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

Report Nos.: 50-280/91-32 and 50-281/91-32

Licensee: Virginia Electric and Power Company
5000 Dominion Boulevard
Glen Allen, VA 23060

Docket Nos.: 50-280 and 50-281 License Nos.: DPR-32 and DPR-37

Facility Name: Surry 1 and 2

Inspection Conducted: November 18-22, 1991

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SUMMARY

Scope:

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

Results:

The inspectors found that the GL 89-10 MOV program for the Surry plant was generally satisfactory at the current stage of implementation, though several concerns were identified. The program was also found to contain strengths.

The concerns identified involved licensee assumptions and methods whose adequacy will require further review, two considerations not accounted for in

electrical calculations, and programmatic practices that had not been fully documented. Concerns similar to these have been identified in the programs of other licensees and are largely the result of technological uncertainties regarding the predictability of MOV operation. It is expected that these uncertainties will be resolved as MOV tests and analyses recommended by GL 89-10 are completed and the associated data is disseminated throughout the industry. The concerns identified for the Surry program are listed below:

Concerns

(1) The process for consideration of flow in design-basis testing and analysis was not adequately specified in the licensee's program. The NRC response to Question 16 of Supplement 1 to GL 89-10 indicated that flow rate should be determined from a design-basis review. As there is currently no accepted method for calculating the effects of flow on setting requirements, it is only used as a target flow for worst-case design-basis testing. Design flows were not determined by the licensee in its design-basis review and its program did not indicate how potential flow effects would be addressed in testing and evaluation. The MOV Engineer indicated that criteria for consideration of flow would be added to the Surry Station Engineering Services (SSES) Procedure that provides guidelines on the responsibilities of the MOV Engineer. [Ref. Section 3.b]

(2) The adequacy of an engineering study used as a basis for increasing the ratings of Limitorque actuators will require further NRC assessment. Licensee personnel indicated full endorsement of the study by Limitorque is expected at the February 1992 MOV Users Group meeting. NRC Region II has referred the engineering study to the NRC Office of Nuclear Reactor Regulation for additional assessment. [Ref. Section 3.c]

(3) The licensee planned to group similar valves and differential pressure test only a portion of each group. Some criteria for grouping valves had been developed but only appeared in the draft SSES procedure. Licensee personnel stated that all of the criteria to be used would be included in the approved SSES. The inspectors expressed concern that the criteria used should be fully documented and that, if grouping is applied to avoid testing valves that are practicable to test, the NRC should be promptly informed of the action and its basis. Similarly, the NRC should be informed of any use of prototype testing. Otherwise the licensee would be in deviation from its commitment to the generic letter recommendation to worst-case design-basis test all valves practicable in-situ. [Ref. Section 3.d]

(4) It was not clear that the licensee employed adequate conservatism in its switch setting calculations. Virginia Electric and Power Company (VEPCO) used the standard industry equation to calculate thrust for gate valves and, except in the case of Westinghouse valves, the valve factors used in the equation were 0.3 for flex wedge gate valves and

0.2 for parallel disk gate valves. Industry testing has shown this to yield non-conservative (i.e., low) thrust values. Other licensees have provided increased conservatism through use of higher valve factors in the thrust determinations made with the standard industry equation. VEPCO used the standard equation but increased the thrust values determined by adding a 15 percent safety factor instead of increasing the valve factor. The specific basis for this margin was not given and it was uncertain if this margin would be adequate. VEPCO's integration of industry and its own test results into the thrust calculation methodology and its justification for the factors used in the calculations will be evaluated during NRC inspection of GL 89-10 program implementation. [Ref. Section 3.c]

(5) The licensee employed a stem friction coefficient of 0.15 in its calculations. According to its actuator manufacturer, Limitorque, the 0.15 value applies when good stem lubrication is assured. Limitorque itself typically employs a more conservative 0.20 stem friction coefficient. From a positive standpoint, the licensee planned to use the lubrication frequency recommended by Limitorque and indicated it would verify the adequacy of the friction coefficient through its diagnostic tests. [Ref. Section 3.c]

(6) Although the MOV Engineer indicated that "as found" diagnostic testing would be performed before any preventive maintenance, this was not documented in any approved program document. The inspectors were informed that the requirement would be incorporated. [Ref. Section 3.e]

(7) Various program documents required revision or initial issuance. Examples included the SSES procedure, the sizing and calculation standard (STD-GN-0002) and the MOV setpoint procedures (1- and 2-DRP-007). [Ref. Sections 3.b and 3.d for the SSES Procedure and Section 3.c for the sizing and calculation standard and setpoint procedures]

(8) The effects of high ambient accident temperatures on motor torque, if any, had not been accounted for in the licensee's calculations. Licensee personnel indicated they would evaluate the need for correction to calculations when the results of a related study being conducted by Limitorque are released in December 1991. [Ref. Section 3.c]

(9) The effects of thermal overload resistances had not been considered in degraded voltage determinations. Licensee personnel stated that the need for any changes would be determined. [Ref. Section 3.c]

(10) The licensee had recently experienced a failure of Circulating Water System Valve 2-CW-MOV-200D. The initial information on this failure was reviewed by the inspectors. A copy of the licensee's Component Failure Analysis (CFA) Report was requested for further evaluation.

Licensee personnel agreed to provide a copy of the CFA Report through the NRC Senior Resident Inspector. [Ref. Section 3.f]

(11) The limited progress made in completing the testing recommended by the generic letter was of concern. Design-basis testing was not considered fully complete on any valves because the accompanying diagnostic testing was determined insufficient by the licensee. The positive aspects of this concern were that the licensee had performed many tests and had recognized the need for improvements to obtain more useful results. In particular, the licensee had determined that a single diagnostic method should be used for testing and that accurate torque determinations should be accomplished. [Ref. Section 3.d]

The following strengths were noted in the licensee's program:

Strengths

(1) Participation in industry groups, sometimes in a leadership role. [Ref. Section 3.h]

(2) The extent to which design-basis reviews and initial calculations had already been completed. [Ref. Section 3.g]

(3) Training. [Ref. Section 3.j]

(4) Current corrective action program. [Ref. Section 3.f]

(5) The necessary engineering expertise to facilitate implementation of the program was provided on site. Assigned personnel were very knowledgeable regarding the ongoing issues and the state-of-the-art. [Ref. Section 3.h]

(6) The need to measure torque as-well-as thrust had been recognized. [Ref. Section 3.d]

The inspectors concluded that the licensee's program and, particularly the concerns identified above, would require further evaluation during the planned NRC inspection of GL 89-10 program implementation.

No violations or deviations were identified.

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REPORT DETAILS

NRC Inspection of the Program Developed in Response to Generic Letter 89-10 for the Surry Plant

1. Background

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

In GL 89-10, the NRC staff requested licensees to submit a response to the generic letter by December 28, 1989. Virginia Electric and Power Company (VEPCO) submitted a response to the generic letter for its Surry and North Anna facilities on December 26, 1989. In that response, VEPCO stated that it would meet the recommendations of the generic letter and comply with its 5-year (completion by June 28, 1994) or 3 refueling outage schedule for the two plants. The NRC staff acknowledged the submittal in a letter dated June 25, 1990.

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

Each of the section subheadings below represents a program area inspected. The findings which require followup in GL 89-10 implementation inspections are identified as [Concern (X)]. These identifications provide reference to a

listing of the findings discussed in the Summary at the beginning of the report. The bracketed concern identification is located following the paragraph containing the discussion related to the associated concern.

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. In Supplement 1 to the generic letter, the NRC defines "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 found that the Surry MOV matrix (Surry MOV Status Matrix, dated Oct. 6, 1991) identified 184 MOVs in the Surry Unit 1 and 2 GL 89-10 program, 92 in each unit. According to Motor-Operated Valve Action Plan MAMA06-PED-1 (Rev. 0, April 19, 1989), VEPCO identified 261 safety-related motor-operated valves for Surry. The difference between the 261 MOVs specified as safety-related and the 184 MOVs was mainly due to omission of valves whose breaker was locked out during operation and omission of valves which were out of service. Two Condensate Polishing bypass valves were still under consideration for inclusion in the program.

The inspectors reviewed piping and instrumentation drawings for the Residual Heat Removal, Circulating and Service Water Systems to sample the completeness of the scope of valves included in the GL 89-10 program. Based on a review of these drawings and evaluation of the licensee's exclusion of certain MOVs from its program, the inspectors determined that the scope of the Surry program was consistent with the recommendations of GL 89-10.

3.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. VEPCO committed to comply with the recommendations of GL 89-10 in its letter to the NRC dated December 26, 1989.

To assess the design-basis review process used by VEPCO, the inspectors interviewed VEPCO personnel regarding the process and evaluated examples of design-basis reviews documented in ME-211, "MOV Thrust Calculations," for 2-SI-MOV-2890, (October 20, 1989, Rev. 0), 2-FW-MOV-251F, (December 13, Rev. 0), and 2-SI-MOV-2864A, (November 28, 1989, Rev. 0).

The inspectors were informed that analyses to determine the design-basis differential pressure for MOVs had been completed in the 1984 to 1987 time frame in response to NRC Bulletin 85-03 (November 15, 1985), "Motor-Operated Valve Common Mode Failures During Plant Transients Due to Improper Switch Settings." These calculations had been later evaluated for use in the licensee's GL 89-10 program. Licensee engineering personnel indicated that a review of emergency operating procedures had recently been conducted to ensure

that the highest differential pressures had been determined for the MOVs within its GL 89-10 program. A VEPCO internal memorandum to P. E. Detine from E. W. May, (August 9, 1991), indicated that while some changes were needed for the North Anna station, Surry's existing differential pressure calculations were satisfactory.

The inspectors noted that the licensee's design-basis review had determined only differential pressure and not other design-basis parameters, such as fluid flow. The generic letter recommended consideration of all relevant factors that might affect the capability of an MOV to perform its function and specifically cited maximum flow as a parameter to be determined. The NRC inspectors expressed concern that the program did not indicate that flow would be considered. Licensee personnel stated that in establishing MOV test conditions existing system pumps would be used to achieve the maximum flow rate attainable and that flow would be considered in the written evaluations of test results. The licensee MOV Engineer informed the inspectors that this would be prescribed in the Surry Station Engineering Services (SSES) Procedure that provides guidelines for the responsibilities of the MOV Engineer. The SSES was currently in draft. [Concerns (1) and (7)]

3.c MOV Switch Settings

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

The inspectors reviewed the licensee's Motor-Operated-Valve Sizing and Calculations Standard, STD-GN-0002 (September 19, 1989, Rev. 0 and Draft Rev. 1), which provides guidance for the sizing and setting of MOVs. The MOV Engineer indicated that Rev. 0 is being revised to reflect changes in the type of diagnostic equipment that will be used at Surry. The licensee's draft calculation standard, when approved, will implement many changes to their program. The inspectors were concerned that the documentation may lag behind the program implementation and noted some significant errors in the document, such as in Section 6.1.1.1, which stated that thrust requirements associated with stem rejection would not be included when verification of sizing is performed for existing rising stem valves. The MOV Engineer stated that this error would be corrected. [Concern (7)]

In reviewing the VEPCO calculation standard (both Rev. 0 and Draft Rev. 1), the inspectors noted that, except in the case of Westinghouse valves, a valve factor of 0.3 was assumed for flex wedge gate valves and 0.2 was assumed for parallel disk gate valves. With the standard industry equation used by VEPCO to calculate thrust, these valve factors yield values that industry testing has shown to be non-conservative. The inspectors have observed that licensee's typically increase the conservatism in their thrust calculations by increasing the assumed valve factors. Instead, VEPCO was adding an engineering margin of 15 percent to the calculated minimum thrust requirement. The specific basis for this margin was not given and it was not clear that this margin would be adequate. VEPCO's integration of industry and its own test results into the thrust calculation methodology and its justification for the factors used in

the calculations will be evaluated during NRC inspection of GL 89-10 program implementation. [Concern (4)]

The inspectors found that VEPCO employed a stem friction coefficient of 0.15 in its calculations (per Section 6.1.1.1 of STD-GN-0002). The assumption of 0.15 as the stem friction coefficient may not be valid unless specific lubrication frequencies are identified and implemented to ensure the continued high efficiency of torque to thrust conversion. VEPCO specified an 18 month lubrication frequency (stated in Section 6.2 of VPAP-0805, Rev. 2); however, it is not clear that this frequency is sufficient to ensure the 0.15 coefficient remains valid. According to the licensee's actuator manufacturer, Limitorque, the 0.15 value applies when good stem lubrication is assured. Limitorque recommends an 18 month lubrication frequency but still employs a conservative 0.20 stem friction coefficient for its calculations. Licensee personnel stated that they intend to develop justification for the 0.15 friction coefficient through their diagnostic test program. The program will measure both actuator torque and stem thrust, permitting determination and evaluation of the stem friction coefficient. The inspectors consider the measurement of actuator torque and its application in evaluating friction coefficient to be positive aspects of the licensee's program. The licensee's determination of friction coefficients and resultant actions will be examined during the NRC inspection of GL 89-10 program implementation. [Concern (5)]

The licensee's calculation standard, STD-GN-0002, established an allowable band of actuator output torque or thrust for setting MOV torque switches. As outlined in the standard, the licensee determined the maximum allowable output based on the weak link in the motor, actuator, or valve. STD-GN-0002 specifies a minimum thrust setting value based on the calculated thrust needed to overcome design-basis differential pressure (which includes an engineering margin of 15 percent) and additional margin to account for inaccuracies due to diagnostic equipment and torque switch repeatability. STD-GN-0002 also identified torque as repeatable within 5 percent for torque ranges above 50 foot-pounds and 10 percent for torque ranges below 50 foot-pounds. A square-root of the sum of the squares methodology was used to sum the diagnostic equipment and torque switch inaccuracies. The licensee's methodology did not include specific margin to address the "rate of loading" effect, which can reduce available thrust at high differential pressure conditions. Licensee personnel stated that they will evaluate rate of loading effects, as revealed by their testing program, and quantify those effects for incorporation into MOV sizing and switch setting evaluations. The inspectors indicated that this would be examined during the NRC inspection of program implementation.

The inspectors found that the licensee had previously used MOVATS diagnostic equipment on its MOVs and, even though it had begun using VOTES equipment during its last refueling outage, some of its procedures still reflected MOVATS criteria. The two current MOV setpoint documents (1-DRP-007 and 2-DRP-007, August 20, 1991, Rev. 3), had minimum and maximum thrust values that had been adjusted for MOVATS diagnostic equipment inaccuracies, even though the document revisions were approved following the initiation of the VOTES testing. As discussed in Section 3.e, the MOV engineer stated he was aware of this problem and plans a revision of the setpoint document in the near future. [Concern (7)]

The MOV engineer stated that Surry had implemented the results of an independent engineering study to increase the Limitorque published thrust ratings for the Limitorque actuators on valves FW-MOV-260A and B. He indicated that Surry also intends to use the study to extend the ratings for FW-MOV-160A and B and for a few other actuators. As stated in Section 6.1.1.3 of STD-GN-0002, Surry used the study to set torque switches to obtain 100 to 140 percent of the published actuator ratings. The total thrust, including effect of inertia, is not allowed to exceed 162 percent of the published rating. If testing shows low amounts of additional thrust due to inertia, then it would be permissible to set the torque switch above the 140 percent target. The MOV Engineer provided a brief letter dated October 30, 1991, from P. G. McQuillan, Manager Nuclear/Special Projects, Limitorque to Neal Estep, Nuclear Maintenance, Duke Power Company, which indicated that Limitorque agreed with the study's conclusions regarding actuator thrust rating increases. The MOV Engineer indicated full endorsement of the study by Limitorque is expected at a February 1992 MOV Users Group meeting. The NRC inspectors determined that the adequacy of the study as a basis for increasing the ratings of Limitorque actuators will require further evaluation. NRC Region II has referred the engineering study to the NRC Office of Nuclear Reactor Regulation for additional assessment. [Concern (2)]

As specified in STD-GN-0002, Surry generally sets MOV limit switches to bypass the torque switch for the first 20 to 25 percent of valve travel. For MOVs that have had their maximum thrust rating extended (as outlined above), the MOV Engineer stated that Surry used the closed limit switch to stop MOV operation. The torque switch was still in operation to serve as a backup to the limit switch. This method was not used for MOVs that have a specified leakage criteria. The MOV Engineer indicated that the VOTES diagnostic system allowed them to set the closed limit switch when the valve disk is seated.

The inspectors evaluated the licensee's assumptions regarding degraded voltage in its EE-034 (May 30, 1989, Rev. 0), "Surry Voltage Profiles" and 13930.09-4 (February 5, 1982, Rev. 1), Voltage Drop Calculations for Class 1E Motor Leads." Licensee personnel used the Auxiliary System Design Optimization Program (ASDOP) computer software to determine voltages at all motor control center buses. The ASDOP program considers motor starting characteristics, line impedances, transformer impedances, and cable impedances. Licensee personnel determined the losses associated with cables assuming 90 degree Celsius ambient temperatures. For MOVs required to operate early in an accident scenario the voltage was assumed to be 80 percent of nominal. For MOVs that would operate later in accident scenarios the voltage was assumed to be 90 percent of nominal. The inspectors noted that resistances from thermal overloads were not included in the degraded voltage calculations. License personnel indicated that they would consider the added resistances from thermal overloads as part of a planned update of their degraded voltage calculations. [Concern (9)]

The inspectors also found that the effects of high ambient accident temperatures on the MOV motor output had not been evaluated. Licensee electrical engineering personnel stated that they intend to evaluate ongoing industry efforts with respect to such temperature effects and to revise their determinations of available torque and thrust if necessary. It was the

inspectors' understanding that information from a related study being conducted by Limitorque was expected in December 1991. The inspectors were informed that all of the MOVs were AC powered; therefore, the effect was not anticipated to be large. [Concern (8)]

Licensee personnel stated that thermal overload protection devices were used at all times for MOVs in the GL 89-10 program. The inspectors reviewed the licensee's criteria for selection of thermal overload devices (STD-GN-0002, Rev. 0, Section 6.1.4.6 and Section 6.1.3.6 in Draft STD-GN-0002). In cases where operational needs and motor protection conflicted, STD-GN-0002 specified that MOV operation had priority. Thermal overloads were sized to trip in approximately 10 seconds or less at locked rotor current and to allow operation at 200 percent full load amps. The inspectors did not identify any concerns in this area.

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 under these conditions is not practicable, it permits 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 the time, an alternate method of demonstrating MOV capability can not 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 licensee committed to perform design-basis differential pressure and flow testing for each MOV within its GL 89-10 program where practicable. The MOV Engineer indicated an intention to group similar MOVs in the program and to test 40 percent of the MOVs within each group. Some of the grouping criteria had been developed and identified in the draft Surry Station Engineering Services (SSES) Procedure. The MOV Engineer indicated that all of the criteria to be used would be included in the approved SSES Procedure. The inspectors stated that if grouping is applied to avoid testing valves that are practicable to test, then the NRC should be promptly informed of this action and the basis. Use of grouping to avoid testing valves that are practicable to test would be a deviation from the licensee's current commitment to the recommendations of GL 89-10. Discussions with the cognizant System Engineer indicated the application of grouping to valves that are practicable to test had not been determined yet but was under consideration. The inspectors were informed that the licensee plans to prototype test some valves. If these valves are practicable to test in situ under worst-case design-basis conditions, the need to notify the NRC to avoid deviation from the generic letter commitment applies as for the use of grouping. [Concerns (3) and (7)]

Licensee personnel stated that design-basis differential pressure testing was not considered fully completed for any MOV within the GL 89-10 program. Informal status information provided to the inspectors indicated that design-basis tests had been performed using MOVATS and, more recently, VOTES

diagnostic test equipment. The inspectors verified test data for several of the valves included in this testing (e.g., 2-SI-MOV-2867D). They were informed that, as a result of the experience gained in the testing and evaluation of test data, it had been determined that accurate actuator torque measurements were needed. Licensee personnel stated that an actuator spring tester was being obtained to facilitate accurate torque measurements on rising stem valves and that all diagnostic testing would include torque determinations. Also, a decision had been made to rely on a single diagnostic method for rising stem valves to facilitate comparisons of data. A diagnostic method for determination of torque on quarter turn valves had not been selected, although consideration was being given to use of the same method as for rising stem valves. As a consequence of the decision to diagnostically measure torque, previous testing would be repeated. The inspectors stated that the lack of progress in completing design-basis diagnostic testing was of concern, as the licensee's program relied on diagnostic testing for initial setting and subsequent verification of valve capabilities. However, the inspectors also recognized positive aspects of the rejection of previous tests, in that the licensee had gained experience in design-basis diagnostic testing and had recognized the need for improvements to obtain more useful results. [Concern (11)]

The inspectors were informed that 31 rising stem MOVs were scheduled to be differential pressure and flow tested with diagnostics during the upcoming Unit 1 refueling outage in February 1992. This represented most of the 36 rising stem valves that the licensee had determined would be practicable to design-basis differential pressure test. Determinations regarding the practicability of design-basis testing approximately a dozen other rising stem valves were reportedly still in progress. The MOV Engineer stated that all MOVs in the program would to be tested at static conditions.

There were 34 quarter turn valves per unit in the GL 89-10 program. Based on a review of the MOV matrix referred to previously and discussions with licensee personnel, it was the inspectors' understanding that 20 in each unit had been shown to operate at design-basis conditions. This was stated to have been demonstrated by normal operation or heat exchanger tests. All quarter turn valves were reportedly limit switch controlled and their torque switches had been set at maximum. The inspectors were informed that a diagnostic method for assessing torque had not been selected for these valves, although it was anticipated that the method to be used on rising stem valves would suffice.

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. Section j of the generic letter 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 MOV Engineer stated that static diagnostic tests will be conducted on GL 89-10 program MOVs in an effort to periodically demonstrate their continued capability to perform under design-basis conditions. The inspectors observed that at this time it is not clear that static tests can demonstrate design-basis capability because of the uncertainties between the performance of MOVs under static and design-basis conditions. The licensee will need to justify that its periodic testing methodology can demonstrate the capabilities of valves at design-basis conditions.

Licensee personnel indicated that initially an 18 month frequency had been established for periodic testing as compared to the maximum 5 years or three refueling outages that is discussed in the generic letter. The MOV Engineer indicated that "as found" diagnostic testing would be performed on the MOVs before any preventive maintenance (PM). This requirement was not documented in any approved program procedure. The inspectors were informed that this requirement would be incorporated into program procedures. [Concern (6)]

From their review of procedures the inspectors found that VPAP-0803, Preventive Maintenance Program, established the requirements and guidelines for periodic preventive maintenance and stem lubrication on the MOVs in the generic letter program. These PMs were scheduled on an 18 month frequency. PMs and testing were also found to be scheduled on a 5 year frequency for thermal overload devices. The MOV Engineer stated that approximately 50 percent of the actuators had been refurbished during the 1988-1989 time frame. The licensee did not have a specific schedule for refurbishing MOVs, but reportedly conducted refurbishment based on the results of PMs and diagnostic testing.

VPAP-2003, Post Maintenance Testing Program, and VPAP-0805, Motor Operated Valve Program were found to establish requirements for testing MOVs following maintenance or modification and before returning the MOV to service. Attachment 5 to VPAP-0805 listed post-maintenance testing guidelines for MOVs based on the specific maintenance performed on the actuator or the valve. For maintenance activities which affected the thrust delivered to the valve (e.g., adjust/replace stem packing, replace/tighten stem nut, adjust/replace spring pack), VPAP-0805 required comprehensive testing to verify the adequacy of the thrust being delivered to the valve, the switch actuations, and the motor current over the entire stroke of the valve.

3.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 is to include the results and history of each as-found deteriorated condition, malfunction, test, inspection, analysis, repair, or alteration. All documentation is to be retained and reported in accordance with plant requirements. It also suggests 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 periodically verify 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 program requirements for identifying and evaluating MOV failures and degradation and for MOV failure trending were described in Section 6.1 of procedure VPAP-0805. Requirements were also described in procedures VPAP-1501, Station Deviation Reports; VPAP-1606, Corrective Action; and MDAP-0010, Component Failure Analysis and Trending. Licensee personnel stated that these procedures ensure that the cause of each MOV failure is determined. They further stated that a Deviation Report (DR) is written for all MOV failures (both safety related and non-safety related). A Component Failure Analysis (CFA) is also performed in accordance with procedure MDAP-0010. The MOV Coordinator and MOV Engineer are notified of all MOV failures per procedures OC-30 and VPAP-0805. The MOV Coordinator has the lead role in performing the failure evaluation and all remedial actions. After a failure, the MOV is quarantined (if possible) and left in the "as is" condition so that an accurate assessment of the failure can be made by the licensee's MOV team. A valve is quarantined in accordance with operations instruction OC-30, Equipment Failure/ Malfunction Report.

All MOV failures and associated CFAs are entered in the MOV trending program in accordance with VPAP-0805. The purpose of the MOV trending program is to review and trend MOV data in order to identify equipment degradations before they become significant. The MOV Coordinator is responsible for the MOV trending program. The MOV Coordinator includes selected trend information in the MOV quarterly reports that are provided to VEPCO management. The reports include but are not limited to information for the MOVs which received corrective and preventive maintenance; types of problems found; status of MOVs in the MOV program (e.g., operational status, failure status, and root cause); trend information; failure rate; etc. The inspectors reviewed the Surry MOV Quarterly Report for the third quarter of 1991 (July-September) and found that two MOV failures occurred during the quarter. The report provided a detailed description of the two failures.

The inspectors reviewed licensee actions related to the failure of Circulating Water (CW) System D waterbox outlet valve 2-MOV-CW-200D, which occurred on November 17, 1991. The MOV Engineer was notified of the failure and the valve was quarantined in accordance with instruction OC-30. Deviation Report S-91-1745 was written to document the problem. The inspectors discussed this failure with the MOV Coordinator and MOV Engineer. The valve motor was removed and the licensee found that the motor pinion gear was damaged. The motor pinion gear is attached to the motor shaft by means of a key (to transmit the rotary force) and a set screw (to prevent axial movement of the gear on the shaft). The motor pinion gear and the worm gear were replaced and the valve was returned to service. Although the failure was still being evaluated, the MOV Coordinator stated that the suspected cause of the failure was due to wear of the set screw which allowed excessive axial movement of the motor pinion gear. The wear to the set screw was possibly caused by the additional force on the set screw when the valve was throttled. The valve is normally throttled to maintain canal level and when the waterbox is taken out of service to be cleaned. Licensee personnel stated that the valve motor had been removed during the spring of 1989 in order for the operator to be overhauled. The motor pinion gear was checked in accordance with electrical corrective maintenance procedure ECM-1505-01, MOV Disconnect and Reconnect. There was no

evidence of a problem with the motor pinion gear. The inspectors reviewed the procedure and found that the procedure included the vendor recommendations for inspection of the motor pinion gear. Licensee personnel stated that corrective actions being considered included removing the motors on the CW System discharge MOVs in order to inspect the motor pinion gear for movement, inspect the set screw and replace if needed, and inspect the spot drill in the motor shaft to see if it is properly aligned with the set screw such that the set screw enters the spot drill hole to prevent axial movement of the gear along the shaft. The results of the inspection of the CW discharge MOVs will determine the course of action needed for the CW intake MOVs. Licensee personnel agreed to provide the inspectors with a copy of the CFA and final disposition of this MOV failure. [Concern (10)]

The inspectors considered the licensee's current corrective action program for evaluating and trending MOV failures to be a strength.

3.g Schedule

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

As indicated in Section 1 above, the VEPCO response to the generic letter stated that it would comply with the schedule specified by the generic letter. From a review of the tentative refueling outage schedule, the inspectors found that each Surry unit had two refueling outages remaining in which to complete the testing and other actions recommended by GL 89-10.

The inspectors reviewed and assessed schedular information obtained from the licensee relative to the reviews, calculations, tests, etc., which it intended to perform to comply with GL 89-10, and concluded that progress appeared generally satisfactory. However, there was some concern with regard to the status of planned diagnostic testing. In a letter to NRC Region II dated October 30, 1991, the licensee provided an unapproved matrix that identified the GL 89-10 valves for which design-basis reviews, setting calculations, and differential pressure testing had been performed. The matrix also included designations indicating diagnostic testing had been performed on many of the valves, though in some cases whether the tests were conducted at design-basis pressure was unclear. Subsequently, identical information was provided to the inspectors in a Surry Power Station MOV Status Matrix, which was dated November 13, 1991 and was approved by the MOV Coordinator. The matrix showed completion of GL 89-10 design-basis reviews for all 91 GL 89-10 valves in each unit and completion of setting calculations for 34 in each unit. The System Engineer indicated the remaining setting calculations would be completed before the end of 1991. The inspectors considered the extent of completion of design-basis reviews and setting calculations to be a strength in the licensee's program. Differential pressure tests were indicated complete for 29 Unit 1 and 39 Unit 2 valves. As discussed in Section 3.d above, the inspectors were informed that none of the diagnostic tests on the rising stem valves were considered adequate and that a diagnostic system had not been selected yet for the quarter turn

valves. The inspectors stated that this lack of progress in completing diagnostic testing was of concern, as the licensee's program relied on diagnostic testing for initial setting and subsequent verification of valve capabilities.

3.h Overall Administration of MOV Activities

The inspectors found that the overall administration of the licensee's GL 89-10 program was described in procedure VPAP-0805. The procedure contained detailed guidance regarding most required program activities and was supplemented by additional VEPCO administrative procedures and plant specific documents. Discussions with licensee personnel regarding the guidance revealed that they were very knowledgeable of the issues involved in GL 89-10 and the activities required to address these issues. The MOV Engineer described significant participation in industry groups dealing with GL 89-10 related issues, sometimes in a leadership role. The knowledgeability of personnel and their participation in the ongoing industry activities were considered positive aspects of the licensee's program.

Included in VPAP-0805 was a description of the responsibilities of plant and corporate personnel relative to the GL 89-10 program. According to VPAP-0805, the Corporate Director of Maintenance Support is responsible for the development and assessment of the MOV program at the Surry and North Anna Stations. The Superintendent Maintenance is responsible for overall implementation of the overall MOV program (including the GL 89-10 program) at Surry. The MOV Coordinator is responsible for implementation of the MOV program and for coordination of MOV activities. The MOV Engineer is responsible for all design aspects of the MOV program. Control of maintenance activities on MOVs was accomplished by establishment of a MOV team. The team ensures that individuals performing maintenance and engineering activities are sensitized to station and industry concerns. Other maintenance personnel not assigned to the MOV team may perform certain maintenance tasks on MOVs provided they meet minimum training requirements.

The necessary engineering expertise to facilitate implementation of the program was provided on site. Assigned personnel were very knowledgeable regarding the ongoing issues and the state-of-the-art. This was considered a strength in the licensee's program.

During further review of the MOV program the inspectors noted several areas which did not appear to be addressed in sufficient detail in the program document (VPAP-0805). Areas which needed to be addressed in greater detail include the licensee's philosophy on thrust calculations, degraded voltage calculations, and design basis review information. These items were discussed with licensee personnel.

3.i MOV Setpoint Control

The inspectors found that Surry controlled torque switch setpoints and thermal overload device values using Design Reference Procedure DRP-007. A thrust range was developed in the design-basis review and was entered into DRP-007 as

minimum and maximum thrust values. Changes to the MOV setpoints were reportedly handled through Engineering Work Requests and required an engineering evaluation or 10CFR50.59 review and approval of the Station Nuclear Safety Operating Committee. The inspectors determined that open and close limit switch and bypass settings were controlled through wiring diagrams.

3.j Training

The inspectors reviewed the licensee's MOV training program and held discussions with training personnel. The training requirements are described in Section 6.5 of procedure VPAP-0805. Training requirements are specified for the MOV Coordinator, MOV Engineer, MOV team members (electrical and mechanical), contractors performing MOV maintenance, and the corporate maintenance support group involved in the MOV program. Operations personnel are also provided MOV training. In addition to the general training requirements which involves a nine step training program, specialty job performance measures were required to be completed as initial training prior to assigning an individual to the MOV team to work on a specific MOV component. MOV team members must successfully complete initial training and annual retraining on selected subjects. The training consists of a combination of classroom and hands on training. Electrical team members also received training on diagnostic/signature analysis.

MOV awareness training is provided to maintenance personnel not assigned to the MOV team, maintenance planners, engineers, supervisors, and QA/QC personnel. Maintenance personnel not assigned to the MOV team must also complete the nine step general training program. Maintenance personnel not assigned to the MOV team may perform certain maintenance tasks on MOVs, provided they meet minimum training requirements delineated for craftsmen performing MOV maintenance. Tasks that may be performed by nonmembers of the MOV team include, but are not limited to electrical disconnects/reconnects; operator removal/reinstallation; and grease sampling. Licensee personnel stated that contractors performing maintenance on MOVs must receive training in accordance with the training program specified in Section 6.5 of VPAP-0805. Contract personnel were not members of the MOV team so their training must be comparable to that received by VEPCO maintenance personnel who are not MOV team members. Licensee personnel further stated that the contractor's training program was audited by VEPCO in order to determine the acceptability of the training program and to verify the qualifications of the contract personnel provided to perform maintenance on MOVs.

The inspectors reviewed selected lesson plans and training records for selected MOV team members and verified that the MOV team members had completed the required training. The inspectors also reviewed licensee QA audit records of the contractor who provided personnel to perform maintenance on MOVs. The inspectors determined that the licensee has a comprehensive program to ensure that personnel performing maintenance on MOVs are properly trained and qualified. This area is considered a strength in the licensee's MOV program.

3.k Industry Experience and Vendor Information

The licensee's program for ensuring that vendor information is appropriately controlled is covered in Administrative Procedure VPAP-0602, Vendor Technical Manual Control which was implemented May 10, 1991. This effort includes updating and consolidating all applicable vendor manual information and is part of the licensee's overall program for upgrading administrative procedures.

Vendor manuals and vendor information can be received by any corporate or station individual. After the information is received, it is forwarded to the Vendor Information Coordinator (VIC). A VIC is located at each nuclear station and the licensee's corporate office. The VIC is responsible for receiving vendor manuals and vendor information and screens the information to determine if it should be included in the Vendor Technical Manual Control program. The VIC ensures that the information is logged, tracked, and reviewed for station applicability by appropriate station and/or corporate groups.

The inspectors reviewed selected vendor manuals located in the maintenance library pertaining to the licensee's MOV program and verified that the latest vendor information had been incorporated into the licensee's copies of the manuals and the applicable information had been further incorporated into licensee maintenance procedures.

Procedure VPAP-3002; Operating Experience Program, establishes responsibilities and provides instructions for implementing the VEPCO Operating Experience (OE) program, including in-house OE, industry OE, and the Nuclear Plant Reliability Data System (NPRDS). The in-house OE program consists primarily of those activities controlled by VPAP-1501, Station Deviation Reports; VPAP-1601, Corrective Action; and VPAP-0212, Human Performance Enhancement System. The Assistant Station Manager Nuclear Safety and Licensing is responsible for approving, setting priorities for, and implementing OE program actions applicable to the station. The Supervisor Station Nuclear Safety (SNS) is responsible for screening, reviewing, evaluating, trending, tracking, and assisting in action plan development for selected industry and station OE documents.

SNS tracks and trends deviation reports (DRs) with a computer database. SNS trends DRs by overall program status and equipment/component/system related problems. The equipment/component/system trends are developed with input from the Work Planning and Tracking System (WPTS) and NPRDS. SNS evaluates DRs to identify adverse trends or patterns or potential common mode failures. This includes reviewing the DR and WPTS history files.

The inspectors determined that the licensee has an adequate program for controlling and disseminating vendor information and industry experience information related to MOVs.

3.l Use of Diagnostics

Licensee personnel stated that Surry will use VOTES diagnostic test equipment for measurement of thrust on rising stem valves. Further, as was mentioned in

Section 3.d, they indicated that torque will be assessed. This will reportedly be accomplished by measuring spring pack displacement with a linear variable differential transformer and determining the relation between torque and displacement utilizing a spring pack tester. The licensee had previously performed many tests with MOVATS equipment but the MOV Engineer stated that data from that testing would not be used in the GL 89-10 program.

As noted in Section 3.c, the inspectors expressed concern that the current MOV setpoint documents (1-DRP-007 and 2-DRP-007) contained adjustments to thrust values for MOVATS equipment accuracy rather than for VOTES. The inspectors observed that some valves had already been reportedly set and tested with VOTES equipment in the last Unit 2 outage (though none of the testing had been accepted for the GL 89-10 program) and questioned how the MOVATS adjusted setpoints had been used in this work. The MOV Engineer stated that this was resolved in reviews of diagnostic test results in accordance with Section 5.5 of the DRP-007 documents which provided that the reviewer should take into account diagnostic equipment accuracy in determining if as-left settings were acceptable. The Engineer indicated that revision of the setpoint documents to account for VOTES equipment accuracy had been delayed awaiting related industry test results and that the correction would be made in the near future.

As previously noted in 3.d above, the diagnostics to be used for measurements on quarter turn valves had not been determined.

4. Conclusions

A program had been developed which adequately addressed most of the generic letter recommendations, although some concerns were identified. These concerns involved licensee assumptions and methods whose adequacy will require further review, two considerations not accounted for in electrical calculations, and programmatic practices that had not been fully documented. Concerns similar to these have been identified in the programs of other licensees and are largely the result of technological uncertainties regarding the predictability of MOV operation. The licensee's program was still developing and will require further NRC evaluation, which may be accomplished as part of the NRC inspection of GL 89-10 implementation.

5. Exit Interview

The inspection scope and all findings were summarized on November 22, 1991, with those persons indicated in Appendix 1. The licensee was apprised of the concerns identified during the inspection and listed in the "SUMMARY" at the beginning of this report. No dissenting comments were received.

APPENDIX 1

PERSONS CONTACTED

Licensee Employees

*W. Benthall, Supervisor - Licensing
*A. Camillo, MOV Test Team Member
*R. Green, Supervisor - System Engineering
*D. Hart, Supervisor - Quality
*J. Hartka, Staff Engineer, Licensing
*M. Kansler, Station Manager
*J. Patrick, Supervisor - Training
*M. Pittman, MOV Engineer, System Engineering
*J. Price, Assistant Station Manager
*R. Saunders, Assistant Vice President, Nuclear Operations
*T. Sowers, Superintendent of Engineering
*J. Stauffer, MOV Coordinator, Maintenance Engineering
*A. Wright, System Engineer, System Engineering

NRC Personnel

*M. Branch, Senior Resident Inspector
*S. Rubin, Acting Deputy Director, Division of Reactor Safety, Region II

*Attended exit interview

APPENDIX 2

ACRONYMS AND INITIALISMS

ASDOP	-	Auxiliary System Design Optimization Program
CFA	-	Component Failure Analysis
GL	-	Generic Letter
MOVATS	-	Motor-Operated Valve Analysis and Testing System
NPRDS	-	Nuclear Plant Reliability Data System
NRC	-	Nuclear Regulatory Commission
OE	-	Operating Experience
PM	-	Preventive Maintenance
QA	-	Quality Assurance
QC	-	Quality Control
SNS	-	Station Nuclear Safety
SSES	-	Surry Station Engineering Services
TI	-	Temporary Instruction
VEPCO	-	Virginia Electric and Power Company
VIC	-	Vendor Information Coordinator
VOTES	-	Valve Operation Test and Evaluation System
WPTS	-	Work Planning and Tracking System