UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO GENERIC LETTER 96-05,

"PERIODIC VERIFICATION OF DESIGN-BASIS

CAPABILITY OF SAFETY-RELATED MOTOR-OPERATED VALVES"

COMMONWEALTH EDISON COMPANY

LASALLE COUNTY STATION, UNITS 1 AND 2

DOCKET NOS. 50-373 AND 374

1.0 INTRODUCTION

Many fluid systems at nuclear power plants depend on the successful operation of motor-operated valves (MOVs) in performing their safety functions. Several years ago, MOV operating experience and testing, and research programs sponsored by the nuclear industry and the U. S. Nuclear Regulatory Commission (NRC), revealed weaknesses in a wide range of activities (including design, qualification, testing, and maintenance) associated with the performance of MOVs in nuclear power plants. For example, some engineering analyses used in sizing and setting MOVs did not adequately predict the thrust and torque required to operate valves under their design-basis conditions. In addition, inservice tests of valve stroke time under zero differential-pressure and flow conditions did not ensure that MOVs could perform their safety functions under design-basis conditions.

Upon identification of the weaknesses in MOV performance, significant industry and regulatory activities were initiated to verify the design-basis capability of safety-related MOVs in nuclear power plants. After completion of these activities, nuclear power plant licensees began establishing long-term programs to maintain the design-basis capability of their safety-related MOVs. This safety evaluation (SE) addresses the program developed by Commonwealth Edison Company (ComEd, the licensee) to verify periodically the design-basis capability of safety-related MOVs at the LaSalle County Station, Units 1 and 2.

ENCLOSURE

2.0 REGULATORY REQUIREMENTS

The NRC regulations require that MOVs important to safety be treated in a manner that provides assurance of their intended performance. Criterion 1 to Appendix A, "General Design Criteria for Nuclear Power Plants," to Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 50) states, in part, that structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. The quality assurance program to be applied to safety-related components is described in Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50. In Section 50.55a of 10 CFR Part 50, the NRC requires licensees to establish inservice testing (IST) programs in accordance with Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code).

In response to concerns regarding MOV performance, NRC staff issued Generic Letter (GL) 89-10 (June 28, 1989), "Safety-Related Motor-Operated Valve Testing and Surveillance," which requested that nuclear power plant licensees and construction permit holders ensure the capability of MOVs in safety-related systems to perform their intended functions by reviewing MOV design bases, verifying MOV switch settings initially and periodically, testing MOVs under design-basis conditions where practicable, improving evaluations of MOV failures and necessary corrective action, and trending MOV problems. The staff requested that licensees complete the GL 89-10 program within approximately three refueling outages or 5 years from the issuance of the generic letter. Permit holders were requested to complete the GL 89-10 program before plant startup or in accordance with the above schedule, whichever was later.

The NRC staff issued seven supplements to GL 89-10 that provided additional guidance and information on MOV program scope, design-basis reviews, switch settings, testing, periodic verification, trending, and schedule extensions. GL 89-10 and its supplements provided only limited guidance regarding MOV periodic verification and the measures appropriate to assure preservation of design-basis capability. Consequently, the staff determined that additional guidance on the periodic verification of MOV design-basis capability should be prepared. On September 18, 1996, the NRC staff issued GL 96-05, "Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves," requesting each licensee to establish a program, or ensure the effectiveness of its current program, to verify on a periodic basis that safety-related MOVs continue to be capable of performing their safety functions within the current licensing bases of the facility. In GL 96-05, the NRC staff summarized several industry and regulatory activities and programs related to maintaining long-term capability of safety-related MOVs. For example, GL 96-05 discussed non-mandatory ASME Code Case OMN-1, "Alternative Rules for Preservice and Inservice Testing of Certain Electric Motor Operated Valve Assemblies in LWR Power Plants, OM Code 1995 Edition; Subsection ISTC," which allows the replacement of ASME Code requirements for MOV quarterly stroke-time testing with exercising of safety-related MOVs at least once per operating cycle and periodic MOV diagnostic testing on a frequency to be determined on the basis of margin and degradation rate. In GL 96-05, the NRC staff stated that the method in OMN-1 meets the intent of the generic letter with certain limitations. The NRC staff also noted in GL 96-05 that licensees remain bound by the requirements in their code of record regarding MOV stroke-time testing, as supplemented by relief requests approved by the NRC staff.

In GL 96-05, licensees were requested to submit the following information to the NRC:

a. within 60 days from the date of GL 96-05, a written response indicating whether or not the licensee would implement the requested actions; and

b. within 180 days from the date of GL 96-05, or upon notification to the NRC of completion of GL 89-10 (whichever is later), a written summary description of the licensee's MOV periodic verification program.

3.0 JOINT OWNERS' GROUP PROGRAM ON MOV PERIODIC VERIFICATION

In response to GL 96-05, the Boiling Water Reactor Owners' Group (BWROG), Westinghouse Owners' Group (WOG), and Combustion Engineering Owners' Group (CEOG) jointly developed an MOV periodic verification program to obtain benefits from the sharing of information between licensees. The Joint Owners Group (JOG) Program on MOV Periodic Verification is described by the BWROG in its Licensing Topical Report NEDC-32719, "BWR Owners' Group Program on Motor-Operated Valve (MOV) Periodic Verification," and described by WOG and CEOG in their separately submitted Topical Report MPR-1807, "Joint BWR, Westinghouse and Combustion Engineering Owners' Group Program on Motor-Operated Valve (MOV) Periodic Verification." The stated objectives of the JOG program on MOV Periodic Verification are (1) to provide an approach for licensees to use immediately in their GL 96-05 programs, (2) to develop a basis for addressing the potential age-related increase in required thrust or torque under dynamic conditions, and (3) to use the developed basis to confirm, or if necessary to modify, the applied approach. The specific elements of the JOG program are (1) providing an "interim" MOV periodic verification program for applicable licensees to use in response to GL 96-05, (2) conducting a dynamic testing program over the next 5 years to identify potential age-related increases in required thrust or torque to operate gate, globe, and butterfly valves under dynamic conditions, and (3) evaluating the information from the dynamic testing program to confirm or modify the interim program assumptions.

The JOG interim MOV periodic verification program includes (1) continuation of MOV stroke-time testing required by the ASME Code IST program, and (2) performance of MOV static diagnostic testing on a frequency based on functional capability (age-related degradation margin over and above margin for GL 89-10 evaluated parameters) and safety significance. In implementing the interim MOV static diagnostic test program, licensees will rank MOVs within the scope of the JOG program according to their safety significance. The JOG program specifies that licensees need to justify their approach for risk ranking MOVs. In Topical Report NEDC-32264, "Application of Probabilistic Safety Assessment to Generic Letter 89-10 Implementation," BWROG described a methodology to rank MOVs in GL 89-10 programs with respect to their relative importance to core-damage frequency and other considerations to be added by an expert panel. In a Safety Evaluation (SE) dated February 27, 1996, the NRC staff accepted the BWROG methodology for risk ranking MOVs in boiling water reactor nuclear plants with certain conditions and limitations. In the NRC SE (dated October 30, 1997) on the JOG Program on MOV Periodic Verification, the NRC staff indicated its view that the BWROG methodology for MOV risk ranking is appropriate for use in response to GL 96-05. With respect to Westinghouse-designed pressurized water reactor nuclear plants, WOG prepared Engineering Report V-EC-1658, "Risk Ranking Approach for Motor-Operated Valves in

Response to Generic Letter 96-05." On April 14, 1998, the NRC staff issued an SE accepting, with certain conditions and limitations, the WOG approach for ranking MOVs based on their risk significance. Licensees not applicable to BWROG or WOG methodologies need to justify their MOV risk-ranking approach individually.

The objectives of the JOG dynamic test program are to determine degradation trends in dynamic thrust and torque, and to use dynamic test results to adjust the test frequency and method specified in the interim program if warranted. The JOG dynamic testing program includes (1) identification of conditions and features which could potentially lead to MOV degradation, (2) definition and assignment of valves for dynamic testing, (3) testing valves three times over a 5-year interval with at least a 1-year interval between valve-specific tests according to a standard test specification, (4) evaluation of results of each test, and (5) evaluation of collective test results.

In the last phase of its program, JOG will evaluate the test results to validate the assumptions in the interim program to establish a long-term MOV periodic verification program to be implemented by licensees. A feedback mechanism will be established to ensure timely sharing of MOV test results among licensees and to prompt individual licensees to adjust their own MOV periodic verification program, as appropriate.

Following consideration of NRC staff comments, BWROG submitted Licensing Topical Report NEDC-32719 (Revision 2) describing the JOG program on July 30, 1997. Similarly, the CEOG and the WOG submitted Topical Report MPR-1807 (Revision 2) describing the JOG program on August 6 and 12, 1997, respectively. On October 30, 1997, the NRC staff issued an SE accepting the JOG program with certain conditions and limitations as an acceptable industry-wide response to GL 96-05 for valve age-related degradation.

4.0 LASALLE GL 96-05 PROGRAM

On November 13, 1996, ComEd submitted a 60-day response to GL 96-05 notifying the NRC that it would implement the requested MOV periodic verification program. On March 15, 1997, the licensee submitted a 180-day response to GL 96-05 providing a summary description of the MOV periodic verification program planned to be implemented at LaSalle. In a letter dated August 24, 1998, the licensee updated its commitment to GL 96-05. On April 12, 1999, the licensee provided a response to a request for additional information regarding GL 96-05 forwarded by the NRC staff on February 4, 1999.

In its submittal dated March 15, 1997, the licensee described its MOV periodic verification program, including scope, existing and planned testing, capability margin, and implementation of the JOG program at LaSalle. For example, the licensee will use the methodology described in ASME Code Case OMN-1 for periodic verification of MOV design-basis capability. The licensee also stated that dynamic testing of selected MOVs would be performed under its MOV periodic verification program. In its submittal dated August 24, 1998, the licensee committed to continue its participation in the JOG program on MOV Periodic Verification as a member of the BWROG, and to implement the program elements described in the Topical Report NEDC-32719 (Revision 2) describing the JOG program. The licensee also stated that it would

evaluate degradation for any safety-related MOVs not covered by the JOG program within the same time frame as the JOG program.

5.0 NRC STAFF EVALUATION

The NRC staff has reviewed the information provided in the licensee's submittals describing the program to verify periodically the design-basis capability of safety-related MOVs at LaSalle in response to GL 96-05. NRC Inspection Report 50-373 & 374/95009 (IR 95009) provided the results of an inspection to evaluate the licensee's program to verify the design-basis capability of safety-related MOVs in response to GL 89-10. The staff closed the review of the GL 89-10 program in IR 95009 based on verification of the design-basis capability of safety-related MOVs at LaSalle. The NRC staff's evaluation of the licensee's response to GL 96-05 is described below.

5.1 MOV Program Scope

In GL 96-05, the NRC staff indicated that all safety-related MOVs covered by the GL 89-10 program should be considered in the development of the MOV periodic verification program. The staff noted that the program should consider safety-related MOVs that are assumed to be capable of returning to their safety position when placed in a position that prevents their safety system (or train) from performing its safety function; and the system (or train) is not declared inoperable when the MOVs are in their nonsafety position.

In IR 95009, the NRC staff reviewed the scope of the licensee's MOV program in response to GL 89-10 at LaSalle and found that the licensee planned to remove a number of MOVs from GL 89-10 program scope based on plant modifications or changes in the design basis that eliminated the MOVs' active safety function. For two MOVs, the staff found that the scope change was consistent with GL 89-10 and its supplements. The other MOVs were part of the main steam isolation leakage control system which the licensee had proposed to remove from the plant. During a phone call conducted on June 30, 1999, the licensee stated that the main steam isolation leakage control system had been removed.

In its letter dated November 13, 1996, the licensee committed to implement the requested MOV periodic verification program at LaSalle in response to GL 96-05 and did not take exception to the scope of the generic letter. The staff considers the licensee to have made adequate commitments regarding the scope of its MOV program.

5.2 MOV Assumptions and Methodologies

Licensees maintain the assumptions and methodologies used in the development of their MOV programs for the life of the plant (a concept commonly described as a "living program"). For example, the design basis of safety-related MOVs is maintained up to date, including consideration of any plant modifications or power uprate conditions.

In IR 95009, the NRC staff reviewed the licensee's justification for the assumptions and methodologies used in the MOV program in response to GL 89-10. The staff determined that

the licensee had adequately justified the assumptions and methodologies used in its MOV program with certain long-term items discussed in the following section.

In its letter dated August 24, 1998, the licensee described activities to support the basis for several MOV program assumptions. The licensee stated that, in some instances, MOV stems are lubricated between periodic verification tests which prevent the gathering of as-found test data for evaluating stem factor degradation. However, the licensee uses results from other as-left and as-found periodic verification tests to determine stem factor degradation for valves where as-found conditions were not obtained. Further, the licensee stated that, if the valve factor for a newly installed or overhauled MOV exceeds the grouping valve factor, a differential pressure test for the applicable MOV will be accomplished within three refueling outages of the baseline differential pressure test regardless of apparent margin. The licensee's letter dated April 12, 1999, discussed ongoing activities, such as review of motor actuator output, to update MOV program assumptions and methodologies.

The staff considers the licensee to have adequate processes in place to maintain the assumptions and methodologies used in its MOV program, including the design basis of its safety-related MOVs.

5.3 GL 89-10 Long-Term Items

When evaluating the GL 89-10 program at LaSalle, the NRC staff discussed in IR 95009 several items of the licensee's MOV program to be addressed over the long term. In its letter dated April 12, 1999, the licensee reported on the status of those long-term GL 89-10 items. For example, the licensee (1) completed margin improvement actions for several low margin MOVs; (2) revised globe valve calculations to use guide-based diameter values when appropriate; and (3) reviewed its MOV butterfly valve torque prediction methodology and found that it was consistent with the methods used by the Electric Power Research Institute MOV Performance Prediction Methodology.

The NRC staff completed the review of the licensee's actions in response to GL 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," in an SE dated November 23, 1998.

In IR 95009, the NRC staff summarized its review of the qualitative and quantitative aspects of the licensee's program for trending MOV performance at LaSalle. In its letter dated April 12, 1999, the licensee described a six-element program that was established to trend MOV motor actuator output. Rate of loading variation, springpack relaxation, and motor current are examples of MOV parameters that are monitored.

In IR 95009, the NRC staff concluded that the licensee had demonstrated the design-basis capability of its safety-related MOVs at LaSalle. No outstanding issues regarding the licensee's GL 89-10 program remain at LaSalle.

5.4 JOG Program on MOV Periodic Verification

In its letter dated August 24, 1998, the licensee updated its commitment to implement the JOG Program on MOV Periodic Verification as described in Topical Report MPR-1807 (Revision 2). In an SE dated October 30, 1997, the staff accepted the JOG program as an industry-wide response to GL 96-05 with certain conditions and limitations. The JOG program consists of the following three phases: (1) the JOG interim static diagnostic test program, (2) the JOG 5-year dynamic test program, and (3) the JOG long-term periodic test program. The staff considers the licensee's commitment to include implementation of all three phases of the JOG program at LaSalle. The staff considers the commitments by the licensee to implement all three phases of the JOG program at LaSalle to be an acceptable response to GL 96-05 for valve age-related degradation.

In its letter dated March 15, 1997, the licensee noted that interim MOV static diagnostic testing under the JOG program would be performed on a test frequency based on the safety significance and available margin of each GL 96-05 MOV. In its letter dated August 24, 1998, the licensee indicated that margin requirements and static diagnostic test frequencies were consistent with the JOG recommendations. The conditions and limitations discussed in the NRC SE dated February 27, 1996, which accepted Topical Report NEDC-32264 on implementing the BWROG MOV risk-ranking methodology apply to the JOG program at LaSalle.

The licensee's program at LaSalle to verify periodically the design-basis capability of safety-related MOVs will implement the provisions of ASME Code Case OMN-1 with certain clarifications described in the licensee's March 15, 1997, letter in response to GL 96-05. The licensee stated that it will use the OMN-1 methodology to satisfy GL 96-05, with clarifications such as: (1) testing is scheduled according to the intervals specified in the JOG MOV program, (2) motor actuator torque capability of ac-powered MOVs is based on the ComEd method previously accepted by the NRC staff, (3) the margin between MOV capability and operating requirements is based on stem thrust, (4) stem factor may be determined from stem thrust and measured torque or tested spring pack displacement, and (5) stem lubrication may be performed in some instances between verification tests. In addition to OMN-1, the licensee will continue to perform stroke-time tests of MOVs in accordance with its Inservice Testing program. As discussed in GL 96-05, the NRC staff considers it acceptable to apply ASME Code Case OMN-1 to verify periodically the design-basis capability of safety-related MOVs. The licensee's MOV program satisfies the limitations regarding the use of ASME Code Case OMN-1 in meeting the intent of GL 96-05, such as evaluating data over the first 5 years to support long test intervals. Based on the review of the licensee's responses to GL 96-05, the staff considers the identified clarifications to OMN-1 to be justified.

The JOG program is intended to address most gate, globe and butterfly valves used in safety-related applications in the nuclear power plants of participating licensees. The JOG has indicated that each licensee is responsible for addressing any MOVs outside the scope of applicability of the JOG program. In the NRC SE dated October 30, 1997, the NRC staff specified that licensees implementing the JOG program must identify any MOVs outside the scope of the JOG program (including service conditions) and justify a separate program for periodic verification of the design-basis capability of those MOVs. The NRC staff recognizes

that the JOG has selected a broad range of MOVs and conditions for the dynamic testing program. Consequently, the NRC staff expects significant information to be obtained on the performance and potential degradation of safety-related MOVs during the interim static diagnostic test program and the JOG dynamic test program. As the test results are evaluated, the JOG might include or exclude additional MOVs with respect to the scope of its program. Although the test information from the MOVs in the JOG dynamic test program might not be adequate to establish a long-term periodic verification program for each MOV outside the scope of the JOG program, sufficient information should be obtained from the JOG dynamic test program to identify any immediate safety concern for potential valve age-related degradation during the interim period of the JOG program. In its submittal dated August 24, 1998, the licensee stated that it would evaluate valve degradation for any safety-related MOVs at LaSalle not covered by the JOG program within the same time frame as the JOG program. The NRC staff considers it acceptable for the licensee to apply its interim static diagnostic test program to GL 96-05 MOVs that currently might be outside the scope of the JOG program with the feedback of information from the JOG dynamic test program to those MOVs.

5.5 Motor Actuator Output

The JOG program focuses on the potential age-related increase in the thrust or torque required to operate valves under their design-basis conditions. In the NRC SE dated October 30, 1997, on the JOG program, the NRC staff specified that licensees are responsible for addressing the thrust or torque delivered by the MOV motor actuator and its potential degradation. Although the JOG does not plan to evaluate degradation of motor actuator output, significant information on the output of motor actuators will be obtained through the interim MOV static diagnostic test program and the JOG dynamic test program. The NRC staff notes that several parameters can be obtained during MOV static and dynamic testing to help identify motor actuator output degradation when opening and closing the valve including, as applicable, capability margin, thrust and torque at control switch trip, stem friction coefficient, load sensitive behavior, and motor current.

In its letter dated April 12, 1999, the licensee indicated that it uses a combination of periodic static testing, preventative maintenance, and data analysis in accordance with established site procedures and programs to assure adequate actuator output capability for safety-related MOVs at LaSalle to perform their design-basis functions. For example, the licensee performs preventative maintenance and inspections to minimize the degradation of MOV actuator output. The licensee's MOV periodic verification program includes evaluation of as-found and as-left static baseline test results to monitor stem lubricant degradation. The licensee's setup method include margins for variations in stem factor, load sensitive behavior, and gearbox efficiency.

In Technical Update 98-01 and its Supplement 1, Limitorque Corporation provided updated guidance for predicting the torque output of its ac-powered motor actuators. As discussed in its letter dated April 12, 1999, the licensee uses its own method for determining motor gearing capability for ac-powered motor actuators that is based on a comprehensive motor and actuator test program. As noted in NRC inspection reports, the NRC staff has accepted the use of the ComEd methodology for estimating MOV motor-actuator output capability, based on test data obtained by the licensee. Any MOV operability concerns that might be identified in the future will be processed in accordance with established regulatory requirements and plant-specific

commitments. The staff considers that calculations that are used to demonstrate the design-basis capability of safety-related MOVs are required to meet the requirements of 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." Therefore, controls are required to be in place to ensure that any changes in the licensee's methodology that might be necessary as a result of the Limitorque updated guidance are properly implemented.

In its letter dated July 17, 1998, forwarding Technical Update 98-01, Limitorque indicated that a future technical update will be issued to address the application of dc-powered MOVs. In its letter dated April 12, 1999, the licensee noted that the BWROG has initiated an effort to evaluate dc-powered motor capability and that LaSalle will incorporate the BWROG dc-powered MOV methodology when completed.

The NRC staff concludes that the licensee has established sufficient means to monitor MOV actuator output and its potential degradation.

6.0 CONCLUSION

The staff finds that the licensee has established an acceptable program to periodically verify the design-basis capability of the safety-related MOVs at LaSalle through its commitment to all three phases of the JOG program on MOV Periodic Verification. Therefore, the staff concludes that the licensee is adequately addressing the actions requested in GL 96-05. The staff may conduct inspections to verify that implementation of the MOV periodic verification program is in accordance with the licensee's commitments; this NRC SE; the NRC SE dated October 30, 1997, on the JOG Program on MOV Periodic Verification; and the NRC SE dated February 27, 1996, on the BWROG methodology for ranking MOVs by their safety significance.

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