October 14, 2003

MEMORANDUM TO: Eugene Imbro, Chief
Mechanical and Civil Engineering Branch
Division of Engineering
Office of Nuclear Reactor Regulation

FROM: David Terao, Chief ***/RA/***
Components & Containment Reliability Section
Mechanical and Civil Engineering Branch
Division of Engineering
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF MEETING WITH JOINT OWNERS' GROUP TO DISCUSS MOTOR-OPERATED VALVE PERIODIC VERIFICATION PROGRAM (TAC #MA5035)

On October 1 and 2, 2003, the NRC staff held a public meeting with representatives of the Joint Owners' Group (JOG) to discuss the results of the JOG Program on Motor-Operated Valve (MOV) Periodic Verification. This memorandum summarizes the information presented by the JOG during the meeting and the discussion of that information by the JOG and NRC staff. A list of meeting participants is provided in Attachment 1 to this memormandum. The meeting agenda is provided in Attachment 2.

The Boiling Water Reactor Owners' Group (BWROG), B&W Owners' Group (B&WOG), Combustion Engineering Owners' Group (CEOG), and Westinghouse Owners' Group (WOG) developed the JOG Program on MOV Periodic Verification as an industry-wide response to Generic Letter (GL) 96-05, "Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves." The JOG program consists of the following three phases: (1) an interim MOV static diagnostic test program; (2) a 5-year MOV dynamic diagnostic test program; and (3) a long-term MOV periodic diagnostic test program. The JOG has completed the 5-year dynamic testing program and is preparing a final topical report to establish the long-term MOV periodic diagnostic test program based on its review of the dynamic test data.

At the outset of the meeting, the NRC staff summarized activities to verify the design-basis capability of safety-related MOVs at nuclear power plants. In particular, NRC issued GL 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," in response to performance concerns with MOVs in nuclear power plants. All 103 operational nuclear power plants have completed their GL 89-10 programs. The NRC issued GL 96-05 to request that licensees periodically verify MOV design-basis capability. In response to GL 96-05, the JOG established the MOV Program on Periodic Verification to allow licensees to share resources in developing an industry-wide approach in evaluating the long-term performance of MOVs in nuclear power plants. The NRC staff prepared a Safety Evaluation (dated October 30, 1997) accepting the JOG Program on MOV Periodic Verification, with certain conditions. Most licensees committed to implement the JOG Program on MOV Periodic Verification as part of their response to

CONTACT: T. Scarbrough, NRR/DE/EMEB
301-415-2794

GL 96-05. The staff prepared Safety Evaluations documenting the review of the GL 96-05 program for each nuclear power plant. The staff plans to prepare a Safety Evaluation describing its review of the JOG final topical report when submitted. The staff will consider preparation of a Regulatory Issue Summary to discuss completion of its review of the JOG program. The staff has suggested that the JOG summarize the lessons learned from its MOV testing program, including those aspects applicable to other power-operated valves.

In beginning their presentation, the JOG representatives provided an overall summary of the 5-year MOV dynamic testing program and its results. The JOG presentation slides can be found at ADAMS Accession No. ML032801390. The JOG representatives reported that licensees of 98 reactor units participated in the program. The JOG 5-year dynamic testing program included 176 valves that received three dynamic tests with at least a 1-year time interval between the tests. An additional 14 valves received two dynamic tests with at least a 1-year time interval between the tests. In total, the JOG program included 514 dynamic valve tests and involved 52 person-years of effort. The JOG representatives believed that the JOG program constituted the largest set of MOV dynamic tests obtained to date for use by nuclear power plant licensees.

One of the key observations from the JOG program was that an increase in the required thrust or torque did not occur due only to the passage of time (without operation of the valve under dynamic fluid conditions). Further, the JOG program results indicated that significant service-related degradation in valve performance is not expected for MOVs as currently designed, installed and maintained in nuclear power plants. However, the MOV tests revealed that, where the initial valve factor is low because of prior disassembly of the valve or its limited service under dynamic fluid conditions, the thrust requirements for gate valves can increase significantly up to a bounding value over their service life. The program also found that a significant variation can occur in the operating torque requirements for butterfly valves with bronze bearings without a hub seal installed in untreated water systems; and for butterfly valves with non-metallic bearings. The JOG is preparing a final topical report to replace its original topical report for implementation by licensees as part of their GL 96-05 commitment to periodically verify the design-basis capability of safety-related MOVs. The target date for submittal of the JOG final topical report to the NRC for review is February 2004. The JOG requested that the staff complete its review of the program by August 2004.

Following the program summary, the JOG representatives presented a detailed discussion of the results of the MOV dynamic testing program, and draft provisions for the long-term periodic verification of MOV design-basis capability. JOG's long-term MOV periodic verification approach builds on the interim program by specifying static diagnostic testing based on margin and risk ranking of each GL 96-05 MOV, and addressing the potential for increased required thrust or torque where actions beyond static testing might be necessary. The JOG is establishing four MOV classes (A, B, C, D) in its long-term program. In particular, Class A valves are considered not to be susceptible to degradation as supported directly by JOG dynamic testing, or have been sized and set based on the bounding values in accordance with the Electric Power Research Institute (EPRI) MOV Performance Prediction Methodology (PPM). The JOG program will specify that Class A valves undergo periodic static diagnostic testing in accordance with the schedule for high margin valves in the JOG risk-margin table to verify proper MOV setup, to quantify capability margin, and to provide any needed information to address motor actuator degradation. Class B valves are considered not to be susceptible to degradation, based on JOG dynamic test results extended by analysis and engineering

judgement to configurations and conditions beyond those tested in the JOG program. The JOG program will specify that Class B valves be static diagnostically tested in accordance with the schedule in the JOG risk-margin table for their individual risk significance and calculated margin. Class C valves are considered to be susceptible to changes in required torque or thrust. The JOG program will specify an allowance for computing margin for Class C valves based on design attributes, service application, and valve setup information. Class C valves must be setup to achieve positive margin or must be dynamically tested on a defined interval. Class D valves are not covered by the JOG program and must be evaluated separately by the applicable licensees. As part of its valve classification method, the JOG established a Configuration & Application Information rating based on specific design configurations and inservice application conditions, including disk-to-body guide materials, frequency of inservice dynamic stroking, and fluid type and temperature. The JOG has developed flow charts and tables to assist licensees in classifying their valves to determine appropriate action for long-term periodic verification of the safety-related MOVs at their nuclear power plants.

The JOG is incorporating information provided in Feedback Notices to its licensee participants as part of the final topical report. The JOG representatives reported that a new Feedback Notice had been issued in September 2003 to alert the participants to potential variations in bearing friction coefficient for butterfly valves with bronze bearings in untreated water service. The NRC staff reviewed the new Feedback Notice, and returned it to the JOG representatives at the conclusion of the meeting. The JOG representatives indicated that the findings in the NRC Safety Evaluation dated October 30, 1997, on the original topical report are being incorporated in the final topical report. The JOG representatives also stated that the JOG final topical report will include lessons learned from the 5-year MOV dynamic testing program.

The NRC staff and the JOG representatives discussed several aspects of the JOG program and the draft long-term MOV periodic verification provisions. A summary of the more significant discussion items are provided in Attachment 3 to this memorandum. At the conclusion of the meeting, the NRC staff and JOG representatives set a tentative date of March 17 and 18, 2004, for a public meeting to discuss the JOG final topical report following its submittal to the NRC.

Attachments:
1. Meeting Participants
2. Meeting Agenda
3. Summary of Discussion Items

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NRC/JOG PUBLIC MEETING

MOTOR-OPERATED VALVE PROGRAM ON PEIODIC VERIFICATION

October 1 and 2, 2003

MEETING PARTICIPANTS

Name	Organization
E. Imbro	NRC/NRR/DE/EMEB
D. Terao	NRC/NRR/DE/EMEB
T. Scarbrough	NRC/NRR/DE/EMEB
B. Benney	NRC/NRR/DE/EMEB
T. Chan	TVA
I. Ezekoye	Westinghouse
W. Fiock	GE-BWROG
R. Schomaker	Framatome
C. Smith	Duke Energy
G. Warren	SNC-BWROG
D. Kreps	Westinghouse
P. Damerell	MPR
T. Spears	MPR

ATTACHMENT 1

NRC/JOG PUBLIC MEETING

MOTOR-OPERATED VALVE PROGRAM ON PERIODIC VERIFICATION

October 1 and 2, 2003

AGENDA

October 1

8:30 a.m.	Opening Remarks (NRC and JOG)
8:45 a.m.	Overall Summary of JOG Program (JOG)
10:00 a.m.	NRC Overview Comments (NRC)
10:15 a.m.	Break and Caucus
10:30 a.m.	Overview of JOG Final Periodic Verification Approach (JOG)
Noon	Lunch and Caucus
1:30 p.m.	JOG Program Results and Periodic Verification - Globe Valves (JOG)
2:15 p.m.	Globe Valve Follow-up Items (JOG and NRC)
2:30 p.m.	Break and Caucus
2:45 p.m.	JOG Program Results and Periodic Verification - Butterfly Valves (JOG)
3:30 p.m.	Butterfly Valve Follow-up Items (JOG and NRC)
3:45 p.m.	Break and Caucus
4:00 p.m.	JOG Program Results and Periodic Verification - Gate Valves (JOG)
5:00 p.m.	Gate Valve Follow-up Items (JOG and NRC)
5:15 p.m.	Adjourn for day

October 2

8:30 a.m.	Summary of Gate, Globe, and Butterfly Valve Items (NRC)
8:45 a.m.	Completion of Any Discussion Topics (JOG and NRC)
9:45 a.m.	Break and Caucus
10:00 a.m.	JOG Plans to Address Follow-up Items and Feedback (JOG and NRC)
10:45 a.m.	Status, Format, and Implementation of JOG Topical Report (JOG)
11:15 a.m.	Review Approach for JOG Topical Report (NRC)
11:45 a.m.	Action Items and Plans for Next Meeting (JOG and NRC)
Noon	Closing Remarks (JOG and NRC)

ATTACHMENT 2

NRC/JOG PUBLIC MEETING

MOTOR-OPERATED VALVE PROGRAM ON PERIODIC VERIFICATION

October 1 and 2, 2003

SUMMARY OF DISCUSSION ITEMS

1. The presentation by the Joint Owners' Group (JOG) indicated that the final topical report on the JOG Program on Motor-Operated Valve (MOV) Periodic Verification might allow the test intervals for periodic verification of the design-basis capability of safety-related MOVs to exceed 10 years. The staff noted that such intervals would exceed the provisions in the JOG interim test program. The staff also indicated that MOV test intervals beyond 10 years had not been accepted in risk-informed inservice testing (IST) programs or in ASME Code Case OMN-1, "Alternative Rules for Preservice and Inservice Testing of Certain Electric Motor-Operated Valve Assemblies in Light-Water Reactor Power Plants."

2. The NRC staff observed that the graphs of MOV dynamic test data presented by the JOG representatives did not specify the change in valve friction coefficients between successive tests. The staff noted that such information would be beneficial in determining the extent to which friction coefficients are stable for valves tested as part of the JOG program.

3. In some instances, the information provided during the JOG presentation did not fully explain the basis for assigning a valve to a particular class. For example, the basis for assigning an unbalanced disk globe valve to Class B when operating in non-flashing water conditions above 150 °F was not apparent. The NRC staff recommended that the JOG ensure that the final topical report fully explains the bases for assigning valves to particular classes.

4. The JOG program found that butterfly valves with bronze bearings installed in untreated water systems did not experience significant variations in their bearing friction coefficient if equipped with a hub seal. The NRC staff suggested that it would be beneficial for the JOG to compare its results to operating experience from nuclear power plants that have experienced significant variations in the performance of their butterfly valves.

5. The JOG presentation indicated that licensees might be allowed to substitute a plant-specific method in classifying certain valves (e.g., butterfly valves). The NRC staff stated that it would be difficult to reach a conclusion regarding the acceptability of plant-specific methods that are not described in the final topical report.

6. The JOG presentation indicated that the highest measured bearing friction coefficient was applied in determining the allowance for potential degradation in the performance of butterfly valves. The NRC staff stated that it would be beneficial to compare this specific measured test value for bearing friction coefficient to a value determined from the data set using a statistical approach (such as the mean of the data plus two standard deviations).

7. The JOG presentation indicated that MOVs with control switches set based on the Electric Power Research Institute (EPRI) Thrust Uncertainty Method might be assigned to Class A. The NRC Safety Evaluation dated September 30, 2002, found the EPRI Thrust Uncertainty Method acceptable for the prediction of minimum allowable thrust at control switch trip for applicable motor-operated gate valves under cold water applications. The NRC staff's review of the EPRI Thrust Uncertainty Method recognized that the method might remove margin from the MOV thrust setting originally provided by application of the EPRI MOV Performance Prediction Methodology (PPM). In response to this concern, EPRI had specified that MOVs set using the Thrust Uncertainty Method must have at least 5 percent margin for valves with low risk significance, and at least 10 percent margin for valves with medium or high risk significance. The staff will review the JOG final topical report to determine whether assigning MOVs with control switches set using the EPRI Thrust Uncertainty Method to Class A is appropriate.

8. The JOG presentation indicated that the classification of a valve might depend on the extent of service that the valve experiences under dynamic conditions. The NRC staff noted that classification based on operation under dynamic conditions might result in a valve being incapable of performing its safety function if operated under dynamic conditions either intentionally or unintentionally prior to its needed use. This restriction on a valve's operation as part of its classification might also limit the operational flexibility of plant systems where a valve might only be capable of operating under one or two dynamic strokes.

9. In evaluating the change in valve performance with service, the JOG representatives discussed observed changes in friction coefficient from one stroke to another. The NRC staff recommended that the JOG also consider the change in friction coefficient over the entire 5-year test program.

10. The JOG presentation indicated that the standard deviation of the data for gate valves with a stable friction coefficient was applied in determining the bounding friction coefficient for gate valves with unstable friction coefficient performance. The NRC staff noted that the basis for application of test data from gate valves with stable performance to those with unstable performance should be justified in the final topical report.

11. The JOG representatives stated that deterministic approaches were applied in the evaluation of data sets from tests of some valves while statistical approaches were applied for data sets from tests of other valves. The NRC staff recommended that the JOG report apply deterministic approaches where the applicability of the statistical approach is not readily apparent. The staff suggested that the JOG use statistical approaches to confirm the deterministic approaches where practical.

12. The JOG representatives stated that they had chosen to apply deterministic approaches that ensured that 95% of the test data is bounded. The NRC staff indicated that this approach is generally consistent with the analysis of test data during other MOV activities.

13. The NRC staff noted that the Office of Nuclear Regulatory Research had completed its study of the aging effects of Stellite 6 valve seat material under reactor coolant fluid conditions in boiling water reactor (BWR) nuclear power plants. The staff recommended that the JOG review the results of this study for insights applicable to the JOG long-term program.

14. The JOG representatives stated that a schedule had not been established for participating licensees to implement the provisions of the JOG final topical report. The NRC staff and JOG representatives discussed a possible 6-year or three refueling outage schedule with the goal of addressing high-risk MOVs and very low margin MOVs by the end of the first outage after issuance of the NRC Safety Evaluation on the JOG final topical report, medium-risk MOVs by the end of the second outage, and low-risk MOVs by the end of the third outage. The JOG representatives indicated that additional details, such as outages occurring shortly after issuance of the Safety Evaluation, would need to be addressed.

15. The JOG representatives and NRC staff discussed possible means to specify the implementation schedule for the JOG long-term program. An efficient approach would be to provide the implementation schedule in the JOG final topical report.

16. Regardless of the specified implementation schedule for the JOG long-term program, the NRC staff noted that licensees are responsible for determining whether the JOG test results challenge the operability of safety-related MOVs at their nuclear power plants and for taking appropriate action in a timely manner. The staff also indicated that licensees and other organizations need to satisfy their applicable responsibilities under 10 CFR Part 21.

17. In that licensees committed to implement the JOG program as part of their response to Generic Letter 96-05, the NRC staff noted that licensees do not need to inform the NRC of their implementation of the JOG final topical report where consistent with the Safety Evaluation to be prepared on the report. If a licensee takes exception to some aspect of the JOG final topical report or the Safety Evaluation, the staff will expect the licensee to follow its approved procedures for processing changes to commitments made to the NRC in response to a generic letter.

18. The NRC revised 10 CFR 50.55a to require licensees implementing the 1995 Edition and the 1996 Addenda of the ASME *Code for Operation and Maintenance of Nuclear Power Plants* to supplement the MOV stroke-time test provisions in the ASME Code by establishing a program to periodically verify the design-basis capability of MOVs in the IST program. The NRC staff emphasized the benefit of incorporating the JOG program results into the ASME Code to address the weakness of stroke-time testing in assessing MOV capability.