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February 18, 1993

Mr. A. Bert Davis
Regional Administrator
U.S. Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Subject: LaSalle County Station Units 1 and 2
Response to Questions
Engineering Report
Docket Nos. 50-373 and 50-374

Reference: H.J. Miller (USNRC) to C. Reed (CECo)
dated December 16, 1992

Dear Mr. Davis:

The LaSalle Generic Letter 89-10 Inspection report contained a request that CECo document the evaluation of the provisions contained in a Kalsi Engineering study used as part of the LaSalle response. This letter contains the requested evaluation.

Attachment 1 to this letter provides the response developed by the participants in the Kalsi-Limitorque Actuator Uprating Program after receipt of NRC generated questions during the Wolf Creek (Wolf Creek Nuclear Operation Company) Generic Letter 89-10 inspection. CECo has accepted the evaluations, conclusions, and recommended utility actions contained in Attachment 1 and is submitting them as a response to the subject questions.

In response to the Wolf Creek questions, Attachment 1 has listed "Utility Actions". These are actions which individual participants are expected to address in order to fit the specific response/actions to their particular site/utility. Attachment 2 lists the specific response/actions that CECo is taking with regard to the "Utility Actions" in Attachment 1.

Please direct any questions you may have concerning this submittal to this office.

Respectfully,

Mary Beth Depuydt

Mary Beth Depuydt
Nuclear Licensing Administrator

Attachments

cc: T. Martin - RIII
G. Replogle - RIII
R. Stransky, LaSalle Project Manager - NRR
D. Hills, Senior Resident Inspector - LSCS
Illinois Department of Nuclear Safety - IDNS

RESPONSE TO NRC QUESTIONS

Introduction

Kalsi Engineering Incorporated (KEI) Report 1707C, describes testing and engineering analysis to justify exceeding the current thrust ratings for Limitorque model SMB-000 through SMB-1 electric motor actuators. Limitorque, the equipment manufacturer, has reviewed this report and supports the conclusions (Limitorque Technical Update 92-01 and Technical Agreement 92-01). It is important to note that actuator ***thrust*** ratings, not ***torque*** ratings, were the subject and product of this report. The data contained in this report is used to support values used in engineering calculations in exactly the same manner that seismic, EQ, and stress reports are used. Past industry and NRC practice has been to retain such reports on site for review should questions arise. The level of regulatory scrutiny, and the consumption of both regulatory and industry resources to address NRC questions has been extensive for a document of this type.

Mechanical aging and qualification according to IEEE 382 and 323 require applying the qualified load (usually in the close direction only) to the test specimen for 2000 cycles, followed by 6 seismic tests (5 OBE and 1 SSE). Thermal and radiation aging are not required since they have been shown to have no impact on non-organic materials such as metal. Once completed, the test article and as many other articles that can be shown to be "similar" are officially qualified to the test load for the bounding 2000 cycle life. Should this practice have been followed during the subject thrust testing program, none of the anomalies documented in the subject report would have occurred. As such, KEI Report 1707C demonstrates that Limitorque model SMB-000 through SMB-1 actuators are qualified to 200% thrust overload for 4000 cycles according to IEEE 382 and 323.

To be conservative, the program participants <u>voluntarily</u> applied a de-rating methodology using ASME Section III, Appendix 2 as a guideline to arrive at the recommended thrust ratings documented in the subject report. In addition, each unit was tested in both the open and close directions at <u>200%</u> thrust overload for <u>4000</u> cycles, including 5 open and close <u>stall</u> thrust cycles (10 total), and in excess of <u>50</u> strokes under seismic conditions. Clearly, to the knowledgeable engineer, this testing far exceeded original equipment qualification standards, and previous test efforts of this kind.

Provided below are responses to NRC questions on docket pertaining to the subject report taken from the following sources:

1. Duke Power Company, McGuire Nuclear Station, Summary of Meeting with Duke Power on the Use of Extended Motor Operated Valve Thrust Limits, June 10, 1992, Docket Nos. 50-369, 50-370. Referenced as "NRC Meeting," below.

2. Wolf Creek Nuclear Operating Corporation, NRC Inspection Report 50-482/92-15, Attachment 2, Docket No. 50-482, September 30, 1992. Referenced as "Wolf Creek Inspection Report," below.

It is our hope that these responses successfully address outstanding NRC concerns.

Question 1

Limitorque and licensees should monitor the performance of MOVs to ensure that the results of the Kalsi study are confirmed by plant experience. (Ref. NRC Meeting, Question 1)

The industry has years of successful performance of the Limitorque actuators with the original thrust ratings, but little experience with the higher thrust allowable limits proposed by the Kalsi study. The Kalsi study did not include the effects of running load in applying overthrust to the tested actuators. The Kalsi study conducted tests on only one actuator for evaluating the overthrust capability of actuators in each actuator size class within the scope of the study.

How will WCNOC demonstrate that the results of the Kalsi study were applicable to its MOVs? (Ref. Wolf Creek Inspection Report, Question 1)

Response to Question 1

This question actually consists of three separate issues that are addressed below regarding the applicability of the test results to an actual in-plant actuator:

Issue 1 - Industry has little experience with higher thrust ratings

Both technically and historically this is not correct. Actuator switch setting procedures typically have used a 0.2 stem coefficient of friction and made no allowance for inertia. If an actuator was set close to its maximum thrust rating using this procedure, overthrusting would result if actual stem coefficients are lower and if inertial overshoot is present. For example, consider a SMB-00 actuator sized with a 1.25 in. diameter, 1/4 in. pitch, 1/2 in. lead standard Acme stem using this procedure and set to deliver 12,000 lb. of thrust. If the actual stem coefficient of friction were between 0.1 and 0.15 and a 25% thrust inertial overshoot were present, the actuator would be delivering between 27% and 55% overthrust. This situation is not considered unusual based on recent test history and recent technical developments. However, since no MOV diagnostic devices were being used in the past, overthrusting actuators went undetected and did not become a visible issue.

Secondly, results from utility Bulletin 85-03 as-found diagnostic testing indicated that many actuators were operating successfully in overthrust conditions due to unaccounted inertial overshoot in combination with better stem friction coefficients.

In summary, actuators have operated successfully under overthrust conditions in the past, but because no diagnostic devices were used, no quantification of the overthrusting magnitude was known.

Issue 2. Effects of running load were not included in applying overthrust to the actuators.

KEI Report 1707C, Section 2.5 discusses the effects of running load on the actuator fatigue life. In this study, the effects of running load were carefully evaluated and found to be inconsequential from a fatigue standpoint. To justify this position Section 2.5 of the report states the following:

> "The fatigue life of the thrust-related components is completely unaffected by the magnitude of the running load and is dependent only upon the maximum and the minimum values of the peak stresses reached during each test cycle. Furthermore, evaluation of the running loads due to stem packing and stem rejection load on the fatigue life of the torque-related components shows that the maximum stresses due to these loads are well within the endurance limits of the materials (see Section 5.2.1). Therefore, fatigue life of the torque-related components is also unaffected by these stem running loads. However, running loads under differential pressure operation are usually higher, and may affect the fatigue life of the torque-related components. If a large number of cycles under DP conditions are anticipated, the effect of running loads on fatigue life of the torque-related components should be evaluated. Consideration should also be given to wear of the worm gear by performing suitable inspections and maintenance."

Since most valves are not operated repeatedly under differential pressure conditions, and are operated within the existing torque ratings, the effect of running load on the fatigue and wear of the torque related components is considered insignificant. Even periodic dynamic testing of 1 to 2 strokes per outage for 40 years should not create a situation requiring further evaluation for increased wear or reduced fatigue life. Again, if an extremely large number of cycles under DP conditions are anticipated, the effect of running load on fatigue and wear life of torque related components should be evaluated. The Phase 2 testing program will provide guidance based on testing and analysis to perform such evaluations.

Issue 3. Conducted testing on only one actuator for each size class.

Initial mechanical qualification testing by Limitorque conducted in the 1970 to 1980 time period (Limitorque Report B0058, "Limitorque Valve Actuator Qualification for Nuclear Power Station Service") included one test specimen of one actuator size, SMB-0, to represent the entire line of SB/SMB/SBD-HBC actuators in all available unit sizes (000 to 5). The testing involved 2000 open and close cycles, with the rated torque and thrust being produced during the closing cycle **only**. The number of test cycles and the ability to group components are specified in IEEE Standard 382. An SMB-00 was subjected to this same qualification sequence at a later time. It should be emphasized that the approach taken by Limitorque is in full compliance with IEEE Standards for equipment qualification.

In contrast, the test effort documented in the KEI Report 1707C involved testing one each SMB-000, SMB-00, SMB-0, and SMB-1 actuator for 4000 open and close cycles. The rated torque and 200 percent of the rated thrust were developed in both the open and close directions. In addition, 10 stall tests were performed, and a matrix of seismic qualification tests meeting IEEE Standard 344-1975 were conducted in both the open and close directions. Test results were not extrapolated for unit models and sizes beyond the sample tested.

In addition, neither IEEE Standard 323 nor 382 require a safety margin be applied based on sample size or number of test cycles. For the testing contained in the Report, a safety margin was applied. The approach described in ASME Section III (1989), Appendix II, was selected as a guide for establishing a safety margin based on the number of test cycles, the load intensity, and the sample size. The ASME Code allows a sample size of one to be used and considers this to be acceptable Engineering practice. This safety margin accounts for items such as normal variations in material properties and tolerances from one actuator to the next.

Conclusions:

The testing described in the subject report far exceeds industry equipment qualification standards. These standards would allow a continuous 200% thrust overload for 4000 cycles based on actual test results. To provide margin to account for normal uncertainties, however, the participants in this study voluntarily elected to apply a safety factor based on ASME Code guidelines. Therefore, the test results documented in the Report are applicable to in-plant actuators.

Utility Actions:

Issue 1: No action

Issue 2: If large number of operational cycles at overload and under DP conditions are experienced or anticipated, evaluation or inspection for fatigue and wear damage of torque related components is necessary. Phase 2 testing results will provide guidance based on testing and analysis to perform such evaluations.

Issue 3: No action

Question 2

To allow the Kalsi study to be completed in a reasonable period of time, Kalsi lubricated the stem on a more frequent basis than is performed in a power plant. With the increased deterioration of lubricants over time from ambient temperature and collection of dirt and debris, the Kalsi results may not reflect the extent of wear that would actually occur while the MOV is in service. Periodic internal inspections may be needed to allow early detection of increased wear. (Ref. NRC Meeting, Question 2)

The Kalsi study provided frequent lubrication of the actuator stem and stem nut. The Kalsi report stated that long-term aging and degradation of the lubricant was not evaluated. In a nuclear plant environment, stem lubricant degradation may result in accelerated wear of the stem nut. As found recently at two nuclear plants (Fitzpatrick and Cooper), stem nut failure may occur without warning. In the Kalsi study, stem and stem nut damage occurred during the testing of one actuator. Because of worm and worm gear failures, the Kalsi report recommends consideration of periodic inspection and maintenance of the actuator.

How will WCNOC provide for identifying stem nut wear before the operability of the MOV, under design basis conditions, becomes questionable? (Ref. Wolf Creek Inspection Report, Question 2)

Response to Question 2:

Several statements made in this question require additional clarification. First, stem lubrication was not implemented to control wear, but to ensure actuator target thrust was maintained within the maximum/minimum test limits. Typically, this lubrication interval was several hundred cycles of operation. This is not considered to be "frequent" from a plant application standpoint in which an actuator may see only a few cycles between lubrication intervals. Second, stem nut wear and failures can occur at thrust levels below the current actuator ratings if proper lubrication practices are not in place. Finally, the stem nut and stem thread damage mentioned during the test program occurred in the debugging phase. This phase of testing required frequent strokes of prolonged duration. As clarified in Section 4.1 of the subject report, temperatures at the top of the stem reached in excess of 240 degrees F during this debugging phase. Damage observed during these extreme operating conditions was thread surface deterioration that produced a stem coefficient of friction of 0.16. This damage was easily removed by hand polishing and the same stem and stem nut were used to complete the remaining test cycles with no failure of these components and with a relatively normal stem coefficient of friction between 0.1 and 0.15.

Conclusions:

Stem nut failure from excessive wear is a legitimate concern if poor lubrication practices were used, regardless of thrust levels.

Utility Actions:

Each Utility should verify that an adequate stem lubrication program is in place.

Question 3

The Kalsi study found failures and significant wear of components experiencing torque. Kalsi and licensees should ensure that these components were not adversely affected by thrust as well. Providing a specific listing of the components considered by Kalsi to be thrust-related and torque-related in the Kalsi study would be helpful. (Ref. NRC Meeting, Question 3)

The Kalsi study experienced several failures of actuator parts because of torque. In some cases, the torque failures occurred at less than the torque rating of the actuator.

How will WCNOC ensure that the failures were not also the result of excessive thrust? (Ref. Wolf Creek Inspection Report, Question 3)

Response to Question 3:

The only actuator components that see combined thrust and torque loading are the stem nut, housing, and actuator drive sleeve; none of these components failed during the subject testing program. Of the components that did fail, only torque loading is present. The list below identifies actuator components that are thrust, torque, or both thrust and torque loaded:

Component	Thrust Only	Torque Only	Thrust & Torque
Stem			X
Stem nut			X
Drive Sleeve			X
Housing			X
Base of Housing			X
Housing Cover	X		
Thrust Bearings	X		
Upper housing cover bolts	X		
Actuator hold down bolts	X		
Worm		X	
Worm Shaft		X	
Motor Pinion Key		X	
Motor pinion and w.s Clutch gear		X	
Bushing (SMB 0-4 only Pc. No. 97)		X	

A summary of torque related component failures is provided below:

Component	Actuator Model	Torque (% of Rating)	Number of Cycles to Failure in Test Fixture (Average)
Worm	SMB-000	117%	1,620
Worm	SMB-00	96%	3,774
Motor Pinion Key	SMB-0	104%	226
Worm Shaft	SMB-1	141%	1,285

As is evident from the above summary, no failures of actuator torque related components were experienced when operating at or below the torque rating and for less than 2000 cycles. Each of the above listed failures is discussed below:

Failure of SMB-000 worm:

Three fatigue failures of the SMB-000 worm were encountered during the test cycles at 117% of the rated torque. Several differences between test conditions and those that occur in practice that lessen the severity of this anomaly are:

- operation at 117% of the rated torque
- reverse loading in the opening direction
- longer duration during load ramp portion of stroke

Each of these three items tend to exacerbate worm fatigue loading. Section 5.2.1, Page 47 of 52 from the subject report states that:

> From the details of this preliminary analysis, it can be seen that, while extending the test results concerning the torque related components to a specific MOV application, the differences between actual MOV torque vs. test fixture torque levels, valve stiffness vs. test fixture disc spring stiffness, and the severity in the number of worm revolutions and worm loads in the test fixture as compared to the real valves should all be properly taken into account. Detailed analysis effort under Phase II of this program will accurately account for all of these factors in determining the fatigue life of the torsional components in the Limitorque actuators used on MOV's.

This Section of the subject report clearly explains the differences in the test fixture loading and that found in typical MOV operation that would contribute to fatigue failure of the SMB-000 worm. The likelihood of such a failure occurring in an actual in-plant SMB-000 operating below the torque rating is remote.

SMB-00 worm failure

One SMB-00 worm failure occurred during the test cycles at 96 percent of the rated torque. This failure occurred at cycle 3,744 in the test fixture. Again, in comparing the SMB-00 test condition to that experienced in actual plant operation, the following items should be considered:

- reverse loading in the opening direction
- longer duration during load ramp portion of stroke

Section 5.2.3, Page 48 of 52 from the subject report provides preliminary analysis results which indicate that very small reductions in worm loading will produce increases in worm life. Therefore, no corrective actions are deemed necessary at this time. Phase 2 results should provide the necessary tools to assess the severity of the SMB-00 worm failure for specific plant applications.

Shearing of SMB-0 motor pinion keys

NRC Information Notice 90-37, "Sheared Pinion Gear-to-Shaft Keys in Limitorque Motor Actuators" involved only high-speed SMB-0 actuators with 25 ft-lb motors on 30-inch Jamesbury butterfly valve. Many utilities dismissed this notice since they did not have MOVs meeting the description specified in the IN 90-37 notice. There have been, however, numerous other industry notices pertaining to motor pinion keys:

- NRC Information Notice 88-84, "Defective Motor Shaft Keys in Limitorque Motor Actuators"
- NRC Information Notice 81-08, "Repetitive Failures of Limitorque Operator SMB-4 Motor-to-Shaft Key"
- INPO O&MR-25, "Limitorque Key Stock Material"
- INPO O&MR-46, "Limitorque Key Stock Material"

The SMB-0 test actuator was being stroked near its rated torque (104%) with an average of 226 cycles to failure. Page 12 of 52 in the referenced document recommends the following action be taken:

> The key material should be reviewed in all SMB-0 actuators and changed to a higher strength alloy steel, e.g., 4140, which eliminated the failures in our testing.

SMB-1 Worm Shaft

Three worm shaft failures occurred during the SMB-1 testing at 141 percent of the rated torque. Section 5.2.4, Pages 48 and 49 of 52 provides an assessment of these failures. Preliminary analysis indicates that, had the testing been performed at or below the rated torque, no worm shaft failures would have occurred. Therefore, no corrective action is necessary at this time. Again, the Phase II results should provide insight into the torque limitations associated with the SMB-1 components.

Conclusions:

The subject report clearly states that the existing actuator torque ratings should not be exceeded. If this practice is followed, no torque failures are anticipated. In addition, the torque loading produced during the subject testing far exceeds that anticipated in actual plant operations. Again, one focus of the Phase 2 testing program is to quantify the fatigue life of the torque related components through testing and engineering analysis.

Utility Actions:

The SMB-0 motor pinion keys should be changed to the 4140 material during actuator refurbishment. This is not an immediate concern since the failures occurred while operating above the torque rating (104%) and averaged 226 cycles between failures. Limitorque now offers replacement keys in the 4140 material.

No additional Utility actions are required provided the units are operated within the current torque ratings.

Question 4

The Kalsi study found cracking of components as a result of thrust after 2000 cycles. In light of the occurrence of those cracks, Kalsi and licensees should give consideration to whether the Kalsi study results are applicable to other actuators which may have different material compositions based on manufacturing tolerances. (Ref. NRC Meeting, Question 4)

During the Kalsi study, small cracks in the housing of actuators occurred after 2000 cycles.

Because of the statistical methodology used by Kalsi in establishing margin for a sample size of one relied on 4000 successful cycles, how will WCNOC ensure that the cracks did not affect the acceptability of the remaining cycles? (Ref. Wolf Creek Inspection Report, Question 4)

Response to Question 4:

As a point of clarification, the cracks observed during the testing were merely surface cracks, **NOT** through wall cracks. In accordance with the test procedure, the actuator components were disassembled and inspected every 500 cycles, including dye penetrant examination. These cracks were observed after 2000 cycles at 200% thrust overload in the SMB-00 housing and housing cover, and in the SMB-0 housing cover only. ASME Section III, Appendix 2 does not consider surface cracks or crack initiation as a failure. As such, these surface cracks did not prevent the actuator from successfully completing the goal of 4000 cycles at 200% of rated thrust with no apparent crack propagation. Again, a sample size of one or more is acceptable using the ASME criteria when appropriate de-rating factors for the specific sample population are applied. The ASME criteria is applied to account for normal variations in material properties and manufacturing tolerances for a specific material.

Conclusions:

The criteria applied and documented in the subject report adequately account for the presence of crack initiation, and normal variations in material properties.

Utility Actions:

No specific Utility actions are required to address this issue.

Question 5

The Kalsi study did not include the effects of the inaccuracy of the load cell used to measure thrust and torque, nor the uncertainty associated in reading the strip chart used to record test data in the margin provided to support the conclusions.

How will WCNOC ensure that the accuracy of MOV diagnostic equipment and the strip chart are included when using the results of the Kalsi study? (Ref. Wolf Creek Inspection Report, Question 5)

The accuracy of MOV diagnostic equipment should be considered when using the thrust values from the Kalsi study. (Ref. NRC Meeting, Question 5)

Response to Question 5:

The strip chart recorder was used primarily to observe data trends and number of cycles. Precision digital read-out indicators scaled in engineering units of lbs. and ft.-lbs. were used to record the actual torque and thrust values during the test sequence.

Two different ranges of load cells were used to achieve high measurement accuracy while covering the wide range of loads used in testing the four sizes of actuators.

The load cells were calibrated three times: before starting the tests, after completion of 2000 cycles and seismic testing, and after the conclusion of the 4000 cycle goal. The complete calibration history is documented in Appendix C of the Kalsi Report.

The load cells and the digital indicator readout were calibrated as a unit so that the total instrument error is reflected in the calibration. The maximum error (including the error in the calibration master), in the axial load cell in the compression direction was found to be 0.48 percent of the reading (not full scale) and for the large load cell was 0.67 percent of the reading. These measurement errors are small in comparison to the 200 percent of the target thrust values used to qualify the actuator for increased thrust ratings. Therefore, the impact of the measurement errors on the final thrust conclusions is insignificant.

For mechanical aging IEEE 382 and 323 require only 2000 operational cycles at the load to be qualified. As such, the test units in the subject report were operated in excess of 4000 cycles at 200% thrust overload. If IEEE guidelines are strictly adhered to this testing conclusively demonstrates that the SMB-000 through SMB-1 units are qualified for 200% thrust overload at 2000 operational cycles with a 2 to 1 safety margin. However, the participants in this testing voluntarily used the ASME Section III, Appendix 2 criteria, which provided for a 5.24 cycle margin and a 1.47 load margin to arrive at 162% thrust overload for 2000 operational cycles. Therefore, a substantial de-rating of the test results has already been applied to provide margin for various unknowns.

Conclusions:

The uncertainty of instrumentation and indicators used to conduct the subject testing was quite small and insignificant when compared to the 200 percent thrust overload values. In addition, the mechanical aging simulated in this test program exceeded that specified by the referenced IEEE Standards.

Utility Actions:

Each Utility will need to include the accuracy of the diagnostic equipment used to measure actuator thrust as mentioned in Limitorque Technical Update 92-01 and Limitorque Technical Agreement 92-01.

Question 6

Limitorque has issued Technical Update 92-01 which, among other conditions, indicates that the actuator bolts must be tightened to a certain torque before applying the increased allowable percentage thrust above the ratings. The Kalsi study is only applicable if those bolts had been tightened before the overthrust condition was experienced. Dr. Kalsi stated that not having the bolts tightened to the prescribed amount could result in increased wear of the components. Therefore, licensees should recognize this limitation in the use of the Kalsi study to evaluate overthrust events for actuators that do not have bolts tightened to the prescribed amount. (Ref. NRC Meeting, Question 6)

The Kalsi report stated that the actuator housing cover bolts must be torqued in a prescribed manner. The NRC has been informed by Limitorque that Kalsi may be able to justify removal of this precondition for the use of the Kalsi report.

How does WCNOC satisfy the appropriate conditions of the Kalsi study for bolt torquing? (Ref. Wolf Creek Inspection Report, Question 6)

Response to Question 6:

During the subject test program, bolt pre-load torque values were selected to prevent joint separation during 270% to 280% thrust overload. Another purpose for the selected bolt torque values was to minimize the potential for fastener failures due to alternating stress as the joint is loaded since the focus of the report was to address actuator components. As such, the guidance provided in the subject report and in Limitorque Technical Update/Agreement 92-01 provide values that may be overly restrictive based on plant specific thrust overload and seismic requirements. Bolt torque values affect only the fatigue life of the bolts and <u>not the fatigue life or wear of other actuator components</u>.

Both the housing cover and actuator base joints are loaded only in the valve closing direction. In a rigid joint (such as the actuator base to valve yoke), only loads in excess of the bolt preload provide significant contribution to the bolt alternating stress. However, for a flexible joint (such as the upper housing cover where a gasket is present), the bolt will see significant alternating stress with little sensitivity to the bolt preload.

Therefore, for the upper housing cover, the exact bolt preload contributes little to minimizing the bolt alternating stress since the upper housing cover joint is flexible. As long as the upper housing cover bolts have some preload (i.e. are not loose) there should be no significant impact on the bolt fatigue life between a light preload and the maximum preload values specified on pages 17 to 20 of Appendix A in the subject report.

Kalsi Engineering Report 1752C documents testing and analysis to demonstrate the insensitivity of the bolt preload on fatigue life for SMB-000 new and old style housing covers. The SMB-000 actuator fasteners are subjected to the most severe alternating stress magnitude in this series of actuators (from SMB-000 through SMB-1). A subsequent report, 1759C, documents the comparative stresses of fasteners used for this series of actuators and provides recommendations for upper housing cover and actuator mount bolt torque values.

Conclusions:

In order to use the increased thrust ratings for SMB-000 through SMB-1, it is not necessary to preload the housing cover or mounting fasteners to the torque levels used by Kalsi Engineering in the Limitorque Phase 1 overload testing (Kalsi Engineering Document No. 1707C issued November 25, 1991) and recommended by Limitorque in Technical Update/Agreement 92-01.

Utility Actions:

It is concluded that, within the constraints of the increased thrust recommendations, the fatigue life of the housing cover bolts is unaffected by the amount of fastener preload. However, to prevent bolt loosening during operation and vibration, it is recommended that these bolts be tightened to some prescribed level of pre-load (standard craft practice or actual torque values).

For the actuator mounting bolts evaluations should be performed to ensure that bolt material and torque pre-load values are adequate to accommodate increased thrust loads in combination with plant specific seismic loads.

Question 7

A report in accordance with 10 CFR 50, Part 21, was issued regarding the sizing of the bolts used in Limitorque 000 actuators.

How will WCNOC ensure that actuator housing cover and mounting bolts are adequately sized for the increased allowable thrust limits? (Ref. Wolf Creek Inspection Report, Question 7)

Response to Question 7:

As mentioned in the response to Question 6, each Utility should ensure that the proper grade fastener tightened to the appropriate pre-load values are used.

Conclusions:

See Conclusions for Question 6.

Utility Actions:

See Utility Actions for Question 6.

Question 8

The Kalsi report does not consider manufacturing differences of aging effects.

How does WCNOC provide assurance that the results of the Kalsi study are applicable to actuators at Wolf Creek considering any manufacturing differences and aging effects? (Ref. Wolf Creek Inspection Report, Question 8)

The Kalsi study used new actuators in its testing program. The applicability of the study's findings to older actuators installed in nuclear plants should be addressed. Two considerations are the possible differences in manufacturing over the years and the effects of aging. (Ref. NRC Meeting, Question 7)

Response to Question 8:

Limitorque was involved in the review process for this report and confirmed that there were no manufacturing differences that needed to be considered from a thrust loading aspect other than the new and old style SMB-000 housing covers. The applicability of the test results to the old style SMB-000 housing cover is documented in KEI Report 1752C.

The testing documented in the KEI Report 1707C exceeds the mechanical aging requirements specified by IEEE Standard 382. Qualification testing normally involves the use of new test specimens to establish experimental control. Controlled mechanical, thermal and radiation aging are applied to simulate the qualified life. IEEE Standard 382 and 323 allow exemption from thermal and radiation aging those parts that are not affected by these mechanisms. Limitorque Report B0058 states the following:

- Since metal parts are unaffected by moderate elevated temperatures, only organic parts are considered in thermal aging. (Page 4, 2.2.2)
- Limitorque test experience clearly demonstrates that for Limitorque actuators there is no difference on the equipment as a result of where irradiation occurs in the aging sequence. (Page 5, 2.2.4)
- Some materials, such as metallic parts, do not respond at all (Page 10, 3.2.1.1)
- Metal components are unaffected by aging and would not respond to thermal aging. No effort was made to thermally age the metal components. (Page 15, 3.2.4)
- In all cases, there was no noticeable detrimental effect of radiation on any component in any of the test sequences or radiation level employed. (Page 17, 3.4)

Metal components are only affected by neutron radiation. The radiation called for in the IEEE Standards is developed by a gamma source which only affects organic materials.

Conclusions:

In terms of aging effects, no action is required. The mechanical aging simulated during the test program documented in the Report far exceeds that specified by the IEEE Standards or that performed in prior equipment qualification efforts.

Utility Actions:

No actions are required.

Question 9

The low stem friction coefficients observed during the Kalsi study might not be achieved under running loads and actual nuclear plant conditions. The Kalsi report also indicates that thrust overload can occur without exceeding the torque rating of an actuator if the stem friction coefficient is low.

How will WCNOC justify stem friction coefficient assumptions at WCGS?
How will WCNOC ensure that the thrust allowable limits are not exceeded? (Ref. Wolf Creek Inspection Report, Question 9)

The Kalsi study found stem friction coefficients ranging from 0.077 to 0.135. These stem friction coefficients are less than some of the values found in actual plant applications. This potential disparity in stem friction coefficients needs to be considered for use of the Kalsi study in licensee applications. (Ref. NRC Meeting, Question 8)

Response to Question 9:

No specific recommendations were made, and none are to be inferred regarding the stem friction coefficients documented in the subject report. However, it should be noted that a standard industry lubricant (Felpro N5000), and standard stem and stem nut materials (4140 stem and Limitorque standard manganese-bronze stem nuts) were used for this testing program which repeatedly subjected the actuator to 200% thrust levels. As such, this report does provide legitimate test data which may or may not be representative of a plant specific application.

In addition, this question implies that thrust ratings in excess of the current rating can occur without exceeding the torque rating of an actuator only if the stem friction coefficient is low. Depending on the stem geometry, this same situation can be produced even with 0.2 stem friction coefficients. The important variable is the actual stem factor, regardless of actual stem friction coefficients. It is recognized, of course, that low stem friction coefficients will result in lower stem factors for a given stem geometry and are therefore more likely to allow actuator overthrust without overtorque. The exact stem friction coefficient obtained during testing versus that obtained in plant applications is of no consequence as long as the torque rating is not exceeded and the thrust values are within those allowed by the report.

Conclusions:

No specific efforts were made to obtain the "low" stem friction coefficients obtained during the subject testing. Also, the exact stem friction coefficient obtained during testing versus that obtained in plant applications is of no consequence as long as the torque rating is not exceeded and the thrust values are within those allowed by the report.

Utility Actions:

Each Utility is responsible for ensuring that the thrust limits justified by the subject report are not exceeded by using diagnostic test equipment, or conservative engineering calculations.

Question 10

The Kalsi report indicated that the actuator bolts had to be tightened during the seismic tests.

How will WCNOC ensure that the tightening of the bolts did not affect the acceptability of the remaining cycles following the seismic tests in determining the total number of successful cycles? (Ref. Wolf Creek Inspection Report, Question 10)

The Kalsi study provided actuator testing for 2000 cycles, seismic testing for several cycles, and subsequent actuator testing for another 2000 cycles. However, the Kalsi study allowed tightening of actuator bolts after the seismic testing before continuation of the final 2000 cycles of testing. The Kalsi study bases its consideration of margin for the testing of a single sample on the conduct of 4000 test cycles. The Kalsi study should ensure that tightening the bolts after the seismic testing does not affect the reliance on tests for 4000 cycles. (Ref. NRC Meeting, Question 9)

Response to Question 10:

Only the SMB-000 actuator experienced hold-down bolt loosening during seismic testing. This was discovered during seismic test run 12, indicating that 12 operational cycles had been successfully completed even with loose hold-down bolts for some portion of these 12 cycles. According to IEEE 344 requirements, only 6 (5 OBE and 1 SSE test) cycles under seismic operation are required. To satisfy plant design basis requirements, typically only a single open or close stroke is required under seismic conditions. The reason that more than 6 seismic test cycles were conducted was to fully envelope the seismic requirements for a majority of the program participants. Again, the loosening of the hold-down bolts did not prevent the actuator from successfully achieving 200% overthrust in the open and close directions under seismic conditions.

Once the hold-down bolts were tightened, they did not loosen until seismic test run 41. Again, these successful operational cycles between test run 12 and 41 (29 runs) far exceed seismic qualification and plant design basis requirements.

In regards to impacting the actuator thrust rating, loose bolts only impact the fatigue life of the bolts themselves, and not the actuator structural components. See the response for question 6 for additional detail.

Conclusions:

Resolution for this particular test anomaly involves making sure that the actuator to valve hold-down bolts are properly torqued as stated in Question 6. Again, had this anomaly occurred during the first 6 seismic tests it would be of greater concern. Re-tightening of the SMB-000 mounting bolts did not impact the validity of the test results for the actuator structural components, and recent test results indicate that there was no impact on the bolting as well.

Utility Actions:

See Utility Actions for Question 6.

Question 11

The stated objective of the Kalsi study was to demonstrate the capability of the Limitorque actuators to withstand a specific thrust for 2000 cycles. All cycles experienced by the actuators since its manufacture must be included in the 2000 cycle limit.

How will WCNOC ensure that its actuators do not exceed the 2000 cycles? (Ref. Wolf Creek Inspection Report, Question 11)

Dr. Kalsi stated that the total number of cycles that an actuator has operated from beginning of its life must be counted in the 2000 cycle limit stated in the study. Licensees need to maintain an accurate count of the number of cycles that each MOV has operated in order to rely on the Kalsi study. Kalsi Engineering and Limitorque should discuss this issue and correct the inconsistency in item 1 of the Limitorque Technical Update 92-01 which appears to incorrectly allow 2000 cycles under increased thrust limit without consideration of the number of cycles experienced by the actuator before the new thrust limits are applied. The letter from Limitorque to the participating utilities should also be similarly corrected. (Ref. NRC Meeting, Question 10)

Response to Question 11:

Fatigue failures are a function of stress intensity and number of cycles. Therefore it is important to conservatively estimate the past number of cycles and stress intensity to determine the cumulative fatigue damage and the remaining component life. Normally, station operations personnel can provide a conservative estimate of past cycle history and anticipated future use. The percent of rated thrust during past operation can usually also be conservatively estimated and applied to the allowable thrust fatigue life curve provided in the subject report to determine the allowable cycle fatigue life.

Using the allowable thrust load versus number of cycles curve given in KEI Report 1707C, the procedure for determining the cumulative fatigue damage and the remaining cycle life is determined as follows:

Definitions:

- Tn = Allowable thrust overload (% of rated thrust) corresponding to a given number of cycles, N
- Nt = Allowable number of cycles corresponding to a given thrust overload, T (% of rated thrust)
- n = Number of cycles of overload applied at a given % rated thrust from operations history

$Tn = 456.4 - 88.95(\text{Log } N)$ **for 763<N<10,156** Eqn. 11.1

$Tn = 200$ **for N=1 to 763** Eqn. 11.2

$$Nt = \text{Log}^{-1}\left(\frac{456.4 - Tn}{88.95}\right)$$ Eqn. 11.3

Cumulative fatigue damage assessment using Miner's Rule:

$$\frac{n_1}{N_1}+\frac{n_2}{N_2}+\ldots+\frac{n_i}{N_i}=1.0 \qquad \text{Eqn. 11.4}$$

Example 1:

SMB-0 actuator has been operating at 100% of rated thrust for 4000 cycles. Determine the allowable number of remaining cycles at 162% of rated thrust.

Step 1: Determine allowable number of cycles, Nt, at 100% thrust:

$$Nt = Log^{-1}\left(\frac{456.4-100}{88.95}\right)=10{,}156$$

Step 2: Determine allowable number of cycles, Nt, at 162% thrust:

$$Nt = Log^{-1}\left(\frac{456.4-162}{88.95}\right)=2{,}040$$

Step 3: Determine cumulative fatigue damage fraction remaining using equation 11.4:

$$\frac{4000}{10{,}156}+\frac{n_2}{2040}=1.0$$

Therefore, n_2 = 1236. This means that there are 1236 permissible cycles remaining at the 162% thrust value for this actuator with a load history of 4000 cycles at 100% thrust. The following table is provided to assess the remaining permissible cycles assuming operation at 100% of the thrust rating for the specified number of cycles:

Number of remaining cycles, N_2, at 162% thrust overload given a history of n_1 operating cycles at 100% thrust rating:		
n_1 Operating Cycle History at 100% Thrust Rating	N_1 Maximum Allowable Operating Cycles at 100% Thrust Rating	N_2 Remaining Allowable Operating Cycles at 162% Thrust Rating
500	10,156	1940
1000	10,156	1840
1500	10,156	1738
2000	10,156	1638
2500	10,156	1537
3000	10,156	1437
3500	10,156	1337
4000	10,156	1236

Conclusions:

Counting cycles is virtually unnecessary if the unit has been operated below the existing thrust ratings for fewer than several thousand cycles. Even with 4000 cycles of operation at 100% of the existing thrust rating, there are still 1236 permissible cycles remaining at 162% thrust overload. The above response provides the methodology for calculating remaining allowable cycles at a specific thrust load (including overthrusting), given the past thrust load and cycle history.

Utility Actions:

Each Utility should perform an evaluation to see if counting cycles and calculating remaining cycle life are necessary for actuators set at thrust overload conditions. If this is necessary, the above response provides the methodology to assess cumulative fatigue damage and remaining cycle life.

Question 12

The NRC has been informed of decreased thrust output of actuators that had their housing cover bolts tightened to the torque prescribed in the Kalsi report. The thrust reduction apparently was caused by an overcompression of the housing cover gasket resulting in internal actuator binding.

How will WCNOC ensure that any tightening of actuator housing cover bolts is followed by thrust verification tests? (Ref. Wolf Creek Inspection Report, Question 12)

Subsequent to the meeting on April 15, 1992, Region IV personnel were informed by the licensee of Arkansas Nuclear One that, when implementing the Kalsi study and the conditions for its use, the licensee had found the thrust delivered at MOV torque switch trip decreased by up to 50% as compared to the thrust delivered before implementation of the Kalsi study. The licensee believed that the probable cause was the over-compression of the housing cover gasket resulting from the new torque requirements of the housing cover bolts. Some of the MOV diagnostic equipment in use by licensees would likely not have detected this loss in delivered thrust. Duke Power needs to ensure that this concern is resolved before licensees implement Limitorque Technical update 92-01 and the Kalsi study. Reporting requirements under 10 CFR part 21 might also be applicable. (Ref. NRC Meeting, Question 11)

Response to Question 12:

Many utilities have successfully applied the recommended housing cover bolt torque values without over preloading the upper thrust bearing or binding the actuator. In the subject report, standard Limitorque guidelines were followed for determining upper housing cover gasket thickness with no indication of upper bearing or actuator binding. Normal procedures usually involve hand operation or diagnostic testing after tightening the upper housing cover bolts to ensure that binding has not been introduced.

Conclusions:

Only isolated occurrences of actuator binding have been identified, even when using the unusually high upper housing cover torque values provided in the subject report.

Utility Actions:

Utilities should ensure that adequate procedural controls are in place to prevent actuator binding following tightening of upper housing cover bolts. The standard NMAC and Limitorque procedure of using a gasket thickness of the measured housing cover gap plus 10% proved successful in preventing actuator binding during the subject test program and when applied by various Utility participants. In addition, hand operation and/or diagnostic testing with equipment capable of measuring stem thrust reductions (non-spring pack displacement methods) are suggested.

Question 13

The Kalsi study experienced several failures of the motor pinion key in its tested Limitorque SMB-0 actuator. The Kalsi report stated that the motor pinion key should be replaced with high strength material in all SMB-0 actuators for which the Kalsi study will be applied. The NRC discussed potential failure of motor pinion keys in Information Notice 90-37.

How will WCNOC ensure that motor pinion keys in all safety-related actuators are of sufficient strength to withstand the stress exerted on them? (Ref. Wolf Creek Inspection Report, Question 13)

Response to Question 13:

This issue was addressed in the response to Question 3.

Question 14

The Kalsi study experienced spurious engagement of the manual declutch lever during the seismic testing of the Limitorque SMB-000 actuator. The Kalsi report stated that the declutch lever in SMB-000 actuators should be secured before applying the Kalsi conclusions. As noted in NRC Vendor Inspection Branch Report 99900404/92-01, a study of overthrust capability by Westinghouse Corporation experienced spurious engagement of the declutch lever of a different size Limitorque actuator.

How will WCNOC ensure that the manual declutch levers are secured for all Limitorque actuators that will be evaluated using the Kalsi study? (Ref. Wolf Creek Inspection Report, Question 14)

Response to Question 14:

During the 54th and 55th seismic test, the manual declutch lever vibrated to the manual engangment position. It was mechanically secured in the disengaged position using duct tape for the remainder of the seismic testing. Accordingly, KEI recommended in the Report that the lever be positively locked in the disengaged position for seismic considerations **only**. Having the declutch lever positively locked has absolutely no impact on the actuator ability to withstand the thrust levels specified in the subject report, and should not be interpreted as such. Limitorque is presently addressing the problem and a modification or "fix" is forthcoming, most likely in the form of a light alloy operating lever.

It should be noted that a similar anomaly occurred with an SMB-00 actuator during the Limitorque-Westinghouse testing. In an effort to reproduce this condition, Limitorque performed an additional seismic test on 1/23/92. This duplicate seismic test failed to produce the subject anomaly. As stated above, however, Limitorque is in the process of reviewing potential design modifications to the declutch system.

This particular anomaly appears to be a potential generic problem with the SMB-000 and SMB-00 model line, regardless of the thrust developed. Variations in drive sleeve declutch spring stiffness appears to be the root cause of this condition. Since the original Limitorque seismic qualification testing was performed on only the SMB-0 model, this problem with the SMB-000 and SMB-00 models would not have been detected. In addition, other seismic testing has been performed on these same model actuators without experiencing this anomaly. This anomaly would be of greater concern had it occurred during the first 6 seismic tests (number of tests specified in IEEE-344 - five OBE plus one SSE), rather than during tests 54 and 55.

Page 28 of 52 in the subject report recommends that the SMB-000 manual declutch lever be secured with a cable to keep in from spuriously engaging during a seismic event. While this may be a suitable solution at a seismic test facility, it is not a suitable solution at an operating nuclear plant.

Conclusions:

Spurious engagement of the SMB-000 declutch lever occurred during seismic test 54 and 55, which is well beyond the 6 seismic sequences required for equipment qualification. This issue has been reported to Limitorque for resolution.

Utility Actions:

The recommended solution is to implement the Limitorque "fix" for all SMB-000 and SMB-00 model actuators over the course of several refueling cycles (ref. Limitorque Potentially Reportable 10 CFR Part 21 Condition, December 7, 1992). Only actuators required for operation during a seismic event need be targeted for this modification.

Question 15

The Kalsi study used specific stem and stem nut materials in its tested actuators.

How will WCNOC ensure that the conclusions of the Kalsi study are applicable to the stem and stem nut materials used at WCGS? (Ref. Wolf Creek Inspection Report, Question 15)

Response to Question 15:

As stated in the response to question 9, the exact stem friction coefficient obtained during testing versus that obtained in plant applications is of no consequence as long as the torque rating is not exceeded and the thrust values are within those allowed by the report. Question 9 also provides the stem and stem nut material used (4140 and standard Limitorque manganese-bronze, respectively).

In addition, the response to question 2 provides a discussion on the stem friction coefficients obtained during the subject testing.

Conclusions:

This issue was previously addressed in the response to questions 2 and 9. No additional recommendations nor utility actions are necessary based on this question.

Attachment 2

CECo Specific Utility Action

Question 1 Utility Actions

The valves for which the Kalsi thrust uprating is expected to be applied at CECo are not expected to experience a large number of operational cycles at overload under design basis dP conditions. CECo will evaluate the population of MOVs for which the Kalsi thrust rating is applied to determine if evaluation and/or inspection is necessary. CECo will rely on the results of the Phase II testing for guidance to perform such evaluations, as needed.

Question 2 Utility Actions

As recommended in Attachment 1, an adequate stem lubrication program exists at CECo. Therefore, it is considered that excessive stem nut wear should be prevented and should not adversely affect the operability of MOVs at CECo plants. Anomalies detected by diagnostic testing will be evaluated.

Question 3 Utility Actions

Established torque ratings for Limitorque actuators at CECo are not exceeded by application of CECo's GL 89-10 Program. CECo is currently evaluating the impact of the SMB-0 motor pinion key issue now that Limitorque offers appropriate replacement keys.

Question 4 utility Actions

No utility specific actions required.

Question 5 Utility Actions

CECo utilizes VOTES fc MOV diagnostic testing. Per the requirements of the CECo MOV Program Document, the "VOTES" equipment inaccuracies are accounted for during valve testing such that ratings are not exceeded.

Question 6 Utility Actions

The housing cover bolts are tightened to some prescribed level of preload (standard craft practice is used) to prevent bolt loosening during operation and vibration. Valves in the CECo MOV Program have been or are in the process of being analyzed for seismic/weak link limitations. In this analysis, the yoke to operator bolting is specifically analyzed under seismic loading to determine the maximum limit for the operator thrust contribution. The methodology used by CECo to determine maximum allowable thrust values for MOVs ensures that increased thrust loads from actuator thrust upratings will not exceed valve to operator bolting load limits under seismic conditions.

Question 7 Utility Actions

CECo is evaluating the referenced 10 CFR 50, Part 21 issue regarding the size of the bolts used in Limitorque actuators.

For the operator mounting bolts, CECo is utilizing the torque recommendations provided by Limitorque as design input for performing the seismic analysis. The material (grade) of bolting is evaluated during the valve seismic/weak link analysis as mentioned in the response to Question 6.

Question 8 Utility Actions

No specific utility response is required.

Question 9 Utility Actions

CECo is using the VOTES diagnostic test system to "set-up" valves in the field following cleaning and lubrication of the valve stems. Stem friction coefficients are approximated from these tests to assure no over thrust. If the stem friction coefficient degrades from this point, the thrust will also decrease which is accounted for high initial setpoints. Test equipment inaccuracies are accounted for during the field setup. Maximum allowable thrusts are clearly identified prior to diagnostic testing such that they will not be exceeded.

Question 10 Utility Actions

See Question 7 response.

Question 11 Utility Actions

At this time, CECo does not consider counting cycles for each valve necessary. In accounting for 2000 cycles over the 40 year life of the unit, it would be necessary to cycle each actuator 50 times per year. In the future, CECo will reevaluate the MOVs for which Kalsi is applied to determine if cycle counting is necessary.

Question 12 Utility Actions

Post maintenance VOTES diagnostic testing following this type of work will be required at CECo upon revision of CECo's corporate guidance for MOVs, NOD-MA.1.

Question 13 Utility Actions

See Question 3 response.

Question 14 Utility Actions

CECo is currently evaluating this anomaly which includes monitoring ongoing industry actions. Upon completion of the evaluation, CECo will implement any necessary modifications.

Question 15 Utility Actions

No specific utility response is required.

Commonwealtb Edison
1400 Opus Place
Downers Grove, Illinois 60515

March 5, 1993

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Document Control Desk

Subject: LaSalle County Nuclear Power Station Units 1 and 2
Reply to Notice of Violations
Inspection Report Nos. 50-373/92023; 50-374/92023
NRC Docket Nos. 50-373 and 50-374

Reference: H.J. Miller letter to C. Reed dated December 16, 1992
transmitting NRC Inspection Report 50-373/92023;
50-374/92023

Enclosed is the Commonwealth Edison Company (CECo) response to the Notice of Violations (NOVs) which were transmitted with the reference inspection report.

The violations address the use of stall torque to determine operability of motor operated valves and the characterization of documents presented during the inspection.

If your staff has any questions or comments concerning this letter, please refer them to Sara Reece-Koenig, Compliance Engineer at (708) 663-7250.

Sincerely,

D.L. Farrar
Regulatory Services Manager

Attachment

cc: A.B. Davis, Regional Administrator - Region III
B. Stansky, Project Manager - NRR
D. Hills, Senior Resident Inspector

SR/cah/ltr/1

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Attachment A

RESPONSE TO NOTICE OF VIOLATION
NRC INSPECTION REPORT
50-373/92023; 50-374/92023

VIOLATION 1: (373/92023-01; 374/92023-01)

10 CFR 50, Appendix B, Criterion III requires, in part, that measures shall be established to assure that applicable regulatory requirements and the design basis, as defined in 10 CFR 50.2, are correctly translated into specifications, drawings, procedures, and instructions. These measures shall include provisions to assure that appropriate quality standards are specified and included in the design documents and that deviations from such standards are controlled.

Contrary to the above, as of November 20, 1992, an inappropriate equation (Limitorque's "stall torque" equation) was used to evaluate the design basis capability of safety-related MOVs. Appropriate technical justification for deviating from the vendor's recommendations was not presented.

This is a Severity Level IV Violation (Supplement I).

CECo's RESPONSE TO VIOLATION

Executive Summary

CECo agrees that the appropriate written documentation justifying CECo's application of the motor stall capability calculation was not readily available for review by the NRC inspectors present at the Lasalle MOV inspection. However, CECo was not using the Limitorque "stall torque" equation to define MOV design basis capability as stated in the violation. CECo's stall capability calculation is distinct from the Limitorque "stall torque" equation and is used for a different application. CECo's stall capability calculation is used in limited cases for establishing testing thrust windows and performing operability assessments on certain MOVs. The limited use of the stall capability calculation is appropriate for the circumstances for which it is applied at CECo. CECo's approach is consistent with the NRC operability guidance provided in GL 91-18.

The Limitorque "stall torque" equation referenced by the NRC in the inspection report is an equation used for calculating maximum output of a specified actuator in an overload analysis. All variables in this "stall torque" equation are set to maximize the thrust output of the actuator to evaluate the potential for MOV structural overload damage. This is distinct from the CECo stall capability calculation which assumes degraded voltage conditions and conservative stem friction factors. The ability of AC motors to generate greater than start torque exists at the stall condition. CECo feels that it is appropriate to utilize this available "margin" to demonstrate valve operability. CECo's stall capability calculation is only applied in limited circumstances on a interim basis, taking into account all available MOV design margins. It is never used for permanent MOV design evaluation.

There is no "standard industry equation" for MOV sizing calculations, either for permanent design sizing or for determining operability. The MOV motor/gearing capacity equation is given in standard format in the Limitorque Selection Guides (Reference 1). However, the industry application of that motor/gearing equation for MOV sizing calculations is not consistent. It is CECo's understanding that some licensees are applying different values to the variables in the equation. This has been noted in previous NRC GL 89-10 inspection reports.

CECo's methodology for determining permanent MOV sizing is conservative. CECo's permanent sizing calculations incorporate conservative assumptions like locked rotor current (LRC) at design basis degraded voltage conditions, stem lubricant degradation, and inertial effects. Based on the conservative approach CECo utilizes for permanent MOV sizing, we believe that our use of motor stall torque to determine operability on certain valves is appropriate. In addition, CECo's GL 89-10 Program has taken an aggressive approach to addressing problem valves, including extensive MOV modification work at all six nuclear stations.

The remainder of this violation response contains a detailed technical justification of CECo's application of motor stall. In addition, it will be shown that the technical intent of the Limitorque Maintenance Updates, 89-1 and 92-1 (References 2 and 3), is incorporated in CECo's GL 89-10 Program.

Context of CECo's Use of Stall Capability Calculations

The calculation of stall torque capability by Commonwealth Edison is appropriate and justifiable, in the context in which it is used.

CECo has reviewed the methodology and variables presented in the Limitorque Selection Guides (Reference 1) and the Limitorque Maintenance Updates, 89-1 and 92-1, (References 2 and 3) and has concluded that our stall capability methodology is appropriate for assessing the capabilities of selected MOVs on an interim basis only. It is not appropriate for use as permanent design input. Specifically, the stall capability calculations are being used on certain MOVs to support testing and to establish interim torque switch settings until modifications to enhance margin can be completed or test data outside of our standard MOV calculational assumptions is reconciled.

Because the MOV torque switch setpoints within CECo's GL 89-10 program are established considering locked rotor current at degraded voltage conditions, degradation of stem lubrication, instrument tolerances, and inertia effects, the concerns documented in the referenced Limitorque Maintenance Updates with respect to MOV sizing are addressed.

Stall Torque Used on an Interim Basis Only

Stall capability calculations have been used only on a limited basis, in some cases to establish testing thrust windows. These testing thrust windows take into account degraded voltage, proper use of diagnostic test equipment, degraded stem to stem nut coefficients of friction, and inertia effects. The limited use of the stall capability calculation preserves the margin inherent in the consideration of these phenomena, thus permitting a deliberate and systematic approach to CECo's MOV Program. The established testing windows determined through the use of stall calculations preserves the overall margin for MOVs until such time as final MOV disposition is completed.

Necessary permanent MOV modifications are not precluded by CECo's motor stall capability application.

Testing Thrust Windows Were Set to Avoid Stall

In establishing the thrust windows for testing, the windows specified for MOVs are such that the valves will accomplish their design function without the motors reaching a stall condition. That is, the torque switches are set below the calculated stall capability, so that the motor will not reach a stall condition, even under the conditions of degraded voltage and/or degraded stem to stem nut coefficients of friction.

Limitorque Selection Guide and Maintenance Updates 89-1 and 92-1

The Limitorque Selection Guide, (Reference 1), SEL-3 page 4 of 4, provides a stall equation at 100% voltage to verify that the resultant MOV thrust does not exceed 2.5 times the actuator thrust rating. This calculation is part of a sizing procedure to assure inherent mechanical survivability in the event the control devices fail. EPRI Guide NP-6660-D, Reference 4, provides a more detailed but similar discussion of the use of the stall equation in sizing and/or evaluation of the actuator for stall conditions.

The intent of the Limitorque "stall torque" equation is to maximize the delivered thrust to the valve and actuator for mechanical overload analysis. For this specific overload analysis, the variables of standard MOV sizing are maximized. For the overload analysis, the changes in the variables of the normal sizing equation are as follows:

- The *application factor*, which is typically set to 0.9 or less, is taken to be 1.0.
- The voltage supplied to the motor is assumed to be *full rated voltage*, instead of *degraded voltage*.
- The *start torque* of the motor is replaced by the *stall torque* (or 110% of the start torque if the stall torque is not available from generic motor curves).
- The *pullout efficiency* is replaced by the *stall efficiency*. Note that the pullout efficiency is related to motor speed of 0 rpm, (Reference 2, Section 6.1.2.2, page 6-4).
- The *stem factor* at a low assumed coefficient of friction is assumed.

Each of the above changes in the value of the variables in the sizing equation has the effect of increasing the final thrust output of the actuator, and thus is conservative for evaluating an overload condition.

The focus of Limitorque Maintenance Update 89-1 (Reference 2) was not stall calculations, but the use (or discontinued use) of limiter plates. Within the context of the discussion in 89-1 on limiter plate use and function, the potential misuse of stall calculations in determining the maximum output of the actuator and the maximum torque switch setting was included. The concern was specifically addressed to the possibility that even with diagnostic test equipment, field personnel could set the torque switch at a level corresponding to a higher torque output than the motor/gearing was capable of producing under degraded voltage and degraded stem/stem nut coefficient of friction conditions.

The concern with the use of stall calculations is that the motor would stall and the torque switch would never be activated. Under these conditions, the thermal overload would be required to protect the motor, or the motor insulation would fail. The motor would reach stall conditions upon valve seating following flow isolation. Note that the opening stroke at CECo nuclear stations is controlled by limit switches, with the torque switches being by-passed for pullout.

The specific recommendations made in the Limitorque Maintenance Update 89-1 are as follows:

Recommendations

1. Limitorque does not recommend removal of the torque switch limiter plate.

2. The maximum torque switch settings should be based on the criteria we've outlined including the maximum pullout torque capability of the actuator based on the minimum voltage.

3. Stall torque calculations should only be used for overload analysis.

4. Diagnostic thrust testing should not be used as justification for increasing the maximum torque switch setting.

5. Training should be provided for engineering and maintenance personnel concerning the torque switch limiter plates with particular emphasis on the reduced voltage affect on in-plant test data."

CECo has evaluated all the recommendations in Limitorque Maintenance Update 89-1 within the context of CECo's GL 89-10 program. In CECo's MOV Program, use of limiter plates is not mandatory, gear run efficiency is used for the closing stroke on AC powered MOVs, stall capability calculations have been performed only on a selective basis, and diagnostic test equipment which measures thrust is used for setting torque switches. Degraded voltage is considered and appropriate training of both maintenance and engineering personnel has been performed. In essence, the Limitorque 89-1 recommendations have all been addressed in CECo's GL 89-10 Program.

As stated in the executive summary, CECo's calculation of stall capability is distinct from the Limitorque "stall torque" calculation referred to in Recommendation #3 above. The technical acceptability of CECo's specific calculation of stall capability is contained further in this document.

Limitorque Maintenance Update 92-1 (Reference 3) elaborates on the discussion provided in Maintenance Update 89-1 regarding stall torque calculations. The discussion highlights three issues: 1) the application of degraded voltage, 2) an assumed coefficient of friction between the stem and stem nut for stall event assessments, and 3) the use of stall efficiencies.

The section on stall torque calculations is summarized as follows:

"In summary, Limitorque recommends that Stall torque calculations should only be used for overload analysis and not for determining maximum torque switch settings [see Maintenance Update 89-1].

"Also Engineering personnel should be aware that the Stall efficiencies in Limitorque SEL guides include inertial effects seen in a stall condition. Finally, in making stall calculations, assumptions about the motor terminal voltage and the stem nut coefficient of friction must be made."

In this case, Maintenance Update 92-1 addresses assessment for stall events, specifically for MOV overthrust evaluations. As stated previously, the stall capability calculations performed by CECo are for establishing testing thrust windows and performing operability assessments on certain valves, not for determining maximum allowable torque switch settings.

Therefore, while specific cautions are given in 92-1 against using the overthrust equation for establishing the maximum allowable torque switch settings, CECo is 1) not currently performing overthrust evaluations and 2) the stall capability calculations performed are primarily being used to establish testing thrust windows, which seek to preserve MOV design margin.

Technical Acceptability of Calculating the Stall Torque Capability

Calculation of stall capability is technically appropriate and justifiable, in the context in which it is performed at CECo. As stated previously, there is no standard industry equation for taking credit for motor stall. In the absence of such an equation, CECo has developed a reasonable approach and technical basis for its limited use.

The motor/gearing capacity is determined from the equation provided in the Limitorque Selection Guides (Reference 1):

$$\text{Total Thrust} = \frac{MT*OAR*EF*AF*DV}{FS}$$

where,

MT = Motor Torque, ft-lbs
OAR = Unit Ratio, dimensionless
EF = Unit Efficiency, dimensionless
AF = Application Factor, dimensionless
DV = Degraded Voltage Ratio, dimensionless
(Ratio of degraded to rated voltage, squared for AC, simple ratio for DC)
FS = Stem Factor, ft

As noted previously, motor torque, gear efficiency, terminal voltage, and application factor are maximized to perform an overload analysis, i.e. the Limitorque "stall torque" equation. In the case of the normal sizing analysis or CECo's stall capability analysis, the total thrust resulting from the motor/gearing is calculated using the same equation, only the values of the variables differ. The specific justification for the value of each factor in CECo's stall capability analysis is presented below.

Motor Stall Torque (MT)

In analyzing the stall capacity of an actuator, the motor start torque is replaced with the stall torque of the motor. The Limitorque Selection Guides in performing an overload analysis would use either the stall torque or 110% of the motor start torque.

Stall capability calculations performed for CECo utilize the stall torque of the motor when available from the generic motor curves. CECo believes that there is ample evidence that the motor capacity exceeds 110% of the motor start torque and that it is appropriate to use the stall torque developed by the motor in place of the motor start torque. The Limitorque Selection Guide SEL-3 (Reference 1, page 3 of 4), states:

"Limitorque motors will produce whatever torque is demanded <u>up to and including the locked rotor torque rating;</u>"

The generic motor curves themselves represent expected, though not guaranteed, motor performance. In Reference 2, it states,

"However, motor stall torque is better estimated by using the motor curves. If the correct motor curve can be identified, the speed vs. torque curve can provide a generic stall torque value for a specific design motor."

In separate EPRI documents, the stall capacity of the motors provided with Limitorque actuators are clearly described as exceeding 110% of motor start torque. From Reference 4, Section 3.4.1, Page 3-24:

"The rated starting torque of the motor is usually 65% to 90% of the motor stall torque."

From the section for DC motors, Section 3.4.3, Page 3-27:

"The rated starting torque (10 ft-lb) is 63% of the locked-rotor torque (16 ft-lb). This margin is larger than in an AC motor."

From Reference 5, Section 7, Page 7-15,

"Motor Stall Torque

These values normally exceed nominal motor ratings by as much as 40% for AC motors (120% for DC motors) at rated voltages."

CECo has also independently performed testing of DC motors and has found that the Peerless DC motors meet or exceed the stall torque values documented on the

Limitorque generic motor curves. The testing has also demonstrated that the voltage ratio relationship for degraded voltage is valid at voltages as low as 10% of the motor's rated voltage, (Reference 6).

In summary, it is CECo's position that the stall torque of the motor as documented in the generic motor curves may be used within a stall capability calculation.

In addition, please note that this is consistent with the assumption of using locked rotor current to determine the voltage drop from the motor control center to the motor terminals.

Application Factor (AF)

The application factor is described in Reference 2 (Section 6.1.2.2, Page 6-4) as accounting for:

"losses in efficiency not otherwise included in the calculation."

The application factor is purely a term used to provide design margin for effects or phenomena not explicitly defined.

It is CECo's position that in using stall capacity calculations for interim testing and operability assessments, this additional design margin need not be provided, i.e., the application factor is to provide margin for permanent sizing purposes.

Degraded Voltage (DV)

The degraded voltage term in CECo's stall capability calculations is used in the same way as CECo's normal sizing calculations. The motor terminal voltage is conservatively calculated at locked rotor conditions. The ratio of the motor terminal voltage to rated voltage at degraded voltage conditions is squared for AC motors and is used as a simple ratio for DC motors. However, this is distinct from the Limitorque "stall torque" equation which uses rated voltage, i.e., the ratio of voltages is 1.0.

Overall Gear Ratio and Efficiencies (OAR & EF)

The gear ratios are physical constants related to the actual physical dimensions of the gears. There are no adjustments taken for the gear ratios.

The efficiencies used in CECo's stall capability calculations are based on the specific gear set, the motor rpm, and the actuator model. CECo test data has

shown that the motor attains full motor speed before the gears are engaged in pullout. This phenomenon is physically attributed to a relaxation of the gears after the closing stroke, whereupon a gear backlash occurs in pullout. In addition, the motor and gearing are not loaded until the stem is placed in tension from its compressed state. Furthermore, in the case of gate valves, loading does not occur until the hammer blow feature on gate valves has impacted and engaged the drive sleeve and the T-head clearance between the stem and the disc is taken-up.
In the closing stroke, the motor speed is maintained even when considering stall capacity calculations, because the torque switches are set below the calculated motor stall condition, i.e., the MOV is set up to complete its design function (flow isolation) before the torque switch would trip. The stall capacity calculation simply verifies that sufficient margin is available to trip the torque switch under conditions of degraded voltage and stem lubricant degradation.

The use of the stall efficiencies in place of the pullout and run efficiencies, by definition, take credit for the inertia effects expected in opening and closing strokes. It is CECo's position, that in closing and opening, sufficient speed has developed in the motor/gearing assemble such that inertia effects are present.

Stem Factor

The stem factor is directly related to the coefficient of friction between the stem and stem nut. Specific analytical equations are available for calculating the stem factor for given coefficients of friction for a given stem thread.

CECo's GL 89-10 program allows for lubrication degradation of the stem coefficient of friction when evaluating MOV performance. The assumptions for stem factors are the same for the stall application as used during CECo's normal sizing calculations.

Conclusions

CECo is not using the Limitorque "stall torque" equation to define design basis capability as stated in the inspection report. CECo's stall capability approach is distinct from the Limitorque "stall torque" equation and is justified for the limited application for which it is used at CECo, i.e.; for establishing MOV testing thrust windows or for limited cases to determine interim operability until modifications are installed and/or test data outside of CECo's standard calculational assumptions is reconciled. CECo believes that sufficient technical information exists that demonstrate that AC motors produce greater than start torque at the stall condition. CECo feels that is appropriate to utilize this available "margin" to demonstrate MOV operability. This approach is consistent with the operability guidance provided by the NRC in GL 91-18.

References

1. Selection Procedures for Nuclear Actuators, Limitorque Corporation, June 6, 1979.

2. Limitorque Maintenance Update 89-1, Limitorque Corporation.

3. Limitorque Maintenance Update 92-1, Limitorque Corporation.

4. EPRI Report NP-6660-D, Research Project 2814-6, "Application Guide for Motor-Operated Valves in Nuclear Power Plants," March 1990.

5. EPRI Report, "Technical Repair Guidelines for the Limitorque Model SMB-000 Valve Actuator."

6. GDS Associations Calculation MSC-GN-001, "Study for Degraded Voltage Impact on DC Motor Starting Capability," Rev. 1, August 13, 1992.

Attachment B

RESPONSE TO NOTICE OF VIOLATION
NRC INSPECTION REPORT
50-373/92023; 50-374/92023

VIOLATION 2: (373/92023-02; 374/92023-02)

10 CFR 50.9 requires, in part, that information provided to the Commission by a licensee shall be complete and accurate in all material aspects.

Contrary to the above, the licensee provided incomplete and inaccurate information to the Commission during a meeting on November 18, 1992, by presenting a copy of a telephone conversation record dated February 6, 1991, between Bechtel and the vendor (Limitorque). The record was represented by the licensee as Limitorque's position and as justification for the licensee's use of the stall torque equation. This information was incomplete and inaccurate in that the licensee has prior knowledge that use of the stall torque equation for the purpose intended by the licensee was not Limitorque's position. In addition, the record directly conflicted with information previously issued by Limitorque and discussed with CECo technical representative.

This is a Severity Level IV violation (Supplement I).

CECo's RESPONSE TO VIOLATION

CECo's Understanding of the NRC's Description of the 11/18/92 Meeting:

CECo's understanding of the NRC's description of the 11/18/92 meeting is that CECo personnel presented to the NRC a 2/6/91 telecon record between Bechtel and Limitorque that represented Limitorque's position, as well as justification for the licensee's use of the stall torque equation. In addition, the NRC stated that CECo personnel had prior knowledge that use of the stall torque equation for the purpose intended by the licensee was not Limitorque's position because the 2/6/91 telecon directly conflicted with documented guidance issued by Limitorque in Maintenance updates 89-1 and 92-1. In addition, the NRC determined that Limitorque had advised licensee technical representatives that it should not use the "stall torque" equation for determining operability and that the Limitorque sales representative that signed the 2/6/91 telecon record was not authorized to sign technical concurrence documents.

CECo's Understanding of the 50.9 Violation

Based on conversations between CECo and the NRC after the inspection, CECo further understands that the 50.9 violation was issued because of inaccurate information documented in the Bechtel telecon record with Limitorque. This violation was issued based on a verbal discussion between the NRC inspectors and Limitorque. A written confirmation of this telephone conference was not provided to the NRC by Limitorque. However, based on the verbal information, CECo was cited for providing inaccurate information.

CECo's Response

Based on the CECo personnel's recollection of the 11/18/92 meeting with the NRC, CECo's understanding of the event is as follows:

Specifically, CECo did not represent the 2/6/91 telecon record as Limitorque's corporate position on the use of motor stall in MOV sizing calculations. CECo personnel discussed the conflicting Limitorque documentation on the use of the stall torque equation on several occasions with the NRC before and during the inspection. The telecon record was presented to the NRC at the 11/18/92 meeting as one piece of CECo's technical justification for the stall capability application. CECo personnel advised the NRC that CECo's use of the stall capability calculation was distinct from the Limitorque equation and was limited in scope and duration. The NRC was also told that CECo's specific application of the stall capability calculation was appropriate. CECo's justification for the use of motor stall is discussed in detail in CECo's response to Violation 1 (Attachment A).

CECo's personnel involved in the Lasalle MOV inspection understood that the NRC Inspectors were concerned with the fact that there appeared to be no formal documentation supporting the licensee's use of the stall capability calculations, even on an interim basis. CECo agrees that appropriate written documentation justifying CECo's application of motor stall was not readily available for review by the NRC inspectors. Because of the NRC's concerns, the 2/6/91 telecon record was presented to the Inspectors as one piece of contemporaneous documentation justifying CECo's initial bases for the use of the motor stall capability calculations. It was not presented as Limitorque's current or prior corporate position on the issue.

Prior to the issuance of the citation, in early December, the six licensee personnel present at the meeting individually wrote down their recollection of what happened at the meeting. After the citation was issued, the six CECo personnel completed a questionnaire concerning the facts alleged in the inspection report. No CECo individual present at the meeting recalls the facts as described in the violation. CECo knew the Limitorque employee who signed the 2/6/91 telecon record as an applications engineer with a technical background associated with MOVs, not as a sales representative as characterized in the inspection report. CECo had dealt with this Limitorque employee previously on other technical issues and, thus, did not challenge the authenticity of his concurrence with our technical position. The cover letter that accompanied the fax transmittal of the 2/6/91 telecon record from the Limitorque representative to Bechtel makes reference to another engineer at Limitorque in the Nuclear Support Group. This led to CECo's perception that the content of the 2/6/91 telecon record was given some level of technical review at Limitorque.

Conclusion

In summary, CECo did not represent the 2/6/91 telecon record as Limitorque's corporate position on the use of motor stall in MOV sizing calculations. CECo disagrees with the apparent violation of 10 CFR 50.9 as stated in the inspection report. CECo requests that the NRC reconsider the issuance of the violation.

Commonwealth Edison
1400 Opus Place
Downers Grove, Illinois 60515

April 23, 1993

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Document Control Desk

Subject: LaSalle County Nuclear Power Station Units 1 and 2
Reason to Reply to Notice of Violations
Inspection Report Nos. 50-373/92023; 50-374/92023
NRC Docket Nos. 50-373 and 50-374

Reference: H.J. Miller letter to C. Reed dated December 16, 1992 transmitting NRC Inspection Report 50-373/92023;50-374/92023

D.L. Farrar letter to Document Control Desk dated March 5, 1993, transmitting response to Notice of Violation transmitted with NRC Inspection Report 50-373/92023; 50-374/92023

T.O. Martin (NRC) letter to L.O. DelGeorge (CECo), dated April 14, 1993, "Summary of Meeting Held on April 6, 1993, with Commonwealth Edison Company Representatives to Discuss Motor-Operated Valve Operability Criteria"

Enclosed is the Commonwealth Edison Company (CECo) response to the Notice of Violations (NOVs) which were transmitted with the reference inspection report.

Attachment A supersedes the referenced response. CECo requests that the previously submitted response be withdrawn.

If your staff has any questions or comments concerning this letter, please refer them to Sara Reece-Koenig, Regulatory Performance Administrator at (708) 663-7250.

Sincerely,

D.L. Farrar
Regulatory Services Manager

Attachment
cc: A.B. Davis, Regional Administrator - Region III
B. Stransky, Project Manager - NRR
D. Hills, Senior Resident Inspector

SR/cah/ltr/5

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Attachment A

RESPONSE TO NOTICE OF VIOLATION
NRC INSPECTION REPORT
50-373/92023; 50-374/92023

VIOLATION 1: (373/92023-01; 374/92023-01)

10 CFR 50, Appendix B, Criterion III requires, in part, that measures shall be established to assure that applicable regulatory requirements and the design basis, as defined in 10 CFR 50.2, are correctly translated into specifications, drawings, procedures, and instructions. These measures shall include provisions to assure that appropriate quality standards are specified and included in the design documents and that deviations from such standards are controlled.

Contrary to the above, as of November 20, 1992, an inappropriate equation (Limitorque's "stall torque" equation) was used to evaluate the design basis capability of safety-related MOVs. Appropriate technical justification for deviating from the vendor's recommendations was not presented.

This is a Severity Level IV Violation (Supplement I).

THE REASON FOR THE VIOLATION

CECo agrees that the appropriate written documentation justifying CECo's application of the motor stall capability calculation was not available for review by the NRC inspectors. The stall capability calculation was developed by CECo as an approach to address operability concerns on MOVs. Lacking an industry standard methodology for determining operability on MOVs, CECo developed the stall capability methodology using engineering judgement for known phenomena with respect to the operation of motor operated valves. CECo's stall capability calculation is only used in limited cases for establishing testing thrust windows and performing operability assessments on certain MOVs. Due to the changing nature of the industry's implementation of the recommendations in GL 89-10 and the need to address operability concerns in a timeframe commensurate with safety significance, the development and documentation of CECo's stall capability methodology was not subject to the rigorous approach that would typically be applied to design calculations. CECo believes that this approach is consistent with guidance for operability provided in GL 91-18. CECo presented the engineering basis for the stall capability methodology to the NRC during the LaSalle MOV inspection. However, CECo was not able to provide the NRC inspectors with appropriate written documentation justifying CECo's position.

CORRECTIVE STEPS TAKEN

Based on information provided by the NRC during the April 6, 1993, Management Meeting between CECo and NRC personnel at the Region III headquarters, CECo understands that the NRC disagrees with some of the assumptions that CECo utilizes in evaluating MOV operability via the stall capability calculation. Specifically, the NRC disagrees with the motor torque assumptions, motor gearing efficiency assumptions, and the application factor assumptions CECo has been using when evaluating operability for certain MOVs using the motor gearing capacity equation for stall capability.

CECo's understanding of the NRC's position, as provided in the April 6, 1993, meeting summary (Reference 3) is as follows:

1. The NRC does not believe that there is sufficient technical justification to use the 0 RPM stall torque value from the generic motor curves. Based on available information from Limitorque, the NRC believes the licensees would be technically justified in using up to and including 110% of the motor nameplate torque rating for evaluating MOV operability.

2. The NRC does not agree with CECo removing the Application Factor from the thrust equation when using the stall capability calculations to evaluate MOV operability.

3. Degraded voltage at locked rotor current should be considered in the evaluation.

4. Utilization of a stem friction coefficient assumption <0.15 to justify MOV operability needs to have a rigorous technical justification.

5. Licensees should be using pullout and run efficiencies for the applicable circumstances in lieu of stall efficiency.

6. Operability determination for any MOV should consider the available design margins in all of the variables in the standard thrust equation as a whole, not just individually. The NRC staff believes that it is not necessary or productive to define specific values for each of the parameters in the MOV thrust equation. The NRC would consider reasonable technical assumptions where appropriate technical justifications were provided.

The population of MOVs that CECo justified operability through utilization of the old stall capability methodology have been reviewed by the NRC utilizing their own methodology. No operability concerns were identified. However, CECo no longer uses the stall capability methodology as discussed with the NRC inspectors during the LaSalle MOV inspection.

CORRECTIVE STEPS TAKEN TO AVOID FURTHER VIOLATION

Commonwealth Edison is no longer using the stall capability methodology as presented to the NRC during the LaSalle MOV inspection. Any future modification to CECo's methodology will be appropriately documented.

DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

Full compliance has been achieved in that the previous stall capability methodology is no longer used at CECo to justify operability on MOVs.

RESPONSE TO NOTICE OF VIOLATION
NRC INSPECTION REPORT
50-373/92023; 50-374/92023

VIOLATION 2: (373/92023-02; 374/92023-02)

10 CFR 50.9 requires, in part, that information provided to the Commission by a licensee shall be complete and accurate in all material aspects.

Contrary to the above, the licensee provided incomplete and inaccurate information to the Commission during a meeting on November 18, 1992, by presenting a copy of the telephone converstation record dated Feruary 6, 1991, between Bechtel and the vendor (Limitorque). The record was represented by the licensee as Limitorque's position and as justification for the licensee's use of the stall torque equation. This information was incomplete and inaccurate in that the licensee has prior knowledge that use of the stall torque equation for the purpose intended by the licensee was not Limitorque's position. In addition, the record directly conflicted with information previously issued by Limitorque and discussed with CECo technical representatives.

This is a Severity Level IV violation (Supplement I).

REASON FOR VIOLATION:

CECo's personnel involved in the LaSalle MOV inspection understood that the NRC Inspectors were concerned with the fact that there appeared to be no formal documentation supporting the licensee's use of the stall capability calculations, even on an interim basis. CECo personnel advised the NRC that CECo's use of the stall capability calculation was distinct from the Limitorque equation and was limited in scope and duration. CECo agrees that documentation justifying CECo's application of motor stall was not available in CECo's files for review by the NRC inspectors. Because of the NRC's concerns, the 2/6/91 telecon record was presented to the Inspectors. It was not expressly represented to be Limitorque's current corporate position on the issue. However, CECo agrees that by presenting the document, the implication was that it represented Limitorque's position.

RESPONSE TO NOTICE OF VIOLATION
NRC INSPECTION REPORT
50-373/92023; 50-374/92023
(Continued)

REASON FOR VIOLATION (Continued)

CECo was acquainted with the Limitorque employee who signed the 2/6/91 telecon record as an Applications Engineer with a technical background associated with MOVs, not as a sales representative as characterized in the inspection report. The cover letter that accompanied the fax transmittal of the 2/6/91 telecon record from the Limitorque representative to Bechtel makes reference to another engineer at Limitorque in the Nuclear Support Group. This contributed to CECo's perception that the content of the 2/6/91 telecon record had been given some level of technical review within Limitorque.

CECo did not intentionally represent the 2/6/91 telecon record as Limitorque's corporate position on the use of motor stall in MOV sizing calculations. Nonetheless, CECo agrees that the inspector was not provided completely accurate information, in that the relationship between the 2/6/91 telecon and Limitorque's position was not clearly communicated by CECo to the inspector. Therefore, CECo accepts the violation.

CORRECTIVE STEPS AND RESULTS ACHIEVED:

The events surrounding the meeting and the circumstances which led to presentation by CECo of the 2/6/91 telecon record and the subsequent Notice of Violation of 10 CFR 50.9 from the NRC were reviewed with the CECo personnel. The importance of providing complete and accurate information to the NRC during inspections is clear to all individuals involved in the event.

CORRECTIVE STEPS TAKEN TO AVOID FURTHER VIOLATION:

A Lessons Learned report will be distributed by May 31, 1993, describing the circumstances which contributed to the 10 CFR 50.9 violation and the importance of providing complete & accurate information.

DATE WHEN FULL COMPLIANCE WILL BE ACHIEVED

Full compliance is achieved with submittal of this response. Additional information to be used in lieu of the teleconference in question is not available.