SOUTHERN CALIFORNIA
EDISON
An EDISON INTERNATIONAL Company

A. Edward Scherer
Manager of
Nuclear Regulatory Affairs

October 15, 2004

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: **Docket Nos. 50-361 and 50-362**
Additional Information Supporting Third Ten-Year Inservice Inspection (ISI) Interval Relief Request ISI-3-1 Request to Use Risk-Informed Inservice Inspection (RI ISI)
San Onofre Nuclear Generating Station Units 2 and 3

References: 1) Letter from A. E. Scherer (SCE) to the Document Control Desk (NRC) dated July 2, 2003; Subject: Docket Nos. 50-361 and 50-362, Notification of Updating the Inservice Inspection Program and Submittal of Relief Requests for the Third 10-Year Inspection Interval, San Onofre Nuclear Generating Station Units 2 and 3

2) Letter from A. E. Scherer (SCE) to the Document Control Desk (NRC) dated September 15, 2004; Subject: Additional Information Supporting Third Ten-Year Inservice Inspection (ISI) Interval Relief Request ISI-3-1 Request to Use Risk-Informed Inservice Inspection (RI ISI) San Onofre Nuclear Generating Station Units 2 and 3

Dear Sir or Madam,

As requested, this letter provides WCAP-15882-NP, Revision 4, "San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 Risk-Informed Inservice Inspection Program Evaluation" to support the Southern California Edison (SCE) Relief Request ISI-3-1, Request to Use Risk-Informed Inservice Inspection. Relief Request ISI-3-1 was submitted on July 2, 3003, by reference 1 and supplemented by reference 2 on September 15, 2004.

A047

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

Should you have any questions, please contact Mr. Jack Rainsberry, Manager, Plant Licensing at (949) 368-7420.

Sincerely,

cc: B. S. Mallett, Regional Administrator, NRC Region IV
B. M. Pham, NRC Project Manager, San Onofre Units 2 and 3
C. C. Osterholtz, NRC Senior Resident Inspector, San Onofre Units 2 and 3

Westinghouse Non-Proprietary Class 3

WCAP-15882-NP
Revision 04

July 2004

San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 Risk-Informed Inservice Inspection Program Evaluation

Westinghouse

LEGAL NOTICE

This report was prepared as an account of work sponsored by Southern California Edison and Westinghouse Electric Company LLC. Neither Southern California Edison nor Westinghouse Electric Company LLC, nor any person acting on their behalf:

A. Makes any warranty or representation, express or implied including the warranties of fitness for a particular purpose or merchantability, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, method, or process disclosed in this report.

Westinghouse Electric Company
P.O. Box 500
Windsor, Connecticut 06095-0500

Westinghouse Non-Proprietary Class 3

WCAP–15882-NP, Rev. 04

San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 Risk-Informed Inservice Inspection Program Evaluation

July 2004

Author: ____________________
Rupert A. Weston
Reliability & Risk Assessment

Reviewer: ____________________
Robert E. Jaquith
Reliability & Risk Assessment

Approved: ____________________
Gary G. Ament
Reliability & Risk Assessment

TABLE OF CONTENTS

List of Tables

1.0 INTRODUCTION

1.1 RELATION TO NRC REGULATORY GUIDE 1.174

Inservice inspections (ISI) are currently performed on piping to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI, 1989 Edition as required by 10CFR50.55a. San Onofre Nuclear Generating Station (SONGS) Units 2 & 3 are currently in the second inspection interval as defined by the Code for Program B.

The objective of this evaluation is to support a change to the inservice inspection (ISI) program plan for SONGS Units 2 and 3 ASME Section XI Examination Category B-J and B-F welds in accordance with the risk-informed process described in EPRI TR 112657, Revision B-A, "Risk-Informed Inservice Inspection (RI-ISI) Evaluation Procedure" (Reference 6.1).

SONGS Units 2 & 3 plan to incorporate the RI-ISI program during the first period of the third inspection interval. The third 10-year inspection interval is scheduled to begin on August 18, 2003.

As a risk-informed application, this evaluation meets the intent and principles of Regulatory Guide 1.174. Further information is provided in Section 3.8 relative to defense-in-depth.

1.2 PROBABILISTIC RISK ANALYSIS (PRA) QUALITY

The consequences of pipe ruptures were evaluated by using the SONGS Units 2 & 3 Living Probabilistic Risk Assessment (PRA). A summary of the PRA results and conclusions and how they are used in the evaluation is presented below.

The base core damage frequency from the PRA is 4.1E-5 per year and the base large early release frequency from this version is 1.4E-6 per year. The main contributors to core damage frequency (CDF) are summarized in Table 1.2-1.

Several measures have been implemented in the development of the SONGS Units 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 Units 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 application 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. More recently (February 2002), Westinghouse performed a pre-certification evaluation of the SONGS Units 2 & 3 PRA. In addition to reviewing against the CEOG Peer Certification Guidance (which mirrors NEI peer review guidance NEI-002), Westinghouse reviewed the SONGS Units 2 & 3 PRA against the high level requirements of Revision 14a of the ASME standard. Based on both reviews, SCE concludes that the SONGS Units 2 & 3 PRA was adequate to support risk-informed in-service inspection.

In addition to extensive review, these refined full-scope models were used to support the approved SONGS Units 2 & 3 Diesel Generator (DG), Low Pressure Safety Injection (LPSI), and Safety Injection Tank (SIT) allowed outage extension submittals to the NRC as well as the SONGS Units 2 & 3 approved risk-informed in-service test (IST) program. In addition to detailed model review of the SONGS Units 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 Units 2 & 3 PRA has been subjected to extensive peer and regulatory reviews. 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 plant and the most recent historical data. Therefore, the SONGS Units 2 & 3 PRA is of a quality consistent with that required to perform accurate, thorough, and comprehensive evaluations for a risk-informed ISI application.

2.0 PROPOSED ALTERNATIVE TO ASME SECTION XI ISI PROGRAM

2.1 ASME SECTION XI

Subsection IWB of ASME Section XI specifies the inservice inspection requirements for Class 1 components in light-water cooled plants. The specific examination and inspection requirements for pressure retaining welds in Class 1 piping are contained in Subarticle IWB-2500 and Table IWB-2500-1 Examination Category B-J and B-F.

As an alternative, a RI-ISI program will be implemented in accordance with guidance and process procedures described in EPRI TR-112657 Revision B-A. The RI-ISI program will be substituted for the current examination program on piping in accordance with 10 CFR 50.55a(a)(3)(i) by alternatively providing an acceptable level of quality and safety. Other non-related portions of the ASME Section XI Code will be unaffected. EPRI TR-112657 Revision B-A provides the requirements defining the relationship between the risk-informed examination program and the remaining unaffected portions of ASME Section XI.

2.2 AUGMENTED PROGRAMS

None of the augmented inspections at SONGS Units 2 & 3 changed as a result of these RI-ISI selections.

3.0 RISK-INFORMED ISI PROCESSES

The processes used to develop the RI-ISI program are consistent with the methodology described in EPRI TR 112657 Revision B-A. The process that is being applied, involves the following steps:

- Scope Definition
- Consequence Evaluation
- Failure Assessment
- Risk Evaluation
- Element Selection
- Program Implementation
- Feedback Loop

3.1 SCOPE OF PROGRAM

The scope of the RI-ISI evaluation included all ASME Section XI Examination Category B-J and Category B-F welds. The systems included in the risk-informed ISI program are identified in Tables 3.1-1A and 3.1-1B for SONGS Units 2 & 3, respectively. The piping and instrumentation diagrams and additional plant information were used to define system boundaries.

3.2 CONSEQUENCE EVALUATION

The consequences of pressure boundary failures were evaluated and ranked based on their impact on core damage and containment performance (isolation, bypass and large early release). The impact on these measures due to both direct and indirect effects was considered using the guidance provided in EPRI TR-112657 Revision B-A.

The consequences of pressure boundary failures were evaluated and ranked based on their impact on conditional core damage probability (CCDP) and conditional large early release probability (CLERP). The impact on these measures due to both direct and indirect effects associated with pipe ruptures was determined using the PRA model described in Section 1. Consequence categories (High, Medium or Low) were assigned according to Table 3-1 of EPRI TR-112657 Revision B-A. One of the enhancements incorporated into this application of the EPRI RI-ISI methodology was the direct use of the PRA models to support the estimation of CCDP and CLERP values for each pipe element in the scope of the RISI evaluation, in lieu of the consequence tables in EPRI TR-112657 Revision B-A. This step was taken to support a more complete and realistic quantification of the risk impacts of the RI-ISI program in comparison with previous applications of this methodology.

All Class 1 piping at SONGS Units 2 & 3 is located inside containment. Direct effects associated with pipe ruptures inside the containment cause a loss of reactor coolant initiating event. Indirect/spatial effects associated with pipe ruptures inside containment were based on pipe whip, jet impingement, pressurization, and temperature effect analyses documented in Reference 6.2. All safety equipment inside containment has been qualified to function under accident/postaccident environmental conditions. There are no indirect/spatial effects associated with flooding caused by pipe ruptures inside containment.

3.3 FAILURE ASSESSMENT

Failure potential estimates were generated utilizing industry failure history, plant specific failure history and other relevant information. These failure estimates were determined using the guidance provided in EPRI TR-112657 Revision B-A.

Table 3.3-1 summarizes the failure potential assessment by system for each degradation mechanism that was identified as potentially operative.

3.4 RISK EVALUATION

In the preceding steps, each run of piping within the scope of the program was evaluated to determine its impact on core damage and containment performance (isolation, bypass, and large, early release) as well as its potential for failure. Given the results of these steps, piping segments are then defined as continuous runs of piping potentially susceptible to the same type(s) of degradation and whose failure will result in similar consequence(s). Segments are then ranked based upon their risk significance (i.e., risk categories) as defined in EPRI TR-112657 Revision B-A.

The results of these calculations are presented in Tables 3.4-1, 3.4-2A, and 3.4-2B.

3.5 ELEMENT SELECTION

In general, EPRI TR-112657 Revision B-A requires that 25% of the locations in the high risk regions (i.e., risk categories 1, 2, and 3) and 10% of the locations in the medium risk regions (i.e., risk categories 4 and 5) be selected for inspection. The results of the selection are presented in Tables 3.5-1A and 3.5-1B for SONGS Units 2 & 3, respectively. Once the risk-informed inspection scope is defined, non-destructive examination (NDE) methods tailored to the applicable degradation mechanism were then defined for each weld. Section 4 of EPRI TR-112657 Revision B-A was used to determine the examination requirements for these locations.

<u>SONGS Unit 2</u>

At SONGS Unit 2, 679 examination Category B-J and Category B-F welds, excluding socket welds, were evaluated. A total of 83 welds (~12%) were subsequently selected for inclusion in the RI-ISI program inspection population. These welds are distributed among risk categories 2, 4, and 5 as described below for the various systems.

Thermal transients (TT), thermal stratification, cycling and striping (TASCS), and primary water stress corrosion cracking (PWSCC) degradation mechanisms were identified in the thirty-six risk category 2 segments for the Reactor Coolant System (RCS). Thirty risk category 2 welds were selected from these segments. The bimetallic welds in the RCS are considered especially vulnerable to PWSCC. All such welds are included in risk category 2 segments for the RCS. Twelve bimetallic welds were selected for inspection. Six of the twelve bimetallic welds were selected to monitor for PWSCC, and the remaining six welds were selected to monitor for PWSCC and TT. Eighteen non-bimetallic category 2 welds were selected to monitor for either TT or TASCS. Eight risk category 4 welds were selected from the twenty-four risk category 4 segments for the RCS. One risk category 5 weld was selected from the four risk category 5 segments that were identified for this system.

Four risk category 2 segments were identified for the Chemical and Volume Control System (CVCS). The degradation mechanism evaluation for this system identified the welds in two of the risk category 2 segments as being susceptible to TT. The welds in the remaining two risk category 2 segments were identified as being susceptible to both TT and PWSCC. Three risk category 2 welds were selected from these segments. Two welds were selected to monitor for TT, and one weld was selected to monitor for TT and PWSCC. One risk category 4 weld was selected from the one risk category 4 segment that was identified for this system.

Four risk category 2 segments were identified for the Main Spray System (MSS). The degradation mechanism evaluation for this system identified the welds in two of the risk category 2 segments as being susceptible to PSWCC. The welds in another risk category 2 segment were susceptible to TASCS, and the welds in the remaining segment were susceptible to both TASCS and PWSCC. Six risk category 2 welds were selected from these segments. Four welds were selected to monitor for TASCS, one weld was selected to monitor for PWSCC, and one weld was selected to monitor for both PWSCC and TASCS. Nine risk category 4 welds were selected from the four risk category 4 segments that were identified for this system.

Both TT and TASCS were the degradation mechanisms identified in the one risk category 2 segment for the Auxiliary Spray System. Two risk category 2 welds were selected from the segment. No other selections were made for this system.

Eight risk category 2 segments were identified for the Safety Injection System (SIS). The degradation mechanism evaluation for this system identified the welds in four of the risk category 2 segments as being susceptible to either TT or TASCS. The welds in the remaining four risk category 2 segments were identified as being susceptible to both TASCS and PWSCC. Nine risks category 2 welds were selected from these segments. Seven welds were selected to monitor for TASCS, and two welds were selected to monitor for both PWSCC and TASCS. Two risk category 4 welds were selected from the two risk category 4 segments. TASCS was also the only degradation mechanism identified in the four risk category 5 segments for the SIS. Five risk category 5 welds were selected from the four risk category 5 segments for this system.

Three risk category 2 segments were identified for the Shutdown Cooling System (SDCS). The degradation mechanism evaluation for this system identified the welds in two of the risk category 2 segments as being susceptible to either TT or TASCS. The weld in the remaining risk category 2 segment was identified as being susceptible to both PWSCC and TT. Two risk category 2 welds were selected to monitor for TT, one weld was selected to monitor for TASCS, and one weld was selected to monitor for PWSCC and TT. One risk category 4 weld was also selected from the two risk category 4 segments that were identified for this system. TT was also identified as the degradation mechanism for the welds in the risk category 5 segment for this system. One risk category 5 weld was selected for this system.

SONGS Unit 3

At SONGS Unit 3, 660 examination Category B-J and Category B-F welds, excluding socket welds, were evaluated. A total of 80 welds (~12%) were subsequently selected for inclusion in the RI-ISI program inspection population. These welds are distributed among risk categories 2, 4, and 5 as described below for the various systems.

TT, TASCS, and PWSCC degradation mechanisms were identified in the thirty-six risk category 2 segments for the RCS. Twenty-seven risk category 2 welds were selected from these segments. The bimetallic welds in the RCS are considered especially vulnerable to PWSCC. All such welds are included in risk category 2 segments for the RCS. Twelve bimetallic welds were selected for inspection. Six of the twelve bimetallic welds were selected to monitor for PWSCC, and the remaining six welds were selected to monitor for PWSCC and TT. Fifteen non-bimetallic category 2 welds were selected to monitor for either TT or TASCS. Nine risk category 4 welds were selected from the twenty-four risk category 4 segments for the RCS. One risk category 5 weld was selected from the four risk category 5 segments that were identified for this system.

Four risk category 2 segments were identified for the CVCS. The degradation mechanism evaluation for this system identified the welds in two of the risk category 2 segments as being susceptible to TT. The welds in the remaining two risk category 2 segments were identified as being susceptible to both TT and PWSCC. Four risk category 2 welds were selected from these segments. Three welds were selected to monitor for TT, and one weld was selected to monitor for TT and PWSCC. One risk category 4 weld was selected from the one risk category 4 segment that was identified for this system.

Four risk category 2 segments were identified for the MSS. The degradation mechanism evaluation for this system identified the welds in two of the risk category 2 segments as being susceptible to PSWCC. The welds in another risk category 2 segment were susceptible to TASCS, and the welds in the remaining segment were susceptible to both TASCS and PWSCC. Four risk category 2 welds were selected from these segments. Two welds were selected to monitor for TASCS, one weld was selected to monitor for PWSCC, and one weld was selected to monitor for both PWSCC and TASCS. Nine risk category 4 welds were selected from the four risk category 4 segments that were identified for this system.

Both TT and TASCS were the degradation mechanisms identified in the one risk category 2 segment for the Auxiliary Spray System. Two risk category 2 welds were selected from these segments. No other selections were made for this system.

Eight risk category 2 segments were identified for the SIS. The degradation mechanism evaluation for this system identified the welds in four of the risk category 2 segments as being susceptible to either TT or TASCS. The welds in the remaining four risk category 2 segments were identified as being susceptible to both TASCS and PWSCC. Ten risks category 2 welds were selected from these segments. Eight welds were selected to monitor for TASCS, and two welds were selected to monitor for both PWSCC and TASCS. One risk category 4 weld was selected from the two risk category 4 segments. TASCS was also the only degradation mechanism identified in the four risk category 5 segments for the SIS. Four risk category 5 welds were selected from the four risk category 5 segments for this system.

Three risk category 2 segments were identified for the SDCS. The degradation mechanism evaluation for this system identified the welds in two of the risk category 2 segments as being susceptible to either TT or TASCS. The weld in the remaining risk category 2 segment was identified as being susceptible to both PWSCC and TT. Two risk category 2 welds were selected to monitor for TT, one weld was selected to monitor for TASCS, and one weld was selected to monitor for PWSCC and TT. Two risk category 4 welds were also selected from the two risk category 4 segments that were identified for this system. TT was also identified as the degradation mechanism for the welds in the risk category 5 segment for this system. One risk category 5 weld was selected for this system.

3.6 ADDITIONAL EXAMINATIONS

Since the risk-informed inspection program may require examinations of a number of elements constructed to lesser pre-service inspection requirements, the program in all cases will determine through an engineering evaluation the root cause of any unacceptable flaw determined to be service related or relevant condition found during examination. The evaluation will include the applicable service conditions and degradation mechanisms to establish that the element(s) will still perform their intended safety function during subsequent operation. Elements not meeting this requirement will be repaired or replaced.

The evaluation will include whether other elements of the segment or segments are subject to the same root cause and degradation mechanism. Additional examinations will be performed on these elements up to a number equivalent to the number of elements initially required to be inspected on the segment or segments. If unacceptable flaws determined to be service related or relevant conditions are again found similar to the initial problem, the remaining elements identified as susceptible will be examined. No additional examinations will be performed if there are no additional elements identified as being susceptible to the same service related root cause conditions or degradation mechanism.

3.7 PROGRAM RELIEF REQUESTS

Alternate methods are specified to ensure structural integrity in cases where examination methods cannot be applied due to limitations such as inaccessibility or radiation exposure hazard.

A minimum of > 90% volume coverage (per Code Case N-460) will be provided, when possible, when performing the risk-informed examinations. However, some limitations will not be known until the examination is performed, since some locations may be examined for the first time by the specified techniques.

At this time, all the risk-informed examination locations that have been selected are estimated to exceed > 90% volume coverage. In instances where a location may be found at the time of the examination that does not meet > 90% coverage, the process outlined in EPRI TR 112657 Revision B-A will be followed.

3.8 RISK IMPACT ASSESSMENT

Change in Risk

The risk-informed ISI program has been developed in accordance with Regulatory Guide 1.174, and the risk from implementation of this program is expected to remain neutral or increase negligibly compared to that estimated from current requirements.

This evaluation identified the allocation of segments into High, Medium, and Low risk regions of the EPRI TR-112657 risk ranking matrix, and then determined for each of these risk classes what inspection changes are proposed for each of the locations in each segment. The changes include changing the number and location of inspections within the segment and in many cases improving the effectiveness of the inspection to account for the findings of the RI-ISI degradation mechanism assessment. For example, for locations subject to thermal fatigue, inspection locations have an expanded volume and the examination is focused to enhance the probability of detection during the inspection process. A comparison of the current Section XI and proposed RI-ISI inspection programs is summarized in Tables 3.8-1A and 3.8-1B for SONGS Units 2 & 3, respectively.

A comprehensive risk impact evaluation was performed in accordance with Section 3.7 of EPRI TR-112657 Revision B-A (Reference 6.1). The risk impact evaluation followed the decision process and evaluation criteria in EPRI TR-112657 Revision B-A Figure 3-6 and included the following elements:

1. A qualitative evaluation - The potential risk impacts was assessed for each pipe segment due to increases and decreases in the number of examinations; and for expected enhancements to the inspection detection probability due to the implementation of expanded weld inspection volumes prescribed in Section 4.0 of EPRI TR-112657 Revision B-A.

2. Bounding and simplified quantitative evaluations - The rupture frequencies from Table A-8 in EPRI TR-111880 (Reference 6.3) were used to assess the risk impacts for all piping segments. The bounding quantitative evaluations conservatively took no credit for the inspection effectiveness (e.g., probability of detection - POD) associated with either the RI-ISI or Section XI based inspection programs. Inspection effectiveness was credited in the simplified quantitative evaluation.

As shown in Tables 3.8-1A and 3.8-1B, risk category 2, as defined in EPRI TR-112657 Revision B-A, is the only high-risk category identified for SONGS Units 2 & 3. Risk category 2 occurs in all systems, which include RCS, CVCS, MSS, SIS, SDCS, and Auxiliary Spray System. For the majority of systems, there is a decrease in the number of inspections required by the proposed RI-ISI program over the current ASME Section XI program for SONGS Units 2 & 3, except for the Auxiliary Spray System and SDCS risk category 2 inspections at Unit 2 and the Auxiliary Spray System, MSS, and SDCS risk category 2 inspections at Unit 3. The risk category 2 inspections for the Auxiliary Spray System remained unchanged and the inspections for the SDCS were increased at SONGS Unit 2. The risk category 2 inspections for the Auxiliary Spray System and MSS were increased and the inspections for SDCS remained unchanged at SONGS Unit 3.

Based on the overall population of risk category 2 welds, the number of inspections decreased under the proposed RI-ISI program.

The medium risk region consists of risk categories 4 and 5. Risk category 4 occurs in all of the systems for SONGS Units 2 and 3, except the Auxiliary Spray System. In each of the applicable systems, the number of risk category 4 inspections decreased under the proposed RI-ISI program over the current ASME Section XI program. Risk category 5 occurs in three systems (RCS, SIS, and SDC) for SONGS Units 2 and 3. For SONGS Unit 2, the number of risk category 5 inspections decreased for SIS and the number of category 5 inspections increased for RCS and SDCS under the proposed RI-ISI program. For SONGS Unit 3, the number of category 5 inspections decreased for RCS and SIS and the number of risk category 5 inspections for SDCS increased under the proposed RI-ISI program.

As discussed in EPRI TR-112657 Revision B-A, the contribution to risk from risk category 6 and 7 locations is negligible. Risk category 6 occurs in four systems (CVCS, AS, SIS, and SDC). No risk category 7 locations were identified.

Tables 3.8-1A and 3.8-1B present a summary of the proposed RI-ISI program versus the current Section XI program. These results of the quantitative risk impact evaluation show that the total change in core damage frequency (CDF) and large early release frequency (LERF) associated with the proposed RI-ISI program satisfy the acceptance guidelines specified in EPRI TR-112657 Revision B-A.

Defense-In-Depth

The intent of the inspections mandated by ASME Section XI for piping welds is to identify conditions such as flaws or indications that may be precursors to leaks or ruptures in a system's pressure boundary. Currently, the process for picking inspection locations is based upon structural discontinuity and stress analysis results. As depicted in ASME White Paper 92-01-01 Revision 1, "Evaluation of Inservice Inspection Requirements for Class 1, Category B-J Pressure Retaining Welds," this method has been ineffective in identifying leaks or failures. EPRI TR-112657 Revision B-A and ASME Code Case N-578 provide a more robust selection process founded on actual service experience with nuclear plant piping failure data.

This process has two key independent ingredients: (1) a determination of each location's susceptibility to degradation and (2) an independent assessment of the consequence of the piping failure. These two ingredients assure defense-in-depth is maintained. First, by evaluating a location's susceptibility to degradation, the likelihood of finding flaws or indications that may be precursors to leak or ruptures is increased. Secondly, the consequence assessment effort has a single failure criterion. As such, no matter how unlikely a failure scenario is, it is ranked High in the consequence assessment, and no lower than Medium in the risk assessment (i.e., Risk Category 4), if, as a result of the failure, there is no mitigative equipment available to respond to the event. In addition, the consequence assessment takes into account equipment reliability, with less credit given to less reliable equipment.

All locations within the reactor coolant pressure boundary will continue to receive a system pressure test and visual VT-2 examination as currently required by the Code regardless of its risk classification.

4.0 IMPLEMENTATION AND MONITORING PROGRAM

Upon approval of the RI-ISI program, SONGS Units 2 & 3 procedures that comply with the guidelines described in EPRI TR-112657 Revision B-A will be prepared to implement and monitor the program. The new program will be integrated into the third ASME Section XI interval. No changes to the Updated Final Safety Analysis Report are necessary for program implementation.

The applicable aspects of the Code not affected by this change would be retained, such as inspection methods, acceptance guidelines, pressure testing, corrective measures, documentation requirements, and quality control requirements. Existing ASME Section XI program implementing procedures would be retained and would be modified to address the RI-ISI process, as appropriate.

The RI-ISI program is a living program requiring feedback of new relevant information to ensure the appropriate identification of high safety significant piping locations. As a minimum, risk ranking of piping segments will be reviewed and adjusted on an ASME period basis. In addition, significant changes may require more frequent adjustment as directed by NRC Bulletin or Generic Letter requirements, or by industry and plant specific feedback.

5.0 PROPOSED ISI PROGRAM CHANGE

The initial program will be started in the first period of the third interval scheduled to start on August 18, 2003. The current second interval, which ends on August 17, 2003, will not be impacted.

6.0 REFERENCES/DOCUMENTATION

6.1 EPRI TR 112657, Rev. B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure," Final Report, December 1999.

6.2 SONGS Units 2 and 3 UFSAR Section 3.6, Revision 13.

6.3 EPRI TR-111880, "Piping System Failure Rates and Rupture Frequencies for Use In Risk Informed In-service Inspection Applications," Final Report, September 1999.

6.4 A-SG2-ST-0001, Rev. 1, "Implementation of the EPRI Risk-Informed Inservice Inspection Evaluation Procedure for Class 1 Piping at SONGS Unit 2," July 2004.

6.5 A-SG3-ST-0001, Rev. 2, "Implementation of the EPRI Risk-Informed Inservice Inspection Evaluation Procedure for Class 1 Piping at SONGS Unit 3," July 2004.

Table 1.2-1

Main Contributors to CDF at SONGS Units 2 and 3

Initiating Event	IE Frequency (Per Year)	CDF (Per Year)	Percent
Turbine Trip with PCS Initially Available (TT)	1.3E+00	1.1E-06	2.7%
Loss of Power Conversion System (PCS)	4.2E-01	2.4E-06	5.8%
Loss of Offsite Power (LOP)	5.4E-02	7.8E-07	1.9%
Main Steam Line/Feedwater Line Break (SLB)	5.4E-04	2.6E-07	0.6%
Large LOCA (LL)	6.5E-05	4.8E-07	1.2%
Medium LOCA (ML)	7.1E-05	3.6E-07	0.9%
Small LOCA (SL)	2.9E-03	9.6E-06	23.3%
Small-Small LOCA (SSL)	1.1E-04	4.5E-09	0.0%
Steam Generator Tube Rupture (SGR)	3.9E-03	4.9E-08	0.1%
Interfacing System LOCA (VL)	3.5E-08	3.5E-08	0.1%
Reactor Pressure Vessel Rupture	2.7E-07	2.7E-07	0.7%
Loss of Component Cooling Water (CCW)	Initiator Fault Tree	9.1E-07	2.2%
Loss of DC Power 125 VDC Bus D1 (LDC1)	8.0E-04	4.5E-08	0.1%
Loss of DC Power 125 VDC Bus D2 (LDC2)	8.0E-04	4.5E-08	0.1%
Loss of Control Room HVAC	Initiator Fault tree	1.4E-06	3.4%
Fire	Area dependent	1.4E-05	33.9%
Internal Flooding	Screened during IPE	Screened during IPE	0.0%
Seismic	Seismic level dependent	9.5E-06	23.0%
Total		4.1E-05	

Table 3.1-1A

System Selection and Element Scope for SONGS Unit 2

System Description	Number of Segments	Number of Elements
Reactor Coolant System (RCS)	64	167
Chemical and Volume Control System (CVCS)	10	54
Main Spray (MS)	8	101
Auxiliary Spray (AS)	3	37
Safety Injection System (SIS)	32	282
Shutdown Cooling System (SDC)	7	38
Total	124	679

Table 3.1-1B

System Selection and Element Scope for SONGS Unit 3

System Description	Number of Segments	Number of Elements
Reactor Coolant System (RCS)	64	162
Chemical and Volume Control System (CVCS)	10	51
Main Spray (MS)	8	88
Auxiliary Spray (AS)	3	44
Safety Injection System (SIS)	32	277
Shutdown Cooling System (SDC)	7	38
Total	124	660

Table 3.3-1

Degradation Mechanism Assessment Summary for SONGS Units 2 and 3

SYSTEM	Thermal Fatigue		Stress Corrosion Cracking				Local Corrosion			Flow Sensitive	
	TT	TASCS	IGSCC	TGSCC	ECSCC	PWSCC	MIC	Pitting	CC	E-Cav	FAC
RCS	X	X				X					
CVCS	X					X					
MS		X				X					
AS	X	X				X					
SIS	X	X				X					
SDC	X	X				X					

Nomenclature:
RCS – Reactor Coolant System, CVCS – Chemical and Volume Control System, MS – Main Spray, AS – Auxiliary Spray, SIS – Safety Injection System, SDC – Shutdown Cooling,

TT – Thermal Transient, TASCS – Thermal Stripping, Cycling and Stratification, IGSCC – Intergranular Stress Corrosion Cracking, TGSCC – Transgranular Stress Corrosion Cracking, ECSCC – External Chloride Stress Corrosion Cracking, PWSCC – Primary Water Stress Corrosion Cracking, MIC – Microbiologically Influenced Corrosion, Pitting – Pitting, CC – Crevice Corrosion Cracking, E-Cav –Cavitation, FAC – Flow Accelerated Corrosion.

Table 3.4-1

Number of Segments by Risk Category (1) for SONGS Units 2 and 3

System	Risk Category 1	Risk Category 2	Risk Category 3	Risk Category 4	Risk Category 5	Risk Category 6	Risk Category 7
RCS	0	36	0	24	4	0	0
CVCS	0	4	0	1	0	5	0
MS	0	4	0	4	0	0	0
AS	0	1	0	0	0	2	0
SIS	0	8	0	2	4	18	0
SDC	0	3	0	2	1	1	0
TOTAL	0	56	0	33	9	26	0

Note 1 – As defined in EPRI TR-112657 Revision B-A, Reference 6.1.

Table 3.4-2A

Number of Welds by Risk Category [1] for SONGS Unit 2

System	Risk Category 1	Risk Category 2	Risk Category 3	Risk Category 4	Risk Category 5	Risk Category 6	Risk Category 7
RCS	0	84	0	75	8	0	0
CVCS	0	8	0	12	0	34	0
MS	0	18	0	83	0	0	0
AS	0	10	0	0	0	27	0
SIS	0	35	0	8	45	194	0
SDC	0	11	0	19	6	2	0
TOTAL	0	166	0	197	59	257	0

Note 1 – As defined in EPRI TR-112657 Revision B-A, Reference 6.1.

Table 3.4-2B

Number of Welds by Risk Category [1] for SONGS Unit 3

System	Risk Category 1	Risk Category 2	Risk Category 3	Risk Category 4	Risk Category 5	Risk Category 6	Risk Category 7
RCS	0	78	0	76	8	0	0
CVCS	0	10	0	12	0	29	0
MS	0	12	0	76	0	0	0
AS	0	10	0	0	0	34	0
SIS	0	40	0	8	38	191	0
SDC	0	11	0	19	6	2	0
TOTAL	0	161	0	191	52	256	0

Note 1 – As defined in EPRI TR-112657 Revision B-A, Reference 6.1.

Table 3.5-1A

Number of Locations/Inspections by Risk Category (1) for SONGS Unit 2

System	Risk Category 2		Risk Category 4		Risk Category 5		Risk Category 6	
	Pop	Insp.	Pop	Insp.	Pop	Insp.	Pop	Insp.
RCS	84	30	75	8	8	1	0	0
CVCS	8	3	12	1	0	0	34	0
MS	18	6	83	9	0	0	0	0
AS	10	3	0	0	0	0	27	0
SIS	35	9	8	2	45	5	194	0
SDC	11	4	19	1	6	1	2	0
TOTAL	166	55	197	21	59	7	257	0

Pop. Population, the number of welds in each risk category
Insp. Inspected, the number of welds in each category selected for inclusion in the RI-ISI program

Note 1 – As defined in EPRI TR-112657 Revision B-A, Reference 6.1.

Table 3.5-1B

Number of Locations/Inspections by Risk Category (1) for SONGS Unit 3

System	Risk Category 2		Risk Category 4		Risk Category 5		Risk Category 6	
	Pop	Insp.	Pop	Insp.	Pop	Insp.	Pop	Insp.
RCS	78	27	76	9	8	1	0	0
CVCS	10	4	12	1	0	0	29	0
MS	12	4	76	9	0	0	0	0
AS	10	3	0	0	0	0	34	0
SIS	40	10	8	1	38	4	191	0
SDC	11	4	19	2	6	1	2	0
TOTAL	161	52	191	22	52	6	256	0

Pop. Population, the number of welds in each risk category
Insp. Inspected, the number of welds in each category selected for inclusion in the RI-ISI program

Note 1 – As defined in EPRI TR-112657 Revision B-A, Reference 6.1.

Table 3.8-1A

Summary of Proposed RI-ISI and ASME Section XI Programs for SONGS Unit 2

System	Risk Category	Consequence Rank	Damage Mechanism	Section XI Exams	RI-ISI Exams	Delta Inspections	Augmented Programs	Qualitative Risk Impact [2]	Quantitative Risk Impact			
									w/o POD		w/POD	
									ΔCDF	ΔLERF	ΔCDF	ΔLERF
RCS	2	HIGH	TT, TASCS, PWSCC	33	30	-3		INCREASE [1]	6.67E-07	2.97E-09	-1.33E-08	-2.09E-09
	4	HIGH	NONE	52	8	-44		INCREASE [1]	7.22E-08	2.73E-10	3.61E-08	1.37E-10
	5	MEDIUM	TT	0	1	1		DECREASE [3]	-8.27E-12	-1.51E-13	-7.45E-12	-1.36E-13
CVCS	2	HIGH	TT, PWSCC	5	3	-2		INCREASE [1]	2.62E-08	4.77E-10	-1.36E-08	-2.48E-10
	4	HIGH	NONE	4	1	-3		INCREASE [1]	5.58E-09	1.02E-10	2.79E-09	5.08E-11
	6	MEDIUM	NONE	14	0	-14		NEGLIGIBLE	2.60E-08	4.74E-10	1.30E-08	2.37E-10
MS	2	HIGH	TASCS	8	6	-2		INCREASE [1]	5.97E-08	2.71E-10	-3.79E-08	-1.72E-10
	4	HIGH	NONE	36	9	-27		INCREASE [1]	4.13E-08	1.88E-10	2.07E-08	9.38E-11
AS	2	HIGH	TT, TASCS, PWSCC	3	3	0		NO CHANGE	0.00E+00	0.00E+00	-1.72E-08	-3.14E-10
	6	MEDIUM	NONE	7	0	-7		NEGLIGIBLE	1.30E-11	2.37E-13	6.51E-12	1.19E-13
SIS	2	HIGH	TASCS, PWSCC	13	9	-4		INCREASE [1]	2.69E-08	1.01E-10	-1.27E-08	-4.77E-11
	4	HIGH	NONE	6	2	-4		INCREASE [1]	1.84E-09	8.36E-12	9.22E-10	4.18E-12
	5	MEDIUM	TASCS	18	5	-13		INCREASE [1]	2.38E-10	7.56E-11	1.65E-11	5.23E-12
	6	MEDIUM	NONE	49	0	-49		NEGLIGIBLE	3.28E-10	1.02E-10	1.64E-10	5.12E-11

Table 3.8-1A (Continued)

Summary of Proposed RI-ISI and ASME Section XI Programs for SONGS Unit 2

System	Risk Category	Consequence Rank	Damage Mechanism	Section XI Exams	RI-ISI Exams	Delta Inspections	Augmented Programs	Qualitative Risk Impact (2)	Quantitative Risk Impact			
									w/o POD		w/POD	
									ΔCDF	ΔLERF	ΔCDF	ΔLERF
SDC	2	HIGH	TT, TASCS, PWSCC	3	4	1		DECREASE (3)	-1.55E-09	-5.81E-12	-1.04E-08	-3.90E-11
	4	HIGH	NONE	5	1	-4		INCREASE (1)	2.68E-09	1.01E-11	1.34E-09	5.04E-12
	5	MEDIUM	TT	0	1	1		DECREASE (3)	-1.55E-09	-5.81E-12	-1.39E-09	-5.23E-12
	6	MEDIUM	NONE	0	0	0		NO CHANGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
			Total	256	83	-173			9.27E-07	5.04E-09	-3.15E-08	-2.33E-09

(1) Increase due to reduced inspections.
(2) Per EPRI TR-112657 Revision B-A, the contribution to risk from Risk Category 6 locations is negligible.
(3) Decrease due to increased inspections.

Table 3.8-1B

Summary of Proposed RI-ISI and ASME Section XI Programs for SONGS Unit 3

System	Risk Category	Consequence Rank	Damage Mechanism	Section XI Exams	RI-ISI Exams	Delta Inspections	Augmented Programs	Qualitative Risk Impact (2)	Quantitative Risk Impact			
									w/o POD		w/POD	
									ΔCDF	ΔLERF	ΔCDF	ΔLERF
RCS	2	HIGH	TT, TASCS, PWSCC	35	27	-8		INCREASE (1)	6.77E-07	3.87E-09	1.40E-08	-1.59E-09
	4	HIGH	NONE	55	9	-46		INCREASE (1)	7.61E-08	3.01E-10	3.80E-08	1.51E-10
	5	MEDIUM	TT	3	1	-2		INCREASE (1)	1.65E-11	3.02E-13	0.00E+00	0.00E+00
CVCS	2	HIGH	TT, PWSCC	8	4	-4		INCREASE (1)	4.53E-08	8.25E-10	-1.36E-08	-2.48E-10
	4	HIGH	NONE	3	1	-2		INCREASE (1)	3.72E-09	6.78E-11	1.86E-09	3.39E-11
	6	MEDIUM	NONE	13	0	-13		NEGLIGIBLE	2.42E-08	4.40E-10	1.21E-08	2.20E-10
MS	2	HIGH	TASCS	3	4	1		DECREASE (3)	-1.26E-08	-5.73E-11	-5.39E-08	-2.44E-10
	4	HIGH	NONE	25	9	-16		INCREASE (1)	3.50E-08	1.59E-10	1.75E-08	7.93E-11
AS	2	HIGH	TT, TASCS, PWSCC	2	3	1		DECREASE (3)	-9.56E-09	-1.74E-10	-2.01E-08	-3.66E-10
	6	MEDIUM	NONE	2	0	-2		NEGLIGIBLE	3.72E-12	6.78E-14	1.86E-12	3.39E-14
SIS	2	HIGH	TASCS, PWSCC	13	10	-3		INCREASE (1)	2.53E-08	9.50E-11	-1.41E-08	-5.29E-11
	4	HIGH	NONE	4	1	-3		INCREASE (1)	1.38E-09	6.27E-12	6.91E-10	3.14E-12
	5	MEDIUM	TASCS	23	4	-19		INCREASE (1)	3.47E-10	1.10E-10	6.03E-11	1.92E-11
	6	MEDIUM	NONE	37	0	-37		NEGLIGIBLE	2.63E-10	8.14E-11	1.32E-10	4.07E-11

Table 3.8-1B (Continued)

Summary of Proposed RI-ISI and ASME Section XI Programs for SONGS Unit 3

System	Risk Category	Consequence Rank	Damage Mechanism	Section XI Exams	RI-ISI Exams	Delta Inspections	Augmented Programs	Qualitative Risk Impact (2)	Quantitative Risk Impact			
									w/o POD		w/POD	
									ΔCDF	ΔLERF	ΔCDF	ΔLERF
SDC	2	HIGH	TT, TASCS, PWSCC	4	4	0		NO CHANGE	0.00E+00	0.00E+00	-9.92E-09	-3.72E-11
	4	HIGH	NONE	7	2	-5		INCREASE (1)	3.35E-09	1.26E-11	1.68E-09	6.29E-12
	5	MEDIUM	TT	0	1	1		DECREASE (3)	-1.55E-09	-5.81E-12	-1.39E-09	-5.23E-12
	6	MEDIUM	NONE	2	0	-2		NEGLIGIBLE	1.34E-09	5.04E-12	6.71E-10	2.52E-12
			Total	239	80	-159			8.69E-07	5.73E-09	-2.63E-08	-1.99E-09

(1) Increase due to reduced inspections.
(2) Per EPRI TR-112657 Revision B-A, the contribution to risk from Risk Category 6 locations is negligible.
(3) Decrease due to increased inspections.

WCAP-15882-NP, Rev. 04
Westinghouse Non-Proprietary Class 3

Westinghouse Electric Company, LLC
20 International Drive
Windsor, Connecticut 06095-0500