



UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
LICENSEE RESPONSE TO GENERIC LETTER 96-05, "PERIODIC VERIFICATION OF
DESIGN-BASIS CAPABILITY OF SAFETY-RELATED MOTOR-OPERATED VALVES"

CONSUMERS ENERGY COMPANY

PALISADES PLANT

DOCKET NO. 50-255

1.0 INTRODUCTION

Many fluid systems at nuclear power plants depend on the successful operation of motor-operated valves (MOV) 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 Consumers Energy Company (licensee) to verify periodically the design-basis capability of safety-related MOVs at the Palisades Plant.

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 of 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 programs in

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accordance with Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code.

In response to concerns regarding MOV performance, the 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 that each licensee 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 was later), a written summary description of the licensee's MOV periodic verification program.

The NRC staff is preparing an SE on the response of each licensee to GL 96-05. The NRC staff is conducting inspections to verify the implementation of GL 96-05 programs at nuclear power plants as necessary.

3.0 PALISADES GL 96-05 PROGRAM

In letters dated November 14, 1996, and March 12, 1997, Consumers Energy Company provided its responses to the recommendations of GL 96-05 and described its long-term MOV periodic verification program for Palisades. The NRC conducted an inspection at Palisades from May 3 to 6, 1999, using Temporary Instruction 2515/140 to determine whether the licensee's MOV program was consistent with its commitments to GL 96-05 and satisfied the recommendations of GL 96-05. The results of that inspection are documented in NRC Inspection Report (IR) 50-255/99005 (dated May 19, 1999). By letter dated November 14, 1996, the licensee notified the NRC that Palisades would implement the actions requested in GL 96-05. The licensee also stated that it would review its current program to ensure the effectiveness in verifying, on a periodic basis, that safety-related MOVs will continue to be capable of performing their safety functions within the current licensing basis.

In its letter dated March 12, 1997, the licensee provided a summary of its GL 96-05 program at Palisades. The licensee will conduct periodic static and dynamic testing of its GL 96-05 MOVs to monitor their continued design-basis capability. The licensee stated that all 30 MOVs in its GL 96-05 program would be static diagnostically tested on an interval of three refueling outages (or 5 years). The licensee will conduct dynamic testing of 17 dynamically testable GL 96-05 MOVs every three refueling outages for those MOVs with less than 25-percent margin and every five refueling outages for those MOVs with more than 25-percent margin. Those MOVs not dynamically testable are assigned operating requirements to bound potential valve age-related degradation such that only MOV motor actuator output under static conditions will need to be monitored. The licensee will obtain information on MOV operating requirements and actuator output through this combination of static and dynamic testing. The licensee's test schedule provides MOV performance information over the first 5-year interval. The MOV diagnostic test interval does not exceed 10 years.

The licensee has established a long-term tracking and trending program to assess periodically the condition of the GL 96-05 MOVs at Palisades. The licensee evaluates MOV test performance in accordance with plant procedures. The licensee reviews test results to ensure continued MOV capability and resolves indications of negative design margin. The licensee prepares an MOV Trend Summary Report within 90 days of the completion of each refueling outage or every 2 years (whichever is shorter) to provide qualitative and quantitative trending of MOV performance.

4.0 NRC STAFF EVALUATION

The NRC staff has reviewed the information provided in the licensee's submittals and IR 99005 describing the program at Palisades to verify periodically the design-basis capability of safety-related MOVs in response to GL 96-05. The staff also reviewed IR 96002 (dated April 8, 1996), which provided the results of an inspection at Palisades to evaluate the licensee's

program to verify the design-basis capability of safety-related MOVs in response to GL 89-10. The NRC staff's evaluation of the licensee's response to GL 96-05 is described below.

4.1 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 its letter dated March 12, 1997, the licensee stated that the GL 96-05 program at Palisades included 30 MOVs with 15 gate valves and 15 globe valves. The scope of the licensee's MOV program remains the same as under GL 89-10. As noted in IR 99005, the licensee enters the applicable Limiting Condition for Operation of the Palisades Technical Specifications when MOVs are placed in their nonsafety position. The NRC staff considers the licensee to have made adequate commitments regarding the scope of its MOV program. The licensee will be responsible for justifying any deviations from the recommended scope of GL 96-05 at Palisades.

4.2 MOV Assumptions and Methodologies

The NRC staff expects licensees to maintain the assumptions and methodologies used in the development of its 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 will need to be maintained up to date, including consideration of any plant modifications or power uprate conditions. In IR 96002, the staff evaluated the licensee's justification for the assumptions and methodologies used in the MOV program, and the maintenance of those assumptions and methodologies based on the licensee's review of in-plant and industry information. In IR 99005, the staff evaluated the ongoing activities at Palisades to maintain its MOV program. The NRC 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.

4.3 GL 89-10 Long-Term Items

In IR 96002, the NRC staff closed its review of the MOV program implemented at Palisades in response to GL 89-10 based on the licensee's actions to verify the design-basis capability of its safety-related MOVs. The staff identified five long-term actions planned by the licensee in support of GL 89-10 program closure in IR 96002, including: (1) continued review of industry information with respect to valve factors; (2) inclusion of a 5-percent stem lubrication and valve degradation margin when calculating thrust requirements in the valve opening direction; (3) proposed margin improvement plans for low margin MOVs; (4) resolution of concern regarding application of valve seating area when determining valve factors; and (5) extrapolation of valve performance data from tests conducted at less than design-basis conditions. In IR 99005, the staff determined that the licensee had addressed these items. On May 5, 1998, the NRC staff

accepted the licensee's response to GL 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," for Palisades.

In GL 89-10, the NRC staff recommended that MOV performance be trended on a long-term basis. In IR 96002, the staff described the licensee's program to track and trend MOV design changes, maintenance histories, test results, failures, and corrective actions with summary reports prepared on a semiannual basis. In IR 99005, the staff reported on the review of the licensee's qualitative and quantitative trending of MOV performance, including the recent MOV trend summary report.

With the licensee's ongoing implementation of its MOV testing plans and trending program, no outstanding issues regarding the licensee's GL 89-10 program remain at Palisades.

4.4 Valve Operating Requirements

In its letter dated March 12, 1997, the licensee indicated that the 17 MOVs in its GL 96-05 program that are practicable to dynamically test would be part of an ongoing dynamic test program to determine the effects of age-related degradation on valve operating requirements. The licensee stated that MOVs with more than 25-percent margin would be dynamically tested at an interval not to exceed five refueling outages and MOVs with less than 25-percent margin would be dynamically tested every three refueling outages. The licensee arranged the test schedule so that some MOVs would typically be tested under dynamic conditions each refueling outage. In IR 99005, the NRC staff evaluated the licensee's review of the results of recent MOV testing and potential age-related valve degradation. The staff considered the licensee's MOV performance review to be acceptable but noted areas to be addressed, including: (1) reevaluation of MOV capability margins in response to an identified incorrect method for determining valve factor from dynamic test data (discussed below); (2) establishing criteria for reassessing the dynamic test frequency based on test results; and (3) considering the licensee's procedure for statically testing each MOV immediately prior to dynamic testing that could influence the results of the dynamic tests. As noted in IR 99005, the licensee is addressing these areas.

As discussed in IR 99005, the licensee established the operating requirements for the 13 non-dynamically-testable MOVs to bound the effects of potential valve age-related degradation. The licensee achieved its bounding operating requirements through such means as the application of the high valve factor assumptions or modification of MOV circuitry to provide for operation based on the limit switch. In addition, the licensee has established a preventive maintenance program to ensure that its GL 96-05 MOVs are maintained in good condition.

The licensee was not participating in the industry-wide Joint Owners Group (JOG) Program on MOV Periodic Verification. During the inspection, as documented in IR 99005, the licensee noted that the relatively small MOV program scope and the use of MOV diagnostic test equipment at Palisades different from the equipment used in the JOG program were factors in its decision to develop a separate GL 96-05 program. The licensee demonstrated that its MOV program could satisfy GL 96-05 without reliance on the industry-wide program.

As indicated in IR 99005, the licensee had not relied on MOV risk rankings in establishing the schedule for diagnostic testing of its GL 96-05 MOVs. The NRC staff noted that the licensee had informally considered risk insights in prioritizing the tests of high safety-significant MOVs. For example, the MOV risk rankings at Palisades had been discussed among plant operations, systems, and MOV staff, and had been compared to the results of MOV risk ranking at the similarly designed Calvert Cliffs nuclear power plant.

In IR 99005, the NRC staff identified an incorrect calculation method by the licensee in determining the actual valve factor from MOV dynamic test results. The licensee initiated a condition report to reevaluate the margins for dynamically tested MOVs in response to the identified error. The licensee determined that the capability margins of the 17 dynamically tested MOVs were reduced, but did not identify any immediate operability concerns. During a telephone conference with the NRC staff on June 10, 1999, the licensee described its ongoing corrective action to revise the affected plant documents.

With the licensee's ongoing actions, the NRC staff considers the licensee to be implementing an acceptable test program for dynamically testable MOVs to identify potential valve age-related degradation, and to have established sufficient operating requirements for its non-dynamically-testable MOVs to bound the effects of valve age-related degradation in combination with its preventive maintenance program.

4.5 Motor Actuator Output

As described in IR 99005, the licensee will monitor potential degradation in MOV performance through static diagnostic testing of each GL 96-05 MOV every 5 years or three refueling outages. The licensee will also obtain information on MOV motor actuator output during periodic dynamic diagnostic tests of 17 GL 96-05 MOVs. The parameters to be monitored include thrust, motor current, stem friction coefficient, rate of loading, and stroke time, as appropriate. In MOV trend summary reports, the licensee documents test results and trends for MOV performance, including potential output degradation.

The licensee conducts periodic preventive maintenance of its GL 96-05 MOVs to help ensure their continued reliable output capability. For example, the valve stem of each MOV is to be relubricated each refueling outage. The licensee also performs a general mechanical inspection (including grease sampling), an electrical inspection, and an inspection and cleaning of the MOV motor control center breakers every other refueling outage.

The licensee has responded to the updated guidance on ac-powered MOV motor actuator output provided in Limitorque Technical Update 98-01 and its Supplement 1. The licensee identified reduced margins in the capability of its GL 96-05 MOVs to perform their safety functions but did not identify any operability concerns. The licensee established plans to increase the capability margin of several GL 96-05 MOVs at Palisades. The licensee has revised its engineering analyses to incorporate the new guidance on motor actuator output predictions. Palisades does not currently have any dc-powered MOVs in safety-related applications.

The NRC staff considers the licensee to have established sufficient means to monitor MOV motor actuator output and its potential degradation.

5.0 CONCLUSION

On the basis of this evaluation, the NRC staff finds that the licensee has established an acceptable program to verify periodically the design-basis capability of the safety-related MOVs at Palisades. Therefore, the staff concludes that the licensee has adequately addressed the actions requested in GL 96-05. The NRC staff may conduct inspections to verify the implementation of the MOV periodic verification program is in accordance with the licensee's commitments and this SE.

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