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PG&E Letter DCL-16-115

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

10 CFR 50.55a

Docket No. 50-275, OL-DPR-80
Diablo Canyon Power Plant (DCPP) Unit 1
Supplement: ASME Section XI Inservice Inspection Program Relief Request NDE-RCS-SE-1R20 to Allow Use of Alternative Depth Sizing Criteria

References:
1. PG&E Letter DCL-16-102, "ASME Section XI Inservice Inspection Program Relief Request NDE-RCS-SE-1R20 to Allow Use of Alternative Depth Sizing Criteria," dated October 10, 2016
2. PG&E Letter DCL-13-038, "ASME Section XI Inservice Inspection Program Relief Request NDE-RCS-SE-1R18 to Allow Use of Alternative Depth Sizing Criteria," dated April 11, 2013 (ADAMS Accession No. ML13102A048)
3. NRC Letter from D.A. Broaddus to E.D. Halpin, PG&E, "Diablo Canyon Power Plant, Unit 1 – Relief Request No. NDE-RCS-SE-1R18 to Allow Use of Alternative Depth-Sizing Criteria (TAC No. MF1427)," dated January 3, 2014 (ADAMS Accession No. ML13350A151)

Dear Commissioners and Staff:

In Reference 1, Pacific Gas and Electric Company (PG&E) submitted a relief request (RR) to allow use of alternative depth sizing criteria. The Enclosure in Reference 1 was based on a previous submittal (Reference 2) that had been approved by the NRC in Reference 3.

Subsequent to the original approved relief, the Code of Record for Diablo Canyon Power Plant (DCPP) was changed to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, 2007 Edition with Addenda through 2008. The Code Cases that were the basis of the RR in Reference 1 were incorporated into the Code of Record for DCPP. Accordingly, this letter revises the RR submitted in Reference 1 such that it is based on the Code rather than the Code Cases.

This submittal supplements Reference 1. The Enclosure to this submittal replaces the Enclosure from Reference 1 in its entirety.

The commitments (as defined in NEI 99-04) made in this submittal, which are restated in Attachment 1 of the Enclosure, are the same as were included in Reference 1.

If you have any questions regarding this RR or other inservice inspection program activities please contact Mr. Hossein Hamzehee at (805) 545-4720.

Sincerely,

James M. Welsch
Vice President, Nuclear Generation

rntt/4231/SAPN 50652488-11
Enclosure
cc: Diablo Distribution
cc/encl: Kriss M. Kennedy, NRC Region IV Administrator
Christopher W. Newport, NRC Senior Resident Inspector
Balwant K. Singal, NRC Senior Project Manager
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10 CFR 50.55a Relief Request NDE-RCS-SE-1R20

Alternative Request
in Accordance with 10 CFR 50.55a(g)(5)(iv)

--Examination Required by Code is Impractical--

1. ASME Code Components Affected

The American Society of Mechanical Engineers (ASME) Section XI Class 1 Diablo Canyon Power Plant (DCPP) Unit 1 reactor vessel nozzle to safe-end and safe-end to piping welds are listed below. See Figure 1 for safe-end general configuration and materials.

Code Cat./ Item No. *	Description	Weld Number *	Line Size/ Nominal Wall
N-770-1 / A-2	Loop 1 outlet nozzle to safe-end	WIB-RC-1-1(SE)	29 in./2.5 in.
R-A / R1.20	Loop 1 outlet safe-end to pipe	WIB-RC-1-1	29 in./2.5 in.
R-A / R1.20	Loop 1 inlet elbow to safe-end	WIB-RC-1-18	27.5 in/2.38 in.
N-770-1 / B	Loop 1 inlet safe-end to nozzle	WIB-RC-1-18(SE)	27.5 in/2.38 in.
N-770-1 / A-2	Loop 2 outlet nozzle to safe-end	WIB-RC-2-1(SE)	29 in./2.5 in.
R-A / R1.20	Loop 2 outlet safe-end to pipe	WIB-RC-2-1	29 in./2.5 in.
R-A / R1.20	Loop 2 inlet elbow to safe-end	WIB-RC-2-20	27.5 in./2.38 in.
N-770-1 / B	Loop 2 inlet safe-end to nozzle	WIB-RC-2-20(SE)	27.5 in./2.38 in.
N-770-1 / A-2	Loop 3 outlet nozzle to safe-end	WIB-RC-3-1(SE)	29 in./2.5 in.
R-A / R1.20	Loop 3 outlet safe-end to pipe	WIB-RC-3-1	29 in./2.5 in.
R-A / R1.20	Loop 3 inlet elbow to safe-end	WIB-RC-3-18	27.5 in./2.38 in.
N-770-1 / B	Loop 3 inlet safe-end to nozzle	WIB-RC-3-18(SE)	27.5 in./2.38 in.
N-770-1 / A-2	Loop 4 outlet nozzle to safe-end	WIB-RC-4-1(SE)	29 in./2.5 in.
R-A / R1.20	Loop 4 outlet safe-end to pipe	WIB-RC-4-1	29 in./2.5 in.
R-A / R1.20	Loop 4 inlet elbow to safe-end	WIB-RC-4-18	27.5 in./2.38 in.
N-770-1 / B	Loop 4 inlet safe-end to nozzle	WIB-RC-4-18(SE)	27.5 in./2.38 in.

*Safe-end welds with SE suffix are dissimilar metal welds fabricated with Alloy 82/182 weld material and are examined in accordance with ASME Code Case N-770-1.

2. Applicable Code Edition and Addenda

The DCPP fourth interval Inservice Interval Program Plan (ISIPP) is based on the ASME Boiler and Pressure Vessel Code, Section XI, 2007 Edition with Addenda through 2008.

The ISIPP is augmented with the requirements of ASME Code Case N-770-1 as modified by 10 CFR 50.55a for the examination of dissimilar metal vessel nozzle butt welds containing Alloy 82/182 material. These requirements apply to the dissimilar metal welds connecting the reactor nozzles to the reactor coolant system (RCS) piping.

The DCPP Unit 1 fourth inspection interval commenced on May 7, 2015, and is nominally scheduled to end on November 2, 2024 (expiration of DCPP Unit 1 operating license).

3. Applicable Code Requirement

ASME Code Case N-770-1 stipulates ultrasonic examination of dissimilar metal welds fabricated from Alloy 82/182 material. These requirements apply to the DCPP reactor nozzle to safe-end welds.

DCPP Risk-Informed ISIPP Examination Category R-A, Item R1.20 (formerly Code Category B-F, B5.10 in the 2007 Edition through 2008 Addenda) specifies volumetric examination for the associated RCS safe-end to piping welds that are fabricated with 308 stainless steel weld material.

All of the specified ultrasonic examinations are to be conducted per Section XI, Appendix VIII Supplements 2 (wrought austenitic welds), 10 (dissimilar metal welds), and 14 (coordinated implementation of Supplements 10, 2, and 3 for piping examinations conducted from the inside surface) with the exception of the cast side of the cold leg elbow to safe-end welds. The cast elbow sides of these welds are to be examined per Section XI, Appendix III as modified by Appendix III, Supplement 1.

With regard to depth sizing accuracy, Appendix VIII, Supplement 14 states, "Supplement 2 or Supplement 3 examination procedures, equipment, and personnel are 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."

4. Impracticality

Relief is requested from the 0.125 in. root mean square error (RMSE) depth sizing accuracy requirement of Appendix VIII, Supplement 14.

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

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

Additionally, relief is requested from implementing the requirements of ASME Appendix III as modified by Appendix III, Supplement 1 for the examination of the cast stainless steel side of the cold leg elbow to safe-end welds. Specific examination requirements for cast stainless steel materials are not yet addressed in Section XI. Examinations using the Appendix III, Supplement 1 process rather than the Appendix VIII Supplement 2 requirements used on the wrought side of the weld would result in additional burden without benefit. The Appendix III examinations would require separate procedures, calibration blocks, calibrations, and possibly completely separate examinations.

4.1 Additional Information

PG&E submitted additional information in response to a request for additional information received from NRC regarding the previous relief request on the same topic (References 8.3). For completeness, the same additional information is presented below.

Access and General Considerations

The outside diameter (OD) of the DCPP Unit 1 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.

OD examination of the reactor nozzle to safe-end welds and safe-end to RCS piping welds are addressed separately below.

Reactor Nozzle to Safe-End Welds

Automated Examination

The eight nozzle to safe-end dissimilar metal welds are accessible for OD examination. An ASME Section XI, Appendix VIII, Supplement 10 qualified

vendor has estimated that automated OD examination of the nozzle to safe-end welds would require 6 man-hours of duration for each of the eight welds, in the annulus area. The 6-hour duration includes various inspection-related activities, including installation and removal of scanner tracks, search unit tending and change out, and calibrations.

Review of previous reactor annulus work activities indicates that the average dose accrual rate to be approximately 0.050 rem per hour. Based on the 6 man-hour annulus time per weld estimate, the accumulated dose for automated examinations of the eight welds would be 2.4 rem.

When the related support activities such as access cover removal/restoration, insulation removal/restoration, radiation protection support, etc., are included, the total dose estimate for automated examination of reactor nozzle to safe-end welds is 3.45 rem.

Manual Examination

Qualified manual examination of the reactor nozzle to safe-end dissimilar welds from the OD is possible; the dose estimate based on historical data exceeds 4.25 rem for examination and related support activities for these eight welds.

Safe-End to RCS Piping Welds

Automated Examination

The four hot leg safe-end to RCS pipe welds are accessible from the OD for examination. PG&E estimates that automated examination of these four welds would accrue dose at a rate similar to the nozzle to safe-end welds for a total dose of 1.2 rem.

The four cold leg safe-end to RCS pipe welds join to cast elbows; the OD configuration of the welds and elbows are not suitable for OD examination. Furthermore, no ASME XI, Appendix VIII ultrasonic examination techniques have been qualified for OD detection or sizing through cast austenitic material. Examination of these welds would therefore be limited to the axial direction from the safe-end side only. PG&E estimates that accumulated dose for OD automated examination of these four welds would be 0.8 rem since examination is limited to a single side.

When including the related support activities such as insulation removal/restoration, radiation protection support, etc., the total dose estimate for automated examination of safe-end to RCS piping welds is 2.15 rem.

Manual Examination

Qualified manual examination of the hot leg safe-end and one side of the cold leg safe-end welds from the OD is possible, although cold leg examinations are limited for the same reasons as automated examinations. PG&E estimates a total exposure of 2.55 rem for manual OD examination of these eight safe-end to RCS piping welds.

Generic Examination-Related Issues

Safe-end OD examinations result in added risk to plant equipment. The small diameter annulus personnel access portals also house the ex-core nuclear instrumentation cabling which is vulnerable to damage from contact with personnel or equipment. The multiple entries and exits with tracks, scanners, and related equipment pose an incremental damage threat to safety-related equipment that is likely to be required to be inservice during examinations.

Conclusion

The estimates of 5.6 rem total exposure associated with automated OD examinations and the 6.8 rem for manual OD examination of the 16 subject welds far exceed the very small incremental exposure increase associated with automated ID examinations (estimated by PG&E to be 0.1 rem) when included with other reactor vessel examinations, or approximately 0.2 rem when performed with a single-purpose RCS weld ID inspection robot.

Limited examination coverage of the safe-end to cast elbow welds and increased risk to plant equipment are also significant considerations, in addition to the "as low as is reasonably achievable" (ALARA) dose concerns described above.

5. Proposed Alternative and Basis for Use

PG&E proposes to use a vendor qualified for ID detection and length sizing per Appendix VIII as applicable to the welds included in this request. Indications requiring depth sizing will be treated as detailed in the following paragraphs. Since PG&E is in the vendor selection process at the time of this submittal, references to vendor depth sizing RMSE values are generic.

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.

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-1R20, PG&E will provide a flaw evaluation including the measured flaw size as determined by ultrasonic testing (UT) for review by the 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 examination area where UT probe lift-off is evident, if any, will be included.

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-1R20, the following criteria will be implemented:

- ID connected flaws detected and measured as less than 50 percent through-wall in depth will 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 RMSE 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 are to remain in service without mitigation or repair, PG&E will submit flaw evaluation(s) for review and approval by the NRC prior to reactor startup. The flaw evaluation will include:

    - information concerning the mechanism that caused the flaw,
    - information concerning the inside surface roughness/profile of the region surrounding the flaw, and
    - information concerning areas where UT probe lift-off is observed.

All welds included in this request have been previously examined from the ID with an Appendix VIII qualified detection process and length sizing in the previous refueling outages. The ultrasonic examinations were supplemented by surface profilometry and eddy current testing. Greater than 90 percent coverage of the required examination 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.

In the event the proposed alternate examination process grossly mischaracterizes a significant planar flaw, the potential resulting failure of one of the RCS loop outlet/inlet welds could result in a loss-of-coolant accident (LOCA). Depending on the size of the postulated break, the specific consequences will vary. At the smallest end of the break size spectrum, the charging system would be capable of maintaining RCS pressure through normal makeup. Larger break sizes would result in depressurization of the RCS, reactor trip and a safety injection. The worst-case consequence would occur if one of the nozzle to pipe

welds were to suffer 360-degree circumferential cracking. In this case, the break size is bounded by the line ID which is less than the break size used in the large break LOCA design basis analysis.

NRC review of vendor performance demonstration initiative qualification test results concluded that for flaw depths less than 50 percent wall thickness, reasonable assurance that a flaw will be appropriately depth sized may be obtained by adding a correction factor to the flaw depth such that the adjusted flaw depth is equal to the measured flaw depth plus (contractor RMSE minus 0.125 in.). Therefore, the proposed alternative for correcting measured flaw depths for flaws less than 50 percent wall thickness and performing and submitting a flaw specific analysis for flaws equal to or greater than 50 percent wall thickness will have little effect on the likelihood of gross flaw mischaracterization and any potential for resulting component failure.

For the cast stainless steel side of cold leg elbow to safe-end welds, the proposed Appendix VIII ID examination supplemented with surface profilometry and eddy current is better suited for detection of ID connected flaws than the code-specified Appendix III, Supplement 1 process.

The DCPP Unit 1 reactor coolant nozzle to safe-end and safe-end to piping welds will be examined from the ID using personnel, procedures, and equipment qualified by demonstration in all aspects except depth sizing. The proposed method of addressing depth sizing RMSE values will compensate for the potential through-wall sizing variation and provides reasonable assurance of structural integrity in accordance with 10 CFR 50.55a(g)(5)(iv).

6. Duration of Proposed Alternative

The duration of the proposed alternative is for the remainder of the DCPP Unit 1 fourth ISI interval, nominally scheduled to end on November 2, 2024 (expiration of DCPP Unit 1 operating license).

7. Precedents

The proposed alternative method of addressing the difference between the demonstrated and required RMSE values was approved for the DCPP Unit 1 third inspection interval by NRC Letter from D.A. Broaddus to E.D. Halpin, PG&E, "Diablo Canyon Power Plant, Unit 1 – Relief Request No. NDE-RCS-SE-1R18 to Allow Use of Alternative Depth-Sizing Criteria (TAC No. MF1427)," dated January 3, 2014 (ADAMS Accession No. ML13350A151).

The proposed alternative method of addressing the difference between the demonstrated and required RMSE values was approved for McGuire Nuclear Station Unit 2 by NRC Letter from R.J. Pascarelli to S.D. Capps, McGuire

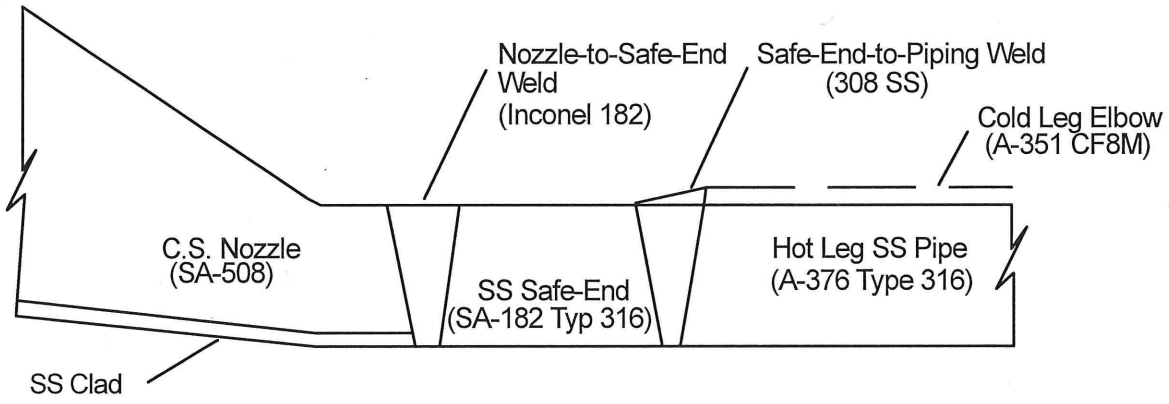
Nuclear Station, "McGuire Nuclear Station, Unit 2, Proposed Relief Request 12-MN-003 (TAC No. ME8712)," dated September 24, 2012 (ADAMS Accession No. ML12258A363).

8. References

8.1 PG&E Letter DCL-13-038, "ASME Section XI Inservice Inspection Program Relief Request NDE-RCS-SE-1R18 to Allow Use of Alternative Depth Sizing Criteria," dated April 11, 2013 (ADAMS Accession No. ML13102A048)

8.2 E-mail from NRC Project Manager J. Rankin, "Request for Additional Information - Relief Request NDE-RCS-SE-1R18 to Allow Use of Alternative Depth Sizing Criteria," dated July 9, 2013 (ADAMS Accession No. ML13191A083)

8.3 PG&E Letter DCL-13-078, "Response to NRC Request for Additional Information Regarding Request for Relief NDE-RCS-SE-1R18 to Allow Use of Alternative Depth Sizing Criteria," dated August 6, 2013 (ADAMS Accession No. ML13219A011)



DCPP Unit 1 Sketch of Hot Leg and Cold Leg Safe-End General Configuration

Figure 1

List of Regulatory Commitments

Commitment 1

If a reportable flaw is detected and determined to be inside diameter (ID) surface connected during examination of the welds that are included in Relief Request NDE-RCS-SE-1R20, PG&E will provide a flaw evaluation including the measured flaw size as determined by ultrasonic testing (UT) for review by the 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.

Commitment 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-1R20, the following criteria will be implemented:

- Inside diameter (ID) connected flaws detected and measured as less than 50 percent through-wall in depth will 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 root means square 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 are to remain in service without mitigation or repair, PG&E will submit flaw evaluation(s) for review and approval by the NRC prior to reactor startup. The flaw evaluation will include:

    - information concerning the mechanism that caused the flaw,
    - information concerning the inside surface roughness/profile of the region surrounding the flaw, and
    - information concerning areas where ultrasonic testing probe lift-off is observed.