November 25, 1986

Docket Nos. 50-275
and 50-323

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Dear Mr. Shiffer:

SUBJECT: REACTOR COOLANT PUMP TRIP - GENERIC LETTER 85-12

We have performed a preliminary review of your submittals regarding the subject as described in the Enclosure. We request that you review the Enclosure and suggest that it be used as a basis for a telephone conference call or meeting to discuss those areas where clarification is needed. Please contact me as soon as possible so that we can arrange for the discussion.

Sincerely,

Original signed by:

Hans Schierling, Senior Project Manager
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Enclosure:
As stated

cc: See next page

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ENCLOSURE

PRELIMINARY STAFF REVIEW OF
REACTOR COOLANT PUMT (RCP) TRIP CRITERIA
DIABLO CANYON NUCLEAR POWER PLANT, UNITS 1 AND 2

INTRODUCTION

Listed below are the evaluation criteria the staff is applying to RCP trip review and our preliminary appraisal of whether sufficient information was provided for the staff to complete its review. The organization of this Enclosure is a staff provided guidance or evaluation criterion statement based upon Generic Letter 85-12 (Ref. 1), generally followed by a staff critique of the licensee submittals (Refs. 2 and 3).

The staff plan to complete the review is to use this Enclosure as the basis for a telephone conference call prior to initiation of a significant response effort on the part of the licensee. The staff then plans to document the results of the preliminary review and the telephone conference call, and to provide that documentation to the licensee. Then the licensee can provide a written response regarding the accuracy of the staff perception of the telephone conference call, together with any desired corrections and supplemental information. This should allow the staff to complete the review and prepare a Safety Evaluation Report (SER). An alternate, if the licensee desires (and which is not presently contemplated), is for the staff to prepare formal questions for licensee consideration.

OVERALL GUIDANCE PERTINENT TO RCP TRIP

During a small break accident in certain break size ranges, there exists a window in time during which tripping RCPs will make the accident worse.

Therefore, in a small break situation, one must trip RCPs prior to entering the window. If one wishes to depend upon manual trip, two criteria are applicable:

1. One must show that at least 2 minutes exist within which to trip RCPs following "receipt of a trip signal" using licensing calculations as a basis.

2. One must show that at least 10 minutes exist within which to trip RCPs following "receipt of a trip signal" using best estimate calculations as a basis.

If, for some reason, the RCPs have not been tripped within 10 minutes of the time at which plant conditions indicate trip should be performed, they are to be left running until after the window is closed. Closure can be indicated by parameters such as regaining both adequate subcooling margin and pressurizer level after they have been lost.

Analyses are required to establish timing relative to items 1 and 2, as well as to establish the dimensions of the window.

It is desirable to leave pumps running for control purposes during other transients and accidents, including steam generator tube rupture accidents of sizes up to one tube broken. Therefore, insofar as is practical, procedures and criteria should be developed to attain this goal. Note that leaving pumps running during "non-break" transients and accidents is not a 100% requirement, as contrasted to the small break, where trip must be accomplished to remain in compliance with the regulations. (Failure to trip as required could lead to exceeding Appendix K specified temperatures.) For "non-break" transients and accidents, RCPs may be tripped when desirable. If in doubt, the small break criteria are to be applied.

New plants coming on line should have dealt with RCP trip prior to power operation.

Note much of the work pertinent to the above criteria has been done on a generic basis, and is applicable to individual plants. Where this is the case, it is sufficient to establish applicability, and the generic work need not be repeated on a plant specific basis.

SPECIFIC EVALUATION CRITERIA AND COMMENTS

The evaluation criteria are generally those provided in Reference 1, including the Safety Evaluation and its appendices, which were an enclosure to Reference 1.

A. Determination of RCP Trip Criteria

Demonstrate and justify that proposed RCP-trip setpoints are adequate for small-break LOCAs but will not cause RCP trip for other non-LOCA transients and accidents such as SGTRs. This is to include performance of safety analyses to prove the adequacy of the setpoints.

Consider using partial or staggered RCP-trip schemes.

Staff Evaluation. Pacific Gas and Electric (PG&E) has selected a Reactor Coolant System (RCS) pressure of 1275 psig as the criterion for tripping the Reactor Coolant Pump (RCP). The RCS pressure option was previously identified by the staff as the least desirable of the three options described by the Westinghouse Owners Group (WOG) in their evaluation of RCP trip. The staff requests additional background (brief) pertinent to this selection.

A1. Identify the instrumentation to be used to determine the RCP trip set point, including the degree of redundance of each parameter signal needed for the criterion chosen. Establish the quality level for the instrumentation, identify the basis for the sensing-instruments' design features, and identify the basis for the degree of redundance.

Staff Evaluation. PG&E has selected PT-403 as the primary channel for pressure for purposes of RCP trip. This provides a pressure reading from the RCS Hot Leg Loop 4. As a redundant channel, they have selected PT-405, which provides RCS Hot Leg Loop 3 pressure. The quality level and basis for design are not identified.

A2. 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 instrumentation reliability.

Staff Evaluation. Instrumentation uncertainty for normal and adverse environmental conditions is stated as plus or minus 65 psi, and is determined statistically from information which is provided in references. PG&E states that the pressure transmitters and associated devices are located outside containment, and that the uncertainties for both normal and adverse containment conditions are therefore the same.

PG&E reported they have performed a high energy line break study for breaks postulated in accordance with the FSAR criterion, and determined that no local conditions such as fluid jets or pipe whip from breaks would affect the instrumentation used to determine the RCP trip setpoint.

The staff has the following observations and questions:

1. Since the pressure transmitters are located outside containment, they probably are connected to the RCS via long tubes, perhaps with isolation devices in the lines as well. What is the instrument response time for the configuration?

2. As observed above, portions of the instrumentation system are located inside containment. These must be addressed prior to excluding the influence of adverse conditions inside containment.

3. Performance of a high energy line break evaluation from the viewpoint of FSAR criteria and LOCA may not be sufficient to establish that there is no effect from local conditions such as pipe whip or fluid jets. There are many other sources of these phenomena.

4. Conditions outside of containment that may influence uncertainty also are not addressed in general. For example, has PG&E surveyed the wiring and connections between the transmitters and the control room to assure that a steam line break outside of containment will not introduce problems with the pressure readings in the control room?

5. Operator response to instruments under normal and abnormal conditions when one instrument is inoperative should be addressed. Emphasis should generally be upon abnormal conditions.

A3. In addressing criterion selection, provide consideration of uncertainties associated with the WOG supplied analyses values. These uncertainties are to include uncertainties in computer program results and uncertainties resulting from plant specific features not representative of the generic data group.

If a licensee (or applicant) 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. Licensees (or applicants) should take credit for all equipment (instrumentation) available to the operators for which the licensee (or applicant) has sufficient confidence that it will be operable during the expected conditions.

Staff Evaluation. Calculations of instrument uncertainties are summarized, and comparisons are discussed between Diablo Canyon Units 1 and 2 and the Westinghouse Owners Group (WOG) information. PG&E states that the calculated overall uncertainty for Diablo Canyon is from +30 psig to +200 psig for the RCS pressure trip point.

The licensed Westinghouse LOFTRAN computer code is referenced for performance of the non-LOCA analyses. The computer program result uncertainties evaluation is based on the assumption of no changes in initial plant conditions (such as full power, pressurizer level, all Safety Injection (SI) pumps running, and all Auxiliary Feed Water (AFW) pumps running). The major contributors to uncertainty are stated to be break flow rate, SI flow rate, decay heat generation rate, and AFW flow rate. Parametric studies are summarized in which the major uncertainties are stated to be due to the break flow model and SI flow inputs.

PG&E states there are no uncertainties resulting from plant specific features not representative of the generic data group, and that RCS pressure provides ample margin to the trip setpoint for the non-LOCA accidents that were evaluated in the WOG analyses.

PG&E has not directly addressed such topics as the accuracy of the numerical solution scheme or of nodalization. Further, there is no determination of the influence of equipment or operational failures. Information pertinent to the former result from comparisons of the LOFTRAN code to operational and experimental data, and as a result will have been included in the uncertainty number. Determination of equipment or operational failures is not a necessity as long as the expected configuration of the plant is addressed since the objective of RCP trip is to provide reasonable assurance of not tripping for transients for which a trip is undesirable. It is not necessary to establish that one will never trip since the plant is capable of being safely controlled if an unnecessary trip does occur. Thus, no additional information is needed for the staff to complete review of this item.

B. Potential Reactor Coolant Pump Problems

B1. Assure that containment isolation, including inadvertent isolation, will not cause problems if it occurs for non-LOCA transients and accidents. 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. Confirm that containment isolation with continued pump operation will not lead to seal or pump damage or failure.

Staff Evaluation. This portion of the submittal is general, and does not provide specific information. For example, a statement such as "Restart of the RCPs is accomplished by the operator, who is directed by procedure to restart the RCPs when specified conditions are met." does not provide information useful to the review, and is not sufficient.

The submittal also states "Containment isolation with continued pump operation is not allowed by the EOPs. Operators are directed by the EOPs and trained to shutdown the RCPs." Is this for any containment isolation or certain "levels"? How is this operational scheme consistent with operation with RCPs running for transients which result in containment isolation? Typically, there are a number of items the staff expects to be addressed. If there are levels of isolation where RCP operation is continued, some aspects of RCP support equipment operation probably should be mentioned. For example, do the conditions which lead to containment isolation result in termination of any portion of the CVCS and is there an indirect effect upon RCP seal injection? If CCW pump operation is terminated, how long does it take for the pump to be restarted and flow restored to the thermal barrier heat exchangers and other RCP associated components? What are the implications? Information should be provided pertinent to restart of RCPs following restoration of services leading to a trip. Items such as trip parameters, operator response and timing of operations should be identified. The staff does not need a large volume of material on these topics, but does need a brief mention with perhaps reference to procedures in a list provided with the submittal.

B2. Identify the components required to trip the RCPs, including relays, power supplies and breakers. Assure that RCP trip, when necessary, will occur. Exclude extended RCP operation in a voided system where pump head is more than 10% degraded unless analyses or tests can justify pump and pump-seal integrity when operating in voided systems. If necessary, as a result of

the location of any critical component, include the effects of adverse containment conditions on RCP trip reliability. Describe the basis for the adverse containment parameters selected.

Staff Evaluation. The major components associated with RCP trip are identified, as is their location.

A brief consideration should be given to the potential for adverse conditions outside containment and the implications, if any. For example, can a steam line break outside of containment introduce difficulties with respect to the equipment of interest here?

The timing of operations associated with alternate operator actions required to trip the RCPs should be mentioned. For example, if the operator attempts a trip from the control room and fails, how long will it take to trip from an alternate location, including travel time? (See Item C1, below.)

RCP operation in a voided system is not mentioned.

C. Operator Training and Procedures (RCP Trip)

C1. 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. Also cover priorities for actions after engineered safety features actuation.

Assure that training and procedures provide direction for use of individual steam generators with and without operating RCPs.

Assume manual RCP trip does not occur earlier than two minutes after the RCP-trip set point is reached.

Determine the time available to the operator to trip the RCPs for the limiting cases if manual RCP trip is proposed. Best Estimate

calculational procedures should be used. Most probable plant conditions should be identified and justified by the licensee, although NRC will accept conservative estimates in the absence of justifiable most probable conditions.

Justify that the time available to trip the RCPs is acceptable if it is less than the Draft ANSI Standard N660. If this is the case, then address the consequences if RCP trip is delayed. Also develop contingency procedures and make them available for the operator to use in case the RCPs are not tripped in the preferred time frame.

Staff Evaluation. A discussion of training is presented, but the background philosophy is not clearly described, and some of the above points are not addressed. For example, what is the general need to trip RCPs as contrasted to keeping them running? What is the RCP restart philosophy and how is it implimented? If one has tripped RCPs, and desires to restart them for control purposes and to aid in plant cooldown, what requirements must be met?

C2. Identify those procedures which include RCP trip related operation:

(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

Ensure that emergency operating procedures exist for the timely restart of the RCPs when conditions warrant.

Staff Evaluation. PG&E has presented a listing of selected procedures which address RCP trip and restart. The staff previously commented on the need to consider adverse environments in the submittal. The only additional question here is what is meant by "No PZR lvl requirement" for

RCP restart in procedure ECA-3.3? For example, would this allow RCP restart with a voided upper head, no water in the pressurizer, and an adequate subcooling margin? If so, could the RCPs then be left running with a saturated RCS when the head void collapsed?

REFERENCES

1. Thompson, Hugh L. Jr., "Implementation of TMI Action Item II.K.3.5, 'Automatic Trip of Reactor Coolant Pumps' (Generic Letter No. 85-12)", NRC Letter Addressed to All Applicants and Licensees with Westinghouse (W) Designed Nuclear Steam Supply Systems (NSSSs), Jun. 28, 1985.

2. Shiffer, J. D., "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," Letter to Hugh L. Thompson, Jr., NRC, from Pacific Gas and Electric Company, Letter No. DCL-85-280, Aug. 26, 1985.

3. Shiffer, J. D., "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," Letter to Hugh L. Thompson, Jr., NRC, from Pacific Gas and Electric Company, Letter No. DCL-85-370, Dec. 24, 1985.