



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

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"
EDWIN I. HATCH NUCLEAR PLANT, UNITS 1 AND 2
DOCKET NUMBERS 50-321 AND 366

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 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 Southern Nuclear Operating Company, Inc. (licensee) to verify periodically the design-basis capability of safety-related MOVs at Edwin I. Hatch Nuclear Plant, Units 1 and 2.

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.

Enclosure

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 that MOVs in safety-related systems are capable of performing their intended functions. This can be accomplished 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 five 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 is 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 intends to rely to a significant extent on an industry initiative to identify valve age-related degradation which could adversely affect the design-basis capability of safety-related MOVs (described in Section 3.0) where a licensee commits to implement that industry program. The

NRC staff will conduct inspections to verify the implementation of GL 96-05 programs at nuclear power plants as necessary.

3.0 JOINT OWNERS GROUP PROGRAM ON MOV PERIODIC VERIFICATION

In response to GL 96-05, the Boiling Water Reactor Owners Group (BWROG), the Westinghouse Owners Group (WOG), and the Combustion Engineering Owners Group (CEOG) jointly developed an MOV periodic verification program to obtain benefits from the sharing of information among 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 the WOG and the 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," the 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 an 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, the 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 who do not use the 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, the 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, the BWROG submitted Licensing Topical Report NEDC-32719 (Revision 2) describing the JOG program on July 30, 1997. Similarly, Topical Report MPR-1807 (Revision 2) describing the JOG program was submitted by the CEOG on August 6 and by the WOG on August 12, 1997. 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 HATCH GL 96-05 PROGRAM

On October 29, 1996, Southern Nuclear Operating Company, Inc. submitted a 60-day response to GL 96-05 stating that it would implement the requested MOV periodic verification program at Hatch. On March 17, 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 Hatch. In a letter dated February 27, 1998, the licensee updated its commitment to GL 96-05. On April 9, 1999, the licensee provided a response to a request for additional information regarding GL 96-05 forwarded by the NRC staff on January 28, 1999.

In its letter dated February 27, 1998, the licensee committed to continue its participation in the JOG MOV Periodic Verification Program as a member of the BWROG and to implement the program elements described in Topical Report NEDC-32719 (Revision 2) describing the JOG program. In its letter dated March 17, 1997, the licensee described its MOV periodic verification program, including planned testing, scope, and implementation of the JOG program at Hatch. For example, the licensee indicated that static testing of all MOVs in the program scope would be performed in accordance with the static test frequency matrix in Topical Report NEDC-32719. In addition, the licensee noted that the JOG program would begin implementation at Hatch in late 1997.

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 Hatch in response to GL 96-05. NRC Inspection Report 50-321 & 366/95-25 (IR 95-25) provided the results of inspections to evaluate the licensee's program to verify the design-basis capability of safety-related MOVs in response to GL 89-10. In a letter dated February 29, 1996, the staff closed the review of the GL 89-10 program at Hatch based on verification of the design-basis capability of safety-related MOVs at Hatch obtained from previous inspection results and

information contained in the licensee's GL 89-10 submittals. The 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 when the system (or train) is not declared inoperable when the MOVs are in their nonsafety position.

In a letter dated February 3, 1994, the licensee notified the NRC of the deletion of specified MOVs and testing from the scope of its GL 89-10 program. In IR 95-25, the NRC staff reviewed the scope of the licensee's MOV program in response to GL 89-10 at Hatch and noted that the licensee had removed from its GL 89-10 program the MOVs that were referenced in the February 3, 1994, letter. In IR 95-25, the staff reported that the subject valves were set and sized adequately to meet the intent of GL 89-10. The NRC staff reviewed the licensee's reclassification and removal of MOVs from its GL 89-10 program, and on October 16, 1995, the NRC issued an SE describing the results of its review. The NRC staff concluded that the licensee inappropriately reclassified certain MOVs based on the staff's determinations that the valves had active safety functions. In a letter dated January 26, 1996, the licensee stated that the subject MOVs would be maintained consistent with the provisions of GL 89-10 until the scope issue was resolved. In the NRC letter that closed the review of the licensee's GL 89-10 program, dated February 29, 1996, the NRC staff closed the licensee's GL 89-10 program based on the licensee's commitment to maintain the MOVs in question as GL 89-10 valves. In a letter dated October 21, 1996, the licensee informed the NRC that all the MOVs referenced in the NRC SE dated October 16, 1995, had been returned to the GL 89-10 program at Hatch.

In its letter dated October 29, 1996, the licensee committed to implement the requested MOV periodic verification program at Hatch 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. The licensee will be responsible for justifying any deviations from the recommended scope of GL 96-05 at Hatch.

5.2 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 95-25, the NRC staff reviewed the licensee's justification for the assumptions and methodologies used in the MOV program in response to GL 89-10 at Hatch. With certain long-term items discussed in the following section, the staff determined that the licensee had adequately justified the assumptions and methodologies used in its MOV program. The licensee's letter dated April 9, 1999, indicated activities were ongoing, such as review of motor actuator output, to update its 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 Hatch, the NRC staff discussed in IR 95-25 and its letter dated February 29, 1996, several items of the licensee's MOV program to be addressed over the long term. In its letter dated April 9, 1999, the licensee reported on the status of those long-term GL 89-10 aspects. For example, the licensee (1) replaced MOVs 1B21-F016 and 1B21-F019 with Anchor/Darling valves having larger actuators and valve internals with rounded edges, (2) installed larger motors on MOVs 2B31-F031A/B to increase available margin, (3) revised maintenance procedures to ensure that the blowdown valve internal edges are rounded to improve valve performance under design-basis conditions, and (4) increased the available margin for MOV 1G31-G004 by increasing the torque switch setting and repacking the valve.

The NRC staff is reviewing licensee's actions in response to GL 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," and will issue an SE at the completion of the review.

In NRC Inspection Report 50-321 & 366/95-02, the NRC staff discussed the licensee's program for tracking and trending quantitative and qualitative aspects of MOV performance at Hatch. The licensee's trending of MOV parameters for testing, performance, preventive maintenance, and corrective action, was considered to be a strength. In its submittal dated April 9, 1999, the licensee provided additional information on its trending of performance parameters to evaluate motor actuator capabilities. A combination of thrust and torque data taken on a regular basis to detect changes in MOV performance are examples of MOV parameters that are trended.

In IR 95-25, the NRC staff concluded that the licensee had demonstrated the design-basis capability of its safety-related MOVs at Hatch. With the licensee's ongoing MOV activities and trending program, no outstanding issues regarding the licensee's GL 89-10 program remain at Hatch.

5.4 JOG Program on MOV Periodic Verification

In its letter dated February 27, 1998, the licensee updated its commitment to implement the JOG Program on MOV Periodic Verification as described in Topical Report NEDC-32719 (Revision 2). In an SE dated October 30, 1997, the NRC staff accepted the JOG program as an industry-wide response to GL 96-05 with certain conditions and limitations. The JOG program includes (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 commitments by the licensee to implement the JOG program at Hatch to be an acceptable response to GL 96-05 for valve age-related degradation. The staff considers the licensee's commitment to include all three phases of the JOG program. The licensee is responsible for reviewing and implementing the conditions and limitations discussed in the NRC SE dated October 30, 1997, in applying the JOG program at Hatch. If the licensee proposes to implement an approach at Hatch different from the JOG program, the NRC will evaluate the proposed alternative approach.

In its letter dated March 17, 1997, the licensee noted that the interim MOV static diagnostic testing under the JOG program would be performed on a test frequency based on the safety significance and functional capability of each GL 96-05 MOV as described in Topical Report NEDC-32719. The licensee's margin determinations include consideration of age-related degradation of actuator output. The licensee indicated that MOV ranking at Hatch was assigned based on the MOV risk-ranking approach and results presented in the BWROG Topical Report NEDC-32264. The NRC staff notes that the BWROG also provided an example list of risk-significant MOVs for consideration by each licensee in applying the owners group methodology. The licensee will be expected to address the conditions and limitations in the NRC SE dated February 27, 1996, when implementing the BWROG MOV risk-ranking methodology.

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 indicates 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 specifies 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 in 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. Therefore, 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 including the feedback of information from the JOG dynamic test program to those MOVs. Upon completion of the JOG dynamic test program and development of the JOG long-term MOV periodic verification criteria, the licensee will be expected to establish a long-term MOV periodic verification program for those MOVs outside the scope of the JOG program by applying information from the JOG program or additional dynamic tests, as necessary.

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 specifies that licensees are responsible for addressing the thrust or torque delivered by the MOV motor actuator and potential degradation of the MOV output. 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.

In its letter dated April 9, 1999, the licensee indicated that it uses a combination of preventive maintenance activities, periodic actuator refurbishment, periodic static diagnostic testing,

appropriate design margins, and periodic trending reviews in accordance with established site procedures and programs to ensure adequate actuator output capability for safety-related MOVs at Hatch to perform their design-basis functions. Preventive maintenance activities include stem lubrication, actuator grease inspections, environmental qualification inspections, and motor control center inspections. The licensee also reported that it is monitoring stem friction coefficient, comparing data from MOV tests with existing assumptions, and making adjustments as necessary. The licensee also noted that the MOV periodic verification program collects as-found static diagnostic test results to monitor stem lubricant degradation and specifies lubrication of valve stems every 18 months. The licensee also collects motor power traces to trend potential degradation from magnesium rotor corrosion. The staff notes that several parameters can be obtained during MOV static and dynamic diagnostic 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 Technical Update 98-01 and its Supplement 1, Limatorque Corporation provided updated guidance for predicting the torque output of its ac-powered motor actuators. In its letter dated April 9, 1999, the licensee reported that it incorporated the Limatorque guidance into the MOV sizing calculations at Hatch and that all active safety function MOVs were verified to be capable of performing their design-basis safety functions. The licensee noted that modifications and switch setting adjustments to improve margins had been completed.

In its letter dated July 17, 1998, forwarding Technical Update 98-01, Limatorque indicates that a future technical update will be issued to address the application of dc-powered MOVs. In its letter dated April 9, 1999, the licensee notes that the BWROG has initiated an effort to evaluate dc-powered motor capability and that Hatch will incorporate any necessary enhancements into the MOV program based upon evaluation of the most current information. The NRC staff notes that the licensee is responsible for resolving any MOV operability concerns in accordance with regulatory and plant-specific requirements.

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

6.0 CONCLUSION

On the basis of this evaluation, the staff finds that the licensee has established an acceptable program to verify periodically the design-basis capability of the safety-related MOVs at Hatch. Therefore, the staff concludes that the licensee has adequately addressed the actions requested in GL 96-05. The staff may conduct inspections to verify that the 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.

Principal Contributors: T. Scarbrough
S. Tingen

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