

April 04, 2006

Mr. John S. Keenan
Senior Vice President and Chief Nuclear Officer
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Diablo Canyon Power Plant
P.O. Box 770000
San Francisco, CA 94177-0001

SUBJECT: DIABLO CANYON POWER PLANT, UNIT 2 - RELIEF REQUEST FOR
SECOND INSERVICE INSPECTION (ISI) INTERVAL FOR STEAM
GENERATOR WELDS (TAC NO. MC9473)

Dear Mr. Keenan:

By letter dated December 30, 2005, Pacific Gas and Electric Company (the licensee) requested relief from certain American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, inspection requirements for the steam generators' welds at the Diablo Canyon Power Plant (DCPP), Unit 2. The licensee submitted the Relief Request NDE-SGW, requesting relief from the inspection requirements of the ASME Boiler and Pressure Vessel Code pursuant to 10 CFR 50.55a(a)(3)(ii). The steam generators are scheduled for replacement in February 2008.

Rather than authorizing this alternative pursuant to 10 CFR 50.55a(a)(3)(ii) as the licensee had requested, the Nuclear Regulatory Commission (NRC) staff is authorizing this alternative pursuant to 10 CFR 50.55a(a)(3)(i). The NRC staff has concluded that the previous inspections and the alternative proposed by the licensee to perform visual examinations for leakage during the DCPP, Unit 2, 13th refueling outage provide reasonable assurance of structural integrity for the short remaining service life of the steam generators. Therefore, the staff has determined that the proposed alternative would provide an acceptable level of quality and safety and is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the remainder of the second 10-year ISI interval.

All work under TAC No. MC9473 is complete.

Sincerely,

/RA/

David Terao, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-323

Enclosure: Safety Evaluation

cc w/encl: See next page

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Enclosure: Safety Evaluation

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST NDE-SGW

PACIFIC GAS AND ELECTRIC COMPANY

DIABLO CANYON POWER PLANT, UNIT 2

DOCKET NO. 50-323

1.0 INTRODUCTION

By letter dated December 30, 2005, Pacific Gas and Electric Company (PG&E/the licensee) submitted a request for relief NDE-SGW from the volumetric examination requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI, associated with the Diablo Canyon Power Plant (DCPP), Unit 2, steam generators (SGs). As the SGs are scheduled to be replaced during the fourteenth refueling outage (RFO 2R14) in February 2008, the remaining service life is short and the licensee has proposed an alternative testing method until the SGs are replaced. Should the SG replacement be deferred beyond the scheduled RFO 2R14 replacement date, the licensee will perform all of these required examinations on the existing SGs during RFO 2R14, the first outage of the third inspection interval.

2.0 REGULATORY EVALUATION

The inservice inspection (ISI) of the ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable addenda as required by Title 10, *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(g), except where specific written relief has been granted by the U.S. Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 50.55a(g)(6)(i). As stated in 10 CFR 50.55a(a)(3), alternatives to the requirements of Paragraph (g) may be used, when authorized by the NRC, if (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) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for ISI 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 applicable edition of the ASME Code, Section XI, for the second 10-year ISI interval of DCP, is the 1989 Edition with no Addenda.

3.0 TECHNICAL EVALUATION

3.1 Code Requirements for which Relief is Requested

ASME Code, Section XI, 1989 Edition, Table IWB-2500-1, Category B-B, Item B2.40; Table IWC-2500-1, Category C-A, Items C1.10, C1.20, and C1.30; Category C-B, Items C2.21 and C2.22, require volumetric examination for the Class 1 channel head-to-tubesheet weld, and Class 2 tubesheet-to-stub barrel, transition cone-to-upper shell, and upper shell-to-upper head welds. Volumetric and surface examination is required for the main steam outlet nozzle weld. Volumetric examination is also required for the nozzle inside radius section. Essentially, 100 percent of the length of each weld is required to be examined on one steam generator each inspection interval.

3.2 Licensee's Proposed Alternative

The licensee proposes that a visual examination (VT-2) of the secondary side of the DCP, Unit 2, SG will be performed by VT-2 qualified examiners at the end of RFO 2R13. This examination will be, in addition, to the ASME Code-required VT-2 examination of the secondary side of the SG for interval two, period three, which was performed during RFO 2R12 in 2004. This additional examination for leakage, together with the ASME Code-required VT-2 examination of the primary side of the SG will provide added assurance of the integrity of the SG's primary and secondary side pressure boundary.

3.3 Licensee's Basis for Relief

Pursuant to 10 CFR 50.55a(a)(3)(ii), the licensee stated that performing the ASME Code weld examinations instead of the alternative method requested would subject plant personnel to significant radiation exposures without a compensating increase in the level of quality and safety. The SG shell welds are located in a significant radiation field (20-30 millirem/hour general area dose rate as documented in previous examination reports) that would adversely affect inspection and support personnel during scaffold assembly, removal and handling of the large insulation sections involved, conduct of the examinations, insulation replacement, and scaffold removal (conservatively estimated to take greater than 100 man hours). The licensee indicated that the radiation exposure to personnel is not justified considering that the SGs will be replaced during the next refueling outage.

The licensee stated that during the first DCP, Unit 2, inspection interval, the entire Class 1 channel head-to-tubesheet weld on all four Unit 2 SGs was examined. Additionally, during the first and second periods of the current second inspection interval, two-thirds of one SG's channel head-to-tubesheet weld (areas 0-120 degrees and 240-0 degrees) was reexamined. All Class 1 weld examinations performed to date have yielded acceptable results. All required Class 2 welds including the tubesheet-to-

stub barrel, transition cone-to-upper shell, upper shell-to-upper head, main steam outlet nozzle weld and the main steam nozzle inside radius section were examined during the first DCP, Unit 2, inspection interval with acceptable results. During the first and second periods of the current second inspection interval, the stub-barrel-to-lower shell, lower shell-to-transition cone, the feedwater nozzle-to-shell welds, and the feedwater nozzle inside radius section were examined with acceptable results. In addition, two-thirds of the tubesheet-to-stub barrel weld (areas 0-120 degrees and 240-0 degrees) was successfully examined with no recordable indications discovered. In addition to DCP, Unit 2, examinations, the required Class 1 channel head-to-tubesheet weld and required Class 2 shell and nozzle welds were examined on the same type of DCP, Unit 1, SGs during similarly timed, first and second inspection intervals. These examinations also yielded acceptable results. The acceptable SG shell weld examinations on Unit 1 give additional confidence in the integrity of the welds subject to this request.

A review of industry experience shows that the discovery of significant flaws in SG shell welds and material is rare. The SG shell and upper head are composed of SA-533 Grade A, Class 1 Alloy steel. The tubesheet and main steam outlet nozzle are forged SA-508 Class 2 steel. The channel head is cast SA-216 Grade WCC steel. The pertinent degradation mechanism for these materials in this application, based on industry experience, is thermal fatigue. Industry events are documented in NRC Information Notices (INs) 82-37, 85-65, and 90-04. These INs discuss how past SG shell weld cracking/indications were most likely the result of corrosion-assisted thermal fatigue. This degradation mechanism is promoted by thermal cycling due to plant transients, poor feedwater chemistry leading to internal corrosion pitting and possibly weld-repairs that received inadequate local post-weld heat treatments. DCP has an operational history of few plant thermal transients. Past visual inspections of the inside of the secondary side of the SGs noted no significant corrosion pitting, and no weld repairs have been performed on the DCP, Unit 2, SG shell welds. In consideration of the acceptable results from prior examinations, potentially high radiation exposure to personnel, and the single operating cycle before SG replacement, performance of the examinations would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety in accordance with 10 CFR 50.55a(a)(3)(ii).

The licensee proposes to forego examining the remaining DCP, Unit 2, SG shell welds during 2R13 in 2006, the last outage of the second inspection interval. The existing SGs will be replaced during the next outage, 2R14 in 2008. In the unlikely event that the SG replacement would be deferred beyond the scheduled 2R14 replacement date, the licensee will perform all of these required examinations on the existing SGs during 2R14 in 2008, the first outage of the third inspection interval. If these deferral examinations are performed in 2R14, they will not be counted as third interval examinations.

3.4 Staff Evaluation

The licensee stated that during the first 10-year inspection interval, the entire Class 1 channel head-to-tubesheet welds on all four DCP, Unit 2, SGs were examined. Additionally, during the first and second periods of the current second inspection interval, two-thirds of one SG's channel head-to-tubesheet weld (areas 0-120 degrees

and 240-0 degrees) was reexamined. All Class 1 weld examinations performed to date are acceptable. All required Class 2 welds including the tubesheet-to-stub barrel, transition cone-to-upper shell, upper shell-to-upper head, main steam outlet nozzle weld, and the main steam nozzle inside radius section were examined during the first DCP, Unit 2, inspection interval with acceptable results. During the first and second periods of the current second inspection interval, the stub-barrel-to-lower shell, lower shell-to-transition cone, and the feedwater nozzle-to-shell welds and the feedwater nozzle inside radius section were examined with acceptable results. In addition, two-thirds of the tubesheet-to-stub barrel weld (areas 0-120 degrees and 240-0 degrees) was successfully examined with no recordable indications discovered. In addition to Unit 2 examinations, the required Class 1 channel head-to-tubesheet weld and required Class 2 shell and nozzle welds were examined on the same type of DCP, Unit 1, SGs during similarly timed, first and second inspection intervals. These examinations also yielded acceptable results. Based on the testing results reported by the licensee, the NRC staff agrees with the licensee's conclusion that acceptable SG shell weld examinations on Unit 1 give additional confidence in the integrity of the welds subject to this request.

The volumetric examinations with regard to ISI performed during each inspection interval serve two purposes. First, the nondestructive examination (NDE) results provide assurance of continuing structural integrity of these welds and adjacent base metal. Second, the NDE results provide documentation of the "NDE signature" of the examination volume (e.g., geometric reflectors, acceptable flaws) with current NDE technology that can be used for comparison with future inservice examination results. Based on the acceptable results of the volumetric examinations conducted in the first and a portion of the second 10-year inspection intervals, the NRC staff concludes that there is reasonable assurance of continued structural integrity of these items until at least the end of current inspection period. In addition, there is no information which would suggest that there is a degradation mechanism active in the subject items that would cause a failure during the remaining service life of the SGs until their replacement.

The licensee's ISI program, which conforms to the applicable ASME Code, Section XI, requires volumetric examination of the subject items during the second period of the current second 10-year interval. However, the licensee has planned and scheduled the replacement of the DCP SGs during the beginning of the third period of the current inspection interval, approximately 4 months after completion of the ASME Code-required volumetric examinations. Considering the amount of radiation exposure to licensee personnel during the performance of the ASME Code-required examinations, and the reasonable assurance of structural integrity of the subject items for the remaining life of the current SGs provided by the satisfactory results of past volumetric examinations of these and similar welds, the NRC staff has determined that compliance to the ASME Code requirement would result in hardship without a compensating increase in the level of quality and safety. The NRC staff further believes that should there be an unacceptable through-wall flaw existing in the subject items, the licensee's proposed alternative of performing a VT-2 visual examination during a system pressure test at the end of 2R13 in lieu of the ASME Code-required volumetric examinations would detect through-wall flaws and ensure leak-tight integrity of the pressure boundary.

4.0 CONCLUSION

The NRC staff concludes that the volumetric examinations of the subject items completed during the previous interval and examinations completed during the current interval provide reasonable assurance of structural integrity for the short remaining service life of the SGs. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the licensee's proposed alternative is authorized for the remainder of the second 10-year ISI interval of DCPP.

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

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Date: April 04, 2006

Diablo Canyon Power Plant, Units 1 and 2

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March 2006