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SUBJECT: Forwards response to Generic Ltr 85-12, "Implementation of TMI Action Item II.K.3.5, 'Automatic Trip of Reactor Coolant Pumps,'" dtd 850628. Continued pump operation not allowed by emergency operating procedures.

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JAMES D. SHIFFER
VICE PRESIDENT
NUCLEAR POWER GENERATION

December 24, 1985

PGandE Letter No.: DCL-85-370

Mr. Hugh L. Thompson, Jr., Director
Division of PWR Licensing-A
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
Generic Letter 85-12 - TMI Action Item II.K.3.5, Automatic Trip of RCP

Dear Mr. Thompson:

In accordance with the requirement of Generic Letter 85-12, "Implementation of TMI Action Item II.K.3.5, Automatic Trip of Reactor Coolant Pumps," dated June 28, 1985, PGandE hereby submits the Diablo Canyon plant-specific information requested in Section IV of the Safety Evaluation transmitted by Generic Letter 85-12.

Kindly acknowledge receipt of this material on the enclosed copy of this letter and return it in the enclosed addressed envelope.

Sincerely,

J D Shiffer

Enclosure

cc: L. J. Chandler
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ENCLOSURE

PGandE's Response to Generic Letter 85-12

Implementation of TMI Action Item II.K.3.5,

"Automatic Trip of Reactor Coolant Pumps"

INTRODUCTION

On March 9, 1984, Westinghouse submitted a letter, WOG-84-143, to the NRC transmitting a report entitled "Justification of Manual RCP Trip for Small Break LOCA Events." PGandE has reviewed the report and has determined that the generic information presented provides the necessary justification that the manual RCP trip is acceptable for Diablo Canyon Units 1 and 2 when the RCP trip setpoints, consistent with Revision 1 to the WOG Emergency Response Guidelines, are in use. The result of PGandE's review on the WOG report was transmitted to the NRC on September 5, 1984, in PGandE letter DCL-84-300. Subsequently, the NRC Staff issued Generic Letter 85-12 on June 28, 1985, requesting plant-specific information about instrumentation uncertainties, potential reactor coolant pump problems, and operator training and procedures. This enclosure provides the plant-specific information requested in Section IV of the Safety Evaluation (SE) transmitted by Generic Letter 85-12 as committed in PGandE's Letter dated August 26, 1985, DCL-85-280.

DIABLO CANYON PLANT-SPECIFIC INFORMATION

A. Determination of RCP Trip Criteria

Per WOG procedure, PGandE has selected the Reactor Coolant System (RCS) pressure as the RCP trip criterion for Diablo Canyon Units 1 and 2. The RCP trip setpoint was determined to be 1275 psig.

1. Identify the instrumentation to be used to determine the RCP trip set point, including the degree of redundancy of each parameter signal needed for the criterion chosen.

Response:

PGandE has identified the following instrumentation to be used to determine the RCP trip setpoint:

a. Primary Channel (PT-403; RCS Hot Leg Loop 4)

Wide Range Pressure Recorder
PR-403 (0-3000 psig range)

The Primary Channel (PT-403) also provides a 0-3000 psig range digital readout for Channel 1 of the subcooled margin monitor and for the P-250 computer.

b. Redundant Channel (PT-405: RCS Hot Leg Loop 3)

Wide Range Pressure Indicator
PI-405 (0-3000 psig range)

2. Identify the instrumentation uncertainties for both normal and adverse containment conditions. Describe the basis for the selection of the adverse containment parameters. Address, as appropriate, local conditions such as fluid jets or pipe whip which might influence the instrumentation reliability.

Response:

The pressure transmitters and associated devices are located outside the containment; as a result, the instrumentation uncertainties for both normal and adverse containment conditions will be the same. Tabulated below are the uncertainties associated with the instruments, instrument calibration, operator reading errors, etc.

Transmitter Reference Accuracy PT403, PT405	±.5% of span .005 x 3000 psi ±15 psi
Isolator Accuracy PM403A, RM405	±.5% of span .005 x 3000 psi ±15 psi
Isolator Accuracy PM403	±.1% of span .001 x 3000 psi ±3 psi
Transmitter Drift	±.5% of span per yr .005 x 3000 psi x 1.5 yr ±22.5 psi
Calibration Accuracy	±.5% of span .005 x 3000 psi ±15 psi
Indicator Accuracy PI-405	±1.5% of scale .015 x 3000 psi ±45 psi
Operator Error in Reading Indicator PI-405	±1/2 of smallest scale ±1/2 x 50 psi ± 25 psi
Recorder Accuracy PR 403	±.5% of span .005 x 3000 ±15 psi
Operator Error in Reading Recorder PR 403	±1/2 of smallest scale ±1/2 x 50 psi ±25 psi

The above errors are random and independent, so they can be combined statistically by the square root of the sum of the squares.

a. PI-405 (0-3000 psig range)

$$\pm 62 \text{ psi} = \sqrt{3(15)^2 + (22.5)^2 + (45)^2 + (25)^2}$$

b. PR-403 (0-3000 psig range)

$$\pm 46 \text{ psi} = \sqrt{4(15)^2 + 3^2 + (22.5)^2 + (25)^2}$$

An uncertainty of ±65 psi will be used for the total RCS pressure.

PGandE has performed a High Energy Line Break Study for Diablo Canyon Units 1 and 2 for breaks postulated in accordance with the FSAR criterion, and determined No local conditions such as fluid jets or pipe whip from small break LOCA would affect the instrumentation used to determine the RCP trip setpoint.

3. In addressing the selection of the criterion, consideration of uncertainties associated with the WOG-supplied analyses values must be provided. These uncertainties include both uncertainties in the computer program results and uncertainties resulting from plant-specific features not representative of the generic data group.

If a licensee determines that the WOG alternative criteria are marginal for preventing unneeded RCP trip, it is recommended that a more discriminating plant-specific procedure be developed. For example, use of the NRC-required inadequate-core-cooling instrumentation may be useful to indicate the need for RCP trip. Licensees should take credit for all equipment (instrumentation) available to the operators for which the licensee has sufficient confidence that it will be operable during the expected conditions.

Response:

The LOFTRAN computer code was used to perform the alternate RCP trip criteria analyses. Both steam generator tube rupture (SGTR) and non-LOCA events were simulated in these analyses. Results from the SGTR analyses were used to obtain all but three of the trip parameters. LOFTRAN is a Westinghouse licensed code used for FSAR SGTR and non-LOCA analyses. The code has been validated against the January 1982 SGTR event at the Ginna plant. The results of this validation show that LOFTRAN can accurately predict RCS pressure, RCS temperatures, and secondary pressures, especially in the first 10 minutes of the transient. This is the critical time period when minimum pressure and subcooling are determined.

The major causes of uncertainties and conservatism in the computer program results, assuming no changes in the initial plant conditions (i.e., full power, pressurizer level, all SI and AFW pumps run), are due to either models or inputs to LOFTRAN. The following are considered to have the most impact on the determination of the RCP trip criteria:

1. Break flow
2. SI flow
3. Decay heat
4. Auxiliary feedwater flow

The following sections provide an evaluation of the uncertainties associated with each of these items.

To conservatively simulate a double-ended tube rupture in safety analyses, the break flow model used in LOFTRAN includes substantial amount of conservatism (i.e., predicts higher break flow than actually expected). Westinghouse has performed analyses and developed a more realistic break flow model that has been validated against the Ginna SGTR tube rupture data. The break flow model used in the WOG analyses has been shown to be approximately 30% conservative when the effect of the higher predicted break flow is compared to the more realistic model. The consequence of the higher predicted break flow is a lower than expected predicted minimum pressure.

The SI flow inputs used were derived from best estimate calculations, assuming all SI trains operating. An evaluation of the calculational methodology shows that these inputs have a maximum uncertainty of ±10%.

The decay heat model used in the WOG analyses was based on the 1971 ANS 5.1 standard. When compared with the more recent 1979 ANS 5.1 decay heat inputs, the values used in the WOG analyses are higher by about 5%. To determine the effect of the uncertainty due to the decay heat model, a sensitivity study was conducted for SGTR. The results of this study show that a 20% decrease in decay heat resulted in only 1.1% decrease in RCS pressure for the first 10 minutes of the transient. Since RCS temperature is controlled by the steam dump, it is not affected by the decay heat model uncertainty.

The AFW flow rate inputs used in the WOG analyses are best estimate values, assuming that all auxiliary feed pumps are running, minimum pump start delay, and no throttling. To evaluate the uncertainties with AFW flow rate, a sensitivity study was performed. Results from the two-loop plant study show that a 64% increase in AFW flow resulted in only an 8% decrease in minimum RCS pressure, a 3% decrease in minimum RCS subcooling, and an 8% decrease in minimum pressure differential. Results from the three-loop plant study show that a 27% increase in AFW flow resulted in only a 3% decrease in

minimum RCS pressure, a 2% decrease in minimum RCS subcooling, and a 2% decrease in pressure differential.

The effects of all these uncertainties with the models and input parameters were evaluated, and it was concluded that the contributions from the break flow conservatism and the SI uncertainty dominate. The calculated overall uncertainty in the WOG analyses as a result of these considerations for Units 1 and 2 is +30 to +200 psig for the RCS pressure RCP trip setpoint. Due to the minimal effects from the decay heat model and AFW input, these results include only the effects of the uncertainties due to the break flow model and SI flow inputs.

B. Potential Reactor Coolant Pump Problems

1. Assure that containment isolation, including inadvertent isolation, will not cause problems if it occurs for non-LOCA transients and accidents.

   a. Demonstrate that, if water services needed for RCP operations are terminated, they can be restored fast enough once a non-LOCA situation is confirmed to prevent seal damage or failure.

   b. Confirm that containment isolation with continued pump operation will not lead to seal or pump damage or failure.

   Response:

   In a letter (Section I.1.e) dated May 31, 1985, PGandE discussed the effects of containment isolation on non-LOCA transients and accidents.

   a. PGandE Emergency Operating Procedures (EOPs) address restoration of auxiliary water services essential for RCP operation in a timely manner to prevent RCP damage or failure. Restart of the RCPs is accomplished by the operator, who is directed by procedure to restart the RCPs when specified conditions are met.

   b. Continued pump operation with containment isolation is not allowed by the EOPs. Operators are directed by the EOPs and trained to shut down the RCPs.

2. Identify the components required to trip the RCPs, including relays, power supplies and breakers. Assure that RCP trip, when determined to be necessary, will occur. If necessary, as a result of the location of any critical components, include the effects of adverse containment conditions on RCP trip reliability. Describe the basis for the adverse containment parameters selected.

   The following response does not include a discussion about adverse containment conditions.

Response:

The components required to trip the RCPs are listed below:

COMPONENTS REQUIRED TO MANUALLY TRIP THE UNIT 1 RCPs

COMPONENT DESCRIPTION	RCP NO.	LOCATION	MFR.	TYPE/CAT. NO.
Control Switch	1-1	Reactor Coolant Control Bd.	W	M04-52-40
	1-2	Reactor Coolant Control Bd.	W	M04-52-40
	1-3	Reactor Coolant Control Bd.	W	M04-52-40
	1-4	Reactor Coolant Control Bd.	W	M04-52-40
Magne-Blast Circuit Breaker	1-1	12 kV Switchgear Bus E Cubicle 3	GE	AM-138-750
	1-2	12 kV Switchgear Bus D Cubicle 7	GE	AM-138-750
	1-3	12 kV Switchgear Bus E Cubicle 4	GE	AM-138-750
	1-4	12 kV Switchgear Bus D Cubicle 6	GE	AM-138-750
125VDC Control Power	1-1	125VDC Distr. Pnl. 12 Breaker 72-1233 (fed from Battery #12)	ITE (Bkr.)	HE2-B100
	1-2	125VDC Distr. Pnl. 13 Breaker 72-1342 (fed from Battery #13)	ITE (Bkr.)	HE2-B100
	1-3	same as RCP 1-1	ITE (Bkr.)	HE2-B100
	1-4	same as RCP 1-2	ITE (Bkr.)	HE2-B100

Notes: The RCPs trip automatically on overcurrent, bus differential current, 12 kV bus undervoltage, and 12 kV bus underfrequency.

Unit 2 equipment is identical to that for Unit 1.

C. Operator Training and Procedures (RCP Trip)

1. Describe the operator training program for RCP trip. Include the general philosophy regarding the need to trip pumps versus the desire to keep pumps running.

Response:

PGandE adopted the full WOG Emergency Operating Procedure (EOP) set in March 1985. Prior to its implementation, training was conducted to the present NRC operator license holders and has also been factored into the "Hot License" training program. A classroom and simulator training environment is used in conducting this training. The current hot license training program reinforces the guidance contained within the EOP set and includes a discussion on the following topics:

a. Specific reasons for tripping RCPs during condition III and IV events with special emphasis placed on small break LOCA analysis and loss-of-heat-sink accidents.

b. Effects of loss of cooling flow (CCW) to RCP motor oil coolers.

c. Effects of a Phase B isolation signal on RCP operation.

d. Consequences and limitations on plant operation if RCPs are tripped.

   1) PTS concerns due to insufficient mixing of injection flow.

   2) Advantage of normal (pressurizer) spray for RCS pressure control and boron mixing in the pressurizer.

   3) Limitations placed on operators during natural circulation cooldowns.

   4) Effects of natural circulation on RCS decay heat removal rates and PTS concerns when using steam generators as a heat sink.

e. Consequences of missing the trip criteria or loss of RCPs at a critical time.

   1) Discussion of FR-C.1 and FR-C.2 (Core Cooling Function Restoration Procedures)

   2) Discussion of RCP restart criteria.

f. Discussion of when RCP trip criteria do not apply.

g. Response of RVLIS to both natural circulation and forced flow conditions.

The ongoing licensed operator requalification program reinforces a majority of the topics identified above on an annual basis during simulator training utilizing the WOG emergency procedures.

2. Identify those procedures which include RCP trip related operations:

(a) RCP trip using WOG alternate criteria
(b) RCP restart
(c) Decay heat removal by natural circulation
(d) Primary system void removal
(e) Use of steam generators with and without RCPs operating
(f) RCP trip for other reasons

Response:

The following six items respond to the above RCP trip-related operations from (a) through (f), respectively:

(a) DCPP uses only RCS pressure as the plant parameters governing RCP trip criteria. There are no procedures that use alternate trip criteria. The alternate parameters are not necessary since the pressure transmitters are located outside the containment and not subject to adverse containment environs.*

(b) See Table 1, noted by "R".

(c) Table 1 attached notes procedures by "NC" for decay heat removal by natural circulation, but it must be remembered that the emergency procedures are written assuming the possibilities of loss of OFFSITE power making RCPs unavailable, in which case the method of cooldown will be by natural circulation to RHR conditions to provide forced circulation

(d) Table 1, noted by "V".

(e) Table 1, noted by "SG".

(f) Table 1, see notes.

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* BI-10 RCP trip criteria background document attached for analysis of trip criteria.

Table 1

SUMMARY OF RCP TRIP AND RCP RESTART STEPS* IN THE ERGS

ERG	RCP TRIP	RCP RESTART
E-0	T	
E-0.1		R
E-0.2	NC,SG	R
E-0.3	NC,V,SG	R
E-0.4	NC,V,SG	R
E-1	T	
E-1.1		R
E-1.2	TA,TI,SG	R
E-3	T,TA,TI,SG	R
ECA-1.1	TI	
ECA-2.1	T,SG	R
ECA-3.1	TA,TI,SG	R
ECA-3.2	TA,TI,SG	R
ECA-3.3	TI,SG	R (No PZR lvl requirement)
FR-C.1	ST,SG	SR
FR-C.2	ST,SG	
FR-H.1	ST,SG	
FR-P.1		R
FR-I.3	V	R

* T - RCP trip criteria steps
TA - Trip all but one RCP steps
TI - No. 1 Seal RCP trip steps
ST - Other special trip steps
R - Restart criteria and support conditions required
SR - Special restart without support conditions required
NC - Decay heat removal by natural circulation
V - Void removal
SG - Steam generator