6.2 Generic Letter 89-10

June 28, 1989

To: **All Licensees of Operating Nuclear Power Plants and Holders of Construction Permits for Nuclear Power Plants**

Subject: **SAFETY-RELATED[1] MOTOR-OPERATED VALVE TESTING AND SURVEILLANCE (GENERIC LETTER NO. 89-10)—10 CFR 50.54(f)**

Background

In Bulletin 85-03, dated November 15, 1985, and Supplement 1 of Bulletin 85-03, dated April 27, 1988, the NRC recommended that licensees develop and implement a program to ensure that valve motor-operator switch settings (torque, torque bypass, position limit, overload) for motor-operated valves (MOVs) in several specified systems are selected, set, and maintained so that the MOVs will operate under design-basis[2] (2) conditions for the life of the plant. NRC staff assessments of the reliability of all safety-related MOVs, based on extrapolations of the currently available results of valve surveillances performed in response to Bulletin 85-03, indicate that the program to verify switch settings should be extended in order to ensure operability of all safety-related fluid systems. The NRC staff's evaluation of the data indicates that, unless additional measures are taken, failure of safety-related MOVs and position-changeable MOVs (as defined under “Recommended Actions” of this generic letter) to operate under design-basis conditions will occur much more often than had previously been estimated.

The ASME Code Section XI stroke-timing test for MOVs is performed to meet the inservice testing requirements of 10 CFR 50.55a(g). Section XI testing for MOVs consists of stroking Class 1, 2, and 3 valves open and closed, usually without fluid pressure or flow in the lines, and measuring stroke time. This Section XI

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[1]. The term “safety-related” refers to those systems and components that are relied on to remain functional during and following design-basis events to ensure (a) the integrity of the reactor coolant pressure boundary, (b) the capability to shut down the reactor and maintain it in a safe shutdown condition, and (c) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guidelines of 10 CFR Part 100.

[2]. Design-basis events are defined as conditions of normal operation, including anticipated operational occurrences, design-basis accidents, external events, and natural phenomena for which the plant must be designed to ensure the functions delineated in footnote a. The design bases for each plant are those documented in pertinent licensee submittals such as the final safety analysis report.

testing is a useful tool and complements other tests used to verify MOV operability. Variations in measured stroke times can be significant for DC-powered MOVs and can indicate valve degradation. Additionally, periodic stroking of MOVs provides valve exercise and some measure of on-demand reliability.

Section XI requires corrective action if a MOV does not exhibit its required change of disk position. However, it is now recognized that the Section XI testing alone is not sufficient to provide assurance of MOV operability under design-basis conditions. Assurance of design basis operability is necessary in order to meet the requirements in General Design Criteria 1, 4, 18, and 21 of Appendix A to 10 CFR Part 50 and Criterion XI of Appendix B to 10 CFR Part 50.

The design basis for certain normally open primary system MOVs (for example, those serving the reactor water cleanup system and the steam supply to high-pressure coolant injection and reactor core isolation cooling system turbines in boiling water reactors) demand that these MOVs close to isolate the largest postulated downstream pipe break outside the containment. These MOVs are the subject of a full-scale blowdown flow testing program being conducted by Idaho National Engineering Laboratory (INEL) under NRC sponsorship as part of the resolution of Generic Issue 87, "Failure of HPCI Steam Line Without Isolation." Preliminary test results[3] (3) indicate that some MOVs may be subjected to mechanisms and loads that were not accounted for previously. INEEL's preliminary conclusions indicate that industry sizing equations for MOVs that must perform this type of safety-related function may not be conservative for all design-basis conditions. The purpose of these tests is to confirm that these valves will operate under design-basis conditions and, if possible, to identify the causes of any failures. The design, testing, and maintenance of all valves and assuring of their operability are the responsibility of the licensees.

INEL has concluded that diagnostic systems that measure both stem thrust and motor torque are best suited for predicting valve motor performance under design-basis conditions. However, on the basis of INEEL's preliminary conclusions, it is not clear that tests of an MOV at low or moderate pressure differentials can be directly extrapolated to determine correct switch settings at design-basis conditions using any type of diagnostic techniques, even for single-phase liquid flow. Currently, the most accurate method of determining switch settings and overall competence of the MOV is to perform testing at or near design-basis conditions, either in situ or on prototype valves.

However, demonstrating operability in situ at design-basis conditions is not practical for some MOVs. Alternatives to testing at design-basis conditions that industry has used include testing at low differential pressure and/or low flow, as appropriate, combined with MOV surveillance using suitable signature analysis diagnostic techniques. Licensees should ensure that any tests conducted using diagnostic techniques, along

[3]. On February 1, 1989, in Rockville, Maryland, results of the INEL tests were described in an NRC sponsored public meeting to review valve blowdown tests. A transcript of the meeting is available from Heritage Reporting Corporation, 1220 L Street, N.W., Suite 600, Washington, D.C. 20005.

with in situ tests conducted at conditions less severe than design-basis conditions, will be applied appropriately to ensure design-basis operability of safety-related MOVs.

Licensees should also be aware that increasing MOV thrust by increasing torque switch settings, in order to satisfy design-basis operability considerations, may subject the valve components to increased forces when the valve is operated at no-load or low-load conditions. Such conditions should be evaluated by the licensee to ensure that MOV operability is not compromised. The NRC will provide additional information on MOV performance under full-scale blowdown test conditions as it becomes available. Licensees are specifically cautioned, however, that the INEL tests are not directed toward determining the capability and limitations of various MOV diagnostic systems. Therefore, licensees are also encouraged to consider the need for industry-sponsored MOV test programs to ensure that diagnostic techniques can be used to determine the correct adjustments to ensure operability of those safety-related MOVs for which testing at design-basis conditions cannot practically be performed in situ.

Assurance of MOV operability is a complex task. It involves many factors such as development of strong testing and maintenance programs, management support, and coordination of engineering, maintenance, and testing. This effort should be viewed by all concerned as a long-term ongoing program. Licensees that have already implemented extensive programs on MOVs have found it very beneficial and cost-effective to require that all maintenance and adjustments on the MOVs be performed by technicians who have received specific training.

Surveillance, adjustment, maintenance, and repair of safety-related MOVs should be performed in accordance with quality assurance program methods that meet the requirements of 10 CFR Part 50. The recommended actions given in the following section are intended to be consistent with NRC's maintenance policy statement as published in the Federal Register on March 23, 1988 (53 FR 9430). The nuclear power industry has undertaken several generic activities in the area of MOV maintenance and testing. For example, the Electric Power Research Institute has published a maintenance guide and intends to publish an applications guide for MOVs. The results of these efforts may be useful to the industry in developing an effective program.

This letter is part of the resolution of Generic Issue II.E.6.1, “In Situ Testing of Valves,” that relates to MOV testing.

Recommended Actions

By this letter NRC extends the scope of the program outlined in Bulletin 85-03 and Supplement 1 of Bulletin 85-03 to include all safety-related MOVs as well as all position-changeable MOVs as defined below. The licensee's program should provide for the testing, inspection, and maintenance of MOVs so as to provide the necessary assurance that they will function when subjected to the design-basis conditions that are to be considered during both normal operation and abnormal events within the design basis of the plant. Although this program should address safety-related MOVs and position-changeable MOVs as a minimum, NRC envisions that, as part of a good maintenance program, other MOVs in the balance of plant should be considered for inclusion in the program, commensurate with the licensee's assessment of their importance to safety.

Any MOV in a safety-related system that is not blocked from inadvertent operation from either the control room, the motor control center, or the valve itself should be considered capable of being mispositioned (referred to as position-changeable MOVs) and should be included in the program. When determining the maximum differential pressure or flow for position-changeable MOVs, the fact that the MOV must be able to recover from mispositioning should be considered.

The program to respond to this letter should address items a. through h. below. Items a., b., and c. and the first paragraph of d. are repeated, with limited changes, from Bulletin 85-03 or from Supplement 1 of that bulletin. The second paragraph of item d. and items e., f., g., and h. provide additional clarification and guidance.

a. Review and document the design basis for the operation of each MOV. This documentation should include the maximum differential pressure expected during both the opening and closing of the MOV for both normal operations and abnormal events, to the extent that these MOV operations and events are included in the existing approved design basis.

b. Using the results from item a., establish the correct switch settings. This should include establishing a program to review and revise, as necessary, the methods for selecting and setting all switches (i.e., torque, torque bypass, position limit, overload) for each valve operation (opening and closing). One purpose of this letter is to ensure that a program exists for selecting and setting valve operator switches to ensure high reliability of safety-related MOVs.

c. Individual MOV switch settings should be changed, as appropriate, to those established in response to item b. Whether the switch settings are changed or not, the MOV should be demonstrated to be operable by testing it at the design-basis differential pressure and/or flow determined in response to item a. Testing MOVs at design-basis conditions is not recommended where such testing is precluded by the existing plant configuration. An explanation should be documented for any cases where testing with the design-basis differential pressure or flow cannot practicably be performed. This explanation should include a description of the alternatives to design-basis differential pressure testing or flow testing that will be used to verify the correct settings.

   Note: This letter is not intended to establish a recommendation for valve testing for the condition simulating a break in the line containing the MOV. However, a break in the line should be

considered in the analyses described in items a., b., and c. if MOV operation is relied on in the design basis.

Each MOV should be stroke tested, to verify that the MOV is operable at no-pressure or no-flow conditions even if testing with differential pressure or flow cannot be performed.

d. Prepare or revise procedures to ensure that correct switch settings are determined and maintained throughout the life of the plant. These procedures should include provisions to monitor MOV performance to ensure the switch settings are correct. This is particularly important if the torque or torque bypass switch setting has been significantly raised above that required.

   It may become necessary to adjust MOV switch settings because of the effects of wear or aging. Therefore, it is insufficient to merely verify that the switch settings are unchanged from previously established values. The switch settings should be verified in accordance with the program schedule (see item j.). The ASME Code Section XI stroke-timing test required by 10 CFR Part 50 is not oriented toward verification of switch settings. Therefore, additional measures should be taken to adequately verify that the switch settings ensure MOV operability. The switch settings need not be verified each time the ASME Code stroke-timing test is performed.

e. Regarding item a., no change to the existing plant design basis is intended and none should be inferred. The design-basis review should not be restricted to a determination of estimated maximum design-basis differential pressure, but should include an examination of the pertinent design and installation criteria that were used in choosing the particular MOV. For example, the review should include the effects on MOV performance of design-basis degraded voltage, including the capability of the MOV's power supply and cables to provide the high initial current needed for the operation of the MOV.

f. Documentation of explanations and the description of actual test methods used for accomplishing item c. should be retained as part of the required records for the MOV.

   It is also recognized that it may be impracticable to perform in situ MOV testing at design-basis degraded voltage conditions. However, the switch settings established in response to item b. should at least be established to account for the situation where the valves may be called on to operate at design-basis differential pressure, or flow, and under degraded voltage conditions. If the licensee failed to consider degraded voltage, power supply, or cable adequacy for MOVs in systems covered by Bulletin 85-03, the design review and established switch settings for those MOVs should be reevaluated.

   Alternatives to testing a particular MOV in situ at design-basis pressure or flow, where such testing cannot practicably be performed, could include a comparison with appropriate design-basis test results on other MOVs, either in situ or prototype. If such test information is not available, analytical methods and extrapolations to design-basis conditions, based on the best data available, may be used until test data at design-basis conditions become available to verify operability of the MOV. If this two-stage approach is followed, it should be accomplished within the schedule outlined in item i. and would allow for MOV testing and surveillance to proceed without excessive delay.

Testing of MOVs at design-basis conditions need not be repeated unless the MOV is replaced, modified, or overhauled to the extent that the licensee considers that the existing test results are not representative of the MOV in its modified configuration.

g. A number of deficiencies, misadjustments, and degraded conditions were discovered by licensees, either as a result of their efforts to comply with Bulletin 85-03 or from other experiences. A list of these conditions (including improper switch settings) is included in Attachment A to this letter for licensee review and information.

h. Each MOV failure and corrective action taken, including repair, alteration, analysis, test, and surveillance, should be analyzed or justified and documented. The documentation should include the results and history of each as-found deteriorated condition, malfunction, test, inspection, analysis, repair, or alteration. All documentation should be retained and reported in accordance with plant requirements.

It is suggested that these MOV data be periodically examined (at least every 2 years or after each refueling outage after program implementation) as part of a monitoring and feedback effort to establish trends of MOV operability. These trends could provide the basis for a licensee revision of the testing frequency established to periodically verify the adequacy of MOV switch settings (see items d. and j.). For this monitoring and feedback effort, a well-structured and component-oriented system (e.g., the Nuclear Plant Reliability Data System [NPRDS]) is needed to capture, track, and share the equipment history data. The NRC encourages the use of the industry-wide NPRDS, appropriately modified, for this purpose in view of the multiple uses for these data.

Schedule

The program to respond to this letter should be implemented in accordance with the schedule outlined in items i. through k. below. The scheduled dates should ensure that item c. is implemented soonest for those MOVs that the licensee considers to have the greatest impact on plant safety.

i. Each licensee with an operating license (OL) should complete all design-basis reviews, analyses, verifications, tests, and inspections that have been instituted in order to comply with items a. through h. within 5 years or three refueling outages of the date of this letter, whichever is later. Each licensee with a construction permit (CP) should complete these actions within 5 years of the date of this letter or before the OL is issued, whichever is later.

For plants with an OL, the documentation described in items 1. and 2. below should be available within 1 year or one refueling outage of the date of this letter, whichever is later. For plants with a CP, the documentation outlined in items 1. and 2. should be available within one year of the date of this letter or before the OL is issued, whichever is later. The documents should include:

1. The description and schedule for the design-basis review recommended in item a. (including guidance from item e.) for all safety-related MOVs and position-changeable MOVs as described, and

(1) The program description and schedule for items b. through h. for all safety-related MOVs and position-changeable MOVs.

a. The program for the verification of the procedures outlined in item d., as well as other tests or surveillance that the owner may choose to use to identify potential MOV degradations or misadjustments, such as those described in Attachment A, should be implemented after maintenance or adjustment (including packing adjustment) of each MOV, and periodically thereafter. The surveillance interval should be based on the licensee's evaluation of the safety importance of each MOV as well as its maintenance and performance history. The surveillance interval should not exceed 5 years or three refueling outages, whichever is longer, unless a longer interval can be justified (see item h.) for any particular MOV.

b. In recognition of the necessity for preplanning, refueling outages that start within 6 months of the date of this letter need not be counted in establishing the schedule to meet the time limits recommended in items i. and j.

Reporting Requirements

Pursuant to 10 CFR 50.54(f), licensees are required to provide information to NRC as outlined in items l. and m. below:

c. Each licensee shall advise the NRC in writing, within 6 months of the date of this letter, that the above schedule and recommendations will be met. For any date that cannot be met, the licensee shall advise the NRC of a revised schedule and provide a technical justification in writing. For any recommendation that it cannot meet or proposes not to meet, the licensee shall inform the NRC and provide a technical justification, including any proposed alternative action, in writing. Each licensee shall also submit, in writing, any future changes to scheduled commitments; for example, changes made on the basis of trending results (see items h. and j.). These revised schedules or alternative actions may be implemented without NRC approval. Justification for the revised schedules and alternative actions should be retained on site.

d. Each licensee shall notify the NRC in writing within 30 days after the actions described in the first paragraph of item i. have been completed.

This generic letter supersedes the recommendations in Bulletin 85-03 and its supplement. Bulletin 85-03 addressees need not make any further responses regarding that bulletin or its supplement. The information that was or would have been submitted to the NRC in response to Bulletin 85-03 or its supplement should be retained in accordance with the recommendations of this generic letter.

Documented results of tests or other surveillances that were used to satisfy the recommended actions of Bulletin 85-03 or the supplement to that bulletin or a voluntary extension of the recommendations in those documents to other MOVs may be used, to the extent applicable, to satisfy the recommendations stated herein.

This request is covered by Office of Management and Budget Clearance Number 3150-0011, which expires December 31, 1989. The estimated average burden hours are 2000 person-hours per licensee response, including assessing the new recommendations, searching data sources, gathering and analyzing the data, and preparing the required letters. These estimated average burden hours pertain only to the identified response-related matters and do not include the time for the actual implementation of the requested actions.

Comments on the accuracy of this estimate and suggestions to reduce the burden may be directed to the Office of Management and Budget, Paperwork Reduction Project (3150-0011), Washington D.C. 20503, and the U.S. Nuclear Regulatory Commission, Records and Reports Management Branch, Office of Information Resources Management, Washington, D.C. 20555.

If you have any questions regarding this matter, please contact the NRC Lead Project Manager Thierry Ross at (301) 492-3016 or the technical contact listed below.

James G. Partlow
Associate Director for Projects
Office of Nuclear Reactor Regulation

Enclosure: Listing of Recently Issued Generic Letters
Technical Contact:
T. Marsh, NRR/EMEB
(301) 492-0902

ATTACHMENT A OF GENERIC LETTER SUMMARY OF COMMON MOTOR-OPERATED VALVE DEFICIENCIES, MISADJUSTMENTS, AND DEGRADED CONDITIONS

1. Incorrect torque switch bypass settings
2. Incorrect torque switch settings
3. Unbalanced torque switch
4. Spring pack gap or incorrect spring pack preload
5. Incorrect stem packing tightness
6. Excessive inertia
7. Loose or tight stem-nut locknut
8. Incorrect limit switch settings
9. Stem wear
10. Bent or broken stem
11. Worn or broken gears
12. Grease problems (hardening, migration into spring pack, lack of grease, excessive grease, contamination, non-specified grease)
13. Motor insulation or rotor degradation
14. Incorrect wire size or degraded wiring
15. Disk/seat binding (includes thermal binding)
16. Water in internal parts or deterioration therefrom
17. Motor undersized (for degraded voltage conditions or other conditions)
18. 18Incorrect valve position indication
19. Misadjustment or failure of handwheel declutch mechanism
20. Relay problems (incorrect relays, dirt in relays, deteriorated relays, miswired relays)
21. Incorrect thermal overload switch settings
22. Worn or broken bearings.
23. Broken or cracked limit switch and torque switch components
24. Missing or modified torque switch limiter plate
25. Improperly sized actuators
26. Hydraulic lockup
27. Incorrect metallic materials for gears, keys, bolts, shafts, etc.
28. Degraded voltage (within design basis)
29. Defective motor control logic
30. Excessive seating or backseating force application
31. Incorrect reassembly or adjustment after maintenance and/or testing
32. Unauthorized modifications or adjustments
33. Torque switch or limit switch binding.

33.June 13, 1990

To: **All Licensees of Operating Nuclear Power Plants and Holders of Construction Permits for Nuclear Power Plants, and Individuals on the Attached Distribution List**

Subject: **SUPPLEMENT 1 TO GENERIC LETTER 89-10: RESULTS OF THE PUBLIC WORKSHOPS**

In September 1989, the NRC staff held three public workshops to discuss Generic Letter 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance." This generic letter, issued on June 28, 1989, requests holders of nuclear power plant operating licenses and construction permits to establish a program to provide for the testing, inspection, and maintenance of safety-related motor-operated valves (MOVs) and certain other MOVs in safety-related systems. Attached for the use of licensees and construction permit holders are the results of the public workshops.

This supplement to Generic Letter 89-10 includes the opening remarks by NRC representatives and the responses provided by the NRC staff to all significant questions. These responses reflect the best information currently available to the staff from research and operating experience regarding the operability of MOVs under design-basis conditions. For example, the staff believes that, at the present time, the most reliable means of demonstrating operability of an MOV under design-basis conditions is to perform a test of the MOV in situ under those conditions. Such testing in situ, however, will not be practicable for some MOVs within the scope of Generic Letter 89-10. For those instances, the staff indicated in the generic letter that alternatives to testing the MOV in situ may be developed by the licensee or permit holder. The staff discussed several possible alternatives at the workshops, including potential problems and limitations associated with those alternatives, and various factors that should be considered when a licensee or permit holder intends to use one of those alternatives.

This generic letter supplement has been prepared to assist licensees and permit holders in developing programs that will provide assurance of MOV operability under design-basis conditions. Because the workshops were held to answer specific questions on the generic letter, the supplement does not contain all of the information necessary to develop and implement such programs. Therefore, licensees and permit holders, together with the Nuclear Management and Resources Council (NUMARC), should coordinate their efforts in developing and implementing MOV programs. In this regard, NUMARC is preparing guidelines for use by licensees and permit holders in implementing the generic letter. NUMARC is also working with the Electric Power Research Institute to establish a research program aimed, in part, at determining the relationship between MOV performance characteristics. The NRC staff will also provide the industry with additional information on MOV operability as it becomes available.

Licensees and permit holders should review the entire package because the staff guidance in the generic letter supplement should be considered in the context of all questions and responses. This supplement has been approved in accordance with NRC procedures for generic guidance and reflects the current staff positions concerning the implementation of the generic letter. Staff positions expanded, clarified, or modified following the workshops are identified in the supplement. For example, the staff position on the scope of the generic

letter, provided in the response to Question 3, has been modified with respect to dampers and other MOVs not located in piping systems. In addition, as discussed in the response to Question 9, the prevention of inadvertent MOV operation within the context of the generic letter has been limited to the potential for MOV mispositioning from the control room.

As a result of operating experience and research results, the NRC staff determined that MOV tests beyond those acceptable in the past are necessary to satisfy the NRC regulations. This determination constitutes backfitting. Consequently, the staff guidance in Generic Letter 89-10 contains provisions that were approved as backfits. Those provisions include MOV testing beyond Section XI of the ASME Boiler and Pressure Vessel Code; consideration of the operability of position-changeable MOVs located in safety-related systems; testing of MOVs under design-basis conditions, where practicable, because of uncertainties regarding industry sizing equations, and the extrapolation and application of MOV test data; preparation or revision of procedures to ensure correct MOV switch settings; and maintenance of records of test methods, MOV failures, and corrective action (including trending). In hindsight, the discussion in the generic letter should have referenced 10 CFR 50.109 and also should have stated that licensees and construction permit holders were required to advise the NRC "if" the provisions of the generic letter would be met. Nevertheless, the staff considers Generic Letter 89-10 to be a backfit and prepared the generic letter in accordance with NRC procedures for the issuance of staff guidance containing backfit provisions.Please direct questions or comments regarding this generic letter supplement to the appropriate NRC project manager.

James G. Partlow
Associate Director for Projects
Office of Nuclear Reactor Regulation

Enclosure: As stated

August 3, 1990

To: **All Licensees of Operating Nuclear Power Plants and Holders of Construction Permits for Nuclear Power Plants**

Subject: **SUPPLEMENT 2 TO GENERIC LETTER 89-10: "AVAILABILITY OF PROGRAM DESCRIPTIONS"**

On June 28, 1989, the U.S. Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," recommending that holders of nuclear power plant operating licenses and construction permits establish a program to provide for the testing, inspection, and maintenance of safety-related motor-operated valves (MOVs) and certain other MOVs in safety-related systems. In GL 89-10, licensees were requested to have a description and schedule for their program in response to the generic letter available on site for NRC review by June 28, 1990, or the first refueling outage after December 28, 1989, whichever was later. Holders of construction permits were requested to have the program description and schedule available by June 28, 1990, or before the operating license is issued, whichever was later.

On June 13, 1990, the NRC issued Supplement 1 to GL 89-10. The supplement forwards staff responses to questions addressed during the 1989 MOV Workshops. Supplement 1 provides a significant amount of information regarding the implementation of MOV programs in response to the generic letter. The staff encourages licensees and permit holders to review that information and modify their programs as appropriate. Because of the amount of effort required to be expended on MOVs, the staff has decided to delay commencement of onsite inspections for 6 months to allow licensees time to incorporate the information provided by Supplement l to GL 89-10 into their MOV programs. Therefore, licensees and permit holders need not have MOV program descriptions available onsite until at least January 1, 1991. The staff may audit a few facilities before that date to obtain information regarding the licensees' progress in developing their programs. Licensees or permit holders need not specifically request to extend the date for program description availability to January 1, 1991.

The schedule requested in the first paragraph of item i (and item k) of GL 89-10 for completing recommended actions a through h of the generic letter by June 28, 1994, or three refueling outages after December 28, 1989 (or operating license issuance for construction permit holders), whichever is later, remains unchanged. Please contact your project manager when your program description is available on site for review.

Sincerely,

James G. Partlow
Associate Director for Projects
Office of Nuclear Reactor Regulation

To: All Licensees of Operating Nuclear Power Plants and Holders of Construction Permits for Nuclear Power Plants

Subject: **GENERIC LETTER 89-10, SUPPLEMENT 3, "CONSIDERATION OF THE RESULTS OF NRC-SPONSORED TESTS OF MOTOR-OPERATED VALVES"**

Background

In Generic Letter 89-10 (June 28, 1989), "Safety-Related Motor-Operated Valve Testing and Surveillance," the staff of the U.S. Nuclear Regulatory Commission (NRC) requested holders of operating licenses and construction permits to establish a program to provide for the testing, inspection, and maintenance of safety-related motor-operated valves (MOVs) and certain other MOVs in safety-related systems. Supplement 1 to Generic Letter 89-10 (June 13, 1990) provides the results of public workshops held to discuss the generic letter and to answer questions on the staff positions regarding its implementation. In Supplement 2 (August 3, 1990) the NRC staff stated that inspections of program descriptions would not commence until January 1, 1991, and, thus, the program descriptions need not be available on site until that date.

In parallel with the NRC staff's activities leading to Generic Letter 89-10, the staff performed tests of MOVs as part of an ongoing research effort. The tests were conducted on 6-inch and 10-inch gate valves typically used to provide containment isolation in the steam supply lines of the High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) systems, and in the supply line for the Reactor Water Cleanup (RWCU) system at boiling water reactor (BWR) nuclear power plants. On June 5, 1990, the staff issued Information Notice 90-40, "Results of NRC-Sponsored Testing of Motor-Operated Valves." As discussed in Information Notice 90-40, the NRC-sponsored tests revealed that, regardless of fluid conditions, the tested valves required more thrust for opening and closing under various differential pressure and flow conditions than would have been predicted from standard industry calculations using typical friction factors. Thus, although the NRC-sponsored tests focused on the HPCI, RCIC and RWCU containment isolation valves at BWR plants, the information obtained from those tests may be applicable to valves used in other systems at BWR and pressurized water reactor (PWR) plants. For example, calculations using low valve friction factors may underestimate thrust requirements for opening and closing valves.

In response to a staff request, the BWR Owners' Group obtained information from the BWR licensees regarding the capability of MOVs used to provide containment isolation in the steam lines of the HPCI and RCIC systems, and in the supply line of the RWCU system. The staff's review of the NRC-sponsored test results and the MOV data provided by the BWR Owners' Group indicates that deficiencies might exist in those MOVs.

Discussion

In Generic Letter 89-10, the NRC staff requested that licensees and construction permit holders complete the programs established in response to the generic letter (excluding the periodic verification of MOV switch settings) by June 28, 1994, or within 3 refueling outages after December 28, 1989 (or operating license issuance for construction permit holders), whichever is later. While recommending that licensees and permit holders consider the safety significance of MOVs in developing their programs, the staff did not have sufficient information at that time to recommend that licensees and permit holders establish any particular priority for MOVs within the generic letter program. The information recently obtained from the NRC-sponsored tests, however, may affect the priorities being established by licensees and permit holders for implementing their generic letter programs. From its evaluation of the MOV data provided by the BWR Owners' Group and the results of the NRC-sponsored tests, the staff has determined that correction of any deficiencies in the HPCI, RCIC and RWCU MOVs described herein need to be given high priority in the implementation of generic letter programs. While such deficiencies may not need to be corrected immediately, the staff has determined by means of a safety assessment (Enclosure 1) that any MOV deficiencies should be corrected within 18 months or by the end of the first refueling outage, following issuance of this generic letter supplement, whichever is later. The staff's review of a generic safety assessment performed by the BWR Owners' Group (Enclosure 2) confirmed that this time period is acceptable for correcting any deficiencies in those MOVs. If a BWR licensee believes that there are MOVs with potential deficiencies at its facility that have greater safety significance than the HPCI, RCIC, and RWCU MOVs described herein, the licensee should determine the appropriate priority for completing the generic letter program for those valves.

Requested Actions

BWR licensees are requested to assess the applicability of the data from the NRC-sponsored MOV tests, to determine the “as-is” capability of the HPCI, RCIC, and RWCU MOVs described herein, and to identify any deficiencies in those MOVs. Where applicable, BWR licensees should also evaluate the MOVs used for containment isolation in lines to the isolation condensers. Elements that a BWR licensee may consider in determining whether the NRC-sponsored test data are inapplicable to its HPCI, RCIC and RWCU MOVs include valve size, type and manufacturer; disk type; design-basis differential pressure and flow conditions; internal dimensions and clearances; and disk and guide surface materials.

BWR licensees are requested to perform a plant-specific safety assessment to verify that the generic safety assessments performed by the NRC staff and the BWR Owners' Group are applicable. In performing the plant-specific safety assessment, BWR licensees should address factors such as consideration of functional valve test results; operating procedures and emergency operating procedures; the conduct of training; current torque switch bypass settings including the potential for motor overload on a first attempt to close the valve; leak detection capabilities; inspection programs for erosion-corrosion and intergranular stress corrosion cracking (including response to Generic Letter 88-01, “NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping”); water-hammer prevention practices; the environmental qualification of the MOVs and other nearby equipment; radiological consequences both on and off the plant site that could result from a pipe leak or break; and probabilistic risk considerations. Where applicable, BWR licensees should include in their plant-

specific safety assessments MOVs used for containment isolation in lines to the isolation condensers. If a BWR licensee believes that there are MOVs with potential deficiencies at its facility that have greater safety significance than the HPCI, RCIC and RWCU MOVs (and the MOVs in the isolation condenser lines) described herein, the licensee should justify as part of its plant-specific safety assessment the prioritization of its effort to identify and correct MOV deficiencies. BWR licensees should consider the implementation of short-term corrective actions. For example, BWR licensees should evaluate the feasibility of increasing torque switch settings where the motor, actuator, and valve are designed to accommodate such an increase. BWR licensees should develop procedures and provide training for plant personnel to respond to a pipe leak or break in a line containing a deficient MOV, particularly if the deficiency cannot be corrected in the short term.

BWR licensees may accomplish these recommendations as part of an accelerated response to Generic Letter 89-10 for the applicable MOVs. For example, BWR licensees could complete the design-basis reviews for those MOVs and could establish torque switch settings as described in Recommended Actions a and b of the generic letter, respectively. Recommended Action c of the generic letter requests that the MOVs be tested in situ under design-basis differential pressure and flow conditions, where practicable. For those instances where design-basis testing in situ is not practicable and an alternative to such testing cannot be justified at this time, the staff recommends that the BWR licensee use the "two-stage" approach discussed in Generic Letter 89-10 and Supplement 1. Following that approach, the BWR licensee would determine the operating requirements of the MOV using the best data currently available and then obtain applicable data as soon as possible.

While the reporting requirements below are addressed to BWR licensees, all licensees and construction permit holders should consider the applicability of the information obtained from the MOV tests and the staff evaluation of the test results to other MOVs within the scope of Generic Letter 89-10. In addition, all licensees and permit holders should consider this information in the development of priorities for implementing the generic letter program.

Reporting Requirements

In order for the NRC to determine whether any BWR operating licenses should be modified, suspended or revoked, BWR licensees shall provide written information, signed under oath or affirmation pursuant to Section 182 of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f), as follows:

1. Within 30 days of the receipt of this letter, BWR licensees shall notify the NRC staff that a plant-specific safety assessment report addressing, as a minimum, the factors described herein, is available on site for staff review. BWR licensees shall also notify the NRC staff whether they believe that there are MOVs with deficiencies of greater safety significance than the MOVs used to provide containment isolation in the steam supply lines of the HPCI and RCIC systems, in the supply line of the RWCU system, and in the line to the isolation condenser.

   (1) Within 120 days of the receipt of this letter, BWR licensees shall provide to the NRC staff the following:

   a. Criteria, reflecting operating experience and the latest test data, that were applied in determining whether deficiencies exist in the HPCI, RCIC and RWCU MOVs described

herein, in the MOVs in isolation condenser lines, and in any MOVs considered to be more safety significant, as applicable;

b. The identification of any MOVs found to have deficiencies; and

c. A schedule for any necessary corrective action.

(1) Subsequent to the determination of necessary corrective actions or the establishment of the schedule for completion of those actions, BWR licensees shall inform the NRC staff of any changes to the planned actions or schedule.

As noted above, based on the generic safety assessments prepared by the NRC staff and the BWR Owners' Group, the staff believes that justification exists for individual plants to which those safety assessments are applicable to take 18 months or to the end of the first refueling outage, following issuance of this generic letter supplement, whichever is later, to resolve any deficiencies in the HPCI, RCIC and RWCU MOVs described herein. However, if a BWR licensee determines that a more limited time is mandated by its plant-specific safety assessment, the licensee should utilize the more restrictive time. If additional time is needed to complete the corrective actions, BWR licensees should submit the plant-specific safety assessment and obtain staff approval for the corrective action schedule.

Backfit Discussion

Based on operating experience and research results, the staff determined several years ago that MOV tests beyond those previously acceptable are necessary to satisfy the NRC regulations. As that determination constituted a backfit, the staff prepared Generic Letter 89-10 in accordance with NRC procedures for the issuance of staff guidance containing backfit provisions. Supplement 3 represents a further backfit in that the staff is requesting BWR licensees to advance the schedule for Generic Letter89-10 with respect to specific MOVs at BWR plants. This limited advancement of the Generic Letter 89-10 schedule is the result of the information obtained from NRC-sponsored MOV tests indicating that deficiencies might exist in certain MOVs installed to perform containment isolation functions at BWR plants. The staff has determined that the issuance of Supplement 3 to Generic Letter 89-10 is necessary to provide confidence that BWR facilities are in compliance with their safety analyses and NRC regulations such as described in 10 CFR Part 50, Appendix A, Criteria 54 and 55. More specifically, because deficiencies might exist in the MOVs described herein, the staff does not have adequate confidence that (1) as required by Criterion 54, the applicable piping systems which penetrate containment have been provided with leak detection, isolation, and containment capabilities having redundancy, reliability, and performance capabilities which reflect the importance to safety of isolating these piping systems, or have been designed with the capability to test periodically the operability of the isolation valves and associated apparatus or (2) as required by Criterion 55, appropriate requirements, such as higher quality in design, fabrication, and testing, to minimize the probability or consequences of an accidental rupture of lines which are part of the reactor coolant pressure boundary and penetrate reactor containment have been provided as necessary to assure adequate safety. Therefore, the staff has determined that the backfit provisions of this generic letter supplement are justified under 10 CFR 50.109(a)(4)(i). Based on its safety assessment, the staff determined that no immediate corrective actions are needed and that BWR licensees may proceed to resolve any deficiencies in the MOVs described herein as recommended in this letter.

This request is covered by Office of Management and Budget Clearance Number 3150-0011, which expires December 31, 1991. The estimated average burden hours are 150 person-hours per licensee response, including assessment of the new recommendations, searching data sources, gathering and analyzing the data, performing data evaluations, and preparing the required letters. (These estimated average burden hours pertain only to the identified response-related matters and do not include the time for actual implementation of the requested action.) 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, Division of Information Support Services, Office of Information Management, U.S. Nuclear Regulatory Commission, Washington, D.C., 20555; and to the Paperwork Reduction Project (3150-0011), Office of Management and Budget, Washington, D.C. 20503.

James G. Partlow
Associate Director for Projects
Office of Nuclear Reactor Regulation

February 12, 1992

To: **All Licensees of Operating Nuclear Power Plants and Holders of Construction Permits for Nuclear Power Plants**

Subject: **GENERIC LETTER 89-10, SUPPLEMENT 4, "CONSIDERATION OF VALVE MISPOSITIONING IN BOILING WATER REACTORS"**

In Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve (MOV) Testing and Surveillance," the staff recommended, among other things, that any MOV in a safety-related system that is not blocked from inadvertent operation from either the control room, the motor control center, or the valve itself be considered capable of being mispositioned (referred to as position-changeable MOVs) and be included in licensees' MOV programs. When determining the maximum differential pressure or flow for position- changeable MOVs, the licensee should consider the fact that the MOV must be able to recover from mispositioning. Supplement 1 to GL 89-10 limited the prevention of inadvertent MOV operation within the context of the generic letter to the potential for MOV mispositioning from the control room.

The Boiling Water Reactors Owners' Group (BWROG) submitted a backfit appeal on the recommendations for position-changeable valves. The staff, with the assistance of Brookhaven National Laboratory (BNL), has reviewed and evaluated the issues concerning mispositioning of valves from the control room and has determined that the recommendations in GL 89-10 should be changed for boiling water reactors (BWRs). The BNL study, which used probabilistic risk assessment techniques, and the staff's evaluation were included in a letter from NRC to the BWROG dated this same date. The staff no longer considers the recommendations for inadvertent operation of MOVs from the control room to be within the scope of GL 89-10 for BWRs. However, the staff believes that consideration of valve mispositioning benefits safety.

Modifying the provisions in GL 89-10 for valve mispositioning does not affect the GL 89-10 provisions for licensees to review safety analyses, emergency procedures, and other plant documentation to determine the design basis[4] fluid conditions under which all MOVs in safety-related piping systems may intentionally be called upon to function. This position also does not supersede the NRC's generic recommendations or regulations on valve mispositioning that pertain to other issues such as intersystem loss-of-coolant accidents (ISLOCA) or fire protection (10 CFR 50, Appendix R).

This modification to the recommendations addresses only BWR plants. The NRC will perform a similar review for pressurized water reactors (PWR). The NRC staff will review results of the PWR study and may revise GL 89-10, if warranted, appropriately to clarify the NRC's position regarding consideration of valve mispositioning within the scope of GL 89-10 for PWRs. The BWROG may complete the design basis reviews consistent with the position herein.

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[4]. Design basis conditions are those conditions during both normal operation and abnormal events that are within the design basis of the plant.

This generic letter contains no information collection requirements and therefore is not subject to the requirements of the Paperwork Reduction Act of 1980 (44 U.S.C. 3501 et seq.).

James G. Partlow
Associate Director for Projects

Office of Nuclear Reactor Regulation

June 28, 1993

To: **All Licensees of Operating Nuclear Power Plants and Holders of Construction Permits for Nuclear Power Plants**

Subject: **GENERIC LETTER 89-10, SUPPLEMENT 5, "INACCURACY OF MOTOR-OPERATED VALVE DIAGNOSTIC EQUIPMENT"**

Background

In Generic Letter (GL) 89-10 (June 28, 1989), "Safety-Related Motor-Operated Valve Testing and Surveillance," the NRC staff requested holders of operating licenses and construction permits for nuclear power plants to provide additional assurance of the capability of safety-related motor-operated valves (MOVs) and certain other 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 NRC staff issued several supplements to GL 89-10 to clarify or modify its recommendations.

As an integral part of their GL 89-10 programs, most licensees are relying on MOV diagnostic equipment to provide information on the thrust required to open or close the valve as well as the thrust delivered by the motor actuator. The various types of MOV diagnostic equipment estimate stem thrust using different parameters, such as spring pack displacement or strain in the stem, mounting bolts, or yoke. Because some licensees make decisions regarding the operability of safety-related MOVs based on diagnostic equipment thrust readings, the use of MOV diagnostic equipment can have a significant effect on the safe operation of a nuclear power plant.

Discussion

The NRC staff has recently become aware of new information on the accuracy of MOV diagnostic equipment. This new information raises a generic concern regarding the reliability of the data provided by MOV diagnostic equipment. For example, the MOV Users Group (MUG) of nuclear power plant licensees on February 3, 1992, released "Final Report - MUG Validation Testing as Performed at Idaho National Engineering Laboratories" (Volume 1). The MUG final report indicates that the MOV diagnostic equipment that relied on spring pack displacement to estimate stem thrust did not meet the accuracy claims of its vendors. In addition, the NRC staff has been informed of increased inaccuracy of specific MOV diagnostic equipment that relies on valve yoke strain to estimate stem thrust.

On March 2, 1992, the NRC staff held a public meeting with representatives of ITI-MOVATS to discuss the accuracy of the ITI-MOVATS thrust measuring device (TMD) to estimate stem thrust on the basis of spring pack displacement. At this meeting, the representatives of ITI-MOVATS indicated that the results of their field validation program showed that the inaccuracy of the TMD may be larger than licensees had assumed in some instances. The ITI-MOVATS representatives also discussed the results of their activities to resolve concerns regarding the fact that the TMD is calibrated in the valve opening direction, although it also is used to predict the thrust delivered by the actuator in the valve closing direction. ITI-MOVATS prepared Engineering Report

5.2 (March 13, 1992) to provide guidance to its licensee customers for evaluating the capability of an MOV to perform its safety function under design-basis conditions in light of the increased inaccuracy of the TMD. The Nuclear Management and Resources Council (NUMARC) has developed guidelines for licensees to use in evaluating individual MOVs that had been verified as properly sized and set, using MOV diagnostic equipment manufactured by ITI-MOVATS that relies on spring pack displacement to estimate stem thrust. Subject to comments provided to NUMARC on May 12, 1992, the NRC staff considers the NUMARC guidelines to contain an acceptable approach for addressing the uncertainty resulting from the use of the ITI-MOVATS TMD.

ABB-Impell manufactures MOV diagnostic equipment that relies on spring pack displacement to estimate stem thrust. Following the release of the MUG report, Impell representatives stated that they would be working with their licensee customers to develop new accuracy values. The NRC staff has not reviewed any guidance by Impell to address the new information on MOV diagnostic equipment inaccuracy.

Liberty Technologies has manufactured MOV diagnostic equipment, referred to as valve operation test and evaluation system (VOTES), that estimates the thrust needed to open or close a valve on the basis of strain of the valve yoke. The VOTES equipment derives thrust from yoke strain that has been calibrated to stem thrust using measured diametral strain of the valve stem and nominal engineering material properties. On October 2, 1992, Liberty Technologies notified the NRC, in accordance with 10 CFR Part 21, that it had determined that two new factors can affect the thrust values obtained with its VOTES equipment. Those factors involve (1) the possible use of improper stem material constants and (2) the failure to account for a torque effect when the equipment is calibrated by measuring strain of the threaded portion of a valve stem. In its October 2 submittal, Liberty Technologies provides guidance to licensees for correcting the thrust data by hand calculations and states that its new Software Version 2.3 will assist in performing the corrections. The staff has not evaluated guidance provided to licensees by Liberty Technologies to address the increased inaccuracy of its MOV diagnostic equipment.

GL 91-18, “Information to Licensees Regarding Two NRC Inspection Manual Sections on Resolution of Degraded and Nonconforming Conditions and Operability,” contains information on guidance provided to NRC inspectors in the area of operability of safety-related components. If an MOV is determined to be inoperable, the licensee will be expected to satisfy the requirements of the NRC regulations and plant technical specifications.

Requested Actions

- On the basis of the new information on MOV diagnostic equipment inaccuracy discussed in this letter, licensees are requested to reexamine their MOV programs and to identify measures taken or planned to account for uncertainties in properly setting valve operating thrust to ensure operability. Licensees should not limit their evaluation to only the specific examples of increased inaccuracy of MOV diagnostic equipment provided in the Discussion section of this GL supplement, but should consider any information reasonably available to them.

- Licensees are requested to evaluate the schedule necessary (a) to consider the new information on MOV diagnostic equipment inaccuracy and (b) to respond to that information.

Reporting Requirements

- Pursuant to section 182a of the Atomic Energy Act of 1954, as amended, 10 CFR 50.54(f) and 10 CFR 2.204, each addressee is required to submit a written response providing the information described below. The response shall be addressed to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555, under oath or affirmation. A copy shall also be submitted to the appropriate regional administrator. This generic letter supplement requires information that will enable the NRC to verify whether the licensee is evaluating new information on the accuracy of MOV diagnostic equipment. This information will enable the Commission to determine whether or not any license should be modified, suspended or revoked.

  Within 90 days of receipt of this letter, all licensees are required to notify the NRC staff of the diagnostic equipment used to confirm the proper size, or to establish settings, for MOVs within the scope of GL 89-10

  Within 90 days of receipt of this letter, licensees are required to report whether they have taken actions or plan to take actions (including schedule and summary of actions taken or planned) to address the information on the accuracy of MOV diagnostic equipment.

Backfit Discussion

The NRC staff has determined that the actions requested in this generic letter supplement are necessary to provide confidence that nuclear power facilities are in compliance with their safety analyses and Criterion XI, "Test Control," of Appendix B to 10 CFR Part 50, which requires that test procedures include provisions for ensuring that adequate test instrumentation is available. Therefore, the NRC staff has determined that this generic letter supplement is exempt from the requirements for preparation of a backfit analysis under 10 CFR 50.109(a)(4)(i).

The NRC published a proposed version of this generic letter supplement for public comment in the Federal Register on July 8, 1992. The NRC staff response to each public comment received on the proposed generic letter supplement is being placed in the NRC Public Document Room. The accession number for this document is 9306010155.

Paperwork Reduction Act Statement

This generic letter contains information collection requirements that are subject to the Paperwork Reduction Act of 1980 (44 U.S.C. 3501 et seq.). These requirements were approved by the Office of Management and Budget, approval number 3150-0011.

The public reporting burden for this collection of information is estimated to average 150 hours per licensee 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 further reducing this burden, to the Information and Records Management Branch (MNBB-7714), U.S. Nuclear Regulatory Commission, Washington, D.C., 20555; and to 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 the NRC in evaluating the cost of complying with this generic letter supplement:

The licensee's time and costs to perform requested inspections, corrective actions, and associated testing

The licensee's time and costs to prepare the requested reports and documentation

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

An estimate of the additional long-term costs that 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 contacts listed below or the appropriate Office of Nuclear Reactor Regulation project manager.

Sincerely,
Orig /s/'d by JGPartlow
James G. Partlow
Associate Director for Projects
Office of Nuclear Reactor Regulation

Enclosure: List of Recently Issued NRC Generic Letters
Technical Contact:
Thomas G. Scarbrough
(301) 504-2794
Lead Project Manager:
Anthony T. Gody, Jr.
(301) 504-1387
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.

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:

The completion status of the licensee's GL 89-10 program as of the current commitment date

(1) 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

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

(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 l 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
    - (1) 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
    - (2) Diagnostic testing of each MOV in the group under at least static conditions
    - (3) 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
    - (4) Validation of design-basis assumptions for all MOVs in the group based on benchmarked data
    - (5) 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
    - (6) 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

(1) 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
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. Letter 89-10, Supp. 6 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
   (1) The licensee staff time and costs to prepare requested reports and documentation
   (2) 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
   (3) 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,
/s/'d by Luis A. Reyes

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

Technical Contact:
Thomas G. Scarbrough
(301) 504-2794
Lead Project Manager:

Enclosure 1

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.

(1) 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:

Method One: 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.

Method Two: 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.

(1)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.

January 24, 1996

To: **All Holders of Operating Licenses (Except Those Licenses that have been Amended to a Possession Only Status) or Construction Permits for Nuclear Power Reactors**

Subject: **NRC GENERIC LETTER 89-10, SUPPLEMENT 7: CONSIDERATION OF VALVE MISPOSITIONING IN PRESSURIZED-WATER REACTORS**

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this generic letter supplement to notify addressees about a revised NRC position regarding consideration of valve mispositioning within the scope of Generic Letter (GL) 89-10 for pressurized-water reactors (PWRs). Although this generic letter supplement forwards a new staff position, no specific action or written response is required.

Background

In GL 89-10 (June 28, 1989), Safety-Related Motor-Operated Valve Testing and Surveillance, the staff recommended, among other things, that any motor-operated valve (MOV) in a safety-related system that is not blocked from inadvertent operation from the control room, the motor control center, or the valve itself, be considered capable of being mispositioned (referred to as position-changeable MOVs) and be included in licensee MOV programs. When determining the maximum differential pressure or flow for position-changeable MOVs, the licensees were asked to consider "the fact that the MOV must be able to recover from mispositioning ..." Supplement 1 to GL 89-10 limited the prevention of inadvertent MOV operation within the context of the generic letter to the potential for MOV mispositioning from the control room.

The Boiling Water Reactor Owners Group (BWROG) submitted a backfit appeal on the recommendations for position-changeable valves. The staff, with the assistance of Brookhaven National Laboratory (BNL), reviewed and evaluated the issues concerning the mispositioning of valves from the control room and determined that the recommendations in GL 89-10 should be changed for BWRs. The BNL study, which used probabilistic risk assessment (PRA) techniques, and the NRC staff evaluation and conclusions were transmitted in a letter from the

NRC to the BWROG dated February 12, 1992. The conclusions were communicated to industry and the public at large via Supplement 4 to GL 89-10, also dated February 12, 1992. Supplement 4 indicated that the NRC would perform a similar review for PWRs and stated that GL 89-10 might be revised, if warranted, to clarify the NRC position regarding consideration of MOV mispositioning within the scope of GL 89-10 for PWRs.

Description of Circumstances

By letter dated July 21, 1992, the Westinghouse Owners Group (WOG) asked the NRC staff to notify PWR licensees that the provisions of GL 89-10 for valve mispositioning are not applicable to PWRs, based on arguments similar to those made by the BWROG.

Discussion

Under contract to the NRC staff, BNL performed a study similar to the one performed for BWRs of the safety significance of inadvertent operation of MOVs in safety-related piping systems of three PWRs. Consistent with Supplement 1 to GL 89-10, the scope of the study was limited to MOVs in safety-related systems that could be mispositioned from the control room. However, because the available PRA models do not include active mispositioning of MOVs or the physical phenomena that could inhibit repositioning, BNL's study of available plant models was limited in its ability to address this issue. Given this limited scope, BNL concluded that the risk insights from the mispositioning of unlocked MOVs were similar for both PWRs and BWRs. Although PWRs tend to have a higher core damage frequency (CDF) than BWRs, which would suggest that the net increase in CDF from mispositioning of MOVs would be higher for PWRs than for BWRs, PWRs typically have a lower conditional containment failure probability, which would tend to balance the overall risk to the public.

The NRC is removing the recommendation that MOV mispositioning be considered by PWR licensees in responding to GL 89-10, as was done for BWR licensees in Supplement 4, in light of the following:

- Corrective actions have been taken by licensees subsequent to the Davis-Besse event (i.e., detailed control room design reviews, independent valve position verification programs, and operator training improvements),
- Corrective actions are being applied to many of the most important valves under the other provisions of GL 89-10,
- Other operational events are absent (other than Davis-Besse) in which mispositioning MOVs from the control room actually set up conditions that prevented repositioning, and
- The results of the BNL study for PWRs.

Implementation of this relaxation by licensees is voluntary.

Staff Position

The staff no longer considers the inadvertent operation of MOVs from the control room to be within the scope of GL 89-10 for PWRs. However, the staff believes that consideration of valve mispositioning benefits safety.

Licensees that have already taken action or made commitments related to valve mispositioning may take advantage of this relaxed staff position provided the licensees document this change in their GL 89-10 programs.

Modifying the provisions in GL 89-10 for valve mispositioning does not affect the GL 89-10 recommendations for licensees to review safety analyses, emergency procedures, and other plant documentation to determine the design-basis[5] fluid conditions under which all MOVs in safety-related

[5]. Design-basis conditions are those conditions during both normal operation and abnormal events that are within the design basis of the plant.

piping systems may be called upon to function. This position also does not supersede the NRC generic recommendations or regulations on valve mispositioning that pertain to such other issues as interfacing-systems loss-of-coolant accidents (ISLOCAs) or fire protection (10 CFR Part 50, Appendix R).

Backfit Discussion

This letter represents a relaxation of recommendations set forth in GL 89-10 and prior supplements. Implementation of this relaxation is voluntary and this generic letter supplement requests neither actions nor information from licensees. Therefore, this generic letter supplement is not considered a backfit and the staff has not performed a backfit analysis.

Federal Register Notification

The proposed generic letter supplement was published in the *Federal Register* for a 30-day public comment period on July 26, 1995. Four comments were received (from Nuclear Energy Institute, Florida Power Corporation, Centerior Energy, and Virginia Power). All four comments supported issuance of the generic letter supplement as written. Centerior Energy also suggested that the supplement clarify how licensees should administratively handle any commitments they might have made related to valve mispositioning. This comment was accepted and is incorporated in the staff position section of this supplement.

This generic letter requires no specific action or written response. If you have any questions about this matter, please contact the technical contact listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

signed by
Dennis M. Crutchfield, Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation
Technical Contact:
David C. Fischer, NRR
(301) 415-2728
Internet:dcf@nrc.gov
Lead Project Manager:
Allen G. Hansen, NRR