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TEXAS UTILITIES GENERATING COMPANY

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February 7, 1985

JOHN W. BECK
MANAGER-LICENSING

Director of Nuclear Reactor Regulation
Attention: Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION
DOCKET NOS. 50-445 AND 50-446
CONTAINMENT SUMP PERFORMANCE

REF: (a) NRC letter dated November 27, 1984

(b) TUGCO letter TXX-4378 dated December 17, 1984

(c) TUGCO letter TXX-4394 dated January 11, 1985

(d) C. M. Thompson, et. al., Inadequate Core Cooling Studies of Scenarios with Feedwater Available Using the NO TRUMP Computer Code, Westinghouse Electric Corporation, WCAP-9753, (Proprietary) WCAP-9754, (Non-Proprietary), June, 1980.

(e) Zion Probabilistic Safety Study, Commonwealth Edison, 1981.

(f) J. Butler, et. al., Bryon Generating Station Limiting Conditions for Operation Relaxation Program, Westinghouse Electric Corporation, WCAP-10526, April 1984.

Dear Mr. Youngblood:

This letter supplements and summarizes the reponse to the second information request of reference (a) and is intended to be complete with respect to that item. Our earlier responses to this request are contained in references (b) and (c). Restating the NRC information request:

"Discuss whether the reactor coolant pumps can be restarted during the recirculation phase and the potential for core blockage assuming the maximum debris volume (300 ft^3) stored in the reactor vessel lower plenum."

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Response

Each of the CPSES Emergency Response Guidelines (ERGs) that calls for a Reactor Coolant Pump (RCP) start contains an attachment which details the conditions for starting a RCP. Each attachment to these procedures (with the exception of FRC-0.1, Response to Inadequate Core Cooling) has been changed to state that a RCP should not be started if containment spray has been actuated and transfer to cold leg recirculation has been performed. This limitation is not restrictive in any way on the operator's ability to respond to the expected course of any accident and to pursue optimum recovery procedures. The RCP start attachment to procedure FRC-0.1 (Response to Inadequate Core Cooling) does not contain this limitation and the body of the procedure states that normal conditions for start of a RCP are desired but not necessary when core exit temperatures are greater than 1200°F. The precautions and limitations for starting a RCP contained in the CPSES Emergency Response Guidelines are attached.

For information, the 300 ft^3 debris volume assumption is not appropriate. Ten cubic feet in the maximum volume expected (see response to information request 1(b) of reference (a) contained in reference (b).

Background

1. Start of Reactor Coolant Pumps in ERG's

   There are three conditions where it may be desirable to start a RCP per the ERGs. The first situation would be a condition where imminent pressurized thermal shock is of concern. These conditions would most likely occur at the beginning of an accident not after the cold leg recirculation has been established. In any event, the analysis used as the basis for guidance for pressurized thermal shock provided in the ERGs has not assumed that RCP restart occurs. RCP restart is included in FRP-0.1 solely as a potential additional benefit but not required. The analysis performed as a basis for recovery guidance did not assume RCP start, but the effect was evaluated. Nonetheless, operator guidance is provided whether or not an RCP is restarted.

   The second case where a RCP would be restarted is the case where adequate subcooling margin and pressurizer level have been restored and forced circulation cooldown is desirable. This would be the condition when the LOCA initiating break is sufficiently small that make-up water flow to the RCS will balance loss and the plant is still at higher temperatures. These conditions would be most likely satisfied early in the accident scenario. Establishing subcooling and pressurizer level where a LOCA was sufficiently large to cause containment isolation, spray initiation, RWST depletion and subsequent shift to cold leg recirculation is not likely. If it were to occur, it is not logical to expect the operator to want to leave an established core cooling regime (cold leg recirculation) to go to a forced circulation cooldown and the new limitation discussed above proceduralizes this conclusion.

   The design basis for long term heat removal following a LOCA is containment sump recirculation. The guidance provided in the ERG's is consistent with that basis. Additional guidance is provided to cooldown and depressurize the primary system, if possible, in EOS-1.2, Post-LOCA Cooldown and Depressurization. The intent of the guideline is to cool down and depressurize the RCS prior to going on emergency coolant recirculation. After recirculation is initiated the restart of the RCP is not expected nor required to satisfy any applicable safety criteria. Guidance is provided whether or not a RCP is restarted. In any event the specific change in RCP starting limitations and guidelines preclude the starting of a reactor coolant pump after entering cold leg recirculation except for the inadequate core cooling case.

The remaining case for starting a RCP is the case where core exit temperature is greater than 1200°F and all Engineered Safety Feature cooling modes have failed to restore of cooling. The RCP's will be started even under conditions where the RCP may be damaged. This would of course only be done when core damage was imminent and no other cooling mode is available. This case is extremely remote. In order to reach this condition, a series of system failures would be required. First, a small LOCA would be assumed to initiate, followed by failure at some time of all high pressure safety injection capability (two SI pumps and two charging/SI pumps). Since makeup would not be available, the ERG's direct use of secondary steam release capability to lower RCS pressure and cause SI accumulator and low head SI pump injection to re-establish makeup capability. This action is listed in four guidelines to provide multiple levels of contingency: (1) EOS-1.2, Post LOCA Cooldown and Depressurization; (2) ECA-1.1, Loss of Emergency Coolant Recirculation; (3) FRC-0.2, Response to Degraded Core Cooling; and (4) FRC-0.1 Response to Inadequate Core Cooling.

The basis for the steam dump recovery action and generic analyses demonstrating successful recovery for cases with significant core uncovery are presented in Reference (d). Only for the unlikely event that steam release capability is not available would a condition be reached where RCP restart would be directed in the ERG's.

The event frequency for a small LOCA with a loss of high pressure SI and failure of steam release capability is less than 1×10^{-8} per reactor year. This is based on: (1) an initiating event frequency for small LOCA of 3.54×10^{-2}/year from Reference (e); (2) a failure frequency of primary system feed through SI or charging/SI pumps of 1.1×10^{-7} from Reference (f) and (3) a failure frequency of a single valve to bound the failure frequency of steam release capability of 1×10^{-3}/year. Therefore, RCP restart following a small LOCA is an extremely low probability event and is only directed by the emergency procedures when all other means of re-establishing core cooling have been unsuccessful.

2. Pressurizer Operation

In the interest of completeness, operation of the pressurizer should be discussed. It is unlikely that an appreciable amount of paint chips could enter the pressurizer. The major components that affect the operation of the pressurizer are the spray nozzle and the heaters. Paint particles 1/8 inch and smaller will readily pass through the spray nozzle since it is a 3 1/4 inch diameter hollow casting with vane located on the inside diameter. There are no orifices in this nozzle. Any debris which could potentially enter the spray nozzle would pass through the nozzle with no difficulty.

Pressurizer heaters are not required for a LOCA before or after transfer to emergency coolant recirculation. The ERG's are consistent with the design basis which relies on recirculation for long term heat removal capability. If pressurizer level is established and heaters are available the ERG's direct use of heaters to optimize primary system pressure control in order to potentially cooldown and depressurize before transfer to recirculation. It is not expected nor required that the heaters be available during recirculation to satisfy any applicable safety criteria.

3. Other Investigations

Reference (c) discussed additional investigation areas in (1) determination of particle size distribution and the influence of temperature and turbulence on that distribution, (2) the behavior of paint chip particles inside the containment sump, (3) the time constant associated with the concentration of paint particles in the RCS, and (4) the studies of reactor vessel lower plenum velocities when RCPs are operating. In view of the change in CPSES procedures discussed above which preclude the conditions stated in question 2 of reference (a), we have ceased all further analysis in these areas at this time.

Sincerely,

J S Marshall for

John W. Beck

JSM/grr
Attachment

c - A. Vieti
Conrad McCracken

STARTING REACTOR COOLANT PUMPS

1. Precautions and Limitations

   - A steam bubble should be present in the Pressurizer.

   - Seal injection water temperature must be maintained below 130°F.

   - RCP must be stopped if the following temperature limits are exceeded:

     a) Pump bearing temperature greater than 225°F.
     b) Upper or lower motor bearing temperature greater than 200°F.
     c) Motor winding temperature greater than 265°F.

   - A pressure differential of greater than 200 psid must be maintained across the number 1 seal when RCP is running.

   - RCP CCW return temperatures must be maintained less than 135°F.

   - The following starting duty must be adhered to:

     a) Within any two (2) hour period, the number of starts should be limited to a maximum of three (3) with a minimum idle time of 30 minutes prior to each restart.

     b) When three starts or attempted starts have been made within a two hour period, then a fourth start should not be made until the motor has been allowed to cool by standing idle for at least one hour,

     c) Only one RCP is to be started at any one time.

   - An RCP shall not be started if containment spray has been actuated and transfer to Cold Leg recirculation has been performed. (Not included in FRC-0.1)

2. Starting an RCP

   a. Verify oil reservoir alarms clear for RCP to be started.

   b. Ensure seal injection flow is between 6 and 10 gpm.

   c. Verify seal leakoff flow between 0.2 and 5 gpm.

   d. Verify RCP CCW return flows within normal range.

   e. Ensure greater than 200 psid across number 1 seal.

   f. Verify seal water standpipe low level alarm clear.

g. Start Oil Lift Pump. Verify pressure permissive interlock satisfied (blue light on).

h. After Oil Lift Pump running for at least two minutes, start the associated RCP.

i. Verify an increase in RCS loop flow within 10 seconds. IF NOT, THEN stop the RCP.

j. Verify current decay to less than 750 amps within one minute. IF NOT, THEN stop the RCP.

k. Observe RCP parameters for normal operation.

l. After one minute of RCP Operation, stop the Oil Lift Pump.