March 27, 2000

Mr. Harold B. Ray
Executive Vice President
Southern California Edison Company
San Onofre Nuclear Generating Station
P.O. Box 128
San Clemente, CA 92674-0128

SUBJECT: SAN ONOFRE NUCLEAR GENERATING STATION (SONGS), UNITS 2 AND 3 - RISK-INFORMED INSERVICE TESTING PROGRAM FOR PUMPS AND VALVES (TAC NOS. MA4509 AND MA4510)

Dear Mr. Ray:

On December 30, 1998, you submitted a request to the Nuclear Regulatory Commission (NRC) to utilize a risk-informed inservice testing (RI-IST) program at SONGS, Units 2 and 3. The proposed program will determine inservice test (IST) frequencies for certain low safety significant valves and pumps. You submitted the request as an alternative to certain IST requirements specified in Section XI of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (BPV Code) pursuant to 10 CFR 50.55a(a)(3).

The NRC staff has completed its review of your submittals and enclosed is its safety evaluation. The staff concludes that your proposed alternative to the ASME BPV Code Section XI requirements is authorized pursuant to 10 CFR 50.55a(a)(3)(i) because it provides an acceptable level of quality and safety.

Please be advised that you are not expected to resubmit your RI-IST Program Description unless significant changes are made to the RI-IST program that could potentially affect the staff's overall conclusions. However, you are still required to submit your 120-month updates to the IST Program Plan for pumps and valves including any requests for relief pursuant to 10 CFR 50.55a(f)(5). Further, please be informed that failure to comply with the RI-IST program as reviewed and approved by the NRC staff and authorized pursuant to 10 CFR 50.55a(a)(3) [e.g., including scope, test strategy, documentation, and other programmatic requirements] constitutes noncompliance with 10 CFR 50.55a and is enforceable.

If you have any questions regarding this matter, please write or call the project manager, L. Raghavan, at 301-415-1471.

Sincerely,

/***RA/***

Stephen Dembek, Chief, Section 2
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-361/50-362

Enclosure: Safety Evaluation

cc w/encl: See next page

program as reviewed and approved by the NRC staff and authorized pursuant to 10 CFR 50.55a(a)(3) [e.g., including scope, test strategy, documentation, and other programmatic requirements] constitutes noncompliance with 10 CFR 50.55a and is enforceable.

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Stephen Dembek, Chief, Section 2
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Docket Nos. 50-361/50-362

Enclosure: Safety Evaluation

cc w/encl: See next page

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**SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION**

**RELATED TO THE SOUTHERN CALIFORNIA EDISON REQUEST**

**TO IMPLEMENT A RISK-INFORMED INSERVICE TESTING PROGRAM AT**

**SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3**

**DOCKET NUMBERS 50-361 AND 50-362**

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## 1.0 INTRODUCTION

In Title 10, Section 50.55a, of the *Code of Federal Regulations* (10 CFR 50.55a), the U.S. Nuclear Regulatory Commission (NRC) requires that licensees perform inservice testing (IST) of certain pumps and valves designated as Code Class 1, 2, or 3 under the *Boiler and Pressure Vessel Code* (BPV Code) or the *Code for Operation and Maintenance of Nuclear Power Plants* (OM Code) promulgated by the American Society of Mechanical Engineers (ASME). Further, 10 CFR 50.55a requires that licensees perform this testing in accordance with the ASME BPV Code Section XI or OM Code, and applicable addenda, except where the NRC has granted relief requested by the licensee, or where the NRC has authorized the use of proposed alternatives pursuant to 10 CFR 50.55a(f)(6)(i), (a)(3)(i), or (a)(3)(ii). In order to obtain such relief or authorization, the licensee must demonstrate that (1) conformance is impractical for the given facility, (2) the proposed alternative provides an acceptable level of quality and safety, or (3) compliance would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. Further, 10 CFR 50.55a(f)(4)(iv) provides that inservice tests of pumps and valves may meet the requirements set forth in subsequent editions and addenda of the ASME Code that are incorporated by reference in 10 CFR 50.55a(b), subject to the limitations and modifications listed, and subject to Commission approval.

The regulation at 10 CFR 50.55a authorizes the Commission to grant relief from ASME Code requirements or to approve proposed alternatives upon making the necessary findings. The NRC staff provided acceptance guidelines for alternative risk-informed inservice testing (RI-IST) programs in Regulatory Guide 1.174 (Ref. 1) and Regulatory Guide 1.175 (Ref. 2) and review procedures in standard review plan (SRP) Chapter 19 (Ref. 3) and SRP Section 3.9.7 (Ref. 4). This safety evaluation (SE) presents the findings of the staff with respect to authorizing the alternative RI-IST program proposed by Southern California Edison (SCE), the licensee for the San Onofre Nuclear Generating Station (SONGS), Units 2 and 3.

## 2.0 BACKGROUND

On December 30, 1998, SCE submitted (Ref. 5) a request to the NRC to utilize an RI-IST program to determine IST frequencies for certain valves and pumps that are categorized as low safety significant as an alternative to certain IST requirements specified in the ASME Code as required by 10 CFR 50.55a. SCE's proposed RI-IST program addresses test methods and frequencies, and performance-based concepts for IST beyond that required by the ASME Code. On April 20, 1999, the NRC staff transmitted to SCE a request for additional information (RAI) related to the proposed RI-IST program (Ref. 6). SCE responded to the NRC staff's RAI on June 17, 1999 (Ref. 7). SCE's response also included revised pages to SCE's overall RI-IST program, an RI-IST Program Description, and spreadsheets calculating the design-basis margins for motor-operated valves (MOVs). Based on an August 12, 1999, telephone conference with the staff, SCE provided additional information related to MOV testing on September 28, 1999 (Ref. 8). Based on telephone conferences between the staff and licensee on November 3rd and 19th, 1999, SCE submitted a revised RI-IST Program Description to the staff on November 30, 1999 (Ref. 9).

The Inservice Testing Plan for Pumps and Valves at SONGS Units 2 and 3 utilizes the 1989 Edition of ASME BPV Code Section XI. The 1989 Edition of the ASME BPV Code, Section XI, references ASME/American National Standards Institute (ANSI) Operations and Maintenance (OM) Standards, Part 1 for relief valves (OM-1); Part 6 for pumps (OM-6); and Part 10 for valves (OM-10). Both SONGS units began the second 10-year interval on April 1, 1994, and the interval will end on August 17, 2003.

The ASME Code specifies the following test frequencies:

| **Test Type** | **Test Frequency (nominal)** | **Code Reference** |
|---|---|---|
| Pump Test | 3 months | OM Part 6 |
| Valve Position Indication Verification | 2 years | OM Part 10 |
| Valve Exercising Test | 3 months | OM Part 10 |
| Valve Fail-Safe Test | 3 months | OM Part 10 |
| Valve Leak Rate Test | 2 years (Non-Containment Isolation Valves)<br><br>Frequency per Appendix J (Containment Isolation Valves) | OM Part 10<br><br>10 CFR Part 50 App. J, Option B |
| Check Valve Exercise Test | 3 months | OM Part 10 |
| Safety/Relief Valve Test | 5 years (class 1, class 2, MSSV)<br><br>10 years (class 2, 3) | OM Part 1<br><br>OM Part 1 |

## 3.0 GENERAL DESCRIPTION OF SCE'S PROPOSED RI-IST PROGRAM

The following sections provide a general description of SCE's proposed RI-IST program, SCE's basis for proposing this alternative, and a general description of the staff's evaluation of SCE's proposed RI-IST program.

### 3.1 Licensee's Proposed Approach

The proposed "alternate testing," as stated by the licensee in its December 30, 1998, RI-IST Program submittal is:

> Establish testing frequencies by implementing a Risk-Informed Inservice Testing Program per the guidance detailed in Regulatory Guide 1.175, "An Approach for Plant-specific, Risk-Informed Decisionmaking: Inservice Testing."

Valve Testing shall be performed in accordance with the requirements stated in ASME/ANSI OM (Part 10), except that the testing frequencies are determined per the methodology outlined in enclosure 2 [SONGS RI-IST Program, Engineering Analysis and Program Description, Revision 0, as proposed by SCE in its December 30, 1998, submittal].

Pump Testing shall be performed in accordance with the requirements stated in ASME/ANSI OM (Part 6), except that the testing frequencies are determined per the methodology outlined in enclosure 2.

Safety/Relief Valve Testing[1] shall be performed in accordance with the requirements stated in ASME/ANSI OM (Part 1), except that the testing frequencies are determined per the methodology outlined in enclosure 2.

The licensee's December 30, 1998, RI-IST Program submittal also states:

In lieu of performing Inservice tests on pumps and valves whose function is required for safety at frequencies specified in the ASME Code, as required by 10 CFR 50.55a(f)(4)(i) for the second 120-month interval, SCE presents an alternative testing strategy. The alternative would allow the inservice test strategies of those pumps and valves to be determined in accordance with the following guidelines, which are consistent with the guidelines established by TU Electric in their recently approved RI-IST program [for the Comanche Peak Steam Electric Station, Units 1 and 2]:

1. The safety significance of pumps and valves whose function is required for safety will be classified as either High Safety Significant Components (HSSCs) or Low Safety Significant Components (LSSCs). Inservice testing of HSSCs will (nominally) be conducted at the Code-specified frequency using approved Code methods. The inservice testing of those components that have been categorized as LSSC will be performed at extended test frequencies determined in accordance with the RI-IST program description. Unless otherwise specified in the RI-IST program description, inservice test methods for all pumps and valves whose function is important to safety will continue to be performed in accordance with the ASME Code.

2. The safety significance assessment of pumps and valves will be updated every other refueling interval based on Unit 3 refueling, as specified in this report.

This alternative testing strategy will also apply to successive 120-month intervals as discussed in 10 CFR 50.55a(f)(4)(ii).

[1] As discussed in Enclosure 2 [to the licensee's December 30, 1998, RI-IST Program submittal], the expert panel decided to maintain the current testing frequencies for Safety/Relief valves. The expert panel will review the testing frequencies in the future, when additional valve history is established for these valves. Any changes to the frequencies will be per the methodology outlined in Enclosure 2.

The licensee’s June 17, 1999, response to the staff’s RAI states that the SONGS RI-IST program summary (Enclosure 3 to the licensee’s June 17, 1999, RAI response) should “be used by the NRC in identifying commitments by the Southern California Edison Company (SCE).” Therefore, the SONGS RI-IST Program Description constitutes the specific alternative being proposed by the licensee for authorization pursuant to 10 CFR 50.55a(a)(3)(i). The latest revision to the licensee's RI-IST Program Description was forwarded to the staff via a letter dated November 30, 1999 (Ref. 9). The SONGS Risk-Informed Program (Enclosure 2 to the licensee’s December 30, 1998, submittal) provides additional details and results.

### 3.2 Basis for Alternative

The licensee’s December 30, 1998, Program submittal states:

> The proposed alternative testing strategy provides an acceptable level of quality and safety because key safety principles of defense-in-depth and safety margins are maintained. The impact of the proposed changes to the current testing strategy has been evaluated and meets the criteria specified in the acceptance guidelines of Regulatory Guide 1.174, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis.” The complete description and supporting bases reside in Enclosure 2, “San Onofre Nuclear Generating Station Risk-Informed Inservice Testing Program.”
>
> Enclosure 2 contains the basis for San Onofre Nuclear Generating Station’s Risk-Informed (RI) Inservice Testing (IST) Program, including Probabilistic Risk Analysis (PRA) descriptions and results.

Enclosure 2 to the licensee’s December 30, 1998, submittal provides a more detailed basis:

> Current Code-prescribed test intervals are based on a deterministic approach that considers a set of challenges to safety and determines how those challenges should be mitigated. This approach considers elements of probability, such as the selection of accidents to be analyzed as design basis accidents (e.g., the reactor vessel rupture is considered too improbable to be included) and the requirements for emergency core cooling (e.g., redundancy of trains). The alternative testing strategy presented here incorporates a probabilistic approach to regulation that enhances and extends this traditional, deterministic approach by:
>
> - Allowing consideration of a broader set of potential challenges to safety,
> - Providing a logical means for prioritizing these challenges based on risk significance, and
> - Allowing consideration of a broader set of resources to defend against these challenges.
>
> First, the Probabilistic Risk Assessment (PRA) model has identified a broader set of challenges to safety. In particular, the RI-IST project team has identified LSSCs and HSSCs that were not in the ASME Section XI IST Program. Even though the HSSC components are outside the traditional ASME component

eligibility requirements, they will be tested commensurate with their safety significance. Where the ASME Section XI testing is practical, the [H]SSCs not in the current ASME Section XI IST Program Plan will be tested in accordance with OM-10 for active valves. Where the ASME Section XI testing is not practical, alternative methods will be developed to ensure operational readiness.

Second, the RI-IST Testing program prioritizes these challenges based on the results of the SONGS PRA, which includes effects from both external event initiators (e.g., fires and seismic events) and from enhanced common cause failure modeling. The ranking process also considers risk impacts of other operating modes, specifically the most risk-significant plant shutdown configurations. These rankings consider importance with respect to both prevention of core damage and prevention of large early releases of radiation to the public. Section 3 [of the licensee's December 30, 1998, RI-IST Program submittal] describes the program methodology. Table 2.3-2 lists current component categorization results derived from the initial implementation of that methodology.

Finally, an Integrated Decision-making Process (IDP) allows a broader set of resources to be considered to defend against challenges to safety. The IDP includes a panel of experienced individuals with expertise in the areas of ASME Code requirements and testing methodology, plant operations, maintenance engineering, system engineering, design engineering, and probabilistic risk assessment. The IDP ensures that the risk ranking inputs are consistent with plant design, operating procedures, and plant-specific operating experience. More important, an integrated decision-making process that incorporates risk insights assures that a defense-in-depth philosophy is maintained (Section 2.4).

The licensee identified (in table form) where in its December 30, 1998, submittal each piece of documentation required by Section 4.1, "Documentation that Should Be in The Licensee's RI-IST Submittal," of Regulatory Guide 1.175 could be found.

RI-IST Project Results

Component categorization of IST valves and pumps yielded the following results:

| **RISK RANKING** | **PERCENTAGE OF COMPONENTS (UNITS 2 AND 3)** |
|---|---|
| High safety-significant components (HSSCs) | 15.8% (144 components) |
| Low safety-significant components (LSSCs) | 83.1% (757 components) |

According to the above table, 83.1% of the components ranked are eligible for interval extension. Although the engineering analysis was performed for components in both Units 2 and 3, Tables 2.3-1 (Comparison of Component Functions), 2.3-2 (Component Categorization and Expert Panel Basis), and 3.2-1

(Inservice Testing Program Changes) list only Unit 2 components and components common to both units. Unit 2 component functions mirror Unit 3 component functions, so the tables reflect information that applies to components in both units. When the performance history of a component group on one unit dictated a more conservative extension, that extension was applied to both units.

### 3.3 General Description of the Staff's Evaluation

Traditionally, licensees have proposed alternatives to ASME Code requirements pursuant to 10 CFR 50.55a(a)(3)(i), to specific provisions of the Code for a discrete component or group of components. In contrast, SCE's proposed RI-IST program would apply 10 CFR 50.55a(a)(3)(i) more broadly. The licensee's RI-IST program applies to all of the pumps and valves in the current Code-required IST program. Further, the licensee's RI-IST program is not described in terms of discrete alternatives to specific Code test requirements. Consequently, the staff's review of the licensee's RI-IST program focused on an integrated use of PRA and deterministic considerations to help define IST requirements as well as to establish implementation, performance monitoring, and corrective action strategies.

All components in the current Code-required IST program (as well as selected non-Code components categorized as HSSC) will be included in the licensee's proposed RI-IST program and therefore the licensee could modify their testing strategy (i.e., test frequency, test method, or both). The actual test strategy for a particular component may or may not change as a result of implementing the licensee's RI-IST program (e.g., certain components categorized as HSSC may continue to be tested in accordance with the current ASME Code test frequency and methods).

The staff's review was conducted using the guidance contained in Regulatory Guide 1.175 and Standard Review Plan Section 3.9.7. The staff's review of the licensee's proposed RI-IST program included:

- <u>Review of Simplified Piping and Instrumentation Diagrams</u>

The staff conducted a review of simplified piping and instrumentation diagrams (P&IDs) for the affected systems at SONGS. These diagrams were marked up to indicate the licensee's categorization of pumps and valves (e.g., high or low safety significant). If there was a particular reason why the licensee's expert panel categorized a component a certain way, this was annotated on the diagram. The diagrams were then reviewed to see if components appeared to be categorized in a logical and consistent manner. Defense-in-depth considerations (equipment redundancy) were also taken into account in this portion of the review.

- <u>Review of the SONGS PRA</u>

The staff reviewed the SONGS PRA with a focus on the dominant risk contributors, pump and valve failure rates, and modeling assumptions which may affect the results of the categorization process. The staff also reviewed the licensee's process to ensure PRA quality (i.e., internal review process and quality assurance procedures, and external peer review requirements). Results and findings of the staff's review of the SONGS Units 2 and 3 PRAs submitted as part of the Individual Plant Examination (IPE) and Individual Plant Examination for External Events (IPEEE) as well as results of other previous staff reviews of the PRA (e.g., evaluation of allowed outage time extensions for the safety injection tanks, low pressure safety injection, and emergency diesel generators) were also taken into consideration. As discussed in Section 4.4, the SONGS PRA was found to be of adequate quality for the RI-IST program submittal.

- Evaluation of Licensee's Proposed RI-IST Implementation Plans

The staff reviewed the implementation plans for each group of components in the proposed RI-IST program. As discussed in Section 5.2, implementation consists of grouping similar components and then staggering the testing of the group over the extended test interval for components categorized potentially high (L-H) and LSSC (see Section 4.5). The initial results of the licensee's categorization and grouping are documented in Table 3.2-1 of the licensee's December 30, 1998, RI-IST Program Plan. The grouping is consistent with the guidance contained in Regulatory Guide 1.175 and is therefore acceptable to the staff. The staggered test strategy allows trending and monitoring of the performance of components in the group to ensure that the selected test frequency is appropriate. The staggered test strategy also reduces susceptibility to common-cause failure modes, as selected components in the same failure mode group will be periodically tested over the group's extended test interval, thereby helping to ensure that component capability will be maintained over the interval.

- Review of Performance Monitoring and Corrective Action Plans

The staff reviewed the testing strategy planned for each component or group of components in the proposed RI-IST program. As discussed in Sections 5.3 and 5.4, component groups were reviewed and the resulting staggered test approach was evaluated to ensure that potential common-cause failures would be promptly identified and that appropriate corrective action would be taken (e.g., testing the other components in the group and possibly decreasing the test interval for the entire group).

## 4.0 REVIEW OF THE LICENSEE'S ENGINEERING EVALUATION

The licensee's November 30, 1999, RI-IST Program Description presents the proposed alternative to the ASME BPV Code IST Program at SONGS. It is a risk-informed process which determines the safety significance and testing strategy of components (pumps & valves) in the ASME IST Program, and identifies non-ASME IST components modeled in the PRA determined to be HSSC. The process consists of the following elements:

- Categorize components by Fussell-Vesely (FV) and Risk Achievement Worth (RAW) importance measures based on the SONGS Units 2 and 3 Living PRA (PRA Process)

- Blend deterministic and probabilistic data to perform a final importance categorization of components as either LSSC, L-H, or HSSC. (Integrated Decision Process — IDP)
- Develop/Determine Test Frequencies and Test Methodologies for the ranked components. (Testing Philosophy)
- Evaluate cumulative risk impact of new test frequencies and new test methodologies to ensure risk reduction or risk neutrality. (Cumulative Risk Impact)
- Develop an implementation plan. (Implementation)
- Develop a Performance Monitoring plan for RI-IST components. (Monitoring)
- Develop a Corrective Action plan. (Corrective Action)
- Perform periodic reassessment. (Periodic Reassessment)
- Develop a methodology for making changes to the RI-IST program. (Changes to RI-IST)

In the following sections, the staff's review of the SCE proposed RI-IST program is described and evaluated using the acceptance guidelines contained in Regulatory Guide 1.174 and Regulatory Guide 1.175, and the review procedures contained in SRP Chapter 19 and RI-IST SRP Section 3.9.7.

## 4.1 Evaluation of Proposed Changes

### 4.1.1 Licensee's Proposed Approach

The licensee's December 30, 1998, RI-IST Program submittal states:

> SCE's proposed RI-IST program addresses the majority of the 1140 pumps and valves in the current Code-required IST program, including motor-operated valves (MOVs), check valves (CVs), air-operated valves (AOVs), and manual valves. Relief valves and diesel generator valves were excluded from the risk ranking process because SCE plans to continue to test these components at current Code-prescribed test intervals. Specifically, the 109 relief valves are tested in accordance with ASME/ANSI OM-1987 Part 1 with the associated 10-year staggered testing interval commitment. The majority of the 120 valves associated with the diesel generators are skid-mounted and are therefore tested monthly according to current diesel generator testing protocol. The remaining diesel generator valves are tested in accordance with ASME/ANSI OM 1987, OMa 1988 Addenda, Part 10, in concert with the guidance presented in NUREG-1482, relative to skid mounted components.
>
> In lieu of performing inservice tests on pumps and valves whose function is required for safety at frequencies specified in the ASME Code, as required by 10 CFR 50.55a(f)(4)(i) for the second 120-month interval, SCE presents an

alternative testing strategy. The alternative would allow the inservice test strategies of those pumps and valves to be determined in accordance with the following guidelines, which are consistent with the guidelines established by TU Electric in their recently approved RI-IST program:

1. The safety significance of pumps and valves whose function is required for safety will be classified as either High Safety Significant Components (HSSCs) or Low Safety Significant Components (LSSCs). Inservice testing of HSSCs will (nominally) be conducted at the Code-specified frequency using approved Code methods. The inservice testing of those components that have been categorized as LSSC will be performed at extended test frequencies determined in accordance with the RI-IST program description. Unless otherwise specified in the RI-IST program description, inservice test methods for all pumps and valves whose function is important to safety will continue to be performed in accordance with the ASME Code.

2. The safety significance assessment of pumps and valves will be updated every other refueling interval based on Unit 3 refueling, as specified in this report.

This alternative testing strategy will also apply to successive 120-month intervals as discussed in 10 CFR 50.55a(f)(4)(ii).

4.1.2 <u>Staff Evaluation</u>

The licensee described its RI-IST Program as outlined in Section 1.1 of Regulatory Guide 1.175. Other than the RI-IST program changes discussed in Section 5 of this SE, there are no other aspects of the plant's design or operation being modified by the licensee which require staff evaluation.

The specific alternative testing proposed by the licensee is in part to establish testing frequencies by implementing an RI-IST program according to the guidance detailed in Regulatory Guide 1.175. Section 3.1 of Regulatory Guide 1.175 states that "[i]n establishing the test strategy for components, the licensee should consider design, service condition, and performance as well as risk insights." In this respect, Regulatory Guide 1.175 does not distinguish between components categorized as HSSC and LSSC. The licensee's November 30, 1999, RI-IST Program Description indicates that components categorized as either L-H or LSSC will have their test intervals extended based in part on an evaluation of the component's design, service condition, and performance history. This is consistent with the guidance contained in Regulatory Guide 1.175 (see Section 5.1.2).

The licensee's June 17, 1999, response to staff's RAI states that the licensee's evaluation of component design, service condition, performance history and compensatory actions reside in the RI-IST data system. Changes to the data system are in progress that will facilitate integration of these evaluations to a single, coherent, and widely accessible controlled location. Ongoing consideration of component design, service condition, and performance history when establishing the test strategy for components categorized as LSSC will be subject to NRC inspection.

4.1.3 Conclusion

Regulatory Guide 1.175 states that the licensee should identify those aspects of the plant's design, operation, and other activities that would be changed by the proposed RI-IST program and that require NRC approval. Other than the RI-IST program changes discussed in Section 5 of this SE, there are no other aspects of the plant's design or operation being modified by the licensee which require staff evaluation. Therefore, there is nothing additional (i.e., other than the RI-IST program changes discussed in Section 5.1 of this safety evaluation) for the staff to review as suggested in Section III.A.1 of SRP Section 3.9.7.

## 4.2 IST Program Scope

4.2.1 Licensee's Proposed Approach

The licensee's December 30, 1998, RI-IST Program submittal states:

> Aside from exceptions noted in Section 3 of the RI-IST program, components in the current ASME Section XI IST program that are determined to be HSSCs will continue to be tested in accordance with the current program, which meets the requirements of Section XI of the ASME Boiler and Pressure Vessel Code (except where specific written relief has been granted). Similarly, components in the current ASME Section XI IST program which are determined to be LSSCs will also be tested in accordance with the ASME Section XI IST program. However, the LSSC test frequency may initially be extended to a maximum of once every 6 years, except for the refueling water storage tank outlet check valves and the emergency sump check valves which may be extended to a maximum of 8 years. Hence, no LSSC will be removed from the IST program scope. The extended test frequency will be staggered over the respective test interval as described in the RI-IST program description (Section 3).
>
> The RI-IST program includes valves and pumps in the following plant systems:

| ENGINEERING SYSTEM DESIGNATION | SYSTEM DESCRIPTION |
|---|---|
| *Pumps* | |
| 1203 | Component Cooling Water System (CCW) |
| 1204 | Safety Injection System (SI) |
| 1206 | Containment Spray System (CS) |
| 1208 | Chemical Volume and Control System (CVCS) |
| 1218 | Boric Acid Makeup System (BAMU) |
| 1305 | Auxiliary Feedwater System (AFW) |

| | |
|---|---|
| 1413 | Salt Water Cooling System (SWC) |
| 1513 | Emergency Chilled Water System (ECW) |
| 2421 | Diesel Transfer Fuel Oil (DGFO) |
| *Valves* | |
| 1201 | Reactor Coolant System (RCS) |
| 1203 | Component Cooling Water System (CCW) |
| 1204 | Safety Injection System (SI) |
| 1206 | Containment Spray System (CS) |
| 1208 | Chemical Volume and Control System(CVCS) |
| 1212 | Post Accident Sampling System (PASS) |
| 1218 | Boric Acid Makeup System (BAMU) |
| 1219 | Fuel Storage and Refueling System |
| 1220 | Penetration Assemblies |
| 1301 | Main Steam System (MS) |
| 1305 | Auxiliary Feedwater System (AFW) |
| 1318 | Blowdown Processing System (BPS) |
| 1413 | Salt Water Cooling System (SWC) |
| 1415 | Nuclear Service Water (NSW) |
| 1417 | Demineralized Water |
| 1500 | Hydrogen System |
| 1501 | Containment Purge |
| 1513 | Emergency Chilled Water System (ECW) |
| 1901 | Liquid Radwaste |
| 1902 | Gaseous Radwaste |
| 2004 | Radwaste Monitoring |
| 2301 | Fire Protection |
| 2417 | Instrument Air |
| 2418 | Backup Nitrogen |
| 2420 | Diesel Air |
| 2421 | Diesel Transfer Fuel Oil (DGFO) |
| 2423 | Service Air |
| 2426 | Floor Drains |

As indicated on page 2-3 of the licensee's December 30, 1998, RI-IST Program submittal,

> For the few HSSCs that are not within the scope of the current IST program, it is not practicable to perform Code testing. For example, the control room emergency chillers are high safety significant, but are not currently part of the IST program. The chillers are units that cool the fluid to the control room/ECCS

> emergency coolers. They have not previously been classed as pumps in the IST program. However, as they are highly safety significant, SCE is adding additional monitoring and trending to ensure their continued operability. Trending of the chiller parameters will be done in concert with the chilled water pump IST.

In addition, Table 2.3-2 (page 114) of the licensee's December 30, 1998, RI-IST Program submittal states (and as supplemented by the licensee's June 17, 1999, response to staff's RAI):

> 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 [to the RI-IST Program] 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.

### 4.2.2 Staff Evaluation

The scope of the proposed RI-IST program includes all of the components in the licensee's current ASME BPV Code, Section XI, IST Program Plan. The scope of the proposed RI-IST program also includes those non-Code components that the licensee's IDP categorized as HSSC. SCE's IDP identified one non-Code component (i.e., the auxiliary building emergency chiller units) that was categorized as HSSC that is not in the current SONGS IST program. The chillers are units that cool the fluid to the Control Room Emergency Air Cleanup System (CREACUS)/Engineered Safeguards (ESF) emergency coolers. SCE stated that testing these chillers in accordance with the ASME Code is impractical (see page 2-25 of the licensee's December 30, 1998, RI-IST Program Plan). While SCE is still evaluating the most appropriate test methods for these chillers (see page 2-39 of the licensee's December 30, 1998, RI-IST Program Plan), SCE plans to add additional monitoring and trending to ensure their continued availability and operability (see Section 5.1). The emergency chillers will be diagnostically tested on a periodic basis. Trending of the chiller parameters will be performed in concert with the chilled water pump IST (a quarterly RI-IST interval). While the specific chiller parameters to be monitored have not been identified by the licensee, the staff finds that the licensee's plans are acceptable because they will provide reasonable assurance of the operational readiness of the chillers and will ensure timely identification of degradation in chiller performance (i.e., degradation associated with failure modes identified as important in the licensee's PRA).

The licensee included manual valve 1417MU230 in the scope of its RI-IST program to reduce the risk associated with the potential failure of a single component (MU476) in a single makeup flow path. Including MU230 in the scope of the SONGS RI-IST program is consistent with the risk-informed philosophy proposed in Section 2.4 of Regulatory Guide 1.175 in that the licensee is using risk analysis to improve operational and engineering decisions by taking advantage of opportunities for reducing risk.

#### 4.2.3 Conclusion

The licensee's RI-IST program includes, in addition to components in the current Code-prescribed program, other components categorized HSSC that were identified as part of the PRA or licensee's IDP (i.e., the auxiliary building emergency chiller units). This RI-IST program scope is consistent with the acceptance guidelines contained in Section 1.2 of Regulatory Guide 1.175 and is therefore acceptable.

### 4.3 Relief Requests and Technical Specification Amendments

#### 4.3.1 Licensee's Proposed Approach

The licensee stated that “no new relief requests or exemptions beyond the currently approved relief requests and this submittal are needed to implement the RI-IST program at this time.” The licensee did not resubmit relief requests for components that were categorized as HSSC. Instead, the existing relief requests were evaluated as part of the expert panel deliberations and a summary was provided for staff evaluation.

#### 4.3.2 Staff Evaluation

The licensee indicated that no exemptions from regulations, technical specification amendments, or new relief requests were necessary to implement its proposed RI-IST program.

The licensee did not resubmit relief requests for HSSCs that were the subject of previously approved relief requests. The staff's guidance as contained in Regulatory Guide 1.175 suggests that these relief requests be resubmitted to the NRC and reevaluated in light of the safety significance of the subject components. Rather, SCE provided a description of the relief requests in the current SONGS IST program. This list identified the nature of the relief (e.g., relief from the full-scale range requirements specified by the ASME Code for certain analog instruments where the instrument accuracy exceeds that required by the ASME Code such that the intent of the Code is met, relief from the loop accuracy and analog instrument range requirements for certain pumps where the combination of range and accuracy of the installed instrumentation meets the intent of the Code) and specified each component’s categorization (i.e., HSSC, L-H, or LSSC). In this manner, the staff was able to determine that the previously approved relief requests, for components categorized as HSSC, continued to be appropriate in light of the safety significance of the component.

Individual component relief requests are not required to adjust the test interval of individual components that are categorized as LSSC because the licensee's implementation plan for extending specific component test intervals was reviewed as part of the licensee’s RI-IST program submittal. Similarly, because the proposed alternative includes improved test strategies to enhance the test effectiveness of components, such as the use of ASME Code Case OMN-1, "Alternate Rules for Preservice and Inservice Testing of Certain Electric Motor Operated Valve Assemblies in LWR Power Plants, OM-Code - 1995 Edition; Subsection ISTC," additional relief from the Code requirements (i.e., beyond staff approval of the licensee's RI-IST program describing the licensee's intention to adopt such a Code case) is not required.

4.3.3 Conclusion

The licensee's RI-IST program provides for testing of HSSCs in accordance with the Code test frequency and method requirements, in accordance with a NRC-approved Code case, or in accordance with an alternative test strategy that has been authorized by the staff as part of the RI-IST program review (see Section 5.1). Similarly, the licensee will test LSSCs in accordance with the Code test method requirements (although on an extended interval) or approved alternative methods. The licensee has not identified any exemptions, technical specification amendments, or relief from other Code requirements which would require review and approval before the implementation of its RI-IST program. Therefore, the staff finds this aspect of SCE’s proposed RI-IST program to be acceptable because it is consistent with the acceptance guidelines contained in Section 2.1.2 of Regulatory Guide 1.175.

**4.4 Scope, Level of Detail, and Quality of the PRA for IST Application**

The licensee’s November 30, 1999, RI-IST Program Description states:

> PRA methodology facilitates determination of the risk significance of components based on end states of interest, such as core damage frequency (CDF) and release of radioactivity (e.g., large early release frequency (LERF)).
>
> The full scope (internal and external events, and shutdown) PRA used to develop the importance measures is adequate for this application, and is complemented by the Integrated Decision Process (IDP). Evaluation of initiating events also includes loss of support systems and other special events such as Loss of Coolant Accident (LOCA), Steam Generator Tube Rupture (STGR), Station Blackout (SBO), and Anticipated Transient without Scram (ATWS).
>
> The SONGS 2/3 full-scope, all-modes, living PRA will be used to initially categorize components based on risk importance and also used to calculate changes in core damage frequency and large early release frequency. The

> initial categorization and change in CDF and LERF will be provided to the expert panel as part of the IDP. The quality of the Living PRA will be maintained under a formal PRA change and review process to ensure that the component importance measures and CDF/LERF calculations accurately reflect the as-built design and operation of SONGS 2/3.
>
> The PRA will be periodically updated (See Section 8 [Section 5.5.1 of this SE]) to reflect the current plant design, procedures, and programs.

### 4.4.1 Scope of the PRA

4.4.1.1 Licensee's Proposed Approach

The licensee's December 30, 1998, RI-IST Program submittal states:

> Since the submittal of the SONGS 2/3 IPE, SCE has continued to refine and improve the PRA to include external events (fire and seismic), recent design, maintenance, and operational changes, shutdown risk, and enhanced common cause failure and initiating event modeling . . . The refined SONGS 2/3 PRA model used to support this submittal reflects the current as-built and operated plant and is consistent with the definition of a full scope model described in Regulatory Guide 1.174. Further, the Safety Monitor, which is used to analyze and quantify the SONGS 2/3 models, includes average annual maintenance (average risk analysis) and historical plant unavailabilities (dynamic risk analysis) such that plant-configuration-based risk modeling can be readily performed.

The licensee's November 30, 1999, RI-IST Program Description states:

> The full scope (internal and external events, and shutdown) PRA used to develop the importance measures is adequate for this application, and is complemented by the Integrated Decision Process (IDP).

4.4.1.2 Staff Evaluation

The SONGS PRA is a full-scope PRA which includes internal initiating events and events initiated by earthquakes and fires. The shutdown modes of operation are also modeled. In addition, the licensee has considered risks from various plant operating configurations (dynamic risks) in the categorization of components. Risk insights from the PRA were used as part of the licensee's IDP.

4.4.1.3 Conclusion

The staff finds that the scope of the SONGS PRA is consistent with that described in Section 2.3.1 of Regulatory Guide 1.175. The PRA addresses the potentially significant risk contributors and is adequate to provide insights on plant risk and to provide input to the component categorization process used in the licensee's RI-IST program.

### 4.4.2 Level of Detail of the PRA

4.4.2.1 Licensee's Proposed Approach

The licensee's December 30, 1998, RI-IST Program submittal states:

> With respect to the scope of the specific IST components modeled by the PRA, pumps and valves which are important to systems required to prevent core damage and radioactivity release are explicitly modeled . . . Pumps and valves which are in-service tested but not modeled in the PRA are categorized by the Expert Panel with consideration of importance to core damage and radioactivity release prevention, level of redundancy, and operational requirements.
>
> The SONGS 2/3 PRA models the specific failure modes of the pumps and valves. In some cases, the pumps and valves have more than one failure mode. For valves, these failure modes may include failure to open, failure to close, failure to remain open, and failure to remain closed. For pumps, the failure modes include failure to start and failure to run. Each of these failure modes are explicitly modeled by a specific basic event. Direct mapping of these failures to the associated component permits calculation of component-specific FV and RAW importance values.

4.4.2.2 Staff Evaluation

A review of the SONGS PRA showed that the models include the important pumps and valves (and the relevant failure modes) required to prevent or mitigate the effects of the modeled initiating events. For the RI-IST submittal, the IST functions were mapped to the PRA failure modes of each modeled pump and valve. For IST components or failure modes not modeled in the PRA, the licensee performed a detailed evaluation on each component by comparing the IST functions to potential functions in the PRA, and the risk significance of such components were determined by the expert panel. The licensee also provided qualitative evaluations to show that increased test intervals for these components will only result in a very small or no risk increase.

The staff's review also found that the SONGS PRA is of sufficient detail to model system and operator dependencies important to the plant risk.

4.4.2.3 Conclusion

The SONGS PRA includes IST components (and relevant failure modes) that contribute most significantly to the plant's estimated risk, and the system and operator dependencies important to the plant risk. The staff therefore finds that the licensee's PRA has sufficient detail for the

RI-IST application, and is consistent with the guidance provided in Section 2.3.1 of Regulatory Guide 1.175.

IST components not included in the PRA model have been appropriately dispositioned by the licensee's expert panel which deliberated on each non-modeled component, and provided a qualitative evaluation as to why test intervals for these components can be extended. Staff review of the expert panel process used (as well as the results of this process) showed that expert panel dispositioning of non-modeled IST components is consistent with Section 2.3.2 of Regulatory Guide 1.175 and is therefore acceptable.

### 4.4.3 Quality of the PRA

4.4.3.1 Licensee's Proposed Approach

The licensee's December 30, 1998, RI-IST Program submittal states:

> The risk assessment satisfies industry standards associated with PRA. Enhancements to the PRA have been made in support of the RI-IST and other plant applications, including use of the latest common cause failure method and data, as well as enhanced modeling of external event initiators.
>
> Several measures have been implemented in the development of the SONGS 2/3 PRA to ensure quality. Changes in the model that impact assumptions, success criteria, basic event probabilities, system, and plant models formally undergo several levels of review, and, depending on the complexity of the change, may also include peer and/or technical expert panel review. A comprehensive independent peer review of the SONGS 2/3 Level 1 and Level 2 internal events living PRA for full power and shutdown operations was conducted between August 1996 and April 1997. During this review, documents, procedures and supporting calculations and analyses were available. The review was based primarily on the guidance provided in the PRA procedure guides such as NUREG/CR-2300 and NUREG/CR-4550, as well as PRA applications documents such as EPRI TR-105396 and NUREG-1489. The results of all independent review activities performed by internal and external reviewers were documented in the SCE PRA Change Package process and tracked in the PRA Punch List Database.
>
> In addition to extensive internal and external peer review, these refined full-scope models were used to support the approved SONGS 2/3 diesel generator (DG), low pressure safety injection (LPSI), and safety injection tank (SIT) allowed outage extension submittals to the NRC. In addition to detailed model review of the SONGS 2/3 Individual Plant Examination (IPE) by the NRC, the SONGS PRA received application-specific regulatory reviews as a pilot plant for risk-informed Technical Specifications. This review was in many ways similar to the review performed for the Comanche Peak risk-informed IST pilot project. The safety evaluation report (SER) for the DG was granted on September 9, 1998. The SER for the SIT and LPSI submittals was granted on June 19, 1998.

> In summary, the SONGS PRA has been subjected to extensive peer and regulatory review. The PRA model, assumptions, database changes and improvements, and computer code are controlled and documented by administrative procedure. The model and database reflect the as-built plan and the most recent historical data. Therefore, the SONGS PRA is of a quality consistent with that required to perform accurate, thorough, and comprehensive evaluations for a risk-informed IST application.

In addition, the licensee stated in its November 30, 1999, RI-IST Program Description:

> The quality of the Living PRA will be maintained under a formal PRA change and review process to ensure that the component importance measures and CDF/LERF calculations accurately reflect the as-built design and operation of SONGS 2/3.
>
> The PRA will be periodically updated . . . to reflect the current plant design, procedures, and programs.

#### 4.4.3.2 Staff Evaluation

As part of the review of the overall quality of the SONGS PRA, the staff reviewed the licensee's process to ensure quality. This review took into account the process used in the licensee's internal review and the external peer review. Results, findings, resolutions to the findings, and conclusions from staff reviews of the IPE and IPEEE reviews were also used. Finally, staff evaluations of the PRA from previous risk-informed submittals and applications by the licensee were also considered.

To reach specific findings regarding the quality of the SONGS PRA for the licensee's RI-IST application, the staff performed a focused-scope evaluation that concentrated on IST specific attributes of the PRA and on the assumptions and elements of the PRA model that drive the results and conclusions. Pump and valve reliabilities and availabilities were reviewed and found to be consistent with generic industry data (for example those found in NUREG/CR-4550). Modeling for event trees and fault trees, parameter estimation, and human reliability analysis were found to be consistent with currently accepted practices (e.g., NUREG/CR-2300 and NUREG/CR-4550). The staff concluded that potential uncertainties of the PRA model were addressed through the use of sensitivity studies and by use of the licensee's expert panel process.

#### 4.4.3.3 Conclusion

There is reasonable assurance of the adequacy of the SONGS PRA, as shown by the licensee's process to ensure quality and by the staff's focused-scope review. In its review, the staff found that the components affected by the RI-IST process and those that are important to decision-making are appropriately modeled. The staff concludes that the SONGS PRA is consistent with the guidance provided in Section 2.3.1 of Regulatory Guide 1.175 and is therefore of sufficient quality to support the RI-IST application.

## 4.5 Categorization of Components

### 4.5.1 Licensee's Proposed Approach

The licensee's November 30, 1999, RI-IST Program Description states:

> Two figures of merit will be used to initially categorize components: Fussell-Vesely (FV) and Risk Achievement Worth (RAW). For the RI-IST Program, the following criteria will be used to initially rank components for review by the Integrated Decision Process (IDP).

| Category | Criteria |
|---|---|
| High (HSSC) | FV > 0.001 |
| Potentially High (L-H) | FV < 0.001 and RAW > 2 |
| Low (LSSC) | FV < 0.001 and RAW < 2 |

> These CDF and LERF thresholds coupled with the cumulative risk impact evaluation detailed in Section 4 [Section 4.6 of this SE], ensure that the cumulative risk impact due to changes in test frequencies are within the acceptance guidelines of Regulatory Guides 1.174.

***Methodology/Decision Criteria for PRA***

The following describes a methodology that will be used to categorize components in the RI-IST when the program is reassessed. However, only those elements that are significantly affected by the model changes (e.g., design modifications or procedural changes) need to be reviewed in detail using this process. The scope of the review and the justification for it will be documented as part of the IDP. The following steps will be applied by the IDP:

a) Review FV and RAW importance measures for pumps and valves considered in the PRA against the classification criteria.

b) Review component importance measures to ensure that their bases are well understood and are consistent with the SONGS specific levels of redundancy, diversity, and reliability.

***PRA Limitations***

a) Address the sensitivity of the results to common cause failures (CCF), assuming all/none of the CCF importance is assigned to the associated component.

b) Evaluate the sensitivity due to human action modeling. Identify/evaluate proceduralized operator recovery actions omitted by the PRA that can reduce the ranking of a component.

c) Evaluate the sensitivity of the component classifications to the uncertainty of the component failure probabilities.

d) Consider industry history for particular IST components. Review such sources as NRC Generic Letters, Significant Operating Event Report (SOERs), and Technical Bulletins and rank accordingly.

e) For components with high RAW/ low FV, ensure that other compensatory measures are available to maintain the reliability of the component.

f) Identify and evaluate components whose performance shows a history of causing entry into LCO conditions. To ensure that safety margins are maintained, consider retaining the ASME test frequency for these components.

***Level II (LERF)***

Consider components/systems that are potential contributors to large, early release. Determine LERF FV and RAW for components and/or determine which would have the equivalent of a high FV or low FV /high RAW with respect to LERF and rank accordingly. Also, in order to ensure that containment integrity continues to be maintained, consider:

- Containment isolation features that may not directly impact the value of LERF, and

- Interfacing systems LOCA that may provide a direct release path outside containment.

***IST Components Not in PRA***

Review scenarios involving the "not-modeled" IST components to validate that the components are in fact low risk.

***High-Risk PRA Components Not in the IST Program***

- Identify, if any, other high risk pumps and valves in the PRA that are not in the IST program but should be tested commensurate with their importance.

- Determine whether current plant testing is commensurate with the importance of these valves. If not, determine what test, e.g., the IST test, would be the most appropriate

***Other Considerations***

Review the PRA to determine that sensitivity studies for cumulative effects and defense in depth have been adequately addressed in the determination of component importance factors.

4.5.2 <u>Staff Evaluation</u>

The staff reviewed the licensee’s component categorization process by evaluating the PRA risk-ranking process and results, the sensitivity studies carried out to demonstrate the robustness of the ranking results, considerations of the limitations in the PRA used in the ranking process, and considerations of plant operating experience.

The results of the component risk ranking using the FV and RAW measures were found to be reasonable and consistent with the as-built and as-operated plant. The sensitivity studies showed that the results were robust for a plausible range of common-cause failures, operator recovery probabilities, and component reliability/unavailability. The use of LERF as a risk metric provided insights on pumps and valves that are important to large, early releases. Finally, the licensee addressed the impact of the RI-IST program on multiple components through the confirmatory assessment of the change in risk metrics, and showed that this change in risk is small (see Section 4.6).

4.5.3 <u>Conclusion</u>

The licensee’s process for categorizing pumps and valves was found to be consistent with the guidance described in Section 2.3.2 of Regulatory Guide 1.175 and is therefore acceptable.

The licensee's process on the determination of risk importance of components in the RI-IST program is robust in terms of the important PRA modeling techniques, assumptions, and data. Expert panel deliberations have been appropriately used to account for traditional engineering considerations, plant operating experience and PRA limitations. The categorization of components as LSSC (and therefore, eligible for extension in test intervals) is supported by calculations which indicate that the risk increase is acceptable given the increase in test interval.

## 4.6 Evaluating the Effect of Proposed Changes on Overall Plant Risk

### 4.6.1 Modeling of the Effects of IST on PRA Basic Events

4.6.1.1 Licensee's Proposed Approach

The licensee's December 30, 1998, RI-IST Program Plan states:

> The inclusion of IST program effects on cumulative plant risk is comprehensive, as a total quantitative estimate of risk has been produced considering both average and dynamic plant models. This quantitative evaluation of key RI-IST program elements includes the effects of compensatory measures, the influence of staggered testing on CCF, and the adverse effect of some ISTs on risk.
>
> An analysis was performed to determine the potential risk impact of increasing in-service testing intervals simultaneously on all less risk significant components. Consideration was given to available information on how changes in test intervals will change component failure probabilities, common cause failure probabilities, and initiating event frequencies.
>
> *Component Failure Probabilities*. Uncertainty in the available information, together with the complexity required to model such an approach, dictated the use of a number of assumptions for calculating changes in component failure probabilities:
>
> - It is assumed that any increase in test intervals would simultaneously impact the reliability of all IST components in the low safety-significant component (LSSC) category.
> - Consistent with the PRA techniques, the component unavailability, Q, is assumed to be:
>
>   $Q = Q_{OD} + (\lambda T)/2$
>
>   where,
>
>   $Q_{OD}$ = the component unavailability on demand,
>
>   l = the standby component failure rate per hour, and,
>
>   T = the interval between tests that verify operability of the component.
> - The component unavailability is assumed to increase by the same factor as the increase in the test interval (i.e., unavailability linearly increases with the time between tests) . . . This is a very conservative assumption because it assumes that not only the "interval dependent" standby failure probability [$(\lambda T)/2$] increases by a factor of two, but also the 'interval independent' failure on demand probability ($Q_{OD}$) increases by a factor of two.
> - Decrease in wearout due to less frequent testing is assumed to be negligible although frequent testing has been seen to cause components to be less available due to wearout.
> - Component unavailable hours due to testing were not adjusted for change in the test interval. If a component is tested less frequently, the

component unavailability due to testing should also be reduced. However, the component unavailabilities due to testing were kept at the higher value in this analysis.

- It is conservatively assumed that all IST tests are fully effective in finding the causes of component unavailabilities.

*Common Cause Failures*. As discussed above, the common cause failure probabilities can also increase with IST interval changes. The most conservative time between testing was assumed for the CCF value estimate for the factor increase in failure rate . . . Accordingly, the modeling of CCF changes due to IST program changes reflects the significant risk benefit that can result from implementing the staggered testing philosophy suggested by RG1.175.

*Initiating Event Frequencies*. IST component failures can also result in initiating events. Configuration specific Initiating Events are included in the SONGS model as fault trees. For example, the loss of CCW/SWC fault tree and interfacing systems LOCA (ISLOCA) are developed based upon fault trees included in the model. The same [($\lambda$T)/2] model is used to adjust these initiating event frequencies. The remaining initiating events were evaluated and determined to be unaffected by the IST interval extensions.

The licensee's December 30, 1998 RI-IST Program Plan also included discussions of the potentially non-conservative assumptions used in modeling the effects of RI-IST program changes and justified why they are not considered significant. These assumptions include: fully effective compensatory measures and use of constant failure rates (i.e., no impact from aging effects).

The submittal states that credited compensatory measures (such as subgroup relay tests or Technical Specification surveillance tests) are fully effective and essentially equivalent to the IST. The licensee also stated that many compensatory measures were not credited in calculations of change in risk, including: those required by the SONGS RI-IST program for low FV, high RAW components; normal system evolutions; and equipment rotations for run-time equalization. Consequently, the licensee concluded that the treatment of compensatory measures is conservative.

The December 30, 1998, submittal states that the SONGS RI-IST program considered the effects of aging. For example, one element of the RI-IST program is performance monitoring. If changes to the RI-IST program lead to a gradual equipment degradation and a resulting performance problem, the problem will be identified through root cause analysis and the corrective action program. Also, because the tests will be staggered, corrective action can be taken to effectively remove or correct for any degradation mechanisms such as aging. Therefore, the program will identify and correct potential age-related performance degradation.

The licensee’s conclusions, as stated in the December 30, 1998, RI-IST Program Plan, are:

> *Conclusion*. Modeling the effects of changes in the RI-IST program requires changes to individual component failure probabilities, common cause failure probabilities, and initiating event frequencies. The [($\lambda$T)/2] model can be considered adequate for these applications because conservatisms and programmatic elements such as staggered testing and performance monitoring compensate for potential non-conservatisms in the model.

4.6.1.2 Staff Evaluation

In the licensee’s submittal, the effect of the test interval extension on a component’s failure probability (including common-cause failures and initiating event frequencies) is obtained by prorating the failure probability by the ratio of the new-to-old test interval. This is equivalent to assuming a constant (i.e., non-time-dependent) standby failure rate $\lambda$, and estimating the basic event probability using $\lambda T/2$, where T is the time between tests. As it is applied, there is an assumption that the components are returned to the “good as new” state following a test. If there is no significant active degradation mechanism, including that resulting from intermittent use of the component, and the failures are primarily caused by random external influences, this formula is appropriate. Because the tests on the components will be staggered and component performance will be monitored with the help of enhanced test methods designed to identify significant degradation mechanisms, corrective action can be taken to effectively remove or correct for these degradation mechanisms including those caused by aging. Therefore, the $\lambda T/2$ model is adequate for this application.

The submittal credited compensatory measures such as subgroup relay tests and Technical Specification surveillance tests. (The licensee has also stated that many other compensatory measures were not credited in calculations of change in risk and that credit for these measures may reduce the calculated risk increase.) In the context of the $\lambda T/2$ model, a test that demonstrates functional success can be regarded as a “compensatory” measure, because it limits the exposure time to the failed state. In the framework of the model used by the licensee, credit taken for a compensatory test would require that the test be performed at the same frequency as the original test (usually 3 months). This condition holds true for the most part when compensatory measures are proposed in the RI-IST program. In the cases where the frequency of compensatory tests is not consistent with the IST frequency, the licensee has made appropriate adjustments in the calculation of risk.

4.6.1.3 Conclusion

A model for unavailability in terms of fault exposure time was used in the PRA for evaluating the risk significance of extending the selected component test intervals. Fault exposure time for IST components was modeled appropriately and is linked either to the proposed IST intervals or to “compensatory tests” which are required as part of IST activities on other components or as part of the plant’s technical specifications. The effects of aging and environmental stresses (time dependent degradation of the failure rates) have been addressed as part of the licensee's IDP which adopted improved test methods as documented in Section 5.1 below. The staff therefore finds that the licensee’s modeling of the effects of IST on pumps and valves to be consistent with the guidance provided in Section 2.3.3.1 of Regulatory Guide 1.175 and is acceptable.

### 4.6.2 Evaluation of Change in Risk

4.6.2.1 Licensee's Proposed Approach

SCE stated in its December 30, 1998, RI-IST Program submittal that "the inclusion of IST program effects on cumulative plant risk is comprehensive, as a total quantitative estimate of risk has been produced considering both average and dynamic plant models. This quantitative evaluation of key RI-IST program elements includes the effects of compensatory measures, the influence of staggered testing on CCF, and the adverse effect of some ISTs on risk."

The PRA used for the quantification of risk, and the change in risk from IST changes is a full scope PRA which includes the seismic and fire initiating events as well as the low power and shutdown modes of operation. The submittal notes that:

> the total plant risk is at a favorable level compared to the acceptance criteria in RG1.174. Total plant CDF is slightly less than 1E-4 per year and total plant LERF is about 1E-6 per year. Hence, CDF is slightly less than the RG1.174 acceptance criteria for total plant risk and LERF is well below its corresponding RG1.174 acceptance criteria.

When calculating the change in risk for the RI-IST application, the licensee evaluated two scenarios. The first scenario used average maintenance unavailabilities (static risk analysis). The second scenario used historical maintenance unavailabilities during a 6-month cycle ending in 1998 (dynamic risk analysis).

Using average maintenance unavailabilities, risk changes as obtained from Table 2.3–5 of the licensee's December 30, 1998, submittal indicates the following:

| **RISK METRIC AND MAGNITUDE** | **CDF CHANGES** | **CDF FRACTIONAL CHANGE (%)** | **LERF CHANGES** | **LERF FRACTIONAL CHANGE (%)** |
|---|---|---|---|---|
| Increases due to interval extensions | 2.0E-07 | 0.3 | 0.0 | 0.0 |
| Decreases due to IST changes | 1.2E-07 | 0.2 | 1.9E-08 | 2.3 |
| Total Change | +8.0E-08 | +0.1 | -1.9E-08 | -2.3 |

Both the CDF and LERF decrease results from a decrease in interfacing systems LOCA (ISLOCA) frequency. When the LPSI discharge valves are opened for testing, a potential ISLOCA scenario can occur if the RCS check valves have failed. By extending the interval of IST on the LPSI discharge valves, the frequency of ISLOCA is decreased by a factor of two.

Using dynamic conditions (i.e., configuration-specific component unavailabilities), the change in risk was calculated to be almost identical to the case for average unavailabilities. In addition, the licensee stated that:

> the CDF risk increase is also small in any single time interval during the 6-month cycle evaluated. The dynamic risk analysis results were compared on a time-step by time-step basis. For the 6 months of OOS data representing the actual plant schedule, the risk changes for CDF and LERF ranged from zero to 2%, but never higher than 2%. This is a surprising result at first, since in theory it would seem easy to postulate a plant configuration where a significant increase in risk is calculated. However, there are very few components with a FV between 1E-04 and 1E-03. Most of the components with a FV in this range are ranked low-high (L-H), requiring Expert Panel consideration of a compensatory measure.

In terms of shutdown risk, the licensee concludes the following:

> The effect of the IST changes on cumulative shutdown CDF risk was calculated using the schedule for the SONGS Unit 2 Cycle 10 outage. The baseline risk for the outage was 6.98E-06/outage. This value did not increase when IST interval increases were assumed. Therefore, the contribution from shutdown to the CDF risk change was zero.

The licensee describes the following as important direct and indirect safety benefits beyond the reduction in ISLOCA frequency:

- Added testing for selected components not in the IST program
- Reliability improvements for HSSCs in the IST program:
    1. Reduction in exposure to potential system re-alignment errors
    2. Improved performance resulting from improving the quantity and quality of plant personnel time devoted to HSSCs
- Reduction in human errors due to a reduction in operator burden
- Improved system failure probabilities upon demand due to fewer off-normal operational line-ups
- Other safety impacts related to improvement in safety culture:
    1. Improved understanding of component level importance
    2. Monitoring of CCF components
    3. Operator awareness of important PRA failure modes for IST components

Combining the risk estimate as calculated by the PRA with a more limited quantification of the direct safety benefits, the licensee indicates that total plant CDF and LERF will both be reduced (on the order of 8% and 10%, respectively) as a result of changes to be implemented in the RI-IST program. The licensee concludes that:

> Given the relaxation of test intervals, the addition of components to the program and the non-quantified tangible risk benefits, the impact of the proposed RI-IST program will be either risk beneficial or, at the very least, risk neutral.

4.6.2.2 Staff Evaluation

The staff's review of the licensee's evaluation of the change in risk focused on the areas of initiating event analysis, modeling of common-cause failures, component failure rates, and the quantification of risk impact. The staff finds that the licensee has adequately considered the effects of IST changes on initiating events that were analyzed in the PRA. The staff also finds that the estimation of baseline risk, as well as the quantification of the change in risk for the RI-IST program, to be reasonable and consistent with the guidelines found in Regulatory Guide 1.175.

On the basis of bounding calculations, the impact on plant risk from the proposed RI-IST program was estimated to be an increase in CDF of 8.0E-8/yr and a decrease in LERF of 1.9E-8/yr. This calculated increase in CDF may to be smaller (or perhaps negated) on the basis of qualitative risk arguments regarding the safety benefits of using improved test methods, the reduction in exposure to potential system re-alignment errors, and the added testing for high safety significant non-IST components. Similarly, the decrease in LERF may be even larger for the same reasons. Therefore, it is concluded that this RI-IST application will result in risk increases that are small (or negligible), and thus this submittal meets the guidelines provided in Regulatory Guide 1.174 in terms of risk considerations.

4.6.2.3 Conclusion

This RI-IST application will result in a CDF increase that is small (or negligible), and will result in a decrease in LERF. These changes in risk (CDF and LERF) are consistent with the guidance provided in Section 2.3.3.3 of Regulator Guide 1.175 and Figures 3 and 4 in Regulatory Guide 1.174 for allowed increases in risk and are therefore acceptable.

## 4.7 Integrated Decision-making

### 4.7.1 Integrated Decision-making Process

4.7.1.1 Licensee's Proposed Approach

The licensee's December 30, 1998, RI-IST Program states that a key element of the RI-IST program is the Integrated Decision-making Process (IDP).

> SCE's IDP is comprehensive, ensuring that key safety principles such as defense-in-depth and safety margins are maintained. The process considered relevant component-specific information, including design basis safety functions, PRA risk importance, and a detailed analysis of component corrective maintenance history.

> All project tasks were conducted with reproducibility and retrievability in mind. The project deliverables - including tables of IST functions, PRA functions, PRA risk measures, component ranking outcomes, component functional failures, Expert Panel decision bases, valve groups, test interval information, and monitoring requirements - are housed in a database from which the IST coordinator may administer the risk-informed IST program. In addition, all Expert Panel judgements have been transcribed and indexed to ensure that component information is traceable and retrievable.

The licensee's November 30, 1999, RI-IST Program Description states:

> The purpose of using the Integrated Decision Process (IDP) is to confirm or adjust the initial risk ranking developed from the PRA results, and to provide a qualitative assessment based on engineering judgement and expert experience. This qualitative assessment compensates for limitations of the PRA, including cases where adequate quantitative data is not available.
>
> The IDP uses deterministic insights, engineering judgement, experience, and regulatory requirements as detailed in this section. The IDP will review the initial PRA risk ranking, evaluate applicable deterministic information, and determine the final safety significance categories. The IDP considerations will be documented for each individual component to allow for future repeatability and scrutiny of the categorization process.
>
> The scope of the IDP includes both categorization and application. The IDP is to provide deterministic insights that might influence categorization. The IDP will identify components whose performance justifies a higher categorization.
>
> The IDP will determine appropriate changes to testing strategies. The IDP will identify compensatory measures for potentially high safety significant components, or justify the final categorization. The IDP will also concur on the test interval for components categorized as a Low Safety Significant Component (LSSC).
>
> The end product of the IDP will be components categorized as LSSC, Potentially High Safety Significant (L-H) or High Safety Significant Component (HSSC).
>
> In making these determinations, the Integrated Decision Process (IDP) ensures that key safety principles (namely defense-in-depth and safety margins), are maintained. It also ensures the changes in risk for both CDF and LERF are acceptable . . .

***Categorization Guidelines***

Expert Panel Structure and Role

The role of the Expert Panel (EP) is crucial in ensuring that the results presented in this submittal are comprehensive. The Panel members consider and ultimately validate the results of all work activities and studies performed by the IST project members. The Panel consists of members with expertise in the following disciplines:

- Power plant operations,
- Plant maintenance,
- Probabilistic risk assessment (PRA) and nuclear safety analysis,
- Reliability engineering,
- Station technical support (systems and component engineering),
- Design engineering, and
- Inservice testing (including ASME B&PV Code Section XI and ASME Code Cases).

The above disciplines are considered as required functional disciplines. The participation of these core disciplines is necessary to achieve a Panel quorum at every Panel meeting. Periodic participation by a plant licensing expert and other component or system experts is on an as required basis. Each core member of the Panel shall have at least ten years experience in nuclear power and at least five years site specific experience.

In addition to ensuring an integrated RI-IST effort through active technology transfer, the Expert Panel serves as the central point of decision-making for major technical issues and offers guidance to risk-informed IST project members in performing their work. Further, common membership of several members on the risk-informed IST Expert Panel and the Maintenance Rule Expert Panel, assures consistency in decision bases.

Ultimately, the Panel's principal responsibility is to ensure that the risk ranking information is consistent with plant design, operating procedures, and with plant-specific operating experience. To that end, the Panel members perform each of the following steps:

- Understand the scope of IST and the scope of PRA. Understand the IST functions for which the assigned ISTs test, the component failure modes modeled by the PRA, and important differences between the two.
- Understand the basis of IST and PRA models and assumptions.

- Understand the design basis for the IST function, the basis for the PRA ranking, the concepts of redundancy and reliability, and the concept of common cause failure.
- Accept (or reject) the scope and bases of both IST and PRA.
- Accept (or reject) the initial PRA ranking.
- Possibly adjust the ranking of components not modeled by the PRA from LSSC to a higher ranking. Assign compensatory measures if the component is considered to be of low safety significance solely on the basis of component reliability.
- Review the corrective maintenance history. Understand the basis for the corrective maintenance history. Adjust the ranking if the component is considered to be unreliable in the performance of IST safety functions.
- Accept final ranking.

Based on the process outlined above, the Panel makes a qualitative assessment of the risk importance categories that are developed for the components using the PRA results and deterministic insights, plant-specific history, engineering judgments, and probabilistic risk analysis insights. The panel reviews the PRA component risk rankings, compares the PRA and IST functions to ensure consistency with plant design, and analyzes applicable deterministic information in its effort to resolve the final safety significance categorizations for all the IST components under scrutiny.

Modeled Components/Functions

For modeled components/functions with a FV >0.001 the IDP either confirms the component categorization is HSSC or a justification of conservatism in the PRA model will be developed.

For modeled components/functions with a FV <0.001, but a RAW >2.0, the component will be categorized L-H. The component may be considered LSSC provided a compensatory measure exists that ensures operational readiness and the component's performance is acceptable. If a compensatory measure is not available or the component has a history of poor performance, the component will not be considered for test interval extension and will be considered for potential test method enhancement.

For modeled components/functions with a FV <0.001 and a RAW <2.0, the component will be categorized as LSSC provided the component's performance has been acceptable. For those components with performance problems, a compensatory measure will be identified to ensure operational readiness or the component will be categorized as HSSC.

Non-Modeled Components/Functions

For components not modeled or the safety function not modeled in the PRA, the categorization is as follows:

If the sister train is modeled then the component takes that final categorization.

If the component is implicitly modeled in the PRA, the FV and RAW are estimated and the deliberation is as discussed for modeled components/functions.

If the component is not implicitly modeled, the component performance history will be reviewed. For acceptable performance history the component will be categorized as LSSC. For poor performance history, a compensatory measure will be identified to ensure operational readiness and the component categorized as LSSC, or if no compensatory measures are available, categorize the component as HSSC.

***Documentation***

Documentation of the IDP will be available for review at the plant site. The basis for risk ranking and component grouping will be entered in the IST data system.

4.7.1.2 Staff Evaluation

The licensee utilized an expert panel to ensure integrated decision-making. Inputs used by the expert panel to categorize components and to determine IST intervals include PRA results and insights, deterministic insights, and plant operating data.

The staff finds that the licensee's IDP is well defined, systematic, and scrutable. The process is technically defensible and sufficiently detailed to allow an independent party to reproduce the major results. The licensee's IDP (i.e., an expert panel) was effective in identifying components whose testing strategy could be reduced as well as components whose testing strategy should be improved. The staff concludes that the licensee's IDP conforms with the principles of risk-informed regulation as specified in Regulatory Guide 1.174 and the guidance in Regulatory Guide 1.175 based on the following:

- The proposed RI-IST program is consistent with the defense-in-depth philosophy (see Section 4.7.2).

- The proposed RI-IST program maintains sufficient safety margins. Proposed test intervals will be significantly less than the expected time-to-failure of the component and the licensee will ensure that adequate component capability (i.e., margins) exists, above that required during plant design-basis conditions, such that component operating characteristics over time will not result in reaching a point of an insufficient margin before the next scheduled test activity (see Section 4.7.3 for more discussion).

- The overall process used by SCE to categorize components is acceptable (see Section 4.5). Specifically, the information provided to the IDP with regard to determining the risk importance of contributors for inservice testing is robust in terms of model inputs and assumptions including issues like the use of both CDF and LERF, completeness of the risk model, and sensitivity of the results to common cause failure modeling and modeling of human reliability.

- Potential increases in estimated CDF and LERF resulting from proposed RI-IST program changes are small and consistent with the guidelines provided in Reg Guide 1.174.

- The scope and quality of the traditional and probabilistic analyses conducted to justify the proposed RI-IST change are appropriate and are based on the as-built, as-operated and maintained plant, including plant operating experience.

- The plant-specific PRA used to support the application has been subjected to quality controls.

- While the licensee did not perform a comprehensive uncertainty analysis, the staff found that the results of the assessment are relatively robust. The licensee's program of monitoring, feedback and corrective action is an important factor in addressing uncertainties related to the impact of degradation mechanisms and aging effects.

- The impact of the proposed change will be monitored using performance measurement strategies. The extension of test intervals will be implemented in a step-wise manner; performance monitoring will be conducted to ensure that degradation is not significant for components that are placed on an extended test interval; and the licensee's corrective action procedures will ensure that test strategies are adjusted when a component, or group of components, experience repeated failures or nonconforming conditions (see Sections 5.2 through 5.4).

- All safety impacts of the proposed change were evaluated in an integrated manner as part of an overall risk management approach where risk analysis was used to improve operational and engineering decisions broadly by identifying and taking advantage of opportunities for reducing risk, and not just to eliminate requirements that were considered undesirable.

4.7.1.3 Conclusion

The staff finds the licensee's IDP to be consistent with guidance provided in Regulatory Guide 1.175 and is therefore acceptable. As discussed in Sections 4.5 and 4.6, the staff finds the role of the IDP in the component categorization process and in the assessment of the risk impact of the proposed RI-IST program to be acceptable.

### 4.7.2 Defense-in-Depth Philosophy

4.7.2.1 Licensee's Proposed Approach

The licensee's November 30, 1999, RI-IST Program Description states:

> The SONGS RI-IST program ensures consistent defense in depth by maintaining strict adherence to seven objectives of the defense in depth philosophy described in Regulatory Guides 1.174 and 1.175. The review and documentation of these objectives are an integral feature of the IDP for future changes to the program. Those objectives are:
>
> 1) A reasonable balance is preserved among prevention of core damage, prevention of containment failure, and consequence mitigation. Multiple risk metrics, including core damage frequency (CDF) and large early release frequency (LERF), will be used to ensure reasonable balance between risk end states (Objective 1).
>
> 2) No changes to the plant design or operations procedures will be made as part of the RI-IST program which either significantly reduces defense-in-depth, barrier independence or places strong reliance on any particular plant feature, human action, or programmatic activity (Objective 2, 5).
>
> 3) The methodology for component categorization, namely the selection of importance measures and how they are applied and understanding the basic reasons why components are categorized HSSC or LSSC, will be reviewed to ensure that redundancy and diversity are preserved as the more important principles. Component reliability can be used to categorize a component LSSC only when:
>
>    a) plant performance has been good, and

b) a compensatory measure or feedback mechanism is available to ensure adverse trends in equipment performance can be detected in a timely manner.

A review will ensure that test frequency relaxation in the RI-IST program occurs only when the level of redundancy or diversity in the plant design or operation supports it. In this regard, all components that have significant contributions to common cause failure will be reviewed to avoid relaxation of requirements on those components with the lowest level of diversity within the system (Objective 3, 4).

4) Defenses against human errors are preserved by performing sensitivity studies. Sensitivity studies will be performed for human actions to ensure that components which mitigate the spectrum of accidents are not ranked low solely because of the reliability of a human action (Objective 6).

5) The intent of the General Design Criteria in 10CFRPart 50, Appendix A will be maintained (Objective 7).

***Other Considerations Related to Defense-In-Depth***

When the PRA does not explicitly model a component, function, or mode of operation, a qualitative method may be used to classify the component HSSC, L-H, or LSSC and to determine whether a compensatory measure is required. The qualitative method is consistent with the principles of defense in depth because it preserves the distinction between those components which have high relative redundancy and those which have only high relative reliability.

4.7.2.2 <u>Staff Evaluation</u>

The component categorization process used by the licensee for the RI-IST process will ensure that redundancy and diversity of plant functions are preserved. In its December 30, 1998, submittal, the licensee indicated that two rules are applicable in these areas. The first is that the level of redundancy within each safety function is the principal criterion upon which classification is based. The second rule indicated that a system which has less diversity is more vulnerable to common-cause failure (CCF); thus, all components that had significant contributions to CCF were ranked HSSC. This action had the effect of avoiding relaxation of requirements on those components with the lowest level of diversity within the system. In addition to ensuring that all components important to CCF are ranked HSSC, it is noted that the proposed implementation and monitoring strategies ensure that potential increases in CCF are detected in a timely manner. As part of the implementation program (Section 5.2 below), the step-wise implementation strategy and the staggering of testing by component groups provide assurance that potential CCF mechanisms are detected before multiple components are affected. The monitoring and corrective action programs (Section 5.4 below) will be used to determine if the potential exists for like-component failures.

The staff finds that the major aspects of the licensee's RI-IST program (component categorization, expert panel, implementation, monitoring and corrective action programs) are consistent with the guidance provided in Sections 2 and 3 of Regulatory Guide 1.175 and provide reasonable assurance that adequate redundancy and diversity are maintained.

4.7.2.3 Conclusion

SCE's proposed RI-IST program is consistent with the defense-in-depth philosophy as discussed in Regulatory Guide 1.174 and Regulatory Guide 1.175. The staff's conclusion that the defense-in-depth philosophy is preserved is based on the following:

- The risk analysis shows that a reasonable balance is maintained between prevention of core damage, prevention of containment failure, and consequence mitigation.

- System redundancy, independence, and diversity are preserved commensurate with the expected frequency and consequences of challenges to the system.

- Potential common-cause failures that could result from IST changes are addressed as part of the risk quantification and/or as part of the implementation and monitoring strategies associated with the IST change.

- Defenses against human errors are preserved and no credit is taken for operator actions to compensate for relaxations in IST strategies.

- Independence of barriers to the release of radioactivity is not degraded.

### 4.7.3 Safety Margin Evaluation

4.7.3.1 Licensee's Proposed Approach

The licensee's December 30, 1998, RI-IST Program states:

> The SONGS RI-IST program assures that sufficient safety margin is maintained. The basis for this conclusion is that the RI-IST program merely extends the test interval for certain IST components. For these test interval extensions,

> corresponding program actions to monitor component performance are taken to ensure the overall safety margin does not degrade. Further, the RI-IST program in no way reduces the scope of the IST program. Safety analysis acceptance criteria will continue to be met.
>
> In fact, the RI-IST program increases the IST program scope . . . Additionally, the program does not remove any safety functions. It builds an awareness of risk functions by identifying them side by side with safety functions. Finally, there is no degradations in the effectiveness of test methods. Consequently, these program improvements should tangibly enhance the safety margin.

The licensee's November 30, 1999, RI-IST Program Description states:

> The IDP will perform reviews consistent with Regulatory Guides 1.174 and 1.175 to ensure that sufficient safety margin is maintained when compared to the deterministic IST program. In performing this review, the IDP will consider such things as proposed changes to test intervals and, where appropriate, test methods. The IDP will ensure that the proposed compensatory measures, when required by the program, are effective in maintaining adequate safety margin. To enhance the safety margin, the IDP will also review PRA important components not in the current IST program for potential inclusion in the RI-IST program.

4.7.3.2 Staff Evaluation

The licensee states that its RI-IST program does not remove any components from the current IST program and therefore testing of design functions for the design-basis accidents and the associated margins in those functions are unchanged. The staff notes that the licensee has proposed to test certain components using test methods that are more effective than current Code requirements at detecting important failure modes of components. These improved test methods reduce the uncertainty associated with the component failure rates as a function of time and will tend to improve safety margins.

4.7.3.3 Conclusion

Consistent with the guidance contained in Section 2.2.2 of Regulatory Guide 1.175, the staff concludes that SCE's proposed RI-IST program maintains safety margins on the basis of the following:

- ASME Code testing requirements or improved alternatives authorized for use by the NRC will be applied.

- Safety analysis acceptance criteria (e.g., USAR, supporting analyses) will continue to be met. For example, test interval extensions will not affect the test acceptance criteria.

- Component degradation is accounted for, either by quantitative methods (analysis and data) or by qualitative arguments which show that significant degradation will not occur. Component degradation will be addressed by the use of enhanced testing methods and by the trending of appropriate performance parameters to determine an acceptable test interval.

- The component categorization process is robust (see Section 4.5), and the components identified for relaxation in IST because of their low safety significance as determined by this categorization will only have a small effect on plant risk (see Section 4.6). In addition, test intervals will be derived on the basis of margin to failure (by trending of appropriate performance characteristics) commensurate with the risk significance of the components.

## 5.0 REVIEW OF IMPLEMENTATION, PERFORMANCE MONITORING, AND CORRECTIVE ACTION

### 5.1 Changes to Component Test Requirements

5.1.1 <u>Licensee's Proposed Approach</u>

As modified by the testing philosophy described below, components in the current IST program which are determined to be HSSCs will continue to be tested in accordance with the current IST program, which meets the requirements of the 1989 Edition of the ASME BPV Code, Section XI except where specific written relief has been granted.

The licensee’s RI-IST Program submittal dated December 30, 1998 states that HSSCs not in the current ASME Code IST Program Plan will be tested in accordance with their safety significance. Where the ASME Code testing is practical, the HSSCs not in the current ASME Code IST Program Plan will be tested in accordance with OM-10 for active valves. Where the ASME Code testing is not practical, alternative methods will be developed to ensure operational readiness.

As modified by the testing philosophy described below, components in the current IST program which are determined to be LSSC will also be tested in accordance with the ASME Code requirements, except that the test frequency will initially be extended to a maximum of once every 6 years plus a 25% margin[2] (except for the refueling water storage tank outlet isolation valves 1204MU001 and 1204MU002) and the emergency sump outlet check valves (1204MU003 and 1204MU004) which may be extended not to exceed 8 years plus a 25% margin. The extended test frequency will be staggered over the extended interval as described in Section 5.2 below. All other Code testing methods, corrective actions, documentation, and other requirements will remain in effect. No LSSCs will be deleted from the ASME Code IST program.

By using PRA methods, a maximum test interval was determined for LSSCs. This test frequency was determined to be a maximum of 6 years (with 25% margin – see footnote 2). This information was made available to the expert panel and was considered during its deliberations. During periodic reassessments, the maximum test interval will be verified or modified as dictated by the licensee's IDP.

The testing philosophy for each component group, as stated in the licensee's November 30, 1999, RI-IST Program Description, is specified below. Additional monitoring proposed by SCE for components in each group is specified in Section 5.3.1 below.

**Motor Operated Valves (MOVs)**

HSSC Testing will be performed in accordance with Code Case OMN-1 and NRC Generic Letter 89-10 and 96-05 commitments. MOV's with a passive function will be tested per the Code of Record as defined in 10CFR50.55a. Additionally, stroke time testing will initially continue per the current code of record at quarterly, cold shutdown, or refueling interval based on the practicability of testing. When sufficient data accumulates and analysis indicates extension of the current stroke interval may be acceptable (i.e., exercising on a refueling interval basis pursuant to OMN-1 paragraph 3.6.3), the Integrated Decision making Process (IDP) determines the acceptability of the extension. The IDP ensures the cumulative risk measures remain consistent with the acceptance guidelines specified in the SCE RI-IST Program including section 4.3.3 [2.3.3] of Regulatory Guide 1.175. The

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[2] Technical Specifications define the use of a stagger test interval as all components within the stagger test group must be tested within "n* the specified frequency". This equation results in an effective test interval for the stagger test group. In the case of the RI-IST a 6-year stagger interval results in a 2-year frequency for the individual components in the stagger group. In concert with the technical specification allowance for a 25% extension for surveillances, the RI-IST program would allow application of an extension up to 25% of 2 years. In the spirit of the Technical Specification allowance the extension would not be allowed as a routine occurrence, rather it would be applied infrequently to allow establishing the plant conditions required for the testing. SCE maintains an even 12-week rotating schedule for surveillance testing. Therefore, if a portion of extension is used to accommodate plant conditions in one interval, the next test is still completed at the baseline interval. The next surveillance due date is calculated from the previous due date, not the actual test date.

IDP also ensures the performance history supports the extension, and monitors to ensure the judgment to extend the interval does not adversely impact component performance.

L-H Testing will be performed in accordance with Code Case OMN-1 and NRC Generic Letter 89-10 and 96-05 commitments at an initial interval not to exceed 6 years until sufficient data exist to determine a more appropriate test frequency. MOV's with a passive function will be tested per the Code of Record, except, based on evaluation of design, service condition, performance history, and compensatory actions, at a test frequency not to exceed 6 years (plus a 25% margin based on a 2-year frequency – see footnote 2 on page 16) and exercised at least once during a refueling cycle per OMN-1, Paragraph 3.6.1. Seat leakage testing, if required, will be per the Code of record, except at a test interval not to exceed 6 years plus a 25% margin based on a 2-year frequency – see footnote 2.

LSSC Testing will be performed in accordance with Code Case OMN-1, and NRC Generic Letter 89-10 and 96-05 commitments at an initial interval not to exceed 6 years until sufficient data exist to determine a more appropriate test frequency. MOV's with a passive function will be tested per the Code of Record, except, based on evaluation of design, service condition, and performance history, at a test frequency not to exceed 6 years (plus a 25% margin based on a 2-year frequency – see footnote 2) and exercised at least once during a refueling cycle per OMN-1, Paragraph 3.6.1. Seat leakage testing, if required, will be per the Code of record, except at a test interval not to exceed 6 years (plus a 25% margin based on a 2-year frequency – see footnote 2).

SCE will ensure procedurally that the potential benefits (such as identification of decreased thrust output and increased thrust requirements) and potential adverse affects (such as accelerated degradation due to aging or valve damage) are considered when determining the appropriate testing for each MOV.

RI-IST program and MOV trend procedures will contain guidance to ensure performance and test experience from previous tests are evaluated to justify the periodic verification interval.

SCE will develop and proceduralize a schema to determine an MOV test interval that is based on IDP final risk ranking, available valve margin, and valve performance history. The schema will consist of an evaluation of risk ranking, relative margin, and group as well as individual valve performance.

The result of the evaluation determines the testing interval with the most frequent testing interval applied to high risk, low margin valves with poor, or questionable performance history. Stepwise increases in interval out to the maximum allowable interval depend on the combination of risk rank, margin, and performance history.

**Relief Valves**

Testing of relief valves will continue to be conducted in accordance with the Code of record (OM-1) with no change in test interval. The Southern California Edison Company (SCE) believes that relief valve performance as a whole does not warrant interval extension. In the future, should performance history change, SCE will rank valves per the Integrated Decision-making Process (IDP) and extend intervals accordingly. The initial testing strategy will be:

HSSC Testing will be performed in accordance with the Code of Record as defined in 10CFR50.55a.

L-H Testing will be performed in accordance with the Code of Record as defined in 10CFR50.55a.

LSSC Testing will be performed in accordance with the Code of Record as defined in 10CFR50.55a.

**Check Valves**

HSSC Testing will be performed in accordance with the ASME Code of Record as defined by 1OCFR50.55a.

L-H Testing will be performed in accordance with the ASME Code of Record as required by 10 CFR 50.55a except, based on evaluation of design, service condition, performance history, and compensatory actions, the test interval may be extended not to exceed 6 years (plus a 25% margin based on a 2-year frequency – see footnote 2), except for the refueling water storage tank outlet check valves and the emergency sump outlet check valves which may be extended not to exceed 8 years (plus a 25% margin based on a 2-year frequency – see footnote 2 ).

LSSC Testing will be performed in accordance with the ASME Code of Record as defined by 1OCFR5O.55a except, based on evaluation of design, service condition, and performance history, the test interval may be extended not to exceed 6 years (plus a 25% margin based on a 2-year frequency – see footnote 2).

HSSC, L-H, and LSSC check valves at SONGS are candidates for inclusion in the Check Valve Program (CVP), which has been developed to provide confidence that check valves will perform as designed. Station procedure(s) establish test/exam frequencies, methods, and acceptance criteria and provide performance-monitoring requirements for check valves in the CVP. Check valves in the CVP include check valves that are in the IST program, check valves identified as susceptible to unusually high wear, fatigue, or corrosion, and special valves used for personnel safety such as those in the breathing air system. The CVP includes approaches for identification of existing and incipient check valve failures using non-intrusive (e.g., radiography, acoustic emission (AE), magnetic flux (MF), and/or ultrasonic examination (UE) testing methods) and disassembly examination. Test data will be used (e.g., trended as appropriate) to provide confidence that check valves in the CVP will be capable of performing their intended function until the next scheduled test activity. Check valves may be added to or deleted from the CVP based on nonintrusive testing, disassembly examination results, component replacement, or site maintenance history. Kalsi Engineering recently completed a wear trending study for all check valves in the CVP. The results of this study will be factored into the check valve test strategy using the Integrated Decision-making Process (IDP).

The CVP is assessed on a biennial frequency, updated as appropriate with new design and operational information, and incorporates any applicable site or industry lessons learned.

**Air Operated Valves (AOVS)**

HSSC Testing will be performed in accordance with the Code of Record as defined by 1OCFR5O.55a.

L-H Testing will be performed in accordance with the Code of Record as required by 10CFR50.55a, except based on evaluation of design, service condition, performance history, and compensatory actions, the test interval may be extended not to exceed 6 years (plus a 25% margin based on a 2-year frequency – see footnote 2). Additionally L-H AOVs will be stroked at least once during each operating cycle.

LSSC Testing will be performed in accordance with the Code of Record as defined by 1OCFR5O.55a, except based on evaluation of design, service condition, and performance history, the test interval may be extended not to exceed 6 years (plus a 25% margin based on a 2-year frequency – see footnote 2). Additionally, LSSC AOVs will be stroked once during the operating cycle.

SCE has committed to work with the Joint Owners Group for Air Operated Valves (JOG AOV) to develop an enhanced AOV testing program similar to the MOV test program established in response to GL 89-10 and GL 96-05 (described above). The intent of this program is to specify AOV Program requirements to provide assurance that AOVs are capable of performing their intended safety-significant or risk-significant functions. Elements of the proposed program include establishing a scope of applicability, a categorization methodology, validation of safety significant functions by performing design basis reviews, performing baseline testing, and identifying the types of periodic testing necessary to identify potential degradation in a timely manner. SCE's current testing program meets or exceeds the current JOG AOV testing requirements for components within the IST program. To date, the design basis evaluations of all AOVs have not been performed. These evaluations will check the availability capability margin versus the required design-bases conditions to ensure adequate margin does indeed exist.

The current SCE AOV program is assessed on a biennial frequency, updated as appropriate with new design and operational information, and incorporates any applicable site or industry lessons learned.

**<u>Hydraulic Valves (E/H), Solenoid Valves, and Others (Manual Valves, etc.)</u>**

SCE proposes to test these valves in accordance with the Code of Record (OM-10) with the exception that the test frequency will be in accordance with the component risk categorization defined below:

HSSC Testing will be performed in accordance with the Code of Record as required by 10CFR50.55a.

L-H Testing will be performed in accordance with the Code of Record as required by 10 CFR 50.55a except, based on evaluation of design, service condition, performance history, and compensatory actions, the test interval may be extended not to exceed 6 years (plus a 25% margin based on a 2-year frequency – see footnote 2). Additionally, L-H HOVs and SOVs will be stroked once during the operating cycle.

LSSC Testing will be performed in accordance with the Code of Record as required by 10 CFR 50.55a except, based on evaluation of design, service condition, and performance history, the test interval may be extended not to exceed 6 years (plus a 25% margin based on a 2-year frequency – see footnote 2).

Additionally, LSSC HOVs and SOVs will be stroked once during the operating cycle.

**Pumps**

Pumps will be tested in accordance with the Code of Record (OM-6) with the exception that the test frequency may be in accordance with the component risk categorization defined below:

HSSC Testing will be performed in accordance with the Code of Record as required by 10 CFR 50.55a. Additionally, Code testing will be augmented with periodic oil analysis and thermography. A motor current monitoring program is in the development stage. Once implemented, HSSC pumps will be included in the scope of that program.

L-H Testing will be performed in accordance with the Code of Record as required by 10 CFR 50.55a except based on evaluation of design, service condition, performance history, and compensatory actions, the test interval may be extended not exceed 6 years (plus a 25% margin based on a 2-year frequency – see footnote 2).

LSSC Testing will be performed in accordance with the Code of Record as required by 10 CFR 50.55a except, based on evaluation of design, service condition, and performance history, the test interval may be extended not to exceed 6 years plus a 25% margin based on a 2-year frequency – see footnote 2.

All pumps will receive periodic thermography of their driver, lube oil analysis, alignment checks performed following major pump maintenance (using vibration analysis methods to confirm alignment), motor current testing (when the motor current testing program is implemented), vibration monitoring (required by the current Code), and flange loading checks of connected piping (note that this flange loading test is not periodic, but is performed after major maintenance/overhauls that required the disassembly of any flange in a safety-related system). Additional tests (e.g., thermography of the driver, or motor current testing[3]) are predictive in nature and involve trending of parameters that need to be compared more frequently in order to provide meaningful results. This augmented testing program for pumps provides reasonable assurance that adequate pump capacity margin exists such that pump operating characteristics over time do not degrade to a point of insufficient margin before the next scheduled test activity.

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[3] Both driver thermography and motor current testing are currently in the early stages of implementation at SCE.

### 5.1.2 Staff Evaluation

The specific testing to be performed on each component or group of components is expected to be documented in the licensee's IST Program Plan and is subject to NRC inspection. The licensee's IST Program Plan continues to be required to be updated every 120 months with Code requirements determined to be impractical submitted to the staff for review pursuant to 10 CFR 50.55a(f)(5). The updated IST Program Plan should provide the specific test frequencies and test methods for each pump and valve (or group).

SCE's proposed RI-IST program identified components that are candidates for an improved test strategy (i.e., frequency, methods, or both) as well as LSSC components for which the test strategy may be relaxed. The proposed RI-IST program also identified components categorized HSSC that are not included in the current IST program. The information contained in, and derived from, the licensee's PRA was used to help construct the testing strategy for components. Given the testing philosophy described in the licensee's RI-IST program, components with high safety significance will be tested using methods that are at least as effective as the current Code-required test at detecting their risk-important failure modes and causes (e.g., at least as effective at detecting failure, detecting conditions that are precursors to failure, or predicting end of service life). Components categorized as LSSC will generally be tested less rigorously than components categorized as HSSC (e.g., less frequent tests).

The licensee's December 30, 1998, RI-IST Program Plan (page 1-2) states that where the ASME Code testing is practical, HSSCs not in the current ASME Code IST Program Plan will be tested in accordance with OM-10 for active valves. Where the ASME Code testing is not practical, alternative methods will be developed to ensure operational readiness. (See Section 4.2)

The licensee considered component design, service condition, and performance, as well as risk insights, in establishing the technical basis for the test interval assigned to each component (or group of components), as illustrated by the following examples (see Sections 2.4.1 and 3.2.1 of the licensee's December 30, 1998, RI-IST Program Plan):

- The performance history of the electro-hydraulic valves in the auxiliary feedwater flow path (HV4762 and HV4763) is such that this valve group (1305_102) did not merit an initial increase in test frequency.

- The check valve (1201MU019) in the auxiliary spray line from the chemical and volume control system (CVCS) to the reactor coolant system (RCS) and the check valve (1201MU021) in the CVCS line to charging loop 1A were replaced with an improved design (Kerotest valves was replaced with Borg Warner valves). While these valves were ranked LSSC by the licensee's expert panel, their test interval was not extended because they have not accumulated adequate performance history. Their test frequency will remain at the cold shutdown interval. When adequate performance history is obtained, these valves will be re-evaluated and the interval will be extended as appropriate.

- Due to concerns about the reliability of the CCW surge tank nitrogen backpressure regulators (PCV6358 and PCV6361), these valves (which were not modeled in the SONGS PRA), were ranked L-H (with compensatory measures assigned) by the licensee's expert panel. The test interval for these components will not be extended initially.

- The emergency bearing cooling water check valves (1413MU013, 1413MU016, 1413MU021, and 1413MU024) were categorized LSSC but their test interval was not extended because these valves have exhibited higher than expected failure rates in the past. While corrective action had been implemented, there was insufficient acceptable performance history to initially extend the test interval.

- The check valves in the steam supply line to the auxiliary feedwater turbine (1301MU003 and 1301MU005) were categorized as HSSC by the licensee's expert panel because the valve design was considered poor given the application and service conditions experienced. The valve/internals are usually replaced every two years. The licensee plans to replace these valves with nozzle style check valves during the next outage. Until then, these valves will be categorized HSSC given the current failure history. Note: The licensee's bounding PRA analysis did not assume that the test interval for these check valves would eventually be extended.

The staff's review of the licensee's December 30, 1998, RI-IST Program Plan (pages 3-3 through 3-8) and review of the initial RI-IST program results confirm that the licensee's RI-IST process adequately considers component design, service condition, and performance history in determining the appropriate test strategy for components. The licensee's bases for extending the test interval for valves whose performance history initially did not warrant a test interval extension will be subject to NRC inspection.

The staff has reviewed the proposed testing philosophy described by the licensee for each component group (see Section 5.1.1). The staff finds the testing philosophy to be consistent with existing staff positions on component test strategies (i.e., as generally described in Section 3.1 of Regulatory Guide 1.175 and as specified in the most recent version of 10 CFR 50.55a published in Federal Register on September 22, 1999, 64 FR 51370) as well as with the general direction that the staff is encouraging the ASME Code committees to take in defining test strategies for components (i.e., as reflected in ASME risk-informed Code Cases which are currently being reviewed by the staff for possible endorsement in a regulatory guide). For example, the licensee's proposed test strategies for MOVs are consistent with NRC approval of ASME Code Case OMN-1 in Generic Letter 96-05, "Periodic Verification of Design-Basis Capability of Safety-Related Power-Operated Valves" for use in implementing that generic letter.

The testing strategy, described by SCE for each component group in Section 5.1.1 above, will also ensure to the extent practicable that adequate component capability margin exists above that required during design-basis conditions. As such, component operating characteristics will not be allowed to degrade to a point of insufficient margin before the next scheduled test activity. On this basis, the testing strategy is acceptable to the staff.

The component test intervals proposed by SCE were not extended beyond once every 6 years or 3 refueling outages (whichever is longer), except for:

- MOVs which were allowed a maximum diagnostic test interval of 10 years as discussed below, and

- The refueling water storage tank and emergency sump outlet check valves which may be extended up to 8 years plus a 25% margin as discussed below (see footnote 2).

The licensee's November 30, 1999, RI-IST Program Description states that components categorized as L-H or LSSC (e.g., MOVs, AOVs, HOVs, SOVs) with the exception of relief valves, check valves, and manual valves will be exercised or operated at least once every refueling cycle.

The testing strategy for each component (or group of components) in the licensee's RI-IST program is summarized its November 30, 1999, RI-IST Program Description (copied into Section 5.1.1 above). In evaluating the acceptability of the testing strategy for each group of components, consideration was given to the implementation plans for that group of components (see Section 5.2) as well as the feedback and corrective action program proposed by the licensee (see Section 5.4).

The staff's evaluation of the testing philosophy for each group of components follows.

Motor-Operated Valves (MOVs)

The ASME BPV Code and the ASME OM Code specify the performance of stroke-time testing of MOVs at quarterly intervals as part of the requirements for IST programs established under 10 CFR 50.55a. In response to concerns regarding MOV performance in nuclear power plants, the NRC issued Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," in June 1989 to request that licensees verify the design-basis capability of their safety-related MOVs by reviewing MOV design bases, verifying MOV switch settings initially and periodically, testing MOVs under design-basis conditions where practicable, improving evaluations of MOV failures and necessary corrective action, and trending MOV problems. With recognition of the weakness in information provided by quarterly MOV stroke-time testing, the ASME developed Code Case OMN-1, "Alternative Rules for Preservice and Inservice Testing of Certain Electric Motor-Operated Valve Assemblies in Light-Water Reactor Power Plants, OM Code-1995, Subsection ISTC," as an acceptable alternative program of exercising and diagnostic testing to provide continuing assurance of the capability of MOVs to perform their safety functions.

As additional information on MOV performance became available, the NRC issued GL 96-05 in September 1996 to request that licensees establish a program, or to ensure the effectiveness of their current program, to verify on a periodic basis that safety-related MOVs continue to be capable of performing their safety functions within the current licensing bases of the facility. GL 96-05 supersedes GL 89-10 with respect to periodic verification of MOV design-basis capability. In GL 96-05, the NRC staff stated that, with certain limitations, the method described in ASME Code Case OMN-1 is considered to meet the intent of the generic letter to verify the design-basis capability of safety-related MOVs on a periodic basis.

Recently, the NRC amended its regulations (64 FR 51370) to incorporate by reference the 1995 Edition with the 1996 Addenda of the ASME BPV Code and the ASME OM Code for construction, inservice inspection, and IST of nuclear power plant components. Section 50.55a(b)(3)(iii) of the revised regulations allows the voluntary implementation of ASME Code Case OMN-1 in lieu of the quarterly MOV stroke-time testing specified in the 1995 Edition with the 1996 Addenda of the ASME OM Code with certain conditions.

In its submittal dated November 30, 1999, SCE proposes to implement an alternative MOV testing program in the RI-IST Program at SONGS. In this SE, the NRC staff addresses the licensee's request to apply ASME Code Case OMN-1 as part of its risk-informed IST program. The staff is reviewing the licensee's MOV program established in response to GL 96-05 as a separate activity. The description of the licensee's program to implement ASME Code Case OMN-1 as an alternative to the quarterly MOV stroke-time testing provisions required by the licensee's Code of Record (i.e., 1989 Edition of the ASME BPV Code — OM-10 for valves) is approved on the basis that:

a. The NRC regulations in 10 CFR 50.55a(b)(3)(iii) allow licensees to apply ASME Code Case OMN-1 as an alternative to the quarterly MOV stroke-time testing provisions described in the ASME OM Code. The 1989 Edition of the ASME BPV Code applied by SCE also includes provisions for quarterly MOV stroke-time testing. The NRC staff further finds that the licensee satisfies the two modifications related to OMN-1 specified in 10 CFR 50.55a(b)(3)(iii) as follows:

    (1) Section 50.55a(b)(3)(iii)(A) specifies that licensees evaluate the information obtained for each MOV, during the first 5 years or three refueling outages (whichever is longer) of voluntary use of ASME Code Case OMN-1, to validate assumptions made in justifying a longer test interval. In the RI-IST Program Description (enclosure to the licensee's submittal dated November 30, 1999), the licensee states that, as a living process, components will be reassessed at a frequency not to exceed every other refueling outage to reflect changes in plant configuration, component performance test results, industry experience, and other inputs to the process. In its submittal dated September 28, 1999, the licensee indicates that the maximum IST interval for MOVs at San Onofre is 6 years or three refueling cycles. The licensee states that testing of groups of MOVs containing more than one valve is based on a stagger test model that evenly distributes component testing over the maximum interval. The licensee reports that its RI-IST program procedures will contain guidance to ensure performance and test experience are evaluated to support the periodic verification interval.

    (2) Section 50.55a(b)(3)(iii)(B) clarifies the provision in Paragraph 3.6.2 of ASME Code Case OMN-1 for the consideration of risk insights if extending the exercising frequencies for MOVs with high risk significance beyond the quarterly frequency specified in the ASME Code. In particular, licensees will ensure that increases in core damage frequency and/or risk associated with the increased exercise interval for high-risk MOVs are small and consistent with the intent of the Commission's Safety Goal Policy Statement (51 FR 30028; August 21,

1986). The NRC also considers it important for licensees to have sufficient information from the specific MOV, or similar MOVs, to demonstrate that exercising on a refueling outage frequency does not significantly affect component performance. The information may be obtained by grouping similar MOVs and staggering the exercising of MOVs in the group equally over the refueling interval. In its RI-IST Program Description, the licensee stated that high-risk valves at San Onofre initially will continue to be stroke-time tested quarterly, at cold shutdown, or at refueling intervals based on practicality as required by the Code of record. The licensee stated that it might extend these test intervals to refueling cycles when sufficient data are obtained, and analyses through the IDP support such extensions. The licensee further specified that it will develop and proceduralize an approach for determining an MOV test interval that is based on risk ranking, available capability margin, and valve performance history.

In GL 96-05, the NRC staff noted that some licensees are developing risk-informed IST programs as part of a pilot industry effort. The staff stated that licensees need to address the relationship between ASME Code Case OMN-1 and their risk-informed IST programs. In its submittal dated September 28, 1999, the licensee noted that its IDP confirms or adjusts the initial risk ranking developed from the PRA results, and provides a qualitative assessment based on engineering judgment and expert experience to determine the final safety significance categories. This process identifies components whose performance justifies a higher categorization, determines appropriate changes to testing strategies, and identifies compensatory measures of L-H components, or justifies the final categorization. The process also evaluates the test interval and basis test methodology for LSSC components.

In GL 96-05, the NRC staff noted a precaution that the benefits (such as identification of decreased thrust output and increased thrust requirements) and potential adverse effects (such as accelerated aging or valve damage) need to be considered when determining the appropriate testing for each MOV. In the RI-IST Program Description, the licensee states that it will ensure by means of plant procedures that the benefits and potential adverse effects are considered as part of the determination of appropriate MOV testing.

b. ASME Code Case OMN-1 specifies in Paragraph 3.6.1 that all MOVs within the scope of the Code case are to be exercised on an interval not to exceed one year or one refueling cycle (whichever is longer). This exercising is intended to ensure proper lubrication of each MOV regardless of diagnostic test intervals that might extend beyond this time period. In its submittal dated June 17, 1999, the licensee committed to apply ASME Code Case OMN-1 in its entirety. In its submittal dated September 28, 1999, the licensee acknowledged this provision of OMN-1 and reported that all MOVs in its program will be exercised on at least a refueling outage frequency. The licensee’s November 30, 1999, RI-IST Program Description includes a provision for exercising MOVs at least once during a refueling cycle.

c. ASME Code Case OMN-1 specifies in Paragraph 3.3.1 that MOV inservice testing is to be conducted every two refueling cycles or 3 years (whichever is longer) unless sufficient data exist to determine a more appropriate test frequency. In the SCE RI-IST Program Description, the licensee states that L-H and LSSC MOVs will be tested in accordance with ASME Code Case OMN-1 and NRC Generic Letters 89-10 and 96-05 commitments at an initial interval not to exceed 6 years until sufficient data exist to determine a more appropriate test frequency. In its submittal dated June 17, 1999, the licensee stated that it was implementing the provisions of Paragraph 6.4.4 of ASME Code Case OMN-1, which provides direction for determining acceptable test intervals. In its submittal dated September 28, 1999, the licensee discussed its use of a stagger test model to obtain data on MOV performance throughout the test interval. The licensee stated that valves identified with reduced margin or degradation rates greater than expected will be subject to more frequent testing. The licensee’s November 30, 1999, RI-IST Program Description specifies that RI-IST program procedures and MOV trend procedures will contain guidance to ensure performance and test experience from previous tests are evaluated to justify the periodic verification interval.

d. In Paragraph 3.5, ASME Code Case OMN-1 specifies that MOVs with identical or similar motor operators and valves, and with similar plant service conditions, may be grouped together based on the results of design-basis verification and preservice tests. In the SCE RI-IST Program Description, the licensee notes that components will generally be grouped based on system, component type, manufacturer, size, style, and application. In its submittal dated September 28, 1999, the licensee noted that its grouping of MOVs includes such aspects as system conditions and valve internal materials.

e. In the SCE RI-IST Program Description, the licensee states that MOV seat leakage testing for L-H and LSSC MOVs, as applicable, will be performed per the Code of Record, except at a test frequency not to exceed 6 years (with a 25% margin – see footnote 2). In its submittal dated September 28, 1999, the licensee stated that the basis for the extension of MOV seat leakage testing intervals is derived from its IDP. This process includes consideration of performance history, industry history of similar components as available, and risk.

f. ASME Code Case OMN-1 references MOV test procedures and other plant documents containing acceptance criteria for MOV performance. In its submittal dated September 28, 1999, the licensee indicated that development of OMN-1 procedures is in progress. The licensee stated that it intends to incorporate the analysis and evaluation of data sections of OMN-1 as an additional enhancement to the current MOV program independent of the RI-IST program. The NRC staff may review those procedures during an on-site inspection when they are available.

The NRC staff has determined that the licensee's proposed application of ASME Code Case OMN-1, as discussed herein, is consistent with the guidance contained in Regulatory Guide 1.175 and is an acceptable alternative to stroke time testing required by the licensee’s Code of Record. The licensee has not completed the development of procedures for implementing ASME Code Case OMN-1 at SONGS. The NRC staff may review the procedures during an on-site inspection. The NRC staff is reviewing the licensee’s program established in response to GL 96-05 to verify on a periodic basis the design-basis capability of safety-related MOVs at SONGS as a separate activity.

Relief Valves

Testing of relief valves will continue to be conducted in accordance with the licensee's Code of Record (OM-1) with no change of test interval for either HSSC, L-H, or LSSC relief valves. This is acceptable to the staff.

Check Valves (CVs)

SCE proposes to test check valves in accordance with the Code of Record (OM-10) with the exception that the test interval for CVs categorized as LSSC will generally be extended up to as much as once every 6 years (with 25% margin – see footnote 2). SCE indicated that certain check valves (in both the HSSC, L-H, and LSSC categories) will also be tested in accordance with the licensee's check valve program (CVP). The purpose of the licensee's CVP is to provide confidence that selected check valves perform as designed. Station procedures establish test/exam frequencies, methods, and acceptance criteria, and provide performance monitoring requirements for check valves in the CVP. Check valves included in the CVP are those which have been evaluated as susceptible to unusually high wear, fatigue, or corrosion, and special valves used for personnel safety. The CVP includes approaches for identifying existing and incipient check valve failures using non-intrusive methods such as acoustic emission (AE) testing or magnetic flux (MF) testing, and disassembly examination. Test data will be trended to provide confidence that check valves in the CVP will be capable of performing their intended function until the next scheduled test activity. The adequacy of the licensee's CVP in support of proposed RI-IST program is subject to NRC inspection.

As discussed in Section 5.2 below, the licensee will group its check valves and then stagger the testing of the check valves in the group over the extended (e.g., 6-year) test interval. Testing will be scheduled on regular intervals over the 6-year period to ensure that all check valves in the group are tested at least once during the 6-year test interval and not all components are tested at one time. Testing will be planned such that there is no more than one cycle between tests of components in a group.

The testing proposed by SCE for check valves (described above) is consistent with the guidance provided in Section 5.1 of Regulatory Guide 1.175 and is therefore acceptable.

For the refueling water storage tank outlet check valves and the emergency sump check valves, SCE proposes to extend the test interval to a maximum of 8 years. The licensee's November 30, 1999, RI-IST Program Description states:

> The refueling water storage tank (RWST) and emergency sump outlet check valves currently comprise 2 cross unit valve groups, 1) S2(3)1204MU001 and S2(3)1204MU002, and 2) S2(3)1204MU003, and S2(3)1204MU004. All eight valves are 24 inch Mission Duo-Check split disk check valves. Testing is

currently scheduled on a 6 year stagger test interval consisting of a disassembly, inspection, and hand stroke. Extending the test interval to 8 years on these 2 valve groups is reasonable given the valve history, and does not result in an interval which would allow degradation without prior detection. The results of the inspections indicate there is little, if any, wear over the initial 15 years of operation. These inspections validate the wear predictions calculated using the CVAP wear analysis software developed by Kalsi Engineering. The process of draining the 350 feet of 24 inch header piping (~8000 gallons) through ¾ inch drain, removing the two valves (one from each group), and hand stroking requires several days. Once the header is re-filled, the venting operation requires multiple start-stop cycles on each of the high pressure injection, low pressure injection, and containment spray pumps on the particular train, and is extremely resource intensive. In addition, there is significant dose accumulation associated with disassembly, inspection and subsequent post maintenance test activities. To support a partial flow test of the sump check valves, the sump must be cleaned, then partially filled. The partial flow activity uses a low pressure injection pump for a short duration partial flow through the check valve. Due to the limited volume available in the sump, the pump run is very short in duration and requires exclusive attention in the control room during preparation and execution.

The RWST valves are partially opened for the quarterly pump inservice tests, and the sump valves are only exercised during the course of the hand stroke. A search of the NPRDS data archives shows there are no records of failures of this valve style (Mission check valves) in this application. The recorded NPRDS failures typically pertain to seat leakage increases, but do not involve failures to close. The NPRDS events primarily concern inservice water systems which have higher service duty than refueling water storage tank and emergency sump outlet check valves. Given this fact, coupled with the above discussion, extending the test interval to 8 years on these 2 valve groups is reasonable and does not result in an interval which would allow degradation without prior detection.

The refueling water storage tank outlet check valves and the emergency sump check valves were the subject of the licensee's alternative test justification number 15.0 Parts 11 and 12 as contained in the SONGS IST Program Plan for the second ten-year interval. The staff reviewed and approved the extension of the test interval for these valves in a SE dated August 31, 1994. The proposed alternative was approved because it was consistent with Position 2 of NRC Generic Letter 89-04. Position 2 of Generic Letter states that valve disassembly and inspection can be used as an alternative to full flow testing of check valves (required by the licensee Code of Record — OM-10) under certain specified circumstances. As stated by the licensee, testing is currently scheduled on a 6-year stagger test interval consisting of a disassembly, inspection, and hand stroke. Position 2 of Generic Letter 89-04 also states, "[i]f the fuel cycle is increased to 24 months, each valve in a four-valve sample group would be disassembled and inspected only once every 8 years." The refueling interval for SONGS Units 2 and 3 was extended from 18 months to 24 months, effective June 8, 1990. Further, the licensee's proposed alternative for these valves is consistent with paragraph ISTC 4.5.4(c) of the 1995 Edition of the ASME OM Code. The NRC approved the use of the 1995 Edition of the ASME OM Code on

September 22, 1999 (64 FR 51370). ISTC 4.5.4 states that sample disassembly examination programs shall group check valves of similar design, application, and service condition, and "[a]t least one valve from each group shall be disassembled and examined at each refueling outage [and] all valves in each group shall be disassembled and examined at least once every 8 years." Therefore, the licensee's proposed alternative to the requirements of OM-10 paragraph 4.3.2.4(c) for the refueling water storage tank outlet check valves and the emergency sump check valves is acceptable.

Air Operated Valves (AOVs)

SCE proposes to test AOVs in accordance with its Code of Record (OM-10) with the exception that the test interval for AOVs categorized as L-H or LSSC will be extended up to as much as once every 6 years (with 25% margin – see footnote 2).

SCE committed to work with the Joint Owners Group for Air Operated Valves to develop an enhanced AOV testing program similar to the MOV test program established in response to GL 89-10 and GL 96-05 (described above). The intent of the enhanced AOV testing program is to specify AOV Program requirements to improve assurance that AOVs are capable of performing their intended safety or risk-significant functions. This will ensure that adequate AOV capability margin is maintained above that required during design-basis conditions, such that degradation of AOV operating characteristics over time does not result in reaching a point of insufficient margin before the next scheduled test activity. Elements of SCE's enhanced AOV testing program include establishing a scope of applicability, a categorization methodology, validation of safety significant functions by performing design basis reviews, performing baseline testing, and identifying the types of periodic testing necessary to identify potential degradation in a timely manner. SCE's calculations to ensure that adequate AOV capability exists and the specific AOV testing are subject to NRC inspection.

In addition, all AOVs in SCE's RI-IST Program will be exercised at least once during each operating cycle.

The licensee's proposed testing program and planned test activities for AOVs (described above) are consistent with the guidance provided in Sections 5.1 and 5.2 of Regulatory Guide 1.175 and are therefore acceptable to the staff.

Hydraulic Valves (E/H), Solenoid Valves, and Others (Manual Valves, etc.)

SCE proposes to test hydraulic, solenoid, and other valves in accordance with its Code of Record (OM-10) with the exception that the test interval for valves categorized as LSSC will be extended up to as much as once every 6 years (with 25% margin – see footnote 2).

In addition, all HOVs and SOVs in SCE's RI-IST Program will be exercised or operated at least once every refueling cycle. In light of SCE's implementation plans (see Section 5.2) as well as the feedback and corrective action program proposed by the licensee (see Section 5.4), the staff finds that the licensee's proposed testing program and planned test activities for hydraulic, solenoid, and other valves (e.g., manual valves) are consistent with the guidance provided in Regulatory Guide 1.175 and are therefore acceptable to the staff.

Pumps

SCE proposes to test HSSC and LSSC pumps in accordance with its Code of Record (i.e., OM-6) with the exception that the test interval for pumps categorized as LSSC will be extended up to as much as once every 6 years (with 25% margin – see footnote 2).

In addition, SCE indicated that all HSSC pumps will be augmented with periodic oil analysis and thermography. Pumps categorized as HSSC will also be included in their motor current monitoring program once it is developed. All pumps (i.e., HSSC, L-H, and LSSC pumps) will receive periodic thermography of their driver, lube oil analysis, alignment checks (using vibration analysis following major pump maintenance), motor current testing (once that program is developed and implemented), vibration monitoring (required by the current Code), and flange loading checks of connected piping (after major maintenance/overhaul that requires the disassembly of any flange in the safety-related system). While the periodicity of this augmented testing is not specified in SCE's proposed RI-IST Program Description, the staff notes that some of these additional tests (e.g., thermography of their driver and motor current testing) are predictive in nature and involve trending of parameters that will be compared more frequently than once every 6 years in order to provide meaningful results. Thus, this augmented testing program for pumps is consistent with the guidance provided in Regulatory Guide 1.175 because it provides reasonable assurance that adequate pump capability margin exists such that pump operating characteristics over time do not degrade to a point of insufficient margin before the next scheduled test activity.

As indicated in Table 3.2-1 of the licensee's December 30, 1998, RI-IST Program Plan, there are initially three groups of LSSC pumps at SONGS, that is, the two CCW system makeup pumps, the two containment spray pumps, and the four diesel fuel oil transfer pump group. The table also indicates that the testing of these pumps will not be extended initially. As described in Section 5.2 below, if the test interval for these pumps is extended at a future time, these LSSC pumps will be grouped and their testing will be staggered in regular intervals over the extended test interval. The staggering allows the trending of components in the group to ensure the test frequency selected is appropriate. The licensee's November 30, 1999, RI-IST Program Description states that "[t]esting will be scheduled/planned such that there is no more than one cycle between tests of components in a group." For groups consisting of two pumps, such as the CCW system makeup pumps and the containment spray pumps, the staff understands that this will require testing of each pump in that group more frequently than once every 6 years.

The staff notes that the Code-required testing to be performed on the pumps categorized as LSSC at SONGS will include testing under full or substantial flow conditions.

The licensee's proposed testing program for pumps (described above) is consistent with the guidance provided in Section 3.1 of Regulatory Guide 1.175 and is therefore acceptable to the staff.

5.1.3 Conclusion

The licensee considered component design, service condition, and performance, as well as risk insights, in establishing the test strategy for components. The proposed test intervals for components were less than the expected time to failure of the components. In addition, the licensee will ensure that adequate component capability exists such that component operating characteristics over time will not degrade to a point of insufficient margin before the next scheduled test activity. The RI-IST intervals for components were generally not extended beyond once every 6 years or once every three refueling outages (whichever is longer).

The licensee has made a commitment to exercise MOVs, AOVs, HOVs, and SOVs at least once every refueling cycle, where practical.

The licensee's proposed test strategies are consistent with the acceptance guidelines contained in Section 3.1 of Regulatory Guide 1.175 and are therefore acceptable.

## 5.2 Program Implementation

5.2.1 Licensee's Proposed Approach

The licensee's November 30, 1999, RI-IST Program Description states:

> Implementation of the RI-IST to LSSC (including L-H) will consist of grouping components and then staggering the testing of the group over the test frequency.
>
> **Grouping:**
>
> Components will generally be grouped based on:
>
> - System
> - Component type (MOV, AOV, Check Valve, etc.)
> - Manufacturer
> - Size
> - Style (globe, gate, swing check, tilt disk, etc.)
> - Application (pump discharge, flow path, orientation, etc).

The population of the group will be dependent on:

- total population available
- maintaining current testing schedule

Grouping components in this manner and testing on a staggered basis over the test interval reduces the importance of common cause failure modes since at least one valve in the group is tested during each cycle.

Testing of components within the defined group will be staggered over the test interval, typically 6 years. Testing will be scheduled on regular intervals over the test interval to ensure all components in the group are tested at least once during the interval, the same component is not tested repeatedly, while deferring others in the group, and not all components are tested at one time. The staggering allows the trending of components in the group to ensure the test frequency selected is appropriate. A test interval extension of 25% of the fundamental stagger interval (i.e., 1 refueling cycle or 2 years) accommodates operational circumstances that may interfere with establishing the plant conditions to meet the baseline test schedule (see footnote 2).

Testing will be scheduled / planned such that there is no more than one cycle between tests of components in a group.

5.2.2 Staff Evaluation

The staff reviewed the licensee's IDP (see Section 4.7). The process utilizes both probabilistic and deterministic information to determine an appropriate test interval for each component or group of components. SCE proposes to group similar LSSC and L-H components and stagger the testing of components in the group in regular intervals over the extended test interval (typically 6 years). Testing will be planned such that there is no more than one cycle between tests of components in a group. SCE's proposed implementation plans (discussed above) will reduce the potential risk associated with common-cause failure of components categorized as either LSSC or L-H and are consistent with the guidance provided in Regulatory Guide 1.175. On this basis, the staff finds the licensee's process for determining the test intervals for components categorized LSSC or L-H to be acceptable (see Sections 4.6 and 4.7).

A general description of the testing planned for a particular component, or group of components, is provided in SCE's RI-IST Program Description. General guidelines for grouping of components and testing on a staggered basis were also provided by the licensee in its RI-IST Program Description. The initial results of the licensee's categorization and grouping are documented in Table 3.2-1 of the licensee's December 30, 1998, RI-IST Program Plan. The grouping strategy proposed by the licensee is consistent with the guidance contained in

Regulatory Guide 1.175. That is, the licensee’s grouping of check valves is consistent with the guidance provided in Generic Letter 89-04, Position 2, where check valves in each group are of the same design (manufacturer, size, model number, and materials of construction) and have the same service conditions including valve orientation. Further, the licensee’s grouping of MOVs is consistent with Supplement 6 to Generic Letter 89-10 where MOVs are grouped based on such similarities as: valve manufacturer, model and size; valve flow, temperature, pressure, hydraulics, and installation configuration; valve materials and condition; seat/guide stresses; and performance during static and dynamic testing (as applicable) as evidenced by full-stroke diagnostic traces.

The licensee’s IST Program Plan will be revised (after the RI-IST Program Description is authorized by the NRC) to identify the specific type and frequency of testing to be conducted on each component. In addition, the revised IST Program Plan will specify each component’s grouping. These details of the licensee’s RI-IST program will be subject to NRC inspection.

The licensee’s December 30, 1998, RI-IST Program Plan states that the SONGS RI-IST Program will incorporate the expansion criteria described in NUREG-1482, which states that, if a potentially generic problem is identified during a test, all valves in the group in that unit must be inspected or tested during the refueling outage.

The licensee’s corrective action and feedback plans, as described in the licensee’s November 30, 1999, RI-IST Program Description, will ensure that testing failures are evaluated to determine whether adjustment to the component's grouping and test strategy is appropriate. For example, the corrective action section of the RI-IST Program Description indicates that component failures will be evaluated to determine if they are generic. If the failure has generic implications that affect a group of components, SCE will initiate corrective action for all components in the affected group. Component corrective action procedures (see Section 5.4) will be in place before any test intervals are extended on components categorized as either LSSC or L-H.

Components (HSSC, L-H, and LSSC) that will continue to be tested (frequency and method) in accordance with the licensee’s ASME Code of Record (or ASME Code cases that have been approved by the NRC) were not specifically reviewed as part of the RI-IST program but are subject to site-specific inspections (e.g., relief valves at SONGS).

The staff notes that the licensee’s proposed RI-IST Program does not change the current IST program alternate test justifications, in that testing previously identified as cold shutdown or refueling will remain in a “test at shutdown” classification.

5.2.3 Conclusion

For components that the licensee’s IDP categorized as HSSC, the licensee will either continue to test these components in accordance with the current ASME Code of Record for the facility (i.e., test frequency and method requirements) or has proposed an alternative test strategy that is acceptable to the staff. Testing strategies are adequately described in the licensee's RI-IST Program Description and were found to be acceptable (see Section 5.1).

For components that the licensee’s IDP categorized as LSSC or L-H, the licensee will either continue to test these components in accordance with the current ASME Code of Record for the facility or has proposed an alternative test strategy that is acceptable to the staff. The test interval for components categorized as LSSC or L-H may be beyond that specified in the licensee’s Code of Record. Testing methods are adequately described in the licensee's RI-IST Program Description and were found to be acceptable (see Section 5.1).

Components categorized as LSSC or L-H that will be tested less often than required by the current Code of Record may be tested at an extended interval only if the interval can be justified on the basis of previous component performance. The licensee will group similar components and test them on staggered intervals. Corrective action procedures will ensure that the licensee evaluates and corrects failures or nonconforming conditions that may apply to other components in the group. The grouping is consistent with the guidance contained in Regulatory Guide 1.175 and is therefore acceptable to the staff.

The licensee has identified plant corrective action and feedback plans to ensure that testing failures are evaluated for possible adjustment to the component's grouping and test strategy.

As described above, the implementation aspects of SCE’s proposed RI-IST program are consistent with the acceptance guidelines contained in Section 3.2 of Regulatory Guide 1.175 and are acceptable.

## 5.3 Performance Monitoring of IST Components

### 5.3.1 Licensee's Proposed Approach

The licensee’s RI-IST Program Description dated November 30, 1999 states:

> In addition to the specific inservice testing proposed for each component group discussed in Section 3 above [Section 5.1.1 of this SE], the following additional monitoring for each component group is currently in place per existing site procedures. The additional performance monitoring activities listed below by component type are applicable to all components within a given group regardless of individual ranking (HSSC, L-H, or LSSC).
>
> The proposed monitoring plan is sufficient to detect component degradation in a timely manner. Further, the monitoring activities identified for each component group ensure that the following criteria are met:
>
> - Sufficient tests are conducted to provide meaningful data.
>
> - The inservice tests are conducted such that the probability of detecting incipient degradation is high.

- Appropriate parameters are trended to provide reasonable assurance that the component will remain operable over the test interval.

The proposed performance-monitoring plan is sufficient to ensure that degradation is not significant for components placed on an extended test interval, and that failure rates assumed for these components will not be significantly compromised. The proposed performance monitoring, when coupled with SCE's corrective action program (discussed in Section 7 [Section 5.4.1 of this SE]), ensures corrective actions are taken and timely adjustments are made to individual component test strategies where appropriate.

Components that do not warrant test frequency extension based on limited, poor, or marginal performance histories will be monitored through the Corrective Action and Integrated Decision-making Processes and reviewed during the program periodic reassessment as described in Section 8 [Section 5.5.1 of this SE].

The SCE RI-IST Program will be reassessed at a frequency not to exceed once every other refueling outage, based on Unit 3, to reflect changes in plant configuration, component performance test results, industry experience, and other inputs to the process. Configuration changes will be assessed in concert with the current design change process. Therefore, the monitoring process for RI-IST is adequately coordinated with existing programs (e.g., Action Request program, Maintenance Rule monitoring, and design change process) for monitoring component performance and other operating experience on this site and, where appropriate, throughout the industry. Although the monitoring of reliability and unavailability goals for operating and standby systems/trains is required by the Maintenance Rule, it alone might not be sufficient to ensure operational readiness of components in the RI-IST program. The SONGS Action Request program requires timely operability assessment for component performance issues detected outside the auspices of the IST program. This process, coupled with the evaluations performed in Maintenance Rule space in concert with IST trending, ensures continued operational readiness of RI-IST components. The individual condition monitoring points for each component type are governed by site procedure and the 10CFR50.59 change process.

Preventative maintenance activities are dictated by the individual component procedures. Intervals range from three to five refueling cycles depending on component type, application, and individual performance history. The periodicity may be altered as accumulated data and industry experience warrant via site procedures, the IDP, and the 10 CFR 50.59 change process. The specific inspection points may vary as dictated by inspection and diagnostic test results. The preventative maintenance activities currently include the items listed below:

***Motor-Operated Valves (MOVs)***

- Actuator electrical inspections
  - ◊ Limit switch assemblies
  - ◊ Torque switch assemblies
  - ◊ Leads, jumpers, lugs, caps, tape, space heaters, environmentally qualified (EQ) wire splices and cable ties
  - ◊ Terminal blocks, motor T-drains
  - ◊ Assess motor overheating indication
  - ◊ Perform motor meggar

- Actuator lubrication inspection
  - ◊ Inspect for weeping, grease relief for function, grease level in main gear and clutch housing, and grease quality
  - ◊ Add grease to stem reservoir
  - ◊ Lubricate upper drive sleeve bearing
  - ◊ Lubricate valve bushing via grease fitting, stem threads, and yoke legs/anti-rotation plate on WKM globes

- Inspect stem nut for tightness and staking, actuator type SB compensator spring housing for cracks, and stem protective cover

- Valve PM activities

- Other activities
  - ◊ Perform hand wheel operation
  - ◊ Visual inspection for gross irregularities, upper bearing housing cover for warping on SMB-000,
  - ◊ Remove spring pack/worm to inspect spring pack, worm, worm gear, torque switch roller, grease in main housing
  - ◊ Remove motor to inspect motor pinion, worm shaft gear, declutch mechanism, and grease in motor compartment
  - ◊ Verify/tighten actuator mounting bolts, anti-lock rotation plat jam nuts
  - ◊ Verify/adjust actuator stop nuts and monitor stem nut thread condition

***Relief Valves***

- Test results trended

- New valves tested prior to installation

- Valves set as close to nominal as practical

***<u>Check Valves</u>***

- Combination of acoustic, magnetic, and/or ultrasonic testing methods are used as appropriate

- Data retrieved from these methods will be compared with previous results and the differences evaluated

- Open and close exercise testing

- Check valve disassembly inspections are performed where other testing is not practicable

- Leak rate testing is performed by 10 CFR 50, Appendix J program

- Leak testing for check valve closed exercise testing where appropriate

***<u>Air-Operated Valves (AOVs)</u>***

RI-IST AOV preventative maintenance activities are currently scheduled not to exceed 5 fuel cycles for Category 2 valves and 4 fuel cycles for Category 1 valves[4]. This initial periodicity may be altered as accumulated data and industry experience warrant as described below. The specific inspection points may vary as dictated by inspection and diagnostic test results. Initial intervals as well as the specific points monitored may be adjusted per station procedures and the 10CFR50.59 process. The preventative maintenance activities initially include the items listed below:

- Routine overhauls (scheduled as noted for Category 1 & 2 above) that include:
  - ◊ Disassembly, cleaning, inspection

[4] Currently the atmospheric steam dump valves, 2(3)HV8419 and 2(3)HV8421 are classified as Category 1 due to the component risk ranking. 2(3)HV4053 and 2(3)HV4054 are scheduled for PM every other refueling as part of a diaphragm wear study program.

- ◊ Replacement of elastomers
- ◊ Replacement of air filter / pressure regulator assembly
- ◊ Re-assembly and testing
- ◊ Response time testing
- ◊ Diagnostic testing as outlined below.

- Valves exposed to extreme environmental conditions will have repetitive maintenance orders for actuator replacement consistent with the service conditions.

- Positioner PMs consist of the following:
    - ◊ Removal disassembly, cleaning, inspection
    - ◊ Parts replacement as required
    - ◊ Reassembly and test

- Static diagnostic testing performed following valve or actuator overhaul (Preventative Maintenance) or corrective maintenance that could impact valve function, or as requested.

- Diagnostic testing of the following testing parameters as applicable
    - ◊ Bench set
    - ◊ Maximum available pneumatic pressure
    - ◊ Seat load
    - ◊ Spring rate
    - ◊ Stroke time
    - ◊ Actual travel
    - ◊ Total friction
    - ◊ Minimum pneumatic pressure required to accomplish the safety function(s) of the valve assembly (under development)
    - ◊ Pneumatic pressure at appropriate point in operation
    - ◊ Set point of pressure switch(s), relief valve, regulator, etc

- Others as dictated by the specific valve/actuator style and application.

***Pumps***

- Margin to safety limit deviations – head curves

- Lube oil analysis

- Alignment checks

- Motor current testing (recently initiated – program still developing)

- Vibration monitoring

- Flange loading checks of connected piping – (not periodic – only performed after disassembly)

- Thermography (recently initiated – Program not yet fully developed or implemented)

5.3.2 Staff Evaluation

SCE's performance monitoring plans for each group of components are adequately described in its RI-IST Program Description. The proposed performance monitoring, in conjunction with the proposed inservice tests specified in the RI-IST Program Description, is sufficient to detect component degradation in a timely manner.

SCE's proposed performance monitoring plan will ensure that the following criteria, as specified in Section 3.3 of Regulatory Guide 1.175, are met:

- Sufficient tests are conducted to provide meaningful data.

- The inservice tests are conducted such that incipient degradation can reasonably be expected to be detected.

- The licensee will trend appropriate parameters to provide reasonable assurance that the component will remain operable over the test interval.

The proposed performance monitoring plan is sufficient to ensure that degradation is not significant for components placed on an extended test interval, and that failure rates assumed for these components will not be significantly compromised. The proposed performance monitoring when coupled with SCE's corrective action program (see Section 5.4.1) will ensure that corrective actions are taken and timely adjustments are made to individual component (or group of components) test strategies where appropriate. Specifically, the corrective action section of the licensee's RI-IST Program Description states that unsatisfactory conditions will be reviewed to evaluate the adequacy of the test strategy. If a change is required, the licensee will review the IST test schedule and change the schedule as appropriate.

SCE stated in its November 30, 1999, RI-IST Program Description that components will be reassessed at a frequency not to exceed once every other refueling outage to reflect changes in plant configuration, component performance test results, industry experience, and other inputs to the process. Therefore, the licensee's monitoring process for RI-IST is adequately coordinated with existing programs (e.g., corrective action program, operating experience program, Maintenance Rule monitoring) for monitoring components performance and other operating experience at SONGS and, where appropriate, throughout the industry. On this basis, the component-level monitoring described by SCE in its RI-IST Program Description is acceptable to the staff. (Also, see Section 5.4 below on the licensee's feedback and corrective action program.)

5.3.3 Conclusion

SCE's proposed RI-IST program contains a performance monitoring plan that covers all components in the RI-IST program. The proposed monitoring plan is capable of adequately tracking the performance of components which, if degraded, could alter the conclusions that were key to supporting the acceptance of the RI-IST program. SCE has committed to maintain the performance monitoring program as part of its overall RI-IST program.

As described above, the performance monitoring aspects of SCE's proposed RI-IST program are consistent with the acceptance guidelines contained in Section 3.3 of Regulatory Guide 1.175 and are therefore acceptable.

## 5.4 Feedback and Corrective Action Program

5.4.1 Licensee's Proposed Approach

The licensee's RI-IST Program Description dated November 30, 1999, states:

> When an LSSC (including L-H) on the extended test interval fails to meet established test criteria, corrective actions will be taken in accordance with the SONGS corrective action program as described below for the RI-IST.
>
> For all components not meeting the acceptance criteria, an Action Request (AR) will be generated. This document initiates the corrective action process. An AR may result from activities other than IST that identify degradation in performance.
>
> The initiating event could be any other indications that the component is in a non- conforming condition. The unsatisfactory condition will be evaluated to:
>
> a) Determine the impact on system operability since the previous test.

b) Review the previous test data for the component and all components in the group.

c) Perform an apparent cause analysis and/or a root cause analysis as applicable.

d) Determine if this is a generic failure. If it is a generic failure whose implications affect a group of components, initiate corrective action for all components in the affected group.

e) Initiate corrective action for failed IST components.

f) Evaluate the adequacy of the test interval. If a change is required, review the IST test schedule and change as appropriate.

The results of component testing will be provided to and reviewed by the PRA group for potential impact to a PRA model update. The PRA model will be updated as necessary with changes tracked and documented per the PRA Change Process Program.

For an emergent plant modification, any new IST component added will initially be included at the current Code of Record test frequency. Only after evaluation of the component through the RI-IST Program (i.e., PRA model update if applicable and IDP review) will this be considered LSSC with an extended test interval.

5.4.2 Staff Evaluation

The licensee's corrective action program is initiated by component failures that are detected by the IST program, as well as by other mechanisms, such as normal plant operation, or inspections.

The licensee’s December 30, 1998, RI-IST Program states that the SONGS AR process (i.e., the licensee's corrective action guidance and procedures), as outlined in Section 5.4.1 above, will achieve the following objectives:

- The procedures comply with Criterion XVI, “Corrective Action,” as specified by Appendix B to 10 CFR Part 50.

- The procedures institute a process that determines the impact of the failure or nonconforming condition on system/ train operability. SCE refers to the appropriate Technical Specification when component capability cannot be demonstrated.

- The procedures determine and correct the apparent or root cause of the failure or nonconforming condition (e.g., improve testing practices, repair or replace the component).

- The procedures assess the applicability of the failure or nonconforming condition to other components in the IST program (including any test sample expansion that may be required for grouped components such as relief valves).

- The procedures correct other susceptible similar IST components as necessary.

- The procedures consider the effectiveness of the component's test strategy (i.e., frequency and methods) in detecting the failure or nonconforming condition. They adjust the test frequency or methods or both, as appropriate, where the component (or group of components) experiences repeated or age-related failures or nonconforming conditions.

These objectives are consistent with the acceptance criteria specified in Section 3.4 of Regulatory Guide 1.175 for a RI-IST corrective action program, and are therefore acceptable.

The licensee’s corrective action evaluations will be periodically provided to the licensee's PRA group so that any necessary model changes and regrouping can be performed as appropriate.

As stated in Section 5.5 below, the licensee’s RI-IST program documents will be periodically revised to record any RI-IST program changes resulting from corrective actions taken.

### 5.4.3 Conclusion

The licensee’s corrective action program contains a performance-based feedback mechanism to ensure that, if a particular component's test strategy is adjusted in a manner that is ineffective in detecting component degradation and failure, the IST program weakness will be promptly detected and corrected. That is, the feedback and corrective action aspects of SCE’s proposed RI-IST program are consistent with the acceptance guidelines contained in Section 3.4 of Regulatory Guide 1.175 and are therefore acceptable for implementation with the RI-IST program.

## 5.5 Periodic Reassessment

### 5.5.1 Licensee's Proposed Approach

The licensee's December 30, 1998, RI-IST Program submittal states:

> The PRA will be periodically updated to reflect the current plant design, procedures, and programs.

The licensee's November 30, 1999, RI-IST Program Description states:

> As a living process, components will be reassessed at a frequency not to exceed every other refueling outage (based on Unit 3 refueling outages) to reflect changes in plant configuration, component performance test results, industry experience, and other inputs to the process. The RI-IST reassessment will be completed within 9 months of completion of the outage.
>
> Part of this periodic reassessment will be a feedback loop of information to the PRA. This will include information such as components tested since last reassessment, number and type of tests, number of failures, corrective actions taken including generic implication and changed test frequencies. Once the PRA has been reassessed, the information will be brought back to the IDP for deliberation and confirmation of the existing lists of HSSCs and LSSCs or modification of these lists based on the new data. As part of the IDP, confirmatory measures previously used to categorize components as LSSC, as well as compensatory measures used to justify the extension of L-H components, will be validated.
>
> During the periodic reassessment L-H and LSSC components whose performance history did not justify extension will be reviewed. The review will focus on the adequacy and effectiveness of corrective actions, as well as the performance of similar components in similar applications. If the Expert Panel judges the performance warrants a test interval extension based on the combination of risk metrics, available margin, and successive satisfactory performance, then and only then with Panel consensus may the test interval be adjusted.
>
> Additionally, the maximum test interval for each component or component group will be verified or modified as dictated by the IDP.

### 5.5.2 Staff Evaluation

As discussed in the licensee's RI-IST Program Description, the proposed program for periodic reassessment of its RI-IST program has the following objectives:

- It prompts the licensee to conduct overall program assessments periodically to reflect changes in plant configuration, component performance test results, industry experience, and other inputs to the process.

- It prompts the licensee to review and revise as necessary the models and data used to categorize components.

- It prompts the licensee to adjust component test strategies (e.g., the maximum test interval) based on changes to component categorization and integrated decision-making process.

Consistent with the guidance provided in Regulatory Guide 1.175, periodic reassessments will be conducted at a frequency not to exceed once every other refueling outage. The licensee's December 30, 1998, RI-IST Program Plan states that significant changes in plant configuration may require more expedient re-assessments (i.e., before the normal two-refueling-outage reassessment interval is required).

The licensee's proposed program for periodic reassessment of the RI-IST program will incorporate the results of its corrective action program. This is consistent with the guidance provided in Regulatory Guide 1.175 and is therefore acceptable to the staff (see Section 5.4).

The licensee's December 30, 1998, RI-IST Program Plan states that as part of the periodic reassessment, compensatory measures (i.e., associated with components that had a high RAW but were categorized as LSSC) used as part of the IDP to justify the extension of test interval for specific components will be monitored to ensure their continued effectiveness. The staff agrees with SCE that it is appropriate to periodically verify that compensatory measures remain in effect because those measures may include licensee activities and controls that might otherwise be outside the purview of the RI-IST program.

5.5.3 Conclusion

The staff concludes that the licensee's plans for periodic reassessment of its RI-IST program is consistent with the acceptance guidelines contained in Section 3.5 of Regulatory Guide 1.175, and is therefore acceptable to the staff.

## 5.6 RI-IST Program Changes After Initial Approval

5.6.1 Licensee's Proposed Approach

The licensee's December 30, 1998, RI-IST Program submittal states:

> As a living process, components will be reassessed periodically as stated in Section 1.1 to reflect changes in plant configuration, component performance,

> test results, industry experience, and other factors. When significant changes that do not require prior regulatory approval occur, those changes will be provided to the NRC in a program update. All potential future changes will be evaluated against the change mechanisms described in the regulations (e.g., 10 CFR 50.55a, 10 CFR 50.59) prior to implementation. Further, any future changes will consider the cumulative risk impact of all RI-IST program changes (i.e., initial approval plus later changes) and the compliance of this calculated risk impact with acceptance guidelines discussed in Regulatory Guide1.174 and Regulatory Guide1.175.

The licensee's November 30, 1999, RI-IST Program Description states:

> Changes to the process described above (such as acceptance guidelines used for the IDP) as well as changes in test methodology issues that involve deviation from NRC endorsed Code requirements, NRC endorsed Code Case, or published NRC guidance are subject to NRC review and approval prior to implementation. Other changes using the process detailed above (such as relative ranking, risk categorization, and grouping) are subject to site procedures and the associated change process pursuant to 10CFR50.59. SONGS will periodically submit changes to the NRC for their information.

5.6.2 Staff Evaluation

The licensee requested permission to implement changes to its RI-IST program that are consistent with the NRC-approved RI-IST process and with its evaluation of risk without prior NRC approval. The staff's guidance provided in Regulatory Guide 1.175 states that licensees may change their RI-IST programs consistent with the process as defined in the RI-IST program description and results that were reviewed and approved by the NRC. Therefore, the licensee's proposal is acceptable to the staff.

As stated in Regulatory Guide 1.175, examples of changes to RI-IST programs which would not require prior NRC review and approval include, but are not limited to, the following:

- changes to component groupings, test intervals, and test methods that do not involve a change to the overall RI-IST process (as described in the licensee's RI-IST Program Description) which has been reviewed and approved by the NRC

- component test method changes that involve the implementation of an NRC-endorsed ASME Code or an NRC-endorsed Code case

- re-categorization of components as a result of experience, PRA insights, or design changes where the process used to recategorize the components is consistent with the RI-IST Program Description and results that have been reviewed and approved by the NRC.

Changes to the licensee's RI-IST program which would require staff review and approval prior to implementation may include, but are not limited to, the following:

- changes to the approved RI-IST program that involve programmatic changes (e.g., changes in the acceptance guidelines used for the licensee's IDP and specified in the RI-IST Program Description)
- test method changes that involve deviation from the NRC-endorsed Code requirements, NRC-endorsed Code case, or published NRC guidance
- changes to the licensee's RI-IST Program Description (e.g., test philosophies, test methods, implementing strategies)

The cumulative impact of all RI-IST program changes (initial approval plus later changes) will be consistent with the results that were reviewed and approved by the NRC staff and will continue to comply with the acceptance guidelines in Section 2.3.3 of Regulatory Guide 1.175, or prior staff approval of the change must be obtained.

Changes to the licensee's RI-IST program will also be evaluated using change mechanisms described in the regulations (e.g., 10 CFR 50.55a, 10 CFR 50.59), as appropriate, to determine if prior NRC staff review and approval is required before implementation.

The licensee is not required to submit periodic RI-IST program updates. However, IST Program 120-month updates continue to be required by 10 CFR 50.55a(f)(4)(ii). SCE may elect to submit RI-IST program updates to keep the staff apprised of significant program changes that do not require prior NRC review and approval.

### 5.6.3 Conclusion

The staff concludes that the licensee will have adequate processes and procedures in place to ensure that RI-IST program changes that could adversely affect the RI-IST program or results previously reviewed and approved by the NRC staff will be evaluated and approved by the NRC before implementation.

The licensee's process for controlling changes to its RI-IST program after initial NRC approval is consistent with the acceptance guidelines contained in Section 1.3 of Regulatory Guide 1.175 and is therefore acceptable.

## 6.0 OVERALL CONCLUSIONS

The licensee's proposed RI-IST program at SONGS Units 2 and 3 meets the detailed acceptance guidelines specified in each section of Regulatory Guide 1.175. The staff finds that the SONGS RI-IST program is consistent with the five key safety principles to be met for all risk-informed applications as discussed in Regulatory Guide 1.174. The SONGS RI-IST program:

(1) meets current regulations unless it is explicitly related to a requested exemption or rule change,

(2) is consistent with the defense-in-depth philosophy,

(3) maintains sufficient safety margins,

(4) results in small increases in core damage frequency (CDF) or risk that are consistent with the Commission's Safety Goal Policy Statement, and

(5) uses performance measurement strategies to monitor changes.

Consequently, the licensee's proposed risk-informed IST program may be authorized as an alternative to the ASME BPV Code Section XI requirements related to the test frequencies and methods used to ensure operational readiness of certain pumps and valves in SONGS Units 2 and 3, pursuant to 10 CFR 50.55a(a)(3)(i) based on the alternative providing an acceptable level of quality and safety. The authorization of this alternative to the ASME Code IST requirements provides reasonable assurance of the operational readiness of pumps and valves and will not have an adverse impact on safe operation of SONGS Units 2 and 3.

The implementation of the licensee's RI-IST Program Description is authorized for the remainder of each unit's plant life for SONGS Units 2 and 3. SCE is not expected to resubmit its RI-IST Program Plan unless significant changes are made to the RI-IST Program Description that could potentially affect the staff's overall conclusions. SCE continues to be required to update its IST Program Plan for pumps and valves every 120 months and submit requests for relief from impractical Code requirements pursuant to 10 CFR 50.55a(f)(4)(ii) and (f)(5).

The staff may review the licensee's procedures for implementing the RI-IST program at SONGS Units 2 and 3 during an on-site inspection.

## 7.0 REFERENCES

1. USNRC, Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions in Plant-Specific Changes to the Current Licensing Basis," July 1998.

2. USNRC, Regulatory Guide 1.175, "An Approach for Using Plant-Specific, Risk-Informed Decisionmaking: Inservice Testing," August 1998, 63 FRN 48771, September 11, 1998.

3. USNRC, Standard Review Plan Chapter 19, “Use of Probabilistic Risk Assessment in Plant-Specific, Risk-Informed Decisionmaking: General Guidance,” July 1998.

4. USNRC, Standard Review Plan Chapter 3.9.7, “Risk-Informed Inservice Testing,” 63 FRN 48771, September 11, 1998.

5. SCE letter from A. Edward Scherer to the NRC, December 30, 1998.

6. Letter from L. Raghaven, NRC, to Harold B. Ray, SCE, April 20, 1999.

7. SCE letter from A. Edward Scherer to the NRC, June 17, 1999.

8. SCE letter from A. Edward Scherer to the NRC, September 28, 1999.

9. SCE letter from A. Edward Scherer to the NRC, November 30, 1999.



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