

### 3/4.1 REACTIVITY CONTROL SYSTEMS

#### 3/4.1.1 BORATION CONTROL

SHUTDOWN MARGIN -  $T_{avg} > 200^{\circ}\text{F}$

#### LIMITING CONDITION FOR OPERATION

3.1.1.1 The SHUTDOWN MARGIN shall be  $\geq 5.0\% \Delta k/k$ .

APPLICABILITY: MODES 1, 2\*, 3 and 4.

ACTION:

With the SHUTDOWN MARGIN  $< 5.0\% \Delta k/k$ , immediately initiate and continue boration at  $> 40$  gpm of 1720 ppm boron or equivalent until the required SHUTDOWN MARGIN is restored.

#### SURVEILLANCE REQUIREMENTS

4.1.1.1.1 The SHUTDOWN MARGIN shall be determined to be  $\geq 5.0\% \Delta k/k$ :

- a. Within one hour after detection of an inoperable CEA(s) and at least once per 12 hours thereafter while the CEA(s) is inoperable. If the inoperable CEA is immovable or untrippable, the above required SHUTDOWN MARGIN shall be increased by an amount at least equal to the withdrawn worth of the immovable or untrippable CEA(s).
- b. When in MODES 1 or 2§, at least once per 12 hours by verifying that CEA group withdrawal is within the Power Dependent Insertion Limits of Specification 3.1.3.6.
- c. When in MODE 2§§, at least once during CEA withdrawal and at least once per hour thereafter until the reactor is critical.
- d. Prior to initial operation above 5% RATED THERMAL POWER after each fuel loading, by consideration of the factors of e below, with the CEA groups at the Power Dependent Insertion Limits of Specification 3.1.3.6.

\* See Special Test Exception 3.10.1.  
§ With  $K_{eff} \geq 1.0$   
§§ With  $K_{eff} < 1.0$ .

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## REACTIVITY CONTROL SYSTEMS

### SURVEILLANCE REQUIREMENTS (Continued)

e. When in MODES 3 or 4, at least once per 24 hours by consideration of the following factors:

1. Reactor coolant system boron concentration,
2. CEA position \*
3. Reactor coolant system average temperature,
4. Fuel burnup based on gross thermal energy generation,
5. Xenon concentration, and
6. Samarium concentration.

4.1.1.1.2 The overall core reactivity balance shall be compared to predicted values to demonstrate agreement within  $\pm 1.0\% \Delta k/k$  at least once per 31 Effective Full Power Days (EFPD). This comparison shall consider at least those factors stated in Specification 4.1.1.1.1.e, above. The predicted reactivity values shall be adjusted (normalized) to correspond to the actual core conditions prior to exceeding a fuel burnup of 60 Effective Full Power Days after each fuel loading.

\*For Modes 3 and 4, during calculation of shutdown margin with all CEA's verified fully inserted, the single CEA with the highest reactivity worth need not be assumed to be stuck in the fully withdrawn position.

## REACTIVITY CONTROL SYSTEMS

### MODERATOR TEMPERATURE COEFFICIENT

#### LIMITING CONDITION FOR OPERATION

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- 3.1.1.4 The moderator temperature coefficient (MTC) shall be:
- a. Less positive than  $0.5 \times 10^{-4} \Delta k/k/^\circ F$  whenever THERMAL POWER is  $\leq 70\%$  of RATED THERMAL POWER,
  - b. Less positive than  $0.2 \times 10^{-4} \Delta k/k/^\circ F$  whenever THERMAL POWER is  $> 70\%$  of RATED THERMAL POWER, and
  - c. Less negative than  $-2.2 \times 10^{-4} \Delta k/k/^\circ F$  at RATED THERMAL POWER.

APPLICABILITY: MODES 1 and 2\*#

ACTION:

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

#### SURVEILLANCE REQUIREMENTS

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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.

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

#See Special Test Exception 3.10.2

### 3/4.4 REACTOR COOLANT SYSTEM

#### REACTOR COOLANT LOOPS

#### LIMITING CONDITION FOR OPERATION

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3.4.1 Four reactor coolant pumps shall be in operation.

APPLICABILITY: As noted below, but excluding MODE 6.

ACTION:

MODES 1 and 2:

With less than four reactor coolant pumps in operation, be in at least HOT STANDBY within 6 hours.

MODES 3, 4 and 5:

Operation may proceed provided (1) at least one reactor coolant loop is in operation with an associated reactor coolant pump or shutdown cooling pump and (2) the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is increased to and maintained at  $> 5.0\% \Delta k/k$  during operation in MODE 3 when less than four reactor coolant pumps are in operation. The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

#### SURVEILLANCE REQUIREMENT

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4.4.1 The Flow Dependent Selector Switch shall be determined to be in the 4 pump position within 15 minutes prior to making the reactor critical and at least once per 12 hours thereafter

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# All reactor coolant pumps and shutdown cooling pumps may be de-energized for up to 1 hour, provided no operations are permitted which could cause dilution of the reactor coolant system boron concentration.

## 3/4.1 REACTIVITY CONTROL SYSTEMS

### BASES

#### 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  $T_{avg}$ . The most restrictive condition occurs at EOL, with  $T_{avg}$  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 of 5.0%  $\Delta k/k$  is required to control the reactivity transient. Accordingly, the SHUTDOWN MARGIN required by Specification 3.1.1.1 is based upon this limiting condition and is consistent with FSAR accident analysis assumptions. For earlier periods during the fuel cycle, this value is conservative. With  $T_{avg} \leq 200^\circ\text{F}$ , the reactivity transients resulting from any postulated accident are minimal and a 2%  $\Delta k/k$  shutdown margin provides adequate protection.

##### 3/4.1.1.3 BORON DILUTION AND ADDITION

A minimum flow rate of at least 3000 GPM provides adequate mixing, prevents stratification and ensures that reactivity changes will be gradual during boron concentration changes in the Reactor Coolant System. A flow rate of at least 3000 GPM will circulate an equivalent Reactor Coolant System volume of 11,400 cubic feet in approximately 26 minutes. The reactivity change rate associated with boron concentration changes will be within the capability for operator recognition and control.

##### 3/4.1.1.4 MODERATOR TEMPERATURE COEFFICIENT (MTC)

The limiting values assumed for the MTC used in the accident and transient analyses were  $+ 0.5 \times 10^{-4} \Delta k/k/^\circ\text{F}$  for THERMAL POWER levels  $< 70\%$  of RATED THERMAL POWER,  $+ 0.2 \times 10^{-4} \Delta k/k/^\circ\text{F}$  for THERMAL POWER levels  $> 70\%$  of RATED THERMAL and  $-2.2 \times 10^{-4} \Delta k/k/^\circ\text{F}$  at RATED THERMAL POWER. Therefore, these limiting values are included in this specification. Determination of MTC at the specified conditions ensures that the maximum positive and/or negative values of the MTC will not exceed the limiting values.

