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PG&E Letter DCL-03-056

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
Response to NRC Request for Additional Information Regarding License Amendment Request 02-05, "Revision to Technical Specification Table 3.3.1-1, 'Reactor Trip System Instrumentation,' and Revised Reactor Coolant System Flow Measurement"

Dear Commissioners and Staff:

On March 11, 2003, and March 18, 2003, respectively, the NRC staff identified additional information required to complete the evaluation associated with PG&E License Amendment Request (LAR) 02-05.

LAR 02-05 proposes to revise the term "minimum measured flow per loop" to "measured loop flow" in the allowable value and nominal trip setpoint for the Reactor Coolant Flow-Low reactor trip function contained in Technical Specification (TS) 3.3.1 Table 3.3.1-1, "Reactor Trip System Instrumentation." In addition, LAR 02-05 proposes to allow an alternate method for the measurement of reactor coolant system (RCS) total volumetric flow rate through measurement of the elbow tap differential pressures on the RCS primary cold legs. LAR 02-05 was submitted by PG&E letter DCL-02-097, "License Amendment Request 02-05, Revision to Technical Specification Table 3.3.1-1, 'Reactor Trip System Instrumentation,' and Revised Reactor Coolant System Flow Measurement," dated August 27, 2002.

PG&E's responses to the requests for additional information are included in Enclosure 1.

The additional information does not affect the results of the safety evaluation or no significant hazards consideration determination previously transmitted in PG&E letter DCL-02-097.

A001

As discussed with the NRC project manager, PG&E has requested approval of LAR 02-05 by June 1, 2003 to address the current low flow margin for Diablo Canyon Power Plant (DCPP) Unit 2 resulting from steam generator tube plugging during the recent DCPP Unit 2 refueling outage.

If you have any questions regarding this response, please contact Stan Ketelsen at 805-545-4720.

Sincerely,

David H. Oatley
Vice President and General Manager - Diablo Canyon

kjs/4328
Enclosures
cc: Edgar Bailey, DHS
Ellis W. Merschoff
David L. Proulx
Diablo Distribution
cc/enc: Girija S. Shukla
David Jaffe

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

David H. Oatley, of lawful age, first being duly sworn upon oath says that he is Vice President and General Manager - Diablo Canyon of Pacific Gas and Electric Company; that he has executed this response to the request for additional information on License Amendment Request LAR 02-05 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.

David H. Oatley
Vice President and General Manager - Diablo Canyon

Subscribed and sworn to before me this 15th day of May 2003.

Notary Public
County of San Luis Obispo
State of California

SANDRA EATHERLY
Commission # 1225422
Notary Public - California
San Luis Obispo County
My Comm. Expires Jul 18, 2003

PG&E Response to NRC Request for Additional Information Regarding License Amendment Request 02-05, "Revision to Technical Specification Table 3.3.1-1, 'Reactor Trip System Instrumentation,' and Revised Reactor Coolant System Flow Measurement"

Questions received on March 11, 2003

NRC Question 1

"Page 16 of enclosure 1, the first full paragraph identifies two significant differences between the uncertainty calculation used in WCAP-15113 and NUREG/CR-3659 and justifies the differences by making a general statement. Provide the detailed justification on how the differences in the methodology used by WCAP-15113 meets the intent of NUREG/CR-3659 methodology."

PG&E Response to Question 1

NUREG/CR-3659 (PNL-4673), "A Mathematical Model for Assessing the Uncertainties of Instrumentation Measurements for Power and Flow of PWR Reactors," dated February 1985, identifies a process and terms that should be considered in determining the measurement uncertainty of reactor coolant system (RCS) Flow. It limits the discussion to the performance of a single precision calorimetric measurement for either power or RCS Flow. The process described in WCAP-15113, Revision 1, "RCS Flow Measurement Using Elbow Tap Methodology at Diablo Canyon Units 1 and 2," dated April 2002, utilizes the process and terms identified in NUREG/CR-3659 and extends it to encompass the additional uncertainties required by the use of the Elbow Tap Methodology. There are two significant differences between the uncertainty calculation methodology used in WCAP-15113, Revision 1, and that recommended by NUREG/CR-3659. The first difference in the uncertainty calculation used in WCAP-15113, Revision 1, from that in NUREG/CR-3659 is the utilization of multiple precision calorimetric flow measurements. The elbow tap process defines a baseline calorimetric flow for correlation with elbow tap measurements in future cycles. As required by the NRC staff, the baseline calorimetric flow is based on precision flow calorimetric measurements over several cycles. In the specific instance of Diablo Canyon Power Plant (DCPP) Units 1 and 2, two measurements were taken for Cycle 1 and two measurements were taken for Cycle 2, on each unit. As described in Section 4.3.1 of WCAP-15113, Revision 1, the baseline calorimetric flow is then based either on the average of the four calorimetric flows or on the calorimetric flow measured in Cycle 1, whichever is smaller (i.e., more conservative). The unit with the more limiting (i.e., larger) average of the measurement uncertainties was determined and that unit's measurement uncertainties were conservatively used to envelope the precision calorimetric flow measurement average uncertainty for both units.

The second difference with respect to NUREG/CR-3659 is the presumption that the elbow taps are normalized to the single cycle specific precision flow calorimetric measurement each cycle. WCAP-15113, Revision 1, identifies a process by which the

baseline measurements are utilized to establish a correlation between elbow tap differential pressure and the previously performed precision flow calorimetric measurements. This process requires the appropriate inclusion of additional uncertainties associated with the elbow tap differential pressure measurement each cycle. The additional uncertainties can be easily determined by a comparison of Table 3-10 of WCAP-11082, Revision 5, "Westinghouse Setpoint Methodology for Protection Systems Diablo Canyon Units 1 & 2, 24 Month Fuel Cycle Evaluation," dated January 1997, and Table A-5 of WCAP-15113, Revision 1. WCAP-11082, Revision 5, was submitted to the NRC in PG&E letter DCL-96-214, "Transmittal of WCAPs to Support NRC Review of License Amendment Request (LAR) 96-10, Revision of Technical Specifications to Support Extended Fuel Cycles to 24 Months," dated January 31, 1997, in support of LAR 96-10 submitted in PG&E letter DCL-96-213, "License Amendment Request 96-10 Revision of Technical Specifications to Support Extended Fuel Cycles to 24 Months," dated December 9, 1996, and approved by the NRC for DCPP by Amendment No. 122 to Facility Operating License No. DPR-80 and Amendment No. 120 to Facility Operating License No. DPR-82 in NRC letter "Issuance of Amendments for Diablo Canyon Nuclear Power Plant, Unit No. 1 (TAC M97472) and Unit No. 2 (TAC No. M97473)," dated February 17, 1998.

<u>NRC Question 2</u>

"Appendix A of WCAP-15113 lists the assumptions used in the uncertainty calculation without providing any justification. Provide the basis and justification for the acceptability of these assumptions."

<u>PG&E Response to Question 2</u>

The uncertainty calculation assumptions noted on page A-2 of WCAP-15113, Revision 1, are a list of items that are under plant control. For example, Item 1 is an Eagle 21 scaling constant that is modeled in the elbow tap uncertainties. If the scaling constant is changed, the elbow tap uncertainties will change. Item 2 identifies that no allowances were made for the effects of reduced power on the elbow tap differential pressure normalization. A small power mismatch, i.e., correlation above 85 percent, will have no significant effect, correlation below 85 percent should have some compensation in uncertainties. Item 3 identifies how many elbow tap channels were assumed in the averaging process and are reflected in the uncertainty calculation. Items 4, 5, 7 and 8 place controls on the elbow tap differential pressure transmitter calibration and operation environment. Item 6 identifies the uncertainties of the two control systems. If the uncertainties of the control systems are increased, they would have an effect on the elbow tap uncertainty. PG&E has verified that the uncertainty calculation assumptions contained on page A-2 of WCAP-15113, Revision 1, are met for DCPP Units 1 and 2 for the baseline flow calorimetric calculations. PG&E will include requirements to control the uncertainty calculation assumptions contained in page A-2 of WCAP-15113, Revision 1, to ensure they are within the assumed limits when the RCS flow is measured using the elbow tap methodology.

NRC Question 3

"Appendix A of WCAP-15113 lists the instrument uncertainties used in determining the acceptability of the analysis. Confirm that these numbers are based on the 24±6 (25% allowance provided in the TS) months and are determined using 95/95 criteria."

PG&E Response to Question 3

Only one term in the uncertainty calculation is based on a 24±6 month surveillance interval; the elbow tap transmitter drift (SD on Tables A-4 and A-5 of WCAP-15113, Revision 1). All other uncertainty terms were determined based on the surveillance interval required by the DCPP Units 1 and 2 Technical Specifications and reflected in DCPP Units 1 and 2 plant procedures when the surveillance was or is performed for the hardware (e.g., transmitters for the calorimetric flows were on 18 month intervals during Cycles 1 and 2 and process racks were/are on 92 day intervals). A 95/95 basis is used for all inputs to the flow uncertainty calculations.

Questions received on March 18, 2003

NRC Question 1

"You stated several times that removal of the RTD bypass system had no effect on total reactor coolant system (RCS) flow rate, but that the elimination increased flow rate through the elbows by about 0.15%. The staff agrees that elbow tap flow rate is not equal to loop flow rate at the reactor vessel nozzles when the manifolds are installed, and a correction is therefore necessary for that effect. However, the staff also believes there are several effects that combine to reduce total RCS flow rate at the reactor vessel nozzles by 250 gpm to 300 gpm when the bypass is removed. These include (1) removal of the cold leg bypass, thus forcing additional reactor coolant pump (RCP) flow to pass through the reactor vessel and steam generators and (2) removal of the hot leg bypass, thus forcing additional hot leg flow to pass through the steam generators. Further, the staff believes your model may involve a convergence process where you (1) assume loop flow rates at the reactor vessel nozzles and compute pressure drop through the RCS, (2) use the pressure drop with a RCP flow rate correlation to compute flow rate provided by the RCP, and (3) correct the assumed flow rates until agreement is obtained between the assumed flow rates and the calculated RCP flow rates. Without the manifolds installed, the converged assumed flow rates and RCP flow rates should be equal. However, if manifolds are installed, the RCP flow rate must be decreased by the cold leg bypass flow rate before making the comparison to the assumed loop flow rate. This affects the predicted effect of removing manifolds. Please discuss your model and your conclusions with respect to the above staff discussion."

PG&E Response to Question 1

The Westinghouse RCS flow analyses were based on the assumption that elimination of the small resistance temperature detector (RTD) bypass manifold flows had a

negligible effect on RCS flows. Since calculations determined the elbow taps would measure about 0.15 percent more flow after removal of the hot leg manifolds, elbow tap flows have been adjusted to avoid measuring a non-conservative flow. During the preparatory work for the DCPP elbow tap flow program, Westinghouse performed detailed RCS flow calculations to confirm the above assumption. These calculations, specifically applicable to DCPP defined differences in flow resistances with and without the parallel bypass flow paths. The calculation with parallel bypass flow paths defined a closed solution, and no trial-and-error calculations were required. The calculations confirmed that the flow resistance applied at the RCP was slightly higher without the bypass manifolds. The DCPP RCP flow without bypass manifolds was calculated to be 85 gpm per RCP lower than with bypass manifolds. Since the manifold flow bypassing the reactor vessel was 100 gpm per RCP, the net reactor vessel flow without manifolds increased by only 15 gpm per RCP, or less than 0.02 percent flow. Since the flow increase was determined to be negligible, adjustments to reactor flow were considered to be unnecessary.

NRC Question 2

"Please substantiate your use of a 0.3 percent flow rate change in correcting for impeller smoothing when adjusting Cycle 2 flow rates to Cycle 1. Why, for example, isn't the correction 0.5 percent? 0.1 percent? Zero? Why does your assumption differ from that of WCAP-14750-P-A Revision 1 on Page 26 where impeller smoothing is stated to reduce flow rate by about 0.6 to 0.8 percent with an assumed smoothing reduction of 0.6 percent prior to flow measurement for the second fuel cycle. The staff's concern is that providing any correction to compensate for smoothing by adding flow is in the non-conservative direction. For example, if all smoothing occurred prior to entering Cycle 2, then no compensation should be made. Therefore, any compensation should be based on substantiation that impeller smoothing continued into Cycle 2."

PG&E Response to Question 2

The decision to use an impeller smoothing flow adjustment at DCPP of 0.3 percent in Cycle 2 and another adjustment of 0.3 percent in Cycle 3 was based on preliminary evaluations of elbow tap flow measurements in 1993. When the current elbow tap evaluations were initiated, revising the adjustment to 0.6 percent in Cycle 2 was considered, but the adjustment of 0.3 percent for Cycles 2 and 3 was retained because it did not change the overall conclusions relative to elbow tap flow measurements.

As discussed in WCAP-14750-P-A, Revision 1, "RCS Flow Verification Using Elbow Taps at Westinghouse 3-Loop PWRs," dated September 1999, the elbow tap flow measurement procedure approved by the NRC in 1999 states that calorimetric flows from cycles used to define baseline calorimetric flow shall be adjusted for known hydraulics differences so that these flows are consistent with the baseline cycle hydraulics configuration. Therefore, the average of these flows is affected only by the repeatability of the instrumentation, and not by a change in system hydraulics. Configuration adjustments for impeller smoothing as well as steam generator tube

plugging, thimble plug removal, etc., are applied when appropriate. The Westinghouse evaluation of elbow tap flows at other plants has confirmed an impeller smoothing flow reduction of 0.6 percent. For DCPP, although the larger adjustment of +0.6 percent could have been applied, as typically applied at other plants, the impeller smoothing adjustment of +0.3 percent was applied to the Cycle 2 calorimetric flows. As a result, the baseline calorimetric flow defined by the procedure in WCAP-14750-P-A, Revision 1, was slightly lower and was more conservative relative to the baseline calorimetric flow that would have been specified if the +0.6 percent adjustment had been applied.

NRC Question 3

"An audit calculation performed by the staff showed behavior due to steam generator plugging similar to that described in Section 6.5.1 and the staff believes the effect of steam generator plugging can be accurately predicted. This appears to contradict your discussion in the first paragraph where you apparently cannot differentiate between flow reduction behavior due to steam generator tube plugging and due to changes within the reactor vessel. This, in turn, reflects on your conclusion that you can use the elbow tap flow measurements in future cycles because of observed conservative behavior relative to the calculations. Consequently, please expand your discussion of Section 6.5.1 in WCAP-15113, Revision 1, to better describe the agreements and differences and to address the above staff comments."

PG&E Response to Question 3

As discussed in WCAP-14750-P-A, Revision 1, the comparison of elbow tap and best estimate flow trends is intended to confirm that the flow defined by the elbow taps is reasonable or conservative relative to the best estimate flow trend. The acceptance limit discussed in this report assures that an elbow tap flow that exceeds the best estimate flow trend by more than the elbow tap repeatability allowance of +0.4 percent is not used. Based on measurement uncertainty analyses, the uncertainty related to repeatability would be somewhat larger, so the smaller allowance of +0.4 percent is conservative when applied in the elbow tap procedure. The degree of flow trend agreement is affected by elbow tap measurement repeatability and best estimate hydraulic model uncertainty. Differences of up to 0.4 to 0.5 percent do not indicate an unacceptable measurement or prediction. There have been a few cases where elbow tap measurements differed from (usually were lower than) the best estimate trend by more than this allowance. At other plants, additional evaluations have found a cause for the larger difference, such as a calibration shift. In some cases, the differences occurred in cycles after initial startup and before elbow tap flow measurements were being used to verify flow, so less accurate procedures may have been used to obtain these measurements. In these cases, the baseline cycle and the most recent cycle elbow tap measurements have been in better agreement, as is the case for DCPP. The differences for the most recent cycles are considered to be acceptable to meet the elbow tap flow methodology requirements. Therefore, the use of elbow taps for future cycles is still considered to be appropriate.

NRC Question 4

"If the staff accepts the presumption that elbow tap results are correct, then the behavior illustrated in Figures 6-1 and 6-2 of WCAP-15113 Rev 1 appears to lead to a conclusion that the calculated behavior may be missing important phenomena. Conversely, if the calculated results are correct, then something would appear to be incorrect with the elbow tap data. The staff notes it has also observed that such disagreements at another plant were due, in part, to failure to properly calibrate and process the elbow tap data and, in part, due to the need for analysis modeling changes. Please provide an explanation of the differences illustrated in these figures or, if you do not have an explanation, then describe your investigation that led to the conclusion that you could not explain the differences and assess these differences with respect to your elbow tap conclusions."

Response to Question 4

The degree of flow trend agreement is affected by elbow tap measurement repeatability and best estimate hydraulic model uncertainty. Differences of up to 0.4 to 0.5 percent do not indicate an unacceptable measurement or prediction. There have been a few cases where elbow tap measurements differed from (usually were lower than) the best estimate trend by more than this allowance. At other plants, additional evaluations have found a cause for the larger difference, such as a calibration shift. In some cases, the differences occurred in cycles after initial startup and before elbow tap flow measurements were being used to verify flow, so less accurate procedures may have been used to obtain these measurements. In these cases, the baseline cycle and the most recent cycle elbow tap measurements have been in better agreement, as is the case for DCPP. The differences for the most recent cycles are considered to be acceptable to meet the elbow tap flow methodology requirements. Therefore, the use of elbow taps for future cycles is still considered to be appropriate. It is noted that even the largest difference of approximately 1 percent between the elbow tap measurement and the best estimate trend in Figures 6-1 and 6-2 of WCAP-15113, Revision 1, is well within the 2.4 percent measurement uncertainty allowance for RCS flow measurement.

NRC Question 5

"Please discuss the effect of fuel assembly/core fouling and boric acid concentration changes on RCS flow rate during operating cycles. Include an assessment of the effect on the four calorimetrics you selected from Cycles 1 and 2 as summarized in Table 6-5 of WCAP-15113 Revision 1."

PG&E Response to Question 5

The effects of fuel assembly fouling and boric acid concentration are not included in calorimetric or elbow tap measurement procedures. Elbow tap data is compared to the hydraulic flow model at the beginning of cycle when minimal fuel crud buildup exists.

The effect of fuel crud buildup on the four baseline calorimetrics is conservative and does not require additional modeling. The elbow tap flow data is taken at the beginning of cycle when the RCS boric acid concentration is near its peak. RCS boric acid concentration will change during the cycle, approaching zero at the end of the cycle. The effects of RCS boric acid concentration during cycle operation can be monitored by the elbow tap flow data. Technical Specification Surveillance Requirement (SR) 3.4.1.3 requires verification that the RCS total flow rate is within the limits of Table 3.4.1-1 for DCPP Unit 1 and Table 3.4.1-2 for DCPP Unit 2 every 12 hours. Verification that SR 3.4.1.3 is met is performed by using indicated RCS loop flow rate which is based on the ΔP from the elbow taps located in the RCS cold legs. It is noted that there is no correction required to the indicated RCS loop flow to account for RCS boron concentration changes during verification that SR 3.4.1.3 is met.

NRC Question 6

"If you determine that any of the above results in changes in your determinations, then please assess the impact on your uncertainty evaluations."

PG&E Response to Question 6

None of the considerations discussed in the above questions and responses result in the need to revise the evaluation of the DCPP Units 1 and 2 elbow tap flow measurements or to revise the measurement uncertainties.

NRC Question 7

"The proposed technical specifications (TSs) in Table 3.3.1-1 (page 3 of 7) contain the term "measured loop flow" and percentages of this are used as an allowable value and a nominal trip setpoint. The existing TSs contained a footnote that defined measured loop flow as 89,800 gpm per loop for Unit 1 and 90,625 gpm per loop for Unit 2. The footnote is deleted in the proposed TSs. What is the definition of "measured loop flow" in the proposed TSs and where is this definition located? (The staff's concern is that, without clarification, "measured loop flow" could be taken as the indicated value although that is not the intent.)"

PG&E Response to Question 7

"Measured loop flow" is the loop flow measured by the cold leg elbow tap differential pressure channels. Upon approval of the LAR, the following sentence will be added to the Bases of Technical Specification 3.3.1, "RTS Instrumentation," Function 10, "Reactor Coolant Flow-Low": "The allowable value and nominal trip setpoint are based on a percentage of the loop flow measured by the RCS cold leg elbow tap differential pressure channels."

Several prior amendments to plant Technical Specifications such as those for Seabrook (Amendment 77, page 2-5), Shearon Harris (Amendment 107, page 2-5), Comanche

Peak 1 & 2 (Amendment 64, page 3.3-17) and Kewaunee (Amendment 162, page 2.3-3) have used the term "indicated loop flow" based on Westinghouse recommendations. Based on review of Seabrook Amendment 77, PG&E chose to use the term "measured loop flow" instead of "indicated loop flow" because the allowable value and nominal trip setpoint are based on a percentage of the flow measured by the elbow taps. The percentage of flow is not based on the control board indicated loop flow which includes additional indication uncertainties. PG&E believes the use of "measured loop flow" is a more accurate term since the allowable value and nominal trip setpoint are based on the percentage of the actual measured elbow tap loop flow and not the percentage of the control board indicated loop flow, which includes additional uncertainties. The use of the term "indicated loop flow" could lead to the literal interpretation that the control board indication uncertainties would need to be considered in the setpoint. However, since the reactor coolant flow-low allowable value and nominal trip setpoint are based on the percentage of loop flow measured by the elbow taps and it is physically impossible for them to be based on the percentage of the control board indicated loop flow, the use of measured loop flow or indicated loop flow actually means the same thing.