

December 13, 2007

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, UNIT 2 AND UNIT 3 - RE:
REQUEST APPROVAL TO USE ALTERNATIVES TO THE REQUIREMENTS
OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS CODE,
SECTION XI, IWA-4000, FOR REPAIR/REPLACEMENT ACTIVITIES RELATED
TO THE PERFORMANCE OF STRUCTURAL WELD OVERLAYS (TAC NOS.
MD6256 AND MD6257)

Dear Mr. Rosenblum:

By letter dated August 1, 2007, Southern California Edison Company (SCE, the licensee) submitted Relief Request (RR) ISI-3-28 to use alternatives to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, 1995 Edition through 1996 Addenda, IWA-4000, for repair/replacement activities related to the performance of structural weld overlays at San Onofre Nuclear Generating Station, Units 2 and 3, for the third 10-year inservice inspection (ISI) interval. Specifically, the licensee, requested U.S. Nuclear Regulatory Commission (NRC) approval to modify the 48-hour hold time requirement defined in RR ISI-3-25 and RR ISI-3-27.

The licensee, through RR ISI-3-28, proposes to change the requirement to allow performance of the nondestructive examinations 48 hours after the third temper bead weld layer is completed. The overall effect of the change would be a reduction in the time needed for weld overlay installation.

The NRC staff has completed its review and evaluation of RR ISI-3-28 and, as discussed in the enclosed safety evaluation, the staff concludes that the proposed modification of the 48-hour hold time requirement provides an acceptable level of quality and safety. Therefore, pursuant to paragraph 50.55a(a)(3)(i) of Title 10 of *Code of Federal Regulations*, the staff authorizes RR ISI-3-28 for the third 10-year ISI interval. All other ASME Code, Section XI, requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

R. M. Rosenblum

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Due to the immediate need of this relief request, verbal authorization for the use of this relief request, in association with RR ISI-3-25 activities, was granted on October 30, 2007. The enclosed safety evaluation provides the documented basis for authorizing relief for RR ISI-3-28 activities associated with RRs ISI-3-25 and ISI-3-27.

If you have any questions, please contact N. Kalyanam, Project Manager, at 301-415-1480.

Sincerely,

/RA/

Thomas G. Hiltz, 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

R. M. Rosenblum

-2-

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Docket Nos. 50-361 and 50-362

Enclosure: Safety Evaluation

cc w/encl: See next page

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ADAMS Accession No.: ML073240437

*No major changes from Staff SE

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December 2007

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF ISI-3-28

SOUTHERN CALIFORNIA EDISON

SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 2 AND UNIT 3

DOCKET NO. 50-362

1.0 INTRODUCTION

By letter dated August 1, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML072150046), Southern California Edison (SCE, the licensee) requested U.S. Nuclear Regulatory Commission (NRC) approval to modify the 48-hour hold time requirement defined in Relief Request (RR) ISI-3-25 and RR ISI-3-27. By letter dated June 12, 2007, the NRC approved use of the licensee's RR ISI-3-25, which requires, in part, when ambient temperature temper bead welding is used in weld overlay of dissimilar metal butt welds, the nondestructive examinations (NDE) are required to be conducted at least 48 hours after the completed overlay has returned to ambient temperature. Similarly, RR ISI-3-27 requires the same condition for the 48-hour hold time. The licensee, through RR ISI-3-28, proposes to change this requirement to allow performance of the NDE 48-hours after the third temper bead weld layer is completed. The overall effect of the change would be a reduction in the time needed for weld overlay installation.

2.0 REGULATORY EVALUATION

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) paragraph 50.55a(g)(4), American Society of Mechanical Engineers (ASME) Boiler and Pressure Code Class 1, 2, and 3 components (including supports) must 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 (ISI) 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 ISI code of record for San Onofre Nuclear Generating Station, Units 2 and 3 (SONGS 2 and 3), third 10-year ISI interval, which started in August 2003 and is scheduled to be completed in August 2013, is the 1995 Edition through the 1996 Addenda of Section XI of the ASME Code.

Pursuant to 10 CFR 50.55a(a)(3), alternatives to requirements may be authorized by the NRC if the licensee demonstrates that: (i) the proposed alternatives provide an acceptable level of

quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The licensee sets forth in RR ISI-3-28 a proposed alternative that provides an acceptable level of quality and safety. 10 CFR 50.55a(a)(3)(i) provides the regulatory basis to evaluate the proposed modification.

3.0 TECHNICAL EVALUATION

3.1 Requirements For Which Relief Is Requested

By letter dated July 14, 2006 (ADAMS Accession No. ML061990111), the licensee submitted for NRC approval RR ISI-3-25, which stated that the licensee would implement Subarticle 4.0(b) of ASME Code Case N-638-1 for Class 1 components. Subarticle 4.0(b) states, in part, that the final weld surface shall be examined using NDE methods when the completed weld has been at ambient temperature for at least 48 hours. By letter dated June 12, 2007 (ADAMS Accession No. ML071380013), the NRC approved use of ISI-3-25.

By letter dated February 21, 2007 (ADAMS Accession No. ML070570433), the licensee submitted for NRC approval RR ISI-3-27, which stated that the licensee would implement Subarticle 4.0(b) of ASME Code Case N-638-1 for Class 1 components. By letter dated December 14, 2007 (ADAMS Accession No. ML073250004), the NRC approved use of RR ISI-3-27.

3.2 Licensee's Proposed Alternative

The licensee, through RR ISI-3-28, proposes to start the 48-hour hold period before performance of NDE immediately after completion of the third temper bead layer.

3.3 Components For Which Relief Is Requested (As Provided by the Licensee)

RR ISI-3-28 applies to the following components of RRs ISI-3-25 and ISI-3-27:

- RR ISI-3-25 applies to the following ASME Code Class 1 welds:
 - Unit 2 Pressurizer S21201ME087 surge line nozzle to safe end HSS [high safety significant] dissimilar metal weld (ISI Designation Number 02-005-031) with Alloy 82/182 weld material subject to PWSCC [primary water stress-corrosion cracking];
 - The adjacent Unit 2 Pressurizer S21201ME087 stainless steel weld (ISI Designation Number 02-016-001);
 - Unit 3 Pressurizer S31201ME087 surge nozzle to safe end HSS dissimilar metal weld (ISI Designation Number 03-005-031) with Alloy 82/182 weld material subject to PWSCC; and

- The adjacent Unit 3 Pressurizer S31201ME087 stainless steel weld (ISI Designation Number 03-016-001).
- RR ISI-3-27 applies to the following ASME Code Class 1 welds from both Units 2 and 3:
 - Reactor Coolant System Hot Leg surge nozzle to safe end HSS dissimilar metal welds (ISI Designation Number 02-006-010/03-006-010) with Alloy 82/182 weld material subject to PWSCC;
 - Reactor Coolant System Hot Leg surge nozzle adjacent stainless steel welds (ISI Designation Number 02-016-016/03-016-016);
 - Reactor Coolant System Hot Leg drain nozzle to safe end HSS dissimilar metal welds (ISI Designation Number 02-006-011/03-006-011) with Alloy 82/1 82 weld material subject to PWSCC;
 - Reactor Coolant System Hot Leg drain nozzle adjacent stainless steel welds (ISI Designation Number 02-030-001/03-030-010);
 - Shutdown Cooling System Hot Leg nozzle to safe end HSS dissimilar metal weld (ISI Designation Number 02-007-009/03-007-009) with Alloy 82/1 82 weld material subject to PWSCC; and
 - Shutdown Cooling System Hot Leg nozzle adjacent stainless steel welds (ISI Designation Number 02-021-001/03-021-010).

3.4 Staff Evaluation

Code Case N-638-1 requires that when temper bead welding is used, surface and ultrasonic examinations shall be performed when the completed weld has been at ambient temperature for at least 48 hours. This delay was provided to allow sufficient time for hydrogen cracking to occur (if it is to occur) in the heat affected zone (HAZ) of ferritic materials prior to performing examinations, to ensure detection of hydrogen cracking by NDE. However, based on research and industry experience, the Electric Power Research Institute (EPRI) has provided a technical basis for starting the 48-hour hold after completion of the third temper bead weld layer rather than waiting 48 hours after the weld overlay cools to ambient temperature. EPRI has documented their technical basis in Technical Update report 1013558, "Repair and Replacement Applications Center: Temperbead Welding Applications 48-Hour Hold Requirements for Ambient Temperature Temperbead Welding" (ADAMS Accession No. ML070670060).

After evaluating the issues relevant to hydrogen cracking, such as microstructure of susceptible materials, availability of hydrogen, applied stresses, temperature, and diffusivity and solubility of hydrogen in steels, EPRI concluded that "...there appears to be no technical basis for waiting the 48 hours after cooling to ambient temperature before beginning the NDE of the completed weld. There should be no hydrogen present, and even if it were present, the temper bead welded component should be very tolerant of the moisture ..." EPRI also notes that over

20 weld overlays and 100 repairs have been performed using temper bead techniques on low-alloy steel components over the last 20 years. During this time, there has never been an indication of hydrogen cracking by the NDEs performed after the 48-hour hold or by subsequent ISIs.

An ASME Technical Basis Paper (ADAMS Accession No. ML070790679), supporting the proposed revision to the 48-hour hold time requirement, indicates that the introduction of hydrogen to the ferritic HAZ is limited to the first weld layer, because this is the only weld layer that makes contact with the ferritic base material. The Technical Paper states that while the potential for the introduction of hydrogen to the ferritic HAZ is negligible during subsequent weld layers, these layers provide a heat source that accelerates the dissipation of hydrogen from the ferritic HAZ in nonwater-backed applications. The Technical Basis Paper concludes that there is sufficient delay time to facilitate the detection of potential hydrogen cracking when NDE is performed 48 hours after completion of the third weld layer.

Furthermore, the solubility of hydrogen in austenitic weld materials such as Alloy 52M is much higher than that of ferritic materials, while the diffusivity of hydrogen in austenitic materials is lower than that of ferritic materials. As a result, hydrogen in the ferritic HAZ tends to diffuse into the austenitic weld metal, which has a much higher solubility for hydrogen. This diffusion process is enhanced by heat supplied in subsequent weld layers.

Based on this information, the staff finds that starting the 48-hour hold time after completion of the third temper bead weld layer is acceptable. The staff finds that the licensee has provided sufficient technical justification to show that hydrogen cracking in the weld overlay would not likely occur under the proposed alternative. A staff review of operational experience and research in this area has found no technical objection to the proposed alternative. Therefore, the staff finds that it is not necessary to wait until 48 hours after the completed overlay has reached ambient temperature to perform NDE, because any delayed hydrogen cracking, were it to occur, would be expected to occur within the 48 hours following completion of the third temper bead weld layer.

4.0 CONCLUSION

The staff has reviewed the licensee's submittal and determined that the proposed modification to perform NDE of the weld overlay 48 hours after completion of the third temper bead weld layer will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 0.55a(a)(3)(i), the staff authorizes the use of RR ISI-3-28 as a modification of RR ISI-3-27 and RR ISI-3-25. This relief is authorized through the period of applicability of RRs ISI-3-25 and ISI-3-27, which is through the remainder of the current SONGS 2 and 3 third 10-year ISI interval that started in August 2003 and is scheduled to end in August 2013.

This authorization is applicable only when welding is performed in accordance with RRs ISI-3-25 and ISI-3-27 for the full structural weld overlay of dissimilar metal welds and the adjacent welds, identified in Section 3.3 above, at SONGS 2 and 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 October 30, 2007.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: J. Collins

Date: December 13, 2007