated valves using VOTES. A separate procedure [SC.MD-EU.ZZ-0015(Q)] is being developed to provide instructions for the proper installation of the VOTES Force Sensor.

The team observed the diagnostic test of valve 11SJ40 using VOTES. Problems were noted in positioning the VOTES calibration tool on the valve stem. Repeated adjustments had to be made throughout the test. Apparently, due to the valve stem configuration, the calibration device was clamped in the only accessible area of the valve stem referred to as the "Transition Region". This region in which the stress distribution is non-uniform occurs when the geometry of a valve stem suddenly changes. For example, the stress distribution in the stem changes from uniform to non-uniform. The non-uniform distribution occurs within 1/2 to 2 diameters of the transition in the unthreaded portion of the stem and within one (1) diameter of the threaded portion of the stem. For situations were this occurs PSE&G must go back to the VOTES vendor for a new "effective diameter" calculation. In addition, when the testing had been stopped, the as found valve had overthrusted into the seat at 38,854 lbs.; the valve had backseated at a force of 4514 lbs.; and the torque switch setting varied from stroke to stroke at the same setting. These deficiencies were documented in a deficiency report (DR) dated May 6, 1992.

2.4 MOV Sizing and Switch Settings

The inspectors reviewed the licensee's response to the recommendation in GL 89-10 to establish the sizing and switch settings for MOVs within the GL 89-10 program. In particular, the inspectors reviewed the following documents:

1. The MOV Program Document 0033;

2. Appendix 5 (Rev. 1, April 24, 1992), MOV Electrical Capability Review, of MOV Program Document 0033;

3. Appendix 6 (Rev. 1, April 24, 1992), MOV Mechanical Capability Review, of MOV Program Document 0033;

4. Appendix 8 (Rev. 1, April 24, 1992), MOV Capability Assessment, of MOV Program Document 0033;

5. Appendix 9 (Rev. 1, April 24, 1992), PS-MOV Database System, of MOV Program Document 0033;

6. Appendix 13 (Rev. 0, December 11, 1991), MOV Mechanical Capability Review for 90 degree Rotation Valves, of MOV Program Document 0033;

7. PSE&G Position Paper 4 (Rev. 1, April 24, 1992), MOV Analysis Assumptions;

8. PSE&G Position Paper 5 (Rev. 1, April 24, 1992), Switch Setting Criteria;

9. PSE&G Position Paper 6 (Rev. 0, October 25, 1991), Operating Margin;

10. PSE&G Position Paper 7 (Rev. 1, April 24, 1992), Switch Setting Administrative Control;

11. PSE&G Position Paper 8 (Rev. 0, October 25, 1991), Torque Switch Setting Limiting Plates;

12. PSE&G Position Paper 21 (Rev. 1, April 24, 1992), Thermal De-rating of Limitorque Operator Motors;

13. PSE&G Position Paper 22 (Rev. 1, March 30, 1992), Determination of Limitorque Motor Power Factor; and

14. The sizing calculations for several MOVs.

The MOV Program Document 0033 states that the electrical and mechanical capability will be determined for each MOV in the GL 89-10 program. Appendix 5, MOV Electrical Capability Review, describes the determination of the degraded voltage factor to be used in the sizing calculations for each MOV in the program. In Position Paper 22, the licensee indicates that the latest information on power factor of the motor under locked rotor conditions will be used in determining the voltage drop in the cable between the motor control center and the valve motor.

In Appendix 6, MOV Mechanical Capability Review, of MOV Program Document 0033, the licensee provides its requirements for determining mechanical capability for each MOV in its GL 89-10 program. Appendix 6 states that actuator rating will be assumed for the weak link of an MOV where the valve limits are not available. The inspectors discussed the validity of this assumption, with the licensee. The licensee stated that the MOV sizing and switch setting calculations will be revised to reflect any changes based on valve limits when received from the vendors.

Appendix 6 requires that MOV capability be evaluated in terms of operating requirements. This appendix provision was not linked to the licensee's procedures for assessing operability. The licensee stated that this linkage will be clarified in its documents. Also, the licensee will need to address rate of loading margins, diagnostic equipment accuracy, and torque switch repeatability in its evaluation of MOV operability.

In Appendix 8, MOV Capability Assessment, of MOV Program Document 0033, the licensee provides instructions for compiling the conclusions developed for its reviews, evaluations and calculations that assess the capability of each MOV in the GL 89-10 program. Appendix 8 stated that the capability of the MOV under full voltage conditions may be assumed, if justified.

In Position Paper 4, MOV Analysis Assumptions, the licensee specifies the assumptions for its MOV sizing and switch setting calculations. For example, the valve factors provided in Limitorque sizing guidelines will be used for the initial calculations, when such information was not provided by the vendor. The licensee stated that it will evaluate the valve factors determined from its MOV tests and revise its calculations accordingly.

In Position Paper 4, the licensee states that a stem friction coefficient of 0.2 will be assumed unless a different coefficient is provided by the valve vendor or determined through empirical methods. The inspectors noted that the licensee will need to verify its assumptions for stem friction coefficient for the entire stem lubrication interval.

In Position Paper 4, the licensee indicates that MOV information may be obtained from nameplate data. However, past experience indicates that the information provided on MOV nameplates may not always be correct.

In Position Paper 4, the licensee indicates that generic spring pack charts provided by Limitorque might be used for estimating operator output torque and establishing switch settings. In the past these generic charts were observed to be unreliable. The licensee obtained equipment in early 1992, to verify the actuator output torque used in its MOVs. However, the program for using this equipment for verification had not been developed.

In Position Paper 5, Switch Setting Criteria, the licensee describes its methodology and criteria for setting Limitorque MOV limit and torque switches. The position paper notes that the licensee will contract directly with ROTORK for setting switches in the MOVs obtained from that manufacturer. In the position paper, the licensee states that the minimum target setting for the torque switch for each MOV will be at least 130% of the minimum required thrust from its calculations. This margin is intended to account for torque switch repeatability, diagnostic equipment accuracy, rate of loading effects, and variations in valve factors and packing loads. The position paper requires an evaluation by the licensee's engineering staff where the 130% criterion cannot be met. In the position paper, the licensee states that it will use the results of static and dynamic MOV tests to determine if this margin is sufficient. The position paper indicates that uncertainties will be considered in ensuring that the maximum limits of the MOV are not exceeded.

In Position Paper 6, Operating Margin, the licensee states that "operating margin" will be defined as the difference between the minimum valve thrust requirement at maximum differential pressure compared to operator capability. The inspectors discussed with the licensee the relationship between operating margin and operability because the licensee's definition did not consider the as found torque switch settings. The licensee stated that its position paper would be revised to refer "capability margin."

In Appendix 9, PS-MOV Database System, of MOV Program Document 0033, the licensee describes the methodology to be used to control the database for its MOVs. Although the appendix indicates that a computer program will be developed with the capability to perform MOV calculations, the licensee stated that all MOV calculations are presently being performed and checked manually. The licensee stated that computer-programmed MOV calculations, will be developed consistent with the licensee's Quality Assurance requirements for such a program.

In Position Paper 7, Switch Setting Administrative Control, the licensee describes its policy for the administrative control of Limitorque operator switch settings. The licensee requires the engineering resolution before changing any switch settings. The licensee is developing the "Maintenance Management Information System" to provide a database for MOV information and switch settings.

In Position Paper 8, Torque Switch Setting Limiter Plates, the licensee indicates that the limiter plates are not required to be installed on MOVs if adequate control is provided for minimum and maximum torque switch settings. The licensee is implementing a program to verify that torque switches had not been improperly set above Limitorque maximum limits. The licensee stated that some MOVs had been found to be set above the Limitorque maximum setting and it has been evaluating those MOVs for any adverse effects from the settings.

The inspectors reviewed the licensee's sizing and switch setting calculations for the PORV block valve 1PR6. The licensee's preliminary calculations conclude that the MOV has adequate torque to perform its safety function. However, the calculations had not included a review to verify the stem friction coefficient assumptions. The licensee stated that the assessment of the PORV block valves was not complete at the time of this inspection. The licensee agreed to justify the stem friction coefficient used in the final assessment.

2.4.1 Minimum Motor Voltage

MCC voltage values used by PSE&G to determine voltage drop to MOV's appears to be based on conservative results from the voltage profile calculations ES-15.008(Q) for Salem 480v and 240v ac vital systems. The calculation assumes that the 4160v buses are at 91.6% of 4160v and all motors connected to the low voltage ac buses are assumed to be operated at 80% of the nameplate load. The minimum voltage criteria (90% of motor rated voltage) at the motor terminal was not met for all loads. Where deviations occurred they were indicated in the calculation computer report. None of the motors were found to be below their running voltage dip of 80% which would cause them to stall during the acceleration time of the starting motor. In addition, the calculation is used to determine minimum vital bus voltage grid tap changer response and capability to regulate the Vital bus voltages. The results indicate that the Load Tap Changer (LTC) for the Station Power Transformers 11SPT and 12SPT for Unit 1 and 21SPT and 22SPT for Unit 2 have sufficient capacity to raise the 4.16kV, 480v, and 230v motors to operate above their minimum running voltages.

The calculation further indicates that under starting conditions where the largest motor on the bus is started no motors had their terminal voltage drop below 80% and only two motors had a terminal voltage below 80% on starting. Justification and disposition was adequately documented in engineering evaluation no. S-C.ZZXXX-EEE.0255-0.

Under the electrical distribution upgrade project a modification was being prepared to further improve voltage available at the motor terminals.

2.5 Design Basis Testing

Action "c" of the generic letter recommended that licensees test motor-operated valves in situ under their design basis differential pressure and flow conditions. If in situ testing under those conditions is not practicable, the NRC allows alternate methods to be used to demonstrate the capability of the motor-operated valve. The NRC suggested a two-stage approach for a situation where neither design basis testing in situ is practicable nor an alternate method of demonstrating motor-operated valve capability can be justified. With the two-stage approach the capability for the motor-operated valve is evaluated using the best data available and then continue the efforts to obtain valve specific test data within the schedule of the generic letter.

The licensee outlined their approach to Design Basis Differential Pressure (DBDP) testing in A-O-ZZ-MEE-0609, Rev 1, position paper 10. Based on review of industry data, the licensee determined that those valves that can reach greater than 30% of DBDP should be tested. If the test pressure is greater than 80% of DBDP, the results can confidently be extrapolated to full DBDP. For those valves falling between 30 and 80% of DBDP the licensee intends to use the 2 step approach recommended in GL 89-10. To determine which MOVs can be DBDP tested, the licensee is conducting engineering evaluation A-O-ZZ-MEE-0715. Of 100 valves in the Salem Unit 1 MOV program, 54 have been determined to be testable. A total of 12 valves are not testable, 4 because they have insufficient DP (<30%) and 8 because of possible equipment damage or excessive plant transients. Evaluations of the 34 remaining valves are not completed.

The licensee has established conservative criteria to determine the design basis testing population and to meet the intent of the generic letter by testing as many valves as practical. One area of potential improvement was noted in validating the assumptions made in the position paper regarding the behavior of valve factors over a wide range of differential pressures (DP). This would require testing valves at more than one DP to see if the upper limit of 80% could be lowered to include some of the valves between 30-80% of DBDP (4 valves for Salem 1). Additionally, the lower limit of 30% of DBDP could possibly be lowered to include valves < 30% (currently 4 valves for Salem 1).

The licensees schedule for conducting MOV DBDP testing is based on component availability and the prioritization of MOVs within the program scope. Appendix 2 of the MOV programmatic standard provides a method to prioritize valves using a detailed weighing factor matrix based on the general guidance in the generic letter. This procedure was not used during the current outage since component availability was driving the DP test schedule. The licensee should be more proactive during the next outage by factoring the calculated valve priority into the DP test schedule.

The inspectors reviewed procedure S2.OP-PT.CS-0102(Q)- REV 0, Differential Pressure Test of Containment Spray Pump Discharge Stop Valves, 21CS2 and 22CS2. The procedure was adequate for safely performing the test and obtaining the data to conduct the DP analysis per Appendix 14 to the programmatic standard. However, one concern was noted in the test acceptance criteria. Step 5.4.1 states that the procedure is considered to be satisfactory if the valves open and close and all the data required by VOTES diagnostic procedure has been collected. There was no provision to ensure that a timely partial evaluation of the data occurs to give the appropriate line management reasonable assurance that the valve is operable. For example, the inspectors noted that the thrust required to open these MOVs under static conditions was greater than the thrust required under differential pressure conditions. Further, those static pullout thrust requirements exceeded the calculated maximum thrust capability of the MOVs under degraded voltage conditions. The licensee subsequently provided test data obtained from torque measurements which indicated that the MOVs would be able to open under degraded voltage conditions. The licensee stated that a clear connection would be established between its procedures for the performance of differential pressure tests and the evaluation of the test data. They also indicated that pullout thrust requirements would be evaluated for both static and dynamic test conditions.

2.6 MOV Maintenance and Post Maintenance Testing

The licensee has developed a number of procedures for performing maintenance on various models of Limitorque operators. The following maintenance procedures were reviewed:

1. SC.MD-PM.ZZ-0032(Q) - Rev 1, Inspection of Non-Environmentally Qualified Limitorque Valve Motor Operators;

2. SC.MD-PM.ZZ-0025(Q) - Rev 2, Inspection of Environmentally Qualified (EQ) Limitorque Valve Motor Operators;

3. SC.MD-CM.ZZ-0013(Q) - Rev 0, Disassembly and Reassembly of Type SMB-0 thru 4 Limitorque Actuators; and

4. SC.MD-CM.ZZ-0014(Q) - Rev 0, Disassembly and Reassembly of Type SMB-00 Limitorque Actuators.

The team found the procedures to be detailed and comprehensive. However, the following observations were noted:

- The current procedure for inspection of EQ operators does not adequately check for grease buildup in the spring pack area - the primary mechanism for hydraulic lock. The procedure has the technician remove the dust cap or cartridge cap which does not allow for visual inspection of the grease condition around the Belleville Spring area. Additionally, an updated draft inspection procedure removed the step to perform any visual inspection of the spring pack area. The licensee indicated that they plan to rely on the VOTES diagnostic data and the recording of measured thrust to detect potential spring pack relaxation or hydraulic lock. The inspectors noted that overemphasis of VOTES diagnostic data without information from physical MOV inspections could result in misleading conclusions of actual MOV conditions. Several inspector observations as follows suggested the need for feedback from testing and physical MOV inspections. First, a review of previous valve failures revealed two instances of motor failures and two failures due to stripped or worn gears that may have indicated a potential for hydraulic lock. Secondly, it was noted that the spring packs on 11SJ40 and ZPR6 were filled with hardened grease and may have been susceptible to hydraulic lock. Also, recent testing resulted in the identification of three valves with probable spring pack relaxation (11RH19, 12RH19 and 12CS2) along with 12 valves identified through paper evaluations. The team concluded that the combination of these events indicated the need for a balanced approach to periodic verification of operator condition using both comprehensive visual inspections and diagnostic test data. As a result, the licensee agreed to evaluate their program to include periodic partial actuator overhauls with the routine inspection procedure. Also, since operability may have been affected for the above MOVs (11RH19, etc.) where recent testing identified potential spring pack relaxation concerns, this item is unresolved pending the operability reviews of these MOVs. (Unresolved Item 50-272/92-80-001, 50-311/92-80-001)

- The licensee current valve stem lubrication frequency of 36 months does not comply with the Limitorque recommendations of 18 months. The licensee agreed to evaluate changing the frequency of this inspection to 18 months.

- The licensee does not have any plans to perform overhauls of actuators prior to Design Basis Differential Pressure (DBDP) testing. The inspectors emphasized the importance of ensuring the actuator is as close to an "as new" condition as

possible prior to establishing baseline design basis data for performance trending. Based on the results from the first stage of testing which have revealed some performance degradation, the licensee agreed to consider actuator overhaul prior to DBDP testing.

The inspectors reviewed procedure M23B, Maintenance Testing and Retest Notification Guidelines. This procedure is used in conjunction with NC.NA-AP.ZZ-0050(Q) Station Testing Program, to implement the station Post Maintenance Testing (PMT) program. The entire scope of testing includes an exercise test, stroke time test, remote position indicator verification, and MOVATS diagnostic testing. There was only general guidance on when to perform the MOVATS PMT e.g. "any maintenance that could affect valve operation , i.e. limitorque operator corrective maintenance, valve internals repair, valve repack, etc." This does not include current guidance to perform diagnostic testing after valve packing adjustments and periodic stem lubrication. The licensee has drafted a new procedure for conducting PMT based on the recent change to VOTES diagnostic equipment (attachment 5 to NC.NA.-AP.ZZ-0050(Q), Station Testing Program). This procedure gives specific PMT requirements for a wide range of corrective and preventative maintenance activities and incorporates most of the Electric Power Research Institute guidelines documented in their final report dated December 1989. However, the inspectors noted that the draft matrix did not require a VOTES static test following periodic stem lubrication. This information may be needed to provide feedback to verify the accuracy of the stem friction coefficients used in the DP test analysis.

The inspector observed electricians performing preventive maintenance (PM) on the environmentally qualified (EQ) Limitorque operator of component cooling water valve 1CC187 in accordance with procedure SC.MD-PM.ZZ-0025 (Q). In addition to the PM, the electricians replaced the torque switch as recommended by vendor information on roll pin failures. 1CC187 is the inboard containment isolation valve for the return header of component cooling water to reactor coolant pump bearings.

No degraded conditions or non-conforming components described in the EQ procedure were identified by the electricians during their inspection of the limit switch compartment. The inspector noted that the Raychem splices on the motor leads did not have the two inch overlap required by the licensee's Raychem installation procedure for EQ applications. The licensee's response stated that the short splices were previously identified and evaluated by the EQ group. Their conclusion is that no deficiency exists since test results have qualified the splices with 1/2 inch overlap. The licensee also stated that the splices should be replaced in order to meet the current EQ guidelines. This satisfied the inspector's immediate concern, however, no steps were taken during the EQ PM on 1CC187 to document the short splices or to replace them.

The electricians checked two locations on the actuator housing for grease quality and quantity. They found clean tan grease at the higher elevation and a dark grease with poor consistency at the lower elevation. When the workers removed the torque switch, the inspector noted that the dark grease appeared to cover the interior surfaces of the actuator housing. The licensee's preliminary test results indicate the tan and dark greases are the same. They believe the dark grease is old tan grease but, neither matches the approved grease sample tested (Nebula EP1). The licensee stated that if they could not identify the lubricant, the actuator would be degreased and relubricated. The inspector concluded that if any grease were found in the spring pack area, it would be the dark (old) grease. Also, depending on an actuator's orientation and where the housing grease is sampled, the sample may not provide an accurate indication of grease quality in the spring pack area.

2.7 Periodic Verification of MOV Capability

Action "d" of the generic letter recommended that licensees prepare or revise procedures to ensure that adequate motor-operated valve switch settings are established and maintained throughout the life of the plant. Paragraph "j" of the generic letter recommended surveillance intervals be commensurate with the safety function of the motor-operated valve as well as its maintenance and performance history. The surveillance interval in no case should exceed 5 years or 3 refueling outages. Further, the capability of the motor-operated valve has to be verified if the motor-operated valve is replaced, modified, or overhauled to an extent that the test results are not representative of the motor-operated valve performance.

PSE&G's MOV Program provides for reverification of MOV switch setting adequacy over the life of the plant. The extent of this verification testing will be based on the reviews of MOV experience from the following maintenance programs and activities:

1. preventive maintenance
2. corrective maintenance
3. reliability centered maintenance
4. inservice testing
5. post maintenance testing

The frequency of this reverification testing will not exceed 5 years or three refueling outages, whichever is later.

The team discussed with PSE&G personnel the role that design-basis testing would play in their periodic verification of MOV switch settings. The MOV Program requires design-basis testing if modifications are performed that change the existing design-basis test data for an MOV. Although not explicitly stated in the current MOV Program, PSE&G recognizes that MOV test results from design-basis testing must be reviewed to determine what design-basis MOV tests should be included as part of the periodic reverification of MOV switch settings.

2.8 MOV Failures, Corrective Actions, and Trending

Action "h" of the generic letter recommended that licensees analyze each motor-operated valve failure and justify corrective action. The results and history of each as-found deteriorated condition, malfunction, test, inspection, analysis, repair, or alteration were recommended to be documented and maintained. This motor-operated valve information was recommended to be periodically examined as part of the monitoring and feedback effort to establish trends of motor-operated valve operability.

The licensee's failure analysis program is contained within the following general process. Per Nuclear Administrative Procedure NC.NA-AP.ZZ-0009(Q), Work Control Process, the maintenance worker is required to enter the cause of component failures and any corrective action on the associated work control form. The maintenance supervisor then reviews the work control form for accuracy and forwards the package to planning for entry into the Management Maintenance Information System. A periodic review of corrective maintenance procedures is performed to generate any necessary Nuclear Plant Reliability Data System reports. These reports are reviewed by the system engineers and compared to industry standards to see if there are any generic problems developing. This process identified recurring problems with several service water valves in 1989 and 1990, and resulted in the submittal of project task SM-0556 to evaluate the reliability of Jamesbury type service water (SW) system MOVs and recommend appropriate corrective action.

The inspector reviewed such assessments for the failures of 21SW17 and 22SW17 in January and March 1992 respectively. The team identified the following weaknesses in the licensee's approach to failure analysis:

1. The initial assessment of root cause and corrective action is done by the maintenance personnel. Maintenance staff determined that the failures were caused by stripped gears due to normal aging. No formal analysis was conducted and the documented corrective action was to replace the actuator. However, the inspector observed that the time between failures is not indicative of a failure due to normal aging. This observation indicated less than adequate analysis for these failures.

2. There is not a reliable mechanism to ensure appropriate root cause failure analyses are performed and documented (this was also identified by the maintenance team inspection in April 1990). For example, a design review is initiated only for nonconforming conditions which are defined as conditions that can not be corrected with "as kind" replacements. As a result, an actuator motor failure on 21SW20 was not investigated since an as kind replacement was available and subsequently installed. Additionally, Nuclear Administrative procedure NC.NA-AP. ZZ - 0006 (Q), Incident Report/Reportable Event Program and Quality/Safety Concern Reporting system requires an Incident

Report to be generated after multiple failures in a particular system. This mechanism was not used to document the recurring failures in the service water system because an engineering evaluation was already in progress. However, the licensee has not completed the evaluation requested per project task SM-0556 and it is unclear whether system operability was addressed when the reliability of these motor-operated valves was questionable. This item is unresolved pending completion and review of this evaluation of Jamesbury type SW system MOVs including operability considerations. (Unresolved Item 50-272/92-80-002, 50-311/92-80-002)

The licensee's formal trending program outlined in Technical Directive 19, requires trending of diagnostic data, valve stroke time, and motor running load. However, the current trending program does not provide adequate guidance as to what parameters or failures to trend or how to document the trend data, as recommended in the generic letter. Preventative maintenance inspection results are not formally evaluated, and corrective maintenance trending relies on the component engineers experience to recognize potential problem areas. For example, the condition of stem lubrication is not evaluated to determine if the current inspection frequency is adequate.

The licensee understands the requirement to establish a formal trending program per the recommendations of GL 89-10, and is scheduled to begin developing a trending program on May 15, 1992. However, there is not a firm completion date for this part of the 89-10 project.

2.9 Motor-Operated Valve Training

The PSE&G Nuclear Training Center provides training for workers assigned to both the Hope Creek and Salem power stations. In July 1991 the NRC reviewed the licensee's MOV training programs for actuators and diagnostic equipment during the Hope Creek MOV Team Inspection (IR 50-354/91-80). No deficiencies were identified. Since July 1991, PSE&G decided to use VOTES instead of MOVATS for diagnostic testing. As of April 1992, B&W has given two classes on VOTES diagnostic equipment for various PSE&G engineering, projects and training personnel.

B&W certified VOTES technicians are performing the current VOTES testing. The licensee's Quality Assurance (QA) group has audited the VOTES system vendor, Liberty Technologies, and B&W Nuclear Services who provide training and certify technicians. PSE&G considers both vendors "Suppliers With Approved Quality Systems." The inspectors reviewed the QA audit documentation and the qualifications of the VOTES technicians. The team noted that the contract technicians are very knowledgeable on VOTES and have significant experience with diagnostic testing equipment.

The licensee plans to have station personnel perform future VOTES testing. PSE&G has contracted B&W to develop a VOTES training program, in accordance with the licensee's INPO accredited training program, by August 1992. B&W will conduct the initial course presentation in August at which time two or three PSE&G instructors will become certified on VOTES. The licensee's training program requires contract instructors to complete the PSE&G instructors training course or have the class monitored by a PSE&G instructor. After the initial VOTES class and certification of the licensee's instructors, the PSE&G instructors will be teaching VOTES courses. The licensee plans to maintain two instructors and eight qualified technicians.

The inspectors toured the training facility, reviewed lesson plans, and met with licensee personnel. The team made several observations: 1) training craft personnel on actuator overhaul in order to perform other less involved actuator maintenance is advantageous; 2) the layout and mockups at the training facility are advantageous for simulating diagnostic testing situations; and 3) formal refresher training or continuing training on MOV maintenance is not currently included in the training program. The licensee has covered MOV lubrication during a continuing training on general lubrication practices for the plants.

The team concluded that the licensee's general plan for MOV training and training facilities are assets to the MOV program. They also concluded that PSE&G has taken appropriate steps to assure that contractors performing VOTES testing and training are qualified. No deficiencies in the licensee's program were identified during this inspection. The effectiveness of the licensee's program implementation will be assessed during Phase II of the MOV inspection.

2.10 Industry Experience and Vendor Information

The team reviewed the licensee's vendor information program to assess its effectiveness in disseminating industry information into the various areas of the MOV program. In response to a violation on the incorporation of vendor information during the NRC's Hope Creek MOV Team Inspection the licensee made several changes to its Vendor Technical Document program. The changes included revision of procedures to clarify procedure hierarchy, identify responsibilities, and relocate administrative requirements. The licensee's revised program for processing vendor information was approved in April 1992. No examples of vendor information processed under the revised program were available for review during this inspection.

The inspectors reviewed station procedures and tracking system closeouts for inclusion of six selected vendor technical documents which may have an impact on operability. Of the six, only Limitorque Maintenance Update (MU) 90-1 had not been fully addressed. Although the item was entered in the tracking system in August 1991, no evaluation of the equipment in service has been made. The procedural changes recommended by MU 90-1 were reviewed and implemented by the licensee.

The "Operating Experience Feedback Program" (NC.NA-AP.ZZ-0054(Q)), Revision 0, is the new implementing procedure for the vendor information program. In this procedure a determination for further review of vendor recommendations and the negotiation of an expected completion date are described. The inspector's review of the revised vendor information program did not identify any deficiencies. The timeliness and content of the reviews performed under the new program will be evaluated during Phase II of the MOV Inspection.

2.11 Schedule

In Generic Letter 89-10, the staff requested that licensee's complete all actions initiated to satisfy the generic letter recommendations by June 28, 1994, or 3 refueling outages after December 28, 1989, whichever is later. The licensee has stated that the design basis review and switch setting calculations would be complete for Salem later this year. The licensee believes that approximately 50% of the MOVs within the GL 89-10 program at Salem can be differential pressure tested. The licensee stated that only 4 MOVs had been differential pressure tested at the time of the inspection. The inspectors considered the status of the licensee's testing to indicate that licensee may have difficulty meeting its commitments to the GL 89-10 schedule because of the slow progress made before the July 1991 inspection at Hope Creek. The licensee acknowledged this potential difficulty but stated that a midcycle outage might be used to complete the program on schedule.

3.0 WALKDOWN

In addition to the in-plant observations concerning MOV maintenance as noted in section 2.6, a walkdown inspection of several MOVs was conducted. Several actuators appeared to be new. For example, a new actuator and motor had been installed on 2SJ2 during the last refueling outage.

In general, excessive oil/grease leakage was not evident at MOVs. However, slight oil seepage was noted at the spring pack cap for several MOVs. Poor stem lubrication was not apparent at the several MOVs observed.

4.0 CONCLUSION

The licensee is developing an MOV program that is consistent with the recommendations of Generic Letter 89-10. The various documents, such as the MOV program appendices and position papers, supporting the MOV program description were of good quality. MOV maintenance was identified by the NRC team as an area requiring further improvements as the failure trending and procedure revisions were not completed to address all the concerns of Generic Letter 89-10.

The licensee completed initial design-basis testing of 4 MOVs at the time of the inspection and expects to perform the design-basis testing of approximately 50 percent of the MOVs for Salem 1 and 2. The licensee's MOV program schedule is consistent with the recommendations of Generic Letter 89-10.

5.0 UNRESOLVED ITEMS

Unresolved items are matters for which more information is required to ascertain whether they are acceptable items, violations or deviations. Two unresolved items are discussed in Section 2.6 and 2.8 of this report.

6.0 EXIT MEETING

The inspectors met with those denoted in Appendix A on May 8, 1992, to discuss the preliminary inspection findings as detailed in this report. The licensee acknowledged the inspection findings and agreed to review the items listed in Table 1 for resolution and further improvement of the MOV program.

APPENDIX A - Persons Contacted

PSE&G Persons Contacted

* T. Carrier, Salem Maint. Engr.
* R. Chranowski, Tech. Engr.
* M. Davidson, Project Mgr. General Physics
* C. diGirolamo, System Engr.
* P. Duca, Site Rep. Delmarra Power
* S. Gallogly, Lead Test Engr. General Physics
* A. Giardino, Mgr QA Programs & Audits
* M. Gross, Salem QA
* D. Jagt, Mgr. Nuclear Engineering
* T. Johnson, Electrical Project Engr. E&PB
* S. Ketcham, Principal Engr. E&PB
* S. LaBruna, Vice President, Nuclear Operations
* M. LeFevre, External Affairs
* B. Lewis, Sr. Staff Engr. E&PB
* S. Maginnis, Project Mgr. E&PB
* C. Manges, Licensing Engr.
* M. Metcalf, Mgr. Special Projects E&PB
* R. Metzinger, Sr. Staff Engr. E&PB
* S. Miltenberger, Vice President and Chief Nuclear Officer
* M. Morroni, Salem Tech. Dept. Mgr.
* D. Perkins, Mgr. QA Eng. & Procurement
* L. Piotti, Sr. Staff Engr. QA Programs
* J. Ranalli, Nuclear Mechanical Engr. Mgr.
* M. Shedlock, Salem Maint. Mgr.
* B. Sutherland, Valve Engr.
* R. Swanson, General Mgr. E&PB
* M. Taylor, Principal Engr. General Physics
* F. Thomson, Mgr. Licensing & Regulation
* C. Vondra, General Maintenance Salem Operations

Nuclear Regulatory Commission (NRC)

* P. Eapen, Chief, Systems Section
* T. Johnson, Sr. Resident Inspector
* S. Pindale, Resident Inspector
* B. Westreich, Reactor Engr.

* Denotes present at exit meeting held at Salem Nuclear Power Plant, May 8, 1992.

TABLE 1

Licensee Plans and Commitments for Further Program Improvements

	Reference Paragraph
Section 2.1 Scope and Administration of the Program	
- Include corrective action requirements for problem resolutions in the program standard and per the QA program	2
Section 2.2 Design Basis Reviews	
- Document review of design basis parameters other than differential pressure (e.g., flow and temperature)	4
Section 2.4 MOV Sizing/Switch Settings	
- Clarification of assumptions and revision of calculations made for weak link analyses after receipt of valve limits.	3
- Justify use of 0.2 stem friction coefficient	7
Section 2.5 Design Basis Testing	
- Incorporation of maximum allowable torque and thrust in operability reviews	5
Section 2.6 MOV Maintenance and Post Maintenance Testing	
- Implement changes to maintenance program preventive maintenance and overhaul procedures to identify hydraulic lock	2
- Justify use of 36 month stem lubrication frequency	3
- Resolution of operability issues for MOVs identified with springpack relaxation box (Unresolved Item 50-272/92-80-001, 50-311/92-80-001)	2

Section 2.8 MOV Failures, Corrective Actions, and Trending

	Reference Paragraph
- Resolution of various problems with the service water valves (Unresolved Item 50-272/92-80-002, 50-311/92-80-002)	6
- Development of trending program	4