

ENCLOSURE 3

SHEARON HARRIS NUCLEAR POWER PLANT  
NRC DOCKET NO. 50-400  
OPERATING LICENSE NPF-63  
REQUEST FOR LICENSE AMENDMENT  
BORON DILUTION/SLIDING SHUTDOWN MARGIN

REVISED TECHNICAL SPECIFICATION PAGES

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INDEX

3.0/4.0 LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

<u>SECTION</u>	<u>PAGE</u>
<u>3/4.0 APPLICABILITY</u> .....	3/4 0-1
<u>3/4.1 REACTIVITY CONTROL SYSTEMS</u>	
3/4.1.1 BORATION CONTROL	
Shutdown Margin - $\bar{T}_{avg}$ <sup>Modes 1 and 2</sup> <del>Greater Than 200°F</del> .....	3/4 1-1
Shutdown Margin - $\bar{T}_{avg}$ <sup>Modes 3, 4, and 5</sup> <del>Less Than or Equal to 200°F</del> .....	3/4 1-3
Moderator Temperature Coefficient.....	3/4 1-4
Minimum Temperature for Criticality.....	3/4 1-6
3/4.1.2 BORATION SYSTEMS	
Flow Path - Shutdown.....	3/4 1-7
Flow Paths - Operating.....	3/4 1-8
Charging Pump - Shutdown.....	3/4 1-9
Charging Pumps - Operating.....	3/4 1-10
Borated Water Source - Shutdown.....	3/4 1-11
Borated Water Sources - Operating.....	3/4 1-12
3/4.1.3 MOVABLE CONTROL ASSEMBLIES	
Group Height.....	3/4 1-14
TABLE 3.1-1 ACCIDENT ANALYSES REQUIRING REEVALUATION IN THE	
EVENT OF AN INOPERABLE ROD.....	3/4 1-16
Position Indication Systems - Operating.....	3/4 1-17
Position Indication System - Shutdown.....	3/4 1-18
Rod Drop Time.....	3/4 1-19
Shutdown Rod Insertion Limit.....	3/4 1-20
Control Rod Insertion Limits.....	3/4 1-21
FIGURE <del>3.1-1</del> <sup>3.1-2</sup> ROD GROUP INSERTION LIMITS VERSUS THERMAL POWER	
THREE-LOOP OPERATION.....	3/4 1-22
FIGURE 3.1-1 Shutdown Margin Versus RCS Boron ...	3/4 1-3a
Concentration Modes 3, 4, and 5.	

### 3/4.1 REACTIVITY CONTROL SYSTEMS

#### 3/4.1.1 BORATION CONTROL

*Modes 1 and 2*

SHUTDOWN MARGIN -  $T_{avg}$  GREATER THAN 200°F

#### LIMITING CONDITION FOR OPERATION

3.1.1.1 The SHUTDOWN MARGIN shall be greater than or equal to 1770 pcm for 3-loop operation.

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

*and*

#### ACTION:

With the SHUTDOWN MARGIN less than 1770 pcm, immediately initiate and continue boration at greater than or equal to 30 gpm of a solution containing greater than or equal to 7000 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 greater than or equal to 1770 pcm:

- 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 above required SHUTDOWN MARGIN shall be verified acceptable with an increased allowance for the withdrawn worth of the immovable or untrippable control rod(s);
- b. When in MODE 1 or MODE-2 with  $K_{eff}$  greater than or equal to 1 at least once per 12 hours by verifying that control bank withdrawal is within the limits of Specification 3.1.3.6;
- c. Within 4 hours prior to achieving reactor criticality by verifying that the predicted critical control rod position is within the limits of Specification 3.1.3.6;
- d. Prior to initial operation above 5% RATED THERMAL POWER after each fuel loading, by consideration of the factors of ~~Specification 4.1.1.1.1c~~ ~~Specification 4.1.1.1.1c~~ below, with the control banks at the maximum insertion limit of Specification 3.1.3.6; and

\*See Special Test Exceptions Specification 3.10.1.

## REACTIVITY CONTROL SYSTEMS

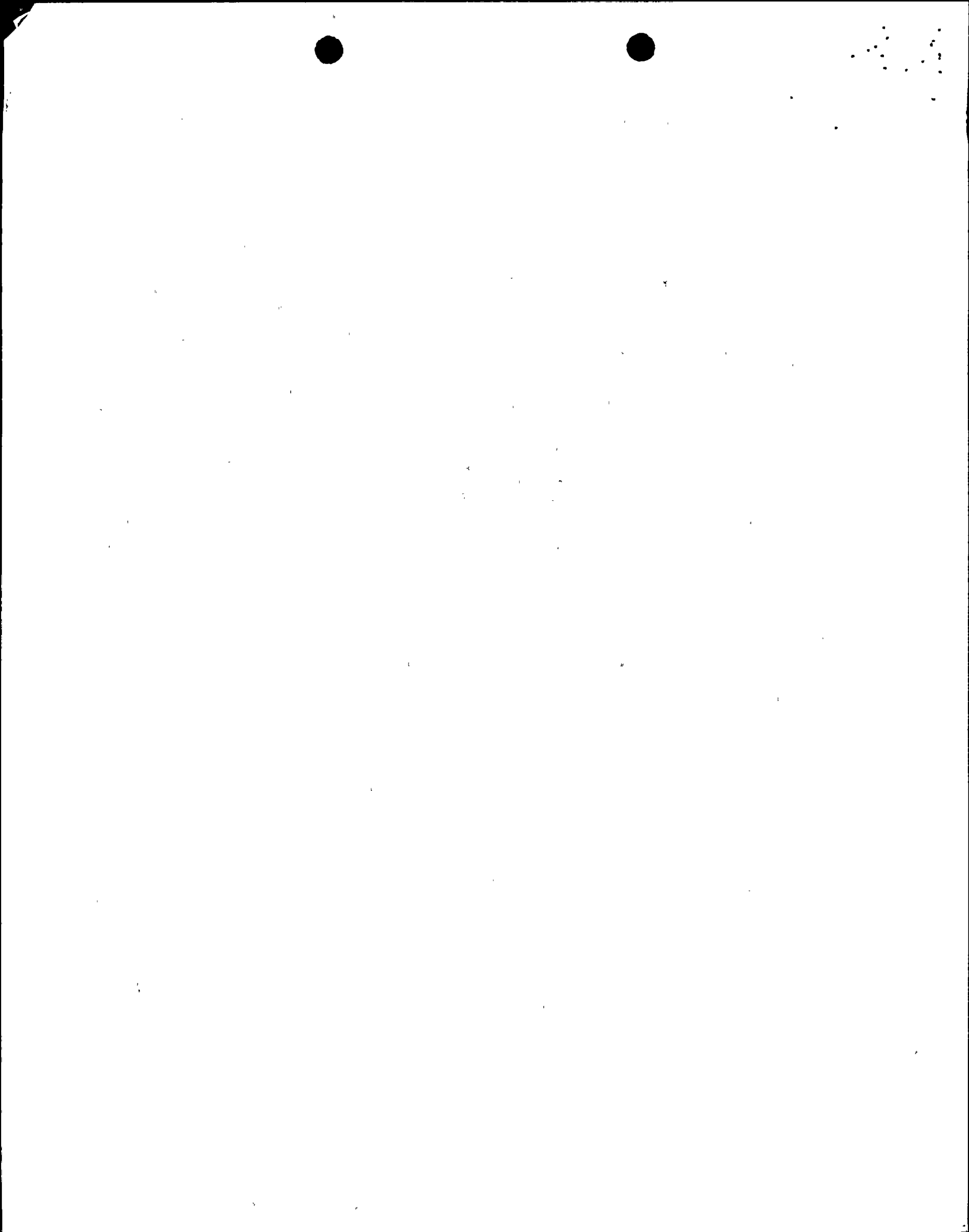
### SURVEILLANCE REQUIREMENTS (Continued)

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~~e. When in MODE 3 or 4, 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.

4.1.1.1.2 The overall core reactivity balance shall be compared to predicted values to demonstrate agreement within  $\pm 1000$  pcm 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.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 EFPD after each fuel loading. If later experience shows adjustment is desirable at approximately 60 EFPD, the adjustment is permissible.



REACTIVITY CONTROL SYSTEMS

*Nodes 3, 4, and 5*

SHUTDOWN MARGIN -  $T_{avg}$  LESS THAN OR EQUAL TO 200°F

LIMITING CONDITION FOR OPERATION

3.1.1.2 The SHUTDOWN MARGIN shall be greater than or equal to ~~2000 ppm~~.

APPLICABILITY: ~~MODE 5~~ *Nodes 3, 4, and 5*

*the limit shown in Figure 3.1-1*

ACTION:

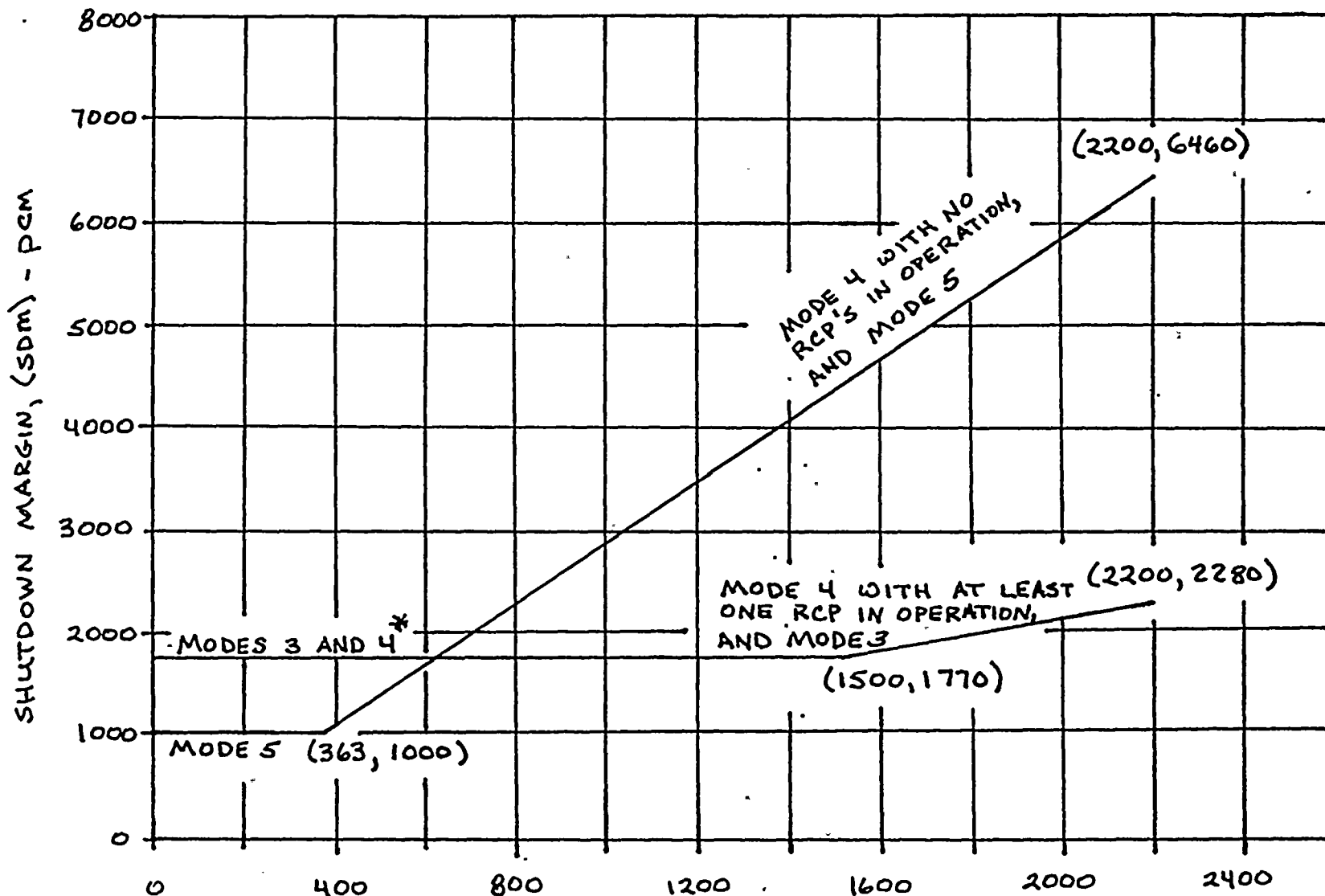
With the SHUTDOWN MARGIN less than ~~2000 ppm~~ <sup>the required value</sup> immediately initiate and continue boration at greater than or equal to 30 gpm of a solution containing greater than or equal to 7000 ppm boron or equivalent until the required SHUTDOWN MARGIN is restored.

SURVEILLANCE REQUIREMENTS

4.1.1.2 The SHUTDOWN MARGIN shall be determined to be greater than or equal to ~~2000 ppm~~ *the required value*:

- 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.

FIGURE 3.1-1  
 SHUTDOWN MARGIN VERSUS RCS BORON CONCENTRATION, MODES 3, 4, AND 5



REQUIRED RCS BORON CONCENTRATION (ppm) (BURNUP DEPENDENT)

\* Applicable to Mode 4, with or without RCP's in operation

SHEARON HARRIS - UNIT 1  
3/4 1-3a

## REACTIVITY CONTROL SYSTEMS

### FLOW PATHS - OPERATING

#### LIMITING CONDITION FOR OPERATION

3.1.2.2 At least two of the following three boron injection flow paths shall be OPERABLE:

- a. The flow path from the boric acid tank via a boric acid transfer pump and a charging/safety injection pump to the Reactor Coolant System (RCS), and
- b. Two flow paths from the refueling water storage tank via charging/safety injection pumps to the RCS.

APPLICABILITY: MODES 1, 2, and 3.

#### ACTION:

With only one of the above required boron injection flow paths to the RCS OPERABLE, restore at least two boron injection flow paths to the RCS to OPERABLE status within 72 hours or be in at least HOT STANDBY and borated to a SHUTDOWN MARGIN ~~equivalent to at least 2000 pcm~~ at 200°F within the next 6 hours; restore at least two flow paths to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

*as required by Figure 3.1-1*

#### SURVEILLANCE REQUIREMENTS

4.1.2.2 At least two of the above required flow paths shall be demonstrated OPERABLE:

- a. At least once per 7 days by verifying that the temperature of the flow path between the boric acid tank and the charging/safety injection pump suction header tank is greater than or equal to 65°F when a flow path from the boric acid tank is used;
- b. At least once per 31 days by verifying that each valve (manual, power-operated, or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position;
- c. At least once per 18 months during shutdown by verifying that each automatic valve in the flow path actuates to its correct position on a safety injection test signal; and
- d. At least once per 18 months by verifying that the flow path required by Specification 3.1.2.2a. delivers at least 30 gpm to the RCS.



REACTIVITY CONTROL SYSTEMS

CHARGING PUMPS - OPERATING

LIMITING CONDITION FOR OPERATION

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3.1.2.4 At least two charging/safety injection pumps shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTION:

With only one charging/safety injection pump OPERABLE, restore at least two charging/safety injection pumps to OPERABLE status within 72 hours or be in at least HOT STANDBY and borated to a SHUTDOWN MARGIN ~~equivalent to at least 2000 pcm~~ at 200°F within the next 6 hours; restore at least two charging/safety injection pumps to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

*As required by Figure 3.1-1*

SURVEILLANCE REQUIREMENTS

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4.1.2.4 At least two charging/safety injection pumps shall be demonstrated OPERABLE by verifying, on recirculation flow or in service supplying flow to the Reactor Coolant System and reactor coolant pump seals, that a differential pressure across each pump of greater than or equal to 2446 psid is developed when tested pursuant to Specification 4.0.5.

## REACTIVITY CONTROL SYSTEMS

### BORATED WATER SOURCE - SHUTDOWN

#### LIMITING CONDITION FOR OPERATION

---

3.1.2.5 As a minimum, one of the following borated water sources shall be OPERABLE:

- a. A boric acid tank with:
  1. A minimum contained borated water volume of <sup>7100</sup>~~4900~~ gallons, which is equivalent to <sup>17%</sup>~~10%~~ indicated level,
  2. A boron concentration of between 7000 and 7750 ppm, and
  3. A minimum solution temperature of 65°F.
- b. The refueling water storage tank (RWST) with:
  1. A minimum contained borated water volume of <sup>106,000</sup>~~82,000~~ gallons, which is equivalent to <sup>12%</sup>~~6%~~ indicated level,
  2. A boron concentration of between 2000 and 2200 ppm, and
  3. A minimum solution temperature of 40°F.

APPLICABILITY: MODES 5 and 6.

#### ACTION:

With no borated water source OPERABLE, suspend all operations involving CORE ALTERATIONS or positive reactivity changes.

#### SURVEILLANCE REQUIREMENTS

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4.1.2.5 The above required borated water source shall be demonstrated OPERABLE:

- a. At least once per 7 days by:
  1. Verifying the boron concentration of the water,
  2. Verifying the contained borated water volume, and
  3. Verifying the boric acid tank solution temperature when it is the source of borated water.
- b. At least once per 24 hours by verifying the RWST temperature when it is the source of borated water and the outside air temperature is less than 40°F.

## REACTIVITY CONTROL SYSTEMS

### BORATED WATER SOURCES - OPERATING

#### LIMITING CONDITION FOR OPERATION

3.1.2.6 As a minimum, the following borated water source(s) shall be OPERABLE as required by Specification 3.1.2.2:

a. A boric acid tank with:

1. A minimum contained borated water volume of <sup>21,400</sup>~~16,800~~ gallons, which is equivalent to ~~46%~~<sup>60%</sup> indicated level.
2. A boron concentration of between 7000 and 7750 ppm, and
3. A minimum solution temperature of 65°F.

b. The refueling water storage tank (RWST) with:

1. A minimum contained borated water volume of 436,000 gallons, which is equivalent to 92% indicated level.
2. A boron concentration of between 2000 and 2200 ppm,
3. A minimum solution temperature of 40°F, and
4. A maximum solution temperature of 125°F.

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

#### ACTION:

- as required by Figure 3.1-1*
- a. With the boric acid tank inoperable and being used as one of the above required borated water sources, restore the boric acid tank to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and borated to a SHUTDOWN MARGIN, ~~equivalent to at least 3000 ppm~~ at 200°F; restore the boric acid tank to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.
  - b. With the RWST inoperable, restore the tank to OPERABLE status within 1 hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

## REACTIVITY CONTROL SYSTEMS

### 3/4.1.3 MOVABLE CONTROL ASSEMBLIES

#### GROUP HEIGHT

#### LIMITING CONDITION FOR OPERATION

3.1.3.1 All shutdown and control rods shall be OPERABLE and positioned within  $\pm 12$  steps (indicated position) of their group step counter demand position.

APPLICABILITY: MODES 1\* and 2\*.

#### ACTION:

- a. With one or more rods inoperable due to being immovable as a result of excessive friction or mechanical interference or known to be untrippable, determine that the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied within 1 hour and be in HOT STANDBY within 6 hours.
- b. With more than one rod misaligned from the group step counter demand position by more than  $\pm 12$  steps (indicated position), be in HOT STANDBY within 6 hours.
- c. With more than one rod inoperable, due to a rod control urgent failure alarm or obvious electrical problem in the rod control system existing for greater than 36 hours, be in HOT STANDBY within the following 6 hours.
- d. With one rod trippable but inoperable due to causes other than addressed by ACTION a., above, or misaligned from its group step counter demand height by more than  $\pm 12$  steps (indicated position), POWER OPERATION may continue provided that within 1 hour:
  1. The rod is restored to OPERABLE status within the above alignment requirements, or
  2. The rod is declared inoperable and the remainder of the rods in the group with the inoperable rod are aligned to within  $\pm 12$  steps of the inoperable rod while maintaining the rod sequence and insertion limits of Figure 3.1-1. The THERMAL POWER level shall be restricted pursuant to Specification 3.1.3.6 during subsequent operation, or 3.1-2
  3. The rod is declared inoperable and the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied. POWER OPERATION may then continue provided that:
    - a) A reevaluation of each accident analysis of Table 3.1-1 is performed within 5 days; this reevaluation shall confirm that the previously analyzed results of these accidents

\*See Special Test Exceptions Specifications 3.10.2 and 3.10.3.

## REACTIVITY CONTROL SYSTEMS

### CONTROL ROD INSERTION LIMITS

#### LIMITING CONDITION FOR OPERATION

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3.1.3.6 The control banks shall be limited in physical insertion as shown in Figure ~~3.1-1~~.

~~3.1-1~~  
3.1-2

APPLICABILITY: MODES 1\* and 2\* \*\*:

#### ACTION:

With the control banks inserted beyond the above insertion limits, except for surveillance testing pursuant to Specification 4.1.3.1.2:

- a. Restore the control banks to within the limits within 2 hours, or
- b. Reduce THERMAL POWER within 2 hours to less than or equal to that fraction of RATED THERMAL POWER which is allowed by the bank position using Figure ~~3.1-1~~, or  
3.1-2
- c. Be in at least HOT STANDBY within 6 hours.

#### SURVEILLANCE REQUIREMENTS

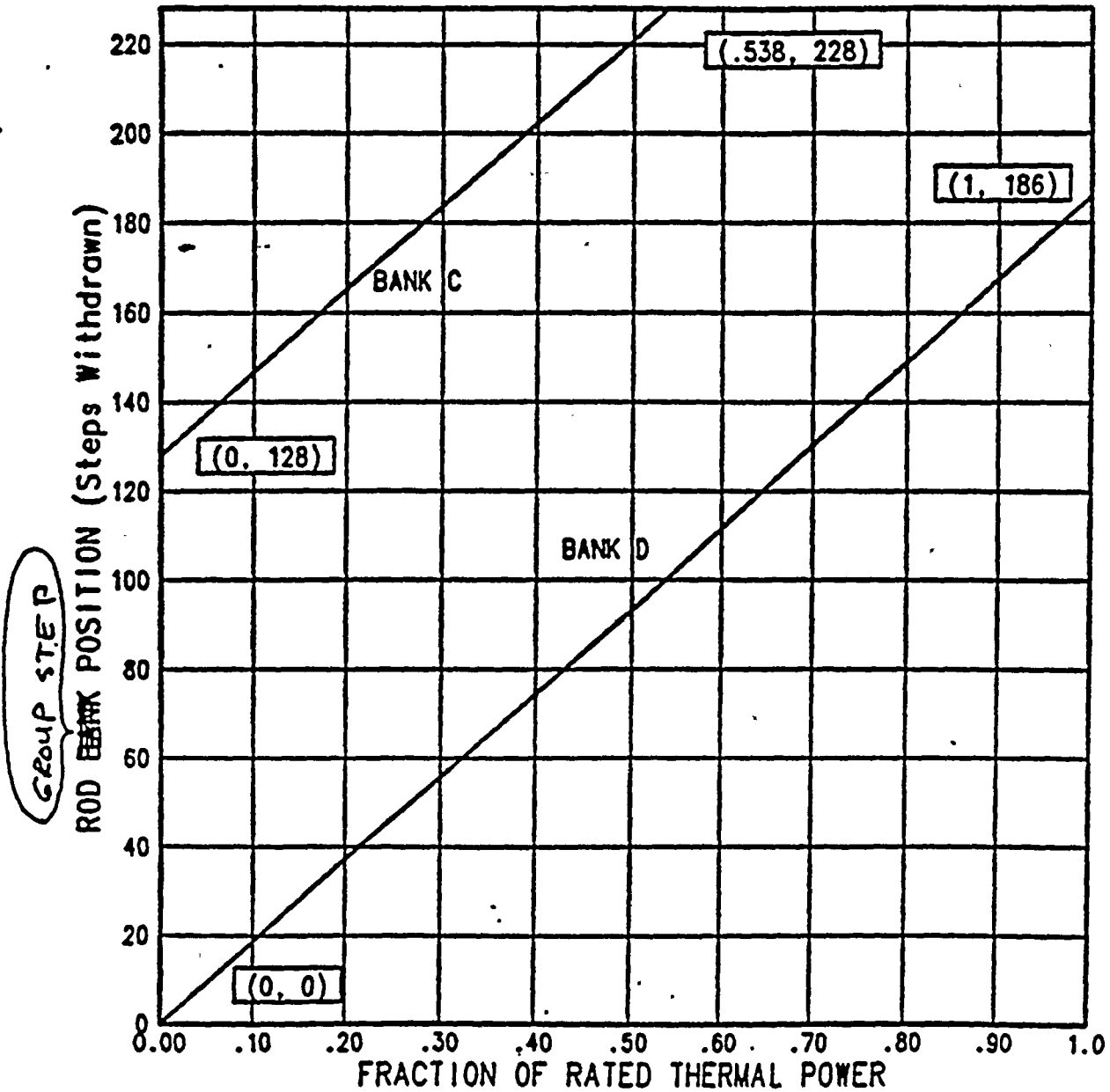
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4.1.3.6 The position of each control bank shall be determined to be within the insertion limits at least once per 12 hours except during time intervals when the rod insertion limit monitor is inoperable, then verify the individual rod positions at least once per 4 hours.

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\*See Special Test Exceptions Specifications 3.10.2 and 3.10.3.

\*\*With  $K_{eff}$  greater than or equal to 1.



2  
**FIGURE 3.1-X**  
**ROD GROUP INSERTION LIMITS VERSUS THERMAL POWER**  
**THREE-LOOP OPERATION**

SHEARON HARRIS - UNIT 1 3/4 1-22

## 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 sub-critical 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 <sup>In Modes 1 and 2</sup> life as a function of fuel depletion, RCS boron concentration, and RCS  $T_{avg}$ . <sup>The most restrictive condition</sup> 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 1770 pcm 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. <sup>With  $T_{avg}$  less than 200°F,</sup>

~~the reactivity transients resulting from a postulated steam line break cooldown are minimal, but a 2000 pcm SHUTDOWN MARGIN is required to provide adequate protection for postulated inadvertent dilution events. The unit "pcm" is used throughout these specifications to conform with the reactivity information provided by the NSSS supplier; 1000 pcm is equal to 1%  $\Delta k/k$ .~~

~~Analysis of inadvertent boron dilution at cold shutdown is based on:~~

- ~~1. all RCGA's in the core while the RCS, except the reactor vessel, is drained (i.e., not filled), and~~
- ~~2. all RCGA's, except shutdown banks C and D, are fully inserted in the core while the RCS is filled.~~

~~In addition, by assuming the most reactive control rod is stuck out of the core, its worth is effectively added to the 2000 pcm shutdown margin in calculating the necessary soluble boron concentration.~~

##### 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; i.e., the positive limit is based on core conditions for all rods withdrawn, BOL, hot zero THERMAL POWER, and the negative limit is based on core conditions for all rods withdrawn, EOL, RATED THERMAL POWER. 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.

Insert A to Technical Specification page B 3/4 1-1

In MODES 3, 4, and 5, the most restrictive condition occurs at BOL, when the boron concentration is the greatest. In these modes, the required SHUTDOWN MARGIN is composed of a constant requirement and a variable requirement, which is a function of the RCS boron concentration. The constant SHUTDOWN MARGIN requirement is based on an uncontrolled RCS cooldown from a steamline break accident, as is the case for MODES 1 and 2. The variable SHUTDOWN MARGIN requirement is based on the results of boron dilution accident analyses, where the SHUTDOWN MARGIN is varied as a function of RCS boron concentration, to guarantee a minimum of 15 minutes for operator action prior to a loss of SHUTDOWN MARGIN.

Figure 3.1-1 must be used with a curve giving the required shutdown boron concentrations for various temperatures as a function of core burnup. This cycle dependent relationship is provided for each cycle in the plant Curve Book. From the Curve Book, a required boron concentration that will provide adequate SHUTDOWN MARGIN can be determined and this concentration may be used to enter Figure 3.1-1 to determine the specific required SHUTDOWN MARGIN for that condition.

The boron dilution analysis assumed a common RCS volume and dilution flow rate for MODES 3 and 4, which differed from the volume and flow rate assumed for MODE 5 analysis. The MODE 5 conditions assumed limited mixing in the RCS and cooling with the RHR system only. In MODES 3 and 4, it was assumed that at least one reactor coolant pump was operating. If a least one reactor coolant pump is not operating in MODE 4, then the SHUTDOWN MARGIN requirements for MODE 5 shall apply, provided that the dilution flow rate assumed in the MODE 5 Boron Dilution analysis is not exceeded.



## REACTIVITY CONTROL SYSTEMS

### BASES

#### MODERATOR TEMPERATURE COEFFICIENT (Continued)

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. These corrections involved subtracting the incremental change in the MDC associated with a core condition of all rods inserted (most positive MDC) to an all rods withdrawn condition and, a conversion for the rate of change of moderator density with temperature at RATED THERMAL POWER conditions. This value of the MDC was then transformed into the limiting MTC value  $-42 \text{ pcm}/^\circ\text{F}$ . The MTC value of  $-33 \text{ pcm}/^\circ\text{F}$  represents a conservative value (with corrections for burnup and soluble boron) at a core condition of 300 ppm equilibrium boron concentration and is obtained by making these corrections to the limiting MTC value of  $-42 \text{ pcm}/^\circ\text{F}$ .

The Surveillance Requirements for measurement of the MTC at the beginning and near the end of the fuel cycle are adequate to confirm that the MTC remains within its limits since this coefficient changes slowly due principally to the reduction in RCS boron concentration associated with fuel burnup.

#### 3/4.1.1.4 MINIMUM TEMPERATURE FOR CRITICALITY

This specification ensures that the reactor will not be made critical with the Reactor Coolant System average temperature less than  $551^\circ\text{F}$ . This limitation is required to ensure: (1) the moderator temperature coefficient is within its analyzed temperature range, (2) the trip instrumentation is within its normal operating range, (3) the pressurizer is capable of being in an OPERABLE status with a steam bubble, and (4) the reactor vessel is above its minimum  $RT_{\text{NDT}}$  temperature.

#### 3/4.1.2 BORATION SYSTEMS

The Boron Injection System ensures that negative reactivity control is available during each mode of facility operation. The components required to perform this function include: (1) borated water sources, (2) charging/safety injection pumps, (3) separate flow paths, (4) boric acid transfer pumps, and (5) an emergency power supply from OPERABLE diesel generators.

With the RCS average temperature above  $350^\circ\text{F}$ , a minimum of <sup>the required</sup> two boron injection flow paths are required to ensure single functional capability in the event an assumed failure renders one of the flow paths inoperable. The boration capability of either flow path is sufficient to provide a SHUTDOWN MARGIN ~~from expected operating conditions of 1770 pcm~~ after xenon decay and cooldown to <sup>BOL</sup>  $200^\circ\text{F}$ . The maximum expected boration capability requirement occurs at ~~EQ~~ <sup>from</sup> full power equilibrium xenon conditions and requires ~~26,000~~ <sup>21,400</sup> gallons of 7000 ppm borated water be maintained in the boric acid storage tanks or 436,000 gallons of 2000-2200 ppm borated water be maintained in the <sup>refueling water storage tank (RWST).</sup>

With the RCS temperature below  $350^\circ\text{F}$ , one boron injection flow path is acceptable without single failure consideration on the basis of the stable reactivity

# REACTIVITY CONTROL SYSTEMS

## BASES

### BORATION SYSTEMS (Continued)

condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single boron injection flow path becomes inoperable.

The limitation for a maximum of one charging/safety injection pump (CSIP) to be OPERABLE and the Surveillance Requirement to verify all CSIPs except the required OPERABLE pump to be inoperable below 335°F provides assurance that a mass addition pressure transient can be relieved by the operation of a single PORV.

The boron capability required below 200°F is sufficient to provide <sup>as defined by Specification 3/4.1.1.2</sup> the required SHUTDOWN MARGIN ~~of 1000 ppm~~ after xenon decay and cooldown from 200°F to 140°F. This condition requires either ~~4900~~ <sup>7,100</sup> gallons of 7000 ppm borated water be maintained in the boric acid storage tanks or ~~82,000~~ <sup>106,000</sup> gallons of 2000-2200 ppm borated water be maintained in the RWST.

The gallons given above are the amounts that need to be maintained in the tank in the various circumstances. To get the specified value, each value had added to it an allowance for the unusable volume of water in the tank, allowances for other identified needs, and an allowance for possible instrument error. In addition, for human factors purposes, the percent indicated levels were then raised to either the next whole percent or the next even percent and the gallon figures rounded off. This makes the LCO values conservative to the analyzed values. The specified percent level and gallons differ by less than ~~0.1%~~ 0.3%

The limits on contained water volume and boron concentration of the RWST also ensure a pH value of between 8.5 and 11.0 for the solution recirculated within containment after a LOCA. This pH band minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components.

The BAT minimum temperature of 65°F ensures that boron solubility is maintained for concentrations of at least the 7750 ppm limit. The RWST minimum temperature is consistent with the STS value and is based upon other considerations since solubility is not an issue at the specified concentration levels. The RWST high temperature was selected to be consistent with analytical assumptions for containment heat load.

The OPERABILITY of one Boron Injection System during REFUELING ensures that this system is available for reactivity control while in MODE 6.

### 3/4.1.3 MOVABLE CONTROL ASSEMBLIES

The specifications of this section ensure that: (1) acceptable power distribution limits are maintained, (2) the minimum SHUTDOWN MARGIN is maintained, and (3) the potential effects of rod misalignment on associated accident analyses are limited. OPERABILITY of the control rod position indicators is required to determine control rod positions and thereby ensure compliance with the control rod alignment and insertion limits.