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

March 8, 1994

TO: ALL LICENSEES OF OPERATING NUCLEAR POWER PLANTS AND HOLDERS OF CONSTRUCTION PERMITS FOR NUCLEAR POWER PLANTS

SUBJECT: GENERIC LETTER 89-10, SUPPLEMENT 6, "INFORMATION ON SCHEDULE AND GROUPING, AND STAFF RESPONSES TO ADDITIONAL PUBLIC QUESTIONS"

BACKGROUND

In Generic Letter (GL) 89-10 (June 28, 1989), "Safety-Related Motor-Operated Valve Testing and Surveillance," the U.S. Nuclear Regulatory Commission (NRC) staff requested holders of operating licenses and construction permits to provide additional assurance of the capability of safety-related motor-operated valves (MOVs) and certain other MOVs in safety-related systems 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. Supplement 1 to GL 89-10 (June 13, 1990) provided the results of public workshops held to discuss the GL. In Supplement 2 to GL 89-10 (August 3, 1990), the NRC staff stated that inspections of program descriptions would not commence until January 1, 1991; thus, the program descriptions did not need to be available on site until that date. Based on the results of NRC-sponsored MOV tests, Supplement 3 to GL 89-10 (October 25, 1990) requested licensees of boiling-water reactor (BWR) nuclear plants to take action in advance of the GL 89-10 schedule to resolve concerns about the capability of MOVs used for containment isolation in the steam supply line of the high pressure coolant injection and reactor core isolation cooling systems and in the supply line of the reactor water cleanup system, as well as other systems directly connected to the reactor vessel. Supplement 4 to GL 89-10 (February 12, 1992) allowed BWR licensees to not address inadvertent MOV operation as part of their GL 89-10 program because a staff study indicated no significant increase in core melt probability resulting from inadvertent MOV operation in BWR plants. Supplement 5 to GL 89-10 (June 28, 1993) requested licensees to provide information on their actions to address increased MOV diagnostic equipment inaccuracy.

DISCUSSION

On February 25, 1993, the NRC staff held a public workshop to discuss GL 89-10 and to answer questions from the public on the inspections of licensee programs developed in response to the GL. In this supplement to the GL, the staff further clarifies the positions on the schedule for completing the MOV testing to verify design-basis capability recommended in GL 89-10 and grouping of MOVs to establish valve setup conditions. The staff responses to other general public questions and a list of recently issued NRC GLs are also provided in the enclosures to this supplement.

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GL 89-10 Schedule

In GL 89-10, the NRC staff requested nuclear power plant licensees to develop a program to verify the capability of safety-related MOVs to perform their safety function by June 28, 1994, or three refueling outages after December 28, 1989 (whichever is later). Some licensees justified longer schedules. From its inspections of GL 89-10 programs, the NRC staff found some licensees to have made insufficient progress toward completing their GL 89-10 programs in a timely manner. In GL 89-10, the staff stated that nuclear power plant licensees must notify the staff of any changes to their schedule commitments to GL 89-10 but that licensees should retain the justification on site for NRC staff review.

Licensees are responsible for taking actions to correctly set up MOVs with known inadequacies. GL 89-10 requested licensees to develop and implement a program to verify the capability of their MOVs to operate under design-basis conditions. As a minimum, the staff expects all licensees to have their valves set up with the best available industry data by the original completion date accepted by the staff, whether or not all testing has been completed. The staff will consider whether subsequent MOV failures represent inadequate corrective action for known MOV inadequacies contrary to the requirements of Criterion XVI, Corrective Action, of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," of Part 50 to Title 10 of the Code of Federal Regulations (10 CFR).

If a licensee does not believe that it can meet its current schedular commitment for verifying the capability of MOVs within the scope of GL 89-10, the following information will be needed to evaluate the licensee's justification for extending the GL 89-10 test program for capability verification and to establish appropriate audit/inspection plans and schedules:

(1) the completion status of the licensee's GL 89-10 program as of the current commitment date;

(2) for those MOVs whose capability will not be verified by dynamic testing by the current commitment date:

   (a) for each valve: the valve type, size, safety function, design-basis differential pressure and flow, and the available valve factor (or similar capability measure), and a discussion of the relative risk significance of the valves involved;

   (b) confirmation that the functionality of these MOVs has been established using the best available information; and

   (c) the schedule for completing both the MOV testing and any needed corrective actions.

In addition to reviewing the above information, the staff will consider the following factors (as available in inspection reports) in assessing the licensee's justification for schedule extensions:

(1) the extent of completed MOV testing under dynamic conditions where practicable and meaningful;

(2) the extent that plant and industry data have been used to establish the sizing and setting methodology;

(3) the maintenance and modification activities to improve the performance of the MOVs and to provide assurance that marginal and deficient MOVs have been addressed; and

(4) the justifications for any grouping methods including design-basis test data and comparison with industry data.

MOV Grouping

In GL 89-10 and its supplements, the NRC staff requests that licensees test each MOV under design-basis differential pressure and flow conditions where practicable. However, the staff recognizes that it is not practicable to test each MOV within the scope of GL 89-10 in situ under dynamic conditions. Therefore, if a licensee does not perform prototype testing at a test facility for each MOV that is not practicable to test in situ, the licensee will have to group MOVs that are not practicable to test in a manner that provides adequate confidence that the MOVs are capable of performing their design-basis function. As indicated in NRC Information Notice (IN) 92-17 (February 26, 1992), "NRC Inspections of Programs Being Developed at Nuclear Power Plants in Response to Generic Letter 89-10," some licensees are attempting to group MOVs, which could be dynamically tested in situ, to reduce the number of MOVs to be dynamically tested under their GL 89-10 programs.

The staff continues to recommend testing MOVs under design-basis conditions where practicable. Paragraph 1 of GL 89-10 allows licensees to propose alternatives to the recommendations of the generic letter where justification is provided. Grouping data from design-basis differential pressure testing of similar MOVs at or near design-basis test conditions may be an acceptable option to establish design-basis valve setup conditions.

If a licensee chooses to group MOVs, the staff believes the following considerations are particularly important:

(1) verification of design adequacy of the grouped MOVs through a review and analysis of both industry and plant-specific data;

(2) use of benchmarked data from a representative sample of the MOVs (nominally 30 percent and no less than two MOVs) in the group tested at or near plant-specific design-basis conditions;

(3) diagnostic testing of each MOV in the group under at least static conditions;

(4) to the extent practicable, selection of valves for dynamic testing in the group based on a prioritization scheme that considers greatest safety-significance and least performance margin;

(5) validation of design-basis assumptions for all MOVs in the group based on benchmarked data;

(6) in assessing group feasibility, consideration and documentation of such similarities as: valve manufacturer, model and size; valve flow, temperature, pressure, hydraulics, and installation configuration; valve materials and condition; seat/guide stresses; and performance during static and dynamic testing (as applicable) as evidenced by full-stroke diagnostic traces; and

(7) if an MOV in a group fails or reveals adverse performance during testing or operations, evaluation of the applicability of that information to each MOV in the group.

In describing these considerations, the staff is not requiring any specific grouping methodology.

In response to Question 24 in Supplement 1 to GL 89-10, the staff stated that it expects licensees to ensure that data intended for use in demonstrating the operability of an MOV have been obtained under the provisions of a quality assurance program in accordance with Appendix B of 10 CFR Part 50. As further information, licensees using data from tests performed under an approved program (for example, other licensee data) developed in accordance with Appendix B of 10 CFR Part 50 need not verify or audit the tests covered by other licensee Appendix B procedures or processes.

Additional Public Questions

In an enclosure to this GL supplement, the staff responds to the additional questions raised during the February 25 public workshop, including questions involving the scope of GL 89-10 programs and the prioritization of MOVs based on probabilistic risk assessments. The staff has paraphrased these additional questions and grouped them by subject. The staff addressed many of the questions previously either in general or in detail. The staff references other documents where particular questions have been addressed. In the enclosure, the staff provides examples of methods to address certain aspects of GL 89-10 (such as test acceptance criteria) found acceptable during staff review of GL 89-10 programs. Licensees may develop different, but equally acceptable, methods to address those aspects of GL 89-10. Licensees may contact their NRC project manager for discussion of plant-specific questions.

BACKFIT DISCUSSION

On the basis of operating experience and research results, the NRC staff determined several years ago that MOV tests beyond those previously accepted under the inservice testing program are necessary to satisfy the NRC regulations. As that determination constituted a backfit, and as discussed in GL 89-10, Supplement 1 (June 13, 1990), the staff prepared GL 89-10 in accordance with NRC procedures for the issuance of staff guidance containing backfit provisions. This GL supplement and its enclosure (1) restate staff positions contained in the GL and its earlier supplements, (2) provide additional guidance for meeting the staff positions contained in the generic letter and its earlier supplements, (3) relax the staff position on the need for in situ testing of each MOV, and (4) require the submittal of specific information if a licensee intends to extend its GL 89-10 schedule.

Backfit analyses for the restated and relaxed staff positions are not required. A backfit analysis was not prepared for the additional guidance in this GL 89-10 supplement because the compliance backfit analysis associated with the original GL and its earlier supplements is applicable. This guidance does not increase the recommendations associated with the staff positions contained in the GL or its earlier supplements. Rather, the guidance provides detailed methods of implementation of the basic GL 89-10 program which the staff has found to be acceptable based on the individual inspections and reviews of licensee programs which the staff has conducted to date. The use of this guidance is voluntary and the staff will review alternate methods on a case by case basis.

The staff prepared this GL supplement in response to questions and comments received during a public workshop on February 25, 1993. Some licensees have indicated their intention to extend their schedule commitment for completing MOV testing under the GL 89-10 programs. The staff has evaluated the justifications prepared by those licensees on a case-by-case basis. In this GL supplement, the staff describes the information that the staff needs to evaluate the licensee justifications for schedule extensions. In their original response to GL 89-10, certain licensees did not commit to the recommendation in GL 89-10 to test each safety-related MOV where practicable, but rather, indicated plans to group MOVs to limit the amount of dynamic testing. In this GL supplement, the staff describes important considerations in grouping MOVs that the staff has been discussing with those licensees. If a licensee intends to extend its MOV dynamic testing schedule, the staff will expect the licensee to provide assurance that all MOVs are set up adequately by the original completion date accepted by the staff. If a licensee intends to group MOVs, the staff will expect the licensee to justify valve grouping including the applicability of the dynamic test data of MOVs in the group and to take action for all MOVs in the group in response to any adverse performance of the dynamically-tested MOVs. Therefore, if a licensee modifies its commitments regarding schedule or grouping of MOVs in accordance with the provisions of this GL supplement, the staff has determined that the intent of GL 89-10 would be appropriately met.

The NRC published this GL supplement for public comment in the Federal Register on July 22, 1993. The staff reviewed the public comments and revised the GL supplement as appropriate. The staff placed the public comments and staff responses in the NRC Public Document Room.

REPORTING REQUIREMENTS

Pursuant to section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f), each addressee that intends to modify its current commitment to GL 89-10 and extend its schedule for responding to the generic letter is required to submit the information described below. The submittal shall be addressed to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555, under oath or affirmation. A copy shall also be submitted to the appropriate Regional Administrator.

If a licensee intends to extend its current schedular commitment for verifying the capability of MOVs within the scope of GL 89-10, the following information shall be submitted at least 60 days prior to the current commitment date to assist the staff in evaluating the licensee's justification for extending the GL 89-10 test program for capability verification and establishing appropriate audit/inspection plans and schedules:

(1) the completion status of the licensee's GL 89-10 program as of the current commitment date;

(2) for those MOVs whose capability will not be verified by dynamic testing by the current commitment date:

   (a) for each valve: the valve type, size, safety function, design-basis differential pressure and flow, and the available valve factor (or similar capability measure), and a discussion of the relative risk significance of the valves involved;

   (b) confirmation that the functionality of these MOVs has been established using the best available information; and

   (c) the schedule for completing both the MOV testing and any needed corrective actions.

PAPERWORK REDUCTION ACT STATEMENT

The information collections contained in this request are covered by the Office of Management and Budget clearance number 3150-0011, which expires June 30, 1994. The public reporting burden for this collection of information is estimated to average 50 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Information and Records Management Branch (MNBB-7714), U.S.

Nuclear Regulatory Commission, Washington, D.C. 20555, and the Desk Officer, Office of Information and Regulatory Affairs, NEOB-3019, (3150-0011), Office of Management and Budget, Washington, D.C. 20503.

Compliance with the following request for information is purely voluntary. The information would assist NRC in evaluating the cost of complying with this generic letter:

(1) the licensee staff time and costs to perform requested inspections, corrective actions, and associated testing;

(2) the licensee staff time and costs to prepare requested reports and documentation;

(3) the additional short-term costs incurred as a result of the inspection findings such as the costs of the corrective actions or the costs of down time; and

(4) an estimate of the additional long-term costs which will be incurred in the future as a result of implementing commitments such as the estimated costs of conducting future inspections or increased maintenance.

If you have any questions about this matter, please contact the technical contact or lead project manager listed below, or the appropriate Office of Nuclear Reactor Regulation project manager.

Sincerely,

Luis A. Reyes
Acting Associate Director for Projects
Office of Nuclear Reactor Regulation

Enclosures:
1. Public Questions during the February 1993 Workshop on GL 89-10
2. List of Recently Issued NRC Generic Letters

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PUBLIC QUESTIONS DURING THE FEBRUARY 1993 WORKSHOP ON GENERIC LETTER 89-10

General

The NRC staff received general questions regarding the need for a single approach to resolving the motor-operated valve (MOV) issue throughout the industry, the need to continue licensee efforts to improve MOV performance, the parallel efforts of the NRC staff and industry in such areas as probabilistic risk assessment (PRA) studies, and the sharing of technical information among the NRC staff and licensees.

NRC Response

As discussed under BACKGROUND in Generic Letter (GL) 89-10, the NRC staff issued GL 89-10 to request that nuclear power plant licensees develop programs to verify the capability of safety-related MOVs to perform their design-basis functions as a result of NRC Bulletin 85-03, NRC-sponsored MOV research, and operating experience at nuclear power plants. GL 89-10 and its supplements provided one recommended approach to the resolution of the concerns regarding the performance of MOVs in nuclear power plants. The NRC staff required licensees to respond to the recommendations of the GL, but did not require licensees to follow its specific recommendations if a licensee could justify a different approach. For example, some licensees provided a response that indicated their intent to develop a justifiable grouping methodology to minimize the number of MOVs to be tested under dynamic conditions. The staff indicated in its replies to those licensee submittals, and during inspections, that licensees will be expected to justify that their particular approach will resolve the concern for the performance of safety-related MOVs at their plants.

During the implementation of GL 89-10, licensees have discovered more MOV problems than envisioned by the staff when the generic letter was issued in 1989. Although the staff believes that licensees have made progress toward resolving the concerns regarding the performance of MOVs in nuclear power plants, the staff does not consider that sufficient progress has been made at all plants to generically reduce the scope of the program or lengthen its completion schedule. The staff will discuss proposals on specific MOV programs with licensees as requested. Information on individual schedule extensions is provided in the body of Supplement 6 to GL 89-10.

The staff performs independent regulatory oversight of activities on MOV issues performed by licensees, the Electric Power Research Institute (EPRI), and the Nuclear Management and Resources Council (NUMARC). The staff will continue to meet with the industry to discuss MOV issues.

The staff periodically informs licensees of generic information on MOV issues. For example, the staff issues information notices and participates in meetings

of the MOV Users Group. The staff believes that licensees would benefit from increased cooperative efforts to resolve concerns regarding the performance of MOVs.

Scope and the Use of PRA Studies in Prioritizing MOVs

The NRC staff received questions on the scope of GL 89-10 involving such areas as the status of the staff's study of valve mispositioning in pressurized-water reactor (PWR) nuclear plants, the use of PRA studies within the GL 89-10 program, the removal of certain valves under various flow conditions from the GL 89-10 program, and the consideration of MOVs identified in emergency operating procedures.

NRC Staff Response

The staff discussed the scope of GL 89-10 in response to Questions 3 to 13 and 25 in Supplement 1 and in Supplement 4 to the generic letter. The staff has not changed the scope of GL 89-10 from the discussions in Supplements 1 and 4. Except where valve mispositioning is applicable, a licensee may eliminate MOVs from its GL 89-10 program where the licensee can clearly demonstrate that operation of that valve does not represent a safety function and that its operation is not necessary to permit the operation of its safety-related equipment.

In response to Question 25 in Supplement 1 to GL 89-10, the staff stated that a licensee might justify that sufficient margin exists for the extrapolation of test results to demonstrate that a specific MOV would operate under design-basis conditions. In its response to Question 25 in Supplement 1, the staff provided examples of a significantly oversized MOV and an MOV where static loads dominate the loads during design-basis conditions. For example, a licensee might determine that the scope of MOVs to be dynamically tested may be reduced by eliminating MOVs in hard-piping ventilation systems with low design-basis differential pressure in which static loads are significant compared to dynamic loads. Licensees may determine that certain MOVs are not practicable to test or that the test would not provide useful results in justifying design-basis capability. However, the licensee should continue to include those MOVs within the other aspects of the GL 89-10 program.

As discussed in Supplement 4 to GL 89-10 and NRC Information Notice (IN) 92-17 (February 26, 1992), "NRC Inspections of Programs Being Developed at Nuclear Power Plants in Response to Generic Letter 89-10," the NRC staff has contracted a national laboratory to perform a core melt frequency study of the effect of valve mispositioning in PWR plants. This study is complete and the staff is considering the findings to make a determination on the issue.

In response to Question 12 in Supplement 1 to GL 89-10, the staff stated that a licensee may choose to give priority to MOVs that it considers to be most important to safe and reliable operations. In Supplement 3 to GL 89-10, the staff requested BWR licensees to give high priority to MOVs used for containment isolation in certain high pressure systems connected directly to the reactor vessel. In discussing possible extensions of the schedule for

completing MOV testing under GL 89-10, the staff has requested individual licensees to prioritize their MOVs to ensure that testing for the most safety significant MOVs is completed in a timely manner. For example, the staff will consider whether the licensee assigned a higher priority to testing of MOVs that must operate to perform an active safety function than to testing of MOVs that only receive a confirmatory signal to operate. Also, the licensee could assign a lower priority to MOVs with significant design margin.

The staff considers the use of PRA studies to be appropriate as an input for prioritizing the schedule for testing MOVs in response to GL 89-10. However, the staff does not consider PRA studies to be sufficiently reliable to allow their use as the sole basis for eliminating safety-related MOVs from the GL 89-10 program. Further, PRA studies alone are not well-suited for common-mode problems such as the weakness in the original design and qualification of MOVs. The staff is performing an independent assessment of the use of PRA studies for prioritizing MOVs within the GL 89-10 program. Upon request, the staff will meet with industry representatives to discuss this issue.

As discussed in response to Question 3 in Supplement 1 to GL 89-10, the GL scope includes gate, butterfly, and globe valves. Although licensees have found gate valves to be susceptible to the largest number of performance problems, they also have discovered performance problems with butterfly valves at several plants. In response to a specific comment, the staff does not believe that GL 89-10 should be limited to gate valves.

The staff discussed the removal of MOVs from the scope of GL 89-10 programs in response to Questions 3 and 6 in Supplement 1 to GL 89-10. For example, the staff eliminated MOVs in sheet-metal ducting systems because static running loads would likely be significant compared to dynamic loads. In light of Supplement 4 to GL 89-10 on mispositioning, a BWR licensee may delete an MOV from its GL 89-10 program if the licensee can demonstrate that the MOV does not have to change position to perform a safety function. In response to a specific question, if an MOV is pulled closed by flow (such as a globe valve with flow over the seat), the licensee could justify that the MOV does not need to be included in the GL 89-10 test program for the closing direction.

As indicated by the discussion of scope in Supplement 1 to GL 89-10, except where valve mispositioning is applicable, licensees do not need to consider MOVs identified in emergency operating procedures as within the scope of GL 89-10 if they are not within the design basis of the plant.

Additional information on grouping of MOVs is provided in the body of Supplement 6 to GL 89-10.

MOV Sizing and Switch Settings

The NRC staff received questions regarding the responsibility of licensees to validate assumptions used in their calculations (including parameters provided by valve vendors), to consider various uncertainties within the MOV calculations, to ensure the structural capability of safety-related MOVs in

performing their design-basis functions, and to justify the use of a contractor study on the overthrust capability of certain valve actuators.

NRC Staff Response

As discussed in response to Questions 19 and 20 in Supplement 1 to GL 89-10, MOV tests and problems have revealed that valve vendors underestimated the thrust and torque required to operate many valves under dynamic conditions. As indicated in IN 92-17, the staff has found during inspections of GL 89-10 programs that some licensees had not justified their assumptions used in validating the size and settings of the MOVs within the scope of GL 89-10. The staff expects licensees to validate their assumptions for thrust and torque requirements to open and close their valves based on the best available MOV test data.

As further information, the staff considers the best available MOV test data (in order of reliability) to be valve-specific data, plant-specific data, EPRI test data, and industry test data. Where it is not practicable to test an MOV under sufficient dynamic conditions to demonstrate design-basis capability, licensees may use engineering or statistical methods to determine appropriate assumptions for such parameters as valve and stem friction, and load sensitive behavior from other MOVs, where justified.

As required by Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," of Part 50 to Title 10 of the Code of Federal Regulations (10 CFR), the staff expects licensees to include appropriate margin to account for uncertainties in their design assumptions. As discussed in IN 92-17, staff inspections found that some licensees had not addressed uncertainties such as actuator repeatability and diagnostic equipment inaccuracy. The staff also expects licensees to include sufficient margin to provide assurance that the MOV will remain capable of performing its design-basis function until the next test.

Under BACKGROUND in GL 89-10, the staff stated that licensees should be aware that increasing MOV thrust by increasing torque switch settings may subject the valve components to increased forces. In IN 92-83 (December 17, 1992), "Thrust Limits for Limitorque Actuators and Potential Overstressing of Motor-Operated Valves," the staff alerted licensees to possible overstressing of MOVs during operation and testing. As further explanation, the staff expects licensees to provide adequate justification to ensure that the structural or operating capability of the MOVs within the scope of GL 89-10 is not exceeded when performing their design-basis functions. The staff will review this justification during GL 89-10 inspections.

Several licensees contracted Kalsi Engineering to evaluate the structural thrust capability of Limitorque actuators. Limitorque has endorsed the Kalsi study to justify specific thrust limits above the published structural ratings of the actuators but, at this time, has not increased the structural ratings of its actuators. In IN 92-83, the staff alerted licensees to the review by the NRC staff of the Kalsi study. As is the staff's longstanding practice,

licensees that rely on contractor studies are responsible for justifying their use. For example, licensees using the Kalsi overthrust report will be expected to implement the provisions of that report and to periodically inspect the actuators to identify any adverse effects from the increased thrust above the structural ratings. Licensees that rely on contractor studies are responsible for evaluating any subsequent MOV problems that might be attributable to the contractor study and taking corrective action to address the problem for all MOVs whose setup is based on the contractor study. The staff will consider whether any such failure indicates that the licensee may not have met the NRC regulations for design control.

MOV Testing

The NRC staff received questions in such areas as the testing of MOVs where practicable, the testing of MOVs under all design-basis conditions (including degraded voltage), the collection of test data during MOV testing, the measurement of thrust and torque during MOV testing, the acceptance criteria for evaluating MOV tests, the extrapolation of test data, the discovery of new information that might reveal problems with design-basis capability of MOVs, the need to verify design-basis capability for those valve types for which reliable diagnostic equipment might not be available, the determination of minimum voltage at the motor terminals, the application of prototype test data for MOVs installed in nuclear plants, the use of the results of the EPRI MOV Performance Prediction Program, and quality assurance controls for the proposed industry MOV test data base.

NRC Staff Response

GL 89-10 and its supplements recommend that licensees test MOVs within the scope of the generic letter under design-basis differential pressure and flow conditions where practicable. For MOVs that cannot be tested under these conditions, Supplement 1 to GL 89-10 recommended that the MOVs be tested under maximum achievable conditions to provide the best available MOV test data. Since then, licensee results from testing similar MOVs have shown that specific valve testing provides the best available data. However, a licensee might justify an alternative approach, such as grouping, where the licensee has sufficient information to demonstrate the validity of its approach. For example, some licensee test results have indicated that grouping globe valves may be justifiable. Nevertheless, recent testing by Commonwealth Edison Company and EPRI revealed high thrust requirements for certain globe valves tested. Information on grouping is provided in the body of Supplement 6 to GL 89-10. As discussed under Scope, licensees may justify instances where dynamic testing (although practicable) is not necessary on a case-by-case basis.

In response to Question 22 in Supplement 1 to GL 89-10, the staff stated that licensees should consider the safety implications of performing design-basis testing of MOVs in situ. As further explanation, the staff does not expect licensees to test MOVs under all design-basis conditions (such as degraded voltage). Such testing might damage the MOV or jeopardize the safety of the plant and is impractical to perform. The staff expects licensees to

demonstrate the degraded voltage capability of MOVs by a justifiable analytical method.

In response to Question 30 in Supplement 1 to GL 89-10, the staff stated that measured parameters from MOV tests should be capable of providing information to assist the licensee in demonstrating that the MOV will operate under design-basis conditions. As further explanation, licensees need only collect information that is required to evaluate the test data. If the collection of that information can be performed with sufficient accuracy without installation of additional test equipment, the staff does not expect licensees to modify plant systems to obtain test data.

In response to Question 31 in Supplement 1 to GL 89-10, the staff stated that the actuator must be able to deliver the required amount of torque or thrust. In response to Question 30 in Supplement 1 to GL 89-10, the staff stated that if only one parameter (such as thrust) was measured rather than two or more parameters (such as torque and thrust), the licensee may need to ensure that additional margin is available in the demonstration that the MOV will operate under design-basis conditions. As further explanation, if a licensee measures only thrust and assumes a stem friction coefficient to estimate the torque required to operate the valve, the staff expects the licensee to validate its assumption for stem friction coefficient. Licensee testing has indicated that stem friction coefficients are valve specific and may range from less than 0.1 to greater than 0.2. Although laboratory testing might show a low stem friction coefficient, licensees have not demonstrated that a specific assumption for stem friction coefficient can be made at a nuclear plant based on laboratory test results.

NRC regulations in Appendix B to 10 CFR Part 50 require that tests of safety-related MOVs be evaluated. In IN 92-17, the staff reported that weaknesses had been found during GL 89-10 inspections in acceptance criteria at some plants for MOV testing before returning the MOV to service. Several licensees (for example, Comanche Peak) have developed detailed acceptance criteria that the staff considers acceptable. Further, the BWR Owners' Group is developing acceptance criteria that may be adequate when completed. Below, the staff summarizes criteria for the evaluation of test data that have been found acceptable. Other criteria may also be acceptable.

1. Static Test Acceptance:

- Available thrust and torque is within the window defined by the licensee design-basis calculations and margins.

- Diagnostic traces do not indicate significant abnormalities or anomalies that might affect operability.

- Valve stroke times conform with requirements of Section XI of the American Society of Mechanical Engineers (ASME) Code and the applicable technical specifications.

2. Differential Pressure Test Acceptance:

- The valve fully opens with appropriate open torque switch bypass indication and fully closes with diagnostic indication of hard seat contact and control room indication.

- The control switch settings provide adequate thrust margin to overcome design-basis requirements, including consideration of diagnostic equipment inaccuracy, control switch repeatability, load sensitive behavior, and margin for degradation until the next test.

- The motor output capability at degraded voltage is in excess of the control switch setting including consideration of diagnostic equipment inaccuracy, control switch repeatability, load sensitive behavior, and margin for degradation until the next test.

- The maximum thrust and torque achieved by the MOV including diagnostic equipment inaccuracy and control switch repeatability do not exceed the allowable structural capability limits for the individual parts of the MOV.

- The diagnostic traces do not indicate any significant abnormalities or anomalies that might affect MOV operability.

After returning the MOV to service, the licensee performs a more detailed followup evaluation of test data for such items as the following:

- In the event of greater-than-predicted thrust or torque requirements, evaluate other applicable MOVs (such as parallel train valves) before plant startup. If plant is operating, evaluate promptly in accordance with GL 91-18 (November 7, 1991), "Information to Licensees Regarding Two NRC Inspection Manual Sections on Resolution of Degraded and Nonconforming Conditions and on Operability."

- Perform a detailed evaluation of the diagnostic trace for such items as bent stem, spring pack gap, and stem/stem nut interface problems. For example, compare in-rush motor current to running current for magnesium rotor degradation.

- Incorporate valve factors and stem friction coefficients into MOV sizing and switch setting methodology to ensure thrust windows are correct.

In response to Question 25 in Supplement 1 to GL 89-10, the staff stated that licensees may extrapolate the results of MOV tests to design-basis conditions where justified. As further explanation, the staff does not have a specific percentage of design-basis differential pressure where the test results can be reliably extrapolated to design-basis conditions. Licensees may justify their own method of extrapolation and the extent of that extrapolation. The staff describes one extrapolation method developed by the Idaho National Engineering Laboratory (INEL) in NUREG/CR-5720 (June 1992), "Motor-Operated Valve Research Update." Licensees may use that method if justified for their MOVs. The

staff does not have any current plans to mandate the use of the extrapolation method outlined in NUREG/CR-5720.

At the February 25 workshop, a participant asked a question on whether unwedging forces need to be extrapolated. The staff believes that only thrust and torque required to overcome dynamic fluid forces need to be extrapolated from test conditions to design-basis conditions. A licensee might justify that unwedging forces do not need to be extrapolated from test conditions to design-basis conditions.

As required through Criterion XVI, Corrective Action, of Appendix B to 10 CFR Part 50, it is the responsibility of licensees to ensure that adverse information from MOV testing does not reveal a problem with other MOVs in the plant. In IN 92-17, the staff reported that GL 89-10 inspections had found that some licensees did not appear to be aware of their obligations in this area. Although test information might not be sufficient to justify the capability of a similar MOV, adverse test information can reveal a potential operability problem with other MOVs that a licensee must address. The requirements in Criterion XVI of Appendix B also apply to new information that might reveal a problem with the design-basis capability of MOVs, such as increased MOV diagnostic equipment inaccuracy.

In response to Question 30 in Supplement 1 to GL 89-10, the staff stated that it did not plan to insist that licensees use diagnostic equipment in implementing GL 89-10, but believed that such equipment would be almost essential for adequate implementation of the generic letter. As further explanation, licensees are responsible for demonstrating the design-basis capability of MOVs even where uncertainties exist in available diagnostic equipment. However, the staff will consider this factor in reviewing justifications for schedule extensions for completing testing under GL 89-10.

In response to Question 36 in Supplement 1 to GL 89-10, the staff briefly described its position on the consideration of degraded voltage in evaluating MOV capability under GL 89-10. In IN 92-17, the staff reported that many licensees are updating their degraded voltage studies. Below, the staff provides a more detailed explanation of an acceptable approach to considering degraded voltage with respect to MOV capability.

> For 480-Vac motors, the licensee determines minimum voltage at the motor terminals considering cable size and length, temperature, and thermal overload resistance. The licensee considers the worst-case postulated motor control center (MCC) voltage based either on the lower of the voltage supplied from the diesel generator or the offsite supply. Where the offsite supply is the limiting case, as is typical, the licensee uses the degraded grid relay setpoint as the starting point for determining the minimum voltage at the motor terminals for ac motors. The appropriate setpoint to be used is for the degraded grid relay which provides for separation from the offsite supply, and connection to the emergency diesel generator with or without a specific time delay or concurrent accident signal.

In addition to the degraded grid voltage relays, some plants use an additional alarm relay (set higher than the degraded grid voltage relays) to alert the operator to a sustained degraded grid condition. The licensee would not use the alarm relay setting to calculate the voltage required at the MOVs. Likewise, the staff does not consider taking credit for administrative procedures and operator response (to separate from the offsite supply) to be acceptable unless these actions have been evaluated and accepted by the staff.

For dc motors, the licensee uses the worst-case battery voltage profile (including aging and temperature factors). The licensee properly accounts for voltage drops from the battery to the MCC. After determining the minimum voltage at the motor, the degraded voltage factor is calculated. The degraded voltage factor is then multiplied by the rated motor output torque and compared to the torque required.

In Technical Update 92-02, Limitorque states that, between 90 and 99 percent of rated voltage, the degraded voltage factor is equal to one and that the application factor makes allowances for motor torque loss up to 90 percent voltage. In Technical Update 92-02, Limitorque also states that the degraded voltage factor is applied if motor terminal input voltage is less than 90 percent of the motor rated voltage at any time during the valve stroke. For ac-powered MOVs, the degraded voltage factor is equal to the square of the ratio of the minimum motor terminal voltage to the motor rated voltage. For dc-powered MOVs, the degraded voltage factor is equal to the minimum motor terminal voltage divided by the motor rated voltage. However, Limitorque has only approved this approximation for motor voltages over 70 percent.

The following is a summation of two acceptable methods for calculating the expected ac-motor terminal voltage at degraded bus voltage conditions:

<u>Method One</u>: A motor circuit one-line diagram is constructed consisting of the known cable and overload heater impedances. The motor impedance is calculated by the following formula:

$$Z(m) = \frac{V(r)}{SQRT(3) \times I(lr)}$$

where
$Z(m)$ = motor impedance
$V(r)$ = motor nominal voltage
$I(lr)$ = rated locked rotor current

The motor resistance and reactance are calculated from the above impedance using the locked-rotor power factor. Then, a voltage divider calculation is performed with the result being the calculated motor terminal voltage under worst-case bus voltage conditions.

<u>Method Two</u>: A motor current value, representative of worst-case conditions, is assumed. Some licensees assume nominal locked rotor current, which should be the most conservative. Other licensees are assuming alternate values such as current at torque switch trip, which

may not be conservative because the current at torque switch trip may depend on the applied voltage and consequently may be higher under degraded voltage conditions. Additionally, current at torque switch trip is not always the worst case because unseating current could be higher in some cases. Also, if the current was derived from a test at less than full differential pressure, the current at torque switch trip also might be underestimated as a result of differences in inertial forces. Therefore, the licensee justifies the use of any current value less than that of nominal locked-rotor current. Motor terminal voltage is then calculated by multiplying the assumed motor current times the cable and overload impedances and subtracting this value from the worst-case bus voltage. The licensee uses the power factor provided by Limitorque for locked-rotor conditions.

For dc motors, an acceptable approach to determine the worst-case motor voltage is more straightforward. The locked-rotor resistance of the motor is calculated from actual locked-rotor current test data. Then, appropriate values are assumed for cable, overload heater, and starting resistor resistances.

In response to Question 26 in Supplement 1 to GL 89-10, the staff describes the demonstration of the applicability of prototype test data to MOVs installed in nuclear plants. As indicated in Supplement 1, the staff believes that the most justifiable method of demonstrating applicability is to use performance-based criteria where the MOV in question is tested under partial dynamic conditions and its performance is related to the performance of the prototype MOV under similar conditions. However, each licensee may develop its own method of justifying the applicability of prototype test data.

Since the staff issued Supplement 1 to GL 89-10, EPRI has established an MOV Performance Prediction Program that might provide important information to assist licensees in demonstrating the design-basis capability of MOVs that cannot practicably be tested under dynamic conditions. The staff expects licensees to proceed with their GL 89-10 programs and not to wait for the completion of the EPRI program. Where the EPRI program does not provide sufficient information regarding an MOV, the staff expects each licensee to provide justification for the design-basis capability of the MOV.

In response to Question 28 in Supplement 1 to GL 89-10, the staff stated that the capability of an MOV under design-basis conditions might be demonstrated by means of a data base of test results if properly justified. The staff also indicated that the MOV Users Group might be able to provide assistance in developing such a data base. Recently, the MOV Users Group indicated that it is planning to develop a data base of tests conducted by licensees. The staff expects the industry MOV test data base to be established and maintained with appropriate quality assurance controls.

Periodic Verification and Post-Maintenance Testing

The NRC staff received questions on the use of static tests to satisfy the recommendation in GL 89-10 to periodically verify the design-basis capability of MOVs, the frequency of periodic verification of design-basis capability, and the use of motor current following valve packing adjustments or replacement.

NRC Staff Response

Recommendation d of GL 89-10 requests licensees to periodically verify that MOVs within the scope of GL 89-10 are capable of performing their design-basis functions. In response to Question 33 in Supplement 1 to GL 89-10, the staff stated that the licensee should develop a method to ensure that, following the initial demonstration that the MOV would operate under design-basis conditions, the MOV switches remain set adequately. As indicated in IN 92-17, many licensees have stated their intent to rely on static test data to address the GL 89-10 recommendation on periodic verification. In recommendation d of GL 89-10 and in response to Question 35 in Supplement 1 to GL 89-10, the staff stated that the ASME Code Section XI stroke-time testing required by 10 CFR Part 50 would not satisfy this provision of GL 89-10. The staff discussed the relationship between ASME Section XI and GL 89-10 in response to Question 49 in Supplement 1 to GL 89-10.

The staff is not prohibiting licensees from attempting to justify static testing as a method of verifying periodically the design-basis capability of MOVs. However, based on the results of GL 89-10 inspections to date, no licensee has as yet justified the use of static test data for periodically demonstrating the design-basis capability of MOVs. The staff will review the justification provided by licensees during inspections when licensees begin implementing their method for periodically verifying the design-basis capability of MOVs.

In GL 89-10, the staff recommended that the design-basis capability of MOVs be verified approximately every five years but noted that an alternative schedule might be justified. As further information, a licensee may evaluate the safety significance of an MOV in determining an appropriate frequency for periodically verifying design-basis capability.

In response to Question 38 in Supplement 1 to GL 89-10, the staff stated that the licensee should justify that the MOV switch settings remain correct, or have been adjusted adequately, upon completion of any activity involving the MOV that might affect its ability to operate under design-basis conditions. Since then, the industry has found the use of motor current to not always reliably predict changes in thrust delivered in operating a valve. However, Commonwealth Edison Company has developed a method of using motor current when sufficient margin is available following valve packing adjustments.

Trending

The NRC staff received a question on the staff's expectations regarding tracking and trending of MOV problems in response to GL 89-10.

NRC Staff Response

In response to Question 39 in Supplement 1 to GL 89-10, the staff referred licensees to Attachment A to GL 89-10 for MOV problems that could be trended. The staff has documented in its GL 89-10 inspection reports instances in which licensees have developed thorough trending programs.

Schedule

The NRC staff received questions on the need to complete the GL 89-10 program within the schedule recommended in the generic letter and the justification necessary to extend the schedule commitment date.

NRC Staff Response

Information on schedule is provided in the body of Supplement 6 to GL 89-10.

In addition to testing under recommendation c of GL 89-10, the staff discusses the long-term aspects of the MOV program in recommendations d, f, h and j of the generic letter.

Pressure Locking and Thermal Binding of Gate Valves

The NRC staff received questions on the need to consider pressure locking and thermal binding of gate valves as part of a licensee's response to GL 89-10, the drilling of a hole in the valve disk to prevent pressure locking, the schedule for evaluating pressure locking and thermal binding, and the need for detailed measurements of external heat loads in evaluating the potential for pressure locking and thermal binding.

NRC Staff Response

The NRC Office for Analysis and Evaluation of Operational Data (AEOD) has completed AEOD Special Study AEOD/S92-07 (December 1992), "Pressure Locking and Thermal Binding of Gate Valves." The staff issued the AEOD report in NUREG-1275, Volume 9 (March 1993), "Operating Experience Feedback Report - Pressure Locking and Thermal Binding of Gate Valves." In its report, AEOD concludes that licensees have not taken sufficient action to provide assurance that pressure locking and thermal binding will not prevent a gate valve from performing its safety function.

The NRC regulations require that licensees design safety-related systems to provide assurance that those systems can perform their safety functions. In GL 89-10, the staff requested licensees to review the design bases of their safety-related MOVs. In complying with the NRC regulations, licensees are expected to have evaluated the potential for pressure locking and thermal

binding of gate valves and taken action to ensure that these phenomena do not affect the capability of MOVs to perform their safety-related functions. If a licensee identifies a potential for pressure locking and thermal binding of gate valves, the NRC regulations require that the licensee take action to resolve that problem.

Based on information from staff inspections and discussions, the staff considers the following to be an acceptable approach to addressing pressure locking and thermal binding of gate valves within the scope of GL 89-10:

1. Document an evaluation of the gate valves within the scope of GL 89-10 as having operational configurations with a potential for pressure locking or thermal binding, including the basis for determining whether the valves (a) are susceptible to pressure locking or thermal binding or (b) can be removed from further consideration. For example, solid wedge disk gate valves might not be susceptible to pressure locking. Double disk gate valves are not likely to be susceptible to thermal binding.

   The evaluation would include consideration of the potential for an MOV to undergo pressure locking or thermal binding during surveillance testing. For example, the inboard containment isolation MOV in the reactor core isolation cooling (RCIC) system steam line at a plant recently failed in the closed position following closure for routine surveillance testing. The cause was believed to be pressure locking.

   The evaluation also would include review of generic studies for site-specific applicability, such as in the areas of thermal effects and design-basis depressurization.

   Examples of unacceptable reasons for eliminating valves from consideration of pressure locking or thermal binding are (1) leakage rate, (2) engineering judgment without justification, and (3) lack of event occurrence at the specific plant.

   The AEOD study indicated that safety-related gate valves involved in pressure locking events were

   - low pressure coolant injection (LPCI) and low pressure core spray (LPCS) system injection valves
   - core spray (CS) valves
   - residual heat removal (RHR) shutdown cooling (SDC) isolation valves
   - RHR hot leg crossover isolation valves
   - RHR containment sump and suppression pool suction valves
   - high pressure coolant injection (HPCI) steam admission valves

- RHR heat exchanger outlet valves
- emergency feedwater isolation valves

The AEOD study indicated that safety-related gate valves involved in thermal binding events were

- reactor depressurization system isolation valves
- RHR inboard suction isolation valves
- HPCI steam admission valves
- power-operated relief valve (PORV) block valves
- reactor coolant system letdown isolation valves
- RHR suppression pool suction valves
- containment isolation valves (sample line, letdown heat exchanger inlet header)
- condensate discharge valves
- reactor feedwater pump discharge valves

A recent event at a plant involving possible pressure locking of a RCIC valve indicates that MOVs in steam lines also are susceptible to pressure locking.

2. Document an analysis of the safety-related gate valves (identified in 1 above) with the potential for either pressure locking or thermal binding to ensure all such valves can be opened to perform their safety function under all modes of plant operation. Credit for bonnet pressure decay within the valve response time might not be acceptable unless operation of the actuator motor at locked-rotor conditions would not degrade motor torque capability.

   Specific acceptable modifications and actions to prevent pressure locking or thermal binding are listed on page 7 of NUREG/CR-1275.

   The NRC regulations require an analysis under 10 CFR 50.59 for any valve modifications and the establishment of adequate post-modification and inservice testing of any valves installed as part of the modification. For example, the licensee would evaluate the effects of drilling the hole in the disk if used to resolve a pressure locking concern. One consideration in this evaluation is the fact that the MOV will be leaktight in only one direction.

   As required through Appendix B to 10 CFR Part 50, the licensee would establish training for plant personnel to perform any necessary actions

and incorporate specific procedural precautions/revisions into the existing plant operating procedures. For example, plant personnel might periodically stroke certain valves to reduce the potential for thermal binding.

If an MOV is found to be susceptible to pressure locking or thermal binding and the licensee relies on the capability of the MOV to overcome pressure locking or thermal binding, the staff will review the licensee justification during inspections in consideration of the uncertainties surrounding the prediction of the required thrust to overcome these phenomena. If the staff finds that a licensee has not adequately addressed the potential for pressure locking and thermal binding of gate valves, enforcement actions and schedules for response will depend on the safety significance of the issue at the plant.

With respect to a particular question on the consideration of external heat loads, licensees may evaluate the effects of these loads in a bounding manner to minimize the need for detailed measurements and analyses in the plant.

From the evaluation of licensee activities during GL 89-10 inspections, the staff will determine whether regulatory action is necessary with respect to other types of power-operated valves (such as air-operated valves) in regard to the potential for pressure locking and thermal binding.

Miscellaneous

The NRC staff received miscellaneous new questions on plans for a generic letter on air-operated valves (AOVs), the need for on-line continuous monitoring of MOVs, the plans for a proposed NRC staff meeting with MOV experts from other countries, the role of vendors in resolving the MOV issue, and the status of NRC staff comments on the EPRI MOV Performance Prediction Program.

NRC Staff Response

The staff has been considering the issue of performance of AOVs and currently does not believe that a generic letter is necessary.

Use of on-line continuous monitoring would be a licensee decision.

The staff has requested the International Atomic Energy Agency (IAEA) to set up a meeting under the aging program to discuss problems with the performance of MOVs in other countries and the resolution of those problems.

The staff encourages licensees to work closely with the vendors to resolve MOV performance concerns.

The staff sent a letter in December 1992 to EPRI discussing issues regarding the EPRI MOV program.

LIST OF RECENTLY ISSUED GENERIC LETTERS

Generic Letter	Subject	Date of Issuance	Issued To
93-08	RELOCATION OF TECHNICAL SPECIFICATION TABLES OF OF INSTRUMENT RESPONSE TIME LIMITS	12/29/93	ALL HOLDERS OF OLs FOR NPRs
93-07	MODIFICATION OF THE TECHNICAL SPECIFICATION ADMINISTRATIVE CONTROL REQUIREMENTS FOR EMERGENCY AND SECURITY PLANS	12/28/93	ALL HOLDERS OF OLs OR CPs FOR NPRs
93-06	RESEARCH RESULTS ON ON GENERIC SAFETY ISSUE 106, "PIPING AND THE USE OF HIGHLY COMBUSTIBLE GASES IN VITAL AREAS"	10/25/93	ALL HOLDERS OF OLs OR CPs FOR NPRs
93-05	LINE-ITEM TECHNICAL SPECIFICATIONS IMPROVEMENTS TO REDUCE SURVEILLANCE REQUIREMENTS FOR TESTING DURING POWER OPERATION	09/27/93	ALL HOLDERS OF OLs OR CPs FOR NPRs
89-10, SUPP. 5	INACCURACY OF MOTOR-OPERATED VALVE DIAGNOSTIC EQUIPMENT	06/28/93	ALL LICENSEES OF OPERATING NUCLEAR POWER PLANTS AND HOLDERS OF CONSTRUCTION PERMITS FOR NUCLEAR POWER PLANTS
93-04	ROD CONTROL SYSTEM FAILURE AND WITHDRAWAL OF ROD CONTROL CLUSTER ASSEMBLIES, 10 CFR 50.54(f)	06/21/93	ALL HOLDERS OF OLs OR CPs FOR (W)-DESIGNED NPRs EXCEPT HADDAM NECK ALL HOLDERS OF OLs OR CPs FOR (CE)-DESIGNED AND (B&W)-DESIGN NPRs AND HADDAM NECK
93-03	VERIFICATION OF PLANT RECORDS	10/20/93	ALL HOLDERS OF OLs OR CPs FOR NPRs

OL = OPERATING LICENSE
CP = CONSTRUCTION PERMIT
NPR = NUCLEAR POWER REACTORS

Nuclear Regulatory Commission, Washington, D.C. 20555, and the Desk Officer, Office of Information and Regulatory Affairs, NEOB-3019, (3150-0011), Office of Management and Budget, Washington, D.C. 20503.

Compliance with the following request for information is purely voluntary. The information would assist NRC in evaluating the cost of complying with this generic letter:

(1) the licensee staff time and costs to perform requested inspections, corrective actions, and associated testing;

(2) the licensee staff time and costs to prepare requested reports and documentation;

(3) the additional short-term costs incurred as a result of the inspection findings such as the costs of the corrective actions or the costs of down time; and

(4) an estimate of the additional long-term costs which will be incurred in the future as a result of implementing commitments such as the estimated costs of conducting future inspections or increased maintenance.

If you have any questions about this matter, please contact the technical contact or lead project manager listed below, or the appropriate Office of Nuclear Reactor Regulation project manager.

Sincerely,
Original signed by
Luis A. Reyes
Acting Associate Director for Projects
Office of Nuclear Reactor Regulation

Enclosures:
1. Public Questions during the February 1993 Workshop on GL 89-10
2. List of Recently Issued NRC Generic Letters

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