3.3 LIMITING CONDITIONS FOR OPERATION BASES

A. Reactivity Limitations

1. Reactivity margin - core loading

The core reactivity limitation is a restriction to be applied principally to the design of new fuel which may be loaded in the core or into a particular refueling pattern. Satisfaction of the limitation can only be demonstrated at the time of loading and must be such that it will apply to the entire subsequent fuel cycle. The generalized form is that the reactivity of the core loading will be limited so the core can be made subcritical by at least R + 0.25% Δk in the most reactive condition during the operating cycle, with the strongest control rod fully withdrawn and all others fully inserted. The value of R in % Δk is the amount by which the core reactivity, at any time in the operating cycle, is calculated to be greater than at the time of the check; i.e., the initial loading. R must be a positive quantity or zero. A core which contains temporary control or other burnable neutron absorbers may have a reactivity characteristic which increases with core lifetime, goes through a maximum, and decreases thereafter.

The value of R is the difference between the calculated core reactivity at the beginning of the operating cycle and the calculated value of the core reactivity any time later in the cycle where it would be greater than at the beginning. The value of R shall include the potential shutdown margin loss assuming full B_4C settling in all inverted poison tubes present in the core. A new value of R must be determined for each new fuel cycle.

The 0.25% Δk in the expression R + 0.25% Δk is provided as a finite, demonstrable, subcriticality margin. This margin is Verified using an insequence control rod withdrawal at the beginning-of-life fuel cycle conditions ~~demonstrated by full withdrawal of the strongest rod and partial withdrawal of an adjacent rod to a position calculated to insert~~ at ~~least R + 0.25% Δk in reactivity. Observation of subcriticality in this condition~~ This assures subcriticality with not only the stongest rod fully withdrawn but a margin of at least R + 0.25% Δk beyond this.

2. Reactivity margin - stuck control rods

Specification 3.3.A.2 requires that a rod be taken out of service if it cannot be moved with drive pressure. If the rod is fully inserted and then disarmed electrically, (Note: To disarm the drive electrically, four amphenol type plug connectors are removed from the drive insert and withdrawal solenoids, rendering the drive immovable. This procedure is equivalent to valving out the drive

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Also if damage within the control rod drive mechanism and in particular, cracks in drive internal housings, cannot be ruled out, then a generic problem affecting a number of drives cannot be ruled out. Circumferential cracks resulting from stress assisted intergranular corrosion have occurred in the collect housing of drives at several BWR's. This type of cracking could occur in a number of drives and if the cracks propagated until severance of the collet housing occurred, scram could be prevented in the affected rods. Limiting the period of operation with a potentially severed collet housing and requiring increased surveillance after detecting one stuck rod will assure that the reactor will not be operated with a large number of rods with failed collet housings.

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The value of R is the difference between the calculated core reactivity at the beginning of the operating cycle and the calculated value of core reactivity any time later in the cycle where it would be greater than at the beginning. For the first fuel cycle, R was calculated to be not greater than 0.10% delta k. A new value of R must be determined for each fuel cycle.

The 0.25% delta k in the expression R + 0.25% delta k is provided as a finite, demonstrable, sub-criticality margin. ~~This margin is demonstrated by full withdrawal of the strongest rod and partial withdrawal of an adjacent rod to a position calculated to insert at least R + 0.25% delta k in reactivity. Observation of sub-criticality in this condition assures sub-criticality with not only the strongest rod fully withdrawn but at least a R + 0.25% delta k margin beyond this.~~

This margin is verified using an insequence control rod withdrawal at the beginning-of-life fuel cycle conditions. This assures subcriticality with not only the strongest rod fully withdrawn but at least a R+0.25% delta k margin beyond this.

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NOTE: This change issued by letter dated 08/27/75 which noted that 0.02% delta k should be included in the value.

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Bases change per 10/13/94
letter, G.Benes to
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