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

July 23, 2010

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-1R16 FROM EXAMINATION REQUIREMENTS OF ASME CODE, SECTION XI, APPENDIX VIII, SUPPLEMENT 10, ROOT MEAN SQUARE ERROR (TAC NO. ME3942)

Dear Mr. Conway:

By letter dated May 17, 2010, the Pacific Gas and Electric Company (the licensee) submitted a request for relief NDE-RCS-SE-1R16 from certain examination requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) at the Diablo Canyon Power Plant (DCPP), Unit No. 1. Specifically, the licensee proposed using a root mean square error (RMSE) criterion for sizing flaws that is greater than the allowed value in ASME Code Case N-695, "Qualification Requirements for Dissimilar Metal Piping Welds, Section XI, Division 1" (N-695). N-695 is referenced in U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 1.147, Revision 15, "Inservice Inspection Code Case Acceptability, ASME, Section XI, Division 1."

The NRC staff has completed its review of request for relief NDE-RCS-SE-1R16 RR and attached is the NRC staff's safety evaluation (SE). Although the licensee requested relief pursuant to paragraph 50.55a(a)(3)(i) of Title 10 of the *Code of Federal* Regulations (10 CFR), the technical data was inconclusive on determining an acceptable level of quality and safety (i.e., equivalency with the existing requirement). However, the NRC staff has concluded that compliance with the N-695-required 0.125-inch RMSE criteria, at this time, is impractical and that the proposed alternative to add the difference between 0.189-inch RMSE and the ASME Code-required value (0.189-inch minus 0.125-inch = 0.064-inch) provides reasonable assurance of the structural integrity of the dissimilar metal welds that will be examined during the 16th refueling outage of the third 10-year inservice inspection (ISI) interval which is scheduled to being October 2010.

Therefore, request for relief NDE-RCS-SE-1R16 RR is granted pursuant to 10 CFR 50.55a(g)(6)(i), for the DCPP, Unit No. 1, for a one-time use during the 16th refueling outage of the third 10-year ISI interval. The third 10-year ISI interval began on May 8, 2006, and is scheduled to end May 7, 2016. Granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

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

If you have any questions regarding the SE, please contact Alan B. Wang at (301) 415-1445.

Sincerely,

CFlyon for

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

Docket No. 50-275 and 50-323

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO RELIEF REQUEST NDE-RCS-SE-1R16 FOR THE

THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

DIABLO CANYON POWER PLANT, UNIT NO. 1

PACIFIC GAS AND ELECTRIC COMPANY

DOCKET NO. 50-275

1.0 INTRODUCTION

By letter dated May 17, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML101380224), Pacific Gas and Electric Company (the licensee) submitted a request for relief NDE-RCS-SE-1R16 from certain examination requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) at the Diablo Canyon Power Plant (DCPP), Unit No. 1. Specifically, the licensee proposed using a root mean square error (RMSE) criterion for sizing flaws that is greater than ASME Code Case N-695, "Qualification Requirements for Dissimilar Metal Piping Welds, Section XI, Division 1" (N-695). N-695 is referenced in U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 1.147, Revision 15, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1" (RG 1.147, Revision 15). The request is for a one-time use during the 16th refueling outage (1R16) in the third 10-year inservice inspection (ISI) interval, which is scheduled to begin October 2010.

2.0 REGULATORY EVALUATION

The ISI of ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). The regulations in 10 CFR 50.55a(a)(3) state in part that alternatives to the requirements of paragraph (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.

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 regulations in 10 CFR 50.55a(g)(4)(iv) state that inservice examination of components and system pressure tests may meet the requirements set forth in subsequent editions and addenda that are incorporated by reference in paragraph 10 CFR 50.55a(b), subject to the limitations and modification listed in 10 CFR 50.55a(b) and subject to Commission approval. Portions of editions or addenda may be used provided that all related requirements of the respective editions or addenda are met. The Code of record for the third 10-year ISI interval at DCPP, Unit No. 1, is the 2001 Edition with 2003 Addenda of the ASME Code.

3.0 TECHNICAL EVALUATION FOR REQUEST

3.1 Affected Components

Code Category Item Number	Description	Weld Number	Pipe Inside Diameter, Inches
R-A, R1.20	Loop 1, Outlet nozzle-to-safe-end	WIB-RC-1-1 (SE)	29
	Loop 1, Inlet nozzle-to-safe-end	WIB-RC-1-18 (SE)	27.5
	Loop 2, Outlet nozzle-to-safe-end	WIB-RC-2-2 (SE)	29
	Loop 2, inlet nozzle-to-safe-end	WIB-RC-2-20 (SE)	27.5
	Loop 3, Outlet nozzle-to-safe-end	WIB-RC-3-1 (SE)	29
	Loop 3, Inlet nozzle-to-safe-end	WIB-RC-3-18 (SE)	27.5
	Loop 4, Outlet nozzle-to-safe-end	WIB-RC-4-1 (SE)	29
	Loop 4, Inlet nozzle-to-safe-end	WIB-RC-4-18 (SE)	27.5

3.2 Applicable Code Requirement

The third 10-year ISI interval Code of record is the 2001 Edition through 2003 Addenda of the ASME Code, Section XI. For ultrasonic testing (UT) examinations, 10 CFR 50.55a(b)(2)(xv) requires the licensee to use the 2001 Edition ASME Code, Section XI, Appendix VIII, Supplement 10.

N-695 is a Supplement 10 alternative that is endorsed by the NRC in RG 1.147, Revision 15. N-695, Paragraph 3.3(c), states that,

> Examination procedures, equipment, and personnel are qualified for depth-sizing when the RMS [root mean square] error of the flaw depth measurements, as compared to the true flaw depths, do not exceed 0.125 in. (3 mm).

3.3 Proposed Alternative

The licensee proposed to use a demonstrated 0.189-inch RMSE for inside diameter (ID) examination of the nozzle-to-safe-end welds in lieu of the specified 0.125-inch RMSE. In the event an indication that requires sizing is detected, the 0.064-inch difference between the demonstrated RMSE and the required RMSE (0.189-inch minus 0.125-inch = 0.064-inch) will be added to the measured through-wall (TW) extent for comparison with the applicable acceptance criteria.

3.4 Licensee Basis for the Alternative

In its letter dated May 17, 2010, the licensee stated that,

> The ID ultrasonic examination technology used to examine these welds has not evolved significantly since the most recent qualification efforts. Therefore, additional attempts to improve the depth sizing RMSE accuracy are not likely to result in improved performance at this time. If advances in technology are realized and the contracted examination vendor demonstrates an improved RMSE for the Supplement 10 prior to the examinations, the difference of the improved RMSE over the 0.125-inch RMSE requirement, if any, will be added to the measure TW dimension of indications requiring sizing before comparison to the applicable acceptance criteria.

The licensee has determined that the alternative assures the examination of the DCPP, Unit No. 1, nozzle-to-safe-end welds, when examined from the ID, are performed using personnel, procedures, and equipment qualified by demonstration in all aspects except depth sizing. The addition of the difference between demonstrated and required RMSE values will compensate for the potential sizing variation and provides an acceptable level of quality and safety in accordance with 10 CFR 50.55a(a)(3)(i).

3.5 NRC Staff Evaluation

The licensee's Code of record for the third 10-year ISI interval, as required by 10 CFR 50.55a(g)(6)(ii)(C)(2) for UT examinations, is the 2001 Edition with 2003 Addenda. The ASME Code requires that dissimilar metal welds (DMWs) be examined using procedures, equipment, and personnel qualified to Section XI, Appendix VIII, Supplement 10. The regulations in 10 CFR 50.55a(b)(2)(xv) require that ultrasonic examinations be performed using procedures, equipment, and personnel qualified to the 2001 Edition with no Addenda of Section XI, Appendix VIII, Supplement 10. However, the 2001 Edition does not provide criteria for examinations performed from the ID of nozzles and piping. As an alternative to Supplement 10, the ASME Code developed N-695 for qualifications performed from either the ID or outside diameter surfaces of DMWs. N-695 is endorsed in RG 1.147, Revision 15 with no conditions.

N-695 requires that the maximum error for flaw-depth measurements, when compared to the true flaw depth, not exceed 0.125-inch RMSE. The U.S. nuclear power industry is using the Electric Power Research Institute – Performance Demonstration Initiative (EPRI-PDI) program to implement the performance demonstration required by N-695. To date, personnel and

procedures have not been successful at meeting the N-695 depth-sizing qualification requirement, 0.125-inch RMSE maximum for examinations performed from the ID.

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee proposed applying the vendor's RMSE from the EPRI-PDI performance demonstration program for an approximation of the actual flaw depth to provide an acceptable level of quality and safety. The licensee has stated that the vendor's RMSE was 0.189-inch for examinations performed from the ID. The licensee proposed adding the depth-sizing difference between the demonstrated 0.189-inch RMSE and the ASME Code-required 0.125-inch RMSE to the measured value of any flaw detected during the examination of DMWs. The licensee stated that if advances in technology are realized and the contracted examination vendor demonstrates an improved RMSE for Supplement 10 prior to the examinations, the difference of the improved RMSE over the 0.125-inch RMSE, if any, will be added to the measured TW dimension of the indications.

The RMSE is a performance demonstration testing parameter used as a statistical measurement for screening individual's skills and procedure's capabilities. As a statistical measurement, the worst-case error can be calculated which is 0.395-inches for a performance demonstration test set with nine flaws measured precisely and the tenth flaw with maximum error.

The licensee is proposing to use 0.125-inch RMSE as an acceptable tolerance for subtracting from an individual's performance-demonstrated RMSE. The application of RMSE as a tolerance for field applications has some inherent inaccuracies that normally exist between a performance demonstration environment (lax time constraints and ideal office environment) and field applications (outage constraints and field environment). Using the 0.125-inch tolerance to adjustment an individual's RMSE does not take into consideration the RMSE from a successful performance demonstration which is normally less than the Code-required acceptance value. When calculating the worst-case error for a performance demonstration test set with 10 flaws and the proposed 0.189-inch RMSE, the worst-case error is 0.60-inches.

The industry's difficulties in meeting the RMSE requirement are associated with surface roughness and pipe misalignment that existed in pressurized-water reactor (PWR) cooling systems field welds. The licensee proposed to take profilometry measurements during the DMW examinations to record the ID surface profile. The licensee is also proposing to perform an alternative eddy current testing (ET) surface examination. The ET would detect any surface flaws while the profilometry would highlight areas of potentially large UT depth-sizing error. The likelihood of a flaw occurring precisely when surface roughness is affecting the UT examinations is small.

The test mockups used in the EPRI-PDI program were fabricated to replicate the bounding DMW surface conditions for PWR cooling system piping. Since the purchase of EPRI-PDI's mockups, some licensees have made improvements to the surface condition of these welds. However, the EPRI-PDI program does not have PWR cooling system mockups with less severe ID surface roughness (waviness) for depth-sizing performance demonstrations. In the absence of smooth-surface mockups, the licensee's vendor was unable to improve on its existing depth-sizing capabilities or achieve the ASME Code-required depth-sizing qualification. Without representative mockups of the licensee's PWR cooling system DMWs, the vendor is unable to

qualify personnel and procedures to the ASME Code-requirement. The NRC and EPRI-PDI have been discussing the RMSE issue at semiannual public meetings with industry representatives.

Although the licensee requested relief pursuant to 10 CFR 50.55a(a)(3)(i), the technical data was inconclusive on determining an acceptable level of quality and safety (i.e., equivalency with the existing requirement). However, based on the above evaluation, the NRC staff concludes that compliance with the N-695-required 0.125-inch RMSE, at this time, is impractical. Adding the difference between the performance-demonstrated depth-sizing RMSE and the N-695-required depth-sizing RMSE to a flaw size and applying the standards specified in ASME Section XI, IWB-3500 to determine acceptability provides reasonable assurance that structural integrity is being maintained for the subject DMWs.

3.6 Conclusion

Based on the above review and evaluation, the NRC staff concludes that compliance with the N-695-required 0.125-inch RMSE for depth sizing is impractical, and that the proposed alternative to add the difference between 0.189-inch RMSE and the ASME Code-required value (0.189-inch minus 0.125-inch = 0.064-inch) provides reasonable assurance of structural integrity of the DMWs that will be examined during the refueling outage 1R16 of the third 10-year ISI interval. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), request for relief NDE-RCS-SE-1R16 RR is granted to DCPP, Unit No. 1, for a one-time use during the 16th refueling outage of the third 10-year ISI interval. The third 10-year ISI interval began May 8, 2006, and is scheduled to end May 7, 2016. Granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

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

Principal Contributor: D. Naujock

Date: July 23, 2010

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

If you have any questions regarding the SE, please contact Alan B. Wang at (301) 415-1445.

Sincerely,

/ra/ FLyon for

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

Docket No. 50-275 and 50-323

Enclosure:
Safety Evaluation

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