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Richard J. St. Onge
Director
Nuclear Regulatory Affairs

October 2, 2009

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: Docket Nos. 50-361 and 50-362
Revision 1 to Third Ten-Year Inservice Inspection (ISI) Interval Relief Request ISI-3-29, Inspection of Reactor Vessel Head Control Element Drive Mechanism Nozzles
San Onofre Nuclear Generating Station, Units 2 and 3

Reference: Letter from A. E. Scherer (SCE) to Document Control Desk (NRC) dated February 27, 2009; Subject: Docket Nos. 50-361 and 50-362, Third Ten-Year Inservice Inspection (ISI) Interval Relief Request ISI-3-29, Reactor Vessel Head Inspection, San Onofre Nuclear Generating Station, Units 2 and 3

Dear Sir or Madam,

Pursuant to 10 CFR 50.55a(g)(5)(iii), Southern California Edison (SCE) requests approval of Revision 1 to Third Ten-Year Inservice Inspection (ISI) Interval Relief Request ISI-3-29.

The referenced letter submitted Third Ten-Year Inservice Inspection (ISI) Interval Relief Request ISI-3-29 for San Onofre Nuclear Generating Station, Units 2 and 3. The requested relief was from the inspection coverage requirements of American Society of Mechanical Engineers (ASME) Code N-729-1 for San Onofre Nuclear Generating Station (SONGS) Unit 2 and Unit 3 for the third 10-year ISI interval.

As published in the Federal Register on September 10, 2008, NRC revised 10CFR50.55a to supersede the NRC First Revised Order EA-03-009 by incorporating ASME Code Case N-729-1 in new paragraph 10 CFR50.55a(g)(6)(ii)(D). As discussed in the enclosed relief request the design of the SONGS reactor vessel head makes compliance with the inspection coverage requirements of Code Case N-729-1 impractical.

ISI-3-29 requests ASME Code relief that is similar to the relaxation requested from the NRC First Revised Order EA-03-009. Documentation of the relaxation

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P.O. Box 128
San Clemente, CA 92674

requests and approval are listed in the Precedents and the References Sections of ISI-3-29.

Revision 1 of ISI-3-29 is necessary to account for changes to inspection limitations resulting from the qualification program that was recently completed at the Electric Power Research Institute (EPRI). In particular, the qualification of SCE's inspection contractor imposed a limitation against use of circumferentially oriented Time of Flight Diffraction (TOFD) ultrasonic transducers for detection of circumferential flaws. During previous inspections, the circumferentially oriented TOFD transducers were credited for detection of planar flaws in all orientations. The requirement to include axially oriented TOFD hardware for circumferential flaw detection has resulted in additional coverage limitations for the San Onofre Units 2 and 3 Reactor Vessel Head Control Element Drive Mechanism nozzles. This does not affect the technical justification for relief provided in ISI-3-29, Revision 0.

Revision bars in the enclosure show the changes from Revision 0 to Revision 1 of Relief Request ISI-3-29.

Consistent with the schedule for review of ISI-3-29, Revision 0, SCE requests approval of the Enclosed Relief Request ISI-3-29, Revision 1 to support the return to service of SONGS Unit 2 from the Cycle 16 refueling outage. SCE currently anticipates that approval would be needed by December 26, 2009.

This letter and the enclosure contain no new commitments. In Section 7 of the enclosure SCE reiterates an existing commitment.

Should you have any questions, please contact Ms. Linda T. Conklin at (949) 368-9443.

Sincerely,

Enclosure: as stated

cc: E. E. Collins, Regional Administrator, NRC Region IV
R. Hall, NRC Project Manager, San Onofre Units 2 and 3
G. G. Warnick, NRC Senior Resident Inspector, San Onofre Units 2 and 3

Enclosure

Relief Request ISI-3-29, Revision 1, Reactor Vessel Head Inspection in Accordance with 10 CFR 50.55a(g)(5)(iii) Inservice Inspection Impracticality

Enclosure
Relief Request ISI-3-29, Revision 1, Reactor Vessel Head Inspection in Accordance with 10 CFR 50.55a(g)(5)(iii) Inservice Inspection Impracticality

1. ASME Code Component(s) Affected

SONGS Unit 2: Item No. B4.20, Ninety-one (91) Control Element Drive Mechanism (CEDM) penetrations - [Reactor Pressure Vessel Head Penetrations 1 through 91]

SONGS Unit 3: Item No. B4.20, Ninety-one (91) Control Element Drive Mechanism (CEDM) penetrations - [Reactor Pressure Vessel Head Penetrations 1 through 91]

All 91 Control Element Drive Mechanism (CEDM) nozzles in each Unit that are listed above are American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, Class 1 components.

2. Applicable Code Edition and Addenda

Code of Record for Current (Third) Ten-Year Inservice Inspection (ISI) Interval, ASME Section XI, 1995 Edition, through the 1996 Addenda

The inspection requirement from which relief is being requested is ASME Code Case N-729-1, Figure 2, as conditionally required by 10 CFR 50.55a(g)(6)(ii)(D).

3. Applicable Code Requirement

The inspection requirement from which relief is being requested is the Base metal examination volume in Figure 2 of ASME Code Case N-729-1

4. Impracticality of Compliance

The requirements of ASME Code Case N-729-1 cannot be met for each CEDM nozzle due to the presence of a CEDM extension shaft guide cone threaded to the Interior Diameter (ID) surface. The same geometric limitations precluded meeting the volumetric coverage required by NRC First Revised Order EA-03-009 (Reference 1).

A drawing showing detailed dimensions of a CEDM penetration (SO23-901-213, Rev. 1) was provided as Attachment 1 to the letter from Southern California Edison (SCE) dated December 9, 2003 (Reference 2). In the discussions regarding distances below the J-groove weld, the J-groove weld is assumed to

include the associated fillet weld. A letter from SCE dated February 9, 2004 (Reference 3), provided additional information regarding the CEDM extension shaft guide cone threads in support of that relaxation request.

In addition, qualification of SCE's examination contractor has established a new limitation against using circumferentially oriented Time of Flight Diffraction (TOFD) for detection of circumferential flaws. This limitation impacts the lower extent to which fully qualified examination coverage can be credited. This is due to the loss of axial TOFD transducer coupling approximately 0.250 inch above the CEDM counterbore. The use of circumferential TOFD for detection of Primary Water Stress Corrosion Cracking (PWSCC) and planar flaws having any significant axial growth component is qualified and remains consistent with the basis for previously granted relaxation from EA-03-009.

As a result of the new procedure limitations, the fully qualified volumetric coverage of CEDM penetrations terminate approximately 0.250 inch above the previously requested lower exam extent. Examination coverage for detection of PWSCC with an axial growth component is qualified and remains unchanged from ISI-3-29, Revision 0 (Reference 4). Therefore, the technical basis for previously approved relief remains valid. The 0.250 inch incremental loss of qualified coverage for detection of circumferentially oriented planar flaws is not safety significant.

5. Burden Caused by Compliance

Compliance with this requirement requires the reactor vessel head to be redesigned. SONGS has ordered replacement heads for both Units 2 and 3 and currently plans to have them installed during the Cycle 17 refueling outages, currently scheduled to occur in the Fall of 2011 and 2012, respectively. SCE is working with the manufacturer of the new heads to incorporate design changes that would improve the area of inspection coverage in order to meet the requirements of ASME Code Case N-729-1.

6. Proposed Alternative and Basis for Use

SCE proposes to meet the inspection coverage requirements of dimension "a" in Code Case N-729-1, Figure 2, above the top of the attachment weld to as far down the nozzle as physically possible. This distance shall be at least the minimum inspection distance below the bottom of the attachment weld as follows:

Table 1

CEDM Penetrations	Required coverage below the J-weld for non circumferential flaws	Required coverage below the J-weld for all flaw orientations
#1	0.44 inches	**0.19 inches**
#s 2 through 35	0.43 inches	**0.18 inches**
#s 36 through 87	0.42 inches	**0.17 inches**
#s 88 through 91	0.35 inches	**0.10 inches**

The phenomenon of concern is PWSCC, which typically initiates in the areas of highest stress. The area of CEDM penetrations that has the highest residual stress is the area adjacent to the J-groove attachment weld. Therefore, it is most probable that PWSCC will initiate adjacent to the J-groove attachment weld. PWSCC at or above the attachment weld resulting in pressure boundary leakage and the potential development of a safety concern (ejection of a nozzle or substantial corrosion of the low-alloy steel Reactor Pressure Vessel Head [RPVH]) prompted the NRC to issue Order EA-03-009. The inspections at San Onofre Nuclear Generating Station (SONGS) will ensure the integrity of the pressure boundary.

In NRC reviews of relaxation requests from the superseded NRC First Revised Order EA-03-009 (See Precedents) for un-inspectable areas of RPV head penetrations, the NRC had requested that an analysis be performed to characterize the potential growth of postulated cracks in the un-inspected areas. This type of analysis was performed for SONGS Units 2 and 3 to support the Relaxation Requests (Reference 2). Results from the SONGS specific structural integrity evaluation of RPVH head penetrations were provided in the February 9, 2004, submittal (Reference 3). This submittal included Westinghouse Report WCAP-15819, Rev. 1, "Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: San Onofre Units 2 and 3" (Reference 5).

The minimum inspection distance below the weld that was approved (see Section 7 for Precedent) and is proposed for qualified inspection for non-circumferential flaws below the J-Weld for each CEDM nozzle is based on the Appendix C curves provided in WCAP-15819, Rev. 1.

The postulated initial crack for the WCAP-15819, Rev. 1, Appendix C curves extends axially upward from the expected lower extent of the inspection coverage area to the point where hoop stresses on either the ID or the OD become compressive. Appendix C crack growth curves use design weld sizes, which are conservative compared to the as-built weld sizes.

The minimum qualified inspection coverage values for non-circumferential flaws below the J-Weld that are requested are taken from the most conservative crack growth rate curves. These Appendix C curves support that a through-wall axial crack growing from minimum distance inspected for each CEDM below the weld would take at least one operating cycle to reach the bottom of the weld.

This does not include the time that would be required for an axial crack to propagate through the attachment weld and result in a leakage path. Additional operating time would be required for a safety concern (ejection of a nozzle or substantial corrosion of the low-alloy steel RPV head) to develop as a result of that leak. Therefore, multiple refueling intervals would be available to detect an axial flaw that initiates in the un-inspected region prior to potential development of a safety concern.

The threaded portion of the extension shaft guide cone would serve to retain potential loose parts resulting from a circumferential crack in the un-inspected area. A postulated 360-degree through wall crack in the narrow un-inspected annulus above the guide cone threads could result in separation of the guide cone from the penetration. However, in that case, the guide cone would be retained by the control element assembly (CEA) shroud and associated CEA extension shaft. This condition would not interfere with CEA function or any other reactor coolant system function, and would be readily observed in the subsequent refueling outage. Therefore, undetected circumferential flaws in the un-inspectable region below the J-weld are not a safety concern.

Based on a review of data acquired during the Unit 2 and 3, Cycle 13 through Cycle 15 refueling outages, qualified examination data for non-circumferential flaws can be collected from 1.5 inches above the top of the attachment weld to at least the requested minimum distances below the bottom of the attachment weld in all 91 CEDM penetrations as described in the second column of Table 1, above. The proposed minimum inspection distance below the attachment weld provides at least one additional refueling interval to detect all cracks propagating

from the un-inspected area to the bottom of the weld and multiple refueling intervals would be available to detect cracks propagating from the un-inspected area before they could develop into a safety concern.

CEDM volumetric examinations employ TOFD techniques that were demonstrated at EPRI and documented in MRP-89. That examination technique relies on signal response as the centerline of the transducer pair passes over a crack tip. Axially oriented TOFD pairs have optimum response from circumferential planar defects, and circumferentially oriented TOFD pairs respond optimally to axial planar flaws. San Onofre RPVH examinations have included both axial and circumferentially oriented transducer pairs to optimize sensitivity and to provide cross-check capabilities. Previously, either of the TOFD orientations has been considered adequate for detecting any PWSCC orientation because of the characteristic branching.

The relief requested in Reference 4 was based on the achievable coverage using only the circumferentially oriented TOFD transducer pair. The circumferentially oriented TOFD pair remains acoustically coupled to the CEDM penetration ID approximately to the position of the counterbore. However coverage below the J-weld using the axially oriented TOFD pair is more limited because the lower transducer loses acoustic coupling approximately 0.250 inch above the counterbore. As a result of the new procedure limitations, the fully qualified volumetric coverage of CEDM penetrations terminate approximately 0.250 inch above the previously requested lower exam extent.

10CFR50.55(a) specifies that qualification of RPVH volumetric examination techniques be implemented by September 1, 2009. These performance qualification tests have been performed at the EPRI Non-Destructive Examination Center (NDEC) during August 2009. Qualification of SCE's examination contractor has established a new limitation against using circumferentially oriented TOFD for detection of circumferential flaws. This limitation impacts the lower extent to which fully qualified examination coverage can be credited. This is due to the loss of axial TOFD transducer coupling approximately 0.250 inch above the CEDM counterbore. The use of circumferential TOFD for detection of PWSCC and planar flaws having any significant axial growth component is qualified and remains consistent with the basis for previously approved Relaxation from EA-03-009 and the relief proposed in Reference 4.

In all cases, the actual CEDM examination coverage below the J-weld will include the maximum extent geometrically possible. In each examination, the qualified coverage for circumferentially oriented flaws is expected to be approximately 0.250 inch less than the qualified coverage for non circumferential

flaws. This Relief is only needed for the original Alloy 600 CEDM penetrations. SCE is having replacement heads fabricated with Alloy 690 CEDM penetration tubes. The replacement heads will incorporate design changes which are expected to improve CEDM penetration coverage such that relief may not be necessary. SCE plans to install the replacement reactor pressure vessel heads in 2011 and 2012 after operating the existing heads for one more full cycle.

7. Duration of Proposed Alternative

The proposed alternative will apply to the existing RPVH for the remainder of the current SONGS Unit 2 and Unit 3 third 10-year ISI interval. The third 10-year interval began on August 18, 2003 and is scheduled to end on August 17, 2013.

As noted in the Precedents listed, WCAP-15819, Rev. 1 used the crack growth formula in the Electric Power Research Institute report, "Material Reliability Program (MRP) Crack Growth Rates for Evaluating Primary Stress Corrosion Cracking (PWSCC) of Thick Wall Alloy 600 Material (MRP-55), Revision 1;" therefore, the following commitment remains unchanged and in force.

> If the NRC staff finds that the crack-growth formula in industry report MRP-55 is unacceptable, then SCE will revise its analysis that supports the proposed alternative within 30 days after the NRC informs the licensee of an NRC-approved crack growth formula. If SCE's revised analysis shows that the crack growth acceptance criteria are exceeded prior to the end of the current operating cycle, SCE will consider Relaxation Request 3 to be rescinded, and within 72 hours, SCE will submit to the NRC written justification for continued operation. If the revised analysis shows that the crack growth acceptance criteria are exceeded during the subsequent operating cycle, SCE will, within 30 days, submit the revised analysis for the NRC review. If the revised analysis shows that the crack growth acceptance criteria are not exceeded during either the current operating cycle or the subsequent operating cycle, SCE will, within 30 days, submit a letter to the NRC confirming that its analysis has been revised. Any future crack-growth analyses performed for this and future cycles for RPV head penetrations will be based on a crack growth rate formula that is acceptable to the NRC.

8. Precedents

1. Letter from Herbert N. Berkow (NRC) to H. B. Ray (SCE) dated March 19, 2004; Subject: Relaxation of the Requirements of Order EA-03-009 Regarding Reactor Pressure Vessel Head Inspections, San Onofre Nuclear Generating Station (SONGS), Units 2 and 3 (TAC Nos. MC1542 and MC1543) [ML 040840128]

2. Letter from Herbert N. Berkow (NRC) to H. B. Ray (SCE) dated June 27, 2005; Subject: Relaxation of the Requirements of Order EA-03-009 Regarding Reactor Pressure Vessel Head Inspections, San Onofre Nuclear Generating Station (SONGS), Units 2 and 3 - Relaxation Request 3 (TAC Nos. MC5522 and MC5523) [ML 051780416]

3. Letter from Jack Donohew (NRC) to H. B. Ray (SCE) dated September 26, 2005; Subject: San Onofre Nuclear Generating Station (SONGS), Units 2 and 3, Re: Correction to Relaxation of the Requirements of Order EA-03-009 Regarding Reactor Pressure Vessel Head Inspections (TAC Nos. MC5522 and MC5523) [ML 052430666]

9. References

1. First Revised NRC Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors, issued on February 20, 2004 [ML 040220181]

2. Letter from A. E. Scherer (SCE) to the Document Control Desk (NRC) dated December 9, 2003; Subject: Docket Nos. 50-361 and 50-362, Request For Relaxation Of Reactor Pressure Vessel Head Penetration Inspection Requirements In Nuclear Regulatory Commission Order EA-03-009, San Onofre Nuclear Generating Station Units 2 and 3 [ML 033450462]

3. Letter from A. E. Scherer (SCE) to the Document Control Desk (NRC) dated February 9, 2004; Subject: Response to NRC Request for Additional Information Regarding Relaxation Requests 1 and 2 for Reactor Pressure Vessel Head Penetration Inspection Requirements in Nuclear Regulatory Commission Order EA-03-009 for San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 (TAC Nos. MC1540, MC1541, MC1542, and MC1543) [ML 040500598]

4. Letter from A. E. Scherer (SCE) to the Document Control Desk (NRC) dated February 27, 2009; Subject: Docket Nos. 50-361 and 50-362, Third Ten-Year Inservice Inspection (ISI) Interval Relief Request ISI-3-29, Reactor Vessel Head Inspection, San Onofre Nuclear Generating Station, Units 2 and 3 [ML090620358]

5. Westinghouse Report WCAP-15819-P, Rev. 1, "Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: San Onofre Units 2 and 3," dated January 2004