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REGION I

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Waterford, Connecticut

FACILITY: Millstone Nuclear Power Station, Unit 3

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EXECUTIVE SUMMARY

Millstone Unit 3 MOV Inspection 95-17

Effective management oversight of the program for Generic Letter (GL) 89-10, "Safety Related Motor-Operated Valve Testing and Surveillance," was evident in the technical areas needed for program closure. Test data provided an adequate basis to conclude that the safety-related motor operated valves (MOVs) would perform their intended safety functions under worst-case design-basis conditions. With the exception of open items regarding certain program assumptions, the GL 89-10 program at Millstone 3 was considered by the NRC to be completed.

The commissioning of Kalsi Engineering, Inc. to provide valve factor information for non-dynamically tested valves was a noteworthy initiative. Program instructions and motor-operated valve (MOV) maintenance procedures were high quality. The independent oversight of the GL 89-10 program by the Quality Assurance organization was acceptable.

Program assumptions pertaining to load sensitive behavior, stem friction coefficients, extrapolation of test data, and valve lubrication degradation were not completed (viz. technically justified), but were found to be acceptable provisionally. Valve factor information from Kalsi Engineering was not wholly assimilated, and many design-basis calculations for non-testable valves remained to be adjusted for various uncertainties.

Corrective actions were untimely and incomplete regarding the potential for hydraulic locking of valve actuator spring packs and problems associated with Melamine torque and limit switch components. These examples indicate weaknesses in the use and disposition of industry experience, and are characterized as an unresolved item (95-17-08). In addition, estimation of MOV actuator output capability using stall torque derived from generic motor curves was nonconservative and contrary to vendor guidelines. A procedure adherence violation concerning administration of the preventive maintenance program was not cited, and an unresolved item regarding MOV motor brakes was closed.

Thorough pressure locking and thermal binding susceptibility evaluations were performed and, with one exception, corrective actions were adequate. A plant design change which substituted compensatory actions within the primary containment (following certain design-basis events) for manual valve operation from the control room was found to be unacceptable. Subsequent valve actuator capability calculations rendered the change unnecessary.

DETAILS

1.0 INTRODUCTION

On June 28, 1989, the NRC issued Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," requesting licensees to establish a program to ensure that switch settings for safety-related motor-operated valves (MOVs) were selected, set, and maintained properly. Six supplements to the GL have been issued to provide additional guidance and clarification. NRC inspection of licensee implementation of the provisions of the GL and its supplements have been conducted based on the guidance provided in NRC Temporary Instruction (TI) 2515/109, "Inspection Requirements for Generic Letter 89-10," which is divided into Part 1, "Program Review," and Part 2, "Verification of Program Implementation."

The NRC conducted a TI 2515/109 Part 1 inspection at the Millstone site in December 1993, which was documented in combined Inspection Report 50-245/93-26; 50-336/93-22; 50-423/93-21. The purpose of the current inspection was to review and update the licensee's progress regarding the MOV program and related commitments, and to determine the adequacy of the licensee's dynamic test data for MOVs in accordance with Part 2 of TI 2515/109.

2.0 PROGRAM IMPLEMENTATION

2.1 Program Status and Scope

The GL 89-10 program at Millstone 3 currently includes 145 safety-related valves. Dynamic diagnostic tests have been performed on 57 of the valves. Since the 1993 refueling outage, 38 MOVs were removed from the MOV program. The rationale for exclusion of the valves included lack of an active safety function and position changeability. Calculation 89-094-939ES, "Millstone Unit 3 MOV Program Scope Determination," fully documented these reasons. The inspectors concluded that the calculation provided adequate bases for removing the MOVs from the program.

In a letter, dated December 13, 1993, Northeast Utilities (NU) committed to complete the Millstone 3 MOV program during the 1995 refueling outage (RF05). With the exception of the items noted in this report, the inspectors found that the licensee had completed the actions requested in GL 89-10.

2.2 Design Basis Reviews

Generic Letter 89-10 requested licensees to review and document the design basis for operation of all MOVs included in the program. The inspectors assessed the design basis reviews and calculations for the following valves:

3SIH*MV8801A	High pressure boron injection to cold leg
3SIH*MV8802A	Safety injection pump discharge to hot leg
3SIL*MV8809A	Residual heat removal pump discharge to cold leg
3RHS*MV8702C	Residual heat removal pump inlet isolation
3CHS*MV8111C	Charging pump 3C recirculation isolation
3FWA*MOV35A	Steam generator auxiliary feedwater isolation

The design basis reviews for the selected MOVs included calculation assumptions, component elevations, event review summaries, and technical references. The event review summaries clearly documented differential and line pressures, flow rates, and fluid temperatures under normal, abnormal, accident, and line break conditions. The inspectors concluded that the design basis reviews were acceptable.

2.3 Operator Sizing and Switch Settings

The inspectors reviewed program instruction PI-9, "Determination of Stem Thrust Requirements," and the licensee's calculations for determining valve thrust and torque requirements. The licensee assumed a valve factor of 0.60 to calculate the required thrust of non-testable wedge gate valves, and a stem friction coefficient of 0.18 to determine actuator output torque capability. Recently, the licensee chose a ten percent margin to account for load sensitive behavior for the valves which were not tested dynamically. Minimum thrust requirements for setting actuator torque switches were adjusted for diagnostic equipment inaccuracy and torque switch repeatability.

The inspectors noted that NU contracted Kalsi Engineering to provide valve factor information for non-dynamically tested valves at Millstone 3. Kalsi Engineering used an internal software tool (KEIGATE) that was based on information from the Electric Power Research Institute's (EPRI) Performance Prediction Program (PPP). At the time of the inspection, NU was reviewing the information and intended to use the valve factors provided by KEIGATE to support the use of a 0.60 valve factor. Higher valve factors would be used in lieu of the assumed value, if necessary. The inspectors noted that Kalsi Engineering's methods and software were not a part of the NRC staff's review of the EPRI PPP. Therefore, when the staff has issued its safety evaluation report on the PPP, the licensee will be expected to confirm the information through application of EPRI's Performance Prediction Methodology (PPM) software. In memorandum MOV-RTH-95-026, the licensee stated that the NRC safety evaluation report will be reviewed to reconcile any differences with the KEIGATE results. Revisions to the existing calculations utilizing KEIGATE information, or subsequent calculations for new valves or conditions will be analyzed using the NRC-reviewed version of EPRI's PPM. The licensee's arrangement with Kalsi Engineering was a noteworthy initiative, and the inspectors concluded that use of the KEIGATE results was acceptable in the interim. Reconciliation of this information with that derived from the EPRI PPP will be reviewed prior to closure of the licensee's GL 89-10 program. **(IFI 95-17-01)**

The dynamic test evaluations for Millstone 3 determined available thrust margins by calculating an apparent valve factor, extrapolating to design-basis conditions (where necessary), and adjusting the results for diagnostic equipment uncertainty and torque switch repeatability prior to comparing the required thrust to the available thrust at torque switch trip (TST). However, the inspectors noted that the calculated valve factors also were used to update other thrust calculations, and were applied in some cases to other MOVs pursuant to the licensee's grouping methodology. Because the valve factor was based on as-read thrust values from the diagnostic traces, the calculated value would have associated with it an additional uncertainty. Adjustments

normally made to target thrust windows are designed to account for uncertainties in the thrust measured at TST, but not for additional uncertainty which exists in the original thrust calculation. The licensee should consider adjusting the valve factors from in-plant testing for uncertainty when using them to update nonconservative thrust calculations or when applying them to other untested valves. This issue will be reviewed prior to closure of the licensee's program. **(IFI 95-17-02)**

The licensee's MOV program requires thrust calculations to be updated, and new target thrust windows to be implemented, prior to the next diagnostic test, or within one year. The inspectors noted that several thrust calculations had not been updated to reflect dynamic test results. For example, the calculations for valve 3SIH*MV8801A did not consider the measured packing load, which was greater than originally assumed. In another case, the calculation for valve 3SIL*MV8809A had not been adjusted to account for a higher than assumed valve factor. The licensee also indicated that the calculations for other valves needed to be revised to reflect the valve factors provided by KEIGATE, and the load sensitive behavior observed during testing. The inspectors were concerned that the program appeared to rely upon the personal knowledge of key individuals to ensure that the latest, updated target thrust values were used in MOV test procedures. In response, the licensee generated a list of the thrust calculations which required revision. The inspectors identified no valve operability concerns, and considered the licensee's action to be appropriate. The licensee's efforts to revise the MOV thrust calculations will be evaluated in future program inspections.

The licensee determined load sensitive behavior and stem friction coefficients (where torque measurements were available) during dynamic test evaluations. The results were used to verify adequate design-basis capability margins and to justify the assumptions (i.e. ten percent for load sensitive behavior and 0.18 for stem friction coefficient) applied to untested valves. However, the licensee was unable to provide the inspectors with completed technical justifications for these assumptions. The licensee stated its intention to include its preliminary test results with data from other NU sites, and that a statistical method was being developed to demonstrate that the current assumptions were bounding. Completion of this analysis will be necessary to support closure of the GL 89-10 program. **(IFI 95-17-03)**

During the dynamic test evaluations performed prior to RFO5, the licensee discounted load sensitive behavior values of less than 5 percent. The licensee assumed that levels this low would be masked by torque switch repeatability. Recently, the licensee revised its program to consider all levels of load sensitive behavior. However, the inspectors observed that the pre-outage tests had not yet been reevaluated for this consideration. The licensee explained that the corrected values were being used in an analysis to support load sensitive behavior assumptions for non-dynamically tested MOVs, and that the thrust calculations would be updated to reflect the measured rates of loading. This issue will be reviewed prior to closure of the licensee's GL 89-10 program. **(IFI 95-17-04)**

2.4 Design-Basis Capability

The inspectors reviewed program instruction PI-13, "Evaluation of Dynamic Test Results," and dynamic test packages for the selected valves. Test data was reviewed using the industry standard thrust equation, the valves' mean seat diameters, and the dynamic test conditions. The test results indicated gate valve factors in the open direction as high as 0.64, load sensitive behavior up to 8.2 percent, and stem friction coefficients up to 0.153. No operability concerns regarding these valves were identified by the inspectors. The following table provides the test results for the six valves which were tested dynamically during RF05.

MILLSTONE 3 GATE AND GLOBE VALVE DATA
Diagnostics: VOTES

VALVE NUMBER	VALVE TYPE	TEST CONDITIONS (psid)		% DESIGN BASIS		DYNAMIC VALVE FACTOR [1]		STEM[2] FRICTION COEFFICIENT		% LOAD[3] SENSITIVE BEHAVIOR
		Open	Close	Open	Close	Open	Close	Static	Dynamic	
3SIH*MV 8801A	4" Aloyco 1500# Solid Wedge Gate	2592	2593	94	367	0.37[4]	0.40[4]	N/C	0.153	6.8
3SIH*MV 8802A	4" Aloyco 1500# Solid Wedge Gate	1567	1567	88	N/A	0.37[4]	0.25[4]	N/C	N/C	-0.7
3SIL* MV8809A	10" Walworth 1500# Flex Wedge Gate	227	227	60	139	0.64[4]	0.51[4]	N/C	N/C	0.0
3FWA* MOV35A	3" Walworth 900# Solid Wedge Gate	1483	1483	98	98	0.21[4]	0.25[4]	N/C	0.135	4.7
2RHS* MV8702C	12" Westinghouse 1525# Flex Gate	1789	N/A	92	N/A	0.16[4]	N/A	N/C	0.091	N/A
3CHS* MV8111C	2" Velan 1500# Globe	2283	2283	85	85	N/A	1.1[4]	N/C	N/C	8.2

1. The dynamic valve factors listed were calculated by the licensee using a mean seat diameter.
2. Stem Lubricant: Chevron SRI.
3. A negative number indicates that the thrust observed at CST during the dynamic test was greater than the thrust observed at CST during the static test.
4. Calculated valve factor values were not adjusted for diagnostic equipment uncertainties.

Notes:
1. Valve factor data was rounded to two decimal places.
2. "N/A" = Not Applicable; "N/C" = Not Calculated

The licensee's method for evaluating dynamic test data is documented in instruction PI-13. Valve factor, load sensitive behavior, and stem friction coefficient are calculated, and the thrust required under design-basis conditions was determined by linearly extrapolating the required closing thrust under the dynamic test conditions and adjusting the result for equipment inaccuracies and load sensitive behavior. This value then was compared to the thrust measured at control switch trip to determine the available thrust margin. The inspectors noted that the licensee considered a margin of zero percent or greater as acceptable, and were concerned that no allowance had been made for valve/actuator or stem lubrication degradation until the next test. The licensee planned to perform as-found tests to validate the calculational assumptions used to establish required thrust. However, the licensee had not determined the criteria for selecting which MOVs to test, or the number of valves to be tested. In addition, the inspectors noted that the licensee recently changed the MOV preventive maintenance frequency from 18 months to three years. GL 89-10, Supplement 6, states that licensees should include in their design assumptions appropriate margin to account for uncertainties to provide assurance that MOVs will remain capable of performing their design-basis function until the next test. Prior to final closeout of the GL 89-10 program, the licensee will be expected to justify the assumption for degradation. **(IFI 95-17-05)**

During discussions regarding VOTES diagnostic equipment, the licensee indicated that in some open direction tests performed prior to RF05, appropriate corrections had not been applied to account for the increased uncertainty associated with measurements taken outside the sensor calibration range. In response to the inspector's questions, the licensee developed an action plan to screen all of the effected MOVs, to evaluate them using guidance from Liberty Technologies' Customer Bulletin #31, and to initiate adverse condition reports where necessary. The inspectors considered this plan to be adequate, and will review the results of the licensee's evaluations prior to closeout of the GL 89-10 program. **(IFI 95-17-06)**

To determine the operability of an MOV, the licensee linearly extrapolated the thrust needed to overcome differential pressure to design-basis conditions. This was done by determining an apparent valve factor based on the dynamic test conditions and using it to recalculate the minimum thrust requirements under design-basis conditions. Recently, NU changed its extrapolation method by revising downward the minimum threshold for linear extrapolation from 80 percent to 50 percent of design-basis conditions. Prior to the revision, the licensee had relied on engineering judgement to assess the operability of MOVs tested at less than 80 percent of design conditions, basing its decision on information gained from the EPRI PPP. However, the NRC recently requested EPRI to review its guidance in this area to ensure that wide linear extrapolations for MOVs which experience low design-basis differential pressures (e.g. 125 psid) are as acceptable as MOVs which function at higher differential pressures. No extrapolations below 80 percent were required initially at Millstone 3, but could become necessary in the future following post-maintenance testing. The licensee is expected to complete its justification for the use of linear extrapolation from 50 percent up to design-basis conditions, including any additional guidance from EPRI, prior to GL 89-10 program closure. **(IFI 95-17-07)**

2.5 Periodic Verification

GL 89-10 recommended that licensee's implement a program to verify periodically (approximately every five years) the performance of MOVs. According to instruction PI-16, "MOV Periodic Testing, Periodic Verification and Tracking and Trending Program," the licensee ultimately intends to base its program on the requirements of an operations and maintenance procedure (OM-8) being developed by the American Society of Mechanical Engineers (ASME). In the interim, the licensee plans to perform static tests of all GL 89-10 program MOVs at a frequency (viz. five years/three refueling outages or ten years/six refueling outages) commensurate with the risk significance of each valve, and to test dynamically six valves (four percent of the MOV program population) over the next three fuel cycles.

The NRC is preparing a GL on the periodic verification of design-basis MOV capability. Therefore, the inspectors did not make a final determination regarding the long-term acceptability of the licensee's plan. NU will be expected to take the appropriate actions when the generic letter is issued. For example, the licensee should consider the benefits (such as identification of decreased thrust output and increased thrust requirements) and potential adverse effects (such as accelerated aging or valve damage) when determining adequate verification testing for each GL 89-10 MOV. The NRC will review the licensee's periodic verification process following issuance of the new GL.

2.6 Failure Analysis and Trending

GL 89-10 recommends the implementation of a system to examine MOV performance data periodically to identify trends relevant to MOV operability. NU instruction PI-16 describes the performance items to be tracked and sets "alert" and "action required" criteria for each item. In addition, once every refueling outage, the Unit MOV Coordinator obtains and evaluates diagnostic test and IST performance information for significant deviations (i.e. +/- 15 percent) from previous test data.

The Unit MOV Coordinator also will evaluate valve failure trends every refueling outage. Plant-specific and industry failure data is gathered from the Nuclear Plant Reliability Data System (NPRDS) and the Millstone Planned Maintenance Management System. Also noteworthy was the requirement of instruction PI-19, "Use of Vendor, In-House and Industry Experience," to disseminate a "lessons-learned" memorandum to the other NU nuclear units following refueling outages.

Since performance baseline data had been collected at Millstone 3 only recently, little trending was performed. However, the inspectors concluded that the program elements established by the licensee were consistent with the recommendations of GL 89-10.

2.7 Response to Industry Information

The inspectors reviewed NU's internal responses to industry and NRC technical information regarding safety-related MOVs to assess the licensee's program for evaluating potential safety problems. Limitorque Corporation maintenance updates concerning hydraulic locking of spring packs and information regarding the environmental qualification of Melamine limit and torque switches were reviewed.

Spring Pack Hydraulic Lock

Limitorque Maintenance Updates 88-2 and 90-1 discussed the potential for hydraulic lock of MOV actuator spring packs due to grease becoming trapped between the spring cartridge cap and the outer thrust washer, or within the spring pack cavity itself. The condition can inhibit the operation of the torque switch, resulting in overthrusting of the valve, tripping of thermal overload heaters, or motor burnup. Limitorque found through testing that certain factors increased the probability of the condition occurring, including: (1) high stem speed, (2) stiff yoke design, (3) valve orientation with the spring back mounted below the main gear case, and (4) overfilled gear case cavity. Limitorque recommended that licensees consider modifying the spring packs of valves which have these characteristics, or which have experienced hydraulic lock or motor burnout.

The inspectors found that licensee personnel were familiar with the technical issue, but that no generic evaluation of susceptibility to hydraulic locking had been performed at Millstone 3. Three cases of hydraulic locking were documented by the licensee since 1993, and grease was found in the spring packs of five MOVs during outage RF05 in spring 1995. In each instance, the licensee either installed a modified spring pack, or cleaned the old one and scheduled its replacement for a future outage. The licensee stated in a 1995 nonconformance report resolution concerning hydraulic lock of valve 3RSS*MV8837A, that Limitorque makes only recommendations (versus requirements), and that the recommendations should only be implemented when the condition actually occurs. When prompted by the inspectors, the licensee consolidated into a matrix the status of the MOVs in the GL 89-10 program. The matrix showed that approximately 70 percent of the MOVs had unmodified spring packs; ten of the valves met some or all of the susceptibility criteria cited by Limitorque.

Based on recent refurbishment and test results, the inspectors had no current MOV operability concerns at Millstone 3. However, the inspectors concluded that the licensee's approach to this potential safety issue was narrowly focused.

Melamine Torque Switch and Limit Switch Components

NRC Information Notice (IN) 86-71, "Recent Identified Problems with Limitorque Motor Operators," dated August 1986, reported that stress cracks had been found in the white Melamine limit switch rotors of MOV actuators located both inside and outside primary containments. Limit switch rotor failure could

result in valve damage, failure to operate, or inaccurate remote indication of valve position. In a letter to Westinghouse Electric Corporation, dated February 21, 1984, Limitorque recommended the replacement of any white limit switch components found to be cracked.

At Millstone 3, the safety-related Limitorque actuators originally were environmentally qualified with limit and torque switches containing white Melamine parts. Stone and Webster Engineering Corporation reported that all of the MOVs were qualified for their intended applications following inspections conducted in 1984. However, as documented in licensee memoranda dated January and February 1987, cracked limit switch rotors had been identified in eight of 16 MOVs concurrently inspected by a Limitorque field representative. The licensee opened an internal commitment to inspect and evaluate the cracked rotors at a later date. The inspectors found that during the recent (spring 1995) refueling outage, Melamine limit switch rotors were replaced in 23 safety-related valve actuators, including a cracked rotor (valve 3RSS*MOV?9C) that originally had been identified in 1987.

In November 1986, Limitorque had advised licensees in a 10 CFR Part 21 notification that the torque switches in certain SMB-000 and SMB-00 actuators were subject to failure due to post-mold shrinkage of Melamine parts. The condition can result in premature tripping of the actuator motor or overthrusting of the valve. Since Melamine shrinkage is aggravated by age and high temperature, the environmental qualification of the actuators also may be compromised. Limitorque recommended that all SMB-000 and "old style" SMB-00 Melamine torque switches be replaced with environmentally qualified brown Fibrite switches as soon as possible. In 1989 the licensee opened an internal commitment to replace the torque switches in 19 suspect actuators during the next scheduled preventive maintenance. Although completion of this activity was documented in a memorandum dated June 4, 1991, Melamine torque switches in six of the original actuators were replaced during the recent outage. In another memorandum, dated February 8, 1989, the licensee listed an additional 30 SMB-00 actuators with Melamine torque switches. The switches in eleven of these actuators similarly were not replaced until 1995. The status of the remaining 19 actuators was not documented during the inspection.

The licensee has not attributed any valve failures to Melamine components, and all MOVs with an active safety function have been tested satisfactorily under the GL 89-10 program. In addition, degrading valve performance likely would be identified during periodic inservice tests. Therefore, the inspectors concluded that there was no immediate MOV operability concern. However, the inspectors noted that the licensee's approach to this issue at Millstone 3 was contrary to Limitorque's guidance, and was inconsistent with the practice at Millstone Units 1 and 2, where Melamine components were replaced during earlier outages.

The inspectors concluded that the licensee's actions in response to safety significant industry information regarding hydraulic lock and Melamine components were neither timely, systematic, nor comprehensive. This matter is unresolved pending NRC review of licensee efforts to determine the scope and significance of remaining component nonconformances and to establish a plan to correct identified deficiencies. (URI 95-17-08)

2.8 Maintenance of Safety-Related MOVs

Maintenance Procedures

The inspectors found the Millstone Station common maintenance procedures applicable to safety-related MOVs to be of high quality. The procedures provided detailed guidance, incorporated appropriate vendor-recommended inspections, and made abundant use of actuator subassembly diagrams. The inspectors noted that in the transition from unit-specific to common procedures, periodic inspection of spring pack external relief tubing for blockage or hardened grease had been deleted. The inspection is recommended in Limitorque Maintenance Update 90-1. The licensee agreed to review this discrepancy.

Field Walkdowns

Approximately thirty MOVs located in the auxiliary building and intake structure were walked down by the inspectors. The material condition of the valves was good, and, with one exception, no anomalies were found. On valve 3SWP*MOV102D, the inspector found the actuator limit switch compartment cover cap screws to be only finger tight. The licensee promptly corrected the condition and checked the cap screws on approximately 70 additional MOVs with satisfactory results. The inspector concluded that the condition had no adverse safety impact, and was an isolated oversight.

Post-Maintenance Testing

The licensee determines MOV post-maintenance retest requirements in accordance with procedure WC-1, "Work Control," and WC-1, Attachment 14, "Post-Maintenance Testing Requirements." For valves in general, retests are specified in maintenance procedure MP-3702D, "Maintenance Retest Guidelines." However, additional requirements applicable specifically to MOVs in the GL 89-10 program are contained in instruction PI-14, "Post-Maintenance Testing and Lubrication Requirements." The inspector reviewed 30 completed work orders and found that the assigned retests were consistent with the MOV program requirements. However, a weakness was identified in licensee's Planned Maintenance Management System (PMMS) in that some work orders did not contain the GL 89-10 program identifier which prompts the PMMS planners to consult the MOV Coordinator for retest assignments. This was contrary to the Millstone MOV program manual, which stated that all MOVs within the scope of the program will be added to a new special programs PMMS screen to provide a mechanism for identifying components which have special program requirements during the generation of work orders or system reviews.

The inspector found that valves which had been added to the MOV program during the last refueling outage had not yet been updated in the PMMS. In addition, during a demonstration of the PMMS, the inspector observed that the work order "caution" section, which sometimes also is used to identify GL 89-10 program MOVs, can be overridden when adding new caution statements to the work orders. The licensee undertook a review of the PMMS to ensure that all GL 89-10 MOVs are identified properly.

Preventive Maintenance Periodicity Change

The inspector noted that several items previously scheduled for RF05 had been cancelled, and learned that the periodicity of certain preventive maintenance (PM) tasks recently had been changed from 18 months to three years for MOVs in the GL 89-10 program, and five years for other MOVs. The inspectors requested the documentation containing the technical justification for the change to verify that adequate engineering reviews had been performed and that licensee administrative requirements were met.

The PM tasks affected by the change principally involved actuator limit switch compartment inspections, electrical checks, and gear case lubrication checks. Limitorque recommends a minimum 18-month frequency for these checks until experience indicates otherwise. In November 1994, the Millstone 3 Electrical Maintenance Supervisor recommended the periodicity change. The request was evaluated by technical support engineering and concurrence was documented in a memorandum dated December 1994. The approval was based on review of historical maintenance records on a valve-by-valve basis. However, prior to implementing the change, work control management requested that additional reviews be performed by the nuclear safety engineering and probability risk assessment groups. Documentation of these reviews was incomplete, but the licensee indicated that all questions were satisfactorily addressed, and that concurrence was obtained in March 1995. At this time, the December 1994 memorandum again was forwarded to the PMMS planner for implementation.

The inspectors concluded that the technical justification for the PM frequency change was adequate, and noted that the additional reviews which were performed exceeded the PM program requirements. However, the inspectors found several preventive maintenance work orders pertaining to GL 89-10 MOVs that incorrectly specified a five-year periodicity, and concluded that the frequency change had not been implemented consistently. The inspectors also observed that in processing the change request, the licensee did not adhere to procedure MP-3704A, "Preventive Maintenance Program," which requires that: (1) requests for PM periodicity changes be submitted on Maintenance Form 3704A-1, "PMMS Maintenance Update Request"; (2) PM periodicity changes be documented on Form 3704A-1; and (3) Form 3704A-1 be maintained in appropriate equipment files. The licensee's failure to process the PM change in accordance with administrative procedures is a violation of Technical Specification 6.8.1.a. concerning procedure implementation. However, this failure constitutes a violation of minor significance and is being treated as a non-cited violation, consistent with Section IV of the Enforcement Policy (60 FR 34381; June 30, 1995).

2.9 Pressure Locking and Thermal Binding

Licensee instruction PI-20, "MOV Program Pressure Locking and Thermal Binding Evaluation," established the criteria for determining valve susceptibility to pressure locking and/or thermal binding and outlined methods to prevent or correct the condition. The instruction referenced the guidance in GL 89-10, Supplement 6, and the industry operating experience documented in NUREG 1275, Volume 9. Through evaluation of this information, the licensee established thermal binding susceptibility screening criteria of 75°F and 150°F

(temperature differential) for solid and flexible/split wedge gate valves, respectively, and similar operability criteria of 100°F and 175°F. The inspectors considered the criteria to be acceptable, subject to reevaluation in light of industry experience and testing.

The inspectors noted that the method contained in instruction PI-20 for estimating MOV actuator output capability used motor stall torque derived from generic motor curves rather than nameplate torque. This practice is nonconservative and inconsistent with the vendor guidance provided in Limitorque Maintenance Updates 89-1 and 92-1. At the time of the inspection there were no current valve operability determinations that assumed greater than nominal motor torque.

The inspectors reviewed calculation 95ENG-1129 MP3, which documented the susceptibility evaluation results for the Millstone 3 MOVs. In its analyses, the licensee utilized appropriate functional and design-basis documents and procedures, and considered the full spectrum of normal, surveillance, and accident conditions to which each MOV would be subjected. The inspectors reviewed a plant design change associated with residual heat removal (RHR) pump suction isolation valves 3RHS*MV8701A and 3RHS*MV8702B to assess the licensee's use of procedure changes as a corrective action for potential pressure locking.

Millstone 3 was designed and licensed to be capable of being brought to the cold shutdown condition using only safety grade systems such as RHR. The RHR pump suction valves are located within the primary containment, and are required to be capable of being opened remotely (viz. from the control room) during normal shutdowns as well as following non-LOCA transients, such as main steam line break, steam generator tube rupture, or a seized reactor coolant pump (RCP) rotor. While the licensee historically had experienced no difficulty in opening the valves remotely during normal cooldowns, the valves nonetheless met the pressure locking susceptibility criteria of instruction PI-20. The licensee performed an operability determination which concluded that the valve actuators developed thrust sufficient to overcome the anticipated pressure locking forces. However, it was the licensee's policy not to rely on calculations alone to demonstrate MOV operability and design-basis capability in the long term. The licensee considered physically modifying the valves during RF05, but because of potential technical complexities and outage schedule constraints, decided to defer any modifications for one operating cycle (i.e. to RF06). Instead, the RHR system design basis and operating procedure were changed to permit a containment entry to vent excess pressure from the valve bonnets through the packing glands if the first attempt to open the valves from the control room failed. The licensee estimated that the most limiting accident (locked RCP rotor with six percent fuel cladding damage) would result in a 17 Rem/hour radiation field near the valves. Based on walkdowns, the estimated maximum personal exposure for the anticipated 10 minute job would be about three Rem/person; less than the regulatory whole body exposure limit. To protect the actuator motors and valves on the first attempt, the torque switch bypass feature was removed from the valve-open circuits.

The inspectors noted that the 10 CFR 50.59 safety evaluation for the design change was exhaustive, and that the licensee's pre-planning and walkdowns were consistent with industry standards. Notwithstanding, the inspectors informed the licensee that the acceptability of post-accident containment entry to maintain system design-basis capability was questionable. Subsequent to the inspection, the NRC informed the licensee that its approach was unacceptable. The licensee performed a new assessment of thrust requirements and actuator output capability, and concluded that the MOVs were operable. The licensee plans to reinsert the torque switch bypass feature into the valve circuits during the next regularly scheduled containment entry. The inspectors considered these actions to be acceptable.

Excepting the above, the inspectors concluded that the licensee adequately addressed this area for GL 89-10 program closure. However, the licensee's future efforts concerning pressure locking and thermal binding of safety-related gate valves will be re-evaluated under the guidance of a proposed generic letter, and will be tracked as an unresolved item. **(URI 95-17-09)**

2.10 (Closed) URI 50-245/93-24-07 Motor Brake Performance

This item involved the licensee's response to NRC IN 93-98, "Motor Brakes on Valve Actuator Motors," that discussed the potential that certain MOV motor brakes may not operate properly under design-basis degraded voltage conditions. The issue was resolved by removal of the brakes at Millstone 1 and 2, but remained unresolved at Millstone 3. Licensee memorandum MP3-TS-95-437 documented that there were no motor brakes installed at Millstone 3. The conclusion was based on field observations and review of valve electrical drawings. Through discussions with licensee MOV program engineers and review of documents provided by the licensee, the inspectors concluded that this item was adequately resolved.

3.0 QUALITY ASSURANCE PROGRAM/MANAGEMENT SUPPORT

In 1993, the licensee performed a comprehensive self-assessment of the GL 89-10 program. Performance of the self-assessment was approved by the NRC in lieu of a TI 109 Part 1 inspection. The high quality of the licensee's effort in this area was documented in Millstone Inspection Report 50-245/93-26; 50-336/93-22; 50-423/93-21. The inspectors discussed the resolutions of several self-assessment items with licensee quality assurance personnel, and verified that all of the findings and observations had been resolved.

During RF05, the licensee performed a quality assurance assessment of portions of the MOV program as part of an larger audit of refueling outage activities. The audit scope included valve modifications to address pressure locking, MOV structural (weak link) calculations, calibration of maintenance and test equipment, and diagnostic testing, and was considered by the inspectors to be adequate. Nonconformance reports were generated to disposition audit findings where appropriate. The inspectors noted, however, that the audit did not address many of the technical assumptions and justifications (e.g. valve factor, stem coefficient of friction, degradation of valve performance between diagnostic tests) needed for program closure.

The inspectors found that management oversight was particularly effective when focused on resolving the technical issues required for GL 89-10 program closure. The licensee's hiring of Kalsi Engineering for valve factor information was noteworthy in this regard. However, the licensee was less effective in assimilating and comprehensively applying industry experience in a timely manner, and in assuring that administrative procedure requirements were implemented properly.

4.0 MANAGEMENT MEETINGS

Licensee representatives were informed of the purpose and scope of the inspection at an entrance meeting conducted on June 19, 1995. Findings were discussed periodically with the licensee throughout the course of the inspection.

The inspectors met with the principals listed below to summarize preliminary findings on June 30, 1995. The licensee acknowledged the preliminary findings and conclusions, with no exceptions taken. The bases for the inspection conclusions did not involve proprietary information, and none was included in this inspection report.

Northeast Nuclear Energy Company

E. DeBarba	Vice President, Nuclear Engineering Services
M. Brothers	Nuclear Unit Director, Millstone 3
R. Harris	MOV Program Team Manager
D. Gerber	Technical Support Manager, Millstone 3

U. S. Nuclear Regulatory Commission

E. Kelly	Chief, Systems Section, DRS
M. Buckley	Reactor Engineer, DRS
R. Reyes	Operations Engineer, DRS
L. Dudes	Mechanical Engineer, EMEB/NRR