2.3 LIMITING SAFETY SYSTEM SETTINGS, PROTECTIVE INSTRUMENTATION

Applicability

Applies to trip settings for instruments monitoring reactor power and reactor coolant pressure, temperature, and flow and pressurizer level.

Objective

To provide for automatic protective action in the event that the principal process variables approach a safety limit.

Specification

2.3.1 Protective instrumentation settings for reactor trip shall be as follows:

2.3.1.1 Start-up protection

a. High flux, power range (low setpoint) $\leq$25% of rated power.

2.3.1.2 Core protection

a. High flux, power range (high setpoint) $\leq$109% of rated power*

b. High pressurizer pressure $\leq$2385 psig.

c. Low pressurizer pressure $\geq$1835 psig.

*Rated power is defined here as 1955 Mwt under the reduced T_{avg} program and 2300 Mwt under the normal T_{avg} program.

d. Overtemperature ΔT

$$\leq \Delta T_o \{K_1 - K_2 (T - 575.4) + K_3 (P - 2235) - f(\Delta I)\} \quad *$$

where:
ΔT_o = Indicated ΔT at rated power**, °F;
T = Average temperature, °F;
P = Pressurizer pressure, psig;
K_1 = 1.1619;
K_2 = 0.01035;
K_3 = 0.0007978;

and $f(\Delta I)$ is a function of the indicated difference between top and bottom detectors of the power-range nuclear ion chambers; with gains to be selected based on measured instrument response during plant start-up tests such that:

(1) For $(q_t - q_b)$ within +12% and -17%, where q_t and q_b are percent power in the top and bottom halves of the core, respectively, and $q_t + q_b$ is total core power in percent of rated power (2300 Mwt), $f(\Delta I) = 0$. For every 2.4% below rated power (2300 Mwt) level, the permissible positive flux difference range is extended by +1 percent. For every 2.4% below rated power (2300 Mwt) level, the permissible negative flux difference range is extended by -1 percent.

(2) For each percent that the magnitude of $(q_t - q_b)$ exceeds +12% in a positive direction, the ΔT trip setpoint shall be automatically reduced by 2.4% of the value of ΔT at rated power (2300 Mwt).

(3) For each percent that the magnitude of $(q_t - q_b)$ exceeds -17%, the ΔT trip setpoint shall be automatically reduced by 2.4% of the value of ΔT at rated power (2300 Mwt).

*When operating under the reduced T_{avg} program, replace the number 575.4 with 537.9 in the overtemperature ΔT calculation.

**Rated power is defined here as 1955 Mwt under the reduced T_{avg} program and 2300 Mwt under the normal T_{avg} program.

e. Overpower ΔT

$$\leq \Delta T_o [K_4 - K_5 \frac{dT}{dt} - K_6 (T - T') - f(\Delta I)],$$

where:

ΔT_o = Indicated ΔT at rated power**, °F;

T = Average temperature, °F;

T'* = Indicated average temperature at nominal conditions and rated power**, °F;

K_4 = 1.07;

K_5 = 0 for decreasing average temperature and 0.2 seconds per °F for increasing average temperature;

K_6 = 0.002235 for $T>T'$; $K_6 = 0$ for $T<T'$;

$f(\Delta I)$ = as defined in d. above.

f. Low reactor coolant loop flow $\geq 90\%$ of normal indicated flow

g. Low reactor coolant pump frequency ≥ 57.5 Hz

h. Undervoltage $\geq 70\%$ of normal voltage.

2.3.1.3 Other Reactor Trips

a. High pressurizer water level $\leq 92\%$ of span

b. Low-low steam generator water level $\geq 14\%$ of narrow range instrument span.

2.3.2 Protective instrumentation settings for reactor trip interlocks shall be as follows:

2.3.2.1 The low pressurizer pressure trip, high pressurizer level trip, and the low reactor coolant flow trip (for two or more loops) may be bypassed below 10% of rated power.

2.3.2.2 The single-loop-loss-of-flow trip may be bypassed below 45% of rated power.

*The value of T' for nominal conditions and rated power is 575.4°F. When operating under the reduced temperature conditions described in the November 11, 1981 license submittal, replace the number 575.4 with 537.9 in the overpower ΔT calculation.

**Rated power is defined here as 1955 Mwt under the reduced T_{avg} program and 2300 Mwt under the normal T_{avg} program

3.10.1.5 Except for physics tests, if a full length control rod is withdrawn as follows:

- at positions $\geq$200 steps and is >15 inches out of alignment with its bank position, or
- at positions <200 steps and is >7.5 inches out of alignment with the average of its bank position

then within two hours, perform the following:

a. Correct the situation, or

b. Determine by measurement the hot channel factors and apply Specification 3.10.2.1, or

c. Limit power to 70 percent of rated power* for three-loop operation.

3.10.1.6 Insertion limits do not apply during physics tests or during period exercise of individual rods. However, the shutdown margin indicated in Figure 3.10-2 must be maintained, except during the low power physics test to measure control rod worth and shutdown margin. For this test, the reactor may be critical with all but one full length control rod inserted.

3.10.2 Power Distribution Limits

3.10.2.1 At all times except during low power physics tests, the hot channel factors defined in the basis must meet the following limits:

Under the normal T_{avg} program	Under the reduced T_{avg} program
$F_Q(Z) \leq (2.20/P) \times K(Z)$ for $P > .5$,	$F_Q(Z) \leq (2.32/P1) \times K(Z)$ for $P1 > .5$,
$F_Q(Z) < (4.40) \times K(Z)$ for $P \leq .5$,	$F_Q(Z) < (4.64) \times K(Z)$ for $P1 \leq .5$

*Rated power is defined here as 2300 Mwt for the normal T_{avg} program and 1955 Mwt for the reduced T_{avg} program where P is the fraction of rated power (2300 Mwt) at which the core is operating under the normal T_{avg} program, P1 is the fraction of 1955 Mwt at which the core is operating under the reduced T_{avg} program, K(Z) is based on the function given in Figure 3.10-3, and Z is the core height location of F_Q.

Under both the normal T_{avg} program and the reduced T_{avg} program:

$$F^N_{\Delta H} < 1.55\ (1 + 0.2(1-P))$$

where P is the fraction of rated power (2300 Mwt) at which the core is operating.

3.10.2.1.1 At power levels in excess of 94% rated power, or if the value of Fxy for the unrodded plane of the core exceeds 1.435 as determined from power distribution maps using the movable detector system, the Axial Power Distribution Monitoring System (APDMS) will be employed to monitor $F_Q(Z)$ above a predetermined power level, P_{APDMS}. The limiting value is expressed as:

Under the normal T_{avg} program	Under the reduced T_{avg} program
$[F_j(Z)S(Z)]_{max} \leq \frac{1.994/P}{\overline{R}_j(1+\sigma_j)}$	$[F_j(Z)\ S(Z)]_{max} \leq \frac{2.103/P1}{\overline{R}_j\ (1+\sigma_j)}$

where:

a. P is the fraction of rated power (2300 Mwt) at which the core is operating ($P \leq 1.0$) and P1 is the fraction of 1955 Mwt at which the core is operating ($P1 \leq 1.0$).

b. $\overline{R}_j$, for thimble j, is determined from core power maps i and is by definition:

$$\overline{R}_j = 1/6 \sum_{i=1}^{6} \frac{F_{qi}^{N}}{[F(Z)_{ij}S(Z)]_{max}}$$

F_{qi}^{N} is the value obtained from a full core map without the measurement uncertainty factor F_u^N. The quantity $F(Z)_{ij}S(Z)$ is the measured value without inclusion of the instrument uncertainty factor F_q^a. Those uncertainty factors, $F_u^N = 1.05$ and $F_q^a = 1.02$, have been included in the limiting value of 1.994/P for the normal T_{avg} program and 2.103/P1 for the reduced T_{avg} program.

c. σ_j is the standard deviation associated with the determination of $\overline{R}_j$.

d. S(Z) is the inverse of the K(Z) function given in Figure 3.10-3.

This limit is not applicable during physics test and excore calibrations.

3.10.2.1.2 The predetermined power level at which APDMS initiation is required is given by the relation

For the normal T_{avg} program	For the reduced T_{avg} program
$P_{APDMS} \leq \frac{1.435}{Fxy} \times 0.94$	$Pl_{APDMS} \leq \frac{1.435}{Fxy}$

where P_{APDMS} is the fraction of rated power and Pl_{APDMS} is the fraction of 1955 Mwt.

3.10.2.1.3 Fxy shall be determined for the unrodded core plane regions away from fuel support grids, located between a core plane elevation 2.0 feet from the top of the core and a core plane elevation 2.0 feet from the bottom of the core with no control rod inserted more than 2.0 feet into the core. This determination shall be made from the movable incore detector maps specified in 3.10.2.3.

3.10.2.2 If either measured hot channel factor exceeds these values, the reactor power shall be reduced so as not to exceed a fraction of the design value* equal to the ratio of the F_Q^N or $F_{\Delta H}^N$ limit to the measured value, whichever is less, and the high neutron flux trip setpoint shall be reduced by the same ratio. If subsequent incore mapping cannot, within a 24-hour period, demonstrate that the hot channel factors are met, the overpower ΔT and overtemperature ΔT trip setpoints shall be similarly reduced.

3.10.2.3 Following initial loading and at regular monthly intervals thereafter, power distribution maps using the movable detector system, shall be made to confirm that the hot channel factor limits of Specification 3.10.2.1 are satisfied. For the purpose of this confirmation:

a. The measurement of total peaking faactor, F_Q^{Meas}, shall be increased by three percent to account for manufacturing tolerances and further increased by five percent to account for measurement error.

*Design value is defined here as the maximum power at which the F_Q or $F_{\Delta H}$ limit is defined in specification 3.10.2.1.

b. The measurement of enthalpy rise hot channel factor, $F^N_{\Delta H}$, shall be increased by four percent to account for measurement error.

3.10.2.4 The reference equilibrium-indicated axial flux difference for each encore channel as a function of power level (called the target flux difference) shall be measured at least once per effective full power quarter*. If the axial flux difference has not been measured in the last effective full power month, the target flux difference must be updated monthly by linear interpolation, using the most recent measured value and the value predicted for the end of the cycle life.

3.10.2.5 The indicated axial flux difference shall be considered outside of the limits of Sections 3.10.2.6 through 3.10.2.9 when more than one of the operable excore channels are indicating the axial flux difference to be outside a limit.

3.10.2.6 Except during physics tests, during excore detector calibration, and except as modified by 3.10.2.7 through 3.10.2.9 below, the indicated axial flux difference shall be maintained within a ±5 percent band about the target flux difference (defines the target band on axial flux difference).

3.10.2.7 At a power level greater than 90 percent of rated power*, if the indicated axial flux difference deviates from its target band, the flux difference shall be returned to the target band immediately or reactor power shall be reduced to a level no greater than 90 percent of rated power*.

3.10.2.8 At a power level no greater than 90 percent of rated power*,

a. The indicated axial flux difference may deviate from its ±5 percent target band for a maximum of one hour (cumulative) in any 24-hour period provided the flux difference

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*Full power and rated power are defined here as 2300 Mwt under the normal T_{avg} program and 1955 Mwt under the reduced T_{avg} program.

does not exceed an envelope bounded by and ± 11 percent at 90 percent of rated power* and increasing by ± 1 percent for each 2 percent of rated power below 90 percent of rated power*. If the cumulative time exceeds one hour, then the reactor power shall be reduced immediately to no greater than 50 percent of rated power* and the high neutron flux setpoint reduced to no greater than 55 percent of rated power*.

b. A power increase to a level greater than 90 percent of rated power* is contingent upon the indicated axial flux difference being within its target band.

3.10.2.9 At a power level no greater than 50 percent of rated power*,

a. The indicated axial flux difference may deviate from its target band.

b. A power increase to a level greater than 50 percent of rated power* is contingent upon the indicated axial flux difference not being outside its target band for more than two hours (cumulative) out of the preceding 24-hour period. One-half of the time the indicated axial flux difference is out of its target band up to 50 percent of rated power* is to be counted as contributing to the one-hour cumulative maximum the flux difference may deviate from its target band at a power level less than or equal to 90 percent of rated power*.

3.10.2.10 Alarms shall normally be used to indicate non-conformance with the flux difference requirement of 3.10.2.7 or the flux difference-time requirement of 3.10.2.8.a. If the alarms are temporarily out of service, the axial flux difference shall be logged, and conformance with the limits assessed, every hour for the first 24 hours, and half-hourly thereafter. The requirement for alarms becomes effective December 1, 1975.

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*Rated power is defined here as 2300 Mwt under the normal T_{avg} program and 1955 Mwt under the reduced T_{avg} program.

3.10.3 Quadrant Power Tilt Limits

3.10.3.1 Except for physics tests and during power increases below 50 percent of rated power*, whenever the indicated quadrant power tilt ratio exceeds 1.02, the tilt condition shall be eliminated within two hours or the following actions shall be taken:

a. Restrict core power level and reset the power range high flux setpoint to be less two percent of rated values* for every percent of indicated power tilt ratio exceeding 1.0, and

b. If the tilt condition is not eliminated after 24 hours, the power range high flux setpoint shall be reset to 55 percent of rated power*. Subsequent reactor operation would be permitted up to 50 percent of rated power* for the purpose of measurement and testing to identify the cause of the tilt condition.

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

a. The core power level shall be reduced by 2 percent of rated values* for every 1 percent of indicated power tilt exceeding 1.0, and

b. If the tilt condition is not eliminated within two hours, the reactor shall be brought to a hot shutdown condition.

c. After correction of the misaligned rod, reactor operation will be permitted to 50 percent of rated power* until the indicated quadrant tilt falls below 1.09.

3.10.3.3 If the indicated quadrant tilt exceeds 1.09 and there is not a simultaneous indication of rod misalignment, except as stated in Specification 3.10.3.2.c, the reactor shall immediately be brought to a hot shutdown condition.

*Rated power and rated values are defined here as 2300 Mwt under the normal T_{avg} program and 1955 Mwt under the reduced T_{avg} program.

3.10.6.2 No more than one inoperable control rod shall be permitted during power operation.

3.10.6.3 If a full length control rod cannot be moved by its mechanism, boron concentration shall be changed to compensate for the withdrawn worth of the inoperable rod such that a shutdown margin equal to or greater than shown on Figure 3.10-2 results.

3.10.7 Power Ramp Rate Limits

3.10.7.1 During the return to power following a shutdown where fuel assemblies have been handled (e.g., refueling, inspection), the rate of reactor power increase shall be limited to 3 percent of rated power in an hour between 20 percent and 100 percent of rated power. This ramp rate requirement applies during the initial startup and may apply during subsequent power increases, depending on the maximum power level achieved and length of operation at that power level. Specifically, this requirement can be moved for reactor power levels below a power level P (20 percent $< P \leq$ 100 percent), provided that the plant has operated at or above power level P for at least 72 cumulative hours out of any seven-day operating period following the shutdown.

3.10.7.2 The rate of reactor power increases above the highest power level sustained for at least 72 cumulative hours during the preceding 30 cumulative days of reactor power operation shall be limited to 3 percent of rated power in an hour. Alternatively, reactor power increase can be accomplished by a single step increase less than or equal to 10 percent of rated power followed by a maximum ramp rate of 3 percent of rated power in an hour beginning three hours after the step increase.

3.10.8 Required Shutdown Margins

3.10.8.1 When the reactor is in the hot shutdown condition, the shutdown margin shall be at least that shown in Figure 3.10-2.

shutdown margin. The specified control rod insertion limits meet the design basis criteria on (1) potential ejected control rod worth and peaking factor,[4] (2) radial power peaking factors, $F_{\Delta H}$, and (3) required margin shutdown.

The various control rod banks (shutdown banks, control banks) are each to be moved as a bank; that is, with all rods in the bank within one step (5/8 inch) of the bank position. Position indication is provided by two methods: a digital count of actuation pulses which shows the demand position of the banks, and a linear position indicator (LVDT) which indicates the actual rod position.[2] At rod positions $\geq$200 steps, full power reactivity worths of the control rods are sufficiently small such that a 15-inch indicated misalignment from the rod bank has no significant effect on the incore power distribution and is therefore allowable. For rod positions <200 steps, maintaining indicated rod position within 7.5 inches of the average of the indicated bank position provides an enforceable limit which assures design distribution is not exceeded. In the event that an LVDT is not in service, the effects of a malpositioned control rod are observable on nuclear and process information displayed in the control room and by core thermocouples and in-core movable detectors. The determination of the hot channel factors will be performed by means of the movable in-core detectors.

The two hours in 3.10.1.5 are acceptable because complete rod misalignment (control rod 12 feet out of alignment with its bank) does not result in exceeding core safety limits in steady state operation at rated power and is short with respect to probability of an independent accident. If the condition cannot be readily corrected, the specified reduction in power will ensure that design margins to core limits will be maintained under both steady state and anticipated transient conditions.

e. Axial power distribution control procedures, which are given in terms of flux difference control, are observed. Flux difference refers to the difference in signals between the top and bottom halves of two-section excore neutron detectors. The flux difference is a measure of the axial offset which is defined as the difference in power between the top and bottom halves of the core.

For operation at a fraction P of full power, the design limits are met, provided the limits of Specification 3.10.2.1 are not exceeded.

The permitted relaxation in $F_{\Delta H}^{N}$ with reduced power allows radial power shape changes with rod insertion to the insertion limits. It has been determined that provided the above conditions 1 through 4 are observed, these hot channel factors limits are met.

The procedures for axial power distribution control referred to above include operator control of flux difference to minimize the effects of xenon redistribution on the axial power distribution during load-follow maneuvers. Basically, control of flux difference is required to limit the difference between the current value of Flux Difference (ΔI) and a reference value which corresponds to the full power equilibrium value of Axial Offset (Axial Offset = ΔI/fractional power). The reference value of flux difference varies with power level and burnup but expressed as axial offset, it varies primarily with burnup.

The target (or reference) value of flux difference is determined as follows: At any time that equilibrium xenon conditions have been established, the indicated flux difference is noted with control Bank D more than 190 steps withdrawn. This value, divided by the fraction of full power at which the core was operating is the full power value of the target flux difference. Values for all other core power levels are obtained by multiplying the full power value by the fractional power. Since the indicated equilibrium value was noted, no allowances for excore detector error are necessary and the specified deviation of ΔI is permitted from the indicated reference value. During periods where extensive load following is required, it may be impossible to establish the required core conditions for measuring the target flux difference every month. For this reason, the specification provides two methods for updating the target flux difference.

Strict control of the flux difference (and rod position) is not as necessary during part power operation. This is because xenon distribution control at part power is not as significant as the control at full power, and allowance has been made in predicting the heat flux peaking factors for less strict control at part power.

Strict control of the flux difference is not possible during certain physics tests, control rod exercises, or during the required periodic excore calibration which require larger flux differences than permitted. Therefore, the specifications on power distribution are not applicable during physics tests, control rod exercises, or excore calibrations; this acceptable due to the extremely low probability of a significant accident occurring during these operations. Excore calibration includes that period of time necessary to return to equilibrium operating conditions. In some instances of rapid plant power reduction, automatic rod motion will cause the flux difference to deviate from the target band when the reduced power level is reached. This does not necessarily affect the xenon distribution sufficiently to change the envelope of peaking factors which can be reached on a subsequent return to full power within the target band; however, to simplify the specification, a limitation of one hour in any period of 24 hours is placed on operation outside the band. This ensures that the resulting xenon distributions are not significantly different from those resulting from operation within the target band. The instantaneous consequence of being outside the band, provided rod insertion limits are observed , is not worse than a 10 percent increment in peaking factor for flux difference in the range +14 percent to -14 percent (+11 percent to -11 percent indicated) increasing by +1 percent for each 2 percent decrease in rated power*. Therefore, while the deviation exists, the power level is limited to 90 percent of rated power* or lower depending on the indicated flux difference.

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*Rated power is defined here as 2300 Mwt under the normal T_{avg} program and 1955 Mwt under the reduced T_{avg} program.

If, for any reason, flux difference is not controlled with the target band for as long a period as one hour, then xenon distributions may be significantly changed and operation at 50 percent of rated power* is required to protect against potentially more severe consequences of some accidents.

As discussed above, the essence of the limits is to maintain the xenon distribution in the core as close to the equilibrium full power condition as possible. This is accomplished by using the chemical volume control system to position the full length control rods to produce the required indication flux difference.

An upper bound envelope of peaking factors has been determined from extensive analysis considering all operating maneuvers consistent with the technical specifications on power distribution control as given in Section 3.10.2. The specifications on power distribution control ensure that xenon distributions are not developed which, at a later time, could cause greater local power peaking even though the flux difference is then within limits. The results of a Loss-of-Coolant Accident analysis based on this upper bound envelope indicate that a peak clad temperature would not exceed the 2200°F limit. The nuclear analyses of credible power shapes consistent with the power distribution control procedures have shown that the F_Q^T limit is not exceeded.

For transient events, the core is protected from exceeding 21.1 kw/ft locally, and from going below a minimum of DNBR of 1.30 by automatic protection on power, flux difference, pressure and temperature.

Measurements of the hot channel factors are required as part of startup physics tests and whenever abnormal power distribution conditions require a reduction of core power to a level based on measured hot channel factors.

In the specified limit of F_Q^N there is a 5 percent allowance for uncertainties[1] which means that normal operation of the core within the defined conditions and procedures is expected to result in a measured F_Q^N 5 percent

*Rated power is defined here as 2300 Mwt for the normal T_{avg} program and 1955 Mwt for the reduced T_{avg} program.

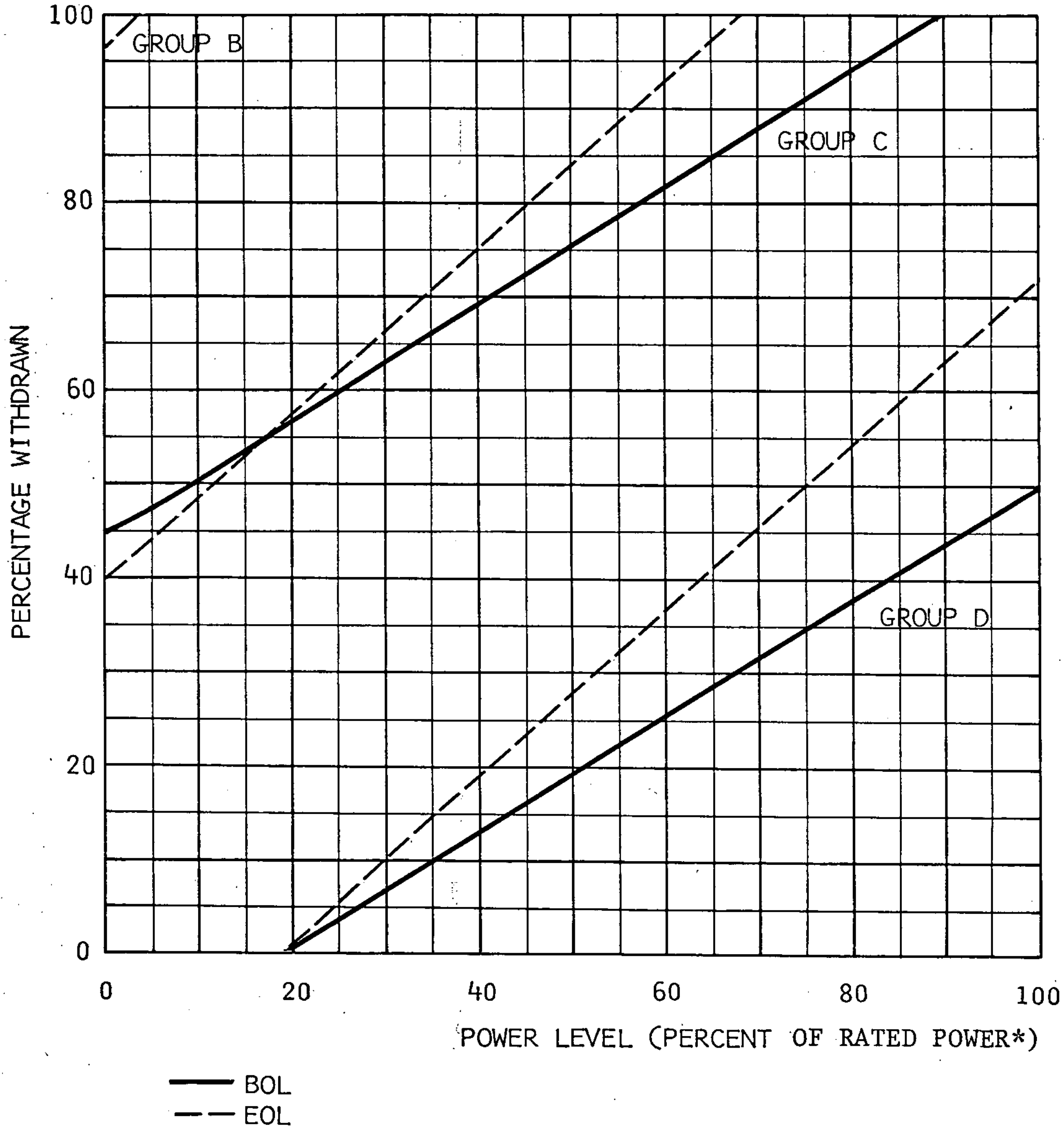
less than the limit, for example, at rated power* even on a worst case basis. When a measurement is taken, experimental error must be allowed for, and 5 percent is the appropriate allowance for a full core representative map taken with the movable incore detector flux mapping system.

In the specified limit of $F_{\Delta H}^N$, there is an 8 percent allowance for design prediction uncertainties, which means that normal operation of the core is expected to result in $F_{\Delta H}^N$ at least 8 percent less than the limit at rated power. The uncertainty to be associated with a measurement of $F_{\Delta H}^N$ by the movable incore system, on the other hand, is 4 percent, which means that the normal operation of the core shall result in a measured $F_{\Delta H}^N$ at least 4 percent less than the value at rated power. The logic behind the larger design uncertainty in this case is that (a) abnormal perturbation in the radial power shape (e.g., rod misalignment) affects $F_{\Delta H}^N$ in most cases without necessarily affecting F_Q^N through movement of part length rods, and can limit it to the desired value; (b) while the operator has some control over F_Q^N through F_z^N by motion of control rods, he has no direct control over $F_{\Delta H}^N$, and (c) an error in the predictions for radial power shape, which may be detected during startup physics tests, can be compensated for in F_Q^N by tighter axial control, but compensation for $F_{\Delta H}^N$ is less readily available.

Quadrant power tilts are based upon the following considerations. The radial power distribution within the core must satisfy the design values assumed for calculation of power capability. Radial power distributions, measured as part of the startup physics testing, are periodically measured at a monthly or greater frequency. These measurements are taken to assure that the radial power distribution with any quarter core radial power asymmetry conditions is consistent with the assumptions used in power capability analyses. It is not intended that extended reactor operation would continue with a power tilt condition which exceeds the radial power asymmetry considered in the power capability analysis.

During normal plant startup, quadrant power tilt ratio may exceed 1.02 due to instrumentation instabilities as a result of rodded configurations

*Rated power is defined here as 2300 Mwt under the normal T_{avg} program and 1955 Mwt under the reduced T_{avg} program.



CONTROL GROUP INSERTION LIMITS FOR
THREE LOOP OPERATION

FIGURE 3.10-1

*Rated Power is defined here as 2300 Mwt under the normal T_{avg} program and 1955 Mwt under the reduced T_{avg} program.

3.11 MOVABLE IN-CORE INSTRUMENTATION

Applicability

Applies to the operability of the movable detector instrumentation system.

Objective

To specify functional requirements on the use of the in-core instrumentation systems, for the calibration of the excore symmetrical offset detection system.

Specification

3.11.1 A minimum of 16 total accessible thimbles and at least 2 per quadrant and sufficient movable in-core detectors shall be operable during recalibration of the excore symmetrical offset detection system.

3.11.2 Power shall be limited to 90% of rated power* for 3-loop or 40% of rated power* for 2-loop operation if recalibration requirements for the excore symmetrical offset detection system identified in Table 4.1-1 are not met.

Basis

The Movable In-Core Instrumentation System[1] has five drives, five detectors, and 46 thimbles in the core. Each detector can be routed to twenty or more thimbles. Consequently, the full system has a great deal more capability than would be needed for the calibration of the excore detectors.

To calibrate the excore detector system, it is only necessary that the Movable In-Core System be used to determine the gross power distribution in the core as indicated by the power balance between the top and bottom halves of the core.

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*Rated power is defined here as 2300 Mwt under the normal T_{avg} program and 1955 Mwt under the reduced T_{avg} program.

After the excore system is calibrated initially, recalibration is needed only infrequently to compensate for changes in the core, due, for example, to fuel depletion, and for changes in the detectors.

If the recalibration is not performed, the mandated power reduction assures safe operation of the reactor since it will componsate for an error of 10% in the excore protection system. Experience at the Beznau No. 1 and R. E. Ginna plants has shown that drift due to the core on instrument channels is very slight. Thus, limiting the operating levels to 90% of the rated* two and three-loop powers is very conservative for both operational modes.

Reference

(1) FSAR Section 7.4

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*Rated power is defined here as 2300 Mwt under the normal T_{avg} program and 1955 Mwt under the reduced T_{avg} program.

4.11 REACTOR CORE

Applicability

Applies to surveillance of the reactor core.

Objective

To ensure the integrity of the fuel cladding.

Specification

4.11.1 APDMS Operation

4.11.1.1 Prior to establishing normal operation with APDMS, at least six maps will be taken to determine applicable values of $\overline{R}$ and σ for surveillance thimbles.

4.11.1.2 Plant operation up to rated power* shall be permitted for the purposes of obtaining the initial maps of Specification 4.11.1.1, provided the APDMS is operational and hot channel factors are shown to be below the limiting values set forth in Specification 3.10.2. Suitably conservative values of $\overline{R}$ and σ shall be derived from maps previously run during the current fuel cycle for use in the APDMS system during this initial period.

4.11.1.3 Subsequent updates of $\overline{R}$ and σ shall employ the last six maps in accordance with Specification 4.11.1.1.

4.11.1.4 Each power distribution map will be based on flux traverses obtained from 36 or more of the 46 monitoring channels.

4.11.2 Except during physics tests and EXCORE calibrations, axial surveillance of F(Z)S(Z) shall consist of traverses with the movable incore detectors in appropriate pairs of detector paths, taken every eight hours, or a frequency of approximately 0, 10, 30, 60, 120, 180, 240, 360, and 480 minutes following accumulated control rod motion in any one direction of five.

*Rated power is defined here as 2300 Mwt under the normal T_{avg} program and 1955 Mwt under the reduced T_{avg} program.