GE Nuclear Energy

Enclosure 1

Supplemental Reload Licensing Report

Reload 3, Cycle 4

INFORMATION ONLY

INTENT
INSTRUCTION TEMPORARY CHANGE

PNPP No. 7310 Rev. 2/92

PAP-0522

TEMPORARY CHANGE NO: TCN- 1

INSTRUCTION NO.	REV.	INSTRUCTION TITLE
PDB-F0001	1	Core Operating Limits Report for the Perry Nuclear Power Plant, Unit 1 Cycle 4 (Reload 3)

ADMIN. USE ONLY

CANCELS TCN(S):
NA

LIST EACH ATTACHED PAGE
3a, 15

REASON

Incorporate the ~~preliminary~~ 9MF 5-21-92 Rotated Bundle Analysis evaluation MCPR penalty to the operating limit MCPR.

PREPARER	DATE	IN DEPTH REVIEWER	DATE
Joanne M Rinckel	5-21-92	[signature]	5-21-92

PORC MTG. NO.	PORC MTG. DATE	RECOMMENDED FOR APPROVAL	EFFECTIVE DATE
92-070	5-21-92	☑ YES ☐ NO	5-22-92

APPROVAL

APPROVER	DATE	APPROVED	DATE
Peter D Sledzik	5-21-92	Steven F Kenneke	5/21/92
APPROVED	DATE	APPROVED	DATE
NA		NA	
APPROVED	DATE	APPROVED	DATE
NA		NA	

Ensure an approved 10CFR50.59 Applicability Check is attached prior to submittal for PORC Review or final approval if Non-PORC.

INFORMATION ONLY

PLANT DATA BOOK ENTRY SUBMITTAL SHEET

TITLE: CORE OPERATING LIMITS REPORT FOR THE PERRY NUCLEAR POWER PLANT, UNIT 1 CYCLE 4 (RELOAD 3)

PDB - F0001 /Rev. 1 EFFECTIVE DATE: 5-21-92

MPL: J11 TCN: N/A PAGES AFFECTED: N/A

SCOPE OF CHANGE: Incorporate new fuel type information for Cycle 4 including MCPR limits which are fuel type dependent and delta T dependent.

REFERENCE: PY-CEI/NRR-1104 L
PY-CEI/NRR-1157 L
PY-NRR/CEI-0529 L

PREPARED BY: J. M. Rinckel Jaruw M. Rinckel 4-27-92 Date

REVIEWED BY: [signature] Patricia Buckley 4-30-92 Date

APPROVED BY: [signature] Manager - Sponsoring Group 4-30-92 Date

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TAB F USE ONLY

PORC MEETING NUMBER: 92-058 5-7-92 Date

APPROVED BY: Steven L. Kouski PPTD Director 5/12/92 Date

UNIT 1 CORE OPERATING LIMITS REPORT

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UNIT 1 CORE OPERATING LIMITS REPORT

INDEX (Continued)

INTRODUCTION AND REFERENCES

INTRODUCTION

This Core Operating Limits Report for PNPP Unit 1 Cycle 4 is prepared in accordance with the requirements of PNPP Technical Specification 6.9.1.9. The core operating limits presented were developed using NRC-approved methods (Reference 2). Results from the reload analyses for the General Electric fuel in PNPP Unit 1 for Cycle 4 are documented in References 3, 4, 5 and 6.

The cycle-specific core operating limits for the following PNPP Unit 1 Technical Specifications are included in this report:

1. Average Planar Linear Heat Generation Rate (APLHGR) Limits for each fuel/lattice type, including the power and flow dependent MAPFAC curves. (Technical Specification 3/4.2.1)

2. Minimum Critical Power Ratio Operating Limit including the power and flow dependent MCPR curves. (Technical Specification 3/4.2.2)

3. Linear Heat Generation Rate (LHGR) Limit for each fuel type. (Technical Specification 3/4.2.3)

REFERENCES

1. J.R. Hall (USNRC) to M.D. Lyster (CEI), Amendment No. 33 to Facility Operating License No. NPF-58, September 13, 1990.

2. "General Electric Standard Application for Reactor Fuel-GESTAR II," NEDE-24011-P-A-10 and NEDE-24011-P-A-10-US (US Supplement), April 1991.

3. "Supplemental Reload Licensing Report for the Perry Nuclear Power Plant Unit 1, Reload 3, Cycle 4," GE Document 23A7147 Rev. 0 (March, 1992).

4. "Supplement 1 to the Supplemental Reload Licensing Submittal for the Perry Nuclear Power Plant Unit 1, Reload 1, Cycle 2," GE Document 23A5948AA Rev. 0 (October 1988).

5. "Supplement 1 to the Supplemental Reload Licensing Submittal for the Perry Nuclear Power Plant Unit 1, Reload 2, Cycle 3," GE Document 23A6492AA Rev. 0 (September 1990).

6. "Supplement 1 to the Supplemental Reload Licensing Submittal for the Perry Nuclear Power Plant Unit 1, Reload 3, Cycle 4," GE Document 23A7147AA, Rev. 0 (January 1992).

7. Perry Nuclear Power Plant Updated Safety Analysis Report, Unit 1, Appendix 15B-Reload Safety Analysis.

8. R. E. Parr (GE) to M. S. Rupp (CEI), PY1C04R03 - Rotated Bundle Analysis, PY-GEF/CEI-439, May 13, 1992.

9. Fax transmittal from J. Worthington (GE) to M. S. Rupp (CEI), Reanalysis of GE10 Rotated Bundle, May 19, 1992.

TC-1

AVERAGE PLANAR LINEAR HEAT GENERATION RATE (TS 3.2.1)

All AVERAGE PLANAR LINEAR HEAT GENERATION RATES (APLHGRs) shall not exceed the result obtained from multiplying the applicable MAPLHGR values* by the smaller of either the flow dependent MAPLHGR factor ($MAPFAC_f$) Figure 3.2.1-1, or the power dependent MAPLHGR factor ($MAPFAC_p$) Figure 3.2.1-2.

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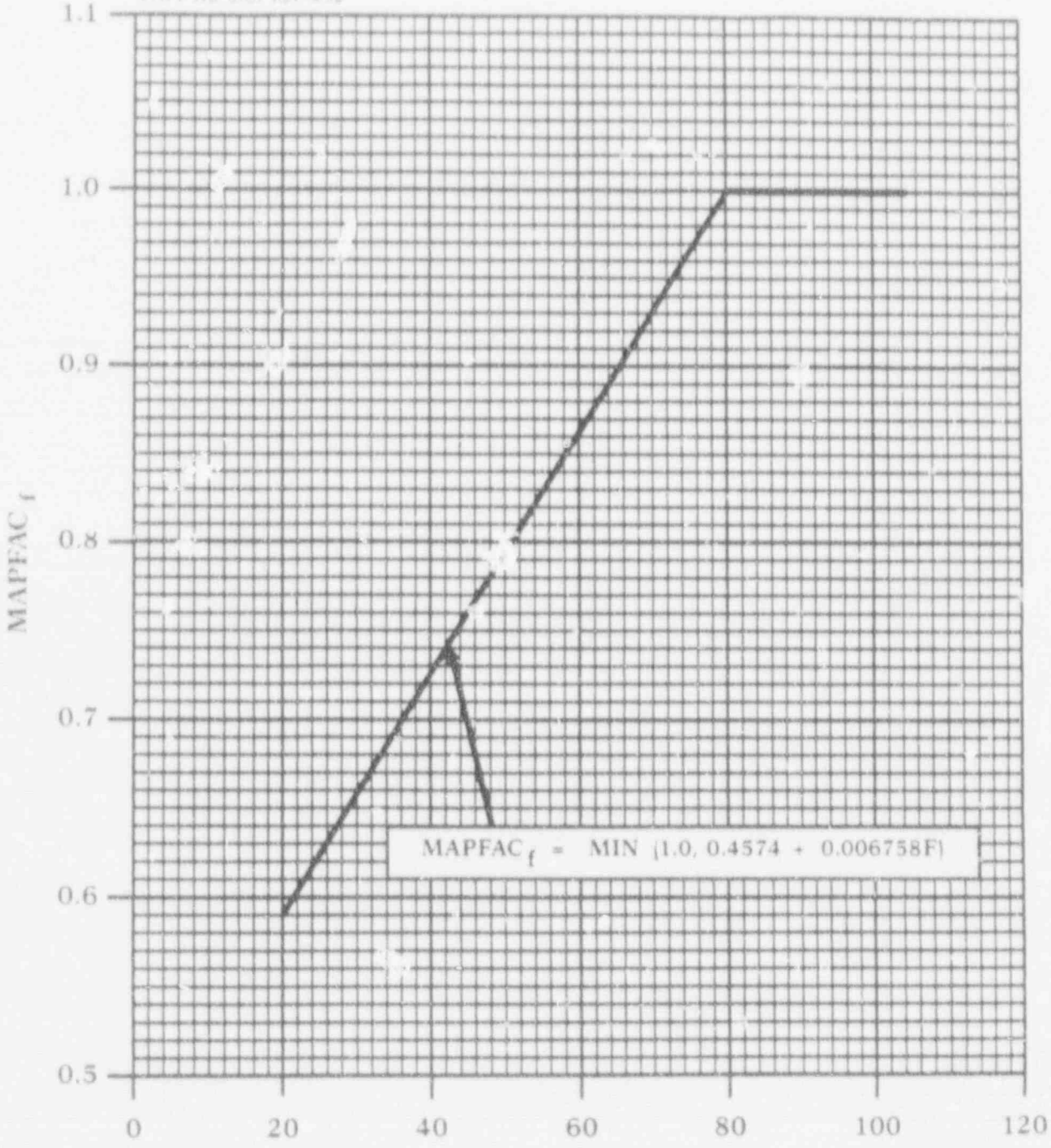
* These applicable MAPLHGR values are:

1. Those for the respective fuel and lattice type as a function of the average planar exposure (as described by the NRC approved methodology described in GESTAR-II)

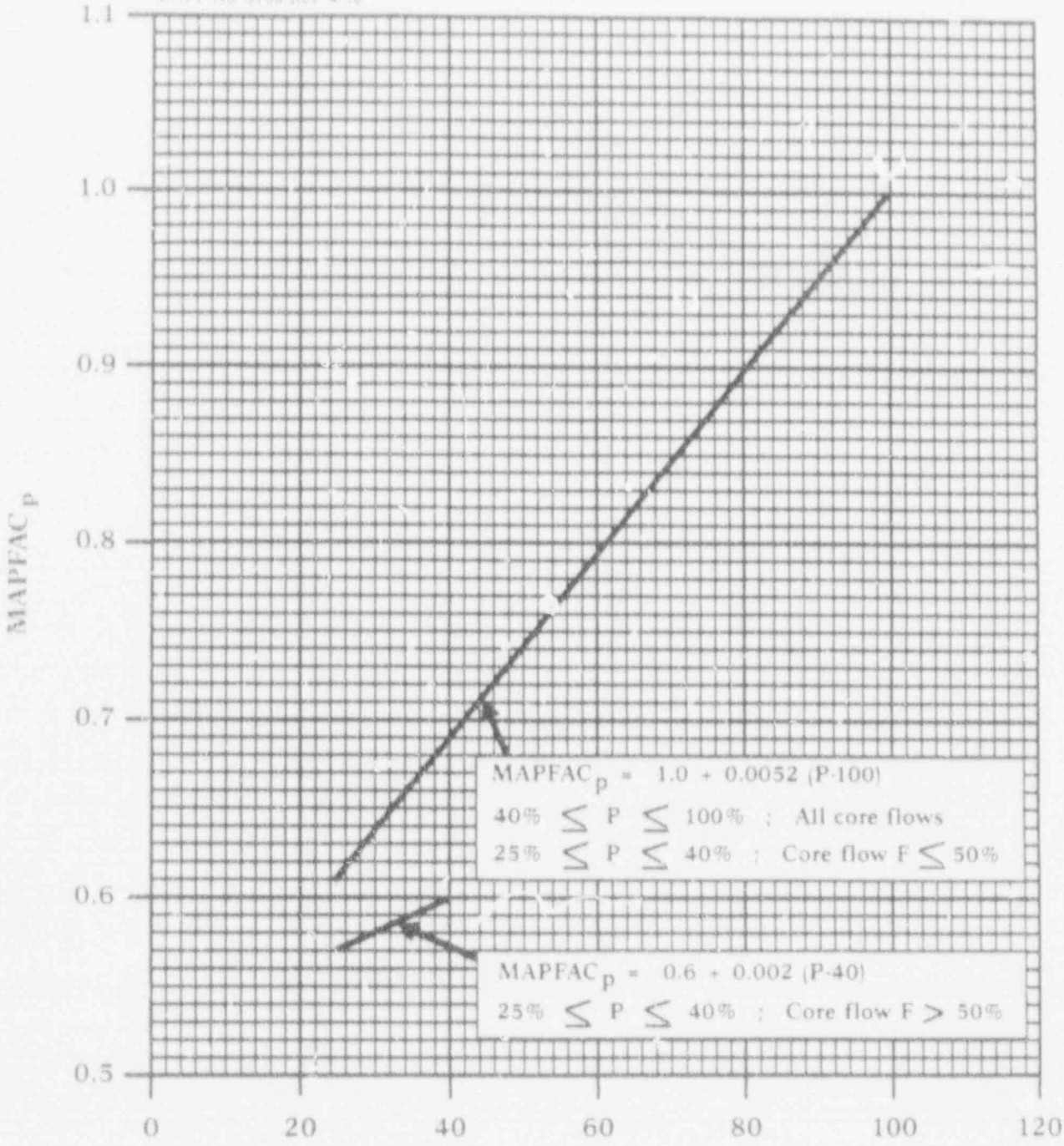
   or,

2. When hand calculations are required, the MAPLHGR as a function of the average planar exposure for the most limiting lattice shown in Figures 3.2.1-3 through Figure 3.2.1-10 for the applicable type of fuel.



FLOW DEPENDENT MAPLHGR FACTOR
(MAPFAC $_f$)

FIGURE 3.2.1-1



POWER DEPENDENT MAPLHGR FACTOR
(MAPFAC $_p$)

FIGURE 3.2.1-2

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Figure 3.2.1-3

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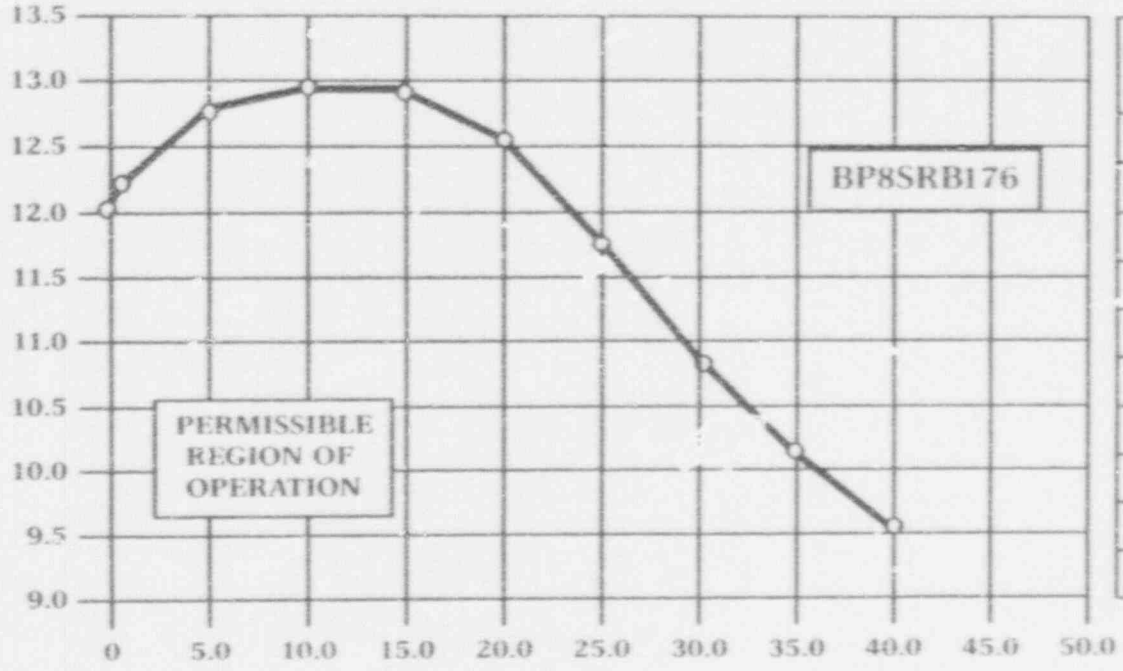


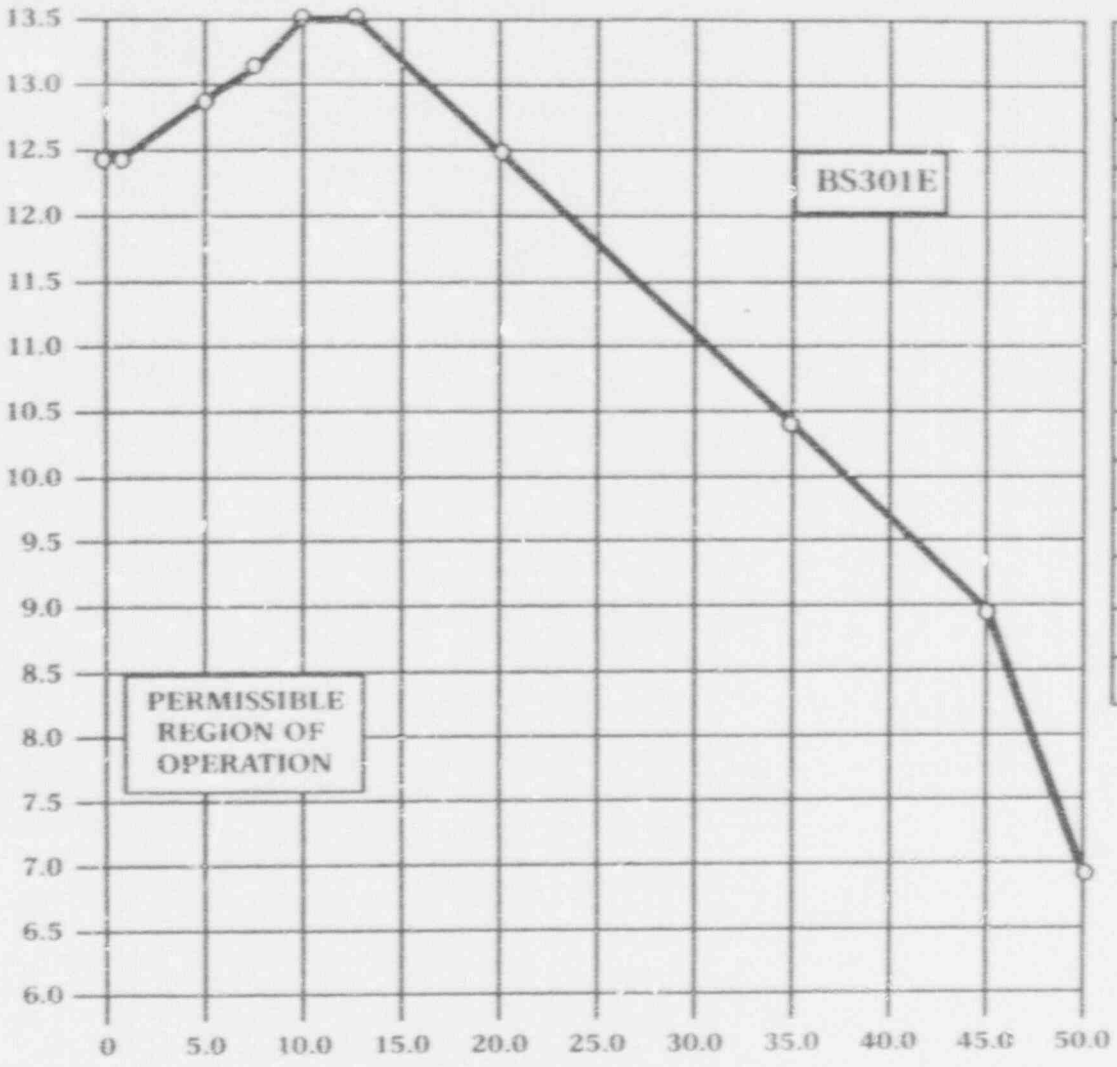
EXPOSURE (GWd/t)	MAPLHGR (kW/ft)
0.0	12.0
1.0	12.2
5.0	12.7
10.0	12.9
15.0	12.9
20.0	12.6
25.0	11.7
30.0	10.8
35.0	10.2
40.0	9.6

MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE (MAPLHGR) VERSUS AVERAGE PLANAR EXPOSURE, BP8x8R

FUEL TYPE BP8SRB176

FIGURE 3.2.1-4

Note: Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.



EXPOSURE (GWd/t)	MAPLHGR (kW/ft)
0.0	12.4
1.0	12.4
5.0	12.8
7.0	-
8.0	13.2
10.0	13.5
12.5	13.5
20.0	12.5
25.0	-
35.0	10.4
45.0	8.9
50.0	6.9

MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE (MAPLHGR) VERSUS AVERAGE PLANAR EXPOSURE, GE8x8EB

FUEL TYPE BS301E

FIGURE 3.2.1-5

Note: 1. Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
2. This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 4.

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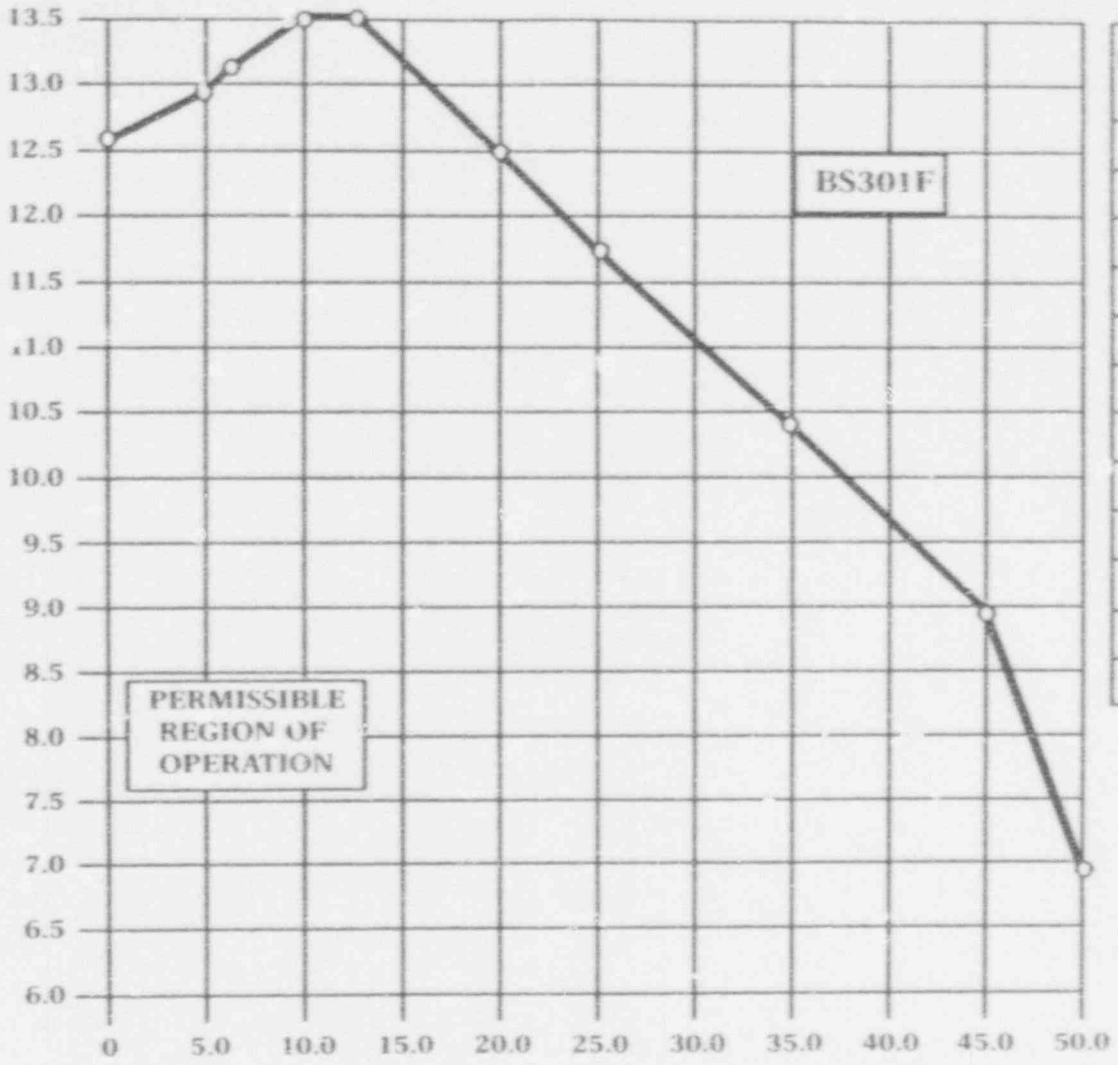


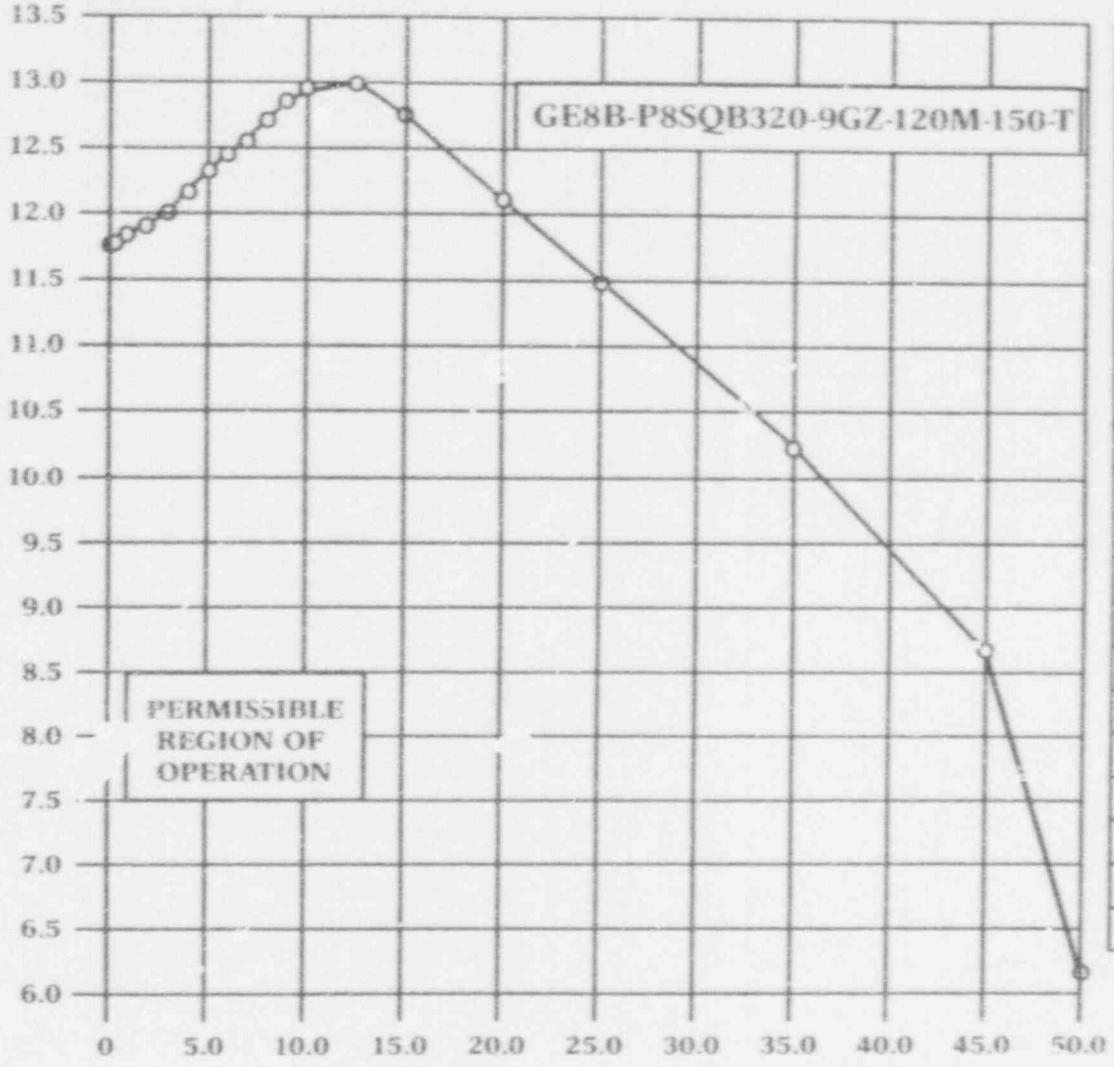
EXPOSURE (GWd/t)	MAPLHGR (kW/ft)
0.0	12.6
1.0	-
5.0	12.9
7.0	13.2
8.0	-
10.0	13.5
12.5	13.5
20.0	12.5
25.0	11.8
35.0	10.4
45.0	8.9
50.0	6.9

MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE (MAPLHGR) VERSUS AVERAGE PLANAR EXPOSURE, GE8x8EB

FUEL TYPE BS301F

Notes:
1. Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
2. This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 4.

FIGURE 3.2.1-6



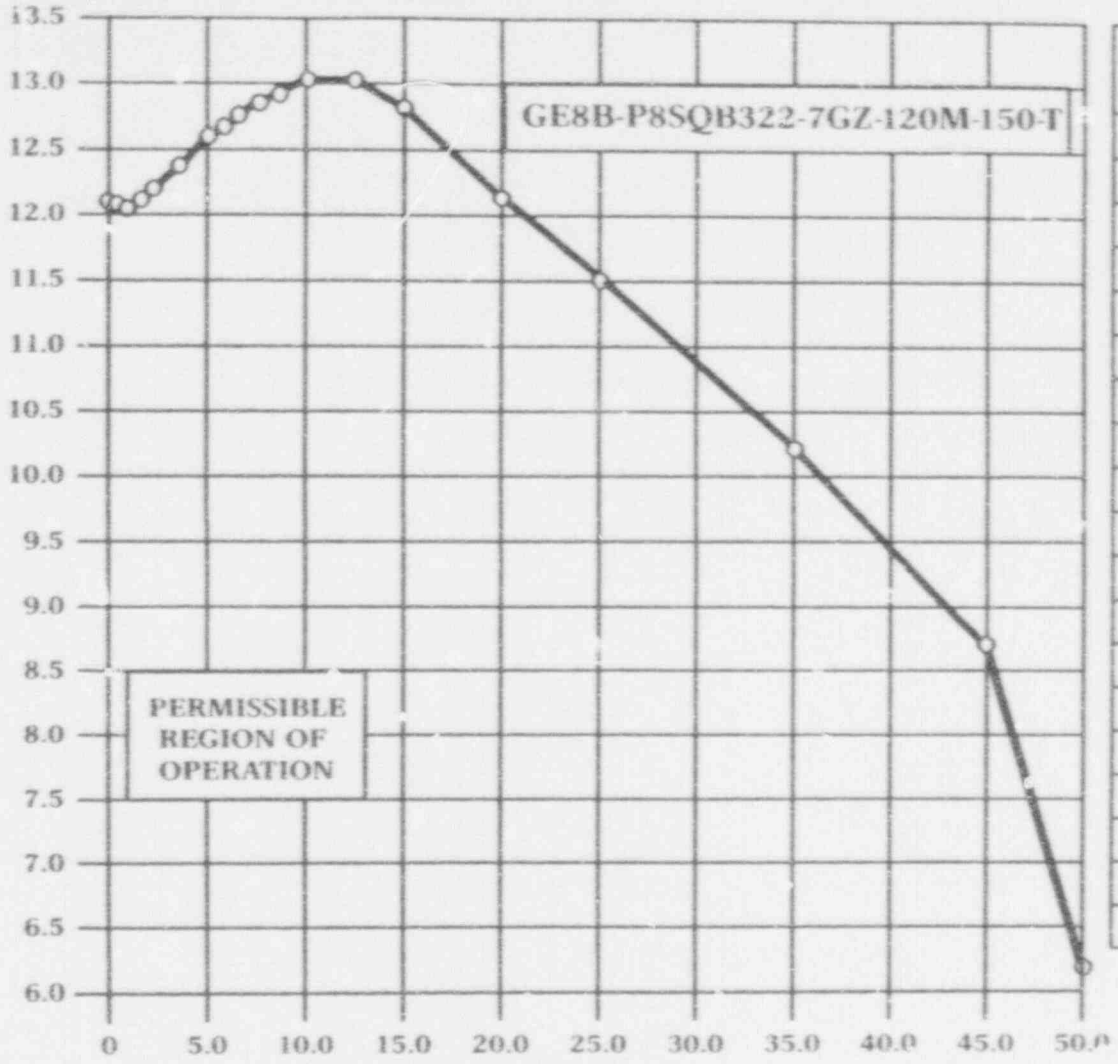
EXPOSURE (GWd/t)	MAPLHGR (kW/ft)
0.0	11.75
0.2	11.78
1.0	11.83
2.0	11.91
3.0	12.02
4.0	12.17
5.0	12.32
6.0	12.44
7.0	12.56
8.0	12.70
9.0	12.84
10.0	12.97
12.5	13.00
15.0	12.73
20.0	12.10
25.0	11.48
35.0	10.23
45.0	8.66
50.0	6.16

MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE (MAPLHGR) VERSUS AVERAGE PLANAR EXPOSURE, GE8x8EB

FUEL TYPE GE8B-P8SQB320-9GZ-120M-150-T

Notes:
1. Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
2. This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 5.

FIGURE 3.2.1-7



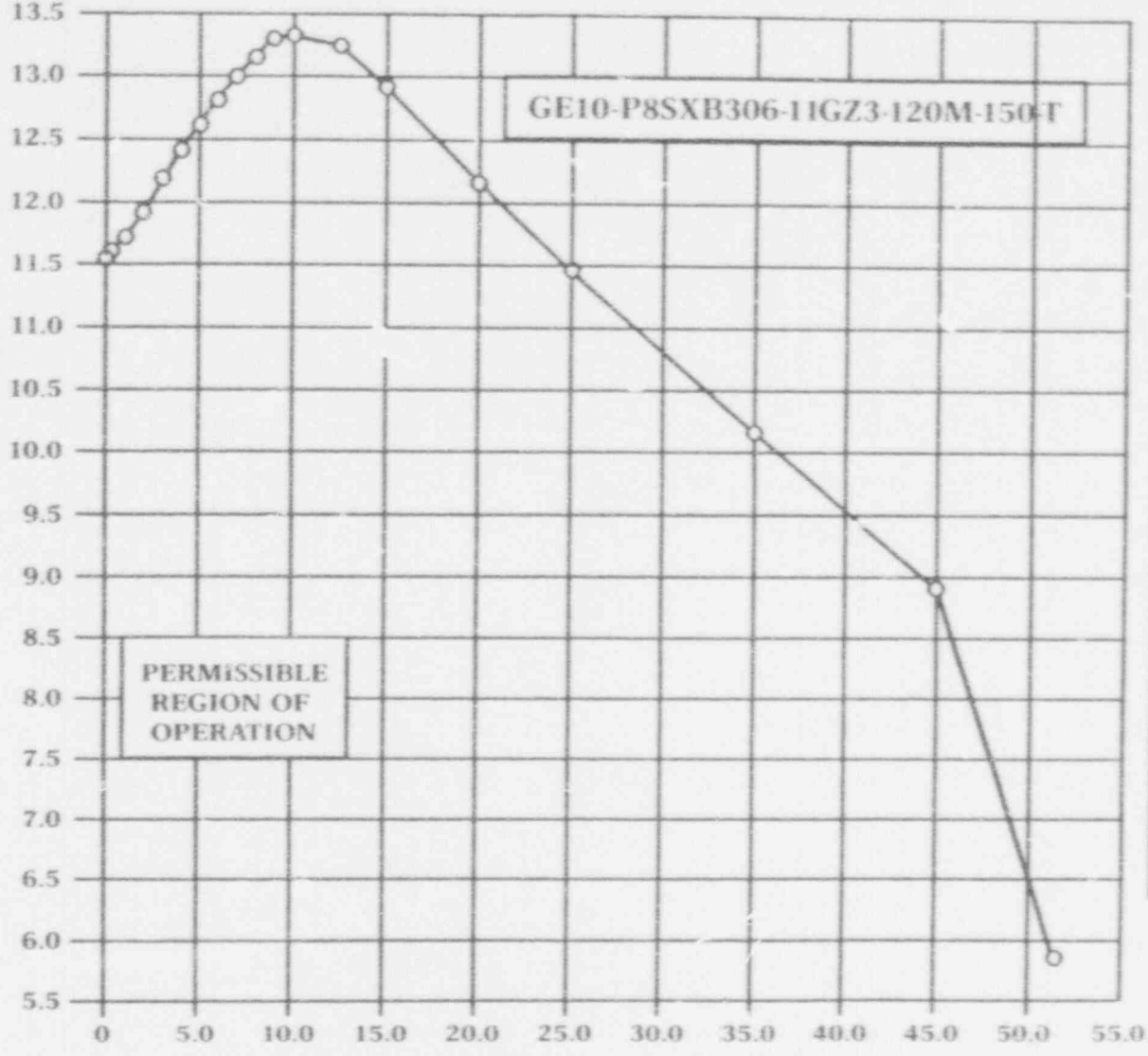
EXPOSURE (GWd/t)	MAPLHGR (kW/ft)
0.0	12.11
0.2	12.10
1.0	12.09
2.0	12.16
3.0	12.28
4.0	12.42
5.0	12.58
6.0	12.67
7.0	12.75
8.0	12.83
9.0	12.92
10.0	13.02
12.5	13.07
15.0	12.79
20.0	12.19
25.0	11.56
35.0	10.29
45.0	8.77
50.0	8.27

MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE (MAPLHGR) VERSUS AVERAGE PLANAR EXPOSURE, GE8x8EB

FUEL TYPE GE8B-P8SQB322-7GZ-120M-150-T

Notes:
1. Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
2. This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 5.

FIGURE 3.2.1-8



EXPOSURE (GWd/ST)	MAPLHGR (kW/ft)
0.0	11.55
0.2	11.61
1.0	11.71
2.0	11.92
3.0	12.17
4.0	12.41
5.0	12.61
6.0	12.81
7.0	12.99
8.0	13.16
9.0	13.31
10.0	13.34
12.5	13.23
15.0	12.92
20.0	12.16
25.0	11.44
35.0	10.14
45.0	8.90
51.7	5.87

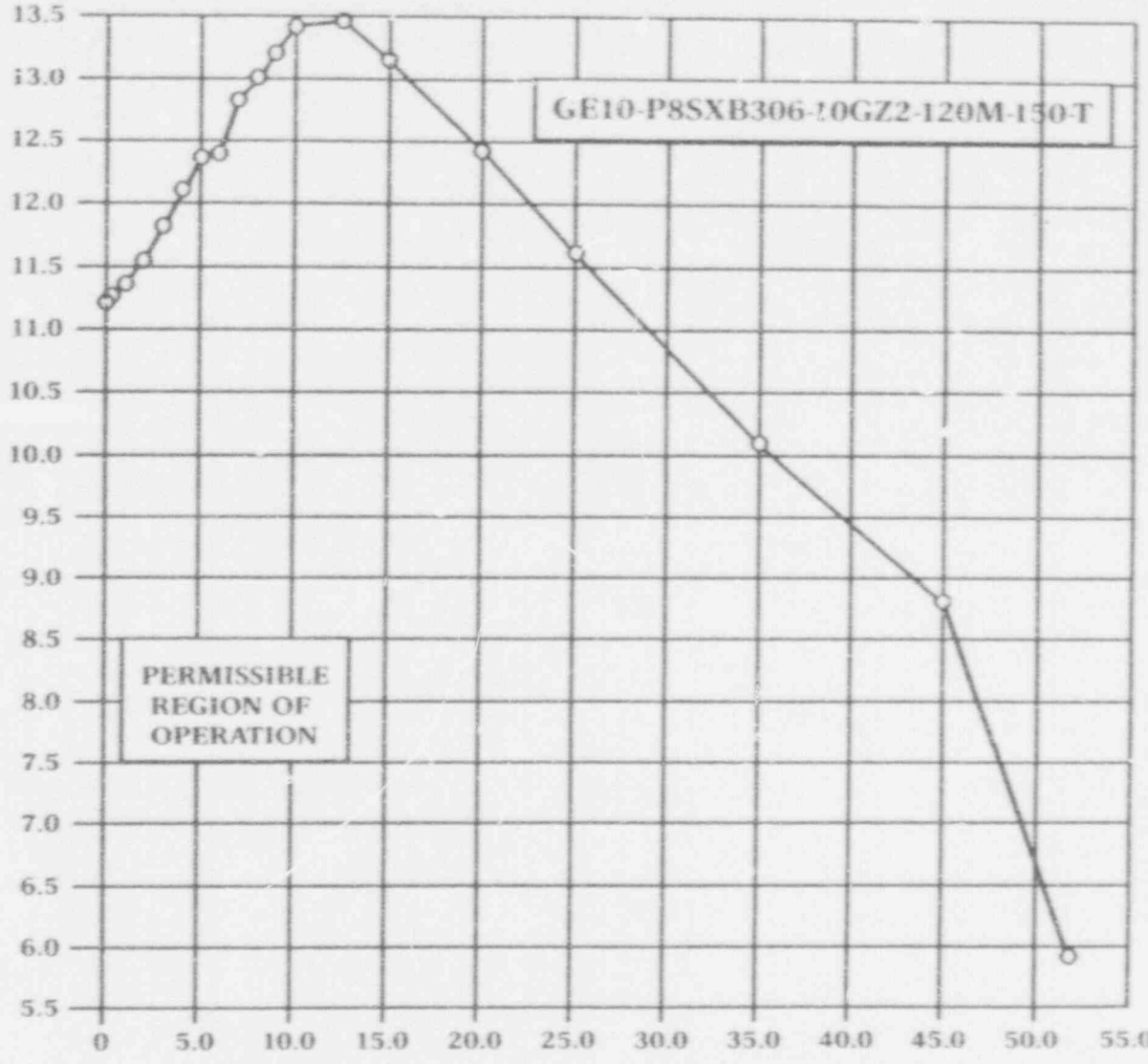
MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE (MAPLHGR) VERSUS AVERAGE PLANAR EXPOSURE, GE8x8NB-3

FUEL TYPE GE10-P8SXB306-11GZ3-120M-150T

Notes:
1. Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
2. This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 6.

FIGURE 3.2.1-9

PNPP No 9267



EXPOSURE (GWd/ST)	MAPLHGR (kW/ft)
0.0	11.21
0.2	11.26
1.0	11.36
2.0	11.56
3.0	11.81
4.0	12.08
5.0	12.35
6.0	12.57
7.0	12.80
8.0	13.00
9.0	13.20
10.0	13.37
12.5	13.45
15.0	13.14
20.0	12.40
25.0	11.61
35.0	10.12
45.0	8.83
52.1	5.87

MAXIMUM AVERAGE PLANAR LINEAR HEAT GENERATION RATE (MAPLHGR) VERSUS AVERAGE PLANAR EXPOSURE, GE8x8NB-3

FUEL TYPE GE10-P8SXB306-10GZ2-120M-150T

Notes:
1. Intermediate MAPLHGR values are obtained by linear interpolation between adjacent points.
2. This curve is a composite of the most limiting enriched fuel lattices. For lattice specific values consult Reference 6.

FIGURE 3.2.1-10

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MINIMUM CRITICAL POWER RATIO (TS 3.2.2)

The MINIMUM CRITICAL POWER RATIO (MCPR) shall be equal to or greater than the $MCPR_f$, $MCPR_p$, and OLMCPR limits at the indicated core flow, THERMAL POWER, delta T^* and core average exposure compared to the End of Cycle Exposure (EOCE)** as specified in Figures 3.2.2-1 through 3.2.2-4. TC-1

NOTE: MCPR limits are fuel type dependent and delta T dependent. The $MCPR_f$ and $MCPR_p$ limits are applicable for all core average exposures, nominal rated feedwater temperature (420°F), and all core flows less than or equal to 105% core flow. For planned reduction of rated feedwater temperature from rated feedwater temperature (420°F), increase the appropriate $MCPR_f$ and $MCPR_p$ limits by the following offset:

FW Temperature ***	GE8X8EB, BP8X8R (Fig. 3.2.2-1, 3.2.2-2)	GE8X8NB-3 (Fig. 3.2.2-3, 3.2.2-4)
420 to 370°F	0.0	0.0
420 to 320°F	0.01	0.0
420 to 250°F	0.02	0.0

OLMCPR, operating limit MCPR,	based on Rotated (Bundle Analysis)
GE8B-P8SQB301-5GZ-120M-150-T	1.19
GE8B-P8SQB301-7GZ-120M-150-T	1.20
GE8B-P8SQB320-9GZ-120M-150-T	1.21
GE8B-P8SQB322-7GZ-120M-150-T	1.21
GE10-P8SQB306-10GZ2-120M-150-T	1.21
GE10-P8SQB306-11GZ3-120M-150-T	1.23

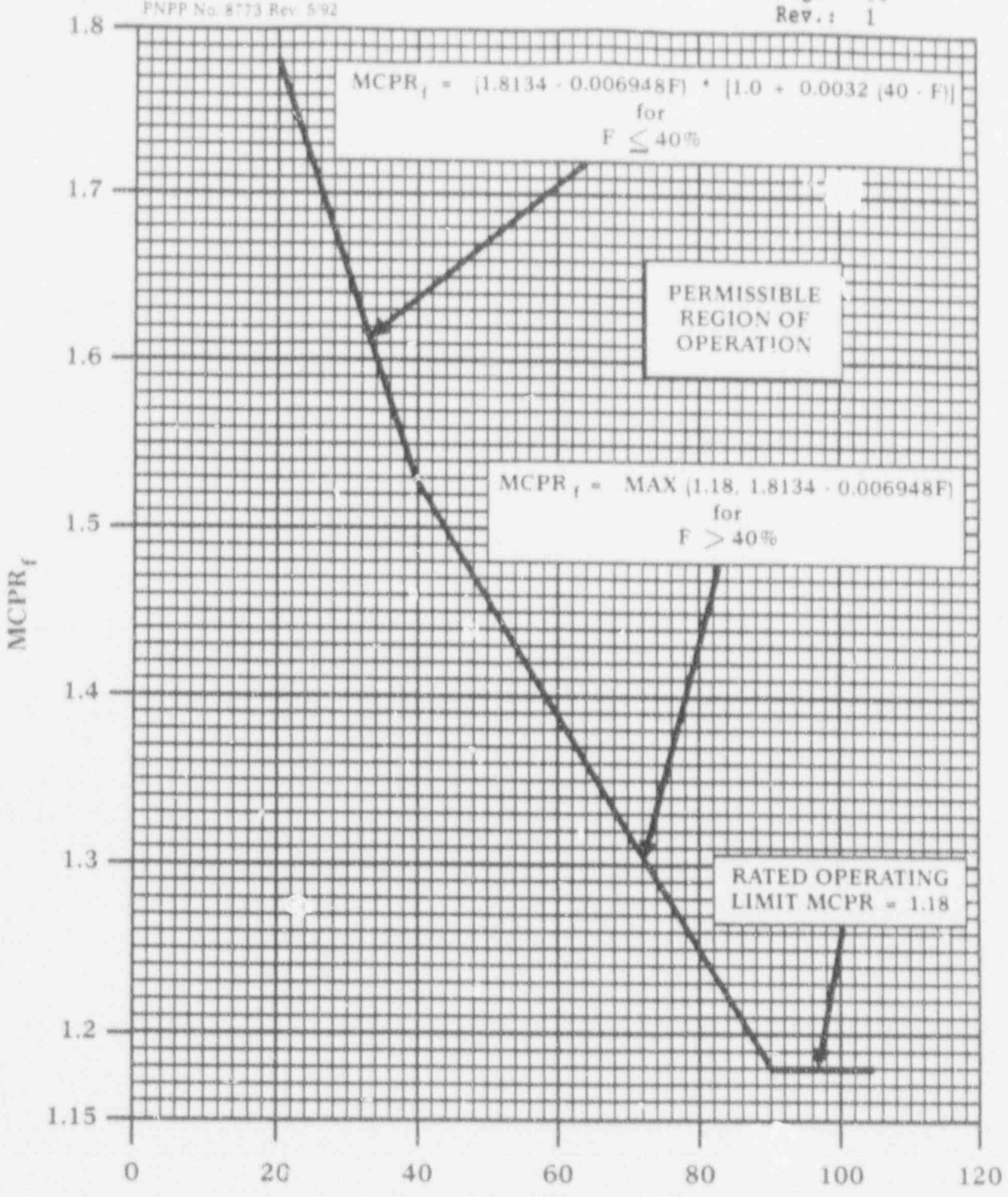
TC-1

There are a total of 19 safety/relief valves, the two lowest setpoint valves are assumed to be out-of-service in the transient analyses.

* This delta T refers to the planned reduction of rated feedwater temperature from nominal rated feedwater temperature (420°F), such as prolonged removal of feedwater heater(s) from service.

** End of Cycle Exposure (EOCE) is defined as 1) the core average exposures at which there is no longer sufficient reactivity to achieve RATED THERMAL POWER with rated core flow, all control rods withdrawn, all feedwater heaters in service and equilibrium Xenon, or 2) as specified by the fuel vendor.

*** Partial feedwater heating to 320°F during the cycle with final feedwater temperature reduction to 250°F after ALL RODS OUT at end of cycle.

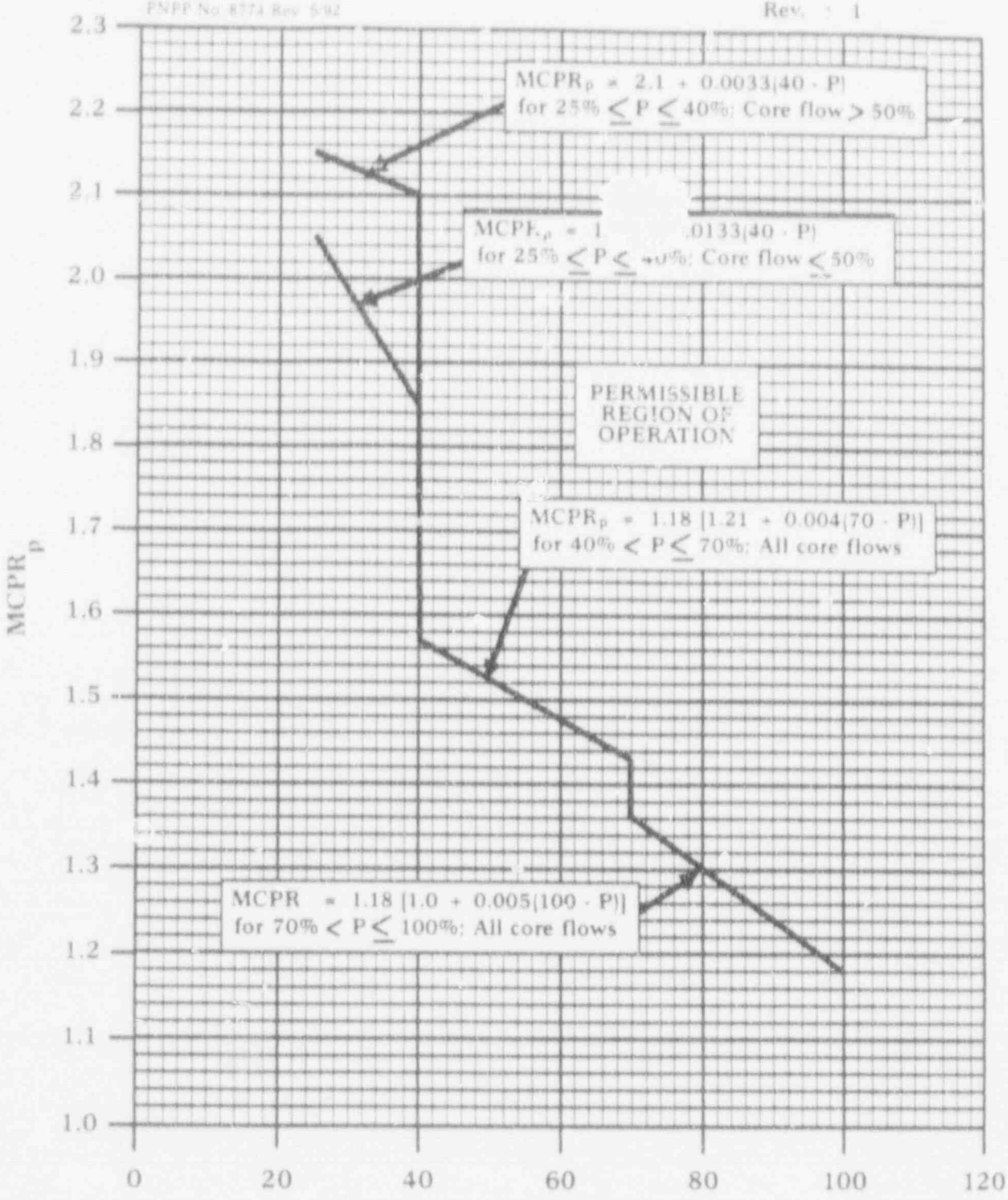


FLOW DEPENDENT MCPR LIMIT
(MCPR$_f$)

FUEL TYPE GE8X8EB, BP8X8R

FIGURE 3.2.2-1

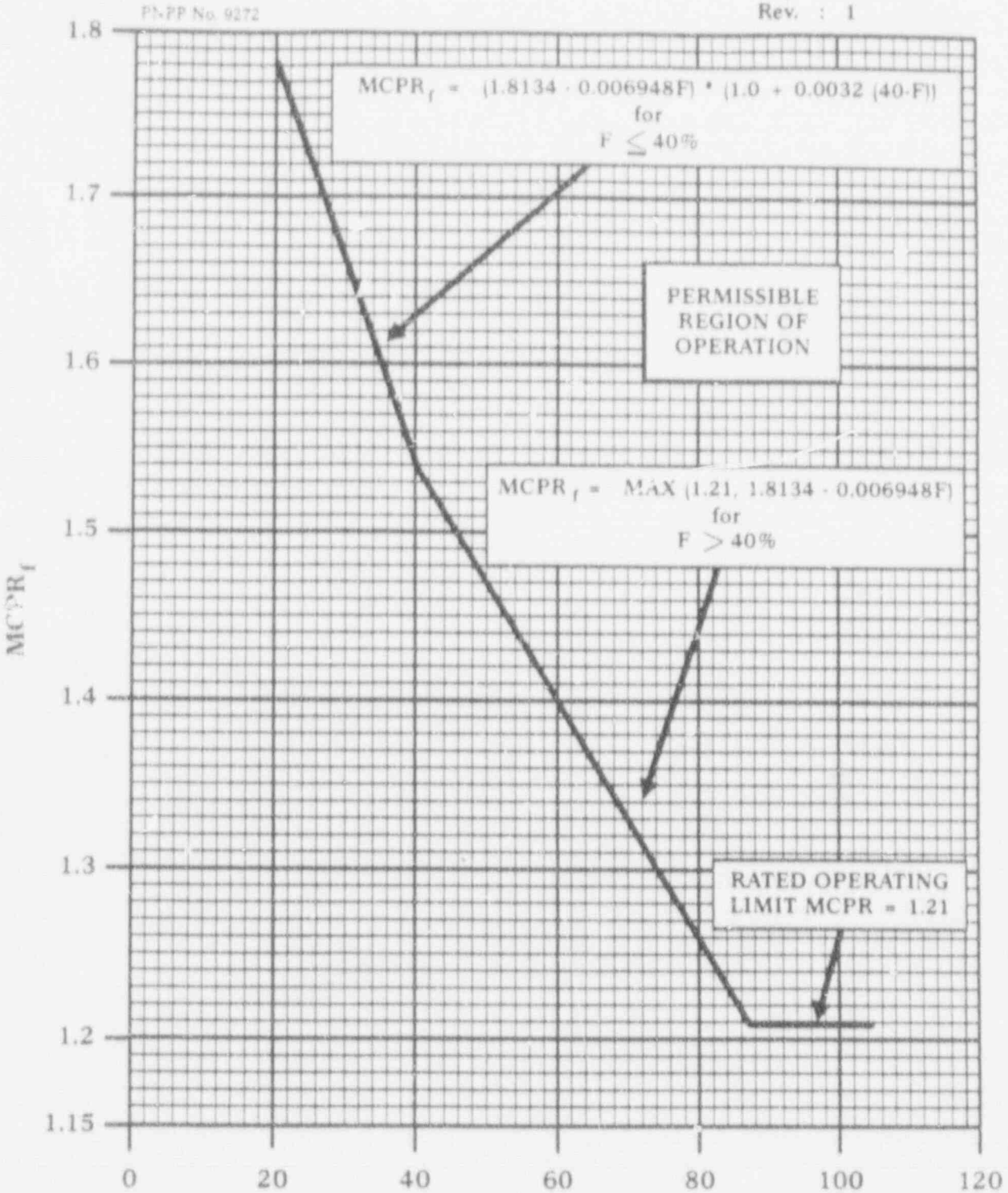
(See Note on page 15)



POWER DEPENDENT MCPR LIMIT
(MCPR$_p$)
FUEL TYPE GE8X8EB, BP8X8R
FIGURE 3.2.2-2

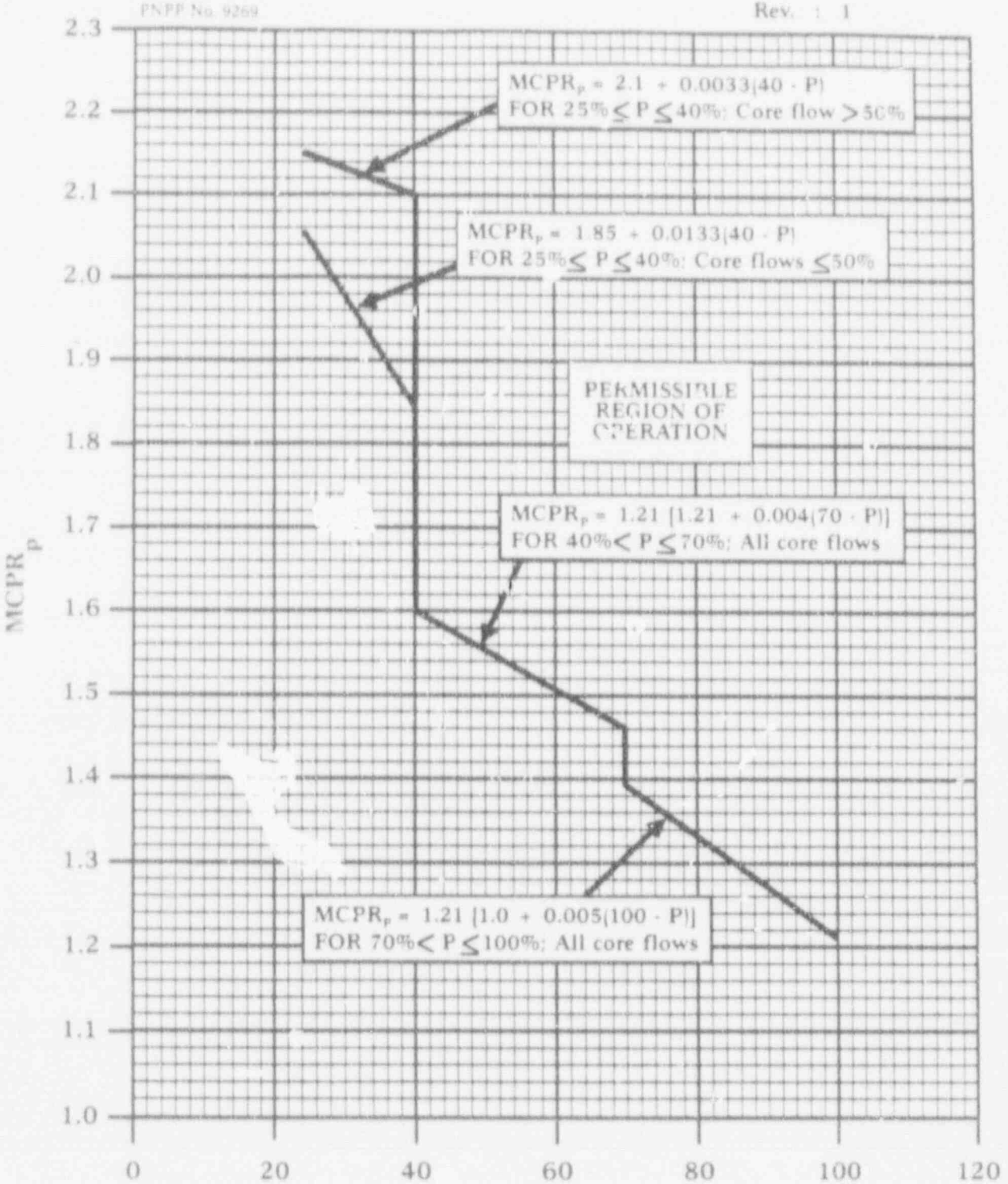
(See Note on page 15)

PN-PP No. 9272



FLOW DEPENDENT MCPR LIMIT
(MCPR$_f$)
FUEL TYPE: GE8 x 8NB - 3
FIGURE 3.2.2-3

(See Note on page 15)



POWER DEPENDENT MCPR LIMIT
($MCPR_p$)

FUEL TYPE: GE8 x 8NB - 3

FIGURE 3.2.2-4

(See Note on page 15)

LINEAR HEAT GENERATION RATE (TS 3.2.3)

The LINEAR HEAT GENERATION RATE (LHGR) shall not exceed:

a. 13.4 kw/ft for the following fuel types:

Deleted
[illegible]BSRB176 (BP8X8R)

[illegible]/ft for the following fuel types:

[illegible]B-P8SQB301-7G2-120M-150-T (BS301E) (GE8X8EB)
[illegible]E8B-P8SQB301-5G2-120M-150-T (BS301F) (GE8X8EB)
[illegible]E8B-P8SQB320-9G2-120M-150-T (GE8X8EB)
[illegible]E8B-P8SQB322-7GZ-120M-150-T (GE8X8EB)
5. [illegible]8B-P8SXB306-10GZ2-120M-150-T (GE8X8NB-3)
6. [illegible]8B-P8SXB306-11GZ3-120M-150-T(GE8X8NB-3)

Enclosure 1

Supplemental Reload Licensing Report

Reload 3, Cycle 4

GE Nuclear Energy
175 Curtner Avenue
San Jose, CA 95125

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March 1992

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Supplemental Reload Licensing Report

for

Perry Nuclear Power Plant Unit 1

Reload 3 Cycle 4

Approved Gary G Jones for
Manager
Fuel Licensing

Approved R. Savoia for
P. J. Savoia, Manager
Reload Nuclear Engineering

Important Notice Regarding Contents of This Report

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Acknowledgment

The engineering and reload licensing analyses which form the technical basis of this Supplemental Reload Licensing Report, were performed by P. A. Hahn and J. L. Casillas of the Fuel Engineering Section. The Supplemental Reload Licensing Report was prepared by P. A. Lambert and verified by J. L. Embley of Regulatory and Analysis Services.

The basis for this report is *General Electric Standard Application for Reactor Fuel*, NEDE-24011-P-A-10, April 1991; and the U. S. Supplement, NEDE-24011-P-A-10-US, April 1991.

1. Plant-unique Items

Appendix A: Analysis Conditions

Appendix B: Basis For Analysis of Loss-of-feedwater Heating Event

Appendix C: Analyzed Operating Domain

Appendix D: Transient Analyses

2. Reload Fuel Bundles

Fuel Type	Cycle Loaded	Number
Irradiated		
GE8B-P8SQB301-7GZ-120M-150-T (BS301E) (GE8x8EB)	2	136
GE8B-P8SQB301-5GZ-120M-150-T (BS301F) (GE8x8EB)	2	135
GE8B-P8SQB320-9GZ-120M-150-T (GE8x8EB)	3	104
GE8B-P8SQB322-7GZ-120M-150-T (GE8x8EB)	3	168
New		
GE10-P8SXB306-11GZ3-120M-150-T (GE8x8NB-3)	4	68
GE10-P8SXB306-10GZ2-120M-150-T (GE8x8NB-3)	4	136
Total		748

3. Reference Core Loading Pattern

	MWd/ST	MWd/MT
Nominal previous cycle core average exposure at end of cycle:	16,740	18,453
Minimum previous cycle core average exposure at end of cycle from cold shutdown considerations:	16,340	18,012
Assumed reload cycle core average exposure at beginning of cycle:	11,799	13,006
Assumed reload cycle core average exposure at end of cycle:	21,699	23,919
Core loading pattern:	Figure 1	

4. Calculated Core Effective Multiplication and Control System Worth - No Voids, 20°C

Beginning of Cycle, $K_{effective}$

Uncontrolled	1.128
Fully controlled	0.958
Strongest control rod out	0.989
R, Maximum increase in cold core reactivity with exposure into cycle, ΔK	0.001

5. Standby Liquid Control System Shutdown Capability

Boron (ppm)	Shutdown Margin (ΔK) (20°C, Xenon Free)
660	0.029

6. Reload Unique GETAB AOO Analysis Initial Condition Parameters

Fuel Design	Peaking Factors Local	Radial	Axial	R Factor	Bundle Power (MWt)	Bundle Flow (1,000 lb/hr)	Initial MCPR
Exposure: BOC4 to EOC4 Increased core flow/Feedwater temperature 420°F							
GE8x8NB-3	1.20	1.58	1.40	1.000	7.369	116.5	1.21
GE8x8EB	1.20	1.48	1.40	1.051	6.925	120.3	1.17
Exposure: BOC4 to EOC4 Increased core flow/Feedwater temperature reduction to 250°F							
GE8x8NB-3	1.20	1.64	1.40	1.000	7.620	114.6	1.20
GE8x8EB	1.20	1.53	1.40	1.051	7.140	118.6	1.18
Exposure: BOC4 to EOC4 Increased core flow/Feedwater temperature reduction to 320°F							
GE8x8NB-3	1.20	1.61	1.40	1.000	7.523	115.3	1.20
GE8x8EB	1.20	1.51	1.40	1.051	7.048	119.3	1.18
Exposure: BOC4 to EOC4 Increased core flow/Feedwater temperature reduction to 370°F							
GE8x8NB-3	1.20	1.61	1.40	1.000	7.517	115.5	1.19
GE8x8EB	1.20	1.50	1.40	1.051	7.024	119.5	1.17

7. Selected Margin Improvement Options

Recirculation pump trip:	Yes
Rod withdrawal limiter:	Yes
Thermal power monitor:	Yes
Measured scram time:	No
Exposure dependent limits:	No
Exposure points analyzed:	1 (EOC)

8. Operating Flexibility Options (S.5.2)

Single-loop operation:	Yes
Load line limit:	No
Extended load line limit:	No
Maximum extended load line limit:	No
Increased core flow at end of cycle:	Yes
Increased flow throughout the cycle:	Yes
Flow point analyzed:	105%
Feedwater temperature reduction throughout the cycle:	Yes
Final feedwater temperature reduction:	Yes
Temperature reduction:	50°F, 100°F, 170°F
ARTS Program:	No
Maximum extended operating domain:	Yes
Main steam isolation valve out of service:	No
Recirculation pump trip out of service:	No
Turbine bypass out of service:	No

9. Core-wide AOO Analysis Results

Methods used: GEMINI and GEXL-PLUS

Event	Flux (%NBR)	Q/A (%NBR)	Uncorrected ΔCPR GE8x8NB-3	Uncorrected ΔCPR GE8x8EB	Figure
Exposure range: BOC4 to EOC4 Increased core flow/Feedwater temperature 420°F					
Load rejection without bypass	401	113	0.14	0.10	2
Feedwater controller failure (143%)	289	112	0.11	0.09	3
Pressure regulator failure downscale	146	105	0.07	0.05	4
Loss of 100°F feedwater heating	*	*	0.10	0.10	*
Exposure: BOC4 to EOC4 Increased core flow/Feedwater temperature reduction to 250°F					
Feedwater controller failure (143%)	280	117	0.13	0.12	5
Pressure regulator failure downscale	148	106	0.07	0.06	6
Exposure: BOC4 to EOC4 Increased core flow/Feedwater temperature reduction to 320°F					
Feedwater controller failure (143%)	292	116	0.12	0.11	7
Exposure: BOC4 to EOC4 Increased core flow/Feedwater temperature reduction to 370°F					
Feedwater controller failure (143%)	293	114	0.12	0.10	8

10. Local Rod Withdrawal Error (With Limiting Instrument Failure) AOO Summary

The generic bounding BWR/6 rod withdrawal error (RWE) is analyzed in NEDE-24011-P-A-9-US and GESSAR-II Appendix 15B is applied; the resulting ΔCPR is 0.11. The generic RWE ΔCPR was verified to be applicable to the new fuel design. The original generic analysis in GESSAR-II was not applicable for control cell core operation; however, it was subsequently shown to be applicable for control cell core operation and GESSAR-II was revised to reflect this application in Revision 21.

*See Appendix B.

11. Cycle MCPR Values*

Safety limit: 1.07

Single loop operation safety limit: 1.08

Exposure range: BOC4 to EOC4

Non-pressurization events

	GE8x8NB-3	GE8x8EB
Rod withdrawal error	1.18	1.18
Loss of 100°F feedwater heating (Bounding from 420°F feedwater temperature condition)	1.17	1.17

Pressurization events

	Option A	
	GE8x8NB 3	GE8x8EB
Exposure range: BOC4 to EOC4 Increased core flow/Feedwater temperature 420°F		
Load rejection without bypass	1.21	1.18
Feedwater controller failure	1.19	1.16
Pressure regulator failure downscale	1.15	1.13
Exposure: BOC4 to EOC4 Increased core flow/Feedwater temperature reduction to 250°F		
Feedwater controller failure	1.21	1.20
Pressure regulator failure downscale	1.15	1.14
Exposure: BOC4 to EOC4 Increased core flow/Feedwater temperature reduction to 320°F		
Feedwater controller failure	1.21	1.19
Exposure: BOC4 to EOC4 Increased core flow/Feedwater temperature reduction to 370°F		
Feedwater controller failure	1.20	1.18

*GEMINI ODYN adjustment factors are provided in the letter from J. S. Charnley (GE) to M. W. Hodges (NRC), *GEMINI ODYN Adjustment Factors for BWR/6*, dated July 6, 1987. The MCPR limit does not change because of channel bow. Channel bow is reflected in the monitoring of the core.

12. Overpressurization Analysis Summary

Event	P_{si} (psig)	P_v (psig)	Plant Response
MSIV closure (flux scram)*	1241	1272	Figure 9

13. Loading Error Results

Loading error results are not applicable for BWR/6 plants. NRC approval of the non-applicability of Loading Errors to BWR/6 plants is documented in Section S.2.2.3.7 of NEDE-24011-P-A-10-US.

14. Control Rod Drop Analysis Results

Banked Position Withdrawal Sequence is utilized at the Perry Nuclear Power Plant Unit 1; therefore, the bounding control rod drop analysis (CRDA) described in NEDE-24011-P-A-10-US is applied. NRC approval of the bounding analysis is given in the letter to J. S. Charnley (GE), *Acceptance for Referencing of Licensing Topical Report NEDE-24011, Revision 6, Amendment 9 "GESTAR-II General Electric Standard Application for Reactor Fuel,"* January 25, 1985.

15. Stability Analysis Results

GE SIL-380 recommendations have been included in the Perry Nuclear Power Plant Unit 1 operating procedures and/or Technical Specifications and, therefore, the stability analysis is not required. NRC approval for deletion of a cycle-specific stability analysis is documented in Amendment 8 to NEDE-24011-P-A-US. In addition, the Perry Nuclear Power Plant Unit 1 recognizes the issuance of NRC Bulletin No. 88-07, Supplement 1, *Power Oscillations in Boiling Water Reactors (BWRs)*, and will continue to comply with the recommendations contained herein.

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*The MSIV closure (flux scram) analysis is performed using GEMINI methods at the 102% power level to account for the power level uncertainties specified in Regulatory Guide 1.49. The analysis was performed with 13 highest setpoint safety valves operational.

16. Loss-of-coolant Accident Results

LOCA method used: SAFE/REFLOOD (see the Perry Nuclear Power Plant Unit 1 Updated Safety Analysis Report, as amended)

Bundle Type: GE10-P8SXP306-11GZ3-120M-150-T (GE8x8NB-3)

Average Planar Exposure		MAPLHGR (kw/ft)	
(GWd/ST)	(GWd/MT)	Most Limiting	Least Limiting
0.0	0.0	11.55	12.43
0.2	0.2	11.61	12.47
1.0	1.1	11.71	12.58
2.0	2.2	11.92	12.72
3.0	3.3	12.17	12.88
4.0	4.4	12.41	13.04
5.0	5.5	12.61	13.20
6.0	6.6	12.81	13.33
7.0	7.7	12.99	13.41
8.0	8.8	13.16	13.50
9.0	9.9	13.31	13.56
10.0	11.0	13.34	13.43
12.5	13.8	13.23	13.40
15.0	16.5	12.92	13.07
20.0	22.0	12.16	12.40
25.0	27.6	11.44	11.76
35.0	38.6	10.14	10.40
45.0	49.6	8.90	9.15
51.7	57.0	5.87	6.03
51.9	57.2	--	5.95

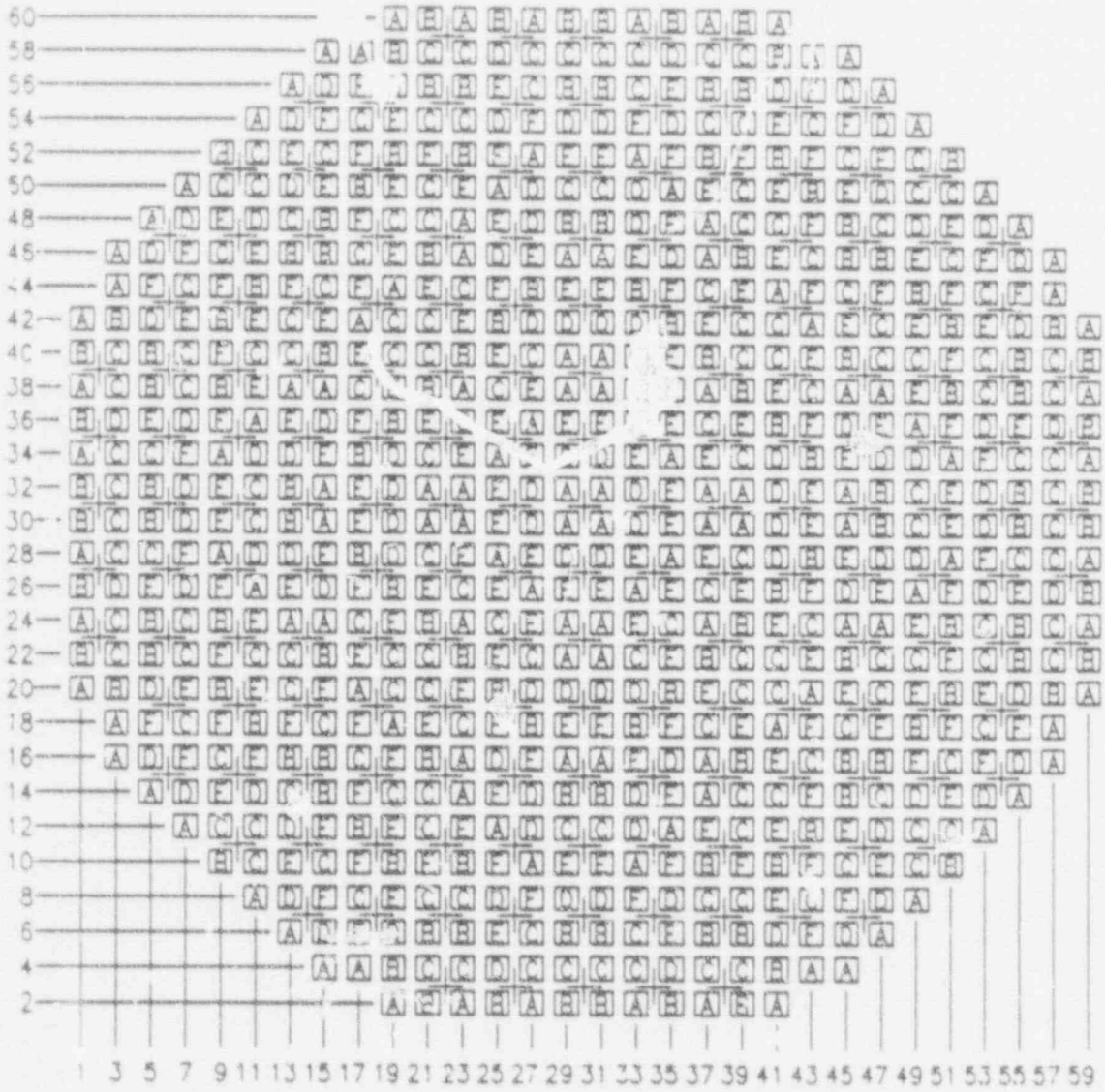
The peak clad temperature (PCT) is ≤2149°F at all exposures; the local oxidation (fraction) is ≤0.061 at all exposures. The MAPLHGR multiplier for single-loop operation (SLO) is 0.80.

16. Loss-of-coolant Accident Results (continued)

Bundle Type: GE10-P8SXB306-10GZ2-120M-150-T (GE8x8NB-3)

Average Planar Exposure		MAPLHGR (kw/ft)	
(GWd/ST)	(GWd/MT)	Most Limiting	Least Limiting
0.0	0.0	11.21	12.35
0.2	0.2	11.26	12.45
1.0	1.1	11.36	12.62
2.0	2.2	11.56	12.75
3.0	3.3	11.81	12.85
4.0	4.4	12.08	12.95
5.0	5.5	12.35	13.06
6.0	6.6	12.57	13.17
7.0	7.7	12.80	13.28
8.0	8.8	13.00	13.38
9.0	9.9	13.20	13.46
10.0	11.0	13.37	13.52
12.5	13.8	13.45	13.52
15.0	16.5	13.14	13.20
20.0	22.0	12.40	12.57
25.0	27.6	11.61	11.94
35.0	38.6	10.12	10.57
45.0	49.6	8.83	9.29
52.1	57.4	5.87	5.96
52.3	57.6	--	5.89

The Peak Clad Temperature (PCT) is ≤2129°F at all exposures; the Local Oxidation (Fraction) is ≤0.058 at all exposures. The MAPLHGR multiplier for single-loop operation (SLO) is 0.80.



FUEL TYPE	
A = GE8B-P8SQB301-5GZ-120M-150-T	D = GE8B-P8SQB320-9GZ-120M-150-T
B = GE8B-P8SQB301-7GZ-120M-150-T	E = GE10-P8SXB306-10GZ2-120M-150-T
C = GE8B-P8SQB322-7GZ-120M-150-T	F = GE10-P8SXB306-11GZ3-120M-150-T

Figure 1 Reference Core Loading Pattern

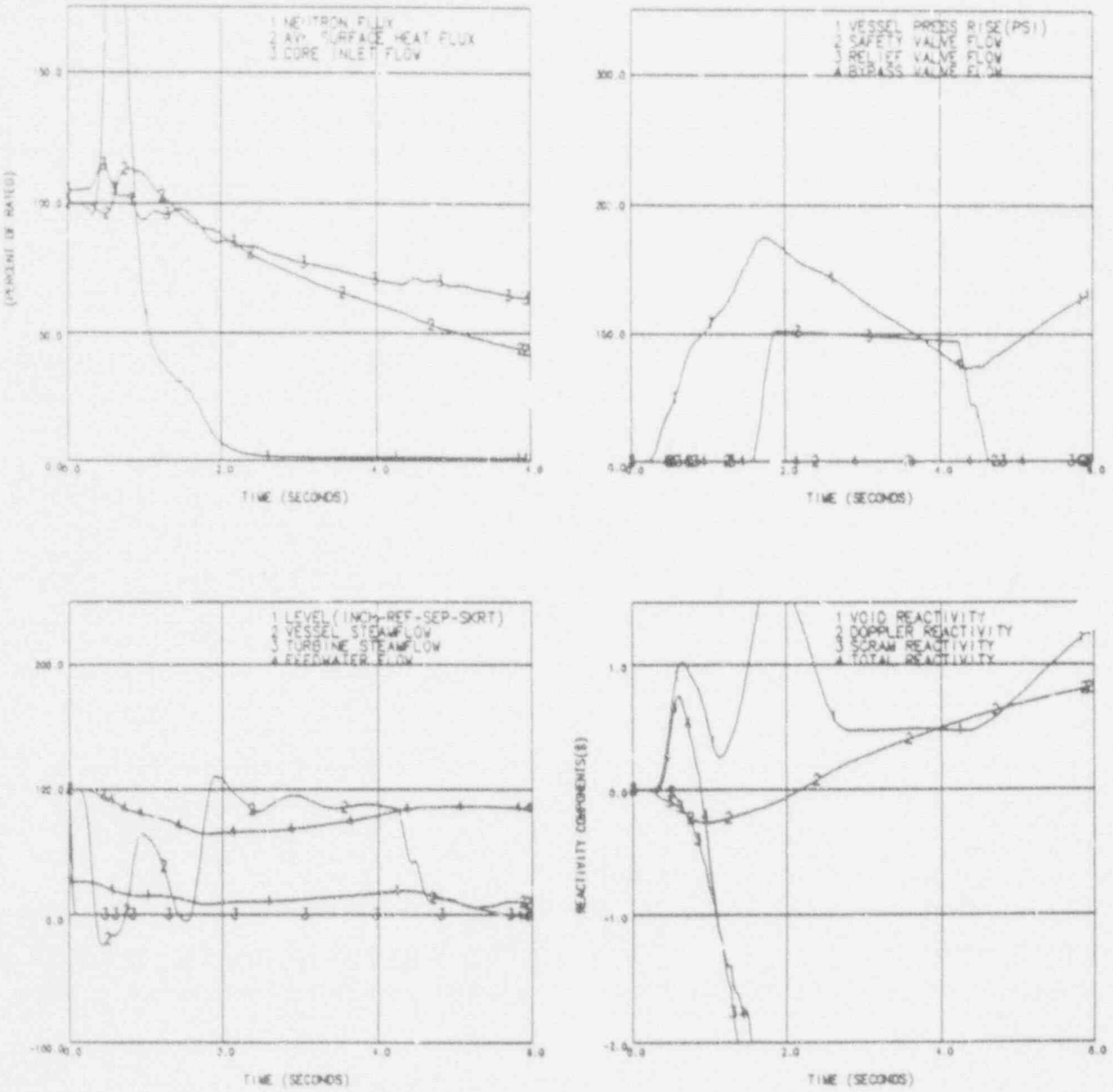


Figure 2. Plant Response to Load Rejection without Bypass
(ICF/FWT 420°F)

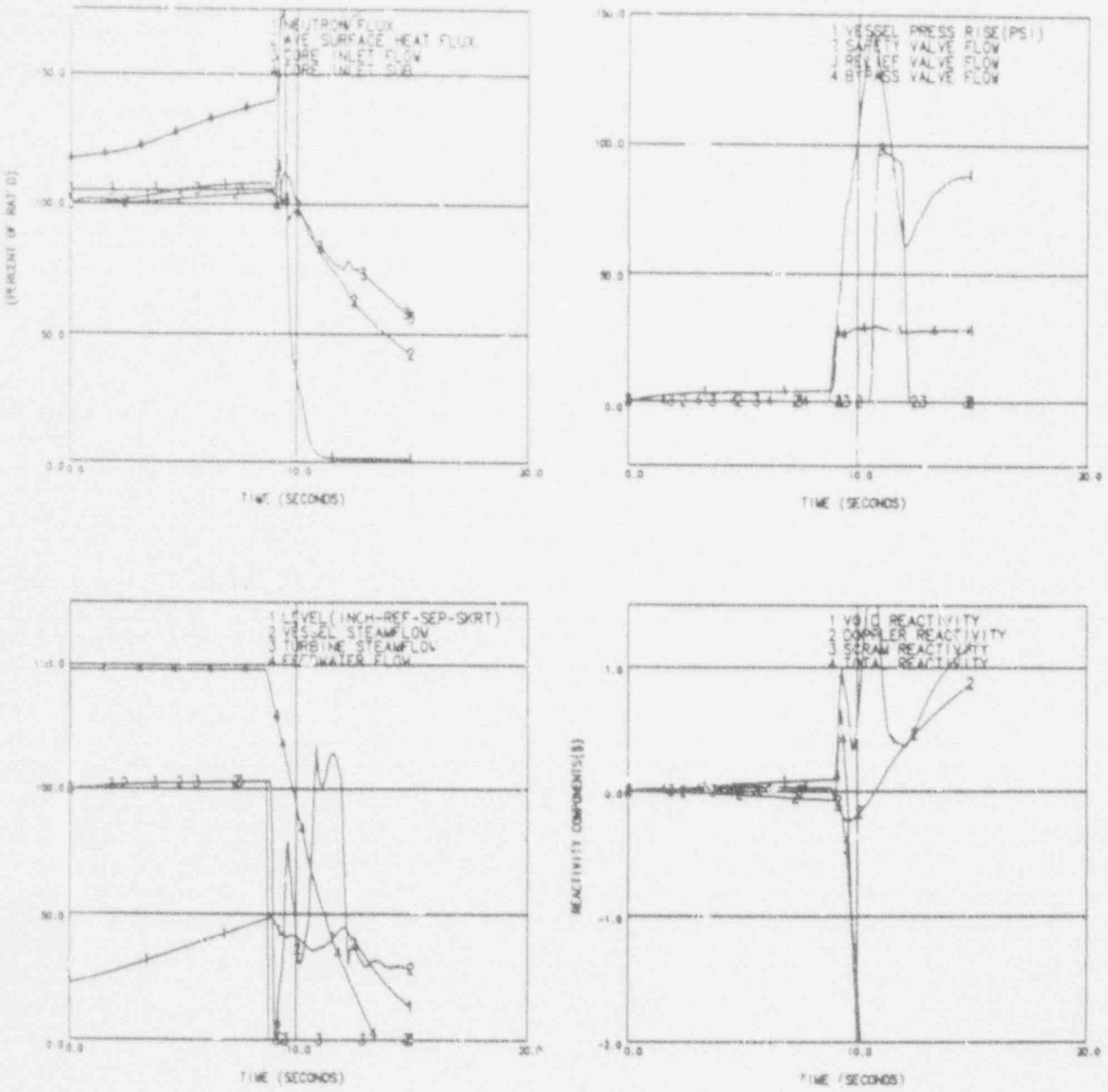


Figure 3. Plant Response to Feedwater Controller Failure (ICF/FWT 420°F)

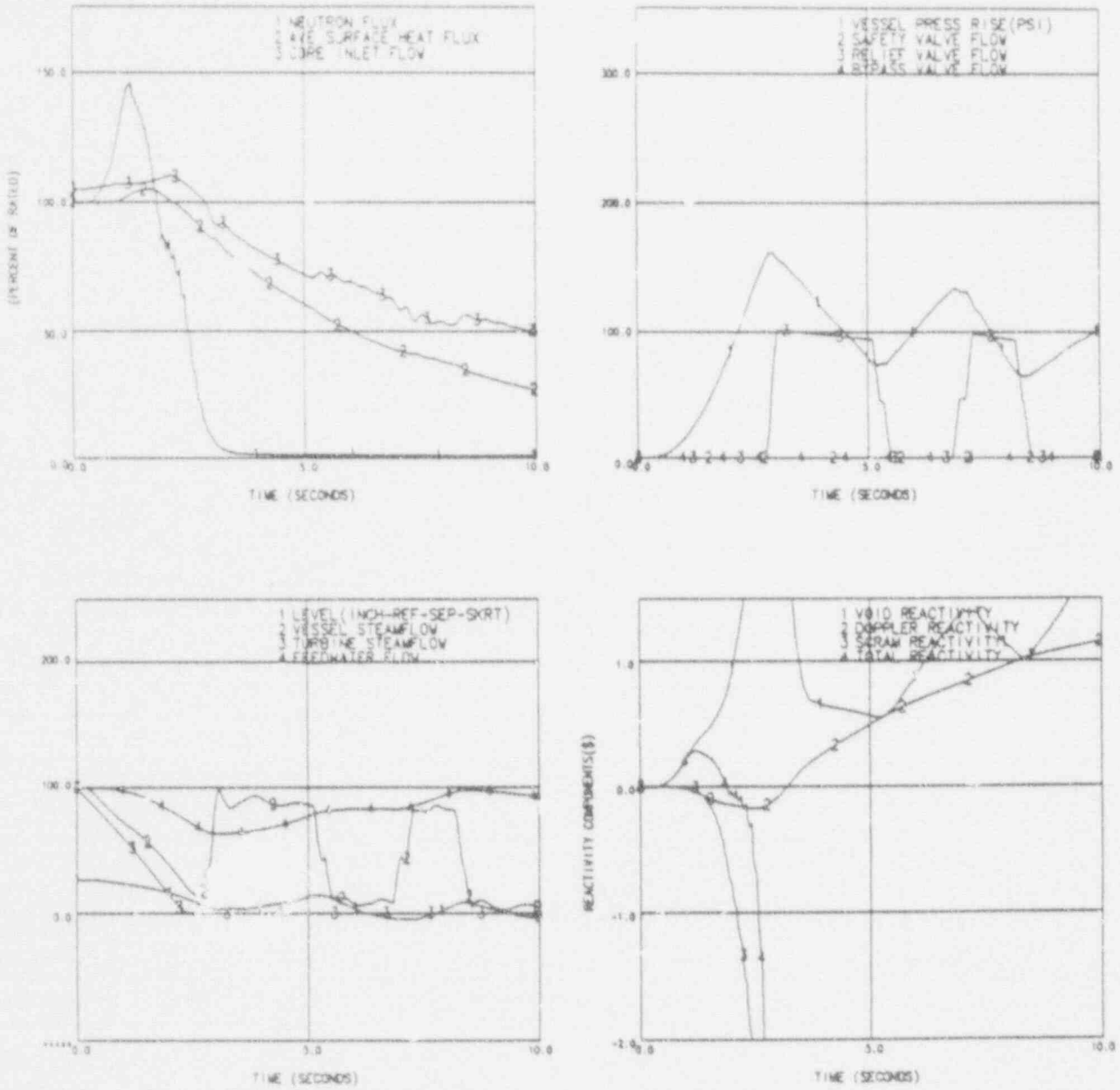


Figure 4. Plant Response to Pressure Regulator Failure Downscale (ICF/FWT 420°F)

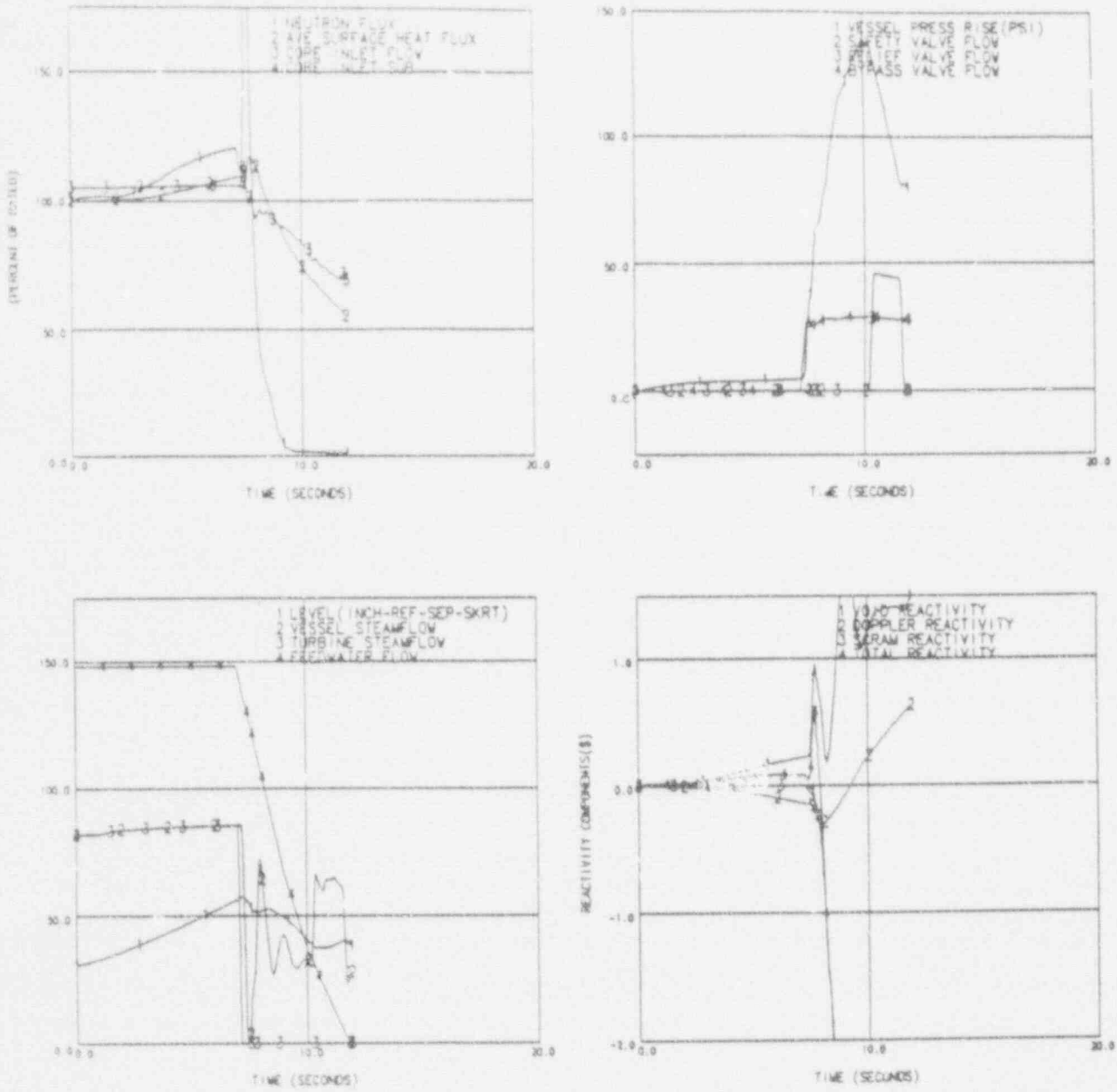


Figure 5. Plant Response to Feedwater Controller Failure (ICF/FWTR to 250°F)

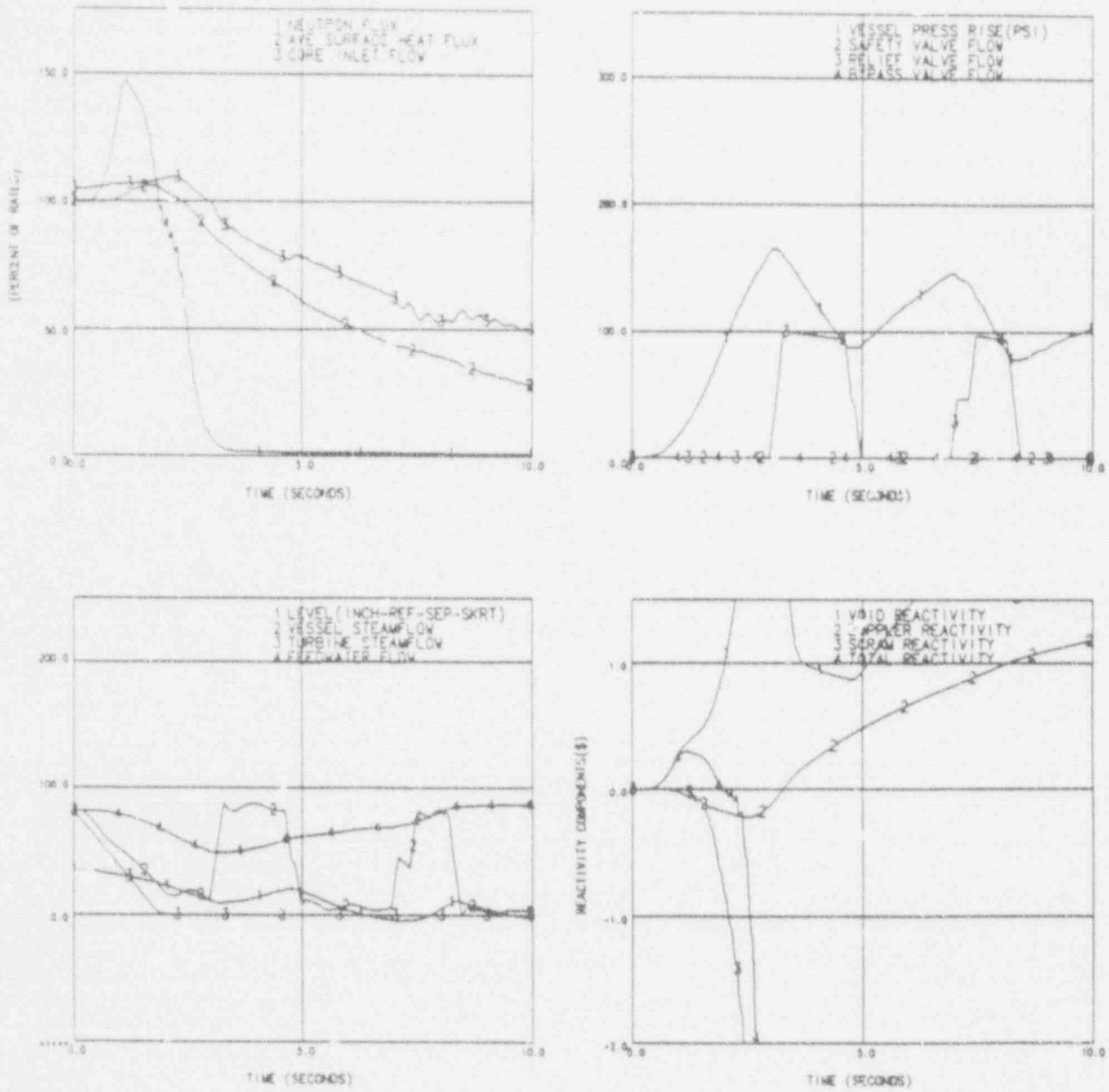


Figure 6. Plant Response to Pressure Regulator Failure Downscale (ICF/FWTR to 250°F)

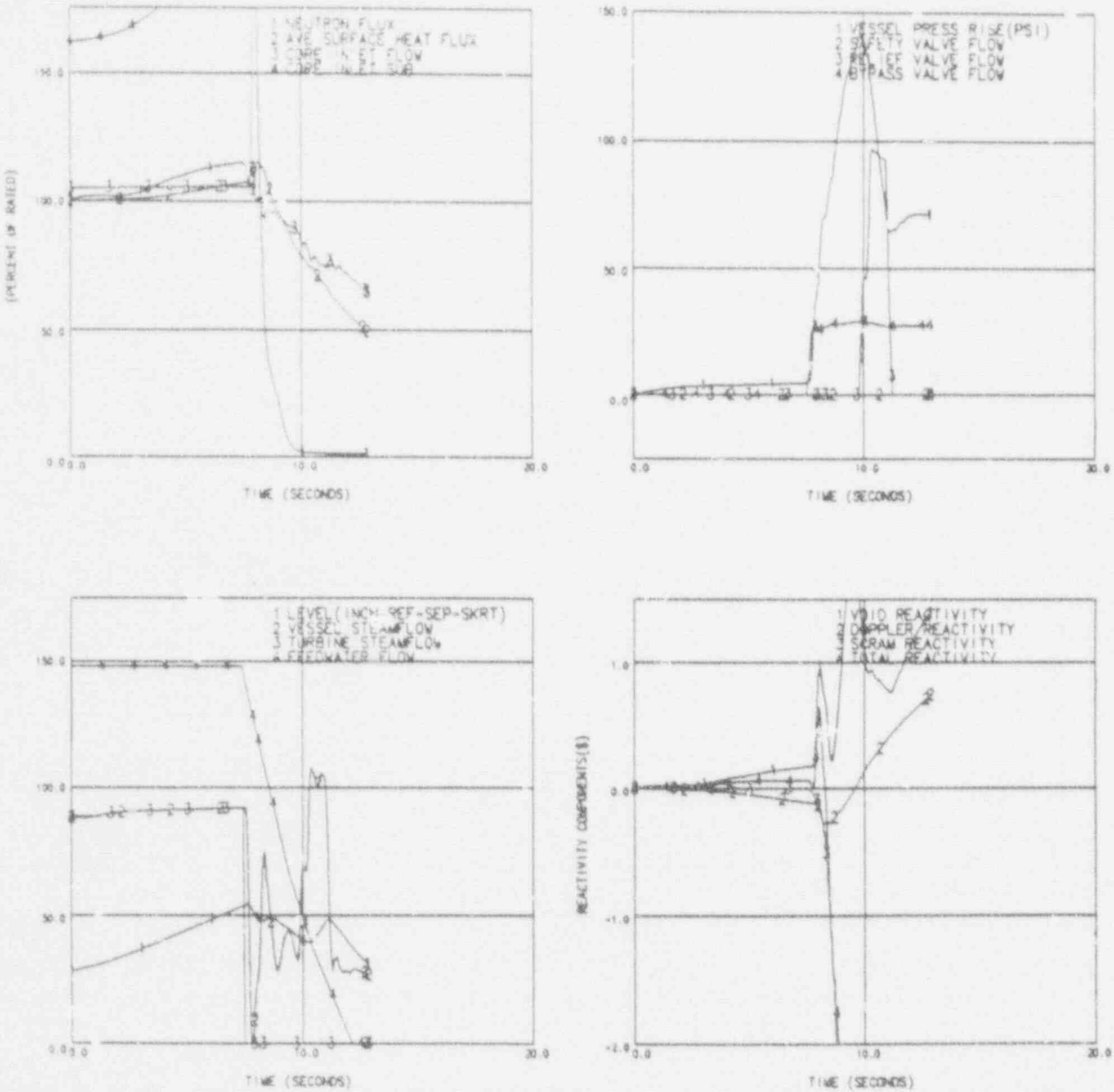


Figure 7. Plant Response to Feedwater Controller Failure (ICF/FWTR to 320°F)

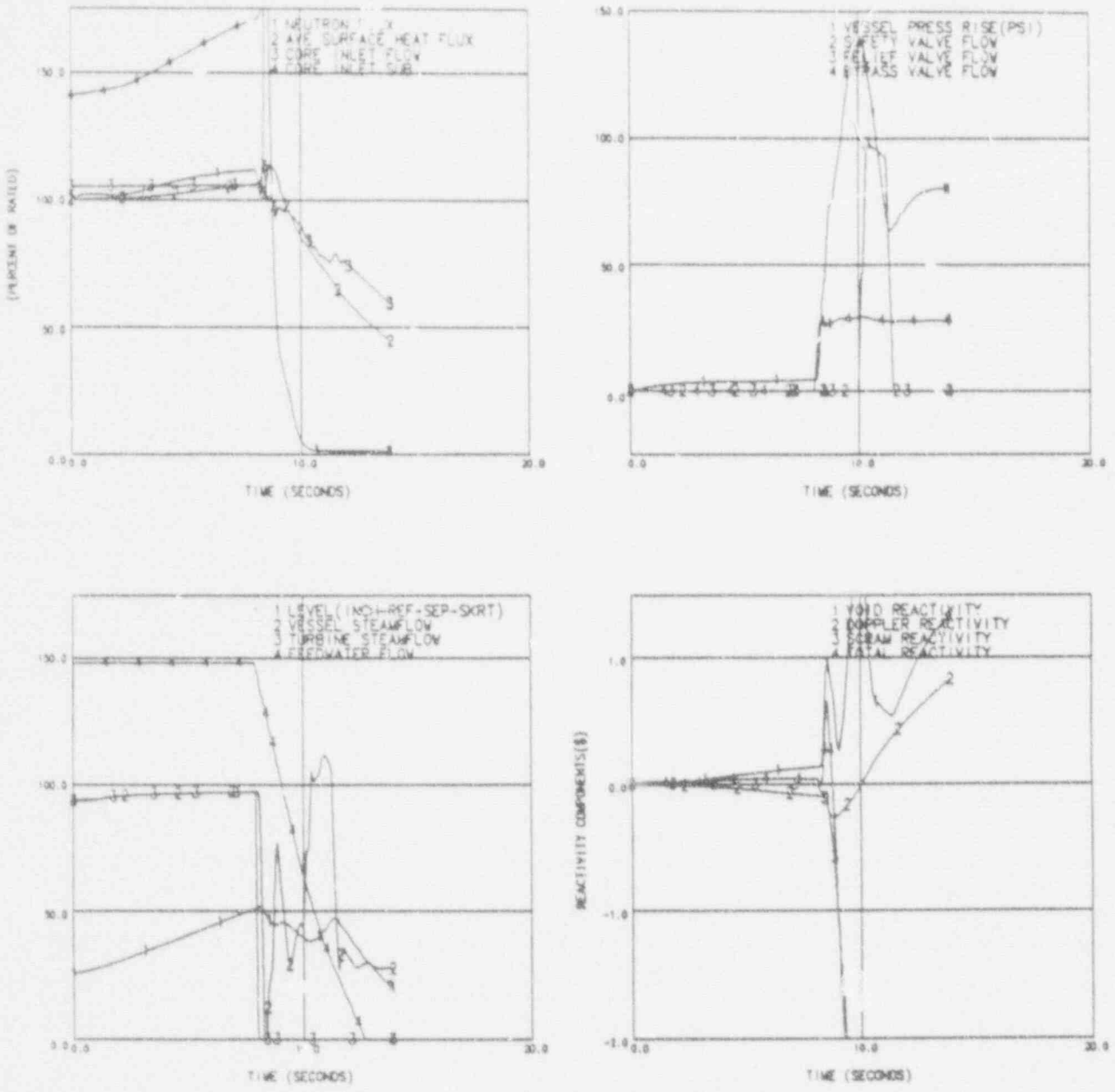


Figure 8. Plant Response to Feedwater Controller Failure (ICF/FWTR to 370°F)

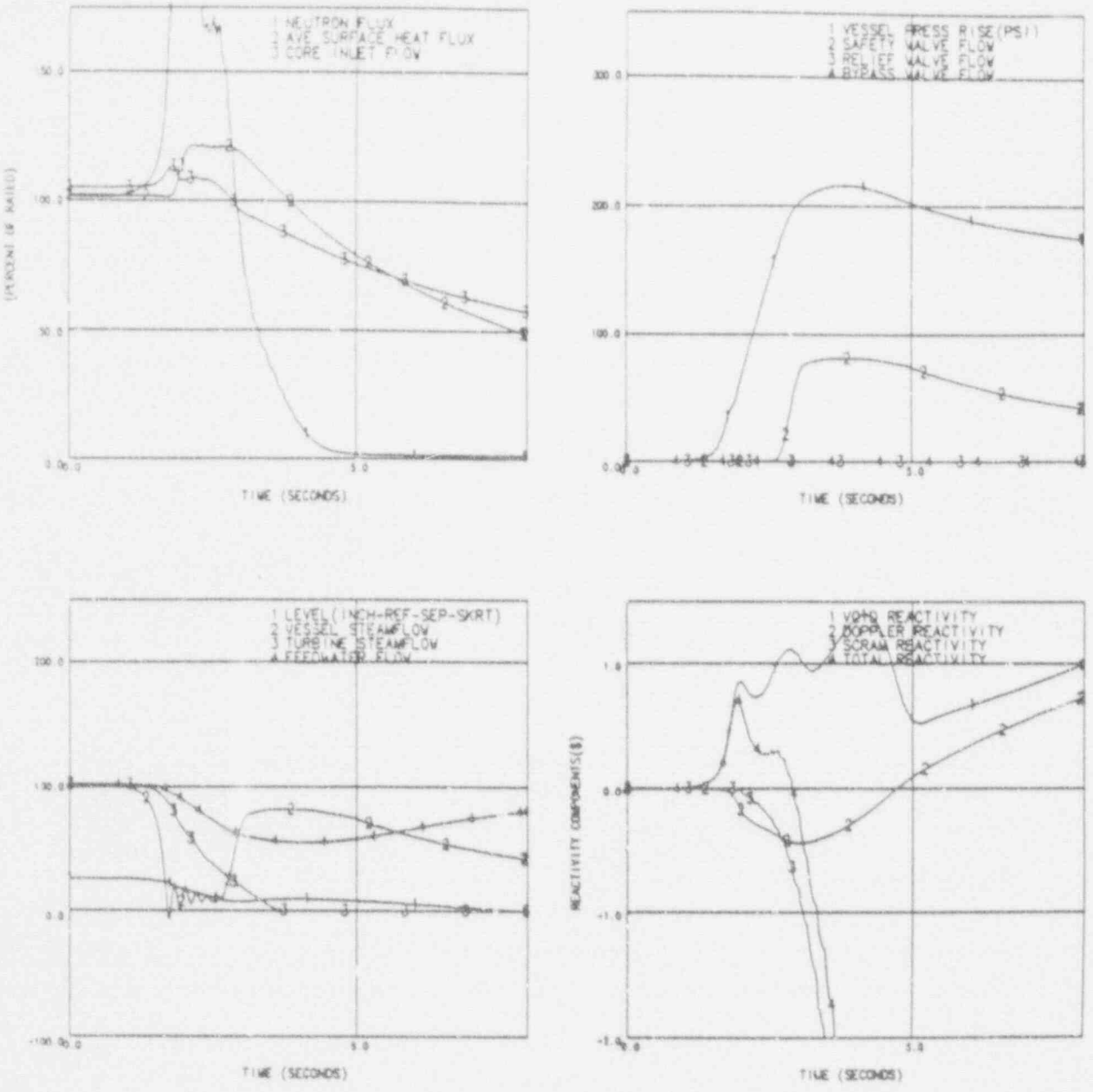


Figure 9. Plant Response to MSIV Closure, Flux Scram

Appendix A

Analysis Conditions

To reflect actual plant parameters accurately, the values shown in Table A-1 were used this cycle to reflect the bounding conditions.

Table A-1

	Analysis Value (FW Temp.)			
Parameter	420°F	250°F	320°F	370°F
Thermal power, MWt	3579	3579	3579	3579
Dome pressure, psig	1028	1008	1015	1019
Steam flow, Mlb/hr	15.70	12.58	13.58	14.42
Turbine pressure, psig	976	974	975	975
Core flow, Mlb/hr	109.2	109.2	109.2	109.2
Reactor pressure, psia	1056	1056	1056	1056
Inlet enthalpy, Btu/lb	528.8	512.4	518.2	523.1
Non-fuel power fraction	0.038	0.038	0.038	0.038
No. of dual mode Safety/Relief Valves	17*	17*	17*	17*
Relief mode lowest setpoint, psig	1143*	1143*	1143*	1143*
Safety mode lowest setpoint, psig	1177	1177	1177	1177

*There are a total of 19 valves; the 2 lowest setpoint safety/relief valves are assumed to be out-of-service in the transient analyses.

Appendix B

Basis for Analysis of Loss-of-feedwater Heating Event

The loss-of-feedwater heating event was analyzed using the BWR Simulator Code (Reference B-1). The use of this code is permitted in GESTAR II (Reference B-2). The transient plots, neutron flux and heat flux values normally reported in Section 10 are not an output of the BWR Simulator code; therefore, these items are not included in this document.

The transient analysis inputs normally reported in Section 6 of the licensing submittal are internally calculated in the BWR Simulator Code and in ODYN.

References

B-1 *Steady-State Nuclear Methods*, NEDE-30130-P-A and NEDO-30130-A, April 1985.

B-2 *General Electric Standard Application for Reactor Fuel*, NEDE-24011-P-A-9, September 1988.

Appendix C

Analyzed Operating Domain

The core-wide abnormal operational occurrence (AOO) analysis results reported in Section 9 are the most limiting values over the entire allowable operating range. This range covers the following operating options:

1. Standard 100% power/flow map;

2. End-of-cycle power coastdown;

3. MEOD with 100% power flow range from 75% to 105% of rated; and

4. Partial feedwater heating to 320°F during the cycle with final feedwater temperature reduction to 2°0°F after *All Rods Out* at end of cycle.

Limiting events and conditions analyzed are based on Reference C-1 and the USAR analytical results. The Reload 3/Cycle 4 analyses were performed assuming all four turbine control valves in a full arc mode of operation. This is conservative for partial arc configuration.

The single-loop operation (SLO) analysis was reverified for the standard power/flow map with normal feedwater temperature.

References

C-1 *General Electric Standard Application for Reactor Fuel*, NEDE-24011-P-A-10-US, April 1991.

Appendix D

Transient Analyses

The turbine trip without bypass (TTNBP) analysis AOO is a pressure increase event normally checked on a cycle-by-cycle basis to determine if this AOO could potentially establish the cycle MCPR operating limit.

The Perry turbine control valves will be operated in the full arc mode throughout Cycle 4. The load rejection without bypass (LRNBP) is always more limiting in this mode of operation; therefore, the TTNBP will not be limiting for Cycle 4 and was not analyzed.

The load rejection without bypass (LRNBP) AOO was run for the standard case only since it has been shown to be more limiting than the feedwater temperature reduction cases in previous reload analyses.