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O. W. DIXON, JR.
VICE PRESIDENT
NUCLEAR OPERATIONS

November 14, 1984

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

Subject: Virgil C. Summer Nuclear Station
Docket No. 50/395
Operating License No. NPF-12
Load Rejection Technical
Specification Change

Dear Mr. Denton:

In a letter from O. W. Dixon, Jr. to H. R. Denton dated August 24, 1984, South Carolina Electric and Gas Company (SCE&G) requested a revision to the Virgil C. Summer Nuclear Station Technical Specifications for the Steam Generator low low level and the overtemperature delta-t reactor trip setpoints. Questions concerning these technical specification changes were transmitted to SCE&G in a letter from the NRC Staff dated October 9, 1984. This letter is provided in response to these questions.

The setpoint revisions requested in the letter dated August 24, 1984 improve the capability of the Virgil C. Summer Nuclear Station to handle a full load rejection without tripping the reactor. During the initial phase of a load rejection transient, T-average increases until the steam dump system actuates and assumes the plant load. With the present overtemperature delta-t and steam dump control system setpoints, T-average increases far enough and rapidly enough to cause a reactor trip on overtemperature delta-t due to the T-average penalty term in the setpoint equation. The change in steam dump control system setpoints will provide increased steam dump sooner in the transient, thus reducing the rate and magnitude of the increase in T-average. The decrease in t_4 in the overtemperature delta-t setpoint equation will reduce the anticipatory response of the T-average compensation reducing the penalty to the setpoint which results from the T-average increase. Together these changes should provide the plant with the capability to handle a full load rejection without initiating a reactor trip on overtemperature delta-t.

Results from full load rejection tests at other Westinghouse plants utilizing Model D steam generators have shown a very rapid

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drop in narrow range level early in the transient of sufficient magnitude to initiate a reactor trip on low low level. The level change is apparently a result of a rapid change in steam generator downcomer fluid velocity and is not due to a change in mass inventory. The change in the low low level setpoint is expected to prevent a reactor trip due to this level change. This setpoint change will also reduce the number of unnecessary reactor trips resulting from feedwater system upsets occurring at higher power levels.

The answers to each of the specific questions received from the Staff in the October 19, 1984 letter are provided in the attachment to this letter.

If you have any further questions, please advise.

Very truly yours,

D A Nauman for

O. W. Dixon, Jr.

SMC:OWD:rh
Attachment:

cc: V. C. Summer
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1. Question: What is the level in feet of the steam generator water level low low trip setpoint of 30% (allowable value: 28.2%) compared to the zero level assumed in the safety analysis of the loss of normal feedwater accident?

Response: The zero level assumed in the safety analysis for the loss of normal feedwater accident (see Final Safety Analysis Report (FSAR) Figure 15.2-27) is the top of the tube sheet. The 30% low low level trip setpoint (measured on the narrow range span) equates to 33.6 feet above the top of the tube sheet.

2. Question: At what level is steam generator heat transfer capability reduced?

Response: The heat transfer capability of the Westinghouse U-tube steam generator does not suddenly begin to reduce at any particular level. When "steam generator level" is referred to it means the water level in the downcomer area of the steam generator and not the level within the tube bundle region. (The narrow and wide range level taps connect to the downcomer area.) When the steam generator is producing steam the fluid in the tube bundle region varies from subcooled water at the tube sheet to a low quality steam/water mixture in the lower region of the tube bundle to a high quality steam/water mixture in the upper region of the tube bundle. Heat transfer capability is relatively constant as long as there are saturated conditions throughout the tube bundle region. Due to the higher density of the water in the downcomer region offsetting the lower density steam/water mixture in the tube bundle region, the saturated conditions in the tube bundle region do not change much until the downcomer level has dropped more than half way down the tube bundle. Heat transfer capability does decrease very rapidly just as the steam generator boils dry.

3. Question: What is the lowest steam generator level that the loss of normal feedwater accident can commence and still not reach the level where steam generator heat transfer capability is reduced at any time during the accident?

Response: The loss of normal feedwater accident analysis presented in section 15.2.8 of the FSAR shows the downcomer level dropping to within five or six feet of the tube sheet resulting in some reduction in heat transfer capability. The important thing that the analysis indicates is that sufficient heat transfer capability is maintained to dissipate core residual heat without water relief from the pressurizer. This analysis assumed that the steam generator low low level trip is initiated when the downcomer level is at zero percent of the narrow range span or approximately 27.8 feet above the top of the tube sheet. The 30% setpoint will result in initiation of the trip at a downcomer level 5.8 feet higher than that assumed in the safety analysis. When worst case instrument uncertainties are considered, the trip is initiated at a downcomer level 5.2 feet higher than that assumed in the safety analysis. This margin indicates that there is significant conservatism in the 30% setpoint.

4. Question: What is the effect on the overtemperature delta-t setpoint by changing t_4 from 33 seconds to 28 seconds?

   Response: Reducing the value of t_4 from 33 seconds to 28 seconds will slow down the response of the T-average dynamic compensation of the overtemperature delta-t setpoint. The dynamic T-average term in the overtemperature delta-t equation compensates for inherent instrument response times and piping transport lags between the core and the temperature sensors in the manifolds. This reduction in t_4 lowers the lead/lag ratio by 15% resulting in a comparable reduction in the anticipatory response of the T-average compensation of the setpoint.

5. Question: What is the effect of the safety analyses listed in FSAR Table 7.2-4 that have a correlation with the overtemperature delta-t trip?

   Response: Of the seven safety analyses listed under overtemperature delta-t in FSAR Table 7.2-4, only four take credit for a reactor trip initiated by overtemperature delta-t. These are uncontrolled rod withdrawal at power, uncontrolled boron dilution, loss of load and accidental depressurization of the reactor coolant system. The other three analyses (excessive heat removal, excessive load increase and accidental depressurization of the main steam system) do not take credit for a reactor trip on overtemperature delta-t; however, the trip does provide diverse backup protection. In these three transients and in the accidental depressurization of the reactor coolant system transient, T-average decreases resulting in a credit to the overtemperature delta-t setpoint. The decrease in t_4 delays this credit thus providing additional conservatism.

   The effect of the decrease in t_4 on the three remaining analyses that take credit for the overtemperature delta-t trip is discussed below for each transient.

Protection for the rod withdrawal at power accident is provided by the overtemperature delta-t trip for low reactivity insertion rates and by the high neutron flux trip for high reactivity insertion rates (see FSAR Figure 15.2.6). The decrease in t_4 will cause the point at which the two segments of the curve in Figure 15.2.8 meet to be at a slightly lower reactivity insertion rate. The high neutron flux portion of the curve will still result in the limiting DNBR which is never less than 1.30.

Uncontrolled boron dilution events require operator action to recognize and terminate the uncontrolled dilution. For an uncontrolled boron dilution at power, the analysis assumes that the operator is alerted to the event by the overtemperature delta-t reactor trip. The analysis indicates that the operator has 43.2 minutes after the trip to terminate the dilution. The decrease in t_4 will result in an insignificant delay in receiving the overtemperature delta-t trip and therefore the response time will not be significantly decreased. The delay is small because the rate of increase in T-average is very slow for a boron dilution event resulting in very little dynamic compensation of the setpoint. The operator response time will still be approximately 43 minutes; more than ample time for the operator to recognize and terminate the event.

Protection for the loss of load accident is provided by the overtemperature delta-t trip when pressurizer pressure control is assumed to function and by the high pressurizer pressure trip when pressurizer pressure control is assumed not to function. FSAR Section 15.2.7 documents the results of analyses for each of these assumptions considering both beginning of life and end of life conditions. For the beginning of life case (small negative moderator temperature coefficient) with pressurizer pressure control, the decrease in t_4 results in a small delay in the overtemperature delta-t trip and a slightly lower minimum DNBR of approximately 1.50 which is still well above the acceptance criteria of 1.30 (see FSAR Figure 15.2-19). For the end of life case (large negative moderator temperature coefficient) with pressurizer pressure control, the decrease in t_4 again results in a small delay in the overtemperature delta-t trip but in this case DNBR does not decrease below its initial value (see FSAR Figure 15.2-21). The increase in DNBR is due to the decrease in nuclear power from the negative moderator temperature coefficient and the increase in pressurizer pressure.

The above discussions demonstrate that the effect of the decrease in t_4 on the protection provided by the overtemperature delta-t reactor trip is minimal and that the safety analysis design basis will continue to be met.