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REGION II
101 MARIETTA STREET, N.W.
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Report Nos.: 50-369/92-11 and 50-370/92-11

Licensee: Duke Power Company
422 South Church Street
Charlotte, NC 28242

Docket Nos.: 50-369 and 50-370 License Nos.: NPF-9 and NPF-17

Facility Name: McGuire 1 and 2

Inspection Conducted: April 6-10, 1992

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SUMMARY

Scope:

This special, announced inspection was conducted to examine the program developed in response to NRC Generic Letter (GL) 89-10, "Safety-Related Motor Operated Valve (MOV) Testing and Surveillance." The inspection was conducted in accordance with NRC Temporary Instruction (TI) 2515/109, issued January 14, 1991. This inspection covered Phase 1 of the Temporary Instruction requirements.

Results:

In the areas inspected, violations or deviations were not identified. The inspectors determined that the GL 89-10 MOV program prepared by Duke Power Company (DPC) to inspect/test the MOVs at this site was satisfactory. The inspectors did identify concerns within the program as well as strengths. The concerns and strengths are listed below:

CONCERNS

1 During review of the MOVs included in the program it was noted that some of the valves have a separate fusing arrangement that provides a fuse to power the motor starter circuit and another for the limit switches which provide power for the indicating lights in the control room. This same condition was recently identified at the Catawba site which defined this condition as a possible situation which could result in an unidentified failure if the fuse in the starter circuit should fail. (Para 3a)

2. The inspectors noted during the review of the Licensee's MOV Program Scope, two MOVs (SM-14 and SM-15) were deleted from the MOV program. During review of procedure EP/1,2/5000/04 (SG Tube Rupture), it was noted that these valves are required to be closed upon a failure of the MSIV and Bypass valves to close. GL 89-10 states that EMO valves operated in EOPs should be included in the GL 89-10 program. (Para 3a)

3. The inspectors noted during the review of design basis guidelines that the mispositioning of MOVs is considered by DPC in their evaluation of GL 89-10 MOVs. Licensee guidelines reference several alternate means of reducing the DP across the valves, which includes opening or closing another valve in the system or stopping an associated pump. However feedback to operations on assumptions used to recover from a mispositioned MOV nad not been provided. (Para 3)

4. DPC may need to revise Electric Motor Operator Sizing Guidelines when the bounding values for both power factor and amperage for different size motors becomes available. (Para 3b)

5. There are no specific instructions provided in Section 2 of the MOV Test Analysis Guideline to define the action to be taken if the calculated torque was greater than the torque identified in the spring pack curve. Also, guidelines need to be provided if the calculated torque is greater than actuator rated torque. The licensee indicated that they would revise their VOTES Sensor Test Report Analysis Guideline accordingly. (Para 3c)

6. The Rotork study regarding ambient temperature on motor performance, has not been determined to be applicable to Limitorque operators. DPC is currently waiting for Limitorque to publish the results of their study. A flow chart used to evaluate MOVs located in high temperature areas needs to be documented in the Guideline for Performing Motor Operated Valve Reviews and Calculations. (Para 3c)

7. When determining stall torque and thrust available from the actuator at under voltage conditions, the application factor should be considered. The guidelines are currently being revised to include the application factor. (Para 3c)

8. DPC is using a valve factor of 0.5 in the thrust calculations for all solid and flexible wedge gate valves and those in high temperature and pressure applications. When a valve factor of 0.5 causes the margin of a Group II valve to be less than 5%, the valve is classified as marginal. Although this practice is currently being used, it is not included in the acceptance criteria for evaluation purposes. (Para 3g)

9. GL 89-10 requires that all MOVs be D/P tested where practicable. The DPC program does not meet this condition. Technical justification for testing fewer than practicable has not been submitted. Also, review of test methods planned for Kerotest valves will be required to determine acceptability. (Para 3d)

10. The inspectors noted that there are no Limitorque training refresher courses provided to IAE persons, nor are IAE personnel required to be requalified on maintenance and test procedures. In addition, it was noted that some IAE individuals had not taken the basic Limitorque training course prior to being certified to the Limitorque corrective action procedure. (Para 3j)

11. The licensee's surveillance testing schedule for completing MOVs in Group II is six RFOs or 8 years from the previous baseline or surveillance test. This interval is not in accordance with the GL recommendations of 3 RFOs or 5 years. Justification for extending the schedule needs to be provided. The licensee also plans to perform these tests under static conditions. The use of static testing to verify continued capability of an MOV to operate under worst case DP and flow conditions is not considered acceptable at this time. (Para 3e)

12. The licensee's Preventative Maintenance procedure for Rotork Actuators currently requires that stems be lubricated every 5 years. This lubrication frequency could have an impact on the valve stem friction coefficient. The

licensee stated that they were revising the Rotork PM procedures to require stem lubrication on an 18 month frequency. The NRC will review this procedure revision at a later date. (Para 3e)

13. The Post-Maintenance Test Matrix should be reviewed to ensure that adequate PMT is performed. Specifically, the inspectors noted that some Major Maintenance Category items (i.e., stem packing replacements or adjustments) do not require new base-line tests. Current practice has been to perform a new baseline diagnostic test. (Para 3e)

STRENGTHS

1. The design basis reviews and MOV sizing and switch calculations were found to be well documented and thorough.

2. Corporate and site engineers responsible for the MOV Program were found to be very knowledgeable regarding on-going MOV issues and personnel exhibited a high level of expertise in their understanding of the issues involved on GL 89-10.

3. Good communication between corporate and site personnel involved in the MOV Program was noted.

4. The DPC Operating Experience Program is effective and comprehensive in evaluating and responding to industry experience and vendor information.

5. DPC is active in industry groups, often in a leadership role.

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REPORT DETAILS

NRC Inspection of the Program Developed in Response to Generic Letter 89-10 for McGuire Nuclear Station, Units 1 and 2.

1. Background

Generic Letter (GL) 89-10, Safety-Related Motor-Operated Valve Testing and Surveillance, was issued June 28, 1989, and 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. Supplement 1 to GL 89-10 was issued June 13, 1990, to provide the results of those public workshops. Supplement 2 to GL 89-10 issued August 3, 1990, stated that inspections of programs developed in response to GL 89-10 would not begin until January 1, 1991. Supplement 3 to GL 89-10 was issued on October 25, 1990, and requested that boiling water reactor licensees evaluate the capability of MOVs used for containment isolation in several systems. In addition all licensees and construction permit holders should consider the applicability of the information contained in Supplement 3 and should consider this information in the development of priorities for implementing the generic letter program. On February 12, 1992, Supplement 4 was issued to remove the recommendations for inadvertent operation of MOVs from the control room to be within the scope of GL 89-10 for BWRs.

The NRC staff requested licensees to submit a response to generic letter by December 28, 1989. Duke Power Company (DPC) submitted a response on that date. The letter stated Duke Power Company's desire for NRC involvement once the program was developed and validated to ensure that it is consistent with the general objectives of the Generic Letter. Also, the number of motor operated valves (MOVs) considered to be in the scope of GL 89-10 for DPC's three plants along with a general discussion of program development and execution, and exceptions were included.

2. Inspection Plan

The NRC inspectors followed the guidance in 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 the Generic Letter Program

The scope of GL 89-10 includes all safety-related MOVs and other MOVs that are position-changeable in safety-related piping systems. GL 89-10 Supplement 1 defined "position-changeable" as any MOV in a safety-related piping system that can be inadvertently operated as a result of an action in the control room.

The inspectors reviewed and discussed with the licensee the scope of their GL 89-10 MOV program. The licensee's program document, "Duke Power Company NRC Generic Letter 89-10 Program Plan", stated that the GL 89-10 program scope included all MOVs in safety-related piping systems with certain exceptions.

Section 4 of the program document described the selection of MOVs for the program as starting with the identification of all MOVs in safety-related systems, then eliminating non-piping and sluice and weir gate valves. Valves in the GL 89-10 MOV program were further categorized and divided into three groups (groups 1, 2, and 3). Group 1 MOVs consisted of those MOVs that are active and contribute to the core melt scenarios and are significant from an accident analysis viewpoint. These are the most important MOVs in the plant. Group 2 MOVs consisted of the balance of active MOVs that were not in Group 1. This group also included passive position changeable MOVs that contribute to core melt scenarios. These are less important MOVs located in safety-related systems. Group 3 consisted of passive position changeable MOVs that do not contribute to core melt scenarios. Inconsequential position changeable, non-position changeable, and unit reliability MOVs are also included in this group. Group 3 MOVs were not part of the Duke Power GL 89-10 MOV program. However, the inspectors noted that the Group 3 MOVs for McGuire were moved to Group 2. Some were evaluated further and deleted from the program.

The licensee identified 484 (combined total for both units) MOVs in its GL 89-10 program. The inspectors reviewed piping and instrumentation drawings for the auxiliary feedwater system (CA), residual heat removal system (ND), safety injection system (NI), and

the main steam system (SM) to sample the completeness of the scope of the licensee's GL 89-10 program. The inspectors also reviewed selected MOVs which had been deleted from the MOV program and the justifications provided for the deleted valves. The inspectors identified the following concerns during this review.

During review of the justifications provided for the MOVs deleted from the program, the inspectors questioned the justification for deleting MOVs SM-14 and SM-15 (both units). Valve SM-14 is located in a 4-inch pipe line and isolates the main steam system from the condenser air ejector system. Valve SM-15 is located in a 14-inch pipe line and isolates the main steam system from the moisture separator reheat system. The justification provided by the licensee for removing both of these valves from the MOV program was that the valves do not receive safety related power, are located in non safety-related and non seismic piping, and are both equipped with handwheels to allow local manual operation.

The inspectors further noted that the valves were initially added to the MOV program by the licensee's Safety Analysis Group because the valves were listed in the emergency procedure (EP) for the steam generator tube rupture. The inspectors reviewed EP/1/A/5000/04, Steam Generator Tube Rupture, and noted that the procedure specified closure of valves SM-14 and SM-15 (along with other valves) from the main control room in order to isolate the main steam header, if the main steam isolation valve (MSIV) and the MSIV bypass valve for the ruptured steam generator failed to close. The inspectors stated that even though the MOVs are not safety-related, because the EP took credit for closure of SM-14 and SM-15 from the main control room, Supplement 1 to GL 89-10 states that the valves cannot be completely removed from the licensee's MOV program.

During a field walkdown, the inspectors observed the location of valves SM-14 and SM-15 and noted that the valves were not easily accessible for local operation. A ladder would be needed to reach both valves. Licensee personnel stated that the EP and their MOV program would be evaluated for SM-14 and SM-15 and appropriate actions taken to address the inspector's concerns. (Concern 2)

The inspectors noted that the licensee's design basis review guidelines (Enclosure 1 to licensee's GL 89-10 program) state that mispositioning is considered in licensee evaluation for GL 89-10 MOVs. The

guidelines further state that in order not to put unnecessary restrictions on motor sizing, several alternate means of reducing the differential pressure across a valve should be considered. These include opening or closing another valve or stopping a pump in the system.

The inspectors noted that the guidelines did not provide clear guidance regarding the feedback between plant operations and design engineering to ensure that assumptions made by design engineering to recover from a mispositioned valve were reviewed by operations. Licensee personnel acknowledged the inspector's concern and stated that applicable controls would be reviewed and revised as appropriate to ensure adequate feedback between operations and engineering regarding assumptions and procedure changes which could affect MOVs in the program. (Concern 3)

During the inspection the inspectors questioned the licensee regarding valve electrical control circuits that might have the two fuse arrangement discussed in Concern 1. The licensee identified 18 valves, 9 per unit, that had this fusing arrangement. These are listed below:

1,2 - ND-2A, C	C NC LOOP TO ND PUMPS
1,2 - NV-94A	NC PUMPS SEAL RETURN (C/I INSIDE)
1,2 - NV-842 A,C	STANDBY MAKEUP PUMP INLET ISOLATION
1,2 - NV-849 A,C	STANDBY MAKEUP PUMP CONTAINMENT ISOLATION OUTSIDE
1,2 - RN-10 A,C	TRAIN 1B LLI SUPPLY
1,2 - RN-12 A,C	TRAIN 1A LLI SUPPLY
1,2 - RN-147 A,C	TRAIN 1A DISCHARGE TO RC
1,2 - RN-283 A,C	TRAIN 1B DISCHARGE TO RC
1,2 - RN-301 A,C	RV SUPPLY FROM LLI

The "C" means powered from the SAFE SHUTDOWN FACILITY (SSF) or the ability to control from the SSF. (Concern 1)

3.b. Design Basis Reviews

In recommended action "a" of GL 89-10, the staff requested the review and documentation of the design basis for the operation of each MOV within the generic letter program to determine the maximum differential pressure and flow (and other factors) expected for both normal operations and abnormal conditions.

The inspectors discussed with licensee personnel the performance of the design basis reviews for MOVs identified in the licensee's GL 89-10 program. The inspectors reviewed DPS-1205.19-00-0003, "Motor Operated Valve Design Basis Review Guidelines," Rev. 2, November 1, 1991. This document required that design basis parameters such as differential pressure, fluid flow, and ambient temperature be determined and that the FSAR, normal and emergency procedures and other plant documents be reviewed to determine these design basis parameters. The inspectors reviewed differential calculations for MOVs CA38B and CA62A which were documented in MCC 1223.42-00-0026 "Documentation of CA Valve Design Basis and GL 89-10 Response," Rev. 2, April 2, 1992. These differential pressure calculations appeared consistent with the requirements specified in Specification DPS-1205.19-00-0003. Out of 484 MOVs, the licensee had completed 322 of their design basis reviews. The licensee plans to have their design basis reviews completed by October of 1992.

The licensee uses the Auxiliary System Design Optimization Program (ASDOP) a computer program software to determine the degraded voltages at the terminals of each MOV by considering the motor starting characteristics, line impedances, transformer impedances, and cable impedances calculations. The inspectors questioned the licensee regarding the use of 167°F as the ambient temperature assumed for cable runs. To justify the ambient temperature used in the degraded voltage calculations, the licensee performed an analysis to determine the voltage drop at 167°F and 330°F and determined the difference. The licensee reviewed the length of cables for MOVs in the reactor building and determined that the longest cable length inside the reactor building was 770.5 ft. The cable length was from the MCC to MOV 1WL1302A. An ASDOP simulation was performed over the entire cable length using 75°C and 330°F as the input parameters. The results of the analysis indicated only a 0.54 voltage difference between 75°C (167°F) and 330°F. Based on the results of this analysis, the licensee felt that the voltage at the terminals of the MOVs would be insignificant at these conservative temperatures.

During discussions with licensee personnel, the inspectors learned that a power factor of 0.25 was used in the degraded voltage calculations. The use of a 0.25 power factor was based on the assumption that the motors for the actuators were continuous duty. Because the motors used on Rotork and Limitorque actuators were not continuous duty, a different power factor will be applied to determine the degraded voltage in the calculations. The licensee was waiting for the operator

manufacturers (Limitorque and Rotork) to provide the bounding generic values for both power factor and amperage for the different size motors. When this information becomes available, the licensee plans to revise the degraded voltage calculations and MOV sizing calculations. The inspectors will review these efforts during future inspections. (Concern 4)

3.c. MOV Switch Settings

Recommended action b. of Generic Letter 89-10 request licensees to review, and to revise as necessary, the methods for selecting and setting all MOV switches.

The NRC inspectors discussed with licensee personnel the process of sizing MOVs and setting their switches. The inspectors reviewed the DPS-1205.19-00-0002, "Guideline for Performing Motor Operated Valve Reviews and Calculations," Rev. 1, January 25, 1991, and several calculation packages.

The licensee has completed sizing and switch setting calculations for approximately 194 MOVs and has used the typical industry thrust equation to perform these calculations. According to Section 5.1.4 of DPS-1205.19-00-0002, a valve factor of 0.50 would be assumed in high temperature/pressure applications for solid and flexible wedge gate valves and in low temperature/pressure applications, a valve factor range between 0.35 to 0.50 would be assumed. Also, DPS-1205.19-00-0002 stated that valve factor of 0.35 would be assumed for parallel disc gate valves and a 1.10 valve factor would be assumed for globe valves. DPS-1205.10-00-0002 made an exception for MOVs with a safety function only in the open direction. To reduce the seating forces, the closing thrust for these MOVs was determined by assuming a valve factor of 0.35.

The inspectors questioned the licensee about Section 5.1.4.3 of DPS 1205.19-00-0002. The use of a lower valve factor would be applied if an operability concern was identified for solid and flexible wedge gate valves used in low pressure/temperature applications. However, this statement was not apparently clear to what the minimum valve factor would be. The statement can be interpreted as using a valve factor below a 0.35. The licensee indicated that for solid and flexible wedge gate valves used in low pressure/temperature applications, the numeric value would not be below a 0.35 valve factor. The licensee indicated to the inspectors that they would clarify and revise DPS-1205.19-00-0002 accordingly.

According to DPS-1205.19-00-0002, a stem coefficient of friction (SCF) of 0.15 was assumed for Rotork and Limitorque operators. The licensee had based their assumed SCF on a study performed by Rotork and test data. The inspectors reviewed the "VOTES Sensor Test Report Analysis Guideline," January 31, 1992 to determine how the SCF was determined. This document indirectly addresses the SCF by multiplying the stem factor (using an assumed SCF) by the measured thrust at Control switch trip (CST). Spring pack deflection was also measured, and torque was determined by referring to the appropriate spring pack curve. The calculated torque value should be equal to, or greater than, the torque value identified from the spring pack curve. The inspectors observed that additional instructions were not provided should the calculated torque value be less then the value from the spring pack curve. The licensee indicated that the VOTES guideline document would be revised to include additional instructions when this requirement is not met.

The VOTES guideline document also required that torque limitations be evaluated. To ensure that torque limitations were not exceeded, the stem factor (using an assumed SCF) was multiplied by the measured thrust at Contactor Drop-out. The calculated torque value was required to be less then the actuator rated torque. However no additional instructions were provided if the calculated torque was found greater than actuator rated torque. The licensee indicated that the Votes guideline document will be revised to provide additional instructions if this requirement is not met. During further discussions, the licensee indicated to the inspectors that the VOTES guideline document will be revised to verify the stem factor by measuring torque and dividing by the maximum thrust at CST. The licensee also indicated that the torque value will be obtained from either of following sources: a torque sensing strain gage, torque bench, torque bench certification sheet, spring pack force test correlated to theoretical torque or standard manufacturer torque/torque switch curves. The inspectors will review the licensee's efforts during future inspections. (Concern 5)

The methodology for determining minimum required thrust/torque requirements was defined in DPS-1205.19-00-0002. Maximum thrust/torque limitations were based on the lesser of the valve structural limits, actuator limits, and motor capability at degraded voltage conditions. The minimum and maximum thrust/torque ratings were adjusted to include a 10% to account for diagnostic instrument inaccuracies. The licensee has performed a two part study to justify increases in thrust ratings for Limitorque and Rotork operators. The

first part of the study performed overload test on certain Limitorque models. The Limitorque test program raised the thrust ratings of SMB-000, SMB-00, SMB-0 and SMB-1 operators to 162 % of their currently published ratings for a 2000 life cycle. To be conservative the licensee only uses 130% of the published rating in its MOV calculations for Limitorque operator models identified above. The second part of the study performed overload test on a selection of operators manufactured by Rotork. The goal of this study was to increase the thrust ratings to 200% of their currently published levels. The results of the study indicated that for certain operators the goal was achieved, but for other Rotork operators the goal was not achieved.

The inspectors discussed with the licensee the recommendations documented in Limitorque Technical Update # 92-01 regarding the Seismic Qualification Tests. The results of the seismic qualification test identified two anomalies associated with the SMB-000 actuator. The first anomaly was the loosening of the actuator mounting bolts, and the second anomaly was the spurious engagement of the manual declutch lever. To use these seismic qualification results, studies indicate that it is necessary to ensure that the actuator mounting bolts are properly tightened to the prescribed levels, and that the manual declutch lever in the SMB-000 actuator should be secured with a cable to keep it from spuriously engaging during a seismic event. The licensee had not addressed this issue. Further the licensee was not following Limitorque's recommendation regarding the tightening of the bolts in the upper housing cover to recommended torque values. In regard to the declutch lever, the licensee's justification for not proceeding with the recommendation was based on a recent Limitorque correspondence which indicated that during seismic testing, a similar anomaly could not be reproduced with a SMB-00 actuator. Limitorque corporation was reviewing potential modifications to the declutch system such as using a lighter mass declutch lever. The design and associated static seismic analysis is expected to be finalized by May 15, 1992. However, the licensee will need to provide justification for not following Limitorque's recommended torque values for the actuator housing cover.

The inspectors reviewed MCC-1205.19-00-0003 "Electric Motor Operator Sizing Guidelines Per GL 89-10 For Gate Valves," Rev. 13, February 12, 1992 and observed that MOVs 1CA0161, 1CA0162, 2CA0161, and 2CA0162 had a degraded voltage of 62%. These MOVs receive electrical power from the station batteries. The primary function of these MOVs was to meet Appendix "R" requirements by

opening and providing flow to the auxiliary feedwater turbine driven pump from the condensate system during a safe shutdown event. The inspectors raised two concerns. The first concern was whether the MOVs would be capable of starting at design basis conditions, and the second concern was whether these MOVs would meet their Technical Specification stroke time requirements at 62% rated voltage. The licensee indicated that Limitorque only had test data showing that torque versus voltage was a linear relationship down to 70% percent. Below 70% of rated voltage, the licensee relies on a draft study performed by Commonwealth Edison entitled a Degraded Voltage Impact on DC Motor Starting Capability. The purpose of study was to calculate the impact of degraded voltage on the starting torque of DC motors serving their respective valve actuators. Test data revealed a linear relationship at 100% down to 25% rated voltage. In regard to the second concern the licensee indicated that these particular MOV were not required to meet any Technical Specification stroke time requirements.

The inspectors noted that no margins were included in the MOV sizing calculations to account for rate of loading (ROL) effects that might decrease the available thrust delivered by the actuator during high pressure conditions compared to the thrust delivered during the static conditions when settings are made. However, test data had been evaluated to identify the rate of loading phenomenon. This data was compared to the design basis conditions to ensure that adequate margin exists. The inspectors also observed that the licensee had performed an extensive evaluation to determine whether a trend existed for various types of MOVs. The licensee indicated to the inspectors that future test data will be evaluated to determine rate of loading effects. Accounting for ROL effects is crucial, especially to those MOVs that cannot be tested at design basis conditions.

The licensee does include margin in its MOV sizing calculations to account for high ambient temperature effect on motor performance. The licensee relies on a study performed by Rotork for that manufactures's actuators. According to this study, temperatures within the range of 162°F and 370°F could reduced motor torque from 10 % up to 17 %. The licensee has applied this study to Limitorque actuators. The inspectors indicated that the Rotork study has not been justified to be applicable to Limitorque operators. The licensee has used the results of this study to developed a flow chart to address MOVs located in high temperature areas that may need to operate upon initiation of an accident during degraded voltage conditions, and MOVs that may need to operate later in a scenario

when voltage has not recovered to normal conditions. This flow chart methodology was documented in the licensee's Electric Motor Operator Sizing Guidelines" but was not documented in DPS-1205.19.00-0002. The licensee indicated to the inspectors that DPS-1205.19-00-0002 will be revised to include the flow chart. The licensee was waiting for Limitorque to provide the results of a study regarding the effect that high ambient temperature has on AC motors output. When this information becomes available, the licensee indicated that its sizing calculations will be revised accordingly. The inspectors will review these efforts during future inspections. (Concern 6)

The inspectors observed that the licensee's FSAR stated that motors connected to the diesel generating units would be capable of starting at 80% voltage. In the electric motor sizing calculations the degraded voltage for several Rotork operators were slightly less than 80%. The licensee needs to ensure that their FSAR commitments are consistent with the minimum voltages documented in their electric motor operator sizing calculations. The licensee indicated that their FSAR would be revised to reflect this situation. The inspectors will review this effort during future inspections.

Section 6.2 of DPS-1205.19-00-0002 discusses the capability of MOVs to satisfy their intended safety functions when supplied with less than nominal voltage. To demonstrate this capability, the licensee described its calculation of the stall torque and thrust available from the actuator at undervoltage conditions. The inspectors raised questions concerning the omission of the "application factor". This factor is a constant used as margin in motor sizing. The licensee indicated that they could not adequately justify the omission of this factor and therefore plan to revise DPS-1205.19-00-0002 to include the application factor. The licensee also realized that the MOV sizing calculations would need to be revised. The NRC staff will review this effort during future inspections. (Concern 7)

In Section 6.5 of its GL 89-10 Program document, the licensee stated that missing Limitorque switch limiter plates were to be identified during preventive maintenance and diagnostic testing activities. These requirements were required and documented in procedures

IP/0/A/3190/10 "Limitorque Actuator Preventive Maintenance," Rev. 0, January 17, 1992, and IP/0/A/3066/02H, "Testing MOVs Using VOTES," Rev. 0, February 8, 1992. The licensee stated that when a torque switch has to be set above the manufacturer's maximum recommendations a safety analysis in accordance with 10 CFR Part 50.59 will be performed.

According to Section 7.1 of its GL 89-10 Program document, motor overload protection at McGuire was intended to meet the intent of Regulatory Guide 1.106 (Rev. 1), "Thermal Overload Protection for Electric Motors on Motor-Operated Valves." McGuire uses a single alarm overload heater in each QA1 MOV circuit which was used for overload indication only. The licensee stated that four MOVs had their closing torque switches bypassed for significant lengths of travel (98% of valve stroke). However, the licensee intends to replace these actuators. For all GL-89-10 gate valves (and globe valves with flow over the disk) the open torque switch bypass was set for 50% +/- 25% to cover high unseating loads to at least 25% of the valve stroke.

3.d Design-Basis Differential Pressure and Flow Testing

Recommended action c of the generic letter, 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 NRC staff allows alternate methods to be used to demonstrate the capability of the MOV. A two-stage approach is suggested for situations 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 DPC letter dated December 28, 1989 in response to GL 89-10 stated that all applicable valves will be baseline stroke tested against static conditions to ensure that switch settings are within design specifications. The letter advised that differential pressure testing would be performed only where practical and only to the extent that the test will provide useful information for the DPC program methodology.

The DPC corporate program defines the objectives of the D/P test plan as well as the constraints in developing the D/P testing plan. Additionally, certain considerations are listed that are important to the D/P testing plan. The program defines the approach to be used for MOV D/P testing by setting guidelines for test conditions, establishing test groups and defining engineering analysis and assessment guidelines. (Concern 9)

The site has established a D/P test plan which is used to categorize the MOVs in the GL 89-10 program. Valves are placed in one of six testable categories listed below:

MOV Case 1 Greater or equal to 90% of design basis D/P

MOV Case 2 Greater or equal to 75% of design basis D/P

MOV Case 3 Greater or equal to 50% of design basis D/P

MOV Case 4 Less than 50% design basis D/P

MOV Case 5 Identical valve can be tested in-plant or flow loop

MOV Case 6 Other industry data available

There is a Case 7 MOV category which is applicable to a unique valve that can not be tested or no industry information is available. For this type valve DPC will wait for the results of the EPRI testing or replace the valve. Licensee representatives stated that the latter choice would more than likely occur.

The D/P test plan consists of a base line test to verify setup criteria. Any corrective maintenance is preformed at this time. Once this is completed and the base line data is within the acceptance criteria, the MOV is D/P tested. If the test is successful the results are documented and the MOV is placed in the surveillance and post maintenance testing program. If the test is not acceptable then acceptable test data from an "identical" valve is used for comparison to verify the D/P test acceptance. The questionable valve is considered an isolated occurrence and corrective actions are performed. The D/P test is performed again. If failure occurs again then more corrective actions or compensatory measures are taken.

3.e. Periodic Verification of MOV Capability

Recommended action d of the generic letter, requests the preparation or revision of procedures to ensure that adequate MOV switch settings are determined and maintained throughout the life of the plant. In section j of the generic letter, the staff recommends surveillance to confirm the adequacy of the settings. The interval of the surveillance is to be based on the safety importance of the MOV as well as its maintenance and performance history, but is not to exceed 5 years or 3 refueling outages. Further the capability of the MOV is 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.

Section 6.1 of the licensee's MOV program document stated that all Group 1 and Group 2 GL 89-10 MOVs are to receive an initial baseline diagnostic test under static conditions (no pressure or flow). The program document further stated that the periodic testing will be performed to identify degradations or changes in MOV performance in relation to the baseline diagnostic test results. The licensee is attempting to develop a "trendable" parameter to allow the capability of the MOVs to be determined based on diagnostic tests under static conditions. The testing is to be perform within 3 refueling outages or 5 years and 6 refueling outages or 9 years from the previous baseline or periodic test for Group 1 and Group 2 MOVs, respectively, or at an extended or reduced interval based on trending results. This interval for Group 2 MOVs is not in accordance with the GL 89-10 recommendation of 3 refueling outages or 5 years. The licensee needs to justify extending the surveillance schedule. The inspectors will review the licensee's justification during future inspections. (Concern 11)

The inspectors stated that the use of static testing to verify continued capability of an MOV to operate under worst case differential pressure and flow conditions is not considered adequate at this time because of the uncertain relationship between the performance of an MOV under static conditions and under design basis conditions. The licensee will need to justify that its periodic testing methodology can demonstrate the capability of valves at design basis conditions. The inspectors will evaluate the licensee's justification for the use of static testing conditions during future inspections. (Concern 11)

The licensee's preventative maintenance (PM) procedure for Limitorque actuators (IP/0/A/3190/10) is performed on an 18-month frequency. Items performed included but were not limited to torque switch and limit switch inspection, valve stem inspection and lubrication, main gearcase lubrication, etc. The preventative maintenance procedure for Rotork actuators (IP/0/A/3066/02D) currently requires performance every 5 years. The procedure covers torque switch settings, checking the gearcase oil level, valve stem inspection and lubrication, etc. The inspectors noted that a 5 year valve stem lubrication frequency could potentially impact the valve stem friction coefficient. Licensee personnel stated that the Rotork actuator PM procedure was in the process of being revised at the time of this inspection. The procedure is being changed to require valve stem lubrication on an 18 month frequency. The inspectors will review the Rotork PM procedure revision during future inspections. (Concern 12)

ensee's program document categorizes maintenance activities)Vs as minor maintenance, intermediate maintenance, and major nance. The program document also provides guidance in the of a post maintenance test matrix which specifies the testing quired and the maintenance category for various maintenance activities. In reviewing the post maintenance test matrix, the inspectors questioned whether adequate post maintenance testing was specified for some major maintenance category activities. Specifically questioned was the testing specified for the valve stem packing adjustment or replacement maintenance activity did not appear to require a new baseline test. Licensee personnel stated that they are attempting to develop a trendable parameter to allow the capability of the MOVs to be determined by means other than a diagnostic test. Licensee personnel further stated that currently the only measures being used to verify MOV capability after a valve stem packing adjustment or replacement is a diagnostic test. The inspectors stated that the post maintenance test matrix should be reviewed by the licensee to ensure that adequate post maintenance testing is performed on MOVs in the GL 89-10 program. (Concern 13)

3.f MOV Failures, Corrective Actions, and Trending

In recommended action h of the generic letter, the staff requires that licensees analyze or 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 retain d and

reported in accordance with plant requirements. It is also suggested that the material be periodically examined (every 2 years or after each refueling outage after program implementation) as part of the monitoring and feedback effort to establish trends of MOV operability. These trends could provide the basis for a licensee revision of the testing frequency established to verify 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 licensee's general requirements for identifying and analyzing MOV degradations and failures are described in Section 6.0 of their GL 89-10 Plan and requires that the cause of all MOV failures be assessed to determine the failure mode. Failure analysis is performed at several different levels and under different existing licensee programs. At the technician level, maintenance procedures for troubleshooting or performing corrective action on actuator problems require that the MOV technicians identify and document the failure mechanism(s). MOV maintenance is documented using the station's work request system which requires that the cause of the failure be documented. Abnormal valve performance or significant failures are reviewed under the licensee's Maintenance Incident Report (MIR) and Problem Investigation Report (PIR) programs, with the latter involving failures that require NRC notifications due to significant system operability concerns.

The inspectors reviewed licensee activities associated with the failure of the Steam Generator "D" Main Feedwater Temper Isolation MOV 1CF-137, which occurred on February 25, 1991. The inspectors discussed this failure with the site MOV Coordinator and reviewed the work request which documented the associated maintenance and subsequent testing. The licensee appeared to adequately investigate the root cause of the failure and took appropriate corrective action.

MOV failure trending is also described in Section 6.0 of the licensee's Plan. The licensee has been annually examining MOV failures, degradations, and other associated problems with MOVs that operate with Rotork actuators using procedure PT/0/B/4350/31. This review was being performed in accordance with NUREG-0538 requirements for Rotork actuators. The site MOV Coordinator has the responsibility for completing this review and the work request database is used to compile the listing. The inspectors reviewed sample reports generated from this review and concluded that they contained sufficient information to determine adverse MOV performance trends. A similar

program has not been established for MOVs that operate with Limitorque actuators, although, in March 1992, the MOV Coordinator performed an equivalent Limitorque failure trending review for failures occurring during the past four years. The licensee is establishing procedures to require yearly Limitorque reviews similar to that conducted for Rotork actuators.

The inspectors discussed with the licensee their plans to trend MOV diagnostic test results. Although diagnostic test data is evaluated, a program to trend the results of diagnostic testing has not yet been established. The licensee indicated that this aspect of the trending program was still in the developmental stages. The licensee stated that an outside contractor had been contracted to develop appropriate trending software.

3.g Schedule

In GL 89-10, the staff requested that licensees complete all design-basis reviews, analyses, verifications test, and inspections that were initiated in order to satisfy the generic letter recommendations by June 28, 1994, or 3 refueling outages after December 28, 1989, whichever is later.

The licensee submitted a response to GL 89-10 dated December 28, 1989. The DPC program includes two phases in which Phase 1 will emphasize all safety-related MOVs in piping systems which have high safety significance in a period of five years from the date of the response (December 28, 1989) or, 3 refueling outages (after June 28, 1990) whichever is longer. The Phase 2 will address the balance of applicable GL 89-10 MOVs within 8 years from December 28, 1989 or 6 refueling outages after June 28, 1990 whichever is longer.

The licensee has identified three groups of MOVs defined as follows:

Group 1	MOVs that are active and contribute to core melt scenarios and are significant from as accident analyses viewpoint. This group contains a plant total of 222 MOVs.
Group 2	The balance of active MOVs that are not in Group 1. This group contains a plant total of 254 MOVs.
Group 3	Passive position changeable MOVs that do not contribute to core melt scenarios.

The identification of MOVs applicable to the GL 89-10 appears to be complete.

The number of MOVs in the groups could vary slightly based on the design review and the component reviews; The licensee is using a valve stem factor of 0.5 in the thrust calculations for all solid and flexible wedge gate valves and for valves utilized in high temperature and high pressure applications.

When a valve factor of 0.5 causes the margin to be less than 5% for valves in the group 2 category, the valve is classified as "marginal." Presently the procedure acceptance criteria used for calculating the valve stem factors do not contain the directions or the guide lines for identifying a valve as "marginal." (Concern 8)

The static test (setup) has been completed for 68 common and Unit 1 MOVs and 18 have been differential pressure tested. The figures for Unit 2 MOVs are 66 and 7 respectively.

Licensee representatives advised the inspectors that the testing at the site will become a greater task as the refueling outages progress because of their commitment to surveillance requirements that will require testing of previously tested valves before the entire valve population is tested.

The engineering component review is currently 41% complete and the engineering design basis review is 66% complete. These tasks will require an additional 4 months to complete. Presently, no projection beyond the commitment of refueling outage No. 12 has been made.

3.h. Overall Administration of MOV activities

The inspectors determined that the overall administration of the McGuire Nuclear Station GL 89-10 program was described in the Duke Power Company Corporate Plan. This document defines the program organization and responsibilities.

The Mechanical Maintenance - Nuclear Services at the corporate level serves as a focal point and is responsible for the initiation of the program, general direction for program elements, program oversight and other tasks related to the MOV industry as well as assisting the sites to insure consistent implementation. The Site engineering group is an engineering support organization and is responsible for the valve selection and grouping; design basis review and component review;

station modifications, configuration control, and generation of GL 89-10 engineering documents; and final review and analysis of MOV test data. These two organization are part of the Nuclear Generation Department.

The site group under the Nuclear Station Manager is responsible for the MOV corrective and preventative maintenance; all MOV testing, hardware replacements and switch settings; and the scheduling of MOV activities as well as personnel training and qualification.

The inspectors noted that all personnel contacted were knowledgeable and understood the portions of the MOV program for which they were responsible. It was noted that in a few instances one person may serve as a single point of contact for a particular program function. This could cause delays in that function if the single point of contact is unavailable or the work load becomes excessive.

3.i MOV Setpoint Control

The licensee controls the setpoint for MOV output by thrust values. MOV thrust calculations and operator capabilities are summarized on the MOV set-up sheets. The MOV set-up sheets are transmitted to the site via variation notices. The variation notice is part of the licensee's design control program and is the control mechanism for ensuring that MOVs are set-up in accordance with GL 89-10 requirements. No changes can be made to a valve set-up sheet unless it is done through another variation notice. All variation notices must be dispositioned by design engineering. The site must have a variation notice for each valve prior to going in the field to set-up the MOV. Limit switch and torque switch settings are controlled through the variation notice process. The inspectors reviewed section 7.8 of the licensee's Nuclear Station Modification Manual and Station Directive 4.4.1, Processing of Modifications, both of which discuss the variation notice process. No deficiencies were identified.

3.j Training

The inspectors reviewed the licensee's MOV training program, held discussions with training personnel, and reviewed training course outlines and training records of selected individuals. MOV maintenance and testing is conducted by personnel from the

Instrumentation and Electrical (IAE) Department. Section 6.9 of the licensee's GL 89-10 Plan indicates that MOV training activities for IAE personnel are to be covered under the licensee's existing Employee Training and Qualification System (ETQS) program.

Under the ETQS program, IAE and station engineering personnel involved with MOV maintenance and testing are provided general training through 32-hour basic courses in both Limitorque and Rotork valve actuators. The lesson plans for these courses were detailed and included MOV theory, actuator operation, actuator repair and maintenance, and reviews of MOV problems identified in the industry. MOV maintenance activities are conducted using approved procedures that IAE personnel must be qualified on prior to their independent use. Qualification involves the successful demonstration in the proper use of the procedures under the observation of the individual's supervisor.

The inspectors noted that basic refresher training is provided on Rotork actuators, however, refresher training on Limitorque actuators is not conducted, nor do IAE personnel have to be requalified periodically on any of the MOV maintenance or test procedures. Since most of the licensee's valves use Rotork actuators, the infrequent performance of Limitorque maintenance and testing or use of associated procedures make it even more important that periodic refresher training be performed. The licensee indicated that they would review the possibility of enhancing their MOV training in this area. (Concern 10)

From the inspectors review of training records of selected individuals, it was discovered that some personnel had not taken the basic Limitorque training course, but, had proceeded to be qualified on the Limitorque maintenance and test procedures. It was also noted that this basic course was not a required prerequisite prior to personnel being qualified on the procedures. The licensee indicated that this would be reviewed and the Limitorque training prerequisites possibly revised.

IAE personnel performing MOV diagnostic testing get 32-hours of Valve Operation Test and Evaluation System (VOTES) training, conducted by instructors contracted from B&W Nuclear Service Company. In addition, B&W has performed advanced training in signature trace analysis for a few of the more experienced IAE personnel involved with MOV testing.

These inspectors verified that vendor personnel hired to perform training, engineering, or technical services are qualified to perform the intended service. The licensee stated that the vendors supplying personnel are on the QA approved suppliers list.

A training program for station operations personnel has also been implemented to provide them with an overview of MOV theory, operation, testing, and potentially damaging operational practices to avoid. To date, the training of Non-Licensed Operators on all but two shifts had been completed. The inspectors considered the training of operations personnel to be a positive and noteworthy initiative.

3.k Industry Experience and Vendor Information

The licensee's program for reviewing industry experience and vendor information is controlled by the corporate Nuclear Safety Assurance Department under Nuclear Production Department (NPD) Directive 4.8.1, Operating Experience Program Description. In accordance with the procedure, the Operational Nuclear Safety (ONS) group is responsible for industry experience and vendor information, and the Regulatory Compliance group is responsible for NRC generated documents.

ONS personnel review and screen incoming documents to determine which Technical/Engineering Support (T/ES) individual the document needs to be assigned. T/ES evaluates the information to determine the specific corrective actions and training recommendations that should be implemented. ONS personnel review these corrective actions and training recommendations, and, for a significant problem, the package is sent to the site's Safety Review Group to ensure urgent attention is given to the problem. The more significant problems which may require NRC notification, are documented as Problem Investigation Reports and are sent to the appropriate station Compliance group for subsequent review and corrective action. The training recommendations are reviewed by the Production Training Services group to ensure that appropriate training is specified and site training personnel are responsible for implementing the training.

The inspectors reviewed the adequacy of the licensee's handling of selected industry experience issues and vendor information letters. Nine issues were reviewed from which it was determined that

personnel are following the instructions in NPD Directive 4.8.1. The inspectors noted evidence that appropriate corrective actions and necessary training is being prescribed and implemented at the site level. The inspectors considered the licensee's program in this area to be a strength.

3.I. Use of Diagnostics

The licensee has employed VOTES diagnostic equipment from Liberty Technologies. As indicated earlier minimum and maximum thrust/torque ratings were adjusted to include a 10% to account for diagnostic instrument inaccuracies. The inspectors reviewed IP/0/A/3066/02H "Testing MOVs Using VOTES," Rev. 0, February 8, 1992. This procedure provides the guidelines for testing Rotork and Limitorque actuators to obtain the thrust values applied to a valve seat under static or dynamic pressure conditions. A TMD was used to measure spring pack deflection to determine actuator torque. When the data is obtained, the licensee uses the VOTES Sensor Test Report Analysis Guideline to evaluate the test data obtained from the VOTES diagnostic equipment.

4. Exit Interview

The inspection scope and results were summarized on April 10, 1992, with those persons indicated in Appendix 1. The inspectors described the areas inspected and discussed in detail the inspection result listed below. Although reviewed during this inspection, proprietary information is not contained in this report. Dissenting comments were not received from the licensee

APPENDIX 1

Licensee Employees

T. Belk, Design Engineer McGuire Engineering
N. Estep, Nuclear Services/Nuclear Plant Engineering/General Office
G. Gilbert, Manager, Safety Assurance/MNS
R. Hall, Engineering Manager, McGuire Engineering
R. Harris, Engineering Supervisor, McGuire Engineering
T. Lyerly, Component Engineering, MNS
T. L. McConnel, Station Manager, MNS
P. F. McHale, Training Director (I&E), MNS
D. Motes, Engineering Supervisor, Component Engineering, MNS
D. Murdock, Manager Engineering Maintenance Support, Nuclear Services
C. D. Painter, Senior Engineer, Systems/General Office
J. N. Pope, Superintendent, Instrument and Electrical , MNS
R. Sharpe, Regulator Compliance Manager, MNS
B. Travis, Component Engineering Manager, MNS

NRC Resident Inspector

K. VanDoorn, Senior Resident Inspector

APPENDIX 2

ACRONYMS & INITIALISMS

C/I	CONTAINMENT ISOLATION
D/P	DIFFERENTIAL PRESSURE
DPC	DUKE POWER COMPANY
EOP	EMERGENCY OPERATING PROCEDURE
FSAR	FINAL SAFETY ANALYSIS REPORT
GL	GENERIC LETTER
IAE	INSTRUMENTATION AND ELECTRICAL
LLI	LOW LEVEL INTAKE
MOV	MOTOR OPERATED VALVE
NC	NUCLEAR COOLANT SYSTEM
ND	RESIDUAL HEAT REMOVAL SYSTEM
NV	CHEMICAL AND VOLUME CONTROL SYSTEM
PMT	POST MAINTENANCE TEST
RC	RECIRCULATING COOLING WATER SYSTEM
RFO	REFUELING OUTAGE
RN	NUCLEAR SERVICE WATER
ROL	RATE OF LOADING
RV	CONTAINMENT VENTILATION SYSTEM
SG	STEAM GENERATOR
SCF	STEM COEFFICIENT FRICTION
CST	CONTROL SWITCH TRIP
ROL	RATE OF LOADING
TMD	THRUST MEASURING DEVICE