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September 12, 2002

PG&E Letter DCL-02-109

U.S. Nuclear Regulatory Commission
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Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
30-Day Response to NRC Bulletins 2002-02, "Reactor Pressure Vessel Head and Vessel Head Penetration Nozzle Inspection Programs"

Dear Commissioners and Staff:

Enclosed is the 30-day response for Diablo Canyon Power Plant Units 1 and 2 to NRC Bulletin 2002-02, "Reactor Pressure Vessel Head and Vessel Head Penetration Nozzle Inspection Programs," dated August 9, 2002.

NRC Bulletin 2002-02 was issued to advise pressurized water reactor (PWR) addressees that visual examinations, as a primary inspection method for the reactor pressure vessel (RPV) head and vessel head penetration (VHP) nozzles, may need to be supplemented with additional measures (e.g., volumetric and surface examinations) to demonstrate compliance with applicable regulations, and to advise them that inspection methods and frequencies to demonstrate compliance with applicable regulations should be demonstrated to be reliable and effective. The bulletin requested information from all PWR addressees concerning their RPV head and VHP nozzle inspection programs to ensure compliance with applicable regulatory requirements, and required that they provide written responses to the bulletin related to their inspection program plans.

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

Sincerely,

Lawrence F. Womack
Vice President – Nuclear Services

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tcg/4231
Enclosures

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PG&E Letter DCL-02-109

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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

AFFIDAVIT

Lawrence F. Womack, being of lawful age, first being duly sworn upon oath says that he is Vice President – Nuclear Services of Pacific Gas and Electric Company; that he has executed this response to NRC Bulletin 2002-02 on behalf of said company with full power and authority to do so; that he is familiar with the content thereof; and that the facts stated therein are true and correct to the best of his knowledge, information, and belief.

Lawrence F. Womack
Vice President – Nuclear Services

Subscribed and sworn to before me this 12th day of September, 2002.

Notary Public
County of San Luis Obispo
State of California

CHUCK MACKEY
Commission # 1204640
Notary Public - California
San Luis Obispo County
My Comm. Expires Dec 12, 2002

30-Day Response to NRC Bulletin 2002-02, "Reactor Pressure Vessel Head and Vessel Head Penetration Nozzle Inspection Programs"

NRC Requested Information

(1) *Within 30 days of the date of this bulletin:*

A. *PWR addressees who plan to supplement their inspection programs with non-visual NDE methods are requested to provide a summary discussion of the supplemental inspections to be implemented. The summary discussion should include EDY, methods, scope, coverage, frequencies, qualification requirements, and acceptance criteria.*

B. *PWR addressees who do not plan to supplement their inspection programs with non-visual NDE methods are requested to provide a justification for continued reliance on visual examinations as the primary method to detect degradation (i.e., cracking, leakage, or wastage). In your justification, include a discussion that addresses the reliability and effectiveness of the inspections to ensure that all regulatory and technical specification requirements are met during the operating cycle, and that addresses the six concerns identified in the Discussion Section of BL 2002-02. Also, include in your justification a discussion of your basis for concluding that unacceptable vessel head wastage will not occur between inspection cycles that rely on qualified visual inspections. You should provide all applicable data to support your understanding of the wastage phenomenon and wastage rates.*

PG&E Response:

PG&E previously committed in PG&E letter DCL-02-033, dated April 1, 2002, to perform a qualified bare metal visual inspection of 100 percent of the Reactor Pressure Vessel (RPV) head penetrations on Units 1 and 2 in response to bulletin 2002-01. The inspection of Unit 1 was completed in May 2002 during Unit 1 refueling outage eleven (1R11) as reported in PG&E letter DCL-02-071, dated June 21, 2002. The 1R11 inspection identified no leakage or head degradation. The bare metal RPV head visual inspection for Unit 2 is scheduled for February 2003 during Unit 2 refueling outage eleven (2R11).

The PG&E responses to Bulletin 2002-01 addressed the adequacy of visual inspection for compliance with the design and licensing basis of the plants. Those responses are still applicable. Additional technical justification for the adequacy of the visual inspections is provided in this response to Bulletin 2002-02.

PG&E has evaluated the expected status of Diablo Canyon Power Plant (DCPP) Units 1 and 2 at the time of the next refueling outage with regard to Effective Degradation Years (EDY) calculated in accordance with Materials Reliability Program (MRP) -48 (Reference 13) (Equation 2.2). The results are presented in the following table referenced to the next scheduled refueling outage for each unit:

Unit	As of Next Refueling Outage	EDY
1	1R12, February 2004	10.2
2	2R11, February 2003	10.9

Since both units are less than 12 EDY at the time of the next refueling outages, non-visual NDE is not requested per the table in BL 2002-02. Therefore, a qualified bare metal visual inspection of 100 percent of the head will be performed during 2R11 and Unit 1 refueling outage twelve (1R12), consistent with the inspection recommendations in NRC Bulletin 2002-02. The current schedule for the start of 1R12 is February 2004.

In addition to the inspections requested by NRC Bulletins 2001-01 and 2002-01, PG&E has committed to perform a volumetric inspection of the DCPP Unit 2 reactor pressure vessel head penetrations as part of the industry response to Generic Letter 97-01. The inspection will be performed during Unit 2 refueling outage twelve (2R12), currently scheduled to begin in October 2004. This commitment is documented in PG&E letter DCL-00-156, "Revised Schedule for Reactor Vessel Closure Head Penetration Inspection," dated December 12, 2000. The scope, methods, qualifications and acceptance criteria for this inspection have not yet been defined. Definition of the scope, methods, qualification, and acceptance criteria will be made prior to the inspection based on the MRP inspection plan, industry experience, plant data, and available equipment and techniques. PG&E will provide details of the inspection scope, methods, qualification, and acceptance criteria to the NRC six months prior to 2R12.

The following describes the qualified visual examinations that will be performed during the next refueling outage for each unit. The methodology, personnel qualifications, examination system qualifications, acceptance criteria, and frequency are the same as those contained in our previous response to NRC Bulletin 2002-01, DCL-02-033.

Method:

The visual inspections under the mirror insulation will be performed using remote examination equipment.

Personnel qualifications:

Personnel performing the remote examination of the bare metal reactor head will be certified at a minimum as VT-2 level II visual examiners in accordance with the requirements of ASME Section XI, 1989 Edition or later approved code editions.

Personnel performing the final evaluation of examination findings will be certified VT-2 level II or III.

Examination system qualification:

The remote examination system will provide visual resolution equivalent to a direct VT-2 visual as specified in the 1992 Edition of ASME Section XI Article IWA-2212 and ASME Section V Article 9 paragraph T-942. The remote examination system and procedure will be demonstrated to resolve a near vision test chart meeting the requirements of ASME Section XI Article IWA table 2210-1 for VT-2 examination.

Acceptance criteria:

Any accumulations of boric acid residue on the reactor pressure vessel head will be investigated to determine the origin of the deposit. Consistent with the ASME Code, discolored surfaces or areas with boric acid buildup will be given particular attention to determine if the surface below the residue is sound, to the extent possible with visual examination equipment. If necessary, supplemental investigation aids such as scrapers/brushes, compressed air and water washing will be applied to suspect areas to assist in the resolution of these areas.

As described in PG&E letter DCL-01-092, "Response to NRC Bulletin 2001-01, 'Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles,'" dated August 30, 2001, if head penetration leakage is found in the course of the visual inspections requested by NRC Bulletin 2001-01 then the remaining tubes will be examined using appropriate nondestructive examination methods (e.g., volumetric examination). Defects will be repaired or evaluated using a qualified ASME Section XI plan or approved alternative.

Boric acid residue whose source is determined to be other than from a penetration tube juncture will be evaluated as noted above. Additional corrective measures regarding the termination of the leak source and the arrest of any corrosive attack of the reactor pressure vessel head will be employed.

Frequency:

The frequency of future inspections beyond those currently scheduled as discussed above will be based on DCPP inspection results, industry inspection results, and industry initiatives (MRP Inspection Plan).

The MRP Inspection Plan has been developed, reviewed, and approved by the pressurized water reactor (PWR) utilities (References 1 and 2). It presents a technically credible inspection regimen that assures to a high degree of certainty that leaks will be detected at an early stage long before wastage or circumferential cracking can challenge the structural integrity of the reactor coolant system (RCS) pressure boundary. Furthermore, implementation of the MRP Inspection Plan will assure continued compliance with the regulatory requirements cited in NRC Bulletin 2002-02.

Therefore, PG&E will implement the MRP Inspection Plan and will comply with its requirements beginning with the conduct of the inspections described above. The MRP Inspection Plan envelopes the inspection commitments made in our responses to Bulletin 2001-01 and Bulletin 2002-01.

Accordingly PG&E provides the following responses as justification for continued reliance on visual examinations as the primary method to detect degradation in the RPV head. Included in these responses are discussions on the reliability and effectiveness of visual examinations as they relate to the six concerns cited in Bulletin 2002-02 and the basis for concluding that unacceptable wastage will not occur between refueling outages.

NRC Concern 1: "Circumferential cracking of CRDM nozzles was identified by the presence of relatively small amounts of boric acid deposits. This finding increases the need for more effective visual and non-visual NDE inspection methods to detect the presence of degradation in CRDM nozzles before nozzle integrity is compromised."

PG&E Response: Since the initial discovery of circumferential cracks above the J-groove weld in 2001, visual inspection techniques and approaches employed have been dramatically improved and a heightened sense of awareness exists for the range in size and appearance of visual indications that must be further investigated. Non-visual techniques similarly have and continue to evolve to more effectively examine the penetration tube and associated welds for evidence of cracks. Nothing in the recent events at Davis-Besse has altered the fundamental inspection capability requirements previously established as necessary to identify the presence of primary water stress corrosion cracking (PWSCC) and subsequent associated wastage. The effectiveness of inspection techniques continues to be evaluated and improved.

EPRI MRP has published detailed guidance for performing visual examinations of RPV heads (Reference 3). A utility workshop was recently conducted to discuss this guidance and lessons learned from recent field experience (including Davis-Besse). RPV head bare metal visual inspections at DCPP will be performed and documented in accordance with written procedures and acceptance criteria that comply with the guidance of the MRP Inspection Plan. Evaluations and corrective actions will be rigorous and thoroughly documented.

In order for outside diameter (OD) circumferential cracks above the J-groove weld to initiate and grow, a leak path must first be established to the control rod drive mechanism (CRDM) annulus region from the inner wetted surface of the RPV head. If primary water does not leak to the annulus, the environment does not exist to cause circumferential OD cracking. Axial cracks in the CRDM nozzles or cracks in J-groove welds must first initiate and grow through wall. Experience has shown that through wall axial cracks will result in observable leakage at the base of the penetration on the outer surface of the vessel, even with interference fits. Alloy 600 steam generator drain pipes at Shearon Harris (1988) and pressurizer instrument nozzles at Nogent 1 and Cattenom 2 (1989) were all roll expanded but still developed observable leaks during operation (Reference 4). Plant specific top head gap analyses have been performed for a large number of plants, with nozzle initial interference fits ranging from 0 to 0.003 inches. These analyses have confirmed the presence of a physical leak path in essentially all nozzles under normal operating pressure and temperature conditions (Reference 4). PG&E has obtained a DCPP specific analysis that demonstrates the presence of a leakage path in all of the DCPP Unit 1 and 2 head penetrations if a weld or tube leak were to be present at normal operating pressure and temperature conditions.

The probability of detecting small CRDM leaks by visual inspections alone is high as indicated in Appendix B of EPRI Document MRP-75 (Reference 4). "Visual inspections of the reactor coolant system pressure boundary have been proven to be an effective method for identifying leakage from PWSCC cracks in Alloy 600 base metal and Alloy 82/182 weld metal. Specifically, visual inspections have detected leaks in RPV head CRDM nozzles, RPV head thermocouple nozzles, pressurizer heater sleeves, pressurizer instrument nozzles, hot leg instrument nozzles, steam generator drain lines, a RPV hot leg nozzle weld, a power operated relief valve (PORV) safe end and a pressurizer manway diaphragm plate" (Reference 4). To date, no leaking CRDM nozzles have been discovered by non-visual non-destructive examinations (NDE) except for the three nozzles at Davis-Besse where leakage would have been detected visually had there been good access for visual inspections and the head cleaned of pre-existing boric acid deposits from other sources (Reference 4).

Finally, as described under Concern 3 below, detailed Probabilistic Fracture Mechanics (PFM) analyses have been performed to demonstrate the effectiveness of visual inspections in protecting the CRDM nozzles against failure due to circumferential cracking (Reference 6). Even though the above discussion illustrates that visual inspections performed in accordance with MRP recommendations have a high probability of detecting through-wall leakage, a very low probability of detection was assumed in the PFM analyses. The PFM analyses assume only a 60 percent probability that leakage will be detected if a CRDM nozzle is leaking at the time a visual inspection is performed. Furthermore, if a nozzle has been inspected previously, and leakage was missed, subsequent visual inspections are assumed to have only a 12 percent probability of detecting the leak. Even with these conservative probabilities of detection assumptions, the PFM analyses show that visual inspection every outage reduces the probability of a nozzle ejection to an acceptable level for plants with 18 or more EDY. Visual inspections of plants with fewer than 18 EDY in accordance with the MRP Inspection Plan will maintain the probability of nozzle ejection for these plants more than an order of magnitude lower than that for the greater than 18 EDY plants.

In summary, the industry has responded to the need to detect small amounts of leakage by increased visual inspection sensitivity, increased inspection frequencies, and improved inspection capabilities. Small amounts of leakage can be detected visually and it has been shown in the PFM analyses that timely detection by visual examination will ensure the structural integrity of the RPV head penetrations with respect to circumferential cracking.

NRC Concern 2: "Cracking of 82/182 weld metal has been identified in CRDM nozzle J-groove welds for the first time and can precede cracking of the base metal. This finding raises concerns because examination of weld metal material is more difficult than base metal."

PG&E Response: Cracks in the J-groove weld do not pose an increased risk regarding nozzle ejection as compared to penetration base metal cracks. J-groove weld cracks that initiate and grow through-wall will leak the same as cracks in the penetration base metal. Therefore, weld cracks pose a similar risk as cracks in the base material and subsequent leakage is equally detectable by visual examination. Although higher crack growth rates have been observed in laboratory testing of weld metal, the industry model of time-to-leakage includes plants that have had weld metal cracking as well as base metal cracking. The visual examination frequencies from the MRP Inspection Plan have been conservatively established based on the risk informed analyses considering leakage due to both weld metal and base metal cracking.

As stated in the response to concern 1, leaks from J-groove welds are detectable during visual inspections. As described in the response to concern 6, leaks from J-groove welds will be detectable prior to causing RPV wastage. The modeling described in the response to concern 3 has conservatively modeled weld cracking and determined that the overall risk is acceptably low.

NRC Concern 3: "Through-wall circumferential cracking from the outside diameter of the CRDM nozzle has been identified for the first time. This raises concerns about the potential for failure of CRDM nozzles and control rod ejection, causing a LOCA."

PG&E Response: PFM analyses using a Monte-Carlo simulation algorithm were performed to estimate the probability of nozzle failure and control rod ejection due to through wall circumferential cracking (Reference 6). The PFM analyses conservatively assume that, once a leak path has extended to the annulus region, an OD circumferential crack develops instantaneously, with a length encompassing 30° of the nozzle circumference. Fracture mechanics crack growth calculations are then performed for this initially assumed crack, using material crack growth rate data from EPRI Report MRP-55 (Reference 7). The parameters used in the PFM model were benchmarked against the most severe cracking found to date in the industry (B&W Plants) and produced results that are in agreement with experience to date. The analyses were used to determine probability of nozzle failure versus effective full power years (EFPY) for various head operating temperatures. Analyses were then performed to estimate the effect of visual inspections and non-visual NDE of the plants in the most critical inspection category, using the conservative assumption discussed above (see Concern #1 response) for the probability of leakage detection by visual inspection. These analyses demonstrate that performing visual inspections significantly reduces the probability of nozzle ejection, and that performing such examinations on a regular basis (in accordance with the inspection schedule prescribed in the MRP Inspection Plan) effectively maintains the probability of nozzle ejection at an acceptably low level indefinitely.

In the extremely unlikely event that nozzle failure and rod ejection were to occur due to an undetected circumferential crack, an acceptable margin of safety to the public would still be maintained (Reference 8). The PFM analyses generically demonstrate that the resulting incremental change in core damage frequency due to CRDM nozzle cracking can be maintained at less than 1×10^{-6} per plant year, through a program of periodic visual examinations performed in accordance with the MRP inspection plan. This result is consistent with NRC Regulatory Guide 1.174 that defines an acceptable change in core damage frequency (1×10^{-6} per plant year) for changes in plant design parameters, technical specifications, etc (Reference 6).

NRC Concern 4: "The environment in the CRDM housing/RPV head annulus will likely be more aggressive after any through-wall leakage because potentially highly concentrated borated primary water may become oxygenated. This raises concerns about the technical basis for current crack growth rate models."

PG&E Response: The MRP panel of international experts on stress corrosion cracking (SCC) (including representatives from ANL/NRC Research), prior to the Davis-Besse incident, gave extensive consideration to the likely environment in the annulus between a leaking CRDM nozzle and the RPV head (Reference 7). After reviewing the conclusions following the Davis-Besse event, the relevant arguments remain valid for leak rates that are less than 1 liter/h or 0.004 gpm, which plant experience has shown to envelope leaks to date, and which are detectable by visual inspections. The conclusions were:

1. An oxygenated crevice environment is highly unlikely because:

   - Back diffusion of oxygen is too low compared to counter flow of escaping steam (two independent assessments based on molecular diffusion models were examined).
   - Oxygen consumption by the metal walls would further reduce its concentration.
   - Presence of hydrogen from leaking water and diffusion through the upper head results in a reducing environment.
   - Even if the concentration of hydrogen was depleted by local boiling, coupling between low alloy steel and Alloy 600 would keep the electrochemical potential low.
   - Corrosion potential will be close to the Ni/NiO equilibrium, resulting in PWSCC susceptibility similar to normal primary water.

2. The most likely crevice environments are either hydrogenated steam or PWR primary water within normal specifications and both would result in similar (i.e., non-accelerated) susceptibility of the Alloy 600 penetration material to PWSCC.

3. Concentration of PWR primary water solutes, lithium hydroxide, and boric acid, can occur if the boiling interface happens to be close to the topside of the J-weld. However, this is a low probability occurrence. Of most concern here would be the accelerating effect of elevated pH on SCC, but calculations and experiments show that any changes are expected to be small, in part because of the buffering effects of precipitates. A factor of 2x on the crack growth rate (CGR) conservatively covers possible acceleration of PWSCC, even up to a high-temperature pH of around 9.

For larger leakage rates that could lead to local cooling of the head, concentration of boric acid, and development of a sizeable wastage cavity adjacent to the penetration, the above arguments no longer directly apply. However, as stated above, leaks would be detected and corrected prior to progressing to these larger leak rates. Limited data (Berge et al., 1997) on SCC in concentrated boric acid solutions indicate that:

- Alloy 600 is very resistant to transgranular SCC (material design basis).
- High levels of oxygen and chloride are necessary for intergranular cracking to occur at all.
- The effects are worse at intermediate temperatures, suggesting that the mechanism is different from PWSCC.

The above considerations show that there is no basis for assuming that any post-leakage crevice environment in the CRDM housing/RPV head annulus would be significantly more aggressive with regard to SCC of the Alloy 600 penetration material than normal PWR primary water, irrespective of the assumed leakage rate and/or annulus geometry. The current industry model (Reference 7), which includes a factor of 2x on CGR to cover residual uncertainty in the composition of the annulus environment, remains valid.

NRC Concern 5: "The presence of boron deposits or residue on the RPV head, due to leakage from mechanical joints, could mask pressure boundary leakage. This raises concerns that a through-wall crack may go undetected for years."

PG&E Response: The experience at Davis-Besse demonstrates that effective visual inspection for leakage from CRDM nozzle and weld PWSCC requires unobstructed inspection access and that the head surface be free of pre-existing boric acid deposits. Accumulations of debris and boric acid deposits from other sources can interfere with a determination as to the presence or absence of boric acid deposits extruding from the tube-to-head annulus. Therefore, to effectively perform a visual examination of the RPV head outer surface for penetration leakage, boric acid deposits and debris accumulations must be carefully inspected, removed, and the area reinspected.

Accordingly, any boric acid deposit on the vessel head will be evaluated to determine the source in accordance with existing industry guidance, supplemented by the most recent industry experience at the time of the inspection. These requirements are incorporated in the visual inspection guidance contained in the MRP Inspection Plan. Implementation of these requirements will preclude an undetected through-wall crack.

As stated in PG&E's 15-day response to NRC Bulletin 2002-01, DCL-02-033, dated April 2, 2002, the RPV heads at DCPP are in good condition and there are no pre-existing boric acid deposits that would mask a visual inspection. The 1R11 inspection demonstrated that the DCPP Unit 1 head is clean and had no boric acid deposits that would mask cracks.

NRC Concern 6: "The causative conditions surrounding the degradation of the RPV head at Davis-Besse have not been definitively determined. The staff is unaware of any data applicable to the geometries of interest that support accurate predictions of corrosion mechanisms and rates."

PG&E Response: The causes of the Davis-Besse degradation are sufficiently well known to avoid significant wastage. The root cause evaluation performed by the utility (Reference 9) clearly identifies the root cause as PWSCC of CRDM nozzles followed by boric acid corrosion. The large extent of degradation has been attributed to failure of the utility to address evidence that had been accumulating over a five-year period of time (Figure 26 of Reference 9).

The industry has provided utilities with guidance for bare metal RPV head visual inspections to ensure that conditions approaching those that existed at Davis-Besse will not occur. Visual inspection guidelines have been provided by EPRI to the member utilities (Reference 3), and a workshop was conducted to thoroughly review industry experience, regulatory requirements, leakage detection, and analytical work performed to understand the causes of high wastage rates (Reference 10).

Subsequent to significant wastage being discovered on the Davis-Besse RPV head, the industry has performed analytical work to determine how a small leak such as seen at several plants can progress to the significant amounts of wastage identified at Davis-Besse. This work is referenced within the basis for the MRP Inspection Plan (Reference 11).

The analytical work shows that the corrosion rate is a strong function of the leakage rate. Finite element thermal analyses show that leak rates must reach approximately 0.1 gpm for there to be sufficient cooling of the RPV top head surface to support concentrated liquid boric acid that will produce high corrosion rates. The leak rate is in turn a strong function of the crack length. The effect of crack length above the J-groove weld on crack opening displacement and area has been confirmed by finite element modeling of nozzles including the effects of welding residual stresses and axial cracks. Leak rates have been calculated using crack opening displacements and areas determined by the finite element analyses and leak rate models based on PWSCC cracks in steam generator tubes.

Cracks that only reach the annulus through the base metal or weld metal will result in small leaks such as those that produced small volumes of boric acid deposits on several RPV heads at locations where the CRDM nozzles penetrate the RPV head outside surface. These leaks have been detected by visual inspections. These leaks are typically on the order of 10^{-6} to 10^{-4} gpm. There is no report of any of these leaks resulting in significant corrosion. A leak rate on the order of 10^{-3} gpm will result in the release of about 500 in^3 of boric acid deposits in an 18-month operating cycle, which will also be detectable by visual inspections.

The time for a crack to grow from a length that will produce a leak rate of 10^{-3} gpm to a leak rate of 0.1 gpm has been estimated by deterministic analyses based on the MRP crack growth models to be 1.7 years for plants with 602°F head temperatures. DCPP Unit 1 and Unit 2 head temperatures are less than 602°F and thus are bounded by the analyses. Probabilistic analyses show that there is less than a 1×10^{-3} probability that corrosion will proceed to the point that the inside surface cladding of the head would be uncovered over a significant area before the wastage would be detected by supplemental visual inspections as required under the MRP Inspection Plan. During the transition from leak rates of 1×10^{-3} gpm to 0.1 gpm, loss of material will be by relatively slow processes (Reference 11).

The ability to detect leakage prior to the risk of structural failure is illustrated by Figure 26 of the Davis-Besse root cause analysis report. Visual evidence of boric acid deposits on the RPV head existed for five years prior to the degradation being identified. Guidance provided in the MRP Inspection Plan would not permit these conditions to exist without determining the source of the leak, including nondestructive examinations if necessary. The inspections that have been and will be performed at DCPP ensure that any leakage will be detected and corrected prior to causing RPV head wastage.

Therefore, while the exact timing of the event progression at Davis-Besse cannot be definitively established, the probable durations can be predicted with sufficient certainty to conclude that a visual inspection regimen can ensure continued structural integrity of the RCS pressure boundary.

NRC Requested Information

(2) *Within 30 days after plant restart following the next inspection of the RPV head and VHP nozzles to identify the presence of any degradation, all PWR addressees are requested to provide:*

A. *the inspection scope and results, including the location, size, extent, and nature of any degradation (e.g., cracking, leakage, and wastage) that was detected; details of the NDE used (i.e., method, number, type, and frequency of transducers or transducer packages, essential variables, equipment, procedure and personnel qualification requirements, including personnel pass/fail criteria); and criteria used to determine whether an indication, "shadow," or "backwall anomaly" is acceptable or rejectable.*

PG&E Response:

PG&E will submit the information as requested.

REFERENCES

1. EPRI Letter MRP 2002-086, "Transmittal of PWR Reactor Pressure Vessel (RPV) Upper Head Penetrations Inspection Plan, Revision 1, August 6, 2002," from Leslie Hartz, MRP Senior Representative Committee Chairman, August 15, 2002
2. EPRI Document MRP-75, "PWR Reactor Pressure Vessel (RPV) Upper Head Penetrations Inspection Plan, Revision 1," September 2002
3. EPRI Technical Report 1006899, "Visual Examination for Leakage of PWR Reactor Head Penetrations on Top of the RPV Head: Revision 1," March 2002
4. Appendix B of EPRI Document MRP-75 "Probability of Detecting Leaks in RPV Top Head Nozzles," September 2002
5. EPRI TR-103696, "PWSCC of Alloy 600 Materials in PWR Primary System Penetrations," July 1994
6. Appendix A of EPRI Document MRP-75 "Technical Basis for CRDM Top Head Penetration Inspection Plan," September 2002
7. EPRI Document MRP-55, "Crack Growth Rates for Evaluating Primary Water Stress Corrosion Cracking (PWSCC) of Thick-Wall Alloy 600 Material," July 2002
8. Walton Jensen, NRC, Reactor Systems Branch, Division of Systems Safety and Analysis (DSSA), Sensitivity Study of PWR Reactor Vessel Breaks, memo to Gary Holahan, NRC, DSSA, May 10, 2002
9. Davis-Besse Nuclear Power Station Report CR2002-0891, "Root Cause Analysis Report – Significant Degradation of the Reactor Pressure Vessel Head," April 2002
10. EPRI Technical Report 1007336, "Proceedings of the EPRI Boric Acid Corrosion Workshop, July 25-26, 2002 (MRP-77)," September 2002
11. Appendix C of EPRI Document MRP-75 "Supplemental Visual Inspection Intervals to Ensure RPV Closure Head Structural Integrity," September 2002
12. Glenn White, Chuck Marks and Steve Hunt, Technical Assessment of Davis-Besse Degradation, Presentation to NRC Technical Staff, May 22, 2002
13. EPRI Technical Report 1006284, "PWR Materials Reliability Program Response to NRC Bulletin 2001-01 (MRP-48)," August 2001