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PG&E Letter DCL-05-008

U.S. Nuclear Regulatory Commission
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Docket No. 50-323, OL-DPR-82
Diablo Canyon Unit 2

60-Day Response to NRC Bulletin 2003-02, "Leakage From Reactor Pressure Vessel Lower Head Penetrations and Reactor Coolant Pressure Boundary Integrity," NRC Bulletin 2004-01, "Inspection of Alloy 82/182/600 Materials Used in the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized Water Reactors," and to Revision 1 of NRC Order EA-03-009, "Issuance of First Revised NRC Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors"

Dear Commissioners and Staff:

The first revision of NRC Order EA-03-009, dated February 20, 2004, requires that, within 60 days after returning a unit to operation, licensees provide a description of the inspections performed in accordance with the order and describe any leaks or boron deposits found during the inspection.

NRC Bulletin 2003-02, dated August 21, 2003, requested that, within 60 days of plant restart following the next inspection of the reactor pressure vessel (RPV) lower head penetrations, the subject pressurized water reactor addressees should submit to the NRC a summary of the inspections performed, the extent of the inspections, the methods used, a description of the as-found condition of the lower head, any findings of relevant indications of through-wall leakage, and a summary of the disposition of any findings of boric acid deposits and any corrective actions taken as a result of indications found.

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NRC Bulletin 2004-01, dated May 28, 2004, requested that, within 60 days of plant restart following the next inspection of the Alloy 82/182/600 pressurizer penetrations and steam space piping connections, licensees provide:

- (a) a statement indicating that the inspections described in the licensee's response to item (1)(c) of this bulletin were completed and a description of the as-found condition of the pressurizer shell, any findings of relevant indications of through-wall leakage, follow-up nondestructive examination (NDE) performed to characterize flaws in leaking penetrations or steam space piping connections, a summary of all relevant indications found by NDE, a summary of the disposition of any findings of boric acid, and any corrective actions taken and/or repairs made as a result of the indications found,

or

- (b) if the licensee was unable to complete the inspections described in response to item (1)(c) of this bulletin, submit to the NRC a summary of the inspections performed, the extent of the inspections, the methods used, a description of the as-found condition of the pressurizer shell, any findings of relevant indications of through-wall leakage, follow-up NDE performed to characterize flaws in leaking penetrations or steam space piping connections, a summary of all relevant indications found by NDE, a summary of the disposition of any findings of boric acid, and any corrective actions taken and/or repairs made as a result of the indications found. In addition, supplement the answer which you provided to item (1)(d) above to explain why the inspections that you completed were adequate for the purpose of maintaining the integrity of your facility's reactor coolant pressure boundary and for meeting all applicable regulatory requirements which pertain to your facility.

Enclosed are the 60-day responses for Diablo Canyon Power Plant (DCPP), Unit 2, requested by NRC Bulletin 2003-02, NRC Bulletin 2004-01, and by the first revision of NRC Order EA-03-009.

During the Unit 2 twelfth refueling outage (2R12), completed on December 16, 2004, PG&E performed a bare metal visual inspection of the RPV upper and the lower head surfaces. PG&E examined 100 percent of the upper and lower RPV head penetrations including 360 degrees around each vessel head penetration (VHP) and bottom mounted instrumentation nozzle. As noted



herein, the top head surface examination was limited by the control rod drive mechanism ventilation/insulation support structure and insulation; however, greater than 95 percent coverage was obtained as required by the order. No general surface area limitations were encountered on the lower head examination. No evidence of VHP nozzle leakage or cracking or degradation of the RPV heads was identified.

During 2R12, examinations were performed on all the pressurizer steam space Alloy 600 locations. There were no findings of through-wall boric acid leakage on any of the examination areas or their surroundings, and there were no signs of boric acid leakage from adjoining piping or components reaching the pressurizer shell.

During 2R12, PG&E performed nonvisual NDE volumetric and surface examination of all 79 reactor head penetration tubes using a combination of ultrasonic and eddy current testing methods. The examinations detected no evidence of primary water stress corrosion cracking discontinuities or indications of boric acid leak paths. No flaws needing disposition or corrective action were noted.

The volumetric examination performed during 2R12 satisfied a commitment made as part of the industry response to Generic Letter 97-01 to perform a volumetric inspection of the DCCP Unit 2 reactor pressure vessel head penetrations, as stated in PG&E Letter DCL-00-156, "Revised Schedule for Reactor Vessel Closure Head Penetration Inspection," dated December 12, 2000.

If you have questions regarding these responses, please contact Mr. Stan Ketelsen at (805) 545-4720.

Sincerely,

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Vice President - Nuclear Services

mjrm/4557
Enclosures

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cc/enc: Girija S. Shukla

60-Day Response to NRC Bulletin 2003-02, "Leakage From Reactor Pressure Vessel Lower Head Penetrations and Reactor Coolant Pressure Boundary Integrity"

NRC Requested Information:

NRC Bulletin 2003-02, dated August 21, 2003, requested that, within 60 days of plant restart following the next inspection of the reactor pressure vessel (RPV) lower head penetrations, the subject pressurized water reactor addressees should submit to the NRC a summary of the inspections performed, the extent of the inspections, the methods used, a description of the as-found condition of the lower head, any findings of relevant indications of through-wall leakage, and a summary of the disposition of any findings of boric acid deposits and any corrective actions taken as a result of indications found.

PG&E Response:

Scope of Inspection:

During the Diablo Canyon Power Plant (DCPP) Unit 2 twelfth refueling outage (2R12), PG&E performed a bare metal visual inspection of all 58 RPV lower head bottom mounted instrument (BMI) penetrations, including 100 percent of the circumference of each penetration as it enters the RPV lower head, and the areas surrounding the penetrations.

Methodology:

The inspections of the RPV lower head and BMI penetrations were performed using a remote examination system consisting of a robotic crawler and a high-resolution pan, tilt, and zoom camera system. The remote examination system provided visual resolution equivalent to a direct VT-2 visual examination as specified in the 1992 Edition of American Society of Mechanical Engineers (ASME) Section XI, Article IWA-2212, and ASME Section V, Article 9, paragraph T-942. The remote examination system was demonstrated to resolve a near vision test chart exceeding the requirements of ASME Section XI, Table IWA-2210-1, for VT-2 examination prior to the inspections.

An examination scan plan detailed the actions to be taken that would assure complete visual coverage of the RPV lower head and all BMI penetrations. Inspection personnel used exam data sheets and drawings to verify the lower head penetration being inspected and to record the location on the videotape record of each segment of a nozzle's inspection, providing verification of examination coverage for the RPV lower head and BMI penetrations. The entire examination was recorded on multiple high-quality videotapes.

Personnel who performed the remote examination were certified VT-2 Level II or Level III visual examiners, in accordance with the requirements of ASME Section XI, 1989 Edition or later approved code editions. A certified Level II or Level III visual examiner reviewed the inspection findings. All examiners engaged in the inspections received familiarization training on photographs of industry examination results and the use of the examination procedure's decision tree for evaluation of indications.

Inspection Results:

No areas of significant boric acid accumulation, or signs of leakage from the BMI penetration/RPV lower head interface areas were identified.

The examination identified some slight trails from above the lower head, which appear to be boric acid residue. These trails were similar to those seen at upper elevations of the vessel insulation exterior, which originate at the cavity seal/vessel interface area. Two of the trails ran onto the interface area of the BMI penetration/lower head over the built up Inconel pads surrounding the penetration tubes. These areas received additional examination scrutiny to obtain detailed resolution data of the head-tube interface area. It was determined that the annulus gap surrounding the tube was visible in both locations, that the deposit did not emanate from the annulus and that the thin boric acid coating could not mask boric acid originating from pressure boundary leakage. The deposit characteristics were such that the procedural evaluation concluded that the source was only from the trails from above. Additional direct hand-held camera photographs were taken of these areas and the different perspective and illumination confirmed that there was no boric acid leakage. There were no deposits in the penetration tube/head locations that would obscure or mask boron emanating from a pressure boundary flaw. The trails on the vessel surface were translucent and non-three-dimensional, with no visible attack on the carbon steel of the vessel head. To a much greater extent, similar boron trails are visible on the outside of the vessel insulation and on the concrete bio-shield wall, supporting the conclusion that they are the result of cavity seal leakage.

Since no evidence of degradation of the RPV lower head was detected, no corrective actions were necessary.

60-Day Response to NRC Bulletin 2004-01, "Inspection of Alloy 82/182/600 Materials Used in the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized Water Reactors"

NRC Requested Information:

Within 60 days of plant restart following the next inspection of the Alloy 82/182/600 pressurizer penetrations and steam space piping connections, the subject pressurized water reactor licensees should either:

(a) *Submit to the NRC a statement indicating that the inspections described in the licensee's response to item (1)(c) of this bulletin were completed and a description of the as-found condition of the pressurizer shell, any findings of relevant indications of through-wall leakage, follow-up nondestructive examination (NDE) performed to characterize flaws in leaking penetrations or steam space piping connections, a summary of all relevant indications found by NDE, a summary of the disposition of any findings of boric acid, and any corrective actions taken and/or repairs made as a result of the indications found,*

or

(b) *if the licensee was unable to complete the inspections described in response to item (1)(c) of this bulletin, submit to the NRC a summary of the inspections performed, the extent of the inspections, the methods used, a description of the as-found condition of the pressurizer shell, any findings of relevant indications of through-wall leakage, follow-up NDE performed to characterize flaws in leaking penetrations or steam space piping connections, a summary of all relevant indications found by NDE, a summary of the disposition of any findings of boric acid, and any corrective actions taken and/or repairs made as a result of the indications found. In addition, supplement the answer which you provided to item (1)(d) above to explain why the inspections that you completed were adequate for the purpose of maintaining the integrity of your facility's reactor coolant pressure boundary and for meeting all applicable regulatory requirements which pertain to your facility.*

For lines attached directly to the pressurizer, with the exception of the surge line, the information requested in (1) and (2) above should be provided for any locations, including those remote from the pressurizer shell, which contain Alloy 82/182/600 materials which are exposed to conditions similar to those of the pressurizer environment.

PG&E Response:

During 2R12, examinations were planned and performed on all the pressurizer steam space Alloy 600 locations. Direct visual examinations were performed on the following locations after removal of insulation:

- RCS-2-RV-8010A / Line-729 (Pressurizer Nozzle to Safe End)
- RCS-2-RV-8010B / Line-728 (Pressurizer Nozzle to Safe End)
- RCS-2-RV-8010C / Line-727 (Pressurizer Nozzle to Safe End)
- PORVs / Line-730 (Pressurizer Nozzle to Safe End)
- Spray / Line-15 (Pressurizer Nozzle to Safe End)

No indications of boric acid leakage were detected at any of the above locations. The examinations required removal of the insulation immediately surrounding the welds. Due to the configuration of the insulation, a large section of insulation was removed around each of the above nozzles, providing direct visual access to the pressurizer head base material. No boric acid leakage was detected on the pressurizer shell and no evidence of current or previous corrosive attack of the shell was discovered.

There were no findings of through-wall boric acid leakage on any of the examination areas or their surroundings, and there were no signs of boric acid leakage from adjoining piping or components reaching the pressurizer shell. Therefore, augmented NDE was not warranted nor were any relevant indications detected by NDE. Likewise, no boric acid findings required disposition or corrective measures.

As a prudent measure, the insulation on the pressurizer surge line Alloy 600 weld (Line-16 Pressurizer nozzle to safe end weld) was removed and a direct visual inspection was also performed on this weld. No boric acid leakage was detected.

As part of an Industry Good Practice Recommendation promulgated by Electric Power Research Institute / Materials Reliability Program (MRP) Letter MRP 2004-038, the inspections were used as an opportunity to gather as-built dimensional information on all of the above welds. This information was obtained and will be forwarded to the appropriate parties in the industry.

60-Day Response to NRC Order EA-03-009, "Issuance of First Revised NRC Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors"

NRC Required Information:

The first revision of NRC Order EA-03-009, dated February 20, 2004, required that, for each inspection required in Paragraph C of the Order, the Licensee shall submit a report detailing the inspection results within 60 days after returning the plant to operation. For each inspection required in Paragraph D of the Order, the Licensee shall submit a report detailing the inspection results within 60 days after returning the plant to operation if a leak or boron deposit was found during the inspection.

PG&E Response:

DCPP Unit 2 accumulated 12.1 total effective degradation years prior to 2R12. Therefore, PG&E was required to perform an inspection in accordance with Order EA-03-009, Sections C. (1) and D.

PG&E complied with Section C. (1)(a) of the Order by performing a bare metal visual inspection of 100 percent of the reactor pressure vessel (RPV) head penetrations, including 360 degrees around each of the vessel head penetration (VHP) nozzles and the head vent penetration, during 2R12, completed on December 16, 2004. PG&E also performed a visual inspection of greater than 95 percent of the RPV head surface to identify any degradation. No evidence of VHP nozzle leakage or cracking, or degradation of the RPV head, was identified.

PG&E complied with Section C. (1)(b) of the Order by performing nonvisual NDE volumetric examination on all 79 reactor head penetration tubes (RHPT), including the head vent penetration. A combination of ultrasonic and eddy current testing methods were used with probes delivered to the tubes by a remote positioning device (or manually in the case of the head vent tube). The inspection encountered limitations to the Order's specified examination areas in a majority of the RHPTs due to the large as-built configuration of the J-welds, the chamfer at the end of the tubes, and the geometry of the transducers on the examination probes. The examination details were provided in PG&E Letter DCL-04-146, "Relaxation Request for NRC Issuance of First Revised Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," dated October 26, 2004, and PG&E Letter DCL-04-158, "Supplement to Relaxation Request for NRC Issuance of First Revised Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," dated November 12, 2004.

The Relaxation Request was subsequently approved on November 23, 2004 (TAC No. MC4932). The examinations detected no discontinuities or indications of boric acid leak paths; no flaws needing disposition or corrective action were identified.

PG&E complied with Section D of the Order by performing a visual inspection to identify potential boric acid leaks from pressure-retaining components above the RPV head. No evidence of leakage was identified.