SOUTHERN CALIFORNIA
EDISON
An EDISON INTERNATIONAL℠ Company

A. Edward Scherer
Manager of
Nuclear Regulatory Affairs

June 17, 1999

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Gentlemen:

Subject: **Docket Nos. 50-361 and 50-362**
**Risk-Informed Inservice Testing and GL 96-05**
**(TAC Nos. MA4509 and MA4510)**
**San Onofre Nuclear Generating Station**
**Units 2 and 3**

References: 1) Letter from L. Raghavan (NRC) to Harold B Ray (SCE), dated April 20, 1999, Subject: Request for Additional Information on the Proposed Risk-Informed Inservice Testing and GL 96-05 Programs At the San Onofre Nuclear Generating Station (TAC Nos. MA4509 And MA4510)

2) Letter from A. E. Scherer (SCE) to the Document Control Desk (NRC), dated December 30, 1998; Subject: Request to Implement a Risk-Informed Inservice Testing Program During the Remainder of the Second Ten-Year Interval, San Onofre Nuclear Generating Station, Units 2 and 3

This letter provides additional information as requested by the U.S. NRC in reference 1 concerning risk informed inservice testing and Generic Letter (GL) 96-05 "Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves" at San Onofre Units 2 and 3. The Southern California Edison responses to the NRC's questions are provided as Enclosure 1 to this letter. Also, as a result of the NRC's questions, SCE has revised several pages of the Risk-Informed Inservice Testing Program. Enclosure 2 provides these revised pages for the NRC to update the copy of the Risk-Informed Inservice Testing Program submitted to the NRC by reference 2. Enclosure 3 provides a program summary in reply to question number one. Enclosure 4 provides spreadsheets calculating the design basis margin for each valve and provides details for MOV margin calculations.

I/I



A073

P. O. Box 128
San Clemente, CA 92674-0128
949-368-7501
Fax 949-368-7575

If you should have any questions or need additional information regarding this matter, please feel free to contact me or Jack Rainsberry at (949) 368-7420.

Sincerely,

Enclosures

cc: E. W. Merschoff, Regional Administrator, NRC Region IV
J. A. Sloan, NRC Senior Resident Inspector, San Onofre Units 2 & 3
L. Raghavan NRC Project Manager, San Onofre Units 2 and 3

ENCLOSURE 1

**The Southern California Edison Company (SCE)**
**Risk-Informed Inservice Testing Program**
**Response to NRC Questions**

RESPONSES TO REQUEST FOR ADDITIONAL INFORMATION

RISK-INFORMED INSERVICE TESTING AND GL 96-05 PROGRAMS

SOUTHERN CALIFORNIA EDISON COMPANY

SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3

DOCKET NOS. 50-361 AND 50-362

**NRC Question**

1. **The licensee's proposed alternative refers to establishing the frequencies based on "the methodology outlined in enclosure 2." Enclosure 2 of the December 30, 1998, submittal contains a description of the methodology used to categorize components, assess overall change in risk, the expert panel process, component test strategies, implementation, and corrective action processes, etc. It also contains results. When the staff writes its safety evaluation (SE) on the San Onofre Nuclear Generating Station (SONGS) risk-informed inservice inspection (RI-IST) program it will rely on (and identify) many of the commitments made in Enclosure 2. If the licensee has a problem with the staff identifying these commitments in the SE, the licensee may want to develop a more concise RI-IST program description, more along the lines of the one submitted by TU Electric for Comanche Peak. That is, a RI-IST program description that contains the key aspects of their RI-IST program in each area.**

Edison Response

A SONGS RI-IST program summary to be inserted as Appendix C to the program submittal, the December 30, 1998, SCE RI-IST submittal, and to be used by the NRC in identifying commitments by the Southern California Edison Company (SCE) is provided as Enclosure 3.

**NRC Question**

2. **Document more clearly why normally closed manual valve S2-1305-MU476 (header supply to/from the condensate storage tank) was ranked LSSC by the expert panel, i.e., why the licensee preferred to add manual valve 1417-MU230 to the RI-IST program as opposed to testing S2-1305-MU476. Include manual valve 1417-MU230 in Table 3.2-1 (i.e., to be exercise-tested**

**every refueling outage as indicated on page 2-38) or document why this alternate supply path valve should not be included in that table. It seems like components added to the licensee's RI-IST program should be included in Table 3.2-1 or in a similar but separate table.**

Edison Response

As indicated in Table 2.3-2 page 114 of the December 30, 1998, SCE RI-IST submittal, the probabilistic risk assessment (PRA) conservatively modeled a single make-up path to the auxiliary feedwater (AFW) condensate storage tank. There are a number of redundant and diverse paths available including the path from the Demineralized Water Storage Tanks through 1417MU230. Although 1305MU476 is in a confined space and a potentially hazardous environment due to the nitrogen blanket on the tank, the primary motivation for adding MU230 was reducing the risk associated with a single component in a single makeup flow path. As described in the December 30, 1998, submittal, part of the integrated decision-making process (IDP) charter is to validate the modeling assumptions of the PRA. In this case there is a fully redundant flow path that depends only on gravity feed to supply the condensate tank. 1417MU230 for both Units has been added to the IST program, and was manually exercised during the last refueling on the respective units.

MU230 is a Cooper ten-inch manual gate valve, while MU476 is an Aloyco 8-inch manual gate valve. Consistent with our grouping criteria 1417MU230 belongs to a single valve group with an interval of 2A (every 2 year testing interval), with group designations of 1417_022 & 1417_023 for the Unit 2 and 3 valves respectively. Entries will be made in the appropriate tables.

**NRC Question**

3. **The table on page 2-47 indicates that S2-1201 -MU976 and MU977 (pressurizer spray line check valves) were ranked "LSS, Test interval not extended because test historically administered incorrectly." Table 3.2-1 (page 3 of 126) indicates that the closure test on these check valves will be extended from cold shutdowns to 4AS. Similarly, the table on page 2-47 indicates that valve group 1305-052 is "Test interval is not extended. Retain LSSC ranking because these valves can be isolated by manual block valves, isolation does not affect performance of key safety function." Table 3.2-1 (page 80 of 126) indicates that the quarterly stroke test of these check valves to the closed position will be extended to 6AS. Document more clearly that while these valves will not have their test interval**

**extended initially (as indicated in the table on page 2-47), the licensee's bounding analysis (as reflected in Table 3.2-1) will permit extending the test interval for these valves.**

Edison Response

SCE added a footnote to the December 30, 1999, Submittal table on page 4-47, Revised Ranking or Disposition column, that reads, "Even though the test interval for these components will not be extended initially due to specific performance issues, the PRA analysis for cumulative risk assumes the bounding values listed in the Table 3.2-1. The interval determined by the Integrated Decisionmaking Process can be no greater than this value for a given grouping without performing specific PRA analysis to support it."

SCE has changed the legend for Table 3.2-1 to read:

| | |
|---|---|
| **RI-IST Test Interval** | Bounding interval determined by PRA analysis. The interval determined by the Integrated Decisionmaking Process can be no greater than this value for a given grouping without performing specific PRA analysis to support it. |

**NRC Question**

4. **Explain why defense-in-depth is not compromised by categorizing certain containment isolation valves (CIVS) as LSSCs (e.g., 2-1201 -HV9218, 2-1902-HV7259, 2-1201-HVO509). It was not clear from the NRC staff's review of simplified system drawings that these were supply and return valves in closed loop systems with a higher design pressure than the containment.**

Edison Response

| Valve | Discussion |
|---|---|
| 2-1201-HV9218 | HV9218 is an air operated valve (AOV) that has a fail closed position. There is redundancy of function with 9217 (inside containment motor operated valve (MOV)), coupled with the diverse actuator types and the failsafe mode of 9218. Additionally, an unmodeled redundancy exists because there are excess flow check valves (FCV0216, 0217, 0218, 0219) between the reactor coolant pumps (RCPs) and HV9217, all of which shut off at ~10 GPM. The final path of the fluid in this line is the chemical and volume control system (CVCS) volume control tank. |

| Valve | Discussion |
|---|---|
| 2-1902-HV7259 | Inboard and outboard valves provide redundancy of the closing function. Diversity of valve styles exists. HV7258 is an MOV, HV7259 is an AOV. The valves close on containment isolation actuation signal (CIAS) and safety injection actuation signal (SIAS). HV7259 fails closed. HV7258 is normally open and must change state. PRA ranks HV7258 as a low safety significant component (LSSC) and HV7259 as a high safety significant component (HSSC). PRA assumes that post accident containment pressure directly communicates from the Reactor Coolant Drain Tank (RCDT) to the surge tank. Gas is compressed in the surge tanks and subsequently passed to the decay tanks. During this scenario, the safety valves on the pressurizer would blow down to the radwaste gas header. If the safety valves fail to reseat, the rupture disk would actuate, causing the reactor coolant system (RCS) to blow down to containment. This would raise containment pressure to 60 lb. HV7259 design delta-pressure is 160 psi. However, the upstream valves, HV9100 and HV9101, are normally closed and remain closed. These valves are not modeled by the PRA. Because these valves are closed and remain closed, they will not conduct gas upstream to the header and subsequently to the RCDT. Additionally, there are redundant valves downstream of HV7259. Therefore, there is little significance if HV7259 fails to close. The PRA Group agrees with this assessment. |
| 2-2004-HV7800<br><br>2-2004-HV7801<br><br>2-2004-HV7802<br><br>2-2004-HV7803<br><br>2-2004-HV7805 | Inboard and outboard solenoid valves provide redundancy of the closing function. The valves close on CIAS and SIAS and fail closed. The lines are very small (1" inside containment, 3/4" outside containment) and the system is a closed path. The path through HV7801 (inboard) attains redundancy through HV7800 (outboard). This is a closed seismic grade system that supplies sample flow for the containment radiation monitoring system. The sample path returns to containment through HV's 7802 & 7803. The path through HV7801 &HV7816 supplies the Post Accident Sampling System; a seismic grade closed system with multiple levels of redundancy in the sample flow path.<br><br>Likewise, HV's 7805, 7810 & 7806, 7811 comprise the closed loop boundary for the containment airborne sample supply and return paths.<br><br>(Continued on next page) |

| Valve | Discussion |
|---|---|
| 2-2004-HV7806<br><br>2-2004-HV7810<br><br>2-2004-HV7811 | With the inclusion of common cause failure and external events in the plant risk model, certain valves in this group increase in importance. However, the PRA Group recognizes that the modeling is very conservative. The system is closed and there is no pathway for direct air-to-air interaction between containment atmosphere and the environment. Therefore, the Expert Panel retained the L,L ranking. From the standpoint of a seismic event, the system contains seismic grade piping, signifying that a seismic breach is highly improbable. |
| 2-1212-HV0509 | HV0509 is a pneumatic valve on the reactor coolant hot leg sample line (outside containment). The Expert Panel downgraded HV0509 from L,H to L,L. MOVs HV0508 & 0517 (Hot leg #1 and Hot leg #2 inside containment isolations) are normally open. HV0509 has a high RAW because of the assumed relative reliability of the two MOVs (i.e., normally open and must close on demand) on the line to which this valve connects. HV0509 is normally closed, but is cycled daily. It is opened for approximately one hour every day. The PRA models a failure mode for which the IST does not explicitly test (failure to remain closed > 95% of the time). The fail to remain closed function of HV0509 is continuously monitored as there is position indication in the control room that announces the failure. HV0509 should be L,L because it is normally closed, failure to remain closed is continuously monitored, and also the redundancy and diversity of the two valves in series serves to increase the reliability of the isolation function.. If the RAW calculations were re-run with only IST related basic events affected in the PRA model, the results would have been a L,L ranking |

**NRC Question**

**5. Describe where the evaluations of design, service condition, performance history and compensatory actions are currently documented and where they will ultimately be documented (e.g., for L-H MOVS, CVs, AOVS, HOVS; for LSSC CVs, AOVS, and HOVS) (see pages 3-3 through 3-7).**

Edison Response

The evaluations of these parameters currently reside in the RI-IST data system. They are currently accessible only by PRA and IST personnel. Changes to the Quality Affecting IST data system are in progress that will facilitate migration of these evaluations to a single, coherent, and widely accessible controlled location.

**NRC Question**

**6. The licensee's letter dated March 13, 1997, indicates that the scope of the motor-operated valve (MOV) program at SONGS in response to Generic Letter (GL)96-05, "Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves," is the same as the SONGS in response to GL 89-10,"Safety-Related Motor-Operated Valve Testing and Surveillance." In GL 96-05, the NRC staff discusses the consideration of safety-related MOVs that are assumed to be capable of returning to their safety position when placed in a position that prevents their safety system (or train) from performing its safety function; and the system (or train) is not declared inoperable when the MOVs are in their nonsafety position. Compare the scope of the MOV program at SONGS to the GL 96-05recommendations.**

Edison Response

The population within the San Onofre GL 96-05 program is equivalent to that of the GL 89-10 program. The Station's inservice test program population was reviewed to determine if any motor operated valves which are included with the inservice test program are not within the GL 96-05 program. Ten valves were found during this review. Of these 10 , none meet the criteria for inclusion within the Generic Letter 96-05 program. These valves have no active safety function. They are either maintained in their safety position with power removed, the train associated with the valve is declared inoperable should the valve be positioned outside of its respective safety position, or their power supply is non-1E and their function is to be able to be manually repositioned in support of Appendix R scenarios.

**NRC Question**

7. **In NRC Inspection Report (IR) 50-361, 362/96-10, the NRC staff closed its review of the GL 89-10 program at SONGS based on the licensee's actions to verify the design-basis capability of the safety-related MOVS. In the inspection report, the NRC staff noted certain long-term actions planned by the licensee. For example, the licensee planned to *(1)* upgrade several low-margin MOVS, *(2)* evaluate diagnostic test traces for MOVs 2-HV-9348 and 3-HV-9306 identified as Inspector Follow-up Item (IFI) 9610-01, *(3)* address new information on motor actuator output capability identified as (IFI) 9610-02, *(4)* improve quality assurance oversight of the MOV program, and *(5)* resolve the questions regarding the safety function of the refueling water storage tank (RWST) outlet valve discussed in IFI 9507-01. Describe the status of these long-term actions.**

Edison Response

7.1. UPGRADE SEVERAL LOW MARGIN MOVS

The emergency core cooling system ECCS mini-flow valve seat control logic was changed from torque seated to limit switch bypass logic to increase the torque available to the valve. Revising the control logic from torque to bypass seating increased the available margin by removing the uncertainty for torque switch repeatability and making the full capability of the actuator available to the valve.

7.2. EVALUATE DIAGNOSTIC TRACES FOR MOVS 2HV-9348 AND 3HV-9306 IDENTIFIED AS INSPECTOR FOLLOWUP ITEM (IFI) 9610-01.

From NRC in Inspection Report IR 96-10: "The licensee planned to retest valve 2HV-9348 during the upcoming outage in November 1996. The licensee stated that the test results will be reviewed to confirm its conclusions regarding the effect of lubrication. Review of the licensee's test results for lubrication effects for valve 2HV-9348 following the November 1996 outage will be included in inspection follow-up item (50-362/9610-01)."

This item was followed up by the NRC in Inspection Report IR 98-16 and closed out based on traces provided to the NRC:

"The inspectors reviewed the Cycle 9 refueling outage test packages for Valves 2HV9348 and 3HV9306. The diagnostic test data were evaluated and no anomalies, as identified following the previous test were found. Based on the new diagnostic test data, the inspectors determined that the previous maintenance on the valve internals had solved the problem of the rapid force increase at midstroke during the dynamic test and of anomalous seating characteristics during the static test, for the two valves. In addition, the inspectors determined that the maintenance procedure that directed internal lubrication during assembly did not affect valve performance."

7.3. ADDRESS NEW INFORMATION ON MOTOR ACTUATOR OUTPUT CAPABILITY IDENTIFIED AS (IFI) 9610-02.

From IR 96-10: "The inspectors emphasized the need for the licensee to remain aware of emerging issues which can affect the adequacy of the licensee's program. The inspectors pointed out the issues recently highlighted in Information Notice 96-48, which included concerns for the use of run efficiency. The licensee currently used run efficiency in the close direction in analyzing actuator capability. The licensee was evaluating Information Notice 96-48 for its applicability and planned to incorporate appropriate measures to assure that its motor-operated valve program remained based on the best available data for predicting motor-operated valve performance. Review of the licensee's evaluation of Information Notice 96-48 will be an inspection follow-up item (50-361/9610-02;50-362/9610-02)."

This item was followed up by the NRC in Inspection Report IR 98-16: "The inspectors reviewed AR 970101858, dated January 31,1997, which the licensee initiated to address issues identified in Information Notice 96-48. One issue related to performance problems with motor-operated valve keys. The licensee stated that they had replaced all of the 1018 material keys with the recommended 4140 material for all of the valves in the Generic Letter 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," program. Since they had replaced all of the 1018 keys in the Generic Letter 89-10 program, the licensee concluded that the key material issue was resolved. To address the potential for motor keyway distress stemming from the use of the stronger 4140 key material, the licensee examined valves in the Generic Letter 89-10 program that were fast acting, had a high motor start torque rating, and whose diagnostic traces indicated high impact loads. The licensee found that none of the motor-operated valves met all three of the criteria. Based on high impact loads, the licensee selected the Units 2 and 3 emergency cooler valves and inspected their motor keyways. No evidence of cracking was found. The licensee stated that, while keyway cracking was not expected, the valves that were most susceptible were scheduled for inspection."

"The second issue that the licensee addressed was the potential for torque output from the motor-operated valve actuators to be less than predicted by the actuator vendor, Limitorque Corporation. The licensee stated that it had received preliminary guidance on actuator efficiencies that was being evaluated. In May 1998 Limitorque issued Technical Update 98-01 to provide updated guidance for determining the output torque capability. Limitorque specified that in the sizing equation the licensee should use nominal motor starting torque, pullout efficiency, overall actuator gear ratio based on the particular actuator, and an application factor."

SCE is aware of the issue regarding actuator efficiencies and has developed a strategy based upon the use of motor power to quantify the actuator efficiency. Testing on a representative sample population conducted in the recently completed cycle 10 refueling outages is expected to provide the necessary information to assess the accuracy of the strategy and provide information on appropriate actuator efficiency values. Test data evaluation should complete by the end of the year.

7.4. IMPROVE QUALITY ASSURANCE OVERSIGHT OF THE MOV PROGRAM.

A peer review/self assessment of the SONGS Valve programs (MOV included) was conducted in September of 1998. SONGS Nuclear Oversight Division (NOD) along with engineering and industry peers participated in the program review.

The NOD organization conducted a surveillance evaluation during the Unit 3 cycle 10 refueling outage, which ended in May 1999.

From IR 96-10: "Although oversight of the program was weak, the licensee's quality assurance involvement in the motor-operated valve program was adequate for closure of Generic Letter 89-10. At the exit meeting on November 8, 1996, the licensee acknowledged the inspectors' concerns and identified that recent organizational changes had been made to improve the technical depth of the nuclear oversight department. The inspectors encouraged further attention to the oversight of the long-term aspects of the licensee's motor-operated valve program."

7.5. Resolve the questions regarding the safety function of the refueling water storage tank (RWST) outlet valve discussed in IFI 9507-01.

The latest correspondence between SCE and the NRC on the issue of the safety function of the refueling water storage tank (RWST) outlet valve are IR99-04, dated April 21, 1999, and Voluntary Licensee Event Report 1999-002, submitted on May 20, 1999.

IR99-04 closed the 1995 IFI and identified this issue as an Unresolved Item (URI). The report stated that the issue would be characterized as a URI to provide SCE with an opportunity to provide their perspective on the NRC staff's determination. Voluntary LER 1999-002 documents SCE determination. The URI is expected to be addressed by the NRC in a future inspection report. Because IFI 9507-01 is closed and has now been characterized as a URI, this issue can not be resolved by this response to the request for additional information regarding the RI-IST.

**NRC Question**

**8. In its March 13, 1997, letter on GL 96-05, the licensee states that motor-operated gate valves with low margin (less than 20%) or an allowable valve factor less than or equal to 0.8 will be diagnostically tested under dynamic conditions at least every 3 refueling cycles. Provide the setup requirements for all GL 96-05 MOVs at SONGS. Identify the MOVs requiring periodic dynamic testing. Provide the basis for grouping MOVs to apply dynamic test data to non-dynamically tested MOVS. Provide the basis for the degradation rate for each GL 96-05 MOV.**

Edison Response

8.1 PROVIDE SETUP REQUIREMENTS FOR ALL GL 96-05 MOVs AT SONGS.

As reviewed and accepted during the close-out inspection of the GL 89-10 program, a general overview of the contributing setpoint elements for a given valve setpoint include standard dynamic forces, stem rejection, packing load, sealing force, seismic acceleration force, rate of load, stem factor degradation, and instrument inaccuracies. When calculating the required force for a gate valve, a bounding valve factor for a given valve group is used based on in-situ testing performed at SONGS. Dynamic forces for globe valves are dependent on whether a valve is seat or guide based which was also determined by in-situ testing. Rate of load values were also determined by in-situ testing.

When implementing a MOV setpoint in the field, the maintenance personnel are required to set the valve to achieve a thrust output between the minimum required and maximum allowable thrust. In addition, for valves which require positive wedging to achieve their design function, a minimum value for required seat load is specified. The torque output at control switch trip is also required to be no greater than the maximum available output torque at degraded voltage. Both the thrust and torque window are appropriately adjusted for diagnostic error.

Detailed margin assessment spreadsheets are included in Enclosure 4. These spreadsheets document each element that is considered when determining required forces for the purposes of assessing available margin. A summary of terms and the equations used within the spreadsheet are also identified in Enclosure 4.

## 8.2 IDENTIFY THE MOVs REQUIRING PERIODIC DYNAMIC TESTING.

As stated in the licensee response to GL 96-05, gate valves with low design basis margin will be periodically dynamically tested, at an interval no greater than three refueling cycles, in order to assure that the valves remain capable of performing their design basis function. A gate valve is considered to have low margin if the allowable valve factor is equal to or less than 0.8 and/or the available design basis thrust margin is equal to or less than 20%.

The MOVs at SONGS that are currently being periodically tested under dynamic conditions include:

| Valve ID | Valve Mfg | Service |
|---|---|---|
| 2(3)HV9306 | WKM | ECCS Pumps Miniflow to RWST, Train A Valve |
| 2(3)HV9307 | WKM | ECCS Pumps Miniflow to RWST, Train A Valve |
| 2(3)HV9347 | WKM | ECCS Pumps Miniflow to RWST, Train A Valve |
| 2(3)HV9348 | WKM | ECCS Pumps Miniflow to RWST, Train A Valve |
| 2HV8161 | Walworth | SDC HX Bypass Block Valve |

Note that MOVs 3HV9347 and 3HV9348 currently have adequate margin to be exempted from periodic dynamic testing but have been voluntarily included in the dynamic testing population in order to provide additional data on valve factor degradation. Additionally, as a living program, the population of gate valves which may be identified as candidates for periodic dynamic testing is subject to change based on available margin or if repeated dynamic testing reveals no significant valve factor degradation trend.

8.3 PROVIDE THE BASIS FOR GROUPING MOVS TO APPLY DYNAMIC TEST DATA TO NON-DYNAMICALLY TESTED MOVS.

The primary purpose of periodic dynamic testing is to confirm that there is no significant change in a given valve's dynamic performance characteristics such that the design basis functional capability of the valve would be jeopardized. The periodic verification program requires that all gate valves that do not have adequate margin to withstand a permissible valve factor of 0.8 will be periodically dynamically tested to assure design basis capability is maintained. Available margin is the sole basis for periodic dynamic testing.

It is expected that repeated dynamic testing will provide a basis for determining if any age related degradation of valve factors is occurring in the population of low margin gate valves. If valve degradation is shown to occur, SCE intends to evaluate the cause of degradation and assess the applicability/impact on all other gate valves within the GL 89-10 program. There is no specific intent to limit the scope of evaluation by the use of grouping. However, it is recognized that if valve factor degradation was confirmed to exist, it may be attributable to a specific valve design or service conditions that could possibly exclude the need to evaluate the impact on valves that do not have like conditions.

8.4 PROVIDE THE BASIS FOR THE DEGRADATION RATE FOR EACH GL 96-05 MOV.

The performance of MOVs at SONGS is assured by an aggressive periodic maintenance and diagnostic testing program. With the exception of valve factor for gate valves, the performance characteristics of the valves in the GL 89-10 program are confirmed to be within allowable limits by performing periodic maintenance and static diagnostic tests at a current interval of no greater than three refueling cycles (approximately 6 yr.). Key valve performance indicators (such as stem factor, seating margin, torque margin, among others), are trended to confirm that there is no historical evidence of degradation which would jeopardize the design basis capability of the valve prior to its next scheduled periodic maintenance. As the number of diagnostic tests accumulates , both for individual valves and groups of valves, valve performance over time and degradation rates will become apparent. The trend program and the test data reconciliation process explicitly look for and document changes in valve/actuator performance from test to test. From this data, the effectiveness of the existing maintenance practices will be judged and appropriate actions initiated. To date, test data suggests no significant degradations in actuator capability exists.

In considering the basis for valve factor degradation rate, SCE believes the application of 0.8 valve factor in determining the need for continued dynamic testing is both conservative and bounding. This position is based on review of Electric Power Research Institute's (EPRI's) in-situ dynamic testing and the results of the friction effect studies performed as part of the Performance Prediction Program (PPM). SCE is also monitoring the results of periodic dynamic testing program currently being undertaken by the Joint Owners Group (JOG) in response to GL 96-05. Although SCE is not actively contributing to the JOG program because of the large number of WKM gate valves in our GL 89-10 population which are unique to SONGS, the findings of the JOG will be considered for applicability.

As stated previously, gate valves currently considered low margin will continue to be periodically tested under dynamic conditions. This periodic dynamic testing will provide the basis for establishing a valve factor degradation rate and confirming our assumption that a valve factor of 0.8 is an appropriately bounding value.

**NRC Question**

**9. In its March 13, 1997, letter on GL 96-05, the licensee states that no periodic dynamic testing is planned for globe or butterfly valves at SONGS. Provide the available margins for these MOVS, and the bases for both the margins and the assumption that no degradation will occur in the performance of these valves.**

Edison Response

9.1 PROVIDE THE AVAILABLE MARGINS FOR GLOBE AND BUTTERFLY VALVES

See margin assessment spreadsheets included in Enclosure 4.

## 9.2 PROVIDE THE BASIS FOR GLOBE AND BUTTERFLY VALVE MARGINS

Globe valve design basis margin is defined as the difference between the required operating forces under design basis conditions and the available actuator output force at control switch trip. For globe valves, the required operating force is calculated using performance data obtained from in-situ static and dynamic testing performed at SONGS as well as available industry data. Validation of appropriate effective pressure area (seat or guide based) and rate of load values were determined for all globe valves either directly by dynamic testing or through grouping methodologies defined by Supplement 6 to GL 89-10. Stem factors and packing loads were confirmed during static testing. In addition to the known physical performance characteristics of the globe valves, the required operating force also includes consideration for maximum instrument inaccuracies, control switch repeatability, spring pack relaxation, and stem factor degradation.

Butterfly valve design basis margins are also defined as the difference between the required operating forces under design basis conditions and the available actuator output force at control switch trip. The design basis operating force requirements for butterfly valves were calculated using vendor specified sizing methodologies and include consideration of the effects of upstream disturbances. In addition, the effects of system friction losses are not considered when determining maximum system differential pressures. A comparison of the SCE calculation methodology with the current EPRI PPM approach for butterfly valves shows a good correlation between predicted required force values. SCE has also performed a small number of dynamic tests on butterfly valves during the GL 89-10 program which confirmed the conservative basis of the SONGS butterfly valve calculation model. With the exception of 2 valves per unit, all butterfly valves in the SONGS GL 89-10 are limit switch controlled thereby making full actuator capability available to the valve.

All globe and butterfly valves within the GL 96-05 population currently are maintained with positive design basis margin (as seen in the attached margin tables). Although there is currently no specified minimum required margin, SCE believes the existing margin for these valves is adequate based on historical performance and current industry guidelines. Additional details of margin assessment are provided in Enclosure 4.

## 9.3 PROVIDE BASES FOR NOT PERFORMING DYNAMIC TESTING OF GLOBE AND BUTTERFLY VALVES

As stated in response to GL 96-05, SCE has not committed to periodic dynamic testing of globe or butterfly valves. It is SCE's position that a valve requires periodic dynamic testing if such testing is the only means to confirm that a dynamic performance characteristic could degrade to the point of challenging the design basis capability of the component over time.

For globe valves there is no current industry evidence available that suggests that the dynamic force required to operate the valve degrades with time. This is understandable since the dynamic force to operate a globe valve under dynamic conditions is a function of pressure times area and is not subject to change. Furthermore, a large percentage of globe valves within the GL 89-10 program were dynamically tested at SONGS, and all valves were found to have dynamic forces within the predicted values, which supports the position that there is no age related degradation mechanism which can affect the dynamic force requirements since the population of valves has been in service since the start of commercial operation. Therefore, it is SCE's position at this time that any changes in the performance requirements of a globe valve such as disc ring hardening can be identified under static testing. If new industry data becomes available which contradicts this position, SCE will assess it appropriately.

The basis for not periodically dynamic testing butterfly valves is similar in part to the position on globe valves. With the exception of bearing degradation, there are no degradation mechanisms currently identified within the industry that would suggest that the force required to overcome dynamic conditions changes with time. SCE recognizes that butterfly valve bearing loads do change under dynamic conditions vs static and can be subject to degradation in certain service conditions. However, it is believed that if butterfly valve bearing degradation were to occur with a magnitude sufficient to jeopardize the large amount of available margins of these valves, it would represent such a severe degradation that it would be identifiable under a static diagnostic test. In addition, review of plant maintenance records does not indicate that there is a history of bearing degradation. Therefore, it is SCE's position at this time that any changes in the performance requirements of a butterfly valve such as seat ring hardening or bearing degradation which could significantly challenge the available design basis margin can be identified under static testing. If new industry data becomes available which contradicts this position, SCE will assess it appropriately.

**NRC Question**

**10. In its March 13, 1997, letter on GL 96-05, the licensee stated that periodic static diagnostic testing will be performed to monitor actuator output. In a telephone discussion on March 11, 1999, the licensee indicated that it had not incorporated the recent Limitorque guidance in Technical Update 98-01 (and its Supplement 1) for AC powered MOVS, but was conducting a research program to evaluate MOV output capability. Provide the basis for the assumptions in predicting the capability of ac powered MOVs and monitoring potential performance degradation during the ongoing research effort at SONGS. Describe the research effort at SONGS to address AC powered MOV output under design-basis conditions, including load requirements, degraded voltage, and temperature effects. Provide the status of the response to the ongoing industry evaluation of manufacturer's guidance for dc-powered MOVs at SONGS, including determination of the degradation rate associated with aging effects that could result in a potential decrease in actuator output.**

Edison Response

10.1 PROVIDE THE BASIS FOR THE ASSUMPTIONS IN PREDICTING THE CAPABILITY OF AC POWERED MOVS AND MONITORING POTENTIAL PERFORMANCE DEGRADATION DURING THE ONGOING RESEARCH EFFORT AT SONGS.

Limitorques' Technical Update 98-01 specified that pullout efficiency was to be used to determine available actuator output torque. This position was based in part on testing performed by the Idaho National Engineering and Environmental Laboratory (INEEL) which has been published as NUREG/CR-6478. The NRC has identified the issue to licensees under Information Notice (IN) 96-48.

SCE is evaluating in-situ test data obtained during diagnostic testing performed during the Cycle 10 refueling to determine if the INEEL findings are appropriate to the population of MOVs at SONGS. SCE believes the use of plant specific in-situ test data is the best and most appropriate means to determine actuator efficiencies and evaluate the impact of Limitorque and INEEL data on the SONGS GL 89-10 population.

At this time, there is no evidence from past on-site testing to suggest that the actuator output capability of the MOVs is less than predicted by current methodologies. SCE currently derates motor/actuator output capability for maximum degraded voltage conditions as well ambient temperature affects. No credit for motor output torque capability beyond motor rated nameplate output capability is taken although industry testing has shown that most AC motors are capable of output greater than rated torque. The evaluation of actuator efficiency is forecast to be complete by the end of the year. Upon completion of SCE in-house study of actuator efficiencies, the impact of the findings will be evaluated. If the results of the evaluation show a component to be outside its design basis capability, a non-conformance report will be initiated, past operability assessed, and corrective actions initiated per SONGS procedures.

10.2 DESCRIBE THE RESEARCH EFFORT AT SONGS TO ADDRESS AC POWERED MOV OUTPUT UNDER DESIGN BASIS CONDITIONS, INCLUDING LOAD REQUIREMENTS, DEGRADED VOLTAGE, AND TEMPERATURE EFFECTS.

SCE is currently evaluating the actuator output efficiency of a selected population (approximately 10% of GL 89-10 program) of MOVs tested during the recent Cycle 10 refueling outage. The research methodology intends to use MOVATS MC2 software to analyze acquired diagnostic traces and determine motor shaft output torque at critical points of operation and compare that torque to the torque determined at the actuator springpack based on springpack displacement. This analysis will determine if the motor output at control switch trip is below the available motor shaft output torque at degraded voltage and permit the calculation of effective actuator efficiency. This data will then be compared to the MOV design basis data identified in the MOV setpoint calculation. If the results of testing validate the current Limitorque Technical Update 98-01 recommendations, SCE will incorporate the data appropriately and assess the impact on past operability.

The testing is not being performed to address any issues other than actuator efficiency. The effects of degraded voltage and temperature effects are currently considered in the MOV setpoint calculations and are in compliance with Limitorque recommendations.

10.3 PROVIDE THE STATUS OF THE RESPONSE TO THE ONGOING INDUSTRY EVALUATION OF MANUFACTURERS GUIDANCE FOR DC POWERED MOVS

SCE is following the performance testing of DC motors by INEEL and is aware of the possible concerns regarding performance capabilities of DC motors (especially larger DC motors). SCE will evaluate the findings of INEEL when available. Currently SONGS MOV design basis calculations consider the impact of degraded voltage on motor output torque and motor speed. Review of preliminary INEEL data obtained by SCE suggests that for the DC motors within the SONGS population the current MOV calculation methodologies are acceptable.

**NRC Question**

**11. Explain how risk insights will be applied in the GL 96-05 program at SONGS. Compare the MOV risk-ranking methodology used at SONGS to generic industry methodologies.**

Edison Response

SCE will implement OMN-1 as an alternative to MOV Stroke time testing. Refer to Enclosure 3 for specific details.

SCE used probabilistic risk measures to initially categorize components and an expert panel to confirm, adjust (if necessary), and approve final component categorization. This is consistent with the two pronged risk-informed approach used by the industry.

The risk achievement worth (RAW) and Fussell-Vessely (FV) Importance measures were used to categorize the risk importance of components in the IST program. These same importance measures are consistent with those used by the industry for categorizing systems, structures, and components (SSC) in the maintenance rule (10CFR50.65) and NUMARC 93-01. Similar to the maintenance rule (MR), the criteria of more (or high) versus less (or low) safety significance is based on cutoff values for both FV and RAW. For the MR, an SSC is considered more safety significant if the FV or the RAW is greater than 0.005 and 2.0, respectively. This is consistent with the values found in NUMARC 93-01. For the RI-IST, three categories were used. An SSC with a FV greater than 0.001 was considered 'high' in safety significance. This is a more stringent FV cutoff value than that used for the MR (FV > 0.005). Systems, structures and components with a FV lower than 0.001 were considered 'low, high' if the RAW was greater than 2 and 'low, low' if the RAW was less than 2. These RAW and FV cutoff values are the same as those used by TU Electric's (Comanche Peak) RI-IST program.

Of additional note, the calculation of RAW by the industry has followed two methods, one more accurate than the other. One method is to re-quantify pre-solved result (cutsets) by setting a component's failure probability to unity. This provides an approximate and possibly non-conservative RAW because cutsets using the SSC's nominal failure rates may be truncated prior to requantification with failure rates equal to 1.0. The more accurate method is to set the component's failure probability to 1.0 prior to solving the plant PRA model. Cutsets truncated by the approximate method would not be truncated in the more accurate method used by SCE.

**NRC Question**

**12. In its RI-IST submittal, the licensee states that the SONGS MOV periodic verification testing program will comply with the provisions of American Society of Mechanical Engineers (ASME) Code Case OMN-1, "Alternative Rules for Preservice and Inservice Testing of Certain Electric Motor Operated Valve Assemblies in LWR Power Plants." Clarify the commitment to implement ASME Code Case OMN-1 as a relief request as an alternative to MOV stroke-time testing in the ASME Code. Address the conditions on use of the code case specified in GL 96-05 and the use of risk insights to evaluate potential extensions if any, of exercise intervals for high-risk MOVS.**

Edison Response

SCE will implement OMN-1 in its entirety as an alternative to MOV stroke time testing in the ASME Code of record. See Enclosure 3.

**NRC Question**

**13. In its RI-IST submittal, the licensee states that the provisions of paragraph 6.4.4, Determination of MOV Test Interval, in OMN-1 will not be followed until sufficient plant-specific data are accumulated. Describe the process the licensee will follow to determine test intervals until that time**

Edison Response

As stated in the response to question 12, SCE will fully implement OMN-1 including paragraph 6.4.4 for determination of acceptable intervals.

**NRC Question**

**14. In Section 2.2.1, the role of defense-in-depth is discussed. "Rule number 1" states that the level of redundancy is the principal criterion upon which classification rests. In Table 2.1-1, the term "average redundancy" is used. Explain how the application determines the level of redundancy. Define "average redundancy."**

Although Rule 1 states that the level of redundancy is the principal criterion upon which classification of component safety significance rests, the application does not directly determine the 'level' of redundancy. The phrase "average redundancy" is not intended as a strict quantitative value or definition but as a concept to describe 'relative' levels of redundancy (i.e., less than, greater than, average). Instead, the concept of "average redundancy' and the effect of common-cause failure as described in Rule 2 are used by the expert panel to aid in their understanding of the relativeness of component importance measures and the meaning of the components safety significance classification. The principles found in both Rule 1 and 2 are implicitly measured using the FV and RAW importance measures. That is, a component's FV and RAW value reflect the relative level of redundancy, diversity, and reliability. In practice, a typical expert panel member is unfamiliar with the PRA concepts of FV and RAW. They are, however, familiar with the concepts of redundancy, diversity, and reliability. By corresponding these relative concepts to FV and RAW values and risk classifications, the expert panel is able to match the 'PRA numbers' and the initial safety significance classifications to their intuitive understanding of levels of redundancy, diversity and reliability and make a quality decision.

NRC Question

15 The Expert Panel has down-classified some components because of conservatism in the probabilistic risk assessment (PRA) (for example, pages 2-17 and A-1 3). The NRC staff agrees that conservatism in the PRA can result in components being classified as HSSC that are not risk significant, however, it is preferred that in these cases, the PRA be modified to remove the conservatism (see page 19-B4 of Chapter 19 of the Standard Review Plan [SRP]). This is particularly true for cases where the Expert Panel has noted discrepancies in the PRA (see the first paragraph on page A-1 3). PRA conservatism or inaccuracies can mask the importance of other SSCs that are otherwise ranked as LSSC.

a. In the calculation of cumulative risk impact, explain how the change in risk is determined for the components that were downgraded, (i.e., if unmodeled success paths were accounted for, or if discrepancies in the PRA were accounted for, etc.)

b. In determining that the PRA was conservative (for example, by taking credit for unmodeled flow paths or unmodeled operator actions), explain the extent to which the Expert Panel considered information on availability of procedures, equipment, training, etc.

c. If alternate success paths (not modeled in the PRA but credited in the RI-IST program were to be modeled in the risk analysis, state if components in these paths would become HSSC.

d. The December 30, 1998, submittal stated that the PRA will be kept as a living document. Thus, changes to the plant design and operations can be reflected in the PRA models, and the effects of these changes can therefore be evaluated for programs such as the RI-IST program. In cases where unmodeled success paths are given credit, describe the mechanisms for ensuring that SSCs in these paths will receive similar treatment (i.e., will remain available at the level credited in the licensing change request).

Edison Response

a. In the calculation of cumulative risk impact, explain how the change

**in risk is determined for the components that were downgraded, (i.e., if unmodeled success paths were accounted for, or if discrepancies in the PRA were accounted for, etc.)**

For the calculation of cumulative risk impact, the component failure modes were reviewed to ensure that the unmodeled redundant systems/functions would provide sufficient defense such that a revised PRA model would show no measurable increase from a test frequency reduction. For example, although only one flow path is modeled for makeup to the Condensate Storage Tank (AFW water source), multiple flow paths are available. An increase in the duration between tests of the modeled makeup valve would not result in a risk increase if the other paths were modeled. The results of the review showed that none of the downgraded components would have any cumulative risk impact if redundant systems/functions were modeled in the PRA. Therefore, none of the basic events for the downgraded components were modified for the calculation of cumulative risk impact.

b. **In determining that the PRA was conservative (for example, by taking credit for unmodeled flow paths or unmodeled operator actions), explain the extent to which the Expert Panel considered information on availability of procedures, equipment, training, etc.**

Each IST component was formally presented to the expert panel. The presentation included the FV and RAW value of the component, the initial categorization, and the basis for its categorization. Conservatively quantified and categorized components were discussed in detail by the expert panel. As applicable, plant drawings were provided to the panel to show unmodeled flow paths. Detailed perspectives on additional available operator actions and procedures that were not modeled were provided by the expert from plant operations and by the PRA/HRA expert who is familiar with SONGS specific plant procedures and operator simulator training. The expert panel agreed that to credit the availability of an alternate path, there must be explicit procedural steps (which guides usage of the alternate path) and adequate time to implement the success path. Also, the procedural steps must be in the emergency or abnormal operating instructions (EOI, AOI) or be referred to by the EOI or AOI.

c. **If alternate success paths (not modeled in the PRA but credited in the RI-IST program were to be modeled in the risk analysis, state if components in these paths would become HSSC.**

If alternate paths were modeled, the components in these paths would not become HSSC. The primary paths were categorized as LSSC due to the availability of these redundant and equally capable alternate paths. Modeling of the alternate paths would result in similar risk importance values as the primary path's values.

d. **The December 30, 1998, submittal stated that the PRA will be kept as a living document. Thus, changes to the plant design and operations can be reflected in the PRA models, and the effects of these changes can therefore be evaluated for programs such as the RI-IST program. In cases where unmodeled success paths are given credit, describe the mechanisms for ensuring that SSCs in these paths will receive similar treatment (i.e., will remain available at the level credited in the licensing change request).**

Valves and pumps that are probabilistically ranked as high but downgraded by the expert panel due to unmodeled alternate success paths will be treated in either of two methods: 1) the alternate success paths will be added to the PRA model and re-evaluated, or 2) the component will be re-visited by the expert panel every two years to ensure that the bases for downgrading the component continues to be valid. In practice, method one will be used in all cases. Method two is used as a temporary measure when method one cannot immediately be implemented.

**NRC Question**

16. **The December 30, 1998, submittal documents a decrease in risk because of a decrease in the interfacing systems loss-of-coolant (ISLOCA) frequency. In the SONGS individual plant examination (IPE) submittal, the ISLOCA frequency for the low pressure safety injection (LPSI) lines was determined based on the NUREG/CR-4550 ISLOCA analysis for a pathway consisting of two check valves. The SONGS IPE then included a factor of 0.01 for the LPSI MOV. Discuss how this IPE analysis was modified to account for the change in test intervals (in the calculation of delta risk).**

Edison Response

The ISLOCA model used in the present SONGS 2/3 PRA has been expanded from the model used in the IPE. The LPSI ISLOCA pathways (penetrations 48, 49, 50, and 51) discussed in the IPE included a conservative, judgement-based LPSI MOV failure probability of 0.01 (due to misalignment, rupture or other failure). The scenario included failure of two check valves and the upstream LPSI MOV. Since the IPE submittal, the ISLOCA model has been revised to include an additional ISLOCA sequence involving the same LPSI discharge lines and a LPSI MOV probabilistic failure model (to replace the IPE's conservative LPSI MOV failure probability).

The new scenario included in the SONGS 2/3 model includes rupture of both LPSI injection line check valves, failure of the pressure transmitter (which measures pressure between the two check valves) and opening of the upstream LPSI MOV to perform an in-service test. The operator uses the transmitter to verify low downstream pressure prior to opening the MOV. Undetected failure of the pressure transmitter combined with failures of the check valves may result in an ISLOCA when the operator performs the next MOV IST. The four scenarios, one for each LPSI line, now dominate the ISLOCA results.

The LPSI MOV failure probability (previously 0.01 in the IPE) is probabilistically modeled and includes LPSI MOV limit switch failure, catastrophic rupture, and operator failure to close the MOV following a test. The failure probability is dominated by the limit switch failure probability. The limit switch failure probability is 2E-3/demand based upon a 5E-04 limit switch failure probability per demand times 4 tests (demands) per year.

Both the original and new scenarios are affected by changing the LPSI MOV test frequency. The frequency of the original IPE scenarios are reduced since the 2E-3/demand is based upon the number of tests performed. Reducing the number of tests from four to two reduces the MOV failure rate by a factor of 2. The new scenario is specifically assumed to occur when the MOV is stroked open for the test. Therefore, a reduction in the test frequency will reduce the ISLOCA frequency. Since these scenarios dominate the present ISLOCA frequency, a change in the LPSI test frequency from 4/year to 2/year will reduce ISLOCA by a factor of 2.

**NRC Question**

**17. Discuss the grouping of components in the RI-IST program relative to the CCF groups used in the PRA. Identify any cases where components with different testing procedures and characteristics (e.g., test intervals) are placed in the same common cause group.**

Edison Response

The December 30, 1998 IST Submittal, Appendix A, discusses IST groupings that were not modeled by the PRA. The summary of the sensitivity analysis (Appendix A to the December 30, 1999, SCE RI-IST submittal) concluded that no additional common cause groupings need to be added to the PRA model.

The PRA common cause groups and IST groups were identical in nearly all cases. In three cases, the PRA conservatively modeled common cause failures between separate IST groups (i.e., groups that are controlled by different IST procedures):

1) The Auxiliary Feed Water Pump discharge MOVs (HV4712, 4705, 4706 & 4713) are AC powered for the motor driven pumps, and DC Powered for the Turbine Driven Pump. These valves are the same size and manufacturer, have the same actuators, but have different motors. The IST intervals are the same, but the tests are controlled by separate procedures. These valves are ranked as HSSC in the PRA. If the two valve groups were treated as separate common cause groups, the valves would still be ranked as HSSC.

2) The Chemical and Volume Control System Charging (CVCS) Pump discharge check valves are presently being replaced on an as available basis, with two of six already replaced (i.e., one of three replaced on each unit) with valves from another manufacturer. The other four valves are from a different manufacturer and have yet to be replaced. The PRA assumed common cause failure of 3 of 3 valves, which will be accurate once all valves are replaced.

3) The CVCS/Boric Acid Makeup supply check valves (MU033, 035, 082, 083, and 052) were treated as one common cause group in the PRA, and separate groups in the IST program. The first four valves are 3" valves and are treated as one IST group, while MU052 is a six-inch valve and is treated as a single valve group. Aloyco manufactures all five check valves. MU052 was ranked by the PRA as an HSSC. All other valves listed are ranked as LSSCs.

In summary, the IST groupings and PRA common cause groupings are identical in most cases. In each of the three cases sampled above, multiple IST groupings were combined as one PRA group. The resulting component classifications with these differences in grouping would not change if the analysis were formally redone with PRA CCF groupings redefined to match the IST groupings.