LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

REACTIVITY CONTROL SYSTEMS

SHUTDOWN MARGIN - COLD SHUTDOWN - LOOPS NOT FILLED

LIMITING CONDITION FOR OPERATION

3.1.1.2 The SHUTDOWN MARGIN shall be greater than or equal to

a) the limits shown in Figure 3.1-5 or

b) the limits shown in Figure 3.1-4 and secure the valves shown in Specification 4.4.1.4.2.3. with the chemical and volume control system (CVCS) aligned to preclude Reactor Coolant System boron concentration reduction

APPLICABILITY: MODE 5 LOOPS NOT FILLED

ACTION:

a. With the SHUTDOWN MARGIN less than the above, immediately initiate and continue boration at greater than or equal to 33 gpm of a solution containing greater than or equal to 6300 ppm boron or equivalent until the required SHUTDOWN MARGIN is restored.

Insert 3.1.1.2

SURVEILLANCE REQUIREMENTS

4.1.1.2.1 The SHUTDOWN MARGIN shall be determined to be greater than or equal to the above:

a. Within 1 hour after detection of an inoperable control rod(s) and at least once per 12 hours thereafter while the rod(s) is inoperable. If the inoperable control rod is immovable or untrippable, the SHUTDOWN MARGIN shall be verified acceptable with an increased allowance for the withdrawn worth of the immovable or untrippable control rod(s); and

b. At least once per 24 hours by consideration of the following factors:

1) Reactor Coolant System boron concentration,

2) Control rod position,

3) Reactor Coolant System average temperature,

4) Fuel burnup based on gross thermal energy generation,

5) Xenon concentration, and

6) Samarium concentration.

Insert 4.1.1.2.2

4.1.1.2.2 Valve 3CHS-V305 shall be verified closed and locked at least once per 31 days.

## Inserts to Page 3/4 1-8

**Insert 3.1.1.2**

b. With the CVCS dilution flow paths not closed and secured in position in accordance with Specification 3.1.1.2(b), immediately close and secure the paths or meet the limits shown in Figure 3.1-5

**Insert 4.1.1.2.2**

4.1.1.2.2 At least once per 31 days the following valves shall be verified closed and locked. The valves may be opened on an intermittent basis under administrative controls except as noted.

SURVEILLANCE REQUIREMENTS (Con't)

| Valve Number | Valve Function | Valve Position |
|---|---|---|
| 1. V304(Z-) | Primary Grade Water to CVCS | Closed |
| 2. V120(Z-) | Moderating Hx Outlet | Closed |
| 3. V147(Z-) | BTRS Outlet | Closed |
| 4. V797(Z-) | Failed Fuel Monitoring Flushing | Closed |
| 5. V100(Z-) | Resin Sluice, CVCS Cation Bed Demineralizer | Closed |
| 6. V571(Z-) | Resin Sluice, CVCS Cation Bed Demineralizer | Closed |
| 7. V111(Z-) | Resin Sluice, CVCS Cation Bed Demineralizer | Closed |
| 8. V112(Z-) | Resin Sluice, CVCS Cation Bed Demineralizer | Closed |
| 9. V98(Z-)/V99(Z-) | Resin Sluice, CVCS Mixed Bed Demineralizer | Closed |
| 10. V569(Z-)/V570(Z-) | Resin Sluice, CVCS Mixed Bed Demineralizer | Closed |
| 11. V107(Z-)/V109(Z-) | Resin Sluice, CVCS Mixed Bed Demineralizer | Closed |
| 12. V108(Z-)/V110(Z-) | Resin Sluice, CVCS Mixed Bed Demineralizer | Closed |
| 13. V305(Z-)* | Primary Grade Water to Charging Pumps | Closed |

* This valve may not be opened under administrative controls

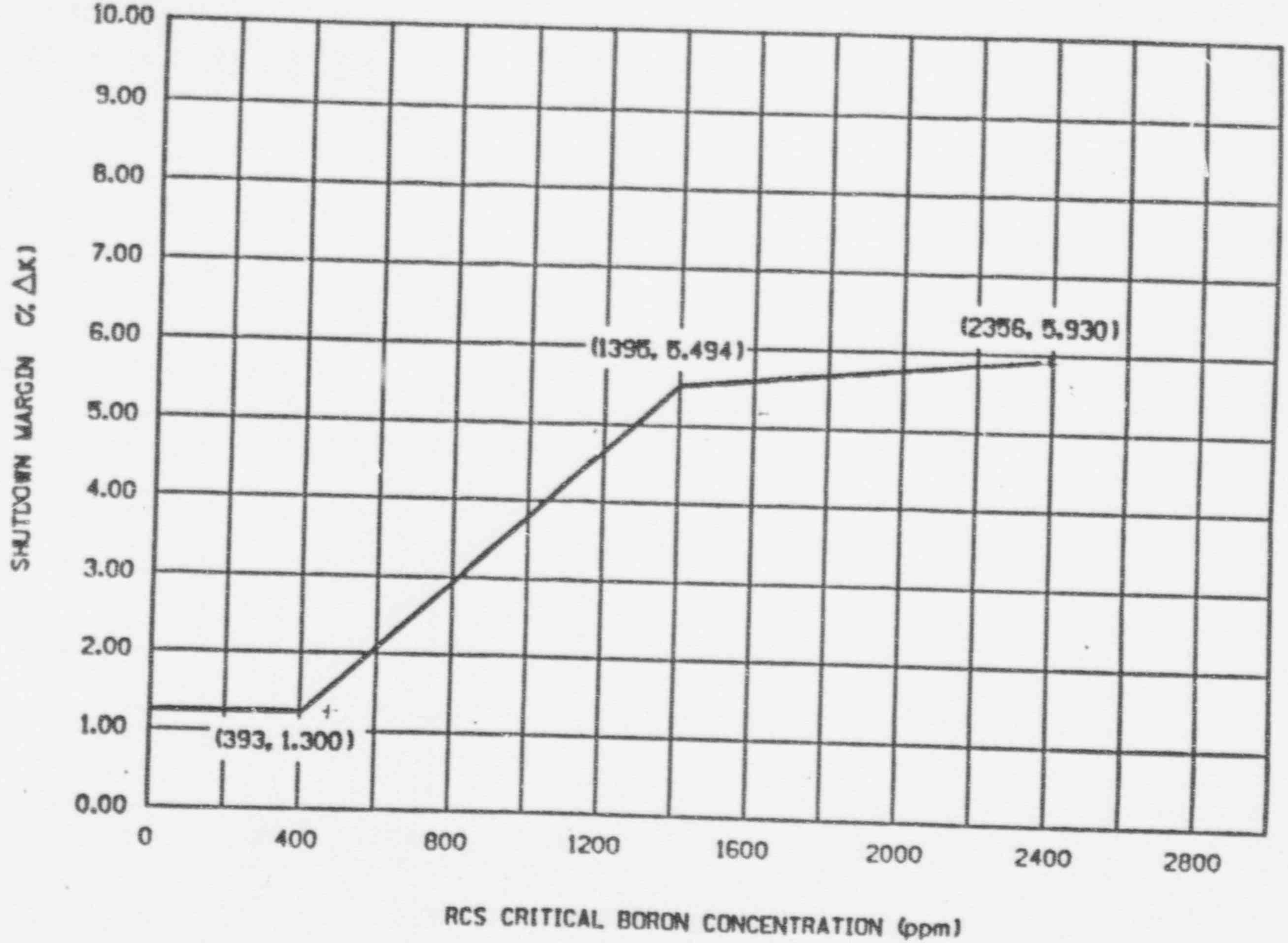


FIGURE 3.1-5

REQUIRED SHUTDOWN MARGIN FOR MODE 5 WITH RCS LOOPS ~~DRAINED~~ NOT FILLED

POWER DISTRIBUTION LIMITS

3/4.2.2 HEAT FLUX HOT CHANNEL FACTOR - $F_Q(Z)$

FOUR LOOPS OPERATING

LIMITING CONDITION FOR OPERATION

3.2.2.1 $F_Q(Z)$ shall be limited by the following relationships:

$$F_Q(Z) \le \frac{F_Q^{RTP}}{P} K(Z) \text{ for } P > 0.5$$

$$F_Q(Z) \le \frac{F_Q^{RTP}}{0.5} K(Z) \text{ for } P \le 0.5$$

$F_Q^{RTP}$ = the $F_Q$ limit at RATED THERMAL POWER (RTP) provided in the core operating limits report (COLR).

Where: $P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$, and

Insert 3.2.2.1

K(Z) = the normalized $F_Q(Z)$ as a function of core height specified in the COLR.

APPLICABILITY: MODE 1.

ACTION:

With $F_Q(Z)$ exceeding its limit:

a. Reduce THERMAL POWER at least 1% for each 1% $F_Q(Z)$ exceeds the limit within 15 minutes and similarly reduce the Power Range Neutron Flux-High Trip Setpoints within the next 4 hours; POWER OPERATION may proceed for up to a total of 72 hours; subsequent POWER OPERATION may proceed provided the Overpower ΔT Trip Setpoints have been reduced at least 1% for each 1% $F_Q(Z)$ exceeds the limit, and

b. Identify and correct the cause of the out-of-limit condition prior to increasing THERMAL POWER above the reduced limit required by ACTION a., above; THERMAL POWER may then be increased provided $F_Q(Z)$ is demonstrated through incore mapping to be within its limit.

Insert 3.2.2.1

With $F_Q(Z)$ exceeding its limit:

a. For RAOC operation with $F_Q(Z)$ outside the applicable limit specified in the COLR, perform one of the following actions:

(1) Within 15 minutes, control the AFD to within new AFD limits which are determined by reducing the applicable AFD limits by 1% AFD for each percent $F_Q(Z)$ exceeds its limits. Within 8 hours, reset the AFD alarm setpoints to these modified limits.

(2) Reduce THERMAL POWER at least 1% for each 1% $F_Q(Z)$ exceeds the limit within 15 minutes and similarly reduce the Power Range Neutron Flux-High Trip Setpoints within the next 4 hours; POWER OPERATION may proceed for up to a total of 72 hours; subsequent POWER OPERATION may proceed provided the Overpower ΔT Trip Setpoints have been reduced at least 1% for each 1% $F_Q(Z)$ exceeds the limit.

(3) Verify that the requirements of Specification 4.2.2.1.3 for base load operation are satisfied and enter base load operation.

Where it is necessary to calculate the percent that $F_Q(Z)$ exceeds the limits for Items (1) and (2) above, it shall be calculated as the maximum percent over the core height (z) that $F_Q(z)$ exceeds its limit by the following expression:

$$\left[\frac{F_Q^M(z) \times W(z)}{\frac{F_Q^{RTP}}{P} \times K(z)}\right] - 1 \quad \times 100 \text{ for } P \geq 0.5$$

$$\left[\frac{F_Q^M(z) \times W(z)}{\frac{F_Q^{RTP}}{0.5} \times K(z)}\right] - 1 \quad \times 100 \text{ for } P < 0.5$$

b. For base load operation outside the applicable limit specified in the COLR, perform either of the following actions:

(1) Place the core in an equilibrium condition where the limit in 4.2.2.1.2.C is satisfied, and remeasure $F_Q^M(Z)$, or

(2) Reduce THERMAL POWER at least 1% for each 1% $F_Q(Z)$ exceeds the limit within 15 minutes and similarly reduce the Power Range Neutron Flux-High Trip Setpoints within the next 4 hours; POWER OPERATION may proceed for up to a total of 72 hours; subsequent POWER OPERATION may proceed provided the Overpower ΔT Trip Setpoints have been reduced at least 1% for each 1% $F_Q(Z)$ exceeds the limit. The percent that $F_Q$ exceeds its limit shall be calculated as the maximum percent over the core height (z) by the following expression:

$$\left[\frac{F_Q^M(z) \times W(z)_{BL}}{\frac{F_Q^{RTP}}{P} \times K(z)}\right] - 1 \quad \times 100 \text{ for } P \geq APL^{ND}$$

c. Identify and correct the cause of the out-of-limit condition prior to increasing THERMAL POWER above the reduced limit required by ACTION a. or b., above; THERMAL POWER may then be increased provided $F_Q(Z)$ is demonstrated through incore mapping to be within this limit.

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS (Continued)

(2) At least once per 31 Effective Full Power Days, whichever occurs first.

e. With the maximum value of

$$\frac{F_Q^M(z)}{K(z)}$$

over the core height (z) increasing since the previous determination of $F_Q^M(z)$, either of the following actions shall be taken:

(1) $F_Q^M(z)$ shall be increased by 2% over that specified in Specification 4.2.2.1.2c, or

(2) $F_Q^M(z)$ shall be measured at least once per 7 Effective Full Power Days until two successive maps indicate that the maximum value of

$$\frac{F_Q^M(z)}{K(z)}$$

over the core height (z) is not increasing.

f. With the relationships specified in Specification 4.2.2.1.2c not being satisfied:

(1) Calculate the maximum percent over the core height (z) that $F_Q(z)$ exceeds its limit by the following expression:

$$\left[\frac{F_Q^M(z) \times W(z)}{\frac{F_Q^{RTP}}{P} \times K(z)}\right] - 1 \quad \times 100 \text{ for } P \geq 0.5$$

$$\left[\frac{F_Q^M(z) \times W(z)}{\frac{F_Q^{RTP}}{0.5} \times K(z)}\right] - 1 \quad \times 100 \text{ for } P < 0.5$$

(2) One of the following actions shall be taken:

(a) Within 15 minutes, control the AFD to within new AFD limits which are determined by reducing the applicable AFD limits by 1% AFD for each percent $F_Q(z)$ exceeds its limits as determined in Specification 4.2.2.1.2f.1. Within 8 hours, reset the AFD alarm setpoints to these modified limits, or

(b) Comply with the requirements of Specification 3.2.2.1 for $F_Q(z)$ exceeding its limit by the percent calculated, or

(c) Verify that the requirements of Specification 4.2.2.1.3 for base load operation are satisfied and enter base load operation.

f g. The limits specified in Specifications 4.2.2.1.2c, and 4.2.2.1.2e, and 4.2.2.1.2f above are not applicable in the following core plane regions:

(1) Lower core region from 0% to 15%, inclusive.
(2) Upper core region from 85% to 100%, inclusive.

4.2.2.1.3 Base load operation is permitted at powers above $APL^{ND}$ if the following conditions are satisfied:

a. Prior to entering base load operation, maintain THERMAL POWER above $APL^{ND}$ and less than or equal to that allowed by Specification 4.2.2.1.2 for at least the previous 24 hours. Maintain base load operation surveillance (AFD within the target band limit about the target flux difference of Specification 3.2.1.1) during this time period. Base load operation is then permitted providing THERMAL POWER is maintained between $APL^{ND}$ and $APL^{BL}$ or between $APL^{ND}$ and

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS (Continued)

f. With the relationship specified in 4.2.2.1.4.c not being satisfied, either of the following actions shall be taken:

(1) Place core in an equilibrium condition where the limit in 4.2.2.1.2.C is satisfied, and remeasure $F_Q^M(z)$, or

(2) Comply with the requirements of Specification 3.2.2.1 for $F_Q(z)$ exceeding its limit by the maximum percent calculated over the core height (z) with the following expression:

$$\left[\frac{F_Q^M(z) \times W(z)_{BL}}{\frac{F_Q^{RTP}}{P} \times K(z)} - 1\right] \times 100 \text{ for } P \geq APL^{ND}$$

f ~~g~~. The limits specified in 4.2.2.1.4.c, and 4.2.2.1.4.e, ~~and 4.2.2.1.4.f~~ are not applicable in the following core plane regions:

(1) Lower core region 0% to 15%, inclusive.
(2) Upper core region 85% to 100%, inclusive.

4.2.2.1.5 When $F_Q(z)$ ~~is~~ measured for reasons other than meeting the requirements of Specification~~s~~ 4.2.2.1.2 or 4.2.2.1.4, an overall measured $F_Q(z)$ shall be obtained from a power distribution map and increased by 3% to account for manufacturing tolerances and further increased by 5% to account for measurement uncertainty.

POWER DISTRIBUTION LIMITS

HEAT FLUX HOT CHANNEL FACTOR - $F_Q(Z)$

THREE LOOPS OPERATING

LIMITING CONDITION FOR OPERATION

3.2.2.2 $F_Q(Z)$ shall be limited by the following relationships:

$$F_Q(Z) \leq \frac{F_Q^{RTP}}{P} [K(Z)] \text{ for } P > 0.375$$

$$F_Q(Z) \leq \left(\frac{F_Q^{RTP}}{0.375}\right) [K(Z)] \text{ for } P \leq 0.375$$

$F_Q^{RTP}$ = The $F_Q$ limit at RATED THERMAL POWER (RTP) specified in the CORE OPERATING LIMITS REPORT (COLR).

Where: $P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$, and

Insert 3.2.2.2

K(Z) = the normalized $F_Q(Z)$ as a function of core height specified in the COLR.

APPLICABILITY: MODE 1.

ACTION:

With $F_Q(Z)$ exceeding its limit:

a. Reduce THERMAL POWER at least 1% for each 1% $F_Q(Z)$ exceeds the limit within 15 minutes and similarly reduce the Power Range Neutron Flux-High Trip Setpoints within the next 4 hours; POWER OPERATION may proceed for up to a total of 72 hours; subsequent POWER OPERATION may proceed provided the Overpower ΔT Trip Setpoints have been reduced at least 1% for each 1% $F_Q(Z)$ exceeds the limit. The Overpower ΔT Trip Setpoint reduction shall be performed with the reactor in at least HOT STANDBY.

b. Identify and correct the cause of the out-of-limit condition prior to increasing THERMAL POWER above the reduced limit required by ACTION a., above; THERMAL POWER may then be increased provided $F_Q(Z)$ is demonstrated through incore mapping to be within its limit.

**Insert 3.2.2.2**

With $F_Q(Z)$ exceeding its limit:

a. For RAOC operation with $F_Q(Z)$ outside the applicable limit specified in the COLR, perform one of the following actions:

(1) Within 15 minutes, control the AFD to within new AFD limits which are determined by reducing the applicable AFD limits by 1% AFD for each percent $F_Q(Z)$ exceeds its limits. Within 8 hours, reset the AFD alarm setpoints to these modified limits.

(2) Reduce THERMAL POWER at least 1% for each 1% $F_Q(Z)$ exceeds the limit within 15 minutes and similarly reduce the Power Range Neutron Flux-High Trip Setpoints within the next 4 hours; POWER OPERATION may proceed for up to a total of 72 hours; subsequent POWER OPERATION may proceed provided the Overpower ΔT Trip Setpoints have been reduced at least 1% for each 1% $F_Q(Z)$ exceeds the limit. The Overpower ΔT Trip Setpoint reduction shall be performed with the reactor in at least HOT STANDBY.

(3) Verify that the requirements of Specification 4.2.2.1.3 for base load operation are satisfied and enter base load operation.

Where it is necessary to calculate the percent that $F_Q(Z)$ exceeds the limits for items (1) and (2) above, it shall be calculated as the maximum percent over the core height (z) that $F_Q(z)$ exceeds its limit by the following expression:

$$\left[\frac{F_Q^M(z) \times W(z)}{\frac{F_Q^{RTP}}{P} \times K(z)}\right] - 1 \quad \times 100 \text{ for } P \geq 0.375$$

$$\left[\frac{F_Q^M(z) \times W(z)}{\frac{F_Q^{RTP}}{0.375} \times K(z)}\right] - 1 \quad \times 100 \text{ for } P < 0.375$$

b. For base load operation outside the applicable limit specified in the COLR, perform either of the following actions:

(1) Place the core in an equilibrium condition where the limit in 4.2.2.2.2.C is satisfied, and remeasure $F_Q^M(Z)$, or

(2) Reduce THERMAL POWER at least 1% for each 1% $F_Q(Z)$ exceeds the limit within 15 minutes and similarly reduce the Power Range Neutron Flux-High Trip Setpoints within the next 4 hours; POWER OPERATION may proceed for up to a total of 72 hours; subsequent POWER OPERATION may proceed provided the Overpower ΔT Trip Setpoints have been reduced at least 1% for each 1% $F_Q(Z)$ exceeds the limit. The Overpower ΔT Trip Setpoint reduction shall be performed with the reactor in at least HOT STANDBY. The percent that $F_Q$ exceeds the limit shall be calculated as the maximum percent over the core height (z) that $F_Q(z)$ exceeds the limit using the following expression:

$$\left[\frac{F_Q^M(z) \times W(z)_{BL}}{\frac{2.25}{P} \times K(z)}\right] - 1 \quad \times 100 \text{ for } P \geq APL^{ND}$$

c. Identify and correct the cause of the out-of-limit condition prior to increasing THERMAL POWER above the reduced limit required by ACTION a. or b., above; THERMAL POWER may then be increased provided $F_Q(Z)$ is demonstrated through incore mapping to be within its limit.

(2) At least once per 31 Effective Full Power Days, whichever occurs first.

e. With the maximum value of

$$\frac{F_Q^M(z)}{K(z)}$$

over the core height (z) increasing since the previous determination of $F_Q^M(z)$, either of the following actions shall be taken:

(1) $F_Q^M(z)$ shall be increased by 2% over that specified in Specification 4.2.2.2.2c, or

(2) $F_Q^M(z)$ shall be measured at least once per 7 Effective Full Power Days until two successive maps indicate that the maximum value of

$$\frac{F_Q^M(z)}{K(z)}$$

over the core height (z) is not increasing.

f. With the relationships specified in Specification 4.2.2.2.2c not being satisfied:

(1) Calculate the maximum percent over the core height (z) that $F_Q(z)$ exceeds its limit by the following expression:

$$\left[\frac{F_Q^M(z) \times W(z)}{\frac{F_Q^{RTP}}{P} \times K(z)} - 1\right] \times 100 \text{ for } P \geq 0.375$$

$$\left[\frac{F_Q^M(z) \times W(z)}{\frac{F_Q^{RTP}}{0.375} \times K(z)}\right] - 1 \quad \times 100 \text{ for } P < 0.375$$

(2) One of the following actions shall be taken:

(a) Within 15 minutes, control the AFD to within new AFD limits which are determined by reducing the applicable AFD limits by 1% AFD for each percent $F_Q(z)$ exceeds its limits as determined in Specification 4.2.2.2.2f.1. Within 8 hours, reset the AFD alarm setpoints to these modified limits, or

(b) Comply with the requirements of Specification 3.2.2.2 for $F_Q(z)$ exceeding its limit by the percent calculated, or

(c) Verify that the requirements of Specification 4.2.2.2.3 for base load operation are satisfied and enter base load operation.

g. The limits specified in Specifications 4.2.2.2.2c, 4.2.2.2.2e, and 4.2.2.2.2f are not applicable in the following core plane regions:

(1) Lower core region from 0% to 15%, inclusive.
(2) Upper core region from 85% to 100%, inclusive.

4.2.2.2.3 Base load operation is permitted at powers above $APL^{ND}$ if the following conditions are satisfied:

a. Prior to entering base load operation, maintain THERMAL POWER above $APL^{ND}$ and less than or equal to that allowed by Specification 4.2.2.2.2 for at least the previous 24 hours. Maintain base load operation surveillance (AFD within the target band limit about the target flux difference of Specification 3.2.1.2) during this time period.

Base load operation is then permitted providing THERMAL POWER is maintained between $APL^{ND}$ and $APL^{BL}$ or between $APL^{ND}$ and 100% (whichever is most limiting) and $F_{QBL}$ surveillance is maintained pursuant to Specification 4.2.2.2.4. $APL^{BL}$ is defined as the minimum value of:

(1) Prior to entering base load operation after satisfying Section 4.2.2.2.3, unless a full core flux map has been taken in the previous 31 Effective Full Power Days with the relative THERMAL POWER having been maintained above $APL^{ND}$ for the 24 hours prior to mapping, and

(2) At least once per 31 Effective Full Power Days.

e. With the maximum value of

$$\frac{F_Q^M(z)}{K(z)}$$

over the core height (z) increasing since the previous determination of $F_Q^M(z)$, either of the following actions shall be taken:

(1) $F_Q^M(z)$ shall be increased by 2 percent over that specified in 4.2.2.2.4.c, or

(2) $F_Q^M(z)$ shall be measured at least once per 7 Effective Full Power Days until 2 successive maps indicate that the maximum value of

$$\frac{F_Q^M(z)}{K(z)}$$

over the core height (z) is not increasing.

f. With the relationship specified in 4.2.2.2.4.c not being satisfied, either of the following actions shall be taken:

(1) Place core in an equilibrium condition where the limit in 4.2.2.2.2.c is satisfied, and remeasure $F_Q^M(z)$, or

(2) Comply with the requirements of Specification 3.2.2.2 for $F_Q(z)$ exceeding its limit by the maximum percent calculated over the core height (z) with the following expression:

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS (Continued)

$$\left[\frac{F_Q^M(z) \times W(z)_{BL}}{\frac{2.25}{P} \times K(z)}\right] - 1 \quad \times 100 \text{ for } P \geq APL^{ND}$$

f g. The limits specified in 4.2.2.2.4.c, and 4.2.2.2.4.e, and 4.2.2.4.f are not applicable in the following core plane regions:

(1) Lower core region 0% to 15%, inclusive.
(2) Upper core region 85% to 100%, inclusive.

4.2.2.2.5 When $F_Q(z)$ is measured for reasons other than meeting the requirements of Specifications 4.2.2.2.2 or 4.2.2.2.4, an overall measured $F_Q(z)$ shall be obtained from a power distribution map and increased by 3% to account for manufacturing tolerances and further increased by 5% to account for measurement uncertainty.

REACTOR COOLANT SYSTEM

COLD SHUTDOWN - LOOPS NOT FILLED

LIMITING CONDITION FOR OPERATION

3.4.1.4.2 Two residual heat removal (RHR) loops shall be OPERABLE* and at least one RHR loop shall be in operation.** The chemical and volume control system (CVCS) shall be aligned to preclude Reactor Coolant System boron concentration reduction or the SHUTDOWN MARGIN of Specification 3.1.1.2 shall be met.

APPLICABILITY: MODE 5 with less than two reactor coolant loops filled.

ACTION:

a. With less than the above required RHR loops OPERABLE, immediately initiate corrective action to return the required RHR loops to OPERABLE status as soon as possible.

b. With no RHR loop in operation, suspend all operations involving a reduction in boron concentration of the Reactor Coolant System and immediately initiate corrective action to return the required RHR loop to operation.

c. With the CVCS dilution flow paths not closed and secured in position, immediately close and secure the paths or satisfy the SHUTDOWN MARGIN of Specification 3.1.1.2.

SURVEILLANCE REQUIREMENTS

4.4.1.4.2.1 The required RHR loops shall be demonstrated OPERABLE pursuant to Specification 4.0.5.

4.4.1.4.2.2 At least one RHR loop shall be determined to be in operation and circulating reactor coolant at least once per 12 hours.

4.4.1.4.2.3 At least per 31 days the following valves shall be verified closed and locked. The valves may be opened on an intermittent basis under administrative control.

*One RHR loop may be inoperable for up to 2 hours for surveillance testing provided the other RHR loop is OPERABLE and in operation.

**The RHR pump may be deenergized for up to 1 hour provided: (1) no operations are permitted that would cause dilution of the Reactor Coolant System boron concentration, and (2) core outlet temperature is maintained at least 10°F below saturation temperature.

SURVEILLANCE REQUIREMENTS (Con't)

| Valve Number | Valve Function | Valve Position |
|---|---|---|
| 1. V304(Z-) | Primary Grade Water to CVCS | Closed |
| 2. V120(Z-) | Moderating Hx Outlet | Closed |
| 3. V147(Z-) | BTRS Outlet | Closed |
| 4. V797(Z-) | Failed Fuel Monitoring Flushing | Closed |
| 5. V100(Z-) | Resin Sluice, CVCS Cation Bed Demineralizer | Closed |
| 6. V571(Z-) | Resin Sluice, CVCS Cation Bed Demineralizer | Closed |
| 7. V111(Z-) | Resin Sluice, CVCS Cation Bed Demineralizer | Closed |
| 8. V112(Z-) | Resin Sluice, CVCS Cation Bed Demineralizer | Closed |
| 9. V98(Z-)/V99(Z-) | Resin Sluice, CVCS Mixed Bed Demineralizer | Closed |
| 10. V569(Z-)/V570(Z-) | Resin Sluice, CVCS Mixed Bed Demineralizer | Closed |
| 11. V107(Z-)/V109(Z-) | Resin Sluice, CVCS Mixed Bed Demineralizer | Closed |
| 12. V108(Z-)/V110(Z-) | Resin Sluice, CVCS Mixed Bed Demineralizer | Closed |

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## 3/4.9.1 BORON CONCENTRATION

### LIMITING CONDITION FOR OPERATION

3.9.1.1 The boron concentration of all filled portions of the Reactor Coolant System and the refueling canal shall be maintained uniform and sufficient to ensure that the more restrictive of the following reactivity conditions is met; either:

a. A $K_{eff}$ of 0.95 or less, or

b. A boron concentration of greater than or equal to 2600 ppm.

Additionally, the CVCS valves of Specification ~~4.4.1.4.2.3~~ 4.1.1.2.2 shall be closed and secured in position.

APPLICABILITY: MODE 6.*

ACTION:

a. With the requirements of the above specification not satisfied, immediately suspend all operations involving CORE ALTERATIONS or positive reactivity changes and initiate and continue boration at greater than or equal to 33 gpm of a solution containing greater than or equal to 6300 ppm boron or its equivalent until $K_{eff}$ is reduced to less than or equal to 0.95 or the boron concentration is restored to greater than or equal to 2600 ppm, whichever is the more restrictive.

b. With any of the CVCS valves of Specification ~~4.4.1.4.2.3~~ 4.1.1.2.2 not closed** and secured in position, immediately close and secure the valves.

### SURVEILLANCE REQUIREMENTS

4.9.1.1.1 The more restrictive of the above two reactivity conditions shall be determined prior to:

a. Removing or unbolting the reactor vessel head, and

b. Withdrawal of any full-length control rod in excess of 3 feet from its fully inserted position within the reactor vessel.

4.9.1.1.2 The boron concentration of the Reactor Coolant System and the refueling canal shall be determined by chemical analysis at least once per 72 hours.

4.9.1.1.3 The CVCS valves of Specification ~~4.4.1.4.2.3~~ 4.1.1.2.2 shall be verified closed and locked at least once per 31 days.

*The reactor shall be maintained in MODE 6 whenever fuel is in the reactor vessel with the vessel head closure bolts less than fully tensioned or with the head removed.

**Except those opened under administrative control.

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 $T_{avg}$. In MODES 1 and 2, 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 1.3% ΔK/K 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. In MODES 3, 4 and 5, the most restrictive condition occurs at BOL, associated with a boron dilution accident. In the analysis of this accident, a minimum SHUTDOWN MARGIN as defined in Specification 3/4.1.1.2 is required to allow the operator 15 minutes from the initiation of the Shutdown Margin Monitor alarm to total loss of SHUTDOWN MARGIN. Accordingly, the SHUTDOWN MARGIN requirement is based upon this limiting requirement and is consistent with the accident analysis assumptions. The required SHUTDOWN MARGIN is plotted as a function of RCS critical boron concentration.

The locking closed of the required valves in MODE 5 (with the loops not filled) will preclude the possibility of uncontrolled boron dilution of the Reactor Coolant System by preventing flow of unborated water to the RCS

3/4.1.1.3 MODERATOR TEMPERATURE COEFFICIENT

The limitations on moderator temperature coefficient (MTC) are provided to ensure that the value of this coefficient remains within the limiting condition assumed in the FSAR accident and transient analyses.

The MTC values of this specification are applicable to a specific set of plant conditions; accordingly, verification of MTC values at conditions other than those explicitly stated will require extrapolation to those conditions in order to permit an accurate comparison.

The most negative MTC, value equivalent to the most positive moderator density coefficient (MDC), was obtained by incrementally correcting the MDC used in the FSAR analyses to nominal operating conditions.

## 3/4.4.1 REACTOR COOLANT LOOPS AND COOLANT CIRCULATION

The plant is designed to operate in MODES 1 and 2 with three or four reactor coolant loops in operation and maintain DNBR greater than the design limit during all normal operations and anticipated transients. With less than the required reactor coolant loops in operation this specification requires that the plant be in at least HOT STANDBY within 6 hours.

In MODE 3, three reactor coolant loops, and in Mode 4, two reactor coolant loops provide sufficient heat removal capability for removing core decay heat even in the event of a bank withdrawal accident; however, a single reactor coolant loop provides sufficient heat removal capacity if a bank withdrawal accident can be prevented, i.e., by opening the Reactor Trip System breakers.

In MODE 4, and in MODE 5 with reactor coolant loops filled, a single reactor coolant loop or RHR loop provides sufficient heat removal capability for removing decay heat; but single failure considerations require that at least two loops (either RHR or RCS) be OPERABLE.

In MODE 5 with reactor coolant loops not filled, a single RHR loop provides sufficient heat removal capability for removing decay heat; but single failure considerations, and the unavailability of the steam generators as a heat removing component, require that at least two RHR loops be OPERABLE.

The locking closed of the required valves in Mode 5 (with the loops not filled) will preclude the possibility of uncontrolled boron dilution of the Reactor Coolant System by preventing flow to the RCS of unborated water.

The operation of one reactor coolant pump (RCP) or one RHR pump provides adequate flow to ensure mixing, prevent stratification and produce gradual reactivity changes during boron concentration reductions in the Reactor Coolant System. The reactivity change rate associated with boron reduction will, therefore, be within the capability of operator recognition and control.

The restrictions on starting an RCP with one or more RCS cold legs less than or equal to 350°F are provided to prevent RCS pressure transients, caused by energy additions from the Secondary Coolant System, which could exceed the limits of Appendix G to 10 CFR Part 50. The RCS will be protected against overpressure transients and will not exceed the limits of Appendix G by either: (1) restricting the water volume in the pressurizer and thereby providing a volume for the reactor coolant to expand into, or (2) by restricting starting of the RCPs to when the secondary water temperature of each steam generator is less than 50°F above each of the RCS cold leg temperatures.

Docket No. 50-423
B14803

Attachment 2

Millstone Nuclear Power Station, Unit No. 3

Proposed Revision to Technical Specifications
Shutdown Margin, Reactor Trip System, and
Heat Flux Hot Channel Factor
Retyped Up Pages

July 1994

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

SHUTDOWN MARGIN - COLD SHUTDOWN - LOOPS NOT FILLED

LIMITING CONDITION FOR OPERATION

3.1.1.2 The SHUTDOWN MARGIN shall be greater than or equal to

a) the limits shown in Figure 3.1-5 or

b) the limits shown in Figure 3.1-4, with the chemical and volume control system (CVCS) aligned to preclude reactor coolant system boron concentration reduction.

APPLICABILITY: MODE 5 LOOPS NOT FILLED

ACTION:

a. With the SHUTDOWN MARGIN less than the above, immediately initiate and continue boration at greater than or equal to 33 gpm of a solution containing greater than or equal to 6300 ppm boron or equivalent until the required SHUTDOWN MARGIN is restored.

b. With the CVCS dilution flow paths not closed and secured in position in accordance with Specification 3.1.1.2(b), immediately close and secure the paths or meet the limits shown in Figure 3.1-5.

SURVEILLANCE REQUIREMENTS

4.1.1.2.1 The SHUTDOWN MARGIN shall be determined to be greater than or equal to the above:

a. Within 1 hour after detection of an inoperable control rod(s) and at least once per 12 hours thereafter while the rod(s) is inoperable. If the inoperable control rod is immovable or untrippable, the SHUTDOWN MARGIN shall be verified acceptable with an increased allowance for the withdrawn worth of the immovable or untrippable control rod(s); and

b. At least once per 24 hours by consideration of the following factors:

1) Reactor Coolant System boron concentration,

2) Control rod position,

3) Reactor Coolant System average temperature,

4) Fuel burnup based on gross thermal energy generation,

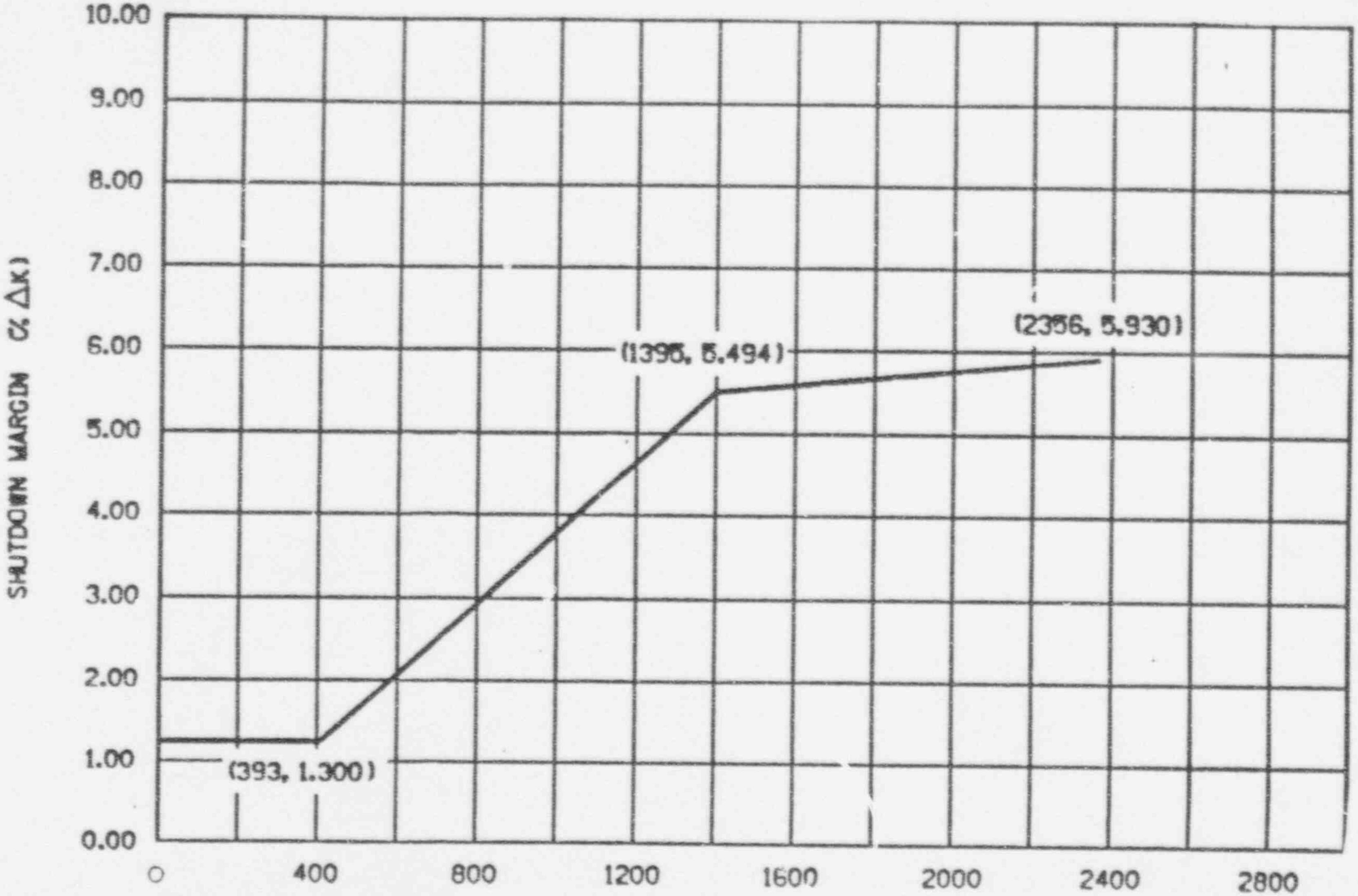
5) Xenon concentration, and

6) Samarium concentration.

4.1.1.2.2 At least once per 31 days the following valves shall be verified closed and locked. The valves may be opened on an intermittent basis under administrative controls except as noted.

| Valve Number | Valve Function | Valve Position |
|---|---|---|
| 1. V304(Z-) | Primary Grade Water to CVCS | Closed |
| 2. V120(Z-) | Moderating Hx Outlet | Closed |
| 3. V147(Z-) | BTRS Outlet | Closed |
| 4. V797(Z-) | Failed Fuel Monitoring Flushing | Closed |
| 5. V100(Z-) | Resin Sluice, CVCS Cation Bed Demineralizer | Closed |
| 6. V571(Z-) | Resin Sluice, CVCS Cation Bed Demineralizer | Closed |
| 7. V111(Z-) | Resin Sluice, CVCS Cation Bed Demineralizer | Closed |
| 8. V112(Z-) | Resin Sluice, CVCS Cation Bed Demineralizer | Closed |
| 9. V98(Z-)/V99(Z-) | Resin Sluice, CVCS Mixed Bed Demineralizer | Closed |
| 10. V569(Z-)/V570(Z-) | Resin Sluice, CVCS Mixed Bed Demineralizer | Closed |
| 11. V107(Z-)/V109(Z-) | Resin Sluice, CVCS Mixed Bed Demineralizer | Closed |
| 12. V108(Z-)/V110(Z-) | Resin Sluice, CVCS Mixed Bed Demineralizer | Closed |
| 13. V305(Z-)* | Primary Grade Water to Charging Pumps | Closed |

*This valve may not be opened under administrative controls.




RCS CRITICAL BORON CONCENTRATION (ppm)

FIGURE 3.1-5

REQUIRED SHUTDOWN MARGIN FOR MODE 5 WITH RCS LOOPS NOT FILLED

## 3/4.2.2 HEAT FLUX HOT CHANNEL FACTOR - $F_Q(Z)$

## FOUR LOOPS OPERATING

## LIMITING CONDITION FOR OPERATION

3.2.2.1 $F_Q(Z)$ shall be limited by the following relationships:

$$F_Q(Z) \leq \frac{F_Q^{RTP}}{P} K(Z) \text{ for } P > 0.5$$

$$F_Q(Z) \leq \frac{F_Q^{RTP}}{0.5} K(Z) \text{ for } P \leq 0.5$$

$F_Q^{RTP}$ = the $F_Q$ limit at RATED THERMAL POWER (RTP) provided in the core operating limits report (COLR).

*Where:* $P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$, *and*

K(Z) = the normalized $F_Q(Z)$ as a function of core height specified in the COLR.

APPLICABILITY: MODE 1.

ACTION:

With $F_Q(Z)$ exceeding its limit:

a. For RAOC operation with $F_Q(Z)$ outside the applicable limit specified in the COLR, perform one of the following actions:

(1) Within 15 minutes, control the AFD to within new AFD limits which are determined by reducing the applicable AFD limits by 1% AFD for each percent $F_Q(Z)$ exceeds its limits. Within 8 hours, reset the AFD alarm setpoints to these modified limits.

(2) Reduce THERMAL POWER at least 1% for each 1% $F_Q(Z)$ exceeds the limit within 15 minutes and similarly reduce the Power Range Neutron Flux-High Trip Setpoints within the next 4 hours; POWER OPERATION may proceed for up to a total of 72 hours; subsequent POWER OPERATION may proceed provided the Overpower $\Delta T$ Trip Setpoints have been reduced at least 1% for each 1% $F_Q(Z)$ exceeds the limit.

(3) Verify that the requirements of Specification 4.2.2.1.3 for base load operation are satisfied and enter base load operation.

Where it is necessary to calculate the percent that $F_Q(Z)$ exceeds the limits for items (1) and (2) above, it shall be calculated as the maximum percent over the core height (Z) that $F_Q(Z)$ exceeds its limit by the following expression:

$$\left[\frac{F_Q^M(Z)\ x\ W(Z)}{\frac{F_Q^{RTP}}{P}\ x\ K(Z)}\right] -1\ x\ 100\ for\ P \geq 0.5$$

$$\left[\frac{F_Q^M(Z)\ x\ W(Z)}{\frac{F_Q^{RTP}}{0.5}\ x\ K(Z)}\right] -1\ x\ 100\ for\ P < 0.5$$

b. For base load operation outside the applicable limit specified in the COLR, perform either of the following actions:

(1) Place the core in an equilibrium condition where the limit in 4.2.2.1.2.C is satisfied, and remeasure $F_Q^M(Z)$, or

## LIMITING CONDITION FOR OPERATION (Continued)

(2) Reduce THERMAL POWER at least 1% for each 1% $F_Q(Z)$ exceeds the limit within 15 minutes and similarly reduce the Power Range Neutron Flux-High Trip Setpoints within the next 4 hours; POWER OPERATION may proceed for up to a total of 72 hours; subsequent POWER OPERATION may proceed provided the Overpower $\Delta T$ Trip setpoints have been reduced at least 1% for each 1% $F_Q(Z)$exceeds the limit. The percent that $F_Q$ exceeds its limit shall be calculated as the maximum percent over the core height (Z) by the following expression:

$$\left[\frac{F_Q^M(Z)\ x\ W(Z)_{BL}}{\frac{F_Q^{RTP}}{P}\ x\ K(Z)}\right] - 1\ x\ 100\ for\ P \geq APL^{ND}$$

c. Identify and correct the cause of the out-of-limit condition prior to increasing THERMAL POWER above the reduced limit required by ACTION a or b, above; THERMAL POWER may then be increased provided $F_Q(Z)$ is demonstrated through incore mapping to be within this limit.

## SURVEILLANCE REQUIREMENTS

4.2.2.1.1 The provisions of Specification 4.0.4 are not applicable.

4.2.2.1.2 For RAOC operation, $F_Q(Z)$ shall be evaluated to determine if $F_Q(Z)$ is within its limit by:

a. Using the movable incore detectors to obtain a power distribution map at any THERMAL POWER greater than 5% of RATED THERMAL POWER.

b. Increasing the measured $F_Q(Z)$ component of the power distribution map by 3% to account for manufacturing tolerances and further increasing the value by 5% to account for measurement uncertainties. Verify the requirements of Specification 3.2.2.1 are satisfied.

c. Satisfying the following relationship:

$$F_Q^M(Z) \leq \frac{F_Q^{RTP} \times K(Z)}{P \times W(Z)} \text{ for } P > 0.5$$

$$F_Q^M(Z) \leq \frac{F_Q^{RTP} \times K(Z)}{W(Z) \times 0.5} \text{ for } P \leq 0.5$$

where $F_Q^M(Z)$ is the measured $F_Q(Z)$ increased by the allowances for manufacturing tolerances and measurement uncertainty, $F_Q^{RTP}$ is the $F_Q$ limit, K(Z) is the normalized $F_Q(Z)$ as a function of core height, P is the relative THERMAL POWER, and W(Z) is the cycle-dependent function that accounts for power distribution transients encountered during normal operation. $F_Q^{RTP}$, K(Z), and W(Z) are specified in the CORE OPERATING LIMITS REPORT as per Specification 6.9.1.6.

d. Measuring $F_Q^M(Z)$ according to the following schedule:

(1) Upon achieving equilibrium conditions after exceeding by 10% or more of RATED THERMAL POWER, the THERMAL POWER at which $F_Q(Z)$ was last determined,* or

(2) At least once per 31 Effective Full Power Days, whichever occurs first.

e. With the maximum value of

$$\frac{F_Q^M(Z)}{K(Z)}$$

over the core height (Z) increasing since the previous determination of $F_Q^M(Z)$, either of the following actions shall be taken:

(1) $F_Q^M(Z)$ shall be increased by 2% over that specified in Specification 4.2.2.1.2c, or

* During power escalation at the beginning of each cycle, power level may be increased until a power level for extended operation has been achieved and power distribution map outlined.

(2) $F_Q^M(Z)$ shall be measured at least once per 7 Effective Full Power Days until two successive maps indicate that the maximum value of

$$\frac{F_Q^M(Z)}{K(Z)}$$

over the core height (Z) is not increasing.

f. The limits specified in Specifications 4.2.2.1.2c and 4.2.2.1.2e above are not applicable in the following core plane regions:

(1) Lower core region from 0% to 15%, inclusive.
(2) Upper core region from 85% to 100%, inclusive.

4.2.2.1.3 Base load operation is permitted at powers above $APL^{ND}$ if the following conditions are satisfied:

a. Prior to entering base load operation, maintain THERMAL POWER above $APL^{ND}$ and less than or equal to that allowed by Specification 4.2.2.1.2 for at least the previous 24 hours. Maintain base load operation surveillance (AFD within the target band limit about the target flux difference of Specification 3.2.1.1) during this time period. Base load operation is then permitted providing THERMAL POWER is maintained between $APL^{ND}$ and $APL^{BL}$ or between $APL^{ND}$ and 100% (whichever is most limiting) and $F_Q$ surveillance is maintained pursuant to Specification 4.2.2.1.4. $APL^{BL}$ is defined as the minimum value of:

$$APL^{BL} = \frac{F_Q^{RTP} \times K(Z)}{F_Q^M(Z) \times W(Z)_{BL}} \times 100\%$$

over the core height (Z) where: $F_Q^M(Z)$ is the measured $F_Q(Z)$ increased by the allowances for manufacturing tolerances and measurement uncertainty. The $F_Q$ limit is $F_Q^{RTP}$. $W(Z)_{BL}$ is the cycle-dependent function that accounts for limited power distribution transient encountered during base load operation. $F_Q^{RTP}$, K(Z), and $W(Z)_{BL}$ are specified in the COLR as per Specification 6.9.1.6.

b. During base load operation, if the THERMAL POWER is decreased below $APL^{ND}$ then the conditions of 4.2.2.1.3.a shall be satisfied before reentering base load operation.

4.2.2.1.4 During base load operation $F_Q(Z)$ shall be evaluated to determine if $F_Q(Z)$ is within its limit by:

a. Using the movable incore detectors to obtain a power distribution map at any THERMAL POWER above $APL^{ND}$.

b. Increasing the measured $F_Q(Z)$ component of the power distribution map by 3% to account for manufacturing tolerances and further increasing the value by 5% to account for measurement uncertainties. Verify the requirements of Specification 3.2.2.1 are satisfied.

c. Satisfying the following relationship:

$$F_Q^M(Z) \le \frac{F_Q^{RTP} \times K(Z)}{P \times W(Z)_{BL}} \text{ for } P > APL^{ND}$$

where: $F_Q^M(Z)$ is the measured $F_Q(Z)$. $F_Q^{RTP}$ is the $F_Q$ limit, the normalized $F_Q(Z)$ as a function of core height. P is the relative THERMAL POWER. $W(Z)_{BL}$ is the cycle-dependent function that accounts for limited power distribution transients encountered during base load operation. $F_Q^{RTP}$, K(Z), and $W(Z)_{BL}$ are specified in the COLR as per Specification 6.9.1.6.

d. Measuring $F_Q^M(Z)$ in conjunction with target flux difference determination according to the following schedule:

(1) Prior to entering base load operation after satisfying Section 4.2.2.1.3 unless a full core flux map has been taken in the previous 31 EFPD with the relative thermal power having been maintained above $APL^{ND}$ for the 24 hours prior to mapping, and

(2) At least once per 31 Effective Full Power Days.

e. With the maximum value of

$$\frac{F_Q^M(Z)}{K(Z)}$$

over the core height (Z) increasing since the previous determination of $F_Q^M(Z)$, either of the following actions shall be taken:

(1) $F_Q^M(Z)$ shall be increased by 2% over that specified in 4.2.2.1.4.c, or

(2) $F_Q^M(Z)$ shall be measured at least once per 7 Effective Full Power Days until 2 successive maps indicate that the maximum value of

$$\frac{F_Q^M(Z)}{K(Z)}$$

over the core height (Z) is not increasing.

f. The limits specified in 4.2.2.1.4.c and 4.2.2.1.4.e are not applicable in the following core plane regions:

(1) Lower core region 0% to 15%, inclusive.
(2) Upper core region 85% to 100%, inclusive.

4.2.2.1.5 When $F_Q(Z)$ is measured for reasons other than meeting the requirements of Specifications 4.2.2.1.2 or 4.2.2.1.4, an overall measured $F_Q(Z)$ shall be obtained from a power distribution map and increased by 3% to account for manufacturing tolerances and further increased by 5% to account for measurement uncertainty.

POWER DISTRIBUTION LIMITS

HEAT FLUX HOT CHANNEL FACTOR - $F_Q(Z)$

THREE LOOPS OPERATING

LIMITING CONDITION FOR OPERATION

3.2.2.2 $F_Q(Z)$ shall be limited by the following relationships:

$$F_Q(Z) \leq \frac{F_Q^{RTP}}{P} [K(Z)] \text{ for } P > 0.375$$

$$F_Q(Z) \leq \left[\frac{F_Q^{RTP}}{0.375}\right] [K(Z)] \text{ for } P \leq 0.375$$

$F_Q^{RTP}$ = The $F_Q$ limit at RATED THERMAL POWER (RTP) specified in the CORE OPERATING LIMITS REPORT (COLR).

*Where*: $P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$, *and*

K(Z) = the normalized $F_Q(Z)$ as a function of core height specified in the COLR.

APPLICABILITY: MODE 1.

ACTION:

With $F_Q(Z)$ exceeding its limit:

a. For RAOC operation with $F_Q(Z)$ outside the applicable limit specified in the COLR, perform one of the following actions:

(1) Within 15 minutes, control the AFD to within new AFD limits which are determined by reducing the applicable AFD limits by 1% AFD for each percent $F_Q(Z)$ exceeds its limits. Within 8 hours, reset the AFD alarm setpoints to these modified limits.

(2) Reduce THERMAL POWER at least 1% for each 1% $F_Q(Z)$ exceeds the limit within 15 minutes and similarly reduce the Power Range Neutron Flux-High Trip Setpoints within the next 4 hours; POWER OPERATION may proceed for up to a total of 72 hours; subsequent

POWER OPERATION may proceed provided the Overpower ΔT Trip Setpoints have been reduced at least 1% for each 1% $F_Q(Z)$ exceeds the limit. The Overpower ΔT Trip Setpoint reduction shall be performed with the reactor in at least HOT STANDBY.

(3) Verify that the requirements of Specification 4.2.2.1.3 for base load operation are satisfied and enter base load operation.

Where it is necessary to calculate the percent that $F_Q(Z)$ exceeds the limits for items (1) and (2) above, it shall be calculated as the maximum percent over the core height (Z) that $F_Q(Z)$ exceeds its limit by the following expression:

$$\left[\frac{F_Q^M(Z)\ x\ W(Z)}{\frac{F_Q^{RTP}}{P}\ x\ K(Z)}\right] -1\ x\ 100\ for\ P \geq 0.375$$

$$\left[\frac{F_Q^M(Z)\ x\ W(Z)}{\frac{F_Q^{RTP}}{0.375}\ x\ K(Z)}\right] -1\ x\ 100\ for\ P < 0.375$$

b. For base load operation outside the applicable limit specified in the COLR, perform either of the following actions:

(1) Place the core in an equilibrium condition where the limit in 4.2.2.2.2.C is satisfied, and remeasure $F_Q^M(Z)$, or

(2) Reduce THERMAL POWER at least 1% for each 1% $F_Q(Z)$ exceeds the limit within 15 minutes and similarly reduce the Power Range Neutron Flux-High Trip Setpoints within the next 4 hours; POWER OPERATION may proceed for up to a total of 72 hours; subsequent POWER OPERATION may proceed provided the Overpower ΔT Trip Setpoints have been reduced at least 1% for each 1% $F_Q(Z)$ exceeds the limit. The Overpower ΔT Trip Setpoint reduction shall be performed with the reactor in at least HOT STANDBY. The percent that $F_Q$ exceeds the limit shall be calculated as the maximum percent over the core height (Z) that $F_Q(Z)$ exceeds the limit using the following expression:

LIMITING CONDITION FOR OPERATION (Continued)

$$\left[\frac{F_Q^M(Z)\ x\ W(Z)_{BL}}{\frac{2.25}{P}\ x\ K(Z)}\right] -1\ x\ 100\ for\ P \geq APL^{ND}$$

c. Identify and correct the cause of the out-of-limit condition prior to increasing THERMAL POWER above the reduced limit required by ACTION a or b, above; THERMAL POWER may then be increased provided $F_Q(Z)$ is demonstrated through incore mapping to be within its limit.

SURVEILLANCE REQUIREMENTS

4.2.2.2.1 The provisions of Specification 4.0.4 are not applicable.

4.2.2.2.2 For RAOC operation, $F_Q(Z)$ shall be evaluated to determine if $F_Q(Z)$ is within its limit by:

a. Using the movable incore detectors to obtain a power distribution map at any THERMAL POWER greater than 5% of RATED THERMAL POWER.

b. Increasing the measured $F_Q(Z)$ component of the power distribution map by 3% to account for manufacturing tolerances and further increasing the value by 5% to account for measurement uncertainties. Verify the requirements of Specification 3.2.2.2 are satisfied.

c. Satisfy the following relationship:

$$F_Q^M(Z) \leq \frac{F_Q^{RTP}\ x\ K(Z)}{P\ x\ W(Z)}\ for\ P > 0.375$$

$$F_Q^M(Z) \leq \frac{F_Q^{RTP}\ x\ K(Z)}{W(Z)\ x\ 0.375}\ for\ P \leq 0.375$$

where $F_Q^M(Z)$ is the measured $F_Q(Z)$ increased by the allowances for manufacturing tolerances and measurement uncertainty, $F_Q^{RTP}$ is the $F_Q$ limit, K(Z) is the normalized $F_Q(Z)$ as a function of core height, P is the relative THERMAL POWER, and W(Z) is the cycle-dependent function that accounts for power distribution transients encountered during normal operation. $F_Q^{RTP}$, K(Z), and W(Z) are specified in the COLR as per Specification 6.9.1.6.

d. Measuring $F^M_Q(Z)$ according to the following schedule:

(1) Upon achieving equilibrium conditions after exceeding by 10% or more of RATED THERMAL POWER, the THERMAL POWER at which $F_Q(Z)$ was last determined,* or

(2) At least once per 31 Effective Full Power Days, whichever occurs first.

e. With the maximum value of

$$\frac{F^M_Q(Z)}{K(Z)}$$

over the core height (Z) increasing since the previous determination of $F^M_Q(Z)$, either of the following actions shall be taken:

(1) $F^M_Q(Z)$ shall be increased by 2% over that specified in Specification 4.2.2.2.2c, or

(2) $F^M_Q(Z)$ shall be measured at least once per 7 Effective Full Power Days until two successive maps indicate that the maximum value of

$$\frac{F^M_Q(Z)}{K(Z)}$$

over the core height (Z) is not increasing.

f. The limits specified in Specifications 4.2.2.2.2c and 4.2.2.2.2e are not applicable in the following core plane regions:

(1) Lower core region from 0% to 15%, inclusive.
(2) Upper core region from 85% to 100%, inclusive.

*During power escalation at the beginning of each cycle, the power level may be increased until a power level for extended operation has been achieved and power distribution map obtained.

4.2.2.2.3 Base load operation is permitted at powers above $APL^{ND}$ if the following conditions are satisfied:

a. Prior to entering base load operation, maintain THERMAL POWER above $APL^{ND}$ and less than or equal to that allowed by Specification 4.2.2.2.2 for at least the previous 24 hours. Maintain base load operation surveillance (AFD within the target band limit about the target flux difference of Specification 3.2.1.2) during this time period.

   Base load operation is then permitted providing THERMAL POWER is maintained between $APL^{ND}$ and $APL^{BL}$ or between $APL^{ND}$ and 100% (whichever is most limiting) and $F_Q$ surveillance is maintained pursuant to Specification 4.2.2.2.4. $APL^{BL}$ is defined as the minimum value of:

$$APL^{BL} = \frac{F_Q^{RTP} \times K(Z)}{F_Q^M(Z) \times W(Z)_{BL}} \times 100\%$$

   over the core height (Z) where: $F_Q^M(Z)$ is the measured $F_Q(Z)$ increased by the allowances for manufacturing tolerances and measurement uncertainty. The $F_Q$ limit is $F_Q^{RTP}$. $W(Z)_{BL}$ is the cycle-dependent function that accounts for limited power distribution transient encountered during base load operation. $F_Q^{RTP}$, K(Z), and $W(Z)_{BL}$ are specified in the COLR as per Specification 6.9.1.6.

b. During base load operation, if the THERMAL POWER is decreased below $APL^{ND}$ then the conditions of 4.2.2.2.3.a shall be satisfied before reentering base load operation.

4.2.2.2.4 During base load operation $F_Q(Z)$ shall be evaluated to determine if $F_Q(Z)$ is within its limit by:

a. Using the movable incore detectors to obtain a power distribution map at any THERMAL POWER above $APL^{ND}$.

b. Increasing the measured $F_Q(Z)$ component of the power distribution map by 3% to account for manufacturing tolerances and further increasing the value by 5% to account for measurement uncertainties. Verify the requirements of Specification 3.2.2.2 are satisfied.

c. Satisfying the following relationship:

$$F_Q^M(Z) \leq \frac{F_Q^{RTP} \times K(Z)}{P \times W(Z)_{BL}} \text{ for } P > APL^{ND}$$

where: $F_Q^M(Z)$ is the measured $F_Q(Z)$. The $F_Q^{RTP}$ is the $F_Q$ limit, the normalized $F_Q(Z)$ as a function of core height. P is the relative THERMAL POWER. $W(Z)_{BL}$ is the cycle-dependent function that accounts for limited power distribution transients encountered during base load operation. $F_Q^{RTP}$, K(Z), and $W(Z)_{BL}$ are specified in the COLR as per Specification 6.9.1.6.

d. Measuring $F_Q^M(Z)$ in conjunction with target flux difference determination according to the following schedule:

(1) Prior to entering base load operation after satisfying Section 4.2.2.2.3, unless a full core flux map has been taken in the previous 31 Effective Full Power Days with the relative THERMAL POWER having been maintained above $APL^{ND}$ for the 24 hours prior to mapping, and

(2) At least once per 31 Effective Full Power Days.

e. With the maximum value of

$$\frac{F_Q^M(z)}{K(z)}$$

over the core height (Z) increasing since the previous determination of $F_Q^M(Z)$, either of the following actions shall be taken:

(1) $F_Q^M(Z)$ shall be increased by 2 percent over that specified in 4.2.2.2.4.c, or

(2) $F_Q^M(Z)$ shall be measured at least once per 7 Effective Full Power Days until 2 successive maps indicate that the maximum value of

$$\frac{F_Q^M(Z)}{K(Z)}$$

over the core height (Z) is not increasing.

f. The limits specified in 4.2.2.2.4.c and 4.2.2.2.4.e are not applicable in the following core plane regions:

(1) Lower core region 0% to 15%, inclusive.
(2) Upper core region 85% to 100%, inclusive.

4.2.2.2.5 When $F_Q(Z)$ is measured for reasons other than meeting the requirements of Specifications 4.2.2.2.2 or 4.2.2.2.4, an overall measured $F_Q(Z)$ shall be obtained from a power distribution map and increased by 3% to account for manufacturing tolerances and further increased by 5% to account for measurement uncertainty.

## COLD SHUTDOWN - LOOPS NOT FILLED

### LIMITING CONDITION FOR OPERATION

3.4.1.4.2 Two residual heat removal (RHR) loops shall be OPERABLE* and at least one RHR loop shall be in operation.**

APPLICABILITY: MODE 5 with less than two reactor coolant loops filled.

ACTION:

a. With less than the above required RHR loops OPERABLE, immediately initiate corrective action to return the required RHR loops to OPERABLE status as soon as possible.

b. With no RHR loop in operation, suspend all operations involving a reduction in boron concentration of the Reactor Coolant System and immediately initiate corrective action to return the required RHR loop to operation.

### SURVEILLANCE REQUIREMENTS

4.4.1.4.2.1 The required RHR loops shall be demonstrated OPERABLE pursuant to Specification 4.0.5.

4.4.1.4.2.2 At least one RHR loop shall be determined to be in operation and circulating reactor coolant at least once per 12 hours.

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*One RHR loop may be inoperable for up to 2 hours for surveillance testing provided the other RHR loop is OPERABLE and in operation.

**The RHR pump may be deenergized for up to 1 hour provided: (1) no operations are permitted that would cause dilution of the Reactor Coolant System boron concentration, and (2) core outlet temperature is maintained at least 10°F below saturation temperature.

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## 3/4.9 REFUELING OPERATIONS

### 3/4.9.1 BORON CONCENTRATION

#### LIMITING CONDITION FOR OPERATION

3.9.1.1 The boron concentration of all filled portions of the Reactor Coolant System and the refueling canal shall be maintained uniform and sufficient to ensure that the more restrictive of the following reactivity conditions is met; either:

a. A $K_{eff}$ of 0.95 or less, or
b. A boron concentration of greater than or equal to 2600 ppm.

Additionally, the CVCS valves of Specification 4.1.1.2.2 shall be closed and secured in position.

APPLICABILITY: MODE 6.*

ACTION:

a. With the requirements of the above specification not satisfied, immediately suspend all operations involving CORE ALTERATIONS or positive reactivity changes and initiate and continue boration at greater than or equal to 33 gpm of a solution containing greater than or equal to 6300 ppm boron or its equivalent until $K_{eff}$ is reduced to less than or equal to 0.95 or the boron concentration is restored to greater than or equal to 2600 ppm, whichever is the more restrictive.

b. With any of the CVCS valves of Specification 4.1.1.2.2 not closed** and secured in position, immediately close and secure the valves.

#### SURVEILLANCE REQUIREMENTS

4.9.1.1.1 The more restrictive of the above two reactivity conditions shall be determined prior to:

a. Removing or unbolting the reactor vessel head, and
b. Withdrawal of any full-length control rod in excess of 3 feet from its fully inserted position within the reactor vessel.

4.9.1.1.2 The boron concentration of the Reactor Coolant System and the refueling canal shall be determined by chemical analysis at least once per 72 hours.

4.9.1.1.3 The CVCS valves of Specification 4.1.1.2.2 shall be verified closed and locked at least once per 31 days.

*The reactor shall be maintained in MODE 6 whenever fuel is in the reactor vessel with the vessel head closure bolts less than fully tensioned or with the head removed.

**Except those opened under administrative control.

## 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 $T_{avg}$. In MODES 1 and 2, 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 1.3% $\Delta K/K$ 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. In MODES 3, 4 and 5, the most restrictive condition occurs at BOL, associated with a boron dilution accident. In the analysis of this accident, a minimum SHUTDOWN MARGIN as defined in Specification 3/4.1.1.2 is required to allow the operator 15 minutes from the initiation of the Shutdown Margin Monitor alarm to total loss of SHUTDOWN MARGIN. Accordingly, the SHUTDOWN MARGIN requirement is based upon this limiting requirement and is consistent with the accident analysis assumption. The required SHUTDOWN MARGIN is plotted as a function of RCS critical boron concentration.

The locking closed of the required valves in MODE 5 (with the loops not filled) will preclude the possibility of uncontrolled boron dilution of the Reactor Coolant System by preventing flow of unborated water to the RCS.

### 3/4.1.1.3 MODERATOR TEMPERATURE COEFFICIENT

The limitations on moderator temperature coefficient (MTC) are provided to ensure that the value of this coefficient remains within the limiting condition assumed in the FSAR accident and transient analyses.

The MTC values of this specification are applicable to a specific set of plant conditions; accordingly, verification of MTC values at conditions other than those explicitly stated will require extrapolation to those conditions in order to permit an accurate comparison.

The most negative MTC, value equivalent to the most positive moderator density coefficient (MDC), was obtained by incrementally correcting the MDC used in the FSAR analyses to nominal operating conditions.

### 3/4.4.1 REACTOR COOLANT LOOPS AND COOLANT CIRCULATION

The plant is designed to operate in MODES 1 and 2 with three or four reactor coolant loops in operation and maintain DNBR greater than the design limit during all normal operations and anticipated transients. With less than the required reactor coolant loops in operation this specification requires that the plant be in at least HOT STANDBY within 6 hours.

In MODE 3, three reactor coolant loops, and in Mode 4, two reactor coolant loops provide sufficient heat removal capability for removing core decay heat even in the event of a bank withdrawal accident; however, a single reactor coolant loop provides sufficient heat removal capacity if a bank withdrawal accident can be prevented, i.e., by opening the Reactor Trip System breakers.

In MODE 4, and in MODE 5 with reactor coolant loops filled, a single reactor coolant loop or RHR loop provides sufficient heat removal capability for removing decay heat; but single failure considerations require that at least two loops (either RHR or RCS) be OPERABLE.

In MODE 5 with reactor coolant loops not filled, a single RHR loop provides sufficient heat removal capability for removing decay heat; but single failure considerations, and the unavailability of the steam generators as a heat removing component, require that at least two RHR loops be OPERABLE.

The operation of one reactor coolant pump (RCP) or one RHR pump provides adequate flow to ensure mixing, prevent stratification and produce gradual reactivity changes during boron concentration reductions in the Reactor Coolant System. The reactivity change rate associated with boron reduction will, therefore, be within the capability of operator recognition and control.

The restrictions on starting an RCP with one or more RCS cold legs less than or equal to 350°F are provided to prevent RCS pressure transients, caused by energy additions from the Secondary Coolant System, which could exceed the limits of Appendix G to 10 CFR Part 50. The RCS will be protected against overpressure transients and will not exceed the limits of Appendix G by either: (1) restricting the water volume in the pressurizer and thereby providing a volume for the reactor coolant to expand into, or (2) by restricting starting of the RCPs to when the secondary water temperature of each steam generator is less than 50°F above each of the RCS cold leg temperatures.