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April 29, 1987

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Virgil C. Summer Nuclear Station
Docket No. 50/395
Operating License No. NPF-12
Charging Pump Miniflow Modification

Dear Mr. Denton:

South Carolina Electric & Gas Company (SCE&G) considers the action described in our letter dated January 22, 1982, in response to IEB 80-18, "Maintenance of Adequate Minimum Flow Through Centrifugal Charging Pumps Following Secondary Side High Energy Line Rupture," adequate to address the concerns identified in the Bulletin.

The following actions were taken in response to the IEB:

1. The safety injection automatic closure signal for the Centrifugal Charging Pumps (CCP) miniflow isolation valves has been removed. Miniflow is now aligned to the Volume Control Tank (VCT) and the VCT relief valve has been verified operable.

2. Emergency Operating Procedures have been changed requiring the operator to: (a) close the miniflow isolation valves for each pump if pressure decreases to 1380 psig and (b) to reopen the valves if pressure increases to 2000 psig or flow decreases to less than 200 gpm per running pump.

The operator actions described above have been justified by Westinghouse in a generic evaluation transmitted to SCE&G by letter CGWS-1047 dated July 16, 1980 (Attachment 1 enclosed). Since this evaluation, SCE&G has removed the Boron Injection Tank (BIT) and performed an additional analysis for a Secondary System Rupture (page 2. Item B, of the attached) which shows core protection in a "credible" steamline rupture, even though the reactor may return to criticality after a reactor trip. Operator action required to isolate miniflow during a LOCA is not required until 10 minutes into the event.

The operator action is initiated by the Reactor Coolant Pump trip criteria which ensures the event is a LOCA and not a steamline, feedline or steam generator tube rupture. The initiating criteria for operator action to trip Reactor Coolant pumps has been evaluated and accepted by the NRC. This information was provided in the SCE&G response to TMI Action Item II.K.3.5, Generic Letter 83-10 and Generic Letter 85-12.

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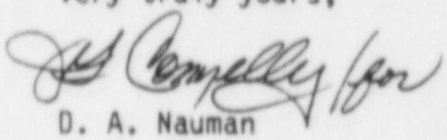
The valves required to be closed are powered from diesel generator backed motor control centers. The individual pump miniflow valves are powered from (B) train power. A common isolation valve is available as a backup to the individual pump miniflow isolation valves. This common valve is powered from the "A" train diesel generator backed motor control centers. The RCS pressure indicators, used to determine when to isolate miniflow, are powered from separate redundant power sources. Each power supply is fed from an inverter which is powered by diesel backed AC or DC which allows continuous uninterrupted indication.

The attached Westinghouse evaluation demonstrates that the accident analysis remains valid for the analyzed events. Since the accident analysis criteria is more conservative than the Technical Specifications bases, the Technical Specifications remain valid.

Based on the above, SCE&G plans no further modification based on IEB 80-18.

If you should have any further questions, please advise.

Very truly yours,



D. A. Nauman

RJB:DAN/bjh

Attachment

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CENTRIFUGAL CHARGING PUMP OPERATION FOLLOWING SECONDARY SIDE HIGH ENERGY LINE RUPTURE

Reference 1: NS-TMA-2245, 5/8/80

Reference 1 notified the NRC of a concern for consequential damage of one or more centrifugal charging pumps (CCP) following a secondary system high energy line rupture. Reference 1 included a calculational method and sample calculation to permit evaluation of this concern on a plant specific basis. Should a plant specific problem be identified, Westinghouse provided several recommendations for the interim until necessary design modifications can be implemented to resolve the problem. These recommendations included two proposed interim modifications which included:

1. Remove the safety injection initiation automatic closure signal from the CCP miniflow isolation valves.

2. Modify plant emergency operating procedures to instruct the operator to:

   a. Close the CCP miniflow isolation valves when the actual RCS pressure drops to the calculated pressure for manual reactor coolant pump trip.

   b. Reopen the CCP miniflow isolation valves should the wide range RCS pressure subsequently rise to greater than 2000 psig.

Prior to making this recommendation, Westinghouse evaluated the impact of the recommended operating procedure modifications on the results of the various accidents which initiate safety injection and are sensitive to CCP flow delivery. The accidents evaluated in detail include secondary system ruptures and the spectrum of small loss of coolant accidents. The analytical results for steam generator tube rupture and large loss of coolant accident are not sensitive to a reduction in CCP flow of the magnitude that results from the recommended modifications. This letter functions to supplement Reference 1 and identify the sensitivity of the accident analyses to the recommended modifications. This evaluation is generic in nature.

Secondary System Rupture

Sensitivity analyses have been performed for secondary high energy line ruptures to evaluate the impact of reduced safety injection flow due to normally open miniflow isolation valves. These analyses indicate an insignificant effect on the plant transient response.

A. Feedline Rupture

Following a feedline rupture, the reactor coolant pressure will reach the pressurizer safety valve setpoint within approximately 100 seconds assuming maximum safeguards with the power-operated relief valves inoperable. With minimum safeguards, the reactor coolant pressure will not reach the pressurizer safety valve setpoint until approximately 300 seconds. The time that the reactor coolant system pressure remains at the pressurizer safety valve setpoint is a function of the auxiliary feedwater flow injected into the non-faulted steam generators and the time at which the operator is assumed to take action. With the miniflow isolation valves open, the peak reactor coolant system pressure and the water discharged via the pressurizer safety valves are insignificantly changed from the FSAR results.

B. Steamline Rupture

The effects of maintaining the miniflow isolation valves in a normally open position was also investigated following a main steamline rupture. For the condition II "credible" steamline rupture, the results of the transient with the miniflow valves open showed that the licensing criterion (no return to criticality after reactor trip) continues to be met. The condition III and IV main steamline ruptures were also reanalyzed assuming the miniflow valves were open. The results of the analysis showed that, even with reduced safety injection flow into the core, no DNB occurred for any rupture.

Small Loss of Coolant Accidents

Sensitivity analyses have been performed to evaluate the impact of reduced safety injection flow on small break loss of coolant accidents (LOCAs). These analyses indicated that miniflow isolation can be delayed, but it must occur at some time into the small break LOCA transient in order to limit the peak clad temperature (PCT) penalty.

The proposed modification delays miniflow isolation and reduces SI flow delivered by approximately 45 gpm at 1250 psia during the delay time period. The impact of this modification was evaluated based on two isolation times: 1) The time equivalent to the RCP trip time, and 2) approximately 10 minutes in the transient, or just prior to system drain to the break for the worst small break sizes. The second time was evaluated to determine the impact if the operator does not isolate miniflow within the proposed prescribed time. The spectrum of small break sizes are considered to encompass all possible small break scenarios. Only cold leg break locations are considered since they will continue to be limiting in terms of PCT.

A. Very small breaks that do not drain the RCS or uncover the core, and maintain RCS pressure above secondary pressure (< ~2" diameter).

   For these break sizes, it is quite possible that the operator may never isolate the miniflow line, since the pressure setpoint will not be reached, and continued pumped SI degradation will persist. However, this will have no adverse consequences in terms of core uncovery and PCT. No core uncovery will be expected for the degraded SI case, similarly to the base comparison case with full SI. The only effect would be a slightly lower equilibration pressure for a given break size.

B. Small breaks that drain the RCS and result in the maximum cladding temperatures (2" < diameter < 6").

   This range of break sizes represents the worst small break size for

most plants as determined utilizing the currently approved October 1975 Evaluation Model version, as shown in WCAP-8970-P-A. If miniflow is isolated at the RCP trip setpoint rather than the "S" signal, a reduction in safety injection flow of less than 45 gpm results, averaged for the approximately 60 second period of time separating the two events. This reduction in RCS liquid inventory results in core uncovery less than one second earlier, and has a negligible impact on PCT. If miniflow is isolated at the time of core uncovery, or approximately 10 minutes for break sizes in this range, a greater reduction in RCS liquid inventory results in a core uncovery 10 seconds earlier in the transients resulting in less than a 10°F PCT penalty for the worst size small break. This would not result in any present FSAR small break analysis becoming more limiting than the corresponding large break LOCA FSAR analysis.

If miniflow isolation does not occur at any time into the transient for this categor. of small LOCA, a PCT penalty of 200°F or more could occur.

C. Small break sizes larger than the worst break through the intermediate break sizes ($\geq$ 6" diameter).

Break sizes in this range have been determined to be non-limiting for small break utilizing the currently approved October 1975 Evaluation Model, WCAP-8970-P-A. If miniflow isolation occurs at the RCP trip time for these break sizes, the negligible effect on PCT presented above also applies. Similarly, if isolation occurs prior to core uncovery, the small (< 10°F) PCT penalty will result as well. However, for these larger break sizes, the time of first core uncovery occurs prior to 10 minutes. If miniflow isolation is not performed until 10 minutes, reduced SI will be delivered during the core uncovery time, which can have a greater impact on PCT. Studies indicate a potential PCT penalty of 40°F resulting for these non-limiting break sizes if miniflow is not isolated until 10 minutes. This is not expected to shift the worst break size to larger breaks, since these breaks are typically hundreds of degrees less than smaller limiting small breaks analyzed with the currently approved Evaluation Model.

For all FSAR small LOCA analyses, one complete train failure is assumed. It is clear that two charging pumps without miniflow isolation provides more flow than one pump with miniflow isolation. The impact presented in this evaluation maintains the one train failure and assumes no miniflow isolation for the remaining pump. If both pumps were operating, the PCT results would be much lower than present FSAR calculations even if miniflow isolation is not assumed to occur for the two pump case. In this situation, the plant FSAR small break calculations remain conservative.

These sensitivity studies form the basis for the recommended interim modifications to the emergency operating procedures. The accidents evaluated are relatively insensitive to the recommended modifications. Further, the accidents evaluated will give results that satisfy acceptance criteria as long as the CCP miniflow is isolated within 10 minutes of event initiation. However, small LOCA sensitivity studies with one SI train operating confirm that small LOCA analyses require miniflow isolation within 10 minutes.

To comply with the recommended modifications, the operator can isolate miniflow at any point in the depressurization transient prior to RCS pressure reaching the RCP trip setpoint. Should a repressurization transient occur, the operator can open CCP miniflow at any point between the RCP trip setpoint and 2000 psig. Such operator actions will ensure that plant accidents satisfy acceptance criteria and protect the CCPs from consequential damage during the repressurization transient that accompanies a secondary system high energy line rupture at high initial power levels.