

September 2, 1986

Docket No. 50-289

Mr. Henry D. Hukill, Vice President  
and Director - TMI-1  
GPU Nuclear Corporation  
P. O. Box 480  
Middletown, Pennsylvania 17057

Dear Mr. Hukill:

SUBJECT: AMENDMENT NO. 120 TO FACILITY OPERATING LICENSE NO. DPR-50

**DISTRIBUTION**

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The Commission has issued the enclosed Amendment No. 120 to Facility Operating License No. DPR-50 for the Three Mile Island Nuclear Station, Unit No. 1 (TMI-1). This amendment consists of changes to the Technical Specifications (TSs) in response to your letter dated July 16, 1986.

This amendment allows the withdrawal of axial power shaping rods (APSRs) under end-of-cycle (EOC) core conditions. The overall result of this amendment allows continued operation until about November 1, 1986 before beginning the Cycle 6 refueling outage. The portion of your amendment request regarding TS 3.5.2.4 on quadrant tilt is being processed separately.

A copy of our Safety Evaluation is also enclosed. Notice of Issuance will be included in the Commission's biweekly Federal Register notice.

Sincerely,

ORIGINAL SIGNED BY

John O. Thoma, Project Manager  
PWR Project Directorate #6  
Division of PWR Licensing-B

Enclosures:

- 1. Amendment No. 120 to DPR-50
- 2. Safety Evaluation

cc w/enclosures:

See next page

\*See previous white for concurrences.

PBD-6 <sup>8/21/86</sup>  
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JStolz\*  
8/15/86

OGC  
JGoldberg\*  
8/18/86

*Chgs. made  
as requested.  
8/21/86*

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P PDR

Docket No. 50-289

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and Director - TMI-1  
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Middletown, Pennsylvania 17057

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John O. Thoma, Project Manager  
PWR Project Directorate #6  
Division of PWR Licensing-B

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See next page

PBD-6m  
RIngram  
8/13/86

PBD-6  
JThoma:cf  
8/15/86

PBD-6  
TRoss  
8/14/86

Raw  
PBD-6  
RWeller  
8/14/86

PBD-6  
JStoltz  
8/15/86

*JG*  
OGC  
J. Goldberg  
8/18/86  
subject to  
change or  
noted

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U.S. Nuclear Regulatory Commission  
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Atomic Safety & Licensing Appeal  
Board Panel (8)  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

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U.S. Nuclear Regulatory Commission  
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-2-

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NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

METROPOLITAN EDISON COMPANY

JERSEY CENTRAL POWER AND LIGHT COMPANY

PENNSYLVANIA ELECTRIC COMPANY

GPU NUCLEAR CORPORATION

DOCKET NO. 50-289

THREE MILE ISLAND NUCLEAR STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 120  
License No. DPR-50

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by GPU Nuclear Corporation, et al. (the licensees) dated July 16, 1986, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
  - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
  - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

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P PDR

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.c.(2) of Facility Operating License No. DPR-50 is hereby amended to read as follows:

Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 120, are hereby incorporated in the license. GPU Nuclear Corporation shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

  
John F. Stolz, Director  
PWR Project Directorate #6  
Division of PWR Licensing-B

Attachment:  
Changes to the Technical  
Specifications

Date of Issuance: September 2, 1986

ATTACHMENT TO LICENSE AMENDMENT NO. 120

FACILITY OPERATING LICENSE NO. DPR-50

DOCKET NO. 50-289

Replace the following pages of the Appendix "A" Technical Specifications with the attached pages. The revised pages are identified by Amendment number and contain vertical lines indicating the area of change.

<u>Remove</u>	<u>Insert</u>
vii	vii
2-3	2-3
3-34a	3-34a
3-35	3-35
3-35a	3-35a
--	3-35b
Figure 2.1-2	Figure 2.1-2
Figure 2.3-2	Figure 2.3-2
Figure 3.5-2E	Figure 3.5-2E
Figure 3.5-2F	Figure 3.5-2F
Figure 3.5-2H	Figure 3.5-2H
--	Figure 3.5-2I

## LIST OF FIGURES

<u>Figure</u>	<u>Title</u>
2.1-1	TMI-1 Core Protection Safety Limit
2.1-2	TMI-1 Core Protection Safety Limits
2.1-3	TMI-1 Core Protection Safety Bases
2.3-1	TMI-1 Protection System Maximum Allowable Set Points
2.3-2	Protection System Maximum Allowable Set Points for Reactor Power Imbalance, TMI-1
3.1-1	Reactor Coolant System Heatup/Cooldown Limitations (Applicable to 5 EFPY)
3.1-2	Reactor Coolant System, Inservice Leak and Hydrostatic Test Limitations (Applicable to 5 EFPY)
3.1-3	Limiting Pressure vs. Temperature Curve for 100 STD cc/Liter H <sub>2</sub> O
3.5-2A	Rod Position Limits for 4 Pump Operation from 0 to 125 ± 5 EFPD, TMI-1
3.5-2B	Rod Position Limits for 4 Pump Operation from 125 ± 5 EFPD, TMI-1
3.5-2D	Rod Position Limits for 2 and 3 Pump Operation from 125 ± 5 EFPD to EOC, TMI-1
3.5-2E	Power Imbalance Envelope for Operation from 0 EFPD to 250 + 10 EFPD
3.5-2F	Power Imbalance Envelope for Operation after 250 ± 10 EFPD
3.5-2G	LOCA Limited Maximum Allowable Linear Heat, TMI-1
3.5-2H	APSR Position Limits for Operation from 0 EFPD to 250 + 10 EFPD
3.5-2I	APSR Position Limits for Operation After 250 + 10 EFPD
3.5-1	Incore Instrumentation Specification Axial Imbalance Indication, TMI-1
3.5-2	Incore Instrumentation Specification Radial Flux Tilt Indication, TMI-1
3.5-3	Incore Instrumentation Specification
3.11-1	Transfer Path to and from Cask Loading Pit
4.17-1	Snubber Functional Test - Sample Plan 2
5-1	Extended Plot Plan TMI

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

2. The control rod group withdrawal limits (Figures 3.5-2A, 3.5-2B, 3.5-2C, 3.5-2D, 3.5-2H, and 3.5-2I) 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 +9.50% determined using the minimum incore detector system (MIT) if the FIT is not available, or +14.20% 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. 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  $\pm$  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.

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.

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:

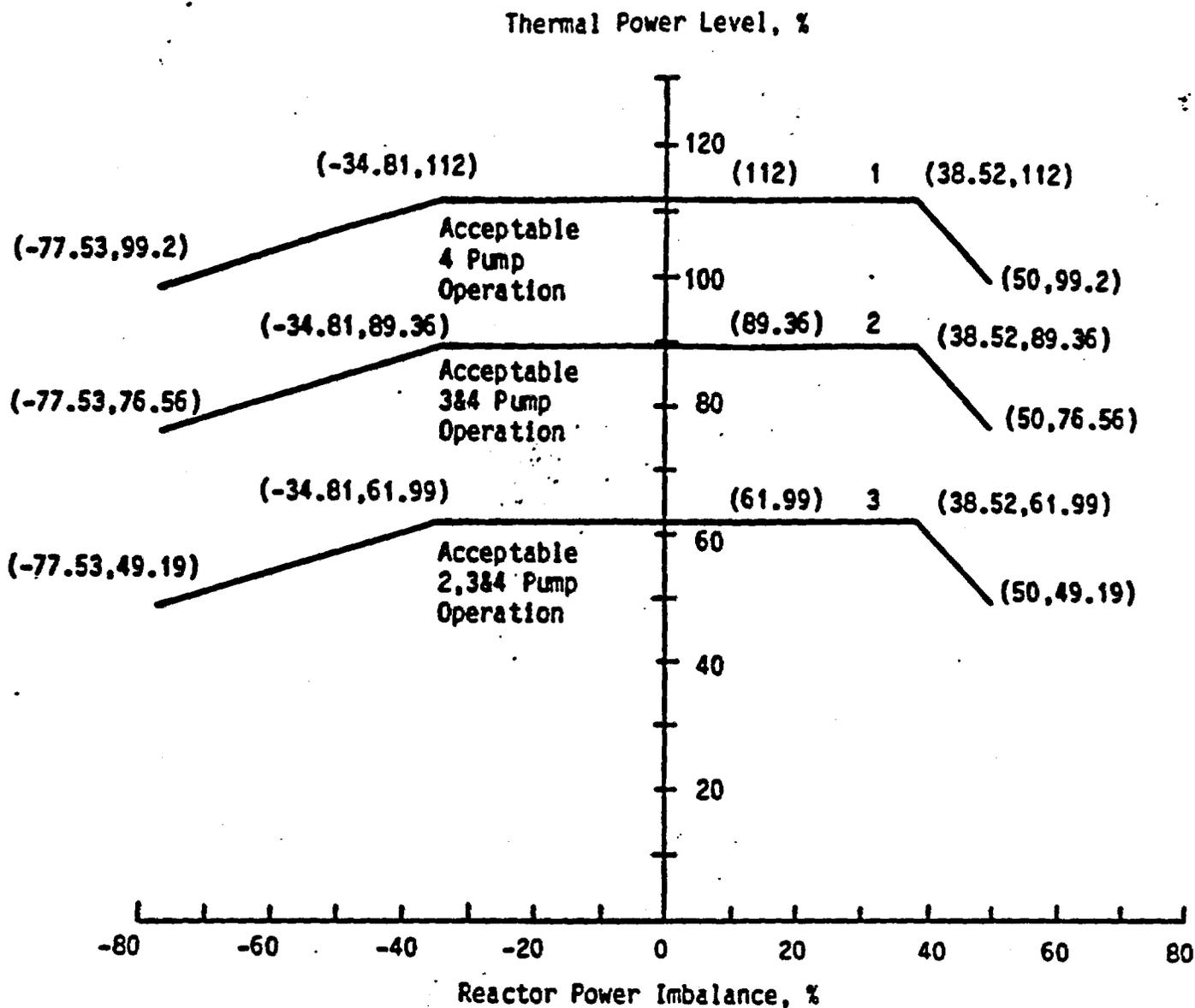
- a. Nuclear uncertainty factors
- b. Thermal calibration uncertainty
- c. Fuel densification effects
- d. Hot rod manufacturing tolerance factors
- e. Postulated fuel rod bow effects

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

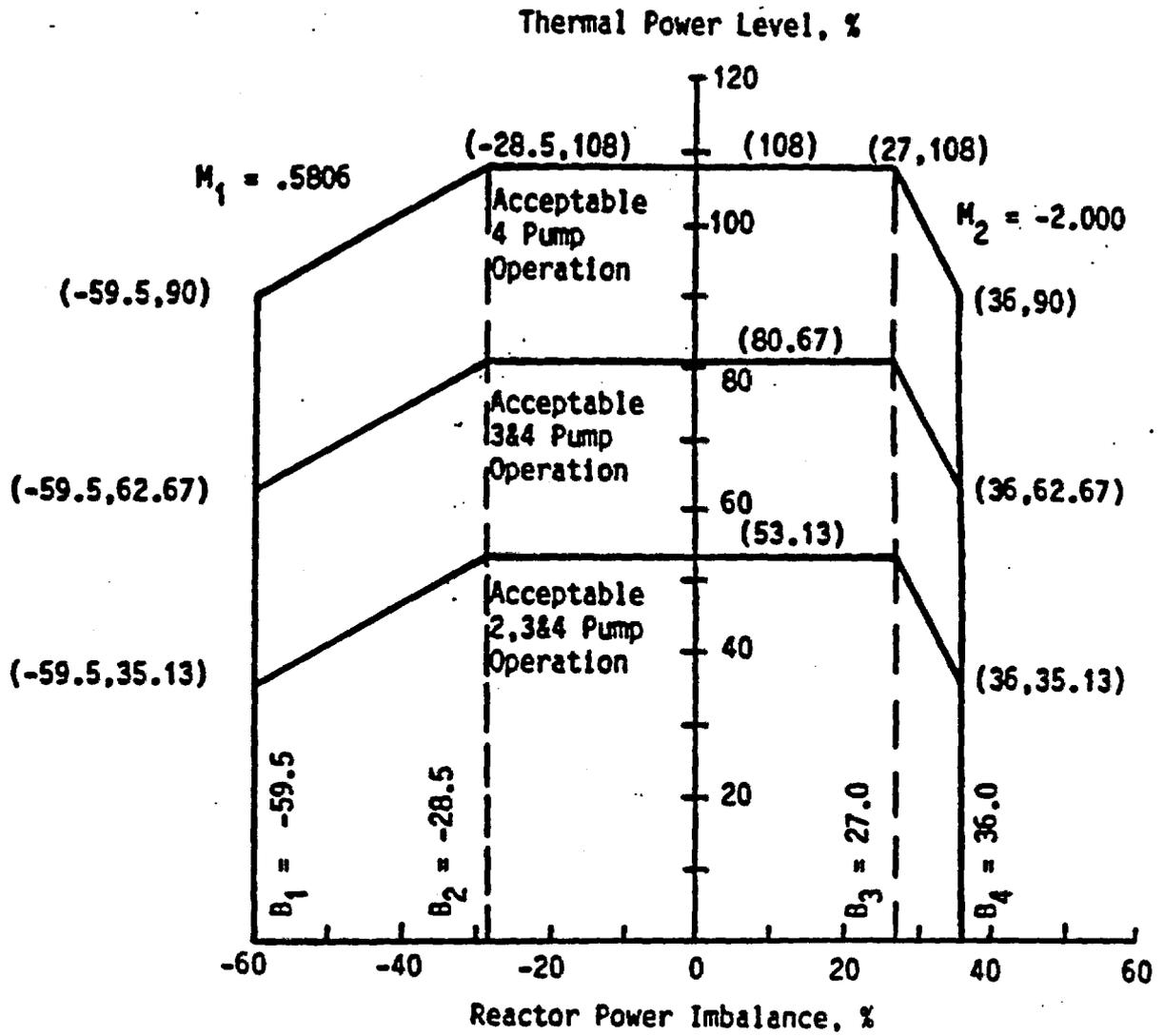
limiting condition for operation. The limiting criteria within the Restricted Region are potential ejected rod worth and ECCS power peaking and since the probability of these accidents is very low especially in a 4 hour time frame, inadvertant operation within the Restricted Region for a period of 4 hours is allowed.



<u>Curve</u>	<u>Reactor Coolant Flow (lb/hr)</u>
1	$139.8 \times 10^6$
2	$104.5 \times 10^6$
3	$68.8 \times 10^6$

TMI-1 Core Protection Safety Limits, Cycle 5

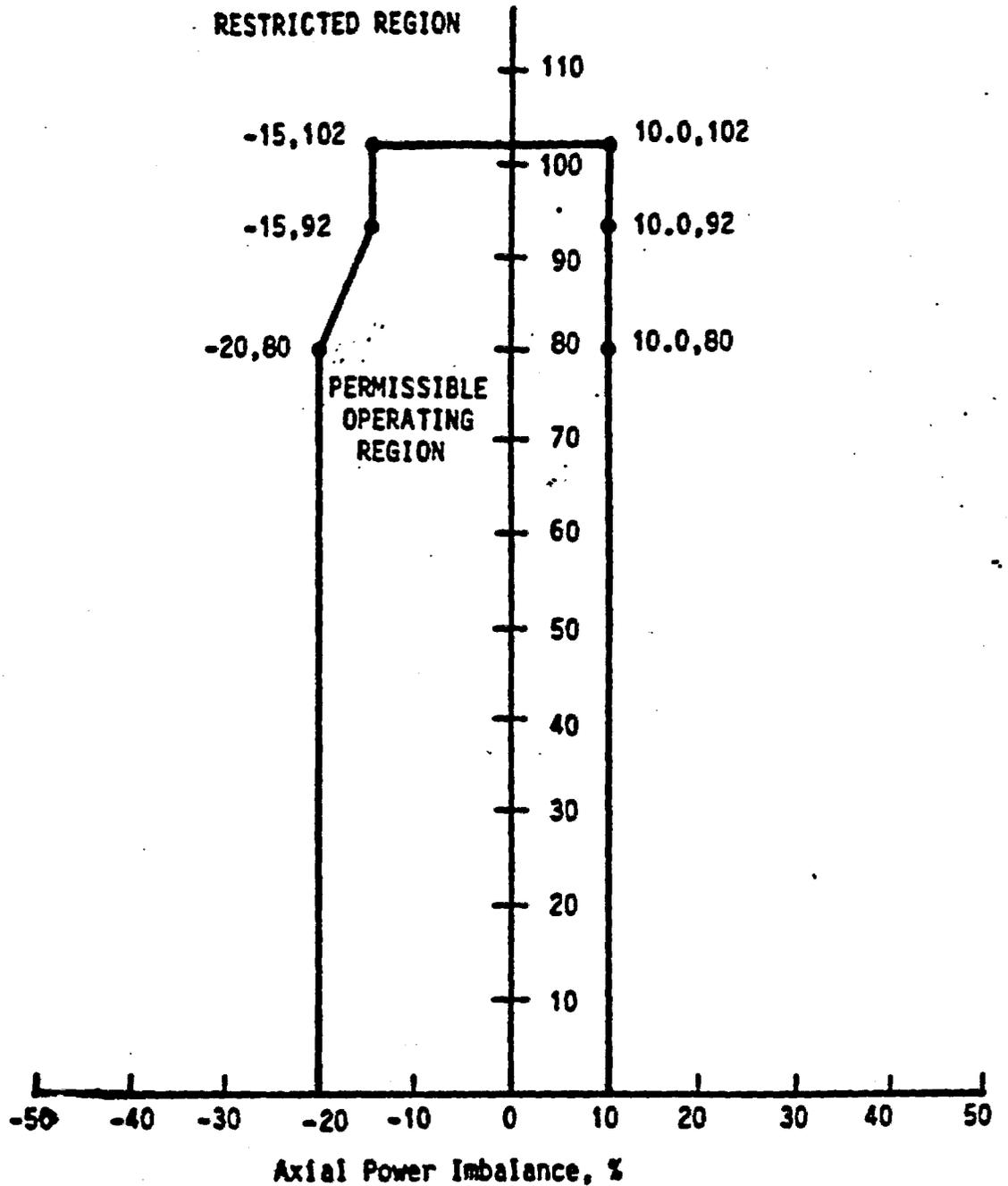
Figure 2.1-2



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

Figure 2.3-2

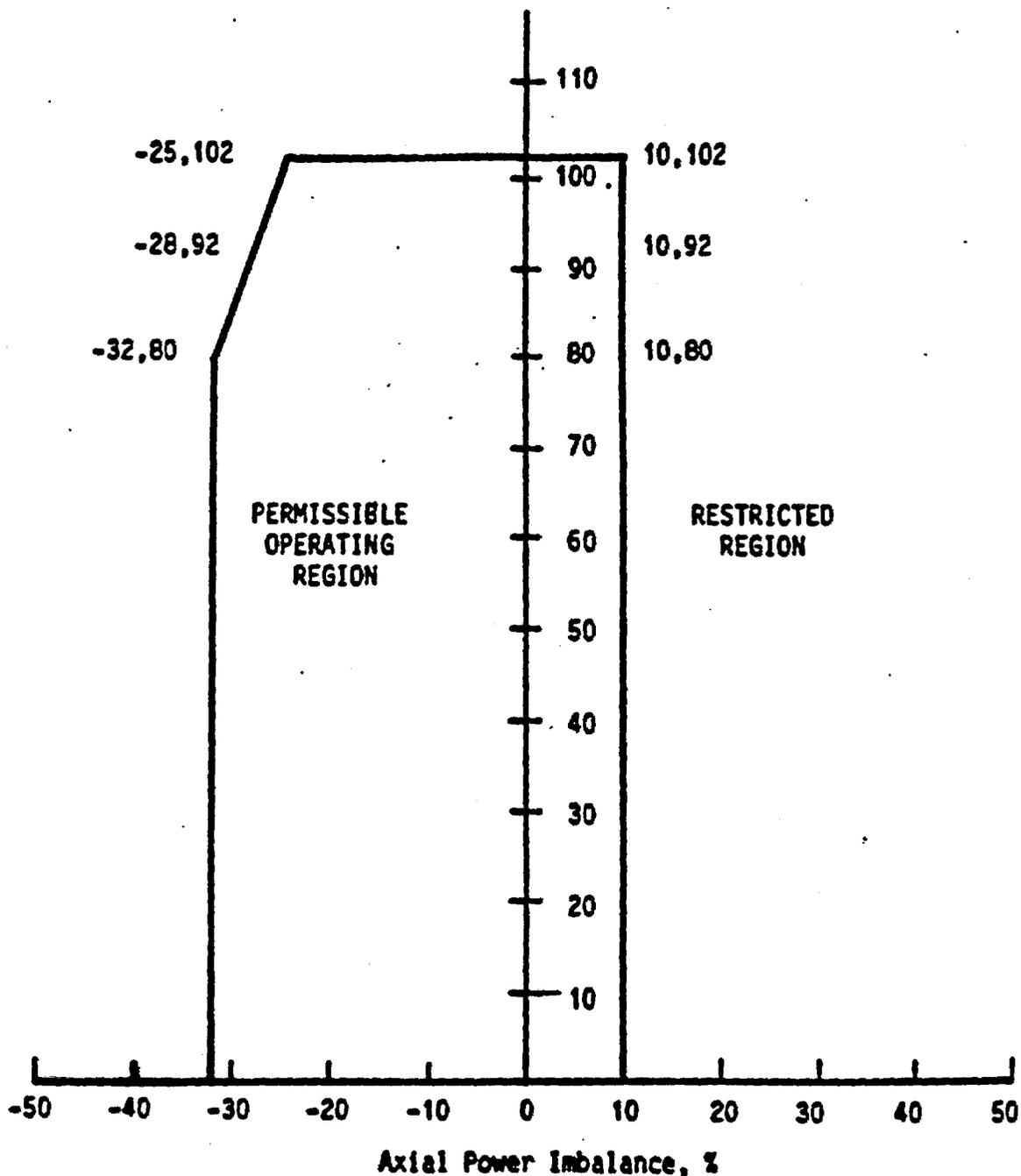
Power, % of 2535 MWt



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

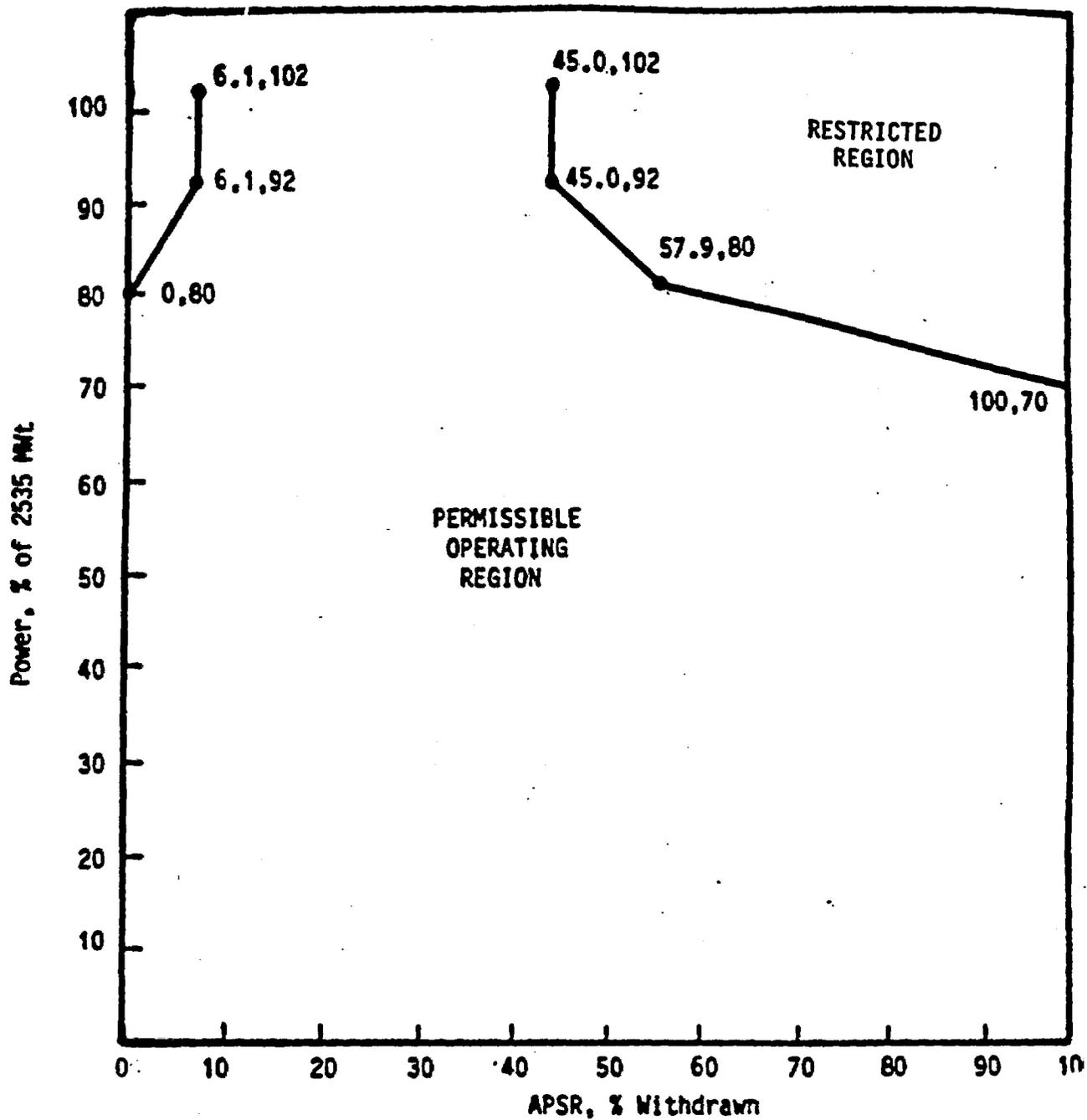
Figure 3.5-2E

Power, % of 2535 Mw



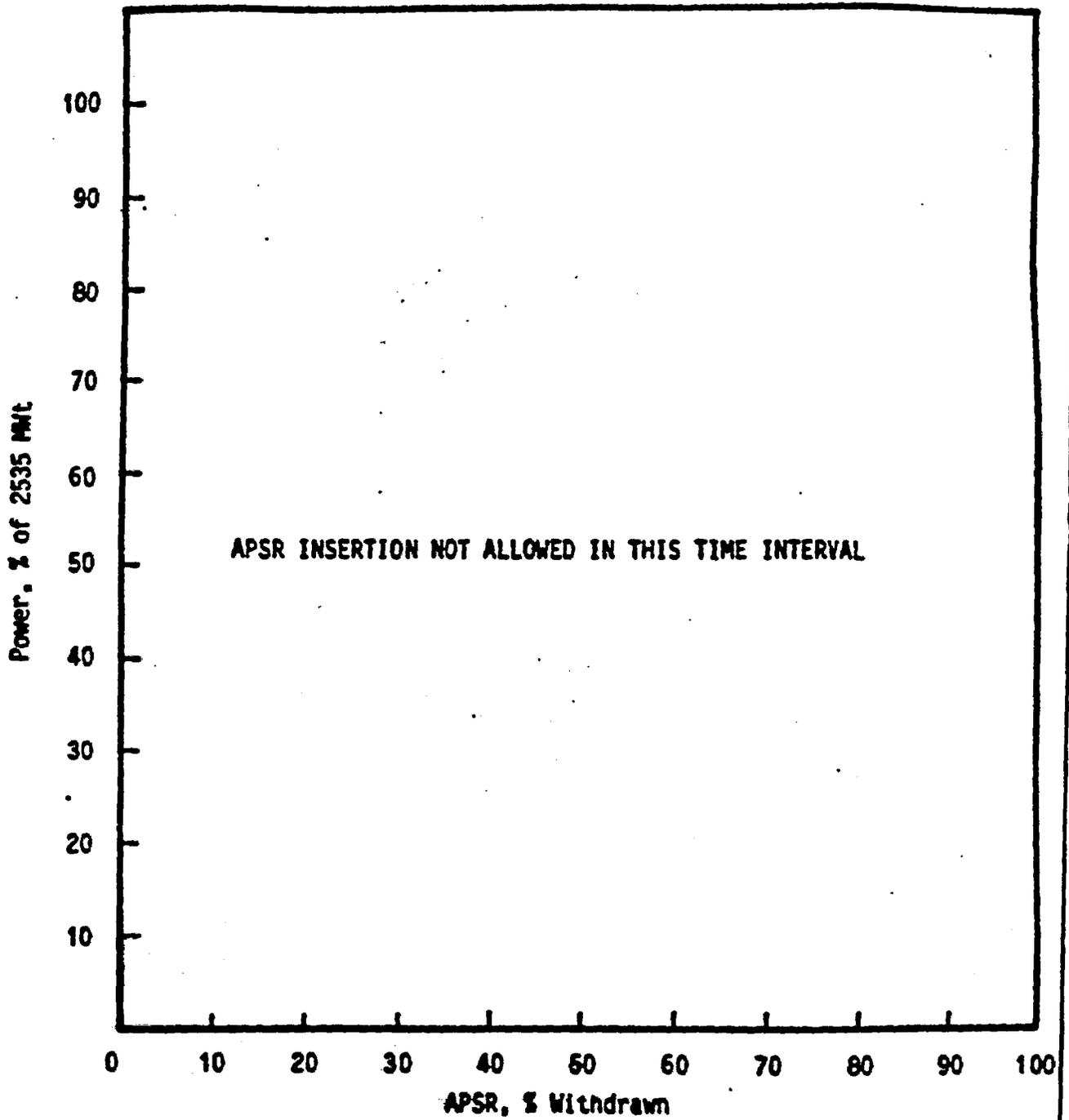
Power Imbalance Envelope for Operation  
After  $250 \pm 10$  EFPD, Cycle 5

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  $250 \pm 10$  EFPD, Cycle 5

Figure 3.5-21



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 120 TO FACILITY OPERATING LICENSE NO. DPR-50

METROPOLITAN EDISON COMPANY  
JERSEY CENTRAL POWER AND LIGHT COMPANY  
PENNSYLVANIA ELECTRIC COMPANY  
GPU NUCLEAR CORPORATION

THREE MILE ISLAND NUCLEAR STATION, UNIT NO. 1

DOCKET NO. 50-289

INTRODUCTION

By letter dated July 16, 1986, GPU Nuclear Corporation (GPU or the licensee) requested amendment to the Technical Specifications (TSs) appended to Facility Operating License No. DPR-50 for the Three Mile Island Nuclear Station, Unit No. 1 (TMI-1). The proposed amendment (titled Technical Specification Change Request No. 159) would allow the withdrawal of the axial power shaping rods (APSRs) from the core as early as 240 effective full power days (EFPDs) into the current Cycle 5. Withdrawing the APSRs will extend Cycle 5 from 280 EFPDs to  $290 \pm 15$  EFPDs. A change to the quadrant tilt Technical Specification 3.5.2.4 was also included in the submittal, but this subject will be addressed by a separate evaluation. The staff has reviewed the proposed changes and prepared the following evaluation.

EVALUATION

The APSRs at TMI-1 are part length control rods used to shape the axial power distribution if an axial xenon transient occurs. These rods do not trip during a reactor scram since their movement may add positive or negative reactivity to the total control rod worth, depending on their position at the time of reactor trip. The APSRs would be fully withdrawn at  $250 \pm 10$  EFPDs to the end of cycle (EOC) 5 now estimated to be  $290 \pm 15$  EFPDs. The increase in Cycle 5's length is caused, primarily, by a net increase in core reactivity of about 0.5% delta k/k when the APSRs are fully withdrawn from the core. The main issues involved in APSR withdrawal from the core are (1) the effect on axial power shape control, (2) the effect on reactor core parameters (e.g., moderator temperature coefficient), (3) the effect on accident and transient analyses, and (4) the effect on fuel and thermal design.

Even though the APSRs are fully withdrawn from the core, the axial power shape can easily be maintained to either prevent or control any axial xenon transient. The axial xenon stability index was calculated to be -0.0387 per hr., therefore any xenon transient induced power oscillation will be damped. Moreover, many PWRs operate without part length control rods indicating the efficacy of various power distribution control schemes. From an analysis

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of power distribution control, the licensee determined that the current rod index limits still maintain the shutdown margin and ejected rod worth criteria. The licensee determined new power/imbalance/flow Technical Specification setpoints to meet power peaking factor limits for near EOC 5 operation with the APSRs fully withdrawn. These setpoints are less restrictive than the original Cycle 5 limits which were established with the intention of bounding future cycles. These new setpoints provide the plant with greater operational flexibility. The staff concludes that the licensee's evaluation of the rod index limits and power/imbalance/flow setpoints is acceptable since previously approved methods have been used in the analysis.

The licensee evaluated the effect of APSR withdrawal from the core on the reactor core parameters. The results indicate that only slight change in various parameters and coefficients will occur. The largest change occurs for the moderator temperature coefficient (MTC). The MTC changed from  $-2.63 \times 10^{-4}$  delta k/k/°F at 17 ppm of boron with the APSRs inserted to  $-2.51 \times 10^{-4}$  delta k/k/°F at 17 ppm of boron with the APSRs fully withdrawn. The Cycle 5 startup tests indicated that the reactor design agreed well with the test measurements and confirmed the adequacy of the Cycle 5 design methodology. The staff concludes that the licensee's evaluation of EOC 5 nuclear design with the APSRs removed is acceptable.

The licensee evaluated the effect of the change in core parameters on the accident and transient analyses. The only FSAR events directly affected by the changes in core parameters are overcooling transients (steam line break and cold water accident) and a dropped control rod. For the steam line break, the EOC 5 would result in a less severe accident than reported in the FSAR due to the less negative MTC. The effect of other parameters on the accident would be negligible. Similarly, a cold water accident would be less severe than reported in the FSAR because of the less negative MTC. The dropped rod is dependent, primarily, on rod worth and the MTC. A review of these parameters indicates that the consequences of a dropped rod would be less severe than the FSAR analysis. The staff concludes that the licensee's assessment of the effect of EOC 5 APSR withdrawal on transients and accidents is acceptable since the FSAR analyses of the affected accidents and transients remained more limiting.

The effect of the increased cycle burnup has no significant effect on the fuel and thermal design. No previous assumptions or criteria on the fuel design were exceeded, including those for cladding collapse and internal pin pressure. The thermal hydraulic design is not affected by the small Cycle 5 burnup extension. Previous assumptions for the rod bow penalty remain bounding. The staff concludes that the licensee's assessment of the fuel and thermal design for the increased Cycle 5 burnup is acceptable.

The staff concludes that the proposed Technical Specifications associated with the withdrawal from the core of the APSRs near EOC 5 and the resultant Cycle 5 extension are acceptable.

#### ENVIRONMENTAL CONSIDERATION

This amendment involves a change in the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. We have determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that this amendment involves no significant hazards consideration and there has been no public comment on such finding. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

#### CONCLUSION

We have concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Dated: September 2, 1986

Principal Contributors: D. Fieno