October 2, 2006

Mr. Richard M. Rosenblum
Senior Vice President and Chief Nuclear Officer
Southern California Edison Company
San Onofre Nuclear Generating Station
P.O. Box 128
San Clemente, CA 92674-0128

SUBJECT: SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3 - RE: REQUEST FOR RELIEF FROM THE REQUIREMENTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) BOILER AND PRESSURE VESSEL CODE (CODE) (TAC NOS. MC9433 AND MC9434)

Dear Mr. Rosenblum:

By letter dated December 23, 2005, Southern California Edison (SCE, the licensee) submitted a request for the use of alternatives to certain American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI requirements at San Onofre Nuclear Generating Station, Units 2 and 3 (SONGS 2 and 3).

Specifically, Relief Request ISI-3-16, sought relief from the requirements of Articles IWA-4410 and IWA-4600 of Section XI of ASME Code, 1995 Edition through the 1996 Addenda, to perform weld repairs on the pressurizer lower level instrument nozzles. The licensee proposed to perform the repair utilizing a half-nozzle repair method with a remotely operated weld tool, using the machine Gas Tungsten Arc Welding process, an ambient temperature temper bead method with 50 °F (degrees Fahrenheit) minimum preheat temperature and no post weld heat treatment, as described in ASME Code Case N-638-1, with an exception involving nondestructive examination requirements. In addition, the licensee also proposed an alternative to the requirements of ASME Code, Section XI, IWA 4610(a), pertaining to preheat and interpass temperature monitoring.

The U.S. Nuclear Regulatory Commission (NRC) staff authorizes the alternative proposed by SCE in accordance with 50.55a(a)(3)(i) of Title 10 of Code of Federal Regulations, which states that the proposed alternatives may be used when authorized by the Director of the Office of Nuclear Reactor Regulation if the applicant demonstrates that the proposed alternatives would provide an acceptable level of quality and safety.

Therefore, Relief Request ISI-3-16 is authorized for Cycle 14 Refueling Outage for SONGS 2, and mid-cycle outage for SONGS 3. Due to the immediate need of this relief request, the NRC staff granted the verbal authorization for the use of this relief request on March 23, 2006, for SONGS 2 and April 27, 2006, for SONGS 3.

The staff's safety evaluation is enclosed.

Sincerely,

/RA/

David Terao, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-361 and 50-362

Enclosure: Safety Evaluation

cc w/encl: See next page

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Docket Nos. 50-361 and 50-362

Enclosure: Safety Evaluation

cc w/encl: See next page

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** See prior concurrence
Accession No.: ML062620491 * Minor editorial changes made in staff supplied SE

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

REQUEST FOR RELIEF NUMBER ISI-3-16

SOUTHERN CALIFORNIA EDISON COMPANY

SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3

DOCKET NOS. 50-361 AND 50-362

1.0 INTRODUCTION

By letter dated December 23, 2005 (Agencywide Documents Access and Management System (ADAMS) Accession Number ML053620021), pursuant to paragraph 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR), Southern California Edison Company(SCE, the licensee) submitted two requests for relief to be implemented during the third 10-year inservice inspection (ISI) interval at San Onofre Nuclear Generating Station, Units 2 and 3 (SONGS 2 and 3).

In relief request ISI-3-16, the licensee sought relief from the requirements of Articles IWA-4410 and IWA-4600 of Section XI of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), 1995 Edition through the 1996 Addenda, to perform weld repairs on the pressurizer lower level instrument nozzles. The licensee proposed to perform the repair utilizing a half-nozzle repair method with a remotely operated weld tool, using the machine Gas Tungsten Arc Welding (GTAW) process, an ambient temperature temper bead method with 50 °F (degrees Fahrenheit) minimum preheat temperature and no post weld heat treatment, as described in ASME Code Case N-638-1. Code Case N-638-1 has been approved with a condition for use by the Nuclear Regulatory Commission (NRC). The Code Case provides relief to allow the use of machine GTAW with ambient temperature preheat and no post weld heat treatment (PWHT). The licensee intends to apply Code Case N-638-1 with one exception. This exception involves nondestructive examination (NDE) requirements. The licensee also proposed an alternative to the requirements of ASME Code, Section XI, IWA 4610(a), pertaining to preheat and interpass temperature monitoring.

2.0 REGULATORY EVALUATION

The ISI requirements of the ASME Code Class 1, Class 2, and Class 3 components in nuclear plants are to be performed in accordance with the ASME Code, Section XI, and applicable edition and addenda as required by 10 CFR 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Paragraph 50.55a(a)(3) of

10 CFR states: "Proposed alternatives to the requirements of paragraphs (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."

Paragraph 50.55a(b)(1) provides the requirements that reactor coolant pressure boundary components must meet. This section states that components which are part of the reactor coolant pressure boundary must meet the requirements for Class 1 components in Section III of the ASME Code. This requirement applies to the new repair weld attaching the replacement half-nozzle to the pressurizer shell.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) will meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” to the extent practical within the limitations of design, geometry, and materials of construction of the components.
The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The SONGS third 10-year ISI interval for both units began on August 18, 2003, and is scheduled to end on August 17, 2013.

3.0 EVALUATION OF RELIEF REQUEST

3.1 System/Component(s) for which Relief is Requested:

ASME Code, Section XI, 1995 Edition through the 1996 Addenda, Class 1, Category B-P, Pressure Retaining Boundary, Item Number B15.20 applies to the pressurizer lower level instrument nozzles. There are two pressurizer lower level instrument nozzles to be repaired per unit for a total of four nozzles to be repaired at SONGS 2 and 3.

3.2 Code Requirements

ASME Code, Section XI, 1995 Edition through the 1996 Addenda, IWA-4410 requires repairs to be made in accordance with the owner's requirements and the original Construction Code (ASME Code, Section III) of the component or system. Later editions and addenda of the Construction Code, either in its entirety or portions thereof, and Code Cases may be used. If repair welding cannot be performed in accordance with these requirements, the applicable alternative requirements of IWA-4600 may be used.

The third 10-year ISI interval for SONGS 2 and 3 follows the ASME Code, Section XI, 1995 Edition through the 1996 Addenda. The construction code for SONGS 2 and 3 is ASME Code, Section III, 1971 Edition, and 1971 Summer Addenda.

3.3 Proposed Alternative

In accordance with 10 CFR 50.55a(a)(3)(i), SCE is requesting relief from the following portion of ASME Code, Section XI, IWA-4410 and its referenced IWA-4600 to perform pressurizer lower level instrument nozzle repairs at SONGS 2 and 3:

"Alternatively, the applicable requirements of IWA-4600 may be used for welding..." In lieu of performing the repair using the alternative welding requirements described in IWA-4600, SCE is proposing to perform a portion of the repair with a remotely operated welding machine, utilizing the machine GTAW process and the ambient temperature temper bead method with 50 ^{o}F minimum preheat temperature and no PWHT, as described in Code Case-638-1.

Code Case N-638-1 provides relief to allow use of machine GTAW with ambient temperature preheat and no PWHT. Code Case N-638-1 requires a surface examination and volumetric examination (ultrasonic testing (UT)) of a 5-inch band of base metal surrounding the weld repair area after the 48-hour hold time. The licensee proposes that only a surface examination of the 5-inch band surrounding the weld (dye penetrant testing (PT) or magnetic particle testing (MT) will be performed.

In addition to the use of Code Case N-638-1, with exceptions listed above, SCE proposes the additional alternatives to the requirements of the Code. In lieu of the requirements of ASME Code, Section IX, IWA-4610(a) to use thermocouples and recording instruments to monitor process temperatures, SCE proposes to use a contact pyrometer.

3.4 Basis for Relief

The licensee contends that the use of an ambient temperature temper bead welding process provides an equivalent acceptable level of quality and safety when compared to the welding process in ASME Code, Sections XI and III, while offering substantial savings in an accumulated radiation dose. In support of its conclusion, the licensee provided a description of the repair process as detailed below.

a) SCE plans to use remote machine processes similar to those used previously at other facilities, including Crystal River Unit 3, South Texas Project, Arkansas Nuclear One, Unit 1, and Millstone.

b) The nozzle will be cut close to the vessel exterior surface. A portion of the nozzle inside the vessel bore will then be removed by machining and the area around the nozzle will be prepared for the application of the weld pad by an abrasive disc or flapper wheel and performing a surface examination (PT or MT) and ultrasonic examination of the area to be welded and the 5-inch wide band surrounding the weld area.

c) A weld pad will be applied to the surface of the pressurizer bottom head using the ambient temperature temper bead weld technique and GTAW process as described in Code Case N-638-1. The weld pad is to be applied as a weld buildup centered on the existing nozzle opening.

d) The weld pad will be suitably prepared for NDE. The pad and its heat affected zone (HAZ) below the pad will be volumetrically examined (UT) to the extent practical. The weld pad and a 5-inch wide band surrounding the weld pad will also be surface examined (PT or MT). Ultrasonic examinations, before and after welding, of the full parent material thickness beneath the weld pad, to the extent practical, will be performed to discern laminar type indications in the examination volume. Observed laminar-type indications will be recorded and evaluated to assure the structural integrity of the modification configuration is not adversely affected.

SCE will follow the NRC's condition of approval of ASME Code Case N-638-1 as described in Regulatory Guide 1.147. "UT examinations shall be demonstrated for the repaired volume using representative samples which contain construction type flaws. The acceptance criteria of NB-5330 of Section III edition and addenda approved in 10 CFR 50.55a apply to all flaws identified within the repaired volume."

e) The approximate center of the weld pad will be machined to re-establish a free path into the nozzle bore of the vessel. A J-groove partial penetration weld preparation will be machined into the weld pad for the attachment weld of the new nozzle.

f) The new nozzle will be inserted and welded in [place] using conventional welding and NDE techniques (manual GTAW and progressive PT). Note that this weld is in full compliance with the construction code (ASME Code III) and therefore requires no relief from the existing code requirements.

Experience gained from the performance of similar repairs/modifications at other plants indicate that remote automated repair methods reduce the radiation dose to repair personnel and still provide acceptable levels of quality and safety. SCE recognizes the importance of as low as reasonably achievable principles and this remote repair method is being proposed for the repair of the pressurizer lower level instrument nozzles at SONGS.

This approach for the repair of pressurizer instrument nozzles will significantly reduce radiation dose to repair personnel while still maintaining acceptable levels of quality and safety. SCE estimates the dose accumulated for [two] nozzles in Unit 2 and [two] nozzles in Unit 3 for providing access, installing heating pads and performing the preheating and postheating after welding required by the existing code rules would be approximately 2.8 Roentgen Equivalent in Man (REM) at each Unit.

Preheat and Interpass Temperature Measurement

Due to the location of the repair and area radiation dose rate, the licensee has determined that the placement of welded thermocouples for monitoring weld interpass temperature is determined to be not beneficial based on dose savings. Therefore, welded thermocouples are not planned for use to monitor interpass temperature during welding. Preheat and interpass temperatures for the weld pad will be measured using a contact pyrometer. Interpass temperature will be monitored for the first three layers at each repair location. On the first

repair location, the interpass temperature measurements will be taken every three to five passes. At subsequent repair locations, interpass temperature measurements will be taken every six to ten passes. The heat input from layers beyond the third layer will not have a metallurgical affect on the low-alloy steel HAZ.

Examination

All NDE will be performed in accordance with ASME Code, Section III, 1995 Edition with the 1996 Addenda, NB-2500 (for base materials) and NB-5000 (for welds).

The area to be welded, plus a 5-inch surrounding band, will be surface examined (PT or MT) both prior to and following welding. All post weld exams will be performed after the required 48-hour hold time. The finished surface of the welded pad and a 5-inch band surrounding the pad will be surface examined (MT or PT) and the weld pad will be examined volumetrically (UT). The entire volume of the weld pad, to the extent practical, will be scanned from the face of the pad, using examination angles of 0°, 45° refracted longitudinal (RL), 60° RL, and an outside diameter (OD) creeping wave. The examination volume shall include the weld-deposited material and the ferritic vessel HAZ.

Ultrasonic examination, before and after welding, of the full parent material thickness beneath the weld pad, to the extent practical, will be performed to detect laminar type indications in the examination boundary. Laminar type indications observed will be recorded and evaluated to assure the structural integrity of the modification configuration is not adversely affected.

Because this is a surface application of the temper bead process, there will be minimal impact to the volume of metal of the pressurizer vessel in the area surrounding the weld. Since this weld is applied to the exterior surface of the pressurizer, there is no additional useful information that can be gained by a volumetric examination of the area surrounding the weld. The weld and HAZ will be post-weld volumetrically examined to the extent possible.
This reduction in the post welding inspection will provide additional dose reduction for this repair while still ensuring sound weld metal is deposited and that the process has not introduced flaws in the base material.

The licensee believes that the use of an ambient temperature temper bead welding process provides an equivalent acceptable level of quality and safety when compared to the welding process in ASME Code, Sections XI and III, while offering substantial savings in accumulated radiation dose.

3.5 Staff Evaluation

The licensee proposed to use a half-nozzle repair method with remotely operated weld equipment, using the machine GTAW process, the ambient temperature temper bead method with a 50° F minimum preheat temperature, and no PWHT for the pressurizer lower level instrument nozzle repairs. In support of the proposed repair design, SCE is requesting relief from the applicable Code edition and addenda of the ASME Code, Section XI, which requires a PWHT at elevated temperature. ASME Code Case N-638-1 provides for machine GTAW temper bead weld repairs at ambient temperature using dissimilar materials, without the need for PWHT. The licensee is requesting permission to use ASME Code Case N-638-1, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine Temper Bead Technique."

This Code Case was conditionally approved per Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability - ASME Code, Section XI, Division 1," Revision 14, dated August 2005. SCE agreed to meet the condition required by Regulatory Guide 1.147. Code Case N-638-1 requires a surface examination and volumetric examination (UT) of a 5-inch band of base metal surrounding the weld repair area after the 48-hour hold time. The licensee proposes that only a surface examination of the 5-inch band surrounding the weld (dye PT or MT) will be performed after the 48-hour hold time. Also, in lieu of the requirements of ASME Code, Section XI, IWA-4610(a) which requires the use of thermocouples and recording instruments to monitor process temperatures, SCE proposes to use a contact pyrometer. To accomplish the repair, the licensee will utilize the half-nozzle repair method which has been successfully employed in the past at other nuclear power plants. A complete description of the licensee's repair can be found in paragraph 3.4 above.

Because this is a surface application of the temper bead process, there will be minimal impact to the volume of metal of the pressurizer vessel in the area surrounding the weld. Since this weld is applied to the exterior surface of the pressurizer, there is no additional useful information that can be gained by a volumetric examination of the area surrounding the weld after the 48-hour hold time. The weld and HAZ will be post-weld volumetrically examined to the extent possible.

Code Case N-638-1 was originally written to be applied to the repair of partial and full penetration groove welds. However, nothing in the Code Case precludes its use in other applications, such as the current SCE application of an alloy 52-weld pad deposited over the OD of the pressurizer. The welding principles involved and application of the weld filler metal are the same as for a groove-weld design. When performing a full penetration groove weld between two pieces of thick, low-alloy steel (over 1-inch thick) using a low-alloy steel filler metal, there can be significant residual stresses built up in the base metal from contraction of the weldment. These stresses can cause distortion and cracking of the base metal, a significant distance from the weld groove. To make certain that these types of defects do not remain in the weld area away from the weld groove, the code has extended the area of the nondestructive examination well into the base metal. The filler metal used in the subject repair is alloy 52, which is more ductile than the low-alloy steel. The thickness of filler metal applied to the pressurizer shell is much less than the pressurizer shell thickness. Therefore, due to the more ductile weld-filler metal and the much thinner weld being applied to the pressurizer shell, the residual stresses built up in the base metal from contraction of the weldment will be much less than that for a full penetration groove weld. Ultrasonic examination of large areas of base metal outside the weld area, as required by the Code Case, provides no additional information for the licensee's repair since the examination would be in base metal (which is unaffected by the repair and this area has already been examined before the welding). The surface examination will still be performed on this area after the 48-hour hold time.

In addition, in accordance with the condition required by RG 1.147, SCE will also perform ultrasonic examination demonstrations using samples which represent the repaired volume. These samples will contain construction type flaws which are more pertinent to the type of weld being performed. This additional performance demonstration will provide the required level of quality and safety.

Paragraph IWA-4610(a) in ASME Code, Section XI, requires that preheat and interpass temperatures be monitored using thermocouples and recording instruments. As an alternative to this requirement, the licensee proposes to use a contact pyrometer to measure the preheat and interpass temperature. The interpass temperature will be monitored for the first three layers of each repair. On the first repair location, the interpass temperature measurements will be taken every three to five passes. On all subsequent repair locations, the interpass temperature will be monitored every six to ten passes. Code Case N-638-1 requires that the preheat temperature shall be 50 °F (minimum) prior to depositing the first weld layer. For the first three layers, the interpass temperatures shall be at least 50 °F but less than 150 °F. The interpass temperature of each remaining layer shall be at least 50 °F but less than 350 °F prior to depositing the subsequent weld layers. The 50 °F preheat temperature is to be maintained on a weldment inside a building which normally is above 50 °F. Therefore, preheat measurement by this alternate method is acceptable. The maximum interpass temperatures required for the licensee's repair (150 °F for the first three layers and a maximum interpass temperature of 350 °F for the balance of welding) can easily be measured with a contact pyrometer because the surface of the weld is accessible to the contact pyrometer probe. Also, the large mass of the pressurizer coupled with the low heat input GTAW process should help to ensure that the maximum interpass temperature is not exceeded. Additionally, with the alternate temperature measurement methods, close control will be maintained on these temperatures. Therefore, this type of temperature measurement will provide an acceptable level of quality and safety.

Based on the above evaluation, the NRC staff has determined that the licensee's proposed alternative to the requirements of ASME Code Case N-638-1 for the half-nozzle repair method is acceptable, because it provides an acceptable level of quality and safety.

4.0 CONCLUSIONS

Based on the information provided in the licensee's submittal, the NRC staff has determined that the licensee has provided an acceptable alternative to the requirements of ASME Code, Section XI, and Code Case N-638-1. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the licensees proposed alternative, Relief Request ISI-3-16, is authorized for the repair of pressurizer nozzles during the third 10-year ISI interval at SONGS 2 and 3. All other requirements of the ASME Code, Sections III and XI, for which relief has not been specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

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Date: October 2, 2006

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