2.10.2 Reactivity Control Systems and Core Physics Parameters Limits

Applicability

Applies to operation of control element assemblies and monitoring of selected core parameters whenever the reactor is in cold or hot shutdown, hot standby, or power operation conditions.

Objective

To ensure (1) adequate shutdown margin following a reactor trip, (2) the MTC is within the limits of the safety analysis, and (3) control element assembly operation is within the limits of the setpoint and safety analysis.

Specification

(1) Shutdown Margin with T_{cold} >210°F

Whenever the reactor is in hot shutdown, hot standby or power operation conditions, the shutdown margin shall be ≥3.0% Δk/k. With the shutdown margin <3.0% Δk/k, initiate and continue boration until the required shutdown margin is achieved.

(2) Shutdown Margin with T_{cold} ≤210°F

Whenever the reactor is in cold shutdown conditions, the shutdown margin shall be ≥3.0% Δk/k. With the shutdown margin <3.0% Δk/k, initiate and continue boration until the required shutdown margin is achieved.

(3) Moderator Temperature Coefficient

The moderator temperature coefficient (MTC) shall be:

a. Less positive than $+0.2 \times 10^{-4}$ Δρ/°F including uncertainties for power levels at or above 80% of rated power.

b. Less positive than $+0.5 \times 10^{-4}$ Δρ/°F including uncertainties for power levels below 80% of rated power.

c. More positive than -2.3×10^{-4} Δρ/°F including uncertainties at rated power.

With the moderator temperature coefficient confirmed outside any one of the above limits, change reactivity control parameters to bring the extrapolated MTC value within the above limits within 3 hours or be in at least hot shutdown within 6 hours.

the shutdown margin requirement is based upon this limiting condition and is consistent with FSAR safety analysis assumptions. With $T_{cold} \leq 210^{o}F$, the reactivity transients resulting from any postulated accident are minimal and a 3.0% $\Delta k/k$ shutdown margin provides adequate protection.

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

The specifications applicable to one or more CEA's that are determined to be untrippable or stuck, and to one or more misaligned CEA's that cannot be restored to within 12 inches of any other CEA in their group, require a prompt shutdown of the reactor since any of these conditions may be indicative of a possible loss of mechanical functional capability of the CEA system and in the event of any untrippable CEA, the loss of shutdown margin.

For small misalignments (<18 inches absolute) of the CEA's, there is 1) a small degradation in the peaking factors relative to those assumed in generating LCO's and LSSS setpoints for DNBR and linear heat rate, 2) a small effect on the time dependent long term power distributions relative to those used in generating LCO's and LSSS setpoints for DNBR and linear heat rate, 3) a small effect on the available shutdown margin, and 4) a small effect on the ejected CEA worth used in the safety analysis. Therefore, the action statement associated with the small misalignment of a CEA permits a one hour time interval during which attempts may be made to restore the CEA to within its alignment requirements prior to initiating a reduction in power. The one hour time is sufficient to 1) identify causes of a misaligned CEA, 2) take appropriate corrective action to realign the CEA's, and 3) minimize the effects of xenon redistribution.

Overpower margin is provided to protect the core in the event of a large misalignment ($\geq$18 inches) of a CEA. However, this misalignment would cause distortion of the core power distribution. The reactor protective system would not detect the degradation in radial peaking factors and since variations in other systems parameters (e.g., pressure and coolant temperature) may not be sufficient

DISCUSSION

The previous boron dilution analysis for a cold shutdown condition assumed that the reactor coolant system (RCS) remained full. Under certain conditions, such as reactor coolant pump seal replacement, the RCS may be drained to a level which is approximately half the normal volume.

The boron dilution incident was reanalyzed using the refueling mode volume for the cold shutdown condition, because it is the minimum volume allowed. If a 2.0% $\Delta k/k$ shutdown margin is assumed for the cold shutdown mode, with a volume equal to that of the refueling condition, a dilution time to criticality of less than 15 minutes exists. To obtain a dilution time greater than 15 minutes, a shutdown margin of 3.0% $\Delta k/k$ is adequate. These dilution times assume the boron concentration corresponds to a configuration with the shutdown groups being withdrawn and all regulating rods except the most reactive being inserted. These assumptions, which are defined by the Technical Specifications, yield the highest boron concentration which gives the minimum dilution time. Normally all rods would be inserted when in the cold shutdown mode. An acceptable dilution time to critical has been maintained in the past (with a shutdown margin of 2.0% $\Delta k/k$) taking credit for the worth of all rods being inserted and the HZP-xenon free boron concentration.

JUSTIFICATION FOR FEE CLASSIFICATION

The proposed amendment is deemed to be Class III within the meaning of 10 CFR 170.22 in that it involves a single safety concern.

ATTACHMENT C