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 Document Control Branch (Document Control Desk)

SUBJECT: Responds to NRC 920124 ltr re weaknesses noted in insp repts
 50-275/91-39 & 50-323/91-39. Corrective actions: calculated
 value internal seismic inertial loads added to MRT to
 provide addl conservatism.

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July 30, 1992

PG&E Letter No. DCL-92-176

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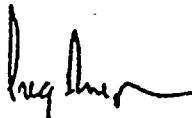
Re: Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
Response to NRC Inspection Report 50-275/91-39 and 50-323/91-39

Gentlemen:

NRC Inspection Report (IR) 50-275/91-39 and 50-323/91-39, dated January 24, 1992, transmitted the results of an inspection of PG&E's motor-operated valve (MOV) testing program. The report indicated that, in general, PG&E appeared to be developing an aggressive, well-integrated program for assuring MOV reliability. The IR also identified areas of weakness regarding the calculation methodology to verify MOV capability and switch setpoints, and the methods for determining when MOV operability evaluations are required. The IR cover letter also identified areas in need of further development regarding periodic verification and trending of MOV performance parameters. PG&E's responses, including the steps being taken to address the NRC's comments, are provided in Enclosure 1.

The IR also identified additional, detailed findings regarding specific issues. PG&E's responses to these additional findings, as well as the steps being taken to address them, are provided in Enclosure 2.

Sincerely,



Gregory M. Rueger

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ENCLOSURE 1

RESPONSE TO ISSUES IDENTIFIED IN NRC INSPECTION REPORT
50-275/91-39 AND 50-323/91-39

A. Calculation Methodology

NRC Concern

There appears to be a reluctance to include a margin for effects that are difficult to quantify. (i.e., rate of loading, seismic/dynamic effects).

PG&E Response

"Rate of Loading" (ROL) is the observed drop in valve stem thrust required to trip the torque switch during a "loaded" stroke, such as during differential pressure (d/p) testing, as opposed to that required during a static, no flow condition. The torque switches are set by PG&E Maintenance personnel during static conditions.

PG&E did not initially incorporate margin for ROL into the MOV calculations because the effect had not yet been quantified for Diablo Canyon Power Plant (DCPP) and it was uncertain whether ROL would actually be observed during MOV dynamic testing. Engineering Procedure ICE-12, "I&C Engineering Procedure for Preparation of Motor Operated Valve Sizing and Switch Setpoint Calculation," did, however, require an evaluation of ROL in the event it was observed in the field. ICE-12 also required that the effect be added to the minimum required thrust (MRT) determination if it were observed. MRT is used in establishing the bottom of the allowable thrust "window" for determining torque switch settings and ensuring sufficient operator capability.

During the Unit 2 fourth refueling outage (2R4) dynamic testing, the ROL phenomenon was observed on some rising-stem MOVs, although no clear pattern was detected. In some cases no ROL was observed, and in other cases a "negative" ROL was observed. Subsequently, a 15 percent margin has been added to the already existing margin for the MRT in order to account for ROL and to provide additional conservatism in operator sizing and setpoint calculations. This margin will be reevaluated for adequacy following future MOV dynamic testing.

Initially, seismic/dynamic inertial effects were not added to the determination of the MRT because the effects tend to be "self-canceling" (i.e., the inertial force of the stem and disc during a seismic event rapidly alternates between helping and hindering the valve stroke). After further review, PG&E has now added the calculated valve internal seismic inertial loads to the MRT to provide additional conservatism in the determination of operator capability and minimum torque switch setpoints.



NRC Concern

There appears to be a lack of conservatism in calculations for degraded voltage.

Specific NRC concerns in this area included the assumption of 90 percent voltage as the worst-case running voltage to the MOV motors during the closing stroke, and using full-load amperage plus ten percent instead of locked-rotor current in establishing voltage drops to the motors.

A voltage of ninety percent had been chosen by PG&E as the worst-case based on industry practice. At the time of the inspection, the plant was taking credit for procedural controls (i.e., manual operator action to restore vital bus voltage) to ensure that this minimum would be available. The inspectors did not consider this to be acceptable for intermittent duty motors, such as those associated with MOVs, since they might be called upon to operate while actions were being taken to restore voltage. The inspectors further considered that the automatic setpoint of the degraded grid voltage relays should be used to ensure that 90 percent voltage is available to the MOV motors.

PG&E Response

PG&E does not plan to use locked-rotor current to determine voltage drops during valve seating conditions since the functioning of the torque switch will preclude a locked-rotor condition. However, PG&E has modified Engineering Procedure ICE-12 to use the motor current at the maximum allowable torque switch setting, rather than the less conservative running current plus ten percent. Locked-rotor current is being used for determining voltages during valve opening, a condition where the torque switch is bypassed.

To provide additional conservatism, it will now be assumed that only automatic protection is available when determining minimum voltage to MOV motors. Using these more conservative assumptions (i.e., no operator action on degraded grid voltage and motor current at the maximum allowable torque switch setting), PG&E has determined that minimum voltages during valve closing strokes can be less than 90 percent for a number of MOVs; however, the minimum voltage has been shown to be greater than 85 percent in all cases. For this reason, Engineering Procedure ICE-12 has been revised to require the use of 85 percent voltage as the minimum voltage during valve closing strokes.

It should be noted that use of the more conservative 85 percent assumption for degraded voltage has not resulted in the need for modification of any MOV above and beyond the modifications PG&E had already planned to implement (see the PG&E response on page three of this Enclosure). However, in a number of cases, use of the 85 percent voltage assumption has resulted in somewhat lower maximum allowable torque switch setpoints because of the calculated reduction in operator thrust output at the lower voltage.



NRC Concern

There appeared to be insufficient justification for the use of lower values of valve stem friction coefficients.

The specific NRC concern was the design calculation practice of using less conservative values for valve factor (0.3 instead of 0.4) and valve stem friction coefficient (0.15 instead of 0.2) when existing motor capability proves to be insufficient using more conservative design factors. Design calculations are used to establish MOV operability and are later verified through actual MOV testing.

PG&E Response

PG&E used a valve factor of 0.3 (as specified in the Limatorque Sizing Manual) if the more conservative value of 0.4 resulted in a calculation showing that a valve weak link allowable would be exceeded. This applied to wedge gate valves with a design basis d/p greater than 1000 psi. Engineering Procedure ICE-12 requires a validation, to the extent practicable, of assumed valve factors by comparing them to the results obtained during the in-situ testing. As a result of the initial Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," testing accomplished during 2R4, it was determined that the back-calculated valve factors for a number of MOVs exceeded the Limatorque Sizing Manual recommendation. Subsequently, the torque switch settings for the affected MOVs have been recalculated using the more conservative 0.4 valve factor. Because of this more conservative assumption and other revised assumptions discussed in this Enclosure and in Enclosure 2, 38 MOVs will be modified to increase operator margins. Of these modifications, 36 will be completed in the next two refueling outages (1R5 and 2R5) and two will be performed during 1R6.

PG&E believes it was justified in using 0.15, instead of the more conservative 0.2 valve stem friction coefficient, since the Limatorque Sizing Manual permits the use of either value for sizing of motor operators. Nevertheless, PG&E agrees that 0.2 is the more conservative value and has committed to the modification of all MOVs not exhibiting sufficient margin using a 0.2 friction coefficient. These modifications will be accomplished during the next three refueling outages. In the interim, PG&E has taken steps to ensure that PG&E Maintenance personnel are aware of the significance of stem lubrication on MOV operability. In particular, the PG&E Maintenance Department has increased the inspection frequency for those MOVs where a 0.15 stem friction coefficient is currently being used in the MOV sizing/switch setpoint calculations. If a degraded lubrication condition exists, then Engineering will be notified and the stem will be relubricated. In addition, PG&E has added a seven percent margin to MRT to account for potential lubrication degradation between the time of testing and the time of relubrication.



B. MOV Testing Evaluations

NRC Concern

The NRC observed that operability evaluations of MOV test results appeared to be overly complex. There also appeared to be a lack of timeliness in completing the evaluations and no evidence of a generic review of the test results.

During the inspection, the NRC was concerned that Engineering Procedure ICE-12 allows 72 hours for a preliminary evaluation of MOV test data and seven days for a final evaluation. The NRC also encouraged PG&E to perform a "generic" review of its MOV test results for the purpose of identifying trends applicable to similar MOVs.

PG&E Response

PG&E believes its current engineering evaluation methodology is appropriate. Regarding timeliness, PG&E is now committed to completing the engineering evaluation of MOV d/p test results required by Engineering Procedure ICE-12 prior to transition to a mode requiring the particular MOV to be operable. In addition, Engineering Procedure ICE-12 now requires that Engineering attempt to complete the evaluations prior to the time periods specified in the procedure.

It should be noted that if a potentially degraded condition (e.g., a valve fails to fully stroke open or shut in the required time) is observed by PG&E Maintenance personnel during MOV testing, Nuclear Plant Administrative Procedure (NPAP) C-29, "Operability Evaluation," requires that a prompt assessment of operability be immediately initiated. Further, the assessment shall be completed within 24 hours of initiation. This assessment would be independent of the GL 89-10 engineering evaluation required by Engineering Procedure ICE-12.

Regarding the review of test results for "generic implications", PG&E agrees it would be beneficial to consider effects on similar MOVs when testing indicates valve factors are significantly different than expected. Engineering Procedure ICE-12 has been revised to require a review for such generic implications. This review would determine whether broad conclusions can be drawn that might affect evaluation methodology or assumptions (including assumed valve factors).

A review has been performed for the MOV test results obtained during 2R4. It has been concluded that there were no generic trends that could adversely affect any specific type of MOV. Thrust margins for sets of "sister" valves (e.g., 2-8802A/B, 2-8809A/B, 2-LCV-106 through 2-LCV-109, 2-FCV-658 through 2-FCV-669, and 2-8105/8106) indicated wide differences in both the available operator thrust margins and the ROLs. The differences in thrust margin and ROL cannot be attributed to differences in test flow/pressure or to the as-left torque switch settings, since these values are very similar within each set reviewed. PG&E understands that these differences, which cannot be readily explained from the test data, have also been observed by other plants performing valve testing.



PG&E has also grouped test results by valve manufacturer and valve type. No clear trends have been identified which would require the use of more conservative assumptions in the calculation of operator sizing or torque switch setting. However, based on this review, PG&E believes that a reduction in the assumed valve factor for relatively low d/p double-disc gate valves is warranted. Specifically, valve factors were back-calculated for three parallel disc gate valves subjected to test d/ps of from 1400 psid to 1450 psid. The maximum back-calculated valve factor was 0.27 (which includes approximately 12 percent margin for diagnostic system and pressure instrument error) as opposed to the 0.30 value used in the original calculations for these valves. Therefore, PG&E believes that a 0.25 valve factor is justified for double-disc gate valves where the design basis d/p is less than 1000 psid.

As additional data is obtained from future testing, it may become possible to identify trends within MOV groupings. If so, the calculation assumptions will be adjusted accordingly.

C. Areas in Need of Further Development

NRC Concern

The NRC believes further development is needed in the area of periodic verification of MOV performance parameters.

GL 89-10 requested that licensees prepare procedures to ensure that MOV switch settings are maintained throughout the lifetime of the plant. In addition, the capability of the MOV should be verified if the MOV is replaced, modified, or overhauled to the extent that the existing test results are not representative of the MOV.

PG&E Response

PG&E recognizes the need to develop procedures to address both the periodic verification of MOV capability and the requirement to retest if an MOV is replaced, modified, or overhauled to the extent that existing test results are not representative. PG&E will evaluate the feasibility of establishing detailed procedures prior to the current commitment of December 1994 as stated in the PG&E response to GL 89-10 (DCL-89-324, dated December 27, 1989).

PG&E is monitoring industry efforts, such as those of the ASME OM-8 committee, to develop guidance in the area of periodic verification. PG&E is actively pursuing the issue of retesting following replacement, modification, or overhaul. One of the near-term actions is to develop criteria for what types of work activities on an MOV would require retesting of the MOV.

NRC Concern

The NRC believes the PG&E MOV trending program needs further development.



GL 89-10 requested that data collected on MOV failures be retained and periodically examined (every two years or after every refueling outage) as part of the monitoring and feedback effort to establish trends of MOV operability. These trends could then provide the basis for a licensee revision of testing frequency used to periodically verify MOV capability.

PG&E Response

PG&E agrees that programmatic requirements for determining MOV performance and reliability trends have not been finalized and further development in this area is needed. PG&E's initial emphasis had been on the methodology for determining MOV capability and switch settings and on initial MOV testing. Efforts are now being initiated to develop the MOV trending program. Initial activities include establishing the scope of the trending program and investigating the availability of commercial trending software. The commitment to establish trending requirements by December 1994 remains unchanged as per the PG&E response to GL 89-10 (DCL-89-324, dated December 27, 1989).



ENCLOSURE 2

RESPONSE TO SPECIFIC FINDINGS IDENTIFIED IN
NRC INSPECTION REPORT 50-275/91-39 AND 50-323/91-39

In addition to those items addressed in Enclosure 1, other items were specified by the NRC within the body of Inspection Report (IR) 50-275/91-39 and 50-323/91-39. PG&E's responses to these additional items are contained in this Enclosure. Where an item from the body of the IR is adequately covered in Enclosure 1, it will not be readdressed in this Enclosure.

A. IR Section 4.3 - MOV Sizing and Switch Setting Calculations (page 4)

NRC Finding

The NRC observed that the PG&E methodology for determining minimum required thrust (MRT) did not fully address valve stem lubrication degradation in that no margins for degradation were included in the calculation of MRT.

PG&E Response

Nuclear Engineering and Construction Services has notified Diablo Canyon Power Plant (DCPP) Electrical Maintenance of those valves where a 0.15 valve stem coefficient of friction is being used and has requested that Electrical Maintenance inspect for degraded lubrication until the specific operators can be modified (as discussed in Enclosure 1). A 7 percent margin is also being added to the MRT to account for lubrication degradation between the time of testing (done in ideal lubricated conditions) and relubrication.

NRC Finding

In calculating maximum allowable thrust (MAT), Limatorque's published limits were exceeded without technical justification. This IR item refers to PG&E's use of 114 percent of rated loading for SMB-00 operators to establish MAT, instead of the 110 percent value permitted by Limatorque.

PG&E Response

Recently, Limatorque released Technical Update 92-01 permitting an increase in thrusts to 140 percent of previously published values, as long as certain provisos are met. PG&E has verified that all of its Limatorque operators, for which credit for the Technical Update will be taken, meet these provisos.

NRC Finding

PG&E's procedures allowed setting of torque switches at the bottom of the thrust window, and thus would allow for the elimination of the margin for repeatability.



PG&E Response

PG&E concurs that its previous methodology did not contain specific margin for torque switch repeatability. Experience with the use of the load cell at DCPD had shown that the three required load cell readings taken at manually actuated torque switch trip were reasonably consistent. In addition, the applicable procedure required the lowest of the three readings to be above the MRT. PG&E believes this methodology adequately addressed torque switch repeatability.

Upon further review of this item, PG&E has decided to add a specific margin to the MRT for the purpose of additional conservatism. At the 1991/1992 Winter MOV User's Group Meeting, Limitorque stated they will be issuing a position which will likely endorse +/- 3 percent for torque switch setting variance. Engineering Procedure ICE-12, "I&C Engineering Procedure for Preparation of Motor Operated Valve Sizing and Switch Setpoint Calculation," has been modified to include an additional +3 percent margin in establishing the bottom of the torque switch setpoint window.

A 1000-to-2000 lb range is generally established for convenience in setting the torque switch. This is contrary to the NRC's IR observation that the 1000 to 2000 lbs added to the thrust window is to account for torque switch repeatability. This misunderstanding was apparently caused by the wording in Engineering Procedure ICE-12. The wording has been modified to clarify the actual intent.

NRC Finding

Several observations were made in the IR concerning thermal overload sizing calculations for 460V Class 1E motors for MOVs. The function of the MOV thermal overload devices (TOLDs) is to prevent winding insulation degradation by interrupting current flow to the motor when the device setting is reached. Observations in this area included:

1. An error in a sample calculation for determining the sizing of TOLDs for 460V Class 1E motors for MOVs.
2. Many existing TOLD settings were not consistent with the calculations.

In addition, the NRC expressed concern that since TOLDs are located in the switchgear, motor temperatures in high ambient regions might rise to an unacceptable value prior to motor protection being initiated. At the NRC's request, PG&E made calculations regarding heat rise in the two MOVs subjected to the highest ambient temperature. The calculations showed that both TOLDs were sized adequately; however, the one located in the lower temperature environment had a smaller margin.

PG&E Response

The error in the sample calculation was typographical in that a box was inappropriately checked. This error has been corrected.



PG&E agrees that inconsistencies exist between the settings of the installed TOLDS and the calculated settings. New criteria were used to recalculate the settings, which resulted in the inconsistency. PG&E has committed to install new TOLDS, consistent with the calculation, by December 31, 1994. The NRC inspectors concurred with PG&E that the inconsistencies were not safety-significant since MOVs receiving an Engineered Safety Feature Actuation Signal will have their TOLDS automatically bypassed.

At the time of the inspection, PG&E believed its methodology for evaluating the two highest temperature MOVs encompassed all TOLDS. To substantiate this, PG&E performed calculations for all MOVs with surface temperatures greater than 40°C. The calculations demonstrated the adequacy of the TOLD sizing methodology.

NRC Finding

During the inspection, the NRC concluded that under worst-case degraded voltage conditions the assumed minimum of 90 percent voltage to the MOV motors would not be met in all cases. Since the criteria for sizing TOLDS is based upon 90 percent voltage, the inspectors were unsure if the selection of TOLDS was accomplished correctly.

PG&E Response

PG&E agrees that under worst-case conditions, MOV motor voltage could fall below the 90 percent value assumed in the TOLD sizing calculations. The lowest voltage would be achieved during valve seating or unseating, but would not occur during the running condition. Since the duration of valve seating/unseating is very short compared to running time and since TOLD sizing is based upon integrating motor current over a number of full valve strokes, PG&E believes that the use of 90 percent voltage is both appropriate and conservative.

B. IR Section 4.4 - Testing of MOVs Under Design Basis Differential Pressure (d/p) and Flow Conditions (page 12)

NRC Finding

GL 89-10 requests licensees to test MOVs under design basis d/p and flow conditions. A two-stage method is suggested where the achievement of design conditions is not considered practical. With the two-stage approach, the licensee evaluates MOV capability using the best available data (maximum achievable conditions) and then works to obtain the full qualification within the schedule of the GL.

With regard to two-stage approach valves, the NRC reviewed PG&E's extrapolation method for calculating required thrust at design d/p conditions. They observed that no justification was given for the extrapolation method used when it was determined that design d/p could not be practically achieved for a particular test.



For two-stage approach valves, the NRC also reviewed the PG&E methodology of comparing the MOV torque switch setting to the thrust developed to determine excess thrust available for design basis operation. The inspectors considered that "Rate of Loading" (ROL) effects might be more pronounced at higher d/ps and thus using the excess thrust approach might not be justified.

PG&E Response

PG&E has evaluated the feasibility of multi-point d/p testing during the upcoming Unit 1 outage to support use of the straight line methodology. The current plans are to perform multi-point testing on a number of double-disk gate valves manufactured by the same vendor. The performance of multi-point testing on wedge-type gate valves during IR5 is not presently considered to be feasible. PG&E will continue to evaluate the feasibility of performing additional multi-point testing during future outages.

PG&E believes it is justified in using its method for calculating the excess thrust available for valve operations during design basis conditions. PG&E is relying upon Liberty Technology test data, which indicates that the majority of the ROL effect is seen at 25 percent of design basis d/p and that essentially all effects are seen at 50 percent of design basis d/p. This testing was performed at 500 psid increments, up to 2000 psid.

PG&E is closely following Electric Power Research Institute (EPRI) research in MOV performance prediction, which includes valve factor and rate-of-loading characteristics as a function of increasing differential pressure. As EPRI results become available, extrapolation and excess thrust methodologies will be reassessed and will be modified to reflect the EPRI findings, if appropriate.

NRC Finding

PG&E d/p tested several flow control valves in the auxiliary feedwater (AFW) system. After some review, the inspectors observed that close to 100 percent of maximum design basis d/p test conditions seemed possible if modifications were made to the AFW system. The licensee acknowledged the feasibility of the test modifications, but considered that it did not satisfy their definition of practicable.

PG&E Response

The PG&E definition of what is practical in performing GL 89-10 testing currently excludes plant modifications. At the Inspection exit meeting, plant management committed to reconsider the possibility of physical modifications to the plant to achieve higher test d/ps.



NRC Finding

No method for validating valve factors was established as part of the test procedures.

PG&E Response

Engineering Procedure ICE-12 includes a requirement to review the test results to back-calculate valve factors and consider the potential for generic implications.

NRC Finding

The inspectors observed that the licensee did not perform a root cause analysis when a valve factor determined during testing differed from that used in a design calculation.

PG&E Response

PG&E did not perform any formal root cause analysis as part of its MOV post-testing evaluations. PG&E procedures require a root cause analysis when there has been a component failure or when evidence exists that a failure is likely, such as when a valve does not open or close properly or when there is anomalous behavior that could prevent proper valve operation during design basis conditions. Neither of these situations occurred during 2R4 testing. Nonetheless, as noted above, PG&E has considered the potential for generic implications from our testing. As described below, no clear trends or generically applicable results have been identified to date.

It was possible to back-calculate the valve factors of 17 MOVs tested during 2R4. Of these 17, only the back-calculated valve factors for Valves 2-8106, 2-8107 and 2-8703 exceeded the values assumed in the engineering calculations.

Valve 2-8106, a globe valve, had an assumed valve factor of 1.1 and a back-calculated valve factor of 1.42. However, the trace was extremely smooth and did not exhibit any evidence of disc binding or galling. Since the Valve 2-8106 "sister" valve, Valve 2-8105, indicated an actual valve factor of 0.89, a diagnostic reading anomaly was suspected for Valve 2-8106. It should also be noted that the methodology for back-calculating valve factors includes approximately a 12 percent margin for diagnostic system and pressure instrument error. The "uncorrected" valve factor for Valve 2-8106 is 1.28, and the "corrected" range is 1.13 to 1.42. Although greater than the assumed value used in the operator sizing calculation, according to the manufacturer the 1.28 value is still within the range of expected values for these types of globe valves. Valve 2-8106 was tested successfully at 96.4 percent of its design basis d/p and exhibited a 39 percent operator margin. It was therefore concluded that a root cause analysis was not required for this valve.

Valve 2-8107, a Velan flex-wedge gate valve, had an assumed valve factor of 0.4 and a significantly higher back-calculated valve factor of 0.61. However, careful examination of the electrical current trace showed no



evidence of disc sticking, galling, machining, or other anomalous behavior. Since there was no valve failure (the MOV successfully operated at 91.5 percent of design basis d/p with 13.5 percent operator margin over the extrapolated thrust requirement), it was concluded that no root cause analysis was required.

Valve 2-8703, a Velan flex-wedge gate valve, had a back-calculated valve factor of 0.62, also considerably higher than the assumed value of 0.3. In addition, a significant drop in stem thrust was observed just prior to flow cutoff. This drop, which actually indicates a stem tension condition, is probably attributable to strain reversal in the valve yoke containing the strain gage since the valve was tested successfully at 99.5 percent of design d/p, exhibited a 103 percent operator margin, and showed no evidence of sticking, galling, or machining. Therefore no root cause analysis was performed.

The higher than expected valve factors for the two Velan gate valves are of a magnitude similar to that observed during the Idaho National Engineering Laboratory tests for gate valves showing "anomalous" behavior. However, since no anomalous behavior was observed by either PG&E or Velan (who reviewed the detailed traces for the Valve 2-8106, 2-8107, and 2-8703 tests), no formal root cause analysis or generic application of the results to other valves is believed to have been necessary.

C. IR Section 4.6 - MOV Failures, Corrective Actions, and Trending (page 16)

NRC Finding

During review of previous PG&E nonconformances (NCRs), the NRC became aware of an instance where a valve actuator was damaged when a technician attempted to manually open an MOV while the control board switch was in the closed position. The technician should have requested the control room to place the switch in the neutral position prior to engaging the manual handwheel. The NRC observed that the PG&E operating procedures routinely positioned the control room switch in the closed position while a valve was cleared for maintenance, thus allowing the potential for "short-stroking" in the event manual operation is attempted.

PG&E Response

MOV "short-stroking" is caused by valve operator spring pack relaxation and the subsequent torque switch closure that occurs when the manual handwheel is engaged with the remote control board switch in the closed position. Upon motor energization, the valve will be seated more tightly, with the result that a force greater than desirable can be applied. Maintenance and operations procedures will be revised to require proper positioning of control board switches to preclude any recurrence of valve short-stroking.



D. IR Section 4.7 - Schedule (page 17)

NRC Finding

The NRC indicated that with regard to two-stage approach valves, PG&E did not appear to have specific plans to complete the second stage of testing or design verification. Further, the licensee was planning to rely on EPRI studies and guidance on the two-stage approach valves. The NRC considered that the EPRI work may not be completed in time for the GL 89-10 schedule, and it also may be inadequate in providing a satisfactory alternative to testing.

PG&E Response

PG&E does plan to use the EPRI MOV Performance Prediction Methodology as part of its overall approach to the GL 89-10 effort. PG&E is active on the EPRI MOV Technical Advisory Group and is closely monitoring the progress of this industry effort. PG&E supports the EPRI MOV Program and believes the results will be of considerable value. PG&E is aware of the requirements for implementing the EPRI methodology and, where practicable, will obtain the internal dimensions of those gate valves which may rely on the EPRI methodology.

While PG&E supports the EPRI program and intends to use the EPRI products, PG&E also recognizes it would not be appropriate to place an over-reliance on the EPRI program. Consequently, PG&E has decided to pursue alternative approaches which would result in the inclusion of additional MOVs within the "completed" status of the initial GL 89-10 program without the need for a second stage evaluation. Potential alternatives include: (1) improving test conditions to increase the test d/p; (2) reviewing the design basis to identify MOVs for which the existing design basis d/p may be reduced and still meet all PG&E and NRC requirements; and (3) evaluating extrapolation methodologies that might allow extrapolation from lower test d/p's. It is anticipated that, in some cases, the use of an alternative approach may result in MOV modifications to improve margins.

NRC Finding

The NRC was concerned that any changing of MOV diagnostic equipment might have a negative impact on the GL 89-10 schedule. They observed that the licensee is using the VOTES diagnostic equipment for testing, but is currently investigating another diagnostic system.

PG&E Response

PG&E has decided to continue with the VOTES system and will only use another system where greater accuracy is required and the schedule will not be adversely affected.



NRC Finding

There was no apparent prioritization in the licensee's schedule as to which GL 89-10 MOVs were being d/p tested. It appeared the licensee would test only valves with calculations that showed a substantial margin, and not marginal valves or valves with high safety significance.

PG&E Response

PG&E has scheduled GL 89-10 testing based on a combination of safety significance, timing of related maintenance, and on the schedule of planned system testing, as well as other factors. One of these other factors is the ability to pass the test with adequate margin. Modifications have been given a high priority. It is important to note that the intent of the modifications is to provide additional margin.

E. IR Section 4.8 - Other MOV Program Areas Addressed (page 18)

NRC Finding

To change required MOV thrust settings, the licensee used Action Requests (ARs) instead of using their established design control measures. The NRC also indicated that PG&E was in the process of implementing a change to use MOV data sheets, which would be controlled as plant drawings and subject to the design control process, to transmit required switch settings. This method would be established by December 31, 1991.

PG&E Response

PG&E completed the MOV data sheets referred to in the IR prior to December 31, 1991. However, prior to data sheet formal issuance, Diablo Canyon plant management decided that the process of implementing future changes to the data sheets would be cumbersome and opted for incorporating MOV switch setting data into the computerized Plant Information Management System (PIMS). The NRC Inspection team leader was informed of this change in direction and that additional time would be required for completion.

The new target date for entering all applicable setpoint information for current as-built configurations and IR5 modifications into PIMS and implementing the design change process to control the PIMS information is December 31, 1992. In the interim, all new MOV setpoints are being controlled by the PG&E Design Change Notice Process, rather than by ARs.

NRC Finding

The NRC indicated that the licensee had been unaware that manual operation of Rotork Actuators could inadvertently change the limit switch settings.



In reviewing selected NCRs, the NRC noted in NCR DC2-91-EM-N086 that damage had occurred to the Rotork actuator for Valve FCV-430 because of the improper setup of the limit switches in relation to the mechanical stops. The PG&E NCR also identified inadequate training as a contributory cause for the failure.

PG&E Response

PG&E was aware that formal electrical maintenance training had not been accomplished on Rotork operators for several years. There are few safety-related Rotork plant applications, and those that do exist are not routinely overhauled. Recent training has placed emphasis on the widely-used Limatorque operators. PG&E's NCR process had identified the Rotork operator training deficiency and, as a result, PG&E Electrical Maintenance personnel received extensive training in December 1991.

NRC Finding

Training on the effects of short-stroking MOVs appeared to be required.

In reviewing selected NCRs, the NRC became aware of an instance where a valve actuator was damaged when a technician attempted to manually open an MOV while the control board switch was in the closed position. As discussed earlier in this Enclosure, the resultant "short stroking" damaged mechanical components of the motor operator.

PG&E Response

PG&E agrees it would be appropriate for Electrical Maintenance personnel to be made aware of what short-stroking is and what combination of conditions will make an operator susceptible to its occurrence. Information on short-stroking and on the actual event causing damage to a DCP valve operator will be incorporated into Lesson ME150101, "Construction and Operation of Limatorque Valve Operators."

NRC Finding

The NRC noted that the licensee's preventive maintenance procedure for Limatorque operators did not include specific observation of stem lubrication. They considered the verification of stem lubrication to be especially significant in cases where the NRC believed that non-conservatism (i.e., where PG&E has used a 0.15 valve stem coefficient of friction, as discussed in Enclosure 1) was used in calculating actuator capability.

PG&E Response

As stated in Enclosure 1, PG&E believes it is justified in the instances it has used a 0.15 valve stem coefficient of friction in lieu of 0.2. However, PG&E concurs with the NRC observation that using the 0.15 value makes periodic verification of the adequacy of stem lubrication important. As stated in Enclosure 1, DCP maintenance is now aware of the importance of checking stem lubrication more frequently for those MOVs where



engineering has assumed "well-lubricated" conditions. Maintenance is developing a program to provide assurance that, on these designated valves, significant degradation of stem/stem nut lubrication does not occur prior to the planned actuator modifications.

NRC Finding

The NRC observed that the licensee contacted their quality vendors every three years to verify all important notices had been received. The inspectors were concerned with the three-year length of time and that the periodic contact did not include other important vendors, such as test equipment vendors.

PG&E Response

PG&E believes there was a misunderstanding with regard to its schedule for vendor contact. Engineering actually contacts vendors by phone on a yearly basis; face-to-face meetings take place every three years. PG&E agrees with the NRC's view that test equipment vendors should be included in the vendor contact program and will include the diagnostic equipment vendor in the vendor manual control program.

F. IR Section 5.0 - Inspection of Previously Identified Items (page 20)

NRC Finding

As part of its GL 89-10 inspection, the NRC team reviewed Unresolved Item 91-07-04 on voltage to 125V dc MOVs. The MOV inspection team agreed with the findings from the Electrical Distribution System Functional Inspection Report (IR 50-275/91-07 and 50-323/91-07), which described apparent non-conservatism in the degraded voltage calculation for the Unit 1 AFW Turbine Inlet Valve FCV-95 and also described instances of high motor current accompanied by the valve sticking in the closed position.

PG&E Response

The FCV-95 motor voltage drop calculation has been revised to assume locked-rotor current at minimum battery voltage. Additionally, the valve operator gear train has been modified to provide increased force for valve opening. This modification appears to have eliminated the valve sticking problem. Unresolved Item 91-07-04 was closed by the NRC in IR 50-275/92-06 and 50-323/92-06, dated March 30, 1992, where the inspector observed that with the operator modification the degraded voltage calculation indicated satisfactory motor performance even with the most conservative values and assumptions.

