



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

January 3, 2014

Mr. Edward D. Halpin  
Senior Vice President and Chief Nuclear Officer  
Pacific Gas and Electric Company  
Diablo Canyon Power Plant  
P.O. Box 56, Mail Code 104/6  
Avila Beach, CA 93424

SUBJECT: DIABLO CANYON POWER PLANT, UNIT 1 – RELIEF REQUEST  
NO. NDE-RCS-SE-1R18 TO ALLOW USE OF ALTERNATIVE DEPTH-SIZING  
CRITERIA (TAC NO. MF1427)

Dear Mr. Halpin:

By letter dated April 11, 2013, as supplemented by letter dated August 6, 2013, the Pacific Gas and Electric Company (the licensee) submitted relief request (RR) NDE-RCS-SE-1R18 to the U.S. Nuclear Regulatory Commission (NRC) for the use of alternate root mean square (RMS) error criteria for sizing flaws that are greater than the requirements of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Case N-695, "Qualification Requirements for Dissimilar Metal Piping Welds" (N-695), and ASME Code Case N-696, "Qualification Requirements for Appendix VIII Piping Examinations Conducted From the Inside Surface" (N-696), at the Diablo Canyon Power Plant, Unit 1 (DCPP).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(6)(i), the licensee requested relief from the depth-sizing uncertainty qualification requirement for ultrasonic examinations conducted from the inside diameter of pipes (i.e., RMS error not greater than 0.125 inches), contained in ASME Code Cases N-695 and N-696. The licensee requested relief and to use alternate requirements for inservice inspection items on the basis that the Code requirement is impractical.

The NRC staff reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(6)(i). Therefore, the NRC staff authorizes use of the proposed alternative until the end of the third 10-year inservice inspection interval at DCPP, Unit 1, currently scheduled to end on May 6, 2015.

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

E. Halpin

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If you have any questions, please contact the Project Manager, Brian Benney, at 301-415-2767 or via e-mail at [Brian.Benney@nrc.gov](mailto:Brian.Benney@nrc.gov).

Sincerely,

*for* 

Douglas A. Broaddus, Chief  
Plant Licensing IV-2 and Decommissioning  
Transition Branch  
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 RELIEF NDE-RCS-SE-1R18

FOR THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

PACIFIC GAS AND ELECTRIC COMPANY

DIABLO CANYON POWER PLANT, UNIT 1

DOCKET NO. 50-275

1.0 INTRODUCTION

By letter dated April 11, 2013 (Agencywide Document Access and Management System (ADAMS) Accession No. ML13102A048), as supplemented by letter dated August 6, 2013 (ADAMS Accession No. ML13219A011), the Pacific Gas and Electric Company (PG&E, the licensee) submitted relief request NDE-RCS-SE-1R18 to the U.S. Nuclear Regulatory Commission (NRC) for the use of alternate root mean square (RMS) error criteria for sizing flaws that are greater than the requirements of American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Case N-695, "Qualification Requirements for Dissimilar Metal Piping Welds" (N-695), and ASME Code Case N-696, "Qualification Requirements for Appendix VIII Piping Examinations Conducted From the Inside Surface" (N-696), at the Diablo Canyon Power Plant, Unit 1 (DCPP).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(6)(i), the licensee requested relief from the depth-sizing uncertainty qualification requirement for ultrasonic examinations conducted from the inside diameter (ID) of pipes (i.e., RMS error not greater than 0.125 inches), contained in ASME Code Cases N-695 and N-696. The licensee requested relief and to use alternate requirements for inservice inspection (ISI) items on the basis that the code requirement is impractical.

2.0 REGULATORY EVALUATION

In its letter dated April 11, 2013, the licensee requested relief from the 0.125-inch RMS error depth-sizing acceptance criteria contained in ASME Code Cases N-695 and N-696 pursuant to 10 CFR 50.55a(g)(5)(iii).

ASME Code Cases N-695 and N-696 are accepted for use in NRC Regulatory Guide (RG) 1.147, Revision 16, "Inservice Inspection Code Case Acceptability ASME Section XI, Division 1," October 2010 (ADAMS Accession No. ML101800536), and incorporated by reference in 10 CFR 50.55a(b).

Enclosure

The regulations in 10 CFR 50.55a(g)(4)(ii) state, in part, that inservice examination of components must comply with the latest edition and addenda of the Code incorporated by reference in 10 CFR 50.55a(b) or the optional ASME Code Cases listed in RG 1.147, Revision 16.

Paragraph 10 CFR 50.55a(g)(5)(iii) states, in part, that licensees may determine that conformance with certain code requirements is impractical and that the licensee shall notify the Commission and submit information in support of the determination.

Paragraph 10 CFR 50.55a(g)(6)(i) states, in part that the Commission will evaluate determinations under paragraph (g)(5) of this section that code requirements are impractical and that the Commission may grant such relief and may impose such alternative requirements as it determines is authorized by law and will not endanger life or property.

Based on the above, and subject to the following technical evaluation, the NRC staff concludes that regulatory authority exists for the licensee to request and the Commission to grant the relief requested by the licensee.

### 3.0 TECHNICAL EVALUATION

#### 3.1 The Licensee's Relief Request

##### Applicable Code and Addenda

The third 10-year ISI interval uses the ASME Code, Section XI, 2001 Edition with Addenda through 2003. All Appendix VIII ultrasonic piping examinations are performed in accordance with the Section XI, 2001 Edition without Addenda.

##### Applicable Code Requirement

The dissimilar metal welds fabricated from Alloys 82 and 182 fall under the requirements of ASME Code Case N-770-1, which requires ultrasonic examination of dissimilar metal welds. The austenitic safe-end to piping welds are covered under the licensee's risk-informed ISI program as Inspection Category R-A, Item R.120 (formerly Code Category B-F, B5.10 in the 2001 Edition through 2003 Addenda).

All inspections were conducted from the inner diameter of the welds. While the specified ultrasonic examinations are to be conducted per Appendix VIII Supplements 2 (wrought austenitic welds) and 10 (dissimilar metal welds), the 2001 Edition of ASME Code Section XI, Appendix VIII does not provide rules for examinations carried out from the inner diameter of the welds. ASME Code Cases N-695 and N-696 provide alternatives to Appendix VIII Supplements 10 and 2 that do allow for inner diameter examinations.

ASME Code Cases N-695 and N-696 include requirements for depth-sizing accuracy. Code Case N-695 3.3(c) states, in part, that "...are qualified for depth-sizing when the RMS error of the flaw depth measurements, as compared to the true flaw depths, do not exceed 0.125 in. (3 mm)", while Code Case N-696 3.3(d) states, in part, that "...qualified for depth-sizing when

the flaw depths estimated by ultrasonics, as compared with the true depths, do not exceed 0.125 in. (3 mm) RMS, when they are combined with a successful Supplement 10 qualification.”

### Components Descriptions

The components covered under relief request NDE-RCS-SE-1R18 include four dissimilar metal hot-leg welds, four dissimilar metal cold-leg welds, and eight austenitic welds. The inspections of the dissimilar metal welds are conducted according to ASME Code Case N-770-1, Inspection Item A-2, “Unmitigated butt weld at Hot Leg operating temperature (-2410)  $\leq 625^{\circ}\text{F}$  ( $329^{\circ}\text{C}$ ),” and Inspection Item B, “Unmitigated butt weld at Cold Leg operating temperature (-2410)  $\geq 525^{\circ}\text{F}$  ( $274^{\circ}\text{C}$ ) and  $< 580^{\circ}\text{F}$  ( $304^{\circ}\text{C}$ ).” The dissimilar metal welds are detailed in Table 1.

The austenitic welds are inspected in accordance with the licensee’s risk-informed ISI program. The license was authorized to use a risk-informed ISI plan for the third 10-year ISI interval in a safety evaluation dated January 16, 2013 (ADAMS Accession No. ML12353A130). These welds are categorized as Inspection Category RA Item Number R1.20, “Elements not Subject to a Damage Mechanism.” The austenitic welds are detailed in Table 2.

Table 1: Large Bore Dissimilar Metal Welds

<b>Weld Designation</b>	<b>N-770-1 Item</b>	<b>Weld Description</b>	<b>Inner Diameter</b>	<b>Nominal Wall Thickness</b>
WIB-RC-1-1(SE)	A-2	Loop 1 outlet nozzle to safe-end	29 in.	2.5 in.
WIB-RC-2-1(SE)	A-2	Loop 2 outlet nozzle to safe-end	29 in.	2.5 in.
WIB-RC-3-1(SE)	A-2	Loop 3 outlet nozzle to safe-end	29 in.	2.5 in.
WIB-RC-4-1(SE)	A-2	Loop 4 outlet nozzle to safe-end	29 in.	2.5 in.
WIB-RC-1-18(SE)	B	Loop 1 inlet safe-end to nozzle	27.5 in	2.38 in.
WIB-RC-2-20(SE)	B	Loop 2 inlet safe-end to nozzle	27.5 in	2.38 in.
WIB-RC-3-18(SE)	B	Loop 3 inlet safe-end to nozzle	27.5 in	2.38 in.
WIB-RC-4-18(SE)	B	Loop 4 inlet safe-end to nozzle	27.5 in	2.38 in.

Table 2: Large Bore Austenitic Welds

<b>Weld Designation</b>	<b>Weld Description</b>	<b>Inner Diameter</b>	<b>Nominal Wall Thickness</b>
WIB-RC-1-1	Loop 1 outlet safe-end to pipe	29 in.	2.5 in.
WIB-RC-1-18	Loop 1 inlet elbow to safe-end	27.5 in	2.38 in.
WIB-RC-2-1	Loop 2 outlet safe-end to pipe	29 in.	2.5 in.
WIB-RC-2-20	Loop 2 inlet elbow to safe-end	27.5 in	2.38 in.
WIB-RC-3-1	Loop 3 outlet safe-end to pipe	29 in.	2.5 in.
WIB-RC-3-18	Loop 3 inlet elbow to safe-end	27.5 in	2.38 in.
WIB-RC-4-1	Loop 4 outlet safe-end to pipe	29 in.	2.5 in.
WIB-RC-4-18	Loop 4 inlet elbow to safe-end	27.5 in	2.38 in.

### Impracticality of Compliance

To date, although examination vendors have qualified for detection and length-sizing in accordance with the Appendix VIII requirements for examinations from the ID, the vendors have not met the established RMS error of 0.125-in. for depth-sizing despite numerous attempts.

Consequently, relief from the Code Case specified 0.125-in. RMS error depth-sizing accuracy requirement is necessary to support evaluation of findings from examinations when conducted from the inside surface.

While the welds can be accessed from the outer diameter (OD), there is a significant radiological dose associated with OD inspections. The outside diameter of the reactor safe-end welds can only be accessed through removable covers in the refueling cavity floor that lead to an annulus that surrounds the reactor vessel. The annulus is a relatively confined area and does not allow unrestricted work access to the welds. Attempts to reduce dose levels by shielding are impractical due to the essentially omnidirectional source from the reactor and coolant piping.

It is estimated that conducting the examinations on the welds from the OD would result in 5.6 roentgen equivalent man (rem) total radiation exposure for automated OD examinations and 6.8 rem for manual OD examination of the 16 subject welds. These radiation doses exceed the very small incremental exposure increases associated with automated ID examinations, which have been estimated by the licensee to be 0.1 rem.

### Licensee's Proposed Alternative

The licensee proposes to use a vendor qualified for ID detection and length-sizing per Appendix VIII as applicable to the welds included in this request. The Appendix VIII examination process will also be used to examine the cast stainless steel side of the cold-leg elbow to safe-end welds in lieu of Appendix III and Supplement 1 requirements. All ID examinations will be augmented with inside surface profilometry and eddy current examination.

In its letter dated April 11, 2013, the licensee agreed to use the following two items as alternatives to the requirements of ASME Code Cases N-695 and N-696 and as regulatory commitments.

1. If a reportable flaw is detected and determined to be ID surface connected during examination of the welds that are included in Relief Request NDE-RCS-SE- R18, PG&E will provide a flaw evaluation including the measured flaw size as determined by [ultrasonic testing (UT)] for review by NRC. Eddy current testing will be used to determine if flaws are surface connected. Additional data including details of the surrounding ID surface contour in the region of the flaw and percentage of the exam area where UT probe lift-off is evident, if any, will be included.

2. In the event that any flaw(s) requiring depth sizing is detected during examination of the welds that are included in Relief Request NDE-RCS-SE-1R18, the following criteria shall be implemented:
  - ID connected flaws detected and measured as less than 50 percent through-wall in depth shall be adjusted by adding a correction factor to the flaw depth such that the adjusted flaw depth is equal to the measured flaw depth plus (contractor [RMS error] minus 0.125 in.), prior to comparison to the applicable acceptance criteria;
  - If ID connected flaw(s) are detected and measured as 50 percent through-wall depth or greater and to remain in service without mitigation or repair, PG&E shall submit flaw evaluation(s) for review and approval by NRC prior to reactor startup. The flaw evaluation shall include:
    - Information concerning the mechanism that caused the flaw
    - Information concerning the inside surface roughness/profile of the region surrounding the flaw
    - Information concerning areas where UT probe lift-off is observed

In its letter dated April 11, 2013, the licensee also stated, in part that:

All welds included in this request have been previously examined from the ID with an Appendix VIII qualified detection and length sizing process in the thirteenth refueling outage. The ultrasonic examinations were supplemented by surface profilometry and eddy current testing. Greater than 90 percent coverage of the required exam areas was achieved in all cases. This inspection history confirms that the inside surface profiles of the welds included in this request are suitable for ultrasonic examination from the ID in accordance with the referenced requirements as modified by the proposed alternative sizing requirements.

#### Duration of Relief

The duration of the proposed alternative is for the remainder of the DCP Unit 1 third 10-year ISI interval, nominally scheduled to end on May 6, 2015.

#### 3.2 NRC Staff Evaluation

As described above, the licensee has requested relief from the requirements of ASME Code Cases N-695 and N-696. These code cases require that procedures used to inspect welds from the ID be qualified by performance demonstration. The acceptance criterion established by the Code Cases is an RMS error of not greater than 0.125 inches.

The NRC staff concludes that this repeated inability to qualify ID UT inspection techniques in accordance with ASME Code Cases N-695 and N-696 constitutes an impracticality as described in 10 CFR 50.55a(g)(5)(iii). Use of an alternate approach, such as an OD examination, represents a burden to the licensee as an OD inspection would result in a minimum of a 5.6 rem radiation dose to the personnel performing the inspections.

To address the issue of increased potential for under-sizing of flaws by inspection procedures which do not meet the ASME Code Cases N-695 and N-696 acceptance criterion, the NRC staff, in July 2012, in conjunction with personnel from the Performance Demonstration Initiative, examined the proprietary data set compiled from all attempts to date to qualify inspection procedures to the acceptance criterion contained in ASME Code Cases N-695 and N-696. Based on this examination, the staff concluded that:

1. For flaws measured as less than or equal to 50 percent through-wall depth, the industry-proposed correction factor (Procedure RMSE - 0.125 inch) provided reasonable assurance that flaws would be adequately sized in Supplement 10 welds.
2. For flaw depths greater than 50 percent wall thickness, the variability of sizing errors was sufficiently great that no single mathematic flaw size adjustment formula was sufficient to provide reasonable assurance of appropriate flaw disposition. As a result, the NRC concluded it is necessary to evaluate these flaws on a case-by-case basis.

The licensee's proposed alternative described in NDE-RCS-SE-1R18 aligns with the NRC's conclusions on the effectiveness of sizing of flaws greater and less than 50 percent through-wall. Normally, the NRC requests the RMS error of the procedure to be used for the inspections as part of the relief request. The licensee has not yet chosen the inspection vendor and cannot provide this information at this time. The licensee's proposed alternative item 1 (i.e. sending the information from any ID-connected flaw to the NRC staff), addresses this issue to the NRC staff's satisfaction.

Based on the concerted efforts by the industry to meet the acceptance criteria contained in ASME Code Cases N-695 and N-696 and the difficulties associated with other inspection methods, the NRC staff concludes that meeting the 0.125-inch acceptance criterion in ASME Code Case N-695 and N-696 is impractical and continued attempts to meet the criteria represents a burden to the licensee. Additionally, the staff concludes that the proposed alternative depth-sizing and flaw evaluation criteria provide reasonable assurance of structural integrity and leak tightness of the subject components and, therefore, reasonable assurance that the subject components "will not endanger life or property."

#### 4.0 CONCLUSION

As set forth above, the NRC staff determines that 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. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(5)(iii). Therefore, the NRC staff grants relief request



NDE-RCS-SE-1R18 for DCP, Unit 1, until the end of its third 10-year ISI interval scheduled to end on May 6, 2015.

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: Stephen Cumblidge

Date: January 3, 2014

E. Halpin

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If you have any questions, please contact the Project Manager, Brian Benney, at 301-415-2767 or via e-mail at [Brian.Benney@nrc.gov](mailto:Brian.Benney@nrc.gov).

Sincerely,

**/RA/ Kaly Kalyanam for**

Douglas A. Broaddus, Chief  
Plant Licensing IV-2 and Decommissioning  
Transition Branch  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-275

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Safety Evaluation

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