MODERATOR TEMPERATURE COEFFICIENT

LIMITING CONDITION FOR OPERATION

3.1.1.3 The moderator temperature coefficient (MTC) shall be:

Insert 1 →

a. Less positive than 0 $\Delta k/k/^{\circ}F$ for all rods withdrawn, beginning of cycle life (BOL), hot zero THERMAL POWER condition, and

b. Less negative than -4.0×10^{-4} $\Delta k/k/^{\circ}F$ for the all rods withdrawn, end of cycle life (EOL), RATED THERMAL POWER condition.

APPLICABILITY: Specification 3.1.1.3a. - MODES 1 AND 2* only#
Specification 3.1.1.3b. - MODES 1, 2, and 3 only#.

ACTION:

a. With the MTC more positive than the limit of Specification 3.1.1.3a. above, operation in MODES 1 and 2 may proceed provided:

Insert 2 →

1. Control rod withdrawal limits are established and maintained sufficient to restore the MTC to less positive than 0 $\Delta k/k/^{\circ}F$ within 24 hours or be in HOT STANDBY within the next 6 hours. These withdrawal limits shall be in addition to the insertion limits of Specification 3.1.3.6;

2. The control rods are maintained within the withdrawal limits established above until a subsequent calculation verifies that the MTC has been restored to within its limit for the all rods withdrawn condition; and

3. A Special Report is prepared and submitted to the Commission, pursuant to Specification 6.9.2, within 10 days, describing the value of the measured MTC, the interim control rod withdrawal limits, and the predicted average core burnup necessary for restoring the positive MTC to within its limit for the all rods withdrawn condition.

b. With the MTC more negative than the limit of Specification 3.1.1.3b. above, be in HOT SHUTDOWN within 12 hours.

*With K_{eff} greater than or equal to 1.
#See Special Test Exceptions Specification 3.10.3.

INSERT A

a. Less positive than $+0.5 \times 10^{-4}$ $\Delta K/K/^{\circ}F$ for the all rods withdrawn, beginning of cycle life (BOL) condition for power levels up to 70-percant RATED THERMAL POWER with a linear ramp to 0 $\Delta K/K/^{\circ}F$ at 100-percent RATED THERMAL POWER.

INSERT B

1. Control rod withdrawal limits are established and maintained sufficient to restore the MTC to within the above limit within 24 hours or be in HOT STANDBY within the next 6 hours. These withdrawal limits shall be in addition to the insertion limits of specification of 3.1.3.6.

SECTION 5

REFERENCES

1. WPT-8043, "Texas Utilities Generating Company Comanche Peak Steam Electric Station - Steamline Break Superheat Mass/Energy Releases," September 19, 1985.

2. WPT-13255, "Texas Utilities Generating Company Comanche Peak Steam Electric Station - Mass and Energy Release Data for Outside Containment Equipment Qualification," March 1991.

ENCLOSURE 3 TO TXX-91179

MARKED UP TECHNICAL SPECIFICATIONS

FOR OPERATION OF COMANCHE PEAK UNIT 1

WITH THE CYCLE-SPECIFIC PARAMETERS RELOCATED,

A POSITIVE MODERATOR TEMPERATURE COEFFICIENT, AND

AN FQ SURVEILLANCE

DEFINITIONS

INDEX

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

INDEX

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

INDEX

ADMINISTRATIVE CONTROLS

UNIDENTIFIED LEAKAGE

1.37 UNIDENTIFIED LEAKAGE shall be all leakage which is not IDENTIFIED LEAKAGE or CONTROLLED LEAKAGE.

UNRESTRICTED AREA

1.38 An UNRESTRICTED AREA shall be any area at or beyond the SITE BOUNDARY access to which is not controlled by the licensee, for purposes of protection of individuals from exposure to radiation and radioactive materials, or any area within the SITE BOUNDARY used for residential quarters or for industrial, commercial, institutional, and/or recreational purposes.

VENTING

1.39 VENTING shall be the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration, or other operating condition, in such a manner that replacement air or gas is not provided or required during VENTING. Vent, used in system names, does not imply a VENTING process.

WASTE GAS HOLDUP SYSTEM

1.40 A WASTE GAS HOLDUP SYSTEM shall be any system designed and installed to reduce radioactive gaseous effluents by collecting Reactor Coolant System offgases from the Reactor Coolant System and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

CORE OPERATING LIMITS REPORT

1.41 The CORE OPERATING LIMITS REPORT (COLR) is the unit-specific document that provides core operating limits for the current operating reload cycle. These cycle-specific core operating limits shall be determined for each reload cycle in accordance with Specification 6.9.1.6. Unit Operation within these operating limits is addressed in individual specifications.

REACTIVITY CONTROL SYSTEMS

MODERATOR TEMPERATURE COEFFICIENT

LIMITING CONDITION FOR OPERATION

3.1.1.3 The moderator temperature coefficient (MTC) shall be within the limits specified in the CORE OPERATING LIMITS REPORT (COLR). The maximum upper limit shall be less than or equal to $+0.5 \times 10^{-4}$ Δk/k/°F for power levels up to 70% RATED THERMAL POWER with a linear ramp to 0 Δk/k/°F at 100% RATED THERMAL POWER. ~~:~~

~~a. Less positive than 0 Δk/k/°F for the all rods withdrawn, beginning of cycle life (BOL), hot zero THERMAL POWER condition; and~~

~~b. Less negative than -4.0×10^{-4} Δk/k/°F for the all rods withdrawn, end of cycle life (EOL), RATED THERMAL POWER condition.~~

APPLICABILITY: Beginning of Cycle Life (BOL) limit ~~Specification 3.1.1.3a~~ - MODES 1 and 2* only**.
End of Cycle Life (EOL) limit ~~Specification 3.1.1.3b~~ - MODES 1, 2, and 3 only**.

ACTION:

a. With the MTC more positive than the BOL limit specified in the COLR ~~of Specification 3.1.1.3a above~~, operation in MODES 1 and 2 may proceed provided:

1. Control rod withdrawal limits are established and maintained sufficient to restore the MTC to less positive than the BOL limit specified in the COLR ~~0 Δk/k/°F~~ within 24 hours or be in HOT STANDBY within the next 6 hours. These withdrawal limits shall be in addition to the insertion limits of Specification 3.1.3.6;

2. The control rods are maintained within the withdrawal limits established above until a subsequent calculation verifies that the MTC has been restored to within its limit for the all rods withdrawn condition; and

3. A Special Report is prepared and submitted to the Commission, pursuant to Specification 6.9.2, within 10 days, describing the value of the measured MTC, the interim control rod withdrawal limits, and the predicted average core burnup necessary for restoring the positive MTC to within its limit for the all rods withdrawn condition.

b. With the MTC more negative than the EOL limit specified in the COLR ~~of Specification 3.1.1.3b above~~, be in HOT SHUTDOWN within 12 hours.

---

*With K_{eff} greater than or equal to 1.

**See Special Test Exceptions Specification 3.10.3.

SURVEILLANCE REQUIREMENTS

4.1.1.3 The MTC shall be determined to be within its limits during each fuel cycle as follows:

specified in the COLR

a. The MTC shall be measured and compared to the BOL limit ~~of Specification 3.1.1.3a., above~~, prior to initial operation above 5% of RATED THERMAL POWER, after each fuel loading; and

b. The MTC shall be measured at any THERMAL POWER and compared to ~~-3.1×10^{-4} Δk/k/°F~~ (all rods withdrawn, RATED THERMAL POWER condition) within 7 EFPD after reaching an equilibrium boron concentration of 300 ppm. In the event this comparison indicates the MTC is more negative than ~~-3.1×10^{-4} Δk/k/°F~~, the MTC shall be remeasured, and compared to the EOL MTC limit ~~of Specification 3.1.1.3b.~~, at least once per 14 EFPD during the remainder of the fuel cycle.

specified in the COLR

the 300 ppm surveillance limit specified in the COLR

the 300 ppm surveillance limit specified in the COLR

3/4.1.3 MOVABLE CONTROL ASSEMBLIES

GROUP HEIGHT

LIMITING CONDITION FOR OPERATION

3.1.3.1 All shutdown and control rods shall be OPERABLE and positioned within ± 12 steps (indicated position) of their group step counter demand position.

APPLICABILITY: MODES 1* and 2*.

ACTION:

a. With one or more rods inoperable due to being immovable as a result of excessive friction or mechanical interference or known to be untrippable, determine that the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied within 1 hour and be in HOT STANDBY within 6 hours.

b. With one rod trippable but inoperable due to causes other than addressed by ACTION a., above, or misaligned from its group step counter demand height by more than ± 12 steps (indicated position), POWER OPERATION may continue provided that within 1 hour:

1. The rod is restored to OPERABLE status within the above alignment requirements, or

2. The rod is declared inoperable and the remainder of the rods in the group with the inoperable rod are aligned to within ± 12 steps of the inoperable rod while maintaining the rod sequence and insertion limits of Specification 3.1.3.6 ~~Figure 3.1-1~~. The THERMAL POWER level shall be restricted pursuant to Specification 3.1.3.6 during subsequent operation, or

3. The rod is declared inoperable and the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied. POWER OPERATION may then continue provided that:

   a) A reevaluation of each accident analysis of Table 3.1-1 is performed within 5 days; this reevaluation shall confirm that the previously analyzed results of these accidents remain valid for the duration of operation under these conditions;

   b) The SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is determined at least once per 12 hours;

*See Special Test Exceptions Specifications 3.10.2 and 3.10.3.

REACTIVITY CONTROL SYSTEMS

LIMITING CONDITION FOR OPERATION

ACTION (Continued)

c) A power distribution map is obtained from the movable incore detectors and $F_Q(Z)$ and $F^N_{\Delta H}$ are verified to be within their limits within 72 hours; and

d) The THERMAL POWER level is reduced to less than or equal to 75% of RATED THERMAL POWER within the next hour and within the following 4 hours the High Neutron Flux Trip Setpoint is reduced to less than or equal to 85% of RATED THERMAL POWER.

c. With more than one rod trippable but inoperable due to a rod control urgent failure alarm or obvious electrical problem in the rod control system, POWER OPERATION may continue provided that:

1. Within 1 hour, the remainder of the rods in the bank(s) with the inoperable rods are aligned to within ± 12 steps of the inoperable rods while maintaining the rod sequence and insertion limits of ~~Figure 3.1-1~~ Specification 3.1.3.6. The THERMAL POWER level shall be restricted pursuant to Specification 3.1.3.6 during subsequent operation, and

2. The inoperable rods are restored to OPERABLE status within 48 hours.

d. With more than one rod misaligned from its group step counter demand height by more than ± 12 steps (indicated position), be in HOT STANDBY within 6 hours.

SURVEILLANCE REQUIREMENTS

4.1.3.1.1 The position of each rod shall be determined to be within the group demand limit by verifying the individual rod positions at least once per 12 hours except during time intervals when the rod position deviation monitor is inoperable, then verify the group positions at least once per 4 hours.

4.1.3.1.2 Each rod not fully inserted in the core shall be determined to be OPERABLE by movement of at least 10 steps in any one direction at least once per 31 days.

REACTIVITY CONTROL SYSTEMS

SHUTDOWN ROD INSERTION LIMIT

LIMITING CONDITION FOR OPERATION

3.1.3.5 All shutdown rods shall be limited in physical insertion as specified in the CORE OPERATING LIMITS REPORT (COLR). ~~fully withdrawn*.~~

APPLICABILITY: MODES 1*@ and 2*@#.

ACTION:

With a maximum of one shutdown rod inserted beyond the insertion limit specified in the COLR, ~~not fully withdrawn,~~ except for surveillance testing pursuant to Specification 4.1.3.1.2, within 1 hour either:

a. Restore the rod to within the insertion limit specified in the COLR, or ~~fully withdraw the rod, or~~

b. Declare the rod to be inoperable and apply Specification 3.1.3.1.

SURVEILLANCE REQUIREMENTS

4.1.3.5 Each shutdown rod shall be determined to be within the insertion limit specified in the COLR: ~~fully withdrawn:~~

a. within 15 minutes prior to withdrawal of any rods in Control Bank A, B, C, or D during an approach to reactor criticality, and

b. At least once per 12 hours thereafter.

~~*Fully withdrawn shall be the condition where shutdown rods are at a position within the interval of ≥ 222 and ≤ 231 steps withdrawn.~~

*@See Special Test Exceptions Specifications 3.10.2 and 3.10.3.

#With K_{eff} greater than or equal to 1.

REACTIVITY CONTROL SYSTEMS

CONTROL ROD INSERTION LIMITS

LIMITING CONDITION FOR OPERATION

3.1.3.6 The control banks shall be limited in physical insertion as ~~shown in Figure 3.1-1.~~ specified in the CORE OPERATING LIMITS REPORT (COLR).

APPLICABILITY: MODES 1* and 2* **.

ACTION:

With the control banks inserted beyond the ~~above~~ insertion limits, except for surveillance testing pursuant to Specification 4.1.3.1.2:

a. Restore the control banks to within the limits within 2 hours, or

b. Reduce THERMAL POWER within 2 hours to less than or equal to that fraction of RATED THERMAL POWER which is allowed by the bank position using the ~~above figure, or~~ insertion limits specified in the COLR, or

c. Be in at least HOT STANDBY within 6 hours.

SURVEILLANCE REQUIREMENTS

4.1.3.6 The position of each control bank shall be determined to be within the insertion limits at least once per 12 hours except during time intervals when the rod insertion limit monitor is inoperable, then verify the individual rod positions at least once per 4 hours.

*See Special Test Exceptions Specifications 3.10.2 and 3.10.3.

**With K_{eff} greater than or equal to 1.

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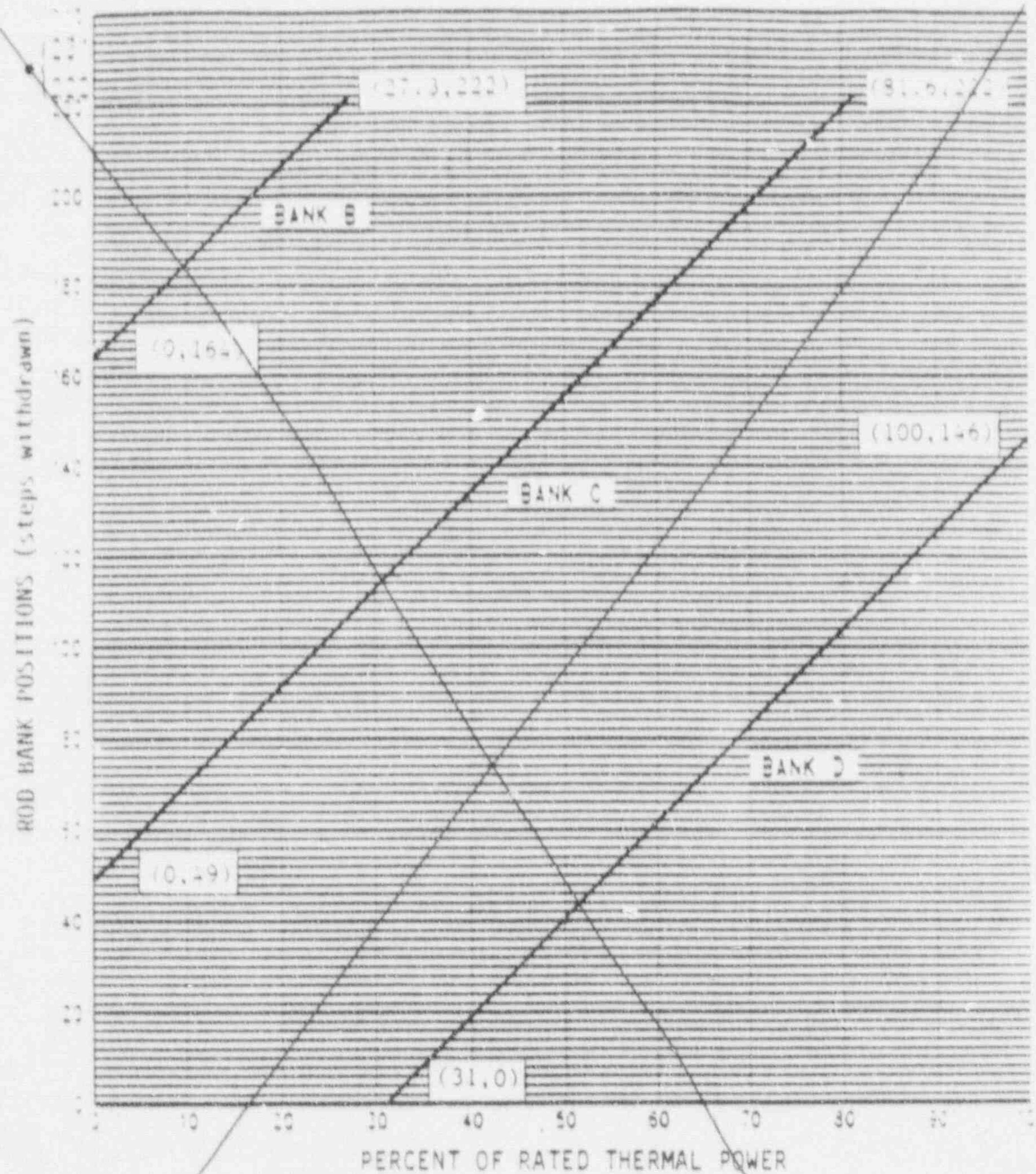

• FULLY WITHDRAWN SHALL BE THE CONDITION WHERE CONTROL RODS ARE AT A POSITION WITHIN THE INTERVAL OF ≥ 222 AND ≤ 231 STEPS WITHDRAWN.

FIGURE 3.1-1

ROD BANK INSERTION LIMITS VERSUS THERMAL POWER

3/4.2 POWER DISTRIBUTION LIMITS

3/4.2.1 AXIAL FLUX DIFFERENCE

LIMITING CONDITION FOR OPERATION

3.2.1 The indicated AXIAL FLUX DIFFERENCE (AFD) shall be maintained within the following target band (flux difference units) about the target flux difference. for Normal Operation and Base Load Operation.# * The target band is specified in the CORE OPERATING LIMITS REPORT (COLR).

a. ± 5% for core average accumulated burnup of less than or equal to 3000 MWD/MTU; and

b. + 3%, -12% for core average accumulated burnup of greater than 3000 MWD/MTU.

For Normal Operation, the The indicated AFD may deviate outside the above required target band at greater than or equal to 50% but less than 90% of RATED THERMAL POWER provided the indicated AFD is within the Acceptable Operation Limits of Figure 3.2-1 specified in the COLR and the cumulative penalty deviation time does not exceed 1 hour** during the previous 24 hours.

For Normal Operation, the The indicated AFD may deviate outside the above required target band at greater than 15% but less than 50% of RATED THERMAL POWER provided the cumulative penalty deviation time does not exceed 1 hour during the previous 24 hours.

For Base Load Operation, the AFD shall remain within the target band defined above.

APPLICABILITY: MODE 1, above 15% of RATED THERMAL POWER.*

ACTION:

a. For Normal Operation with With the indicated AFD outside of the above required target band and with THERMAL POWER greater than or equal to 90% of RATED THERMAL POWER, within 15 minutes either:

   1. Restore the indicated AFD to within the target band limits, or

   2. Reduce THERMAL POWER to less than 90% of RATED THERMAL POWER.

   For Base Load Operation with the indicated AFD outside of the above required target band, within 15 minutes either:

---

* See Special Test Exceptions Specification 3.10.2.

** Surveillance testing of the Power Range Neutron Flux Channels may be performed pursuant to Specification 4.3.1.1 provided the indicated AFD is maintained within the Acceptable Operation Limits specified in the COLR. of Figure 3.2-1. While in Normal Operation, a A total of 16 hours operation may be accumulated with the AFD outside of the above required target band during testing without penalty deviation.

Base Load Operation requires a minimum allowable power level, APL^{ND}, of 75% RATED THERMAL POWER to be maintained based on the figures given in the Radial Peaking Factor Limit Report for Base Load Operation per Specification 6.9.1.6.

POWER DISTRIBUTION LIMITS

LIMITING CONDITION FOR OPERATION

ACTION (Continued)

~~1. Restore the indicated AFD to within the target band limits, or~~

~~2. Discontinue Base Load Operation and adjust THERMAL POWER as necessary for Normal Operation.~~

b. ~~For Normal Operation with~~ With the indicated AFD outside of the ~~above~~ required target band for more than 1 hour of cumulative penalty deviation time during the previous 24 hours or outside the Acceptable Operation Limits ~~of Figure 3.2-1~~ specified in the COLR and with THERMAL POWER less than 90% but equal to or greater than 50% of RATED THERMAL POWER:

1. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 30 minutes, and

2. Reduce the Power Range Neutron Flux - High Trip Setpoints to less than or equal to 55% of RATED THERMAL POWER within the next 4 hours.

c. ~~For Normal Operation with~~ With the indicated AFD outside of the ~~above~~ required target band for more than 1 hour of cumulative penalty deviation time during the previous 24 hours and with THERMAL POWER less than 50% but greater than 15% of RATED THERMAL POWER, the THERMAL POWER shall not be increased equal to or greater than 50% of RATED THERMAL POWER until the indicated AFD is within the ~~above~~ required target band.

SURVEILLANCE REQUIREMENTS

4.2.1.1 The indicated AFD shall be determined to be within its limits during POWER OPERATION above 15% of RATED THERMAL POWER by:

a. Monitoring the indicated AFD for each OPERABLE excore channel:

1) At least once per 7 days when the AFD Monitor Alarm is OPERABLE, and

2) At least once per hour for the first 24 hours after restoring the AFD Monitor Alarm to OPERABLE status.

b. Monitoring and logging the indicated AFD for each OPERABLE excore channel at least once per hour for the first 24 hours and at least once per 30 minutes thereafter, when the AFD Monitor Alarm is inoperable. ~~#~~ The logged values of the indicated AFD shall be assumed to exist during the interval preceding each logging.

~~# During Base Load Operation at less than or equal to 90% RATED THERMAL POWER, the AFD Monitor Alarm shall be considered inoperable unless the AFD Monitor Alarm has provisions to immediately alarm above APL^{ND} with AFD outside the target band.~~

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS

4.2.1.2 The indicated AFD shall be considered outside of its target band when two or more OPERABLE excore channels are indicating the AFD to be outside the target band. Penalty deviation outside of the above required target band shall be accumulated on a time basis of:

a. One minute penalty deviation for each 1 minute of POWER OPERATION outside of the target band at THERMAL POWER levels equal to or above 50% of RATED THERMAL POWER, and

b. One-half minute penalty deviation for each 1 minute of POWER OPERATION outside of the target band at THERMAL POWER levels between 15% and 50% of RATED THERMAL POWER.

~~4.2.1.3 The target flux difference of each OPERABLE excore channel shall be determined by measurement at least once per 92 Effective Full Power Days. The provisions of Specification 4.0.4 are not applicable.~~

~~4.2.1.4 The target flux difference shall be updated at least once per 31 Effective Full Power Days by either determining the target flux difference pursuant to Specification 4.2.1.3 above or by linear interpolation between the most recently measured value and 0% at the end of the cycle life. The provisions of Specification 4.0.4 are not applicable.~~

4.2.1.3 The target flux difference of each OPERABLE excore channel shall be determined in conjunction with the measurement of $F_Q^c(Z)$ as defined in Specification 4.2.2.2e. The provisions of Specification 4.0.4 are not applicable.

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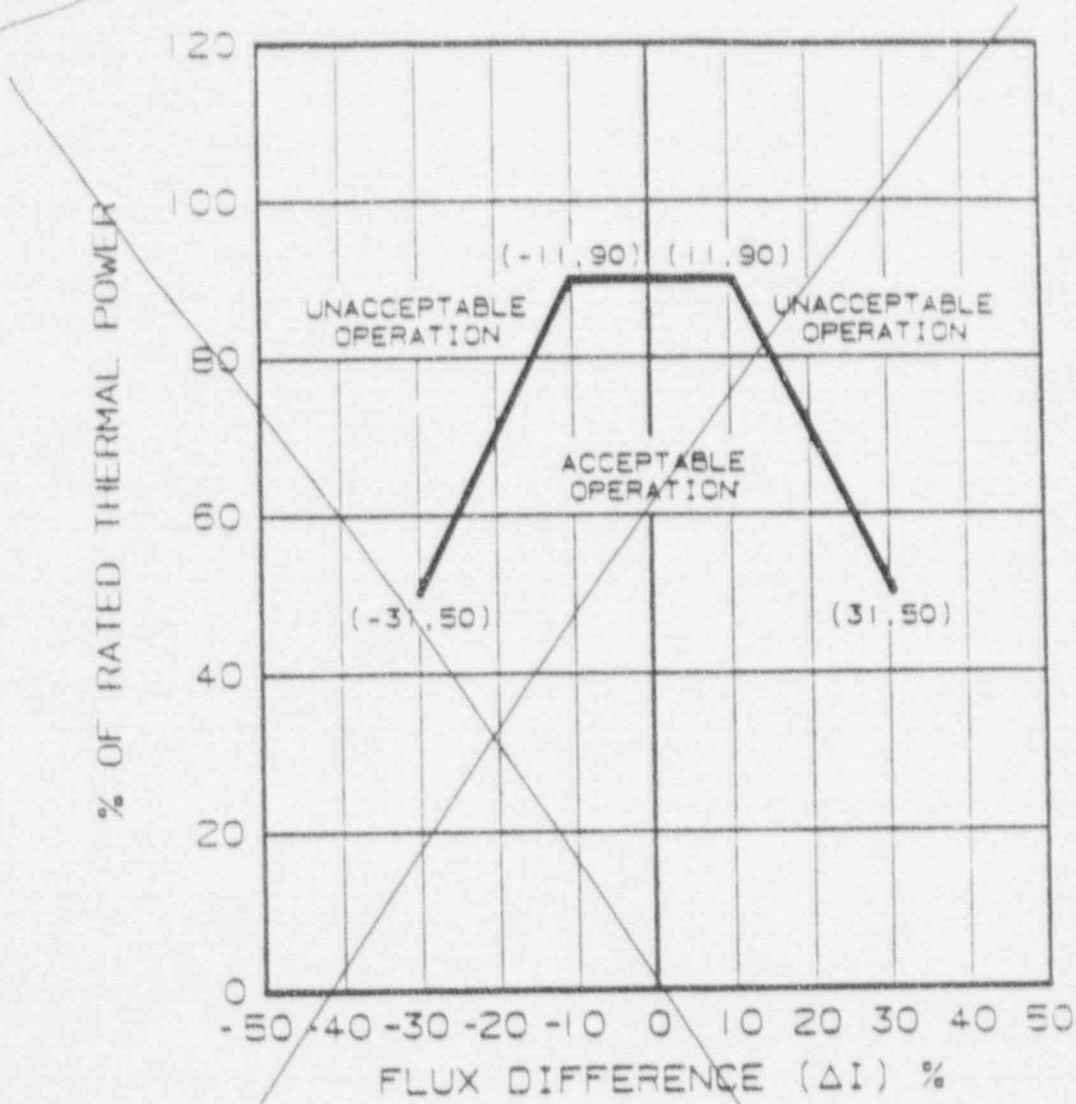

FIGURE 3.2-1

AXIAL FLUX DIFFERENCE LIMITS AS A FUNCTION OF RATED THERMAL POWER

3/4.2.2 HEAT FLUX HOT CHANNEL FACTOR - $F_Q(Z)$

LIMITING CONDITION FOR OPERATION

3.2.2 $F_Q(Z)$ shall be limited by the following relationships:

$F_Q(Z) \le$ [2.32/P] [K(Z)] for P > 0.5 — handwritten replacement: $\frac{[F_Q^{RTP}]}{P}$

$F_Q(Z) \le$ [4.64] [K(Z)] for P ≤ 0.5 — handwritten replacement: $\frac{[F_Q^{RTP}]}{0.5}$

Where: P = $\frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$, and

K(Z) = the function obtained from Figure 3.2-2 for a given core height location.

APPLICABILITY: MODE 1.

ACTION:

With $F_Q(Z)$ exceeding its limit:

a. Reduce THERMAL POWER at least 1% for each 1% $F_Q(Z)$ that exceeds the limit within 15 minutes and simila y reduce the Power Range Neutron Flux-High Trip Setpoints withi the next 4 hours; POWER OPERATION may proceed for up to a tota of 72 hours; subsequent POWER OPERATION may proceed provided t Overpower N-16 Trip Setpoints have been reduced at least 1 for each 1% $F_Q(Z)$ that exceeds the limit; and

b. Identify and correct the cause of the out-of-limit condition prior to increasing THERMAL POWER above the reduced limit required by ACTION a., above; THERMAL POWER may then be increased pro ed $F_Q(Z)$ is demonstrated through incore mapping to be within its limit.

Where: F_Q^{RTP} = the F_Q limit at RATED THERMAL POWER (RTP) specified in the CORE OPERATING LIMITS REPORT (COLR),

P = $\frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$, and

K(Z) = the normalized $F_Q(Z)$ as a function of core height specified in the COLR.

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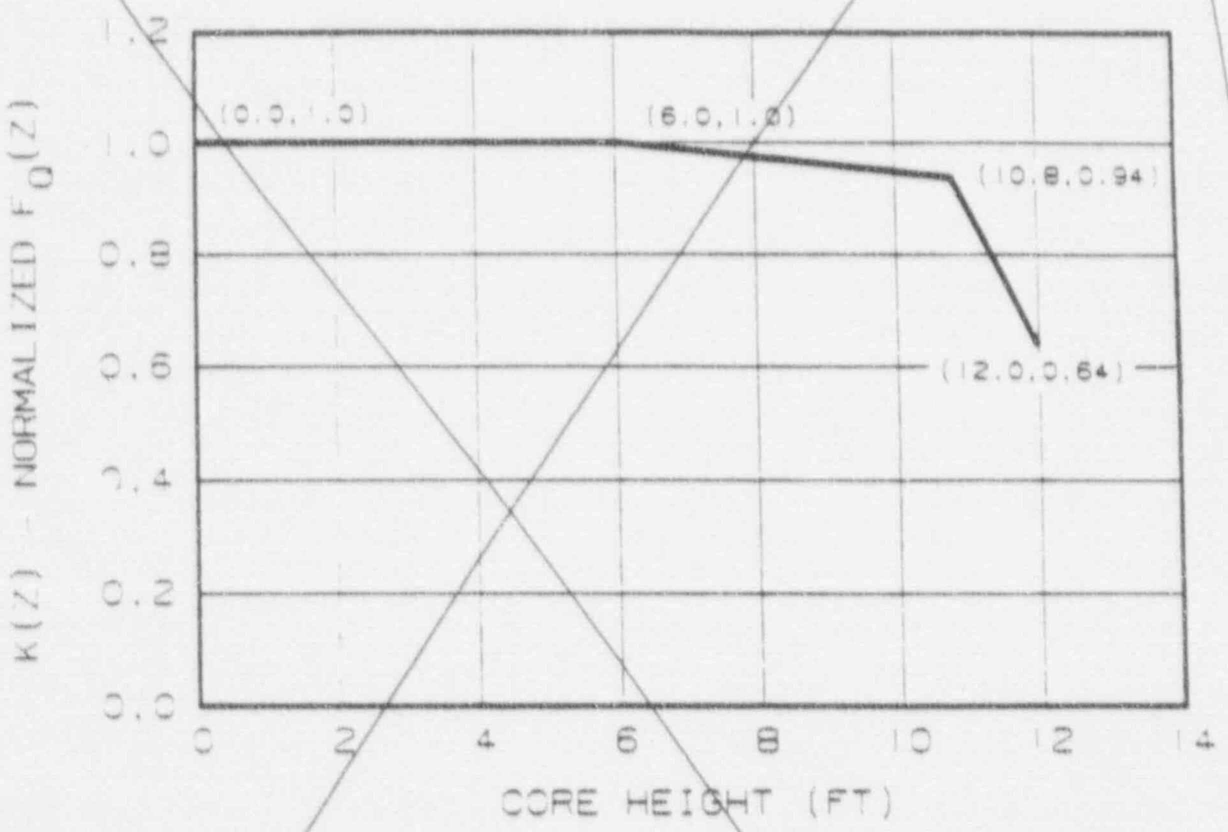


FIGURE 3.2-2

K(Z) - NORMALIZED $F_Q(Z)$ AS A FUNCTION OF CORE HEIGHT

Insert A

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS

4.2.2.1 The provisions of Specification 4.0.4 are not applicable.

4.2.2.2. Base Load Operation# is permitted at powers at/or above APL^{ND} if the following conditions are satisfied:

a. Prior to entering Base Load Operation, maintain THERMAL POWER above APL^{ND} and at or below the maximum allowable power level indicated by the most recent F_{xy} surveillance (and maintain THERMAL POWER within ± 5%) for at least the previous 24 hours. Maintain the AFD within the target band required for Base Load Operation during this time period. Base Load Operation is then permitted provided that THERMAL POWER is maintained at/or above APL^{ND} and F_{xy} surveillance is maintained pursuant to Specification 4.2.2.3.

b. During Base Load Operation, if the THERMAL POWER is decreased below APL^{ND} then the conditions of 4.2.2.2a. shall be satisfied before reentering Base Load Operation.

4.2.2.3 F_{xy} shall be evaluated to determine if $F_Q(Z)$ is within its limit by:

a. Using the movable incore detectors to obtain a power distribution map at any THERMAL POWER greater than 5% of RATED THERMAL POWER for Normal Operation or APL^{ND} for Base Load Operation,

b. Increasing the measured F_{xy} component of the power distribution map by 3% to account for manufacturing tolerances and further increasing the value by 5% to account for measurement uncertainties,

c. Comparing the F_{xy} computed (F_{xy}^{C}) obtained in Specification 4.2.2.3b., above to:

1) The F_{xy} limits for RATED THERMAL POWER (F_{xy}^{RTP}) for the appropriate measured core planes given in Specification 4.2.2.3e. and f., below, and

2) The relationship:

$$F_{xy}^{L} = F_{xy}^{RTP} [1+0.2(1-P)],$$

Where F_{xy}^{L} is the limit for fractional THERMAL POWER operation expressed as a function of F_{xy}^{RTP} and P is the fraction of RATED THERMAL POWER at which F_{xy} was measured.

Base Load Operation requires a minimum allowable power level, APL^{ND}, of 75% RATED THERMAL POWER to be maintained based on the figures given in the Radial Peaking Factor Limit Report for Base Load Operation per Specification 6.9.1.6.

INSERT A

4.2.2.1 The provisions of Specification 4.0.4 are not applicable.

4.2.2.2 $F_Q(Z)$ shall be evaluated to determine if it is within its limit by:

a. Using the movable incore detectors to obtain a power distribution map at any THERMAL POWER greater than 5% of RATED THERMAL POWER.

b. Determining the computed heat flux hot channel factor, $F_Q^C(Z)$, as follows:

Increase the measured $F_Q(Z)$ obtained from the power distribution map by 3% to account for manufacturing tolerances and further increase the value by 5% to account for measurement uncertainties.

c. Verifying that $F_Q^C(Z)$, obtained is Specification 4.2.2.2b. above, satisfies the relationship in Specification 3.2.2.

d. The $F_Q^C(Z)$ obtained in 4.2.2.2b above shall satisfy the following relationship at the time of the target flux determination:

$$F_Q^C(Z) \leq \frac{F_Q^{RTP} \times K(Z)}{P \times W(Z)} \quad \text{for } P > 0.5$$

$$F_Q^C(Z) \leq \frac{F_Q^{RTP} \times K(Z)}{0.5 \times W(Z)} \quad \text{for } P \leq 0.5$$

where $F_Q^C(Z)$ is obtained in Specification 4.2.2.2b. above, F_Q^{RTP} is the F_Q limit, $K(Z)$ is the normalized $F_Q(Z)$ as a function of core height, P is the fraction of RATED THERMAL POWER, and $W(Z)$ is the cycle dependent function that accounts for power distribution transients encountered during normal operation. F_Q^{RTP}, $K(Z)$ and $W(Z)$ are specified in the CORE OPERATING LIMITS REPORT as per Specification 6.9.1.6.

e. Measuring $F_Q(Z)$ according to the following schedule:

1. Upon achieving equilibrium condition after exceeding by 20% or more of RATED THERMAL POWER, the THERMAL POWER at which $F_Q(Z)$ was last determined*, or

2. At least once per 31 Effective Full Power Days, whichever occurs first.

* Power level may be increased until the THERMAL POWER for extended operation has been achieved.

Insert B and C

POWER DISTRIBUTION LIMITS

SURVEILLANCE REQUIREMENTS (Continued)

d. Remeasuring F_{xy} according to the following schedule:

1) When F_{xy}^{C} is greater than the F_{xy}^{RTP} limit for the appropriate measured core plane but less than the F_{xy}^{L} relationship, additional power distribution maps shall be taken and F_{xy}^{C} compared to F_{xy}^{RTP} and F_{xy}^{L} either:

a) Within 24 hours after exceeding by 20% of RATED THERMAL POWER or greater, the THERMAL POWER at which F_{xy}^{C} was last determined, or

b) At least once per 31 Effective Full Power Days (EFPD), whichever occurs first.

2) When the F_{xy}^{C} is less than or equal to the F_{xy}^{RTP} limit for the appropriate measured core plane, additional power distribution maps shall be taken and F_{xy}^{C} compared to F_{xy}^{RTP} and F_{xy}^{L} at least once per 31 EFPD.

e. The F_{xy} limits for RATED THERMAL POWER (F_{xy}^{RTP}) shall be provided for all core planes containing Bank "D" control rods and all unrodded core planes in a Radial Peaking Factor Limit Report per Specification 6.9.1.6;

f. The F_{xy} limits of Specification 4.2.2.3e., above, are not applicable in the following core plane regions as measured in percent of core height from the bottom of the fuel:

1) Lower core region from 0 to 15%, inclusive,

2) Upper core region from 85 to 100%, inclusive,

3) Grid plane regions at 17.8 ± 2%, 32.1 ± 2%, 46.4 ± 2%, 60.6 ± 2%, and 74.9 ± 2%, inclusive, and

4) Core plane regions within ± 2% of core height [± 2.88 inches] about the bank demand position of the Bank "D" control rods.

g. With F_{xy}^{C} exceeding F_{xy}^{L}, the effects of F_{xy} on $F_Q(Z)$ shall be evaluated to determine if $F_Q(Z)$ is within its limits.

4.2.2.4 When $F_Q(Z)$ is measured for other than F_{xy} determinations, an overall measured $F_Q(Z)$ shall be obtained from a power distribution map and increased by 3% to account for manufacturing tolerances and further increased by 5% to account for measurement uncertainty.

INSERT B

f. With measurements indicating

$$\underset{\text{over } Z}{\text{maximum}} \left(\frac{F_Q^C(Z)}{K(Z)} \right)$$

has increased since the previous determination of $F_Q^C(Z)$ either of the following actions shall be taken:

1) Increase $F_Q^C(Z)$ by 2% and verify that this value satisfies the relationship in Specification 4.2.2.2d, or

2) $F_Q^C(Z)$ shall be measured at least once per 7 Effective Full Power Days until two successive maps indicate that

$$\underset{\text{over } Z}{\text{maximum}} \left(\frac{F_Q^C(Z)}{K(Z)} \right) \text{ is not increasing.}$$

g. With the relationships specified in Specification 4.2.2.2d above not being satisfied:

1) Calculate the percent that $F_Q(Z)$ exceeds its limits by the following expression:

$$\left\{ \left(\underset{\text{over } Z}{\text{maximum}} \left[\frac{F_Q^C(Z) \times W(Z)}{\frac{F_Q^{RTP}}{P} \times K(Z)} \right] \right) - 1 \right\} \times 100 \text{ for } P > 0.5$$

$$\left\{ \left(\underset{\text{over } Z}{\text{maximum}} \left[\frac{F_Q^C(Z) \times W(Z)}{\frac{F_Q^{RTP}}{0.5} \times K(Z)} \right] \right) - 1 \right\} \times 100 \text{ for } P \leq 0.5, \text{ and}$$

2) The following action shall be taken:

Within 15 minutes, control the AFD to within new AFD limits which are determined by reducing the AFD limits specified in the CORE OPERATING LIMIT REPORT by 1% AFD for each percent $F_Q(Z)$ exceedes its limits as determined in Specification 4.2.2.2g.1. Within 8 hours, reset the AFD alarm setpoints to these modified limits.

INSERT C

h. The limits specified in Specification 4.2.2.2c are applicable in all core plane regions, i.e. 0 - 100%, inclusive.

i. The limits specified in Specifications 4.2.2.2d, 4.2.2.2f, and 4.2.2.2g, above are not applicable in the following core plane regions:

1. Lower core region from 0 to 15%, inclusive.
2. Upper core region from 85 to 100%, inclusive.

4.2.2.3 When $F_Q(Z)$ is measured for reasons other than meeting the requirements of Specification 4.2.2.2 an overall measured $F_Q(Z)$ shall be obtained from a power distribution map and increased by 3% to account for manufacturing tolerances and further increased by 5% to account for measurement uncertainty.

POWER DISTRIBUTION LIMITS

3/4.2.3 NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR $F^N_{\Delta H}$

LIMITING CONDITION FOR OPERATION

3.2.3 $F^N_{\Delta H}$ shall be limited by the following relationship:

$F^N_{\Delta H} \le$ ~~1.55~~ $F^{RTP}_{\Delta H}$ [1.0 + ~~0.2~~ $PF_{\Delta H}$ (1.0 - P)]

Where:

$F^{RTP}_{\Delta H}$ = the $F^N_{\Delta H}$ limit at RATED THERMAL POWER (RTP) specified in the CORE OPERATING LIMITS REPORT (COLR),

$PF_{\Delta H}$ = the power factor multiplier for $F^N_{\Delta H}$ specified in the COLR, and

$$P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$$

APPLICABILITY: MODE 1.

ACTION:

With $F^N_{\Delta H}$ exceeding its limit:

a. Within 2 hours either:

1. Restore $F^N_{\Delta H}$ to within the above limit, or
2. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER and reduce the Power Range Neutron Flux - High Trip Setpoint to less than or equal to 55% of RATED THERMAL POWER within the next 4 hours.

b. Within 24 hours of initially being outside the above limit, verify through incore flux mapping that $F^N_{\Delta H}$ has been restored to within the above limit, or reduce THERMAL POWER to less than 5% of RATED THERMAL POWER within the next 2 hours.

c. Identify and correct the cause of the out-of-limit condition prior to increasing THERMAL POWER above the reduced THERMAL POWER limit required by ACTION a.2. and/or b., above; subsequent POWER OPERATION may proceed provided that $F^N_{\Delta H}$ is demonstrated, through incore flux mapping, to be within its limit prior to exceeding the following THERMAL POWER levels:

1. A nominal 50% of RATED THERMAL POWER,
2. A nominal 75% of RATED THERMAL POWER, and
3. Within 24 hours of attaining greater than or equal to 95% of RATED THERMAL POWER.

300 ppm surveillance limit

MODERATOR TEMPERATURE COEFFICIENT (Continued)

End of Cycle Life (EOL)

involved subtracting the incremental change in the MDC associated with a core condition of all rods inserted (most positive MDC) to an all rods withdrawn condition and, a conversion for the rate of change of moderator density with temperature at RATED THERMAL POWER conditions. This value of the MDC was then transformed into the limiting MTC value, ~~-4.0 x 10^{-4} Δk/k/°F.~~ The MTC value ~~of -3.1 x 10^{-4} Δk/k/°F~~ represents a conservative value (with corrections for burnup and soluble boron) at a core condition of 300 ppm equilibrium boron concentration and is obtained by making these corrections to the limiting MTC value, ~~of -4.0 x 10^{-4} Δk/k/°F.~~

EOL

The Surveillance Requirements for measurement of the MTC at the beginning and near the end of the fuel cycle are adequate to confirm that the MTC remains within its limits since this coefficient changes slowly due principally to the reduction in RCS boron concentration associated with fuel burnup.

3/4.1.1.4 MINIMUM TEMPERATURE FOR CRITICALITY

This specification ensures that the reactor will not be made critical with the Reactor Coolant System average temperature less than 551°F. This limitation is required to ensure: (1) the moderator temperature coefficient is within it analyzed temperature range, (2) the trip instrumentation is within its normal operating range, (3) the pressurizer is capable of being in an OPERABLE status with a steam bubble, and (4) the reactor vessel is above its minimum RT_{NDT} temperature.

3/4.1.2 BORATION SYSTEMS

The Boron Injection System ensures that negative reactivity control is available during each mode of facility operation. The components required to perform this function include: (1) borated water sources, (2) charging pumps, (3) separate flow paths, (4) boric acid transfer pumps, and (5) an emergency power supply from OPERABLE diesel generators.

With the RCS average temperature above 200°F, a minimum of two boron injection flow paths are required to ensure single functional capability in the event an assumed failure renders one of the flow paths inoperable. The boration capability of either flow path is sufficient to provide a SHUTDOWN MARGIN from expected operating conditions of 1.6% Δk/k after xenon decay and cooldown to 200°F. The maximum expected boration capability requirement occurs at EOL from full power equilibrium xenon conditions and requires 15,700 gallons of 7000 ppm borated water from the boric acid storage tanks or 70,702 gallons of 2000 ppm borated water from the refueling water storage tank (RWST).

3/4.2 POWER DISTRIBUTION LIMITS

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 greater than or equal to 1.30 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 definitions 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~~, and~~.

~~$F_{xy}(Z)$ Radial Peaking Factor, is defined as the ratio of peak power density to average power density in the horizontal plane at core elevation Z.~~

the F_Q limit specified in the CORE OPERATING LIMITS REPORT (COLR)

3/4.2.1 AXIAL FLUX DIFFERENCE

The limits on AXIAL FLUX DIFFERENCE (AFD) assure that the $F_Q(Z)$ upper bound envelope of ~~2.32~~ times the normalized axial peaking factor is 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 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.

POWER DISTRIBUTION LIMITS

BASES

AXIAL FLUX DIFFERENCE (Continued)

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. If the AFD limits result in restrictions in the maximum allowed power level to guarantee operation with $F_Q(Z)$ less than its limiting value, another operating mode which does not allow significant changes in power level has been defined. This mode is called Base Load Operation, which restricts power levels to between APL^{ND} and RATED THERMAL POWER, inclusive. Prior to entering Base Load Operation, a 24-hour waiting period at a power level above APL^{ND} (and maintained within ± 5%) is necessary to allow core xenon stabilization. After the waiting period, Base Load Operation is permitted. During Base Load Operation, AFD must remain within its target band.

Although it is intended that the plant will be operated with the AFD within the target band required by Specification 3.2.1 about the target flux difference, during rapid plant THERMAL POWER reductions, ~~while in Normal Operation,~~ control rod motion will cause the AFD to deviate outside of the target band at reduced THERMAL POWER levels. This deviation will not affect the xenon redistribution sufficiently to change the envelope of peaking factors which may be reached on a subsequent return to RATED THERMAL POWER (with the AFD within the target band) provided the time duration of the deviation is limited. Accordingly, a 1-hour penalty deviation limit cumulative during the previous 24 hours is provided for operation outside of the target band but within the limits ~~of Figure 3.2-1~~ (specified in the COLR) while at THERMAL POWER levels between 50% and 90% of RATED THERMAL POWER. For THERMAL POWER levels between 15% and 50% of RATED THERMAL POWER, deviations of the AFD outside of the target band are less significant. The penalty of 2 hours actual time reflects this reduced significance.

Provisions for monitoring the AFD on an automatic basis are derived from the plant process computer through the AFD Monitor Alarm. The computer determines the 1-minute average of each of the OPERABLE excore detector outputs and provides an alarm message immediately if the AFD for two or more OPERABLE excore channels are outside the target band and the THERMAL POWER is greater than 90% of RATED THERMAL POWER. During operation at THERMAL POWER levels between 50% and 90% and between 15% and 50% RATED THERMAL POWER, the computer outputs an alarm message when the penalty deviation accumulates beyond the limits of 1 hour and 2 hours, respectively.

During Base Load Operation at less than or equal to 90% RATED THERMAL POWER, the AFD Monitor Alarm is considered inoperable unless the AFD Monitor Alarm has provisions to immediately alarm above APL^{ND} with AFD outside the target band

Figure B 3/4 2-1 shows a typical monthly target band.

3/4.2.2 and 3/4.2.3 HEAT FLUX HOT CHANNEL FACTOR and NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR

The limits on heat flux hot channel factor and nuclear enthalpy rise hot channel factor ensure that: (1) the design limits on peak local power density

POWER DISTRIBUTION LIMITS

BASES

HEAT FLUX HOT CHANNEL FACTOR and NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR (Continued)

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.

Insert E

When $F^N_{\Delta H}$ is measured, an adjustment for measurement uncertainty must be included for a full-core flux map taken with the Incore Detector Flux Mapping System.

~~The Radial Peaking Factor, $F_{xy}(Z)$, is measured periodically to provide assurance that the Hot Channel Factor, $F_Q(Z)$, remains within its limit. The F_{xy} limit for RATED THERMAL POWER (F_{xy}^{RTP}) as provided in the Radial Peaking Factor Limit Report per Specification 6.9.1.6 was determined from expected power control manuevers over the full range of burnup conditions in the core.~~

$F_Q(Z)$ ~~$F_{xy}(Z)$~~ should be measured with the reactor core at, or near, equilibrium conditions. Therefore, the effects of transient maneuvers, such as power increases, should be permitted to decay to the extent possible while assuring that flux maps are taken in accordance with the specified surveillance schedules.

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 limit of 1.02 was selected to provide an allowance for the uncertainty associated with the indicated power tilt.

The 2-hour time allowance for operation with a tilt condition greater than 1.02 is provided to allow identification and correction of a dropped or misaligned control rod. In the event such action does not correct the tilt, the margin for uncertainty on F_Q is reinstated by reducing the maximum allowed power by 3% for each percent of tilt in excess of 1.

For purposes of monitoring QUADRANT POWER TILT RATIO when one excore detector is inoperable, the moveable incore detectors are used to confirm that the normalized symmetric power distribution is consistent with the QUADRANT POWER TILT RATIO. The incore detector monitoring is done with a full incore flux map or two sets of four symmetric thimbles.

INSERT E

The heat flux hot channel factor $F_Q(Z)$ is measured periodically and increased by a cycle and height dependent power factor appropriate to CAOC operation, W(Z), to provide assurance that the limit on the heat flux hot channel factor, $F_Q(Z)$, is met. W(Z) accounts for the effects of normal operation transients within the AFD band and was determined from expected power control maneuvers over the range of burnup conditions in the core. The W(Z) function is provided in the CORE OPERATING LIMITS REPORT per Specification 6.9.1.6.

Insert D

MONTHLY OPERATING REPORTS (Continued)

Management, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, with a copy to the Regional Administrator of the Regional Office of the NRC, no later than the 15th of each month following the calendar month covered by the report.

RADIAL PEAKING FACTOR LIMIT REPORT

6.9.1.6 The F_{xy} limits for RATED THERMAL POWER (F_{xy}^{RTP}) shall be established for at least each reload core for Normal Operation and Base Load Operation and shall be maintained available in the Control Room. The limits shall be established and implemented on a time scale consistent with normal procedural changes.

The analytical methods used to generate the F_{xy} limits shall be reviewed and approved by the NRC for CPSES specific use. If changes to these methods are deemed necessary they will be evaluated in accordance with 10 CFR 50.59 and submitted to the NRC for review and approval prior to their use if the change is determined to involve an unreviewed safety question or if such a change would require amendment of previously submitted documentation.

A report containing the F_{xy} limits for all core planes containing Bank "D" control rods and all unrodded core planes along with the plot of predicted $F_q^T \cdot P_{REL}$ axial core height (with the limit envelope for comparison) shall be provided to the NRC Document Control desk with copies to the Regional Administrator and the Resident Inspector within 30 days of their implementation.

The report shall also establish the minimum allowable power level, APL^{ND}, for Base Load Operation for at least each reload core and shall be maintained in the Control Room.

SPECIAL REPORTS

6.9.2 In addition to the applicable reporting requirements of Title 10, Code of Federal Regulations, special reports shall be submitted to the Regional Administrator of the Regional Office of the NRC within the time period specified for each report.

6.10 RECORD RETENTION

6.10.1 In addition to the applicable record retention requirements of Title 10, Code of Federal Regulations, the following records shall be retained for at least the minimum period indicated.

6.10.2 The following records shall be retained for at least 5 years:

a. Records and logs of unit operation covering time interval at each power level;

b. Records and logs of principal maintenance activities, inspections, repair, and replacement of principal items of equipment related to nuclear safety;

Insert D

CORE OPERATING LIMITS REPORT

6.9.1.6 Core operating limits shall be established and documented in the CORE OPERATING LIMITS REPORT (COLR) before each reload cycle or any remaining part of a reload cycle for the following:

a. Moderator temperature coefficient BOL and EOL limits and 300 ppm surveillance limit for Specification 3/4.1.1.3,

b. Shutdown Rod Insertion Limit for Specification 3/4.1.3.5,

c. Control Rod Insertion Limits for Specification 3/4.1.3.6,

d. AXIAL FLUX DIFFERENCE Limits and target band for Specification 3/4.2.1,

e. Heat Flux Hot Channel Factor, K(Z), W(Z), and F_Q^{RTP} for Specification 3/4.2.2,

f. Nuclear Enthalpy Rise Hot Channel Factor Limit and the Power Factor Multiplier for Specification 3/4.2.3.

The analytical methods used to determine the core operating limits shall be those previously approved by the NRC in:

a. WCAP-9272-P-A, "WESTINGHOUSE RELOAD SAFETY EVALUATION METHODOLOGY", July 1985 (W Proprietary). (Methodology for Specifications 3.1.1.3 - Moderator Temperature Coefficient, 3.1.3.5 - Shutdown Bank Insertion Limit, 3.1.3.6 - Control Bank Insertion Limits, 3.2.1 - Axial Flux Difference, 3.2.2. - Heat Flux Hot Channel Factor, and 3.2.3 - Nuclear Enthalpy Rise Hot Channel Factor.)

b. WCAP-8385, "POWER DISTRIBUTION CONTROL AND LOAD FOLLOWING PROCEDURES - TOPICAL REPORT", September 1974 (W Proprietary). (Methodology for Specification 3.2.1 - Axial Flux Difference [Constant Axial Offset Control].)

c. T. M. Anderson to K. Kniel (Chief of Core Performance Branch, NRC January 31, 1980--Attachment: Operation and Safety Analysis Aspects of an Improved Load Follow Package. (Methodology) for Specification 3.2.1 - Axial Flux Difference [Constant Axial Offset Control].)

d. NUREG-0800, Standard Review Plan, U. S. Nuclear Regulatory Commission, Section 4.3, Nuclear Design, July 1981. Branch Technical Position CPB 4.3-1, Westinghouse Constant Axial Offset Control (CAOC), Rev. 2, July 1981. (Methodology for Specification 3.2.1 - Axial Flux Difference [Constant Axial Offset Control].)

e. WCAP-10216-P-A, "RELAXATION OF CONSTANT AXIAL OFFSET CONTROL FQ SURVEILLANCE TECHNICAL SPECIFICATION", June 1983 (W Proprietary).
(Methodology for Specification 3.2.2-Heat Flux Hot Channel Factor (W (z) surveillance requirements for F_Q Methodology).)

f. WCAP-8200, "WFLASH, A FORTRAN-IV COMPUTER PROGRAM FOR SIMULATION OF TRANSIENTS IN A MULTI-LOOP PWR," Revision 2, July 1974 (W Proprietary).
(Methodology for Specification 3.2.2 - Heat Flux Hot Channel Factor).

g. WCAP-9220-P-A "Westinghouse ECCS Evaluation Model, February 1978 Version," February 1978 (W Proprietary).
(Methodology for Specification 3.2.2 - Heat Flux Hot Channel Factor).

The core operating limits shall be determined so that all applicable limits (e.g., fuel thermal-mechanical limits, core thermal-hydraulic limits, ECCS limits, nuclear limits such as shutdown margin, and transient and accident analysis limits) of the safety analysis are met.

The CORE OPERATING LIMITS REPORT, including any mid-cycle revisions or supplements thereto, shall be provided upon issuance, for each reload cycle, to the NRC Document Control Desk with copies to the Regional Administrator and Resident Inspector.

ENCLOSURE 4 TO TXX-91179

PRELIMINARY VERSION OF THE

CORE OPERATING LIMITS REPORT

USING PRELIMINARY CYCLE 2 INFORMATION FOR UNIT 1

PRELIMINARY

CPSES UNIT 1 CYCLE 2

CORE OPERATING LIMITS REPORT

Revision - Preliminary

March 5, 1991

PRELIMINARY

COLR for CPSES UNIT 1 CYCLE 2

1.0 CORE OPERATING LIMITS REPORT

This core operating Limits Report (COLR) for CPSES UNIT 1 CYCLE 2 has been prepared in according with the requirements of Technical Specification 6.9.1.6.

The Technical Specifications affected by this report are listed below:

3/4.1.1.3	Moderator Temperature Coefficient
3/4.1.3.5	Shutdown Rod Insertion Limit
3/4.1.3.6	Control Rod Insertion Limits
3/4.2.1	Axial Flux Difference
3/4.2.2	Heat Flux Hot Channel Factor
3/4.2.3	Nuclear Enthalpy Rise Hot Channel Factor

2.0 OPERATING LIMITS

The cycle-specific parameter limits for the specifications listed in Section 1.0 are presented in the following subsections. These limits have been developed using the NRC-approved methodologies specified in Technical Specifications 6.9.1.6.

2.1 Moderator Temperature Coefficient (Specification 3/4.1.1.3)

2.1.1 The Moderator Temperature Coefficient (MTC) limits are:

The BOL/ARO/HZP-MTC shall be less positive than +5 pcm/°F.

The EOL/ARO/RTP-MTC shall be less negative than - 40 pcm/°F.

2.1.2 The MTC surveillance limit is:

The 300 ppm/ARO/RTP-MTC should be less negative than or equal to -31 pcm/°F.

where: BOL stands for Beginning of Cycle Life
ARO stands for All Rods Out
HZP stands for Hot Zero THERMAL POWER
EOL stands for End of Cycle Life
RTP stands for RATED THERMAL POWER

2.2 Shutdown Rod Insertion Limit (Specification 3/4.1.3.5)

2.2.1 The shutdown rods shall be withdrawn to at least 222 steps.

2.3. Control Rod Insertion Limits (Specification 3/4.1.3.6)

2.3.1 The control rod banks shall be limited physical insertion as shown in Figure 1.

2.4 Axial Flux Difference (Specification 3/4.2.1)

2.4.1 The AXIAL FLUX DIFFERENCE (AFD) target band is +5%, -5%, for core average accumulated burnup ≤ 3000 MWD/MTU.

2.4.2 The AFD target band is +3%, -12%, for core average accumulated burnup > 3000 MWD/MTU.

where: MWD/MTU stands for megawatt days/metric tonne of initial uranium metal

2.4.3 The AFD Acceptable Operation Limits are provided in Figure 2.

PRELIMINARY

2.5 Heat Flux Hot Channel Factor - $F_Q(Z)$ (Specification 3/4.2.2)

$$F_Q(Z) \leq \frac{F_Q^{RTP}}{P} * K(z) \text{ for } P > 0.5$$

$$F_Q(Z) \leq \frac{F_Q^{RTP}}{0.5} * K(z) \text{ for } P \leq 0.5$$

where: $P = \dfrac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$

2.5.1 $F_Q^{RTP} = 2.32$

2.5.2 K(Z) is provided in Figure 3

2.5.3 W(Z) values are provided in Figure 4.

2.6 Nuclear Enthalpy Rise Hot Channel Factor - $F^{N}_{\Delta H}$
(Specification 3/4.2.3)

$$F^{N}_{\Delta H} \leq F^{RTP}_{\Delta H} * (1 + PF_{\Delta H} * (1-P))$$

where: $P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$

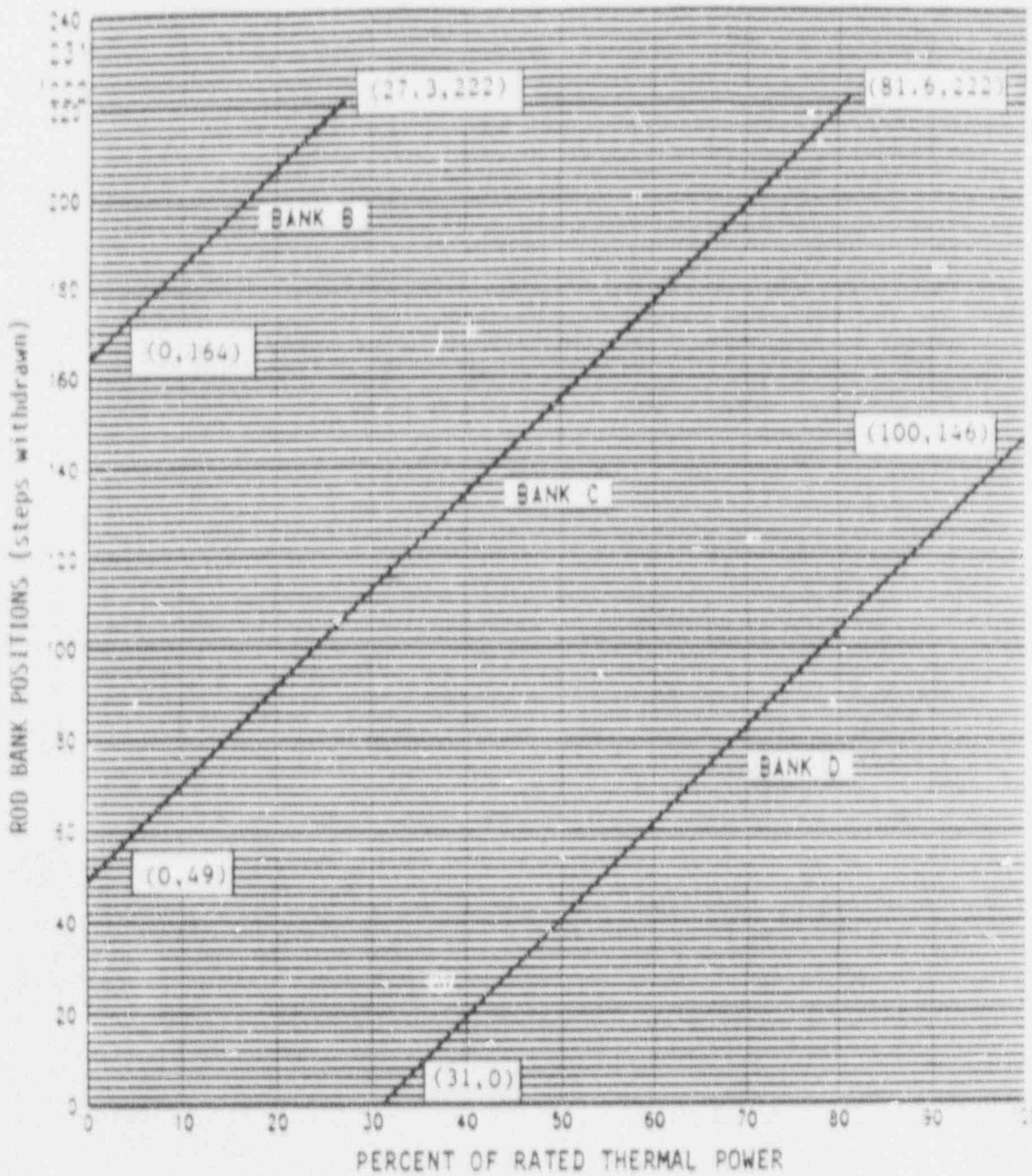
2.6.1 $F^{RTP}_{\Delta H} = 1.55$

2.6.2 $PF_{\Delta H} = 0.2$

PRELIMINARY

COLR for CPSES UNIT 1 CYCLE 2

FIGURE 1 ROD BANK INSERTION LIMITS VERSUS THERMAL POWER

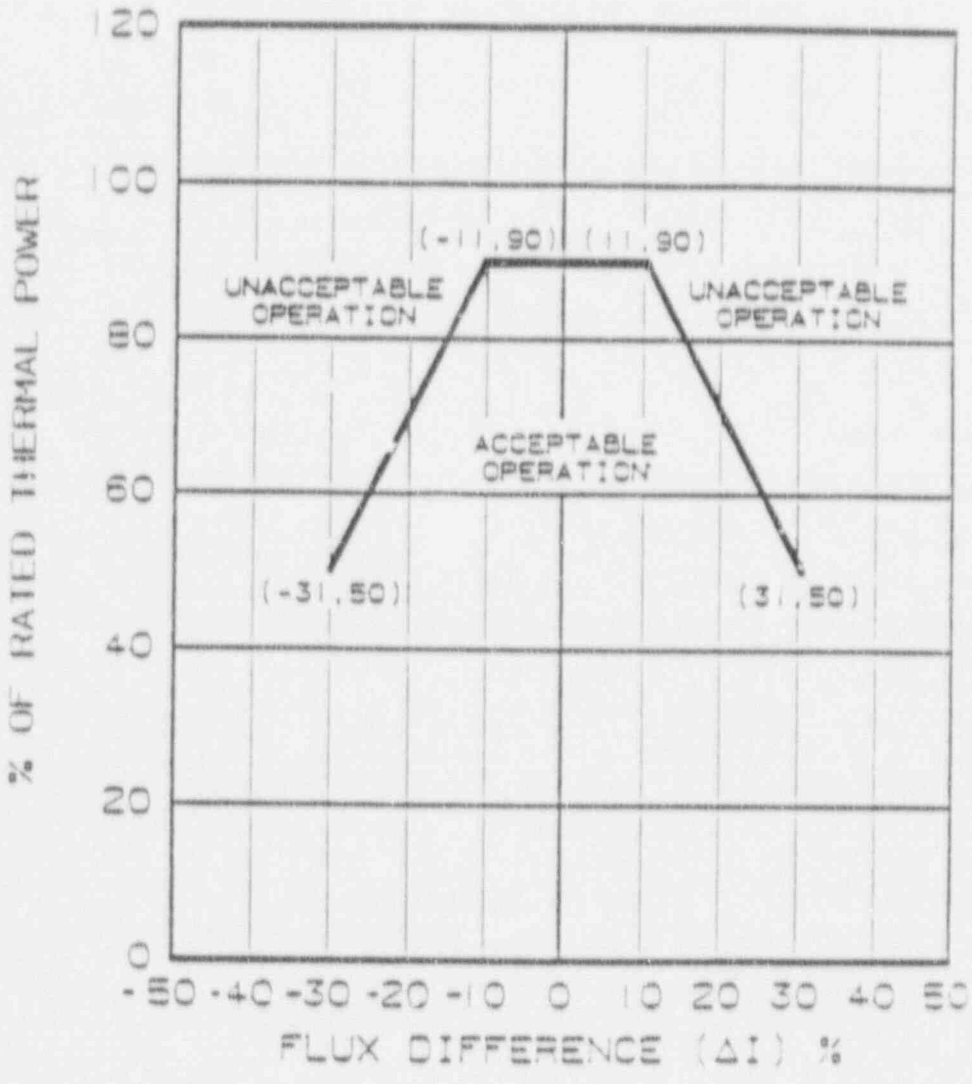


* FULLY WITHDRAWN SHALL BE THE CONDITION WHERE CONTROL RODS ARE AT A POSITION WITHIN THE INTERVAL OF ≥ 222 AND ≤ 231 STEPS WITHDRAWN.

PRELIMINARY

COLR for CPSES UNIT 1 CYCLE 2

FIGURE 2 AXIAL FLUX DIFFERENCE LIMITS AS A FUNCTION OF RATED THERMAL POWER



PRELIMINARY

COLR FOR CPSES UNIT 1 CYCLE 2

FIGURE 3 K(Z) - NORMALIZED $F_Q(Z)$ AS A FUNCTION OF CORE HEIGHT

PRELIMINARY

COLR for CPSES UNIT 1 CYCLE 2

FIGURE 4 W(Z) AS A FUNCTION OF CORE HEIGHT