UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF

DOCKET NO. 50-289
LICENSE NO. DPR-50

METROPOLITAN EDISON COMPANY

This is to certify that a copy of Technical Specification Change Request No. 70 to Appendix A of the Operating License for Three Mile Island Nuclear Station Unit 1, has, on the date given below, been filed with the U. S. Nuclear Regulatory Commission and been served on the chief executives of Londonderry Township, Dauphin County, Pennsylvania and Dauphin County, Pennsylvania by deposit in the United States mail, addressed as follows:

Mr. Weldon B. Arehart
Board of Supervisors of
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Middletown, Pennsylvania 17057

Mr. Harry B. Reese, Jr.
Board of County Commissioners
of Dauphin County
Dauphin County Court House
Harrisburg, Pennsylvania 17120

METROPOLITAN EDISON COMPANY

By [signature]
Vice President

Dated: January 9, 1978

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METROPOLITAN EDISON COMPANY
JERSEY CENTRAL POWER & LIGHT COMPANY

AND

PENNSYLVANIA ELECTRIC COMPANY

THREE MILE ISLAND NUCLEAR STATION UNIT 1

Operating License No. DPR-50
Docket No. 50-289
Technical Specification Change Request No. 70

This Technical Specification Change Request is submitted in support of Licensee's request to change Appendix A to Operating License No. DPR-50 for Three Mile Island Nuclear Station Unit 1. As a part of this request, proposed replacement pages for Appendix A are also included.

METROPOLITAN EDISON COMPANY

By [signature]
Vice President

Sworn and subscribed to me this 9th day of January, 1978.

[signature]
Notary Public

NOTARY PUBLIC
Reading, Berks County, Pa.
My Commission Expires Nov. 19, 1979

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Three Mile Island Nuclear Station Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50289

Technical Specification Change Request No. 70

The licensee requests that the attached changed pages replace pages 2-3, 2-6, and 3-34, through 3-36a and Figures 2.1-2, 2.3-2 and 3.5-2A through 3.5-2H. Figures 3.5-2I through 3.5-2M are to be deleted.

Reasons for Change Request

The change is to provide new Technical Specification (T.S.) limits for operation beyond 3 EFPY which are a result of the following:

1. The mode of operation will be changed from a rodded to a feed-bleed mode for cycle 4.

2. The maximum actual core tilt limit will be increased to 4.92%.

3. The T.S. limits based on the Departure from Nucleate Boiling Ratio (DNBR) and Linear Heat Rate (LHR) criteria include appropriate allowances for projected fuel rod bow penalties, and

4. The power spike penalty due to fuel densification was not used in setting the DNBR - and Emergency Core Cooling System (ECCS) - dependent T.S. limits.

This change is required to comply with the requirements of TMI-1 T.S. Sections 2.1.2, 2.3.1 and 3.5.2.4.

Safety Analysis Justifying Change Request

The changes presented in the attached pages and figures are based on the TMI-1, Cycle 4 Reload Report by B & W.

Section 5 discusses the change in the operational mode from a rodded to the feed and bleed mode. This mode of operation is not unique for TMI-1 in that it has been used at the end of previous cycles and requires no plant modifications. Basically, it means that no full length control rods will be inserted into the core during steady state conditions with the exception of approximately 10% of one regulating bank. This small insertion is to compensate for discrete changes in soluble boron and to accommodate small temperature and load demand changes. Transient xenon reactivity effects are compensated by changing the soluble boron concentration.

The curve of Figure 2.1-1 is the most restrictive of all possible reactor coolant pump-maximum thermal power combinations show 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 87.1 percent due to a power level trip produced by the flux-flow ratio (74.7 percent flow x 1.08 = 80.7 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 ari 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

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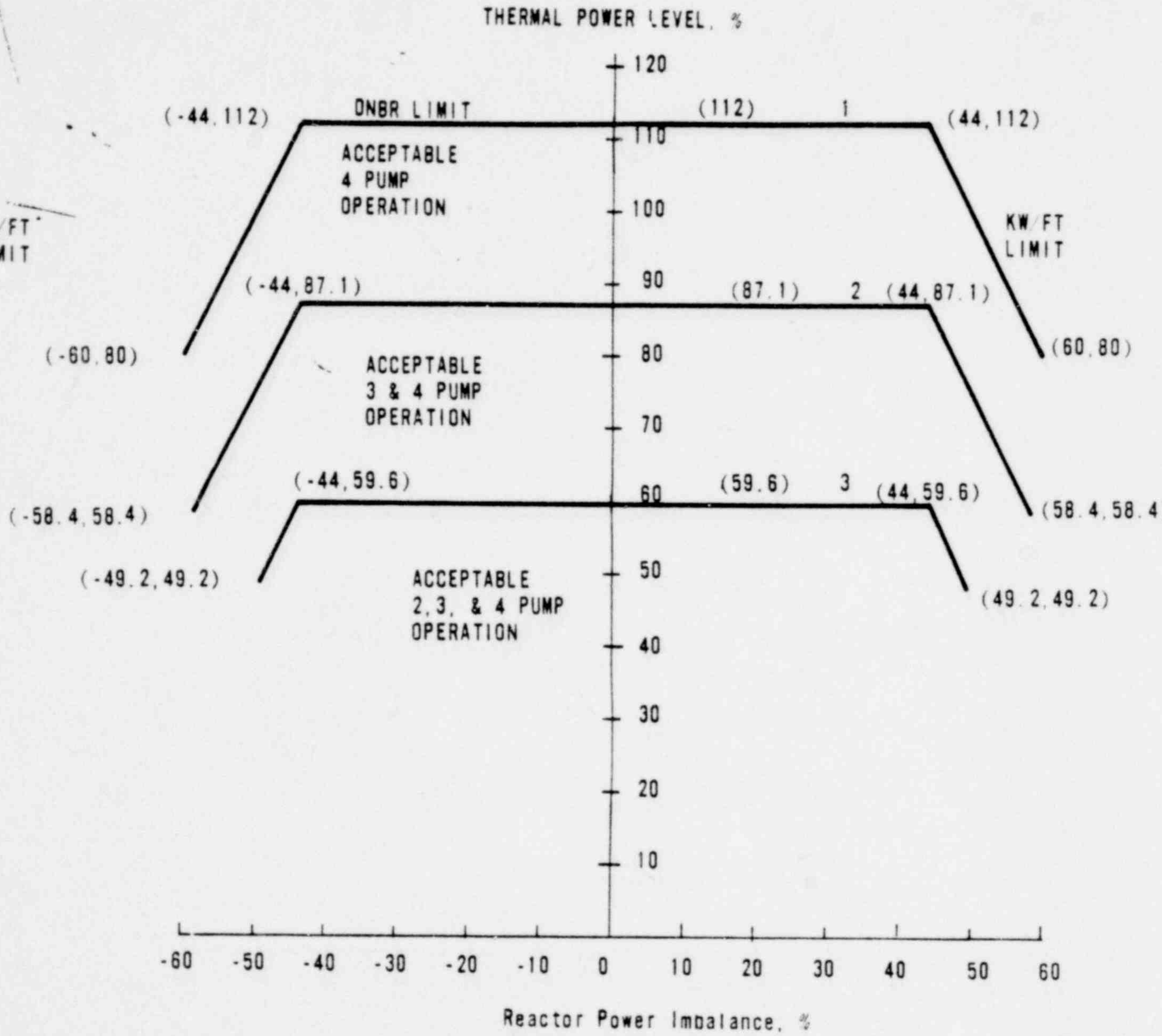

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CURVE	REACTOR COOLANT FLOW (lb/hr)
1	139.8×10^6
2	104.5×10^6
3	68.8×10^6

CORE PROTECTION SAFETY LIMITS
TMI-1, CYCLE 4

Figure 2.1-2

The power level trip set point produced by the power-to-flow ratio provides both high power level and low flow protection in the event the reactor power level increases or the reactor coolant flow rate decreases. The power level trip set point produced by the power to flow ratio provides overpower DNB protection for all modes of pump operation. For every flow rate there is a maximum permissible power level, and for every power level there is a minimum permissible low flow rate. Typical power level and low flow rate combinations for the pump situations of Table 2.3-1 are as follows:

1. Trip would occur when four reactor coolant pumps are operating if power is 108 percent and reactor flow rate is 100 percent, or flow rate is 92.5 percent and power level is 100 percent.

2. Trip would occur when three reactor coolant pumps are operating if power is 80.7 percent and reactor flow rate is 74.7 percent or flow rate is 69.4 percent and power level is 75 percent.

3. Trip would occur when one reactor coolant pump is operating in each loop (total of two pumps operating) if the power is 53.1 percent and reactor flow rate is 49.1 percent or flow rate is 45.3 percent and the power level is 49 percent.

The flux/flow ratios account for the maximum calibration and instrumentation errors and the maximum variation from the average value of the RC flow signal in such a manner that the reactor protective system receives a conservative indication of the RC flow.

No penalty in reactor coolant flow through the core was taken for an open core vent valve because of the core vent valve surveillance program during each refueling outage.

For safety analysis calculations the maximum calibration and instrumentation errors for the power level were used.

The power-imbalance boundaries are established in order to prevent reactor thermal limits from being exceeded. These thermal limits are either power peaking Kw/ft limits or DNBR limits. The reactor power imbalance (power in the top half of the core minus power in the bottom half of core) reduces the power level trip produced by the power-to-flow ratio so that the boundaries of Figure 2.3-2 are produced. The power-to-flow ratio reduces the power level trip and associated reactor power/reactor power-imbalance boundaries by 1.08 percent for a one percent flow reduction.

b. Pump monitors

The redundant pump monitors prevent the minimum core DNBR from decreasing below 1.3 by tripping the reactor due to the loss of reactor coolant pump(s). The pump monitors also restrict the power level for the number of pumps in operation.

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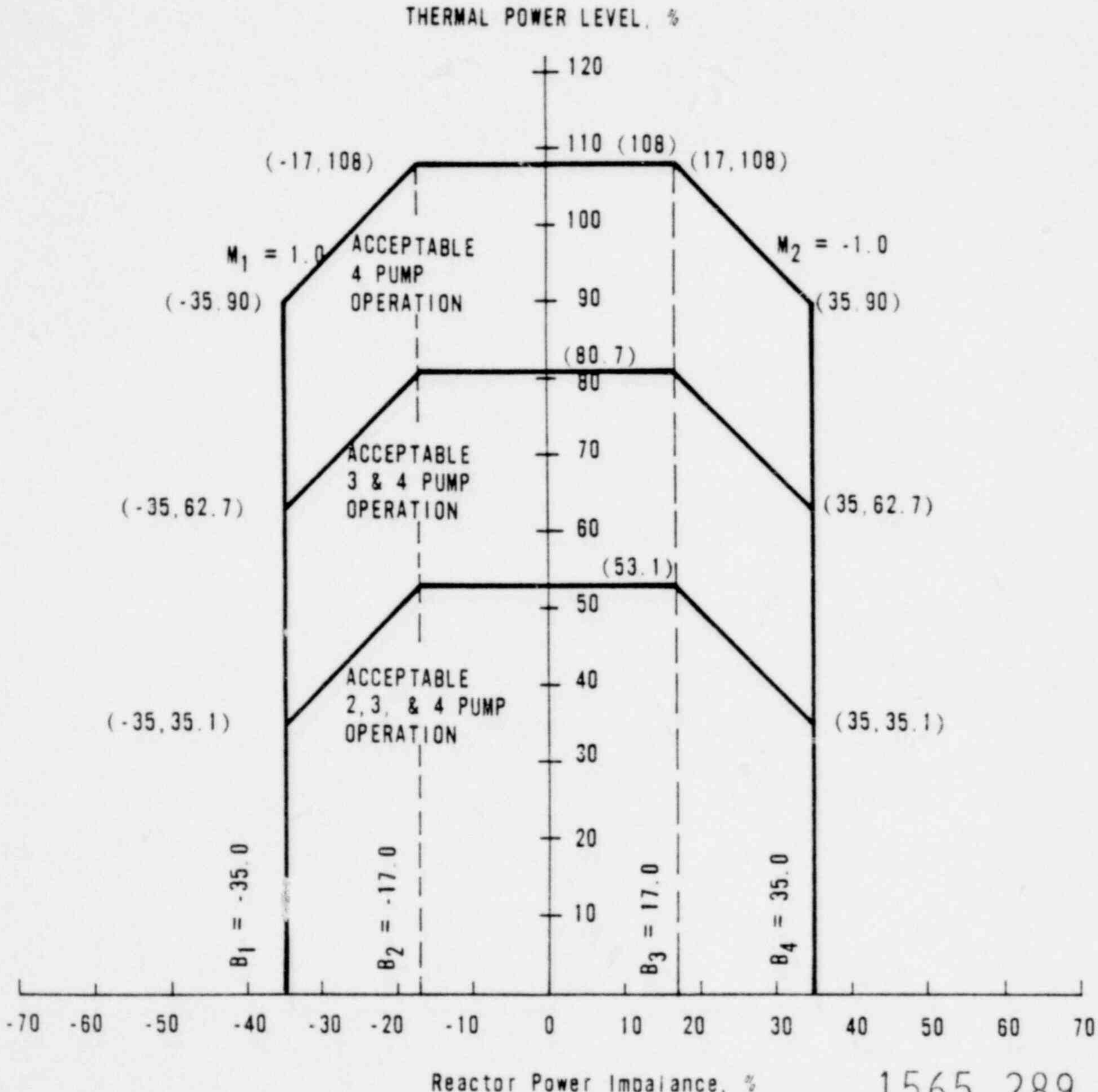

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PROTECTION SYSTEM MAXIMUM ALLOWABLE
SETPOINTS FOR REACTOR POWER IMBALANCE
TMI-1, CYCLE 4

Figure 2.3-2

f. If a control rod in the regulating or axial power shaping groups is declared inoperable per Specification 4.7.1.2., operation may continue provided the rods in the group are positioned such that the rod that was declared inoperable is maintained within allowable group average position limits of Specification 4.7.1.2.

g. If the inoperable rod in Paragraph "e" above is in groups 5, 6, 7, or 8, the other rods in the group may be trimmed to the same position. Normal operation of 100 percent of the thermal power allowable for the reactor coolant pump combination may then continue provided that the rod that was declared inoperable is maintained within allowable group average position limits in 3.5.2.5.

3.5.2.3 The worth of single inserted control rods during criticality are limited by the restrictions of Specification 3.1.3.5 and the Control Rod Position Limits defined in Specification 3.5.2.5.

3.5.2.4 Quadrant tilt:

a. Except for physics tests the quadrant tilt shall not exceed +4.01% as determined using the full incore detector system.

b. When the full incore detector system is not available and except for physics tests quadrant tilt shall not exceed +2.82% as determined using the minimum incore detector system.

c. When neither incore detector system above is available and except for physics tests quadrant tilt shall not exceed +2.04% as determined using the power range channels displayed on the console for each quadrant (out of core detector system).

d. Except for physics tests if quadrant tilt exceeds the tilt limit power shall be reduced immediately to below the power level cutoff (see Figures 3.5-2A, and 3.5-2B. Moreover, the power level cutoff value shall be reduced 2 percent for each 1 percent tilt in excess of the tilt limit. For less than four pump operation, thermal power shall be reduced 2 percent of the thermal power allowable for the reactor coolant pump combination for each 1 percent tilt in excess of the tilt limit.

e. Within a period of 4 hours, the quadrant power tilt shall be reduced to less than the tilt limit except for physics tests, or the following adjustments in setpoints and limits shall be made:

   1. The protection system reactor power/imbalance envelope trip setpoints shall be reduced 2 percent in power for each 1 percent tilt.

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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 (Figure 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 +27.10% determined using the full incore detector system (FIT), or +25.91% determined using the minimum incore detector system (MIT) if the FIT is not available, or +23.04% determined using the out of core detector system (OCT) when neither the FIT nor MIT are available, the reactor will be placed in the hot shutdown condition. Diagnositc 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.

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3.4.2.5 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 Figure 3.5-2H. 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.

e. 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.

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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, 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, and 3.5-2H 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.

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The 25±5 percent overlap between successive control rod groups is allowed since the worth of a rod is lower at the upper and lower part of the stroke. Control rods are arranged in groups or banks defined as follows:

Group	Function
1	Safety
2	Safety
3	Safety
4	Safety
5	Regulating
6	Regulating
7	Regulating (Xenon transient override)
8	APSR (axial power shaping bank)

Control rod groups are withdrawn in sequence beginning with group 1. Groups 5, 6 and 7 are overlapped 25 percent. The normal position at power is for group 7 to be partially inserted.

The rod position limits are based on the most limiting of the following three criteria: ECCS power peaking, shutdown margin, and potential ejected rod worth. As discussed above, compliance with the ECCS power peaking criterion is ensured by the rod position limits. The minimum available rod worth, consistent with the rod position limits, provides for achieving hot shutdown by reactor trip at any time, assuming the highest worth control rod that is withdrawn remains in the full out position (1). The rod position limits also ensure that inserted rod groups will not contain single rod worths greater than: 0.65% $\Delta k/k$ at rated power. These values have been shown to be safe by the safety analysis (2) of the hypothetical rod ejection accident. A maximum single inserted control rod worth of 1.0% $\Delta k/k$ is allowed by the rod position limits at hot zero power. A single inserted control rod worth 1.0%$\Delta k/k$ at beginning of life, hot, zero power would result in a lower transient peak thermal power and, therefore, less severe envrionmental consequences than 0.65% $\Delta k/k$ ejected rod worth at rated power.

The plant computer will scan for tilt and imbalance and will satisfy the technical specification requirements. If the computer is out of service, than manual calculation for tilt above 15 percent power and imbalance above 40 percent power must be performed at least every two hours until the computer is returned to service.

The quadrant power tilt limits set forth in Specification 3.5.2.4 have been established within the thermal analysis design base using an actual core tilt of +4.92% which is equivalent to a +4.01% tilt measured with the full incore instrumentation with measurement uncertainties included.

During the physics testing program, the high flux trip setpoints are administratively set as follows to assure an additional safety margin is provided:

Test Power	Trip Setpoint
0	<5%
15	50%
40	50%
50	50%
75	85%
>75	105.5%

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REFERENCES

(1) FSAR, Section 3.2.2.1.2

(2) FSAE, Section 14.2.2.2

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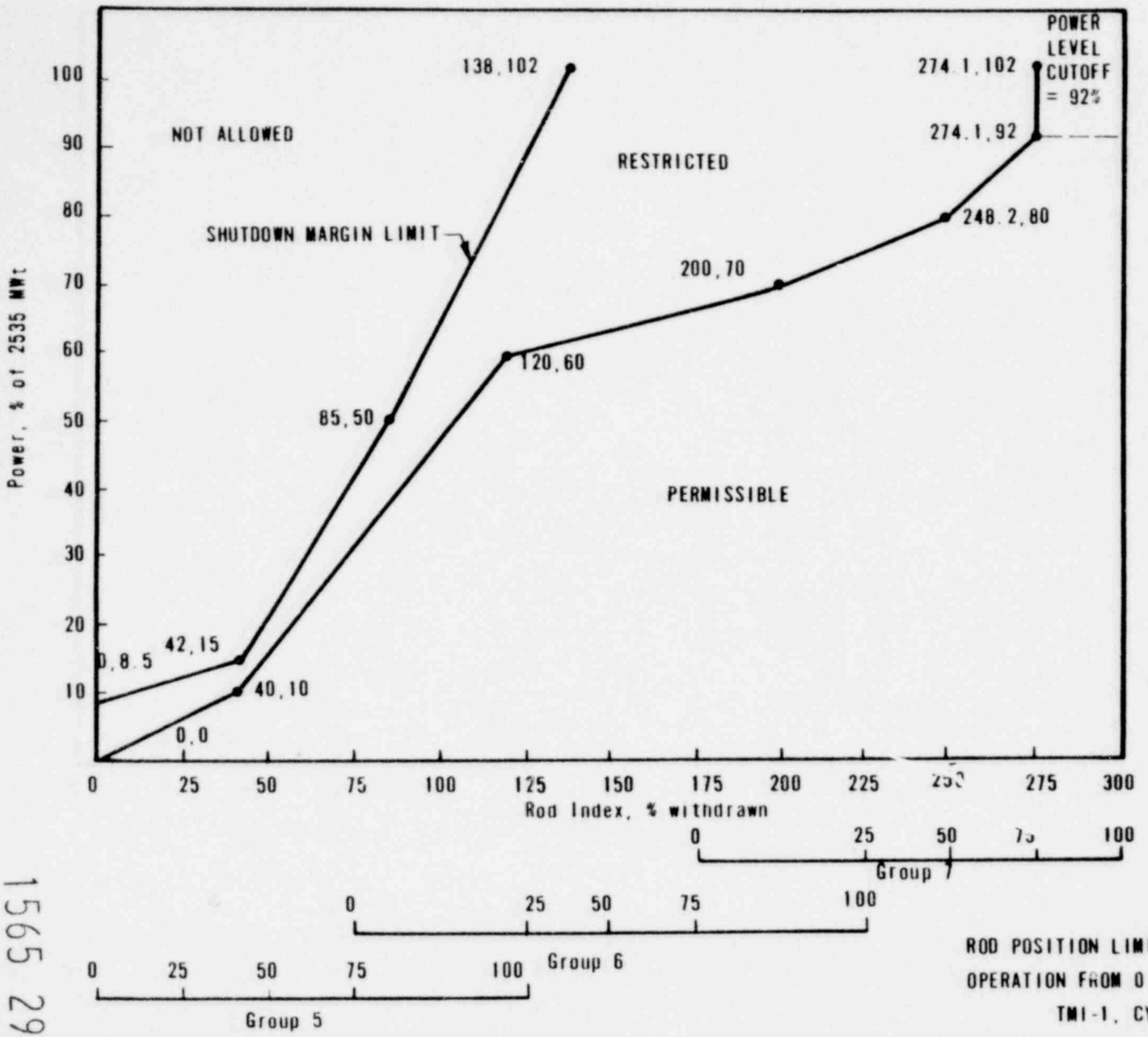

ROD POSITION LIMITS FOR 4 PUMP OPERATION FROM 0 TO TO 125 ± 5 EFPD

TMI-1, CYCLE 4

Figure 3.5-2A

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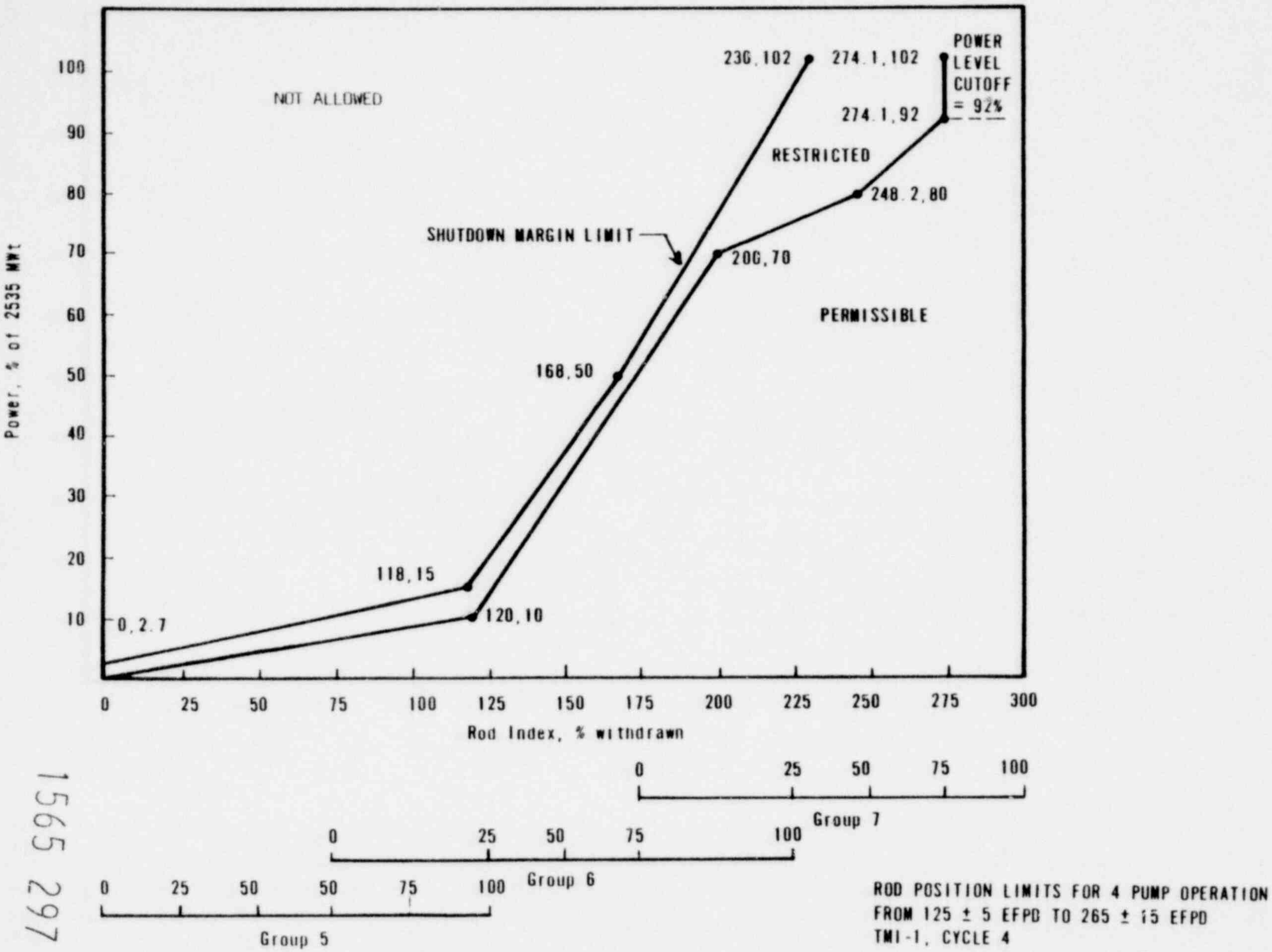

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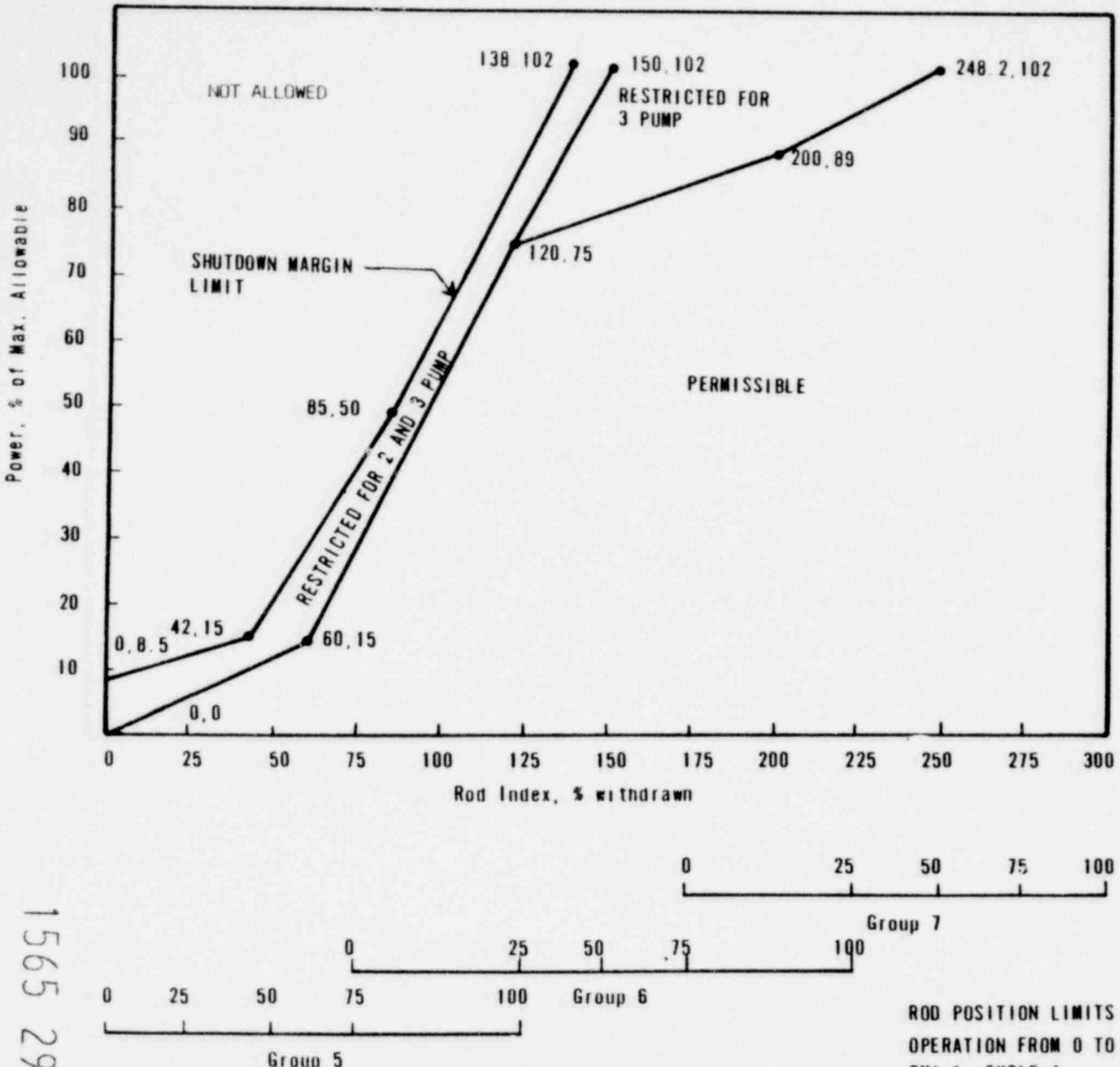
ROD POSITION LIMITS FOR 4 PUMP OPERATION
FROM 125 ± 5 EFPD TO 265 ± 15 EFPD
TMI-1, CYCLE 4

Figure 3.5-2B



ROD POSITION LIMITS FOR 2 & 3 PUMP
OPERATION FROM 0 TO 125 ± 5 EFPD
TMI-1, CYCLE 4

Figure 3.5-2C

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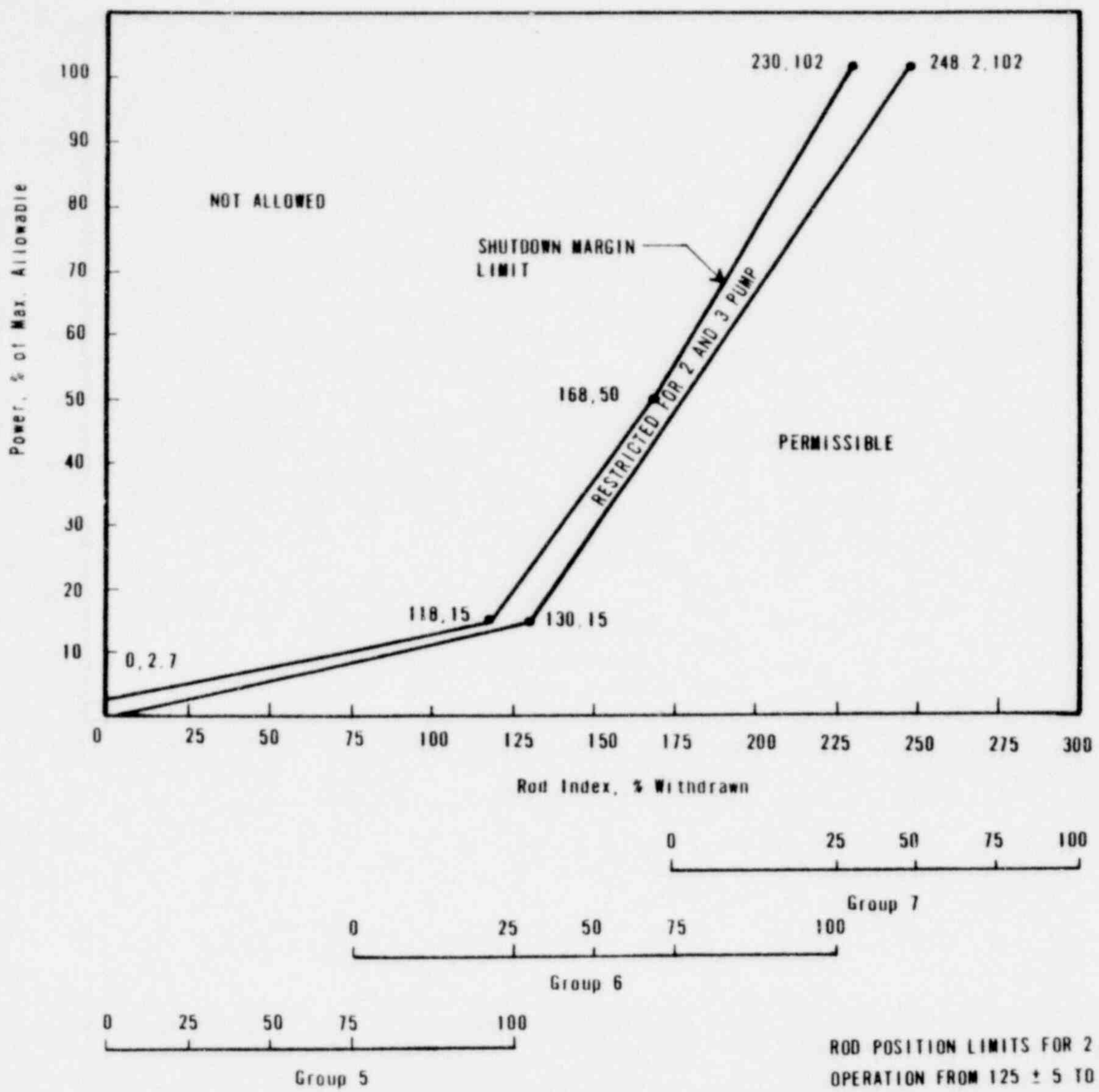

ROD POSITION LIMITS FOR 2 & 3 PUMP
OPERATION FROM 125 ± 5 TO 265 ± 15 EFPD
TMI-1, CYCLE 4

Figure 3.5-2D

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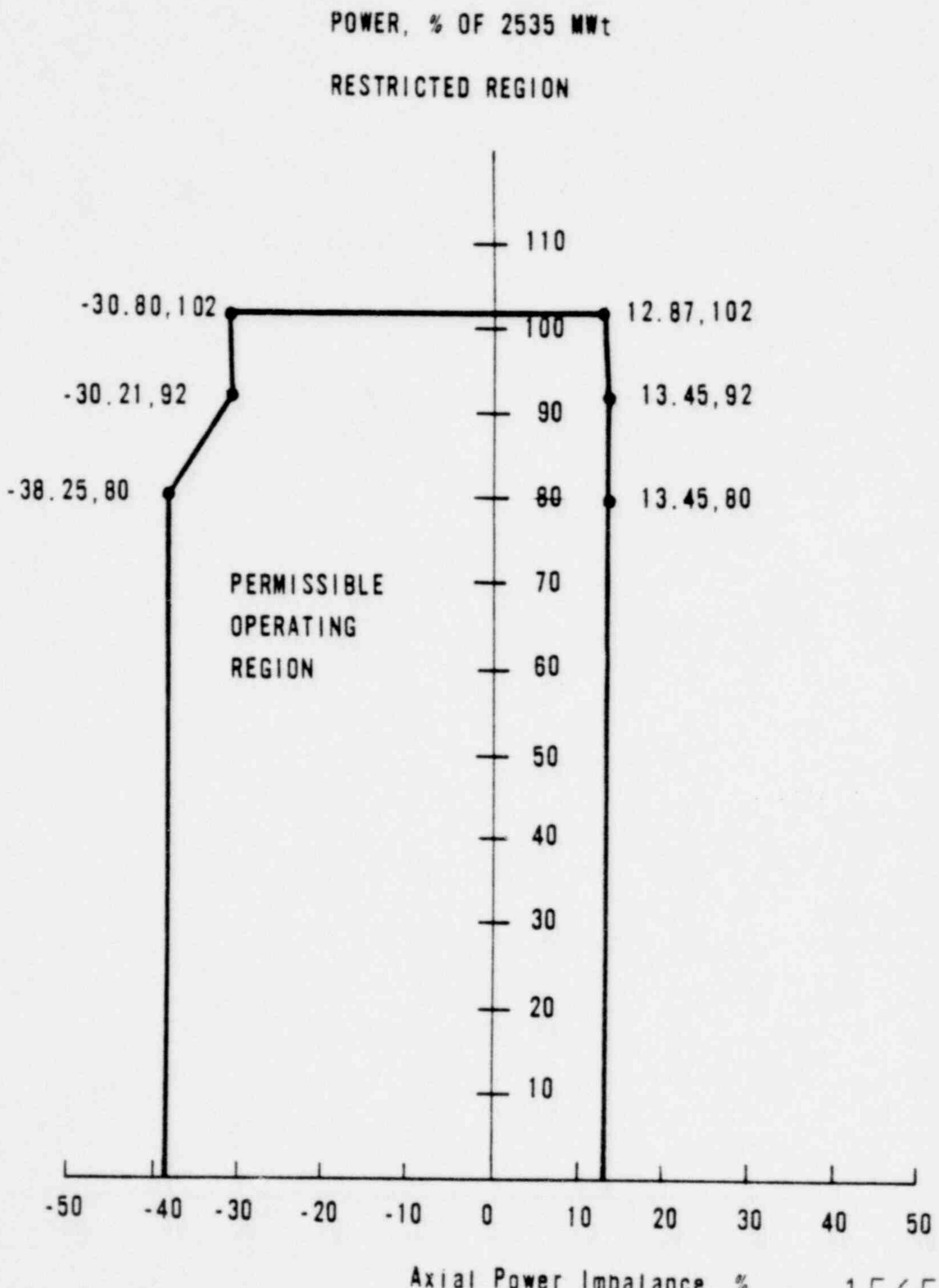

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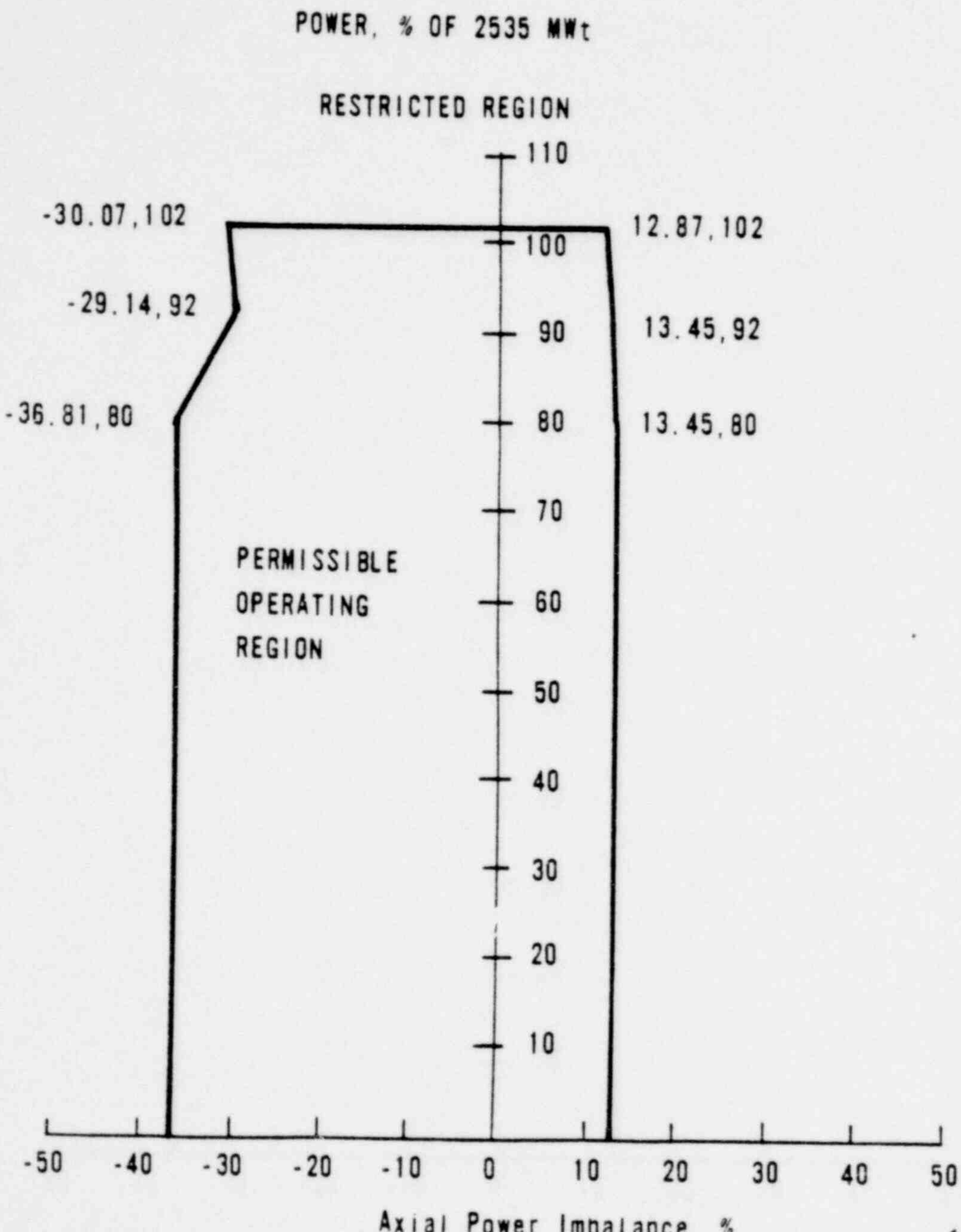
POWER IMBALANCE ENVELOPE FOR
OPERATION FROM 0 TO 125 ± 5 EFPD
TMI-1, CYCLE 4

Figure 3.5-2E



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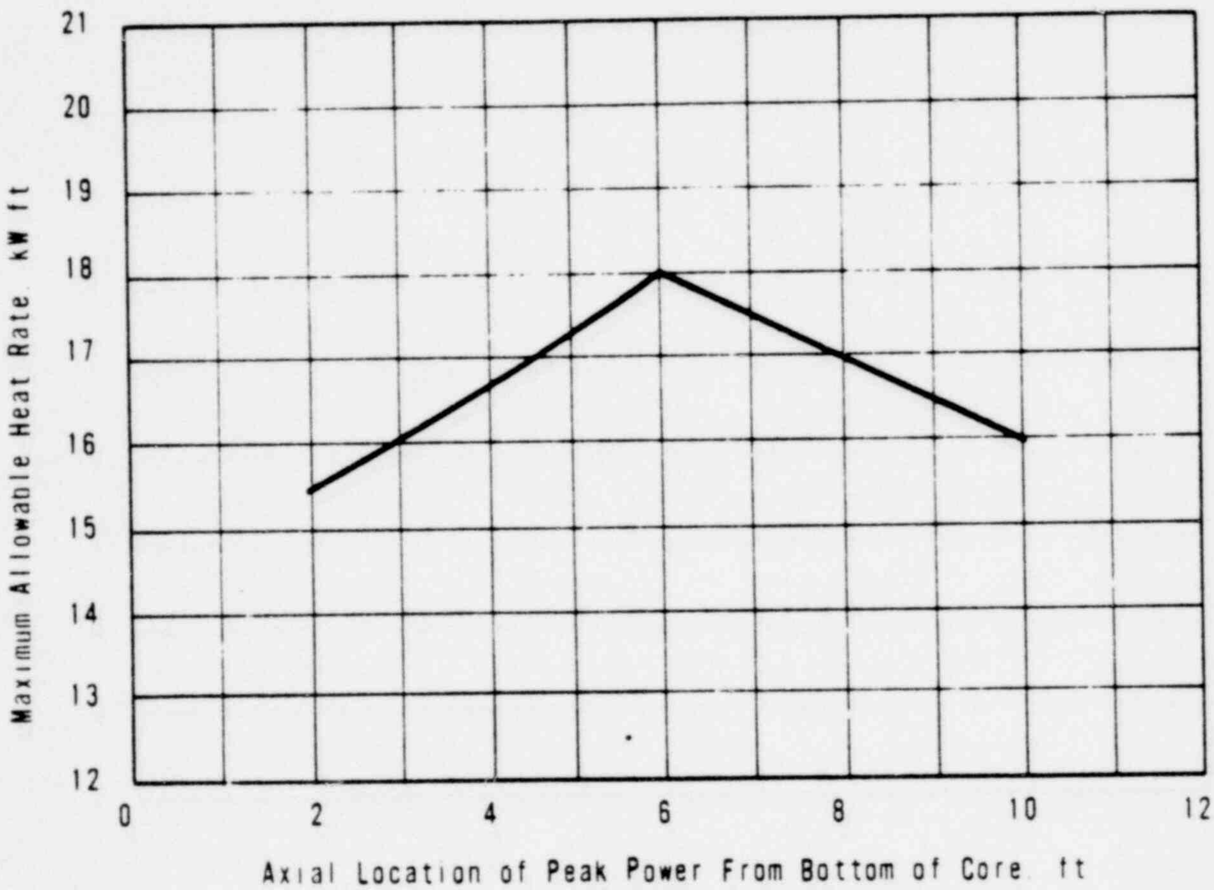
POWER IMBALANCE ENVELOPE FOR
OPERATION FROM 125 ± 5 TO 265 ± 15 EFPD
TMI-1, CYCLE 4

Figure 3.5-2F



LOCA LIMITED MAXIMUM ALLOWABLE
LINEAR HEAT RATE - TMI-1, CYCLE 4

Figure 3.5-2G

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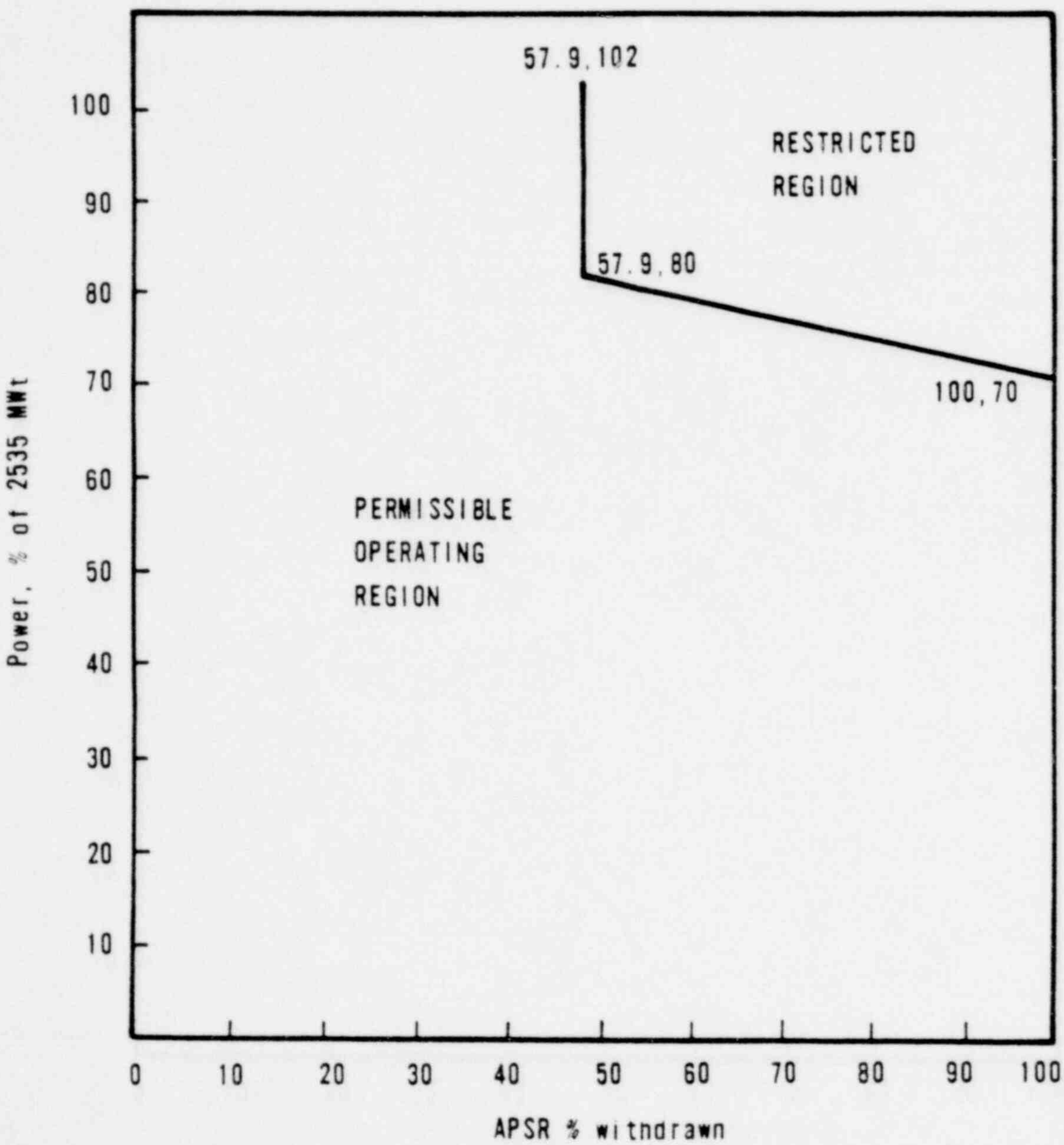

APSR POSITION LIMITS FOR
OPERATION FROM 0 TO 265 ± 15 EFPD
TMI-1, CYCLE 4

Figure 3.5-2H

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