TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401

5N 157B Lookout Place

DEC 15 1987

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

In the Matter of	)	Docket Nos. 50-327
Tennessee Valley Authority	)	50-328

SEQUOYAH NUCLEAR PLANT (SQN) - GENERIC LETTER 85-12 - IMPLEMENTATION OF THREE MILE ISLAND ACTION ITEM II.K.3.5, "AUTOMATIC TRIP OF REACTOR COOLANT PUMPS"

Reference: B. J. Youngblood's letter to S. A. White dated December 30, 1986, "Request for Additional Information on the Reactor Coolant Pump Trip Issue (Generic Letter 85-12)"

Enclosed is TVA's SQN-specific response providing the requested clarification for the reactor coolant pump trip issue. Since no direct questions were asked, we have responded to questions inferred from the enclosure to the referenced letter. The submittal of this information completes the Safety Issues Management System item numbers M45413 and M49694 for unit 1 and M49114 and M51528 for unit 2.

If you have additional questions, please telephone Kathy S. Whitaker at (615) 870-7748.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

R. Gridley, Director
Nuclear Licensing and
Regulatory Affairs

Enclosure
cc: see page 2

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U.S. Nuclear Regulatory Commission

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cc (Enclosure):
Mr. K. P. Barr, Acting Assistant Director
for Inspection Programs
TVA Projects Division
Office of Special Projects
U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

Mr. G. G. Zech, Assistant Director
for Projects
TVA Projects Division
Office of Special Projects
U.S. Nuclear Regulatory Commission
4350 East-West Highway
EWW 322
Bethesda, Maryland 20814

Sequoyah Resident Inspector
Sequoyah Nuclear Plant
2600 Igou Ferry Road
Soddy Daisy, Tennessee 37379

ENCLOSURE

Sequoyah Nuclear Plant (SQN) Reactor Coolant Pump (RCP)
Trip Issue Clarification

A. "Determination of RCP Trip Criteria"

According to Westinghouse Owners Group (WOG), the effectiveness of the three alternative RCP trip parameters, Reactor Coolant System (RCS) pressure, RCS subcooling, and RCS/secondary differential pressure, is essentially equivalent. The selection should be based on plant-specific considerations. At SQN, the choice of RCS pressure as the RCP trip parameter was based on the adequacy of its discrimination capability to prevent RCP trip for steam generator tube ruptures (SGTRs) and non-loss of coolant accident (LOCA) transients. The RCS pressure of 1,250 psig falls within WOG's acceptable range (less than 1,458 psig) as a valid indicator at SQN. Additionally, available instrumentation was a factor in the decision. SQN does not have redundant RCS subcooling instrumentation, and the use of RCS/secondary differential pressure would involve the comparison of values from five meters physically separated from each other.

Uncontrolled depressurization refers simply to any depressurization that is not the direct result of deliberate operator action. The RCP trip criteria should not be applied after an operator-initiated (controlled) depressurization.

A1. RCS pressure is indicated by two pressure transmitters (PTs) at SQN as shown on TVA drawing 47W610-68-7, provided to NRC earlier. PT-68-66 is connected to hot leg 3, and PT-68-69 is connected to hot leg 1. An additional transmitter, PT-68-62, is planned for installation and will be connected to the upper head at a convenient outage. This installation is not considered a commitment.

A2. Two aspects of instrument uncertainties are discussed below: adverse local conditions and operator response to instrumentation.

Adverse local conditions, such as fluid jet and pipe whip, are not a consideration for pressure instrumentation. Walkdowns confirmed that there is no high energy piping in the areas where the PTs are or will be installed. The capillary sensing lines that transmit pressure from the reactor vessel to instruments in the Auxiliary Building are armored and designed to withstand Design Baseline Event conditions. The physical separation of the transmitters from steam lines makes it unlikely that a steam line break would adversely affect their indications. The PTs and associated cables are environmentally qualified in accordance with 10 CFR 50.49.

The philosophy for operators' response to instrumentation is found in Administrative Instruction (AI)-30 (reference 1) and follows.

> All operators shall believe their instruments, and response to these instrument indications and annunciations as specified in instructions shall be complied with unless and until the indications are proved incorrect by a thorough investigation. After instruments are analyzed and considered to be incorrect,

they shall be identified as such and alternate means established to monitor the parameter while the instrument is suspected to be in error. In the event there is no other means to determine the value of the parameter monitored by an instrument, the worst value shall be assumed as a guide to the operator's response.

B. "Potential Reactor Coolant Pump Problems"

B1. Containment isolation affects the Chemical and Volume Control System in the following ways. A Phase A containment isolation results in letdown isolation, excess letdown isolation, and charging flow isolation. RCP seal injection flow is maintained; the RCP seal return aligns to the pressurizer relief tank. Both centrifugal charging pumps start, and the charging pump suction aligns to the refueling water storage tank. The boron injection tank inlet and outlet valves open, and the boron injection tank to boric acid tank valves close. Thermal barrier cooling is maintained. A Phase B containment isolation terminates cooling water to the RCP fan coolers, RCP oil coolers, and thermal barrier. RCPs are tripped, because continued operation without cooling water would result in pump damage. RCP seal cooling is maintained, though, by RCP seal injection flow.

Because RCP seal injection is maintained during a Phase B containment isolation, component cooling water is not essential for RCP seal cooling. Component cooling water flow could be established, however, in approximately ten minutes.

The emergency instructions for restart of the RCPs require either restoration of pressurizer level and subcooling during post-LOCA cooldown or a termination of the event before the pumps are restarted. In accordance with normal operating procedures, support conditions must also be verified before pump restart to ensure small-break LOCA (SBLOCA) concerns do not exist. The Function Restoration Guidelines also contain requirements for RCP restart. Guideline FR-I.3, "Response to Voids in Reactor Vessel," establishes pressurizer level, subcooling, and normal RCP support conditions required before pump restart.

A Phase B containment isolation terminates cooling water to the RCPs, and operators are instructed to trip the RCPs to prevent damage. This is consistent with WOG Emergency Response Guideline (ERG) E-0, "Reactor Trip or Safety Injection," step 14 (revision 1). A pressure differential large enough to initiate a Phase B containment isolation would be indicative of a LOCA or main steam line break. RCP operation has little or no mitigation effect for large-break LOCAs, and a pump trip is desirable for SBLOCAs. RCP trip is not disadvantageous during main steam line breaks.

B2. Seismically qualified RCP undervoltage, underfrequency relays are located in the Auxiliary Building and are connected in series to RCP breakers located on the turbine bay. All other components that are required to trip the RCPs, with the exception of the PTs and their associated cables, are located in mild environments. The potential for adverse conditions in these environmentally protected areas is small.

An RCP trip from the main control room can be accomplished in less than one minute. If the control room handswitches will not operate, an RCP trip from the switchgear can be performed in approximately three minutes.

The WOG background document (reference 2) discusses RCP operation in a voided system. TVA has assessed WOG's evaluation, provided below, and agrees with it.

2.5.2 Pumping High Quality Mixtures

If it is assumed that the RCS is initially in a water-filled condition and then a LOCA occurs, the RCPs will continue to pump this fluid efficiently while the net fluid density in the RCS decreases. If all RCPs remain in operation, the coolant velocities and densities will remain fairly uniform in all loops. Slight variations will be found as the size of SBLOCA increases and the RCS pressure decreases. If one or more, but less than all RCPs continue to operate, there can exist large variations in loop flowrates and qualities in those loops. While the fluid in the pumped loop will be uniform, phase separation may occur in other loops, especially at low fluid densities if the idle loop SGs remain effective in removing heat.

These conditions are consistent with Westinghouse analyses, with scale model RCP tests conducted by Combustion Engineering and by tests conducted at LOFT [Loss of Fluid Test] . . . . Core heat removal capability remains adequate as long as the SGs prove efficient at heat transfer. As is to be expected, pump current decreases as the RCS fluid density decreases.

C. "Operator Training and Procedures (RCP Trip)"

C1. Operator training on RCP trip emphasizes the desirability to maintain RCP operation for virtually all non-LOCA accidents. This philosophy is based on the need for core residual heat removal and provides pressure control assistance and additional margin to safety criteria limits. Continued RCP operation in non-LOCA accidents also makes operator actions easier during recovery.

SBLOCAs, indicated by uncontrolled depressurization below 1,250 psig, warrant RCP trip if the RCPs are running. This maintains RCS inventory and peak clad temperatures within acceptable limits. An RCP trip also should be initiated upon Phase B containment isolation to prevent pump damage from overheating.

The RCPs should not be tripped unless either one centrifugal charging pump or safety injection pump is in operation. The basis for this is provided in the WOG background document (reference 2). TVA has evaluated this position and found it applicable to SQN. An excerpt follows.

2.3 RCP Trip Criteria

RCP trip criteria have been developed and incorporated into the ERGs to provide for RCP trip when required for SBLOCAs and to minimize the probability of RCP trip when not required. The RCP trip criteria consist of 2 fundamental parts:

1) Successful operation of the safety injection system
2) Selected plant parameters reaching critical setpoints

In the Optimal Recovery Guidelines (ORGs), the RCPs are not tripped unless this 2-part criteria is satisfied. It cannot be emphasized too strongly that a fundamental condition which must be satisfied for RCP trip during an emergency condition is that at least one high pressure SI pump be in operation and capable of delivering flow to the RCS. If this fundamental condition is not met, the RCPs should not be tripped regardless of whether or not the plant parameters indicate that a trip setpoint has been reached. Analysis has shown that if the SI system is not in operation, the RCPs can be operated to provide core heat removal. . . . . for SBLOCAs with the high-head safety injection (HHSI) pumps not in operation, the RCPs continue to provide core heat removal via the break and the SGs. With the RCPs running, the RCS can safely be depressurized to the point where the accumulators and the low-head safety injection (LHSI) pumps can ensure core heat removal before symptoms of Inadequate Core Cooling (ICC) are exhibited.

The WOG background document (reference 2) also indicates that it is beneficial to maintain RCP operation in virtually all non-LOCA accidents. TVA concurs with WOG's evaluation, which is provided below.

2.2.2 Non-LOCA Accidents

In virtually all non-LOCA accidents, it is advantageous to have the RCPs in operation. Either this provides additional margin to safety criteria limits or makes operator actions during recovery easier. However, whether or not the RCPs remain in operation or are tripped, safety criteria must be met and plant operators are provided with guidance to mitigate and to recover from the accident. For accidents involving loss of secondary coolant, control of RCS pressure, RCS temperature, and pressurizer level is the major concern, rather than core cooling. For the various types of SGTR events, (either single or multiple ruptures) control of the leak rate, RCS pressure, RCS temperature, and pressurizer level is important. In all cases, RCP operation provides enhanced core heat removal and makes RCS pressure control by the operator a more straight forward matter. In general, for non-LOCA accidents, it is desirable to have the RCPs in operation throughout the event.

> The NRC . . . makes this preference clear in the requests for development of RCP trip setpoints based on parameters which will allow the operation of some (or all) of the RCPs during those accidents which will benefit from them, yet result in a trip of RCPs for SBLOCAs and others which require it.

References

1. SQN Administrative Instruction AI-30, "Nuclear Plant Method of Operation," revision 9, August 27, 1987.

2. Background Information for Westinghouse Owners Group Emergency Response Guidelines, Generic Issue, RCP Trip/Restart, HP/LP-revision 1, September 1, 1983.