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PG&E Letter DCL-06-112

U.S. Nuclear Regulatory Commission
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Docket No. 50-275, OL-DPR-80
Diablo Canyon Unit 1
Response to NRC Request for Information Regarding License Amendment Request 05-07, "Revision to Technical Specification 5.6.5, 'Core Operating Limits Report (COLR)'"

Dear Commissioners and Staff:

On August 1, 2006, the NRC requested information related to Pacific Gas and Electric Company (PG&E) Letter DCL-05-146, License Amendment Request 05-07, "Revision to Technical Specification 5.6.5, 'Core Operating Limits Report (COLR),'" dated December 16, 2005. PG&E's response to the August 1, 2006, request is included in the Enclosure. This information was discussed with the NRC staff in a conference call on August 2, 2006.

The response provided in this submittal does not affect the results of the technical evaluation or the no significant hazards consideration determination previously transmitted in PG&E Letter DCL-05-146.

PG&E makes no regulatory commitments or revisions to regulatory commitments in this letter.

If there are any questions regarding this information, please contact Mr. Stan Ketelsen at (805) 545-4720.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on September 27, 2006.

Sincerely,

James R. Becker

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Enclosure
cc: Edgar Bailey, DHS
Bruce S. Mallett, Region IV
Terry W. Jackson, Senior Resident Inspector
Diablo Distribution
cc/enc: Alan B. Wang

Response to NRC Request for Information Regarding License Amendment Request 05-07, "Revision to Technical Specification 5.6.5, 'Core Operating Limits Report (COLR)'"

Questions received on August 1, 2006:

NRC Question 1

Please provide a statement to the effect that "PG&E and its large-break loss-of-coolant accident (LBLOCA) analyses vendor have ongoing processes that assure that the input values and ranges of parameters for Diablo Canyon Unit 1 LBLOCA analyses conservatively bound the values and ranges of those parameters for the as-operated Diablo Canyon Unit 1 plant." (The statement addresses certain of the programmatic requirements of 10 CFR 50.46, Section (c)). The statements in the December 16, 2005 request [LAR 05-07] were too specific and not sufficiently comprehensive to permit a timely review.

PG&E Response

Pacific Gas and Electric Company (PG&E) and its LBLOCA analyses vendor (Westinghouse) have ongoing processes which assure that the ranges and values of input of parameters for Diablo Canyon Power Plant (DCPP) Unit 1 LBLOCA analyses conservatively bound the ranges and values of those parameters for the as-operated DCPP Unit 1.

NRC Question 2

The December 16, 2005 letter provided peak cladding temperature results for Unit 1 obtained from the analyses performed using the CQD [Code Qualification Document] methodology. The letter did not provide oxidation and core-wide hydrogen generation results. Please provide these results as well.

PG&E Response

The following text summarizes the basis for concluding that the original Best-Estimate Loss-of-Coolant Accident (BELOCA) oxidation and core-wide hydrogen generation results generated in WCAP-14775 (Reference 3) remain conservatively bounding for Unit 1.

Maximum Cladding Oxidation

Acceptance Criterion (b)(2) of 10 CFR 50.46 defines the maximum allowable cladding oxidation as 17 percent of the unoxidized cladding thickness. The BELOCA methodology as approved in Reference 2 addresses this criterion using a modified HOTSPOT (a one-dimensional conduction code) calculation for a

plant-specific transient which has a reflood peak clad temperature (PCT) in excess of the estimated 95 percent probability level. This modified HOTSPOT calculation was performed in the same manner as described in Section 8-3-4 of WCAP-14775 (Reference 3), with the exception that the time period during reflood is increased by 30 percent. This increase in time period reflects the observation that WCOBRA/TRAC (a thermal-hydraulic code) may underpredict the time to PCT and the time to quench, based on comparisons with reflood heat transfer tests. The 30 percent increase in time period is a conservative means to account for this uncertainty. This time period increase results in additional oxidation in the HOTSPOT calculation, because the oxidation is strongly dependent on time at temperature.

The original analysis was performed using superposition case 3 for the reflood-2 period. The BELOCA HOTSPOT nominal PCT was 2238°F. The burst location was limiting for cladding oxidation with a local reaction of 11 percent as summarized in Section 10-2 of WCAP-14775 (Reference 3). Because the PCT for this original transient is well above the reanalysis 95th percentile PCT, the existing calculation remains a bounding demonstration of compliance with the maximum cladding oxidation requirement of less than 17 percent.

This evaluation confirms that Acceptance Criterion (b)(2) of 10 CFR 50.46 is satisfied.

Maximum Hydrogen Generation

Acceptance Criterion (b)(3) of 10 CFR 50.46 defines the maximum allowable hydrogen generation as 1 percent of the hypothetical amount that would be generated if all of the cladding in the active core region were to react with water. The approved BELOCA methodology identifies a number of options for satisfying this criterion. These options range from using a series of extremely conservative assumptions to the use of realistic, plant-specific assumptions. The level of rigor applied is dependent on the results obtained with the initial, conservative assumptions.

The approved analysis option that was used to demonstrate that 10 CFR 50.46, Acceptance Criterion (b)(3), was satisfied, is as follows:

> The same WCOBRA/TRAC transient run selected for the maximum local oxidation was used to calculate the maximum hydrogen generation in the core (original analysis, WCAP-14775 [Reference 3]). An additional WCOBRA/TRAC run with reduced power was applied to the lower power rods in the core. A conservative, generic rod census curve was used to establish the number of rods at specific powers. The rod census curve is verified on a cycle-specific basis. This calculation resulted in a maximum total hydrogen generation of 0.89 percent, indicating that Acceptance Criterion (b)(3) of 10 CFR 50.46 is satisfied.

The following evaluation demonstrates that the original BELOCA analysis remains bounding for the reanalysis. The core-wide oxidation response is dependent on the PCT of the core balance rods. In the current BELOCA model for Unit 1, Rods 3, 4, and 5, represent the core balance rods. Since Rod 5 (the low power rod) remains quenched for most of the transient, Rods 3 and 4 are more limiting.

The original analysis PCTs remain well above those calculated for the reanalysis. For all of the reanalysis superposition transients, the core balance rod PCTs are lower than those of the original analysis (superposition case 3) by more than 200°F during the majority of the transient. The exception is the blowdown peaks for which the balance rod PCTs are approximately the same. Because the accumulation of cladding oxidation occurs at high temperatures and develops over time, the contribution of the blowdown peaks, which occur for only a short time period, to the total cladding oxidation is not significant.

Because the PCTs for the reanalysis are significantly lower than the original analysis, and because the PCT for the current Analysis of Record transient is well above the reanalysis 95th percentile PCT, the existing calculation, which resulted in a maximum total hydrogen generation of 0.89 percent, remains a bounding demonstration of compliance with the core-wide oxidation limit of less than 1 percent.

Coolable Geometry and Long Term Cooling

Acceptance Criterion (b)(4) of 10 CFR 50.46 requires that the calculated changes in core geometry are such that the core remains amenable to cooling. Acceptance Criterion (b)(5) of 10 CFR 50.46 requires that long term core cooling be provided following the successful initial operation of the Emergency Core Cooling System. Criterion (b)(4) is satisfied by adherence to Criteria (b)(1) and (b)(2), and by assuring that fuel deformation due to combined LOCA and seismic loads is specifically addressed. Compliance with Criteria (b)(1) and (b)(2) has been demonstrated for BELOCA applications as described above. In addition, the approved methodology specifies that the effects of LOCA and seismic loads on core geometry do not need to be considered unless grid crushing extends beyond the assemblies in the low power channel as defined in the DCPP WCOBRA/TRAC model. This has not been calculated to occur for DCPP Unit 1. Therefore, Acceptance Criterion (b)(4) is satisfied.

The approved Westinghouse position on Criterion (b)(5) is that this requirement is satisfied if a coolable core geometry is maintained and the core remains subcritical following the LOCA (Reference 1). This position is unaffected by the use of BELOCA methodology.

References

1. Letter, D. B. Vassallo (USNRC) to C. Eicheldinger (Westinghouse), "Topical Report, Evaluation for the Westinghouse ECCS Evaluation Model: Supplementary Information," May 30, 1975.

2. Letter, R. C. Jones, Jr. (USNRC) to N. J. Liparulo (Westinghouse), "Acceptance for Referencing of the Topical Report WCAP-12945(P), Westinghouse Code Qualification Document for Best-Estimate Loss of Coolant Analysis," June 28, 1996.

3. WCAP-14775, Cerrone, M. B., et al., "Best-Estimate Analysis of the Large Break Loss-of-Coolant Accident for Diablo Canyon Power Plant Units 1 & 2 to Support 24-Month Fuel Cycles and Unit 1 Uprating," January 1997.

4. WCAP-12945-P-A, Addendum 1-A, Revision 0, Nissley, M. E., "Method for Satisfying 10 CFR 50.46 Reanalysis Requirements for Best-Estimate LOCA Evaluation Models," December 2004.