April 14, 2005

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, UNITS 2 AND 3 - EVALUATION OF RELIEF FOR RISK-INFORMED INSERVICE INSPECTION PROGRAM (TAC NOS. MC0334 AND MC0335)

Dear Mr. Ray:

By letter dated July 2, 2003, as supplemented by letters dated September 15, 2004, and October 15, 2004, you requested that the U.S. Nuclear Regulatory Commission (NRC) review and approve relief request ISI-3-1 for risk-informed inservice inspection (RI-ISI) selection and examination of Class 1 piping welds at San Onofre Nuclear Generating Station (SONGS), Units 2 and 3. Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i), you proposed your relief request as an acceptable alternative to requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI. The NRC staff has evaluated your requests for relief and reports its findings in the enclosed NRC Safety Evaluation.

The NRC staff concludes that the licensee's relief request ISI-3-1 from the requirements of the ASME Code, Section XI provides an acceptable level of quality and safety, and therefore, is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the third 10-year ISI interval at SONGS, Units 2 and 3.

Sincerely,

/RA by M. Fields for /
Robert A. Gramm, Chief, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-361 and 50-362

Enclosure: Safety Evaluation

cc w/encls: See next page

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

April 14, 2005

SUBJECT: SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3 - EVALUATION OF RELIEF FOR RISK-INFORMED INSERVICE INSPECTION PROGRAM (TAC NOS. MC0334 AND MC0335)

Dear Mr. Ray:

By letter dated July 2, 2003, as supplemented by letters dated September 15, 2004, and October 15, 2004, you requested that the U.S. Nuclear Regulatory Commission (NRC) review and approve relief request ISI-3-1 for risk-informed inservice inspection (RI-ISI) selection and examination of Class 1 piping welds at San Onofre Nuclear Generating Station (SONGS), Units 2 and 3. Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i), you proposed your relief request as an acceptable alternative to requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI. The NRC staff has evaluated your requests for relief and reports its findings in the enclosed NRC Safety Evaluation.

The NRC staff concludes that the licensee's relief request ISI-3-1 from the requirements of the ASME Code, Section XI provides an acceptable level of quality and safety, and therefore, is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the third 10-year ISI interval at SONGS, Units 2 and 3.

Sincerely,
/RA by M. Fields for/
Robert A. Gramm, Chief, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-361 and 50-362
Enclosure: Safety Evaluation
cc w/encls: See next page

DISTRIBUTION:
PUBLIC
RidsNrrLADBaxley
RidsAcrsAcnwMailCenter
RidsRgn4MailCenter (MHay)
ZFu
PDIV-2 r/f
SDinsmore
RidsOgcRp
MRubin
JDixon-Herrity
RidsNrrDlpmLpdiv (HBerkow)
RidsNrrDlpmLpdiv-2 (RGramm)
TChan
MMelnicoff
RidsNrrPmBPham

Accession No: ML051050199 NRR-106

OFFICE	PDIV-2/PM	PDIV/LA	EMCB-B/SC	SPSB-A/SC	OGC	PDIV-2/SC
NAME	BPham	DBaxley	TChan	MRubin	SUttal	MFields for RGramm
DATE	4/7/05	4/6/05	2/28/05	2/25/05	3/14/05	4/14/05

OFFICIAL RECORD COPY

DOCUMENT NAME: E:\Filenet\ML051050199.wpd

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RISK-INFORMED INSERVICE INSPECTION PROGRAM

RELIEF REQUEST ISI-3-1

SOUTHERN CALIFORNIA EDISON

SAN ONOFRE NUCLEAR GENERATING STATION (SONGS), UNITS 2 AND 3

DOCKET NOS. 50-361 AND 50-362

1.0 INTRODUCTION

By letter dated July 2, 2003, as supplemented by letters dated September 15, 2004, and October 15, 2004, Southern California Edison (SCE or the licensee) submitted relief request ISI-3-1 which proposes a risk-informed inservice inspection (RI-ISI) program as an alternative to portions of its current ISI program at SONGS, Units 2 and 3. The scope of the RI-ISI program is only limited to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1 piping, Examination Categories B-F and B-J welds.

The licensee's RI-ISI program was developed in accordance with the methodology contained in the Electric Power Research Institute (EPRI) topical report (TR) EPRI TR-112657, Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure," dated December 1999, which was previously reviewed and approved by the NRC. The licensee proposed the RI-ISI program as an alternative to the requirements in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i). The licensee requests implementation of this alternative during the third 10-year ISI interval at SONGS, Units 2 and 3.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements set forth in the Code to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations of 10 CFR 50.55a(g) also state that ISI of the ASME Code, Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable addenda, except where specific written relief has been granted by the NRC. The objective of the ISI program as described in Section XI of the ASME Code and applicable addenda is to identify conditions (i.e., flaw indications) that are precursors to leaks and ruptures in the pressure boundary of these components that may impact plant safety.

The regulations also require that, during the first 10-year ISI interval and during subsequent intervals, the licensee's ISI program complies with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference into 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The SONGS, Units 2 and 3 began its third 10-year interval on August 18, 2003, using the 1989 Edition edition of Section XI of the ASME Code with no addenda.

According to 10 CFR 50.55a(a)(3), the NRC may authorize alternatives to the requirements of 10 CFR 50.55a(g), if an applicant demonstrates that the proposed alternatives would provide an acceptable level of quality and safety, or that the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment In Risk-Informed Decisions On Plant-Specific Changes to the Licensing Basis," defines the safety principles for an acceptable RI-ISI program as follows:

(1) The proposed change meets current regulations unless it is explicitly related to a requested exemption.

(2) The proposed change is consistent with the defense-in-depth philosophy.

(3) The proposed change maintains sufficient safety margins.

(4) When proposed changes result in an increase in risk, the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement.

(5) The impact of the proposed change should be monitored using performance measurement strategies.

In addition, RG 1.178, "An Approach For Plant-Specific Risk-Informed Decisionmaking - Inservice Inspection of Piping," describes methods acceptable to the NRC staff for integrating insights from probabilistic risk assessment (PRA) techniques with traditional engineering analyses into ISI programs for piping, and addresses risk-informed approaches that are consistent with the basic elements identified in RG 1.174.

The licensee has proposed to use an RI-ISI program for ASME Class 1 piping (Examination Categories B-F and B-J welds) as an alternative to the ASME Code, Section XI requirements. The licensee states that this proposed program was developed using RI-ISI methodology described in EPRI TR-112657. The NRC staff's safety evaluation (SE) of October 28, 1999, approving the methodology described in the TR, concluded that the methodology conforms to guidance provided in RGs 1.174 and 1.178, and that no significant risk increase should be expected from the changes to the ISI program resulting from applying the methodology. The transmittal letter for this SE also stated that an RI-ISI program as described in the TR utilizes a sound technical approach and will provide an acceptable level of quality and safety. It also stated that, pursuant to 10 CFR 50.55a, any RI-ISI program meeting the requirements of the TR provides an acceptable alternative to the piping ISI requirements with regard to (1) the number of locations, (2) the locations of inspections, and (3) the methods of inspection.

3.0 TECHNICAL EVALUATION

Pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff has reviewed and evaluated the licensee's proposed RI-ISI program based on guidance and acceptance criteria provided in the following documents:

- RGs 1.174 and 1.178
- NRC NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Chapter 3.9.8
- EPRI TR-112657 and its NRC SE

3.1 Proposed Changes to the ISI Program

The scope of the licensee's proposed changes to the licensee's ISI program is limited to ASME Code Class 1 piping welds for the following Examination Categories: B-F for pressure retaining dissimilar metal welds in vessel nozzles, and B-J for pressure retaining welds in piping. The RI-ISI program is proposed as an alternative to the existing ISI requirements of the ASME Code, Section XI.

The program changes would result in the number and locations of non-destructive examination (NDE) inspections based on ASME Code Section XI requirements being replaced by the number and locations of these inspections based on RI-ISI guidelines. The ASME Code requires, in part, that for each successive 10-year ISI interval, 100 percent of Category B-F welds and 25 percent of Category B-J welds for the Code Class 1 non-exempt piping be selected for volumetric and/or surface examination based on existing stress analyses and cumulative usage factors. The proposed RI-ISI program for SONGS, Unit 2 selects 83 of 679 Class 1 piping welds for NDE. The proposed RI-ISI program for SONGS, Unit 3 selects 80 of 660 Class 1 piping welds for NDE. The surface examinations required by the ASME Code, Section XI, will be discontinued while system pressure tests and VT-2 visual examinations shall continue. These results are consistent with the concept that, by focusing inspections on the most safety significant welds, the number of inspections can be reduced while at the same time maintaining protection of public health and safety.

The licensee states that none of the augmented piping inspection programs at SONGS, Units 2 and 3 will change as a result of the proposed RI-ISI program.

3.2 Engineering Analysis

In accordance with the guidance provided in RGs 1.174 and 1.178, the licensee provided the results of an engineering analysis of the proposed changes, using a combination of traditional engineering analysis and supporting insights from the PRA. The licensee performed an evaluation to determine the susceptibility of components (i.e., a piping weld) to a particular degradation mechanism that may be a precursor to leak or rupture, and then performed an independent assessment of the consequence of a failure at that location. The results of this analysis assure that the proposed changes are consistent with the principles of defense-in-depth because EPRI TR-112657 methodology requires that the population of welds with high consequences following failure will always have some weld locations inspected regardless of the failure potential. No changes to the evaluation of design-basis accidents in the Updated

Final Safety Analysis Report (UFSAR) are being made by the RI-ISI program. Therefore, sufficient safety margins will be maintained.

3.2.1 Failure Potential

Piping systems within the scope of the RI-ISI program are divided into piping segments. Pipe segments are defined as lengths of pipe whose failure (anywhere within the pipe segment) would lead to the same consequence and which are exposed to the same degradation mechanisms, i.e., some lengths of pipe whose failure would lead to the same consequence may be split into two or more segments when two or more regions are exposed to different degradation mechanisms. The licensee's submittal states that the failure potential assessment, summarized in Table 3.3-1 of the July 2, 2003, submittal, was accomplished utilizing industry failure history, plant-specific failure history, and other relevant information using the guidance provided in the TR.

In Table 3.3-1 of the original July 2, 2003, submittal, the safety injection system (SIS) was not identified as susceptible to thermal transients (TT) or to any sort of stress corrosion cracking (SCC). Nor is the chemical and volume control system (CVCS) identified as susceptible to any sort of SCC. However, in its September 15, 2004, letter, the licensee noted that these systems should have been designated as susceptible to TT and to thermal stratification, cycling, and striping (TASCS). The licensee also indicated that all ASME Code Class 1 systems are susceptible to primary water stress corrosion cracking (PWSCC). This revision in the scope of susceptibility to these degradation mechanisms led to an increase in the number of weld locations to be selected for NDE, as well as a revision to the change in risk calculations.

The NRC staff concludes that the licensee has met the Standard Review Plan (SRP) 3.9.8 guidelines to confirm that a systematic process was used to identify the component's (i.e., pipe segments) susceptibility to common degradation mechanisms, and to categorize these degradation mechanisms into the appropriate degradation categories with respect to their potential to result in a postulated leak or rupture.

3.2.2 Consequence Analysis

The licensee states that 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). Also, the licensee indicated that impact on the above measures due to both direct and indirect effects was considered. Specifically, in its submittal, the licensee notes that all of the in-scope piping is inside containment, and that all indirect effects of pipe breaks inside containment, such as pipe whip, jet impingement, pressurization, temperature excursions, are analyzed as documented in the SONGS, Units 2 and 3 UFSAR. SCE also notes that there are no indirect effects from flooding inside containment. In its July 2, 2003, submittal, the licensee notes that direct effects include loss of coolant initiating events. In its September 15, 2004, letter, the licensee further clarifies that the scope of direct effects also includes the loss or degradation of one or more trains of affected mitigating systems, depending upon the location of the postulated pipe break. The licensee reports no deviations from the approved consequence evaluation guidance provided in the TR. Therefore, the NRC staff considers the consequence analysis performed by the licensee for this application to be acceptable.

3.2.3 PRA

As stated in the July 2, 2003, submittal, the licensee used the SONGS, Units 2 and 3 living PRA for evaluation of the consequences of pipe ruptures. In its September 15, 2004, letter, the licensee states that it updates the PRA "continuously," and that the specific PRA model used for this application is dated October 2, 2001. The licensee indicates in its submittal that the scope of its internal events PRA covers both Level 1 and Level 2 consequences, and addresses accidents initiated both at full power and at shutdown.

The licensee states that the baseline core damage frequency (CDF) estimated from its PRA model is 4.1E-05/yr, and that the estimated baseline large early release frequency (LERF) is 1.4E-06/yr.

3.2.3.1 Staff/Industry Review of the PRA

The original SONGS, Units 2 and 3 individual plant examination (IPE) was submitted to the NRC in April 1993. The IPE estimated a CDF of 3E-05/yr. The NRC's evaluation of the IPE, dated December 28, 1995, did not identify any significant weaknesses with it, and concluded that the IPE met the intent of Generic Letter 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities."

The licensee states in its July 2, 2003, submittal that the Level 1 and Level 2 PRAs for both full power and shutdown operations were subjected to a comprehensive, independent peer review between August 1996 and April 1997. The review was based primarily on the guidance provided in the PRA procedure guides such as NUREG/CR-2300 "PRA Procedures Guide: a Guide to The Performance of Probabilistic Risk Assessments for Nuclear Power Plants" and NUREG/CR4550 "Analysis of Core Damage Frequency: Internal Events Methodology," as well as PRA application documents such as EPRI TR-105396 "PRA Applications Guide" and NUREG-1489 "A Review of NRC Staff Uses of Probabilistic Risk Assessment." All comments were entered in the SONGS PRA Punch List database for review and disposition. In its submittal, the licensee notes that each item in this Punch List was assigned a priority from 1 through 10, with items 7 through 10 being essentially equivalent to an A or B level Fact and Observation (F&O) based on F&O level definitions described in the various nuclear plant owners' groups' peer review guidance documents and in the Nuclear Energy Institute (NEI) 00-02 "Probabilistic Risk Assessment (PRA) Peer Review Process Guidance." The licensee states that all of the Priority 7 through 10 Punch List items have been resolved and incorporated into the SONGS PRA model.

The licensee states in the submittal that, in February 2002, Westinghouse performed a pre-owners' group certification evaluation, using the Combustion Engineering Owners Group (CEOG) Peer Certification Guidance document, as well as the high-level requirements of the current draft of the ASME standard. Westinghouse concluded that the PRA is adequate for supporting ASME Category II applications, including ISI.

In response to an NRC staff question about the CEOG Peer Certification of the SONGS, Units 2 and 3 PRA, the licensee states in its September 15, 2004, letter, that a CEOG Peer Review was conducted in June 2003, using the published ASME PRA standard. However, a list of the F&Os from that review was not available until after the July 2, 2003, submittal was transmitted to the NRC. The licensee provided a copy of this list with its September 15, 2004, letter. For each F&O on the list, the licensee documents its assessment of the F&O's impact on this application. All were found to have negligible impact. The staff reviewed this list with the assessments of the F&O's impacts, and finds the licensee's assessments to be reasonable.

The NRC staff concludes that the licensee has adequately demonstrated that comments from the two industry peer reviews (there were no significant comments from the staff's review of the IPE) of the SONGS, Units 2 and 3 PRA which have not yet been incorporated into the PRA will not measurably affect this RI-ISI application. The NRC staff did not review the October 2, 2001, PRA models to assess the accuracy of their quantitative estimates. The NRC staff recognizes that the quantitative results of the PRA model are used as order of magnitude estimates to support the assignment of segments into three broad consequence categories. Inaccuracies in the models or in assumptions large enough to invalidate the broad categorizations developed to support the RI-ISI should have been identified during the NRC staff's review of the IPE, and by the licensee's model update control program that included peer review/certification of the PRA model. Minor errors or inappropriate assumptions will affect only the consequence categorization of a few segments and will not invalidate the general results or conclusions.

3.2.3.2 Change in Risk

As required by Section 3.7 of EPRI TR-112657, the licensee evaluated the expected change in risk resulting from replacing the current ISI program with the RI-ISI program. The calculations estimated the change in risk due to removing and adding locations to the ISI program.

In its July 2, 2003, submittal, the licensee states that the expected change in risk was both qualitatively and quantitatively evaluated per Section 3.7 of the TR.

For the qualitative evaluation, the licensee states that it has considered (1) the potential for risk impacts for each pipe segment due to increases and decreases in the number of examinations, and (2) 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.

For the quantitative evaluation, the licensee states that it has employed a conservative approach, using rupture frequencies from Table A-8 of EPRI TR-111880, "Piping System Failure Rates and Rupture Frequencies for Use In Risk Informed In-Service Inspection Applications," dated September 1999, taking no credit for the differences in the probability of detection (POD) expected by the current ASME Section XI NDE techniques as compared to those expected when using the techniques prescribed in the TR. Calculated results were then evaluated using the decision criteria described in Figure 3-6 of EPRI TR-112657.

In its July 2, 2003, submittal, the licensee provides results of this bounding analysis (without taking credit for an increased POD), as summarized in the table below:

Unit	Change in CDF		Change in LERF	
	With Increased POD	Without Increased POD	With Increased POD	Without Increased POD
Unit 2	NA	4.79E-07/yr	NA	3.39E-09/yr
Unit 3	NA	4.24E-07/yr	NA	4.45E-09/yr

The change of risk evaluation results also indicate that the change in CDF (ªCDF) for the RCS exceeded the system level guidelines of 1.0E-07/yr, and therefore, the decision criteria of Figure 3-6 (also specified on page 3-85) of EPRI TR-112657 was exceeded. A more detailed evaluation, discussed below, indicates that the system level guidelines value of 1.0E-07/yr is not exceeded.

In its September 15, 2004, letter, the licensee explains that the change in risk analyses were refined using the "Simplified Risk Quantification Method" described in Section 3.7 of EPRI TR-112657. This method credits the enhanced inspection effectiveness associated with using RI-ISI inspection techniques by adjusting the PODs of NDEs performed under the RI-ISI program, relative to those performed under the current ASME Section XI program. The licensee discusses the equation used to calculate the change in risk between the current ASME Section XI program and the RI-ISI program, and points out that it employs POD values similar to those approved for use in the pilot RI-ISI applications at Arkansas Nuclear One Unit 2 (ANO-2) and Vermont Yankee. The NRC staff finds the equation used to be correct, and that the assumed values for POD are consistent with those used in the pilot RI-ISI applications, and therefore, acceptable. In addition, the licensee states that it again uses rupture frequencies from Table
A-8 of EPRI TR-111880. The NRC staff notes that these frequencies are greater than (i.e., conservative with respect to) the frequencies used in the pilot RI-ISI applications at ANO-2 and at Vermont Yankee.

In addition, the licensee explains that the conditional core damage probabilities (CCDPs) and conditional large early release probabilities (CLERPs) were taken from the PRA model and is tabularized in Table 9-1 of its September 15, 2004, letter. These CCDP and CLERP values are consistent with those approved in EPRI TR-112657, which states on page 3-86 that, "These CCDP values can be bounded by using the upper bound of the consequence range, e.g., medium consequence locations would be assigned a value of 10^{-4}, or estimated from the plant-specific PSA. If one substitutes $CLERP_j$ representing the conditional probability of a large early release for $CCDP_j$ in the above Equation (3-9), the change in large early release frequency due to inspection program changes can be determined."

By using these refinements, the licensee provides results of this analysis in WCAP-15882-NP Revision 04, which is replicated in the table below:

Unit	Change in CDF		Change in LERF	
	With Increased POD	Without Increased POD	With Increased POD	Without Increased POD
Unit 2	-3.15E-08/yr	9.27E-07/yr	-2.33E-09/yr	5.04E-09/yr
Unit 3	-2.63E-08/yr	8.69E-07/yr	-1.99E-09/yr	5.73E-09/yr

The licensee notes that the “Without Increased POD” results (i.e., the bounding estimates for ªCDF and ªLERF) increased in the September 15, 2004, update, relative to estimates in the July 2, 2003, submittal because of the identification of PWSCC susceptibility in all Class 1 systems, which ultimately led to an increase in the number of Category 2 (high risk) welds. Per EPRI TR-111880, the rupture frequency for PWSCC is considerably higher than for the only other damage mechanism identified at SONGS–thermal fatigue. This directly contributes to an increase in ªCDF and ªLERF when the risk-related benefits of the RI-ISI NDE methodology (reflected in POD values) are not taken into consideration. But, by taking these benefits into consideration, the licensee demonstrates a net overall reduction in risk, and that no individual system’s CDF or LERF increases more than 1E-07/yr or 1E-08/yr respectively due to the transition from the current ASME Section XI ISI to the RI-IS program, meeting the guidelines specified in EPRI TR-112657.

The NRC staff finds the licensee's process to evaluate and bound the potential change in risk reasonable because it (1) accounts for the change in the number and location of elements inspected, (2) recognizes the differences in degradation mechanisms related to failure likelihood, and (3) considers the synergistic effects of multiple degradation mechanisms within the same piping segment. System level and aggregate estimates of the changes in CDF and LERF are less than the corresponding guideline values in the TR. The NRC staff finds that re-distributing the welds to be inspected with consideration of the safety significance of the segments provides assurance that segments whose failure have a significant impact on plant risk receive an acceptable and often improved level of inspection. Therefore, the NRC staff concludes that the implementation of the RI-ISI program, as described in the licensee’s submittal, will have a small impact on risk consistent with the guidelines of RG 1.174.

3.2.4 Integrated Decisionmaking

The licensee used an integrated approach in defining the proposed RI-ISI program by considering in concert the traditional engineering analysis, the risk evaluation, the implementation of the RI-ISI program, and performance monitoring of piping degradation. This is consistent with the guidelines given in RG 1.178 and is, therefore, acceptable.

3.2.4.1 Risk Characterization

The licensee states in its July 2, 2003, submittal that pipe segments (and ultimately the elements within, which are defined as all having the same degradation susceptibility) are ranked in accordance with definitions given in the TR and is therefore acceptable.

3.2.4.2 Selection of Element Population for Inspection

By indicating that EPRI TR-112657 requires that 25 percent of the locations in high risk regions and that 10 percent of the locations in medium risk regions must be selected for NDE, the licensee has opted to use the element selection guidance provided in EPRI TR-112657 under Section 3.6.4.2 “ASME Code Case–578.” The NRC staff notes that the specific requirement in the TR requires that at least 25 percent of the locations in each high risk category and that at least 10 percent of the locations in each medium risk category must be selected for NDE.

The licensee provides detailed information on the results of the evaluation in the following tables of its submittal:

- Tables 3.1-1A and 3.1-1B identify on a per system basis, the number of segments and number of elements (welds) for Units 2 and 3, respectively.

- Table 3.3-1 provides the degradation mechanism assessment summary for Units 2 and 3.

- Tables 3.4-1 identifies on a per system basis, the number of segments by risk category for Units 2 and 3.

- Tables 3.4-2A and 3.4-2B identify on a per system basis, the number of elements (welds) by risk category for Units 2 and 3, respectively.

- Tables 3.5-1A and 3.5-1B identify on a per system basis, the number of inspection locations by risk category for Units 2 and 3, respectively.

- Tables 3.8-1A and 3.8-1B provide the risk impact analysis results for each system, as well as a summary comparing the number of inspections required under the 1995 ASME Code, Section XI, ISI program with the alternative RI-ISI program, for Units 2 and 3 respectively.

In reviewing the tables above, both in the submittal and in the final program described in WCAP-15882-NP, Revision 04, the NRC staff concludes that EPRI TR-112657's requirement that at least 25 percent of the locations in each high risk category, and that at least 10 percent of the locations in each medium risk category must be selected for NDE has been met.

In its July 2, 2003, submittal, the licensee reported that approximately 11 percent of Class 1 piping welds were selected for RI-ISI NDEs, for both units. Because of the additional welds selected for NDE in order to monitor for PWSCC, the ISI program’s final form, as represented in WCAP-15882-NP, Revision 04, shows that approximately 12 percent of Class 1 piping welds are now selected for RI-ISI NDEs, for both units. Section 3.6.4.2 of EPRI TR-112657 states that if the percentage of Class 1 piping locations selected for examination falls substantially below 10 percent, then the basis for selection needs to be investigated. The licensee has met this expectation of the TR, and no investigation is required.

Based on the NRC staff's review of the above tables (containing the results of element selection), the staff concludes that the element selection results are consistent with the described process and with EPRI TR-112657 guidelines. Hence, the licensee's selection of element locations, which includes consideration of degradation mechanisms in addition to those covered by augmented inspection programs, is judged to be acceptable.

The NRC staff observed that, in the July 2, 2003, submittal, a low ratio of bimetallic welds were selected. In response to the staff's questions, the licensee revised its selection as documented in WCAP-15882-NP, Revision 04. The licensee identified a total of 38 bimetallic welds in each of the units, among which 18 were selected for NDE in order to monitor for the effects of PWSCC. The staff finds this acceptable, as the number and percentage of welds selected are reflective of the weld population, and are adequately high compared to the original submittal.

3.2.4.3 Examination Methods

As noted in Section 2.0 of this SE, the objective of ISI is to identify conditions (i.e., flaw indications) that are precursors to leaks and ruptures in the pressure boundary that may impact plant safety. To meet this objective, the RI location selection process, per EPRI TR-112657, employs an "inspection for cause" approach. To address this approach, Section 4 of the same TR provides guidelines for the areas and/or volumes to be inspected, as well as the examination method, acceptance standard, and evaluation standard for each degradation mechanism. Based on its review and acceptance of the TR, the NRC staff concluded that these examination methods are appropriate since they are selected based on specific degradation mechanisms, pipe sizes, and materials of concern. The licensee states that Section 4 of the TR was used as guidance in determining the examination methods and requirements for these locations.

Based on these considerations, the NRC staff concludes that the licensee's determination of examination methods is acceptable.

3.2.4.4 Relief Requests for Examination Locations and Methods

As required by Section 6.4 of EPRI TR-112657, the licensee has completed an evaluation of existing relief requests to determine if any should be withdrawn or modified due to changes that occur from implementing the RI-ISI program, and found that no relief requests were required to be withdrawn.

The licensee states that any examination location where greater than 90 percent volumetric coverage cannot be obtained, the process outlined in EPRI TR-112657 will be followed. The NRC staff finds that the licensee's proposed treatment of existing relief requests to be acceptable.

3.2.5 Implementation and Monitoring

Implementation and performance monitoring strategies require careful consideration by the licensee and are addressed in Element 3 of RG 1.178 and the SRP 3.9.8. The objective of Element 3 is to assess performance of the affected piping systems under the proposed RI-ISI program by utilizing monitoring strategies that confirm the assumptions and analyses used in the development of the RI-ISI program. Pursuant to 10 CFR 50.55a(a)(3)(i), a proposed alternative, in this case the implementation of the RI-ISI program, including inspection scope, examination methods, and methods of evaluation of examination results, must provide an acceptable level of quality and safety.

The licensee states that upon approval of the RI-ISI program, procedures that comply with EPRI TR-112657 guidelines will be prepared to implement and monitor the RI-ISI program. The licensee states in its submittal that the applicable aspects of the ASME Code not affected by the proposed RI-ISI program would be retained.

The licensee indicates in Section 4 of the July 2, 2003, submittal that the RI-ISI program is a living program and its implementation will require feedback of new relevant information to ensure the appropriate identification of safety significant piping locations. The licensee also states that, as a minimum, risk ranking of piping segments will be reviewed and adjusted on an ASME period basis and that significant changes may require more frequent adjustment as directed by NRC Bulletin or Generic Letter requirements, or by industry and plant-specific feedback. This periodic review and adjustment of the risk-ranking of segments ensure that changes to the PRA that the licensee will make to incorporate the peer review results will also be incorporated into the RI-ISI program as necessary.

The licensee addresses additional examinations in Section 3.6 of the July 2, 2003, submittal, which states that examinations performed that reveal flaws or relevant conditions exceeding the applicable acceptance standards shall be extended to include additional examinations. These additional examinations shall include piping structural elements with the same postulated failure mode and the same or higher failure potential. Additional examinations will be performed on these elements up to a number equivalent to the number of elements initially required to be inspected. If the additional required examinations reveal flaws or relevant conditions exceeding the acceptance standards, the examinations shall be further extended to include all elements subject to the same failure mechanism, throughout the scope of the program. In its September 15, 2004, letter, the licensee clarifies that these additional examinations will be completed during the same outage that flaws or conditions were identified in. The staff finds the licensee’s approach acceptable since the additional examinations, if required, will be performed during the outage that the indications or relevant conditions are identified.

The NRC staff finds that the proposed process for RI-ISI program implementation, monitoring, feedback, and update meets the guidelines of RG 1.174 which states that risk-informed applications should include performance monitoring and feedback provisions. Hence, the licensee’s proposed process for program implementation, monitoring, feedback, and update is judged to be acceptable.

4.0 CONCLUSIONS

Pursuant to 10 CFR 50.55a(a)(3)(i), alternatives to the requirements of 10 CFR 50.55a(g) may be used, when authorized by the NRC, if the licensee demonstrates that the proposed alternatives will provide an acceptable level of quality and safety. In this case, the licensee has proposed an alternative to use the risk-informed process described in NRC-approved EPRI

TR-112657.

RG 1.174 establishes requirements for risk-informed decisions involving a change to a plant's licensing basis. RG 1.178 establishes requirements for risk-informed decisions involving alternatives to the requirements of 10 CFR 50.55a(g) (ISI program requirements), and its directive to follow the requirements of the ASME Code, Section XI. These two RGs, taken together, define the elements of an integrated decisionmaking process that assesses the level of quality and safety embodied in a proposed change to the ISI program. RI-ISI methodology in EPRI TR-112567 contains the necessary details for implementing this process. This methodology provides for a systematic identification of safety-significant pipe segments, for a determination of where inspections should occur within these segments (i.e., identification of locations), and for a determination how these locations will be inspected. Such segments/locations are characterized as having active degradation mechanisms, and/or whose failure would be expected to result in a significant challenge to safety (either immediately by initiating an event or later on in response to an unrelated event).

The methodology in EPRI TR-112657 also provides for implementation and performance monitoring strategies to insure a proper transition from the current ISI program, and to assure that changes in plant performance, and new information from the industry and/or from the NRC, is incorporated into the licensee's ISI program as needed.

Other aspects of the licensee's ISI program, such as system pressure tests and visual examination of piping structural elements will continue to be performed on all Class 1, 2, and 3 systems in accordance with ASME Code, Section XI. This provides a measure of continued monitoring of areas that are being eliminated from the NDE portion of the ISI program. As required by EPRI TR-112657 methodology, the existing ASME Code performance measurement strategies will remain in place. In addition, EPRI TR-112657 methodology provides for increased inspection volumes for those locations that are included in the NDE portion of the program.

The NRC staff concludes that the licensee's development of its RI-ISI program is consistent with the methodology described in the TR. Hence, the NRC staff concludes that the licensee's proposed program which is consistent with the methodology as described in the TR, will provide an acceptable level of quality and safety pursuant to 10 CFR 50.55a(a)(3)(i) for the proposed alternative to the piping ISI requirements with regard to (1) the number of locations, (2) the locations of inspections, and (3) the methods of inspection.

The NRC staff concludes that the licensee's proposed RI-ISI program is an acceptable alternative to the current ISI program for Class 1 piping welds at SONGS, Units 2 and 3. Therefore, the proposed RI-ISI program is authorized for the third 10-year ISI interval pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that this alternative will provide an acceptable level of quality and safety.

Principal Contributors: M. Melnicoff
Z. Bart Fu

Date: April 14, 2005