Technical Specification Change Request No. 49

Replace pages 3/4 1-1, 3/4 1-2, 3/4 1-14, 3/4 1-16, B 3/4 1-2 and B 3/4 1-3 with the attached revised pages 3/4 1-1, 3/4 1-2, 3/4 1-2a, 3/4 1-2b, 3/4 1-14, 3/4 1-16, 3/4 1-16a, B 3/4 1-2,and B 3/4 1-3.

Proposed Change

Change the SHUTDOWN MARGIN requirement for MODES 4 and 5 from $\geq$1% $\Delta k/k$ to $\geq$2.2% $\Delta k/k$ and associated changes to support this.

Reason for Proposed Change

During the analysis of the deboration incident that occurred at Crystal River - Unit 3 on February 7, 1977, it became apparent that criticality could not be prevented when the reactor was shutdown by 1% $\Delta k/k$ and the Sodium Hydroxide Tank (BST-2) was pumped into the RCS by a Decay Heat Removal Pump. To preclude criticality for at least 15 minutes during a similar MODE 4 dilution event, the reactor must be $\geq$2.2% $\Delta k/k$ shutdown. This SHUTDOWN MARGIN is also proposed during MODE 5 for consistency of operation and of the Technical Specifications.

Safety Analysis Justifying the Proposed Change

The proposed change will require $\geq$2.2% $\Delta k/k$ SHUTDOWN MARGIN in MODES 4 and 5. The two single-failure deboration scenarios in MODE 4 are as follows:

1. The Decay Heat Removal System is operating and an isolation valve to BST-2 fails.

2. The Decay Heat Removal System is aligned for operation, the Decay Heat pump is not operating and an isolation valve to the Sodium Hydroxide Tank (BST-2) fails.

Neither scenario is credible in MODE 5, since the manual isolation valves as well as the automatic isolation valves are closed. However, this SHUTDOWN MARGIN is also being proposed for MODE 5 for consistency of the Technical Specifications and plant operation even though this accident is not credible. In MODE 5, the Containment Spray System is not required to be OPERABLE and the manual isolation valves are closed on BST-2.

For the first scenario, the analysis was performed using the same calculational techniques as were used to evaluate the adequacy of the 1% $\Delta k/k$ SHUTDOWN MARGIN in the Cycle 2 Reload Report (BAW-1521, February, 1979). A BOL cold shutdown requirement of 1104 ppm was assumed. This will lead to the maximum boron concentration change due to dilution. The inverse boron worth for this temperature range is 76.4 ppm/% $\Delta k/k$. Using a shutdown margin of 2.16% $\Delta k/k$, it will require 4943 gallons of sodium hydroxide (assumed 0 ppm) for the reactor to attain criticality (B&W Analysis, July 1, 1979). The maximum flow rate is 296 gpm decreasing to 180 gpm within 14 seconds (GAI report to FPC, May 11, 1979). If BST-2 is at its high alarm level, it will drain two (2) feet before the low level is

reached. This will be 746 gallons or 2.7 minutes maximum, before the operator receives the low level annunciator alarm from BST-2. Assuming that the sodium hydroxide goes directly to the reactor vessel from BST-2 and stays there (i.e., no transport time through the Decay Heat Removal System and no mixing with other reactor coolant), it will take an additional 15 minutes until there is sufficient sodium hydroxide in the reactor to cause the decrease of 165 ppm boron that is required for criticality. Realistically analyzing the scenario, the 3000 gpm of 1104 ppm boron reactor coolant will mix with the 280 gpm of 0 ppm boron sodium hydroxide to result in a mixture with a boron concentration of 1001 ppm. This is not sufficient to achieve criticality in the reactor.

In the second scenario, flow from BST-2 is precluded by its isolation check valves if the reactor coolant pressure is $\geq$12 psig (GAI report to FPC, May 11, 1979). While the temperature range of MODE 4 is 200°F to 280°F, approximately 50 psig of pressure is maintained in the RCS at the lower temperature of MODE 4 for saturation condition considerations.

This evaluation will not be invalidated by the proposed power upgrade of Crystal River Unit 3 as the boron dilution accident is limiting only in MODE 4.

3/4.1 REACTIVITY CONTROL SYSTEMS

3/4.1.1 BORATION CONTROL

SHUTDOWN MARGIN

LIMITING CONDITION FOR OPERATION

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

APPLICABILITY: MODES 1, 2* and 3.

ACTION:

With the SHUTDOWN MARGIN <1% $\Delta k/k$, immediately initiate and continue boration at $\geq$10 gpm of 11,600 ppm boron or its equivalent, until the required SHUTDOWN MARGIN is restored.

SURVEILLANCE REQUIREMENTS

4.1.1.1.1.1 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 3.1.3.5.

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.

SURVEILLANCE REQUIREMENTS (Continued)

e. When in MODE 3, 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.

4.1.1.1.1.2 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 4.1.1.1.1.1.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.

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3/4.1.1 BORATION CONTROL

SHUTDOWN MARGIN

LIMITING CONDITION FOR OPERATION

3.1.1.1.2 The SHUTDOWN MARGIN shall be $\geq$2.2% $\Delta k/k$.

APPLICABILITY: MODES 4 and 5.

ACTION:

With the SHUTDOWN MARGIN <2.2% $\Delta k/k$, immediately initiate and continue boration at $\geq$10 gpm of 11,600 ppm boron or its equivalent, until the required SHUTDOWN MARGIN is restored.

SURVEILLANCE REQUIREMENTS

4.1.1.1.2.1 The SHUTDOWN MARGIN shall be determined to be $\geq$2.2% $\Delta k/k$:

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

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SURVEILLANCE REQUIREMENTS (Continued)

c. When in MODE 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.

4.1.1.1.2.2 The overall core reactivity balance shall be compared to predicted values to demonstrate agreement within $\pm 1\%$ $\Delta k/k$ at least once , 31 Effective Full Power Days (EFPD). This comparison shall consider at least those factors stated in Specification 4.1.1.1.2.1.c 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.

BORATED WATER SOURCES - SHUTDOWN

LIMITING CONDITION FOR OPERATION

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

a. A concentrated boric acid storage system and associated heat tracing with:

1. A minimum contained borated water volume of 6000 gallons,

2. Between 11,600 and 14,000 ppm of boron, and

3. A minimum solution temperature of 105°F.

b. The borated water storage tank (BWST) with:

1. A minimum contained borated water volume of 13,500 gallons,

2. A minimum boron concentration of 2270 ppm, and

3. A minimum solution temperature of 40°F.

APPLICABILITY: MODES 5 and 6.

ACTION:

With no borated water sources OPERABLE, suspend all operations involving CORE ALTERATION or positive reactivity changes until at least one borated water source is restored to OPERABLE status.

SURVEILLANCE REQUIREMENTS

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

a. At least once per 7 days by:

1. Verifying the boron concentration of the water,

2. Verifying the contained borated water volume of the tank, and

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BORATED WATER SOURCES - OPERATING

LIMITING CONDITION FOR OPERATION

3.1.2.9 Each of the following borated water sources shall be OPERABLE:

a. The concentrated boric acid storage system and associated heat tracing with:

1. A minimum contained borated water volume of 6000 gallons,

2. Between 11,600 and 14,000 ppm of boron, and

3. A minimum solution temperature of 105°F.

b. The borated water storage tank (BWST) with:

1. A contained borated water volume of between 415,200 and 449,000 gallons,

2. Between 2270 and 2450 ppm of boron, and

3. A minimum solution temperature of 40°F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

MODES 1, 2 and 3:

a. With the concentrated boric acid storage system inoperable, restore the storage system to OPERABLE status within 72 hours or be in at least HOT STANDBY and borated to a SHUTDOWN MARGIN equivalent to 1% $\Delta k/k$ at 200°F within the next 6 hours; restore the concentrated boric acid storage system to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

b. With the borated water storage 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.

MODE 4:

a. With the concentrated boric acid storage system inoperable, restore the storage system to OPERABLE status within 72 hours or be

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BORATED WATER SOURCES - OPERATING

LIMITING CONDITION FOR OPERATION

in at least HOT STANDBY and borated to a SHUTDOWN MARGIN equivalent to 2.2% $\Delta k/k$ at 200°F within the next 6 hours; restore the concentrated boric acid storage system to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

b. With the borated water storage 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.

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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 525°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) makeup or DHR pumps, 3) separate flow paths, 4) boric acid pumps, 5) associated heat tracing systems, and 6) an emergency power supply from OPERABLE emergency busses.

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 all operating conditions of 1.0% $\Delta k/k$ after xenon decay and cooldown to 200°F. The maximum boration capacility requirement occurs at EOL from full power equilibrium xenon conditions and requires either 6000 gallons of 11,600 ppm borated water from the boric acid storage tanks or 38,270 gallons of 2270 ppm borated water from the borated water storage tank.

The requirements for a minimum contained volume of 415,200 gallons of borated water in the borated water storge tank ensures the capability for borating the RCS to the desired level. The specified quantity of borated water is consistent with the ECCS requirements of Specification 3.5.4. Therefore, the larger volume of borated water is specified.

With the RCS temperature below 200°F, one injection system is acceptable without single failure consideration on the basis of the

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3/4.1.2 BORATION SYSTEMS (Continued)

stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity change in the event the single injection system becomes inoperable.

The boron capability required below 200°F is sufficient to provide a SHUTDOWN MARGIN of 2.2% of $\Delta k/k$ after xenon decay and cooldown from 200°F to 140°F. This condition requires either 300 gallons of 11,600 ppm borated water from the boric acid storage system or 1608 gallons of 2270 ppm borated water from the borated water storage tank. To envelope future cycle BWST contained borated water volume requirements, a minimum volume of 13,500 gallons is specified.

The contained water volume limits include allowance for water not available because of discharge line location and other physical characteristics. The limits on contained water volume, and boron concentration ensure a pH value of between 7.2 and 11.0 of the solution sprayed within containment after a design basis accident. The pH band minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion cracking on mechanical systems and components.

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

3/4.1.3 MOVABLE CONTROL ASSEMBLIES

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

The ACTION statements which permit limited variations from the basic requirements are accompanied by additional restrictions which ensure that the original criteria are met. For example, misalignment of a safety or regulating rod requires a restriction in THERMAL POWER. The reactivity worth of a misaligned rod is limited for the remainder of the fuel cycle to prevent exceeding the assumptions used in the safety analysis.

The position of a rod declared inoperable due to misalignment should not be included in computing the average group position for determining the OPERABILITY of rods with lesser misalignments.

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