c. Quadrant Power Tilt Limits

1. Except for physics tests, whenever the indicated quadrant power tilt ratio exceeds 1.02, one of the following actions shall be taken within two hours:

   A. Eliminate the tilt.

   B. Restrict maximum core power level two percent for every one percent of indicated power tilt ratio exceeding 1.0.

2. If the tilt condition is not eliminated after 24 hours, reduce power to 50 percent or lower.

3. Except for low power physics tests, if the indicated quadrant tilt exceeds 1.09 and there is simultaneous indication of a misaligned rod:

   A. Restrict maximum core power level by 2 percent of rated values for every one percent of indicated power tilt ratio exceeding 1.0.

   B. If the tilt condition is not eliminated within 12 hours, the reactor shall be brought to a minimum load condition ($\leq$ 30 Mwe).

4. If the indicated quadrant tilt exceeds 1.09 and there is no simultaneous indication of rod misalignment, the reactor shall immediately be brought to a No Load condition ($\leq$ 5% reactor power).

d. Rod Insertion Limits

1. The shutdown rods shall be fully withdrawn when the reactor is critical or approaching criticality.

2. 2. The control banks shall be limited in physical insertion; insertion limit is shown in Figure TS 3.10-4. Core 4 insertion limits shall be in accordance with Figure TS 3.10-3 to assure sufficient shutdown margin for the cycle. 33

3. Insertion limit does not apply during physics tests or during periodic exercise of individual rods. However, the shutdown margin indicated in Figure TS 3.10-1 must be maintained except for the low power physics test

Trip shutdown reactivity is provided consistent with plant safety analysis assumptions. To maintain the required trip reactivity, the rod insertion limits of Figure TS 3.10-4 must be observed. In addition, for hot shutdown conditions, the shutdown margin of Figure TS 3.10-1 must be provided for protection against the steambreak accident. To assure adequate at power shutdown margin during operation of Core 4, the shutdown margin of Figure TS 3.10-3 shall apply. 33

Rod insertion limits are used to assure adequate trip reactivity, to assure meeting power distribution limits, and to limit the consequences of a hypothetical rod ejection accident. The available control rod reactivity or excess beyond needs, decreases with decreasing boron concentration, because the negative reactivity required to reduce the core power level from full power to zero power is largest when the boron concentration is low.

The intent of the test to measure control rod worth and shutdown margin (Specification 3.10.d.3) is to measure the worth of all rods less the worth of the worst case of an assumed stuck rod; that is, the most reactive rod. The measurement would be anticipated as part of the initial startup program and infrequently over the life of the plant, to be associated primarily with determinations of special interest, such as end-of-life cooldown or startup of fuel cycles which deviate from normal equilibrium conditions in terms of fuel loading patterns and anticipated control bank worths. These measurements will augment the normal fuel cycle design calculations and place the knowledge of shutdown capability on a firm experimental as well as analytical basis.

Operation with abnormal rod configuration during low power and zero power testing is permitted because of the brief period of the test and because special precautions are taken during the test.

Control Rod Insertion Limits
as a Function of Power
Kewaunee Nuclear Plant
Unit 1 - Cycle 4

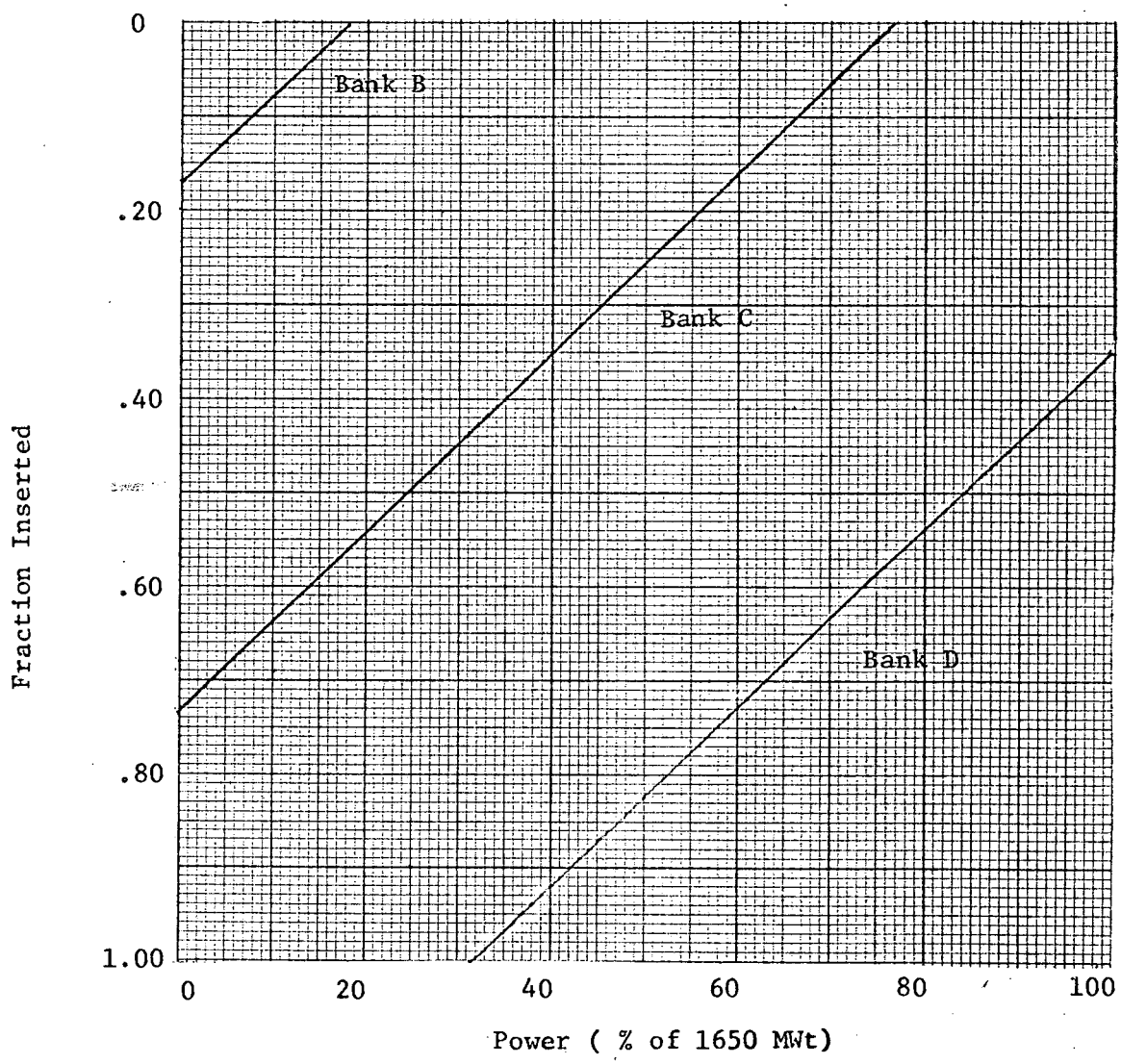

FIGURE TS 3.10-3

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