

ATTACHMENT "A"

### 3/4.1 REACTIVITY CONTROL SYSTEMS

#### 3/4.1.1 BORATION CONTROL

SHUTDOWN MARGIN - T<sub>avg</sub> GREATER THAN 200°F

#### LIMITING CONDITION FOR OPERATION

3.1.1.1 The SHUTDOWN MARGIN shall be greater than or equal to 5.15% delta k/k.

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

#### ACTION:

With the SHUTDOWN MARGIN less than 5.15% delta k/k, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 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 greater than or equal to 5.15% 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or untrippable, the above required SHUTDOWN MARGIN shall be verified acceptable with an increased allowance for the withdrawn worth of the immovable or untrippable CEA(s).
- b. When in MODE 1 or MODE 2 with  $K_{eff}$  greater than or equal to 1.0, at least once per 12 hours by verifying that CEA group withdrawal is within the Transient Insertion Limits of Specification 3.1.3.6.
- c. When in MODE 2 with  $K_{eff}$  less than 1.0, within 4 hours prior to achieving reactor criticality by verifying that the predicted critical CEA position is within the limits of Specification 3.1.3.6.

\* See Special Test Exception 3.10.1.

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## REACTIVITY CONTROL SYSTEMS

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

### LIMITING CONDITION FOR OPERATION

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3.1.1.2 The SHUTDOWN MARGIN shall be greater than or equal to 3.0% delta k/k.

APPLICABILITY: MODE 5.

ACTION:

With the SHUTDOWN MARGIN less than 3.0% delta k/k, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 1720 ppm boron or equivalent until the required SHUTDOWN MARGIN is restored.

### SURVEILLANCE REQUIREMENTS

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4.1.1.2 The SHUTDOWN MARGIN shall be determined to be greater than or equal to 3.0% 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. 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.
  7. Whenever the reactor coolant level is below the hot leg centerline, one and only one charging pump shall be operable; by verifying that power is removed from the remaining charging pumps.

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## REACTIVITY CONTROL SYSTEMS

### BORATED WATER SOURCE - SHUTDOWN

#### LIMITING CONDITION FOR OPERATION

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

- a. One boric acid makeup tank with a minimum boron concentration of 1720 ppm and a minimum borated water volume of 5150 gallons, or
- b. The refueling water storage tanks with:
  1. A minimum borated water volume of 5150 gallons above the ECCS suction connection,
  2. A minimum boron concentration of 1720 ppm, and
  3. A solution temperature between 40°F and 100°F.

APPLICABILITY: MODES 5 and 6.

#### ACTION:

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

#### SURVEILLANCE REQUIREMENTS

4.1.2.7 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, and
  2. Verifying the contained borated water volume of the tank.
- b. At least once per 24 hours by verifying the RWST temperature when it is the source of borated water when the outside air temperature is less than 40°F or greater than 100°F.

# REQUIRED STORED BORIC ACID VOLUME AS A FUNCTION OF CONCENTRATION

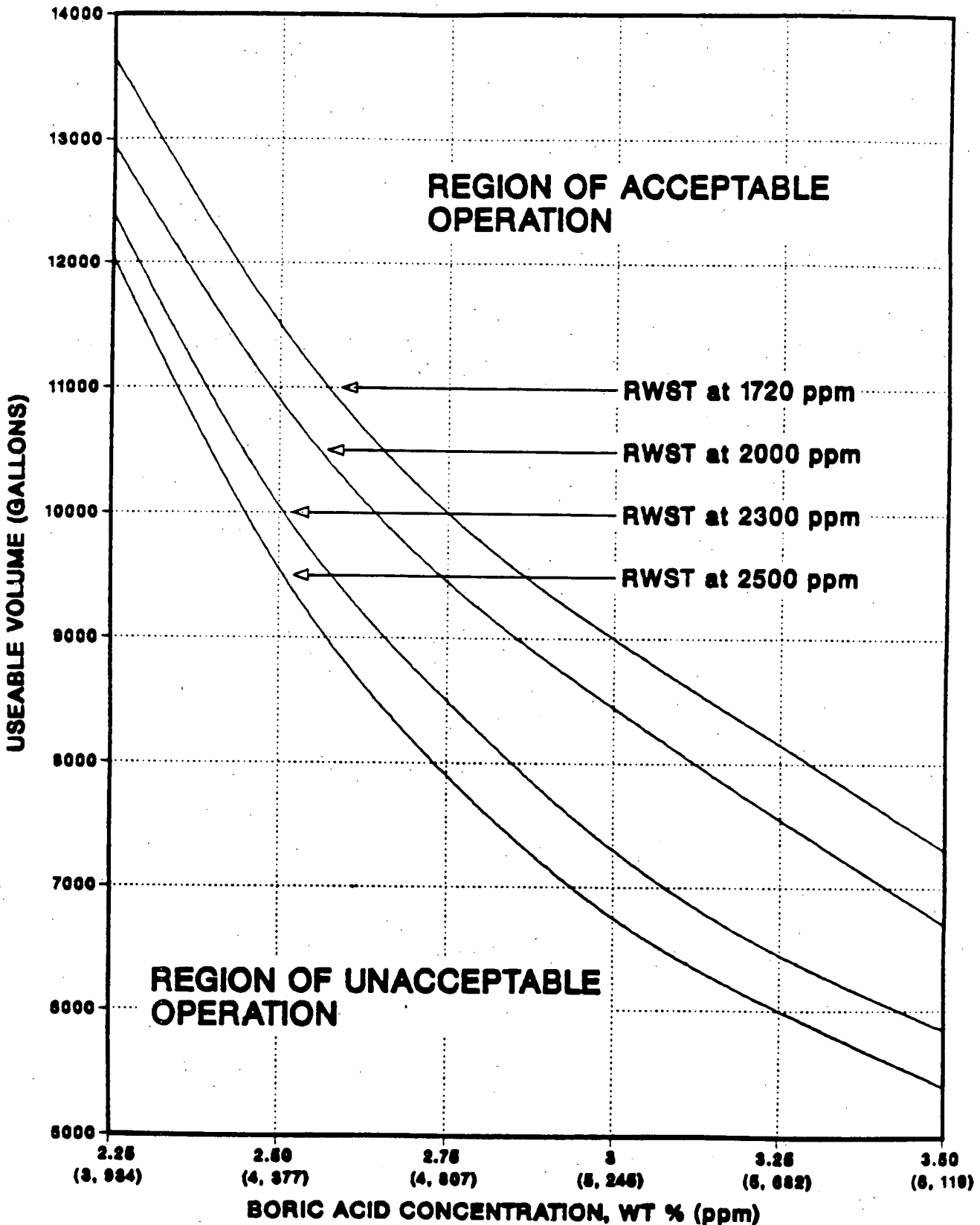


Figure 3.1-1

REACTIVITY CONTROL SYSTEMS

BORATED WATER SOURCES - OPERATING

LIMITING CONDITION FOR OPERATION

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3.1.2.8 The following borated water sources shall be OPERABLE:

- a. At least one of the following combinations:
  - 1) One boric acid makeup tank, with the tank contents in accordance with Figure 3.1-1, its associated gravity feed valve, and boric acid makeup pump,
  - 2) Two boric acid makeup tanks, with the combined contents of the tanks in accordance with Figure 3.1-1, their associated gravity feed valves, and boric acid makeup pumps,
  - 3) Two boric acid makeup tanks, each with contents in accordance with Figure 3.1-1, at least one gravity feed valve, and at least one boric acid makeup pump and,
- b. The refueling water storage tank with:
  - 1) A minimum contained borated water volume of 362,800 gallons above the ECCS suction connection,
  - 2) Between 1720 and 2500 ppm of boron, and
  - 3) A solution temperature between 40°F and 100°F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

- a. With the above required boric acid makeup tank(s) inoperable, restore the tank(s) 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 3.0% delta k/k at 200°F; restore the above required boric acid makeup tank(s) to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.
- b. With the refueling water tank inoperable, restore the tank to OPERABLE status within one hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

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4.1.2.8 Each borated water sources shall be demonstrated OPERABLE:

- a. At least once per 7 days by:
  1. Verifying the boron concentration in the water, and
  2. Verifying the contained borated water volume of the water source,
- b. At least once per 24 hours by verifying the RWST temperature when the outside air temperature is less than 40°F or greater than 100°F.

3/4 5 EMERGENCY CORE COOLING SYSTEMS

3/4 5.1 SAFETY INJECTION TANKS

LIMITING CONDITION FOR OPERATION

3.3.1 Each reactor coolant system safety injection tank shall be OPERABLE with:

- a. The isolation valve open and power to the valve removed,
- b. A contained borated water volume of between 1680 and 1807 cubic feet,
- c. Between 1720 and 2500ppm of boron, and
- d. A nitrogen cover-pressure of between 600 and 625 psig.

APPLICABILITY: MODES 1, 2 and 3."

ACTION:

- a. With one safety injection tank inoperable, except as a result of a closed isolation valve, restore the inoperable tank to OPERABLE status within one hour or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.
- b. With one safety injection tank inoperable due to the isolation valve being closed, either immediately open the isolation valve or be in at least HOT STANDBY within one hour and be in HOT SHUTDOWN within the next 12 hours.

SURVEILLANCE REQUIREMENTS

4.3.1 Each safety injection tank shall be demonstrated OPERABLE:

- a. At least once per 12 hours by:
  1. Verifying that the contained borated water volume and nitrogen cover-pressure in the tanks is within the above limits, and
  2. Verifying that each safety injection tank isolation valve is open.

With pressurizer pressure greater than or equal to 723 psia.

EMERGENCY CORE COOLING SYSTEMS

3/4 5.4 REFUELING WATER STORAGE TANK

LIMITING CONDITION FOR OPERATION

3.5.4 The refueling water storage tank shall be OPERABLE with:

- a. A minimum borated water volume of 362,800 gallons above the ECCS suction connection,
- b. Between 1720 and 2500 ppm of boron, and
- c. A solution temperature between 40°F and 100°F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With the refueling water storage tank inoperable, restore the tank to OPERABLE status within 1 hour or be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.5.4 The RWST shall be demonstrated OPERABLE:

- a. At least once per 7 days by:
  1. Verifying the contained borated water volume in the tank, and
  2. Verifying the boron concentration of the water.
- b. At least once per 24 hours by verifying the RWST temperature when the outside air temperature is less than 40°F or greater than 100°F.



## CONTAINMENT SYSTEMS

### RECIRCULATION FLOW PH CONTROL

#### LIMITING CONDITION FOR OPERATION

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- 3.6.2.2 The recirculation flow pH control system shall be operable with a minimum of 15,400 lbs. (256 cu. ft.) of trisodium phosphate (w/12 hydrates), or equivalent, available in the storage racks in the containment.

APPLICABILITY: Modes 1, 2 and 3

ACTION:

With less than the required amount of trisodium phosphate available, restore the system to the correct amount within 72 hours or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.

#### SURVEILLANCE REQUIREMENTS

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- 4.6.2.2 The recirculation flow pH control system shall be demonstrated operable during each refueling outage by:
- a. Visually verifying that the TSP storage racks have maintained their integrity and the TSP containers contain a minimum of 15,400 lbs. (256 cu. ft.) of TSP (w/12 hydrates) or equivalent.
  - b. Verifying that when a sample of less than 3.00 grams of trisodium phosphate (w/12 hydrates) or equivalent, selected at random from one of the storage racks inside of containment, is submerged, without agitation, in at least 1 litre of  $120 \pm 10$  degrees-F borated demineralized water borated to at least 2482 ppm boron, allowed to stand for 4 hours, then decanted and mixed, the pH of the solution is greater than or equal to 7.0.

### 3/4.9 REFUELING OPERATIONS

#### 3/4.9.1 BORON CONCENTRATION

##### LIMITING CONDITION FOR OPERATION

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3.9.1 With the reactor vessel head closure bolts less than fully tensioned or with the head removed, 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 following reactivity conditions is met:

- a. Either a  $K_{eff}$  of 0.95 or less,
- b. A boron concentration of greater than or equal to 1720 ppm,

APPLICABILITY: MODE 6\*.

##### ACTION:

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 40 gpm of a solution containing greater than or equal to 1720 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 1720 ppm, whichever is the more restrictive.

##### SURVEILLANCE REQUIREMENTS

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4.9.1.1 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 CEA in excess of 3 feet from its fully inserted position within the reactor pressure vessel.

4.9.1.2 The boron concentration of the reactor coolant system and the refueling canal shall be determined by chemical analysis at least once per 72 hours.

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

### 3/4.10 SPECIAL TEST EXCEPTIONS

#### 3/4.10.1 SHUTDOWN MARGIN

##### LIMITING CONDITION FOR OPERATION

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3.10.1 The SHUTDOWN MARGIN requirement of Specification 3.1.1.1 may be suspended for measurement of CEA worth and shutdown margin provided reactivity equivalent to at least the highest estimated CEA worth is available for trip insertion from OPERABLE CEA(s).

APPLICABILITY: MODES 2 and 3\*

ACTION:

- a. With any full length CEA not fully inserted and with less than the above reactivity equivalent available for trip insertion, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 1720 ppm boron or its equivalent until the SHUTDOWN MARGIN required by Specification 3.1.1.1 is restored.
- b. With all full length CEAs fully inserted and the reactor subcritical by less than the above reactivity equivalent, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 1720 ppm boron or its equivalent until the SHUTDOWN MARGIN required by Specification 3.1.1.1 is restored.

##### SURVEILLANCE REQUIREMENTS

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4.10.1.1 The position of each full length and part length CEA required either partially or fully withdrawn shall be determined at least once per 2 hours.

4.10.1.2 Each CEA not fully inserted shall be demonstrated capable of full insertion when tripped from at least the 50% withdrawn position within 7 days prior to reducing the SHUTDOWN MARGIN to less than the limits of Specification 3.1.1.1.

\*Operation in MODE 3 shall be limited to 6 consecutive hours.

## REACTIVITY CONTROL SYSTEMS

### BASES

#### 3/4.1.1.6 MINIMUM TEMPERATURE FOR CRITICALITY

This specification ensures that the reactor will not be made critical with the Reactor Coolant System average temperature less than 520°F. This limitation is required to ensure 1) the moderator temperature coefficient is within its analyzed temperature range, 2) the protective 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 pressure vessel is above its minimum  $RT_{NDT}$  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 pumps, 3) separate flow paths, 4) boric acid makeup pumps, and 5) an emergency power supply from OPERABLE diesel generators.

With the RCS average temperature above 200°F, a minimum of two separate and redundant boron injection systems are provided to ensure single functional capability in the event an assumed failure renders one of the systems inoperable. Allowable out-of-service periods ensure that minor component repair or corrective action may be completed without undue risk to overall facility safety from injection system failures during the repair period.

The boration capability of either system is sufficient to provide a SHUTDOWN MARGIN from expected operating conditions of 3.0% delta k/k after xenon decay and cooldown to 200°F. The maximum expected boration capability requirement occurs at EOL from full power equilibrium xenon conditions and requires boric acid solution from the boric acid makeup tanks in the allowable concentrations and volumes of Specification 3.1.2.8 plus approximately 13,000 gallons of 1720 ppm borated water from the refueling water tank or approximately 45,000 gallons of 1720 ppm borated water from the refueling water tank alone. However, for the purpose of consistency the minimum required volume of 362,800 gallons above ECCS suction connection in Specification 3.1.2.8 is identical to more restrictive value of Specification 3.5.4.

With the RCS temperature below 200°F one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single injection system becomes inoperable.

The boron capability required below 200°F is based upon providing a 3% delta k/k SHUTDOWN MARGIN after xenon decay and cooldown from 200°F to 140°F. This condition requires 5150 gallons of 1720 ppm borated water from either the refueling water tank or boric acid solution from a boric acid makeup tank.

## REACTIVITY CONTROL SYSTEMS

### BASES

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#### BORATION SYSTEMS (Continued)

The water volume limits are specified relative to the top of the highest suction connection to the tank. (Water volume below this datum is not considered recoverable for purposes of this specification.) Vortexing, internal structures and instrument error are considered in determining the tank level corresponding to the specified water volume limits.

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

The limits on water volume and boron concentration of the RWST also ensure a pH value of between 8.0 and 10.0 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 maximum RWST volume is not specified since analysis of pH limits and containment flooding post-LOCA considered RWST overflow conditions.

#### 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 CEA misalignments are limited to acceptable levels.

The ACTION statements which permit limited variations from the basic requirements are accompanied by additional restrictions which ensure that the original design criteria are met.

The ACTION statements applicable to a stuck or untrippable, CEA to two or more inoperable CEAs and to a large misalignment (greater than or equal to 19 inches) of two or more CEAs, require a prompt shutdown of the reactor since either of these conditions may be indicative of a possible loss of mechanical functional capability of the CEAs and in the event of a stuck or untrippable CEA, the loss of SHUTDOWN MARGIN.

For small misalignments (less than 19 inches) of the CEAs, there is 1) a small effect on the time dependent long term power distributions relative to those used in generating LCOs and LSSS setpoints, 2) a small effect on the available SHUTDOWN MARGIN, and 3) a small effect on the ejected CEA worth used in the safety analysis. Therefore, the ACTION statement associated with small misalignments of CEAs permits a one hour time interval during which attempts may be made to restore the CEA to within its alignment requirements. The one hour time limit is sufficient to (1) identify causes of a misaligned CEA, (2) take appropriate corrective action to realign the CEAs and (3) minimize the effects of xenon redistribution.

## EMERGENCY CORE COOLING SYSTEMS

### BASES

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#### ECCS SUBSYSTEMS (Continued)

With the RCS temperature below 350°F, one OPERABLE ECCS subsystem is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the limited core cooling requirements.

The NaOH added to the Containment Spray, via the Spray Chemical Addition pumps, minimizes the possibility of corrosion cracking of certain metal components during operation of the ECCS following a LOCA. The NaOH additive results in post-LOCA sump pH of between 8.0 and 10.0 at the end of the NaOH injection period.

The Surveillance Requirements provided to ensure OPERABILITY of each component ensure that at a minimum, the assumptions used in the accident analyses are met and that subsystem OPERABILITY is maintained. Surveillance requirements for flow balance testing provide assurance that proper ECCS flows will be maintained in the event of a LOCA. Maintenance of proper flow resistance and pressure drop in the piping system to each injection point is necessary to: (1) prevent total pump flow from exceeding runout conditions when the system is in its minimum resistance configuration, (2) provide the proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analyses, and (3) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analyses.

#### 3/4.5.4 REFUELING WATER STORAGE TANK (RWST)

The OPERABILITY of the RWST as part of the ECCS ensures that a sufficient supply of borated water is available for injection by the ECCS in the event of a LOCA. The limits on RWST minimum volume and boron concentration ensure that 1) sufficient water is available within containment to permit recirculation cooling flow to the core, and 2) the reactor will remain subcritical in the cold condition following mixing of the RWST and the RCS water volumes with all control rods inserted except for the most reactive control assembly. The limit on maximum boron concentration is to ensure that boron does not precipitate in the core following LOCA. The limit on RWST solution temperature is to ensure that the assumptions used in the LOCA analyses remain valid.

## EMERGENCY CORE COOLING SYSTEMS

### BASES

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#### REFUELING WATER STORAGE TANK (Continued)

The water volume limits are specified relative to the top of the highest suction connection to the tank. (Water volume below this datum is not considered recoverable for purposes of this specification). The specified volume limits consist of the minimum volume required for ECCS injection above the Recirculation Actuation Signal (RAS) setpoint, plus the minimum volume required for the transition to ECCS recirculation below the RAS setpoint, plus the volume corresponding to the range of the RAS setpoint, including RAS instrument error high and low. Vortexing, internal structure, and instrument error are considered in determining the tank level corresponding to the specified water volume limits.

The limits on water volume and boron concentration of the RWST also ensure that the solution recirculated within containment after a LOCA has a pH value between 8.0 and 10.0 at the end of the NaOH injection period. This pH band minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components. The maximum RWST volume is not specified since analysis of pH limits and containment flooding post-LOCA considered RWST overflow conditions.

## 3/4.9 REFUELING OPERATIONS

### BASES

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#### 3/4.9.1 BORON CONCENTRATION

The limitations on reactivity conditions during REFUELING ensure that: 1) the reactor will remain subcritical during CORE ALTERATIONS, and 2) a uniform boron concentration is maintained for reactivity control in the water volume having direct access to the reactor vessel. These limitations are consistent with the initial conditions assumed for the boron dilution incident in the accident analyses. The value of 0.95 or less for  $K_{eff}$  includes a 1% delta K/K conservative allowance for uncertainties. Similarly, the boron concentration value of 1720 ppm or greater also includes a conservative uncertainty allowance of 50 ppm boron.

#### 3/4.9.2 INSTRUMENTATION

The OPERABILITY of the source range neutron flux monitors ensures that redundant monitoring capability is available to detect changes in the reactivity condition of the core.

#### 3/4.9.3 DECAY TIME

The minimum requirement for reactor subcriticality prior to movement of irradiated fuel assemblies in the reactor pressure vessel ensures that sufficient time has elapsed to allow the radioactive decay of the short lived fission products. This decay time is consistent with the assumptions used in the accident analyses.

#### 3/4.9.4 CONTAINMENT PENETRATIONS

The requirements on containment penetration closure and OPERABILITY ensure that a release of radioactive material within containment will be restricted from leakage to the environment. The OPERABILITY and closure restrictions are sufficient to restrict radioactive material release from a fuel element rupture based upon the lack of containment pressurization potential while in the REFUELING MODE.

#### 3/4.9.5 COMMUNICATIONS

The requirement for communications capability ensures that refueling station personnel can be promptly informed of significant changes in the facility status or core reactivity condition during CORE ALTERATIONS.



ATTACHMENT "B"

### 3/4.1 REACTIVITY CONTROL SYSTEMS

#### 3/4.1.1 BORATION CONTROL

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

#### LIMITING CONDITION FOR OPERATION

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3.1.1.1 The SHUTDOWN MARGIN shall be greater than or equal to 5.15% delta k/k.

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

ACTION:

With the SHUTDOWN MARGIN less than 5.15% delta k/k, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 2350 ppm boron or equivalent until the required SHUTDOWN MARGIN is restored.

#### SURVEILLANCE REQUIREMENTS

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4.1.1.1.1 The SHUTDOWN MARGIN shall be determined to be greater than or equal to 5.15% 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 verified acceptable with an increased allowance for the withdrawn worth of the immovable or untrippable CEA(s).
- b. When in MODE 1 or MODE 2 with  $K_{eff}$  greater than or equal to 1.0, at least once per 12 hours by verifying that CEA group withdrawal is within the Transient Insertion Limits of Specification 3.1.3.6.
- c. When in MODE 2 with  $K_{eff}$  less than 1.0, within 4 hours prior to achieving reactor criticality by verifying that the predicted critical CEA position is within the limits of Specification 3.1.3.6.

\* See Special Test Exception 3.10.1.

## REACTIVITY CONTROL SYSTEMS

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

### LIMITING CONDITION FOR OPERATION

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3.1.1.2 The SHUTDOWN MARGIN shall be greater than or equal to 3.0% delta k/k.

APPLICABILITY: MODE 5.

#### ACTION:

With the SHUTDOWN MARGIN less than 3.0% delta k/k, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 2350 ppm boron or equivalent until the required SHUTDOWN MARGIN is restored.

### SURVEILLANCE REQUIREMENTS

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4.1.1.2 The SHUTDOWN MARGIN shall be determined to be greater than or equal to 3.0% 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. 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.
  7. Whenever the reactor coolant level is below the hot leg centerline, one and only one charging pump shall be operable; by verifying that power is removed from the remaining charging pumps.

## REACTIVITY CONTROL SYSTEMS

### BORATED WATER SOURCE - SHUTDOWN

#### LIMITING CONDITION FOR OPERATION

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

- a. One boric acid makeup tank with a minimum boron concentration of 2350 ppm and a minimum borated water volume of 4150 gallons, or
- b. The refueling water storage tanks with:
  1. A minimum borated water volume of 4150 gallons above the ECCS suction connection,
  2. A minimum boron concentration of 2350 ppm, and
  3. A solution temperature between 40°F and 100°F.

APPLICABILITY: MODES 5 and 6.

#### ACTION:

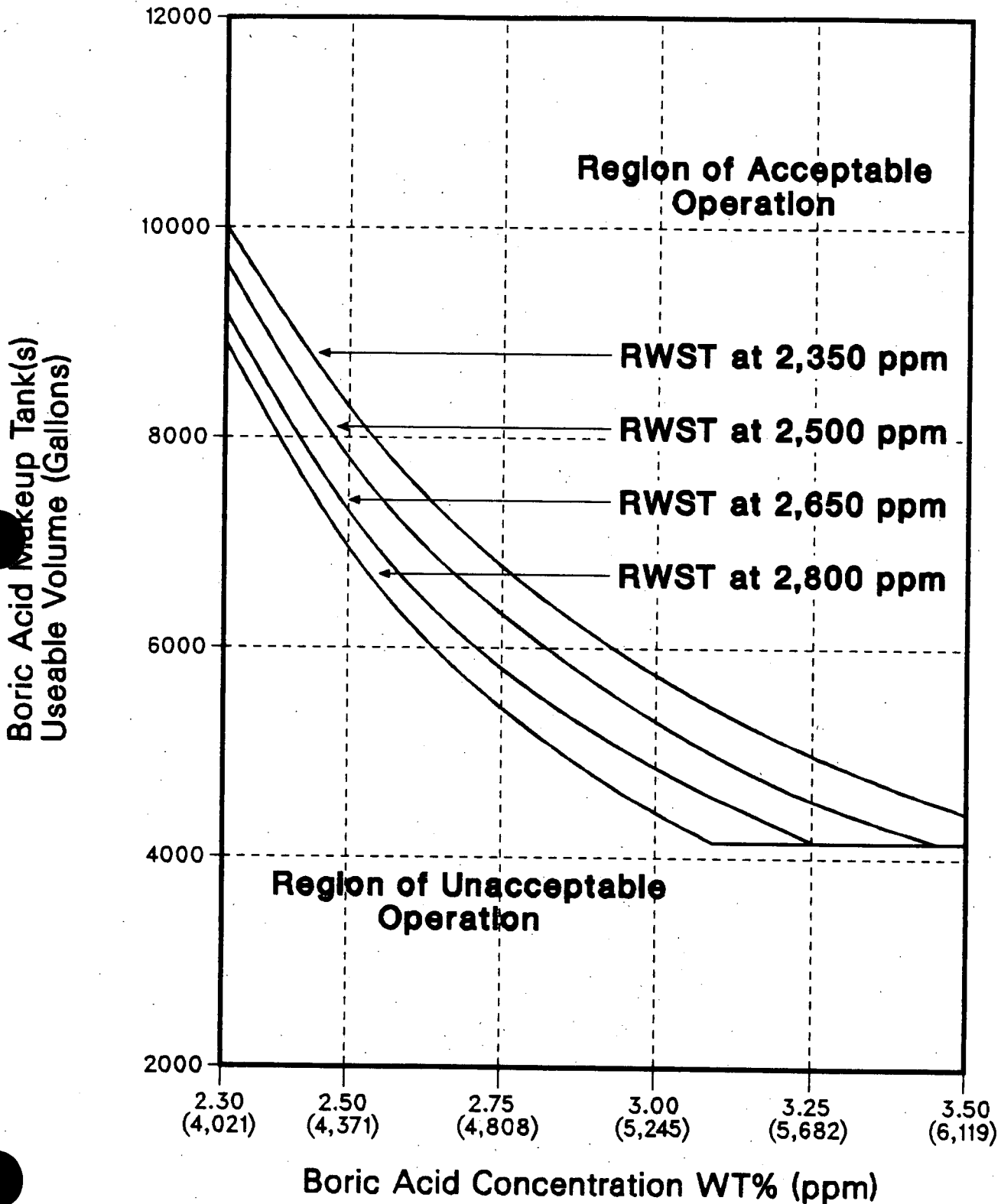
With no borated water sources OPERABLE, suspend all operations involving CORE ALTERATIONS or positive reactivity changes.

#### SURVEILLANCE REQUIREMENTS

4.1.2.7 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, and
  2. Verifying the contained borated water volume of the tank.
- b. At least once per 24 hours by verifying the RWST temperature when it is the source of borated water when the outside air temperature is less than 40°F or greater than 100°F.

**Figure 3.1-1**  
**MINIMUM STORED BORIC ACID VOLUME**  
**AS A FUNCTION OF CONCENTRATION**  
**(Gallons)**



## REACTIVITY CONTROL SYSTEMS

### BORATED WATER SOURCES - OPERATING

#### LIMITING CONDITION FOR OPERATION

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3.1.2.8 The following borated water sources shall be OPERABLE:

a. At least one of the following combinations:

- 1) One boric acid makeup tank, with the tank contents in accordance with Figure 3.1-1, its associated gravity feed valve, and boric acid makeup pump,
- 2) Two boric acid makeup tanks, with the combined contents of the tanks in accordance with Figure 3.1-1, their associated gravity feed valves, and boric acid makeup pumps,
- 3) Two boric acid makeup tanks, each with contents in accordance with Figure 3.1-1, at least one gravity feed valve, and at least one boric acid makeup pump and,

b. The refueling water storage tank with:

- 1) A minimum contained borated water volume of 362,800 gallons above the ECCS suction connection,
- 2) Between 2350 and 2800 ppm of boron, and
- 3) A solution temperature between 40<sup>o</sup>F and 100<sup>o</sup>F.

APPLICABILITY: MODES 1, 2, 3 and 4.

#### ACTION:

- a. With the above required boric acid makeup tank(s) inoperable, restore the tank(s) 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 3.0% delta k/k at 200<sup>o</sup>F; restore the above required boric acid makeup tank(s) to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.
- b. With the refueling water tank inoperable, restore the tank to OPERABLE status within one hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

#### SURVEILLANCE REQUIREMENTS

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4.1.2.8 Each borated water sources shall be demonstrated OPERABLE:

a. At least once per 7 days by:

1. Verifying the boron concentration in the water, and
2. Verifying the contained borated water volume of the water source,

b. At least once per 24 hours by verifying the RWST temperature when the outside air temperature is less than 40<sup>o</sup>F or greater than 100<sup>o</sup>F.

3/4 5 EMERGENCY CORE COOLING SYSTEMS

3/4 5.1 SAFETY INJECTION TANKS

LIMITING CONDITION FOR OPERATION

3.3.1 Each reactor coolant system safety injection tank shall be OPERABLE with:

- a. The isolation valve open and power to the valve removed,
- b. A contained borated water volume of between 1580 and 1807 cubic feet,
- c. Between 1850 and 2800 ppm of boron, and
- d. A nitrogen cover-pressure of between 600 and 625 psig.

APPLICABILITY: MODES 1, 2 and 3.\*

ACTION:

- a. With one safety injection tank inoperable, except as a result of a closed isolation valve, restore the inoperable tank to OPERABLE status within one hour or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.
- b. With one safety injection tank inoperable due to the isolation valve being closed, either immediately open the isolation valve or be in at least HOT STANDBY within one hour and be in HOT SHUTDOWN within the next 12 hours.

SURVEILLANCE REQUIREMENTS

4.3.1 Each safety injection tank shall be demonstrated OPERABLE:

- a. At least once per 12 hours by:
  1. Verifying that the contained borated water volume and nitrogen cover-pressure in the tanks is within the above limits, and
  2. Verifying that each safety injection tank isolation valve is open.

\* High pressure cover pressure greater than or equal to 725 psia.

EMERGENCY CORE COOLING SYSTEMS

3/4 5.4 REFUELING WATER STORAGE TANK

LIMITING CONDITION FOR OPERATION

---

3.5.4 The refueling water storage tank shall be OPERABLE with:

- a. A minimum berated water volume of 362,800 gallons above the ECCS suction connection,
- b. Between 2350 and 2800 ppm of boron, and
- c. A solution temperature between 40°F and 100°F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With the refueling water storage tank inoperable, restore the tank to OPERABLE status within 1 hour or be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

---

4.5.4 The RWST shall be demonstrated OPERABLE:

- a. At least once per 7 days by:
  1. Verifying the contained berated water volume in the tank, and
  2. Verifying the boron concentration of the water.
- b. At least once per 24 hours by verifying the RWST temperature when the outside air temperature is less than 40°F or greater than 100°F.



## CONTAINMENT SYSTEMS

### RECIRCULATION FLOW PH CONTROL

#### LIMITING CONDITION FOR OPERATION

---

3.6.2.2 The recirculation flow pH control system shall be operable with a minimum of 17,461 lbs. (291 cu. ft.) of trisodium phosphate (w/12 hydrates), or equivalent, available in the storage racks in the containment.

APPLICABILITY: Modes 1, 2 and 3

ACTION:

With less than the required amount of trisodium phosphate available, restore the system to the correct amount within 72 hours or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.

#### SURVEILLANCE REQUIREMENTS

---

- 4.6.2.2 The recirculation flow pH control system shall be demonstrated operable during each refueling outage by:
- a. Visually verifying that the TSP storage racks have maintained their integrity and the TSP containers contain a minimum of 17,461 lbs. (291 cu. ft.) of TSP (w/12 hydrates) or equivalent.
  - b. Verifying that when a sample of less than 3.43 grams of trisodium phosphate (w/12 hydrates) or equivalent, selected at random from one of the storage racks inside of containment, is submerged, without agitation, in at least 1 litre of  $120 \pm 10$  degrees-F borated demineralized water borated to at least 2812 ppm boron, allowed to stand for 4 hours, then decanted and mixed, the pH of the solution is greater than or equal to 7.0.

### 3/4.9 REFUELING OPERATIONS

#### 3/4.9.1 BORON CONCENTRATION

##### LIMITING CONDITION FOR OPERATION

---

3.9.1 With the reactor vessel head closure bolts less than fully tensioned or with the head removed, 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 following reactivity conditions is met:

- a. Either a  $K_{eff}$  of 0.95 or less,
- b. A boron concentration of greater than or equal to 2350 ppm,

APPLICABILITY: MODE 6\*.

##### ACTION:

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 40 gpm of a solution containing greater than or equal to 2350 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 2350 ppm, whichever is the more restrictive.

##### SURVEILLANCE REQUIREMENTS

---

4.9.1.1 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 CEA in excess of 3 feet from its fully inserted position within the reactor pressure vessel.

4.9.1.2 The boron concentration of the reactor coolant system and the refueling canal shall be determined by chemical analysis at least once per 72 hours.

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

### 3/4.10 SPECIAL TEST EXCEPTIONS

#### 3/4.10.1 SHUTDOWN MARGIN

##### LIMITING CONDITION FOR OPERATION

---

3.10.1 The SHUTDOWN MARGIN requirement of Specification 3.1.1.1 may be suspended for measurement of CEA worth and shutdown margin provided reactivity equivalent to at least the highest estimated CEA worth is available for trip insertion from OPERABLE CEA(s).

APPLICABILITY: MODES 2 and 3\*

##### ACTION:

- a. With any full length CEA not fully inserted and with less than the above reactivity equivalent available for trip insertion, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 2350 ppm boron or its equivalent until the SHUTDOWN MARGIN required by Specification 3.1.1.1 is restored.
- b. With all full length CEAs fully inserted and the reactor subcritical by less than the above reactivity equivalent, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 2350 ppm boron or its equivalent until the SHUTDOWN MARGIN required by Specification 3.1.1.1 is restored.

##### SURVEILLANCE REQUIREMENTS

---

4.10.1.1 The position of each full length and part length CEA required either partially or fully withdrawn shall be determined at least once per 2 hours.

4.10.1.2 Each CEA not fully inserted shall be demonstrated capable of full insertion when tripped from at least the 50% withdrawn position within 7 days prior to reducing the SHUTDOWN MARGIN to less than the limits of Specification 3.1.1.1.

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\*Operation in MODE 3 shall be limited to 6 consecutive hours.

## REACTIVITY CONTROL SYSTEMS

### BASES

#### 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 520°F. This limitation is required to ensure 1) the moderator temperature coefficient is within its analyzed temperature range, 2) the protective 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 pressure vessel is above its minimum RT<sub>NOT</sub> 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 pumps, 3) separate flow paths, 4) boric acid makeup pumps, and 5) an emergency power supply from OPERABLE diesel generators.

With the RCS average temperature above 200°F, a minimum of two separate and redundant boron injection systems are provided to ensure single functional capability in the event an assumed failure renders one of the systems inoperable. Allowable out-of-service periods ensure that minor component repair or corrective action may be completed without undue risk to overall facility safety from injection system failures during the repair period.

The boration capability of either system is sufficient to provide a SHUTDOWN MARGIN from expected operating conditions of 3.0% delta k/k after xenon decay and cooldown to 200°F. The maximum expected boration capability requirement occurs at EOL from full power equilibrium xenon conditions and requires boric acid solution from the boric acid makeup tanks in the allowable concentrations and volumes of Specification 3.1.2.8 plus approximately 13,000 gallons of 2350 ppm borated water from the refueling water tank or approximately 26,000 gallons of 2350 ppm borated water from the refueling water tank alone. However, for the purpose of consistency the minimum required volume of 362,800 gallons above ECCS suction connection in Specification 3.1.2.8 is identical to more restrictive value of Specification 3.5.4.

With the RCS temperature below 200°F one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single injection system becomes inoperable.

The boron capability required below 200°F is based upon providing a 3% delta k/k SHUTDOWN MARGIN after xenon decay and cooldown from 200°F to 140°F. This condition requires 4150 gallons of 2350 ppm borated water from either the refueling water tank or boric acid solution from a boric acid makeup tank.

## REACTIVITY CONTROL SYSTEMS

### BASES

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#### BORATION SYSTEMS (Continued)

The water volume limits are specified relative to the top of the highest suction connection to the tank. (Water volume below this datum is not considered recoverable for purposes of this specification.) Vortexing, internal structures and instrument error are considered in determining the tank level corresponding to the specified water volume limits.

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

The limits on water volume and boron concentration of the RWST also ensure a pH value of greater than 7.0 for the solution recirculated within containment after a LOCA. This pH minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components. The maximum RWST volume is not specified since analysis of pH limits and containment flooding post-LOCA considered RWST overflow conditions.

#### 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 CEA misalignments are limited to acceptable levels.

The ACTION statements which permit limited variations from the basic requirements are accompanied by additional restrictions which ensure that the original design criteria are met.

The ACTION statements applicable to a stuck or untrippable, CEA to two or more inoperable CEAs and to a large misalignment (greater than or equal to 19 inches) of two or more CEAs, require a prompt shutdown of the reactor since either of these conditions may be indicative of a possible loss of mechanical functional capability of the CEAs and in the event of a stuck or untrippable CEA, the loss of SHUTDOWN MARGIN.

For small misalignments (less than 19 inches) of the CEAs, there is 1) a small effect on the time dependent long term power distributions relative to those used in generating LCOs and LSSS setpoints, 2) a small effect on the available SHUTDOWN MARGIN, and 3) a small effect on the ejected CEA worth used in the safety analysis. Therefore, the ACTION statement associated with small misalignments of CEAs permits a one hour time interval during which attempts may be made to restore the CEA to within its alignment requirements. The one hour time limit is sufficient to (1) identify causes of a misaligned CEA, (2) take appropriate corrective action to realign the CEAs and (3) minimize the effects of xenon redistribution.

## EMERGENCY CORE COOLING SYSTEMS

### BASES

#### ECCS SUBSYSTEMS (Continued)

With the RCS temperature below 350°F, one OPERABLE ECCS subsystem is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the limited core cooling requirements.

The Surveillance Requirements provided to ensure OPERABILITY of each component ensure that at a minimum, the assumptions used in the accident analyses are met and that subsystem OPERABILITY is maintained. Surveillance requirements for flow balance testing provide assurance that proper ECCS flows will be maintained in the event of a LOCA. Maintenance of proper flow resistance and pressure drop in the piping system to each injection point is necessary to: (1) prevent total pump flow from exceeding runout conditions when the system is in its minimum resistance configuration, (2) provide the proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analyses, and (3) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analyses.

#### 3/4.5.4 REFUELING WATER STORAGE TANK (RWST)

The OPERABILITY of the RWST as part of the ECCS ensures that a sufficient supply of borated water is available for injection by the ECCS in the event of a LOCA. The limits on RWST minimum volume and boron concentration ensure that 1) sufficient water is available within containment to permit recirculation cooling flow to the core, and 2) the reactor will remain subcritical in the cold condition following mixing of the RWST and the RCS water volumes with all control rods inserted except for the most reactive control assembly. The limit on maximum boron concentration is to ensure that boron does not precipitate in the core following LOCA. The limit on RWST solution temperature is to ensure that the assumptions used in the LOCA analyses remain valid.

## EMERGENCY CORE COOLING SYSTEMS

### BASES

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#### REFUELING WATER STORAGE TANK (Continued)

The water volume limits are specified relative to the top of the highest suction connection to the tank. (Water volume below this datum is not considered recoverable for purposes of this specification). The specified volume limits consist of the minimum volume required for ECCS injection above the Recirculation Actuation Signal (RAS) setpoint, plus the minimum volume required for the transition to ECCS recirculation below the RAS setpoint, plus the volume corresponding to the range of the RAS setpoint, including RAS instrument error high and low. Vortexing, internal structure, and instrument error are considered in determining the tank level corresponding to the specified water volume limits.

The limits on water volume and boron concentration of the RWST also ensure that the solution recirculated within containment after a LOCA has a pH value of greater than 7.0. This pH minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components. The maximum RWST volume is not specified since analysis of pH limits and containment flooding post-LOCA considered RWST overflow conditions.

## 3/4.9 REFUELING OPERATIONS

### BASES

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#### 3/4.9.1 BORON CONCENTRATION

The limitations on reactivity conditions during REFUELING ensure that: 1) the reactor will remain subcritical during CORE ALTERATIONS, and 2) a uniform boron concentration is maintained for reactivity control in the water volume having direct access to the reactor vessel. These limitations are consistent with the initial conditions assumed for the boron dilution incident in the accident analyses. The value of 0.95 or less for  $K_{eff}$  includes a 1% delta K/K conservative allowance for uncertainties. Similarly, the boron concentration value of 2350 ppm or greater also includes a conservative uncertainty allowance of 50 ppm boron.

#### 3/4.9.2 INSTRUMENTATION

The OPERABILITY of the source range neutron flux monitors ensures that redundant monitoring capability is available to detect changes in the reactivity condition of the core.

#### 3/4.9.3 DECAY TIME

The minimum requirement for reactor subcriticality prior to movement of irradiated fuel assemblies in the reactor pressure vessel ensures that sufficient time has elapsed to allow the radioactive decay of the short lived fission products. This decay time is consistent with the assumptions used in the accident analyses.

#### 3/4.9.4 CONTAINMENT PENETRATIONS

The requirements on containment penetration closure and OPERABILITY ensure that a release of radioactive material within containment will be restricted from leakage to the environment. The OPERABILITY and closure restrictions are sufficient to restrict radioactive material release from a fuel element rupture based upon the lack of containment pressurization potential while in the REFUELING MODE.

#### 3/4.9.5 COMMUNICATIONS

The requirement for communications capability ensures that refueling station personnel can be promptly informed of significant changes in the facility status or core reactivity condition during CORE ALTERATIONS.



ATTACHMENT "C"

### 3/4.1 REACTIVITY CONTROL SYSTEMS

#### 3/4.1.1 BORATION CONTROL

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 5.15% delta k/k.

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

ACTION:

With the SHUTDOWN MARGIN less than 5.15% delta k/k, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 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 greater than or equal to 5.15% 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 verified acceptable with an increased allowance for the withdrawn worth of the immovable or untrippable CEA(s).
- b. When in MODE 1 or MODE 2 with  $K_{eff}$  greater than or equal to 1.0, at least once per 12 hours by verifying that CEA group withdrawal is within the Transient Insertion Limits of Specification 3.1.3.6.
- c. When in MODE 2 with  $K_{eff}$  less than 1.0, within 4 hours prior to achieving reactor criticality by verifying that the predicted critical CEA position is within the limits of Specification 3.1.3.6.

\* See Special Test Exception 3.10.1.

## REACTIVITY CONTROL SYSTEMS

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 3.0% delta k/k.

APPLICABILITY: MODE 5.

ACTION:

With the SHUTDOWN MARGIN less than 3.0% delta k/k, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 1720 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 3.0% 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. 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.
  7. Whenever the reactor coolant level is below the hot leg centerline, one and only one charging pump shall be operable; by verifying that power is removed from the remaining charging pumps.

## REACTIVITY CONTROL SYSTEMS

### BORATED WATER SOURCE - SHUTDOWN

#### LIMITING CONDITION FOR OPERATION

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

- a. One boric acid makeup tank with a minimum boron concentration of 1720 ppm and a minimum borated water volume of 5150 gallons, or
- b. The refueling water storage tanks with:
  1. A minimum borated water volume of 5150 gallons above the ECCS suction connection,
  2. A minimum boron concentration of 1720 ppm, and
  3. A solution temperature between 40°F and 100°F.

APPLICABILITY: MODES 5 and 6.

#### ACTION:

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

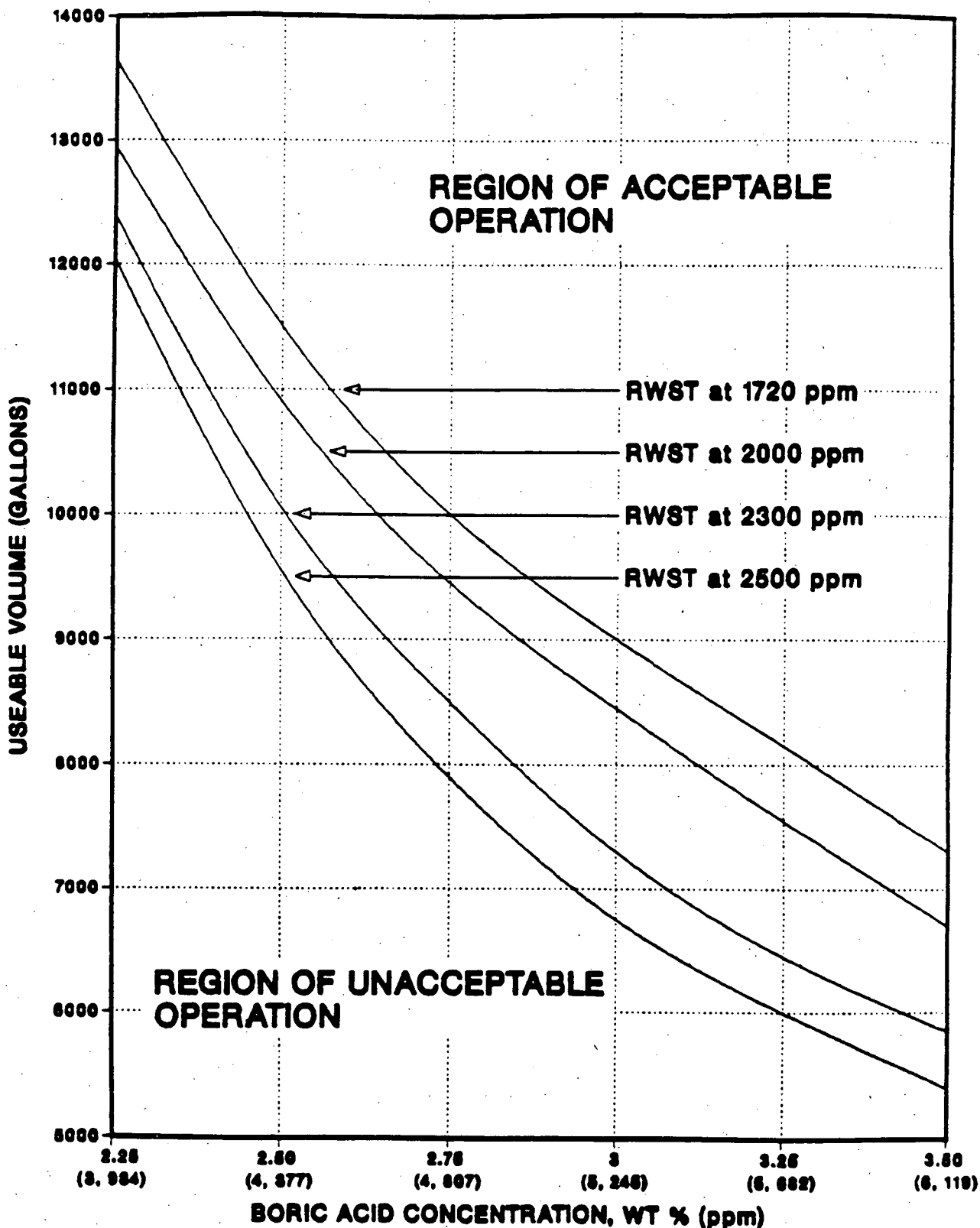
#### SURVEILLANCE REQUIREMENTS

4.1.2.7 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, and
  2. Verifying the contained borated water volume of the tank.
- b. At least once per 24 hours by verifying the RWST temperature when it is the source of borated water when the outside air temperature is less than 40°F or greater than 100°F.

Figure 3.1-1

# REQUIRED STORED BORIC ACID VOLUME AS A FUNCTION OF CONCENTRATION



REACTIVITY CONTROL SYSTEMS

BORATED WATER SOURCES - OPERATING

LIMITING CONDITION FOR OPERATION

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3.1.2.8 The following borated water sources shall be OPERABLE:

a. At least one of the following combinations:

- 1) One boric acid makeup tank, with the tank contents in accordance with Figure 3.1-1, its associated gravity feed valve, and boric acid makeup pump,
- 2) Two boric acid makeup tanks, with the combined contents of the tanks in accordance with Figure 3.1-1, their associated gravity feed valves, and boric acid makeup pumps,
- 3) Two boric acid makeup tanks, each with contents in accordance with Figure 3.1-1, at least one gravity feed valve, and at least one boric acid makeup pump and,

b. The refueling water storage tank with:

- 1) A minimum contained borated water volume of 362,800 gallons above the ECCS suction connection,
- 2) Between 1720 and 2500 ppm of boron, and
- 3) A solution temperature between 40°F and 100°F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

- a. With the above required boric acid makeup tank(s) inoperable, restore the tank(s) 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 3.0% delta k/k at 200°F; restore the above required boric acid makeup tank(s) to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.
- b. With the refueling water tank inoperable, restore the tank to OPERABLE status within one hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

---

4.1.2.8 Each borated water sources shall be demonstrated OPERABLE:

a. At least once per 7 days by:

1. Verifying the boron concentration in the water, and
2. Verifying the contained borated water volume of the water source,

b. At least once per 24 hours by verifying the RWST temperature when the outside air temperature is less than 40°F or greater than 100°F.

3/4 5 EMERGENCY CORE COOLING SYSTEMS

3/4 5.1 SAFETY INJECTION TANKS

LIMITING CONDITION FOR OPERATION

3.3.1 Each reactor coolant system safety injection tank shall be OPERABLE with:

- a. The isolation valve open and power to the valve removed,
- b. A contained borated water volume of between 1680 and 1807 cubic feet,
- c. Between 1720 (1420 for Cycle 2) and 2500 ppm of boron, and
- d. A nitrogen cover-pressure of between 600 and 625 psig.

APPLICABILITY: MODES 1, 2 and 3. \*

ACTION:

- a. With one safety injection tank inoperable, except as a result of a closed isolation valve, restore the inoperable tank to OPERABLE status within one hour or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.
- b. With one safety injection tank inoperable due to the isolation valve being closed, either immediately open the isolation valve or be in at least HOT STANDBY within one hour and be in HOT SHUTDOWN within the next 12 hours.

SURVEILLANCE REQUIREMENTS

4.3.1 Each safety injection tank shall be demonstrated OPERABLE:

- a. At least once per 12 hours by:
  1. Verifying that the contained borated water volume and nitrogen cover-pressure in the tanks is within the above limits, and
  2. Verifying that each safety injection tank isolation valve is open.

with pressurizer pressure greater than or equal to 725 psia.

EMERGENCY CORE COOLING SYSTEMS

3/4 5.4 REFUELING WATER STORAGE TANK

LIMITING CONDITION FOR OPERATION

3.5.4 The refueling water storage tank shall be OPERABLE with:

- a. A minimum borated water volume of 362,800 gallons above the ECCS suction connection,
- b. Between 1720 and 2500 ppm of boron, and
- c. A solution temperature between 40°F and 100°F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With the refueling water storage tank inoperable, restore the tank to OPERABLE status within 1 hour or be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.5.4 The RWST shall be demonstrated OPERABLE:

- a. At least once per 7 days by:
  1. Verifying the contained borated water volume in the tank, and
  2. Verifying the boron concentration of the water.
- b. At least once per 24 hours by verifying the RWST temperature when the outside air temperature is less than 40°F or greater than 100°F.



## CONTAINMENT SYSTEMS

### RECIRCULATION FLOW - PH CONTROL

#### LIMITING CONDITION FOR OPERATION

---

3.6.2.2 The recirculation flow pH control system shall be operable with a minimum of 15,400 lbs. (256 cu. ft.) of trisodium phosphate (w/12 hydrates), or equivalent, available in the storage racks in the containment.

APPLICABILITY: Modes 1, 2 and 3

ACTION:

With less than the required amount of trisodium phosphate available, restore the system to the correct amount within 72 hours or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.

#### SURVEILLANCE REQUIREMENTS

---

4.6.2.2 The recirculation flow pH control system shall be demonstrated operable during each refueling outage by:

- a. Visually verifying that the TSP storage racks have maintained their integrity and the TSP containers contain a minimum of 15,400 lbs. (256 cu. ft.) of TSP (w/12 hydrates) or equivalent.
- b. Verifying that when a sample of less than 3.00 grams of trisodium phosphate (w/12 hydrates) or equivalent, selected at random from one of the storage racks inside of containment, is submerged, without agitation, in at least 1 litre of  $120 \pm 10$  degrees-F borated demineralized water borated to at least 2482 ppm boron, allowed to stand for 4 hours, then decanted and mixed, the pH of the solution is greater than or equal to 7.0.

### 3/4.9 REFUELING OPERATIONS

#### 3/4.9.1 BORON CONCENTRATION

##### LIMITING CONDITION FOR OPERATION

3.9.1 With the reactor vessel head closure bolts less than fully tensioned or with the head removed, 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 following reactivity conditions is met:

- a. Either a  $K_{eff}$  of 0.95 or less,
- b. A boron concentration of greater than or equal to 1720 ppm,

APPLICABILITY: MODE 6\*.

##### ACTION:

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 40 gpm of a solution containing greater than or equal to 1720 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 1720 ppm, whichever is the more restrictive.

##### SURVEILLANCE REQUIREMENTS

4.9.1.1 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 CEA in excess of 3 feet from its fully inserted position within the reactor pressure vessel.

4.9.1.2 The boron concentration of the reactor coolant system and the refueling canal shall be determined by chemical analysis at least once per 72 hours.

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

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## 3/4.10 SPECIAL TEST EXCEPTIONS

### 3/4.10.1 SHUTDOWN MARGIN

#### LIMITING CONDITION FOR OPERATION

---

3.10.1 The SHUTDOWN MARGIN requirement of Specification 3.1.1.1 may be suspended for measurement of CEA worth and shutdown margin provided reactivity equivalent to at least the highest estimated CEA worth is available for trip insertion from OPERABLE CEA(s).

APPLICABILITY: MODES 2 and 3\*.

ACTION:

- a. With any full length CEA not fully inserted and with less than the above reactivity equivalent available for trip insertion, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 1720 ppm boron or its equivalent until the SHUTDOWN MARGIN required by Specification 3.1.1.1 is restored.
- b. With all full length CEAs fully inserted and the reactor subcritical by less than the above reactivity equivalent, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 1720 ppm boron or its equivalent until the SHUTDOWN MARGIN required by Specification 3.1.1.1 is restored.

#### SURVEILLANCE REQUIREMENTS

---

4.10.1.1 The position of each full length and part length CEA required either partially or fully withdrawn shall be determined at least once per 2 hours.

4.10.1.2 Each CEA not fully inserted shall be demonstrated capable of full insertion when tripped from at least the 50% withdrawn position within 7 days prior to reducing the SHUTDOWN MARGIN to less than the limits of Specification 3.1.1.1.

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\* Operation in MODE 3 shall be limited to 6 consecutive hours.

## REACTIVITY CONTROL SYSTEMS

### BASES

#### 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 520°F. This limitation is required to ensure 1) the moderator temperature coefficient is within its analyzed temperature range, 2) the protective 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 pressure vessel is above its minimum  $RT_{HOT}$  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 pumps, 3) separate flow paths, 4) boric acid makeup pumps, and 5) an emergency power supply from OPERABLE diesel generators.

With the RCS average temperature above 200°F, a minimum of two separate and redundant boron injection systems are provided to ensure single functional capability in the event an assumed failure renders one of the systems inoperable. Allowable out-of-service periods ensure that minor component repair or corrective action may be completed without undue risk to overall facility safety from injection system failures during the repair period.

The boration capability of either system is sufficient to provide a SHUTDOWN MARGIN from expected operating conditions of 3.0% delta k/k after xenon decay and cooldown to 200°F. The maximum expected boration capability requirement occurs at BOL from full power equilibrium xenon conditions and requires boric acid solution from the boric acid makeup tanks in the allowable concentrations and volumes of Specification 3.1.2.8 plus approximately 13,000 gallons of 1720 ppm borated water from the refueling water tank or approximately 45,000 gallons of 1720 ppm borated water from the refueling water tank alone. However, for the purpose of consistency the minimum required volume of 362,800 gallons above ECCS suction connection in Specification 3.1.2.8 is identical to more restrictive value of Specification 3.5.4.

With the RCS temperature below 200°F one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single injection system becomes inoperable.

The boron capability required below 200°F is based upon providing a 3% delta k/k SHUTDOWN MARGIN after xenon decay and cooldown from 200°F to 140°F. This condition requires 5150 gallons of 1720 ppm borated water from either the refueling water tank or boric acid solution from a boric acid makeup tank.

## REACTIVITY CONTROL SYSTEMS

### BASES

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#### BORATION SYSTEMS (Continued)

The water volume limits are specified relative to the top of the highest suction connection to the tank. (Water volume below this datum is not considered recoverable for purposes of this specification.) Vortexing, internal structures and instrument error are considered in determining the tank level corresponding to the specified water volume limits.

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

The limits on water volume and boron concentration of the RWST also ensure a pH value of between 8.0 and 10.0 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 maximum RWST volume is not specified since analysis of pH limits and containment flooding post-LOCA considered RWST overflow conditions.

#### 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 CEA misalignments are limited to acceptable levels.

The ACTION statements which permit limited variations from the basic requirements are accompanied by additional restrictions which ensure that the original design criteria are met.

The ACTION statements applicable to a stuck or untrippable CEA, to two or more inoperable CEAs and to a large misalignment (greater than or equal to 19 inches) of two or more CEAs, require a prompt shutdown of the reactor since either of these conditions may be indicative of a possible loss of mechanical functional capability of the CEAs and in the event of a stuck or untrippable CEA, the loss of SHUTDOWN MARGIN.

For small misalignments (less than 19 inches) of the CEAs, there is 1) a small effect on the time-dependent long term power distributions relative to those used in generating LCOs and LSSS setpoints, 2) a small effect on the available SHUTDOWN MARGIN, and 3) a small effect on the ejected CEA worth used in the safety analysis. Therefore, the ACTION statement associated with small misalignments of CEAs permits a 1-hour time interval during which attempts may be made to restore the CEA to within its alignment requirements. The 1-hour time limit is sufficient to (1) identify causes of a misaligned CEA, (2) take appropriate corrective action to realign the CEAs and (3) minimize the effects of xenon redistribution.

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## EMERGENCY CORE COOLING SYSTEMS

### BASES

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#### ECCS SUBSYSTEMS (Continued)

With the RCS temperature below 350°F, one OPERABLE ECCS subsystem is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the limited core cooling requirements.

The NaOH added to the Containment Spray, via the Spray Chemical Addition pumps, minimizes the possibility of corrosion cracking of certain metal components during operation of the ECCS following a LOCA. The NaOH additive results in post-LOCA sump pH of between 8.0 and 10.0 at the end of the NaOH injection period.

The Surveillance Requirements provided to ensure OPERABILITY of each component ensure that at a minimum, the assumptions used in the accident analyses are met and that subsystem OPERABILITY is maintained. Surveillance requirements for flow balance testing provide assurance that proper ECCS flows will be maintained in the event of a LOCA. Maintenance of proper flow resistance and pressure drop in the piping system to each injection point is necessary to: (1) prevent total pump flow from exceeding runout conditions when the system is in its minimum resistance configuration, (2) provide the proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analyses, and (3) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analyses.

#### 3/4.5.4 REFUELING WATER STORAGE TANK (RWST)

The OPERABILITY of the RWST as part of the ECCS ensures that a sufficient supply of borated water is available for injection by the ECCS in the event of a LOCA. The limits on RWST minimum volume and boron concentration ensure that 1) sufficient water is available within containment to permit recirculation cooling flow to the core, and 2) the reactor will remain subcritical in the cold condition following mixing of the RWST and the RCS water volumes with all control rods inserted except for the most reactive control assembly. The limit on maximum boron concentration is to ensure that boron does not precipitate in the core following LOCA. The limit on RWST solution temperature is to ensure that the assumptions used in the LOCA analyses remain valid.

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## EMERGENCY CORE COOLING SYSTEMS

### BASES

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#### REFUELING WATER STORAGE TANK (Continued)

The water volume limits are specified relative to the top of the highest suction connection to the tank. (Water volume below this datum is not considered recoverable for purposes of this specification.) The specified volume limits consist of the minimum volume required for ECCS injection above the Recirculation Actuation Signal (RAS) setpoint, plus the minimum volume required for the transition to ECCS recirculation below the RAS setpoint, plus the volume corresponding to the range of the RAS setpoint, including RAS instrument error high and low. Vortexing, internal structure, and instrument error are considered in determining the tank level corresponding to the specified water volume limits.

The limits on water volume and boron concentration of the RWST also ensure that the solution recirculated within containment after a LOCA has a pH value between 8.0 and 10.0 at the end of the NaOH injection period. This pH band minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components. The maximum RWST volume is not specified since analysis of pH limits and containment flooding post-LOCA considered RWST overflow conditions.

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## 3/4.9 REFUELING OPERATIONS

### BASES

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#### 3/4.9.1 BORON CONCENTRATION

The limitations on reactivity conditions during REFUELING ensure that: 1) the reactor will remain subcritical during CORE ALTERATIONS, and 2) a uniform boron concentration is maintained for reactivity control in the water volume having direct access to the reactor vessel. These limitations are consistent with the initial conditions assumed for the boron dilution incident in the accident analyses. The value of 0.95 or less for  $K_{eff}$  includes a 1% delta K/K conservative allowance for uncertainties. Similarly, the boron concentration value of 1720 ppm or greater also includes a conservative uncertainty allowance of 50 ppm boron.

#### 3/4.9.2 INSTRUMENTATION

The OPERABILITY of the source range neutron flux monitors ensures that redundant monitoring capability is available to detect changes in the reactivity condition of the core.

#### 3/4.9.3 DECAY TIME

The minimum requirement for reactor subcriticality prior to movement of irradiated fuel assemblies in the reactor pressure vessel ensures that sufficient time has elapsed to allow the radioactive decay of the short lived fission products. This decay time is consistent with the assumptions used in the accident analyses.

#### 3/4.9.4 CONTAINMENT BUILDING PENETRATIONS

The requirements on containment penetration closure and OPERABILITY ensure that a release of radioactive material within containment will be restricted from leakage to the environment. The OPERABILITY and closure restrictions are sufficient to restrict radioactive material release from a fuel element rupture based upon the lack of containment pressurization potential while in the REFUELING MODE.

#### 3/4.9.5 COMMUNICATIONS

The requirement for communications capability ensures that refueling station personnel can be promptly informed of significant changes in the facility status or core reactivity condition during CORE ALTERATIONS.

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ATTACHMENT "D"

### 3/4.1 REACTIVITY CONTROL SYSTEMS

#### 3/4.1.1 BORATION CONTROL

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 5.15% delta k/k.

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

#### ACTION:

With the SHUTDOWN MARGIN less than 5.15% delta k/k, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 2350 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 5.15% 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 verified acceptable with an increased allowance for the withdrawn worth of the immovable or untrippable CEA(s).
- b. When in MODE 1 or MODE 2 with  $K_{eff}$  greater than or equal to 1.0, at least once per 12 hours by verifying that CEA group withdrawal is within the Transient Insertion Limits of Specification 3.1.3.6.
- c. When in MODE 2 with  $K_{eff}$  less than 1.0, within 4 hours prior to achieving reactor criticality by verifying that the predicted critical CEA position is within the limits of Specification 3.1.3.6.

\* See Special Test Exception 3.10.1.

## REACTIVITY CONTROL SYSTEMS

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

### LIMITING CONDITION FOR OPERATION

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3.1.1.2 The SHUTDOWN MARGIN shall be greater than or equal to 3.0% delta k/k.

APPLICABILITY: MODE 5.

#### ACTION:

With the SHUTDOWN MARGIN less than 3.0% delta k/k, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 2350 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 3.0% 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. 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.
  7. Whenever the reactor coolant level is below the hot leg centerline, one and only one charging pump shall be operable; by verifying that power is removed from the remaining charging pumps.

## REACTIVITY CONTROL SYSTEMS

### BORATED WATER SOURCE - SHUTDOWN

#### LIMITING CONDITION FOR OPERATION

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

- a. One boric acid makeup tank with a minimum boron concentration of 2350 ppm and a minimum borated water volume of 4150 gallons, or
- b. The refueling water storage tanks with:
  1. A minimum borated water volume of 4150 gallons above the ECCS suction connection,
  2. A minimum boron concentration of 2350 ppm, and
  3. A solution temperature between 40°F and 100°F.

APPLICABILITY: MODES 5 and 6.

#### ACTION:

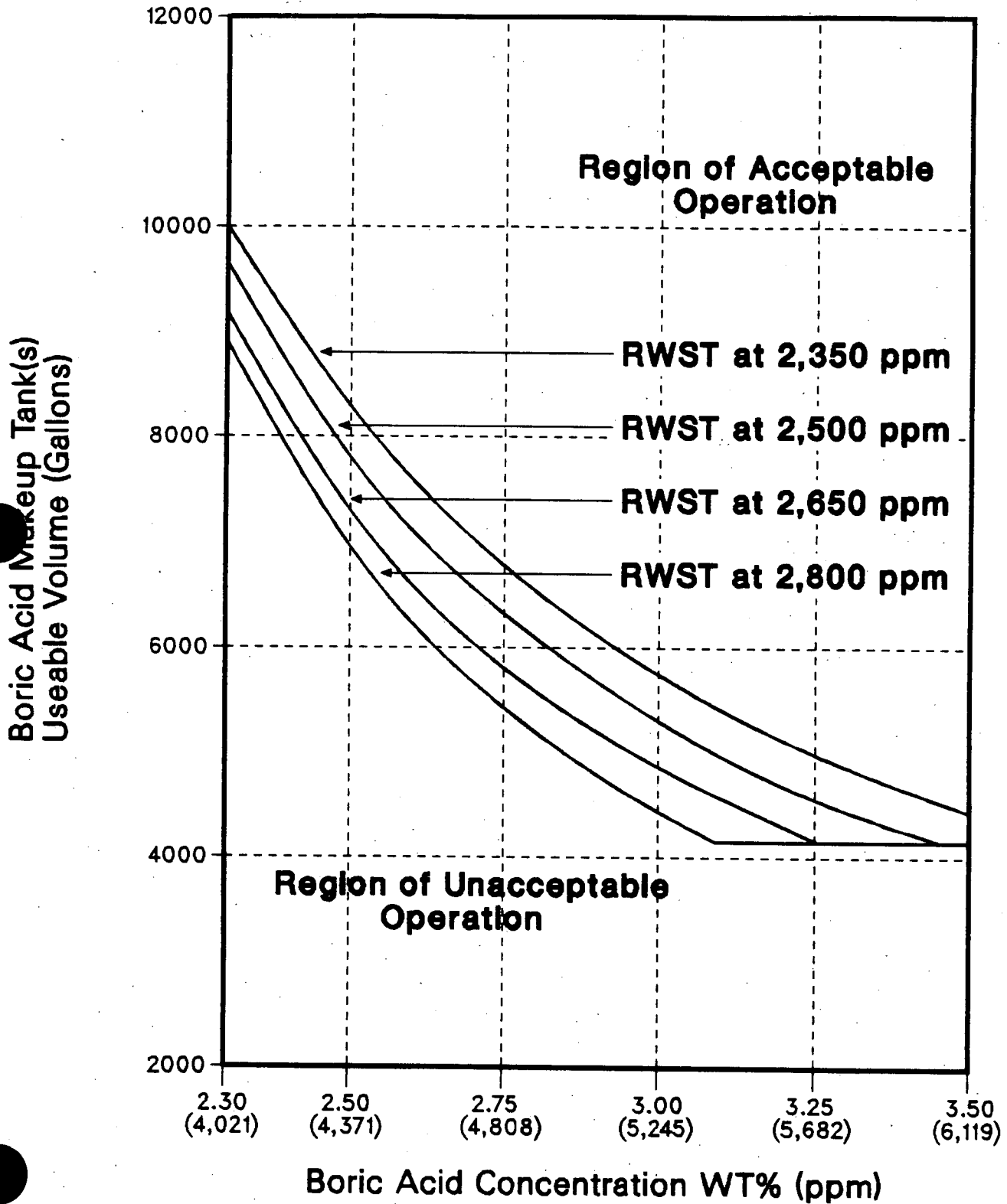
With no borated water sources OPERABLE, suspend all operations involving CORE ALTERATIONS or positive reactivity changes.

#### SURVEILLANCE REQUIREMENTS

4.1.2.7 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, and
  2. Verifying the contained borated water volume of the tank.
- b. At least once per 24 hours by verifying the RWST temperature when it is the source of borated water when the outside air temperature is less than 40°F or greater than 100°F.

**Figure 3.1-1**  
**MINIMUM STORED BORIC ACID VOLUME**  
**AS A FUNCTION OF CONCENTRATION**  
**(Gallons)**



REACTIVITY CONTROL SYSTEMS

BORATED WATER SOURCES - OPERATING

LIMITING CONDITION FOR OPERATION

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3.1.2.8 The following borated water sources shall be OPERABLE:

- a. At least one of the following combinations:
  - 1) One boric acid makeup tank, with the tank contents in accordance with Figure 3.1-1, its associated gravity feed valve, and boric acid makeup pump,
  - 2) Two boric acid makeup tanks, with the combined contents of the tanks in accordance with Figure 3.1-1, their associated gravity feed valves, and boric acid makeup pumps,
  - 3) Two boric acid makeup tanks, each with contents in accordance with Figure 3.1-1, at least one gravity feed valve, and at least one boric acid makeup pump and,
- b. The refueling water storage tank with:
  - 1) A minimum contained borated water volume of 362,800 gallons above the ECCS suction connection,
  - 2) Between 2350 and 2800 ppm of boron, and
  - 3) A solution temperature between 40°F and 100°F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

- a. With the above required boric acid makeup tank(s) inoperable, restore the tank(s) 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 3.0% delta k/k at 200°F; restore the above required boric acid makeup tank(s) to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.
- b. With the refueling water tank inoperable, restore the tank to OPERABLE status within one hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

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4.1.2.8 Each borated water sources shall be demonstrated OPERABLE:

- a. At least once per 7 days by:
  1. Verifying the boron concentration in the water, and
  2. Verifying the contained borated water volume of the water source;
- b. At least once per 24 hours by verifying the RWST temperature when the outside air temperature is less than 40°F or greater than 100°F.

3/4 5 EMERGENCY CORE COOLING SYSTEMS

3/4 5.1 SAFETY INJECTION TANKS

LIMITING CONDITION FOR OPERATION

3.3.2 Each reactor coolant system safety injection tank shall be OPERABLE with:

- a. The isolation valve open and power to the valve removed,
- b. A contained borated water volume of between 1680 and 1807 cubic feet,
- c. Between 1850 and 2800 ppm of boron, and
- d. A nitrogen cover-pressure of between 600 and 625 psig.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

- a. With one safety injection tank inoperable, except as a result of a closed isolation valve, restore the inoperable tank to OPERABLE status within one hour or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.
- b. With one safety injection tank inoperable due to the isolation valve being closed, either immediately open the isolation valve or be in at least HOT STANDBY within one hour and be in HOT SHUTDOWN within the next 12 hours.

SURVEILLANCE REQUIREMENTS

4.3.2 Each safety injection tank shall be demonstrated OPERABLE:

- a. At least once per 12 hours by:
  1. Verifying that the contained borated water volume and nitrogen cover-pressure in the tanks is within the above limits, and
  2. Verifying that each safety injection tank isolation valve is open.

With pressurizer pressure greater than or equal to 723 psia.

EMERGENCY CORE COOLING SYSTEMS

3/4 9.4 REFUELING WATER STORAGE TANK

LIMITING CONDITION FOR OPERATION

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3.5.4 The refueling water storage tank shall be OPERABLE with:

- a. A minimum berated water volume of 362,800 gallons above the ECCS suction connection,
- b. Between 2350 and 2800 ppm of boron, and
- c. A solution temperature between 40°F and 100°F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With the refueling water storage tank inoperable, restore the tank to OPERABLE status within 1 hour or be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

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4.5.4 The RWST shall be demonstrated OPERABLE:

- a. At least once per 7 days by:
  1. Verifying the contained berated water volume in the tank, and
  2. Verifying the boron concentration of the water.
- b. At least once per 24 hours by verifying the RWST temperature when the outside air temperature is less than 40°F or greater than 100°F.



## CONTAINMENT SYSTEMS

### RECIRCULATION FLOW - PH CONTROL

#### LIMITING CONDITION FOR OPERATION

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3.6.2.2 The recirculation flow pH control system shall be operable with a minimum of 17,461 lbs. (291 cu. ft.) of trisodium phosphate (w/12 hydrates), or equivalent, available in the storage racks in the containment.

APPLICABILITY: Modes 1, 2 and 3

ACTION:

With less than the required amount of trisodium phosphate available, restore the system to the correct amount within 72 hours or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.

#### SURVEILLANCE REQUIREMENTS

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4.6.2.2 The recirculation flow pH control system shall be demonstrated operable during each refueling outage by:

- a. Visually verifying that the TSP storage racks have maintained their integrity and the TSP containers contain a minimum of 17,461 lbs. (291 cu. ft.) of TSP (w/12 hydrates) or equivalent.
- b. Verifying that when a sample of less than 3.43 grams of trisodium phosphate (w/12 hydrates) or equivalent, selected at random from one of the storage racks inside of containment, is submerged, without agitation, in at least 1 litre of 120 ± 10 degrees-F borated demineralized water borated to at least 2812 ppm boron, allowed to stand for 4 hours, then decanted and mixed, the pH of the solution is greater than or equal to 7.0.

### 3/4.9 REFUELING OPERATIONS

#### 3/4.9.1 BORON CONCENTRATION

##### LIMITING CONDITION FOR OPERATION

---

3.9.1 With the reactor vessel head closure bolts less than fully tensioned or with the head removed, 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 following reactivity conditions is met:

- a. Either a  $K_{eff}$  of 0.95 or less,
- b. A boron concentration of greater than or equal to 2350 ppm,

APPLICABILITY: MODE 6\*.

##### ACTION:

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 40 gpm of a solution containing greater than or equal to 2350 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 2350 ppm, whichever is the more restrictive.

##### SURVEILLANCE REQUIREMENTS

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4.9.1.1 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 CEA in excess of 3 feet from its fully inserted position within the reactor pressure vessel.

4.9.1.2 The boron concentration of the reactor coolant system and the refueling canal shall be determined by chemical analysis at least once per 72 hours.

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

## 3/4.10 SPECIAL TEST EXCEPTIONS

### 3/4.10.1 SHUTDOWN MARGIN

#### LIMITING CONDITION FOR OPERATION

---

3.10.1 The SHUTDOWN MARGIN requirement of Specification 3.1.1.1 may be suspended for measurement of CEA worth and shutdown margin provided reactivity equivalent to at least the highest estimated CEA worth is available for trip insertion from OPERABLE CEA(s).

APPLICABILITY: MODES 2 and 3\*.

ACTION:

- a. With any full length CEA not fully inserted and with less than the above reactivity equivalent available for trip insertion, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 2350 ppm boron or its equivalent until the SHUTDOWN MARGIN required by Specification 3.1.1.1 is restored.
- b. With all full length CEAs fully inserted and the reactor subcritical by less than the above reactivity equivalent, immediately initiate and continue boration at greater than or equal to 40 gpm of a solution containing greater than or equal to 2350 ppm boron or its equivalent until the SHUTDOWN MARGIN required by Specification 3.1.1.1 is restored.

#### SURVEILLANCE REQUIREMENTS

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4.10.1.1 The position of each full length and part length CEA required either partially or fully withdrawn shall be determined at least once per 2 hours.

4.10.1.2 Each CEA not fully inserted shall be demonstrated capable of full insertion when tripped from at least the 50% withdrawn position within 7 days prior to reducing the SHUTDOWN MARGIN to less than the limits of Specification 3.1.1.1.

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\* Operation in MODE 3 shall be limited to 6 consecutive hours.

## REACTIVITY CONTROL SYSTEMS

### BASES

#### 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 520°F. This limitation is required to ensure 1) the moderator temperature coefficient is within its analyzed temperature range, 2) the protective 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 pressure vessel is above its minimum  $RT_{NBT}$  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 pumps, 3) separate flow paths, 4) boric acid makeup pumps, and 5) an emergency power supply from OPERABLE diesel generators.

With the RCS average temperature above 200°F, a minimum of two separate and redundant boron injection systems are provided to ensure single functional inoperable. Allowable out-of-service periods ensure that minor component repair or corrective action may be completed without undue risk to overall facility safety from injection system failures during the repair period.

The boration capability of either system is sufficient to provide a SHUTDOWN MARGIN from expected operating conditions of 3.0% delta k/k after xenon decay and cooldown to 200°F. The maximum expected boration capability requirement occurs at EDL from full power equilibrium xenon conditions and requires boric acid solution from the boric acid makeup tanks in the allowable concentrations and volumes of Specification 3.1.2.8 plus approximately 13,000 gallons of 2350 ppm borated water from the refueling water tank or approximately 26,000 gallons of 2350 ppm borated water from the refueling water tank alone. However, for the purpose of consistency the minimum required volume of 362,800 gallons above ECCS suction connection in Specification 3.1.2.8 is identical to more restrictive value of Specification 3.5.4.

With the RCS temperature below 200°F one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity changes in the event the single injection system becomes inoperable.

The boron capability required below 200°F is based upon providing a 3% delta k/k SHUTDOWN MARGIN after xenon decay and cooldown from 200°F to 140°F. This condition requires 4150 gallons of 2350 ppm borated water from either the refueling water tank or boric acid solution from a boric acid makeup tank.

## REACTIVITY CONTROL SYSTEMS

### BASES

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#### BORATION SYSTEMS (Continued)

The water volume limits are specified relative to the top of the highest suction connection to the tank. (Water volume below this datum is not considered recoverable for purposes of this specification.) Vortexing, internal structures and instrument error are considered in determining the tank level corresponding to the specified water volume limits.

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

The limits on water volume and boron concentration of the RWST also ensure a pH value of greater than 7.0 for the solution recirculated within containment after a LOCA. This pH minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components. The maximum RWST volume is not specified since analysis of pH limits and containment flooding post-LOCA considered RWST overflow conditions.

#### 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 CEA misalignments are limited to acceptable levels.

The ACTION statements which permit limited variations from the basic requirements are accompanied by additional restrictions which ensure that the original design criteria are met.

The ACTION statements applicable to a stuck or untrippable CEA, to two or more inoperable CEAs and to a large misalignment (greater than or equal to 19 inches) of two or more CEAs, require a prompt shutdown of the reactor since either of these conditions may be indicative of a possible loss of mechanical functional capability of the CEAs and in the event of a stuck or untrippable CEA, the loss of SHUTDOWN MARGIN.

For small misalignments (less than 19 inches) of the CEAs, there is 1) a small effect on the time-dependent long term power distributions relative to those used in generating LCOs and LSSS setpoints, 2) a small effect on the available SHUTDOWN MARGIN, and 3) a small effect on the ejected CEA worth used in the safety analysis. Therefore, the ACTION statement associated with small misalignments of CEAs permits a 1-hour time interval during which attempts may be made to restore the CEA to within its alignment requirements. The 1-hour time limit is sufficient to (1) identify causes of a misaligned CEA, (2) take appropriate corrective action to realign the CEAs and (3) minimize the effects of xenon redistribution.

## EMERGENCY CORE COOLING SYSTEMS

### BASES

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#### ECCS SUBSYSTEMS (Continued)

With the RCS temperature below 350°F, one OPERABLE ECCS subsystem is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the limited core cooling requirements.

The Surveillance Requirements provided to ensure OPERABILITY of each component ensure that at a minimum, the assumptions used in the accident analyses are met and that subsystem OPERABILITY is maintained. Surveillance requirements for flow balance testing provide assurance that proper ECCS flows will be maintained in the event of a LOCA. Maintenance of proper flow resistance and pressure drop in the piping system to each injection point is necessary to: (1) prevent total pump flow from exceeding runout conditions when the system is in its minimum resistance configuration, (2) provide the proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analyses, and (3) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analyses.

#### 3/4.5.4 REFUELING WATER STORAGE TANK (RWST)

The OPERABILITY of the RWST as part of the ECCS ensures that a sufficient supply of borated water is available for injection by the ECCS in the event of a LOCA. The limits on RWST minimum volume and boron concentration ensure that 1) sufficient water is available within containment to permit recirculation cooling flow to the core, and 2) the reactor will remain subcritical in the cold condition following mixing of the RWST and the RCS water volumes with all control rods inserted except for the most reactive control assembly. The limit on maximum boron concentration is to ensure that boron does not precipitate in the core following LOCA. The limit on RWST solution temperature is to ensure that the assumptions used in the LOCA analyses remain valid.

## EMERGENCY CORE COOLING SYSTEMS

### BASES

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#### REFUELING WATER STORAGE TANK (Continued)

The water volume limits are specified relative to the top of the highest suction connection to the tank. (Water volume below this datum is not considered recoverable for purposes of this specification.) The specified volume limits consist of the minimum volume required for ECCS injection above the Recirculation Actuation Signal (RAS) setpoint, plus the minimum volume required for the transition to ECCS recirculation below the RAS setpoint, plus the volume corresponding to the range of the RAS setpoint, including RAS instrument error high and low. Vortexing, internal structure, and instrument error are considered in determining the tank level corresponding to the specified water volume limits.

The limits on water volume and boron concentration of the RWST also ensure that the solution recirculated within containment after a LOCA has a pH value greater than 7.0.

This pH minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components. The maximum RWST volume is not specified since analysis of pH limits and containment flooding post-LOCA considered RWST overflow conditions.

## 3/4.9 REFUELING OPERATIONS

### BASES

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#### 3/4.9.1 BORON CONCENTRATION

The limitations on reactivity conditions during REFUELING ensure that: 1) the reactor will remain subcritical during CORE ALTERATIONS, and 2) a uniform boron concentration is maintained for reactivity control in the water volume having direct access to the reactor vessel. These limitations are consistent with the initial conditions assumed for the boron dilution incident in the accident analyses. The value of 0.95 or less for  $K_{eff}$  includes a 1% delta K/K conservative allowance for uncertainties. Similarly, the boron concentration value of 2350 ppm or greater also includes a conservative uncertainty allowance of 50 ppm boron.

#### 3/4.9.2 INSTRUMENTATION

The OPERABILITY of the source range neutron flux monitors ensures that redundant monitoring capability is available to detect changes in the reactivity condition of the core.

#### 3/4.9.3 DECAY TIME

The minimum requirement for reactor subcriticality prior to movement of irradiated fuel assemblies in the reactor pressure vessel ensures that sufficient time has elapsed to allow the radioactive decay of the short lived fission products. This decay time is consistent with the assumptions used in the accident analyses.

#### 3/4.9.4 CONTAINMENT BUILDING PENETRATIONS

The requirements on containment penetration closure and OPERABILITY ensure that a release of radioactive material within containment will be restricted from leakage to the environment. The OPERABILITY and closure restrictions are sufficient to restrict radioactive material release from a fuel element rupture based upon the lack of containment pressurization potential while in the REFUELING MODE.

#### 3/4.9.5 COMMUNICATIONS

The requirement for communications capability ensures that refueling station personnel can be promptly informed of significant changes in the facility status or core reactivity condition during CORE ALTERATIONS.