LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
DIABLO CANYON UNIT 1	0 5 0 0 0 2 7 5	1 OF 6

TITLE (4) NON-CONSERVATIVE PENALTY USED FOR THE HEAT FLUX HOT CHANNEL FACTOR MULTIPLIER DUE TO VENDOR OVERSIGHT

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MON	DAY	YR	YR	SEQUENTIAL NUMBER	REVISION NUMBER	MON	DAY	YR	FACILITY NAMES	DOCKET NUMBER (8)
07	21	93	93	- 0 0 4 -	0 0	10	18	93	DIABLO CANYON UNIT 2	0 5 0 0 0 3 2 3
										0 5 0 0 0

OPERATING MODE (9)	1
POWER LEVEL (10)	1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (11)

____ 10 CFR ____

_X_ OTHER - VOLUNTARY

(Specify in Abstract below and in text, NRC Form 366A)

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER AREA CODE	TELEPHONE NUMBER
DAVID P. SISK, SENIOR REGULATORY COMPLIANCE ENGINEER	805	545-4420

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
| | YES (if yes, complete EXPECTED SUBMISSION DATE)	| X | NO				

ABSTRACT (16)

This voluntary LER is being submitted for information only purposes as described in Item 19 of Supplement 1 to NUREG-1022.

The heat flux hot channel factor penalty of 2 percent in Technical Specification (TS) 4.2.2.2.e. was identified by PG&E personnel as being potentially non-conservative during the Unit 1 Cycle 6. The penalty of 2 percent was assumed by Westinghouse in the development of TS 4.2.2.2.e. to conservatively bound decreases in the heat flux hot channel factor margin between monthly core flux maps for anticipated increases in the heat flux hot channel factor. Units 1 and 2 have experienced decreases in the heat flux hot channel factor margin of more than 2 percent between monthly flux maps in the early portions of Unit 1 Cycle 6 and Unit 2 Cycles 4 and 5.

The root cause of this event was vendor oversight. A Westinghouse interim methodology for calculating a conservative penalty to the heat flux hot channel factor has been implemented. PG&E will implement, as appropriate, Westinghouse's long-term resolution of the heat flux hot channel factor non-conservative penalty issue.

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I. Plant Conditions

Units 1 and 2 have been in various modes and at various power levels.

II. Description of Event

A. Summary:

The heat flux hot channel factor, $F_Q(z)$ penalty of 2 percent in Technical Specification (TS) 4.2.2.2.e. was discovered by PG&E personnel to be non-conservative. Units 1 and 2 have experienced decreases in $F_Q(z)$ margin of more than 2 percent between monthly flux maps in the early portions of Unit 1 Cycle 6 and Unit 2 Cycles 4 and 5. The penalty of 2 percent is applied when the maximum $F_Q(z)$ / $K(z)$ is increasing between two successive core (AC) flux maps, where $K(z)$ is the normalized $F_Q(z)$ as a function of core height. The $F_Q(z)$ margin is the difference between measured $F_Q(z)$ and the $F_Q(z)$ limit.

The penalty of 2 percent was assumed in the development of TS 4.2.2.2.e. to conservatively bound decreases in $F_Q(z)$ margin between monthly core flux maps. A decrease in $F_Q(z)$ margin of greater than 2 percent between monthly flux maps results in a non-conservative penalty being used to evaluate the $F_Q(z)$ margin. However, neither Unit operated outside the requirements of the TS.

B. Background:

$F_Q(z)$ is the maximum local heat flux on the surface of a fuel rod (AC)(ROD) at core elevation z, divided by the average fuel rod heat flux.

A full core flux map is taken under equilibrium conditions to determine a measured $F_Q(z)$. This $F_Q(z)$ is then increased by 3 percent to account for manufacturing tolerances and further increased by 5 percent to account for measurement uncertainties. The resulting equilibrium measured $F_Q(z)$ including uncertainties is called $F_Q^M(z)$. During normal operation, $F_Q(z)$ is shown to be within its limits by performing surveillances. $F_Q(z)$ surveillance must be performed when power has been increased by 20 percent of rated thermal power over the thermal power when $F_Q^M(z)$ was last determined, or at least every 31 effective full power days (EFPD), whichever occurs first.

To verify operation below the TS $F_Q(z)$ limit, $F_Q(z)$ is shown to be less than or equal to a more restrictive limit, effectively the steady-state $F_Q(z)$ limit. The steady-state $F_Q(z)$ limit is the $F_Q(z)$ limit divided by the $W(z)$ transient function. $W(z)$ is a cycle-dependent function that accounts for power distribution transients

encountered during normal operation. Cycle-specific W(z) is specified in the Core Operating Limits Report (COLR), based on the Westinghouse Reload Safety Evaluation.

In order to account for the increase in $F_Q^M(z)$ that may occur between surveillances, TS 4.2.2.2.e requires that when performing the $F_Q(z)$ surveillance, the resulting maximum $F_Q(z)$ / K(z) value be compared to the maximum $F_Q(z)$ / K(z) determined from the previous flux map. If the maximum $F_Q(z)$ / K(z) has increased since the previous determination of $F_Q(z)$, then TS 4.2.2.2.e allows two options: (1) either the current $F_Q(z)$ must be increased by an additional 2 percent to account for further increases in $F_Q(z)$ before the next surveillance, or (2) the surveillance must be performed every seven EFPD.

If it is then determined that $F_Q^M(z)$, with the 2 percent penalty applied, exceeds the steady-state $F_Q(z)$ limit, continued operation is acceptable provided operational restraints are applied. Either the Axial Flux Difference (AFD) limits of TS 3.2.1 are to be reduced 1 percent for each percent that $F_Q(z)$ exceeds its limit, or the requirements of TS 3.2.2, which include reducing thermal power at least 1 percent for each 1 percent $F_Q(z)$ exceeds the limit and reducing the Power Range Nuclear Flux-High Trip Setpoints, must be complied with.

C. Event Description:

PG&E adopted the $F_Q(z)$ surveillance recommendation in WCAP-10216-PA, "Relaxation of Constant Axial Offset Control / F_Q Surveillance Technical Specification," in Units 1 and 2 Cycle 4. WCAP-10216-PA includes the assumption that the $F_Q(z)$ margin will decrease by no more than 2 percent between monthly flux maps. This assumption was based on previous (pre-1983) core designs which pre-date low-low leakage loading patterns, high amount of burnable poisons (such as integral fuel burnable absorbers (IFBAs)), and 18-month cycles.

A decrease in the $F_Q(z)$ margin of greater than 2 percent between monthly flux maps results in a non-conservative penalty being used to evaluate the $F_Q(z)$ margin for surveillances performed in accordance with TS 4.2.2.2.e. Therefore, $F_Q(z)$ could exceed the $F_Q(z)$ limit between monthly flux maps without implementing the operational restraints of TS 3.2.1 or 3.2.2.

Diablo Canyon Power Plant (DCPP) operating experience has shown that $F_Q^M(z)$ increases in the beginning of the cycle, with a subsequent peak at approximately 3000 megawatt days per metric ton uranium (MWD/MTU), and then exhibits a general decrease in $F_Q^M(z)$ throughout the remainder of the cycle.

DCPP Units 1 and 2 have experienced decreases in $F_Q(z)$ margin of more than 2 percent between monthly flux maps in the early portions of Unit 1 Cycle 6 and Unit 2 Cycles 4 and 5. However, at no time did either Unit operate outside the TS 3.2.2 requirements.

Westinghouse was apprised of the identification of a potentially non-conservative $F_Q(z)$ penalty, and in early 1993 finished review of their existing Units 1 and 2 Cycle 6 core models. Westinghouse showed that the core models simulated this rapid decrease in $F_Q(z)$ margin. At that time Westinghouse was asked to review this issue as an apparent non-conformance and as potentially indicative of a generic problem with the methodology provided in WCAP-10216-PA. Westinghouse was further requested to evaluate this issue as potentially reportable under 10 CFR Part 21. Westinghouse was asked to determine if the methodology should be revisited and updated. Westinghouse investigated the issue in accordance with Westinghouse procedures, and worked with PG&E to develop a conservative interim methodology to use for the current Units 1 and 2 Cycles.

On July 21, 1993, Westinghouse provided PG&E with an interim methodology for determining a conservative penalty to the $F_Q(z)$ multiplier to be applied when the maximum $F_Q(z)$ / $K(z)$ increases from the previous map. The interim methodology provides a penalty sufficient to conservatively bound the $F_Q(z)$ margin decreases expected during the current Units 1 and 2 Cycles.

D. Inoperable Structures, Components, or Systems that Contributed to the Event:

None.

E. Dates and Approximate Times for Major Occurrences:

1.	June 18, 1990:	Event date. Flux Map 5 for Unit 2 Cycle 4 indicated a decrease in $F_Q(z)$ margin of 2.73 percent.
2.	November 27, 1991:	Flux Map 5 of Unit 2 Cycle 5 indicated a decrease in $F_Q(z)$ margin of 4.27 percent.
3.	December 19, 1991:	Flux Map 6 of Unit 2 Cycle 5 indicated a decrease in $F_Q(z)$ margin of 3.44 percent.
4.	December 29, 1992:	Flux Map 5 of Unit 1 Cycle 6 indicated a decrease in $F_Q(z)$ margin of 6.09 percent.

5. July 21, 1993: Discovery Date. Westinghouse provides DCPP with an interim methodology confirming the impact of measured margin decreases on TS 4.2.2.2.e. penalty assumptions.

6. September 30, 1993: Westinghouse provides DCPP with a long-term resolution.

F. Other Systems or Secondary Functions Affected:

None.

G. Method of Discovery:

During review of the Unit 1 Cycle 6 flux map data, the $F_Q(z)$ margin was identified as decreasing 6.09 percent. This information, along with previous flux map data, was forwarded to Westinghouse for review. Subsequent investigation by Westinghouse determined that a non-conservative penalty was being used for the DCPP Heat Flux Hot Channel Factor multiplier.

H. Operator Actions:

None required.

I. Safety System Responses:

None required.

III. Cause of the Event

A. Immediate Cause:

DCPP adopted the $F_Q(z)$ surveillance TS located in WCAP-10216-PA, which includes the assumption that limiting $F_Q(z)$ margin will decrease by no more than 2 percent between monthly flux maps.

B. Root Cause:

The root cause of this event was vendor oversight, in that Westinghouse did not revise their methodology to account for the $F_Q(z)$ effects of low-low leakage loading patterns, IFBAs, and 18-month fuel cycles.

IV. Analysis of the Event

DCPP operating experience has shown that $F_Q^M(z)$ increases in the beginning of the cycle, with a subsequent peak at approximately 3000 MWD/MTU and a general decrease in $F_Q^M(z)$ throughout the remainder of the cycle. DCPP Units 1 and 2 have experienced decreases in $F_Q(z)$ margin of more than 2 percent between monthly flux maps in the early portions of Unit 1 Cycle 6 and Unit 2 Cycles 4 and 5. However, at no time did either Unit operate outside the TS 3.2.2 requirements. Therefore, the health and safety of the public was not affected by operation of DCPP Units 1 and 2.

V. Corrective Actions

A. Immediate Corrective Actions:

1. An engineering evaluation was performed for the identified non-conservative penalty for the $F_Q(z)$ multiplier. Neither Unit operated outside the requirements of the TS.

2. Westinghouse provided DCPP with an interim methodology for determining a conservative penalty for the $F_Q(z)$ multiplier.

3. PG&E has implemented administrative controls to conservatively apply the interim Westinghouse methodology for calculating the penalty to the $F_Q(z)$ multiplier, should it be necessary to apply a $F_Q(z)$ penalty.

B. Corrective Actions to Prevent Recurrence:

PG&E will implement, as appropriate, Westinghouse's long-term resolution of the $F_Q(z)$ multiplier penalty methodology issue. This long-term methodology change will be included in the Westinghouse Reload Safety Evaluation and implemented by PG&E in the COLR for Units 1 and 2 Cycle 7.

VI. Additional Information

A. Failed Components:

None.

B. Previous LERs on Similar Problems:

None.