TECHNICAL SPECIFICATION BASES CHANGES

THIMBLE PLUG REMOVAL

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BASES

The specifications of this section provide assurance of fuel integrity during Condition I (Normal Operation) and II (Incidents of Moderate Frequency) events by: (1) maintaining the minimum DNBR in the core at or above the safety analysis DNBR limits during normal operation and in short-term transients, and (2) limiting the fission gas release, fuel pellet temperature, and cladding mechanical properties to within assumed design criteria. In addition, limiting the peak linear power density during Condition I events provides assurance that the initial conditions assumed for the LOCA analyses are met and the ECCS acceptance criteria limit of 2200°F is not exceeded.

The definition of certain hot channel and peaking factors as used in these specifications are as follows:

$F_Q(Z)$ Heat Flux Hot Channel Factor, is defined as the maximum local heat flux on the surface of a fuel rod at core elevation Z divided by the average fuel rod heat flux, allowing for manufacturing tolerances on fuel pellets and rods; and

$F^N_{\Delta H}$ Nuclear Enthalpy Rise Hot Channel Factor, is defined as the ratio of the integral of linear power along the rod with the highest integrated power to the average rod power.

3/4.2.1 AXIAL FLUX DIFFERENCE

The limits on AXIAL FLUX DIFFERENCE (AFD) assure that the $F_Q(Z)$ upper bound envelope~~s~~ of ~~2.32 and~~ 2.50 for ~~OFA and~~ VANTAGE 5 fuel ~~, respectively,~~ times the normalized axial peaking factor are not exceeded during either normal operation or in the event of xenon redistribution following power changes.

Target flux difference is determined at equilibrium xenon conditions. The full-length rods may be positioned within the core in accordance with their respective insertion limits and should be inserted near their normal position for steady-state operation at high power levels. The value of the target flux difference obtained under these conditions divided by the fraction of RATED THERMAL POWER is the target flux difference at RATED THERMAL POWER for the associated core burnup conditions. Target flux differences for other THERMAL POWER levels are obtained by multiplying the RATED THERMAL POWER value by the appropriate fractional THERMAL POWER level. The periodic updating of the target flux difference value is necessary to reflect core burnup considerations.

The limits on AXIAL FLUX DIFFERENCE (AFD) are given in Specification 3.2.1. Two modes of operation are permissible. One mode is Normal Operation, where the applicable AFD limit is defined by Specification 3.2.1.a. The AFD limit for this mode of operation is a +3, -12% target band about the target flux difference. After extended load following maneuvers, the AFD limits may result in restrictions in the maximum allowed power to quarantee operation with $F_Q(Z)$ less than its limiting value. To prevent this occurrence, another operating mode which

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Each of these is measurable but will normally only be determined periodically as specified in Specifications 4.2.2 and 4.2.3. This periodic surveillance is sufficient to ensure that the limits are maintained provided:

a. Control rods in a single group move together with no individual rod insertion differing by more than ± 12 steps, indicated, from the group demand position.

b. Control rod banks are sequenced with overlapping groups as described in Specification 3.1.3.6.

c. The control rod insertion limits of Specification 3.1.3.6 are maintained.

d. The axial power distribution, expressed in terms of AXIAL FLUX DIFFERENCE, is maintained within the limits.

$F^N_{\Delta H}$ will be maintained within its limits provided conditions a. through d. above are maintained. The relaxation of $F^N_{\Delta H}$ as a function of THERMAL POWER allows changes in the radial power shape for all permissible rod insertion limits.

When an F_Q measurement is taken, an allowance for both experimental error and manufacturing tolerance must be made. An allowance of 5% is appropriate for a full-core map taken with the incore detector flux mapping system and a 3% allowance is appropriate for manufacturing tolerance.

When $F^N_{\Delta H}$ is measured (i.e., inferred), no additional allowances are necessary prior to comparison with the limits of Section 3.2.3. An error allowance of 4% has been included in the limits of Section 3.2.3.

Specifications 3.2.2 and 3.2.3 contain the F_Q and F-delta-H limits applicable to VANTAGE 5 fuel. ~~The OFA fuel is analyzed to lower limits since it will have experienced burnup, thereby reducing the attainable OFA-specific hot channel factors such that the expected peak power levels and peak radial power of the OFA fuel will be much less than that necessary to approach the OFA F_Q and F-delta-H analysis limits.~~

Margin between the safety analysis DNBR limits ~~(1.42 and 1.45 for the Optimized fuel thimble and typical cells, respectively, and~~ (1.61 and 1.69 for the VANTAGE 5 thimble and typical cells) and the design DNBR limits ~~(1.33 and 1.35 for the Optimized fuel thimble and typical cells and~~ (1.33 and 1.34 for the VANTAGE 5 thimble and typical cells, respectively) is maintained. A fraction of this margin is utilized to accommodate the ~~transition core DNBR penalty~~

3/4.2.2 and 3/4.2.3 HEAT FLUX HOT CHANNEL FACTOR AND NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR (Continued)

~~(12% for VANTAGE 5 fuel) and the~~ appropriate fuel rod bow DNBR penalty ~~(less than 1.5%~~ per WCAP-8691, Rev. 1). The margin between design and safety analysis DNBR limits of ~~6.3% for Optimized fuel and~~ 17.4% for VANTAGE 5 fuel includes greater than ~~3%~~ margin for ~~both Optimized fuel and VANTAGE 5 fuel for~~ plant design flexibility.

The hot channel factor $F_Q^M(z)$ is measured periodically and increased by a cycle and height dependent power factor appropriate to either Normal Operation or RESTRICTED AFD OPERATION, $W(z)_{NO}$ or $W(z)_{RAFDO}$, to provide assurance that the limit on the hot channel factor, $F_Q(z)$, is met. $W(z)_{NO}$ accounts for the effects of normal operation transients and was determined from expected power control maneuvers over the full range of burnup conditions in the core. $W(z)_{RAFDO}$ accounts for the more restrictive operating limits required by RESTRICTED AFD OPERATION which result in less severe transient values. The W(z) functions are provided in the Peaking Factor Limit Report per Specification 6.9.1.?.

Provisions to account for the possibility of decreases in margin to the $F_Q(z)$ limit during intervals between surveillances are provided. Any decrease in the minimum margin to the $F_Q(z)$ limit compared to the minimum margin determined from the previous flux map is determined by comparing the ratio of:

$$\begin{matrix}\text{maximum}\\ \text{over } z\end{matrix}\left(\frac{F_Q^M(z)}{K(z)}\right)$$

taken from the current map to the same ratio from the previous map. The ratios to be compared from the two flux maps do not need to be calculated at identical z locations. Increases in this ratio indicate that the minimum margin to the $F_Q(z)$ limit has decreased and that additional penalties must be applied to the measured $F_Q(z)$ to account for further decreases in margin that could occur before the next surveillance. More frequent surveillances may also be substituted for the additional penalty.

3/4.2.4 QUADRANT POWER TILT RATIO

The QUADRANT POWER TILT RATIO limit assures that the radial power distribution satisfies the design values used in the power capability analysis. Radial power distribution measurements are made during STARTUP testing and periodically during power operation.

The limit of 1.02, at which corrective action is required, provides DNB and linear heat generation rate protection with x-y plane power tilts. A

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, the flow anomaly penalty (3.3%), and the thimble plug removal penalty (3.1%).