I. TECHNICAL SPECIFICATION CHANGE REQUEST (TSCR) No. 159

GPUN requests that the following pages be inserted into the existing Technical Specifications:

Revised pages vii, 2-3, 3-34a, 3-35, 3-35a, 3-35b

Revised figures 2.1-2, 2.3-2, 3.5-2E, 3.5-2F, 3.5-2H

New figure 3.5-2I

These pages are attached to this change request.

II. REASON FOR CHANGE

Based on Cycle 5 operation to date, continued full power generation capability will not be available through the scheduled beginning of the Cycle 6 refueling outage on November 1, 1986. This change is to extend the length of Cycle 5 to 290 ±15 Effective Full Power Days (EFPD) by full withdrawal of the axial power shaping rods (APSR) from the core at about 250 EFPD exposure until the end of the cycle.

Withdrawal of axial power shaping rods will need to be performed as early as August 30, 1986 (240 EFPD) based on current burnup of Cycle 5.

III. SAFETY EVALUATION JUSTIFYING CHANGE

APSR withdrawal at 250 ±10 EFPD and extension of the cycle length to 290 ±15 EFPD will change the end-of-cycle (EOC) core conditions. In particular, certain core parameters used to evaluate Cycle 5 in relation to existing safety analyses will change. Analyses have been performed by Babcock & Wilcox (B&W) using previously approved NRC methods to compare core conditions for APSR withdrawal with all appropriate licensing basis analyses in the TMI-1 FSAR and the TMI-1 Cycle 5 Reload Report dated December 1978. Results show that the APSR withdrawal is conservatively bounded by the existing analyses in all cases.

TECHNICAL SPECIFICATION REVISIONS

The impact of the APSR withdrawal on present safety and operating limits was also evaluated. The attached revisions to the following limits are proposed to support operation with APSR's withdrawn:

Safety Limits:

Core Protection Safety Limits

Limiting Safety System Settings:

Protection System Maximum Allowable Setpoints for Reactor Power Imbalance

Limiting Conditions for Operation:

Power Imbalance Envelope
APSR Position Limits

The changes provide wider imbalance windows and prohibit APSR insertion after 250 ±10 EFPD to EOC. Other Technical Specification limits were evaluated and need no revision. The evaluation also assured that the revised limits are still consistent with the Technical Specification bases.

A Cycle 5 specific power distribution analysis was performed to determine the core Limiting Conditions for Operation (LCOs) on rod index and axial imbalance for operation after APSR withdrawal at 250 ±10 EFPD. The analysis included the impact of control rod index, APSR position, power level, burnup, and xenon distribution on the LCO limits. Due to lower power peaking after 250 ±10 EFPD in the fuel cycle, it is possible to set axial imbalance limits which are less restrictive than those applicable for 0 - 250 ±10 EFPD. The current rod index limits were determined to preserve the shutdown margin and ejected rod worth criteria for operation with the APSRs withdrawn. The LCO limits were also verified to preserve criteria established for protection during overcooling transients.

The TMI-1 Cycle 5 RPS power/imbalance/flow Technical Specification setpoints and safety limits were reevaluated for the APSR withdrawal and cycle extension. In doing so, the setpoints and safety limits were expanded to ease operational concerns associated with the APSR withdrawal and cycle extension. The expansion of the envelope is made possible by the existing margin between the power-power imbalance limits actually calculated for Cycle 5 and the original Cycle 5 Technical Specification safety limits which were established very conservatively with the intention of bounding future cycles. The revised Technical Specification setpoints and safety limits preserve the original power-power imbalance limits generated for Cycle 5, while increasing operability by taking advantage of a portion of the available margin.

The revised Technical Specification limits preserve the Final Acceptance Criteria ECCS linear heat rate limits, as well as the thermal design criteria.

Nuclear Design

The startup physics test results for Cycle 5 indicated that the design analysis of the core agreed well with the actual core conditions and physics characteristics. Full power operation continues to indicate that the design predictions are accurately modeling the physics characteristics of the core, particularly as they relate to reactivity. Thus, the conditions of the fuel are being accurately modeled and any perturbation caused by APSR withdrawal has been accurately predicted.

The design analysis for APSR withdrawal at B&W plants began in 1978. Since that time the withdrawal of the APSRs near the end of the cycle has become a routine operational procedure at several plants. The design models have been benchmarked to the measured operational characteristics of the cores and they are correctly predicting the operational changes resulting from the APSR withdrawal. With respect to reactivity changes, the effects of withdrawing the APSRs are to (1) slightly change the relative importance weighting of the fuel radially and (2) change the core leakage, both radially and axially. The changes in the leakage and importance weighting produce a small effect on the TMI-1 core as does an increase in core average burnup.

To ensure the validity of extending the Cycle 5 lifetime to 290 $\pm$ 15 EFPD various reactivity parameters used for accident and transient evaluations have been calculated. These include:

- Critical Boron Concentrations
- Control Rod Worths
  - Group 8 (APSR)
  - Group 7
  - Groups 1 through 7
  - Maximum stuck rod
  - Maximum ejected rod
- Coefficients
  - Doppler
  - Moderator temperature
- Power Deficit
- Boron Worths

As shown on Table 5-1 control rod worths changed very little due to the APSR withdrawal. Table 5-2 shows a small increase in the total Group worth from 8.91% to 8.92% $\Delta\rho$. The largest change in the coefficients was the moderator temperature which increased (became less negative) thus improving the margin to the FSAR analyses for all transients that are limiting at end-of-cycle. The value at 17 ppm, EOC with the APSRs inserted was -2.63×10^{-4} $\Delta k/k/°F$; with the APSRs withdrawn at EOC, 17 ppm, the coefficient is -2.51×10^{-4} $\Delta k/k/°F$. This type of change is typical and has been observed for APSR withdrawals at other plants. The power deficit decreases slightly as expected from the change in the moderator temperature coefficient. The slight change in the power deficit combined with the slight changes in rod worth resulted in an increased shutdown margin, from 2.10% $\Delta\rho$ previously to 2.14% $\Delta\rho$. The boron worths at hot full power remained unchanged.

The results of these calculations are shown on Tables 5-1 and 5-2. All tables are labeled to correspond to tables in the Cycle 5 Reload Report containing similar information.

The axial xenon stability index was calculated to be -0.0387 (hr^{-1}) which indicates that induced axial xenon oscillations are naturally convergent.

Accident and Transient Analysis

The APSR withdrawal, and the associated longer cycle length, introduce small changes to some of the core parameters which determine plant performance for the events analyzed for Chapter 14 of the TMI-1 FSAR. Table 7-1 summarizes the new core parameters relative to the FSAR assumed values and the Cycle 5 base design. A review of FSAR events relative to the parameter changes shown in Table 7-1 is given below to assure that the FSAR analysis remains bounding for Cycle 5 operation.

The only FSAR events directly affected by changes to the EOC physics parameters are overcooling transients (steam line failure, cold water accident) and a dropped control rod.

1. Steam Line Failure

   The rupture of a main steam line causes a rapid cooldown of the primary system. The overcooling leads to a power increase caused by reactivity insertion due to the negative temperature coefficient. The key parameter for this event is moderator temperature coefficient. Although the Doppler feedback also provides a reactivity insertion, this insertion is approximately a factor of 10 less than the moderator feedback at the time of core minimum subcritical margin. The FSAR analysis was performed using EOC core parameters to maximize the reactivity insertion. Since the Cycle 5 base design EOC moderator coefficient is less negative than the FSAR analysis value, the system response to this transient during Cycle 5 is less severe than the results presented in the FSAR. For the APSR withdrawal conditions the EOC moderator coefficient as shown on Table 7-1 is less negative than that of the base design, thus providing more margin to the FSAR analysis. The slightly more negative Doppler coefficient has little effect on the result.

2. Cold Water Accident

   This event assumes a transient initiated by the startup of idle reactor coolant pumps which causes a decrease in the average core coolant temperature. Again, the controlling core parameter is the EOC negative moderator coefficient which causes the largest reactivity insertion. The Cycle 5 base design was bounded by the FSAR analysis. The moderator coefficient at EOC after the APSR withdrawal at 250 EFPD is less negative than that of the base design and, therefore, also bounded by the FSAR analysis.

3. Stuck-Out, Stuck-In, or Dropped Control Rod

   If a control rod were dropped into the core while it was operating, a rapid decrease in neutron power would occur, accompanied by a decrease in the core average coolant temperature. The power distribution would be distorted due to a new control rod pattern, under which conditions a return to full power might lead to localized power densities and heat fluxes in excess of design limitations. The key parameters for this transient are (1) dropped rod worth which determines the magnitude of decrease in the core coolant temperature and (2) the moderator temperature coefficient which exerts the greatest influence on core average power response. The negative Doppler coefficient does provide reactivity insertion,however, it is very small with respect to moderator feedback.

Both the dropped rod worth and the moderator coefficient at EOC for the Cycle 5 base design were bounded by the FSAR values; the Doppler coefficient was more negative than the FSAR assumption. For the APSR pull at EOC-5, Table 7-1 shows no change in the dropped rod worth, a less negative moderator coefficient and a slightly more negative Doppler. Since the rod worth and moderator coefficient effects are controlling during the transient, the consequences of this event in Cycle 5 would be less severe than the FSAR analysis.

4. Other FSAR Events

The consequences of other FSAR events were reviewed for potential effects due to an EOC-5 APSR withdrawal. Certain of these events are most severe assuming BOC core conditions and are, therefore, unaffected by the changed EOC conditions. These include:

- Uncompensated Operating Reactivity Changes
- Startup Accident
- Rod Withdrawal at Rated Power
- Moderator Dilution Accident
- Loss of Coolant Flow
- Loss of Electric Power
- Rod Ejection Accident
- Loss of Feedwater Accident

Small and large break loss of coolant accidents (LOCA) analyses are primarily dependent upon overall system characteristics. The power distribution analysis performed for operation after the APSR withdrawal specifically considered peaking effects. Since these are smaller than peaking early in the cycle used in the LOCA evaluation model, the Final Acceptance Criteria ECCS linear heat rate limits (kw/ft) are preserved during and after the withdrawal.

Remaining FSAR analyses are basically dose evaluations independent or insensitive to system response. These include:

- Steam Generator Tube Failure
- Fuel Handling Accident
- Maximum Hypothetical Accident
- Waste Gas Tank Rupture
- Fuel Cask Drop Accident

Fuel and Thermal Design

The additional burnup due to extending the cycle life to 290 $\pm$ 15 EFPD was reviewed for potential impact on the fuel design evaluations in the Cycle 5 Reload Report. It was determined that the small increase in burnup did not cause any of the previous assumptions or criteria to be exceeded, including those for cladding collapse and internal pin pressure. Furthermore, the thermal-hydraulic design is not affected. Burnup assumptions in the Reload Report for the rod bow penalty calculation remain bounding.

It is therefore concluded that the fuel and core conditions due to an APSR withdrawal and extending the cycle length to 290 ± 15 EFPD are bounded by all previous FSAR analyses and Reload Report evaluations.

TABLE 5-1. TMI-1, CYCLE 5 PHYSICS PARAMETERS

		CYCLE 5	
	Cycle 4[a]	Base Design[b]	EOC APSR[c] Withdrawal
Cycle length, EFPD	277	280	290
Cycle burnup, MWd/mtU	8557	8650	8959
Average core burnup - EOC[d], MWd/mtU	18,165	19,162	19,405
Initial core loading, mtU	82.1	82.1	
Critical boron - BOC, ppm (no Xe)			
HZP[e], Group 8 (max. worth)	1226	1255	
HFP, Group 8 inserted	1045	1064	
Critical boron - EOC, ppm (eq Xe)			
HZP $_{group\ 8}$ (max. worth)	285	311	
HFP/	16	29	42
Control rod worths - HFP, BOC, % Δk/k			
Group 6	1.12	0.98	
Group 7	1.48	1.44	
Group 8 (max. worth)	0.46	0.45	
Control rod worths - HFP, EOC, %Δk/k			
Group 7	1.57	1.56	1.51
Group 8 (max. worth)	0.50	0.50	NA
Max ejected rod worth - HZP, % Δk/k[f]			
BOC	0.81	0.65	
EOC	0.81	0.71	0.71
Max stuck rod worth - HZP, % Δk/k			
BOC	2.01	2.24	
EOC	2.06	2.03	2.03
Power deficit, HZP to HFP, % Δk/k			
BOC	-1.29	-1.34	
EOC	-2.05	-2.06	-2.07
Doppler coeff - BOC, 10^{-5} (Δ k/k/°F)			
100% power (0 Xe)	-1.48	-1.47	
Doppler coeff - EOC, 10^{-5} (Δ k/k/°F)			
100% power (eq Xe)	-1.60	-1.58	-1.60
Moderator coeff - HFP, 10^{-4} (Δ k/k/°F)			
BOC (no Xe, 1064 ppm Group 8 in)	-0.71	-0.77	
EOC (eq Xe, 17 ppm)[g]	-2.53	-2.63	-2.51

TABLE 5-1. TMI-1, CYCLE 5 PHYSICS PARAMETERS (Continued)

	Cycle 4[(a)]	CYCLE 5 Base Design[(b)]	CYCLE 5 EOC APSR[(c)] Withdrawal
Boron worth - HFP, ppm/% Δ k/k			
BOC (1150 ppm)	104	105	
EOC (17 ppm)	94	93	93
Xenon worth - HFP, % Δ k/k			
BOC (4 EFPD)	2.65	2.64	
EOC (equil.)	2.74	2.73	
Effective delayed neutron fraction - HFP			
BOC	0.00583	0.00583	
EOC	0.00520	0.00517	

(a) Based on 287 EFPD at 2535 MWt, Cycle 3.
(b) Based on 277 EFPD at 2535 MWt, Cycle 4; APSRs inserted to EOC.
(c) APSR Withdrawn, EOC = 290 ± 15 EFPD (± 15 EFPD window has negligible effect on the values of the physics parameters), Cycle 4 length of 274 EFPD
(d) BOC denotes beginning-of-cycle; EOC denotes end-of-cycle.
(e) HZP denotes hot zero power (532F T_{avg}); HFP denotes hot full power (579F T_{avg})
(f) Ejected rod worth for groups 5 through 8 inserted for Cycle 4 and Cycle 5 base design; groups 5-7 inserted for EOC-5 APSR withdrawal.
(g) Group 8 inserted at EOC for Cycle 4 and Cycle 5 base design; Group 8 out for EOC - 5 APSR withdrawal.

TABLE 5-2. SHUTDOWN MARGIN CALCULATION FOR TMI-1, CYCLE 5

AVAILABLE ROD WORTH	BOC, % Δk/k	EOC, % Δk/k BASE DESIGN	EOC, % Δk/k EOC APSR[a] WITHDRAWAL
Total Rod Worth, HZP[b]	8.72	8.91	8.92
Worth reduction due to burnup of poison material, HZP	-0.50	-0.51	-0.51
Maximum stuck rod, HZP	-2.24	-2.03	-2.03
Net worth, HZP	5.98	6.37	6.38
Less 10% uncertainty	-0.60	-0.64	-0.64
Total available worth, HZP	5.38	5.73	5.74
Required Rod Worth			
Power deficit, HFP to HZP	1.34	2.06	2.03
Max allowable inserted rod worth, HZP	0.34	0.42	0.42
Flux redistribution, HFP to HZP	0.59	1.15	1.15
Total required worth, HZP	2.27	3.63	3.60
Shutdown Margin			
Total available minus total required, HZP	3.11	2.10	2.14

NOTE: Required shutdown margin is 1.00% Δk/k.

(a) 290 EFPD, APSR out
(b) HZP denotes hot zero power (532F T_{avg}); HFP denotes hot full power (579F T_{avg})

TABLE 7-1. COMPARISON OF KEY PARAMETERS FOR ACCIDENT ANALYSIS

PARAMETER	FSAR AND DENSIF'N REPORT VALUE	CYCLE 5 PREDICTED VALUE BASE DESIGN	EOC APSR WITHDRAWAL
BOC Doppler coeff, $\Delta k/k/°F$	-1.17×10^{-5}	-1.47×10^{-5}	-1.47×10^{-5}
EOC Doppler coeff, $\Delta k/k/°F$	-1.33×10^{-5}	-1.58×10^{-5}	-1.60×10^{-5}
BOC Moderator coeff, $\Delta k/k/°F$	$+0.5 \times 10^{-4}$	-0.77×10^{-4}	-0.77×10^{-4}
EOC Moderator coeff, $\Delta k/k/°F$	-3.0×10^{-4}	-2.63×10^{-4}	-2.51×10^{-4}
BOC all rod group worth (HZP), % $\Delta k/k$	10.0	8.72	8.72
Initial boron conc, (HFP) ppm	1200	1064	1064
Boron reactivity worth (70°F), ppm/1% $\Delta k/k$	75	74	75
Max ejected rod worth (HFP), % $\Delta k/k$	0.65	0.25	0.32
Dropped rod worth (HFP), % $\Delta k/k$	0.46	0.20	0.20

IV. NO SIGNIFICANT HAZARDS CONSIDERATIONS

GPUN has determined that this Technical Specification Change Request poses no significant hazards as defined by NRC in 10 CFR 50.92.

1. Operation of the facility in accordance with the proposed amendment would not involve a significant increase in the probability of occurrence or consequences of an accident previously evaluated. The APSR withdrawal, and longer cycle length, introduce small changes to the EOC physics parameters. The FSAR events have been reviewed relative to the core physics parameter changes at EOC due to APSR withdrawal. The results of this review confirm that the events analyzed in Chapter 14 of TMI-1 FSAR and the TMI-1 Cycle 5 Reload Report remain bounding for Cycle 5 operation. Therefore, APSR withdrawal and cycle extension does not involve a significant increase in the probability of occurrence or consequences of an accident previously evaluated.

2. Operation of the facility in accordance with the proposed amendment would not create the possibility of a new or different kind of accident from any accident previously evaluated. Analyses have been performed by Babcock & Wilcox using approved methods to compare core conditions for APSR withdrawal and cycle extension with all appropriate licensing basis analyses in the TMI-1 FSAR and the Cycle 5 Reload Report. Results show that the APSR withdrawal is conservatively bounded by the existing analyses in all cases. Therefore, it is concluded that APSR withdrawal and cycle extension does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Operation of the facility in accordance with the proposed amendment would not involve a significant reduction in a margin of safety. All safety criteria as described in the Technical Specification bases are preserved by the revised limits. Therefore, it is concluded that APSR withdrawal and cycle extension does not involve a significant reduction in a margin of safety.

   The Commission has provided guidelines pertaining to the application of the three standards by listing specific examples in 48 FR 14870. The proposed amendment is considered to be in the same category as example (iii) of amendments that are considered not likely to involve significant hazards consideration in that the proposed change, although not related to a core reloading, does extend operation of the existing Cycle 5 core, and it has been adequately demonstrated that the acceptance criteria for the Technical Specifications have not been significantly changed, that the analytical methods utilized to demonstrate conformance with the Technical Specifications and regulations are not significantly changed, and that the NRC has previously found such methods acceptable. Thus, operation of the facility in accordance with the proposed amendment involves no significant hazards considerations.

V. IMPLEMENTATION

It is requested that the amendment authorizing this change become effective immediately upon issuance.

VI. AMENDMENT FEE (10 CFR 170.21)

Pursuant to the provisions of 10 CFR 170.21, attached is a check for $150.00.

Attachment

Technical Specification Changes

LIST OF FIGURES

The curve of Figure 2.1-1 is the most restrictive of all possible reactor coolant pump-maximum thermal power combinations shown in Figure 2.1-2. The curves of Figure 2.1-3 represent the conditions at which a minimum DNBR of 1.3 is predicted at the maximum possible thermal power for the number of reactor coolant pumps in operation or the local quality at the point of minimum DNBR is equal to 22 percent, (3) whichever condition is more restrictive.

The maximum thermal power for three pump operation is 89.36 percent due to a power level trip produced by the flux-flow ratio (74.7 percent flow x 1.08 = 80.67 percent power) plus the maximum calibration and instrumentation error. The maximum thermal power for other reactor coolant pump conditions is produced in a similar manner.

Using a local quality limit of 22 percent at the point of minimum DNBR as a basis for curve 3 of Figure 2.1-3 is a conservative criterion even though the quality at the exit is higher than the quality at the point of minimum DNBR.

The DNBR as calculated by the B&W-2 correlation continually increases from the point of minimum DNBR, so that the exit DNBR is always higher and is a function of the pressure.

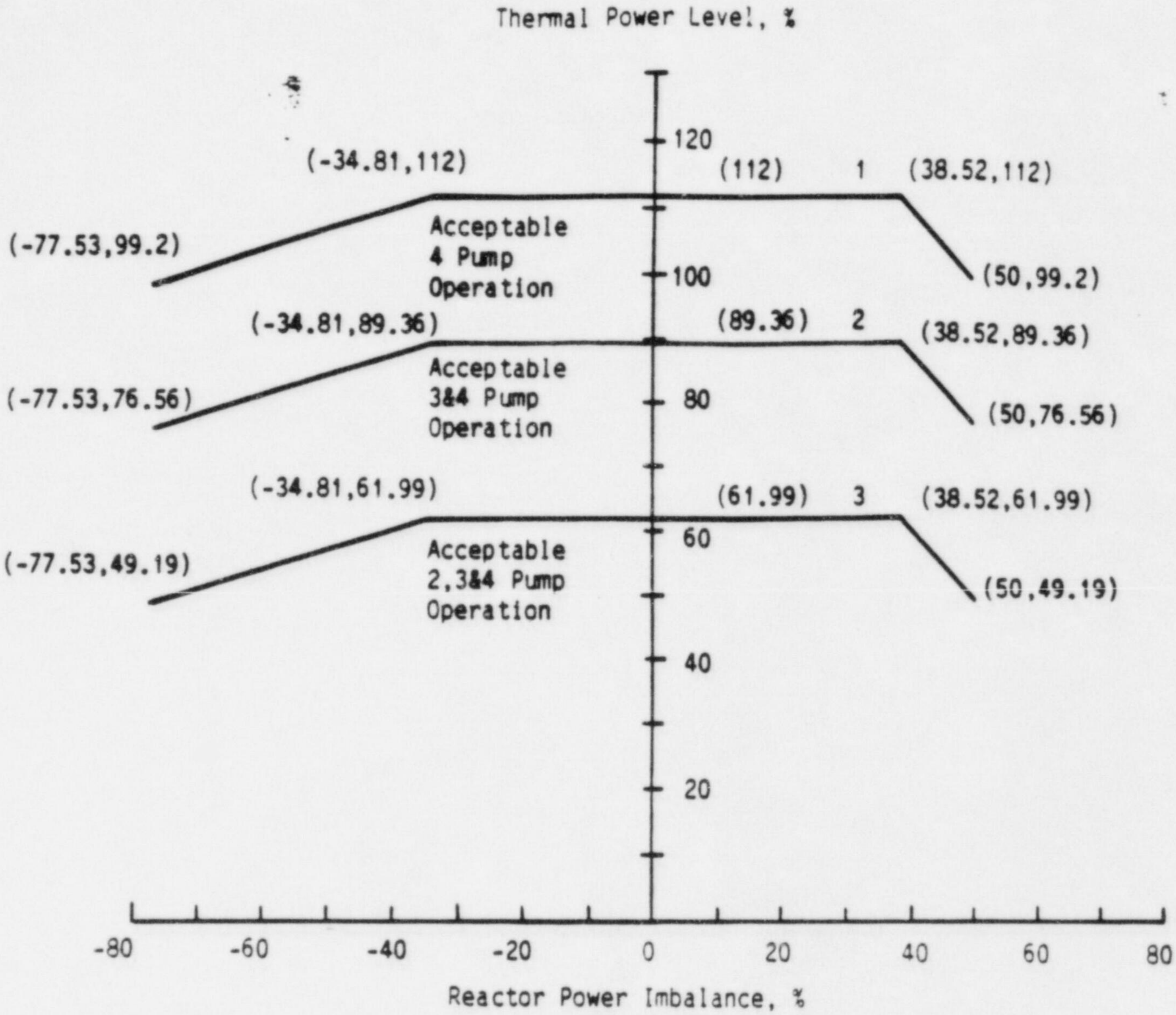
For each curve of Figure 2.1-3, a pressure-temperature point above and to the left of the curve would result in a DNBR greater than 1.3 or a local quality at the point of minimum DNBR less than 22 percent for that particular reactor coolant pump situation. Curve 1 is more restrictive than any other reactor coolant pump situation because any pressure/temperature point above and to the left of this curve will be above and to the left of the other curves.

REFERENCES

(1) FSAR, Section 3.2.3.1.1

(2) FSAR, Section 3.2.3.1.1.c

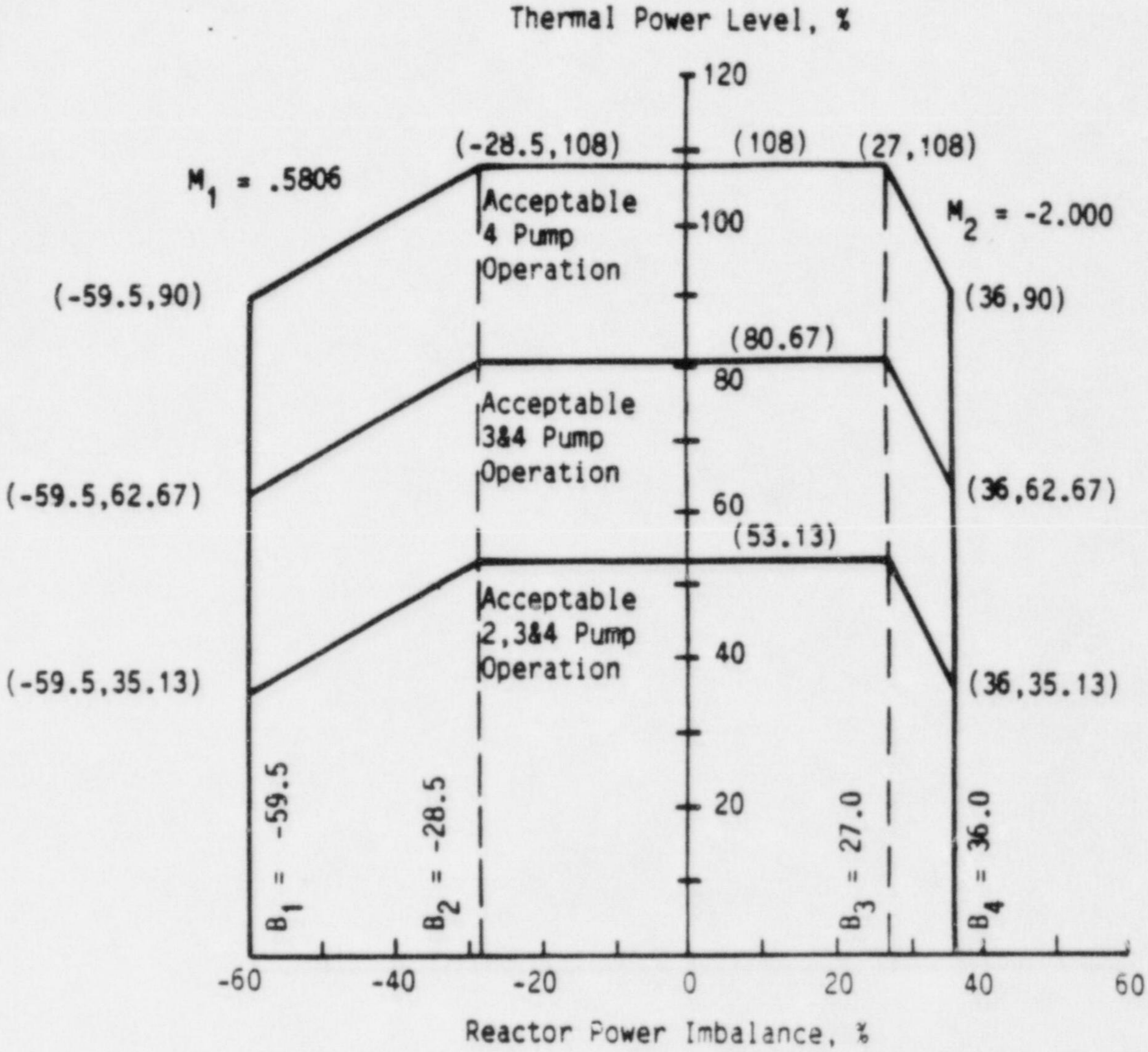
(3) FSAR, Section 3.2.3.1.1.k



Curve	Reactor Coolant Flow (lb/hr)
1	139.8×10^6
2	104.5×10^6
3	68.8×10^6

TMI-1 Core Protection Safety Limits, Cycle 5

Figure 2.1-2



TMI-1 Protection System Maximum Allowable Setpoints for Reactor Power Imbalance, Cycle 5

Figure 2.3-2

2. The control rod group withdrawal limits (Figures 3.5-2A, 3.5-2B, 3.5-2C, 3.5-2D and 3.5-2H) shall be reduced 2 percent in power for each 1 percent tilt in excess of the tilt limit.

3. The operational imbalance limits (Figures 3.5-2E and 3.5-2F) shall be reduced 2 percent in power for each 1 percent tilt in excess of the tilt limit.

f. Except for physics or diagnostic testing, if quadrant tilt is in excess of +16.80% determined using the full incore detector system (FIT), or +14.2% determined using the out of core detector system (OCT) if the FIT is not available, or +9.5% using the minimum incore detector system (MIT) when neither the FIT nor OCT are available, the reactor will be placed in the hot shutdown condition. Diagnostic testing during power operation with a quadrant tilt is permitted provided that the thermal power allowable is restricted as stated in 3.5.2.4.d above.

g. Quadrant tilt shall be monitored on a minimum frequency of once every two hours during power operation above 15 percent of rated power.

3.5.2.5 Control Rod Positions

a. Operating rod group overlap shall not exceed 25 percent ±5 percent, between two sequential groups except for physics tests.

b. Position limits are specified for regulating and axial power shaping control rods. Except for physics tests or exercising control rods, the regulating control rod insertion/withdrawal limits are specified on Figures 3.5-2A, and 3.5-2B for four pump operation and Figures 3.5-2C and 3.5-2D three or two pump operation. Also excepting physics tests or exercising control rods, the axial power shaping control rod insertion/withdrawal limits are specified on Figures 3.5-2H and 3.5-2I. If any of these control rod position limits are exceeded, corrective measures shall be taken immediately to achieve an acceptable control rod position. Acceptable control rod positions shall be attained within four hours.

c. Except for physics tests, power shall not be increased above the power level cutoff of 92 percent of rated thermal power unless one of the following conditions is satisfied:

1. Xenon reactivity never deviated more than 10 percent from the equilibrium value for operation at 100 percent of rated thermal power.

2. Xenon reactivity deviated more than 10 percent and is now within 10 percent of the equilibrium value for operation at 100 percent of rated thermal power and asymptotically approaching stability.

3. Except for Xenon free startup (when 3.5.2.5.c.2 applies) the reactor has operated within a range of 87 to 92 percent of rated thermal power for a period exceeding 2 hours in the soluble poison control mode.

d. Core imbalance shall be monitored on a minimum frequency of once every two hours during power operation above 40 percent of rated power. Except for physics tests, corrective measures (reduction of imbalance by APSR movements and/or reduction in reactor power) shall be taken to maintain operation within the envelope defined by Figures 3.5-2E and 3.5-2F. If the imbalance is not within the envelope defined by Figures 3.5-2E and 3.5-2F, corrective measures shall be taken to achieve an acceptable imbalance. If an acceptable imbalance is not achieved within four hours, reactor power shall be reduced until imbalance limits are met.

Safety rod limits are given in 3.1.3.5.

3.5.2.6 The control rod drive patch panels shall be locked at all times with limited access to be authorized by the superintendent.

3.5.2.7 A power map shall be taken at intervals not to exceed 30 effective full power days using the incore instrumentation detection system to verify the power distribution is within the limits shown in Figure 3.5-2G.

Bases

The power-imbalance envelope defined in Figures 3.5-2E and 3.5-2F is based on LOCA analyses which have defined the maximum linear heat rate (see Figure 3.5-2G) such that the maximum clad temperature will not exceed the Final Acceptance Criteria (2200F). Operation outside of the power imbalance envelope alone does not constitute a situation that would cause the Final Acceptance Criteria to be exceeded should a LOCA occur. The power imbalance envelope represents the boundary of operation limited by the Final Acceptance Criteria only if the control rods are at the withdrawal/insertion limits as defined by Figures 3.5-2A, 3.5-2B, 3.5-2C, 3.5-2D, 3.5-2H, 3.5-2I, and if quadrant tilt is at the limit. Additional conservatism is introduced by application of:

a. Nuclear uncertainty factors

b. Thermal calibration uncertainty

c. Fuel densification effects

d. Hot rod manufacturing tolerance factors

e. Postulated fuel rod bow effects

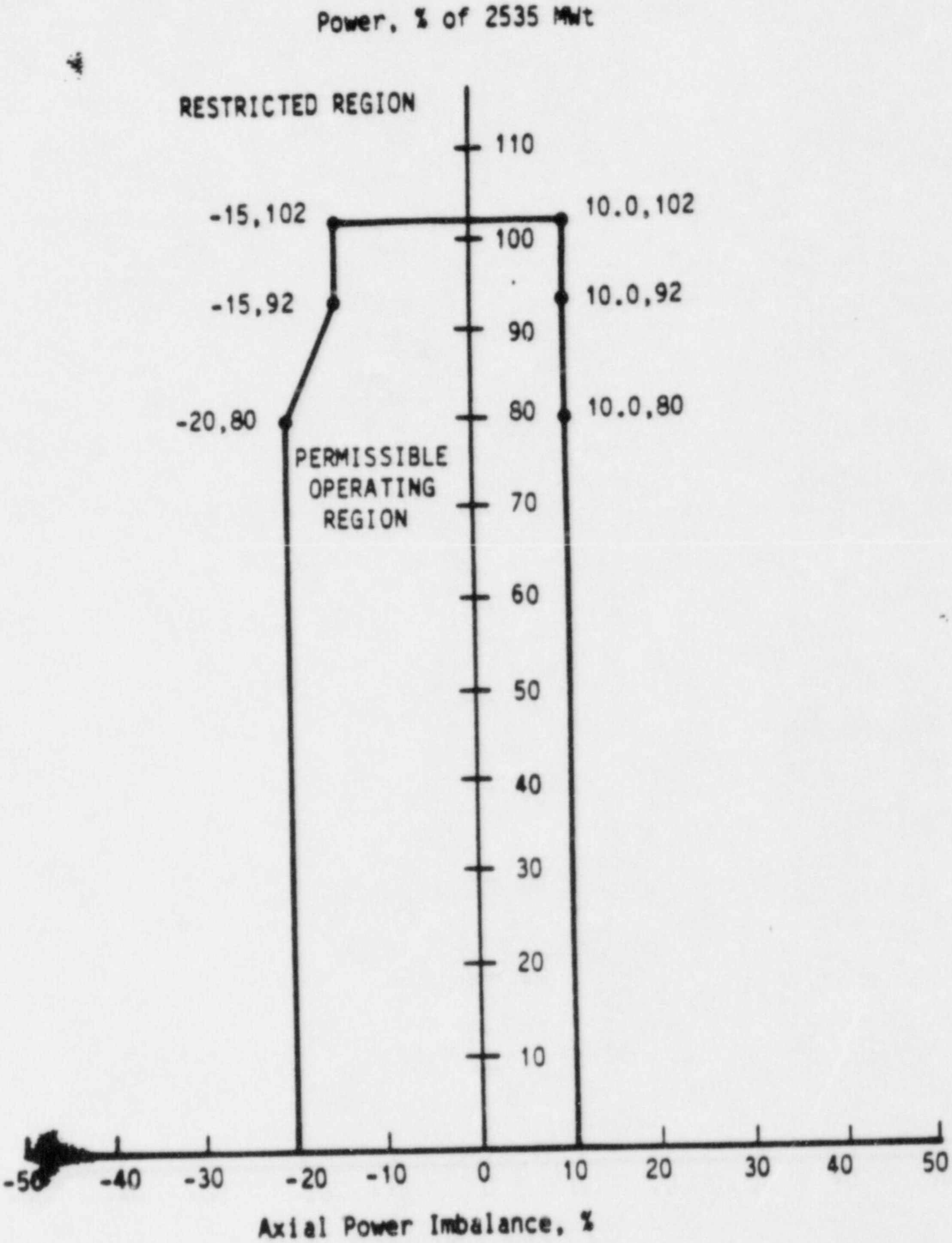
The Rod Index versus Allowable Power curves of Figures 3.5-2A, 3.5-2B, 3.5-2C, 3.5-2D, 3.5-2H, and 3.5-2I describe three regions. These three regions are:

1. Permissible operating Region

2. Restricted Regions

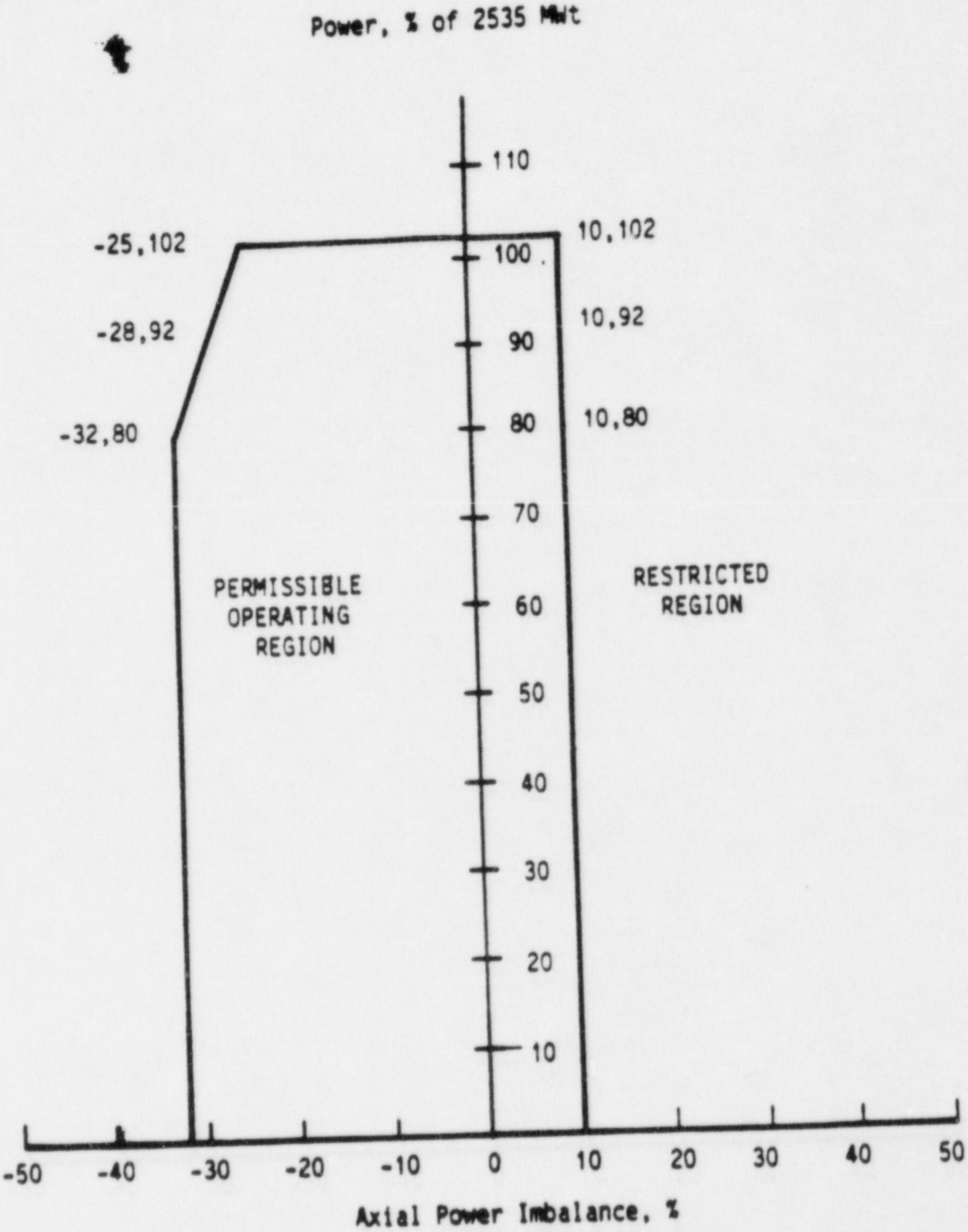
3. Prohibited Region (Operation in this region is not allowed)

NOTE: Inadvertent operation within the Restricted Region for a period of four hours is not considered a violation of a limiting condition for operation. The limiting criteria within the Restricted Region are potential ejected rod worth and ECCS power peaking and since the probability of these accidents is very low especially in a 4 hour time frame), inadvertant operation within the Restricted Region for a period of 4 hours is allowed.



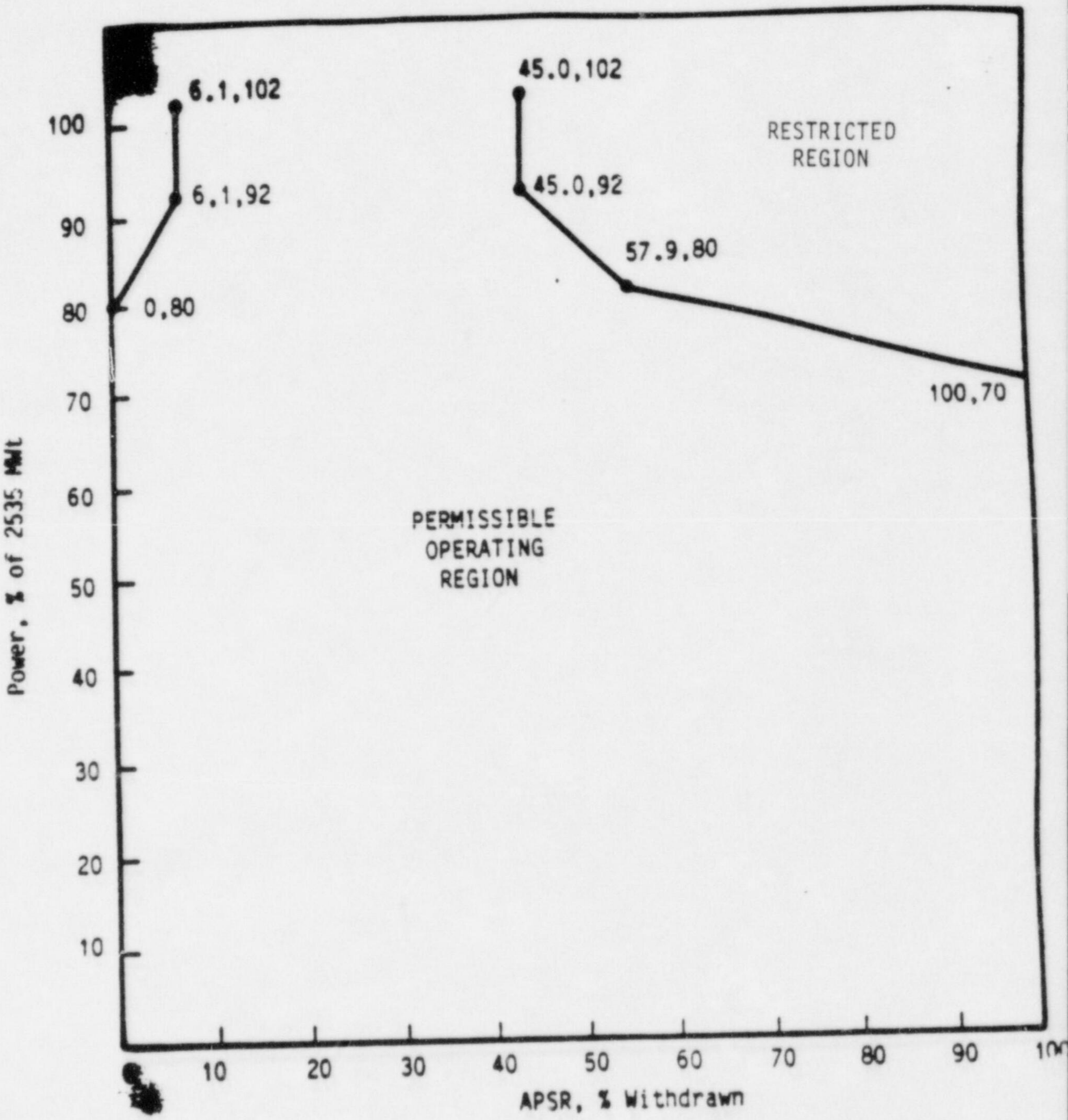
Power Imbalance Envelope for Operation
From 0 EFPD to 250 ±10 EFPD, Cycle 5

Figure 3.5-2E



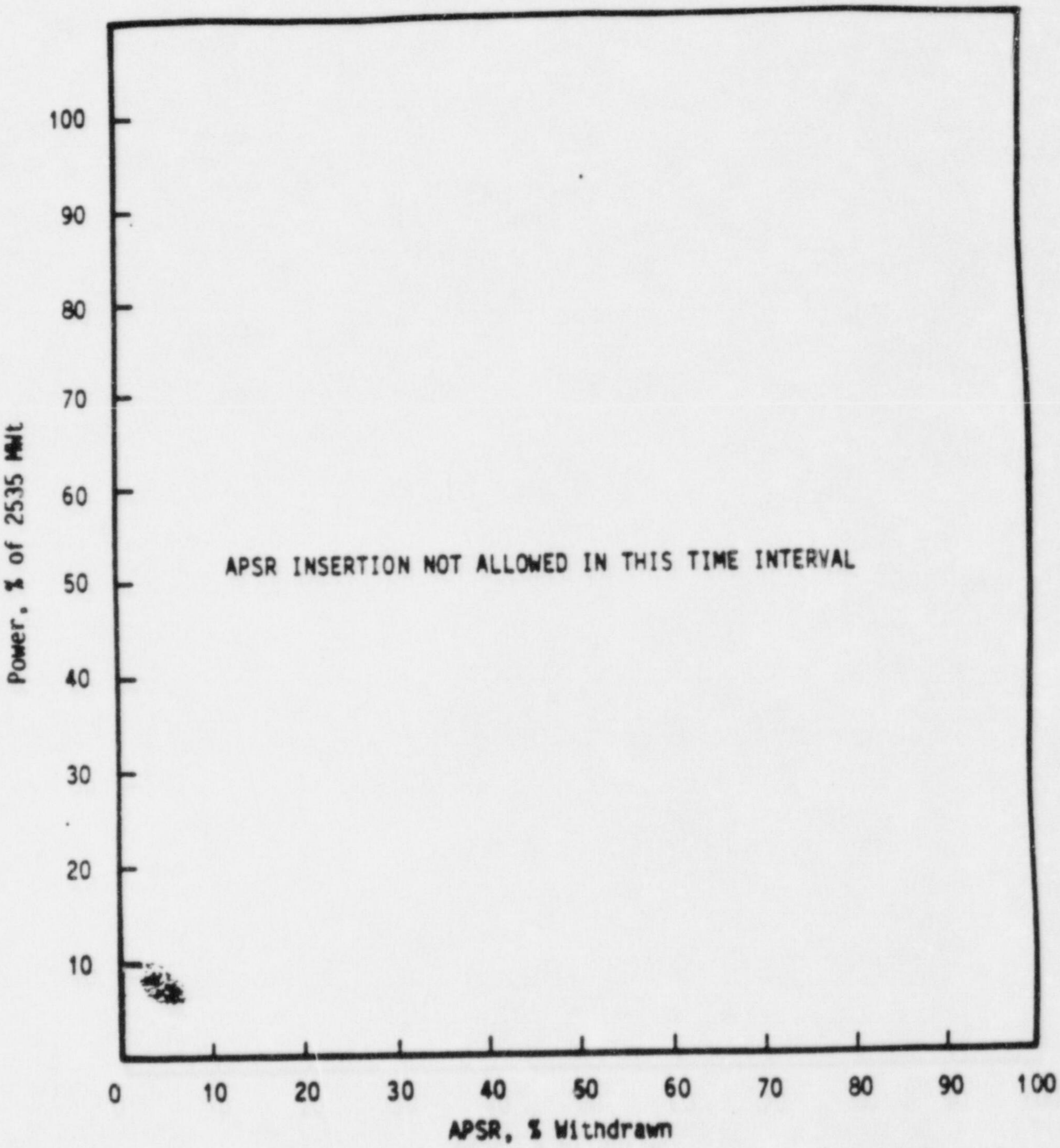
Power Imbalance Envelope for Operation After 250 ± 10 EFPD, Cycle 5

Figure 3.5-2F



APSR Position Limits for Operation From 0 EFPD to 250 ±10 EFPD, Cycle 5

Figure 3.5-2H



APSR Position Limits for Operation
After 250 ± 10 EFPD, Cycle 5

Figure 3.5-2I