Portland General Electric Company

Bart D. Withers, Vice President

January 31, 1986

Trojan Nuclear Plant
Docket 50-344
License NPF-1

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

Dear Sir:

Response to Generic Letter 85-12
Implementation of TMI Action Item II.K.3.5, "Automatic Trip of RCPs"

Reference: Generic Letter 85-12, to All Licensees With Westinghouse-Designed Nuclear Steam Supply System, From H. L. Thompson, Jr., NRC, "Implementation of TMI Action Item II.K.3.5, Automatic Trip of RCPs", Dated June 28, 1985.

The referenced Generic Letter approved the Westinghouse Owners Group (WOG) RCP trip criteria on a generic basis and requested additional information on the Plant-specific RCP trip criteria. The attached enclosures respond to the requests in Section IV and Appendix A of the referenced letter.

The Trojan Plant RCP trip criteria provides RCP trip when needed and excludes RCP trip when continued pump operation is desirable. The RCP trip criteria are an integral part of Trojan Emergency Procedures.

Sincerely,

B D Withers

Bart D. Withers
Vice President
Nuclear

Enclosure

c: Mr. Lynn Frank
State of Oregon
Department of Energy

A046
1/1

A00.

AD - J. KNIGHT (ltr only)
EB (BALLARD)
EICSB (ROSA)
PSB (GAMMILL)
PSB (BERLINGER)
FOB (BENAROYA)

PGE RESPONSE TO NRC GENERIC LETTER 85-12, SECTION IV

NRC Request

IV. IMPLEMENTATION

The generic information presented by the WOG does not address plant-specific concerns about instrumentation uncertainties, potential reactor coolant pump problems and operator training and procedures as requested in Generic Letter 83-10. Appendix A contains a summary related to these issues and may be used as a guideline to assure that these issues are adequately addressed.

In order to complete the response to Generic Letter 83-10c and d, each W licensee is required to submit the following information to the NRC for plant-specific reviews:

A. Determination of RCP Trip Criteria.

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.

PGE Response

The instrumentation used to determine RCP trip are:

1. For normal Containment conditions, wide-range RCS pressure (PT 403 and PT 405);

2. For adverse Containment conditions, the primary-to-secondary pressure differential. This uses the wide-range RCS pressure instruments as above and steam line pressure indication PT 514, 515, or 516 for Loop A, PT 524, 525, or 526 for Loop B, etc.

The two RCS wide-range pressure instrument loops are electrically independent and provide control room indication. The 3 steam line pressure instruments for each of the 4 steam lines are also redundant. Thus, full redundancy is provided for both RCP trip criteria.

NRC Request

IV. A. 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.

PGE Response

The instrument uncertainties for normal and adverse Containment conditions are:

	Normal Containment	Adverse Containment
RCS pressure	+145.5, -100.5 psi	+595.5, -400.5 psi
Steamline pressure	± 47.9 psi	± 47.9 psi

The steamline pressure instruments are located outside of Containment and the uncertainty is not affected by adverse Containment conditions.

The setpoints chosen to initiate the use of adverse Containment parameters are either Containment pressure greater than 3.5 psig or Containment radiation greater than 10^5 rem/hr. These values correspond to those recommended by the Westinghouse Owner's Group and provide convenient indications for alerting the operator to the presence of adverse Containment conditions. Trojan Plant instrumentation qualification test results were reviewed to ensure that instrumentation errors for these transmitters are insignificant below a Containment pressure of 3.5 psig and an integrated radiation dose of 10^6 rads.

Conditions such as fluid jets or pipe whip are considered in the Trojan FSAR Sections 3.5 and 3.6. The design of Trojan meets the requirements of GDC 4, and thus, we conclude that local effects that could affect both trains of instruments will not prevent safe shutdown.

NRC Request

IV. A. 3. In addressing the selection of the criterion, consideration to 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.

PGE 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 are limiting and were used to obtain the trip parameters for Trojan. 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 is determined.

The major causes of uncertainties and conservatism in the computer program results, assuming no changes in the initial Plant conditions [ie, full power, pressurizer level, all SI and auxiliary feedwater (AFW) pumps run], are due to either models or inputs to LOFTRAN. Significant variables in the determination of the RCP trip criteria are:

1. Break flow.
2. SI flow.
3. Decay heat.
4. AFW 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 (ie, predicts higher break flow than is 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 percent 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 to predict a minimum pressure lower than is expected.

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 $\pm$10 percent.

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 is higher by about 5 percent. 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 percent decrease in decay heat resulted in only a 1 percent decrease in RCS pressure for the first 10 minutes of the transient. Since RCS temperature is controlled by the steam dump valves, it is not affected by the decay heat model uncertainty.

The AFW flow rate input used in the WOG analyses are best estimate values, assuming that all AFW 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 percent increase in AFW flow resulted in only an 8 percent decrease in minimum RCS pressure, a 3 percent decrease in minimum RCS subcooling, and an 8 percent decrease in minimum pressure differential. Results from the three-loop plant study show that a 27 percent increase in AFW flow resulted in only a 3 percent decrease in minimum RCS pressure, a 2 percent decrease in minimum RCS subcooling, and a 2 percent 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 the Trojan Nuclear Plant is +5 to +300 psi for the RCP pressure RCP trip setpoint and -5 to +200 psi for the primary-to-secondary differential pressure. The above uncertainties added to the limiting SGTR event for Trojan ensure that the limiting non-LOCA minimum pressure is conservatively predicted and that ample margin exists to avoid unnecessary RCP trip. Due to the minimal effects from the decay heat model and AFW input, the above uncertainties include only the effects of the uncertainties due to the break flow model and SI flow inputs.

Because the range of uncertainty is biased in the conservative direction for the Trojan Plant, there is no need to perform further Plant specific analyses.

NRC Request

IV. 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.

PGE Response

Water services needed for RCP operation are seal injection water and Component Cooling Water (CCW). Seal injection is not terminated on Containment isolation and CCW to the RCPs is isolated only on a Phase B Containment isolation signal at 30 psig. We do not anticipate extended RCP operation with the Containment above 30 psi, nor do we expect the major steam or feedline break non-LOCA transients to generate Containment pressures over 30 psig for significant periods. Operators are trained to identify and correct inadvertent loss of cooling to the RCPs.

With regard to seal integrity, either seal water injection or CCW to the RCP thermal barrier heat exchanger will provide sufficient cooling to prevent seal damage or failure. Because seal water is not isolated, seal cooling will take place.

By virtue of maintaining cooling water services under Phase A Containment isolation, pump and/or seal damage will not occur. Continued pump operation is not expected under Phase B Containment isolation conditions, and seal integrity will be maintained.

NRC Request

IV. B. 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 component, include the effects of adverse Containment conditions on RCP trip reliability. Describe the basis for the adverse Containment parameters selected.

PGE Response

The RCPs are fed by 12.47-kV buses and may be tripped from the control room. To trip the A pump the operator would turn Control Switch 252-104 in the control room which energizes Trip Coil 252-104 which, in turn, opens Breaker 252-104, tripping power to the A pump. The power for the RCP breakers trip is battery backed 125V dc. The control is similar for the other pumps.

The breaker may also be mechanically tripped locally at the breaker.

All components needed to trip the RCPs are located outside Containment and are not affected by adverse Containment conditions.

We conclude that RCP trip will occur upon demand.

NRC Request

IV. 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.

PGE Response

The operator training program for Emergency Operating Procedures (including RCP trip) consists of classroom training and annual simulator exercises. RCP trip criteria are covered during classroom training annually as a part of the Emergency Operating Procedure (EOP) lectures. The criteria and setpoints that require RCP trip are discussed in detail as are the conditions for which RCP trip criteria does not apply, such as during an operator controlled cooldown. During simulator exercises, the operator is exposed to varied accident scenarios which require decisions to be made on when to trip the RCPs based on EOP action steps. The general philosophy conveyed during training on RCP trip is to keep the RCPs running, if at all possible, but to ensure they are manually tripped when the RCP trip criteria are met. It is stressed that the RCP trip criteria are designed to prevent potential core uncovery during a small break LOCA event while allowing continued RCP operation during an SGTR and non-LOCA events.

NRC Request

IV. C. 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.

PGE Response

a. Trojan Emergency Operating Procedures (EOPs) follow the WOG Emergency Response Guidelines (ERGs) for RCP trip related operations. Steps which use the WOG alternate RCP trip criteria for tripping the RCPs during small break LOCAs are located in the following procedures.

1) EI-0, "Reactor Trip, Safety Injection, and Diagnosis".
2) EI-1, "Loss of Reactor or Secondary Coolant".
3) EI-3, "Steam Generator Tube Rupture".
4) ECA-2.1, "Uncontrolled Depressurization of All Steam Generators".

b. In accordance with the WOG ERGs, Trojan EOPs which include RCP restart steps are:

1) ES-0.1, "Reactor Trip Response".
2) ES-0.2, "Natural Circulation Cooldown".
3) ES-0.3, "Natural Circulation Cooldown With Steam Void in Vessel (w/RVLIS)".
4) ES-0.4, "Natural Circulation Cooldown With Steam Void in Vessel (w/o RVLIS)".
5) ES-1.1, "SI Termination".
6) ES-1.2, "Post-LOCA Cooldown and Depressurization".
7) EI-3, "Steam Generator Tube Rupture".
8) ECA-2.1, "Uncontrolled Depressurization of All Steam Generators".
9) ECA-3.1, "SGTR With Loss of Reactor Coolant - Subcooled Recovery Desired".
10) ECA-3.2, "SGTR With Loss of Reactor Coolant - Saturated Recovery Desired".
11) ECA-3.3, "SGTR Without Pressurizer Pressure Control".
12) FR-C.1, "Response to Inadequate Core Cooling".
13) FR-P.1, "Response to Imminent Pressurized Thermal Shock Condition".
14) FR-I.3, "Response to Voids in Reactor Vessel".

c. Decay heat removal by natural circulation with no other accident in progress is covered by the following Trojan EOPs:

1) ES-0.2, "Natural Circulation Cooldown".
2) ES-0.3, "Natural Circulation Cooldown With Steam Void in Vessel (w/RVLIS)".
3) ES-0.4, "Natural Circulation Cooldown With Steam Void in Vessel (w/o RVLIS).

Steps that specifically establish verifiable natural circulation flow during accident conditions are included in the following EOPs in accordance with WOG ERGs:

1) ES-0.1, "Reactor Trip Response".
2) ES-1.1, "SI Termination".
3) ES-1.2, "Post-LOCA Cooldown and Depressurization".
4) EI-3, "Steam Generator Tube Rupture".
5) ECA-2.1, "Uncontrolled Depressurization of All Steam Generators".
6) ECA-3.1, "SGTR With Loss of Reactor Coolant - Subcooled Recovery Desired".
7) ECA-3.2, "SGTR With Loss of Reactor Coolant - Saturated Recovery Desired".

d. Primary system void removal is addressed in the following Trojan EOPs:

1) ES-0.3, "Natural Circulation Cooldown With Steam Void in Vessel (w/RVLIS)".
2) ES-0.4, "Natural Circulation Cooldown With Steam Void in Vessel (w/o RVLIS).
3) FR-I.3, "Response to Voids in Reactor Vessel".

ES-0.3 and ES-0.4 provide actions to continue Plant cooldown and depressurization to cold shutdown under conditions that allow for potential formation of a void in the upper head region. FR-I.3 provides actions to remove voids in the reactor vessel head.

e. Trojan EOPs ES-0.2, ES-0.3, and ES-0.4 listed in Part (c) describe expected conditions and action steps necessary for steam generator operation without RCPs running. All other EOPs cover the use of steam generators with or without RCPs operating as applicable.

f. RCPs are manually tripped for reasons other than meeting the WOG alternate RCP trip criteria in several cases. These cases include tripping all but one RCP to minimize heat addition to the RCS, tripping any RCP which does not meet the Number 1 seal operation requirements, tripping any RCP which has lost component cooling water for greater than 5 minutes, and other special trip criteria specified by the WOG ERGs. The affected Trojan EOPs are:

1) EI-0, "Reactor Trip, Safety Injection, and Diagnosis".
2) ES-1.2, "Post-LOCA Cooldown and Depressurization".
3) EI-3, "Steam Generator Tube Rupture".
4) ES-3.1, "Post-SGTR Cooldown Using Backfill".
5) ES-3.2, "Post-SGTR Cooldown Using Steam Generator Blowdown".
6) ES-3.3, "Post-SGTR Cooldown Using Steam Dump".
7) ECA-1.1, "Loss of Emergency Coolant Recirculation".
8) ECA-3.1, "SGTR With Loss of Reactor Coolant - Subcooled Recovery Desired".
9) ECA-3.2, "SGTR With Loss of Reactor Coolant - Saturated Recovery Desired".
10) ECA-3.3, "SGTR Without Pressurizer Pressure Control".
11) FR-C.1, "Response to Inadequate Core Cooling".
12) FR-C.2, Response to Degraded Core Cooling".
13) FR-H.1, "Response to Loss of Secondary Heat Sink".

PGE RESPONSE TO NRC GENERIC LETTER 85-12, APPENDIX A

NRC Request

APPENDIX A

PUMP-OPERATION CRITERIA THAT CAN RESULT IN RCP TRIP
DURING TRANSIENTS AND ACCIDENTS

A. The NRC staff has concluded that if sufficient time exists, manual action is acceptable for tripping the RCPs following a LOCA provided certain conditions are satisfied.

PGE Response

PGE concurs with this and does not recommend RCP trip, except where necessary. The necessary requirements for manual RCP trip have been met and are further described below.

NRC Request

B. Potential problem areas should be considered in developing RCP-trip setpoints and methods.

1. Tripping RCPs causes loss of pressurizer sprays.

a. This produces a need to use PORVs in some plants to control primary pressure.

b. PORVs have frequently failed to close.

c. Despite testing, PORV operational reliability has not improved significantly.

PGE Response

The general philosophy of tripping RCPs only when absolutely necessary has been incorporated into the EOPs and operator training programs to minimize the potential for loss of normal pressurizer spray capability. The consequences of tripping RCPs in relation to the loss of pressurizer spray capability has been thoroughly analyzed and evaluated by the WOG during ERG development. The requirement to use PORVs for primary pressure control, PORV potential failure to close, and PORV operational reliability have been carefully considered. As a result, the WOG ERGs (and consequently Trojan EOPs) contain action steps which provide alternative primary pressure control methods and contingency actions for primary pressure control should the PORVs fail or become unavailable.

Additionally, verification steps which ensure that PORVs are closed are frequently used in the EOPs in recognition of the reliability history of PORVs. We conclude that the necessary steps to address concerns and problem areas associated with the loss of pressurizer spray have been addressed.

NRC Request

B. 2. Tripping RCPs tends to produce a stagnant region of hot coolant in the reactor-vessel upper elevations.

a. Hot stagnant coolant has flashed and partially voided the upper vessel region during depressurization or cooldown operational events.

b. Operators are not completely familiar with the significance of an upper-head steam bubble.

c. Operators have difficulty controlling coolant conditions to avoid or control flashing.

d. Operators may take precipitous actions when a steam bubble exists.

PGE Response

It is recognized that tripping RCPs tends to produce a stagnant region of hot coolant in the reactor vessel upper-head region with a potential result of void formation. Therefore, Trojan EOPs contain extensive guidance to prevent void formation in the upper head, to remove a void from the upper head, and, if necessary, to cooldown while allowing and managing a void in the upper head. Trojan EOPs described in the response to NRC Request IV.C.2.(c) and (d) provide this guidance. Steps allowing the restart of an RCP are also included whenever possible [see response to NRC Request IV.C.2.(b)] to remove hot stagnant coolant from the upper head.

Classroom training and annual simulator exercises stress the significance of an upper head steam bubble and review the procedural steps and concepts behind controlling coolant conditions to avoid or control flashing. Operational cooldown events at other plants that have resulted in upper-head void formation are periodically reviewed and critiqued during training. Operators are less likely to take precipitous action when a steam bubble exists since they are trained to follow EOP steps and are familiar with the proper response to a steam bubble from classroom and simulator training. The philosophy of tripping RCPs only when absolutely necessary has been incorporated into the EOPs and operator training programs to reduce the potential of producing a void in the upper head.

NRC Request

B. 3. After tripping the RCPs, decay-heat removal by natural circulation is required. This procedure is used less frequently than controlling with the RCPs and it places more demand on the operators to control the primary-system conditions.

PGE Response

Natural circulation procedures, like all EOPs, are used infrequently and place additional demand on the operators. In recognizing this fact, EOP action steps and operator training programs reflect the philosophy that RCPs should be tripped only when absolutely required. EOPs which direct decay heat removal by natural circulation have been validated at the simulator to demonstrate that they provide sufficient guidance to control Plant conditions without placing undue demand on the operators. The operator training programs described in the response to NRC Request IV C.1 help ensure that operators are familiar with natural circulation procedures.

NRC Request

C. Consider the following guidelines in developing RCP-trip setpoints.

1. 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.

PGE Response

The necessary requirements for RCP trip have been developed and analyzed by WOG in Reference 1. PGE has utilized these methods in developing Trojan-specific RCP trip requirements. The uncertainties associated with instrumentation and the WOG analyses have been considered in the development of the RCP trip criteria at Trojan. Our analysis has considered the items below from the outset.

NRC Request

C. 1. a. Assure that RCP trip will occur for all primary-coolant losses in which RCP trip is considered necessary.

PGE Response

The RCP trip criteria are based on avoidance of primary system saturation conditions. If the RCS is subcooled, RCP trip is not needed. Because

the basis of the analysis assumes this, RCP trip will occur when the saturated condition occurs, as in a Small Break LOCA (SBLOCA). WOG analyses (Reference 1) show that this is acceptable.

NRC Request

C. 1. b. Assure that RCP trip will not occur for SGTRs up to and including the design-basis SGTR.

PGE Response

The WOG analysis described in Reference 1 indicates that the minimum RCS pressure during an SGTR event at Trojan is 1,526 psia. This is above the Trojan RCP trip setpoint so no trip will occur.

NRC Request

C. 1. c. Assure that RCP trip will not occur for other non-LOCA transients where it is not considered necessary.

PGE Response

Other non-LOCA, non-SGTR transients were evaluated in Reference 1 by WOG. For Trojan, the most limiting non-LOCA accident is the steam generator tube rupture. RCP trip criteria were not met for the SGTR or other transients.

NRC Request

C. 1. d. Perform safety analyses to prove that a, b, and c above are achieved.

PGE Response

Reference 1 performs the analysis which shows the limiting trip criteria for several transients. The Trojan-specific trip criteria will lead to trip when required, as in a SBLOCA, and will avoid trip in other transients. Further proof is not necessary.

NRC Request

C. 1. e. Consider using partial or staggered RCP-trip schemes.

PGE Response

The premise of RCP trip is to trip the pumps when primary saturation is imminent. If RCS saturation is occurring, it occurs for all pumps. As described in response to NRC Request IV.C.2.f, there are conditions where some RCPs may be left running, but a SBLOCA is not one of them. We do not see any value to a partial or staggered RCP trip scheme at this time.

NRC Request

C. 1. f. Assure that training and procedures provide direction for use of individual steam generators with and without operating RCPs.

PGE Response

Procedures have been written to provide direction for use of individual steam generators with and without operating RCPs as described in the response to NRC Comment IV.C.2.(e). Annual simulator training consisting of a wide variety of accident scenarios and classroom training also ensure that operators can maintain heat removal using steam generators regardless of RCP status.

NRC Request

C. 1. g. Assure that symptoms and signals differentiate between LOCAs and other transients.

PGE Response

The Trojan RCP trip criteria indicate the need for RCP trip when necessary (certain SBLOCAs) and do not require unnecessary trip in non-LOCA transients. The RCP trip criteria are the same for all events and there is no need to tie RCP trip criteria to event identification. As discussed above, adequate differentiation is provided by Trojan RCP trip criteria to assure RCP trip for LOCAs when needed.

NRC Request

C. 1. h. (Westinghouse plant specific) RCP trip is expected to occur for the design-basis SGTR for some Westinghouse plants that have SI pumps with lower shutoff heads. The exact rupture size above which RCP trip would be required has not been determined.

(1) NRC informed Westinghouse that RCPs should not be tripped for SGTR events, such as that which occurred at Ginna, which was essentially equivalent to a design-basis SGTR.

(2) NRC informed Westinghouse that methods should be examined for either improving the RCP-trip setpoints or modifying the plants so that RCPs need not be tripped for design-basis SGTRs.

(3) Restart permission was granted for Ginna with the requirement that supplementary guidelines be developed for RCP trip to assure RCPs would not be tripped for the design-basis SGTR.

(4) NRC agrees with Westinghouse that in the long-term using the reactor-vessel-liquid-inventory system to help determine when to do an RCP trip will increase the probability of maintaining RCP operation during non-LOCAs.

PGE Response

The Trojan Plant design includes high-head centrifugal charging pumps. Westinghouse analysis described in Reference 1 has shown that RCP trip is not expected to occur for the design basis SGTR at Trojan. Since the RCP trip setpoints used in the Trojan EOPs are bounded by this WOG analysis, this question does not apply to Trojan.

NRC Request

C. 1. i. (Westinghouse plant specific) NRC has concluded that recent information by Westinghouse about wide-range pressure uncertainty indicates that analyses confirming Westinghouse's conclusions about RCP trip setpoints for high-head-SI plants are probably necessary.

PGE Response

Development of the Trojan RCP trip criteria has included the latest wide-range pressure instrument uncertainty. These analyses confirmed that the Trojan RCP trip setpoints are adequate.

NRC Request

C. 2. 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.

PGE Response

The WOG alternate RCP trip setpoints adopted for use in the Trojan EOPs are based on ensuring the RCPs are manually tripped when voiding begins to occur in the RCS. Therefore, the RCP trip criteria helps protect against operating the RCPs in a voided system.

There are two cases where procedural guidance is provided to continue RCP operation even in a voided system as a last resort to protect the core for beyond design basis conditions. The first case is that safety injection flow must be verified before tripping the RCPs by the RCP trip criteria. As discussed in WCAP-9753, "Inadequate Core Cooling Studies of Scenarios with Feedwater Available", for small break LOCAs without safety injection flow available, the RCPs continue to provide core heat removal via the break and the steam generators. Continued core cooling from the RCPs, even in a voided system with potential pump and seal integrity degradation, is preferable to the consequences of providing no core cooling at all. The second case where the RCPs are operated in a potentially voided system is in FR-C.1, "Response to Inadequate Core Cooling". In this procedure RCPs are started in a voided system (RCS temperature greater than 1200°F) to preclude core damage. While full-scale tests have not been performed on Trojan-size pumps, tests documented in EGG-LOFT-5471, "Experimental Results Report for LOFT Nuclear Experiments L3-5, L3-6, and L8-1", showed that no pump mechanical damage occurred when restart of an RCP was made under highly voided conditions in the RCS. In both cases described above, RCP operation in a voided system is only performed as a last resort and is not expected to continue for an extended period.

For rare beyond Design Basis Events, core cooling may be enhanced by RCP operation. We do not wish to exclude RCP operation for beyond Design Basis Events when it may improve core cooling.

For Design Basis Events, the RCP trip criteria will assure that pump operation in a voided system does not occur.

NRC Request

C. 3. Avoid challenges to the PORVs where possible.

a. If setpoints lead to RCP trip even though it is neither required nor desirable for transients or accidents with offsite power available, assure that challenges to the PORVs are avoided that would normally be handled by using pressurizer sprays.

b. Challenges to PORVs could be eliminated by using heated auxiliary pressurizer sprays from a source other than the RCP discharge.

c. If submittal recommends use of PORVs to depressurize, then licensees need to develop a program for upgrading the PORVs' operational reliability.

PGE Response

The RCP trip setpoints for Trojan preclude unnecessary RCP trip, thus assuring that pressurizer sprays are available and that PORV challenges are minimized. However, there may be cases where the PORVs are called upon. As described in the response to NRC Request in Appendix A B.1, the consequences of the use of PORVs has been thoroughly analyzed and considered. We do not believe that the likelihood of PORV operation or the consequences of PORV misoperation warrant the additional measures described in Items b and c above.

NRC Request

C. 4. Establish guidelines and procedures for case where RCP trip can lead to hot, stagnant fluid regions at primary-system high points.

a. Describe symptoms of primary-system voiding caused by flashing of hot, stagnant fluid regions including effects on the pressurizer.

b. Specify guidance for detecting, managing, and removing the voids.

c. Train operators concerning the significance of primary-system voids for both non-LOCA and LOCA conditions.

PGE Response

The main priority in the EOPs is to maintain core cooling. The recovery steps of the EOPs address voiding. Symptoms of primary system voiding, including effects on the pressurizer, are covered in FR-I.3, "Response to Voids in Reactor Vessel", and are continuously monitored using the critical safety function status trees. These symptoms include high pressurizer level, low pressurizer pressure, and low reactor vessel level indicated by the Reactor Vessel Level Indicating System (RVLIS). FR-I.3 provides guidance for detecting, managing, and removing the voids by the following major actions:

a. Establish charging and letdown.
b. Repressurize RCS to condense voids.
c. Start an RCP to condense voids (if restart criteria met).
d. Vent reactor vessel voids.

Natural circulation cooldown procedures ES-0.2, ES-0.3, and ES-0.4 also provide guidance for detecting and managing voids. Operators are trained in the classroom and during simulator exercises to understand the significance of, and proper response to, void formation during LOCA and non-LOCA conditions.

We conclude that the existing procedures adequately address the consequences of RCP trip.

NRC Request

C. 5. Assure that containment isolation will not cause problems if it occurs for non-LOCA transients and accidents.

a. Demonstrate that, if water services needed for RCP operation 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.

PGE Response

This is essentially identical to Request IV.B.1. To summarize, Containment isolation will not interrupt necessary water services for seal integrity.

NRC Request

C. 6. RCP-trip decision parameters should provide unambiguous indicators that a LOCA has occurred and the NRC-required inadequate-core-cooling instrumentation should be used where useful in indicating the need for a RCP trip.

PGE Response

The RCP trip criteria ensure that trip will occur when necessary and will not occur otherwise. As discussed above, in response to Item C.1.g, the decision parameters for RCP trip do not depend upon operator identification of the type of event. We conclude that the criteria provide unambiguous indication for RCP trip. The NRC mandated instrumentation, although useful, is not needed for Trojan RCP trip criteria.

NRC Request

C. 7. NRC recommends that the licensee use event trees to systematically evaluate their set points to minimize the potential for undesirable consequences because of a misdiagnosed event.

a. Evaluate set points for events with RCP trip when it is preferable the RCPs remain operational.

b. Evaluate set points for events where early RCP trip does not occur and a delayed trip may lead to undesirable consequences.

PGE Response

The RCP trip criteria setpoints are based on symptoms and are not based on an operator diagnosis of the event. Thus, we do not expect that there will be unnecessary RCP trip resulting from the misdiagnosis of an event. Although event trees are useful for events diagnosis, they are not necessary for RCP trip. In any event, tripping the RCPs would not violate any safety criteria since the design of Trojan safety systems and FSAR analysis for these accidents are based on concurrent loss of offsite power, and therefore RCP trip. Trojan EOPs provide guidance to restart RCPs where applicable to aid in accident recovery and contingency actions are provided to guide the operator if no RCPs are available.

Likewise, the symptom based RCP trip setpoints for Trojan will not lead to delayed trip should the event be misdiagnosed.

NRC Request

D. NRC's guidance for justification of manual RCP trip in the licensee submittals is summarized in this section. This guidance had two purposes. It was intended to assist plants that can and should rely on manual trip to justify it, and it was also intended to help identify those few plants that may not be able to rely on manual trip.

1. Analyses should demonstrate that the limits set forth in 10 CFR 50.46 are not exceeded for the limiting small-break size and location using the RCP-trip set points developed with the guidance of Part C above.

   a. Assume manual RCP trip does not occur earlier than 2 minutes after the RCP-trip set point is reached.

   b. Include allowances for instrument error.

   c. Generic analyses are acceptable if they are shown to bound the plant-specific evaluations.

PGE Response

The generic analyses performed in Reference 1 for small break LOCAs used 10 CFR 50.46 and Appendix K conservatisms and show that 10 CFR 50.46 criteria are met with a manual RCP trip time of at least 2 minutes after trip criteria are reached. The Trojan-specific setpoints include allowance for instrument uncertainty. The generic grouping that includes Trojan is bounding.

NRC Request

D. 2. Determine the time available to the operator to trip the RCPs for the limiting cases if manual RCP trip is proposed.

   a. Perform the analysis for the limiting small-break size and location identified in D.1 above.

   b. Use the most probable best-estimate analysis to determine the time available to trip the RCPs following the time when the RCP-trip signal occurs.

   c. Most probable plant conditions should be identified and justified by each licensee.

   d. NRC will accept conservative estimates in the absence of justifiable most probable plant conditions.

PGE Response

More than 2 minutes are available for operator action between the time the RCP trip setpoint is reached and the time when the trip is required using Appendix K assumptions. The most probable best estimate analysis provided in Reference 2 shows that the RCPs may be tripped at any time during a LOCA event without resulting in excessive clad temperatures. The generic analyses in Reference 2 are applicable to Trojan, as are the most probable plant conditions identified in the generic analysis, and bound Trojan conditions. Therefore, the best estimate analyses justify that manual RCP trip is acceptable.

NRC Request

D. 2. e. Justify that the time available to trip the RCPs is acceptable if it is less than the Draft ANSI Standard N660.

(1) Include an evaluation of operating experience data.

(2) Address the consequences if RCP trip is delayed beyond this time.

(3) Develop contingency procedures and make them available for the operator to use in case the RCPs are not tripped in the preferred time frame.

(4) No justification is required if the time available to trip the RCPs exceeds the Draft ANSI Standard N660.

PGE Response

As demonstrated in Reference 2, the time available to trip RCPs exceeds Draft ANSI Standard N660.

NRC Request

E. Assure that good engineering practice has been used for the following areas.

1. Establish the quality level for the instrumentation that will signal the need for RCP trip.

a. Identify the basis for the sensing-instruments' design features chosen.

b. Identify the basis for the sensing-instrument's degree of redundancy.

c. Licensees can take credit for all equipment available to the operators that they have sufficient confidence in its operability during the expected conditions.

PGE Response

Trojan instrumentation used for RCP trip criteria are: wide-range RCS pressure instruments PT-403 and PT-405 and steam generator pressure instruments PT-514, -515, -516, -524, -525, -526, -534, -535, -536, -544, -545, and -546. These instruments are designated as Category 1, Type A variables for design purposes as required by Regulatory Guide 1.97 and PGE-1043, "Accident Monitoring Instrument Review". Environmental qualification and use of safety-grade power supplies for these instruments ensure that they will be available following an accident. The instruments and power supplies are fully redundant. The chosen instruments are operable under adverse conditions.

NRC Request

E. 2. Ensure that emergency operating procedure exist for the timely restart of the RCPs when conditions warrant.

PGE Response

Trojan EOPs are written to provide guidance to restart RCPs when conditions warrant. This restart is made to enhance core heat removal and/or provide the operator with improved ability to control RCS pressure, RCS temperature, and pressurizer level. The response to NRC Request IV.C.2.b lists the EOPs which include RCP restart steps. RCP restart steps in the Trojan EOPs correspond with those in the WOG ERGs.

NRC Request

E. 3. Instruct operators in their responsibility for tripping RCPs for small-break LOCAs including priorities for actions after the engineered safety features actuation occurs.

PGE Response

Operator instruction for tripping RCPs for small break LOCAs is provided annually during classroom training and simulator exercises. The criteria and setpoints which require RCP trips are discussed in detail as are the conditions in which RCP trip criteria does not apply, such as during an operator-controlled cooldown. During simulator exercises, the operator is exposed to a wide variety of accident scenarios which require decisions to be made on when to trip the RCPs based on EOP action steps. Priorities for actions after the engineered safety features (ESF) actuation occurs are noted, with verification of ESF automatic actions having priority over RCP trip and RCP trip having priority over other manual actions. It is stressed that the RCP trip criteria is designed to prevent potential core uncovery during a small break LOCA event while allowing continued RCP operation during an SGTR and non-LOCA events.

Reference

1. Letter (WOG 83-257) to Westinghouse Owners Group Representatives From Bruce King, WOG, "WOG Evaluation of Alternate RCP Trip Criteria, Final Report", dated October 6, 1983.

2. Letter (WOG 84-143) to Westinghouse Owners Group Representatives from T. A. Lordi, WOG, "Suggested Test for Utility Response - NRC Generic Letter 83-10 c&d" dated March 9, 1984.

GRA/kal
0222P.186