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

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] 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 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.

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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 (i) the integrity of the reactor coolant pressure boundary, (ii) the capability to shut down the reactor and maintain it in a safe shutdown condition, and (iii) 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 foonote 1. The design bases for each plant are those documented in pertinent licensee submittals such as the final safety analysis report.

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] indicate that some MOVs may be subjected to mechanisms and loads that were not accounted for previously. INEL'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 INEL'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 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.

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[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.

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

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

j. 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.

k. 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:

l. 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.

m. 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

ENCLOSURE

LIST OF RECENTLY ISSUED GENERIC LETTERS

Generic Letter No.	Subject	Date of Issuance	Issued To
89-09	ASME SECTION III COMPONENT REPLACEMENTS	5/8/89	ALL HOLDERS OF LIGHT WATER REACTOR OPERATING LICENSES
89-08	ISSUANCE OF GENERIC LETTER 89-08: EROSION/CORROSION - INDUCED PIPE WALL THINNING - 10 CFR §50.54(f)	5/2/89	LICENSEES TO ALL POWER REACTORS, BWRS, PWRS, AND VENDORS IN ADDITION TO GENERAL CODES APPLICABLE TO GENERIC LETTERS
89-07	GENERIC LETTER 89-07, POWER REACTOR SAFEGUARDS CONTINGENCY PLANNING FOR SURFACE VEHICLE BOMBS	4/28/89	LICENSEES TO ALL BWRS, PWRS, AND VENDORS IN ADDITION TO GENERAL CODES APPLICABLE TO GENERIC LETTERS
89-06	TASK ACTION PLAN ITEM I.D.2 - SAFETY PARAMETER DISPLAY SYSTEM - 10 CFR §50.54(f)	4/12/89	LICENSEES OF ALL POWER REACTORS, BWRS, PWRS, HTGR, AND NSSS VENDORS IN ADDITION TO GENERAL CODES APPLICABLE TO GENERIC LETTERS
89-05	PILOT TESTING OF THE FUNDAMENTALS EXAMINATION	4/4/89	LICENSSES OF ALL POWER REACTORS AND APPLICANTS FOR A REACTOR OPERATOR'S LICENSE UNDER 10 CFR PART 55
89-04	GUIDANCE ON DEVELOPING ACCEPTABLE INSERVICE TESTING PROGRAMS	4/3/89	ALL HOLDERS OF LIGHT WATER REACTOR OPERATING LICENSES AND CONSTRUCTION PERMITS
89-03	OPERATOR LICENSING NATIONAL EXAMINATION SCHEDULE	3/24/89	ALL POWER REACTOR LICENSEES AND APPLICANTS FOR AN OPERATING LICENSE

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. Incorrect 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.