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

Report No. 50-400/92-06

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

Docket No. 50-400 License No. NPF-63

Facility Name: Harris 1

Inspection Conducted: April 6-10, 1992

Lead Inspector: P. Taylor 4/30/92
P. Taylor Date Signed

Inspectors: C. Smith 4/30/92
C. Smith Date Signed

for G. Schnebli 4/30/92
Date Signed

Others Contributing to This Inspection:

R. Cain, Idaho National Engineering Laboratory

Approved by: 4/30/92
F. Jape, Chief Date Signed
Test Program Section
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope:

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

Results:

In the areas inspected, violations or deviations were not identified.

The inspectors determined that the GL 89-10 MOV program was satisfactory at the current stage of development. Concerns were identified in some of the MOV program areas. The MOV program was also found to contain strengths.

The concerns identified involved licensee MOV program documents whose adequacy will require further review. In addition concerns similar to these are largely the result of technological uncertainties regarding the predictability of MOV operation. These uncertainties should be resolved as MOV data is disseminated throughout the industry. The concerns and strengths identified for the Harris MOV program are listed below:

CONCERNS

(1) Present commitments require DP-Flow testing MOVs where practicable. CPL letter dated June 6, 1991 and discussions with engineers responsible for the program indicate that selected MOVs may not be in-situ tested that are practicable to be tested. If MOV testing is discontinued the NRC should be notified and technical justification provided (paragraph 3d).

(2) The rate of loading effects had not been addressed in MOV sizing and thrust calculations. Industry tests have shown rate of loading to yield non-conservative (ie lower) thrust values. The rate of loading is planned to be evaluated for those MOVs that are DP-flow tested. Appropriate evaluation of rate of loading should be documented for all MOVs in the program. It is not clear at this time what DP range will bound the rate of loading phenomenon (paragraph 3c).

(3) Static tests are planned during periodic testing to demonstrated MOV capability to perform under design basis conditions. It is not clear that static testing can demonstrate design basis capability because of the uncertainties between the performance of MOVs under static and design conditions. The licensee will need to justify that the present periodic test methodology will demonstrate MOV operability at design basis conditions (paragraph 3e).

(4) MOV program procedures do not require that "as found" periodic test be perform prior to conducting any MOV preventive maintenance. This is necessary in order to properly evaluated existing MOV conditions, trends and degradation (paragraph 3e).

Other program procedures that are being changed and will require further NRC review are: TMM-406, Changes that will strengthen the MOV operability evaluations and onsite reviews of test results; PM-I0043, Changes that will identify the use of equipment data base system for torque switches and for limit switches in procedure CM-I002 and changes to PLP-112 which will describe MOV test program activities and responsibilities (paragraph 3d and 3e).

(5) The licensee took exception to GL 89-10 recommendation regarding MOV mispositioning in their letter dated June 6, 1991. The final disposition of this item remains to be determined and is under review by the NRC (paragraph 3a).

(6) The licensee is using a 0.40 locked rotor power factor for AC MOV calculations. Higher locked rotor power factors have recently been published by Limitorque. The licensee should address the effects that the new power factors have on MOV calculations and corrections applied as appropriate. (paragraph 3.b).

STRENGTHS:

(1) Engineers responsible for the MOV programs were found to be very knowledgeable regarding ongoing MOV issues and state-of-the art regarding diagnostic systems.

(2) Involvement in industry groups is extensive, sometimes in a leadership role.

(3) The extend to which DP-flow testing has already been completed and the priorities and resources given to testing MOVs at the Harris Plant.

(4) The programs that are in place for ensuring industry experiences and vendor information are incorporated into plant documents and training programs were found to be very effective.

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REPORT DETAILS

NRC Inspection of the Program Developed in Response to Generic Letter 89-10 at the Harris Facility

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.

The NRC staff requested licensees to submit a response to the generic letter by December 28, 1989. Carolina Power and Light Company submitted a response to the generic letter for its Harris Facility on December 27, 1989 and June 6, 1991. In those response, CP&L indicated that it planned to meet the recommendations of the generic letter and would comply with the 5-year schedule (completion by June 28, 1994) for the Harris Facility.

2. Inspection Plan

The NRC inspectors followed Temporary Instruction (TI) 2515/109 (January 14, 1991), "Inspection Requirements for Generic Letter 89-10, Safety-Related Motor-Operated Valve Testing and Surveillance," in performing this inspection. The inspection focused on Part 1 of the TI which involves a review of the program being established by the licensee in response to GL 89-10. Part 2 of the TI, which involves a detailed review of program implementation, was not performed. Implementation was examined only where this aided in evaluating the program.

3. Program Areas Inspected and Findings

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 the scope of the GL 89-10 Program with licensee's personnel to ascertain compliance with the above GL recommendation. The inspectors determined that the scope of GL program consisted of 116 MOVs. Criteria used for selecting GL 89-10 MOVs were delineated in Section 3.0 of Nuclear Engineering Department Document No. Q9-MO-002, Revision 2. The licensee in their response dated June 6, 1991, stated that inadvertent mispositioning of MOVs, initiated from the control room, in conjunction with an additional single active failure is beyond the current licensing basis for CP&L plants. The MOV program, therefore only considered events that are within the current licensing basis for Shearon Harris [Concern (5)].

The inspectors independently verified the accuracy of the GL program scope by comparison of selected MOVs shown on P&ID's with those identified in the licensee's GL 89-10 MOV List. The P&ID's used as the basis for this review were the Component Cooling Water System (CCWS), Chemical and Volume Control System (CVCS), Containment Spray (CS) and Residual Heat Removal (RHR). Additional verification of the program scope was accomplished by reviewing selected EOPs. The following EOPs contained required operator actions for positioning selected MOVs during events. These MOVs were compared to the licensee's GL 89-10 MOV List to verify inclusion in the program.

- Procedure No. EOP-RPP-008, SI Termination, Revision 4.
- Procedure No. EOP-EPP-033, Loss of All AC Power Recovery with SI Required, Revision 4.
- Procedure No. EOP-EPP-044. Reactor Trip Response, Revision 4.

All MOVs selected for review was determined to have been included in the scope of the GL 89-10 Program. No deficiencies were identified.

b. Design-Basis Reviews

Recommended action a of GL 89-10, requests 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 reviewed the licensee's Motor Operated Valve Program document as well as other documents as they pertained to the development of design basis reviews. Those documents included 09-MO-002; "NED Scope Document for work tasks authorized by CP&L's Nuclear Facilities in response to Generic Letter 89-10, Motor Operated Valves," (Rev. 2, May 31, 1991), AF-0029; "Mechanical Analysis and Calculations for 1AF-93," (Rev. 2, February 24, 1992), AF-0031; "Mechanical Analysis and Calculations for 1AF-143," (Rev. 1 January 31, 1992), SI-0021; Mechanical Analysis and Calculation for 1CS-278," (Rev. 1 February 24, 1992), SI-0023; "Mechanical Analysis and Calculations for 1SI-359," (Rev. 0, February 24, 1992).

Shearon Harris Nuclear Power Plant (SHNPP) determined the design basis differential pressure for each MOV by reviewing their Final Safety Analysis Report (FSAR), Design Basis Documents (DBDs), plant normal, abnormal and emergency operating procedures. Fluid temperature and flow were specified for design basis condition but was not included in the review for determining the design basis differential pressure. The licensee engineers noted that there is no factor for flow or temperature in the standard industry calculation for thrust. SHNPP intends to monitor and record flow and temperature during the differential pressure test. If these parameters are not the same as would be found during the actual design basis differential pressure for which the MOV is designed, then these differences would have to be reconciled prior to the test considered acceptable.

SHNPP used conservative assumptions in determining their design basis differential pressures. In most cases pipe frictional losses were not included, pumps were considered to be operating at shutoff head, elevational differences were not considered if it reduced the differential pressure, and the highest safety setpoint was used with the appropriate amount of accumulation added to the setpoint. However, the licensee did not determine if valve mispositioning would cause the design basis

differential pressure to be larger. SHNPP and CP&L stated in their response letter to Generic Letter 89-10 (GL 89-10) that valve mispositioning is beyond the design basis for SHNPP and other CP&L plants. Valve mispositioning for pressurized water reactor (PWRs) is currently under review by the NRC staff.

SHNPP reviewed their documentation on plant seismic events to determine the effects, if any, on MOV operation. Licensee engineers showed that seismic events for MOVs were considered in the original design basis documents and the FSAR, and that these documents would bound any seismic event which could effect MOV performance. The inspectors discussed with licensee engineers the Limitorque Corporation Technical Update #92-01, which reviews the Kalsi Engineering Department #1707-C, (Rev. 0, November 25, 1991). The Limitorque Updates included thrust rating increase for SMB-000, SMB-00, SMB-0, and SMB-1 actuators and section 4.5 included seismic qualification tests. Licensee engineers indicated that the seismic qualification tests and results were part of the thrust rating increase report and would be used when SHNPP used the study to increase actuator thrust ratings. The inspectors did not identify any actuators that had implemented the Kalsi study during the inspection.

SHNPP performed degraded voltage calculations for each MOV in their program. Documents used for this analysis were, "Design Guide for Electrical Evaluation of AC Power Motor-Operated Valve." DG-V.67 (Rev. 2, April 1, 1992), "Design Guide for Electrical Evaluation of DC Powered Motor-Operated Valves," DG-V.69 (Rev. 4, April 4, 1992), and SHNPP Design Basis Document, "Plant Electrical Systems, Off Site Power Systems, Generator, Exciter, Isolated Phase Bus Duct, Generator and Exciter Mechanical Support System," DED No. 202 (Rev. 0, January 12, 1987). The purpose of the calculations were to determine the starting terminal voltage at degraded grid and accident temperature conditions for MOVs in the program. These voltages were then used to determine the amount of torque the MOV motor is capable of developing during design basis conditions. SHNPP considered elevated cable temperatures by determining what compartments the cable passed through and then used the worst case temperature (highest temperatures) for that compartment and applied it to the entire length of the cable. Cable lengths and thermal overload (TOL) resistances were used in the calculations with a assumed MOV starting power factor of 0.40 at locked rotor as recommended by Limitorque.

The inspectors determine that Limitorque had recently published higher locked rotor power factors than the 0.40 value used in electrical calculations of AC MOVs. The licensee indicated that they were aware of the new locked rotor power factors recommended (telecon P. Taylor RII and M. Pugh, Nuclear Engineering Department April 30, 1992) by Limitorque and were evaluating the information. The incorporation of Limitorque recommendations in to design guide DG V.67, Electrical Evaluation of AC Power MOVs will be reviewed during a subsequent inspection [Concern (6)].

SHNPP utilized TOL devices to protect their MOVs during normal operation. However, during a safety system actuation SHNPP bypasses their thermal overloads. This was based on the recommendations of Regulatory Guide 1.106. The selection criteria for normal operation included, but was not limited to, ambient temperature differences between the MOV and the motor starter, motor full load amps, motor service factor, relay trip time, and valve stroke time requirements.

Licensee personnel were familiar with the possible degraded AC and DC motor torque output due to MOVs being located in high ambient temperature. For DC MOVs, the licensee had used the recommendations of Limitorque. For AC MOVs, the licensee had developed an on site plan to be used. The SHNPP plan reviewed plant documentation in order to determine the highest ambient temperature that will be seen by a given MOV. Motor resistances are recalculated based on the highest ambient temperature. With these new resistance values, licensee personnel then recalculated the available AC motor torque. Licensee engineers plan to review Limitorque's high ambient temperature findings when made available and will determine which method would best envelop their MOVs.

SHNPP had reviewed the Generic Letter 89-10 issues concerning design basis operating conditions for MOVs in their program. The inspectors concluded the licensee had adequately addressed the area of design basis reviews and it appeared to be consistent with the recommendations of GL 89-10.

c. MOV Switch Settings

Recommended action b of Generic Letter 89-10, requests licensees to review, and to revise as necessary, the methods for selecting and setting all MOV switches. (i.e., torque, torque bypass, limit, thermal overload)

The inspectors reviewed the licensee's documents for MOV sizing and switch settings. These documents included, "Design Guide for Limitorque Motor-Operated Valve Mechanical Evaluations," Design Guide DG-1.11, (Rev. 4, February 3, 1992) and calculations: AF-0029; "Mechanical Analysis and Calculations for 1AF-93," (Rev. 2, February 24, 1992), AF-0031; "Mechanical Analysis and Calculations for 1AF-143," (Rev. 1, January 31, 1992), SI-0021; "Mechanical Analysis and Calculations for 1SI-340," (Rev. 0, February 24, 1992) CS-0007; "Mechanical Analysis and Calculation for 1CS-210," (Rev. 1, January 28, 1992), CS-0016; Mechanical Analysis and Calculation for 1CS-278," (Rev. 1, February 24, 1992), SI-0023; "Mechanical Analysis and Calculation for 1SI-359," (Rev. 0, February 24, 1992). The licensee had 116 MOVs in their program. Of these 116 MOVs, 36 calculations had been completed and undergone internal review. The remaining 80 calculations were still considered to be in draft form until the internal review had been completed.

The licensee's engineers performed the MOV calculations using the standard industry equations for determining minimum required valve thrust and torque. For added conservatism, SHNPP used a valve stem coefficient of friction (COF) of 0.20 for calculating the minimum required thrust value and a value of 0.15 to determine the maximum thrust valve. SHNPP intends to verify their assumption of COF through their test program. The licensee used a valve factor (VF) of 0.40 for gate valves and the mean seat diameter in their MOV sizing calculations. An exception to this methodology was with Westinghouse supplied valves. Westinghouse supplied valve factors to SHNPP for Westinghouse valves which varied from 0.485 to 0.55. After reviewing industry data, SHNPP engineers considered a VF of 0.40 to be the average from the industry data available to date. A VF of 1.1 was used for globe valves. The licensee is planning to use the test results from insitu testing to validated MOV calculation assumptions. A margin of 15% is added to the minimum required thrust to account for diagnostic equipment inaccuracies and torque switch repeatability. The maximum actuator thrust and torque rating is reduced by 10% to account for inertial effects and diagnostic inaccuracies. The inspectors noted that the 10% margin may not be sufficient to bound diagnostic equipment inaccuracies, inertia effects, and torque switch repeatability. The latest Limitorque Technical Update (92-01) extending actuator thrust ratings. Licensee engineers stated they would consider these effects if they used the extended thrust ratings for their actuators.

SHNPP replaces or installs limiter plates on their MOVs. This action is specified in their procedures RM-10020, Rev. 3, and CM-10002, Rev. 4. When it is necessary to increase the torque switch setting greater than the vendor recommended maximum, a design change notice (DCN) or similar document is issued and an appropriate engineering analysis is performed. The analysis would considered spring pack capability, degraded voltage performance, and other factors to ensure maximum actuator torque and thrust rating was not exceeded. A new limiter plate would be ordered and installed.

SHNPP bypasses the open torque switch for the MOVs. The open torque switch is placed back in service above the open limit switch setpoint as a safety feature in case of limit switch failure. Valves which utilize the torque switch in the close direction have their torque switches bypassed for 96% of travel and then the torque switch is placed in the circuit for the last 4% of valve travel to ensure seating. The licensee had a very small population of valves which used the closed limit switch to stop motor operation. The inspectors questioned the licensee if any of their valves which used the closed limit switch to stop motor operation also had specified criteria for leakage. The licensee responded that they did have some limit-close valves which do have specified leakage criteria. However, licensee personnel stated that all the valves which limit close and have specified leakage criteria are of the SB actuator type which utilizes an additional compensating spring. This compensating spring allows setting of the limit switch setpoint to ensure hard seating of the valve has been accomplished.

SHNPP has investigated the phenomena of "rate of loading" (ROL). SHNPP described this phenomena as the difference in the value of thrust indicated at torque switch trip under static conditions as compared to the thrust value at torque switch trip under dynamic conditions. SHNPP personnel stated this phenomena has not been observed on site, although the existence of ROL has been proven in several industry tests. SHNPP plans to use the results of their diagnostic testing to determine where the condition applies at their plant, and to take action as appropriate. The inspectors were concerned that without a margin set aside in the calculations for unknown phenomena, such as ROL, torque switch settings may be set non-conservatively. This could lead to valves failing to operate under design basis conditions. Further, for valves which cannot practicably be tested in situ at design basis conditions, SHNPP did not have in place a method to account for ROL that these valves could experience. Margins assigned for unknown phenomena

based on dynamic test results should be included in the calculations for these valves to ensure that torque switches are set conservatively and to ensure that valves will function under design basis conditions. This area will be reviewed during a future inspection [Concern (2)].

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 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.

CP&L MOV Program Plan (Q9-MO-001, Q9-MO-002) and letters dated December 27, 1989 and June 6, 1991 commit to in situ testing MOVs under design basis conditions where practicable and baseline tests (static conditions) of all MOVs in the program would also be performed. The June 6, 1991 CP&L letter indicated that a preliminary review is underway which would delete MOV testing that are practicable to DP-flow tests. The examples given were small gate and globe valves two inches or less. These would be grouped and a few of these MOV would be differential pressure tested. It is not clear how the licensee will apply tests results to the similar non tested MOVs in the group. The inspectors cautioned that the discontinuation of MOV testing that are practicable to test is a deviation from their present commitment. Therefore NRC notification with appropriate technical justification should be provided. [Concern (1)].

The inspectors reviewed the following documents, which describes the DP-flow testing program requirements and guidance:

- Q9-MO-002, Revision 2 dated May 31, 1991, NED Scope Document GL 89-10 MOVs Enclosure 1, MOV DP Test Program

- Design Guide DG-1.12, Revision 2 dated, February 6, 1992, Review and Reconciliation of MOV Diagnostic Tests

- Technical Support Guide TSG-242, Revision 0 dated March 23, 1992, Guidance for Preparation of MOV Engineering Periodic Tests

- Technical Support Management Manual, TMM-406 Revision 1 dated January 28, 1992 Analysis and Trending of MOV Performance

The inspectors found that the guidance provided in the aforemention documents address MOV operability and the reconciliation of the assumptions (e.g stem factor, valve factor) used in the MOV's torque/thrust calculations. The SHNPP had performed in situ DP-flow tests on 42 MOVs during refueling outage 3 (Spring 1991). The licensee recently completed the review and approval of the test results and reconciliation of torque/thrust calculation assumptions. The inspectors expressed a concern with the significant length of time to complete the review and approval of test results. The licensee indicated that the review/approval process would be completed in more timely manner. In addition the licensee should consider a more detailed review of test results onsite by the Technical Support Group to ensure MOV thrust margins are adequate and any MOV abnormality is addressed prior to returning the MOV/system to operation [Concern (4)].

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.

The licensee's upper-tier program document number Q9-MO-001, GL 89-10 MOV Program Specification, Revision 0, Section 11.0, established requirements for performing periodic diagnostic testing to identify MOV degradations. The frequency for performing periodic tests was given as every 5 years or 3 RFO from the date of the initial baseline test or differential test, whichever was performed later. Site level procedures numbers PLP-112, Motor Operated Valve Program; TMM-406, Analysis and Trending of MOV Performance and PM-I0043, Motor Operated Valve

Testing and Calibration, collectively implement these requirements delineated in the upper-tier program document. The inspectors identified a concern with procedure PLP-112 in that the program controls described in paragraph 5.3 did not specifically address periodic test requirements. Additional programmatic inadequacies related to procedure PM-I0043, paragraph 6.0 was identified. The inspectors determined that the Equipment Data Base System (EDBS) will be the source of design basis information involving torque switch and limit switch settings. Lower-tier site level procedure PM-I0043, which implements periodic test activities involving torque switch settings, needs to be revised to reflect the use of EDBS in this activity. Similarly, procedure CM-I0002, A.C. Limitorque Calibration Check and Stroking will be revised to require limit switch settings to be obtained from the EDBS. These items are identified as concerns that will be reinspected in future MOV inspections [Concern (4)].

Discussion with licensee engineering personnel revealed that static diagnostic testing would be performed periodically to reverify design basis capability of the MOVs within GL 89-10 program scope. The inspectors informed licensee management that the use of static testing to verify continued capability of an MOV to operate under worst case differential pressure and flow conditions was not considered adequate at this time. The reason given was the unknown relationship between the performance of an MOV under static conditions and under design conditions. The licensee will be expected to provide a technical justification for whatever method is used for periodic verification of MOVs capabilities. Additional NRC inspection of this area will be required in order to evaluate the verification method used [Concern (3)].

The licensee's GL 89-10 MOV Program has established requirements for post-maintenance tests to be performed on MOVs following any type of maintenance on the operator or valve. These requirements are specified in Section 9.0 of upper-tier program document Q9-MO-001 and are implemented via site level procedure number PLP-400, Post Maintenance Testing, and CM-P0001, Post Maintenance Testing Requirements for Limitorque Operated Valves. Post maintenance test requirements for MOVs have been established and provisions have been made for incorporating baseline tested MOVs into the PM program. The inspectors verified by review of objective evidence that selected MOVs, that were baseline tested during RFO3, have been included in the PM with a frequency for implementing PM activities that is consistent with program requirements. Additionally, lubrication requirements were verified to have been established; and site level procedures developed for implementing these requirements, in accordance with specified

frequencies based on plant operating experience. MOV program procedures do not require that "as found" periodic test be performed prior to conducting any MOV PM's. This is necessary in order to properly evaluate existing MOV conditions, trends and degradation [Concern (4)].

The Licensee's GL 89-10 MOV Program does not address thermal overloads (TOLs). The Licensee's commitment to Regulatory Guide 1.106 is contained in FSAR Section 7.3.1.5.1a Amendment No. 40. The TOLs and torque switches are bypassed under DBA conditions. Technical Specification Section 3.8.4.2, Motor Operated Valve Thermal Overload Protection, specifies the surveillance required to demonstrate operability. Discussions with licensee's engineering personnel revealed that TOLs are sized in accordance with guidance of IEEE 741-1990. Surveillance requirements are satisfied on an 18 month frequency by implementing procedure OST-1074, Operations Surveillance Test MOV TOL and Torque Switch Bypass Test. No deficiencies were identified in this area.

f. MOV Failures, Corrective Actions, and Trending

Recommended action h of the generic letter requests that licensees analyze and justify each MOV failure and corrective action. The documentation should include the results and history of each as-found deteriorated condition, malfunction, test, inspection, analysis, repair, or alteration. All documentation should be retained and reported in accordance with plant requirements. It is also suggested that the material be periodically examined (every 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 inspectors reviewed the licensee's activities related to MOV failures, corrective actions, and trending. The program requirements for these elements are contained in Technical Support Management Manual, TMM-406, Analysis and Trending of MOV Performance. MOV failures are processed through the site normal work control system using Work Requests and Authorizations (WR&A's) and Adverse Condition Reports (ACR's) as required to correct a problem. MOV coordinators are on distribution for all WR&A as ACR's issued each day and the coordinators track the open items on a computer data base for each MOV in the

program. In addition, completed maintenance packages are reviewed and kept on file by the coordinators to ensure the appropriate steps were taken to correct the problem and to determine if the problem is isolated or generic. The inspectors reviewed several files for MOV's in the program and consider them to be an accurate, up-to-date, machinery history record for each valve. Since this facility is relatively new and has not encountered many MOV failures, the records were readily available for inclusion in the machinery history records.

The licensee's program requires that all WR&A be reviewed by Engineering Support prior to work performance to ensure the proper post maintenance test record (PMTR) is identified and the correct planning and procedures are specified. In addition, the completed work packages are reviewed by this group to ensure the correct root cause is documented, proper corrective actions were taken, and the proper PMTR was performed.

Currently, the licensee only trends MOV failures, however, as more diagnostic data becomes available additional parameters will be trended. TMM-406, Section 5.2, requires that MOV performance be trended by retention of test results from VOTES testing. Trends to be evaluated will include, but not be limited to, increased or decreased thrust values to open or close a valve, increased or decrease motor current values. The inspectors reviewed the final annual MOV Trend Report dated March 23, 1992. This report contains the failure history of the 177 valves in the program from September 16, 1987, to date. The inspectors considered this report to be very informative and will be a good basis for trending and identification of generic MOV failures.

The inspectors concluded that the licensee's current program for MOV failures, corrective action, and trending, in conjunction with planned developments will provide the necessary framework to monitor, identify, and correct any adverse MOV performance.

g. Schedule

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

The inspectors held discussions with licensee personnel and reviewed scheduled MOV program activities to support a completion date of June 28, 1994. The Harris MOV program document (PLP-112,

Revision 1 dated March 10, 1992) currently identified 116 MOVs to be in the program. Design basis reviews and torque/thrust calculations have been completed for 55 MOVs. An additional 30 MOVs are scheduled to have these activities completed by July 1992. Baseline test and in situ DP-flow test have been performed for 42 MOVs (refueling outage 3, Spring 1991). An additional 43 MOVs will be tested during refueling outage 4 (Fall 1992) with the remaining MOVs being tested during refueling outage 5 (Spring 1994). The inspectors concluded that the licensee's current schedule commitments are achievable.

h. Overall Administration of MOV Activities

The Licensee's lower-tier program document, procedure PLP-112, Motor Operated Valve Program, Revision 1, described the overall administrative control of the GL 89-10 program. Responsibility for coordinating the implementation of the program has been vested with the Technical Support Manager. Additionally, a dedicated staff of two engineers from Technical Support-Engineering Support Section has been assigned to the MOV program. Discussions with plant personnel revealed that they were very knowledgeable of the issues involved in GL 89-10 and were actively addressing the issues toward an acceptable solution. Based on review of the MOV Task Force Meeting Minutes, the inspectors concluded that the Licensee had developed a strong interface with industry groups. Licensee personnel actively participate in industry activities in a leadership role. Additionally, discussions with site personnel revealed that they were also involved with industry programs to keep current with MOV activities and MOV diagnostic equipment technology. The inspectors considered these aspects of the licensee program to be a strength.

The overall administrative controls described in site level procedure PLP-112, MOV Program, Revision 1, was considered adequate. Responsibilities have been assigned; program requirements have been established; and lower-tier site level procedures have been developed to ensure performance of design basis reviews; control of plant modifications; control of maintenance activities; and control of analysis and tending of MOV Test data. Based on review of procedure PLP-112, Paragraph 5.3 the inspectors determined that program control requirements for performing periodic MOV tests in accordance with approved site level procedure PM-I0043 have not been incorporated in the program description. This issue was discussed with Licensee personnel and will be identified as a concern to be evaluated during future NRC inspections.

i. MOV Setpoint Control

The inspectors found that the licensee controls torque switch settings and limit switch settings using Nuclear Engineering Department Guidelines E-51, Revision 0 dated November 15, 1991, Control of Safety Related MOV Switch Settings. The information provided by this procedure is available on the licensee's Equipment Data Base System (EDBS), Function 480 screen. The values determined for thrust, torque and limit switch settings for each MOV in the program are maintained at the plant. The ranges established for torque and limit switch settings can not be changed without the review and approval of the Nuclear Engineering Department.

j. Training

The inspectors reviewed the licensee's MOV training program, courses, facilities, and held discussions with training personnel. The training is conducted by the Harris Energy and Environmental Center (E&EC) which conducts MOV training for all three CP&L sites. The E&EC utilizes a mobile training classroom equipped with MOVs and diagnostic test equipment which is taken to each specific site for hands-on-training. The inspectors reviewed the training requirements and training material for personnel performing MOV maintenance and diagnostic testing. MOV maintenance personnel are required to complete a 40 hour course titled: Motorized Valve Operators - MN037G. Personnel performing diagnostic testing are required to complete an additional 40 hour course titled: Valve Operator Test and Evaluation System (VOTES) MN6C01G. The inspectors reviewed the outlines, lesson plans, and tests for the MOV course. Included in the formal classroom material are discussions of MOV related industry problems contained in SOERs, SERs, NRC Bulletins, Notices, and LERs. In addition to the personnel performing MOV maintenance and testing, the licensee has included electrical and mechanical planners, Nuclear Engineer Department engineers, and Technical Support Group engineers in the MOV training program. The MOV coordinators and various Technical Support Group personnel have received vendor training from B&W on the VOTES system for diagnostic testing. The inspector reviewed the training records for several maintenance/engineering personnel associated with the MOV program and found them to be accurate and adequate. Additionally, the inspectors reviewed the MOV awareness training for both licensed and non-licensed operators and found the program to be excellent.

In summary, the inspectors determined that the licensee has a comprehensive training program and methodology to ensure that all MOV maintenance and diagnostic analysis is performed by qualified personnel.

k. Industry Experience and Vendor Information

The licensee's program for reviewing industry experience is controlled under Administrative Procedure, AP-031, Operating Experience Feedback. This procedure provides guidance on the review and processing of operating experience feedback information received at the plant, and prescribes the mechanisms to ensure that any recommended action items are identified and tracked until resolved. This procedure requires the Regulatory Compliance staff to screen the following OEF items for applicability to this site and/or feedback to other CP&L sites: Significant Adverse Condition Reports; Documents routed from other company Regulatory Compliance Units which are designated as potentially warranting OEF; INPO Significant Operating Experience Reports; Significant Event Reports, Significant-by-others Reports, Significant Event Notifications, and Operations and Maintenance Reminders; NRC information Notices; Nuclear Network Items deemed appropriate; and other sources deemed appropriate for OEF (e.g., Nuclear Safety Analysis Center Reports, NRC Office for Analysis and Evaluation of Operational Data information, etc.).

The control of 10 CFR Part 21 is under Administrative Procedure, AP-616, Evaluating and Reporting of Defects and Noncompliance in Accordance with 10 CFR 21. Administrative Procedure, AP-610, Processing Vendor Manuals and Vendor Information, establishes the requirements to control the receipt, review, approval, distribution, and revision of vendor technical manuals and vendor training information. Issues in the above categories are tracked both manually and on a computer data base to ensure the required actions are complete. The inspectors reviewed the current indices for OEF and 10 CFR 21 items and selected the following for further review:

- 90-003, Limitorque-Motor Pinion Keyway (10 CFR 21).
- 90-010, Limitorque-SMB 00 Torque Switch Roll Pin Failure (10 CFR 21).
- 89-015, Limitorque-Cam Type Torque Switches (10 CFR 21).
- 89-001, Limitorque-Melamine Torque Switch (10 CFR 21).

- 89-005, Limitorque - Defective Torque Switch Assembly (10 CFR 21).
- 87-176, Limitorque Motor Operated Failure Caused by Excessive Grease in Spring Pack (INPO SER 20-87).
- 87-261, Valve Inoperability Due to Unbalanced Limitorque Torque Switches (INPO SER 38-87).
- 86-209, Inaccurate Closed Position Indication on Motor Operated Valves (INPO SOER 86-2).
- 84-173, Loosening of Locking Nut on Limitorque Operator (NRC IN 84-36, Supplement 1).
- 86-217, Recent Identified Problems with Limitorque Motor Operators (NRC IN 86-71).
- 88-066, Spring Compensator Housing on Limitorque Valve Operators (Westinghouse NDIS-TB-88-01).
- 91-297, Preliminary Results of Validation Testing of MOV Diagnostic Equipment (NRC IN 91-61).
- 91-303, Motor Operated Valve Drift Due to Valve Actuator Misadjustment (INPO O&MR 391).
- 92-042, Torque Switch Improperly Set (ACR 91-316 from Robinson Plant).

These issues were found to meet the requirements of the licensee's programs and were included in appropriate procedures or were in the review process to determine corrective actions, as required. In addition, the inspectors determined controls were in effect to ensure the events/issues were incorporated into licensee training materials.

In summary, the inspectors consider the licensee programs that are in place for ensuring industry experience and vendor information are incorporated into appropriate training programs are very effective.

I. Use of Diagnostics

SHNPP was using the Votes diagnostic system for measuring thrust during MOV initial set up and to monitor MOV thrust delivered during insitu testing. Licensee personnel converted thrust values from the MOV sizing and thrust calculations into torque values. These torque values were then used to set up the torque switch trip setpoint. This was accomplished by using a torque wrench which would compress the spring pack until a given torque was reached. Once this torque was accomplished the torque switch trip setpoint was adjusted to achieve this value. SHNPP then performed a static test using the Votes diagnostic equipment to monitor the thrust developed. This thrust value is monitored by the use of a strain gauge which is mounted on the yoke of the valve. This strain gauge is calibrated using the Votes diagnostic equipment. The thrust value developed had to be in between the minimum and maximum values of thrust as specified by the licensee's calculations. If the thrust required adjustment, the licensee would use the torque wrench to adjust the torque switch trip setpoint and repeat the static thrust test to ensure the adjustment fell within the required thrust band. The inspectors inquired as to how the licensee intended to measure torque during insitu design basis testing. Licensee engineers stated that the torque setting based on spring pack displacement, should not vary during static verses dynamic testing. The inspectors were concerned that without measuring torque during dynamic insitu testing, the licensee could not detect "peak torque" which could result from continued motor operation. The continued motor operation would occur due to the lag time between torque switch trip and the deenergization of the motor control circuit. Further, the stem coefficient of friction is generally higher just at flow closure (when the valve disc initially contacts the valve seat) than at torque switch trip. The torque at flow closure may differ from the torque at torque switch trip. Since the value of torque at flow closure is used to back calculate a stem coefficient of friction, SHNPP may be introducing an error into their verification of the stem coefficient of friction and masking their ability to observe the effects of ROL. Also, the back calculated stem coefficient of friction could change the available margin between the calculation upper thrust window limit and the torque switch trip setpoint. This analysis is necessary to verify the assumptions used when performing the MOV calculations. However, licensee maintenance personnel were involved in purchasing a device to measure spring pack displacement during in situ design basis testing. The inspectors will review how Shearon Harris uses the device to measure spring pack displacement during in situ design basis testing and how the data obtained from it is used during a future inspection.

The inspectors noticed that SHNPP intended to permanently mount the Votes strain gauges on their valve yokes. Also, SHNPP had used current transformers to hook up their diagnostic equipment and these were left permanently installed. This enabled licensee personnel to hook up diagnostic equipment easily and quickly, thereby reducing radiation dose received to those involved in the testing. This also enabled the licensee to hook diagnostic equipment for retesting if any maintenance had been performed with ease and a minimal amount of set-up time required. The inspectors considered this to be a strength.

4. Exit Interview

The inspection scope and all findings were summarized on April 10, 1992, with those persons indicated in the Appendix 1. The licensee was apprised of the concerns identified during the inspection and listed in the "SUMMARY" at the beginning of this report.

APPENDIX

PERSONS CONTACTED

Licensee Employees

*E. Burkhead, Senior Instructor, Nuclear Training
*M. Grantham, Senior Engineer, Nuclear Engineering Department
*D. Hawley, Senior Engineer, Nuclear Assessment Department
*T. Helms, Project Engineer, Nuclear Engineering Department
*P. Hicks, Electrical Engineer, Nuclear Engineering Department
*C. Hinnant, General Manager, Harris Plant
*D. Kanning, Senior Engineering Technical Support
*S. Mabe, Project Engineer, Nuclear Assessment Department
*M. McDaniel, Mechanical Engineer, Nuclear Engineering Department
*J. Nevill, Manager, Technical Support
*C. Olexik, Manager, Regulatory Compliance
*M. Pugh, Project Engineer, Nuclear Engineer Department
*M. Verrilli, Senior Specialist, Regulatory Compliance
*L. Woods, Manager, System Engineering
*G. Young, Engineer, Technical Support
*R. Zula, Manager, Engineering/Technical Support

NRC Personnel

*J. Tedrow, Senior Resident Inspector
*M. Shannon, Resident Inspector

*Attended Exit Interview