

REACTIVITY CONTROL SYSTEMS

BORATED WATER SOURCE - SHUTDOWN

LIMITING CONDITION FOR OPERATION

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

- a. A boric acid storage tank with:
  - 1) A minimum indicated borated water level of 10% when using the boric acid transfer pump,
  - 2) A minimum indicated borated water level of 20% when using the gravity feed connection,
  - 3) A minimum boron concentration of 7000 ppm, and
  - 4) A minimum solution temperature of 65°F.
- b. The refueling water storage tank (RWST) with:
  - 1) A minimum indicated borated water level of 24%,
  - 2) A minimum boron concentration of ~~2000 ppm~~, and
  - 3) A minimum solution temperature of 40°F.

APPLICABILITY: MODES 5 and 6.

ACTION:

2400 ppm for Unit 1 (2000 ppm for Unit 2)

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

REACTIVITY CONTROL SYSTEMS

BORATED WATER SOURCES - OPERATING

2600 ppm for Unit 1 (2200 ppm for Unit 2)

LIMITING CONDITION FOR OPERATION

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

- a. A boric acid storage tank with:
  - 1) A minimum indicated borated water level of 50%,
  - 2) A minimum boron concentration of 7000 ppm, and
  - 3) A minimum solution temperature of 65°F.
- b. The refueling water storage tank (RWST) with:
  - 1) A minimum indicated borated water level of 5%,
  - 2) A boron concentration between ~~2000 ppm~~ and ~~2200 ppm~~,
  - 3) A minimum solution temperature of 40°F, and
  - 4) A maximum solution temperature of 120°F.

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

ACTION:

2400 ppm for Unit 1 (2000 ppm for Unit 2)

- a. With the boric acid storage tank inoperable and being used as one of the above required borated water sources, restore the tank to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and borated to a SHUTDOWN MARGIN equivalent to at least 1.3%  $\Delta k/k$  at 200°F; restore the boric acid storage tank to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.
- b. With the RWST inoperable, restore the tank to OPERABLE status within 1 hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

### 3/4.5 EMERGENCY CORE COOLING SYSTEMS

#### 3/4.5.1 ACCUMULATORS

##### COLD LEG INJECTION

2600ppm for Unit 1 (2200ppm for Unit 2)

##### LIMITING CONDITION FOR OPERATION

3.5.1 Each cold leg injection accumulator shall be OPERABLE with:

- a. The discharge isolation valve open with power removed,
- b. An indicated borated water level of between 39% and 61%
- c. A boron concentration of between ~~1900~~ and ~~2200 ppm~~, and
- d. An indicated cover-pressure of between 623 and 644 psig.

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

ACTION:

2300ppm for Unit 1 (1900ppm for Unit 2)

- a. With one cold leg injection accumulator inoperable, except as a result of a closed isolation valve or the boron concentration outside the required values, restore the inoperable accumulator to OPERABLE status within 1 hour or be in at least HOT STANDBY within the next 6 hours and reduce pressurizer pressure to less than 1000 psig within the following 6 hours.
- b. With one cold leg injection accumulator inoperable due to the isolation valve being closed, either immediately open the isolation valve or be in at least HOT STANDBY within 6 hours and reduce pressurizer pressure to less than 1000 psig within the following 6 hours.
- c. With the boron concentration of one cold leg injection accumulator outside the required limit, restore the boron concentration to within the required limits within 72 hours or be in at least HOT STANDBY within the next 6 hours and reduce pressurizer pressure to less than 1000 psig within the following 6 hours.

##### SURVEILLANCE REQUIREMENTS

4.5.1.1 Each cold leg injection accumulator shall be demonstrated OPERABLE:

- a. At least once per 12 hours by:
  - 1) Verifying the indicated borated water level and nitrogen cover-pressure in the tanks, and

\*Pressurizer pressure above 1000 psig.

EMERGENCY CORE COOLING SYSTEMS

3/4.5.4 REFUELING WATER STORAGE TANK

2600 ppm for Unit 1 (2200 ppm for Unit 2)

LIMITING CONDITION FOR OPERATION

3.5.4 The refueling water storage tank (RWST) shall be OPERABLE with:

- a. A minimum indicated borated water level of 95%,
- b. A boron concentration of between ~~2000~~ and ~~2200 ppm~~ of boron,
- c. A minimum solution temperature of 40°F, and
- d. A maximum solution temperature of 120°F.

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

ACTION: 2400 ppm for Unit 1 (2000 ppm for Unit 2)

With the RWST 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 indicated 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 120°F.

3/4.9 REFUELING OPERATIONS3/4.9.1 BORON CONCENTRATIONLIMITING CONDITION FOR OPERATION

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

- A  $K_{eff}$  of 0.95 or less, or
- A boron concentration of greater than or equal to ~~2000 ppm~~.\*

Additionally, either valve CS-8455 or valves CS-8560, FCV-111B, CS-8439, CS-8441 and CS-8453 shall be closed and secured in position.

APPLICABILITY: MODE 6.

ACTION:

2400 ppm for Unit 1 (2000 ppm for Unit 2)

- With the requirements a. or b. of the above not satisfied, immediately suspend all operations involving CORE ALTERATIONS or positive reactivity changes and initiate and continue boration at greater than or equal to 30 gpm of a solution containing greater than or equal to 7000 ppm boron or 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 ~~2000 ppm~~, whichever is the more restrictive.
- If either valve CS-8455 or valves CS-8560, FCV-111B, CS-8439, CS-8441 and CS-8453 are not closed and secured in position, immediately suspend all operations involving CORE ALTERATIONS or positive reactivity changes and take action to isolate the dilution paths. Within 1 hour, verify the more restrictive of 3.9.1.a or 3.9.1.b or carry out Action a. above.

SURVEILLANCE REQUIREMENTS

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

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

4.9.1.3 Either valve CS-8455 or valves CS-8560, FCV-111B, CS-8439, CS-8441 and CS-8453 shall be verified closed and secured in position by mechanical stops or by removal of air or electrical power at least once per 31 days to verify that dilution paths are isolated.

\*During initial fuel load, the boron concentration limitation for the refueling canal is not applicable provided the refueling canal level is verified to be below the reactor vessel flange elevation at least once per 12 hours.

## REACTIVITY CONTROL SYSTEMS

### BASES

#### MODERATOR TEMPERATURE COEFFICIENT (Continued)

involved subtracting the incremental change in the MDC associated with a core condition of all rods inserted (most positive MDC) to an all rods withdrawn condition and, a conversion for the rate of change of moderator density with temperature at RATED THERMAL POWER conditions. This value of the MDC was then transformed into the limiting End of Cycle Life (EOL) MTC value. The 300 ppm surveillance limit MTC value represents a conservative value (with corrections for burnup and soluble boron) at a core condition of 300 ppm equilibrium boron concentration and is obtained by making these corrections to the limiting EOL MTC value.

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

#### 3/4.1.1.4 MINIMUM TEMPERATURE FOR CRITICALITY

This specification ensures that the reactor will not be made critical with the Reactor Coolant System average temperature less than 551°F. This limitation is required to ensure: (1) the moderator temperature coefficient is within its analyzed temperature range, (2) the trip instrumentation is within its normal operating range, (3) the pressurizer is capable of being in an OPERABLE status with a steam bubble, and (4) the reactor vessel is above its minimum  $RT_{MOT}$  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 transfer pumps, and (5) an emergency power supply from OPERABLE diesel generators.

With the RCS average temperature above 200°F, a minimum of two boron injection flow paths are required to ensure single functional capability in the event an assumed failure renders one of the flow paths inoperable. The boration capability of either flow path is sufficient to provide a SHUTDOWN MARGIN from expected operating conditions of 1.6%  $\Delta k/k$  for Unit 1 (1.3%  $\Delta k/k$  for Unit 2) 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 15,700 gallons of 7000 ppm borated water from the boric acid storage tanks or 70,702 gallons of ~~2000 ppm~~ borated water from the refueling water storage tank (RWST).

2400 ppm for Unit 1 (2000 ppm for Unit 2)

REACTIVITY CONTROL SYSTEMS

BASES

BORATION SYSTEMS (Continued)

With the RCS temperature below 200°F, one Boron 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 Boron Injection System becomes inoperable.

The limitation for a maximum of two charging pumps to be OPERABLE and the requirement to verify one charging pump to be inoperable below 350°F provides assurance that a mass addition pressure transient can be relieved by the operation of a single PORV.

The limitation for minimum solution temperature of the borated water sources are sufficient to prevent boric acid crystallization with the highest allowable boron concentration.

The boron capability required below 200°F is sufficient to provide a SHUT-DOWN MARGIN of 1.3%  $\Delta k/k$  after xenon decay and cooldown from 200°F to 140°F. This condition requires either 1,100 gallons of 7000 ppm borated water from the boric acid storage tanks or 7,113 gallons of ~~2000 ppm~~ borated water from the RWST.

*2400 ppm for Unit 1 (2000 ppm for Unit 2)*

As listed below, the required indicated levels for the boric acid storage tanks and the RWST include allowances for required/analytical volume, unusable volume, measurement uncertainties (which include instrument error and tank tolerances, as applicable), margin, and other required volume.

Tank	MODES	Ind. Level	Unusable Volume (gal)	Required Volume (gal)	Measurement Uncertainty	Margin (gal)	Other (gal)
RWST	5,6	24%	98,900	7,113	4% of span	10,293	N/A
	1,2,3,4	95%	45,494	70,702	4% of span	N/A	357,535*
Boric Acid Storage Tank	5,6	10%	3,221	1,100	6% of span	N/A	N/A
	5,6	20%	3,221	1,100	6% of span	3,679	N/A
	(gravity feed) 1,2,3,4	50%	3,221	15,700	6% of span	N/A	N/A

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

\*Additional volume required to meet Specification 3.5.4.

## EMERGENCY CORE COOLING SYSTEMS

### BASES

#### ECCS SUBSYSTEMS (Continued)

to be inoperable below 350°F provides assurance that a mass addition pressure transient can be relieved by the operation of a single PORV.

The requirement to remove power from certain valve operators is in accordance with Branch Technical Position ICSB-18 for valves that fail to meet single failure considerations. Power is removed via key-lock switches on the control board.

The Surveillance Requirements provided to ensure OPERABILITY of each component ensures that at a minimum, the assumptions used in the safety analyses are met and that subsystem OPERABILITY is maintained. Surveillance Requirements for throttle valve position stops and 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

The OPERABILITY of the refueling water storage tank (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, (2) for small break LOCA and steam line breaks, 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, (3) for large break LOCAs, the reactor will remain subcritical in the cold condition following mixing of the RWST and the RCS water volumes with all shutdown and control rods fully withdrawn, and (4) sufficient time is available for the operator to take manual action and complete switchover of ECCS and containment spray suction to the containment sump without emptying the RWST or losing suction.

The required indicated level includes a 4-percent measurement uncertainty, an unusable volume of 45,494 gallons and a required water volume of 428,237 gallons. 8.25 for Unit 1 (8.5 for Unit 2)

The limits on indicated water volume and boron concentration of the RWST also ensure a long-term pH value of between 8.5 and 10.5 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.



3/4.9 REFUELING OPERATIONSBASES

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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 safety 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 ~~2000 ppm~~ or greater includes a conservative uncertainty allowance of 50 ppm boron. The locking closed of the required valves during refueling operations precludes the possibility of uncontrolled boron dilution of the filled portion of the RCS. This action prevents flow to the RCS of unborated water by closing flow paths from sources of unborated water.

3/4.9.2 INSTRUMENTATION (2400 ppm for Unit 1 (2000 ppm for Unit 2))

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 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 safety analyses.

3/4.9.4 CONTAINMENT BUILDING PENETRATIONS

The requirements on containment building 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 conditions during CORE ALTERATIONS.