GE Nuclear Energy

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San Jose, CA 95125

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Supplemental Reload Licensing Report

for

River Bend Station

Reload 4 Cycle 5

Approved: J. F. Klapproth
J. F. Klapproth, Manager
Fuel Licensing

Approved: for DGA 8/10/92
D. G. Albertson, Manager
Reload Nuclear Engineering

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Please Read Carefully

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Acknowledgment

The engineering and reload licensing analyses which form the technical basis of this Supplemental Reload Licensing Submittal, were performed by P. K. Wu of Fuel Engineering. The Supplemental Reload Licensing Submittal was prepared by P. A. Lambert and verified by J. L. Rash of Regulatory and Analysis Services.

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

1. Plant-unique Items

Appendix A:	Analysis Conditions
Appendix B:	Basis for Analysis of Loss-of-feedwater Heater Event

2. Reload Fuel Bundles

Fuel Type	Cycle Loaded	Number
Irradiated:		
BP8SRB299 (BP8x8R)	2	24
GE8B-P8SQB322-9GZ-120M-4WR-150-T (BS322C) (GE8x8EB)	3	95
GE8B-P8SQB322-8GZ-120M-4WR-150-T (BS322B) (GE8x8EB)	3	128
GE8B-P8SQB331-11GZ-120M-4WR-150-T (GE8x8EB)	4	16
GE8B-P8SQB333-10GZ-120M-4WR-150-T (GE8x8EB)	4	160
New:		
GE8B-P8SQB334-10GZ-120M-4WR-150-T (GE8x8EB)	5	200
Total		624

3. Reference Core Loading Pattern

	MWd/ST	MWd/MT
Nominal previous cycle core average exposure at end of cycle:	20,575	22,680
Minimum previous cycle core average exposure at end of cycle from cold shutdown considerations:	20,575	22,680
Assumed reload cycle core average exposure at beginning of cycle:	11,520	12,699
Assumed reload cycle core average exposure at end of cycle:	21,625	23,837
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	0.990
Strongest control rod out	0.987
R, Maximum increase in cold core reactivity with exposure into cycle, ΔK	0.002

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**

Exposure range: BOC5 to EOC5

Fuel Design	Peaking Factors Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1,000 lb/hr)	Initial MCPR
GE8x8EB	1.20	1.56	1.40	1.051	7.059	108.1	1.13
BP8x8R	1.20	1.55	1.40	1.051	7.049	108.4	1.13

7. Selected Margin Improvement Options

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

8. Operating Flexibility Options

Single-loop operation:	Yes
Load line limit:	No
Extended load line limit:	No
Maximum extended load line limit	No
Increased core flow throughout the cycle:	No
Increased core flow at end of cycle:	No
Flow point analyzed:	N/A
Feedwater temperature reduction throughout the cycle:	No
Final feedwater temperature reduction:	No
Temperature reduction:	N/A
ARTS Program:	No
Maximum extended operating domain:	No
ADS valve out of service:	No
Safety/relief valve out of service:	No
Main steam isolation valve out of service:	No
Turbine bypass out of service:	No
EOC Recirculation pump trip out of service:	No
Feedwater heaters out of service:	Yes

9. Core-wide AOO Analysis Results

Methods used: GEMINI and GEXL-PLUS

Event	Flux (%NBR)	Q/A (%NBR)	Uncorrected ΔCPR GE8x8EB	Uncorrected ΔCPR BP8x8R	Figure
Exposure range: BOC5 to EOC5					
Load rejection without bypass	298	108	0.06	0.06	2
Feedwater controller failure	219	108	0.05	0.05	3
Pressure regulator failure downscale	144	104	0.03	0.03	4
Loss of 100°F feedwater heating	*	*	0.11	0.11	*

*See Appendix B

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

The generic bounding BWR/6 rod withdrawal error analysis described in NEDE-24011-P-A-10-US is applied; the resulting ΔCPR is 0.11.

11. Cycle MCPR Values*

Safety limit: 1.07

Single loop operation safety limit: 1.08

Non-pressurization events:

	GE8X8EB	BP8X8R
Exposure range: BOC5 to EOC5		
Loss of 100°F feedwater heating	1.18	1.18
Rod withdrawal error	1.18	1.18
Fuel loading error**	1.22	--

Pressurization events:

	GE8X8EB	BP8X8R
Exposure range: BOC5 to EOC5		
Load rejection without bypass	1.13	1.13
Feedwater controller failure	1.12	1.12
Pressure regulator failure downscale	1.10	1.10

12. Overpressurization Analysis Summary

Event	P_{st} (psig)	P_v (psig)	Plant Response
MSIV closure (flux scram)	1212	1256	Figure 5

*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 limiting transients for River Bend Station, Cycle 5, are rod withdrawal error and loss of 100°F feedwater heating.

**See letter, J. F. Klapproth (GE) to R. C. Jones, Jr. (NRC), *Rotated Bundle Evaluation*, July 20, 1992.

13. Loading Error Results*

Variable water gap misoriented bundle analysis: Yes

Event	ΔCPR
Misoriented fuel bundle	0.15

14. Control Rod Drop Analysis Results

River Bend Station is a banked position withdrawal sequence plant, therefore, the control rod drop accident analysis is not required. NRC approval is documented in NEDE-24011-P-A-10-US, March 1991.

15. Stability Analysis Results

GE SIL-380 recommendations have been included in the River Bend Station operating procedures and Technical Specifications; 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. River Bend Station recognizes the issuance of NRC Bulletin No. 88-07, Supplement 1, *Power Oscillations in Boiling Water Reactors (BWRs)*, and will comply with the recommendations contained therein.

*See letter, J. F. Klapproth (GE) to R. C. Jones, Jr. (NRC), *Rotated Bundle Evaluation*, July 20, 1992.

16. Loss-of-coolant Accident Results*

LOCA method used: SAFE/REFLOOD (see River Bend Station Final Safety Analysis Report)**

Bundle Type: GE8B-P8SQB334-10GZ-120M-4WR-150-T (GE8x8EB)

Average Planar Exposure		MAPLHGR (kw/ft)	
(GWd/ST)	(GWd/MT)	Most Limiting	Least Limiting
0.0	0.0	11.36	11.90
0.2	0.2	11.42	11.93
1.0	1.1	11.54	12.03
2.0	2.2	11.71	12.18
3.0	3.3	11.90	12.34
4.0	4.4	12.09	12.51
5.0	5.5	12.30	12.68
6.0	6.6	12.52	12.86
7.0	7.7	12.74	13.05
8.0	8.8	12.97	13.23
9.0	9.9	13.21	13.41
10.0	11.0	13.41	13.56
12.5	13.8	13.60	13.65
15.0	16.5	13.31	13.32
20.0	22.0	12.64	12.64
25.0	27.6	11.96	11.97
35.0	38.6	10.46	10.53
45.0	49.6	9.08	9.21
50.0	55.1	6.97	7.04

The peak clad temperature (PCT) is ≤2131°F at all exposures; the local oxidation (fraction) is ≤0.073 at all exposures. The MAPLHGR multiplier for single-loop operation (SLO) is 0.83 if Technical Specification D/G start time is greater than 13 seconds and less than or equal to 30 seconds; 0.84 if Technical Specification D/G start time is 13 seconds or less.

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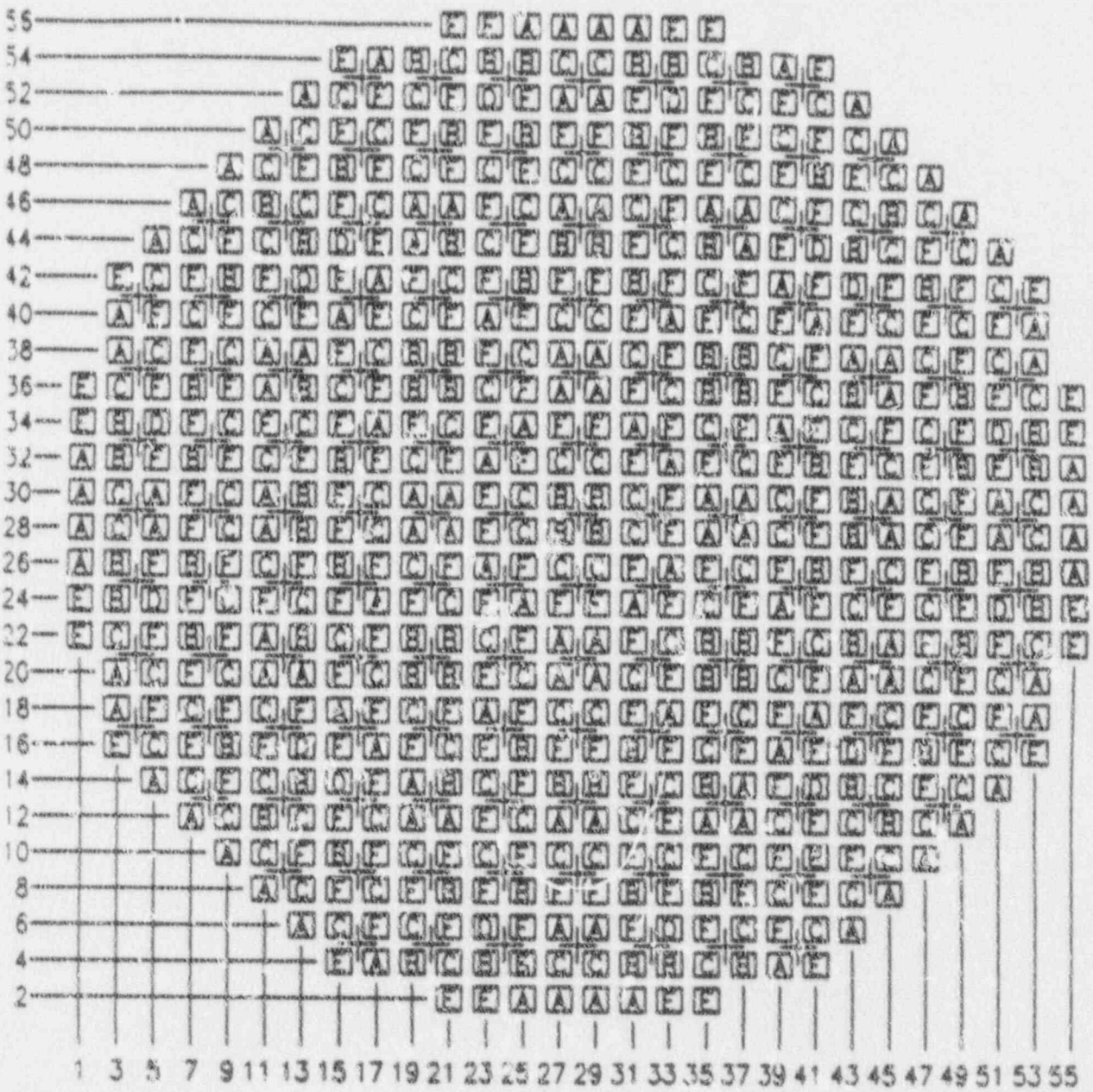
*For format explanation, see letter, J. S. Charnley (GE) to M. W. Hodges (NRC), *Recommended MAPLHGR Technical Specifications for Multiple Lattice Fuel Designs*, March 9, 1987. Most Limiting and Least Limiting refer to the lowest and highest limits, respectively, of any enriched lattice in the bundle.

**As modified by GE Report EAS-66-1088, *ECCS Evaluation for 30 Second Diesel Generator Start Times for River Bend Station*, (R. U. Fortney and J. L. Jacobs), August 1989.



FUEL TYPE	
A=GE8B-P8SQB322-8GZ-120M-4WR-150-T	D=GE8B-P8SQB331-11GZ-120M-4WR-150-T
B=GE8B-P8SQB322-9GZ-120M-4WR-150-T	E=BP8SRB299
C=GE8B-P8SQB333-10GZ-120M-4WR-150-T	F=GE8B-P8SQB334-10GZ-120M-4WR-150-T

Figure 1. Reference Core Loading Pattern

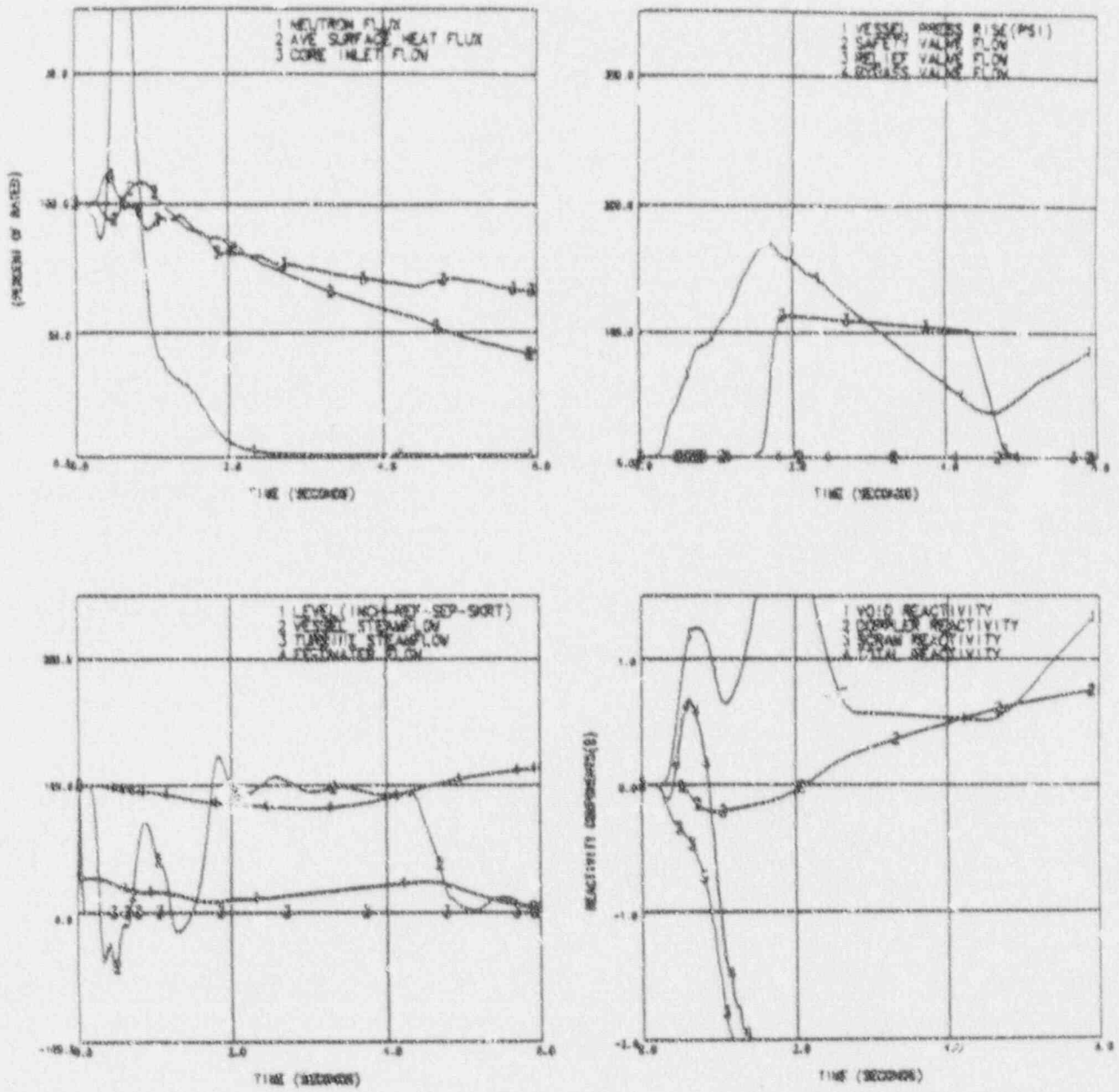


Figure 2. Plant Response to Load Rejection without Bypass (BOC5 to EOC5)

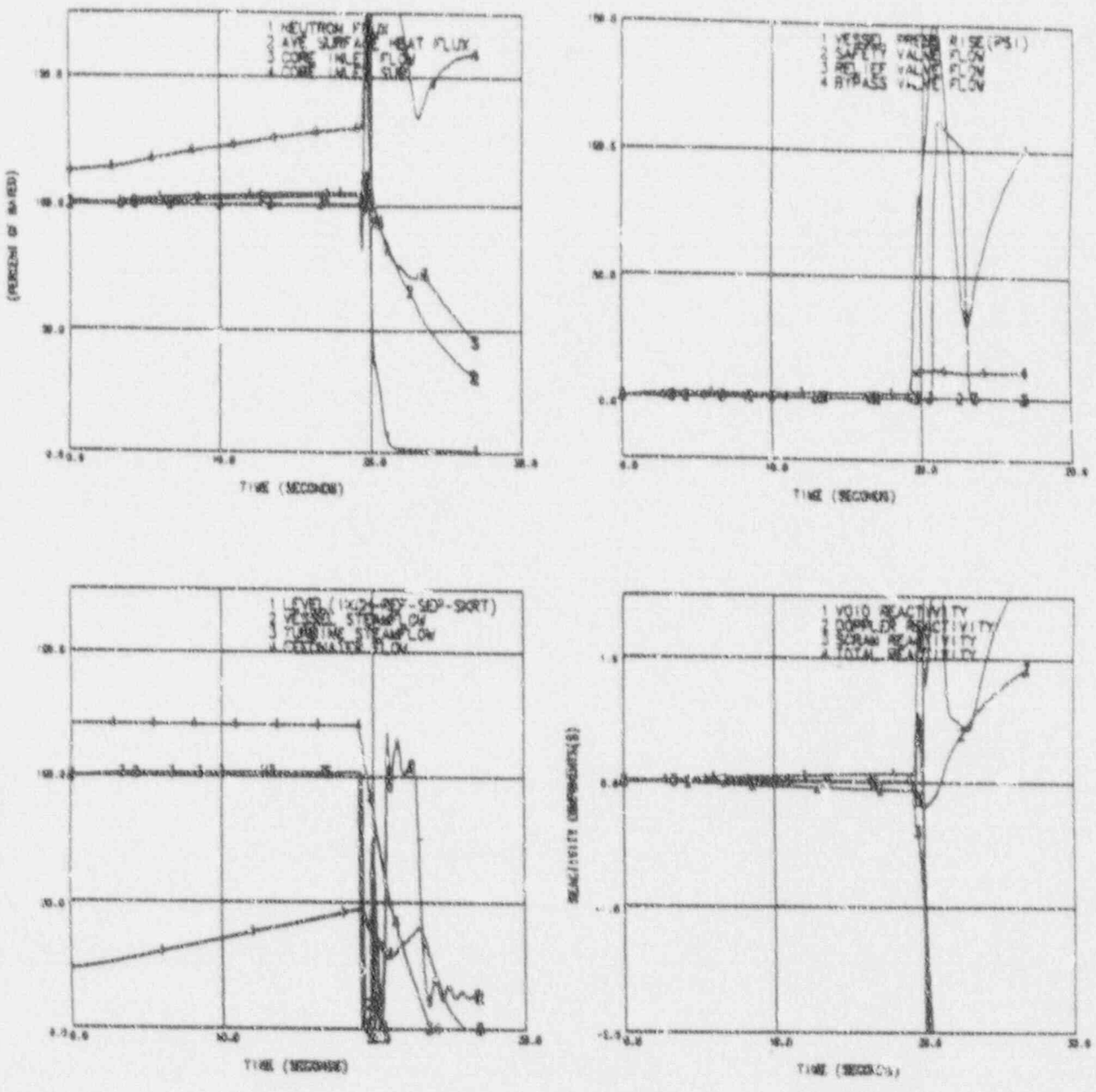


Figure 3. Plant Response to Feedwater Controller Failure (BOC5 to EOC5)

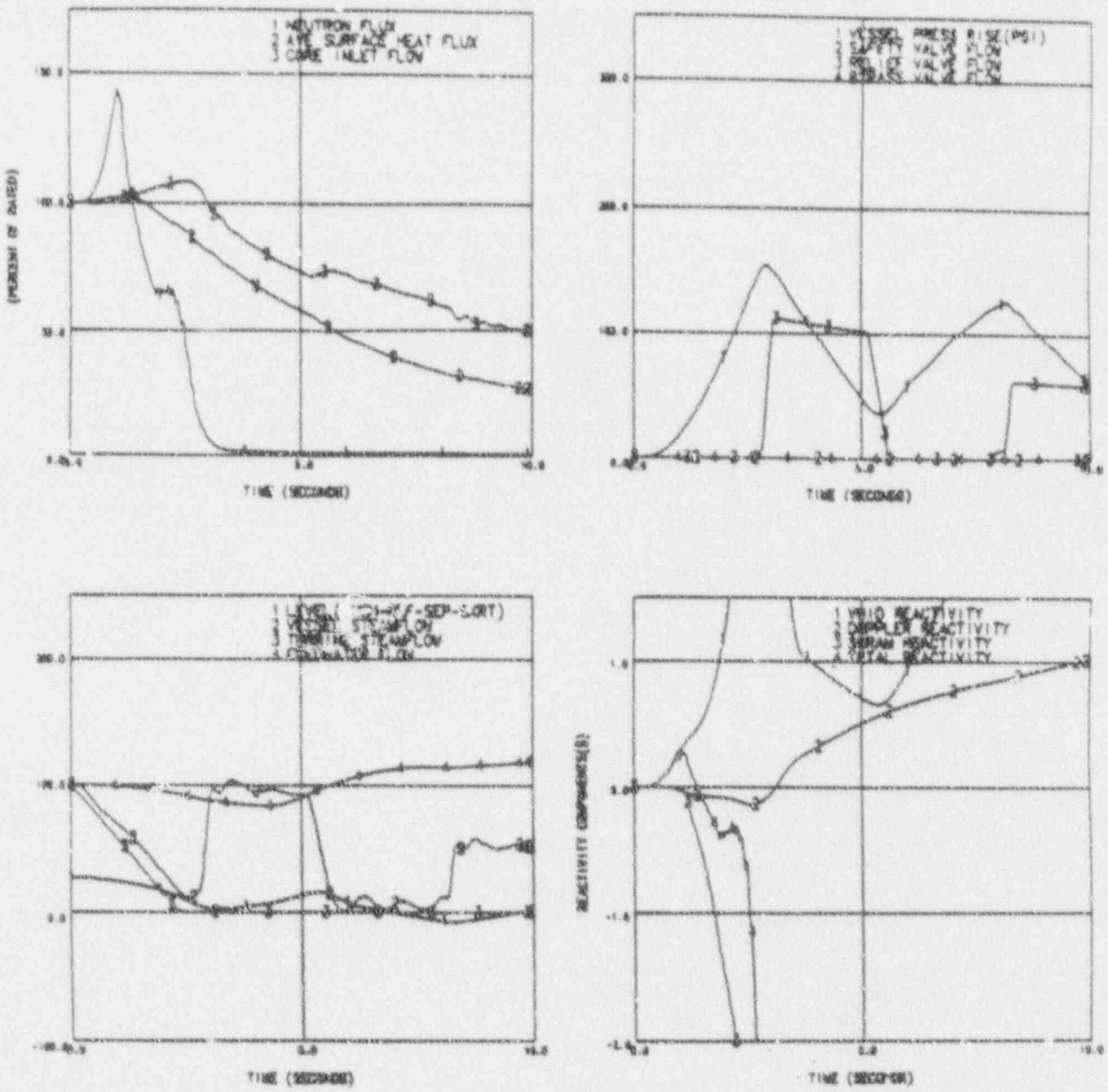


Figure 4. Plant Response to Pressure Regulator Failure Downscale (BOC5 to EOC5)

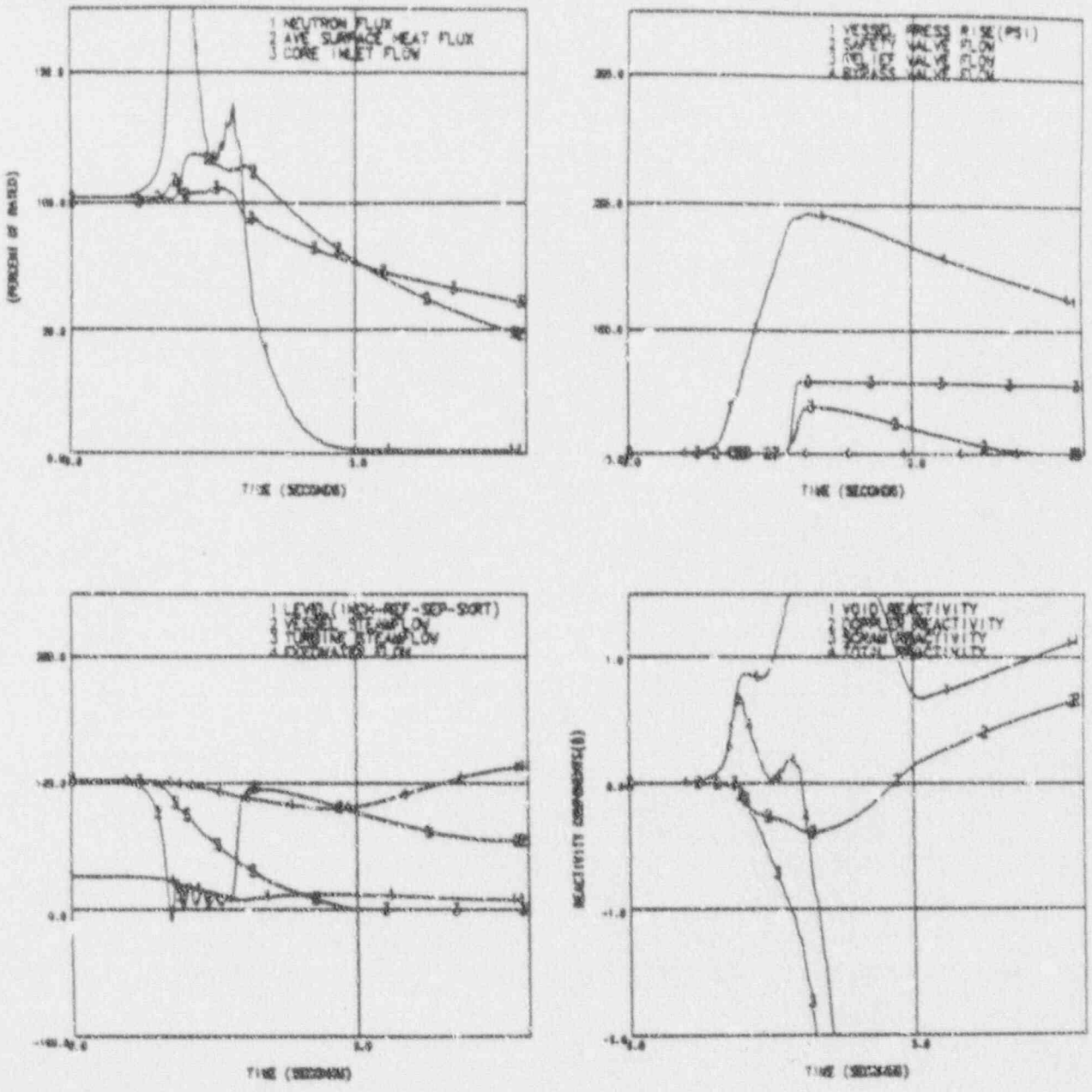


Figure 5. Plant Response to MSIV Closure, Flux Scram

Appendix A

Analyses Conditions

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

Table A-1

Parameter	Analysis Value
Thermal power, MWt	2894
Dome pressure, psig	1025
Steam flow, Mlb/hr	12.45
Turbine pressure, psig	986
Core flow, Mlb/hr	84.5
Reactor pressure, psia	1055
Inlet enthalpy, BTU/lb	527.9
Non-fuel power fraction	0.039
No. of Dual Mode Safety/Relief Valves	16
Relief mode low setpoint, psig	1133
Safety mode low setpoint, psig	1177
Capacity, lb/hr	831,000
(Ref. pressure, psig)	(1080)

Appendix B

Basis for Analysis of Loss-of-feedwater Heater Event

The loss-of-feedwater heating event was analyzed at 102% rated power 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 9 are not an output of the BWR Simulator code; therefore, these items are not included in this document.

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 (latest approved version).