UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

February 24, 2012

Mr. John T. Conway
Senior Vice President – Energy Supply
and Chief Nuclear Officer
Pacific Gas and Electric Company
Diablo Canyon Power Plant
77 Beale Street, Mail Code B32
San Francisco, CA 94105

SUBJECT: DIABLO CANYON POWER PLANT, UNIT NO. 1 - APPROVAL OF REQUEST FOR RELIEF NDE-RCS-SE-LP1CL TO ALLOW USE OF ALTERNATE ASME CODE CASE N-770-1 (TAC NO. ME7236)

Dear Mr. Conway:

By letter dated September 22, 2011, Pacific Gas and Electric Company (the licensee) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) for alternative NDE-RCS-SE-LP1CL, "Use of Alternate ASME Code Case N-770-1 Baseline Exam," at Diablo Canyon Power Plant (DCPP), Unit 1. Specifically, the licensee proposed to credit the ultrasonic examination (UT) of weld number WIB-RC-1-18(SE) from DCPP, Unit 1, refueling outage (RFO) 1R16 in October 2010 to fulfill the baseline examination requirement specified in the American Society of Mechanical Engineers (ASME) Code Case N-770-1, "Alternative Examination Requirements for Pressurized Water Reactor (PWR) Reactor Vessel Upper Heads with Nozzles Having Pressure-Retaining Partial Penetration Welds, Section XI, Division 1." The licensee stated that the surface contour of the loop 1 reactor vessel cold-leg nozzle does not permit the UT transducer to maintain continuous contact on the circumferential scan. As a result, UT examination is only able to achieve approximately 80 percent coverage of the volume required, less than the essentially 100 percent examination required by paragraph 50.55a(g)(6)(ii)(F)(3) of Title 10 of the *Code of Federal Regulations* (10 CFR) for the baseline examination. In accordance with 10 CFR 50.55(a)(3)(ii), the licensee requested an alternative to the requirements of 10 CFR 50.55a(g) on the basis that complying with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The request is applicable to the remainder of third 10-year inservice inspection (ISI) interval for DCPP, Unit 1, which began on January 1, 2006, and ends on May 7, 2015.

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the licensee's alternative provides reasonable assurance of the structural integrity of the weld and that compliance with the requirements of 10 CFR 50.55a(g)(6)(ii)(F)(3) would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(ii) and authorizes crediting the nozzle-to-safe-end weld examination of weld number WIB-RC-1-18(SE) previously performed in DCPP, Unit 1, RFO 1R16, for the baseline examination required by 10 CFR 50.55a(g)(6)(ii)(F)(3) for the remainder of the DCPP, Unit 1, third 10-year ISI interval.

All other requirements for which relief was not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

If you have any questions regarding the safety evaluation, please contact Joe Sebrosky at (301) 415-1132, or via e-mail at joseph.sebrosky@nrc.gov.

Sincerely,

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-275

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ALTERNATIVE NDE-RCS-SE-LP1CL

USE OF ALTERNATE ASME CODE CASE N-770-1 BASELINE EXAM

PACIFIC GAS AND ELECTRIC COMPANY

DIABLO CANYON POWER PLANT, UNIT 1

DOCKET NO. 50-275

1.0 INTRODUCTION

By letter dated September 22, 2011 (Reference 1), Pacific Gas and Electric Company (the licensee), submitted request for alternative NDE-RCS-SE-LP1CL, "Use of Alternate ASME Code Case N-770-1 Baseline Exam," for U.S. Nuclear Regulatory Commission (NRC) review and authorization. Title 10 of the *Code of Federal Regulations* (10 CFR) paragraph 55a(g)(6)(ii)(F)(3) requires that licensees of existing operating pressurized-water reactors (PWRs) perform a baseline examination of dissimilar metal butt welds (DMBWs) in accordance with the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Case N-770-1, "Alternative Examination Requirements for Pressurized Water Reactor (PWR) Reactor Vessel Upper Heads With Nozzles Having Pressure-Retaining Partial Penetration Welds, Section XI, Division 1" by the end of the next refueling outage after January 20, 2012. The licensee is proposing to credit the ultrasonic examination (UT) of weld number WIB-RC-1-18(SE) from Diablo Canyon Power Plant (DCPP), Unit 1, refueling outage (RFO) 1R16 in October 2010 to fulfill the baseline examination requirement. The licensee stated that the surface contour of the loop 1 reactor vessel cold-leg nozzle does not permit the UT transducer to maintain continuous contact on the circumferential scan. As a result, UT examination is only able to achieve approximately 80 percent coverage of the volume required, less than the essentially 100 percent examination required by 10 CFR 50.55a(g)(6)(ii)(F)(3) for the baseline examination. The licensee further stated that fulfilling the essentially 100 percent examination requirements would present a hardship without a compensating increase in the level of quality and safety. The request is applicable to the remainder of third 10-year inservice inspection (ISI) interval for DCPP, Unit 1, which began on January 1, 2006, and ends on May 7, 2015.

2.0 REGULATORY EVALUATION

The regulations in 10 CFR 50.55a(g)(6)(ii)(F) require that licensees of existing operating PWRs implement the requirements of ASME Code Case N-770-1, subject to the conditions specified in paragraphs (g)(6)(ii)(F)(2) through (g)(6)(ii)(F)(10), by the first refueling outage after August 22, 2011.

Enclosure

The regulations in 10 CFR 50.55a(a)(3) state, in part, that alternatives to the requirements of 10 CFR 50.55a(g) may be used when authorized by the NRC if the applicant demonstrates that: (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 difficulty without a compensating increase in the level of quality and safety.

The licensee's request for alternative, which proposes to credit the weld examination from RFO 1R16 for the baseline examination, has been submitted on the basis that compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The ISI Code of record for DCPP, Unit 1, for the third 10-year ISI interval, which began on January 1, 2006 and is scheduled to end on May 7, 2015, is Section XI of the ASME Code, 2001 Edition through the 2003 Addenda.

3.0 TECHNICAL EVALUATION

3.1 Licensee's Request for Alternative

3.1.1 Component Affected

Loop 1 reactor vessel cold leg nozzle-to-safe-end weld, weld number WIB-RC-1-18(SE).

3.1.2 Code Requirements

The regulations in 10 CFR 50.55a(g)(6)(ii)(F)(3) state:

> Baseline examinations for welds in Table 1, Inspection Items A–1, A–2, and B, shall be completed by the end of the next refueling outage after January 20, 2012. Previous examinations of these welds can be credited for baseline examinations if they were performed within the re-inspection period for the weld item in Table 1 using Section XI, Appendix VIII requirements and met the Code required examination volume of essentially 100 percent. Other previous examinations that do not meet these requirements can be used to meet the baseline examination requirement, provided NRC approval of alternative inspection requirements in accordance with paragraphs (a)(3)(i) or (a)(3)(ii) of this section is granted prior to the end of the next refueling outage after January 20, 2012.

The subject weld is classified as Inspection Item "B", "Unmitigated butt weld at Cold Leg operating temperature ≥ 525° F and < 580° F" for which visual and essentially 100 percent volumetric examinations are required.

3.1.3 Licensee's Reason for Request

The licensee stated that the surface configuration of the subject weld does not allow full coverage in the circumferential scan direction. In its letter dated September 22, 2011, the licensee stated, in part, that

> In order to reach "essentially 100 percent" coverage..., removal of the reactor lower internals followed by examination from the inside surface would be required. The additional personnel exposure to the plant staff due to the combined removal/examination/reinstallation is 750 mR [millirem]....
>
> Reconfiguring the outside surface of the safe-end weld to the extent required to create a contour where contact can be maintained on the nozzle forging would involve extensive machining or hand grinding. In addition to the personnel exposure involved, the end result would be a significantly reduced wall thickness with a corresponding reduction in margin or possible minimum wall thickness violation.

The licensee stated that either of these options would result in hardship without a compensating increase in the level of quality and safety.

3.1.4 Licensee's Proposed Alternative and Basis for Use

The licensee proposed that the scan coverage attained during the UT examination in RFO 1R16, which began in October 2010, be credited for the 10 CFR 50.55a(g)(6)(ii)(F)(3) required baseline examination. The licensee stated that the ultrasonic phased array examination in RFO 1R16 was performed using ASME Code, Section XI, Appendix VIII requirements. The licensee stated that although the combined axial and circumferential scan coverage of approximately 80 percent does not meet the essentially 100 percent examination coverage required for the baseline examination, the scan has examined 100 percent of the ASME Code Case N-770-1 required volume of the primary water stress-corrosion cracking (PWSCC) susceptible DMBW material. Therefore, the examination volume provides reasonable assurance of the structural integrity of the weld.

3.2 NRC Staff Evaluation

PWSCC of nickel-based pressure-retaining boundary materials is a safety concern. Operational experience has shown that PWSCC can occur as the result of the combination of susceptible material, such as Alloy 182 (SFA-5.11 ENiCrFe-3) weld metal, corrosive environment, and tensile stresses resulting in leakage and the potential for loss of structural integrity. The examination requirements of ASME Code Case N-770-1 are intended to ensure the structural integrity of DMBWs through nondestructive examination.

The licensee stated that the surface configuration of the subject DMBW does not allow full coverage in the circumferential scan direction. The NRC staff has examined the drawing submitted by the licensee in Reference 1 and concludes that the concave surface of the subject reactor pressure vessel cold-leg nozzle at the nozzle-to-safe-end weld presents a configuration that does not permit adequate contact with currently available UT transducers on the nozzle

side of the weld, resulting in an examination volume that is less than essentially 100 percent of the ASME Code Case N-770-1 volume.

3.2.1 Hardship Evaluation

The licensee stated that there are two options for attaining essentially 100 percent coverage of the subject DMBW: (1) removal of the reactor lower internals followed by examination from the inside surface, or (2) reconfiguring the outside surface of the safe-end weld by extensive machining or hand grinding to create a contour where continuous transducer contact can be maintained on the nozzle forging.

The licensee stated that removal of the reactor lower internals followed by examination from the inside surface and reinstallation of the reactor lower internals would result in an additional estimated radiation exposure of plant personnel of 750 mR. In addition, major evolutions involving heavy loads, such as lower internals removal, result in incremental increases in personnel safety risks and damage to plant components. The NRC staff concludes that additional personnel radiation exposure and the incremental increase in safety risk resulting from inside surface examination would present a hardship.

The licensee stated that the other option, reconfiguring the outside surface of the safe-end weld by extensive machining or hand grinding to create a contour where ultrasonic transducer contact can be maintained on the nozzle forging, would result in additional radiation exposure to plant personnel, and would result in a reduced wall thickness with a corresponding reduction in margin and possible minimum wall thickness violation. The NRC staff concludes that the additional personnel radiation exposure, actions to address any potential minimum wall thickness concerns, and reduction in margin associated with contouring the outside surface of nozzle forging would present a hardship.

The NRC staff is not aware of other options for attaining the required examination coverage and, therefore, concludes that attaining the required ASME Code Case N-770-1 examination coverage would present a hardship.

3.2.2 Proposed Alternative Evaluation

The licensee stated that the subject nozzle-to-safe-end weld was previously examined in RFO 1R16 in October 2010 in accordance with the Electric Power Research Institute's "Material Reliability Program: Primary System Piping Butt Weld Inspection and Evaluation Guideline, (MRP-139, Revision1)," December 2008 (Reference 2), and the requirements of ASME Code, Section XI, Appendix VIII. The RFO 1R16 UT examination of the subject weld attained 100 percent coverage of the required ASME Code Case N-770-1 volume in the axial scan direction, but was only able to attain 61 percent in the circumferential scan direction. Although the combined coverage of approximately 80 percent is less than the required essentially 100 percent examination volume, the licensee proposed to credit the RFO 1R16 examination for the baseline examination required by 10 CFR 50.55a(g)(6)(ii)(F)(3). The licensee stated that the RFO 1R16 UT examination was able to interrogate the entire root volume of the PWSCC-susceptible Alloy 182 weld material. Furthermore, the licensee stated that no inside surface connected flaws were detected in any of the RFO 1R16 hot-leg or cold-leg nozzle-to-safe-end

weld examinations, and that all of the hot-leg and cold-leg examinations, except for the subject DMBW, were able to achieve the required essentially 100 percent examination coverage.

Figure 1 of Reference 1 presents the UT examination coverage attained during the RFO 1R16 examination. The figure shows that the axial UT scan has examined 100 percent of the required volume, but the circumferential scan only examined 61 percent of the required volume, resulting in a combined average of approximately 80 percent. The figure shows that the circumferential scan examined all of the DMBW Alloy 182 susceptible material within the required examination volume. The material which could not be sufficiently examined was the carbon steel nozzle forging, material specification SA-508, adjacent to the DMBW.

The NRC staff notes that the DMBW and carbon steel nozzle material has been previously examined from the inside surface using ASME Code, Section XI, Appendix VIII qualified procedure and personnel during RFO 1R13, and achieved greater than 90 percent coverage of the required exam areas for all reactor coolant system nozzle-to-safe-end welds, including the subject weld. These examinations were supplemented by surface profilometry and eddy current testing; no inside surface connected flaws were detected. While these examinations may not fulfill the baseline examination requirements of 10 CFR 50.55a(g)(6)(ii)(F)(3), they provide evidence of the structural integrity of carbon steel forging nozzle material that were not fully examined in RFO 1R16. The staff further notes that the subject DMBW was made with Alloy 182 weld filler and not with a stainless steel weld filler. Therefore, carbon depletion of the carbon steel nozzle heat-affected zone (HAZ) by stainless steel weld metal, and the accompanying reduction in HAZ fracture toughness, is not an issue. Since operational experience has shown that carbon steel is not subject to PWSCC and other degradation mechanisms are not operative, the staff concludes that there is reasonable assurance of structural integrity of the volume of the material which could not be examined by the circumferential UT scan. The staff's conclusion is supported by the axial scan results of the subject weld and carbon steel material where essentially 100 percent examination coverage was attained, as well as the results of scans of the other hot and cold leg DMBWs where essentially 100 percent coverage was attained and no inside surface connected flaws were detected.

In summary, the NRC staff concludes that compliance with the requirements of 10 CFR 50.55a(g)(6)(ii)(F)(3) would result in hardship and notes that the PWSCC-susceptible weld material has been adequately examined in both the axial and circumferential directions, and only the carbon steel reactor pressure vessel nozzle material, a material that is not susceptible to PWSCC, was not completely examined in the circumferential scan direction. The staff concludes that the nozzle-to-safe-end weld examination, which was previously performed in RFO 1R16 in accordance with requirements of ASME Code, Section XI, Appendix VIII, provides a reasonable assurance of structural integrity. Therefore, performing an inside surface examination or machining the contour of the carbon steel nozzle exterior surface, followed by a scan from the outside in order to comply with the requirements of 10 CFR 50.55a(g)(6)(ii)(F)(3), would result in hardship without a compensating increase in the level of quality and safety.

4.0 CONCLUSION

Based on the above, the NRC staff concludes that the licensee's alternative provides reasonable assurance of the structural integrity of the weld and that compliance with the

requirements of 10 CFR 50.55a(g)(6)(ii)(F)(3) would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(ii) and authorizes crediting the nozzle-to-safe-end weld examination of weld number WIB-RC-1-18(SE) previously performed in DCPP, Unit 1, RFO 1R16, for the baseline examination required by 10 CFR 50.55a(g)(6)(ii)(F)(3), for the remainder of the DCPP, Unit 1, third 10-year ISI interval.

All other requirements for which relief was not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

5.0 REFERENCES

1. Becker, J. R., Pacific Gas and Electric Company, letter to U.S. Nuclear Regulatory Commission, "ASME Section XI Inservice Inspection Program Request for Alternative NDE-RCS-SE-LP1CL to Allow Use of Alternate ASME Code Case N-770-1 Baseline Exam," dated September 22, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML112690216).

2. Electric Power Research Institute, "Material Reliability Program: Primary System Piping Butt Weld Inspection and Evaluation Guideline, (MRP-139, Revision 1)," December 2008 (ADAMS Accession No. ML100970671).

Principal Contributor: Jay Wallace

Date: February 24, 2012

All other requirements for which relief was not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

If you have any questions regarding the safety evaluation, please contact Joe Sebrosky at (301) 415-1132, or via e-mail at joseph.sebrosky@nrc.gov.

Sincerely,

/ra/

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-275

Enclosure:
Safety Evaluation

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