3/4.1 REACTIVITY CONTROL SYSTEMS

3/4.1.1 BORATION CONTROL

SHUTDOWN MARGIN

LIMITING CONDITION FOR OPERATION

3.1.1.1 The SHUTDOWN MARGIN shall be $\geq$ 1% $\Delta k/k$.

APPLICABILITY: MODES 1, 2*, 3, 4 and 5.

ACTION:

With the SHUTDOWN MARGIN < 1% $\Delta k/k$, immediately initiate and continue boration at $\geq$ 18 gpm of 7875 ppm boron or its equivalent, until the required SHUTDOWN MARGIN is restored.

SURVEILLANCE REQUIREMENTS

4.1.1.1.1 The SHUTDOWN MARGIN shall be determined to be $\geq$ 1% $\Delta k/k$:

a. Within one hour after detection of an inoperable control rod(s) and at least once per 12 hours thereafter while the rod(s) is inoperable. If the inoperable control rod is immovable or untrippable, the above required SHUTDOWN MARGIN shall be increased by an amount at least equal to the withdrawn worth of the immovable or untrippable control rod(s).

b. When in MODES 1 or 2#, at least once per 12 hours, by verifying that regulating rod groups withdrawal is within the limits of Specification 3.1.3.6.

c. When in MODE 2## within 4 hours prior to achieving reactor criticality by verifying that the predicted critical control rod position is within the limits of Specification 3.1.3.6.

d. Prior to initial operation above 5% RATED THERMAL POWER after each fuel loading by consideration of the factors of e. below, with the regulating rod groups at the maximum insertion limit of Specification 3.1.3.6.

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

##With $K_{eff} < 1.0$.

*See Special Test Exception 3.10.4.

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SURVEILLANCE REQUIREMENTS (Continued)

e. When in MODES 3, 4 or 5, at least once per 24 hours by consideration of the following factors:

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

4.1.1.1.2 The overall core reactivity balance shall be compared to predicted values to demonstrate agreement within $\pm$ 1% $\Delta k/k$ at least once per 31 Effective Full Power Days (EFPD). This comparison shall consider at least those factors stated in Specification 4.1.1.1.1.e, above. The predicted reactivity values shall be adjusted (normalized) to correspond to the actual core conditions prior to exceeding a fuel burnup of 60 Effective Full Power Days after each fuel loading.

REACTIVITY CONTROL SYSTEMS

BORON DILUTION

LIMITING CONDITION FOR OPERATION

3.1.1.2 The flow rate of reactor coolant through the Reactor Coolant System shall be ≥ 2800 gpm whenever a reduction in Reactor Coolant System boron concentration is being made.*

APPLICABILITY: All MODES.

ACTION:

With the flow rate of reactor coolant through the Reactor Coolant System < 2800 gpm, immediately suspend all operations involving a reduction in boron concentration of the Reactor Coolant System.

SURVEILLANCE REQUIREMENTS

4.1.1.2 The flow rate of reactor coolant through the Reactor Coolant System shall be determined to be ≥ 2800 gpm within one hour prior to the start of and at least once per hour during a reduction in the Reactor Coolant System boron concentration by either:

a. Verifying at least one reactor coolant pump is in operation, or

b. Verifying that at least one DHR pump is in operation and supplying ≥ 2800 gpm to the Reactor Coolant System.

in MODE 5 the boron concentration of the water to be added is equal to or greater than the boron concentration associated with the SHUTDOWN MARGIN requirement of Specification 3.1.1.1, or in MODE 6

MODE 5 or

*In MODE 6 the Reactor Coolant System (RCS) boron concentration may be greater than the boron concentration of water available for addition. If the flowrate of reactor coolant through the RCS is less than 2800 gpm, water of lower boron concentration than the existing RCS concentration may be added to the RCS provided that the boron concentration of the water to be added is equal to or greater than the boron concentration corresponding to the more restrictive reactivity condition specified in Specification 3.9.1.

3/4.1 REACTIVITY CONTROL SYSTEMS

BASES

3/4.1.1 BORATION CONTROL

3/4.1.1.1 SHUTDOWN MARGIN

A sufficient SHUTDOWN MARGIN ensures that 1) the reactor can be made subcritical from all operating conditions, 2) the reactivity transients associated with postulated accident conditions are controllable within acceptable limits, and 3) the reactor will be maintained sufficiently subcritical to preclude inadvertent criticality in the shutdown condition. During Modes 1 and 2 the SHUTDOWN MARGIN is known to be within limits if all control rods are OPERABLE and withdrawn to or beyond the insertion limit.

SHUTDOWN MARGIN requirements vary throughout core life as a function of fuel depletion, RCS boron concentration and RCS T_{avg}. The most restrictive condition occurs at EOL, with T_{avg} at no load operating temperature. The SHUTDOWN MARGIN required is consistent with FSAR safety analysis assumptions.

3/4.1.1.2 BORON DILUTION

A minimum flow rate of at least 2800 gpm provides adequate mixing, prevents stratification and ensures that reactivity changes will be gradual through the Reactor Coolant System in the core during boron concentration reductions in the Reactor Coolant System. A flow rate of at least 2800 gpm will circulate an equivalent Reactor Coolant System volume of 12,110 cubic feet in approximately 30 minutes. The reactivity change rate associated with boron concentration reduction will be within the capability for operator recognition and control.

{INSERT (next page)}

In MODE 6, the RCS boron concentration is typically somewhat higher than the minimum boron concentration required by Specification 3.9.1, and could be higher than the boron concentration of normal sources of water addition. At reduced inventory conditions in the RCS, in order to reduce the possibility of vortexing, the flowrate through the decay heat system may be procedurally restricted to somewhat less than 2800 gpm. In this situation, if water with a boron concentration equal to or greater than the boron concentration required by Specification 3.9.1 is added to the RCS, the RCS is assured to remain above the Specification 3.9.1 requirement, and a flowrate of less than 2800 gpm is not of concern.

3/4.1.1.3 MODERATOR TEMPERATURE COEFFICIENT

The limitations on moderator temperature coefficient (MTC) are provided to ensure that the assumptions used in the accident and transient analyses remain valid through each fuel cycle. The surveillance requirement for measurement of the MTC each fuel cycle are adequate to confirm the MTC value since this coefficient changes slowly due principally to the reduction in RCS boron concentration associated with fuel burnup. The confirmation that the measured MTC value is within its limit provides assurance that the coefficient will be maintained within acceptable values throughout each fuel cycle.

INSERT (New Paragraph, Bases 3/4.1.1.2)

In MODE 5 or MODE 6, the RCS boron concentration is typically somewhat higher than the boron concentration required by Specification 3.1.1.1 (MODE 5) or Specification 3.9.1 (MODE 6), and could be higher than the boron concentration of normal sources of water addition. At reduced inventory conditions in the RCS, in order to reduce the possibility of vortexing, the flowrate through the decay heat system may be procedurally restricted to somewhat less than 2800 gpm. In this situation, if water with a boron concentration equal to or greater than the boron concentration associated with the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 (MODE 5), or the boron concentration corresponding to the more restrictive reactivity condition specified in Specification 3.9.1 (MODE 6), is added to the RCS, the RCS boron concentration is assured to remain above the minimum boron concentration associated with the Specification 3.1.1.1 or Specification 3.9.1 requirement, and a flowrate of less than 2800 gpm is not of concern.

3/4.9 REFUELING OPERATIONS

BORON CONCENTRATION

LIMITING 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:

a. Either a K_{eff} of 0.95 or less, which includes a 1% $\Delta k/k$ conservative allowance for uncertainties, or

b. A boron concentration of $\geq$ 1800 ppm, which includes a 50 ppm conservative allowance for uncertainties.

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 $\geq$ 10 gpm of 8750 ppm boric acid solution or its equivalent until K_{eff} is reduced to $\leq$ 0.95 or the boron concentration is restored to $\geq$ 1800 ppm, whichever is the more restrictive. The provisions of Specification 3.0.3 are not applicable.

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 safety or regulating rod 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 pressure vessel and the refueling canal shall be determined by chemical analysis at least once each 72 hours.

REFUELING OPERATIONS

3/4.9.8 DECAY HEAT REMOVAL AND COOLANT CIRCULATION

ALL WATER LEVELS

LIMITING CONDITION FOR OPERATION

3.9.8.1 At least one decay heat removal loop shall be in operation.*

APPLICABILITY: MODE 6 when the water level above the top of the irradiated fuel assemblies seated within the reactor pressure vessel is ≥ 23 feet.

ACTION:

a. With less than one decay heat removal loop in operation, except as provided in b below, suspend all operations involving an increase in the reactor decay heat load or a reduction in boron concentration of the Reactor Coolant System. Close all containment penetrations providing direct access from the containment atmosphere to the outside atmosphere within 4 hours.

b. The decay heat removal loop may be removed from operation for up to one hour per 8 hour period during the performance of CORE ALTERATIONS in the vicinity of the reactor pressure vessel (hot) legs.

c. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.8.1 Surveillance at least once per 12 hours shall verify at least one decay heat removal loop to be in operation and circulating reactor coolant through the reactor core:

a. At a flow rate of ≥ 2800 gpm, whenever a reduction in Reactor Coolant System boron concentration is being made.*

b. At a flow rate such that the core outlet temperature is maintained ≤140°F, provided no reduction in Reactor Coolant System boron concentration is being made.*

* Water of a lower boron concentration than the existing RCS concentration may be added to the RCS, with the flowrate of reactor coolant through the RCS less than 2800 gpm, provided that the boron concentration of the water to be added is equal to or greater than the boron concentration corresponding to the more restrictive reactivity condition specified in Specification 3.9.1.

REFUELING OPERATIONS

LOW WATER LEVEL

LIMITING CONDITION FOR OPERATION

3.9.8.2 Two independent DHR loops shall be OPERABLE.*

APPLICABILITY: MODE 6 when the water level above the top of the irradiated fuel assemblies seated within the reactor pressure vessel is less than 23 feet.

ACTION:

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

b. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.8.2 At least one DHR loop shall be determined to be in operation per Specification 4.9.8.1. The inactive loop shall be determined to be OPERABLE per Specification 4.0.5.

* The normal or emergency power source may be inoperable for each DHR loop.

REFUELING OPERATIONS

BASES

3/4.9.6 FUEL HANDLING BRIDGE OPERABILITY

The OPERABILITY requirements of the hoist bridges used for movement of fuel assemblies ensures that: 1) fuel handling bridges will be used for movement of control rods and fuel assemblies, 2) each hoist has sufficient load capacity to lift a fuel element, and 3) the core internals and pressure vessel are protected from excessive lifting force in the event they are inadvertently engaged during lifting operations.

3/4.9.7 CRANE TRAVEL - FUEL HANDLING BUILDING

The restriction on movement of loads in excess of the nominal weight of a fuel assembly in a tailed fuel container over other fuel assemblies in the storage pool ensures that in the event this load is dropped (1) the activity release will be limited to that contained in a single fuel assembly, and (2) any possible distortion of fuel in the storage racks will not result in a critical array. This assumption is consistent with the activity release assumed in the accident analyses.

3/4.9.8 COOLANT CIRCULATION

The requirement that at least one decay heat removal loop be in operation ensures that (1) sufficient cooling capacity is available to remove decay heat and maintain the water in the reactor pressure vessel below 140°F as required during the REFUELING MODE, and (2) sufficient coolant circulation is maintained through the reactor core to minimize the effect of a boron dilution incident and prevent boron stratification.

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The requirement to have two DHR loops OPERABLE when there is less than 23 feet of water above the core ensures that a single failure of the operating DHR loop will not result in a complete loss of decay heat removal capability. With the reactor vessel head removed and 23 feet of water above the core, a large heat sink is available for core cooling. Thus, in the event of a failure of the operating DHR loop, adequate time is provided to initiate emergency procedures to cool the core.

3/4.9.9 CONTAINMENT PURGE AND EXHAUST ISOLATION SYSTEM

The OPERABILITY of this system ensures that the containment purge and exhaust penetrations will be automatically isolated upon detection of high radiation levels within the containment. The OPERABILITY of this system is required to restrict the release of radioactive material from the containment atmosphere to the environment.

3/4.9.10 and 3/4.9.11 WATER LEVEL - REACTOR VESSEL AND STORAGE POOL

The restrictions on minimum water level ensure that sufficient water depth is available to remove 99% of the assumed 10% iodine gap activity released from the rupture of an irradiated fuel assembly. The minimum water depth is consistent with the assumptions of the safety analysis.

Insert to Bases 3/4.9.8 (new paragraph)

In MODE 6, the RCS boron concentration is typically somewhat higher than the boron concentration required by Specification 3.9.1, and could be higher than the boron concentration of normal sources of water addition. The flowrate through the decay heat system may at times be reduced to somewhat less than 2800 gpm. In this situation, if water with a boron concentration equal to or greater than the boron concentration required by Specification 3.9.1 is added to the RCS, the RCS is assured to remain above the Specification 3.9.1 requirement, and a flowrate of less than 2800 gpm is not of concern.