SOUTHERN CALIFORNIA
EDISON
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A. Edward Scherer
Manager of
Nuclear Regulatory Affairs

August 26, 2004

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

Subject: **Docket Nos. 50-361 and 50-362**
Third Ten-Year Inservice Inspection (ISI) Interval Relief Request ISI-3-10 Revision 1, Regarding American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Case N-638 Similar and Dissimilar Metal Welding Using Ambient Temperature Machine Gas Tungsten Arc Welding (GTAW) Temper Bead Technique to Support Potential Reactor Vessel Head Repairs.
San Onofre Nuclear Generating Station, Units 2 and 3

Dear Sir or Madam,

This letter submits Southern California Edison (SCE) Company's Relief Request ISI-3-10 Revision 1 to obtain permission to perform repair welding using the ambient temperature machine GTAW temper bead technique. SCE originally submitted Relief Request ISI-3-10 in a letter from A. E. Scherer (SCE) to the Document Control Desk (NRC) dated January 22, 2004. ISI-3-10, Revision 1 provides changes to the request in response to questions raised during discussions with NRC staff.

During the next Unit 3 refueling outage, which is scheduled to begin on September 27, 2004, SCE will be performing inspections as required by the February 20, 2004, NRC First Revised Order EA-03-009, "Establishing Interim Inspection Requirements for Reactor Pressure Vessel Head at Pressurized Water Reactors." SCE may need to use the ambient temperature machine GTAW temper bead technique in the event repairs are required in the reactor pressure vessel head penetrations and/or the attachment welds.

SCE requests approval of Relief Request ISI-3-10, Revision 1 by October 1, 2004, in the event a repair of a Unit 3 reactor pressure vessel head penetration is needed.

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

Sincerely,

Enclosure

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

ENCLOSURE

Relief Request ISI-3-10, Revision 1

Request to use the Ambient Temperature Machine GTAW Temper Bead Technique

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 Affected

Reactor Pressure Vessel Head (RPVH), an American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III, Subsection NB (Class 1) component and includes penetration nozzles for Control Element Drive Mechanisms (CEDM), 91 each, In-Core Instruments (ICI), 10 each, and RPVH vent, one each.

2.0 Applicable Code Edition and Addenda

The Construction Code of Record for Reactor Pressure Vessel Head, ASME Section III, Subsection NB, 1971 Edition through the Summer 1971 Addenda

The Third Ten-Year Inservice Inspection Interval Code of Record, ASME Section XI, Division 1, 1995 Edition through the 1996 Addenda

3.0 Applicable Code Requirements

The topic of this relief request is the potential for repair welding on or within 1/8" of the SA-533 grade B (P-Number 3) ferritic base material of the RPVH in conjunction with repairs to the penetration nozzle or the attachment J-groove welds. The potential repair areas contain P-Number 3 base material and F-Number 43 butter.

The primary ASME Code Section for welding on Code Classified components such as the RPVH is ASME Section XI. Article IWA-4000, contains the rules for repair/replacement activities such as welding.

ASME XI, IWA-4410 (a) and (b) state that such activities shall be performed in accordance with the Owner's Requirements and the Original Construction Code, a later Edition and Addenda of the Construction Code or Code Cases.

3.0 Applicable Code Requirements (continued)

ASME XI, IWA-4410(c) states that the alternate rules of IWA-4600 may be used for welding in lieu of the Construction Code requirements. IWA-4600 (b) states that the alternate welding methods of IWA-4630 may be used for welding dissimilar material combinations, as an alternative to Construction Code requirements, when postweld heat treatment is not to be performed.

ASME XI, IWA-4610(a) states that thermocouples and recording instruments shall be used to monitor the process temperatures.

REQUESTED RELIEF

SCE requests relief from the applicable ASME Code requirements and requests to use the rules of ASME XI Code Case N-638 (Reference 1), with exceptions noted and discussed in Section 5.0, below.

4.0 Reason for the Request

Repair welding per the Construction Code, ASME III, NB-4620, would require an 1100°F minimum postweld heat treatment. ASME Section XI provides an alternative to this Construction Code requirement. Repair welding per the alternate methods in ASME XI, IWA-4630 would eliminate the high temperature postweld heat treatment, but would still require a 300°F preheat. Radiation dose estimates indicate personnel exposure would be on the order of an additional 4.4 Person-Rem per penetration repair to perform the required preheat.

ASME Code Case N-638 (Reference 1) will permit the use of the Ambient Temperature Machine GTAW Temper Bead Technique for the repairs. This technique provides an acceptable level of quality and safety and eliminates the need to install and remove the resistance heating equipment if the alternative repair method in ASME XI, IWA-4630 were employed. Therefore, repairs could be performed with less personnel radiation exposure.

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

Alternative Provides Acceptable Level of Quality and Safety

5.0 Proposed Alternative and Basis for Use

Proposed Alternative

SCE proposes to implement Code Case N-638 as follows:

- General Requirements Section (1.0), Welding Qualifications Section (2.0), Welding Procedure Requirements Section (3.0) and Documentation Section (5.0) will be met without exception.

- Examination Section (4.0) (a) states that prior to welding, a surface examination will be performed on the area to be welded to verify defect removal. This requirement will be met without exception.

- Examination Section (4.0) (b) states that the final weld surface and the band around the repair weld 1-1/2 times section thickness or 5" (whichever is less) shall be examined using the surface and ultrasonic methods once the completed weld has been at ambient temperature for at least 48 hours. The surface examination requirement of Section (4.0) (b) will be met without exception.

    - SCE seeks relief from the requirement for ultrasonic examination in Section (4.0) (b).

- Examination Section (4.0) (c) states that the removal areas of thermocouples attached by welding shall be ground and examined using a surface examination method. (Note: in the proposed repair, the welding process temperatures for preheat and interpass will be monitored using a portable infrared thermometer or a contact pyrometer therefore, this section would not be applicable).

    - SCE seeks relief from the ASME XI, IWA-4610(a) requirement to monitor process temperatures using hardwired thermocouples and recording instruments. SCE proposes to use a portable infrared thermometer or a contact pyrometer to monitor process temperatures in lieu of thermocouples and recording instruments.

- Examination Section (4.0) (d) NDE personnel qualifications will be per ASME XI, IWA-2300. This requirement will be met without exception.

5.0 Proposed Alternative and Basis for Use (continued)

Proposed Alternative (continued)

- Examination section (4.0) (e) states that surface examination acceptance criteria will be per NB-5340 or NB-5350 of the Construction Code. This requirement will be met without exception.

- Examination section (4.0) (e) also states that ultrasonic examination acceptance criteria shall be per ASME XI, IWB-3000. Since SCE is requesting relief from the ultrasonic examination requirement, the acceptance criteria will not apply.

- Code Case N-638 stipulates that the other requirements of ASME XI, Article IWA-4000 be met. Code Case N-638 provides alternate requirements for the following parts of IWA-4000: IWA-4440, IWA-4600 (b), IWA-4610, IWA-4620 and IWA-4630. All of the other applicable requirements of IWA-4000 will be met without exception.

Basis for Use

ASME XI, IWA-4410(c)

EPRI Report GC-111050, Ambient Temperature Preheat for Machine GTAW Temperbead Applications, (Reference 2) documents a comprehensive study performed on the proposed ambient temperbead process. The report establishes that GTAW is an inherently low hydrogen process regardless of the welding environment and therefore requires no preheat or post weld bake steps for hydrogen removal. The report concludes that no preheat or post weld bake above ambient temperature is required to achieve acceptable weld quality and heat affected zone impact toughness properties using the machine GTAW temperbead repair process and that this was accomplished without risk of hydrogen assisted (delayed) cracking. The basis for their conclusion was extensive documentation from numerous industry qualification tests.

Code Case N-638 has been accepted and approved for use by the NRC per Regulatory Guide 1.147, Revision 13 (Reference 3). However, as noted above, the proposed repair methodology takes exception to the Code Case requirements. Therefore, an approved relief request is required.

5.0 Proposed Alternative and Basis for Use (continued)

Basis for Use (continued)

The proposed repair methodology takes exception to performing an ultrasonic examination of the temper bead repair area(s). The nozzle geometry and repair weld accessibility are not suitable for obtaining meaningful examination results with the ultrasonic method. As an alternative, it is proposed that a progressive liquid penetrant examination be performed per ASME III, NB-5245 in lieu of the ultrasonic examination required by Code Case N-638. The repair weld(s) will be examined at one-half the weld deposit thickness or at each ½ inch of deposit, whichever is less, and again on the final weld surface.

Typical flaw evaluation for weld inspection repairs requires interrogation of a subject area with angle beam of specific refracted beam path with certain relationship to the fusion line of the weld (for optimum signal return of probable reflectors).

The subject in question, reactor vessel head penetrations, provides specific difficulties for target interrogation. Lack of uniform geometry around the circumference of the penetration would result in a non-uniform ultrasonic beam entering the target area. This lack of uniformity related to geometry, coupled with the differences in material velocities between the base material, stainless steel cladding and Alloy 600 would significantly affect refracted beam paths for angle beam inspection to a point where the resultant refracted beam paths would be unknown. Any reflector returning to the UT instrument would be extremely difficult to quantify.

Performing Radiography on the same penetration would not be possible. For effective radiography of joints, the radiographic film and source must be in specific orientation to each other. To obtain an image from a flaw, the component being inspected needs to be located between the radiographic film and the source with the plane/axis of the probable flaw at a certain orientation to the source and the film. The stand off distance between the source, component and film is also very critical to obtain Code required parameters such as "geometric unsharpness" (Ug). With regards to the reactor vessel head penetrations, the source could theoretically be placed inside the penetration tube and allow the component to be oriented between the source and film, however, the required stand off distance would be so minimal, the geometric unsharpness would be excessive thus resulting in film quality not meeting Code requirements. Therefore, these penetrations are not suitable for Radiography.

5.0 Proposed Alternative and Basis for Use (continued)

Basis for Use (continued)

The partial penetration welds of the RPVH nozzles were designed and fabricated in accordance with ASME III, NB-3352.4(d). NB-3352.4(d) specifies that the attachment welds be capable of being examined progressively with the magnetic particle or liquid penetrant method. The Construction Code did not require volumetric examinations of the penetration J-groove welds nor did it require the connections be designed for the capability of volumetric examinations. Examining the repair welds with the same methodology and acceptance standards of the Construction Code provides an equivalent level of quality to the original equipment manufacturer supplied attachment welds.

The welding procedure qualification requirements of Code Case N-638 validate the technique's ability to produce a defect free heat affected zone in the ferritic base metal that has fracture toughness equal to or better than the unaffected base metal.

The subject nozzle attachment welds are classified as Category D, per the construction code (ASME III, 1971 Edition, Summer 1971 Addenda). The attachment welds are partial penetration welds designed per ASME III, NB-3352.4(d). NB-3352.4(d)(1) states that these welds shall be designed such that they are capable of being examined progressively at the lesser of one-half the weld deposit thickness or each 1/2" of weld deposit by a magnetic particle or liquid penetrant method in accordance with ASME III, NB-5000.

The design requirements for other welded joint categories, where a volumetric exam is required, such as Category A (NB-3352.1), are required, in the design rules, to be capable of being examined volumetrically. These design requirements bring two points to the discussion.

1) The nozzle weld configuration was not designed for any examination method other than a progressive surface exam. Examining such a weld joint configuration using an examination method that it was not designed for, would likely yield examination results that are inconclusive.

2) If a repair were examined by the same method (progressive surface exam) as the original weld, and evaluated using the same non-destructive examination acceptance standard, it will provide the same level of quality and safety as the original welds.

5.0 Proposed Alternative and Basis for Use (continued)

Basis for Use (continued)

Code Case N-638 has been accepted and approved for use by the NRC per Regulatory Guide 1.147, Revision 13. The exception taken to Code Case N-638 requirement to examine repair weld(s) volumetrically and examine the repair weld(s) per the Construction Code rules in lieu of the volumetric examination ensures the repairs meet the same standards as the original. Therefore, using the ambient temperature machine (GTAW) temper bead technique, as proposed, provides an acceptable level of quality and safety, as required by 10 CFR 50.55a(a)(3)(i).

ASME XI, IWA-4610(a)

A portable infrared thermometer or a contact pyrometer will be used to monitor preheat and interpass temperatures during the weld repair. The expected temperature of the reactor head removed from the vessel and sitting on the storage stand is >70F. Prior to any welding, the initial metal temperature in the excavation of each repair location shall be verified to be at or above the minimum temperature specified in the weld procedure specification. Interpass monitoring shall be performed for each pass of the first three layers. Layers beyond the third layer will have a negligible metallurgical affect on the heat affected zone of the reactor head low alloy base metal, so interpass monitoring frequency may be decreased. Interpass monitoring will be performed at least every three passes for layers beyond the third layer.

Code Case N-638 requires a minimum preheat temperature of 50F. The ambient temperature in containment at the elevation where the reactor head will be stored after removal from the vessel will be around 74F which is 24F higher than the minimum preheat temperature from N-638. This temperature difference between the ambient temperature in containment and the 50F limit ensures that the reactor head will remain substantially above the minimum preheat temperature during the entire repair evolution.

5.0 Proposed Alternative and Basis for Use (continued)

Basis for Use (continued)

Code Case N-638 specifies a maximum interpass temperature of 150F for the first three layers of weld deposit for qualification welds and 350F maximum for the subsequent layers of field welds. The welding procedure specification is consistent with these requirements. The welding procedure specification to be employed has very low heat input limits (layer 1, 22,293J/in; layer 2, 26,785 J/in; layer 3, 29016 J/in; remaining layers, 31,099 J/in). Additionally, the reactor head is a substantial heat sink having a thickness of 7-5/8" minimum and weighing approximately 77.6 tons. For these reasons, the temperature in the weld area between passes (i.e. interpass) is expected to remain well below the required limits. The welding company, contracted by SCE to perform this scope of work, provided in-process inspection data from a previous ambient temperbead weld repairs on multiple reactor head penetrations at North Anna, Unit 2. The highest interpass temperature recorded for all repair locations was 115F.

6.0 Duration of Proposed Alternative

Relief is requested for the third inspection interval at SONGS Units 2 and 3, which began on August 18, 2003 and is scheduled to end on August 17, 2013.

7.0 References

1. ASME Code Case N-638, Similar and Dissimilar Metal welding Using Ambient Temperature Machine GTAW Temper Bead Technique, Section XI, Division 1, Code Committee approval September 24, 1999

2. EPRI Report GC-111050, Ambient Temperature Preheat for Machine GTAW Temperbead Applications, November 1998

3. Regulatory Guide 1.147, Revision 13, Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1, June 2003