GE Nuclear Energy

24A5195
Revision 0
Class I
January 1996

Supplemental Reload Licensing Report

for

Brunswick Steam Electric Plant Unit 2

Reload 11 Cycle 12

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24A5195, Rev. 0

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Approved

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Important Notice Regarding

Contents of This Report

Please Read Carefully

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Acknowledgement

The engineering and reload licensing analyses, which form the technical basis of this Supplemental Reload Licensing Report, were performed by M.R. Morris. The Supplemental Reload Licensing Report was prepared by M.R. Morris. This document has been verified by G.N. Marrotte.

The basis for this report is *General Electric Standard Application for Reactor Fuel*, NEDE–24011–P–A–11, November, 1995; and the U.S. Supplement, NEDE–24011–P–A–11–US, November 1995.

1. Plant–unique Items

Appendix A: Analysis Conditions
Appendix B: Main Steamline Isolation Valve Out of Service (MSIVOOS)
Appendix C: Decrease in Core Coolant Temperature Events
Appendix D: Feedwater Temperature Reduction (FWTR)
Appendix E: Maximum Extended Operating Domain

2. Reload Fuel Bundles

Fuel Type	Cycle Loaded	Number
Irradiated:		
GE8B–P8DQB323–11GZ–80M–4WR–150–T (GE8x8EB)	8	8
GE8B–P8DQB317–9GZ–80M–4WR–150–T (GE8x8EB)	8	16
GE9B–P8DWB329–11GZ–80M–150–T (GE8x8NB)	9	36
GE10–P8HXB329–12GZ1–100M–150–T (GE8x8NB–3)	10	148
GE10–P8HXB322–11GZ–70M–150–T (GE8x8NB–3)	11	8
GE10–P8HXB320–11GZ–100M–150–T (GE8x8NB–3)	11	32
GE10–P8HXB324–12GZ–70M–150–T (GE8x8NB–3)	11	112
New:		
GE13–P9DTB363–11GZ–100T–146–T (GE13)	12	136
GE13–P9DTB363–11GZ1–100T–146–T (GE13)	12	64
Total		560

3. Reference Core Loading Pattern

Nominal previous cycle core average exposure at end of cycle:	27988 MWd/MT (25390 MWd/ST)
Minimum previous cycle core average exposure at end of cycle from cold shutdown considerations:	27743 MWd/MT (25168 MWd/ST)
Assumed reload cycle core average exposure at beginning of cycle:	15044 MWd/MT (13647 MWd/ST)
Assumed reload cycle core average exposure at end of cycle:	27279 MWd/MT (24747 MWd/ST)
Reference core loading pattern:	Figure 1

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

Beginning of Cycle, $k_{effective}$	
Uncontrolled	1.105
Fully controlled	0.963
Strongest control rod out	0.984
R, Maximum increase in cold core reactivity with exposure into cycle, Δk	0.000

5. Standby Liquid Control System Shutdown Capability

Boron (ppm)	Shutdown Margin (Δk) (20°C, Xenon Free)
660	0.041

6. Reload Unique GETAB Anticipated Operational Occurrences (AOO) Analysis Initial Condition Parameters

Exposure: BOC12 to EOC12–2000 MWd/MT with Increased Core Flow (ICF)							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R–Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE8x8NB–3	1.20	1.67	1.40	1.000	7.086	111.8	1.25
GE13	1.45	1.55	1.31	1.020	6.585	110.3	1.36

Exposure: EOC12–2000 MWd/MT to EOC12 with ICF							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R–Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE8x8NB–3	1.20	1.62	1.40	1.000	6.881	113.0	1.29
GE13	1.45	1.59	1.15	1.020	6.726	108.9	1.37

Exposure: BOC12 to EOC12–2000 MWd/MT with Maximum Extended Load Line Limit (MELLL)							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R–Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE8x8NB–3	1.20	1.57	1.40	1.000	6.633	79.4	1.18
GE13	1.45	1.44	1.27	1.020	6.080	78.4	1.32

Exposure: EOC12–2000 MWd/MT to EOC12 with MELLL							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R–Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE8x8NB–3	1.20	1.54	1.40	1.000	6.541	79.8	1.20
GE13	1.45	1.41	1.32	1.020	5.948	79.6	1.33

Exposure: BOC12 to EOC12 with ICF and FWTR							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R–Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE8x8NB–3	1.20	1.73	1.40	1.000	7.317	110.3	1.24
GE13	1.45	1.65	1.20	1.020	6.970	107.5	1.35

Exposure: BOC12 to EOC12–2000 MWd/MT with MSIVOOS and ICF							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R–Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE8x8NB–3	1.20	1.71	1.40	1.000	7.257	110.9	1.21
GE13	1.45	1.58	1.31	1.020	6.687	109.7	1.34

Exposure: EOC12–2000 MWd/MT to EOC12 with MSIVOOS and ICF							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R–Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE8x8NB–3	1.20	1.66	1.40	1.000	7.037	112.1	1.26
GE13	1.45	1.60	1.15	1.020	6.772	108.7	1.36

7. Selected Margin Improvement Options

Recirculation pump trip:	No
Thermal power monitor:	Yes
Improved scram time:	Yes (ODYN Option B)
Measured scram time:	No
Exposure dependent limits:	Yes
Exposure points analyzed:	2 (EOC12–2000 MWd/MT and EOC12)

8. Operating Flexibility Options[1]

Single–loop operation:	Yes
Load line limit:	Yes
Extended load line limit:	Yes
Maximum extended load line limit:	Yes
Increased core flow throughout cycle:	Yes
Flow point analyzed:	105.0 %
Increased core flow at EOC:	Yes
Feedwater temperature reduction throughout cycle:	No
Final feedwater temperature reduction:	Yes
Temperature reduction:	145.0°F
ARTS Program:	Yes
Maximum extended operating domain:	Yes
Turbine bypass system OOS:	No
Safety/relief valves OOS: (credit taken for 9 of 11 valves)	Yes
ADS OOS:	Yes (2 valves OOS)
EOC RPT OOS:	No
Main steam isolation valves OOS:	Yes

9. Core–wide AOO Analysis Results

Methods used: GEMINI; GEXL–PLUS

Exposure range: BOC12 to EOC12–2000 MWd/MT with ICF					
			Uncorrected ΔCPR		
Event	**Flux (%NBR)**	**Q/A (%NBR)**	**GE8x8NB–3**	**GE13**	**Fig.**
	–	–			–
Load Reject w/o Bypass	338	118	0.15	0.27	2
Turbine Trip w/o Bypass	309	118	0.15	0.26	3

1. Note that the reload analysis used 145° of feedwater temperature reduction, but the analysis referenced in Appendix D is only valid up to 130° of feedwater temperature reduction.

Exposure range: EOC12–2000 MWd/MT to EOC12 with ICF					
			Uncorrected ΔCPR		
Event	Flux (%NBR)	Q/A (%NBR)	GE8x8NB–3	GE13	Fig.
	–	–			–
Turbine Trip w/o Bypass	339	117	0.19	0.29	4
Load Reject w/o Bypass	345	117	0.19	0.29	5

Exposure range: BOC12 to EOC12–2000 MWd/MT with MELLL					
			Uncorrected ΔCPR		
Event	Flux (%NBR)	Q/A (%NBR)	GE8x8NB–3	GE13	Fig.
	–	–			–
Turbine Trip w/o Bypass	276	114	0.09	0.22	6
Load Reject w/o Bypass	273	114	0.08	0.22	7

Exposure range: EOC12–2000 MWd/MT to EOC12 with MELLL					
			Uncorrected ΔCPR		
Event	Flux (%NBR)	Q/A (%NBR)	GE8x8NB–3	GE13	Fig.
	–	–			–
Turbine Trip w/o Bypass	287	117	0.11	0.24	8
Load Reject w/o Bypass	285	116	0.11	0.24	9

Exposure range: BOC12 to EOC12 with ICF and FWTR					
			Uncorrected ΔCPR		
Event	Flux (%NBR)	Q/A (%NBR)	GE8x8NB–3	GE13	Fig.
FW Controller Failure	190	115	0.11	0.13	10
Load Reject w/o Bypass	292	115	0.15	0.26	11
Turbine Trip w/o Bypass	283	115	0.15	0.25	12

Exposure range: BOC12 to EOC12–2000 MWd/MT with MSIVOOS and ICF					
			Uncorrected ΔCPR		
Event	Flux (%NBR)	Q/A (%NBR)	GE8x8NB–3	GE13	Fig.
	–	–			–
Load Reject w/o Bypass	310	116	0.13	0.25	13
Turbine Trip w/o Bypass	304	116	0.12	0.24	14

Exposure range: EOC12–2000 MWd/MT to EOC12 with MSIVOOS and ICF					
			Uncorrected ΔCPR		
Event	Flux (%NBR)	Q/A (%NBR)	GE8x8NB–3	GE13	Fig.
	–	–			–
Load Reject w/o Bypass	327	115	0.17	0.28	15
Turbine Trip w/o Bypass	322	114	0.16	0.27	16

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

The rod withdrawal error event in the maximum extended operating domain was originally analyzed in the GE BWR Licensing Report, *Maximum Extended Operating Domain Analysis for Brunswick Steam Electric Plant*, NEDC–31654P, dated February 1989. The MCPR limit for rod withdrawal error is bounded by the operating limit MCPRs presented in Section 11 of this report for RBM setpoints shown in Tables 10–5(a) or 10–5(b) of NEDC–31654P.

11. Cycle MCPR Values[2, 3]

Safety limit: 1.09

Single loop operation safety limit: 1.11

Non–pressurization events:

Exposure Range: BOC12 to EOC12		
	GE8x8NB–3	GE13
Fuel Loading Error (misoriented)		
GE10–P8HXB324–12GZ–70M–150–T	1.33	–
GE10–P8HXB322–11GZ–70M–150–T	1.21	–
GE10–P8HXB320–11GZ–100M–150–T	1.22	–
GE13–P9DTB363–11GZ–100T–146–T	–	1.22
GE13–P9DTB363–11GZ1–100T–146–T	–	1.22
Fuel Loading Error (mislocated)	1.25	1.25

2. The GE8x8NB–3 fuel type MCPR values bound the GE8x8NB and GE8x8EB MCPR values for all pressurization events.

3. The operating limit MCPR for two loop operation (TLO) bounds the operating limit MCPR for single loop operation (SLO), therefore, the operating limit MCPR need not be changed for SLO.

Pressurization events:

Exposure range: BOC12 to EOC12–2000 MWd/MT with ICF **Exposure point: EOC12–2000 MWd/MT**				
	Option A		**Option B**	
	GE8x8NB–3	**GE13**	**GE8x8NB–3**	**GE13**
Load Reject w/o Bypass	1.34	1.41	1.27	1.36
Turbine Trip w/o Bypass	1.34	1.40	1.27	1.35

Exposure range: EOC12–2000 MWd/MT to EOC12 with ICF **Exposure point: EOC12**				
	Option A		**Option B**	
	GE8x8NB–3	**GE13**	**GE8x8NB–3**	**GE13**
Load Reject w/o Bypass	1.34	1.48	1.30	1.40
Turbine Trip w/o Bypass	1.33	1.48	1.29	1.40

Exposure range: BOC12 to EOC12–2000 MWd/MT with MELLL **Exposure point: EOC12–2000 MWd/MT**				
	Option A		**Option B**	
	GE8x8NB–3	**GE13**	**GE8x8NB–3**	**GE13**
Turbine Trip w/o Bypass	1.27	1.36	1.20	1.31
Load Reject w/o Bypass	1.27	1.36	1.20	1.31

Exposure range: EOC12–2000 MWd/MT to EOC12 with MELLL **Exposure point: EOC12**				
	Option A		**Option B**	
	GE8x8NB–3	**GE13**	**GE8x8NB–3**	**GE13**
Turbine Trip w/o Bypass	1.25	1.43	1.21	1.35
Load Reject w/o Bypass	1.25	1.43	1.21	1.35

Exposure range: BOC12 to EOC12 with ICF and FWTR Exposure point: EOC12				
	Option A		Option B	
	GE8x8NB–3	GE13	GE8x8NB–3	GE13
FW Controller Failure	1.24	1.31	1.21	1.23
Load Reject w/o Bypass	1.30	1.45	1.26	1.37
Turbine Trip w/o Bypass	1.29	1.44	1.25	1.36

Exposure range: BOC12 to EOC12–2000 MWd/MT with MSIVOOS and ICF Exposure point: EOC12–2000 MWd/MT				
	Option A		Option B	
	GE8x8NB–3	GE13	GE8x8NB–3	GE13
Load Reject w/o Bypass	1.32	1.39	1.25	1.34
Turbine Trip w/o Bypass	1.31	1.38	1.24	1.33

Exposure range: EOC12–2000 MWd/MT to EOC12 with MSIVOOS and ICF Exposure point: EOC12				
	Option A		Option B	
	GE8x8NB–3	GE13	GE8x8NB–3	GE13
Load Reject w/o Bypass	1.31	1.47	1.27	1.39
Turbine Trip w/o Bypass	1.31	1.46	1.27	1.38

12. Overpressurization Analysis Summary

Event	Psl (psig)	Pv (psig)	Plant Response
MSIV Closure (Flux Scram)	1240	1276	Figure 17

13. Loading Error Results[4]

Variable water gap misoriented bundle analysis: Yes

Misoriented Fuel Bundle	ΔCPR
GE10–P8HXB324–12GZ–70M–150–T (GE8x8NB–3)	0.24
GE10–P8HXB322–11GZ–70M–150–T (GE8x8NB–3)	0.12
GE10–P8HXB320–11GZ–100M–150–T (GE8x8NB–3)	0.13
GE13–P9DTB363–11GZ–100T–146–T (GE13)	0.13
GE13–P9DTB363–11GZ1–100T–146–T (GE13)	0.13

14. Control Rod Drop Analysis Results

This 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–US.

15. Stability Analysis Results

GE SIL–380 recommendations and GE interim corrective actions have been included in the Brunswick Steam Electric Plant Unit 2 operating procedures. Regions of restricted operation defined in Attachment 1 to NRC Bulletin No. 88–07, Supplement 1, *Power Oscillations in Boiling Water Reactors (BWRs)*, are applicable to Brunswick 2.

16. Loss–of–Coolant Accident Results

LOCA method used: SAFER/GESTR–LOCA

The GE8x8EB LOCA analysis results presented in Sections 5 and 6 of *Brunswick Steam Electric Plant Units 1 and 2 SAFER/GESTAR–LOCA Loss–of–Coolant Accident Analysis*, NEDC–31624P, Revision 2, July 1990, conservatively bound the LOCA analysis of the GE8x8NB–3 fuel types. This analysis yielded a licensing basis peak clad temperature of 1537°F, a peak local oxidation fraction of <0.31%, and a core–wide metal–water reaction of 0.036%.

An additional LOCA analysis was performed for the GE13 fuel type. The results, presented in *Brunswick Steam Electric Plant Units 1 and 2 SAFER/GESTAR–LOCA Loss–of–Coolant Accident Analysis: Application to GE13 Fuel*, NEDC–31624P, Supplement 3, Rev. 0, January 1996, indicate that the GE13 fuel is bounded by the results from GE8x8EB fuel.

The most and the least limiting MAPLHGRs for the new GE13 fuel designs are as follows:

4. Includes a 0.02 penalty due to variable water gap R–factor uncertainty.

16. Loss–of–Coolant Accident Results (cont)

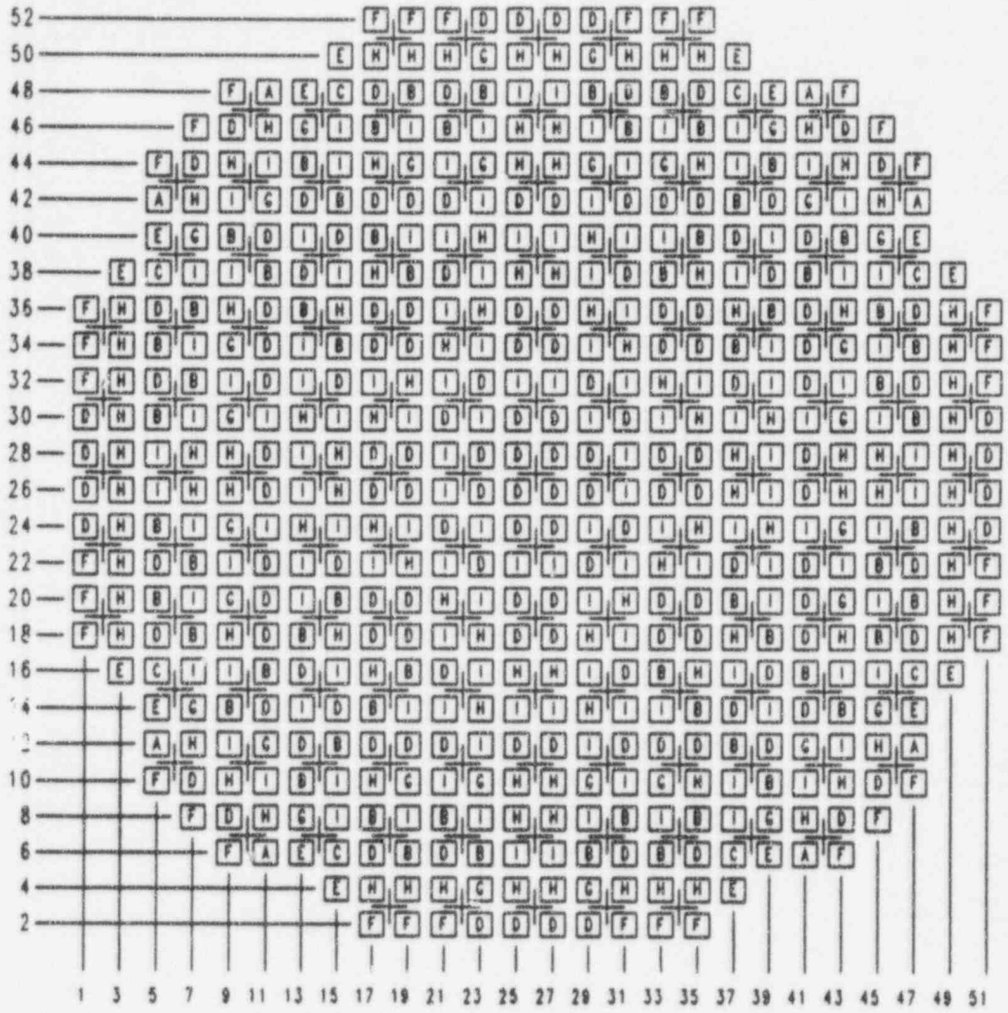
Bundle Type: GE13–P9DTB363–11GZ1–100T–146–T

Average Planar Exposure		MAPLHGR(kW/ft)	
(GWd/ST)	(GWd/MT)	Most Limiting	Least Limiting
0.00	0.00	11.34	11.64
0.20	0.22	11.46	11.65
1.00	1.10	11.62	11.71
2.00	2.20	11.70	11.79
3.00	3.31	11.79	11.87
4.00	4.41	11.89	11.96
5.00	5.51	11.99	12.05
6.00	6.61	12.09	12.15
7.00	7.72	12.20	12.26
8.00	8.82	12.32	12.36
9.00	9.92	12.44	12.47
10.00	11.02	12.55	12.57
12.50	13.78	12.57	12.63
15.00	16.53	12.34	12.40
17.50	19.29	12.07	12.14
20.00	22.05	11.81	11.89
25.00	27.56	11.14	11.23
30.00	33.07	10.43	10.51
35.00	38.58	9.73	9.80
40.00	44.09	9.06	9.10
45.00	49.60	8.41	8.44
50.00	55.12	7.73	7.83
55.00	60.63	7.04	7.20
59.23	65.29	6.44	6.66
59.29	65.35	—	6.44
59.32	65.38	—	6.43

16. Loss–of–Coolant Accident Results (cont)

Bundle Type: GE13–P9DTB363–11GZ–100T–146–T

Average Planar Exposure		MAPLHGR(kW/ft)	
(GWd/ST)	(GWd/MT)	Most Limiting	Least Limiting
0.00	0.00	11.39	11.63
0.20	0.22	11.51	11.65
1.00	1.10	11.62	11.71
2.00	2.20	11.71	11.79
3.00	3.31	11.80	11.88
4.00	4.41	11.89	11.97
5.00	5.51	11.99	12.06
6.00	6.61	12.10	12.16
7.00	7.72	12.21	12.27
8.00	8.82	12.33	12.37
9.00	9.92	12.46	12.48
10.00	11.02	12.59	12.62
12.50	13.78	12.60	12.65
15.00	16.53	12.35	12.41
17.50	19.29	12.08	12.15
20.00	22.05	11.82	11.89
25.00	27.56	11.14	11.24
30.00	33.07	10.43	10.51
35.00	38.58	9.74	9.80
40.00	44.09	9.07	9.10
45.00	49.60	8.41	8.45
50.00	55.12	7.73	7.84
55.00	60.63	7.04	7.20
59.21	65.26	6.44	6.67
59.28	65.34	—	6.44
59.31	65.37	—	6.43



Fuel Type			
A=GE8B–P8DQB323–11GZ–80M–4WR–150–T	(Cycle 8)	F=GE9B–P8DWB329–11GZ–80M–150–T	(Cycle 9)
B=GE13–P9DTB363–11GZ1–100T–146–T	(Cycle 12)	G=GE10–P8HXB320–11GZ–100M–150–T	(Cycle 11)
C=GE10–P8HXB322–11GZ–70M–150–T	(Cycle 11)	H=GE10–P8HXB324–12GZ–70M–150–T	(Cycle 11)
D=GE10–P8HXB329–12GZ1–100M–150–T	(Cycle 10)	I=GE13–P9DTB363–11GZ–100T–146–T	(Cycle 12)
E=GE8B–P8DQB317–9GZ–80M–4WR–150–T	(Cycle 8)		

Figure 1 Reference Core Loading Pattern

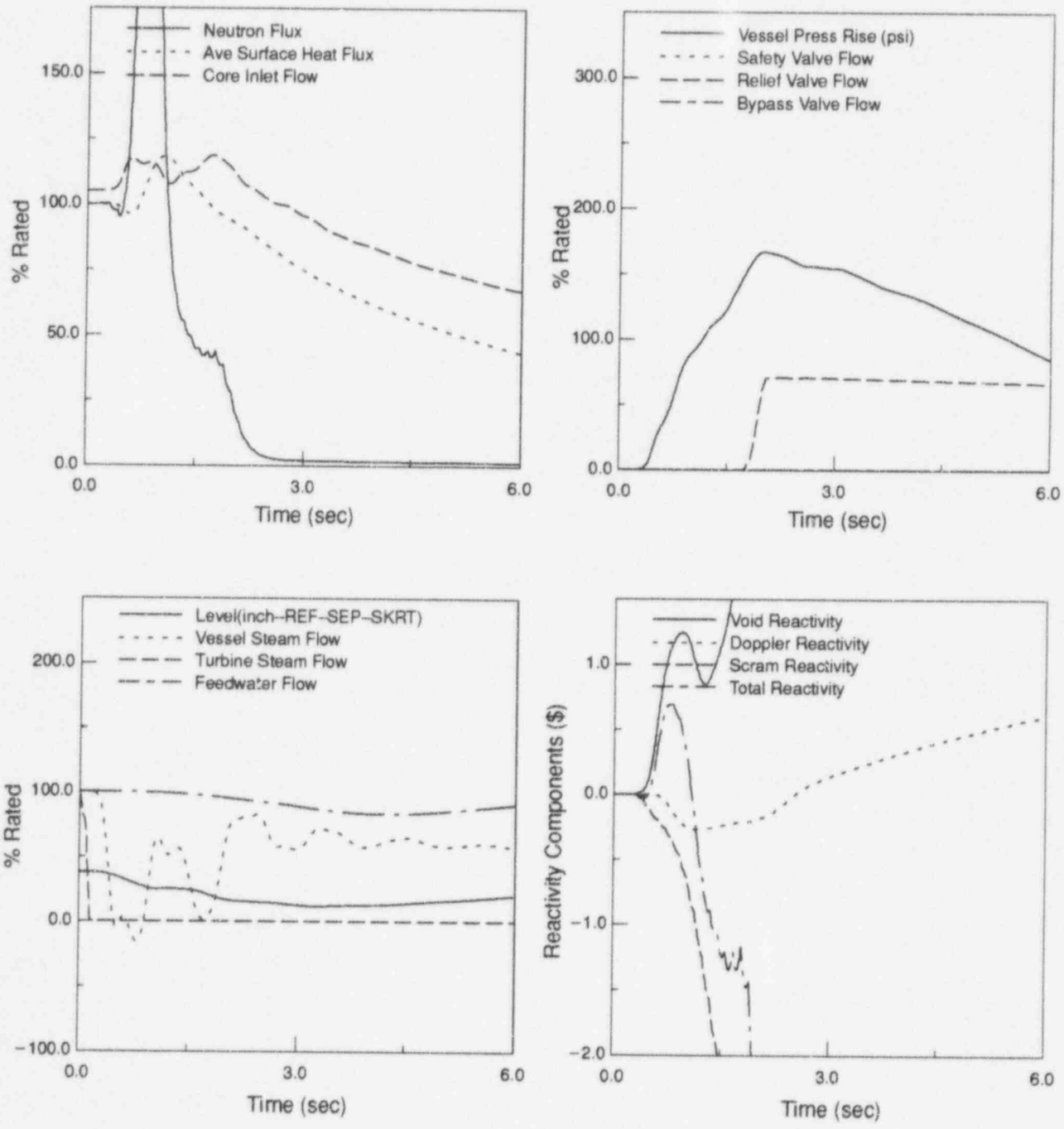


Figure 2 Plant Response to Load Reject w/o Bypass (BOC12 to EOC12–2000 MWd/MT with ICF)

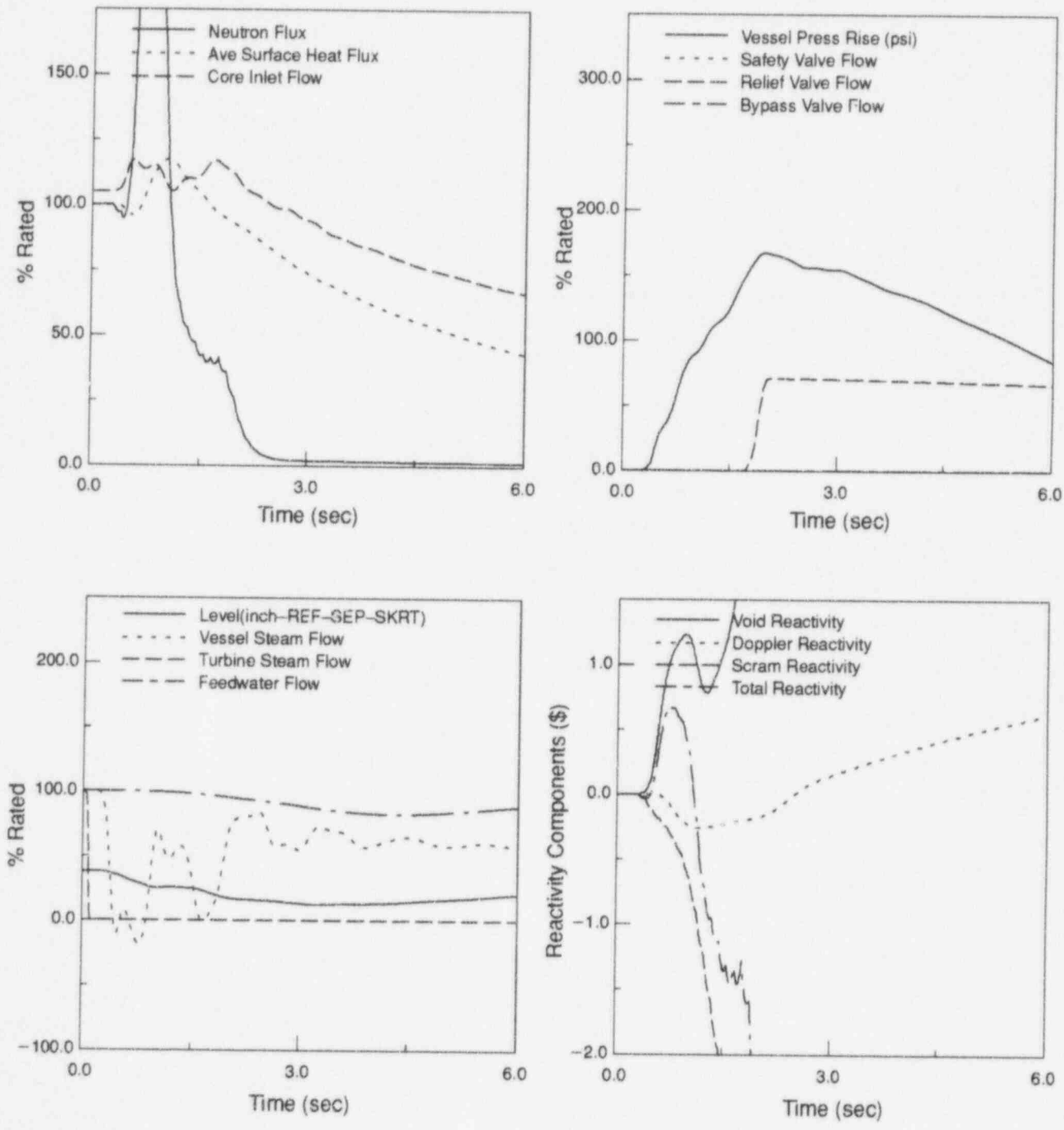


Figure 3 Plant Response to Turbine Trip w/o Bypass (BOC12 to EOC12–2000 MWd/MT with ICF)

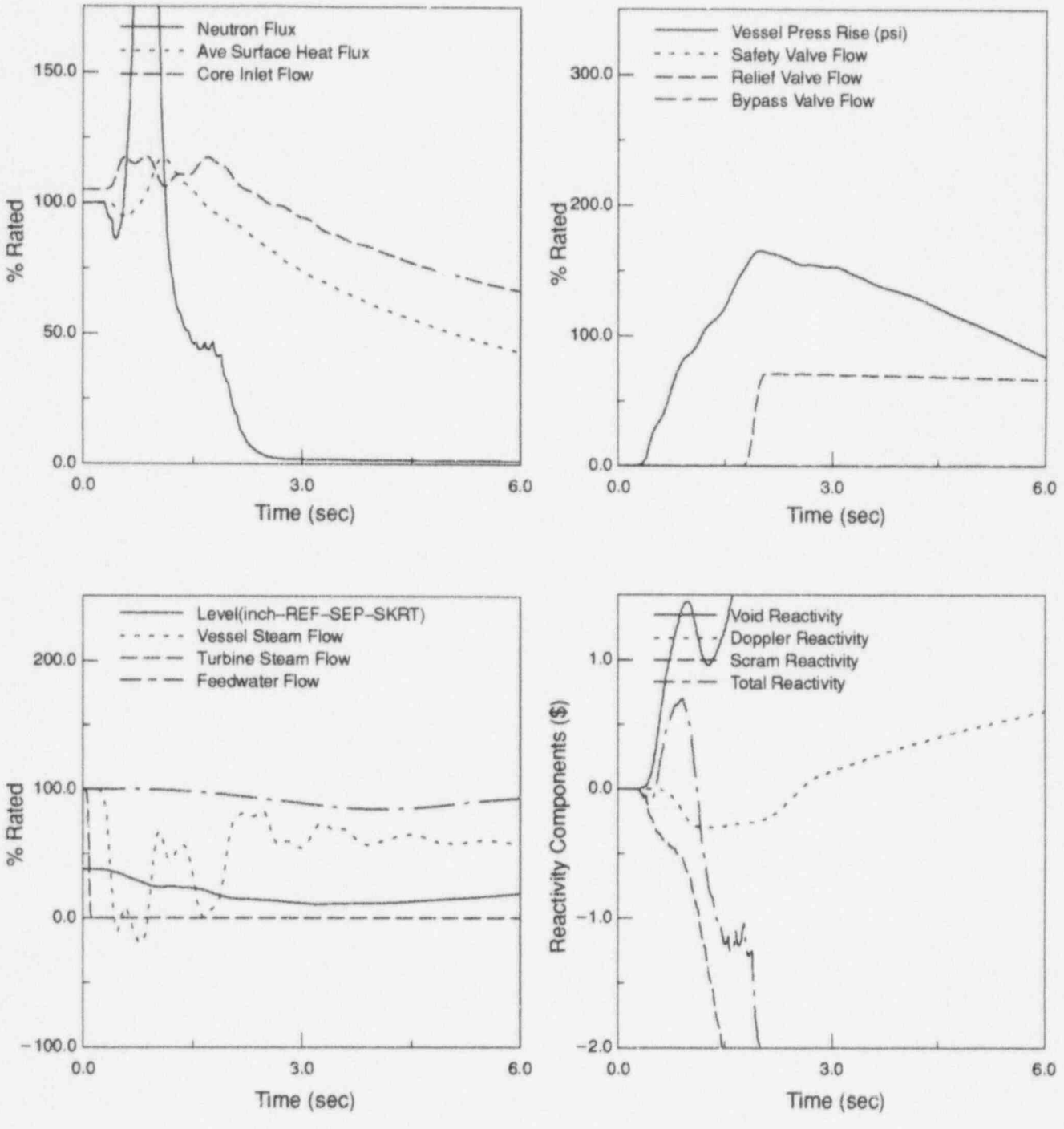


Figure 4 Plant Response to Turbine Trip w/o Bypass (EOC12–2000 MWd/MT to EOC12 with ICF)

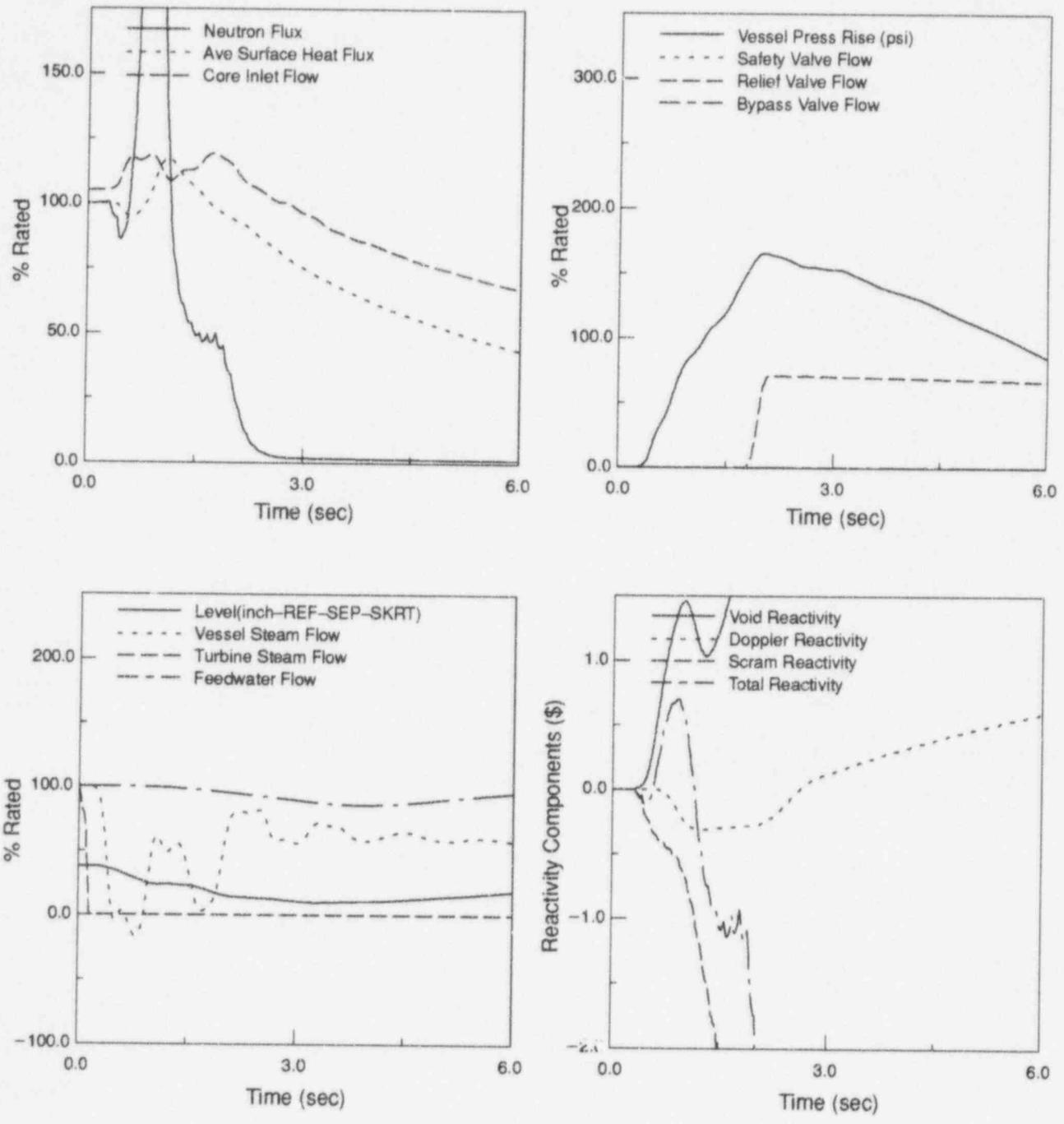


Figure 5 Plant Response to Load Reject w/o Bypass (EOC12–2000 MWd/MT to EOC12 with ICF)

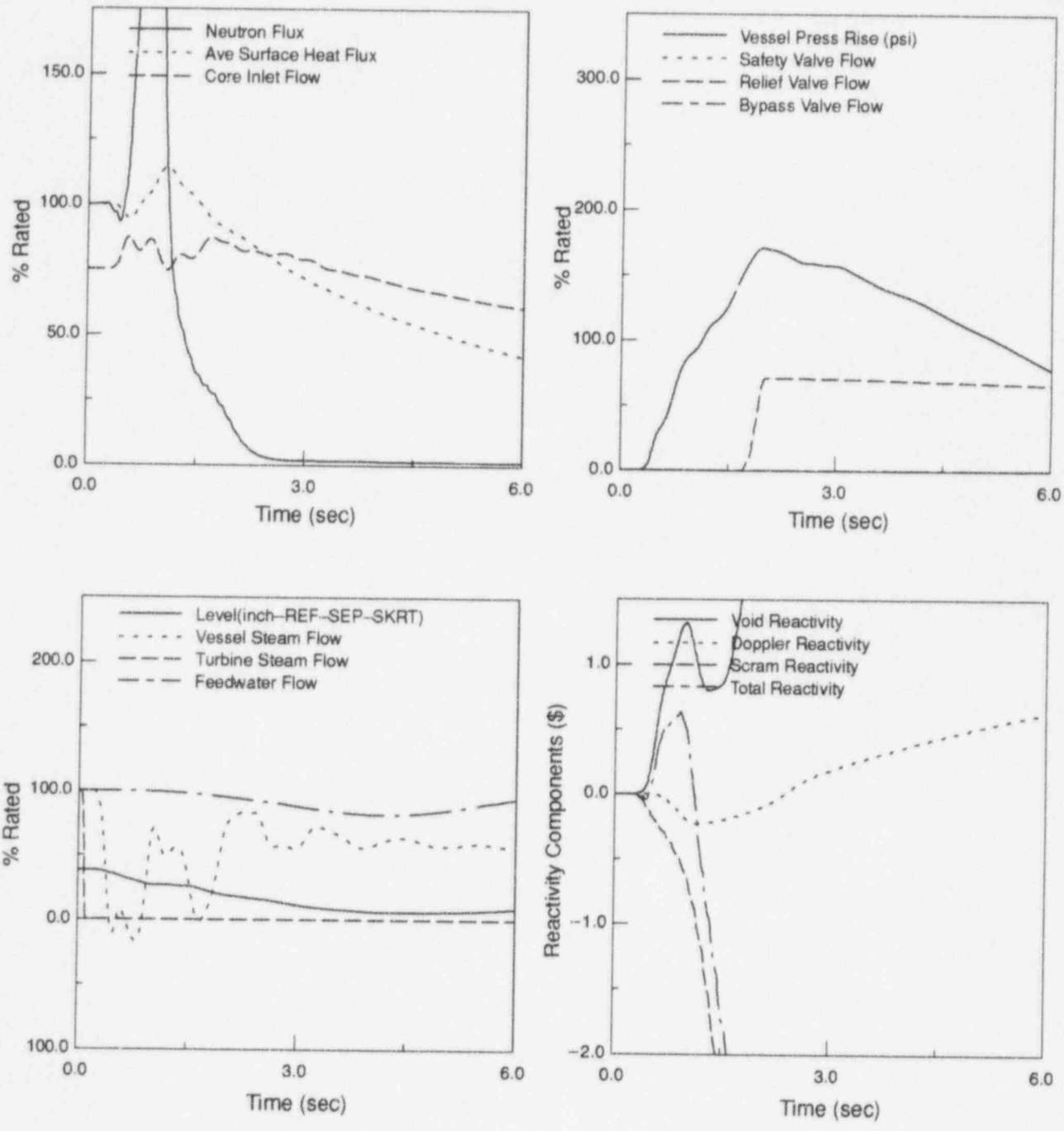


Figure 6 Plant Response to Turbine Trip w/o Bypass (BOC12 to EOC12–2000 MWd/MT with MELLL)

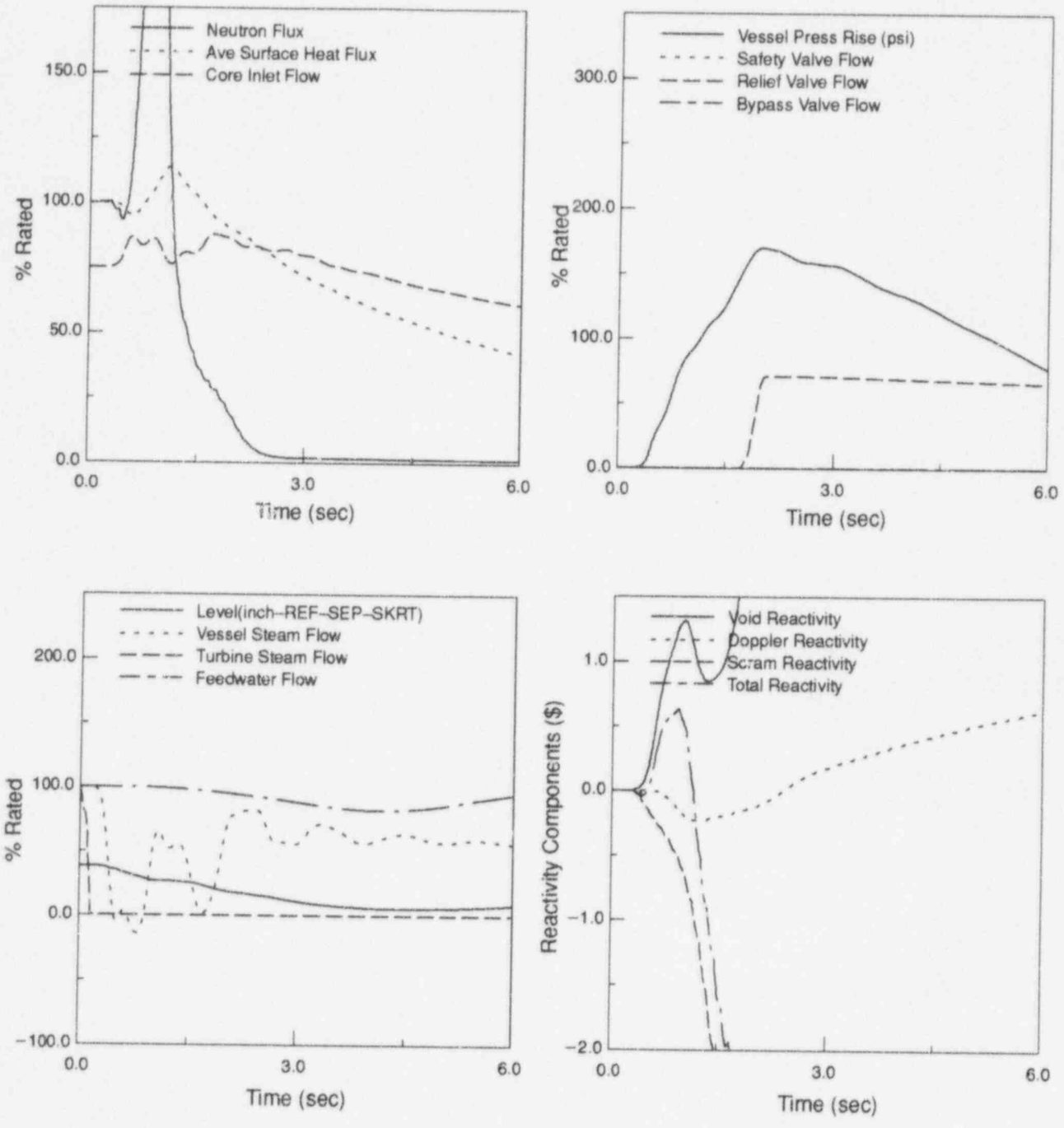


Figure 7 Plant Response to Load Reject w/o Bypass (BOC12 to EOC12–2000 MWd/MT with MELLL)

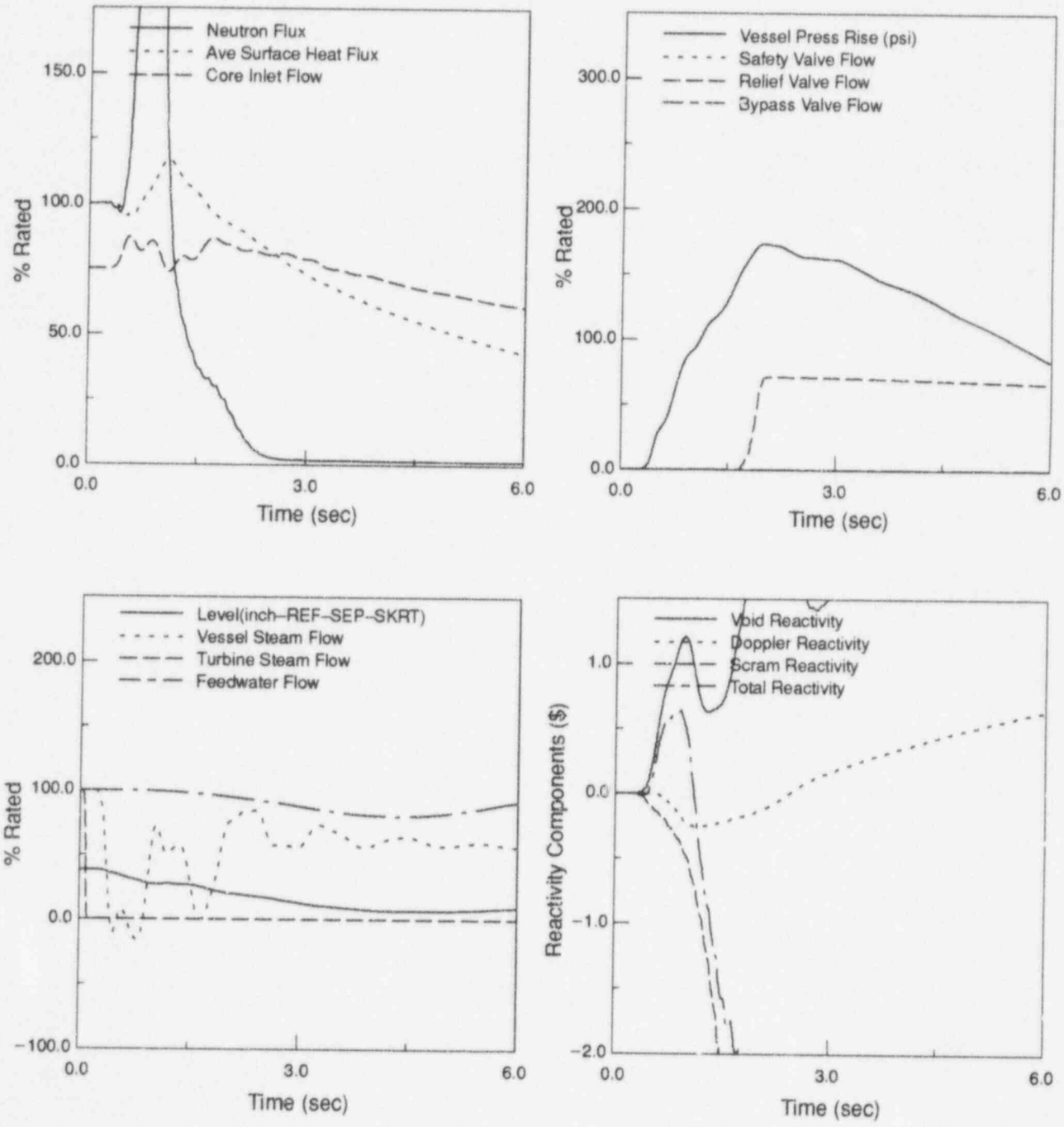


Figure 8 Plant Response to Turbine Trip w/o Bypass (EOC12–2000 MWd/MT to EOC12 with MELLL)

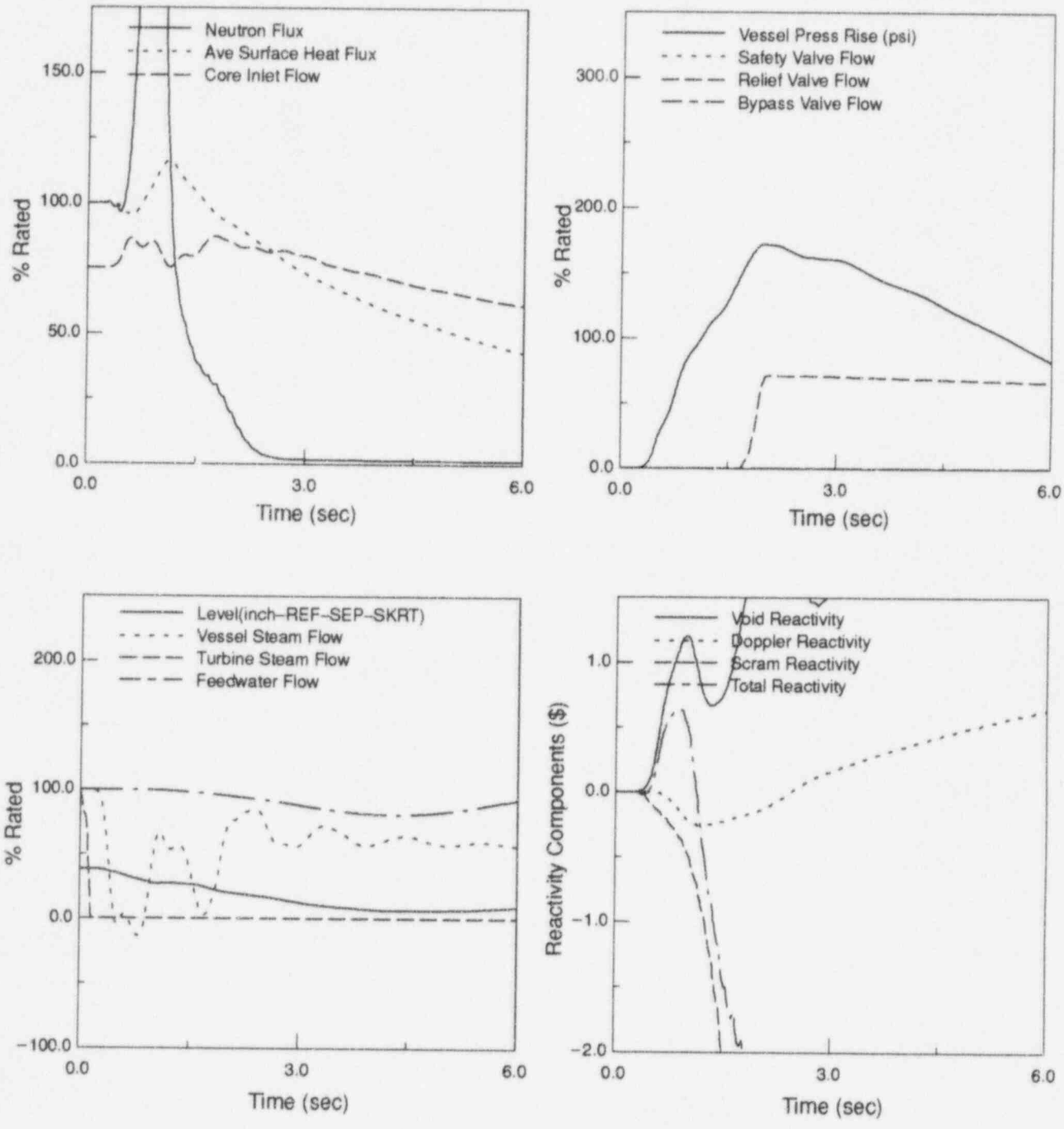


Figure 9 Plant Response to Load Reject w/o Bypass (EOC12–2000 MWd/MT to EOC12 with MELLL)

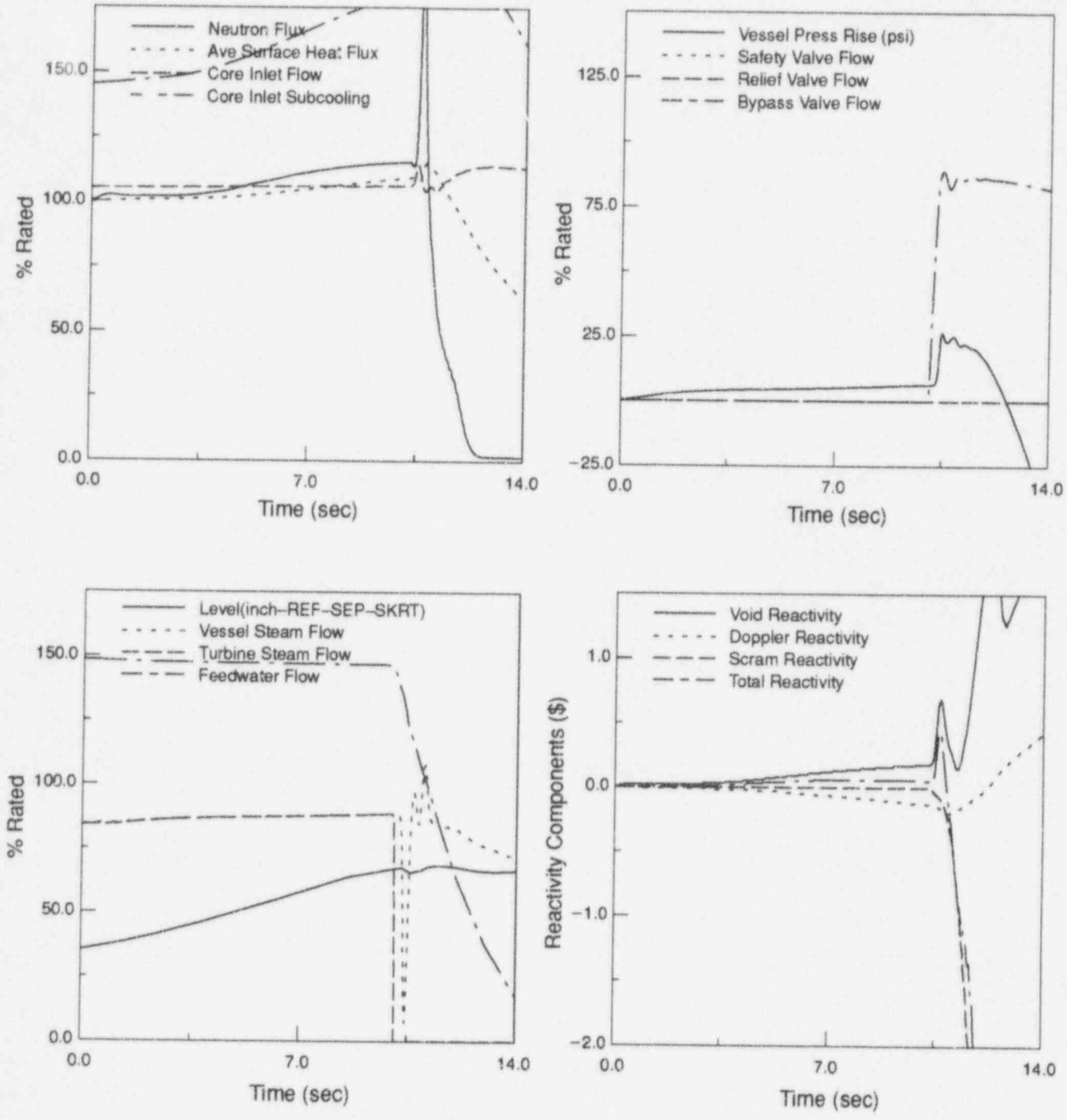


Figure 10 Plant Response to FW Controller Failure (BOC12 to EOC12 with ICF and FWTR)

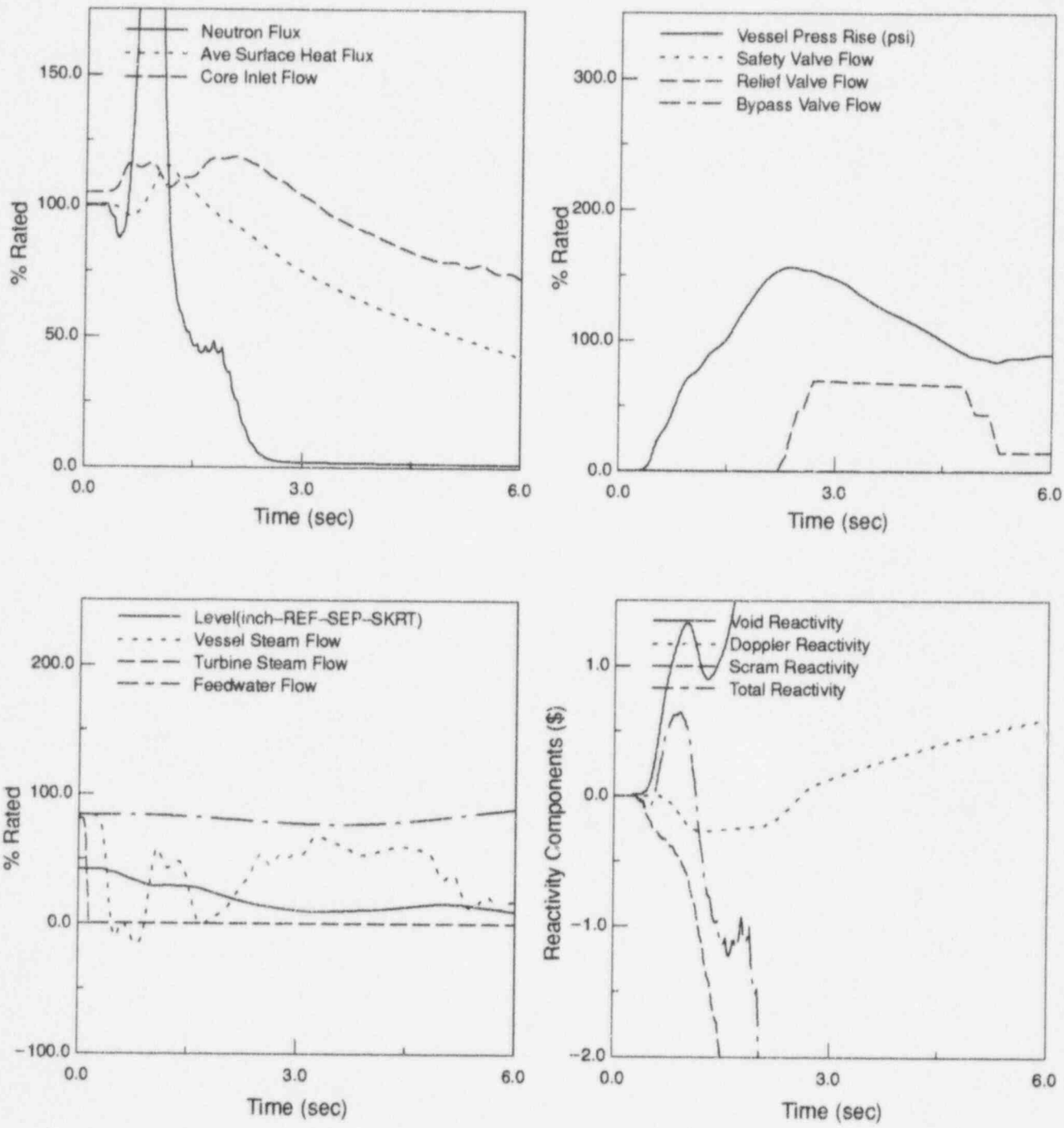


Figure 11 Plant Response to Load Reject w/o Bypass (BOC12 to EOC12 with ICF and FWTR)

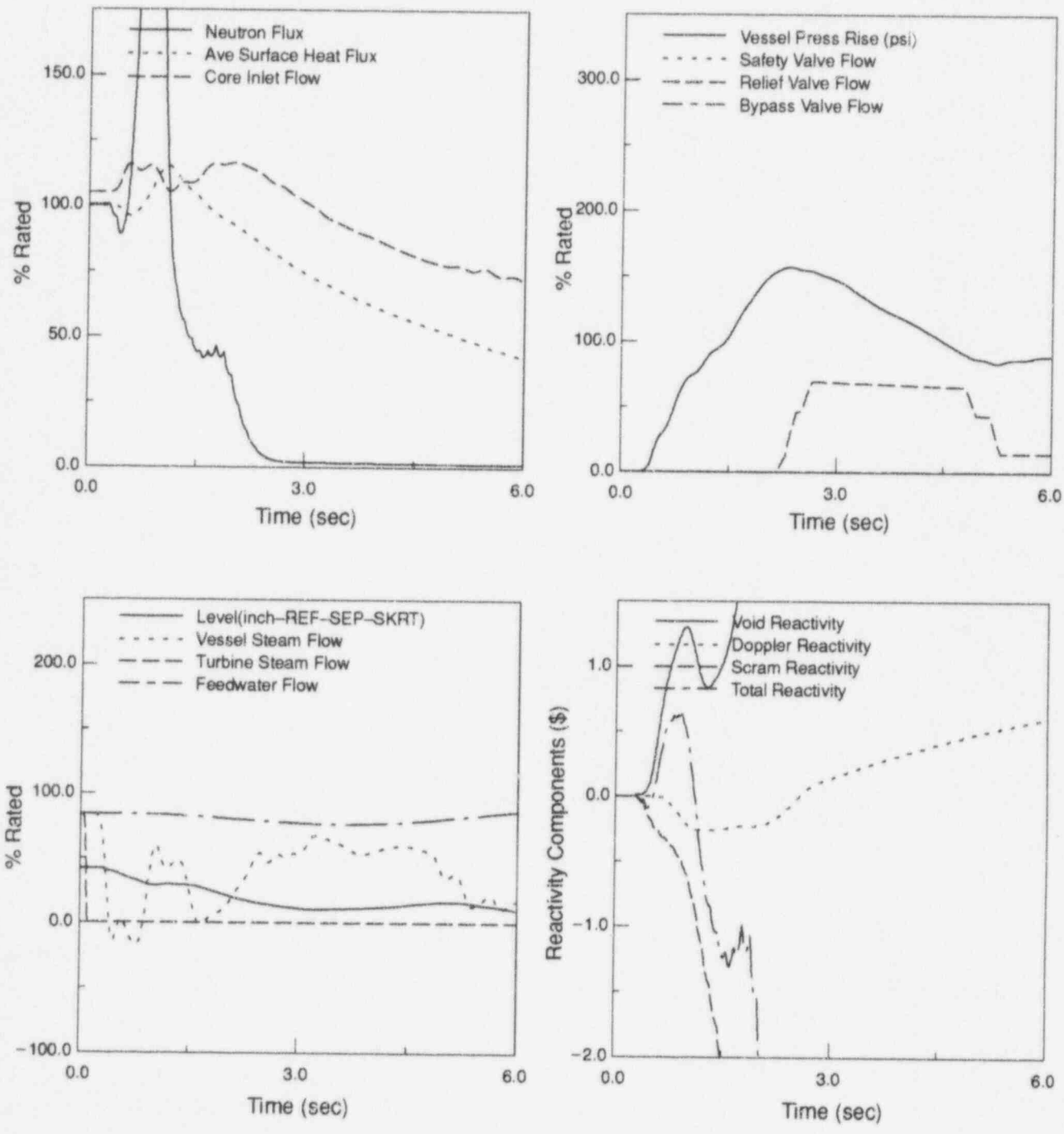


Figure 12 Plant Response to Turbine Trip w/o Bypass (BOC12 to EOC12 with ICF and FWTR)

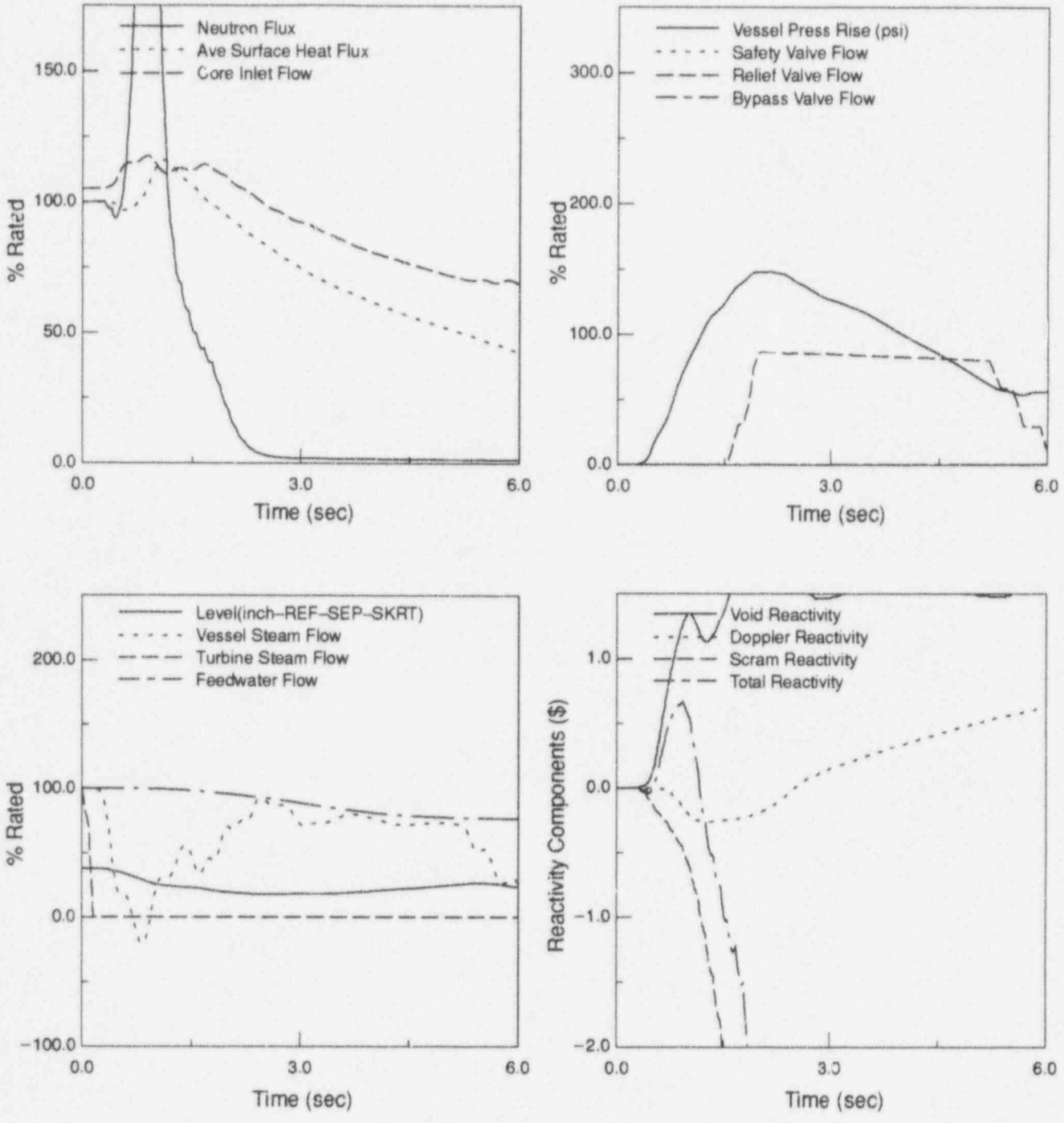


Figure 13 Plant Response to Load Reject w/o Bypass (BOC12 to EOC12–2000 MWd/MT with MSIVOOS and ICF)

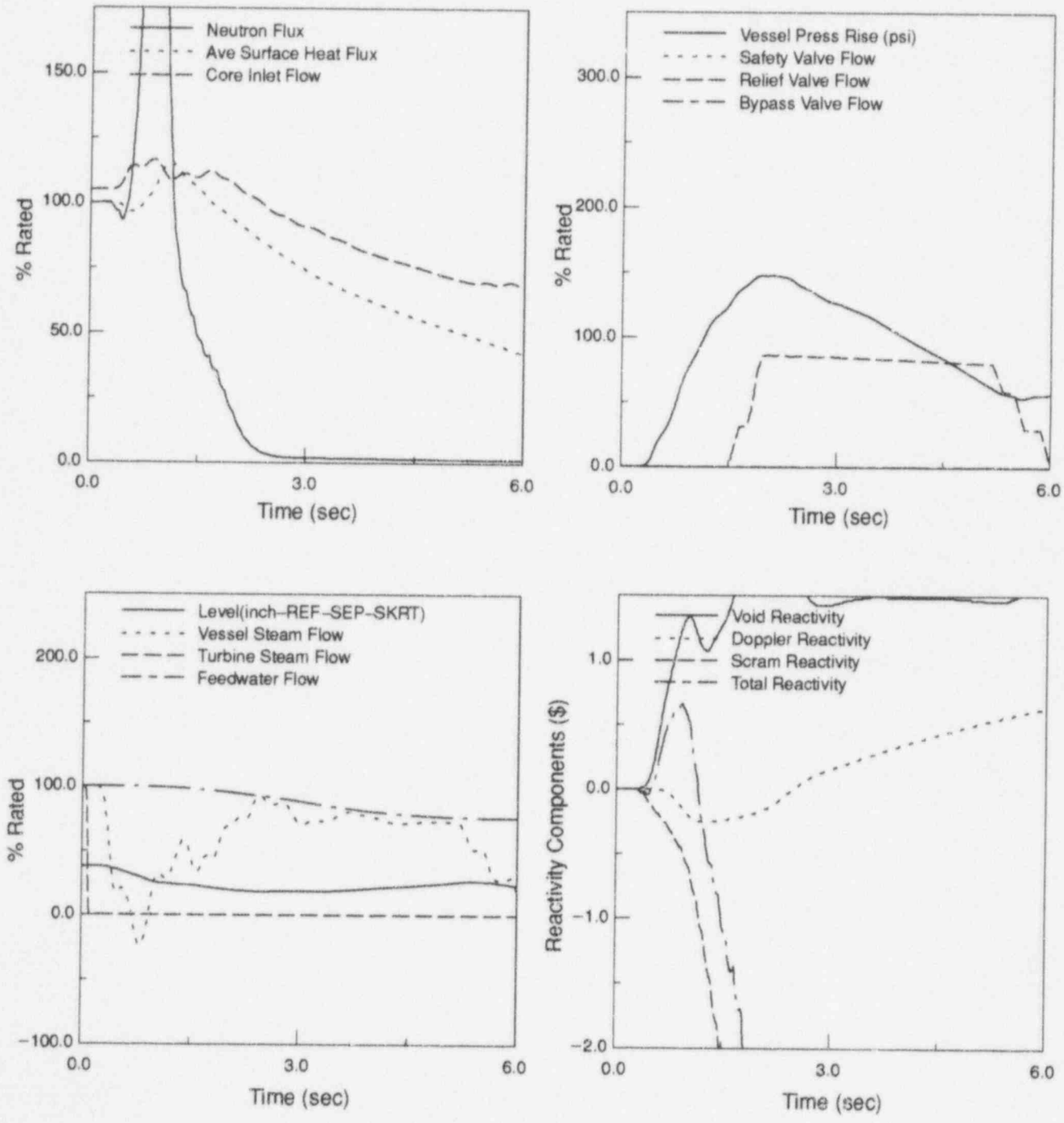


Figure 14 Plant Response to Turbine Trip w/o Bypass (BOC12 to EOC12–2000 MWd/MT with MSIVOOS and ICF)

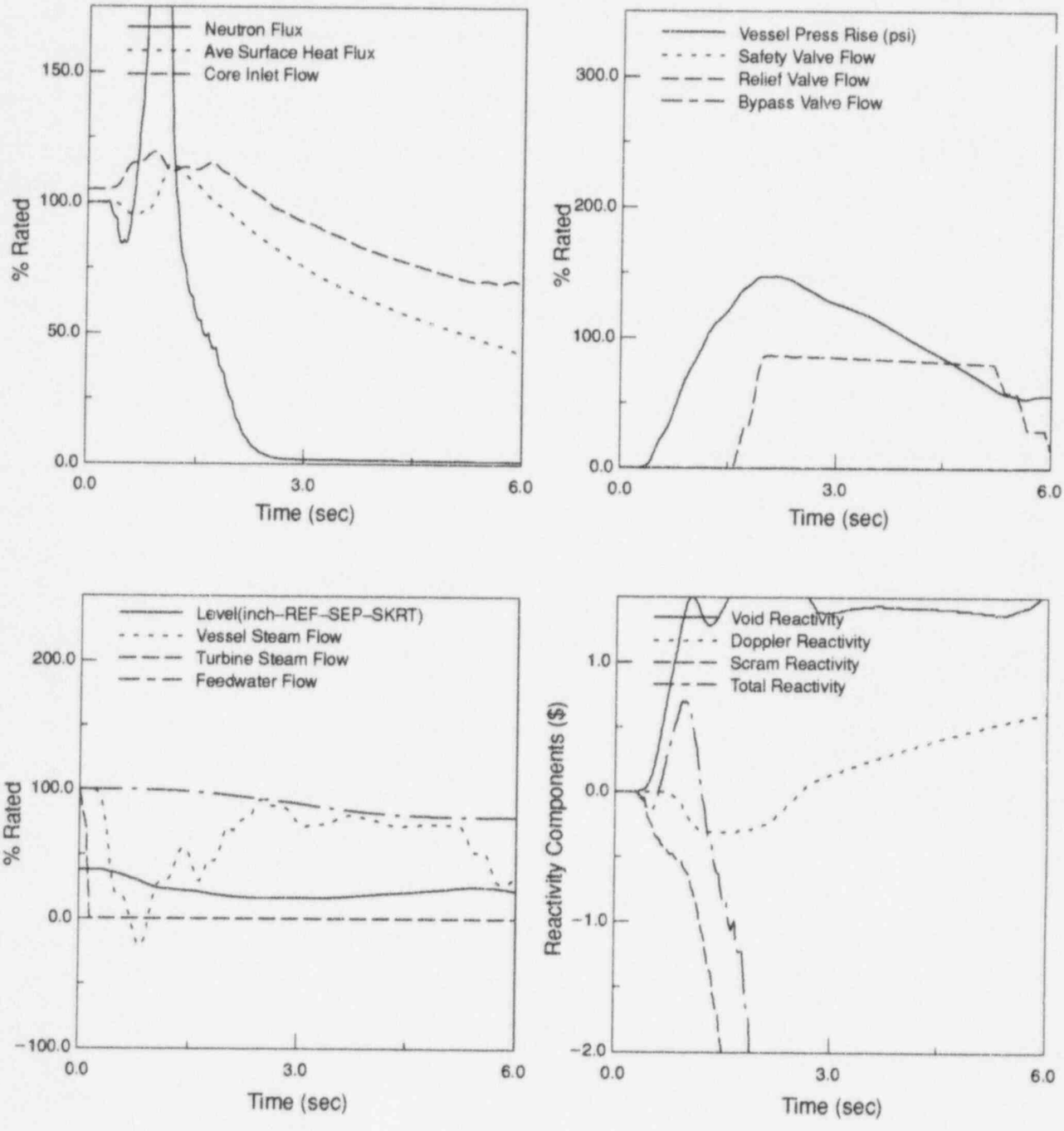


Figure 15 Plant Response to Load Reject w/o Bypass (EOC12–2000 MWd/MT to EOC12 with MSIVOOS and ICF)

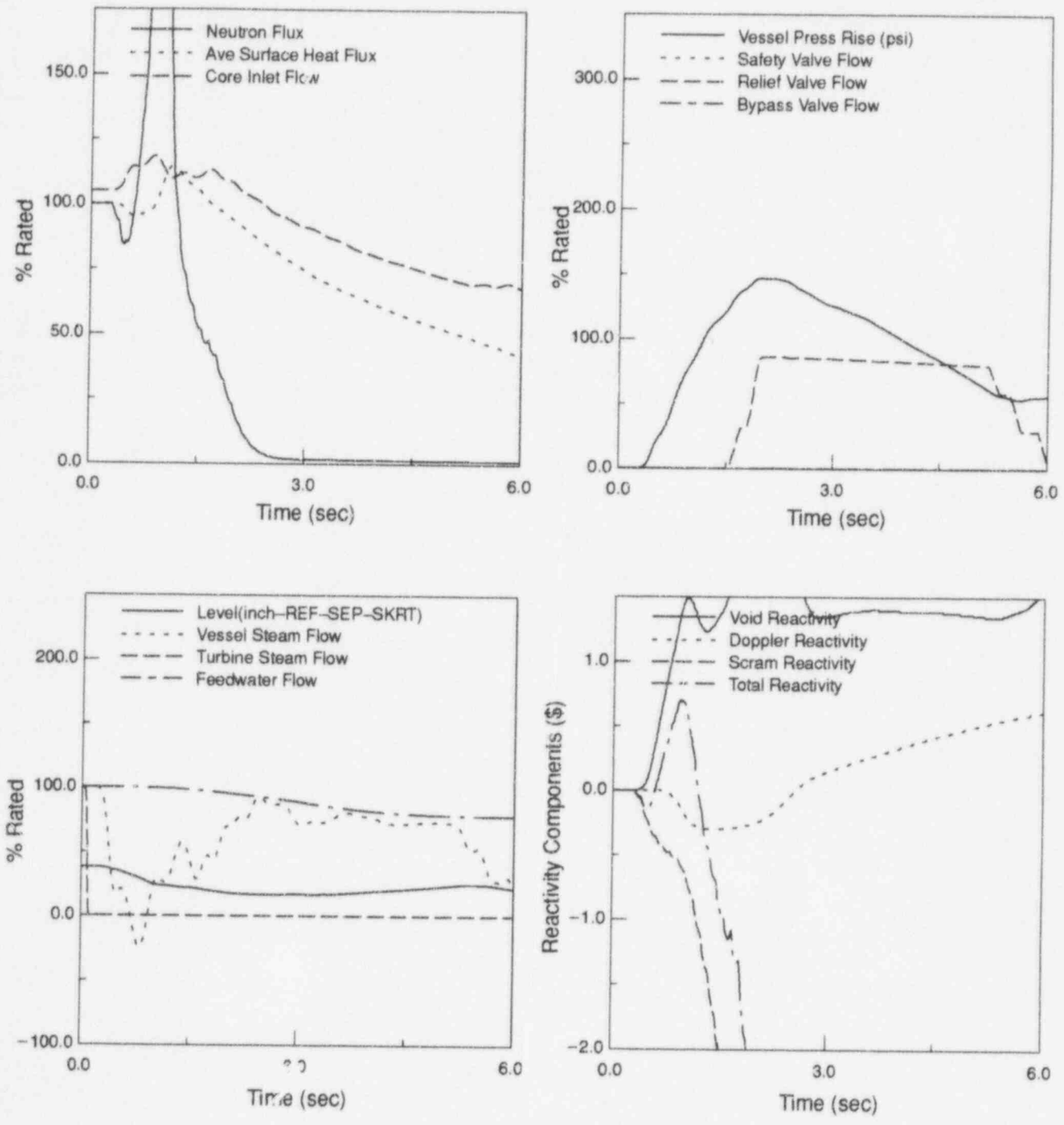


Figure 16 Plant Response to Turbine Trip w/o Bypass (EOC12–2000 MWd/MT to EOC12 with MSIVOOS and ICF)

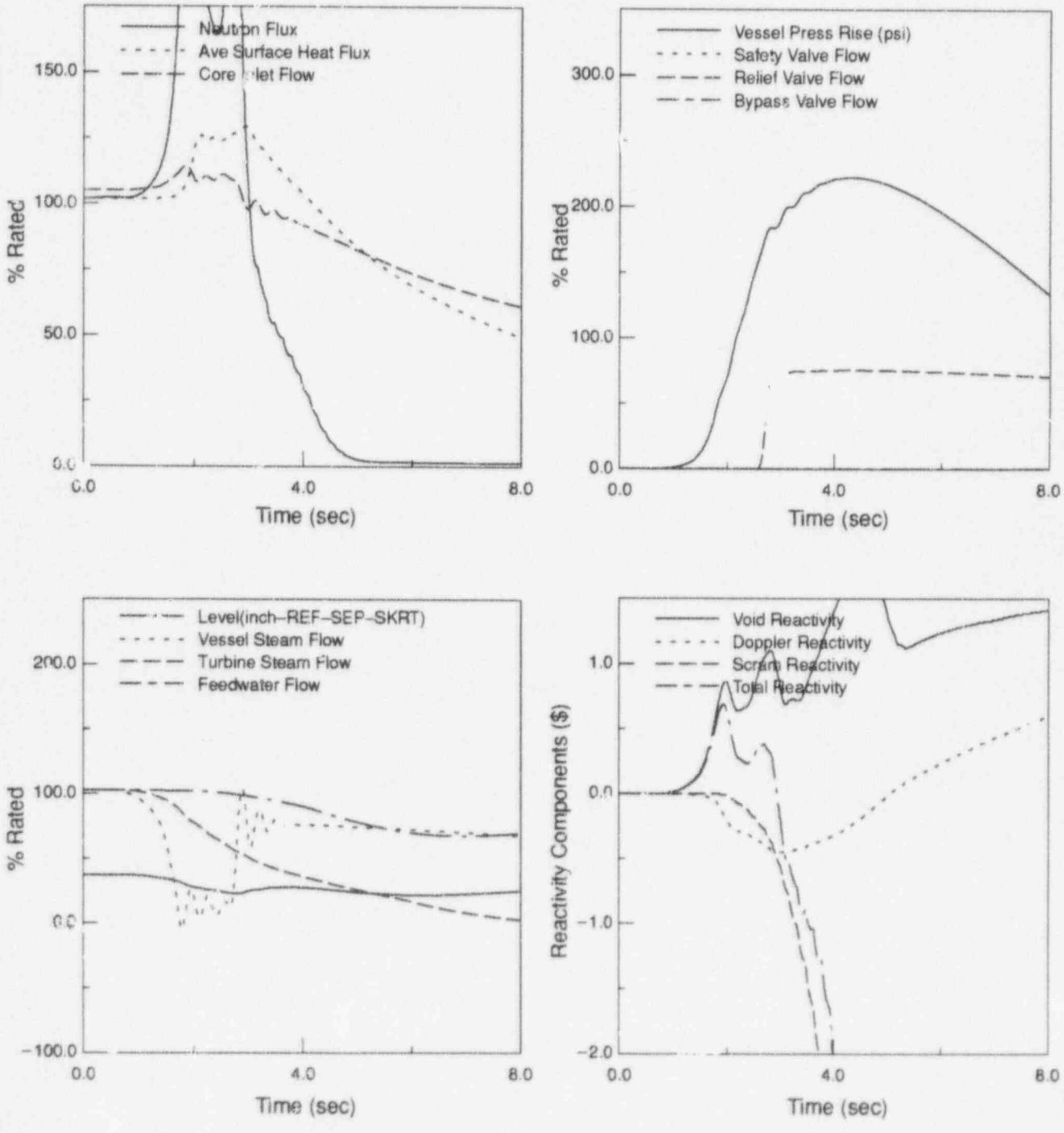


Figure 17 Plant Response to MSIV Closure (Flux Scram)

Appendix A
Analysis Conditions

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

Table A–1

Parameter	Analysis Value			
	ICF	MELLL	ICF and FWTR	MSIVOOS and ICF
Thermal power, MWt	2436.0	2436.0	2436.0	2436.0
Core flow, Mlb/hr	80.8	57.8	80.8	80.8
Reactor pressure, psia	1036.0	1030.5	1018.2	1036.0
Inlet enthalpy, BTU/lb	528.0	519.9	512.4	528.0
Non–fuel power fraction	0.037	0.037	0.037	0.037
Steam flow analysis, Mlb/hr	10.48	10.45	8.79	10.48
Dome pressure, psig	1005.0	1005.0	988.8	1020.0
Turbine pressure, psig	949.3	949.6	949.3	925.7
No. of Safety/Relief Valves	9	9	9	11
Relief mode lowest setpoint, psig	1116.0	1116.0	1116.0	1116.0
Recirculation pump power source	on–site[5]	on–site[5]	on–site[5]	on–site[5]
Turbine control valve mode of operation	Partial arc	Partial arc	Partial arc	Partial arc

5. Bounds operation with off–site power source for reload licensing events for Cycle 12.

Appendix B
Main Steamline Isolation Valve Out of Service

Reference B–1 provided a basis for operation of Brunswick Steam Electric Plant (BSEP) with one Main Steamline Isolation Valve Out of Service (MSIVOOS) (three steamline operation) and all S/RVs in service. For this mode of operation in BSEP Unit 2 throughout Cycle 12, the MCPR limits presented in Section 11 of this report are bounding and should be applied when operating in the MSIVOOS mode at any time during the cycle. The peak steamline and peak vessel pressures for the limiting overpressurization event (MSIV closure with flux scram) were not calculated for the MSIVOOS mode of operation. In this mode of operation it is required that all S/RVs be operational versus the assumed 2 S/RVs OOS for the events evaluated during normal plant operation. Previous cycles analyses have shown that the MSIV closure with flux scram, evaluated in the MSIVOOS mode, has resulted in the peak vessel pressure being reduced by more than 25 psi, when compared to the same case evaluated with all (four) steamlines operational.

Reference

B–1. *Main Steamline Isolation Valve Out of Service for the Brunswick Steam Electric Plant*, EAS–117–0987, GE Nuclear Energy, April 1988.

Appendix C
Decrease in Core Coolant Temperature Events

The Loss of Feedwater Heater (LFWH) event and the HPCI inadvertent start–up event are the only cold water injection AOOs checked on a cycle–by–cycle basis. A Cycle 11 analysis showed a LFWH ΔCPR of 0.13 and a Cycle 10 analysis showed a HPCI inadvertent start–up ΔCPR of 0.15. There is no reason why these events would be expected to be more severe for Cycle 12. The results of the AOOs presented in Section 11 of this report sufficiently bound the expected results of the LFWH and HPCI inadvertent start–up events, therefore these events were not analyzed for Cycle 12.

Appendix D
Feedwater Temperature Reduction (FWTR)

Reference D–1 provides the basis for operation of the Brunswick Steam Electric Plant with FWTR. The MCPR limits presented in Section 11 of this report are bounding and should be applied when operating with FWTR. Previous analysis has shown the FWCF event is most severe at ICF and FWTR.

Reference

D–1. *Feedwater Temperature Reduction with Maximum Extended Load Line Limit and Increased Core Flow for Brunswick Steam Electric Plant Units 1 and 2*, NEDC–32457P, Revision 1, December 1995.

Appendix E
Maximum Extended Operating Domain

Reference E–1 provided a basis for operation of the Brunswick Steam Electric Plant in the Maximum Extended Operating Domain (MEOD). The reload licensing analysis performed for Cycle 12 and documented herein is consistent with and provide the cycle–specific update to the reference E–1 analysis. Application of the GEXL–PLUS correlation to the reload fuel has been confirmed as required in reference E–1. The applicability of GE13 was addressed and found acceptable.

Reference

E–1. *Maximum Extended Operating Domain Analysis for Brunswick Steam Electric Plant*, NEDC–31654P, GE Nuclear Energy (Proprietary), February 1989.

ENCLOSURE 4

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-324/LICENSE NO. DPR-62
TRANSMITTAL OF CORE OPERATING LIMITS REPORT, SUPPLEMENTAL RELOAD LICENSING REPORT, AND LOSS-OF-COOLANT-ACCIDENT ANALYSIS REPORT

AFFIDAVIT FROM GENERAL ELECTRIC NUCLEAR ENERGY
REGARDING WITHHOLDING FROM PUBLIC DISCLOSURE
IN ACCORDANCE WITH 10 CFR 2.790

GE Nuclear Energy

General Electric Company
P. O. Box 780, Wilmington, NC 28402

Affidavit

I, James F. Klapproth, being duly sworn, depose and state as follows:

(1) I am Manager, Product Definition, General Electric Company ("GE") and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in the document *Loss-of-Coolant Accident Analysis Report for Brunswick Steam Electric Plant Unit 2 Reload 11 Cycle 12*, NEDC-31624P, Supplement 2, Revision 3, January 1996.

(3) In making this application for withholding of proprietary information of which it is the owner, GE relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), 2.790(a)(4), and 2.790(d)(1) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information," and some portions also qualify under the narrower definition of "trade secret," within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by General Electric's competitors without license from General Electric constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals cost or price information, production capacities, budget levels, or commercial strategies of General Electric, its customers, or its suppliers;

d. Information which reveals aspects of past, present, or future General Electric customer-funded development plans and programs, of potential commercial value to General Electric;

e. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in both paragraphs (4)a. and (4)b., above.

(5) The information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GE, and is in fact so held. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in (6) and (7) following. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GE, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within GE is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GE are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2) is classified as proprietary because it would provide other parties, including competitors, with information related to details of GE fuel designs, analysis results and potential commercial offerings which GE has developed at considerable expense.

The testing, development and approval of these fuel designs was achieved at a significant cost, on the order of several million dollars, to GE.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GE's competitive position and foreclose or reduce the availability of profit-making opportunities. The fuel design is part of GE's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical, and NRC review costs comprise a substantial investment of time and money by GE.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GE's competitive advantage will be lost if its competitors are able to use the results of the GE experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GE would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GE of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

State of North Carolina)
County of New Hanover) SS:

James F. Klapproth, being duly sworn, deposes and says:

That he has read the foregoing affidavit and the matters stated therein are true and correct to the best of his knowledge, information, and belief.

Executed at Wilmington, North Carolina, this 30th day of January, 1996

James F Klapproth

James F. Klapproth
General Electric Company

ROSA L. DAVIS
NOTARY
PUBLIC
NEW HANOVER COUNTY, NC

Subscribed and sworn before me this 30th day of JANUARY, 1996

Rosa L. Davis

Notary Public, State of North Carolina

My Commission Expires 12-14-97

ENCLOSURE 6

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NO. 2
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TRANSMITTAL OF CORE OPERATING LIMITS REPORT, SUPPLEMENTAL RELOAD LICENSING REPORT, AND LOSS-OF-COOLANT-ACCIDENT ANALYSIS REPORT

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(8) The information identified in paragraph (2) is classified as proprietary because it would provide other parties, including competitors, with information related to detailed results of analytical models, methods and processes, including computer codes, which GE has developed, requested NRC approval of, and applied to perform evaluations of the BWR. The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GE asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GE's competitive position and foreclose or reduce the availability of profit-making opportunities. The fuel design is part of GE's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

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James F. Klapproth
General Electric Company

ROSA L. DAVIS
NOTARY
PUBLIC
NEW HANOVER COUNTY, NC

Subscribed and sworn before me this 30th day of JANUARY, 1996

Notary Public, State of North Carolina

My commission
expires 12-14-97