Pacific Gas and Electric Company™

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August 30, 2001

PG&E Letter DCL-01-092

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

Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
Response to NRC Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles"

Dear Commissioners and Staff:

Enclosed is the Diablo Canyon Power Plant (DCPP) response to NRC Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles," dated August 3, 2001. NRC Bulletin 2001-01 requested information relative to the reactor pressure vessel (RPV) head penetration nozzle configuration, previous RPV head inspections, and plans for future RPV head inspections. DCPP is participating in the Electric Power Research Institute, Inc., Materials Reliability Program associated with the issue. DCPP is in the category of plants with moderate susceptibility to circumferential cracking of the reactor pressure vessel head penetration nozzles. DCPP also coordinated preparation of this response with the other participants in the Strategic Teaming and Resource Sharing (STARS) organization.

If you have additional questions regarding this response, please contact Mr. Pat Nugent at (805) 545-4720.

Sincerely,

cc: Edgar Bailey, DHS
Alexander Marion, NEI
Ellis W. Merschoff
David L. Proulx
Girija S. Shukla
Diablo Distribution

Enclosure

A088

PG&E Letter DCL-01-092

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of PACIFIC GAS AND ELECTRIC COMPANY	)	Docket No. 50-275 Facility Operating License No. DPR-80
Diablo Canyon Power Plant Units 1 and 2	)	Docket No. 50-323 Facility Operating License No. DPR-82

AFFIDAVIT

Gregory M. Rueger, of lawful age, first being duly sworn upon oath says that he is Senior Vice President - Generation and Chief Nuclear Officer of Pacific Gas and Electric Company; that he is familiar with the content thereof; that he has executed this response to NRC Bulletin 2001-01 on behalf of said company with full power and authority to do so; that the facts stated therein are true and correct to the best of his knowledge, information, and belief.

Gregory M. Rueger
Senior Vice President - Generation and Chief Nuclear Officer

Subscribed and sworn to before me this 30th day of August, 2001.

Notary Public
County of Francisco
State of California

AMY EMIKO DONG
Commission # 1206749
Notary Public - California
San Francisco County
My Comm. Expires Jan 2, 2003

Response to NRC Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles"

Below is the Diablo Canyon Power Plant (DCPP) response to NRC Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles," dated August 3, 2001 (Reference 1). The Bulletin's "Requested Information" is shown in italics.

DCPP is participating in the Electric Power Research Institute, Inc. (EPRI) Materials Reliability Program (MRP) associated with this issue. Information associated with the MRP efforts are compiled in "PWR Materials Reliability Program Response to NRC Bulletin 2001-01 (MRP-48), EPRI, Palo Alto, CA: 2001: TP-1006284," (Reference 2). This report was transmitted to the NRC by Nuclear Energy Institute letter, "Generic Information for Use by Licensees in Response to NRC Bulletin 2001-01," dated August 21, 2001 (Reference 3). Reference to the MRP report is made, where appropriate.

NRC Requested Information

1. *All addressees are requested to provide the following information:*

    a. *the plant-specific susceptibility ranking for your plant(s) (including all data used to determine each ranking) using the PWSCC susceptibility model described in Appendix B to the MRP-44, Part 2, report;*

PG&E Response:

As shown in Table 2-1 of Reference 2, DCPP Units 1 and 2 have been evaluated for relative susceptibility to primary water stress corrosion cracking of the reactor pressure vessel (RPV) head penetration nozzles. The evaluation indicates it would take approximately 20.8 and 16.1 effective full power years (EFPY) of additional operation by DCPP Units 1 and 2, respectively, to reach the same time-at-temperature as Oconee Nuclear Station 3 (ONS3). These ranking values are referenced to March 2001. March 2001 is when leaking nozzles were discovered at ONS3. As described in Reference 2, the evaluation used the time-at-temperature model described in Appendix B to MRP-44, Part 2 (Reference 4).

Using the criteria stated in Bulletin 2001-01, DCPP Units 1 and 2 are considered as having a moderate susceptibility to circumferential cracking of the RPV head penetration nozzles.

NRC Requested Information

1. *All addressees are requested to provide the following information:*

b. a description of the VHP nozzles in your plant(s), including the number, type, inside and outside diameter, materials of construction, and the minimum distance between VHP nozzles;

PG&E Response:

Reference 2, Table 2-3, provides the requested nozzle information.

NRC Requested Information

1. All addressees are requested to provide the following information:

c. a description of the RPV head insulation type and configuration;

PG&E Response:

The DCPP RPV head insulation type and configuration are briefly described in Reference 2. The reactor vessel head insulation is a reflective (mirror) insulation constructed to be permanent, yet removable and reusable. The main portion of the insulation is installed horizontally above the dome of the reactor vessel with outer portions stepped down to accommodate the RPV head configuration. The insulation is positioned between the top of the vessel and the head penetration flanges, which connect to the control rod drive mechanism (CRDM) housings. The insulation is provided in individual panels that fit together in a specific arrangement and are fastened by buckles.

NRC Requested Information

1. All addressees are requested to provide the following information:

d. a description of the VHP nozzle and RPV head inspections (type, scope, qualification requirements, and acceptance criteria) that have been performed at your plant(s) in the past 4 years, and the findings. Include a description of any limitations (insulation or other impediments) to accessibility of the bare metal of the RPV head for visual examinations;

PG&E Response:

DCPP has not performed RPV head and nozzle inspections within the past four years. In 1999, during the Unit 1 ninth refueling outage (1R9), reflective insulation was removed to facilitate repairs to two canopy seal welds. This made approximately one-half of the head penetrations visible during this time. While there was no specific inspection of the area, no boric acid was noted by engineering, inservice inspection or radiation protection personnel. Accessibility limitations to the RPV head bare metal for visual examinations include the dose

and time associated with the removal of the insulation and CRDM cooling shroud.

NRC Requested Information

1. *All addressees are requested to provide the following information:*

   e. *a description of the configuration of the missile shield, the CRDM housings and their support/restraint system, and all components, structures, and cabling from the top of the RPV head up to the missile shield. Include the elevations of these items relative to the bottom of the missile shield.*

PG&E Response:

Table 1 provides relative elevation of various significant components to the missile shield.

Reactor Missile Shield	The reactor missile shield is 2-inch steel plate attached to a steel frame and is located above the reactor vessel to provide protection against postulated CRDM missiles. The missile shield is moveable to allow access to the reactor vessel during refueling. During normal plant operation, the missile shield is restrained for seismic loads.
Seismic Support Platform	The seismic support platform is located between the bottom of the missile shield and the top of the CRDMs and serves to provide support for the upper end of the CRDM rod travel housings. The seismic support platform also provides support for the reactor head vents and associated piping. The platform is supported off the RPV head. Power and instrumentation cables traverse upward from the components above the top of the RPV head, through the seismic support platform and across to the cable trays located at approximately the 140-foot 6-inch elevation.
CRDM Cooling Shroud	The CRDM cooling shroud is a generally cylindrical steel structure, which directs forced air cooling flow over the CRDM coils to maintain them in a suitable operating environment. The CRDM cooling shroud encircles the RPV head insulation and impedes access to the insulation panels.
RPV Head Penetrations	Of the 79 (Unit 1) and 78 (Unit 2) RPV head penetrations, 53 are used for CRDMs on each unit; and 8 are used for part length CRDMs on each unit. The remaining RPV head penetrations include spares (12 for each unit) and thermocouple connections (6 for Unit 1, 5 for Unit 2). Each

	unit also includes one 3/4 inch head vent pipe connection, which also provides a connection for the reactor vessel level instrumentation system.
CRDMs	A CRDM consists of four separate subassemblies. They are (1) the pressure vessel (latch housing and rod travel housing), (2) the coil stack assembly, (3) the latch assembly, and (4) the drive rod assembly. A rod position indicator (RPI) assembly surrounds the rod travel housing. The CRDM is connected by a seal-welded threaded connection to the CRDM RPV head penetration and restrained at the top by RPI top plates, which are an integral part of the seismic support platform. The CRDMs provide for withdrawal or insertion of the rod control cluster assemblies (RCCAs), and for RCCA position indication. The CRDM power cables are contained in conduit from the coil stack assemblies to the RPI top plates.
RPV Head Insulation	See response to 1.c.
CRDM RPV Head Penetrations	The CRDM RPV head penetrations provide a pressure boundary from the RPV to the seal-welded threaded connection for the CRDMs. The penetrations are designed to provide a uniform height transition from the RPV head to the CRDM latch housings.

NRC Requested Information

2. *If your plant has previously experienced either leakage from or cracking in VHP nozzles, addressees are requested to provide the following information:*

   a. *a description of the extent of VHP nozzle leakage and cracking detected at your plant, including the number, location, size, and nature of each crack detected;*

   b. *a description of the additional or supplemental inspections (type, scope, qualification requirements, and acceptance criteria), repairs, and other corrective actions you have taken in response to identified cracking to satisfy applicable regulatory requirements;*

   c. *your plans for future inspections (type, scope, qualification requirements, and acceptance criteria) and the schedule;*

   d. *your basis for concluding that the inspections identified in 2.c will assure that regulatory requirements are met (see Applicable Regulatory*

Requirements section). Include the following specific information in this discussion:

(1) If your future inspection plans do not include performing inspections before December 31, 2001, provide your basis for concluding that the regulatory requirements discussed in the Applicable Regulatory Requirements section will continue to be met until the inspections are performed.

(2) If your future inspection plans do not include volumetric examination of all VHP nozzles, provide your basis for concluding that the regulatory requirements discussed in the Applicable Regulatory Requirements section will be satisfied.

PG&E Response:

DCPP Units 1 and 2 have not previously experienced either leakage from or cracking in RPV head penetration nozzles. Therefore, this section is not applicable.

NRC Requested Information

3. *If the susceptibility ranking for your plant is within 5 EFPY of ONS3, addressees are requested to provide the following information:*

   a. *your plans for future inspections (type, scope, qualification requirements, and acceptance criteria) and the schedule;*

   b. *your basis for concluding that the inspections identified in 3.a. will assure that regulatory requirements are met (see Applicable Regulatory Requirements section). Include the following specific information in this discussion:*

      (1) If your future inspection plans do not include performing inspections before December 31, 2001, provide your basis for concluding that the regulatory requirements discussed in the Applicable Regulatory Requirements section will continue to be met until the inspections are performed.

      (2) If your future inspection plans include only visual inspections, discuss the corrective actions that will be taken, including alternative inspection methods (for example, volumetric examination), if leakage is detected.

PG&E Response:

DCPP Units 1 & 2 susceptibility rankings are not within 5 EFPY of ONS3. Therefore, this section is not applicable.

NRC Requested Information

4. *If the susceptibility ranking for your plant is greater than 5 EFPY and less than 30 EFPY of ONS3, addressees are requested to provide the following information:*

   a. *your plans for future inspections (type, scope, qualification requirements, and acceptance criteria) and the schedule;*

   b. *your basis for concluding that the inspections identified in 4.a will assure that regulatory requirements are met (see Applicable Regulatory Requirements section). Include the following specific information in this discussion:*

      (1) *If your future inspection plans do not include a qualified visual examination at the next scheduled refueling outage, provide your basis for concluding that the regulatory requirements discussed in the Applicable Regulatory Requirements section will continue to be met until the inspections are performed.*

      (2) *The corrective actions that will be taken, including alternative inspection methods (for example, volumetric examination), if leakage is detected.*

PG&E Response:

PG&E will perform bare metal visual inspections of the penetration tubes in the next scheduled refueling outage for each unit. The next refueling outage for Unit 1 is scheduled for May 2002. The next refueling outage for Unit 2 is February 2003. The visual inspections will be performed by VT-2 qualified individuals in accordance with an approved procedure. Plant specific configuration and industry experience, including expected evidence of leakage, will be discussed prior to performance of the inspection.

The basis for concluding that regulatory requirements are met is discussed in Reference 2.

If leakage is found in the course of the visual inspections then the remaining tubes will be examined using appropriate nondestructive examination methods (e. g., volumetric examinations). Defects will be repaired or evaluated using a qualified ASME Section XI plan or approved alternative.

NRC Requested Information

5. *Addressees are requested to provide the following information within 30 days after plant restart following the next refueling outage:*

   a. *a description of the extent of VHP nozzle leakage and cracking detected at your plant, including the number, location, size, and nature of each crack detected;*

   b. *if cracking is identified, a description of the inspections (type, scope, qualification requirements, and acceptance criteria), repairs, and other corrective actions you have taken to satisfy applicable regulatory requirements. This information is requested only if there are any changes from prior information submitted in accordance with this bulletin.*

PG&E Response:

PG&E will provide the requested information, or will indicate that no leakage was identified, within 30 days after plant restart following the next refueling outage for each unit.

References

1. NRC Bulletin 2001-01, Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles, dated August 3, 2001.

2. PWR Materials Reliability Program Response to NRC Bulletin 2001-01 (MRP-48), EPRI, Palo Alto, CA: 2001. TP-1006284

3. NEI letter from Alexander Marion to Dr. Brian W. Sheron (NRC), Generic Information for Use by Licensees in Response to NRC Bulletin 2001-01, dated August 21, 2001.

4. PWR Materials Reliability Program, Interim Alloy 600 Safety Assessments for US PWR Plants (MRP-44): Part 2: Reactor Vessel Top Head Penetrations, EPRI, Palo Alto, CA: 2001.

Table 1

Relative Elevations of Significant Components

Elevation	Distance from Missile Shield	Component
143 ft 3 in.	0 ft	Bottom of Missile Shield
140 ft 6 in.	2 ft 9 in.	Seismic Support Platform
140 ft 6 in.	2 ft 9 in.	Top of CRDMs
123 ft 1.5 in.	20 ft 3.5 in.	CRDM Penetration Flanges
121 ft 8.5 in.	21 ft 6.5 in.	Head Insulation (Upper Horizontal Step)
121 ft 7.5 in.	21 ft 7.5 in.	Top of RPV Head
121 ft 10.5 in.	21 ft 4.5 in.	Center of duct for CRDM cooling air
114 ft 1.5 in.	29 ft 1.5 in.	RPV Flange