Attachment 2

Technical Specifications Changes

3.12 CONTROL ROD ASSEMBLIES AND POWER DISTRIBUTION LIMITS

Applicability

Applies to the operation of the control rod assemblies and power distribution limits.

Objective

To ensure core subcriticality after a reactor trip, a limit on potential reactivity insertions from hypothetical control rod assembly ejection, and an acceptable core power distribution during power operation.

Specification

A. Control Bank Insertion Limits

1. Whenever the reactor is critical, except for physics tests and control rod assembly surveillance testing, the shutdown control rod assemblies shall be fully withdrawn. With a shutdown control rod assembly not fully withdrawn, within 1 hour either fully withdraw the assembly or declare the assembly inoperable and apply Specification 3.12.C.

2. Whenever the reactor is critical, except for physics tests and control rod assembly surveillance testing, the full length control banks shall be inserted no further than the appropriate limit determined by core burnup shown on TS Figures 3.12-1A or 3.12-1B. With a control bank inserted beyond the limits shown in the applicable figure, restore the control rod assembly bank to within its limits within 2 hours, or reduce THERMAL POWER within 2 hours to less than or equal to that fraction of RATED POWER which is allowed by the group position using TS Figures 3.12.1A or 1B, or place the reactor in HOT SHUTDOWN within 6 hours.

3. The limits shown on TS Figures 3.12-1A and 1B may be revised on the basis of physics calculations and physics data obtained during unit startup and subsequent operation, in accordance with the following:

a. The sequence of withdrawal of the control banks, when going from zero to 100% power, is A, B, C, D.

b. An overlap of control banks, consistent with physics calculations and physics data obtained during unit startup and subsequent operation, will be permitted.

c. The shutdown margin with allowance for a stuck control rod assembly shall be greater than or equal to 1.77% reactivity under all steady-state operation conditions, except for physics tests, from zero to full power, including effects of axial power distribution. The shutdown margin as used here is defined as the amount by which the reactor core would be subcritical at HOT SHUTDOWN ($T_{avg} \geq 547°F$) if all control rod assemblies were tripped, assuming that the highest worth control rod assembly remained fully withdrawn, and assuming no changes in xenon or boron.

4. Whenever the reactor is subcritical, except for physics tests, the critical control rod assembly position, i.e., the control rod assembly position at which criticality would be achieved if the control rod assemblies were withdrawn in normal sequence with no other reactivity changes, shall not be lower than the insertion limit for zero power.

5. Insertion limits do not apply during physics tests or during periodic surveillance testing of control rod assemblies. However, the shutdown margin indicated above must be maintained except for the LOW POWER PHYSICS TEST to measure control and shutdown bank worth and shutdown margin. For this test the reactor may be critical with all but one full length control rod assembly, expected to have the highest worth, inserted.

6. With a maximum of one control or shutdown bank inserted beyond the insertion limit specified in Specification 3.12.A.2 during control rod assembly testing pursuant to Specification 4.1, and immovable due to a failure of the Rod Control System, POWER OPERATION may continue* provided that:

   a. the affected bank insertion is limited to 18 steps below the insertion limit as measured by the group step counter demand position indicators,

   b. the affected bank is trippable,

   c. each control rod assembly is aligned to within ± 12 steps of its respective group step counter demand position indicator,

   d. The shutdown margin requirement of Specification 3.12.A.3.c is determined to be met at least every 12 hours thereafter, and

   e. the affected bank is restored to within the insertion limits of Specification 3.12.A within 72 hours.

   Otherwise place the unit in HOT SHUTDOWN within the next 6 hours.

B. Power Distribution Limits

1. At all times except during LOW POWER PHYSICS TESTS, the hot channel factors defined in the basis must meet the following limits:

   $F_Q(Z) \leq 2.32/P \times K(Z)$ for $P > 0.5$

   $F_Q(Z) \leq 4.64 \times K(Z)$ for $P \leq 0.5$

   $F^N_{\Delta H} \leq 1.56\,[1 + 0.3\,(1-P)]$ for three loop operation

   where P is the fraction of RATED POWER at which the core is operating, K(Z) is the function given in TS Figure 3.12-2, and Z is the core height location of F_Q.

* Provision for continued operation does not apply to Control Bank D inserted beyond the insertion limit.

2. Prior to exceeding 75% power following each core loading and during each effective full power month of operation thereafter, power distribution maps using the movable detector system shall be made to confirm that the hot channel factor limits of this specification are satisfied. For the purpose of this confirmation:

   a. The measurement of total peaking factor F_Q^{Meas} shall be increased by eight percent to account for manufacturing tolerances, measurement error and the effects of rod bow. The measurement of enthalpy rise hot channel factor $F_{\Delta H}^N$ shall be compared directly to the limit specified in Specification 3.12.B.1. If any measured hot channel factor exceeds its limit specified under Specification 3.12.B.1, the reactor power and high neutron flux trip setpoint shall be reduced until the limits under Specification 3.12.B.1 are met. If the hot channel factors cannot be brought to within the limits of $F_Q(Z) \leq 2.32 \times K(Z)$ and $F_{\Delta H}^N \leq 1.56$ within 24 hours, the Overpower ΔT and Overtemperature ΔT trip setpoints shall be similarly reduced within the next 4 hours.

3. The reference equilibrium indicated axial flux difference (called the target flux difference) at a given power level P_O is that indicated axial flux difference with the core in equilibrium xenon conditions (small or no oscillation) and the control rod assemblies more than 190 steps withdrawn. The target flux difference at any other power level P is equal to the target value at P_O multiplied by the ratio P/P_O. The target flux difference shall be measured at least once per equivalent full power quarter. The target flux difference must be updated during each effective full power month of operation either by actual measurements or by linear interpolation using the most recent value and the value predicted for the end of the cycle life.

4. Except as modified by Specifications 3.12.B.4.a, b, c, or d below, the indicated axial flux difference shall be maintained within a ± 5% band about the target flux difference (defines the target band on axial flux difference).

a. At a power level greater than 90 percent of RATED POWER, if the indicated axial flux difference deviates from its target band, within 15 minutes either restore the indicated axial flux difference to within the target band or reduce the reactor power to less than 90 percent of RATED POWER.

b. At a power level less than or equal to 90 percent of RATED POWER,

(1) The indicated axial flux difference may deviate from its target band for a maximum of one hour (cumulative) in any 24-hour period provided the flux difference is within the limits shown on TS Figure 3.12-3. One minute penalty is accumulated for each one minute of operation outside of the target band at power levels equal to or above 50% of RATED POWER.

(2) If Specification 3.12.B.4.b.(1) is violated, then the reactor power shall be reduced to less than 50% power within 30 minutes and the high neutron flux setpoint shall be reduced to less than or equal to 55% power within the next four hours.

(3) 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.

(4) Surveillance testing of the Power Range Neutron Flux Channels may be performed pursuant to TS Table 4.1-1 provided the indicated axial flux difference is maintained within the limits of TS Figure 3.12-3. A total of 16 hours of operation may be accumulated with the axial flux difference outside of the target band during this testing without penalty deviation.

c. At a power level less than or equal to 50 percent of RATED POWER,

(1) The indicated axial flux difference may deviate from its target band.

(2) 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 one hour accumulated penalty during the preceding 24-hour period. One half minute penalty is accumulated for each one minute of operation outside of the target band at power levels between 15% and 50% of RATED POWER.

d. The axial flux difference limits for Specifications 3.12.B.4.a, b, and c may be suspended during the performance of physics tests provided:

(1) The power level is maintained less than or equal to 85% of RATED POWER, and

(2) The limits of Specification 3.12.B.1 are maintained. The power level shall be determined to be less than or equal to 85% of RATED POWER at least once per hour during physics tests. Verification that the limits of Specification 3.12.B.1 are being met shall be demonstrated through in-core flux mapping at least once per 12 hours.

Alarms shall normally be used to indicate the deviations from the axial flux difference requirements in Specification 3.12.B.4.a and the flux difference time limits in Specifications 3.12.B.4.b and c. If the alarms are out of service temporarily, the axial flux difference shall be logged and conformance to the limits assessed every hour for the first 24 hours and half-hourly thereafter. The indicated axial flux difference for each excore channel shall be monitored at least once per 7 days when the alarm is OPERABLE and at least once per hour for the first 24 hours after restoring the alarm to OPERABLE status.

5. The allowable QUADRANT POWER TILT is 2.0%.

6. If, except for physics and control rod assembly surveillance testing, the QUADRANT POWER TILT exceeds 2%, then:

   a. Within 2 hours, either the hot channel factors shall be determined and the power level adjusted to meet the requirement of Specification 3.12.B.1, or

   b. The power level shall be reduced from RATED POWER 2% for each percent of QUADRANT POWER TILT. The high neutron flux trip setpoint shall be similarly reduced within the following 4 hours.

   c. If the QUADRANT POWER TILT exceeds ± 10%, the power level shall be reduced from RATED POWER 2% for each percent of QUADRANT POWER TILT within the next 30 minutes. The high neutron flux trip setpoint shall be similarly reduced within the following 4 hours.

7. If, except for physics and control rod assembly surveillance testing, after a further period of 24 hours, the QUADRANT POWER TILT in Specification 3.12.B.5 above is not corrected to less than 2%:

   a. If the design hot channel factors for RATED POWER are not exceeded, an evaluation as to the cause of the discrepancy shall be made and a special report issued to the Nuclear Regulatory Commission.

   b. If the design hot channel factors for RATED POWER are exceeded and the power is greater than 10%, then the high neutron flux, Overpower ΔT, and Overtemperature ΔT trip setpoints shall be reduced 1% for each percent the hot channel factor exceeds the RATED POWER design values within the next 4 hours, and the Nuclear Regulatory Commission shall be notified.

c. If the hot channel factors are not determined, then the Overpower ΔT and Overtemperature ΔT trip setpoints shall be reduced by the equivalent of 2% power for every 1% QUADRANT POWER TILT within the next 4 hours, and the Nuclear Regulatory Commission shall be notified.

C. Control Rod Assemblies

1. To be considered OPERABLE during startup and POWER OPERATION each control rod assembly shall :
   1) be trippable,
   2) aligned within ± 24 steps of its group step demand position during the "Thermal Soak" period, as defined in Section 3.12.E.1.b, or ± 12 steps otherwise during power operation, and
   3) have a drop time of less than or equal to 2.4 seconds to dashpot entry.

2. To be considered OPERABLE during shutdown modes, each control rod assembly shall:
   1) be trippable,
   2) have its rod position indicator capable of verifying rod movement upon demand, and
   3) have a drop time of less than or equal to 2.4 seconds to dashpot entry.

3. Startup and POWER OPERATION may continue with one control rod assembly inoperable provided that within one hour either:
   a. The control rod assembly is restored to OPERABLE status, as defined in Specification 3.12.C.1 and 2, or

   b. the shutdown margin requirement of Specification 3.12.A.3.c is satisfied. POWER OPERATION may then continue provided that:
      1) either:

(a) power shall be reduced to less than 75% of RATED POWER within one (1) hour, and the High Neutron Flux trip setpoint shall be reduced to less than or equal to 85% of RATED POWER within the next four (4) hours, or

(b) the remainder of the control rod assemblies in the group with the inoperable control rod assembly are aligned to within 12 steps of the inoperable rod within one (1) hour while maintaining the control rod assembly sequence and insertion limits of Figure 3.12-1A and B; the THERMAL POWER level shall be restricted pursuant to Specification 3.12.A during subsequent operation.

2) the shutdown margin requirement of Specification 3.12.A.3.c is determined to be met within one hour and at least once per 12 hours thereafter.

3) the hot channel factors are shown to be within the design limits of Specification 3.12.B.1 within 72 hours. Further, it shall be demonstrated that the value of Fxy(Z) used in the Constant Axial Offset Control analysis is still valid.

4) a reevaluation of each accident analysis of Table 3.12-1 is performed within 5 days. This reevaluation shall confirm that the previous analyzed results of these accidents remain valid for the duration of operation under these conditions.

5) If power has been reduced in accordance with Specification 3.12.C.3.b, power may be increased above 75% power provided that:

(a) an analysis has been performed to determine the hot channel factors and the resulting allowable power level based on the limits of Specification 3.12.B.1, and

(b) an evaluation of the effects of operating at the increased power level on the accident analyses of Table 3.12-1 has been completed.

4. With more than one inoperable control rod assembly, as defined in Specification 3.12.C.1, determine within 1 hour that the shutdown margin requirement of Specification 3.12.A.3.c is satisfied and be in HOT SHUTDOWN within 6 hours.

5. The provisions of Specifications 3.12.C.1 and 3.12.C.4 shall not apply during physics tests in which the assemblies are intentionally misaligned.

D. QUADRANT POWER TILT

1. If the reactor is operating above 75% of RATED POWER with one excore nuclear channel out of service, the QUADRANT POWER TILT shall be determined:
   a. Once per day, and
   b. After a change in power level greater than 10% or more than 30 inches of control rod motion.

2. The QUADRANT POWER TILT shall be determined by one of the following methods:
   a. Movable detectors (at least two per quadrant)
   b. Core exit thermocouples (at least four per quadrant)

E. Rod Position Indication System

1. Rod position indication shall be provided as follows:

   a. Above 50% power, the Rod Position Indication System shall be OPERABLE and capable of determining the control rod assembly positions to within ± 12 steps of their respective group step demand counter indications.

   b. From movement of control banks to achieve criticality up to 50% power, the Rod Position Indication System shall be OPERABLE and capable of determining the control rod assembly positions to within ± 24 steps of their respective group step demand counter indications for a maximum of one hour out of twenty-four, and to within ± 12 steps otherwise. During the one-hour "Thermal Soak" period, the step demand counters shall be OPERABLE and capable of determining the group demand positions to within ± 2 steps.

   c. In HOT, INTERMEDIATE, and COLD SHUTDOWN, the step demand counters shall be OPERABLE and capable of determining the group demand positions to within ± 2 steps. The rod position indicators shall be available to verify control rod assembly movement upon demand.

2. If a rod position indicator channel is inoperable, then:

   a. For operation above 50% of RATED POWER, the position of the control rod assembly shall be checked indirectly using the movable incore detectors at least once per 8 hours and immediately after any motion of the non-indicating control rod assembly exceeding 24 steps, or

   b. Reduce power to less than 50% of RATED POWER within 8 hours. During operations below 50% of RATED POWER, no special monitoring is required.

3. If more than one rod position indicator channel per group or two rod position indicator channels per bank are inoperable during control bank motion to achieve criticality or POWER OPERATION, then the unit shall be placed in HOT SHUTDOWN within 6 hours.

F. DNB Parameters

1. The following DNB related parameters shall be maintained within their limits during POWER OPERATION:

   - Reactor Coolant System T_{avg} ≤ 578.4°F
   - Pressurizer Pressure ≥ 2205 psig
   - Reactor Coolant System Total Flow Rate ≥ 273,000 gpm

   a. The Reactor Coolant System T_{avg} and Pressurizer Pressure shall be verified to be within their limits at least once every 12 hours.

   b. The Reactor Coolant System Total Flow Rate shall be determined to be within its limit by measurement at least once per refueling cycle.

2. When any of the parameters in Specification 3.12.F.1 has been determined to exceed its limit, either restore the parameter to within its limit within 2 hours or reduce THERMAL POWER to less than 5% of RATED POWER within the next 4 hours.

3. The limit for Pressurizer Pressure in Specification 3.12.F.1 is not applicable during either a THERMAL POWER ramp increase in excess of 5% of RATED POWER per minute or a THERMAL POWER step increase in excess of 10% of RATED POWER.

Basis

The reactivity control concept assumed for operation is that reactivity changes accompanying changes in reactor power are compensated by control rod assembly motion. Reactivity changes associated with xenon, samarium, fuel depletion, and large changes in reactor coolant temperature (operating temperature to COLD SHUTDOWN) are compensated for by changes in the soluble boron concentration. During POWER OPERATION, the shutdown control rod assemblies are fully withdrawn and control of power is by the control banks. A reactor trip occurring during POWER OPERATION will place the reactor into HOT SHUTDOWN. The control rod assembly insertion limits provide for achieving HOT SHUTDOWN by reactor trip at any time, assuming the highest worth control rod assembly remains fully withdrawn, with sufficient margins to meet the assumptions used in the accident analysis. In addition, they provide a limit on the maximum inserted control rod assembly worth in the unlikely event of a hypothetical assembly ejection and provide for acceptable nuclear peaking factors. The limit may be determined on the basis of unit startup and operating data to provide a more realistic limit which will allow for more flexibility in unit operation and still assure compliance with the shutdown requirement.

The maximum shutdown margin requirement occurs at end of core life and is based on the value used in the analyses of the hypothetical steam break accident. The control rod assembly insertion limits are based on end of core life conditions. The shutdown margin for the entire cycle length is established at 1.77% reactivity. Other accident analyses with the exception of the Chemical and Volume Control System malfunction analyses are based on 1% reactivity shutdown margin. Relative positions of control banks are determined by a specified control bank overlap. This overlap is based on the consideration of axial power shape control. The specified control rod assembly insertion limits have been established to limit the potential ejected control rod assembly worth in order to account for the effects of fuel densification. The various control rod assemblies (shutdown banks, control banks A, B, C, and D) are each to be moved as a bank; that is, with each assembly in the bank within one step (5/8 inch) of the bank position.

Position indication is provided by two methods: a digital count of actuating pulses which shows the demand position of the banks, and a linear position indicator, Linear Variable Differential Transformer, which indicates the actual assembly position. The position

indication accuracy of the Linear Variable Differential Transformer is approximately ±5% of span (±12 steps) under steady state conditions. The relative accuracy of the linear position indicator has been considered in establishing the maximum allowable deviation of a control rod assembly from its indicated group step demand position. In the event that the linear position indicator is not in service, the effects of malpositioned control rod assemblies are observable from nuclear and process information displayed in the Main Control Room and by core thermocouples and in-core movable detectors. Below 50% power, no special monitoring is required for malpositioned control rod assemblies with inoperable rod position indicators because, even with an unnoticed complete assembly misalignment (full length control rod assembly 12 feet out of alignment with its bank), operation at 50% steady state power does not result in exceeding core limits.

The "Thermal Soak" allowance below 50% power, during which the Rod Position Indication System tolerance requirement is relaxed, provides time for the system to reach thermal equilibrium. A total of one hour in twenty-four is available for this allowance, which may be a continuous hour or may consist of discrete, shorter intervals. For such a short period of time, a misaligned control rod assembly does not pose an unacceptable risk. At these conditions, the rod position indicators should still be used to verify rod movement but not their exact location. The tolerance is tightened after one hour to ensure that the thermal overshoot does not conceal an actual control rod assembly misalignment.

The reliance upon the step demand counters at HOT and COLD SHUTDOWN shifts the monitoring of control rod assembly position from the Rod Position Indication System to the more reliable demand counters when Reactor Coolant System temperature is changing greatly but the core remains subcritical. The step demand counters also provide precise group demand positions during the thermal soak period.

The specified control rod assembly drop time is consistent with safety analyses that have been performed.

An inoperable control rod assembly imposes additional demands on the operators. The permissible number of inoperable control rod assemblies is limited to one in order to limit the magnitude of the operating burden, but such a failure would not prevent dropping of the OPERABLE control rod assemblies upon reactor trip.

In the event that a failure of the Rod Control System renders control rod assemblies immovable, provision is made for continued operation provided:

- the affected control rod assemblies remain trippable,
- the individual control rod assembly alignment limits are met.

In the event that a failure of the Rod Control System renders control rod assembly banks immovable during control rod assembly surveillance testing, provision is made for 72 hours of continued operation provided:

- the affected control rod assemblies remain trippable,
- the individual control rod assembly alignment limits are met,
- a maximum of one control or shutdown bank is inserted no more than 18 steps below the insertion limit, and
- the shutdown margin requirements are verified every 12 hours during the period the insertion limit is not met.

The 72 hour provision does not apply to Control Bank D since insertion of D bank below the insertion limit is not required for control rod assembly surveillance testing.

Checks are performed for each reload core to ensure that this minor bank insertion will not result in power distributions which violate the Departure from Nucleate Boiling (DNB) criterion for ANS Condition II transient (moderate frequency transients analyzed in Section 14.2 of the UFSAR) during the repair period or in a violation of the shutdown margin requirements of Specification of 3.12.A.3.c during the repair period.

The 72 hour period for a control rod assembly bank to be inserted below its limit restricts the likelihood of a more severe (i.e., ANS Condition III or IV) accident or transient condition.

Two criteria have been chosen as a design basis for fuel performance related to fission gas release, pellet temperature, and cladding mechanical properties. First, the peak value of fuel centerline temperature must not exceed 4700°F. Second, the minimum DNB Ratio (DNBR) in the core must not be less than the applicable design limit in normal operation or in short term transients.

In addition to the above, the peak linear power density and the nuclear enthalpy rise hot channel factor must not exceed their limiting values which result from the large break loss of coolant accident analysis based on the Emergency Core Cooling System acceptance criteria limit of 2200°F on peak clad temperature. This is required to meet the initial conditions assumed for the loss of coolant accident. To aid in specifying the limits of power distribution, the following hot channel factors are defined:

$F_Q(Z)$, Height Dependent 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 tolerance on fuel pellets and rods.

F_Q^E, Engineering Heat Flux Hot Channel Factor, is defined as the allowance on heat flux required for manufacturing tolerances. The engineering factor allows for local variations in enrichment, pellet density and diameter, surface area of the fuel rod, and eccentricity of the gap between pellet and clad. Combined statistically the net effect is a factor of 1.03 to be applied to fuel rod surface heat flux for non-statistical applications.

$F_{\Delta H}^N$, 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 for both loss of coolant accident and non-loss of coolant accident considerations.

It should be noted that the enthalpy rise factors are based on integrals and are used as such in the DNB and loss of coolant accident calculations. Local heat fluxes are obtained by using hot channel and adjacent channel explicit power shapes which take into account variations in radial (x-y) power shapes throughout the core. Thus, the radial power shape at the point of maximum heat flux is not necessarily directly related to the enthalpy rise factors. The results of the loss of coolant accident analyses are conservative with respect to the Emergency Core Cooling System acceptance criteria as specified in 10 CFR 50.46 using the upper bound $F_Q(Z)$ times the hot channel factor normalized operating envelope given by TS Figure 3.12-2.

When an F_Q measurement is taken, measurement error, manufacturing tolerances, and the effects of rod bow must be allowed for. Five percent is the appropriate allowance for measurement error for a full core map (greater than or equal to 38 thimbles, including a

minimum of 2 thimbles per core quadrant, monitored) taken with the movable incore detector flux mapping system, three percent is the appropriate allowance for manufacturing tolerances, and five percent is appropriate allowance for rod bow. These uncertainties are statistically combined and result in a net increase of 1.08 that is applied to the measured value of F_Q.

In the specified limit of $F^N_{\Delta H}$, there is a four percent allowance, which means that normal operation of the core is expected to result in $F^N_{\Delta H} \leq 1.56\ [1 + 0.3\ (1\text{-}P)]/1.04$. The 4% allowance is based on the considerations that (a) normal perturbations in the radial power shape (e.g., rod misalignment) affect $F^N_{\Delta H}$, in most cases without necessarily affecting F_Q, (b) the operator has a direct influence on F_Q through movement of rods and can limit it to the desired value; he has no direct control over $F^N_{\Delta H}$, and (c) an error in the predictions for radial power shape, which may be detected during startup physics tests and which may influence F_Q, can be compensated for by tighter axial control. An appropriate allowance for measurement uncertainty for $F^N_{\Delta H}$ obtained from a full core map (≥38 thimbles, including a minimum of 2 detectors per core quadrant, monitored) taken with the movable incore detector flux mapping system has been incorporated in the statistical DNBR limit.

Measurement of the hot channel factors are required as part of startup physics tests, during each effective full power month of operation, and whenever abnormal power distribution conditions require a reduction of core power to a level based on measured hot channel factors. The incore map taken following core loading provides confirmation of the basic nuclear design bases including proper fuel loading patterns. The periodic incore mapping provides additional assurance that the nuclear design bases remain inviolate and identify operational anomalies which would, otherwise, affect these bases.

For normal operation, it has been determined that, provided certain conditions are observed, the enthalpy rise hot channel factor $F^N_{\Delta H}$ limit will be met. These conditions are as follows:

1. Control rod assemblies in a single bank move together with no individual control rod assembly insertion differing by more than 15 inches from the bank demand position. An indicated misalignment limit of 13 steps precludes a control rod assembly misalignment no greater than 15 inches with consideration of maximum instrumentation error.

2. Control banks are sequenced with overlapping banks as shown in TS Figures 3.12-1A and 1B.
3. The full length control bank insertion limits are not violated.
4. Axial power distribution control procedures, which are given in terms of flux difference control and control bank insertion limits are observed. Flux difference refers to the difference 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 normalized power between the top and the bottom halves of the core.

The permitted relaxation in $F^N_{\Delta H}$ with decreasing power level 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, this hot channel factor limit is met.

A recent evaluation of DNB test data obtained from experiments of fuel rod bowing in thimble cells has identified that the reduction in DNBR due to rod bowing in thimble cells is more than completely accommodated by existing thermal margins in the core design. Therefore, it is not necessary to continue to apply a rod bow penalty to $F^N_{\Delta H}$.

The procedures for axial power distribution control are designed 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 only with burnup.

The technical specifications on power distribution control given in Specification 3.12.B.4 together with the surveillance requirements given in Specification 3.12.B.2 assure that the Limiting Condition for Operation for the heat flux hot channel factor is met.

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 the full length rod control bank more than 190 steps withdrawn (i.e., normal full power operating position appropriate for the time in life, usually withdrawn farther as burnup proceeds). 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 indicated deviation of ±5% ΔI are permitted from the indicated reference value. During periods where extensive load following is required, it may be impractical 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 always possible during certain physics tests or during excore detector calibrations. Therefore, the specifications on power distribution control are less restrictive during physics tests and excore detector calibrations; this is acceptable due to the low probability of a significant accident occurring during these operations.

In some instances of rapid unit 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 consequences of being outside the band, provided rod insertion limits are observed, is not worse than a 10 percent increment in peaking factor for the allowable flux difference at 90% power, in the range ±13.8 percent (±10.8 percent indicated) where for every 2 percent below rated power, the permissible flux difference boundary is extended by 1 percent.

As discussed above, the essence of the procedure 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 boron system to position the full length control rod assemblies to produce the required indicated flux difference.

A 2% QUADRANT POWER TILT allows that a 5% tilt might actually be present in the core because of insensitivity of the excore detectors for disturbances near the core center such as misaligned inner control rod assembly and an error allowance. No increase in F_Q occurs with tilts up to 5% because misaligned control rod assemblies producing such tilts do not extend to the unrodded plane, where the maximum F_Q occurs.

The limits of the DNB-related parameters assure that each of the parameters are maintained within the normal steady-state envelope of operation assumed in the transient and accident analyses. The limits are consistent with the UFSAR assumptions and have been analytically demonstrated to be adequate to maintain a minimum DNBR which is greater than the design limit throughout each analyzed transient. Measurement uncertainties are accounted for in the DNB design margin. Therefore, measurement values are compared directly to the surveillance limits without applying instrument uncertainty.

The 12 hour periodic surveillance of temperature and pressure through instrument readout is sufficient to ensure that these parameters are restored to within their limits following load changes and other expected transient operation. The measurement of the Reactor Coolant System Total Flow Rate once per refueling cycle is adequate to detect flow degradation.

TABLE 3.12-1

ACCIDENT ANALYSES REQUIRING REEVALUATION
IN THE EVENT OF AN INOPERABLE CONTROL ROD ASSEMBLY

Control Rod Assembly Insertion Characteristics

Control Rod Assembly Misalignment

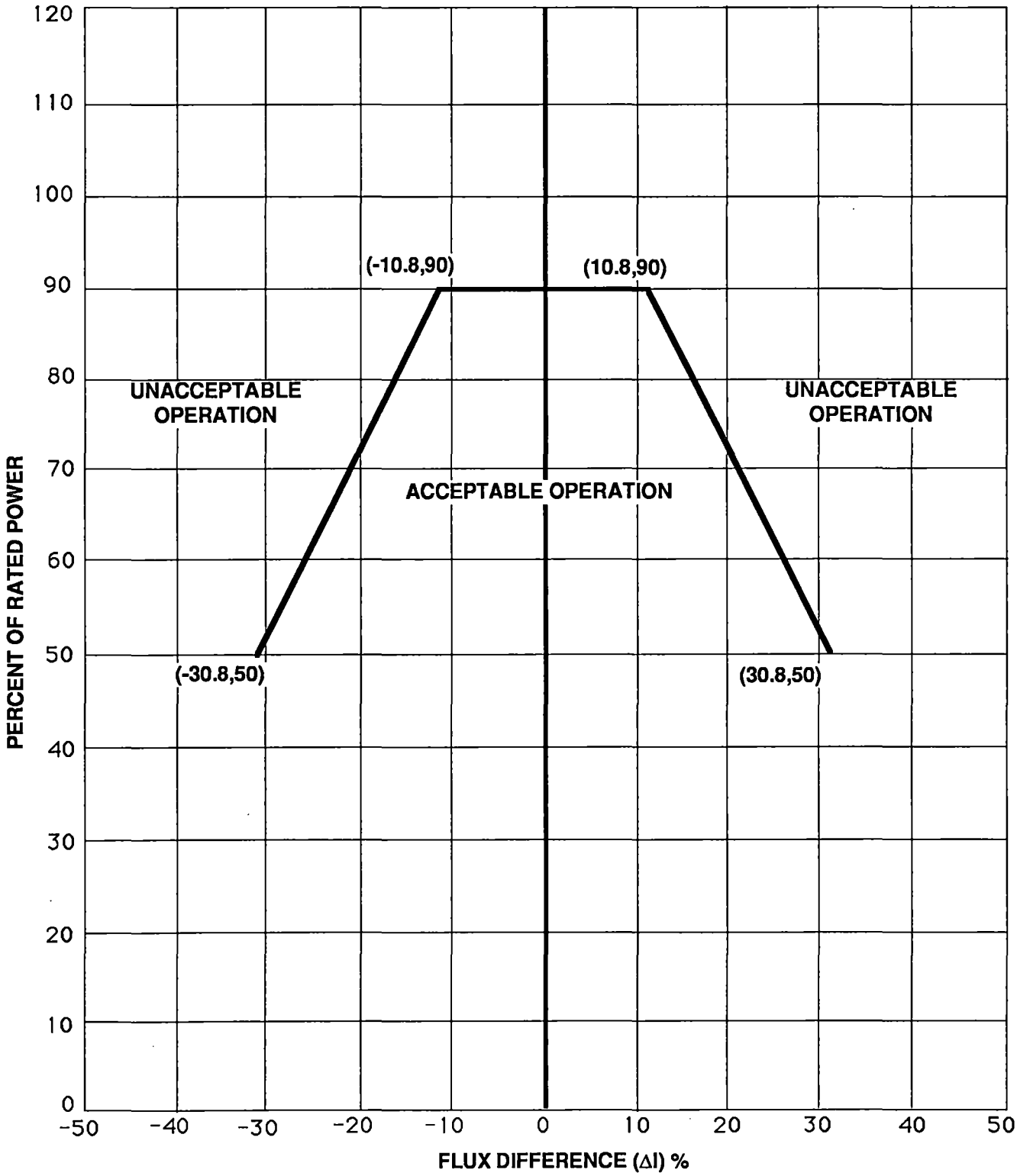
Large and Small Break Loss of Coolant Accidents

Single Reactor Coolant Pump Locked Rotor

Major Secondary Pipe Rupture

Rupture of a Control Rod Drive Mechanism Housing
(Control Rod Assembly Ejection)

AXIAL FLUX DIFFERENCE LIMITS
AS A FUNCTION OF RATED POWER
SURRY POWER STATION



HOT CHANNEL FACTOR NORMALIZED OPERATING ENVELOPE

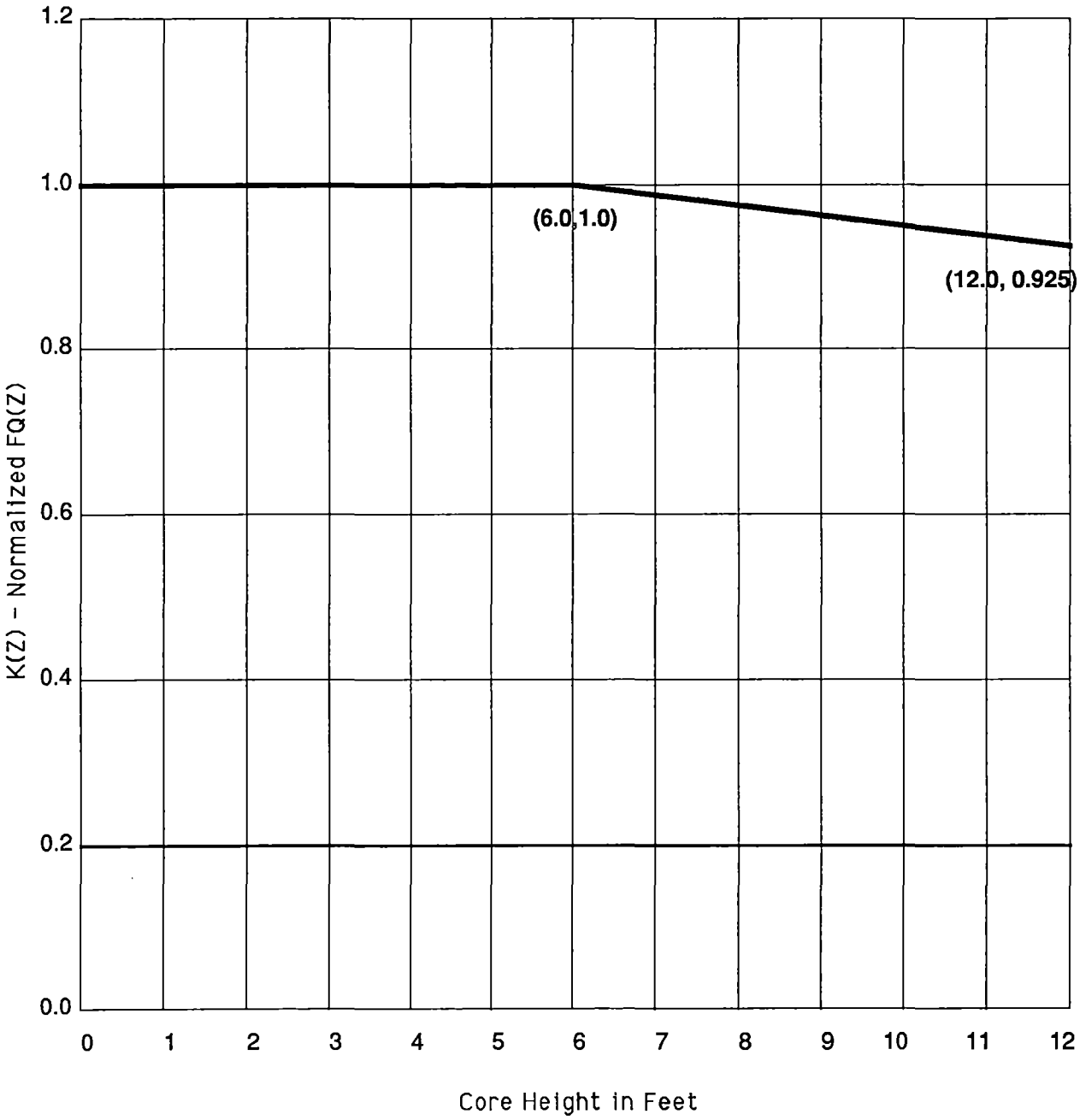


TABLE 4.1-2A

MINIMUM FREQUENCY FOR EQUIPMENT TESTS

	DESCRIPTION	TEST	FREQUENCY	FSAR SECTION REFERENCE
1.	Control Rod Assemblies	Rod drop times of all full length rods at hot conditions	Prior to reactor criticality: a. For all rods following each removal of the reactor vessel head b. For specially affected individual rods following any maintenance on or modification to the control rod drive system which could affect the drop time of those specific rods, and c. Each refueling shutdown.	7
2.	Control Rod Assemblies	Partial movement of all rods	Monthly	7
3.	Refueling Water Chemical Addition Tank	Functional	Each refueling shutdown	6
4.	Pressurizer Safety Valves	Setpoint	Per TS 4.0.3	4
5.	Main Steam Safety Valves	Setpoint	Per TS 4.0.3	10
6.	Containment Isolation Trip	* Functional	Each refueling shutdown	5
7.	Refueling System Interlocks	* Functional	Prior to refueling	9.12
8.	Service Water System	* Functional	Each refueling shutdown	9.9
9.	Fire Protection Pump and Power Supply	Functional	Monthly	9.10
10.	Primary System Leakage	* Evaluate	Daily	4
11.	Diesel Fuel Supply	* Fuel Inventory	5 days/week	8.5
12.	Boric Acid Piping Heat Tracing Circuits	* Operational	Monthly	9.1
13.	Main Steam Line Trip Valves	Functional (Full Closure)	Before each startup (TS 4.7)	10

Attachment 3

Significant Hazards Consideration

Significant Hazards Consideration

Virginia Electric and Power Company has proposed changes to the Surry Power Station Units 1 and 2 Technical Specifications which 1) define trippable, aligned control and shutdown rod banks as operable; 2) provide for up to 72 hours of operation with a trippable and aligned control or shutdown bank below the insertion limit under certain restricted conditions; 3) provide specific actions for various limiting conditions for operation which were not previously addressed in the Specifications; 4) improve consistency in capitalization and usage of operating mode names and improve grammar; and 5) revise the control and shutdown rod surveillance frequency. It has been determined that the proposed changes do not involve a significant hazards consideration as defined in 10 CFR 50.92. The basis for this determination may be stated as follows:

1. The proposed changes will not involve a significant increase in either the probability of occurrence or potential consequences of an accident previously evaluated in the UFSAR. Allowing up to 72 hours for diagnosis and repair associated with electronic or electrical malfunctions of the Control Rod Drive System is acceptable, since the primary safety function of the control rod assemblies (reactor trip) will remain unaffected during the repair period. During the extended troubleshooting and maintenance period, the requirements for control rod assembly alignment, insertion limits (except for a small allowed deviation for one bank) and shutdown margin will be maintained. The small deviation from the control rod insertion limits allowed for one bank during the repair period will have only a minor effect on normal core power distributions. The proposed changes do not affect the ability of the control rod assemblies to perform their intended safety functions when a safety system setting is reached. Nor will any new or unique accident precursors be introduced by the proposed changes. Therefore the probability and consequences of accidents related to or dependent on control rod assembly operation will remain unaffected. The proposed change will result in a small increase in the probability that, at any given time, a control or shutdown bank will be inserted slightly below (i.e. up to 18 steps) its insertion limit. However, by design, the control and shutdown banks will continue to meet the safety analysis criterion for steady state and ANS Condition II (moderate frequency) transients. The allowed misalignment is

not a malfunction of equipment important to safety in this case. Therefore, the probability of a malfunction is not increased.

The proposed changes add action statements and time limits to allow operation for one to two hours, respectively, while shutdown or control rods are returned to within their insertion limits. This brief period of operation with shutdown or control rod assemblies below their insertion limits would have no effect on accident probabilities and a negligible effect on accident consequences. The proposed editorial changes have no effect whatsoever on plant operation. Use of a monthly rod surveillance test cycle will continue to provide adequate verification of the trippability of the control and shutdown banks, as industry experience with the Standard Technical Specifications has shown.

2. The proposed changes will not create the possibility of a new or different kind of accident from any previously evaluated. There are no new failure modes or mechanisms associated with plant operation for an extended period to perform maintenance on the Control Rod Drive System. Limited periods of operation with immovable but trippable control rod assemblies does not involve any modification in the operational limits or physical design of the involved systems. There are no new accident precursors created due to the allowed maintenance period. The proposed changes involve no physical alterations to the plant or new modes of operation. Thus, a new failure mode or accident is not made possible by these changes.

3. The results of the current accident analyses are not impacted by this change. Therefore, the margin of safety is not impacted.