



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
OF RELIEF REQUESTS B-7, B-8, AND B-9, CODE CASE N-481,  
AND PROGRAM CLARIFICATIONS OF THE FIRST TEN-YEAR  
INTERVAL INSERVICE INSPECTION  
SOUTHERN CALIFORNIA EDISON COMPANY  
SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3  
DOCKET NOS. 50-361 AND 50-362

1.0 INTRODUCTION

Technical Specification 4.0.5 for San Onofre Nuclear Generating Station (SONGS), Units 2 and 3, states that inservice inspection and testing of the American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). By a rule change effective September 8, 1992, inservice testing requirements are now in 10 CFR 50.55a(f). Paragraph 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (f) may be used if (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulties without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(f)(4), ASME Code Class 1, 2, and 3 components (including supports) shall 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 ten-year interval 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) on the date twelve months prior to the issuance of the operating license, subject to the limitations and modifications listed therein. The applicable edition of Section XI of the ASME Code for SONGS Units 2 and 3 first 10-year ISI interval is the 1977 Edition through Summer 1979 Addenda. The components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by

reference in 10 CFR 50.55a(b) subject to the limitations and modifications listed therein.

Pursuant to 10 CFR 50.55a(f)(5), if the licensee determines that conformance with an examination requirement of Section XI of the ASME Code is not practical for his facility, information shall be submitted to the Commission in support of that determination and a request made for relief from the ASME Code requirement. After evaluation of the determination, pursuant to 10 CFR 50.55a(f)(6)(i), the Commission may grant relief and may impose alternative requirements that are determined to be authorized by law, when relief will not endanger life, property, or the common defense and security, and is otherwise in the public interest, giving due consideration to the burden on the licensee that could result if the requirements were imposed.

Southern California Edison Company (licensee) found during a performance demonstration test that the alternative examinations proposed in its letter dated June 26, 1991, could not consistently and reliably detect surface connected, crack like defects. As a result of the unsuccessful test, the licensee submitted a revised Relief Request No. B-7 by letter dated March 20, 1992, and Relief Request No. B-9 by letter dated July 31, 1992, for alternative examinations.

In addition, in its letter dated March 20, 1992, the licensee submitted Relief Request B-8 from the requirements of Section XI of the ASME Boiler and Pressure Vessel Code (the Code) which had been determined to be impractical to perform at SONGS Units 2 and 3. Furthermore, in the licensee's letter dated June 26, 1991, additional information necessary to clarify portions of the SONGS Units 2 and 3 first 10-Year interval inservice Inspection Program was also provided for NRC review. The staff, with technical assistance from its contractor, the Idaho National Engineering Laboratory (INEL), has evaluated the subject request for relief and ISI program clarifications in the following sections.

## 2.0 EVALUATION

The information provided by the licensee in support of the request for relief from impractical requirements has been evaluated and the bases for granting relief from those requirements or authorizing alternative examinations are documented below.

### A. Request No. B-7, Examination Category B-J, Pressure Retaining Circumferential and Longitudinal Butt Welds

Code Requirement: Section XI, Table IWB-2500-1, Examination Category B-J requires both volumetric and surface examination of circumferential and longitudinal butt welds in pipes and fittings with nominal pipe size 4 inches and greater as defined by Figure IWB-2500-8 for Class 1 components. The figure defines the examination volume as the inner 1/3 of the nominal wall thickness at the weld.

Licensee's Basis for Requesting Alternative Examination: The licensee states that:

1. A full-volumetric ultrasonic (UT) preservice examination was performed from the inside of the pipe. The results of a "1/3-volumetric-plus-surface" examination will not be comparable to the preservice examination. The preservice examination (PSE) for San Onofre Units 2 and 3 was performed in accordance with the requirements specified by the ASME Code, Section XI, 1974 Edition with Addenda through the Summer, 1975; the code edition approved by 10 CFR 50.55a at the time the PSE was performed. This Code required the examination of 100 percent of the volume of the weld and heat affected zone for longitudinal and circumferential piping welds in Class 1 systems larger than 1 inch in nominal pipe size. UT examination techniques were used to satisfy these requirements.
2. Access to the affected welds is by either removing the refueling cavity seal ring, and entering the area from above, or crawling alongside the primary coolant piping through the penetrations in the primary shield wall. Although these welds did receive surface examinations during construction, the high humidity environment in which they are located is expected to have resulted in surface oxidation, which would require removal prior to performing a successful surface examination.
3. The total effort to perform all required surface examinations without Relief Request B-7 is estimated to increase radiation exposure received in the performance of the required examinations. This increase of person-rem per outage for these examinations is not consistent with ALARA objectives. These welds are located in a high radiation area next to the reactor vessel, with dose rates ranging from 100 mrem-hour to 8 rem/hour at some hot spots, with an average dose rate in the area of examination being approximately 250 mrem/hour.

Approximately 32 person-rem of exposure would be saved if Relief Request B-7 and B-9 are approved, because surface inspections of these welds would not be performed.

4. A full volumetric UT examination from the inside of the pipe was performed during the Cycle 3 refueling outage, for both Units 2 and 3, on two hot leg circumferential welds and four hot leg longitudinal welds. This examination was performed using the guidance in Regulatory Guide 1.150 "Ultrasonic Testing of Reactor Vessel Welds During Preservice and Inservice Examinations." The remaining 12 welds in each Unit will be examined in this manner during the respective Cycle 7 refueling outages. The results of these examinations support the viability of full-volumetric

examinations in lieu of 1/3-volumetric-plus-surface examinations. Specifically, the radiographic punch marks, which are no more than 3/64-inch (0.047 inches) deep, were detected. These marks are less than the minimum Code allowed flaw depth (approximately 0.2 inches).

Licensee's Proposed Alternative Examination: Applicable circumferential and longitudinal pressure retaining piping welds will receive a 100 percent volumetric UT examination in lieu of a "1/3-volumetric-plus-surface" examination. These examinations will be performed using the guidance of Regulatory Guide 1.150 "Ultrasonic Testing of Reactor Vessel Welds During Preservice and Inservice Examinations." Examinations shall be conducted from inside the piping using half-vee examination techniques as a minimum, applied in two directions parallel to the weld, and two directions perpendicular to the weld, except when access is limited by weld configuration or geometry.

Staff Evaluation: The Code requires a volumetric examination of the inner 1/3 of the wall thickness through the weld and a surface examination for the subject Category B-J circumferential and longitudinal butt welds in pipes and fittings. The licensee's proposed examinations shall be conducted from inside the piping using a half-vee examination technique as a minimum applied in two directions parallel to the weld, and two directions perpendicular to the weld, except when access is limited by weld configuration or geometry. This proposed alternative is an acceptable substitute for the Code specified examination methods, as discussed in IWA-2240, "Alternative Examinations." The alternative examination method will provide an acceptable level of quality and safety and, therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff concludes that the proposed alternative examination is authorized.

B. Request for Relief No. B-8, Examination Categories B-J and C-F, Pressure Retaining Circumferential and Longitudinal Butt Welds

Code Requirement: Section XI, Sections IWB-2400, IWC-2400, and Tables IWB-2412-1 and IWC-2412-1 require a minimum of 50 percent of the selected Class 1 and 2 welds, respectively, to be inspected by the end of the second inspection period of the first inspection interval.

Licensee's Code Relief Request: Relief is from the Code required schedule requirements specified in Paragraph IWB-2400 and Table IWB-2412-1 for Class 1 components and Paragraph IWC-2400 and Table IWC-2412-1 for Class 2 components from the surface examination only of Tables IWB-2500-1 and IWC-2500-1, respectively.

Licensee's Basis for Requesting Relief: The licensee states that this relief request is required because an attempt to demonstrate that full-volumetric UT examinations are a satisfactory substitute for 1/3-volumetric-plus-surface examinations was not successful. However, this demonstration, performed on stainless steel weld specimens, did result in successful detection of three surface connected flaws (all of which were less than five percent through-wall penetration). These flaws were

orientated circumferentially along the toe of the welds. This limited success demonstrates that the full-volume UT covers a significant majority of the weld volume inspected and provides a reasonable amount of assurance of the integrity of the welds inspected. We believe these results are also applicable to carbon steel welds, which are typically less difficult to inspect than stainless steel welds.

Licensee's Proposed Alternative Examinations: Sufficient inservice surface examinations will be conducted during the third (last) period of the 10-year examination interval to satisfy Code requirements for 1/3-volumetric-plus-surface examinations. The volumetric requirements of these examinations are being completed in compliance with the Code required schedules as specified in Paragraph IWB-2400 and Table IWB-2412-1 for Class 1 components, and Paragraph IWC-2400 and Table IWC-2412-1 for Class 2 components.

Staff Evaluation: The Code requires a minimum of 50 percent of the selected Class 1 and 2 welds, respectively, to be inspected by the end of the second inspection period of the first 10-year inspection interval. The licensee proposes that sufficient inservice surface examinations will be conducted during the third (last) period of the first 10-year inspection interval to satisfy Code requirements for 1/3-volumetric-plus-surface examinations. In a telephone conference on March 23, 1992, the licensee reported that it had surface examined an additional 18 welds for a total of 38 welds examined for SONGS Unit 2, and no indications were found during these inspections. The licensee surface examined a total of 25 welds in SONGS Unit 3, and one indication was found in a weld for an 8-inch Schedule 40 stainless steel shutdown heat exchanger discharge line. The indication was 1/8 inch long versus the Code allowable of 1/4 inch long, and the licensee did not repair the weld, since it was within the Code allowable.

The alternative examinations will provide an acceptable level of quality and safety and, therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff concludes that the proposed alternative examination is authorized.

C. Request No. B-9, Examination Category B-J, Pressure Retaining Circumferential and Longitudinal Butt Welds

Code Requirement: Section XI, Table IWB-2500-1, Examination Category B-J requires both volumetric and surface examination of circumferential and longitudinal butt welds in pipes and fittings with nominal pipe size 4 inches and greater as defined by Figure IWB-2500-8 for Class 1 components. The figure defines the examination volume as the inner 1/3 of the nominal wall thickness at the weld.

Licensee's Basis for Requesting Alternative Examination: The licensee states that:

1. A full-volumetric UT preservice examination was performed from the inside of the pipe. The results of a "1/3-volumetric-plus-surface"



examination will not be comparable to the preservice examination. The preservice examination (PSE) for San Onofre Units 2 and 3 was performed in accordance with the requirements specified by the ASME Code, Section XI, 1974 Edition with Addenda through the Summer, 1975; the code edition approved by 10 C.F.R. 50.55a at the time the PSE was performed. This Code required the examination of 100 percent of the volume of the weld and heat affected zone for longitudinal and circumferential piping welds in Class 1 systems larger than 1 inch in nominal pipe size. UT examination techniques were used to satisfy these requirements.

2. Access to the affected welds is by either removing the refueling cavity seal ring, and entering the area from above, or crawling alongside the primary coolant piping through the penetrations in the primary shield wall. Although these welds did receive surface examinations during construction, the high humidity environment in which they are located is expected to have resulted in surface oxidation, which would require removal prior to performing a successful surface examination.
3. The total effort to perform all required surface examinations without Relief Request B-9 is estimated to increase radiation exposure received in the performance of the required examinations. This increase of person-rem per outage for these examinations is not consistent with ALARA objectives. These welds are located in a high radiation area next to the reactor vessel, with dose rates ranging from 100 mrem-hour to 8 rem/hour at some hot spots, with an average dose rate in the area of examination being approximately 250 mrem/hour.

Approximately 32 person-rem of exposure would be saved if Relief Request B-7 and B-9 are approved, because surface inspections of these welds would not be performed.

4. A full volumetric UT examination from the inside of the pipe was performed during the Cycle 3 refueling outage, for both Units 2 and 3, on the two hot leg circumferential welds. This examination was performed using the guidance in Regulatory Guide 1.150 "Ultrasonic Testing of Reactor Vessel Welds During Preservice and Inservice Examinations." The remaining 4 welds in the cold legs of each Unit will be examined in this manner during the respective Cycle 7 refueling outage. The results of these completed examinations support the viability of full-volumetric examinations in lieu of 1/3-volumetric-plus-surface examinations. Specifically, the radiographic punch marks, which are no more than 3/64-inch (0.047 inches) deep, were detected. These marks are less than the minimum Code allowed flaw depth (approximately 0.2 inches).

Licensee's Proposed Alternative Examination: All 6 circumferential pressure retaining piping welds on each unit will receive a 100 percent volumetric UT examination in lieu of a "1/3-volumetric-plus-surface"

examination. These examinations will be performed using the guidance of Regulatory Guide 1.150 "Ultrasonic Testing of Reactor Vessel Welds During Preservice and Inservice Examinations." Examinations shall be conducted from inside the piping using half-vee examination techniques as a minimum, applied in two directions parallel to the weld, and two directions perpendicular to the weld, except when access is limited by weld configuration or geometry.

Staff Evaluation: The Code requires a volumetric examination of the inner 1/3 of the wall thickness through the weld and a surface examination for the subject Category B-J circumferential and longitudinal butt welds in pipes and fittings. The licensee's proposed examinations shall be conducted from inside the piping using a half-vee examination techniques as a minimum applied in two directions parallel to the weld, and two directions perpendicular to the weld, except when access is limited by weld configuration or geometry. This proposed alternative is an acceptable substitute for the Code specified examination methods, as discussed in IWA-2240, "Alternative Examinations." The alternative examination method will provide an acceptable level of quality and safety and, therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff concludes that the proposed alternative examination is authorized.

D. Code Case N-481 for Reactor Coolant Pump Casing Welds

The first ten-year interval ISI program included plans to examine the reactor coolant pump casing weld during the tenth-year refueling outage using radiography, unless better techniques were developed. Since the original submittal of the ISI program, SCE has proposed to use ASME Code Case N-481, "Alternate Examination Requirements for Cast Austenitic Pump Casings," which has been approved by the ASME Code Committee and will be approved for generic use in Revision 9 of Regulatory Guide 1.147. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the proposed alternative examination to use Code Case N-481 is acceptable and will provide an acceptable level of quality and safety.

E. Auxiliary Feedwater System Lube Oil Cooling

As part of the first 10-year interval ISI program, the licensee had planned to performed augmented inservice inspections on auxiliary feedwater (AFW) pump turbine steam piping to resolve a concern regarding a steam line pipe break in the AFW pump room and the potential impact on the AFW pump bearings. In a letter to the NRC dated March 7, 1983, SCE committed to install a forced lube oil cooling system to improve AFW system reliability. In a letter dated April 2, 1984, SCE notified the staff that the forced lube oil cooling design was changed to a gravity feed design. Therefore, based on the installation of the gravity feed lube oil cooling system, SCE is not implementing augmented inservice inspections on the AFW pump turbine steam piping, as stated in their March 7, 1983 letter. The staff finds this engineering change to be acceptable and in the interest of public health and safety.

### 3.0 CONCLUSION

Paragraph 10 CFR 50.55a(f)(4) requires that components (including supports) that are classified as ASME Code Class 1, 2, and 3 meet the requirements, except design and access provisions and preservice requirements, set forth in applicable editions of ASME Section XI to the extent practical within the limitations of design, geometry, and materials of construction of the components. Pursuant to 10 CFR 50.55a(f)(5)(iii), the licensee determined that conformance with certain Code requirements is impractical for its facility, and has submitted supporting technical justification. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the proposed alternative examinations as discussed in Relief Request B-8, and the use of Code Case N-481 as an alternative examination, are authorized and will provide an acceptable level of quality and safety for San Onofre Nuclear Generating Station, Units 2 and 3. The alternative examination proposed in Relief Requests B-7 and B-9 is an acceptable substitute for the Code specified examination methods, as discussed in IWA-2240, "Alternative Examinations." The alternative examination method will provide an acceptable level of quality and safety and, therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff concludes that the proposed alternative examination is authorized. The staff also found that the additional information regarding the Auxiliary Feedwater System Lube Oil Cooling is acceptable.

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