MODERATOR TEMPERATURE COEFFICIENT

LIMITING CONDITION FOR OPERATION

3.1.1.4 The moderator temperature coefficient (MTC) shall be within the limits specified in the CORE OPERATING LIMITS REPORT. The maximum upper design limit shall be:

a. Less positive than $+0.5 \times 10^{-4}$ $\Delta k/k/°F$ whenever THERMAL POWER is ≤70% of RATED THERMAL POWER, and

b. Less positive than 0.0 $\Delta k/k/°F$ whenever THERMAL POWER is >70% of RATED THERMAL POWER.

APPLICABILITY: MODES 1 and 2*#

ACTION:

With the moderator temperature coefficient outside any one of the above limits, be in at least HOT STANDBY within 6 hours.

SURVEILLANCE REQUIREMENTS

4.1.1.4.1 The MTC shall be determined to be within its limits by confirmatory measurements. MTC measured values shall be extrapolated and/or compensated to permit direct comparison with the above limits.

4.1.1.4.2 The MTC shall be determined at the following frequencies and THERMAL POWER conditions during each fuel cycle:

a. Prior to initial operation above 5% of RATED THERMAL POWER, after each fuel loading.

b. At any THERMAL POWER, prior to reaching a RATED THERMAL POWER equilibrium boron concentration of 800 ppm.

c. At any THERMAL POWER, within 14 EFPD after reaching a RATED THERMAL POWER equilibrium boron concentration of 300 ppm. (Note 1)

*With $K_{eff} \geq 1.0$.

#See Special Test Exception 3.10.2.

Note 1: The MTC determination of surveillance 4.1.1.4.2.c is not required if the results of the tests required in surveillances 4.1.1.4.2.a and 4.1.1.4.2.b are within a tolerance of ± 0.16 x 10^{-4} $\Delta k/k/°F$ from the corresponding design values.

3/4.1.1 BORATION CONTROL

3/4.1.1.1 and 3/4.1.1.2 SHUTDOWN MARGIN

A sufficient SHUTDOWN MARGIN ensures that 1) the reactor can be made subcritical from all operating conditions, 2) the reactivity transients associated with postulated accident conditions are controllable within acceptable limits, and 3) the reactor will be maintained sufficiently subcritical to preclude inadvertent criticality in the shutdown condition.

SHUTDOWN MARGIN requirements vary throughout core life as a function of fuel depletion, RCS boron concentration, and RCS Tavg. The most restrictive condition occurs at EOL, with Tavg at no load operating temperature, and is associated with a postulated steam line break accident, and resulting uncontrolled RCS cooldown. In the analysis of this accident, a minimum SHUTDOWN MARGIN is required to control the reactivity transient. Accordingly, the SHUTDOWN MARGIN requirement is based upon this limiting condition and is consistent with FSAR safety analysis assumptions. With Tavg $\leq$200°F, the reactivity transients resulting from any postulated accident are minimal and the shutdown margin provides adequate protection.

3/4.1.1.3 BORON DILUTION

A minimum flow rate of at least 2000 GPM provides adequate mixing, prevents stratification and ensures that reactivity changes will be gradual during boron concentration reductions in the Reactor Coolant System. A flow rate of at least 2000 GPM will circulate an equivalent Reactor Coolant System volume of 6,650 cubic feet in approximately 25 minutes. The reactivity change rate associated with boron concentration reductions will therefore be within the capability of operator recognition and control.

3/4.1.1.4 MODERATOR TEMPERATURE COEFFICIENT (MTC)

The limitations on MTC are provided to ensure that the assumptions used in the accident and transient analysis remain valid through each fuel cycle. The Surveillance Requirements consisting of beginning of cycle measurements and end of cycle MTC predictions ensure that the MTC remains within acceptable values. The confirmation that the measured values are within a tolerance of $\pm$ 0.16 X 10^{-4} $\Delta k/k/°F$ from the corresponding design values (MTC predicted values based on core data) prior to 5% power and prior to reaching a Rated Thermal Power equilibrium boron concentration of 800 ppm provides assurances that the MTC will be maintained within acceptable values throughout each fuel cycle. CE NPSD 911-A and CE NPSD 911 Amendment 1-A, "Analysis of Moderator Temperature Coefficients in Support of a Change in the Technical Specifications End of Cycle Negative MTC Limits", provide the analysis that established the design margin of $\pm$ 0.16 X 10^{-4} $\Delta k/k/°F$. The option to eliminate the EOC MTC measurement requires that the reload analysis and predicted design value be performed using the CE methodology.