Pacific Gas and Electric Company®

Diablo Canyon Power Plant
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December 4, 2008

PG&E Letter DCL-08-103

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

Docket No. 50-275, OL-DPR-80
Diablo Canyon Unit 1
ASME Section XI Inservice Inspection Program Relief Request NDE-Leak Path for the Unit 1, Fifteenth Refueling Outage, Third Ten-Year Inservice Inspection Interval to Allow Use of the Rules of the NRC First Revised Order, EA-03-009 for Performance of Volumetric Leak Path Assessment of Reactor Head Penetration Nozzles

Dear Commissioners and Staff:

Pursuant to 10 CFR 50.55a(a)(3)(ii), Pacific Gas and Electric Company (PG&E) hereby requests NRC approval for Inservice Inspection (ISI) Relief Request NDE-Leak Path.

This request for relief proposes an alternative to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, Code Case N-729-1 as conditioned by 10 CFR 50.55a(g)(6)(ii)(D)(3) for "demonstrated volumetric or surface leak path assessment through all J-groove welds." The proposed alternative is the continued use of the volumetric leak path assessment process used to satisfy the requirements of the First Revised NRC Order EA-03-009. The duration of the proposed alternative applies only to the reactor head penetration nozzle examinations to be performed in the Diablo Canyon Unit 1 Fifteenth Refueling Outage (1R15), scheduled to begin January 26, 2009. The Unit 1 reactor head is scheduled to be replaced in the sixteenth refueling outage.

Enclosed is Relief Request NDE-Leak Path, including the basis for the proposed alternative.

To support the implementation of the proposed changes in 1R15, PG&E requests approval of Relief Request NDE-Leak Path by January 26, 2009. Approval of this relief request will allow DCPP to continue to utilize the existing First Revised NRC Order EA-03-009 requirements to govern volumetric leak path assessment during 1R15.

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PG&E makes no regulatory commitments (as defined by NEI 99-04) in this letter.

If you have any questions or require additional information, please contact Stan Ketelsen at (805) 545-4720.

Sincerely,

James R. Becker
Site Vice President

tcg/50042807
Enclosures
cc: Diablo Distribution
cc/enc: Elmo E. Collins, Regional Administrator, NRC Region IV
Michael S. Peck, NRC Senior Resident Inspector
Alan B. Wang, Project Manager, Office of Nuclear Reactor Regulation
State of California, Pressure Vessel Unit

Enclosure
PG&E Letter DCL-08-103

Request for Relief NDE-Leak Path for Inservice Inspection of Reactor Head Penetration Nozzles at the Diablo Canyon Power Plant Unit 1, Fifteenth Refueling Outage

Code of Federal Regulation 10 Part 50.55a Relief Request NDE-Leak Path

Proposed Alternative
in Accordance with 10 CFR 50.55a(a)(3)(ii)

--Hardship or Unusual Difficulty without a Compensating Increase in Level of Safety or Quality--

1. ASME Code Component(s) Affected

Diablo Canyon Power Plant (DCPP) Unit 1 reactor vessel closure head four-inch diameter control rod drive mechanism (CRDM) penetrations, instrument nozzle penetrations and their corresponding J-weld connections to the head. The four-inch penetrations are numbered one through seventy-nine.

This request for relief does not include the three-quarter-inch diameter reactor head vent line penetration.

2. Applicable Code Edition and Addenda

American Society of Mechanical Engineering (ASME) Boiler and Pressure Vessel Code, Section XI, 2001 Edition through 2003 Addenda as augmented by Code Case N-729-1 with conditions for use stated in 10 CFR 50.55a(g)(6)(ii)(D)(3).

3. Applicable Code Requirement

An alternative is requested to the requirement for "demonstrated volumetric or surface leak path assessment through all J-groove welds" as applied to reactor vessel closure head nozzle examinations performed in accordance with ASME Code Case N-729-1 as conditioned by 10 CFR 50.55a(g)(6)(ii)(D)(3).

Code of Federal Regulation 10 Part 50.55a(g)(6)(ii)(D)(3) states in part, "Instead of the specified 'examination method' requirements for volumetric and surface examinations in Note 6 of Table 1 of Code Case N–729–1, the licensee shall perform volumetric and/or surface examination of essentially 100 percent of the required volume or equivalent surfaces of the nozzle tube, as identified by Figure 2 of ASME Code Case N–729–1. A demonstrated volumetric or surface leak path assessment through all J-groove welds shall be performed."

4. Reason for Request

The requirement to execute a "demonstrated volumetric or surface leak path assessment through all J-groove welds" during the DCPP Unit 1 fifteenth refueling outage (1R15) scheduled for January 2009 poses a hardship due to the expedited implementation requirement for demonstrated volumetric leak path assessment and personnel exposure associated with alternative surface examinations. PG&E requests approval to use the proposed alternative described below in accordance with the provisions of 10 CFR 50.55a(a)(3)(ii).

Although the industry has initiated efforts to accomplish a volumetric leak path demonstration, the extent of remaining tasks will likely preclude successful completion in time to support the 1R15 January outage start date. Fabrication of mockups to represent the various postulated nozzle conditions, demonstration protocol development, testing, documentation, blind demonstrations and evaluation of results are examples of outstanding activities that are expected to be necessary to complete the demonstration. Inspection vendor resources are currently challenged by the Fall 2008 outage campaign and preparations for the Spring 2009 outages.

The optional surface examination of the J-welds is a hardship due to the greatly increased personnel radiation exposure associated with this examination technique. The supplementary scans and additional robotic tool reconfigurations required to accomplish surface examinations result in a significant extension to the examination duration and concomitant increase in the total dose received.

More importantly, the complicated geometry of the J-weld surface, particularly on penetrations other than those very close to the reactor head center, poses an extremely difficult challenge for remote inspection. Furthermore, the guide funnels attached to the outside diameter (OD) of the nozzles obstruct access to the J-weld surface on the five instrument penetrations. It is known that the requisite surface examination coverage for all DCPP Unit 1 J-welds can not be obtained using current robotic inspection technology.

Incomplete remote inspections would need to be supplemented with under head entries to manually perform surface examinations to obtain complete coverage.

Dose rates adjacent to the reactor head where the tool reconfiguration and maintenance is performed are approximately 500mR/hour while dose rates under the head near the J-weld areas are expected to be in the 2 to 4 Rem/hour range based on previous survey data. In addition, high contamination levels in excess of one Rad/hour have been documented on under head surfaces.

The hazardous radiological conditions coupled with difficult access and challenging working environment result in excessive (undue) personnel exposure and potential contamination to accomplish surface examination of the J-welds.

5. Proposed Alternative and Basis for Use

In lieu of implementing the "demonstrated volumetric or surface leak path assessment through all J-groove welds" as required by ASME Code Case N–729–1 as conditioned by 10 CFR 50.55a(g)(6)(ii)(D)(3), PG&E proposes that a volumetric leak path assessment be performed in 1R15 that meets the requirements of the First Revised NRC Order EA-03-009, IV.C.(5)(b)(i). The proposed volumetric leak path examination area will extend to a minimum of 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) on each of the four-inch penetrations.

The combination of volumetric leak path assessment and bare metal visual examination of the reactor closure head outside surface provides a comprehensive approach for detection of leakage past the J-weld.

Background

The Westinghouse designed Diablo Canyon Unit 1 reactor vessel closure head was fabricated by Combustion Engineering. The reactor head contains seventy-nine, four-inch outside diameter CRDM and instrument nozzle penetrations and a single three-quarter-inch diameter vent line penetration. The seventy-nine, four-inch diameter nozzles are installed with a maximum specified diametrical interference fit of three mils.

The Diablo Canyon Unit 1 reactor vessel closure head is scheduled to be replaced in the sixteenth refueling outage.

Basis

The Code Case N-729-1 bare metal visual examination combined with a volumetric leak path assessment in accordance with Order EA-03-009, IV.C.(5)(b)(i) provides assurance that reactor closure head penetration nozzle leakage will be detected.

The efficacy of the bare metal visual examination is addressed in MRP 117 "Materials Reliability Program Inspection Plan for Reactor Vessel Closure Head Penetrations in U.S. PWR Plants" section 3.4, "Protection Against Significant Boric Acid Wastage of the Low Alloy Steel Head," which states in part: "Section 7 of the top-level safety assessment report (MRP-110 [5]) describes the evaluations that verify that protection against boric acid wastage is provided by the bare metal visual examinations for evidence of leakage required by Sections 5 and 6 of this document. This conclusion is supported by the experience with over 50 leaking CRDM nozzles, including the observation that the large wastage cavity at one plant would have been detected relatively early in the wastage progression had bare metal visual examinations been performed at each refueling outage, and likely even if performed less frequently, with appropriate corrective action. In addition, the wastage modeling presented in MRP-110 supports the adequacy of bare metal visual examination performed according to the sensitivity and coverage requirements of Section 5.1 and at the frequency defined in Section 6." PG&E will perform a bare metal visual examination in 1R15. Previous Unit 1 bare metal visual examination results are available for comparison and demonstrate that essentially 100 percent inspection coverage of the penetration to top of interface can be achieved on all of the seventy-nine four-inch nozzles.

The volumetric (ultrasonic) leak path assessment technology used on the four-inch nozzles at DCPP to satisfy the First Revised NRC Order EA-03-009 requirements employs a zero degree incidence longitudinal wave introduced from the tube inside diameter (ID). The response from the tube OD in the interference fit region is monitored for changes in amplitude due to variations in reflected versus transmitted energy. Because the tube OD is in intimate contact with the reactor head base material as a result of the interference fit, a portion of the ultrasonic energy is transmitted through this interface. In the case that leakage into the annulus area between the tube and head base material results in steam cutting, the intimate contact is disturbed in a localized area. This condition is detected by distinguishing variation in tube OD response signal amplitude in the reduced intimate contact area as compared to the surrounding areas. Redundantly, leakage resulting in steam cutting would also be detectable by a bare metal visual examination since flow to the atmosphere is inherent.

PG&E's inspection vendor, WesDyne International, manufactured a mockup for leak path technique development that simulates the steam cutting condition. The mockup consists of a sleeve with machined ID grooves and holes that is installed over a section of penetration tube with a two mil interference fit. Test results demonstrate that the machined areas in the sleeve are readily detectable using the zero degree amplitude discrimination methodology described above when imaged by the analysis software. Filling the machined loss of fit areas with water resulted in no affect on detectability. Further details of the mockup configuration and test results are included in reference 8.4.

PG&E has previously completed two volumetric leak path examinations in accordance with the NRC Order on all of the seventy-nine four-inch penetration nozzles. The digitally recorded examination results from those examinations provide an excellent baseline for comparison with the1R15 findings. Moreover, current appraisals indicate that the existing technology used to perform the volumetric leak path assessment in accordance with the First Revised NRC Order EA-03-009 will not need to be significantly altered to meet the new demonstration obligation.

The three-quarter-inch diameter vent line penetration is inspected using eddy current to examine the J-weld and remaining wetted surfaces within the specified examination area. The eddy current surface examination is supplemented by low frequency eddy current designed to detect wastage of the reactor head surrounding the penetration. The vent line examination meets the Code Case N-729-1 requirements, as conditioned by 10 CFR 50.55a(g)(6)(ii)(D)(3), for leak path assessment.

Conclusion

The proposed alternative examination, volumetric leak path assessment performed in accordance with the First Revised NRC Order EA-03-009, when combined with a bare metal visual examination provides confidence that leakage past the J-weld into the annulus region would be detected. These techniques provide a defense-in-depth leak path assessment approach that assures the structural integrity of the reactor head remains intact.

Consequently, performing a "demonstrated volumetric or surface leak path assessment through all J-groove welds" as required by ASME Code Case N–729–1 as conditioned by 10 CFR 50.55a(g)(6)(ii)(D)(3), would result in hardship as the default surface examination will result in undue personnel radiation exposure without providing a compensating increase in the level of quality and safety.

6. Duration of Proposed Alternative

The duration of the proposed alternative applies only to the reactor head penetration nozzle examinations scheduled to be performed in 1R15 in accordance with Code Case N-729-1 as conditioned by 10 CFR 50.55a(g)(6)(ii)(D)(3). The Unit 1 reactor head is scheduled to be replaced in the sixteenth refueling outage.

Diablo Canyon Unit 1 is in the Third Ten-Year Inservice Inspection Interval.

7. Precedent

Leak path assessment is addressed by the First Revised NRC Order EA-03-009, IV.C.(5)(b)(i), which states "In addition an assessment shall be made to determine if leakage has occurred into the annulus between the RPV head penetration nozzle and the RPV head low-alloy steel."

8. References

8.1 First Revised NRC Order EA-03-009 (ADAMS Accession Number ML040220181).

8.2 "Materials Reliability Program Reactor Vessel Closure Head Penetration Safety Assessment for U.S. Pressurized Water Reactor (PWR) Plants (MRP-110)."

8.3 "Materials Reliability Program Inspection Plan for Reactor Vessel Closure Head Penetrations in U.S. PWR Plants" Section 3.4, "Protection Against Significant Boric Acid Wastage of the Low Alloy Steel Head (MRP-117)."

8.4 WDI-TJ-006-03-P, Revision 3 "Ultrasonic Testing of Interference Fit Samples for Leak Path Detection" (ADAMS Accession Number ML040490495).