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A. Edward Scherer
Manager of
Nuclear Regulatory Affairs

July 2, 2003

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

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

Reference: Letter from A. E. Scherer (SCE) to the Document Control Desk (NRC) dated January 24, 2003; Subject: Docket Nos. 50-361 and 50-362, Mechanical Nozzle Seal Assembly Type 2 Code Replacement, Request for Relief from 10 CFR 50.55a, San Onofre Nuclear Generating Station, Units 2 and 3

Dear Sir or Madam:

Enclosed for your review and approval are relief requests in accordance with 10CFR50.55a, associated with the Third Ten-Year Interval Inservice Inspection (ISI) Program for San Onofre Nuclear Generating Station (SONGS) Units 2 and 3. Based on a start date of August 18, 2003, the SONGS ISI program for Class 1, 2, and 3 components is required by 10CFR50.55a(g)(4)(ii) to comply with the requirements of the 1995 Edition (including the 1996 Addenda) of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI.

Southern California Edison (SCE) requests approval of these relief requests by February 2004, in support of the Unit 2 Cycle 13 refueling outage; this is the first outage of the third ten-year ISI interval.

Enclosed relief request, ISI-3-7, is similar to relief request MNSA-2-Cycle 12, which was submitted to the NRC on January 24, 2003 (Reference). In the event SCE does not need to install a MNSA-2 prior to August 17, 2003, SCE will withdraw the January 24, 2003, Relief Request, MNSA-2-Cycle 12.

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A047

The SONGS Containment Inspection Program (ASME Subsection IWE and Subsection IWL) is being maintained in accordance with 50.55a(b)(2)(vi). The SONGS Containment Inspection Program meets the 1992 Edition with the 1992 Addenda of the ASME Code, as modified and supplemented by 10CFR50.55a(b)(2)(viii) and 10CFR50.55a(b)(2)(ix). The initial 120-month inspection interval for the Containment ISI began September 9, 1998, and will end on September 8, 2008.

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

Sincerely,

Enclosure 1	Relief Request ISI-3-1 Attachment WCAP-15882-NP Revision 3
Enclosure 2	Relief Request ISI-3-2
Enclosure 3	Relief Request ISI-3-3
Enclosure 4	Relief Request ISI-3-4
Enclosure 5	Relief Request ISI-3-5 Attachment Supplemental Information provided by the Performance Demonstration Initiative
Enclosure 6	Relief Request ISI-3-6
Enclosure 7	Relief Request ISI-3-7

cc: T. P. Gwynn, Acting 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 & 3

Enclosure 1

San Onofre Nuclear Generating Station Units 2 and 3, Relief Request ISI-3-1 Risk-Informed Inservice Inspection Selection And Examination of Class 1 Piping Welds

New Request

Proposed Alternative
In Accordance with 10 CFR 50.55a(a)(3)(I)

Alternative Provides Acceptable level of Quality and Safety

1.0 ASME Code Components Affected

ASME Section XI, Class 1, Examination Category B-F and B-J, Examination Item Numbers B5.40, B9.11, B9.21, B9.31, and B9.32, pressure retaining dissimilar metal welds and pressure retaining welds in piping.

2.0 Applicable Code Edition and Addenda

Rules for Inservice Inspection of Nuclear Power Plant Components, Section XI, 1995 Edition, 1996 Addenda.

3.0 Applicable Code Requirement

Table IWB 2500-1, Examination Category B-F, item B5.40, requires a volumetric and surface examination on all welds.

Table IWB 2500-1, Examination Category B-J, requires a volumetric and surface examination for items B9.11 and B9.31 and a surface exam for items B9.21 and B9.32, for those welds selected per the following:

a. All terminal end welds in each pipe or branch run connected to vessels.

b. All terminal end welds and joints in each pipe or branch run connected to other components where the stress levels exceed either of the following limits under loads associated with specific seismic events and operational conditions.

   (1) Primary plus secondary stress intensity range of 2.4S for ferritic steel and austenitic steel.

   (2) Cumulative usage factor *U* of 0.4.

c. All dissimilar metal welds not covered under Category B-F

d. Additional piping welds so that the total number of circumferential butt welds (or branch connection or socket welds) selected for examination equals 25% of the circumferential butt welds (or branch connection or socket welds) in the reactor coolant piping system. This total does not include welds excluded by IWB-1220. These additional welds may be located in one loop (one loop is defined for both PWR and BWR plants in the 1977 Edition).

4.0 Reason for Request

Pursuant to 10 CFR 50.55a(a)(3)(i), relief is requested on the basis that the proposed alternative would provide an acceptable level of quality and safety.

In Reference 2, the NRC concludes that the proposed Risk-Informed Inservice Inspection program as described in EPRI TR-112657, Revision B, is a sound technical approach and will provide an acceptable level of quality and safety pursuant to 10 CFR 50.55a for the proposed alternative to the piping inservice inspection requirements with regard to the number of locations, locations of inspections, and methods of inspection.

5.0 Proposed Alternative and Basis for Use

The proposed alternative, as described in Reference 1, "San Onofre Nuclear Generating Station (SONGS) Units 2 and 3, Risk-Informed Inservice Inspection Program Evaluation WCAP-15882-NP Revision 03, April 2003," (Attached) provides an acceptable level of quality and safety as required by 10 CFR 50.55a(a)(3)(i).

Although 2001 SONGS plant specific PRA data were used to develop WCAP-15882-NP Revision 03, SCE has confirmed that results using the current living PRA plant data are bounded by WCAP-15882-NP Revision 03.

SONGS application of the Risk-Informed Inservice Inspection Plan, per the EPRI Topical Report, Reference 2, requires that 25% of the elements that are categorized as "High" risk (Risk Category 1, 2, or 3 as applicable) and 10% of the elements that are categorized as "Medium" risk (Risk Categories 4 and 5) be selected for inspection. The EPRI Topical Report (Reference 1) provides the examination schedule and the guidance for the examination volume for a given degradation mechanism for this application.

In addition, all piping components, regardless of risk classification, will continue to receive ASME Code-required pressure and leak testing, as part of the current ASME Section XI program. Visual examinations (VT-2) are scheduled in accordance with the SONGS pressure and leak test program, which remains unaffected by the Risk - Informed Inservice Inspection Program.

In Reference 3, the NRC concludes that the proposed Risk-Informed Inservice Inspection program as described in EPRI TR-112657, Revision B, is a sound technical approach and will provide an acceptable level of quality and safety pursuant to 10 CFR 50.55a for the proposed alternative to the piping inservice inspection requirements with regard to the number of locations, locations of inspections, and methods of inspection.

6.0 Duration of Proposed Alternative

Relief is requested for the third ten-year inspection interval of the Inservice Inspection Program for SONGS Unit 2 and Unit 3 scheduled to start on August 18, 2003.

7.0 Precedents

February 5, 2002, approval of Relief Request I2R-40 for Application of Risk-Informed Inservice Inspection Program as an alternative to the ASME Boiler and Pressure Vessel Code Section XI Requirements for Class 1 and Class 2 piping welds for Byron Station, Units 1 and 2 (TAC Nos. MB0567 and MB 0568)

January 17, 2003, approval of Application of Risk-Informed Inservice Inspection Program as an alternative to the ASME Boiler and Pressure Vessel Code Section XI Requirements for Class 1 and Class 2 piping welds for Duane Arnold Energy Center (TAC No. MB4751)

March 3, 2003, approval of Relief Request RR-32 for Application of Risk-Informed Inservice Inspection Program as an alternative to the ASME Boiler and Pressure Vessel Code Section XI Requirements for Class 1 and Class 2 piping welds for Limerick Generating Station, Units 1 and 2 (TAC Nos. MB4633 and MB4634)

8.0 References

1. San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 Risk-Informed Inservice Inspection Program Evaluation, WCAP-15882-NP, Revision 03, April 2003

2. W. H. Bateman (U.S. NRC) to G.L. Vine (EPRI) letter dated October 28, 1999 transmitting "Safety Evaluation Report Related to EPRI Risk-Informed Inservice Inspection Evaluation Procedure (EPRI TR-11657, Revision B, July 1999)"

3. Electric Power Research Institute (EPRI) Topical Report (TR) 112657 Rev. B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure"

Enclosure 1

Attachment

San Onofre Nuclear Generating Station (SONGS) Units 2 and 3, Risk-Informed Inservice Inspection Program Evaluation WCAP-15882-NP Revision 03
April 2003

Westinghouse Non-Proprietary Class 3

WCAP-15882-NP
Revision 03

April 2003

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

Westinghouse

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WCAP–15882-NP, Rev. 03

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

April 2003

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Probabilistic Safety Analysis

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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. In both reviews, it was concluded that the SONGS Units 2 & 3 PRA was adequate to support ASME category II applications, which includes risk-informed in-service testing.

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 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/post-

accident 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 73 welds (~11%) were subsequently selected for inclusion in the RI-ISI program inspection population. These welds are distributed among risk categories 2, 4, and 5.

Thermal transients (TT), thermal stratification, cycling and striping (TASCS), and primary water stress corrosion cracking (PWSCC) degradation mechanisms were identified in the eighteen risk category 2 segments for the Reactor Coolant System (RCS). Twenty risk category 2 welds were selected from these segments. The bimetallic welds between the A600 nozzles and the stainless steel graylock flanges were considered especially vulnerable to PWSCC. Hence two of the bimetallic risk category 2 welds were selected. The remaining eighteen risk category 2 welds

were selected for locations considered vulnerable to either TT or TASCS. Eleven risk category 4 welds were selected from the twenty-four risk category 4 segments for the RCS.

TT was the only degradation mechanism identified in the two risk category 2 segments for the Chemical and Volume Control System (CVCS). Two risk category 2 welds were selected from these segments. Two risk category 4 welds were selected from the one risk category 4 segment that was identified for this system.

TASCS was the only degradation mechanism identified in the one risk category 2 segment for the Main Spray System (MSS). Four risk category 2 welds were selected from this segment. 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.

TASCS was the only degradation mechanism identified in the four risk category 2 segments for the Safety Injection System (SIS). Nine risk category 2 welds were selected from these segments. 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. Seven risk category 5 welds were selected from the four risk category 5 segments for this system.

TASCS was the only degradation mechanism identified in the two risk category 2 segments for the Shutdown Cooling System (SDCS). Three risk category 2 welds were selected from these segments. Two risk category 4 welds were also selected from the two risk category 4 segments that were identified for this system. TT was the only degradation mechanism identified for the risk category 5 segment for this system. No risk category 5 welds were selected.

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 69 welds (~11%) were subsequently selected for inclusion in the RI-ISI program inspection population. These welds are distributed among risk categories 2, 4, and 5.

TT, TASCS, and PWSCC were the degradation mechanisms identified in the eighteen risk category 2 segments for the RCS. Nineteen risk category 2 welds were selected from these segments. The bimetallic welds between the A600 nozzles and the stainless steel graylock flanges were considered especially vulnerable to PWSCC. Hence two of the bimetallic risk category 2 welds were selected. The remaining seventeen risk category 2 welds were selected for locations considered vulnerable to either TT or TASCS. Eleven risk category 4 welds were selected from the twenty-four risk category 4 segments for the RCS.

TT was the only degradation mechanism identified in the two risk category 2 segments for the CVCS. Three risk category 2 welds were selected from these segments. One risk category 4 weld was selected from the one risk category 4 segment that was identified for this system.

TASCS was the only degradation mechanism identified in one risk category 2 segment for the MSS. Three risk category 2 welds were selected from this segment. 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.

TASCS was the only degradation mechanism identified in the four risk category 2 segments for the SIS. Seven risk category 2 welds were selected from these segments. Three 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. Six risk category 5 welds were selected from the four risk category 5 segments for this system.

TASCS was the only degradation mechanism identified in the two risk category 2 segments for the SDCS. Three risk category 2 welds were selected from these segments. Two risk category 4 welds were also selected from two risk category 4 segments that were identified for this system. TT was the only degradation mechanism identified for the risk category 5 segment for this system. No risk category 5 welds were selected.

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 of the potential for risk impacts 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. A conservative quantitative evaluation of the risk impacts for all pipe segments using rupture frequencies from Table A-8 in EPRI TR-111880 (Reference 6.3). No credit was taken for the inspection effectiveness (e.g., probability of detection - POD) associated with either the RI-ISI or Section XI based inspection programs. Also, the evaluation included a consideration for the possible effects of synergy between different damage mechanisms for segments found to be susceptible to two or more ISI amenable damage mechanisms.

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. In all of the systems, there is a decrease in the number of inspections required by the proposed RI-ISI program over the current ASME Section XI program, except for the MSS risk category 2 inspections at Unit 3. For MSS risk category 2 at Unit 3, there is an increase in the number of inspections required by 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, except AS. Risk category 5 occurs in three systems (RCS, SIS, and SDC). In each of the applicable systems for risk categories 4 and 5, there is a decrease in the number of inspections required by the proposed RI-ISI program over the current ASME Section XI 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. 0, "Implementation of the EPRI Risk-Informed Inservice Inspection Evaluation Procedure for Class 1 Piping at SONGS Unit 2," August 26, 2002.

6.5 A-SG3-ST-0001, Rev. 1, "Implementation of the EPRI Risk-Informed Inservice Inspection Evaluation Procedure for Class 1 Piping at SONGS Unit 3," January 7, 2003.

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)	46	167
Chemical and Volume Control System (CVCS)	8	54
Main Spray (MS)	5	101
Auxiliary Spray (AS)	3	37
Safety Injection System (SIS)	28	282
Shutdown Cooling System (SDC)	6	38
Total	96	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)	46	162
Chemical and Volume Control System (CVCS)	8	51
Main Spray (MS)	5	88
Auxiliary Spray (AS)	3	44
Safety Injection System (SIS)	28	277
Shutdown Cooling System (SDC)	6	38
Total	96	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										
MS		X									
AS	X	X									
SIS		X									
SDC	X	X									

<u>Nomenclature:</u>
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	18	0	24	4	0	0
CVCS	0	2	0	1	0	5	0
MS	0	1	0	4	0	0	0
AS	0	1	0	0	0	2	0
SIS	0	4	0	2	4	18	0
SDC	0	2	0	2	1	1	0
TOTAL	0	28	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	73	0	86	8	0	0
CVCS	0	8	0	12	0	34	0
MS	0	16	0	85	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	153	0	210	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	67	0	87	8	0	0
CVCS	0	10	0	12	0	29	0
MS	0	10	0	78	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	148	0	204	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	73	20	86	11	8	0	0	0
CVCS	8	2	12	2	0	0	34	0
MS	16	4	85	9	0	0	0	0
AS	10	2	0	0	0	0	27	0
SIS	35	9	8	2	45	7	194	0
SDC	11	3	19	2	6	0	2	0
TOTAL	153	40	210	26	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	67	19	87	11	8	0	0	0
CVCS	10	3	12	1	0	0	29	0
MS	10	3	78	9	0	0	0	0
AS	10	2	0	0	0	0	34	0
SIS	40	7	8	3	38	6	191	0
SDC	11	3	19	2	6	0	2	0
TOTAL	148	37	204	26	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 [No POD Credit]	
									ΔCDF	ΔLERF
RCS	2	HIGH	TT, TASCS, PWSCC	33	20	-13		INCREASE [(1)]	2.39E-07	1.29E-09
	4	HIGH	NONE	52	11	-41		INCREASE [(1)]	9.15E-08	3.42E-10
	5	MEDIUM	TT	0	0	0		NO CHANGE	0.00E+00	0.00E+00
CVCS	2	HIGH	TT	5	2	-3		INCREASE [(1)]	2.87E-08	5.22E-10
	4	HIGH	NONE	4	2	-2		INCREASE [(1)]	3.72E-09	6.78E-11
	6	MEDIUM	NONE	14	0	-14		NEGLIGIBLE	2.60E-08	4.75E-11
MS	2	HIGH	TASCS	6	4	-2		INCREASE [(1)]	2.53E-08	1.15E-10
	4	HIGH	NONE	38	9	-29		INCREASE [(1)]	4.44E-08	2.01E-10
AS	2	HIGH	TT, TASCS	3	2	-1		INCREASE [(1)]	9.56E-09	1.70E-10
	6	MEDIUM	NONE	7	0	-7		NEGLIGIBLE	1.30E-11	2.37E-13
SIS	2	HIGH	TASCS	13	9	-4		INCREASE [(1)]	6.23E-09	2.33E-11
	4	HIGH	NONE	6	2	-4		INCREASE [(1)]	1.84E-09	8.36E-12
	5	MEDIUM	TASCS	18	7	-11		INCREASE [(1)]	2.01E-10	6.40E-11
	6	MEDIUM	NONE	49	0	-49		NEGLIGIBLE	3.29E-10	1.02E-10
SDC	2	HIGH	TASCS	3	3	0		NO CHANGE	0.00E+00	0.00E+00
	4	HIGH	NONE	5	2	-3		INCREASE [(1)]	2.03E-09	7.58E-12
	5	MEDIUM	TT	0	0	0		NO CHANGE	0.00E+00	0.00E+00
	6	MEDIUM	NONE	0	0	0		NO CHANGE	0.00E+00	0.00E+00
			Total	256	73	-183			4.79E-07	3.39E-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.

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 [No POD Credit]	
									ΔCDF	ΔLERF
RCS	2	HIGH	TT, TASCS, PWSCC	35	19	-16		INCREASE (1)	2.11E-07	2.23E-09
	4	HIGH	NONE	55	11	-44		INCREASE (1)	9.70E-08	3.77E-10
	5	MEDIUM	TT	3	0	-3		INCREASE (1)	2.48E-11	4.53E-13
CVCS	2	HIGH	TT	8	3	-5		INCREASE (1)	4.87E-08	8.71E-10
	4	HIGH	NONE	3	1	-2		INCREASE (1)	3.72E-09	6.78E-11
	6	MEDIUM	NONE	13	0	-13		NEGLIGIBLE	2.42E-08	4.42E-10
MS	2	HIGH	TASCS	2	3	1		DECREASE	-1.26E-08	-5.73E-11
	4	HIGH	NONE	26	9	-17		INCREASE (1)	3.65E-08	1.66E-10
AS	2	HIGH	TT, TASCS	2	2	0		NO CHANGE	0.00E+00	0.00E+00
	6	MEDIUM	NONE	2	0	-2		NEGLIGIBLE	3.72E-12	6.78E-14
SIS	2	HIGH	TASCS	13	7	-6		INCREASE (1)	9.39E-09	3.48E-11
	4	HIGH	NONE	4	3	-1		INCREASE (1)	4.61E-10	2.09E-12
	5	MEDIUM	TASCS	23	6	-17		INCREASE (1)	3.11E-10	9.88E-11
	6	MEDIUM	NONE	37	0	-37		NEGLIGIBLE	2.61E-10	8.14E-11
SDC	2	HIGH	TASCS	4	3	-1		INCREASE (1)	1.56E-09	5.81E-12
	4	HIGH	NONE	7	2	-5		INCREASE (1)	3.39E-09	1.26E-11
	5	MEDIUM	TT	0	0	0		NO CHANGE	0.00E+00	0.00E+00
	6	MEDIUM	NONE	2	0	-2		NEGLIGIBLE	1.35E-09	5.04E-12
			Total	239	69	-170			4.24E-07	4.45E-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.

WCAP-15882-NP, Rev. 03

Westinghouse Non-Proprietary Class 3

Westinghouse

Westinghouse Electric Company, LLC
2000 Dayhill Road
Windsor, Connecticut 06095-0500

Enclosure 2

San Onofre Nuclear Generating Station Units 2 and 3, Relief Request ISI-3-2 Alternative Examinations in lieu of Ultrasonic Examination of Cast Austenitic Stainless Steel

2nd 10-year Interval Relief Request 3.3.3

10 CFR 50.55a Request for Relief ISI-3-2

Information to Support NRC Re-Approval of a 10 CFR 50.55a Request For Use During a New 10-Year Interval Inservice Inspection Program

1.0 Previous 10 CFR Request Approved by the NRC

1.1 Relief Request Number 3.3.3

1.1.01 ASME Code Component(s) Affected

ASME Section XI, Class 1, Table IWB-2500-1, Examination Category B-M-1, All Item No. B12.40 Valve Body Welds for Valves, NPS 4 or Larger examined at San Onofre Units 2 and 3.

1.1.02 Submittal Letter:

Letter from W. C. Marsh (SCE) to the Document Control Desk (NRC) dated October 4, 1993; Subject: Docket Nos. 50-361 and 50-362, ASME Code Update for the Second Ten-Year Interval Inservice Inspection Programs, San Onofre Nuclear Generating Station Units 2 and 3

1.1.03 NRC Approval Letter:

Letter from William H. Bateman (NRC) to Harold B. Ray (SCE) dated February 13, 1996; Subject: Evaluation of the Second Ten-Year Interval Inspection Program Plan and Associated Relief Requests for San Onofre Nuclear Generating Station, Units 2 and 3, (TAC Nos. M88906 and M88907)

2.0 Changes to the Applicable ASME Code Section

Rules for Inservice Inspection of Nuclear Power Plant Components, Section XI, 1995 Edition, 1996 Addenda contain the same requirement to perform a volumetric examination of valve body welds of Category B-M-1, Item No. B12.40 as did the 1989 Edition of the ASME Code. Therefore the Code Update does not affect this relief request.

3.0 Component Aging Factors

The basis of this relief request is that the valves in question are made of cast austenitic steels with body welds using the electroslag welding process. The large grain structure of the cast material results in sound dispersion and attenuation that will not provide meaningful examinations for the component being inspected. Therefore Component Aging Factors have no effect on the basis of this relief request.

4.0 Changes in Technology for Inservice Inspection of the Affected ASME Code Components

The volumetric examination technology has not changed in regard to cast austenitic steel. Therefore, this relief request is still required.

5.0 Confirmation of Renewed Applicability

Ultrasonic examination of cast austenitic stainless steel material does not provide meaningful results. If and when a newly developed technique becomes available, it will be used for this examination.

In lieu of the Volumetric Examination required , the following examinations will be performed:

1. Surface examination (PT) of the weld and heat affected zone,
2. Visual Examination (VT-3) of the valve internals when the valve is disassembled for maintenance or repair, and
3. Visual Examination (VT-2) of the component in conjunction with the reactor coolant system pressure test following each refueling outage or repairs to these components.

Based on the information provided in Relief Request 3.3.3 for the second 10-year inservice inspection interval, the information contained in the NRC evaluation of the second 10-year interval program plan and associated relief requests regarding relief request 3.3.3, and the information provided above, the circumstances and basis for Relief Request ISI-3-2 continue to be applicable.

6.0 Duration of Re-Approval of 10 CFR 50.55a Request for Relief ISI-3-2

Relief is requested for the third inspection interval at SONGS Units 2 and 3, which is scheduled to end on August 17, 2013.

7.0 Reference:

No additional references other than those listed in Sections 1.1.02 and 1.1.03.

Enclosure 3

San Onofre Nuclear Generating Station
Units 2 and 3, Relief Request ISI-3-3
Alternative Volumetric Examination Coverage
of Pressurizer and Steam Generator
Category B-D Welds

2nd 10-year Interval Relief Request 3.3.4 Parts 1 and 2

10 CFR 50.55a Request for Relief ISI-RR-3-3

Information to Support NRC Re-Approval of a 10 CFR 50.55a Request For Use During a New 10-Year Interval Inservice Inspection Program

1.0 Previous 10 CFR Request Approved by the NRC

1.1 Relief Request Number 3.3.4 Parts 1 and 2

1.1.01 ASME Code Component(s) Affected

a) ASME Section XI, Class 1, Table IWB-2500-1, Examination Category B-D, All Item No. B3.110 Pressurizer Nozzle to Vessel Welds examined at San Onofre Units 2 and 3.

b) ASME Section XI, Class 1, Table IWB-2500-1, Examination Category B-D, All Item No. B3.130 Steam Generator (Primary Side) Nozzle to Vessel Welds examined at San Onofre Units 2 and 3.

1.1.02 Submittal Letter:

Letter from W. C. Marsh (SCE) to the Document Control Desk (NRC) dated October 4, 1993; Subject: Docket Nos. 50-361 and 50-362, ASME Code Update for the Second Ten-Year Interval Inservice Inspection Programs, San Onofre Nuclear Generating Station Units 2 and 3

1.1.03 NRC Approval Letter:

Letter from William H. Bateman (NRC) to Harold B. Ray (SCE) dated February 13, 1996; Subject: Evaluation of the Second Ten-Year Interval Inspection Program Plan and Associated Relief Requests for San Onofre Nuclear Generating Station, Units 2 and 3, (TAC Nos. M88906 and M88907)

2.0 Changes to the Applicable ASME Code Section

Rules for Inservice Inspection of Nuclear Power Plant Components, Section XI, 1995 Edition, 1996 Addenda contain the same inspection requirements as did the 1989 Edition of the ASME Code:

a) Section XI, Division 1, Subsection IWB, Table IWB-2500-1, Examination Category B-D, Full Penetration Nozzle Welds in Vessels-Inspection Program B, Item No. B3.110, Pressurizer Nozzle to Vessel Welds

b) Section XI, Division 1, Subsection IWB, Table IWB-2500-1, Examination Category B-D, Full Penetration Nozzle Welds in Vessels-Inspection Program B, Item No. B3.130, Steam Generators (Primary Side) Nozzle to Vessel Welds.

Therefore the Code Update does not effect this relief request.

3.0 Component Aging Factors

The basis of this relief request is that the nozzle design of the San Onofre Pressurizers and Steam Generators has a geometric configuration that precludes achieving the required volume. An Ultrasonic scan of the nozzle from the inside surface is possible. However, the dose rate is about 6 Rem/hr for the examiner alone not considering the support personnel that would be required for the examination. Therefore Component Aging Factors have no effect on the basis of this relief request.

4.0 Changes in Technology for Inservice Inspection of the Affected ASME Code Components

The examination technology has not changed in regards to allowing the required examination volume to be achieved given the geometric configuration of the San Onofre Pressurizers and Steam Generators. Therefore, this relief request is still required.

5.0 Confirmation of Renewed Applicability

Volumetric Examination is required for volume A-B-C-D-E-F-G-H-I as shown on Fig. IWB-2500-7(a). For the San Onofre Pressurizers and Steam Generators, this is volume A-B-C-D-E-F-G-H-I from Sketch 4-1.

Relief is requested from the volumetric examination of the nozzle material volume (volume A-B-C-J on Sketch 4-1) which can only be obtained by scanning from the nozzle side. To achieve full Ultrasonic examination coverage of the whole volume required by the Code, the examination has to be performed on the shell side to scan volume D-E-H-J (Sketch 4-1) and on the nozzle side to scan volume A-B-C-J. The nozzle design of the San Onofre Pressurizers and Steam Generators has a geometric configuration that precludes achieving the required volume. An Ultrasonic scan of the nozzle from the inside surface is possible. However, the dose rate is about 6 Rem/hr for the examiner alone not considering the support personnel that would be required for the examination.

Design configuration restrictions and high component interior dose rates make the Code required requirements impractical. To obtain complete volumetric coverage, modifications or replacement of the components with one of a design providing for complete coverage would be required. Imposition of this requirement would cause a considerable burden to SONGS.

In lieu of the required examinations a volumetric examination (UT) of volume D-E-H-J (Sketch 4-1) from the shell or head side of the Pressurizer and Steam Generators will be performed.

Based on the information provided in Relief Request 3.3.4 Parts 1 and 2 for the second 10-year inservice inspection interval, the information contained in the NRC evaluation of the second 10-year interval program plan and associated relief requests regarding relief request 3.3.4 Parts 1 and 2, and the information provided above, the circumstances and basis for Relief Request ISI-3-3 continue to be applicable.

6.0 Duration of Re-Approval of 10 CFR 50.55a Request for Relief ISI-3-2

Relief is requested for the third inspection interval at SONGS Units 2 and 3, which is scheduled to end on August 17, 2013.

7.0 References:

No additional references other than those listed in Sections 1.1.02 and 1.1.03.

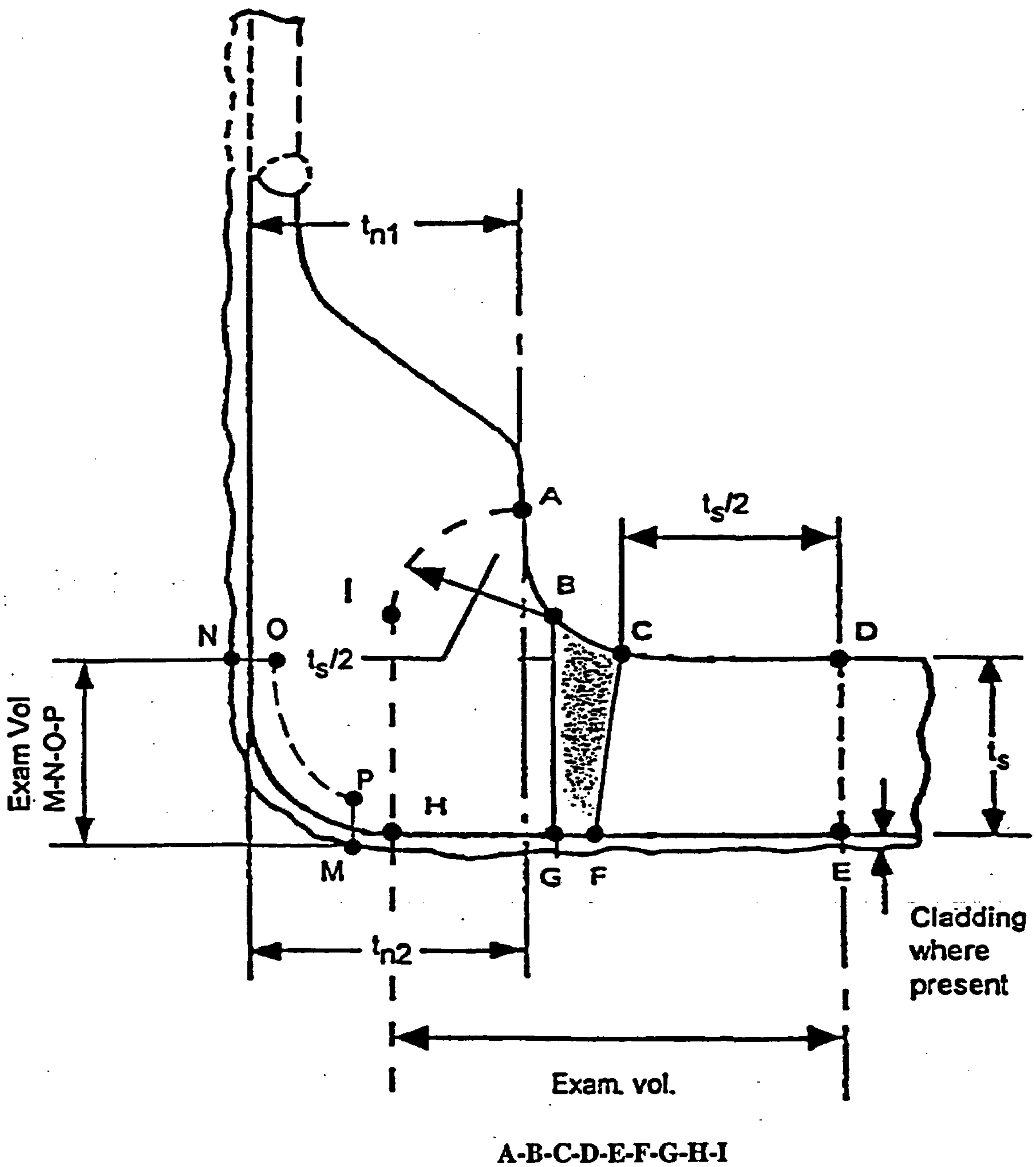
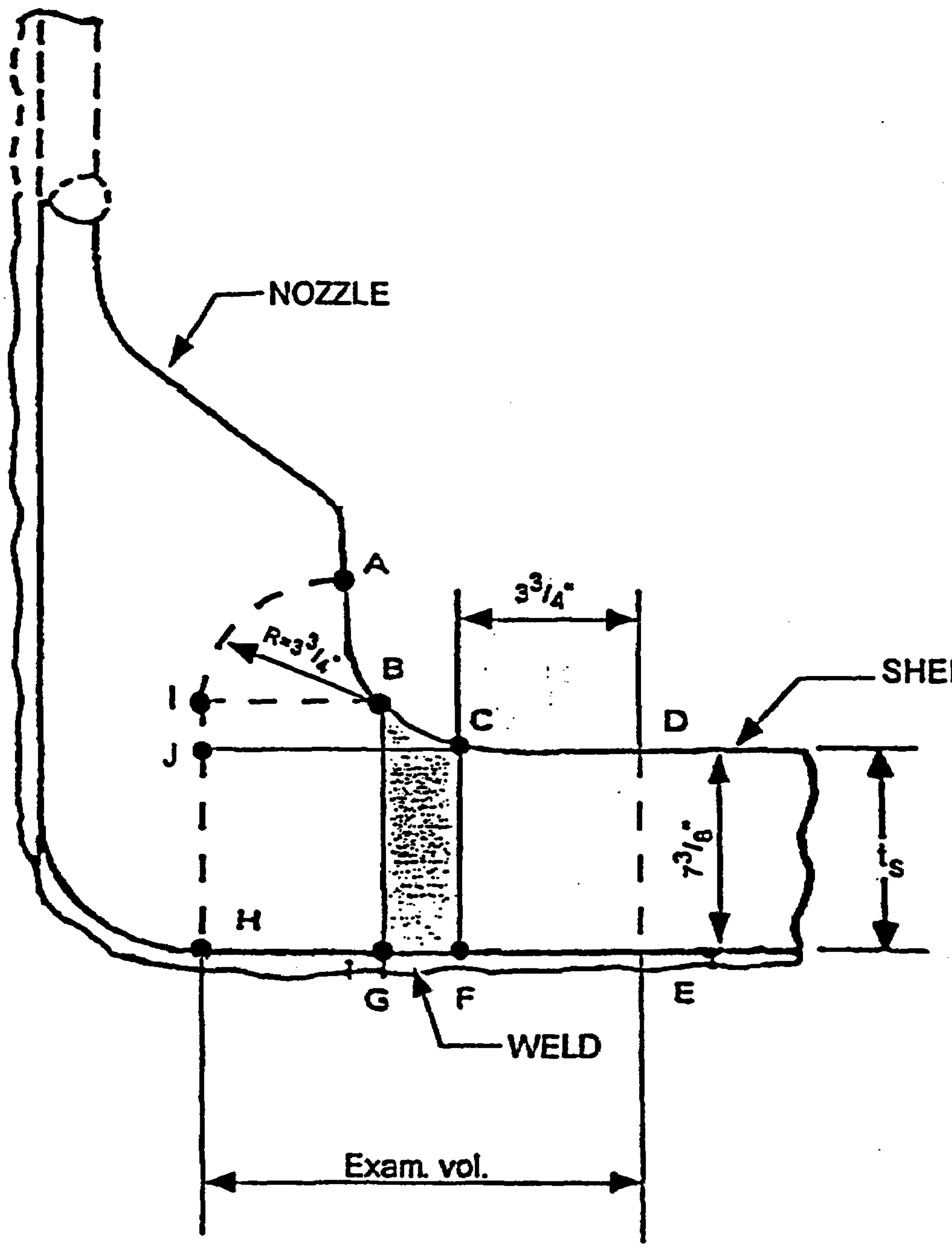


FIG. IWB-2500-7(a)



A-B-C-D-E-F-G-H-I

SKETCH 4-1

Enclosure 4

San Onofre Nuclear Generating Station Units 2 and 3, Relief Request ISI-3-4 Alternative Identification of Category D-B Items

New Request

Proposed Alternative
In Accordance with 10 CFR 50.55a(a)(3)(i)

-Alternative Provides Acceptable Level of Quality and Safety-

1.0 ASME Code Component(s) Affected

ASME Section XI, Class 3, Table IWD-2500-1, Examination Category D-B, Item Nos. D2.10, D2.20, D2.30, D2.40, D2.50, D2.60, D2.70, D2.80, pressure retaining components examined at San Onofre Units 2 and 3.

2.0 Applicable Code edition and Addenda

Rules for Inservice Inspection of Nuclear Power Plant Components, Section XI, 1995 Edition, 1996 Addenda.

3.0 Applicable Code Requirement

Section XI, Division 1, Subsection IWD Table IWD-2500-1, Examination Category D-B, All Pressure Retaining Components, Item Nos. D2.10, D2.20, D2.30, D2.40, D2.50, D2.60, D2.70, D2.80 specific grouping of Pressure Vessels, Piping, Pumps, and Valves.

4.0 Reason for Request

SONGS Units 2 and 3 are currently updating their Section XI ISI programs to the 1995 Edition, 1996 Addenda of Section XI for the third interval. The 1995 Edition, 1996 Addenda, Table IWD-2500-1, Examination Category D-B provides unique item numbers for groups of components such as Pressure Vessels, Piping, Pumps, and Valves. The requirements of the current ISI program that was written to the 1989 Edition, no addenda, did not require the identification by specific group item numbers for these components but simply combined them under a unique item number for pressure retaining components. Identification of specific components requiring the VT-2 Visual for pressure tests is contained in the Inservice Inspection Functional Pressure Test Procedure for VT-2 examination and testing of the particular system.

The NRC has approved for use the 1998 Edition with Addenda through 2000 (Ref. Final Rule, Federal Register, dated September 26, 2002) which revised the identification of item numbers for components in Examination Category D-B. The 1998 Code groups the components as Pressure retaining components without the unique use of item numbers for each particular grouping as is the current practice at SONGS through the use of Section XI 1989 edition. The alternative requested will allow SONGS to continue it's current practice of meeting Section XI Code requirements for pressure testing and visual examination through the particular system functional test procedure without revising and uniquely identifying in it's data base specific item numbers for a grouping of components.

5.0 Proposed Alternative and Basis for Use

As an alternative to the ASME Section XI 1995 Edition, 1996 Addenda, Table IWD-2500-1, Category D-B requirements to uniquely group components by specific item numbers for Vessels, Piping, Pumps, and Valves the requirements of the 1998 Code, Table IWD-2500-1, Category D-B will be utilized. The unique identification of components such as pressure vessels, piping, pumps and valves as applicable will continue to be contained in the inservice inspection functional test procedures.

6.0 Duration of Proposed Alternative

Relief is requested for the third inspection interval at SONGS Units 2 and 3, which is scheduled to end on August 17, 2013.

Enclosure 5

San Onofre Nuclear Generating Station Units 2 and 3, Relief Request ISI-3-5 Alternative Requirements for Implementation of Appendix VIII, Supplement 10

New Request

10 CFR 50.55a Request for Relief ISI-3-5

Proposed Alternative
In Accordance with 10 CFR 50.55a(a)(3)(i)

Alternative Provides Acceptable Level of Quality and Safety

1.0 ASME Code Components Affected

ASME Section XI, 1995 Edition, 1996 Addenda, Class 1, Category B-F, Item No. B5.40, Nozzle-to-safe-end butt welds and Category B-J, Item No. B9.11 (Dissimilar metal piping welds only *Note 1c*) subject to examination using procedures, personnel, and equipment qualified to ASME Section XI, Appendix VIII, Supplement 10 criteria examined at San Onofre Units 2 and 3.

2.0 Applicable Code Edition and Addenda

Rules for Inservice Inspection of Nuclear Power Plant Components, Section XI, 1995 Edition, 1996 Addenda.

3.0 Applicable Code Requirement

The following paragraphs or statements are from ASME Section XI, Appendix VIII, Supplement 10, Qualification requirements for Dissimilar Metal Piping welds, and identify the specific requirements that are included in this request for relief.

Item 1 - Paragraph 1.1(b) states in part - Pipe diameters within a range of 0.9 to 1.5 times a nominal diameter shall be considered equivalent.

Item 2 - Paragraph 1.1(d) states - All flaws in the specimen set shall be cracks.

Item 3 - Paragraph 1.1(d)(1) states - At least 50% of the cracks shall be in austenitic material. At least 50% of the cracks in austenitic material shall be contained wholly in weld or buttering material. At least 10% of the cracks shall be in ferritic material. The remainder of the cracks may be in either austenitic or ferritic material.

Item 4 - Paragraph 1.2(b) states in part - The number of unflawed grading units shall be at least twice the number of flawed grading units.

Item 5 - Paragraph 1.2(c)(1) and 1.3(c) state in part - At least 1/3 of the flaws, rounded to the next higher whole number, shall have depths between 10% and 30% of the nominal pipe wall thickness. Paragraph 1.4(b) distribution table requires 20% of the flaws to have depths between 10% and 30%.

Item 6 - Paragraph 2.0 first sentence states - The specimen inside surface and identification shall be concealed from the candidate.

Item 7 - Paragraph 2.2(b) states in part - The regions containing a flaw to be sized shall be identified to the candidate.

Item 8 - Paragraph 2.2(c) states in part - For a separate length sizing test, the regions of each specimen containing a flaw to be sized shall be identified to the candidate.

Item 9 - Paragraph 2.3(a) states - For the depth sizing test, 80% of the flaws shall be sized at a specific location on the surface of the specimen identified to the candidate.

Item 10 - Paragraph 2.3(b) states - For the remaining flaws, the regions of each specimen containing a flaw to be sized shall be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region.

Item 11 - Table VIII-S2-1 provides the false call criteria when the number of unflawed grading units is at least twice the number of flawed grading units.

4.0 Reason for Request

Relief is requested to use the following alternative requirements for implementation of Appendix VIII, Supplement 10 requirements. They will be implemented through the PDI Program.

As provided by the Performance Demonstration Initiative (PDI) in Attachment 2, a copy of the proposed revision to Supplement 10 is attached. It identifies the proposed alternatives and allows them to be viewed in context. It also identifies additional clarifications and enhancements for information. It has been submitted to the ASME Code Committee for consideration.

5.0 Proposed Alternative and Basis for Use

Pursuant to 10 CFR 50.55a(a)(3)(i), in lieu of the requirements of ASME Section XI, 1995 Edition, 1996 Addenda, Appendix VIII, Supplement 10, the proposed alternative discussed below shall be used. Compliance with the proposed alternatives will provide an adequate level of quality and safety for examination of the affected welds.

Item 1 - The proposed alternative to Paragraph 1.1(b) states:

"The specimen set shall include the minimum and maximum pipe diameters and thicknesses for which the examination procedure is applicable. Pipe diameters within a range of **1/2 in. (13 mm) of the** nominal diameter shall be considered equivalent. Pipe diameters larger than 24 in. **(610 mm)** shall be considered to be

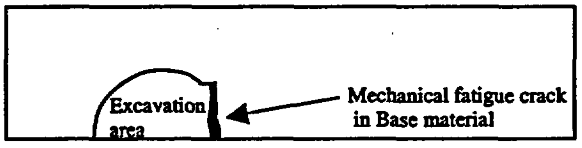
flat. When a range of thicknesses is to be examined, a thickness tolerance of ±25% is acceptable."

Technical Basis - The change in the minimum pipe diameter tolerance from 0.9 times the diameter to the nominal diameter minus 0.5 inch provides tolerances more in line with industry practice. Though the alternative is less stringent for small pipe diameters, they typically have a thinner wall thickness than larger diameter piping. A thinner wall thickness results in shorter sound path distances that reduce the detrimental effects of the curvature. This change maintains consistency between Supplement 10 and the recent revision to Supplement 2.

Item 2 - The proposed alternative to Paragraph 1.1(d) states:

"At least 60% of the flaws shall be cracks, the remainder shall be alternative flaws. Specimens with IGSCC shall be used when available. Alternative flaws, if used, shall provide crack-like reflective characteristics and shall be limited to the case where implantation of cracks produces spurious reflectors that are uncharacteristic of actual flaws. Alternative flaw mechanisms shall have a tip width of less than or equal to 0.002 in. (.05 mm)." Note, To avoid confusion, the proposed alternative modifies instances of the term "cracks" or "cracking" to the term "flaws" because of the use of "alternative flaw mechanisms."

Technical Basis - As illustrated below, implanting a crack requires excavation of the base material on at least one side of the flaw. While this may be satisfactory for ferritic materials, it does not produce a useable axial flaw in austenitic materials because the sound beam, which normally passes only through base material, must now travel through weld material on at least one side, producing an unrealistic flaw response. In addition, it is important to preserve the dendritic structure present in field welds that would otherwise be destroyed by the implantation process. To resolve these issues, the proposed alternative allows the use of up to 40% fabricated flaws as an alternative flaw mechanism under controlled conditions. The fabricated flaws are isostatically compressed which produces ultrasonic reflective characteristics similar to tight cracks.



Item 3 - The proposed alternative to Paragraph 1.1(d)(1) states:

"At least 80% of the flaws shall be contained wholly in weld or buttering material. At least **one and a maximum of** 10% of the **flaws** shall be in ferritic base material. **At least one and a maximum of 10% of the flaws shall be in austenitic base material."**

Technical Basis - Under the current Code, as few as 25% of the flaws are contained in austenitic weld or buttering material. The metallurgical structure of austenitic weld material is ultrasonically more challenging than either ferritic or austenitic base material. The proposed alternative is therefore more challenging than the current Code.

Item 4 - The proposed alternative to Paragraph 1.2(b) states:

"Detection sets shall be selected from Table VIII-S10-1. The number of unflawed grading units shall be at least **one and a half** times the number of flawed grading units."

Technical Basis – New Table VIII-S10-1 provides a statistically based ratio between the number of unflawed grading units and the number of flawed grading units. Based on information provided by the PDI, the proposed alternative reduces the ratio to 1.5 times to reduce the number of test samples to a more reasonable number. However, the statistical basis used for screening personnel and procedures is still maintained at the same level with competent personnel being successful and less skilled personnel being unsuccessful. The acceptance criteria for the statistical basis are in Table VIII-S10-1.

Item 5 - The proposed alternative to the flaw distribution requirements of Paragraph 1.2(c)(1) (detection) and 1.3(c) (length) is to use the Paragraph 1.4(b) (depth) distribution table (see below) for all qualifications.

Flaw Depth (% Wall Thickness)	Minimum Number of Flaws
10-30%	20%
31-60%	20%
61-100%	20%

In addition, the proposed alternative includes the following: "At least 75% of the flaws shall be in the range of 10 to 60% of wall thickness.

Technical Basis - The proposed alternative uses the depth sizing distribution for both detection and depth sizing because it provides for a better distribution of flaw sizes within the test set. This distribution allows candidates to perform detection, length, and depth sizing demonstrations simultaneously utilizing the same test set. The requirement that at least 75% of the flaws shall be in the range of 10 to 60% of wall thickness provides an overall distribution tolerance yet the distribution uncertainty decreases the possibilities for testmanship that would be inherent to a uniform distribution. It must be noted that it is possible to achieve the same distribution utilizing the present requirements, but it is preferable to make the criteria consistent.

Item 6 - The proposed alternative to Paragraph 2.0 first sentence states:

"For qualifications from the outside surface, the specimen inside surface and identification shall be concealed from the candidate. When qualifications are performed from the inside surface, the flaw location and specimen identification shall be obscured to maintain a "blind test"."

Technical Basis - The current Code requires that the inside surface be concealed from the candidate. This makes qualifications conducted from the inside of the pipe (e.g., PWR nozzle to safe end welds) impractical. The proposed alternative differentiates between ID and OD scanning surfaces, requires that they be conducted separately, and requires that flaws be concealed from the candidate. This is consistent with the recent revision to Supplement 2.

Items 7 and 8 - The proposed alternatives to Paragraph 2.2(b) and 2.2(c) state:

"... containing a flaw to be sized **may** be identified to the candidate."

Technical Basis - The current Code requires that the regions of each specimen containing a flaw to be length sized shall be identified to the candidate. The candidate shall determine the length of the flaw in each region (note that length and depth sizing use the term "regions" while detection uses the term "grading units"-the two terms define different concepts and are not intended to be equal or interchangeable). To ensure security of the samples, the proposed alternative modifies the first "shall" to a "may" to allow the test administrator the option of not identifying specifically where a flaw is located. This is consistent with the recent revision to supplement 2.

Items 9 and 10 - The proposed alternative to Paragraph 2.3(a) and 2.3(b) states:

"... regions of each specimen containing a flaw to be sized **may** be identified to the candidate."

Technical Basis - The current Code requires that a large number of flaws be sized at a specific location. The proposed alternative changes the "shall" to a "may" which modifies this from a specific area to a more generalized region to ensure security of samples. This is consistent with the recent revision to Supplement 2. It also incorporates terminology from length sizing for additional clarity.

Item 11 - The proposed alternative modifies the acceptance criteria of Table VIII-S2-1 as follows:

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TABLE VIII-S~~2~~-1
PERFORMANCE DEMONSTRATION DETECTION TEST ACCEPTANCE CRITERIA

Detection Test Acceptance Critera		False Call Test Acceptance Criteria	
No. of Flawed Grading Units	Minimum Detection Criteria	No. of Unflawed Grading Units	Maximum Number of False Calls
~~5~~	~~5~~	~~10~~	~~0~~
~~6~~	~~6~~	~~12~~	~~1~~
~~7~~	~~6~~	~~14~~	~~1~~
~~8~~	~~7~~	~~16~~	~~2~~
~~9~~	~~7~~	~~18~~	~~2~~
10	8	~~20~~ 15	~~3~~ 2
11	9	~~22~~ 17	~~3~~ 3
12	9	~~24~~ 18	~~3~~ 3
13	10	~~26~~ 20	~~4~~ 3
14	10	~~28~~ 21	~~5~~ 3
15	11	~~30~~ 23	~~5~~ 3
16	12	~~32~~ 24	~~6~~ 4
17	12	~~34~~ 26	~~6~~ 4
18	13	~~36~~ 27	~~7~~ 4
19	13	~~38~~ 29	~~7~~ 4
20	14	~~40~~ 30	~~8~~ 5

Technical Basis - The proposed alternative adds new Table VIII-S10-1 above. It is a modified version of Table VIII-S2-1 to reflect the reduced number of unflawed grading units and allowable false calls. As provided by the PDI, as part of ongoing Code activities, Pacific Northwest National Laboratories has reviewed the statistical significance to this new Table VIII-S10-1.

6.0 Duration of Proposed Alternative

Relief is requested for the third inspection interval at SONGS Units 2 & 3, which is scheduled to end on August 17, 2013.

7.0 Precedents

None

8.0 References

The NRC is currently reviewing this relief Request as B-2-06 submitted by Southern California Edison in a letter from A. E. Scherer to the Document Control Desk dated November 19, 2002; Subject: Docket No. 50-362 Second Ten-Year Interval Inservice Inspection Program, Pressure Retaining Piping Welds Relief Requests B-2-06 and B-2-07, San Onofre Nuclear Generating Station, Unit 3

ATTACHMENT to ISI-3-5

SUPPLEMENTAL INFORMATION PROVIDED BY THE PERFORMANCE DEMONSTRATION INITIATIVE (PDI)

SUPPLEMENT 10 – QUALIFICATION REQUIREMENTS FOR DISSIMILAR METAL PIPING WELDS		
Current Requirement	**Proposed Change**	**Reasoning**
	1.0 SCOPE	
	Supplement 10 is applicable to dissimilar metal piping welds examined from either the inside or outside surface. Supplement 10 is not applicable to piping welds containing supplemental corrosion resistant clad (CRC) applied to mitigate Intergranular Stress Corrosion Cracking (IGSCC).	A scope statement provides added clarity regarding the applicable range of each individual Supplement. The exclusion of CRC provides consistency between Supplement 10 and the recent revision to Supplement 2 (Reference BC 00-755). Note, an additional change identifying CRC as "in course of preparation" is being processed separately.
1.0 SPECIMEN REQUIREMENTS	**2.0 SPECIMEN REQUIREMENTS**	Renumbered
Qualification test specimens shall meet the requirements listed herein, unless a set of specimens is designed to accommodate specific limitations stated in the scope of the examination procedure (e.g., pipe size, weld joint configuration, access limitations). The same specimens may be used to demonstrate both detection and sizing qualification.	Qualification test specimens shall meet the requirements listed herein, unless a set of specimens is designed to accommodate specific limitations stated in the scope of the examination procedure (e.g., pipe size, weld joint configuration, access limitations). The same specimens may be used to demonstrate both detection and sizing qualification.	No Change
1.1 General. The specimen set shall conform to the following requirements.	**2.1 General.** The specimen set shall conform to the following requirements.	Renumbered
	(a) The minimum number of flaws in a test set shall be ten.	New, changed minimum number of flaws to 10 so sample set size for detection is consistent with length and depth sizing.
(a) Specimens shall have sufficient volume to minimize spurious reflections that may interfere with the interpretation process.	(b) Specimens shall have sufficient volume to minimize spurious reflections that may interfere with the interpretation process.	Renumbered

SUPPLEMENT 10 – QUALIFICATION REQUIREMENTS FOR DISSIMILAR METAL PIPING WELDS

Current Requirement	Proposed Change	Reasoning
(b) The specimen set shall include the minimum and maximum pipe diameters and thickness for which the examination procedure is applicable. Pipe diameters within a range of 0.9 to 1.5 times a nominal diameter shall be considered equivalent. Pipe diameters larger than 24 in. shall be considered to be flat. When a range of thicknesses is to be examined, a thickness tolerance of ±25% is acceptable.	(c) The specimen set shall include the minimum and maximum pipe diameters and thicknesses for which the examination procedure is applicable. Pipe diameters within a range of **1/2 in. (13 mm) of the** nominal diameter shall be considered equivalent. Pipe diameters larger than 24 in. **(610 mm)** shall be considered to be flat. When a range of thicknesses is to be examined, a thickness tolerance of ±25% is acceptable.	Renumbered, metricated, the change in pipe diameter tolerance provides consistency between Supplement 10 and the recent revision to Supplement 2 (Reference BC 00-755).
(c) The specimen set shall include examples of the following fabrication condition:	(d) The specimen set shall include examples of the following fabrication conditions:	Renumbered, changed "condition" to "conditions".
(1) geometric conditions that normally require discrimination from flaws (e.g., counterbore or weld root conditions, cladding, weld buttering, remnants of previous welds, adjacent welds in close proximity);	(1) geometric **and material** conditions that normally require discrimination from flaws (e.g., counterbore or weld root conditions, cladding, weld buttering, remnants of previous welds, adjacent welds in close proximity**, and weld repair areas**);	Clarification, some of the items listed relate to material conditions rather than geometric conditions. Weld repair areas were added as a result of recent field experiences.
(2) typical limited scanning surface conditions (e.g., diametrical shrink, single-side access due to nozzle and safe end external tapers).	(2) typical limited scanning surface conditions (e.g., **weld crowns,** diametrical shrink, single-side access due to nozzle and safe end external tapers **for outside surface examinations; and internal tapers, exposed weld roots, and cladding conditions for inside surface examinations). Qualification requirements shall be satisfied separately for outside surface and inside surface examinations.**	Differentiates between ID and OD scanning surface limitations. Requires that ID and OD qualifications be conducted independently (Note, new paragraph 2.0 (identical to old paragraph 1.0) provides for alternatives when "a set of specimens is designed to accommodate specific limitations stated in the scope of the examination procedure").
(d) All flaws in the specimen set shall be cracks.		Deleted this requirement, because new paragraph 2.3 below provides for the use of "alternative flaws" in lieu of cracks.

SUPPLEMENT 10 – QUALIFICATION REQUIREMENTS FOR DISSIMILAR METAL PIPING WELDS		
Current Requirement	**Proposed Change**	**Reasoning**
(1) At least 50% of the cracks shall be in austenitic material. At least 50% of the cracks in austenitic material shall be contained wholly in weld or buttering material. At least 10% of the cracks shall be in ferritic material. The remainder of the cracks may be in either austenitic or ferritic material.	**2.2 Flaw Location.** At least **80%** of the **flaws** shall be contained wholly in weld or buttering material. At least **one and a maximum of** 10% of the **flaws** shall be in ferritic **base** material. **At least one and a maximum of 10% of the flaws shall be in austenitic base material.**	Renumbered and re-titled. Flaw location percentages redistributed because field experience indicates that flaws contained in weld or buttering material are probable and represent the more stringent ultrasonic detection scenario.
(2) At least 50% of the cracks in austenitic base material shall be either IGSCC or thermal fatigue cracks. At least 50% of the cracks in ferritic material shall be mechanically or thermally induced fatigue cracks.	**2.3 Flaw Type.** **(a) At least 60% of the flaws shall be cracks, the remainder shall be alternative flaws. Specimens with IGSCC shall be used when available. Alternative flaws, if used, shall provide crack-like reflective characteristics and shall be limited to the case where implantation of cracks produces spurious reflectors that are uncharacteristic of actual flaws. Alternative flaw mechanisms shall have a tip width of less than or equal to 0.002 in. (.05 mm).**	Renumbered and re-titled. Alternative flaws are required for placing axial flaws in the HAZ of the weld and other areas where implantation of a crack produces metallurgical conditions that result in an unrealistic ultrasonic response. This is consistent with the recent revision to Supplement 2 (Reference BC 00-755). The 40% limit on alternative flaws is needed to support the requirement for up to 70% axial flaws. Metricated.
(3) At least 50% of the cracks shall be coincident with areas described in (c) above.	**(b)** At least 50% of the **flaws** shall be coincident with areas described in **2.1(d)** above.	Renumbered. Due to inclusion of "alternative flaws", use of "cracks" is no longer appropriate.

SUPPLEMENT 10 – QUALIFICATION REQUIREMENTS FOR DISSIMILAR METAL PIPING WELDS

Current Requirement	Proposed Change	Reasoning
	2.4 Flaw Depth. All flaw depths shall be greater than 10% of the nominal pipe wall thickness. Flaw depths shall exceed the nominal clad thickness when placed in cladding. **Flaws in the sample set shall be distributed as follows:** **Flaw Depth (% Wall Thickness) / Minimum Number of Flaws** **10-30% — 20%** **31-60% — 20%** **61-100% — 20%** **At least 75% of the flaws shall be in the range of 10 to 60% of wall thickness.**	Moved from old paragraph 1.3(c) and 1.4 and re-titled. Consistency between detection and sizing specimen set requirements (e.g., 20% vs. 1/3 flaw depth increments, e.g., original paragraph 1.3(c)).
1.2 Detection Specimens. The specimen set shall include detection specimens that meet the following requirements.		Renumbered and re-titled and moved to paragraph 3.1(a). No other changes.
(a) Specimens shall be divided into grading units. Each grading unit shall include at least 3 in. of weld length. If a grading unit is designed to be unflawed, at least 1 in. of unflawed material shall exist on either side of the grading unit. The segment of weld length used in one grading unit shall not be used in another grading unit. Grading units need not be uniformly spaced around the pipe specimen.		Renumbered to paragraph 3.1(a)(1). No other changes.
(b) Detection sets shall be selected from Table VIII-S2-1. The number of unflawed grading units shall be at least twice the number of flawed grading units.		Moved to new paragraph 3.1(a)(2).

SUPPLEMENT 10 – QUALIFICATION REQUIREMENTS FOR DISSIMILAR METAL PIPING WELDS		
Current Requirement	**Proposed Change**	**Reasoning**
(c) Flawed grading units shall meet the following criteria for flaw depth, orientation, and type.		Flaw depth requirements moved to new paragraph 2.4, flaw orientation requirements moved to new paragraph 2.5, flaw type requirements moved to new paragraph 2.3, "Flaw Type".
(1) All flaw depths shall be greater than 10% of the nominal pipe wall thickness. At least 1/3 of the flaws, rounded to the next higher whole number, shall have depths between 10% and 30% of the nominal pipe wall thickness. However, flaw depths shall exceed the nominal clad thickness when placed in cladding. At least 1/3 of the flaws, rounded to the next whole number, shall have depths greater than 30% of the nominal pipe wall thickness.		Deleted, for consistency in sample sets the depth distribution is the same for detection and sizing.
(2) At least 30% and no more than 70% of the flaws, rounded to the next higher whole number, shall be oriented axially. The remainder of the flaws shall be oriented circumferentially.	**2.5 Flaw Orientation.** (a) At least 30% and no more than 70% of the flaws, rounded to the next higher whole number, shall be oriented axially. The remainder of the flaws shall be oriented circumferentially.	Note, this distribution is applicable for detection and depth sizing. Paragraph 2.5(b)(1) requires that all length- sizing flaws be oriented circumferentially.
1.3 Length Sizing Specimens. The specimen set shall include length sizing specimens that meet the following requirements.		Renumbered and re-titled and moved to new paragraph 3.2.
(a) All length sizing flaws shall be oriented circumferentially.		Moved, included in new paragraph 3.2(a).
(b) The minimum number of flaws shall be ten.		Moved, included in new paragraph 2.1 above.

SUPPLEMENT 10 – QUALIFICATION REQUIREMENTS FOR DISSIMILAR METAL PIPING WELDS		
Current Requirement	**Proposed Change**	**Reasoning**
(c) All flaw depths shall be greater than 10% of the nominal pipe wall thickness. At least 1/3 of the flaws, rounded to the next higher whole number, shall have depths between 10% and 30% of the nominal pipe wall thickness. However, flaw depth shall exceed the nominal clad thickness when placed in cladding. At least 1/3 of the flaws, rounded to the next whole number, shall have depths greater than 30% of the nominal pipe wall thickness.		Moved, included in new paragraph 2.4 above after revision for consistency with detection distribution.
1.4 Depth Sizing Specimens. The specimen set shall include depth sizing specimens that meet the following requirements.		Moved, included in new paragraphs 2.1, 2.3, 2.4.
(a) The minimum number of flaws shall be ten.		Moved, included in new paragraph 2.1.
(b) Flaws in the sample set shall not be wholly contained within cladding and shall be distributed as follows:		Moved, potential conflict with old paragraph 1.2(c)(1); "However, flaw depths shall exceed the nominal clad thickness when placed in cladding." Revised for clarity and included in new paragraph 2.4.
Flaw Depth (% Wall Thickness) / Minimum Number of Flaws: 10-30% — 20% 31-60% — 20% 61-100% — 20% The remaining flaws shall be in any of the above categories.		Moved, included in paragraph 2.4 for consistent applicability to detection and sizing samples.
	(b) Sizing Specimen sets shall meet the following requirements.	Added for clarity.
	(1) All length-sizing flaws shall be oriented circumferentially.	Moved from old paragraph 1.3(a).

SUPPLEMENT 10 – QUALIFICATION REQUIREMENTS FOR DISSIMILAR METAL PIPING WELDS		
Current Requirement	**Proposed Change**	**Reasoning**
	(2) Depth sizing flaws shall be oriented as in 2.5(a).	Included for clarity. Previously addressed by omission (i.e., length, but not depth had a specific exclusionary statement).
2.0 CONDUCT OF PERFORMANCE DEMONSTRATION	3.0 CONDUCT OF PERFORMANCE DEMONSTRATION	Renumbered
The specimen inside surface and identification shall be concealed from the candidate. All examinations shall be completed prior to grading the results and presenting the results to the candidate. Divulgence of particular specimen results or candidate viewing of unmasked specimens after the performance demonstration is prohibited.	**For qualifications from the outside surface, the specimen inside surface and identification shall be concealed from the candidate. When qualifications are performed from the inside surface, the flaw location and specimen identification shall be obscured to maintain a "blind test".** All examinations shall be completed prior to grading the results and presenting the results to the candidate. Divulgence of particular specimen results or candidate viewing of unmasked specimens after the performance demonstration is prohibited.	Differentiate between qualifications conducted from the outside and inside surface.
2.1 Detection Test. Flawed and unflawed grading units shall be randomly mixed	**3.1 Detection Qualification.**	Renumbered, moved text to paragraph 3.1(a)(3)
	(a) The specimen set shall include detection specimens that meet the following requirements.	Renumbered, moved from old paragraph 1.2.

SUPPLEMENT 10 – QUALIFICATION REQUIREMENTS FOR DISSIMILAR METAL PIPING WELDS		
Current Requirement	**Proposed Change**	**Reasoning**
	(1) Specimens shall be divided into grading units. Each grading unit shall include at least 3 in. **(76 mm)** of weld length. If a grading unit is designed to be unflawed, at least 1 in. **(25 mm)** of unflawed material shall exist on either side of the grading unit. The segment of weld length used in one grading unit shall not be used in another grading unit. Grading units need not be uniformly spaced around the pipe specimen.	Renumbered, moved from old paragraph 1.2(a). Metricated. No other changes.
	(2) Detection sets shall be selected from Table VIII-S10-1. The number of unflawed grading units shall be at least **one and a half** times the number of flawed grading units.	Moved from old paragraph 1.2(b). Table revised to reflect a change in the minimum sample set to 10 and the application of equivalent statistical false call parameters to the reduction in unflawed grading units. Human factors due to large sample size.
	(3) flawed and unflawed grading units shall be randomly mixed.	Moved from old paragraph 2.1.
	(b) Examination equipment and personnel are qualified for detection when **personnel demonstrations** satisfy the acceptance criteria of Table **VIII S10-1** for both detection and false calls.	Moved from old paragraph 3.1. Modified to reflect the 100% detection acceptance criteria of procedures versus personnel and equipment contained in new paragraph 4.0 and the use of 1.5X rather than 2X unflawed grading units contained in new paragraph 3.1(a)(2). Note, the modified table maintains the screening criteria of the original Table VIII-S2-1.
2.2 Length Sizing Test	**3.2 Length Sizing Test**	Renumbered
(a) The length sizing test may be conducted separately or in conjunction with the detection test.	(a) **Each reported circumferential flaw in the detection test shall be length sized.**	Provides consistency between Supplement 10 and the recent revision to Supplement 2 (Reference BC 00-755).

SUPPLEMENT 10 – QUALIFICATION REQUIREMENTS FOR DISSIMILAR METAL PIPING WELDS		
Current Requirement	**Proposed Change**	**Reasoning**
(b) When the length sizing test is conducted in conjunction with the detection test, and less than ten circumferential flaws are detected, additional specimens shall be provided to the candidate such that at least ten flaws are sized. The regions containing a flaw to be sized shall be identified to the candidate. The candidate shall determine the length of the flaw in each region.	(b) When the length sizing test is conducted in conjunction with the detection test, and less than ten circumferential flaws are detected, additional specimens shall be provided to the candidate such that at least ten flaws are sized. The regions containing a flaw to be sized **may** be identified to the candidate. The candidate shall determine the length of the flaw in each region.	Change made to ensure security of samples, consistent with the recent revision to Supplement 2 (Reference BC 00-755). Note, length and depth sizing use the term "regions" while detection uses the term "grading units". The two terms define different concepts and are not intended to be equal or interchangeable.
(c) For a separate length sizing test, the regions of each specimen containing a flaw to be sized shall be identified to the candidate. The candidate shall determine the length of the flaw in each region.	(c) For a separate length sizing test, the regions of each specimen containing a flaw to be sized **may** be identified to the candidate. The candidate shall determine the length of the flaw in each region.	Change made to ensure security of samples, consistent with the recent revision to Supplement 2 (Reference BC 00-755).
	(d) Examination procedures, equipment, and personnel are qualified for length sizing **when** the RMS error of the flaw length measurements, as compared to the true flaw lengths, is less than or equal to 0.75 in. **(19 mm)**.	Moved from old paragraph 3.2(a) includes inclusion of "when" as an editorial change. Metricated.
2.3 Depth Sizing Test	**3.3 Depth Sizing Test**	Renumbered
(a) For the depth sizing test, 80% of the flaws shall be sized at a specific location on the surface of the specimen identified to the candidate.	(a) **The depth sizing test may be conducted separately or in conjunction with the detection test. For a separate depth sizing test, the regions of each specimen containing a flaw to be sized may be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region.**	Change made to ensure security of samples, consistent with the recent revision to Supplement 2 (Reference BC 00-755).

SUPPLEMENT 10 – QUALIFICATION REQUIREMENTS FOR DISSIMILAR METAL PIPING WELDS		
Current Requirement	**Proposed Change**	**Reasoning**
(b) For the remaining flaws, the regions of each specimen containing a flaw to be sized shall be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region.	(b) **When the depth sizing test is conducted in conjunction with the detection test, and less than ten flaws are detected, additional specimens shall be provided to the candidate such that at least ten flaws are sized.** The regions of each specimen containing a flaw to be sized may be identified to the candidate. The candidate shall determine the maximum depth of the flaw in each region.	Change made to be consistent with the recent revision to Supplement 2 (Reference BC 00-755). Changes made to ensure security of samples, consistent with the recent revision to Supplement 2 (Reference BC 00-755).
	(c) Examination procedures, equipment, and personnel are qualified for depth sizing when the RMS error of the flaw depth measurements, as compared to the true flaw depths, is less than or equal to 0.125 in. **(3 mm).**	Moved from old paragraph 3.2(b). Metricated.
3.0 ACCEPTANCE CRITERIA		Delete as a separate category. Moved to new paragraph detection (3.1) and sizing 3.2 and 3.3.
3.1 Detection Acceptance Criteria. Examination procedures, equipment, and personnel are qualified for detection when the results of the performance demonstration satisfy the acceptance criteria of Table VIII-S2-1 for both detection and false calls.		Moved to new paragraph 3.1(b), reference changed to Table S10 from S2 because of the change in the minimum number of flaws and the reduction in unflawed grading units from 2X to 1.5X.
3.2 Sizing Acceptance Criteria		Deleted as a separate category. Moved to new paragraph on length 3.2 and depth 3.3.
(a) Examination procedures, equipment, and personnel are qualified for length sizing the RMS error of the flaw length measurements, as compared to the true flaw lengths, is less than or equal to 0.75 inch.		Moved to new paragraph 3.2(d), included word "when" as an editorial change.

SUPPLEMENT 10 – QUALIFICATION REQUIREMENTS FOR DISSIMILAR METAL PIPING WELDS		
Current Requirement	**Proposed Change**	**Reasoning**
(b) Examination procedures, equipment, and personnel are qualified for depth sizing when the RMS error of the flaw depth measurements, as compared to the true flaw depths, is less than or equal to 0.125 in.		Moved to new paragraph 3.3(c).
	4.0 PROCEDURE QUALIFICATION	New
	Procedure qualifications shall include the following additional requirements. **(a) The specimen set shall include the equivalent of at least three personnel sets. Successful personnel demonstrations may be combined to satisfy these requirements.** **(b) Detectability of all flaws within the scope of the procedure shall be demonstrated. Length and depth sizing shall meet the requirements of paragraph 3.2 and 3.3.** **(c) At least one successful personnel demonstration has been performed.** **(d) To qualify new values of essential variables, at least one personnel qualification set is required.**	New. Based on experience gained in conducting qualifications, the equivalent of 3 personnel sets (i.e., a minimum of 30 flaws) is required to provide enough flaws to adequately test the capabilities of the procedure. Combining successful demonstrations allows a variety of examiners to be used to qualify the procedure. Detectability of each flaw within the scope of the procedure is required to ensure an acceptable personnel pass rate. The last sentence is equivalent to the previous requirements and is satisfactory for expanding the essential variables of a previously qualified procedure.

10

TABLE VIII-S~~2~~-1
PERFORMANCE DEMONSTRATION DETECTION TEST ACCEPTANCE CRITERIA

Detection Test Acceptance Critera		False Call Test Acceptance Criteria	
No. of Flawed Grading Units	Minimum Detection Criteria	No. of Unflawed Grading Units	Maximum Number of False Calls
~~5~~	~~5~~	~~10~~	~~0~~
~~6~~	~~6~~	~~12~~	~~1~~
~~7~~	~~6~~	~~14~~	~~1~~
~~8~~	~~7~~	~~16~~	~~2~~
~~9~~	~~7~~	~~18~~	~~2~~
10	8	~~20~~ 15	~~3~~ 2
11	9	~~22~~ 17	~~3~~ 3
12	9	~~24~~ 18	~~3~~ 3
13	10	~~26~~ 20	~~4~~ 3
14	10	~~28~~ 21	~~5~~ 3
15	11	~~30~~ 23	~~5~~ 3
16	12	~~32~~ 24	~~6~~ 4
17	12	~~34~~ 26	~~6~~ 4
18	13	~~36~~ 27	~~7~~ 4
19	13	~~38~~ 29	~~7~~ 4
20	14	~~40~~ 30	~~8~~ 5

Enclosure 6

San Onofre Nuclear Generating Station
Units 2 and 3, Relief Request ISI-3-6
Mechanical Nozzle Seal Assembly Type 1

2nd 10-year Interval Cycle by Cycle Relief Requests 3.4.2, MNSA Cycle 11, and MNSA Cycle 12

Information to Support NRC Re-Approval of a 10 CFR 50.55a Request For Use During a New 10-Year Interval Inservice Inspection Program

1.0 Previous 10 CFR Request Approved by the NRC

1.1 Relief Request 3.4.2, Relief Request MNSA Cycle 11, and Relief Request MNSA Cycle 12

1.1.01 Submittal Letters:

Letter from J. L. Rainsberry (SCE) to Document Control Desk (U.S. NRC), dated July 11, 1997; Subject: Docket Nos. 50-361 and 50-362, Mechanical Nozzle Seal Assembly Code Replacement, Request for Relief from 10 CFR 50.55a, San Onofre Nuclear Generating Station, Units 2 & 3

Letter from J. L. Rainsberry (SCE) to Document Control Desk (U.S. NRC), dated December 12, 1997; Subject: Docket Nos. 50-361 and 50-362, Mechanical Nozzle Seal Assembly Code Replacement, Request for Relief from 10 CFR 50.55a, San Onofre Nuclear Generating Station, Units 2 & 3

Letter from J. L. Rainsberry (SCE) to Document Control Desk (U.S. NRC), dated January 5, 1998; Subject: Docket Nos. 50-361 and 50-362, Mechanical Nozzle Seal Assembly Code Replacement, Request for Relief from 10 CFR 50.55a, San Onofre Nuclear Generating Station, Units 2 & 3 (TAC Nos. M99558 and M99559)

Letter from J. L. Rainsberry (SCE) to Document Control Desk (U.S. NRC), dated January 29, 1998; Subject: Docket Nos. 50-361 and 50-362, Mechanical Nozzle Seal Assembly Code Replacement, Request for Relief from 10 CFR 50.55a, San Onofre Nuclear Generating Station, Units 2 and 3 (TAC Nos. M99558 and M99559)

Letter from J. L. Rainsberry (SCE) to Document Control Desk (U.S. NRC), dated April 30, 1998; Subject: Docket Nos. 50-361 and 50-362, Use of the Mechanical Nozzle Seal Assembly, San Onofre Nuclear Generating Station, Units 2 and 3 (TAC Nos. M99558 and M99559)

Submittal Letters Continued:

Letter from A. E. Scherer (SCE) to Document Control Desk (U.S. NRC), dated November 18, 1998; Subject: Docket Nos. 50-361 and 50-362, Use of the Mechanical Nozzle Seal Assembly, San Onofre Nuclear Generating Station, Units 2 and 3 (TAC Nos. M99558 and M99559)

Letter from A. E. Scherer (SCE) to Document Control Desk (U.S. NRC), dated September 29, 1999; Subject: Docket Nos. 50-361 and 50-362, Mechanical Nozzle Seal Assembly Code Replacement, Request for Relief from 10 CFR 50.55a, San Onofre Nuclear Generating Station, Units 2 and 3

Letter from A. E. Scherer (SCE) to Document Control Desk (U.S. NRC), dated December 24, 2001; Subject: Docket Nos. 50-361 and 50-362 Mechanical Nozzle Seal Assembly Code Replacement Request for Relief from 10 CFR 50.55a San Onofre Nuclear Generating Station, Units 2 and 3

1.1.02 **NRC Approval Letters:**

Letter from William H. Bateman (U.S. NRC) to Harold B. Ray (SCE), dated January 29, 1999; Subject: Use of Mechanical Nozzle Seal Assemblies for the San Onofre Nuclear Generating Station, Units 2 and 3 (TAC Nos. MA1776 and MA1777)

Letter from Stephen Dembek (U.S. NRC) to Harold B. Ray (SCE), dated July 11, 2000; Subject: San Onofre Nuclear Generating Station, Units 2 and 3 – Relief, Request from Use of Mechanical Nozzle Seal Assemblies as an, Alternate to the American Society of Mechanical Engineers, (ASME) Code Repairs (TAC Nos. MA6901 and MA6902)

Letter from Stephen Dembek (U.S. NRC) to Harold B. Ray (SCE), dated March 27, 2002; Subject: San Onofre Nuclear Generating Station, Units 2 and 3 - Evaluation of Relief for Use of Mechanical Nozzle Seal Assemblies as an Alternate to the American Society of Mechanical Engineers (ASME) Code Repairs (TAC Nos. MB3547 and MB3548)

1.1.03 Component Applicability

By correspondence listed above, SCE has requested and received cycle by cycle relief from the ASME Code requirements for Class 1 components to permit use of mechanical nozzle seal assemblies (MNSA) as an alternative repair method for reactor

coolant system instrumentation nozzles at San Onofre Nuclear Generating Station Units 2 and 3. The original MNSA design referred to throughout this Relief Request will be called "MNSA-1."

The Alloy 600 hot leg and cold leg instrument nozzles have been repaired with Alloy 690 half nozzles. The pressurizer upper shell (steam space) Alloy 600 nozzles have been replaced with full length Alloy 690 nozzles. Therefore, as shown in the table below, MNSA-1 is currently applicable to a total of 21 pressurizer and steam generator nozzles. Seven nozzles have MNSA-1 assemblies installed. Fourteen nozzles are candidates for repair by installation of a MNSA-1 assembly.

Item Number	LOCATION	NOZZLE ID	EXISTING
1.	Unit 2 Pressurizer Lower Shell	2LT-0110-1	MNSA-1 Installed
2.		2LT-0110-2	MNSA-1 Installed
3.	Unit 2 Steam Generator ME088	2PDT-0979-1	Candidate
4.		2PDT-0979-2	Candidate
5.		2PDT-0979-3	Candidate
6.		2PDT-0979-4	Candidate
7.	Unit 2 Steam Generator ME089	2PDT-0978-1	MNSA-1 Installed
8.		2PDT-0978-2	MNSA-1 Installed
9.		2PDT-0978-3	Candidate
10.		2PDT-0978-4	Candidate
11.	Unit 3 Pressurizer Mid Shell	3TE-0101	MNSA-1 Installed
12.	Unit 3 Pressurizer Lower Shell	3LT-0110-1	MNSA-1 Installed
13.		3LT-0110-2	MNSA-1 Installed
14.	Unit 3 Steam Generator ME088	2PDT-0979-1	Candidate
15.		2PDT-0979-2	Candidate
16.		2PDT-0979-3	Candidate
17.		2PDT-0979-4	Candidate
18.	Unit 3 Steam Generator ME089	3PDT-0978-1	Candidate
19.		3PDT-0978-2	Candidate
20.		3PDT-0978-3	Candidate
21.		3PDT-0978-4	Candidate

2.0 Changes to the Applicable ASME Code Section

Rules for Inservice Inspection of Nuclear Power Plant Components, Section XI, 1995 Edition, 1996 Addenda contain similar requirements to the 1989 Edition of the ASME Code. Specifically, per Section XI, IWA 4200, any items used for replacement shall meet the original Construction Code requirements.
Use of a later edition of the Construction Code is permitted based on an evaluation of changes demonstrating the replacement item meets the design requirements.

Components that are part of the reactor coolant pressure boundary must meet the requirements for Class 1 components in Section III of the ASME Boiler and Pressure Vessel Code as stated in 10 CFR 50.55a(c)(1). Therefore the Code Update does not affect this relief request.

3.0 Component Aging Factors

The component parts of the MNSA-1 are analyzed, designed, and manufactured in accordance with ASME Section III, Subsection NB, 1989 Edition, which is approved in 10 CFR 50.55a. The SONGS original Construction Code for the pressurizer, and steam generators is ASME Section III, 1971 Edition through and including the Summer 1971 Addenda. As required by ASME Section XI, addenda to the respective SONGS Units 2 and 3 Stress Reports were completed (References 7.1 and 7.2). Each design report includes reconciliation for use of the 1989 Edition of ASME Section III as it applies to the MNSA-1 and its interface with piping, pressurizer, and steam generator pressure boundaries.

The analyses for the MNSA-1 components demonstrate:

- Stresses will not exceed the allowables as stated in the Code.
- The Code-prescribed cumulative usage factor of 1.0 is not exceeded for any component

The stress analyses considered the loads transmitted to the components of the MNSA-1 due to installation pre-load, normal and upset loads at pressure and temperature, and impact loads due to the ejection of the instrument nozzle in the unlikely event of a complete failure of the J-weld. The results of the stress analysis demonstrate that the applied stresses on each load-bearing component (tie rods, flanges, bolts, and top plate) are below the applicable Code allowables, thereby providing assurance of structural integrity for the MNSA-1.

Fatigue evaluations of the MNSA-1 components considered a forty-year design life. The calculated fatigue usage factors determined in references 7.1 and 7.2

are less than 1.0 for all MNSA-1 components. The primary component of the usage factors is the stress range between heat-up and cooldown conditions. However, for 10 years of operation, the expected number of heat-up and cooldown cycles is substantially less than those accounted for in the stress analysis for a 40-year design life.

The MNSA-1 is attached to the pressure vessels with SA-453 Grade 660 bolts. In addition, two shoulder bolts are provided to accommodate shear loads. For each MNSA-1 installation, six holes are drilled and tapped into the pressurizer or steam generator around the sleeve. The addition of the holes in the applicable pressure vessel was analyzed and documented in references 7.3 and 7.4. The analyses were performed to the requirements of ASME Section III, 1971 Edition through and including the Summer 1971 Addenda. The analyses demonstrate:

- Stresses will not exceed the allowables as stated in the Code.
- The Code prescribed cumulative usage factor of 1.0 is not exceeded at any location.
- Adequate reinforcement in the wall of the affected pressure vessel for the tapped holes exists.

The stress analyses considered all loads evaluated in the original design stress report, including all pressure and temperature transients, the differential thermal expansion loads due to the bolts in the tapped holes, compression collar loads, and the loads on the existing J-weld at operating and during shutdown conditions. The applied stresses and stress ranges were evaluated at the tapped holes for compliance with Code allowables. The applied stresses on the piping or pressure vessel were modified by the appropriate geometry factors for non-radial effects (where applicable) and by additional factors to take into account stress interaction between the tapped holes as determined by finite element analysis (FEA). The results of the stress analysis, considering the tapped holes in the pressure vessel shell, demonstrate applied stresses are below ASME Code allowables and provide assurance of vessel structural integrity.

Fatigue evaluations of the affected pressure vessel shell in the vicinity of the tapped holes considered a forty-year design life. The calculated fatigue usage factors are less than 1.0 in the vicinity of the tapped holes for any location subject to MNSA-1 installation. The primary component of the usage factors is the stress range between heat-up and cooldown conditions. However, for ten years of operation, the expected number of heat-up and cooldown cycles are substantially less than those accounted for in the stress analysis for a 40-year design life.

The area reinforcement calculations performed in the original design stress

report in accordance with ASME Code Section III NB-3330 were updated to evaluate the removal of pressure vessel metal area by machining the tapped holes. The results of the analysis in References 3 and 4 demonstrate that for each nozzle location evaluated for MNSA-1 installation, the area available for reinforcement is greater than the area required as a result of metal removal.

Due to the MNSA clamp being located on the surface of the affected pressure vessel, the extent of degradation will be determined from visual examination of surfaces for evidence of boric acid deposits or leakage. Where necessary these inspections involve building scaffolding and removing insulation to provide improved access. If detected, boric acid deposits would be considered the result of non-isolable thru-wall cracks and the associated leakage would be counted as unidentified RCS pressure boundary leakage. Continued operation in this configuration is not allowed by technical specifications. If detected, boric acid deposits would be cleaned from the leak site and leak path, the material loss would be quantified and repair activities would be initiated.

4.0 Changes in Technology for Inservice Inspection of the Affected ASME Code Components

SCE first obtained approval to use MNSA-1 at SONGS Units 2 and 3 in 1999. Since that time there have not been any changes in technology that would eliminate the need for continued use of MNSA-1 at SONGS.

5.0 Confirmation of Renewed Applicability

During the SONGS Units 2 and 3 Second 10-year ISI Interval, use of the MNSA-1 as an Alternate Method for Replacing Reactor Coolant System Instrument Nozzles was granted cycle by cycle (refer to correspondence listed in section 1). By this submittal of ISI-3-7, SCE requests relief through the Third 10-year Inservice Inspection Interval contingent upon continued successful visual examinations at each refueling outage.

Stress Corrosion Cracking has been experienced in the Alloy 600 nozzles at many nuclear plants. The typical repair of these nozzles involves external weld repairs with half nozzle replacements. The MNSA-1 is used as an alternative replacement to repair leaks or installed proactively to prevent leaks from RCS nozzles.

The Mechanical Nozzle Seal Assembly Type 1 (MNSA-1) provides the leakage sealing and structural integrity functions of a nozzle attachment weld in locations (e.g., bottom of the pressurizer) where the typical repair and replacement techniques may be difficult or impractical. Installation of the MNSA-1 also avoids the need for higher risk plant operations (i.e., reduced inventory for repair or replacement of RCS nozzles). In addition, the MNSA-1

will shorten the repair time significantly and thereby reduces radiation exposure to workers.

The typical repair for nozzles of this type is a half nozzle replacement with external weld. A radiation exposure savings from use of the MNSA instead of the present nozzle repair/replacement method is expected to be approximately 1 person-rem per steam generator nozzle and approximately 1.5 to 2 person-rem per nozzle on the pressurizer. Additionally, the removal of the currently installed MNSA-1 nozzles and subsequent nozzle repair would result in approximately 2 person-rem per nozzle.

SCE will perform the visual inspection plan of each installed MNSA-1 at each refueling outage:

Visual Inspection Plan

a. ASME VT-1 and VT-2 examinations as required under our ASME Section XI program.

b. Additional visual inspections on every installed MNSA, performed during every refueling outage, at approximately two-year intervals. Any evidence of degradation, including leakage or corrosion, of the installed MNSA or the surrounding area, will be recorded. Evidence of leakage from the interface of the vessel wall and the MNSA lower flange, or along the axis of the nozzle, would be considered pressure boundary leakage and would be cause for 1) further investigation, 2) action to stop all pressure boundary leakage, and 3) reporting to NRC.

c. Additional inspections will also include:

    i. Feeler gauge measurements of the top plate (anti-ejection device) gap. This will determine if relative movement has occurred between the MNSA and the nozzle. This will indicate if the fasteners have moved, or if the nozzle has separated from the pressure vessel.

    ii. Inspection of the condition of the locking tab washers and associated fasteners. Satisfactory condition is an indication that there has been no loss of preload or load relaxation on the seal.

Documentation of the visual inspections will be included in the Section XI Inservice Inspection Summary Report submitted to the NRC after each refueling outage. Based on the information provided in the previously submitted relief requests, the information contained in the NRC evaluation of these requests, and the information provided in this relief request, the circumstances and basis for this Relief Request continue to be applicable.

6.0 Duration of Re-Approval of 10 CFR 50.55a Request for Relief ISI-3-6

Relief is requested for the third inspection interval at SONGS Units 2 and 3, which is scheduled to end on August 17, 2013.

7.0 Reference:

Submittal letters listed in Sections 1.1.02 and 1.1.03 and the following:

7.1 Design Report No. S-PENG-DR-002, Rev. 03, Addendum to CENC-1275 and CENC-1296 Analytical Reports for Southern California Edison San Onofre Units 2 and 3 Pressurizer (SCE document SO23-411-57-3-4)

7.2 Design Report No. S-PENG-DR-004 Rev. 02 Addendum to CENC-1272 and CENC-1298 Steam Generator Analytical Reports for Southern California Edison San Onofre Units 2 and 3 (SCE document SO23-411-57-28-2 MNSA-1 for Steam Generator PDT nozzle)

7.3 A-SONGS-9416-1170 Rev. 04 Evaluation of Attachment Locations for Mechanical Nozzle Seal Assemblies on SONGS Units 2 and 3 Pressurizer Shell and Bottom Head Instrument Nozzles (SCE document SO23-411-57-14-4)

7.4 A-SONGS-9416-1183 Rev. 00 Evaluation of Attachment Locations for Mechanical Nozzle Seal Assembly on SONGS Units 2 and 3 Steam Generator PDT Instrument Nozzles (SCE document SO23-411-27-0)

Enclosure 7

**San Onofre Nuclear Generating Station
Units 2 and 3, Relief Request ISI-3-7
Mechanical Nozzle Seal Assembly Type 2**

**New Request
ISI-3-7 Replaces
Submittal of MNSA-2-Cycle 12**

TABLE OF CONTENTS

I. COMPONENTS

Description: Pressurizer Heater Sleeves. Thirty (30) total per Unit.

Code Class: ASME Section III, Class 1

References:

1. ASME Section III, 1989 Edition, no Addenda (MNSA-2 Design Code)
2. ASME Section III, 1971 Edition through and including Summer 1971 Addenda (Pressurizer Design Code)
3. ASME B&PV Code, Section XI, 1989 Edition, no Addenda
4. Westinghouse Calculation Number CN-CI-02-76 Rev. 0 "Analysis of SONGS Unit 2 & 3 Pressurizer Heater Sleeve MNSA-2 Designs," dated 1/10/03
5. Westinghouse Test Report Number TR-CI-02-4, "Seismic Qualification Testing of the SONGS, Units 2 & 3 MNSA-2 Clamps for Pressurizer Heaters" dated 01/10/03.
6. Westinghouse Calculation Number CN-CI-02-73 Rev. 00, "Evaluation of Attachment Locations for the Mechanical Nozzle Seal Assemblies on SONGS Unit 2 and 3 Pressurizer Heater Sleeves," dated 1/10/03
7. Westinghouse Design Report Number DAR-CI-02-21, Rev. 0, "Addendum to CENC-1275 and CENC-1296 Analytical Reports for Southern California Edison San Onofre Units 2 and 3 Pressurizer," dated 1/10/03
8. Letter dated March 1, 2002 from Michael A. Krups to US Nuclear Regulatory Commission; subject: "Entergy operations, Inc. Use of Mechanical Nozzle Seal Assemblies Waterford Steam Electric Station – Unit 3 Docket No. 50-382 License NPF-38" (reference CNRO-2220-00010)
9. Westinghouse Report DS-ME-02-8, rev. 01, "Design Specification for Mechanical Nozzle Seal Assembly (MNSA2) for San Onofre Units 2 and 3."
10. Letter dated January 17, 2003 from A. E. Scherer (SCE) to the Document Control Desk (NRC); Subject: Docket Nos. 50-361 and 50-362, Response to NRC Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," 60-Day Response for San Onofre Nuclear Generating Station, Units 2 and 3, Request for Additional Information (TAC Nos. M4575 and M4576)

11. Letter dated January 24, 2003 from A. E. Scherer (SCE) to the Document Control Desk (NRC); Subject: Subject: Docket Nos. 50-361 and 50-362 Mechanical Nozzle Seal Assembly Type 2 Code Replacement Request for Relief from 10 CFR 50.55a San Onofre Nuclear Generating Station, Units 2 and 3

Unit/Inspection Interval/Applicability

San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 are both in their second 10-year Inservice Inspection (ISI) interval. The current "Code of Record" for Inservice Inspection is the ASME B&PV Code, Section XI, 1989 Edition, no Addenda (Reference 3). On August 18, 2003, SONGS Units 2 and 3 will begin their third 10-year ISI interval and the ASME Code of Record will change to the 1995 Edition; 1996 Addenda.

II. CODE REQUIREMENTS

ASME Section XI, (reference 3) IWA-7200 requires any items used for replacements to be performed in accordance with the existing design requirements and the original Construction Code of the component or system. The affected pressurizer heater sleeves were designed and constructed to the rules of ASME Section III, Subsection NB, 1971 Edition, through and including the Summer 1971 Addenda (Reference 2). ASME Section XI does not include rules that address the use of mechanical clamping devices to replace pressure boundary components and to maintain the structural integrity of the ASME III, Class 1 pressure retaining boundary.

III. PROPOSED ALTERNATIVE

Pursuant to 10CFR50.55a(a)(3)(i), Southern California Edison (SCE) requests NRC authorization to use the improved design of the Mechanical Nozzle Seal Assembly, designated MNSA-2, in applications at the heater sleeves located on the bottom head of the pressurizer vessels at SONGS Units 2 & 3.

SCE makes this request in order to repair leaks attributed to Primary Water Stress Corrosion Cracking (PWSCC) that may be detected while performing inspections during refueling outages.

The typical repair of nozzles or heater sleeves of this type uses a half-nozzle replacement with external weld repair. These repairs would extend high risk reduced inventory reactor coolant system (RCS) drain-down activities and significantly increase worker radiation exposure to perform extensive field machining and temper bead welding activities.

As an alternative, SCE proposes to use the MNSA-2 as a repair to restore pressure boundary integrity and prevent leakage.

IV. BASIS FOR PROPOSED ALTERNATIVE

A. *Background*

The pressurizer, including the heater sleeve penetration assemblies, was designed by Combustion Engineering. Combustion Engineering is currently owned by Westinghouse Electric Company.

- Pressurizer heater sleeves (30)

The pressurizer heater sleeves, thirty (30) on each Unit's pressurizer, are manufactured from Ni-Cr-Fe, SB-167 material (Alloy 600). One heater sleeve at SONGS 3 has a half nozzle welded to the exterior of the vessel. The remaining 30 heater sleeves at SONGS Unit 2 and 29 heater sleeves at SONGS Unit 3 are welded to the internal cladding of the vessel lower head and the heater elements are welded to the lower end of the sleeves. The heater elements are internally supported for seismic loading and vibration by two heater support plates. The outside diameter of the sleeve is approximately 1.660 inches, and the inside bore is approximately 1.273 inches. The length of the sleeves varies from approximately 14 3/8 inches long to approximately 18 3/8 inches long, depending on the location on the bottom head. The upper end of the heater sleeve is provided with a short oversize segment to serve as an anti-ejection device should the sleeve to vessel weld fail completely.

- Pressurizer Vessel

The pressurizer is a low alloy steel vessel with the shell and top head internally clad with 304 austenitic stainless steel and the bottom head with a Ni-Cr-Fe cladding.

The Ni-Cr-Fe heat affected zone of the J-weld has proven to be susceptible to PWSCC. Numerous instances of nozzle cracking have been identified in the industry in recent years. Studies performed by the Westinghouse Owner's Group (Report CENPSD-690-P, *Appendix 1, Reference 1*) have found that the crack growth is predominantly axial. The dominant condition that promotes axial growth rather than circumferential growth is high circumferential stress (hoop stress) compared to the axial stress. The hoop stresses are due to residual stress caused by weld shrinkage that diminishes quickly as the distance from the J-weld increases and operating stresses. The susceptibility to PWSCC is based on several factors that deal with material, stress, and environment.

Inspections required by ASME Section XI, IWB-2500 for Examination Category B-P are performed during each refueling outage. Additionally, the walkdown inspections performed in response to Generic Letter 88-05,

"Boric Acid Corrosion of Carbon Steel Reactor Coolant Pressure Boundary Components" as recommended by the Combustion Engineering Owner's Group are performed during each refueling outage.

B. MNSA-2 Application, Description, and Design

1. Overview

The MNSA-2 is a mechanical device designed to replace the function of partial penetration J-groove welds that attach Alloy 600 nozzles or heater sleeves to the pressurizer. MNSA-2 provides a seal against leakage and positively captures the sleeve preventing ejection in the unlikely event of complete 360-degree weld failure. Figure 1 shows a representative drawing of the MNSA-2 for a heater sleeve.

To install the MNSA-2, four holes are drilled and tapped (1/2" diameter x 1 1/2" deep) equally spaced around the leaking sleeve. A counter-bore (approximately 1/4" wide x 3/4" deep) is also machined into the surface of the vessel perpendicular to and around the leaking sleeve. Four threaded rod studs are threaded into the pressurizer, a split Grafoil primary seal is installed in the bottom of the counter-bore, and a split compression collar is placed over the sleeve to compress the Grafoil seal. The seal assembly is compressively loaded via the compression collar and the inboard and outboard flange assembly, which is in the annulus region. Hex nuts and Belleville spring washers are used to live load the Grafoil seal to accommodate small changes in load on the seal due to differential expansion or minute relaxation of the seal over time and prevent seal leakage.

To prevent heater sleeve ejection in the unlikely event of a complete sleeve weld failure, an anti-ejection clamp is also installed and secured in place via the tie rods, Belleville spring washers, and hex nuts. The anti-ejection clamp acts as a restraint only if the sleeve or partial penetration weld completely fails.

More specific details of the MNSA-2 design are provided in Section B.2, below.

2. Design

The NRC previously authorized use of the MNSA-2 design for nozzles and sleeves at Waterford 3. The NRC has approved similar requests for temporary repair of pressurizer instrument nozzles and heater sleeves by MNSA-1 (the original design) at Southern California Edison's San Onofre Nuclear Generating Station; Entergy Operations Inc.'s Waterford 3; Arizona Public Service Company's Palo Verde Nuclear Generating

Station; and at Dominion Nuclear Connecticut's Millstone Nuclear Power Station.

The original MNSA-1 and MNSA-2 use the same materials of construction and the same seal material. They are attached in a similar fashion, and the seal is loaded by tensioning bolts or studs.

The MNSA-2 design, shown in Figure 1, differs from the original MNSA design in three ways:

- The counter-bore provision that contains the seal
- The manner in which the seal is live-loaded
- The means for diverting leakage, should it occur

Each is discussed in detail below.

a) Counter-Bore Provision

MNSA-2 uses nuclear grade Grafoil as the sealing material. In all cases, regardless of the angle of the surface of the pressurizer relative to the sleeve, a counter-bore is machined perpendicular to the sleeve to receive and contain the seal. The bottom of the counter-bore is perpendicular to the axis of the sleeve, so the angle of the surface of the pressurizer does not affect the leak tightness of the design. When the MNSA-2 seal is compressed, no side loads are introduced, so shoulder bolts used on the original MNSA-1 are not required. The seal designs are simpler than the original MNSA-1 because they involve no variable angles. Therefore, customizing MNSA components for particular slope angles, for other than bolt lengths, is not required.

b) Seal Live-Loading

MNSA-2 uses a live-loaded seal that can accommodate small changes in load on the seal due to differential expansion. The live load provision, provided via Belleville washers, also accommodates minute relaxation of the seal over time to prevent leakage. Finally, it allows for re-tightening of the studs and reloading the seal at some point in the future without disassembly, whereas the original MNSA-1 would require a new seal and complete teardown and re-assembly to reenergize a seal. Figure 1 shows the use of Belleville spring washers.

c) Leak-Off Diversion

Leakage control in the MNSA-2 design is accomplished by using a

compression collar which includes a collection area (similar to a "lantern ring") positioned immediately outboard of the primary seal, as shown in Figure 1. The compression collar has an additional Grafoil seal at the top that is lightly loaded. The seal blocks leakage from passing up along the outside of the compression collar where it could reach the threaded rods. The path of least resistance is out through the annulus between the compression collar and the sleeve, tending to divert any leakage away from the fasteners and the vessel. The presence of the collection area does not impair the primary seal in any way.

In the review of the original MNSA-1 design, the NRC evaluated potential corrosion effects of boric acid on the MNSA and associated RCS components. The evaluation considered:

- Corrosion of the low alloy material with a MNSA-1 installed was determined to be acceptable

- Boric acid corrosion of the materials of construction for the MNSA-1 was determined to be acceptable based on CE Owner's Group corrosion testing

- There is no history of galvanic corrosion problems in similar applications with Grafoil contacting low alloy steel.

- Potential for SCC failures of the SA 453 Grade 660(A-286) bolts was found to be acceptable

There are no changes from the original MNSA-1 to MNSA-2 that adversely impact the four conclusions listed above. With regard to the SA 453 Grade 660 (A-286) bolts, the NRC evaluation concluded that the bolts could be exposed to boric acid deposits or slurries, if the MNSA-1 leaks. This evaluation was appropriate because the design did not include provisions for capturing or diverting seal leakage away from bolting materials. Regardless, at the stress levels that exist in the bolts, including a stress concentration factor of four, the bolts would function satisfactorily. In contrast to the original MNSA-1, the MNSA-2 design includes specific provisions to divert potential seal leakage away from the low alloy steel vessel and the bolting as described below.

The sealing qualities of MNSA-2 are enhanced beyond that of the original MNSA-1 by virtue of the controlled geometry (counter-bore), and by maintaining a live load on the seal. The counter-bore design has been used routinely in hundreds of similar applications for sealing fixed in-core detectors to flanges on the reactor head in Combustion Engineering units. A variety of other repairs and permanent flange upgrades have been installed on both Combustion Engineering and Westinghouse units using

both static and live-loaded Grafoil seal technology. Therefore, the possibility of a leak past the primary seal is very small. Nevertheless, in the unlikely event of such a leak, MNSA-2 is designed to limit exposure of the SA-453 grade 660 (A-286) bolting material and the carbon steel vessel by providing a leak-off path.

d) Installation

The MNSA-2 installation process will be performed such that it will not degrade the existing heater sleeve pressure boundary, and it does not require draining of the pressurizer to install. The tooling is designed to machine the counter-bore without removing the pressure boundary heater element.

Torquing the MNSA-2 threaded rods into the pressurizer will be performed at temperatures above bounding RT_{NDT} (10 °F for the bottom head*)* to ensure the bolting stress does not create a potential for brittle failure. The stress calculations (References 4 and 6) document the installation torque values of 27 ft-lbs for the threaded rods. Pre-load conditions are addressed in the installation procedures.

3. MNSA-2 Materials

The MNSA-2 assembly is fabricated from the same materials as the original MNSA-1, though with different application of some of the components. A detailed assessment of the MNSA-2 metallic components as related to general corrosion, stress corrosion cracking of nozzles and fasteners, galvanic effects, crevice corrosion, and surface pitting of the constituent components is contained in Appendix 1 of this relief request. There are no potential corrosion problems associated with the application of the MNSA-2 to Alloy 600 small diameter heater sleeves.

The stainless steel portions of the MNSA-2 performing an RCS pressure boundary function are manufactured in accordance with material specifications provided in ASME Section III, Subsection NB and the applicable ASME Section III Appendices. Additionally, the material meets the requirements contained in NB-2000 including examination and testing. Materials are supplied to the provisions of ASME Section III, NCA-3800 by suppliers maintaining a valid Quality System Certificate or a Certificate of Authorization with the scope of Material Supply. Metallic pressure boundary material is certified in accordance with ASME Section III, NCA-3800.

The primary Grafoil seal material is Grade GTJ (used in nuclear applications) composed of 99.5% graphite, with the remaining 0.5% made up of ash, halides, and sulfur. The Grafoil seal itself is chemically resistant to attack from organic and inorganic fluids, and is very resistant

to borated water. Similar Grafoil material is used as valve packing in valves installed in the RCS with acceptable results. The Grafoil material is provided under the provisions of a Quality Assurance Program meeting 10CFR50 Appendix B that has been approved by SCE. Material testing and certification is provided with the material to verify compliance with the engineered features that are required to ensure functionality and compatibility with the pressure boundary materials and environment.

In summary, there are no potential corrosion or material stress issues associated with applying the MNSA-2 to the pressurizer heater sleeves.

4. MNSA-2 Structural Evaluation

The component parts of the MNSA-2 for heater sleeve are analyzed, designed, and manufactured in accordance with ASME Section III, Subsection NB, 1989 Edition, which is approved in 10 CFR 50.55a. The SONGS original Construction Code for the pressurizer is ASME Section III, 1971 Edition (Reference 2), through and including the Summer 1971 Addenda. As required by ASME Section XI, an addendum to the SONGS Units 2 and 3 Pressurizer Stress Reports CENC 1275 and CENC 1296 (Reference 7) was completed and includes a reconciliation for use of the 1989 Edition of ASME Section III (Reference 1) as it applies to the MNSA-2 and its interface with the pressurizer.

The analysis for the MNSA-2 components addressed:

- Stresses not to exceed the allowables as stated in the Code.
- Fatigue to demonstrate that the Code-prescribed cumulative usage factor of 1.0 is not exceeded (NB-3222.4) for any component

The stress analysis considered the loads transmitted to the components of the MNSA-2 due to installation pre-load, normal, upset, and faulted loads at pressure and temperature, and impact loads due to the ejection of the heater sleeve in the unlikely event of a complete failure of the J-weld. The results of the stress analysis demonstrate that the applied stresses on each load-bearing component (tie rods, threaded rods, and top plate) are below the applicable Code allowables, thereby providing assurance of structural integrity for the MNSA-2.

Fatigue evaluations of the MNSA-2 clamp components considered a forty-year design life. The calculated fatigue usage factors in Reference 6 are less than 1.0 for MNSA-2 components. The primary component of the usage factors is the stress range between heat-up and cooldown conditions. However, for ten years of operation, the expected numbers of heat-up and cooldown cycles are substantially less than those accounted

for in the stress analysis for a 40-year design life.

5. Pressurizer Modification and Structural Evaluation

The MNSA-2 is attached to the pressurizer with SA-453 Grade 660 threaded rods and hex nuts. To accommodate the threaded rods, four holes are drilled and tapped into the pressurizer in a circular pattern around the sleeve. To provide a seating surface for the Grafoil seal, a counter-bore is machined into the pressurizer extending out approximately ¼" from the existing sleeve bore and to a depth of ¾". The addition of the holes in the pressurizer was analyzed and documented in an attachment to the Westinghouse calculation CN-CI-02-73 (Reference 6) for the heater sleeve locations. The analysis is performed to the requirements of ASME Section III, 1971 Edition through and including the Summer 1971 Addenda. The analysis addresses:

- Stresses not to exceed the allowables as stated in the Code.
- Fatigue to demonstrate that the Code prescribed cumulative usage factor of 1.0 is not exceeded (NB-3222.4) at any location.
- Adequate reinforcement in the wall of the pressurizer for the tapped holes and counter-bore exists (NB-3330)

The stress analysis considered all loads evaluated in the pressurizer original design stress report, including all pressure and temperature transients, the differential thermal expansion loads due to the threaded rods in the tapped holes, compression collar loads, and the loads on the existing J-weld at operating and during shutdown conditions. The applied stresses and stress ranges were evaluated at the counter-bore region and at the tapped holes for compliance with Code allowables. The applied stresses on the pressurizer were modified by the appropriate geometry factors for non-radial effects (where applicable) and by additional factors to take into account stress interaction between the tapped holes and the counter-bore as determined by finite element analysis (FEA). The results of the stress analysis, considering the tapped holes and counter-bore in the pressurizer shell, demonstrate applied stresses are below ASME Code allowables and provide assurance of vessel structural integrity.

Fatigue evaluations of the pressurizer shell in the vicinity of the tapped holes and counter-bores considered a forty-year design life. The calculated fatigue usage factors in Reference 6 are less than 1.0 in the vicinity of the tapped holes and counterbores for any location subject to MNSA-2 installation. The primary component of the usage factors is the stress range between heat-up and cooldown conditions. However, for ten years of operation, the expected number of heat-up and cooldown cycles

are substantially less than those accounted for in the stress analysis for a 40-year design life.

The area reinforcement calculations performed in the original design stress report in accordance with ASME Code Section III NB-3330 were updated to evaluate the removal of pressurizer metal area by machining the tapped holes and counter-bores. The results of the analysis in Reference 6 showed that for each pressurizer heater sleeve location evaluated for possible MNSA-2 installation, the area available for reinforcement is greater than the area required as a result of metal removal.

C. MNSA-2 Design Requirements

In accordance with ASME Section XI, IWA-7200, replacements shall meet the existing design requirements and the original Construction Code. Alternatively, replacements may meet later Editions of the original Construction Code provided:

- The requirements affecting the design, fabrication, and examination of the item to be used for replacement are reconciled with the Owner's through the Stress Analysis Report, the Design Report, or other suitable method that demonstrates the item is satisfactory for the specified design and operating conditions.
- Mechanical interfaces, fits, and tolerances that provide satisfactory performance are compatible with the system and component requirements.
- Materials are compatible with installation and system requirements.

ASME Section III NB-3200 rules are followed for designing and manufacturing the MNSA-2. Specifically, the joints will be designed to meet the following criteria:

1. Provisions must be made to prevent separation of the joint under all service conditions.
2. The joint must be designed to be accessible for maintenance, removal, and replacement activities.
3. The joint must either be designed in accordance with the rules of ASME Section III, Subarticle NB-3200, or be evaluated using a prototype of the joint that will be subjected to additional performance tests in order to determine the safety of the joint under simulated service conditions.

These topics are discussed below.

1. Joint Integrity

In addition to the prototype testing discussed below, the MNSA-2 is analyzed to meet the requirements of NB-3200. The MNSA-2 is designed as an ASME Section III, Class 1, safety-related primary pressure boundary in accordance with the rules of NB-3200 to prevent joint separation under service loads. An addendum to Pressurizer Stress Reports CENC-1275 and CENC-1296 for SONGS Units 2 and 3 (Reference 7) demonstrates that stresses under all service conditions do not exceed the Code allowables as stated within Section III and that fatigue limits are not exceeded using the conditions contained in the Design Specification.

2. Maintenance, Removal, and Replacement

Typical for mechanical connections, the MNSA-2 will be accessible for maintenance, removal, and replacement after service. The MNSA-2 is manufactured without welding and is bolted in place, so disassembly is a mechanical evolution that requires de-tensioning the installation bolting.

3. Qualification Testing

The original MNSA-1 design was qualified by a series of tests and analyses. Entergy Operations, Inc. in their submittal for MNSA-2 (Reference 8) discussed hydrostatic and thermal cycling qualification tests.

Seismic Qualification Testing:

Seismic qualification was performed for the SONGS MNSA-2 assembly in accordance with the guidelines in IEEE-344. A test specimen representative of an outer heater sleeve MNSA-2 design for SONGS Units 2 and 3 was attached to an adapter plate and mounted to a shaker table. The heater sleeve test specimen was not welded to the mounting fixtures. The MNSA-2 components were assembled and installed onto the simulated heater sleeve mock-up. The seismic testing consisted of subjecting the MNSA-2 test rig to five operating basis earthquake events and one safe shutdown earthquake event. The mounting fixture permitted pressurization to 3,175 psig ± 50 psig at ambient temperature during the seismic test. This elevated pressure was conservatively used to account for the fact that the seismic testing was performed at ambient temperatures rather than operating temperatures. The test results indicate that no mechanical damage occurred and no leakage was present

during or after the test. Information contained in Reference 5 provides a basis for performing the seismic testing using ambient temperatures and concludes that the test results were applicable to hot conditions.

Summary:

The test program, test results, and analyses described in References 4, 5, 6, 7 and 8 have been reviewed and found to adequately represent or bound the conditions for which SCE proposes to install the MNSA-2 at SONGS Units 2 and 3.

The MNSA-2s to be installed at SONGS Units 2 and 3 will be subjected to the conditions described below which are obtained from the Design Specification (Reference 9) and form part of the basis for analysis. As evidenced by design analyses (References 4, 6, & 7), and seismic test report (Reference 5), the design conditions equal or exceed the operating conditions for which the clamps will be exposed.

	SONGS 2/3 Conditions	MNSA-2 Design
Design Pressure	2500 psia	2500 psia
Design Temperature (Pressurizer)	700°F	700°F
Nominal Operating Pressure	2250 psia	
Normal Temperature (Pressurizer)	653°F	

D. Inservice Testing and Inspection

1. ASME Section XI Preservice

ASME Code Section XI Preservice inspection requirements, applicable to the MNSA-2 during each 10-year inspection (ISI) interval, include a system leak test at the end of each refueling outage and bolting examination, based on the schedule of percentages required. For the MNSA-2 installed on pressurizer heater sleeves, the Bolting B-G-2 examination requirements would allow VT-1 examination to be performed as follows: (a) in place under tension, and (b) when the connection is disassembled or when the bolting is removed. This examination is required once each ten-year interval.

2. ASME Section XI Pressure Tests

A VT-2 examination will be performed in conjunction with a system leakage pressure test (per IWA-5000) as part of plant re-start and will be conducted at normal operating pressure and temperature for SONGS Unit 2 and 3 Pressure and Temperature Limits as stated in the applicable Technical Specifications.

3. ASME Section XI Inservice Inspection

The VT- 1 inservice inspections required by ASME Section XI for Examination Category B-G-2 are performed during each refueling over the l0-year interval and would not be performed more frequently than each refueling cycle. The VT-2 inspection required by ASME Section XI for Examination Category B-P is required to be performed prior to plant startup following each refueling outage.

A bounding flaw evaluation will be performed for all pressurizer heater sleeves in accordance with the 1989 ASME section XI Code, IWB-3600. Existing site specific bounding flaw evaluations will be updated to address the installation of a MNSA-2 clamp. Flaw growth due to fatigue and stress corrosion cracking has been previously considered and will be re-evaluated for potential MNSA-2 effects.

E. Additional Outage Inspections

After a MNSA-2 is installed, it will be included in the SONGS Boric Acid Leakage Program and Alloy 600 Inspection Program. These programs were recently discussed in detail in the SCE response to a request for additional information regarding Bulletin 2002-02 (Reference 10).

Additionally, SCE will visually inspect for leakage the counter-bore/annulus region of each installed MNSA-2 device during each refueling outage.

V. CONCLUSION

10CFR50.55a(a)(3) states:

"Proposed alternatives to the requirements of(c), (d), (e), (f), (g), and (h) of this section or portions thereof may be used when authorized by the Director of the Office of Nuclear Reactor Regulation. The applicant shall demonstrate that:

(i) The proposed alternatives would provide an acceptable level of quality and safety, or

(ii) Compliance with the specified requirements of this section would result in

hardship or unusual difficulty without a compensating increase in the level of quality and safety."

SCE believes that the proposed alternative provides an acceptable level of quality and safety because:

- The design of the MNSA-2 is in accordance with ASME Section III, 1989 Edition (Reference 1), NB-3200. The analysis includes provisions for fatigue and assurances that stresses do not exceed Code allowables. Additionally, significant prototype testing (seismic, hydrostatic, and thermal cycling) has been completed that demonstrates functionality and leak tightness during conditions of operations that are representative of SONGS.

- Modification of the Pressurizer was analyzed in accordance with the original Construction Code (ASME Section III, 1971 Edition through and including the Summer 1971 Addenda). Analysis included fatigue, reinforcement requirements for the tapped holes and counterbores, and assurance that stresses do not exceed Code allowables.

- Methods of analysis, materials, and fabrication meet ASME Section III, Subsection NB. This is comparable to the original methods of analysis, materials and fabrication used for the Pressurizer.

- The non-Code portions of the MNSA-2 that perform a safety-related function are provided under a program meeting 10CFR50 Appendix B.

- After installation, the MNSA-2 will be inspected under operating pressure (uninsulated) for leakage to ensure quality of installation and leak tightness.

- The information provided in this relief request supports the use of the MNSA-2 for the third ten year ISI interval.

Therefore, we request authorization to perform the requested alternative to the Code requirement pursuant to 10CFR50.55a(a)(3)(i).

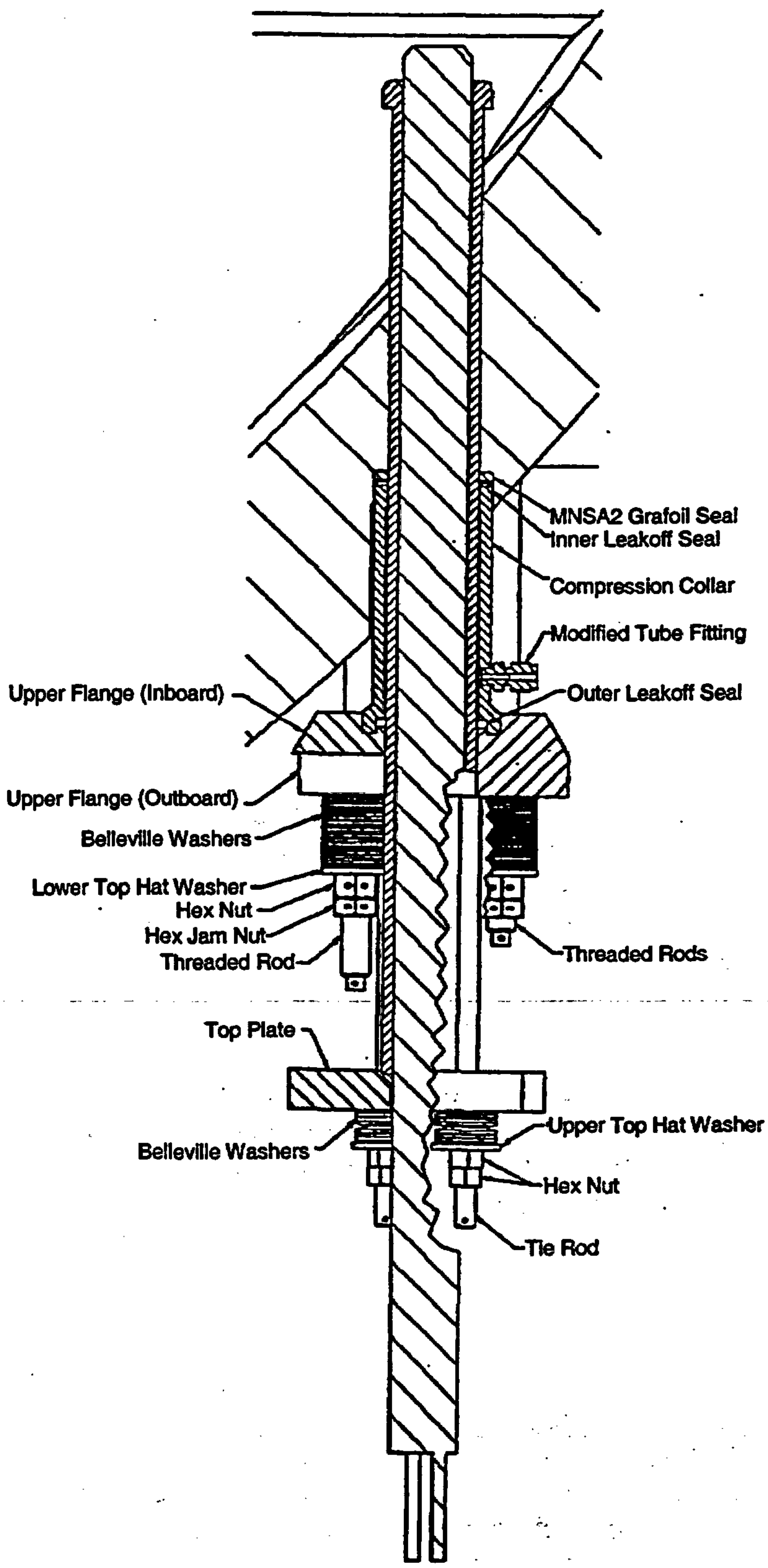
VI. DURATION OF THE REQUEST

SCE requests the use of the MNSA-2 design at SONGS for the 3rd 10-year ISI Interval.

VII. PRECEDENTS

MNSA-2 has been approved for use at the Waterford Steam Electric Station – Unit 3 Docket No. 50-382 License NPF-38, Reference 8

NRC is currently reviewing a MNSA-2 relief request for use during the 2nd 10-year ISI interval, Reference 11.


MNSA2 Grafoil Seal
Inner Leakoff Seal
Compression Collar
Modified Tube Fitting
Upper Flange (Inboard)
Outer Leakoff Seal
Upper Flange (Outboard)
Belleville Washers
Lower Top Hat Washer
Hex Nut
Hex Jam Nut
Threaded Rod
Threaded Rods
Top Plate
Upper Top Hat Washer
Belleville Washers
Hex Nut
Tie Rod

Appendix 1

CORROSION ISSUES WITH MNSA-2 MATERIALS

The appendix summarizes corrosion issues associated with the application of MNSA-2 for small diameter Alloy 600 nozzle repair. The evaluation is a qualitative assessment of the susceptibility of the MNSA-2 fasteners and seals to known corrosion mechanisms that would be the dominant concerns for a MNSA - 2 used to repair a leaking pressurizer heater sleeve. After installation of a MNSA-2 to prevent leakage from a heater sleeve, it will be necessary to evaluate all current and any new data, including stress and fatigue calculations, before the first refueling outage or examination. The materials of interest are the low-alloy steel used to fabricate the pressurizer with defective sleeves, the stainless steels used for the MNSA-2, the fastener material used to attach the MNSA-2 to the pressurizer, and the Alloy 600 nozzles that may be repaired.

Corrosion of Low Alloy Steel. If a repaired nozzle has a through-wall crack, the crevice between the Alloy 600 sleeve and the pressurizer will, under worst case conditions fill with aerated borated water. The crevice environment will be a stagnant solution that cannot be replenished except during shutdowns when the pressurizer is drained and the RCS is depressurized. Thus, the concentration of boric acid will not exceed that of primary coolant at the beginning of a fuel cycle. The corrosion of carbon and low alloy steels has been evaluated (reference 2, section 4). The data show that the highest corrosion rates occur at the interface between hot wetted surfaces and dry surfaces where evaporation will increase the concentration of boric acid. The corrosion rate is maximized in the range of 200 degrees F to 400 degrees F and it diminishes on either side of this band (reference 2, page 4-11). The wetting and drying mechanisms required to concentrate boric acid in the crevice area are not expected to occur during normal operation of the plant at temperatures above 400 degrees F. The corrosion rate data suggest rates of corrosion in the .01 to .001 inch per year rate (reference 2 section 4.9). It would take on the order of tens of years at the expected corrosion rates in the expected conditions to exceed the allowable material loss. This supports the conclusion that carbon and low alloy steel corrosion is not a concern for the duration of a two year refueling cycle (i.e., between inspection periods).

Stress Corrosion Cracking (SCC) of Carbon and Low Alloy Steels. The repaired heater sleeves will have cracks in the Alloy 600 sleeves or the partial penetration weld metals that will remain in place after the repair is installed. Stress corrosion cracking of low alloy steels takes the form of fine cracks possibly without the appearance of surface degradation typical of boric acid

corrosion. Stress corrosion cracking is considered to be environmentally induced stable crack growth under static tensile stress. Industry data (reference 2, section 3.3.5 and reference 1) supports the conclusion that stress corrosion cracking is only a concern in the case of highly loaded components, such as those on steam generator manways in the presence of a sulfur based contaminant. Highly stressed components would have yield strengths in the 100 to 200 ksi range. The pressurizer vessel material is SA-533 grade B class 1 carbon steel with a typical yield strength of approximately 50 ksi. Therefore, stress corrosion cracking of the pressurizer material exposed to borated reactor coolant is not a concern.

Stress Corrosion Cracking (SCC) of the MNSA-2 Fasteners. The fasteners attaching the MNSA-2 components are SA-453 grade 660 (A286 stainless steel). The fasteners are high strength material. Industry data (reference 2, section 4.2) have shown this material is only susceptible to SCC in the presence of boric acid when highly stressed (100 to 200 ksi). Hot worked bolts are more susceptible to SCC than bolts machined from heat treated stock (reference 3) because the deformation is greater in the center. The MNSA-2 fasteners are machined from bar stock and thus will be less susceptible to SCC. The MNSA-2 fasteners are located on the exterior of pressurizer where the material will not be exposed to primary coolant. SCC is not a concern in the absence of an aggressive environment.

In the unlikely event that the live loaded primary seal developed a leak, the secondary seals divert any leakage away from the fasteners and prevent exposure of borated water and steam. If the leakage was not channeled away from the fasteners, a wetting and drying condition could be expected on the exterior of the pressurizer. This may expose the fasteners to concentrated boric acid crystals. However, industry data (reference 2 section 4.2) indicated that the SA-453 material is only susceptible to SCC in a highly stressed condition. The fastener material is not highly stressed in normal service. Leakage is a condition that will require repair and will be observable by visual examination. Therefore, this condition would not be expected to exist for more than one 24 month fuel cycle. Thus, SCC of the MNSA-2 fasteners is not a concern.

Corrosion Near the Pressurizer OD Surface. If the MNSA-2 primary seal leaks, leakage is funneled into the annular area between the stainless steel MNSA-2 collar and the outside diameter (OD) of the stainless steel heater sleeve. The secondary seals should prevent surface exposure of concentrated boric acid. The installation of a MNSA-2 does not require any welding of the nozzle. There will not be any residual stresses such as those that occur due to performing a welded joint. The exterior temperature and pressure of the pressurizer is lower. Since PWSCC is a thermally activated process and the area is not highly stressed, PWSCC is not expected to occur near the pressurizer OD surface. The Grafoil seal material has low leachable chlorides thus significant pitting is not expected to occur. A minor amount of carbon low alloy

steel corrosion may occur if the primary seal fails. Leakage past the secondary seals or through the tell tale by evaporation of borated water trapped in the annular area could expose the outside surface of the pressurizer to borated water crystals even though the crystals would tend to drop away from the bottom shell of the pressurizer. This is not a concern because evaporation would tend to concentrate boric acid in the annular area and the fact that evaporation has occurred will reduce the temperature and pressure such that activation conditions for PWSCC will not be present and the small volume of boric acid transferred in this manner will limit the expected borated water corrosion rates. External leakage is a condition that will require repair and will be observable by visual examination. Therefore, this condition would not be expected to exist for more that one 24 month fuel cycle. Therefore, corrosion near the OD surface is not a concern.

Galvanic Corrosion. Galvanic corrosion occurs as a result of the differences in electrochemical potential between the different parts of a cell in a conductive solution. The material with the highest electrochemical potential corrodes preferentially. The grafoil seal and the carbon or low alloy metals could degrade as a result of this corrosion mechanism. The grafoil seal is very resistant to borated water corrosion and chemical attack. With respect to low alloy metals, galvanic corrosion is more of a concern in welded applications due to high residual stresses. The installation of a MNSA-2 does not require any welding, reducing the residual stresses that would be present if a half sleeve repair were performed. Available data (reference 2, section 3.3.1) has not identified galvanic corrosion as a concern for this type of application. In the absence of leakage past the Grafoil seal, the boric acid solution in the annulus region, below the seal, will become stagnant and will not allow replenishment of oxygen thereby limiting the corrosion potential. Visual examinations will be conducted and would identify leakage that resulted from galvanic corrosion. Therefore, galvanic corrosion is not a concern for the MNSA-2 repair.

Outside Diameter (OD) Initiated Stress Corrosion Cracking of the Alloy 600 Nozzles. The installation of the MNSA-2 requires machining a counter bore area around the OD of the sleeve. The machining is a cold working process that will not produce residual stresses comparable to residual stresses in a welded joint. The additional machining required during installation of a MNSA-2 clamp is not expected to have an adverse effect on the SCC susceptibility of the sleeves for the following reasons:

1. The sleeve OD surfaces were previously machined during original fabrication. The additional machining is the same cold working process and will not create residual stresses different from those already present.

2. The sleeves will not be welded eliminating the residual stresses associated with the partial penetration weld at the pressurizer inside diameter (ID).

3. The temperature at the OD is lower than the ID. Since PWSCC is a thermally activated process, the time to initiate and propagate cracks would be longer.

SCC of 17-7 PH Stainless Steel. 17-7 PH stainless steel is used in the inner and outer Belleville washers in the MNSA-2. 17-7PH materials are very close in composition to 17-4PH materials evaluated in Reference 2. The materials of the MNSA are SA-453 Grade 660 (A-286) and the sleeve is type 304 stainless. Available data on stainless steels (reference 2, section 4.2 EPRI test-1), indicates that these materials are unaffected by concentrated aerated boric acid. SCC is not a concern for these stainless steel components.

Gross Failure of the Inner Seal. If the inner seal fails, the crevice between the MNSA-2 compression collar and the heater sleeve or the pressurizer will receive primary coolant. The leakoff path provided by the design of the MNSA-2 ensures that primary coolant will escape into the containment environment. There is no accident mitigation or safety equipment that is located under the pressurizer such that it could be immediately damaged by escaping high pressure primary coolant. The amount of flow out of the reactor coolant system would be limited by the size of the annular area between the heater sleeve and the pressurizer. External leakage is a condition that will require repair. Small leaks will be observable by visual examination. Larger leaks, those approaching 1 gpm, will be detected by increasing sump level or other means. Review of industry events (section 2 reference 2) has not identified any cases of major loss of primary system integrity due to gasket leakage. Therefore, this condition, if not detected immediately and resolved, would not be expected to exist for more that one 24 month fuel cycle.

Summary

Based on the above evaluation of potential corrosion effects, it is concluded that there are no significant corrosion issues associated with the application of MNSA-2 to pressurizer heater sleeves. The data indicates that corrosion of the sleeve bore will also be acceptable for at least the requested ten year period of use.

References

1. WOG Report CE-NPSD-690-P; subject: "Evaluation of Pressurizer Penetrations and Evaluation of Corrosion After Unidentified Leakage Develops" dated January 1992.

2. EPRI Technical Report 1000975; subject Boric Acid Corrosion Guidebook Revision 1, Managing Boric Acid Corrosion Issues at PWR Power Stations

3. Structure and Properties of Engineering Materials by Robert M. Brick, Alan W. Pense, and Robert B. Gordon fourth edition