May 11, 2000

Mr. James Knubel
Chief Nuclear Officer
Power Authority of the State of
New York
123 Main Street
White Plains, NY 10601

SUBJECT: INDIAN POINT NUCLEAR GENERATING UNIT NO. 3 - CLOSEOUT OF GENERIC LETTER 96-05 (TAC NO. M97580)

Dear Mr. Knubel:

On September 18, 1996, the NRC issued Generic Letter (GL) 96-05, "Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves," requesting each nuclear power plant licensee to establish a program, or to ensure the effectiveness of its current program, to verify on a periodic basis that safety-related motor-operated valves (MOVs) continue to be capable of performing their safety functions within the current licensing bases of the facility. On November 15, 1996, you submitted a 60-day response to GL 96-05 notifying the NRC that you would implement the requested MOV periodic verification program at the Indian Point Nuclear Generating Unit No. 3 (IP3). On November 10, 1997, you submitted a 180-day response to GL 96-05 providing a summary description of the MOV periodic verification program that you planned to implement at IP3. By letters dated April 22, 1999, and December 15, 1999, you provided responses to our requests for additional information dated March 5, 1999, and November 22, 1999, respectively.

The NRC staff has reviewed your submittals and the applicable NRC inspection reports for the MOV program at IP3. The staff has concluded that you have addressed the actions requested in GL 96-05. The NRC staff may conduct inspections at IP3 to verify the implementation of the MOV periodic verification program is in accordance with your commitments.

The staff's safety evaluation is enclosed. This completes the staff's action on TAC No. M97580.

Sincerely,

/RA/

George F. Wunder, Project Manager, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-286

Enclosure: As stated

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO LICENSEE RESPONSE TO GENERIC LETTER 96-05

POWER AUTHORITY OF THE STATE OF NEW YORK

INDIAN POINT NUCLEAR GENERATING UNIT NO. 3

DOCKET NO. 50-286

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 the Power Authority of the State of New York (licensee) to verify periodically the design-basis capability of safety-related MOVs at Indian Point Nuclear Generating Unit No. 3 (IP3).

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 Boiler and Pressure Vessel Code (ASME 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 GL. 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 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 GL 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), 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 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, 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 apply 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, 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, CEOG and 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 to BWROG, CEOG and WOG 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 INDIAN POINT UNIT NO. 3 GL 96-05 PROGRAM

On November 15, 1996, the New York Power Authority submitted a 60-day response to GL 96-05 notifying the NRC that it would implement the requested MOV periodic verification program at IP3. On November 10, 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 IP3. On April 22, 1999, the licensee provided a response to a request for additional information regarding GL 96-05 forwarded by the NRC staff on March 5, 1999. On December 15, 1999, the licensee provided a response to a second request for additional information regarding GL 96-05 forwarded by the NRC staff on November 22, 1999.

In its letter dated November 10, 1997, the licensee described its MOV periodic verification program, including, testing, risk-ranking, and implementation the program elements described in the Topical Report MPR-1807 (Revision 2) describing the JOG program at IP3. For example, the licensee described the interim MOV static diagnostic test program at IP3 with the same MOV margin threshold values as identified in the JOG topical report. The licensee stated that dynamic diagnostic testing of selected MOVs would be performed under its MOV periodic verification program and that adjustments would be made to its GL 96-05 program based on the test results and recommendations from the JOG testing program. The licensee stated that the static diagnostic test portion of the JOG program was scheduled to begin implementation at IP3 during refueling outage (RFO) 10 scheduled for the fall of 1999. Initial tests to support the dynamic test portion of the JOG program were performed during RFO 9 in 1997. In its letter dated December 15, 1999, the licensee described the results of its review of the WOG list of risk-significant MOVs.

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 IP3 in response to GL 96-05. NRC Inspection Report 50-286/98-80 (IR 98-80) 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. The staff closed the review of the GL 89-10 program at IP3 in IR 98-80 based on verification of the design-basis capability of safety-related MOVs at

IP3 and commitments in a letter from the licensee dated January 22, 1998, to confirm several program assumptions. 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 the system (or train) is not declared inoperable when the MOVs are in their nonsafety position.

In its letter dated November 15, 1996, the licensee committed to implement the requested MOV periodic verification program at IP3 in response to GL 96-05 and did not take exception to the scope of the GL. In IR 98-80, the NRC staff did not identify any concerns with the scope of the licensee's MOV program in response to GL 89-10 at IP3. The NRC 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 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 98-80, 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 IP3. With certain long-term items discussed in the following section and specific commitments in its letter dated January 22, 1998, the staff determined that the licensee had adequately justified the assumptions and methodologies used in its MOV program. The licensee's letter dated April 22, 1999, indicated ongoing activities, 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

The licensee's letter dated January 22, 1998, and IR 98-80 discussed several items of the licensee's MOV program to be addressed over the long term. In its letter dated April 22, 1999, the licensee reported on the status of those long-term GL 89-10 aspects. The licensee stated that it (1) used the Electric Power Research Institute (EPRI) MOV Performance Prediction Methodology (PPM) to evaluate six Anchor/Darling valves that do not have measured valve factors and revised switch settings and calculations for these valves; (2) confirmed that all Anchor/Darling double disk gate valves with a containment isolation function (except one high margin valve) had been dynamically tested to verify achievement of hard seat contact for a leak-tight seal; (3) revised its Anchor/Darling valve overhaul procedure to ensure that disc orientation is recorded during future valve internal maintenance activities; (4) completed EPRI MOV PPM calculations for MOVs RC-MOV-535, RC-MOV-536, and AC-FCV-625 and modified

the MOVs to increase their actuator output capability; (5) completed EPRI MOV PPM calculations for MOVs AC-MOV-745A/B; (6) plans to modify MOV AC-MOV-789 to increase its actuator output capability; (7) revised its MOV trending procedure to include the trending of MOV performance parameters; and (8) validated the assumptions used in the actuator sizing equations for two Teledyne actuators. Also in GL 89-10, the NRC identified pressure locking and thermal binding as potential performance concerns for safety-related MOVs. 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 October 14, 1998.

In IR 98-80, the NRC staff discussed qualitative and quantitative aspects of the licensee's program for trending MOV performance at IP3. For example, the licensee reviews site-specific and industry failure data to develop its trending reports. Deficiency evaluation reports, maintenance work histories, and MOV failure reports from the licensee's other nuclear facility are included in this review. The licensee periodically evaluates this information to identify and correct recurring problems, and to detect potential MOV failures. As noted in its letter dated April 22, 1999, the licensee has revised its MOV trending program to include trending of MOV performance parameters, such as torque switch settings, valve factors, stem friction coefficient, and motor current.

In IR 98-80, the NRC staff concluded that, with the commitments in the licensee's letter dated January 22, 1998, the licensee had demonstrated the design-basis capability of its safety-related MOVs at IP3. With the licensee's ongoing MOV activities and trending program, no outstanding issues regarding the licensee's GL 89-10 program remain at IP3.

5.4 JOG Program on MOV Periodic Verification

In its letter dated November 10, 1997, the licensee committed 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 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 IP3 to be an acceptable response to GL 96-05 for valve age-related degradation. The staff considers the licensee's commitment in response to GL 96-05 to include implementation of all three phases of the JOG program at IP3. The conditions and limitations discussed in the NRC SE dated October 30, 1997, apply to the JOG program at IP3.

In its letter dated November 10, 1997, the licensee stated 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 consistent with the JOG recommendations. In its letter dated April 22, 1999, the licensee described the ranking of MOVs at IP3 according to their risk significance. In particular, the licensee applied a method using Risk Achievement Worth (RAW) that was believed to be equivalent to or more conservative than the WOG approach in Engineering Report V-EC-1658-A. The licensee also indicated that common-cause failure modes, system/train redundancy, valve repositioning requirements, and various operating scenarios were considered when risk-ranking MOVs. The licensee compared its MOV risk-ranking method and the WOG risk-ranking approach. The

guidelines in WOG Engineering Report V-EC-1658-A recommends that RAW and Fussel-Vesely importance measures be used to risk-rank MOVs. The licensee's method focuses on RAW importance measures to determine MOV risk significance. The licensee stated that, after applying the IP3 risk-ranking methodology, each MOV received an equal or higher risk-ranking when compared to the approach presented in WOG Engineering Report V-EC-1658-A. The licensee used its Maintenance Rule expert panel to review the current MOV risk-ranking in accordance with the guidance provided by WOG Engineering Report V-EC-1658. The WOG provided an example list of risk-significant MOVs for consideration by each licensee in applying the owners group methodology. In its letter dated December 15, 1999, the licensee justified the differences between the WOG MOV risk-ranking results and its MOV risk-ranking results for the example list of MOVs. In its December 15, 1999, letter, the licensee also compared its application of RAW and Fussel-Vesely values to the WOG approach. Based on the licensee's submittals, the staff considers the licensee's approach for risk-ranking MOVs at IP3 to be acceptable.

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. JOG indicates that each licensee is responsible for addressing any MOVs outside the scope of applicability of the JOG program. The NRC staff recognizes that 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, 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. 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 with feedback of information from the JOG dynamic test program to those MOVs. In the NRC SE dated October 30, 1997, the NRC staff specifies that licensees implementing the JOG program must determine 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 (including static and dynamic operating requirements) of 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 specifies that licensees are responsible for addressing the thrust or torque delivered by the MOV motor actuator and its potential degradation. Although 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. 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 22, 1999, the licensee indicated that it uses a combination of periodic static testing, data trending, and preventive maintenance in accordance with established site procedures and programs to assure adequate actuator output capability for safety-related MOVs at IP3 to perform their design-basis functions. For example, in IR 98-80, the NRC staff reported that the licensee is monitoring stem friction coefficient, including evaluation of as-found and as-left static baseline test results to monitor stem lubricant degradation. In its letter dated April 22, 1999, the licensee stated that the MOV trending program was revised to include trending of MOV performance parameters, such as stem friction coefficient.

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. In its letter dated April 22, 1999, the licensee reported that it was reviewing this information for incorporation into the MOV sizing calculations at IP3 and planned to complete the review prior to the start of RFO 10. Preliminary findings indicate that the existing thrust calculations are adequate to address the Limitorque guidance. In its letter dated December 15, 1999, the licensee indicated that it recently completed RFO 10. The licensee also noted that it does not have any dc-powered motor actuators in its GL 96-05 program. 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 NRC staff considers the licensee to be establishing sufficient means to monitor MOV motor actuator output and its potential degradation.

6.0 CONCLUSION

The staff finds that the licensee has established an acceptable program to verify periodically the design-basis capability of the safety-related MOVs at IP3 through its commitment to all three phases of the JOG program on MOV Periodic Verification and the additional actions described in its submittals. Therefore, the staff concludes that the licensee has adequately addressed the actions requested in GL 96-05. The staff may conduct inspections to verify the implementation of the MOV periodic verification program is in accordance with the licensee's commitments; this NRC SE; and the NRC SE dated October 30, 1997, on the JOG Program on MOV Periodic Verification.

Principal Contributors: T. Scarbrough
S. Tingen

Date: May 11, 2000