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Revision 0
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November 1995

Supplemental Reload Licensing Report
for
RIVER BEND STATION
Reload 6 Cycle 7

GE Nuclear Energy

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for

River Bend Station

Reload 6 Cycle 7

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Important Notice Regarding

Contents of This Report

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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 D. P. Stier. The Supplemental Reload Licensing Report was prepared by D. P. Stier. This document has been verified by W. E. Russell and J. L. Rash.

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: Alternate Analysis for Feedwater Temperature Reduction
Appendix C: Basis for Analysis of Loss-of-Feedwater Heater Event
Appendix D: Basis for Analysis of Core-Wide and Overpressurization Transients
Appendix E: Basis for Analysis of Loss-of-Coolant Accident
Appendix F: Basis for Analysis of Standby Liquid Control System Shutdown Capability
Appendix G: Plant Operation Above the Rated Load Line Up to Rated Power

2. Reload Fuel Bundles

Fuel Type	**Cycle Loaded**	**Number**
Irradiated:		
GE8B-P8SQB333-10GZ-120M-4WR-150-T (GE8x8EB)	4	8
GE8B-P8SQB334-10GZ-120M-4WR-150-T (GE8x8EB)	5	196
GE8B-P8SQB334-10GZ2-120M-4WR-150-T (GE8x8EB)	6	132
GE8B-P8SQB334-11GZ-120M-4WR-150-T (GE8x8EB)	6	56
New:		
GE11-P9SUB353-10GZ-120T-146-T (GE11)	7	128
GE11-P9SUB354-13GZ-120T-146-T (GE11)	7	64
GE11-P9SUB354-14GZ-120T-146-T (GE11)	7	40
Total		624

3. Reference Core Loading Pattern

Nominal previous cycle core average exposure at end of cycle:	26043 MWd/MT (23626 MWd/ST)
Minimum previous cycle core average exposure at end of cycle from cold shutdown considerations:	25259 MWd/MT (22915 MWd/ST)
Assumed reload cycle core average exposure at beginning of cycle:	13188 MWd/MT (11964 MWd/ST)
Assumed reload cycle core average exposure at end of cycle:	26250 MWd/MT (23814 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	1.118
Fully controlled	0.953
Strongest control rod out	0.981
R, Maximum increase in cold core reactivity with exposure into cycle, Δk	0.003

5. Standby Liquid Control System Shutdown Capability (See Appendix F)

Boron (ppm)	Shutdown Margin (Δk) (20°C, Xenon Free)
660	0.021

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

Exposure: BOC7 to EOC7 100%P/100%F

Fuel Design	Peaking Factors: Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE11	1.45	1.39	1.36	1.035	6.307	112.4	1.27
GE8x8EB	1.20	1.51	1.40	1.051	6.821	109.7	1.17

Exposure: BOC7 to EEOC7 WITH ICF 100%P/107%F

Fuel Design	Peaking Factors: Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE11	1.45	1.40	1.38	1.035	6.333	120.9	1.27
GE8x8EB	1.20	1.51	1.40	1.051	6.826	118.3	1.18

Exposure: BOC7 to EEEOC7 WITH ICF AND FFWTR 100%P/107%F 320 Deg. F

Fuel Design	Peaking Factors: Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE11	1.45	1.46	1.37	1.035	6.612	119.6	1.25
GE8x8EB	1.20	1.55	1.40	1.051	7.016	116.9	1.18

Exposure: BOC7 to EOC7 FWTR 100%P/100%F 320 Deg. F							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE11	1.45	1.46	1.34	1.035	6.581	111.1	1.25
GE8x8EB	1.20	1.55	1.40	1.051	6.990	108.4	1.17

Exposure: BOC7 to EOC7 – HALING 100%P/100%F							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE11	1.45	1.50	1.16	1.035	6.768	108.0	1.25
GE8x8EB	1.20	1.56	1.40	1.051	7.079	108.0	1.12

Exposure: BOC7 to EEOC7 WITH ICF – HALING 100%P/107%F							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE11	1.45	1.50	1.18	1.035	6.778	116.5	1.26
GE8x8EB	1.20	1.57	1.40	1.051	7.123	116.3	1.13

Exposure: BOC7 to EEEOC7 WITH ICF AND FFWTR – HALING 100%P/107%F 320 Deg.F							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE11	1.45	1.55	1.23	1.035	6.993	115.4	1.25
GE8x8EB	1.20	1.61	1.40	1.051	7.273	115.1	1.14

Exposure: BOC7 to EOC7 WITH FFWTR – HALING–100%P/100%F 320 Deg. F							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE11	1.45	1.54	1.21	1.035	6.947	107.1	1.24
GE8x8EB	1.20	1.60	1.40	1.051	7.245	106.7	1.12

Exposure: BOC7 to EOC7-3693 MWd/MT (3350 MWd/ST) 100%P/100%F							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE11	1.45	1.56	1.41	1.035	7.056	105.0	1.24
GE8x8EB	1.20	1.60	1.40	1.051	7.261	106.9	1.09

Exposure: BOC7 to EOC7-3693 MWd/MT (3350 MWd/ST) 100%P/107%F							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE11	1.45	1.57	1.39	1.035	7.093	113.0	1.26
GE8x8EB	1.20	1.61	1.40	1.051	7.301	115.1	1.10

Exposure: BOC7 to EOC7-3693 MWd/MT (3350 MWd/ST) 100%P/107%F 320 Deg. F							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE11	1.45	1.66	1.42	1.035	7.489	110.0	1.22
GE8x8EB	1.20	1.66	1.40	1.051	7.513	111.1	1.09

Exposure: BOC7 to EOC7-3693 MWd/MT (3350 MWd/ST) 100%P/100%F 320 Deg. F							
	Peaking Factors						
Fuel Design	Local	Radial	Axial	R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
GE11	1.45	1.65	1.44	1.035	7.449	102.1	1.20
GE8x8EB	1.20	1.66	1.40	1.051	7.500	102.9	1.08

7. Selected Margin Improvement Options

Recirculation pump trip:	Yes
Rod withdrawal limiter:	Yes
Thermal power monitor:	Yes
Improved scram time:	No
Measured scram time:	No
Exposure dependent limits:	Yes
Exposure points analyzed:	2

8. Operating Flexibility Options

Single-loop operation:	Yes
Load line limit:	No (See Appendix G)
Extended load line limit:	No
Maximum extended load line limit:	No
Increased core flow throughout cycle:	Yes
Flow point analyzed:	107.0 %
Increased core flow at EOC:	Yes
Feedwater temperature reduction throughout cycle:	Yes
Temperature reduction:	100.0°F
Final feedwater temperature reduction:	Yes
ARTS Program:	No
Maximum extended operating domain:	No
Moisture separator reheater OOS:	No
Turbine bypass system OOS:	No
Safety/relief valves OOS:	No (See Appendix D)
ADS OOS:	No
EOC RPT OOS:	No
Main steam isolation valves OOS:	No
Feedwater Heater OOS	Yes

9. Core–wide AOO Analysis Results

Methods used: GEMINI; GEXL–PLUS

Exposure range: BOC7 to EOC7 100%P/100%F					
			Uncorrected ΔCPR		
Event	**Flux (%NBR)**	**Q/A (%NBR)**	**GE11**	**GE8x8EB**	**Fig.**
FW Controller Failure	291	113	0.18	0.09	2
Load Reject w/o Bypass	386	114	0.20	0.10	3
Turbine Trip w/o Bypass	336	112	0.18	0.08	4
Press. Regulator Failure	144	104	0.09	0.04	5

Exposure range: BOC7 to EEOC7 EEOC WITH ICF 100%P/107%F					
			Uncorrected ΔCPR		
Event	**Flux (%NBR)**	**Q/A (%NBR)**	**GE11**	**GE8x8EB**	**Fig.**
FW Controller Failure	329	115	0.18	0.10	6
Load Reject w/o Bypass	429	116	0.20	0.12	7
Turbine Trip w/o Bypass	381	113	0.19	0.10	8
Press. Regulator Failure	144	105	0.09	0.04	9

Exposure range: BOC7 to EEEOC7 WITH ICF AND FFWTR 100%P/107%F 320 Deg. F.					
			Uncorrected ΔCPR		
Event	**Flux (%NBR)**	**Q/A (%NBR)**	**GE11**	**GE8x8EB**	**Fig.**
FW Controller Failure	311	118	0.18	0.11	10
Load Reject w/o Bypass	381	115	0.18	0.10	11
Turbine Trip w/o Bypass	335	112	0.16	0.08	12
Press. Regulator Failure	146	105	0.10	0.05	13

Exposure range: BOC7 to EOC7 – 100%P/100%F 320 Deg. F					
			Uncorrected ΔCPR		
Event	**Flux (%NBR)**	**Q/A (%NBR)**	**GE11**	**GE8x8EB**	**Fig.**
FW Controller Failure	289	116	0.18	0.10	14
Load Reject w/o Bypass	361	114	0.18	0.09	15
Turbine Trip w/o Bypass	314	111	0.16	0.07	16
Press. Regulator Failure	144	105	0.10	0.04	17

Exposure range: BOC7 to EOC7 – HALING 100%P/100%F					
			Uncorrected ΔCPR		
Event	Flux (%NBR)	Q/A (%NBR)	GE11	GE8x8EB	Fig.
FW Controller Failure	198	107	0.16	0.04	18
Load Reject w/o Bypass	267	108	0.18	0.05	19
Turbine Trip w/o Bypass	231	105	0.16	0.03	20
Press. Regulator Failure	142	103	0.07	0.03	21

Exposure range: BOC7 to EEOC7 WITH ICF – HALING 100%P/107%F					
			Uncorrected ΔCPR		
Event	Flux (%NBR)	Q/A (%NBR)	GE11	GE8x8EB	Fig.
FW Controller Failure	229	109	0.17	0.05	22
Load Reject w/o Bypass	313	110	0.19	0.07	23
Turbine Trip w/o Bypass	266	107	0.17	0.05	24
Press. Regulator Failure	143	104	0.07	0.03	25

Exposure range: BOC7 to EEEOC7 WITH ICF AND FFWTR – HALING 100%P/107%F					
			Uncorrected ΔCPR		
Event	Flux (%NBR)	Q/A (%NBR)	GE11	GE8x8EB	Fig.
FW Controller Failure	234	112	0.18	0.07	26
Load Reject w/o Bypass	310	110	0.18	0.07	27
Turbine Trip w/o Bypass	256	107	0.16	0.04	28
Press. Regulator Failure	144	104	0.09	0.03	29

Exposure range: BOC7 to EOC7 – HALING–100%P/100%F 320 Deg. F					
			Uncorrected ΔCPR		
Event	Flux (%NBR)	Q/A (%NBR)	GE11	GE8x8EB	Fig.
FW Controller Failure	205	110	0.17	0.05	30
Load Reject w/o Bypass	274	108	0.17	0.05	31
Turbine Trip w/o Bypass	228	105	0.15	0.03	32
Press. Regulator Failure	144	104	0.08	0.03	33

Exposure range: BOC7 to EOC7-3693 MWd/MT (3350 MWd/ST) 100%P/100%F					
			Uncorrected ΔCPR		
Event	Flux (%NBR)	Q/A (%NBR)	GE11	GE8x8EB	Fig.
FW Controller Failure	153	104	0.14	0.03	34
Load Reject w/o Bypass	204	104	0.17	0.02	35
Turbine Trip w/o Bypass	184	102	0.15	0.00	36
Press. Regulator Failure	143	103	0.06	0.03	37

Exposure range: BOC7 to EOC7-3693 MWd/MT (3350 MWd/St) 100%P/107%F					
			Uncorrected ΔCPR		
Event	Flux (%NBR)	Q/A (%NBR)	GE11	GE8x8EB	Fig.
FW Controller Failure	174	105	0.16	0.03	38
Load Reject w/o Bypass	234	106	0.19	0.03	39
Turbine Trip w/o Bypass	205	103	0.17	0.01	40
Press. Regulator Failure	143	103	0.06	0.03	41

Exposure range: BOC7 to EOC7-3693 MWd/MT (3350 MWd/ST) 100%P/107%F 320 Deg. F					
			Uncorrected ΔCPR		
Event	Flux (%NBR)	Q/A (%NBR)	GE11	GE8x8EB	Fig.
FW Controller Failure	144	108	0.14	0.06	42
Load Reject w/o Bypass	196	104	0.15	0.01	43
Turbine Trip w/o Bypass	168	101	0.13	0.00	44
Press. Regulator Failure	144	104	0.06	0.03	45

Exposure range: BOC7 to EOC7-3693 MWd/MT (3350 MWd/ST) 100%P/100%F 320 Deg. F					
			Uncorrected ΔCPR		
Event	Flux (%NBR)	Q/A (%NBR)	GE11	GE8x8EB	Fig.
FW Controller Failure	129	108	0.13	0.05	46
Load Reject w/o Bypass	173	102	0.13	0.01	47
Turbine Trip w/o Bypass	150	100	0.11	0.00	48
Press. Regulator Failure	144	103	0.06	0.03	49

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-US is not applied. A cycle-specific rod withdrawal analysis found the ΔMCPR to be 0.13 based upon a one foot withdrawal, and is not bounded by the generic RWE analysis reported in the referenced report.

11. Cycle MCPR Values[1]

Safety limit: 1.07

Single loop operation safety limit: 1.08

Non-pressurization events:

Exposure range: BOC7 to EOC7		
	GE11	GE8x8EB
Rod Withdrawal Error	1.20	1.20
Loss of Feedwater Heating	1.18	1.18
Fuel Loading Error – Rotated	1.17	1.22
Fuel Loading Error – Mislocated	1.22	1.22

Pressurization events:[2]

Exposure range: BOC7 to EOC7 100%P/100F Exposure point: EOC7		
	GE11	GE8x8EB
FW Controller Failure	1.26	1.17
Load Reject w/o Bypass	1.28	1.18
Turbine Trip w/o Bypass	1.27	1.16
Press. Regulator Failure	1.17	1.12

Exposure range: BOC7 to EEOC7 WITH ICF 100%P/107%F Exposure point: EEOC7		
	GE11	GE8x8EB
FW Controller Failure	1.27	1.18
Load Reject w/o Bypass	1.29	1.19
Turbine Trip w/o Bypass	1.27	1.17
Press. Regulator Failure	1.17	1.12

1. For single-loop operation, the MCPR operating limit is 0.01 greater than the two-loop value.

2. ECCS MCPR value is limiting for GE11 fuel (1.28), the ECCS MCPR value for GE8 fuel is 1.17.

Exposure range: BOC7 to EEEOC WITH ICF AND FFWTR 100%P/107%F 320 Deg. F Exposure point: EEEOC7		
	GE11	**GE8x8EB**
FW Controller Failure	1.27	1.19
Load Reject w/o Bypass	1.26	1.18
Turbine Trip w/o Bypass	1.25	1.16
Press. Regulator Failure	1.19	1.13

Exposure range: BOC7 to EOC7 100%P/100%F 320 Deg. F Exposure point: EOC7		
	GE11	**GE8x8EB**
FW Controller Failure	1.26	1.18
Load Reject w/o Bypass	1.26	1.17
Turbine Trip w/o Bypass	1.25	1.15
Press. Regulator Failure	1.18	1.12

Exposure range: BOC7 to EOC7 – HALING 100%P/100%F Exposure point: EOC7		
	GE11	**GE8x8EB**
FW Controller Failure	1.24	1.12
Load Reject w/o Bypass	1.27	1.13
Turbine Trip w/o Bypass	1.25	1.11
Press. Regulator Failure	1.15	1.11

Exposure range: BOC7 to EEOC7 WITH ICF – HALING 100%P/107%F Exposure point: EOC7		
	GE11	**GE8x8EB**
FW Controller Failure	1.25	1.13
Load Reject w/o Bypass	1.28	1.14
Turbine Trip w/o Bypass	1.26	1.12
Press. Regulator Failure	1.15	1.11

Exposure range: BOC7 to EEEOC7 WITH ICF AND FFWTR – HALING 100%P/107%F Exposure point: EEEOC7		
	GE11	**GE8x8EB**
FW Controller Failure	1.26	1.15
Load Reject w/o Bypass	1.27	1.14
Turbine Trip w/o Bypass	1.25	1.12
Press. Regulator Failure	1.18	1.11

Exposure range: BOC7 to EOC7 FFWTR –HALING--100%P/100%F Exposure point: EOC7		
	GE11	GE8x8EB
FW Controller Failure	1.25	1.13
Load Reject w/o Bypass	1.25	1.13
Turbine Trip w/o Bypass	1.23	1.10
Press. Regulator Failure	1.17	1.11

Exposure range: BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) 100%P/100%F Exposure point: EOC7–3693 MWd/MT (3350 MWd/ST)		
	GE11	GE8x8EB
FW Controller Failure	1.19	nc*
Load Reject w/o Bypass	1.23	nc
Turbine Trip w/o Bypass	1.21	nc
Press. Regulator Failure	1.15	nc

* nc = not calculated

Exposure range: BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) 100%P/107%F Exposure point: EOC7–3693 MWd/MT (3350 MWd/ST)		
	GE11	GE8x8EB
FW Controller Failure	1.21	nc
Load Reject w/o Bypass	1.25	nc
Turbine Trip w/o Bypass	1.23	nc
Press. Regulator Failure	1.15	nc

Exposure range: BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) 100%P/107%F 320 Deg.F. Exposure point: EOC7–3693 MWd/MT (3350 MWd/ST)		
	GE11	GE8x8EB
FW Controller Failure	1.20	nc
Load Reject w/o Bypass	1.21	nc
Turbine Trip w/o Bypass	1.19	nc
Press. Regulator Failure	1.15	nc

Exposure range: BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) 100%P/100%F 320 Deg. F. Exposure point: EOC7–3693 MWd/MT (3350 MWd/ST)		
	GE11	GE8x8EB
FW Controller Failure	1.18	nc
Load Reject w/o Bypass	1.19	nc
Turbine Trip w/o Bypass	1.16	nc
Press. Regulator Failure	1.15	nc

12. Overpressurization Analysis Summary

Event	Psl (psig)	Pv (psig)	Plant Response
MSIV Closure (Flux Scram)	1282	1311	Figure 50

13. Loading Error Results[3]

Variable water gap misoriented bundle analysis: Yes[4]

Misoriented Fuel Bundle	ΔCPR
GE8B–P9SQB334–10GZ2–120M–4WR–150–T	0.15
GE11–P9SUB353–10GZ–120T–146–T	0.10

Mislocated bundle analysis: Yes

ΔCPR	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–US.

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.

16. Loss–of–Coolant Accident Results

LOCA method used: SAFE/REFLOOD

The following table lists the least limiting and most limiting MAPLHGRs for the new fuel: The core–wide metal water reaction is <0.23%. The peak clad temperature is ≤ 2189°F at all exposures; the local oxidation (fraction) is ≤ 0.060. The MAPLHGR multiplier for single–loop operation is 0.84 for all fuels in the core.

3. See letter, J. F. Klapproth (GE) to R. C. Jones, Jr. (NRC), Rotated Bundle Evaluation, July 20, 1992. This letter identifies that the rotation of C–lattice fuel designs may result in a significant CPR change.
4. Includes a 0.02 penalty due to variable water gap R–factor uncertainty.

16. Loss–of–Coolant Accident Results (cont)[5]

Bundle Type: GE11–P9SUB354–14GZ–120T–146–T

Average Planar Exposure		MAPLHGR(kW/ft)	
(GWd/ST)	(GWd/MT)	Most Limiting	Least Limiting
0.00	0.00	11.23	11.65
0.20	0.22	11.29	11.69
1.00	1.10	11.40	11.77
2.00	2.20	11.55	11.88
3.00	3.31	11.70	11.99
4.00	4.41	11.85	12.09
5.00	5.51	12.00	12.20
6.00	6.61	12.16	12.25
7.00	7.72	12.30	12.31
8.00	8.82	12.36	12.36
9.00	9.92	12.48	12.48
10.00	11.02	12.59	12.59
12.50	13.78	12.65	12.71
15.00	16.53	12.40	12.55
17.50	19.29	12.10	12.14
20.00	22.05	11.73	11.79
25.00	27.56	10.96	11.19
30.00	33.07	10.24	10.51
35.00	38.58	9.55	9.78
40.00	44.09	8.92	9.26
45.00	49.60	8.32	8.62
50.00	55.12	7.74	7.95
55.00	60.63	7.11	7.22
58.77	64.78	6.65	6.71
59.14	65.19	—	6.67
59.19	65.25	—	6.66

5. 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.

16. Loss-of-Coolant Accident Results (cont)[6]

Bundle Type: GE11-P9SUB354-13GZ-120T-146-T

Average Planar Exposure		MAPLHGR(kW/ft)	
(GWd/ST)	(GWd/MT)	Most Limiting	Least Limiting
0.00	0.00	11.39	11.65
0.20	0.22	11.44	11.69
1.00	1.10	11.53	11.77
2.00	2.20	11.65	11.88
3.00	3.31	11.77	11.99
4.00	4.41	11.89	12.09
5.00	5.51	12.02	12.20
6.00	6.61	12.15	12.25
7.00	7.72	12.27	12.31
8.00	8.82	12.36	12.36
9.00	9.92	12.48	12.48
10.00	11.02	12.59	12.59
12.50	13.78	12.64	12.71
15.00	16.53	12.40	12.55
17.50	19.29	12.09	12.14
20.00	22.05	11.74	11.79
25.00	27.56	10.97	11.19
30.00	33.07	10.25	10.51
35.00	38.58	9.57	9.78
40.00	44.09	8.93	9.04
45.00	49.60	8.23	8.35
50.00	55.12	7.54	7.76
55.00	60.63	6.85	7.09
58.40	64.37	6.35	6.61
58.52	64.51	—	6.59
59.19	65.25	—	6.50
59.21	65.26	—	6.49

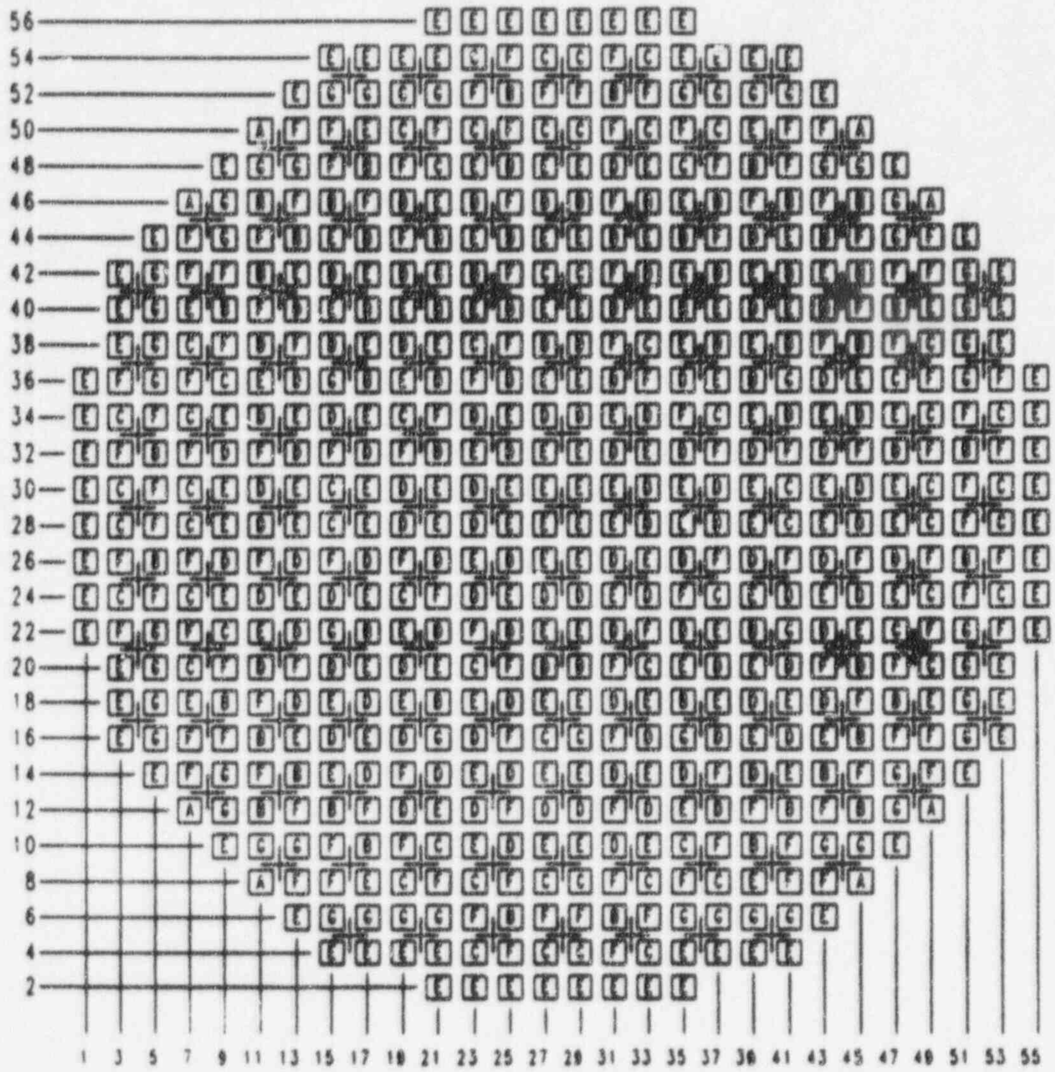
6. For format explanation, see letter J. S. Charnley (GE) to M. W. Hodges (NRC), Recommended MAPLHGR Technical Specifications for Multiple Lattice Fuel Designs, March 9, 1987. Most Limiting and Least Limiting refer to the lowest and highest limits, respectively, of any enriched lattice in the bundle.

16. Loss-of-Coolant Accident Results (cont)[7]

Bundle Type: GE11-P9SUB353-10GZ-120T-146-T

Average Planar Exposure		MAPLHGR(kW/ft)	
(GWd/ST)	(GWd/MT)	Most Limiting	Least Limiting
0.00	0.00	11.65	12.00
0.20	0.22	11.69	12.03
1.00	1.10	11.77	12.09
2.00	2.20	11.88	12.17
3.00	3.31	11.99	12.26
4.00	4.41	12.10	12.35
5.00	5.51	12.22	12.44
6.00	6.61	12.34	12.53
7.00	7.72	12.46	12.63
8.00	8.82	12.56	12.71
9.00	9.92	12.64	12.76
10.00	11.02	12.72	12.81
12.50	13.78	12.69	12.77
15.00	16.53	12.41	12.55
17.50	19.29	12.10	12.15
20.00	22.05	11.75	11.79
25.00	27.56	10.98	11.19
30.00	33.07	10.25	10.59
35.00	38.58	9.58	9.93
40.00	44.09	8.95	9.26
45.00	49.60	8.35	8.63
50.00	55.12	7.76	7.96
55.00	60.63	7.16	7.23
58.86	64.88	6.63	6.65
59.19	65.25	—	6.60
59.25	65.31	—	6.58

7. 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.



Fuel Type	
A=GE8B-P8SQB333-10GZ-120M-4WR-150-T (Cycle 4) B=GE11-P9SUB354-14GZ-120T-146-T (Cycle 7) C=GE11-P9SUB354-13GZ-120T-146-T (Cycle 7) D=GE11-P9SUB353-10GZ-120T-146-T (Cycle 7)	E=GE8B-P8SQB334-10GZ-120M-4WR-150-T (Cycle 5) F=GE8B-P8SQB334-10GZ2-120M-4WR-150-T (Cycle 6) G=GE8B-P8SQB334-11GZ-120M-4WR-150-T (Cycle 6)

Figure 1 Reference Core Loading Pattern

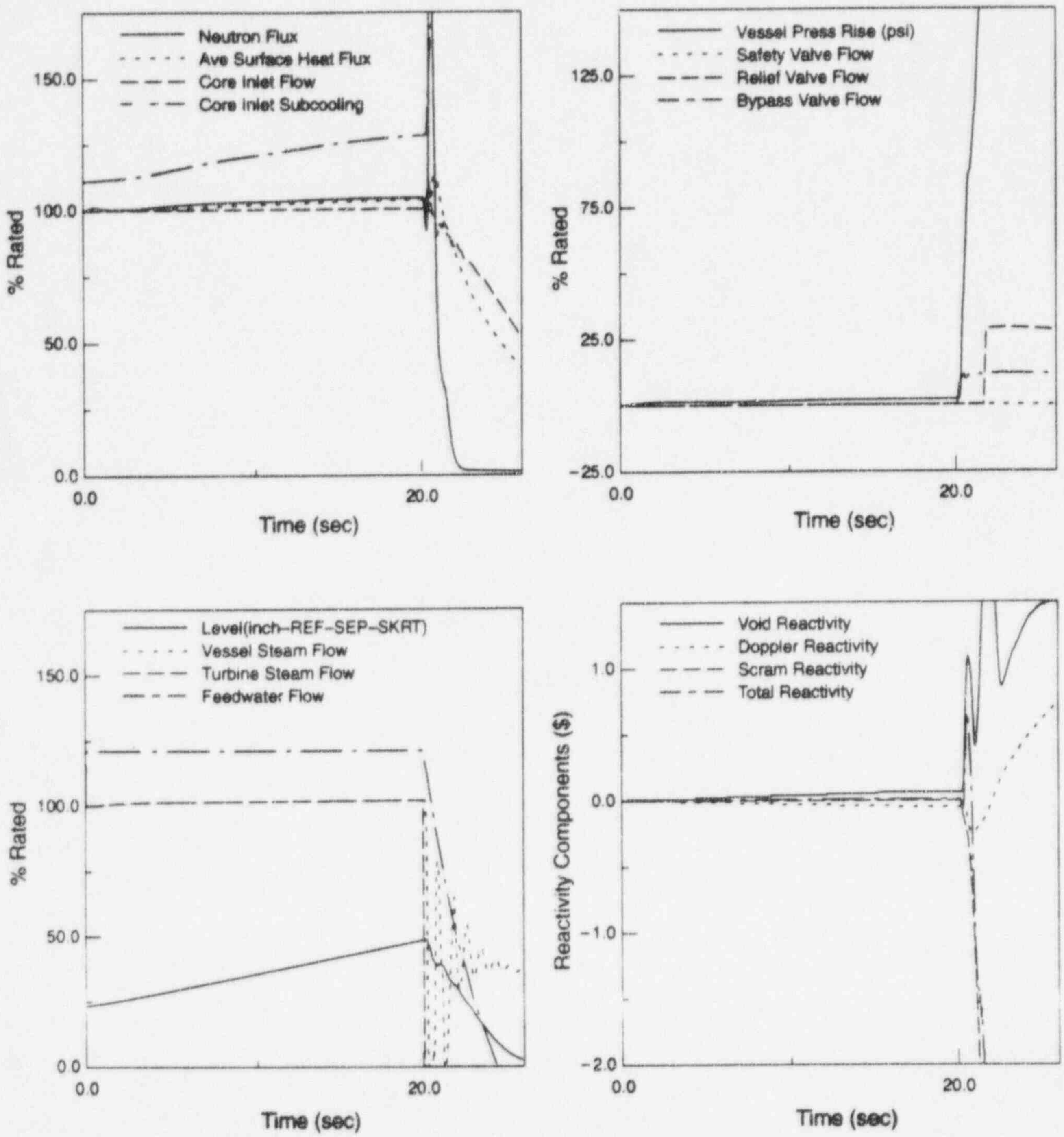


Figure 2 Plant Response to FW Controller Failure (BOC7 to EOC7 STANDARD)

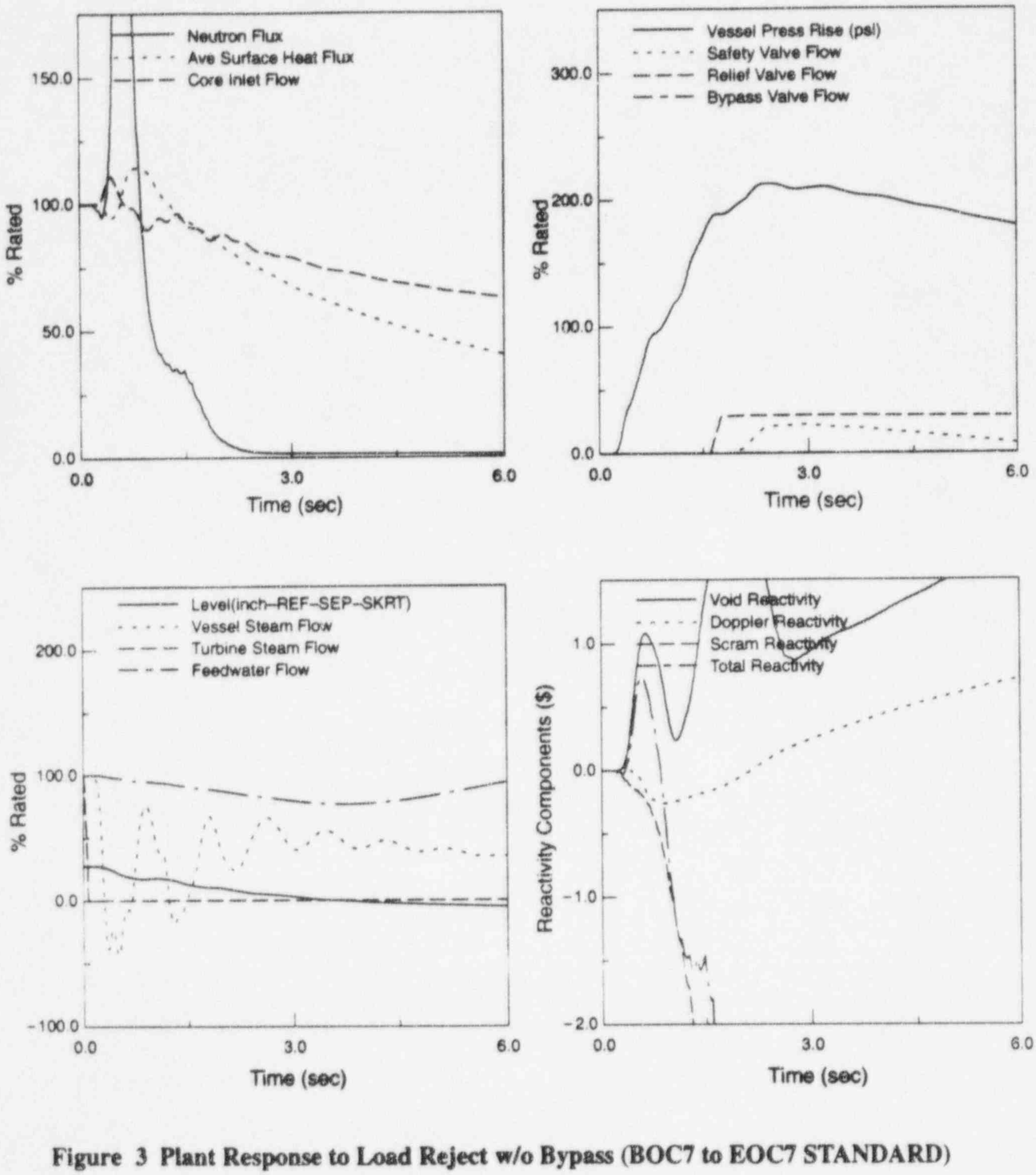


Figure 3 Plant Response to Load Reject w/o Bypass (BOC7 to EOC7 STANDARD)

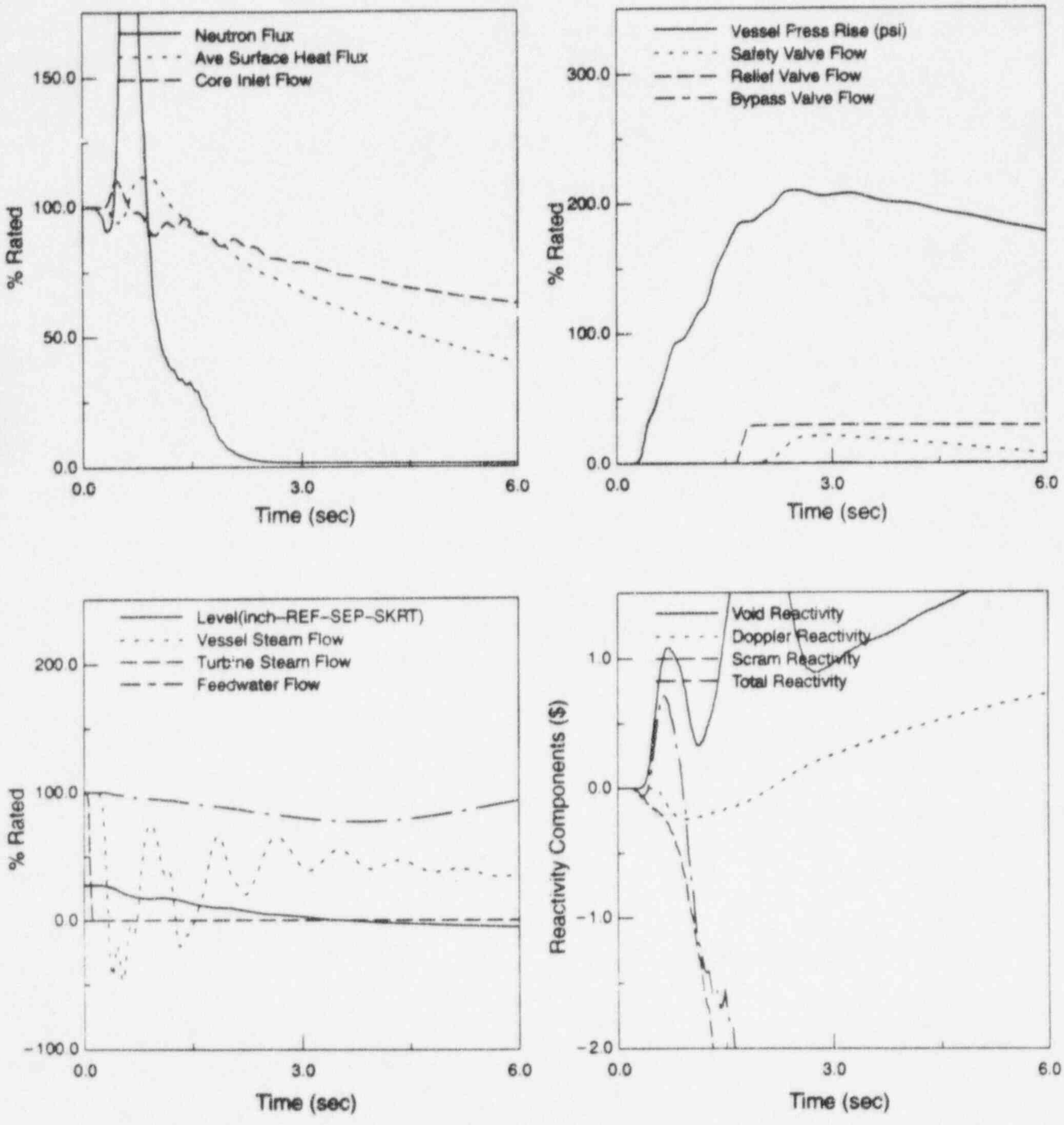


Figure 4 Plant Response to Turbine Trip w/o Bypass (BOC7 to EOC7 STANDARD)

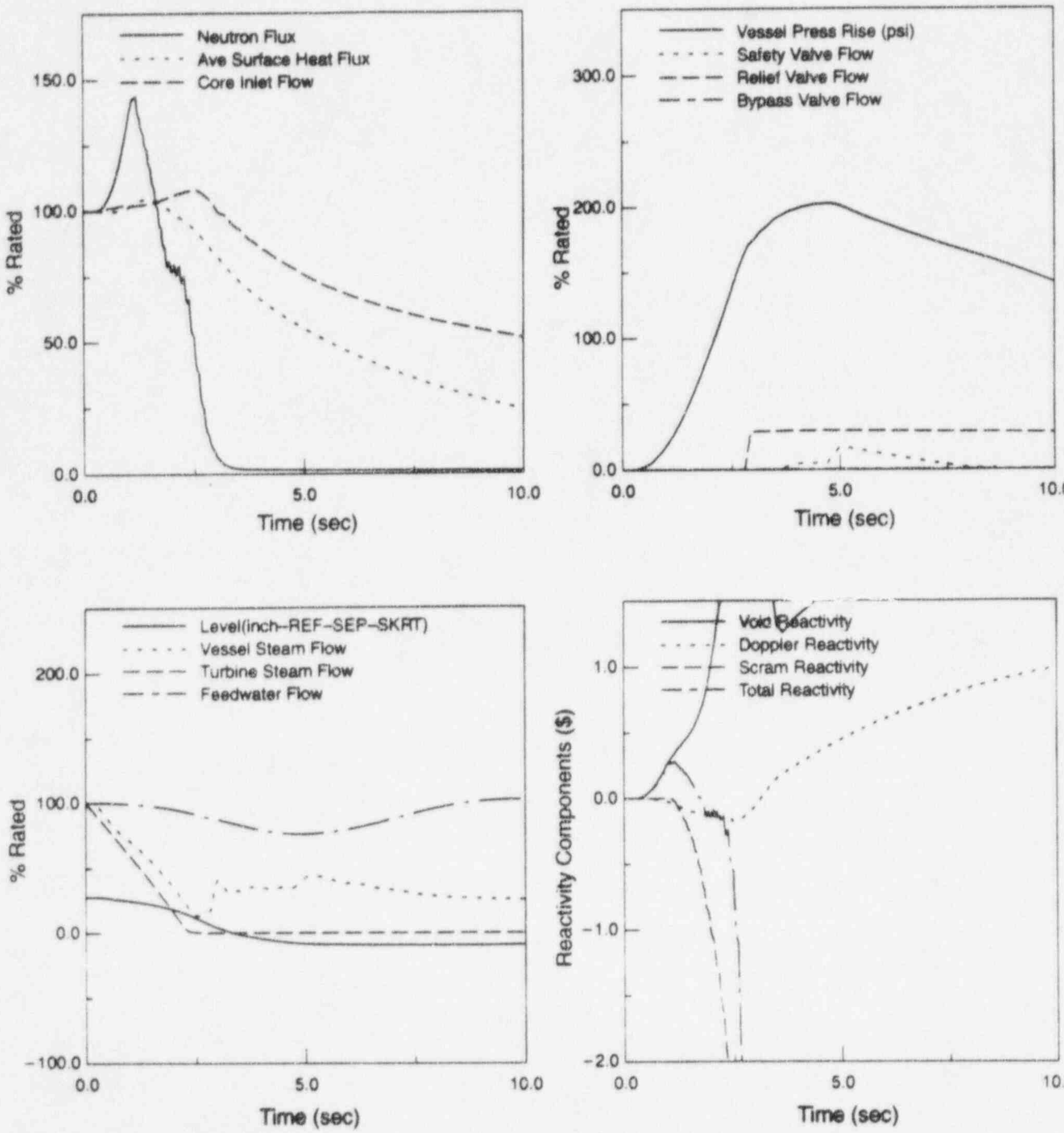


Figure 5 Plant Response to Press. Regulator Failure (BOC7 to EOC7 STANDARD)

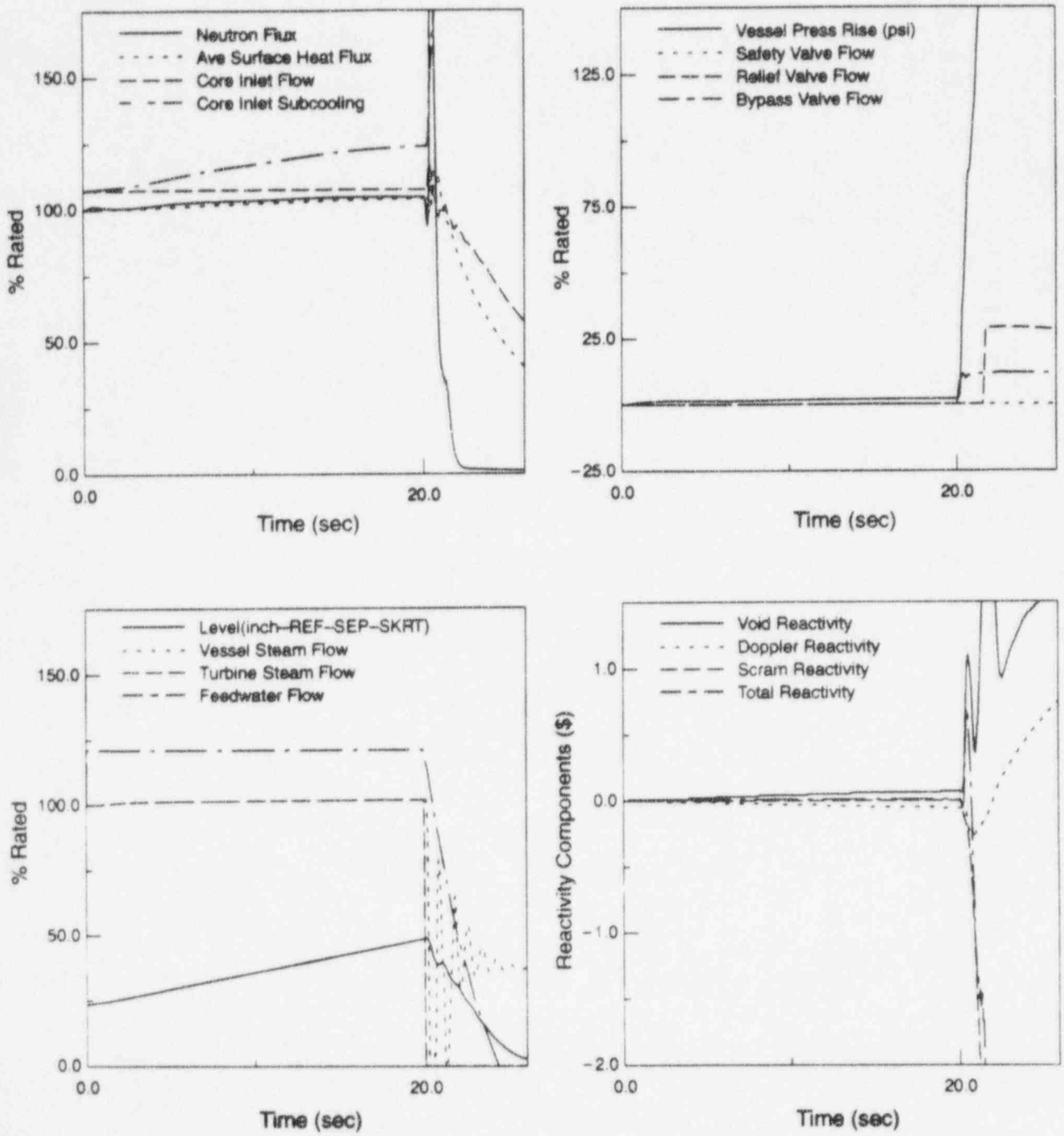


Figure 6 Plant Response to FW Controller Failure (BOC7 to EEOC7 WITH ICF)

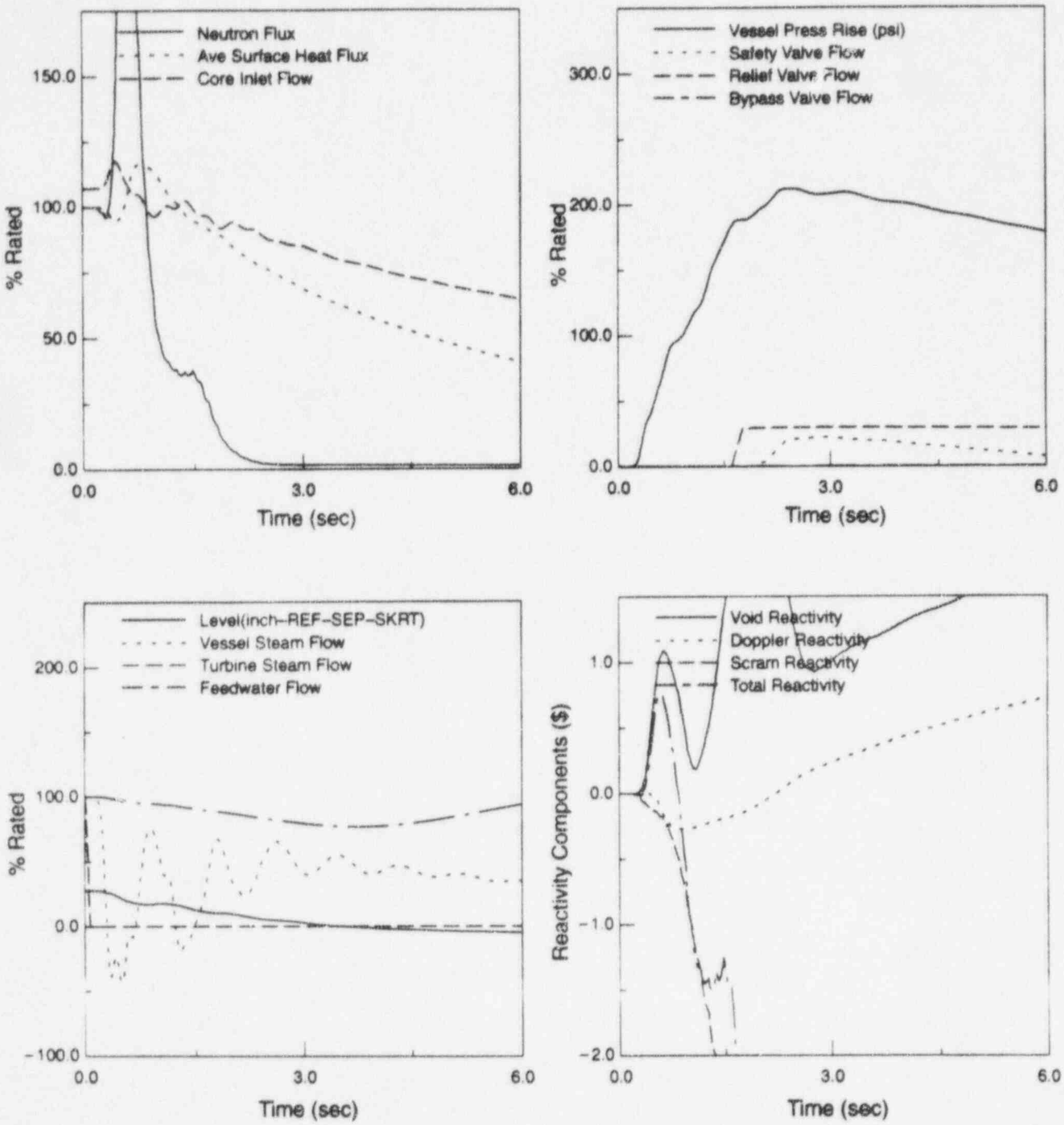


Figure 7 Plant Response to Load Reject w/o Bypass (BOC7 to EEOC7 WITH ICF)

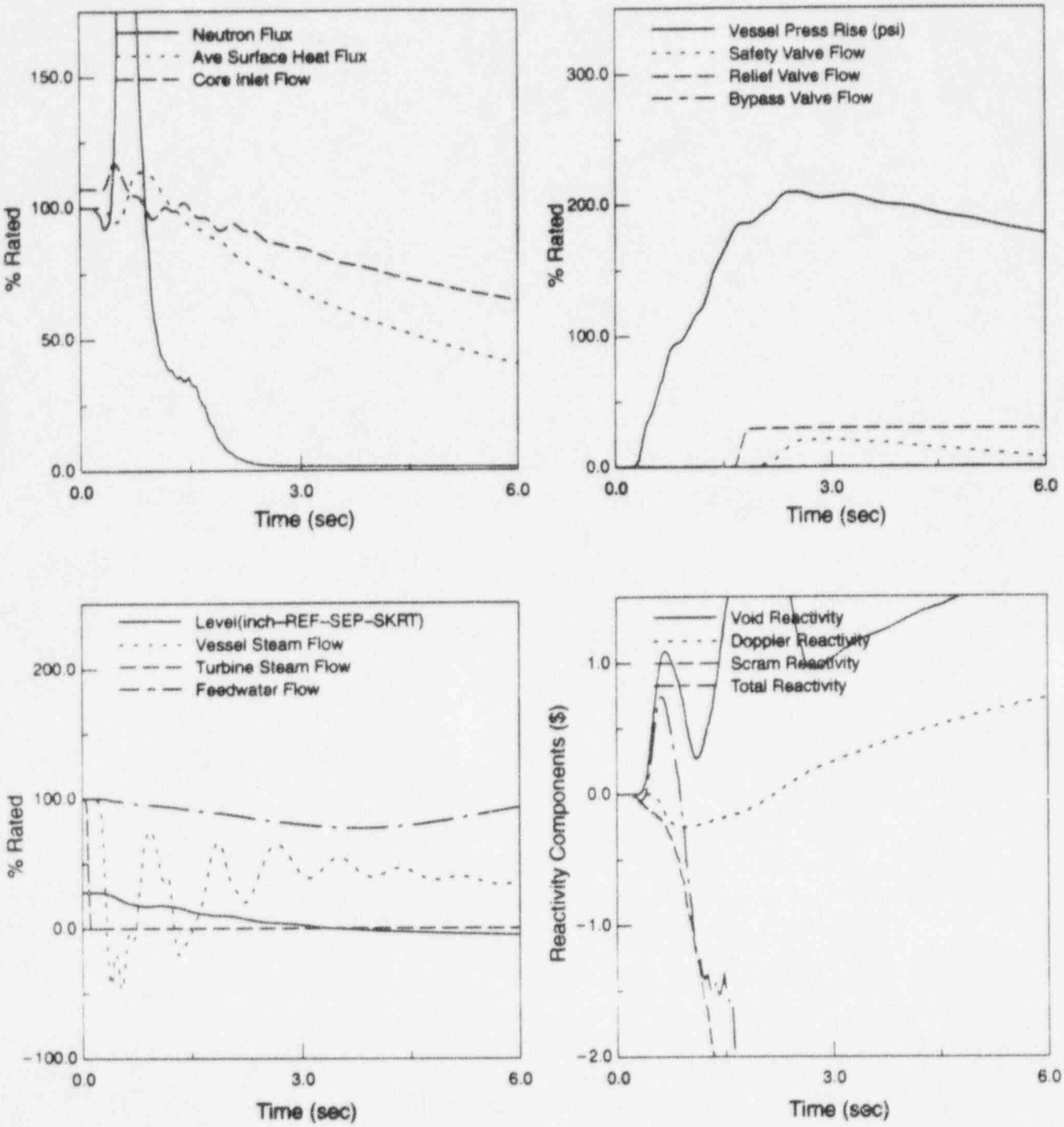


Figure 8 Plant Response to Turbine Trip w/o Bypass (BOC7 to EEOC7 WITH ICF)

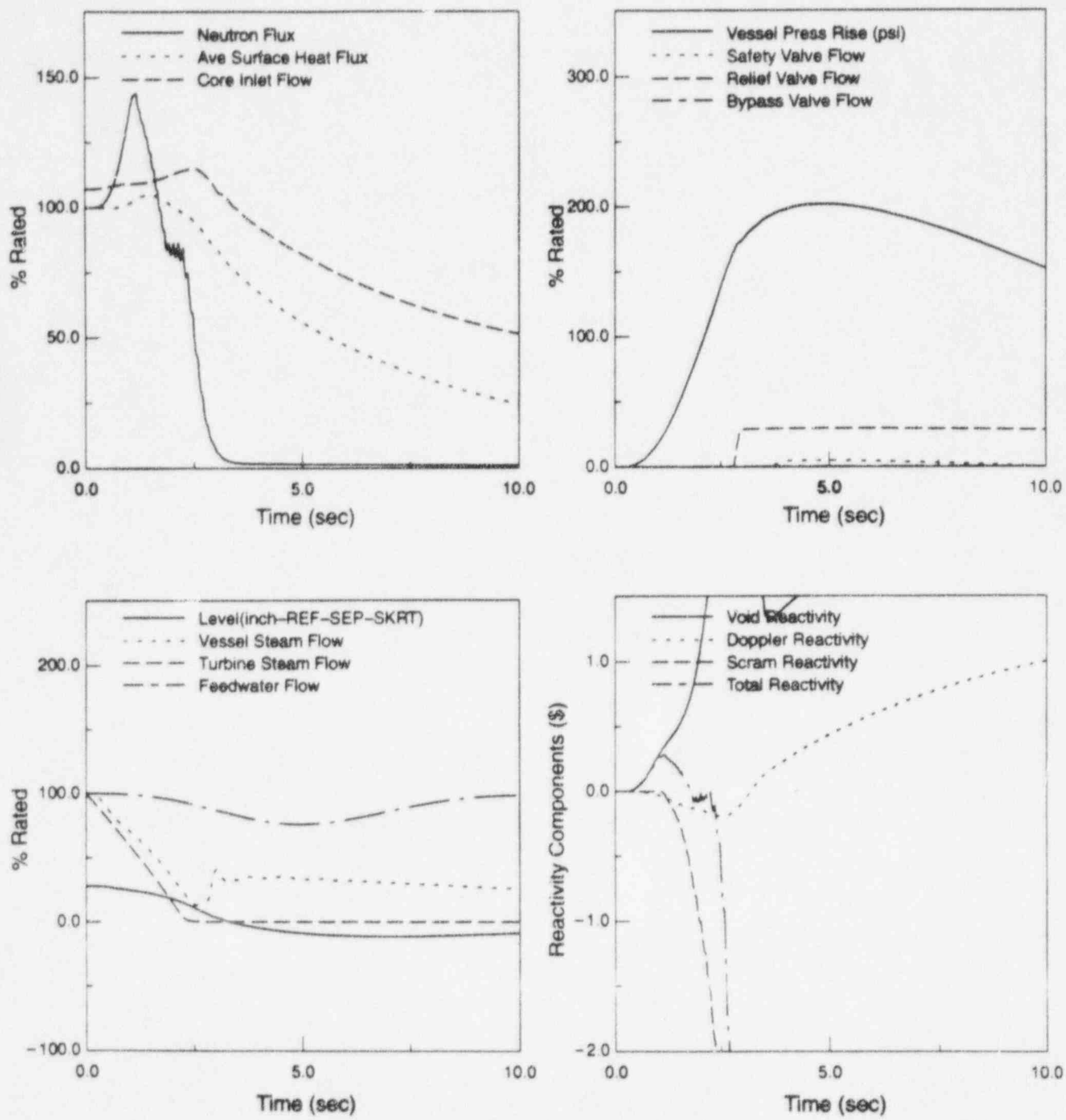


Figure 9 Plant Response to Press. Regulator Failure (BOC7 to EEOC7 WITH ICF)

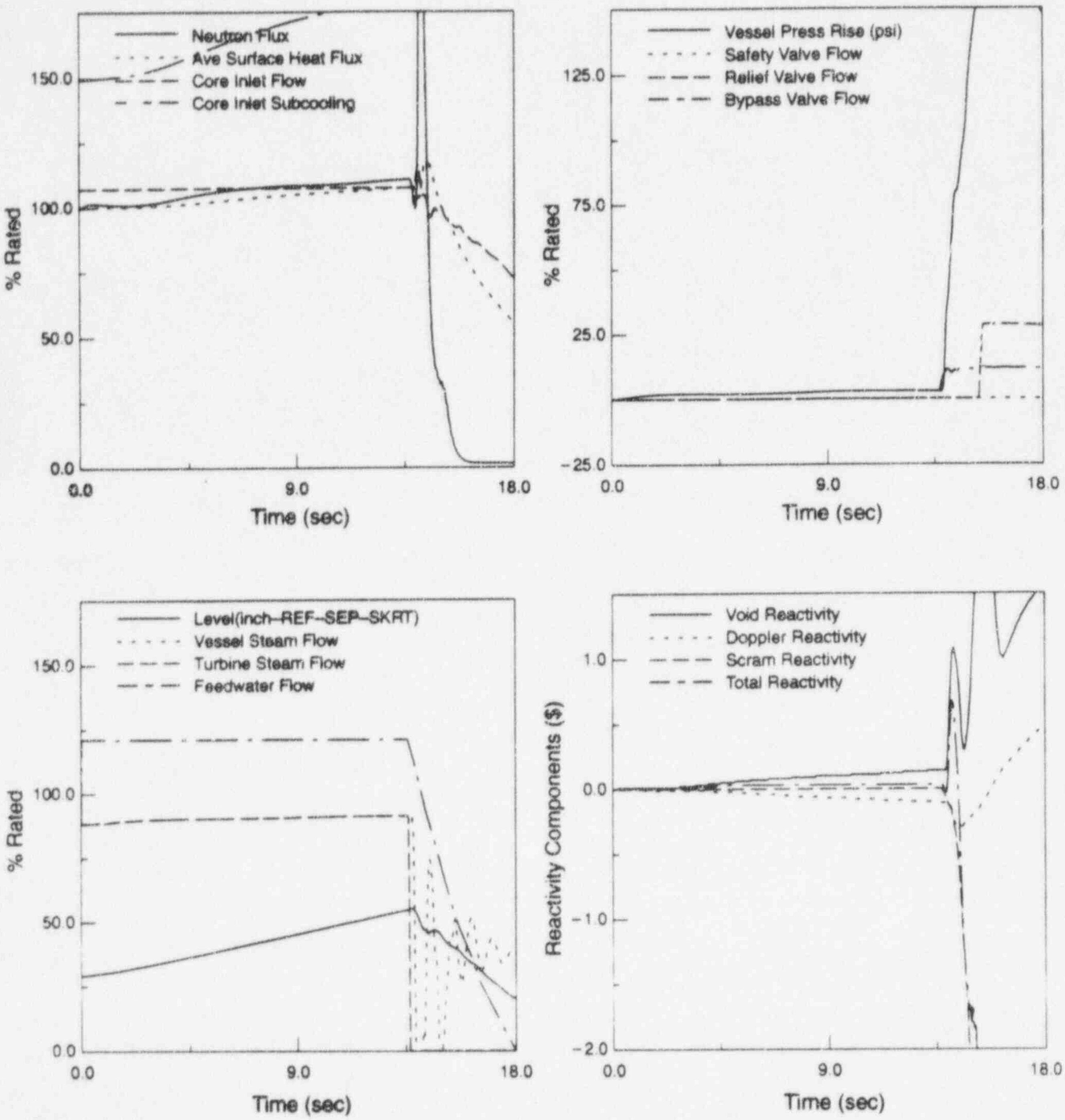


Figure 10 Plant Response to FW Controller Failure (BOC7 to EEEOC7 WITH ICF AND FFWTR)

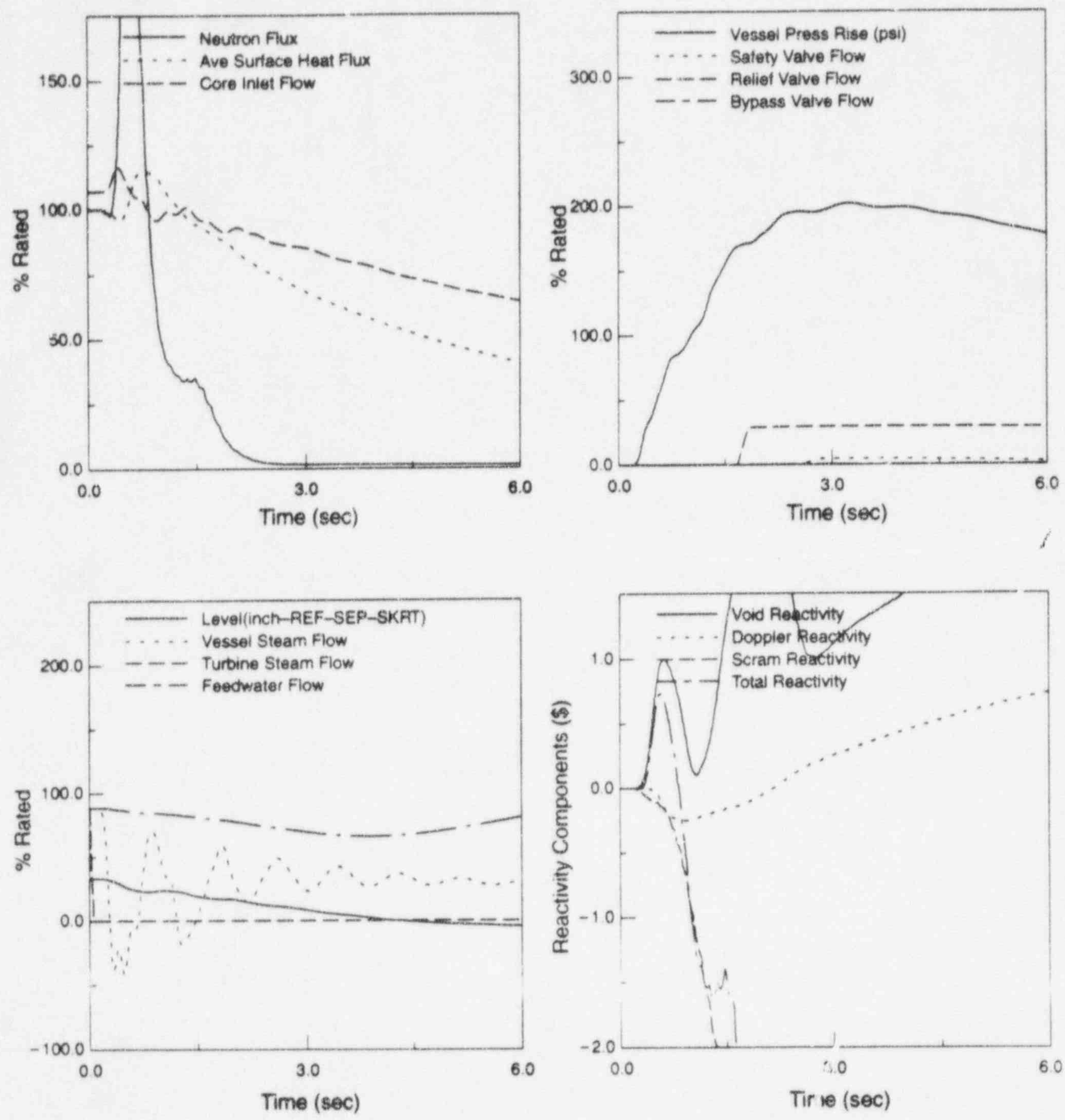


Figure 11 Plant Response to Load Reject w/o Bypass (BOC7 to EEEOC7 WITH ICF AND FFWTR)

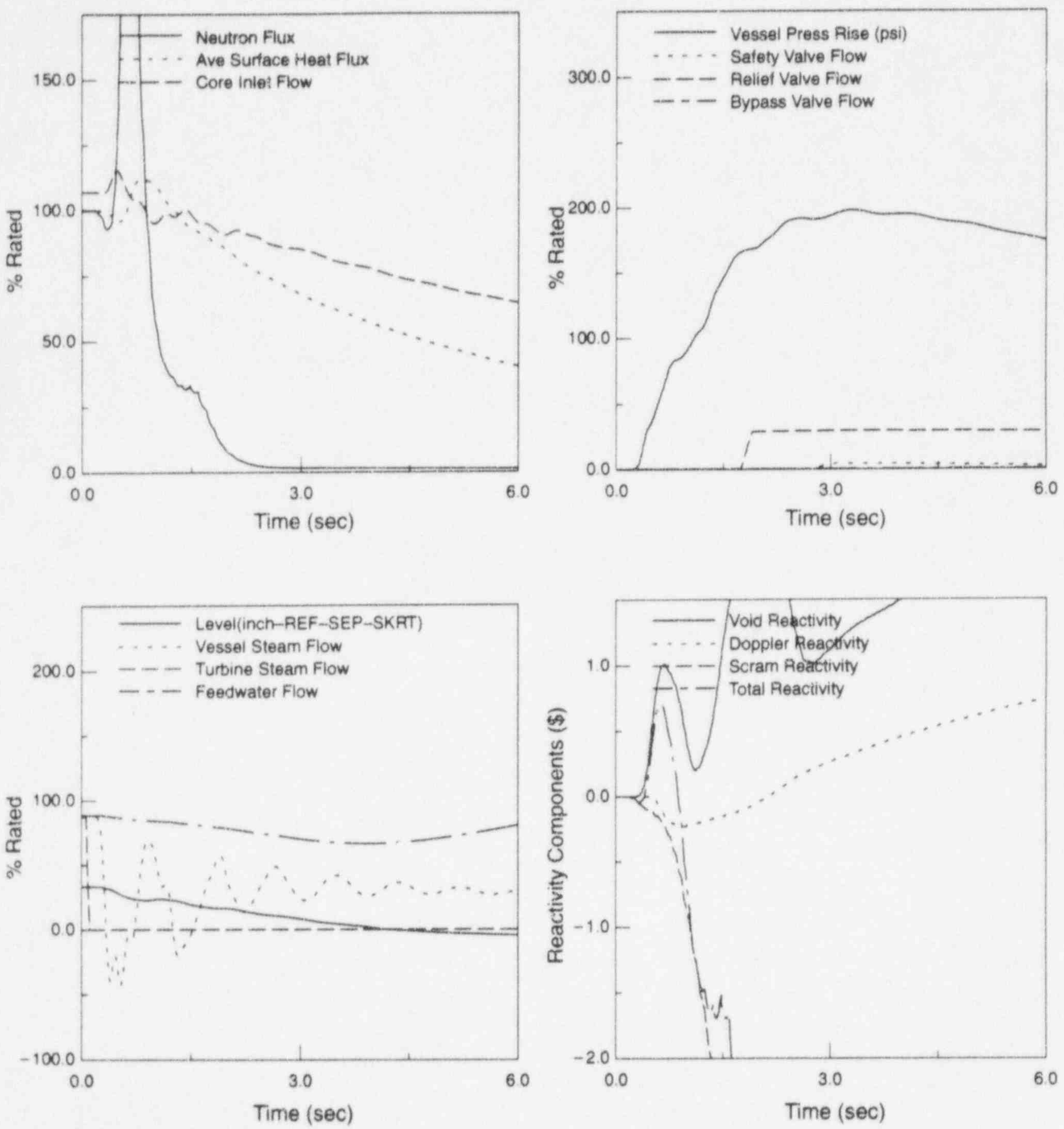


Figure 12 Plant Response to Turbine Trip w/o Bypass (BOC7 to EEEOC7 WITH ICF AND FFWTR)

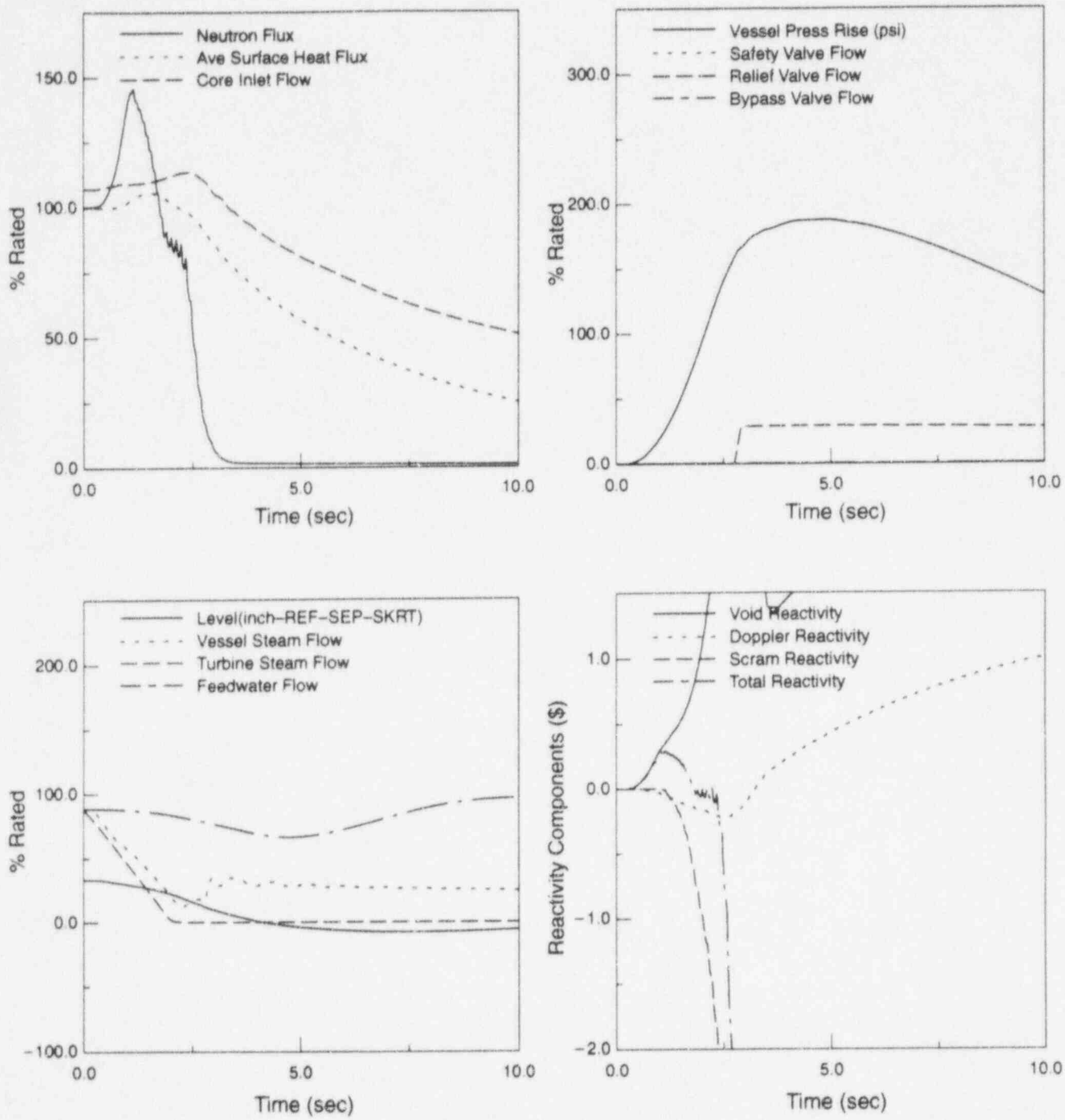


Figure 13 Plant Response to Press. Regulator Failure (BOC7 to EEEOC7 WITH ICF AND FFWTR)

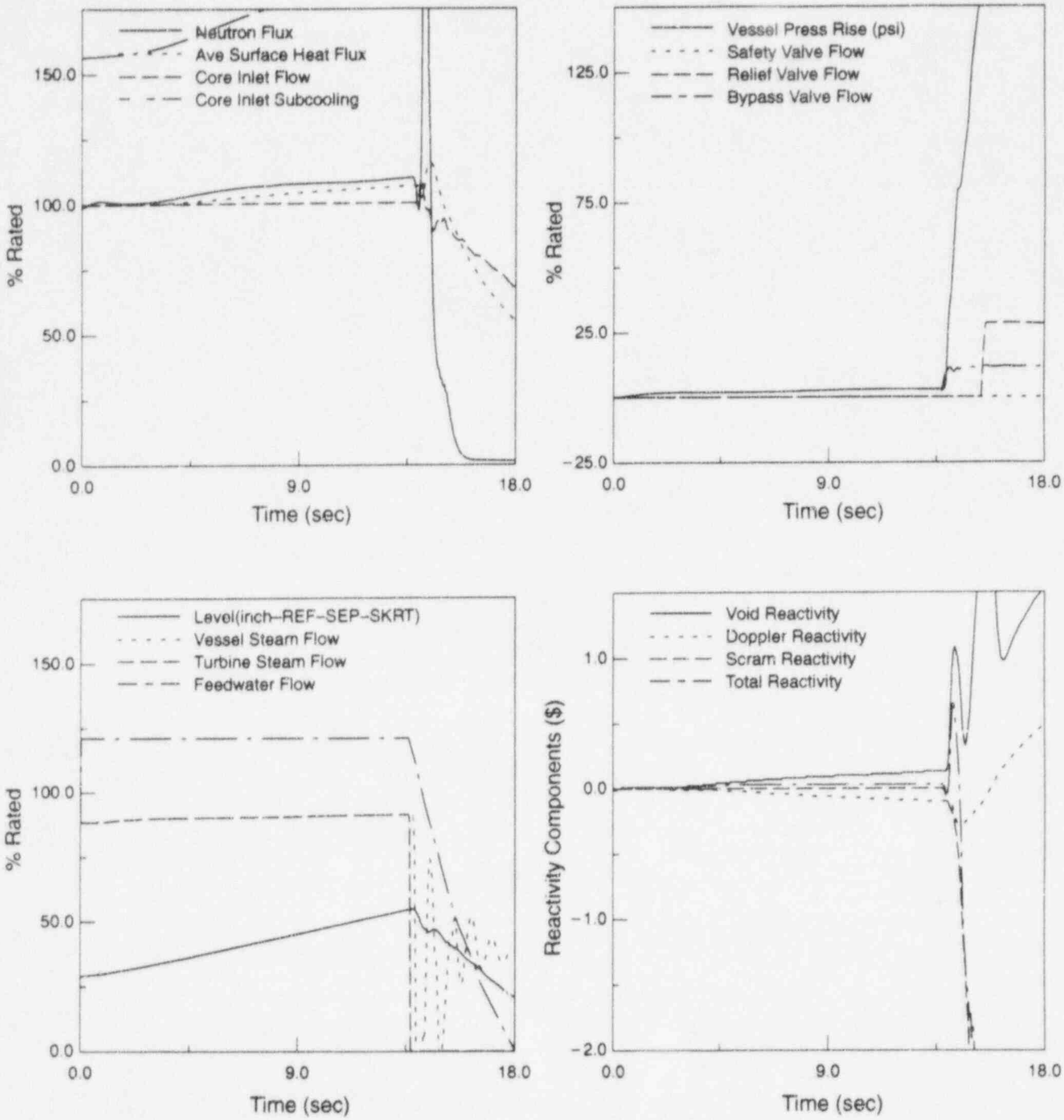


Figure 14 Plant Response to FW Controller Failure (BOC7 to EOC7 FWTR-100%P/100F)

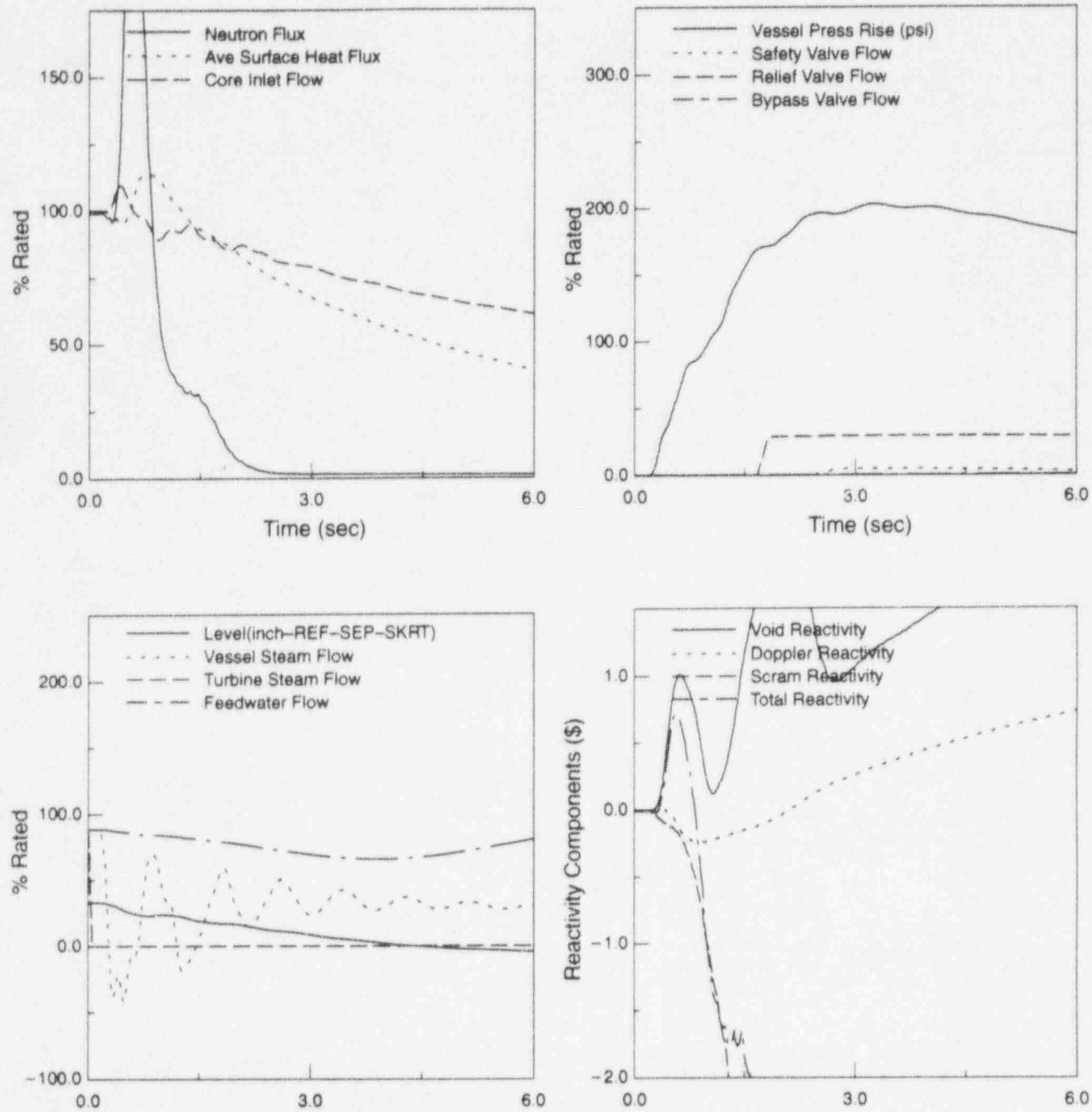


Figure 15 Plant Response to Load Reject w/o Bypass (BOC7 to EOC7 FWTR–100%P/100%F)

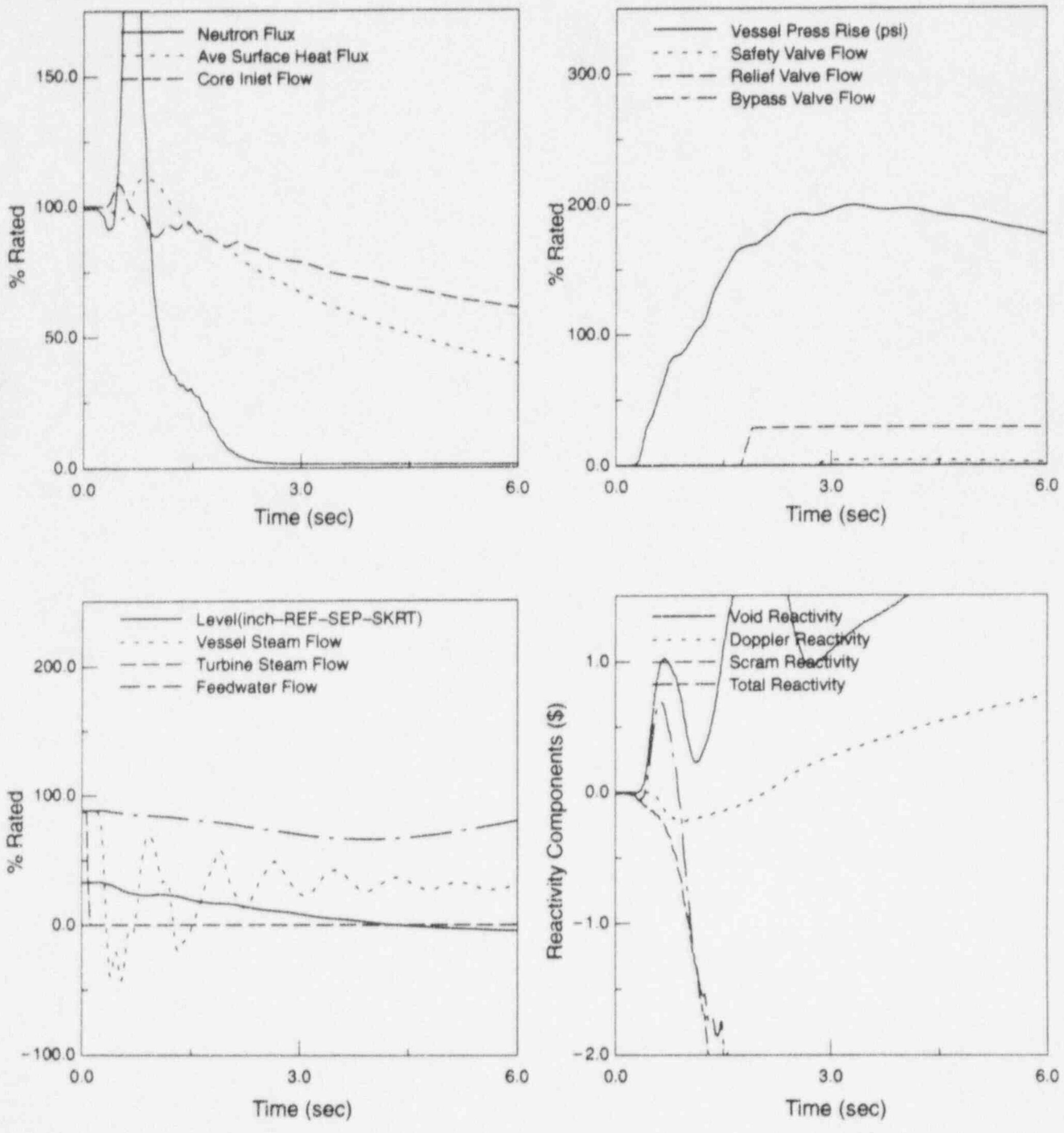


Figure 16 Plant Response to Turbine Trip w/o Bypass (BOC7 to EOC7 FWTR 100%P/100%F)

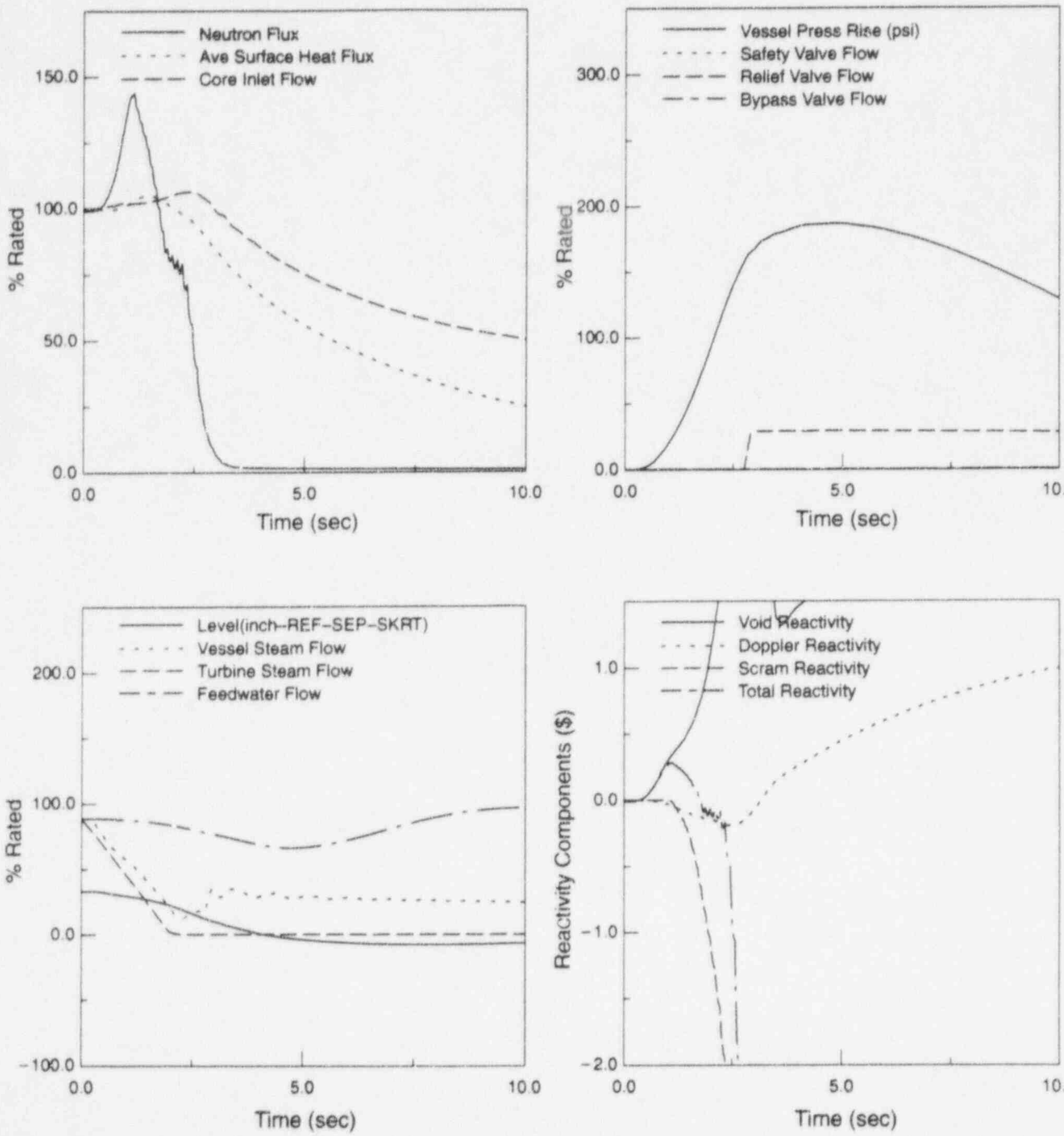


Figure 17 Plant Response to Press. Regulator Failure (BOC7 to EOC7 FWTR 100%p/100F)

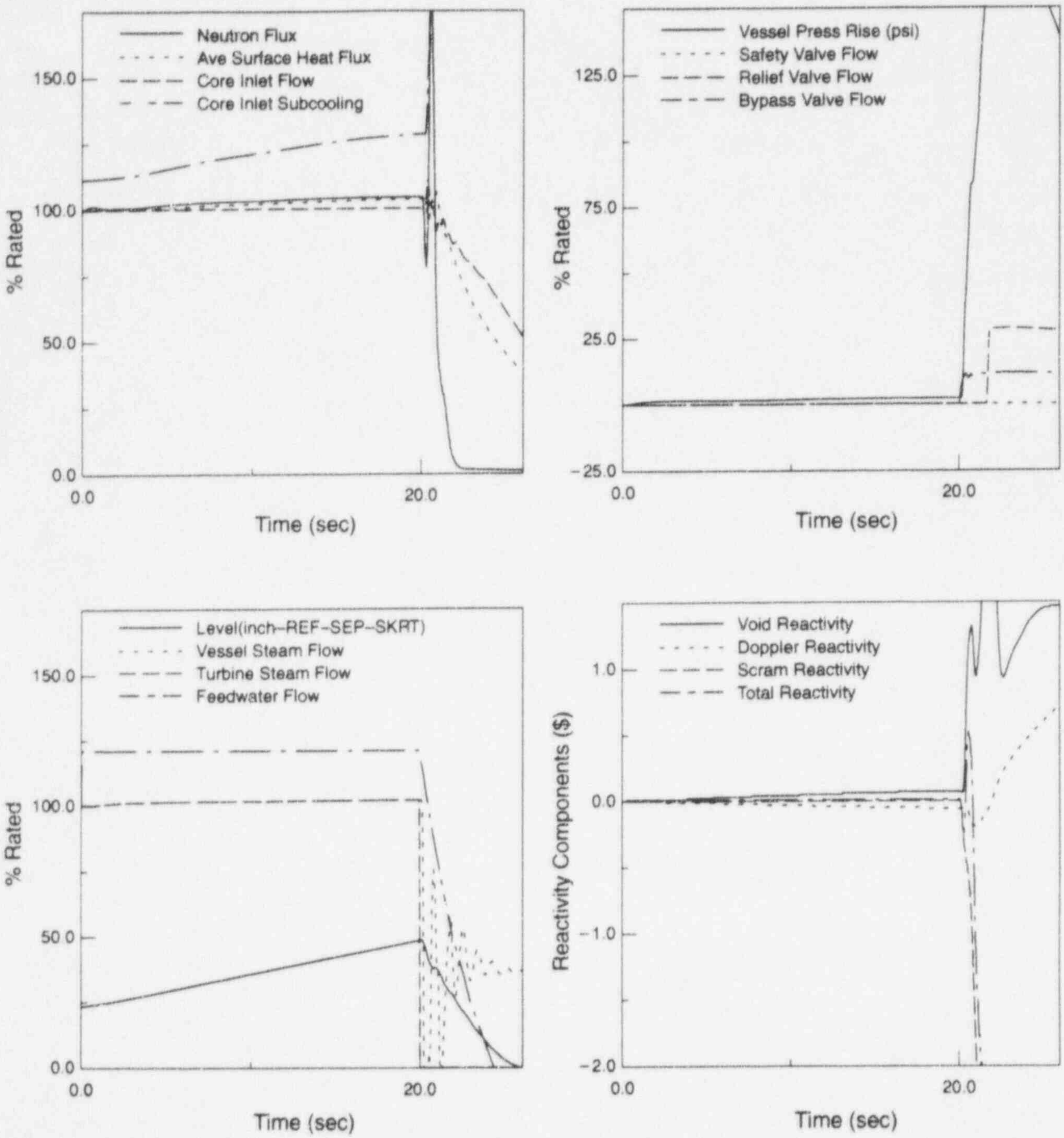


Figure 18 Plant Response to FW Controller Failure (BOC7 to EOC7 STANDARD–HALING)

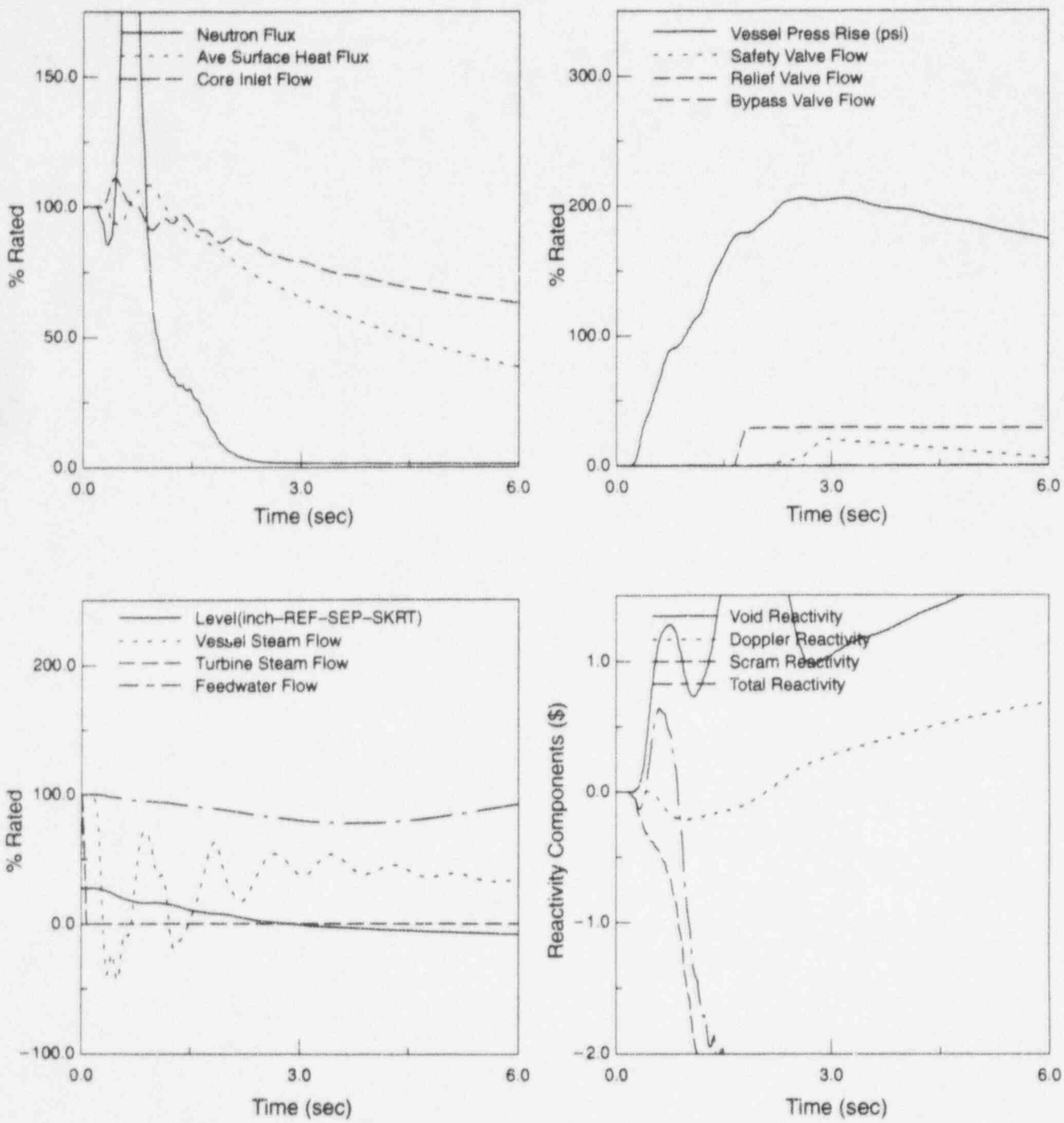


Figure 19 Plant Response to Load Reject w/o Bypass (BOC7 to EOC7 STANDARD–HALING)

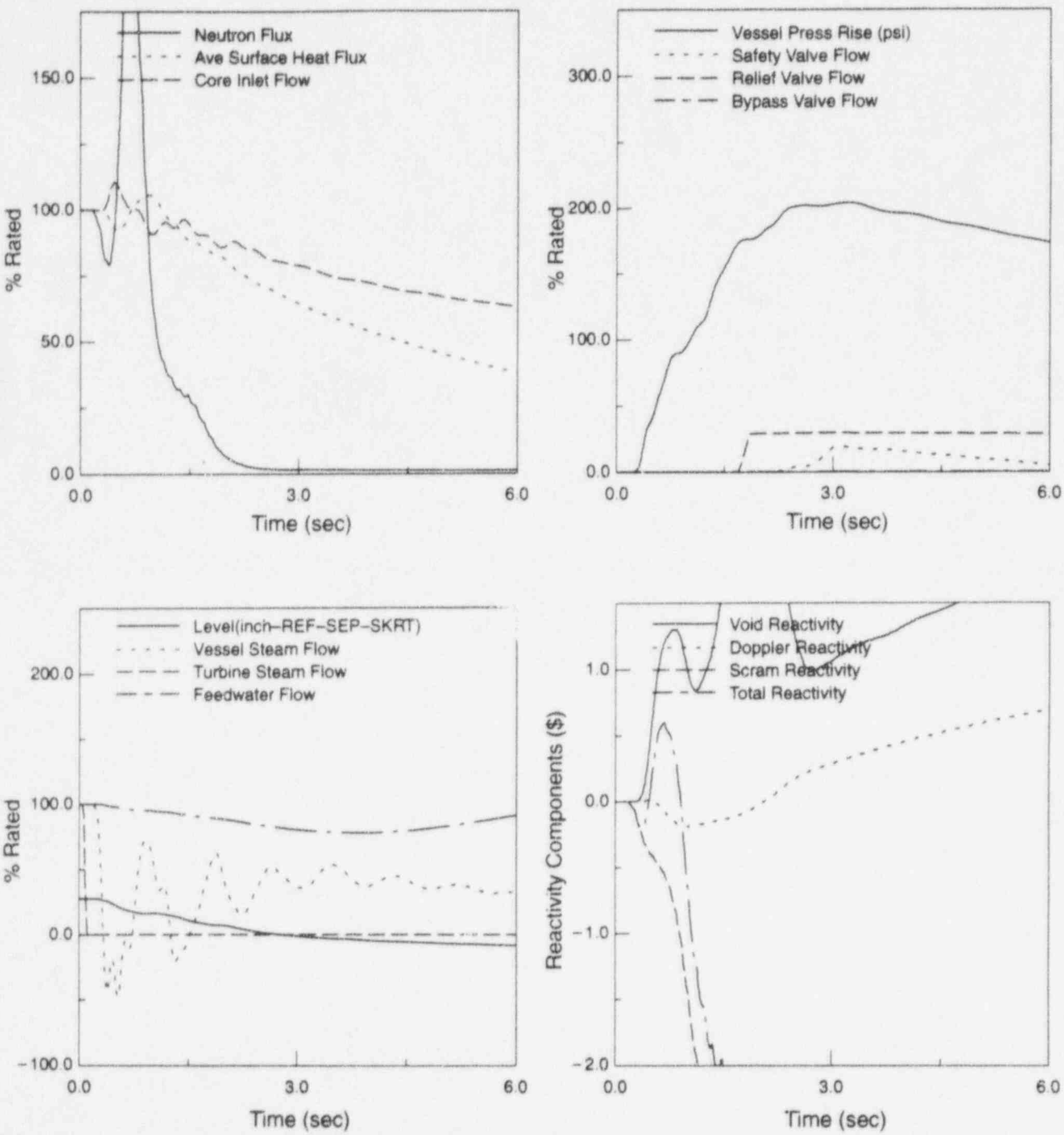


Figure 20 Plant Response to Turbine Trip w/o Bypass (BOC7 to EOC7 STANDARD-HALING)

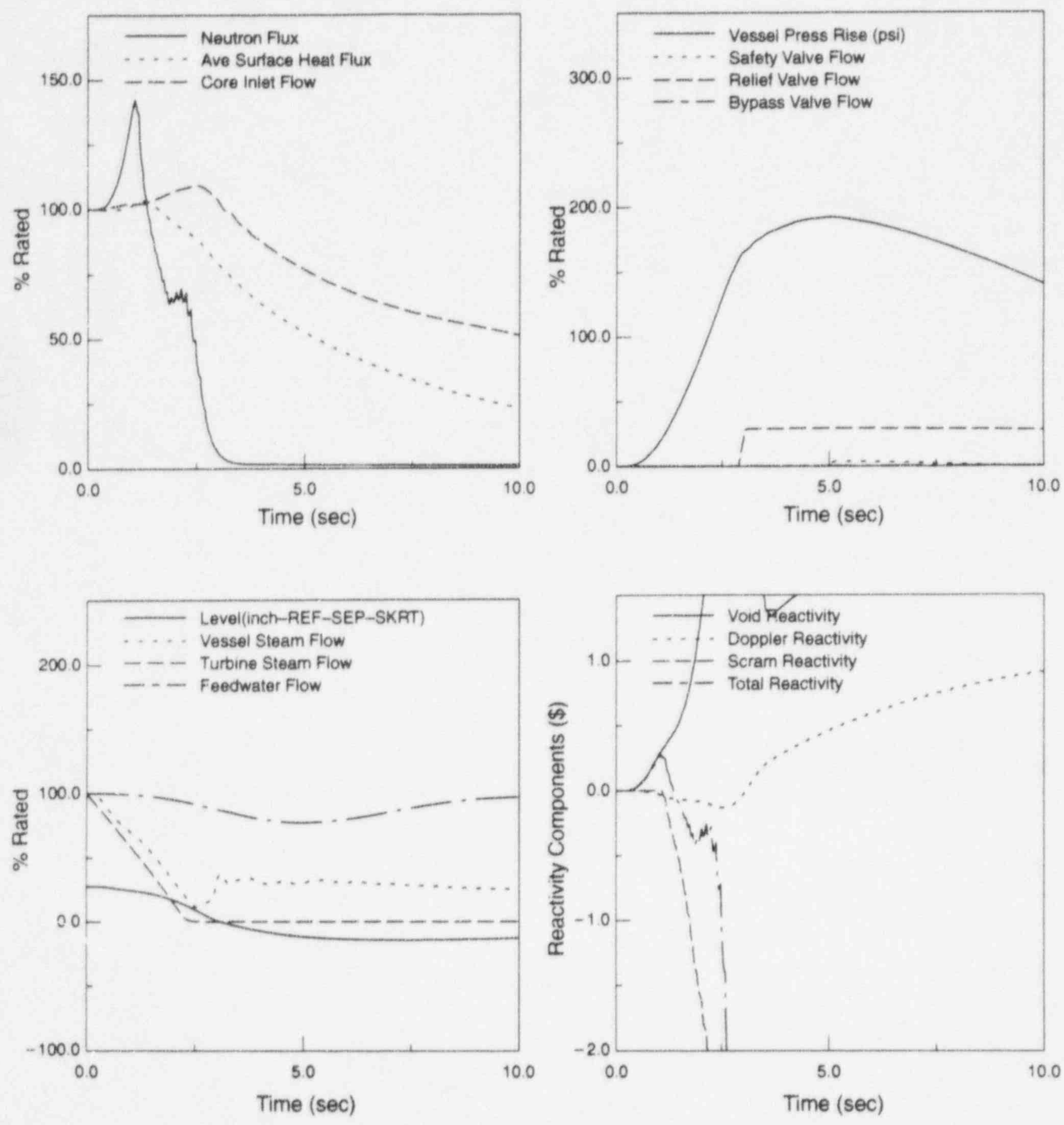


Figure 21 Plant Response to Press. Regulator Failure (BOC7 to EOC7 STANDARD–HALING)

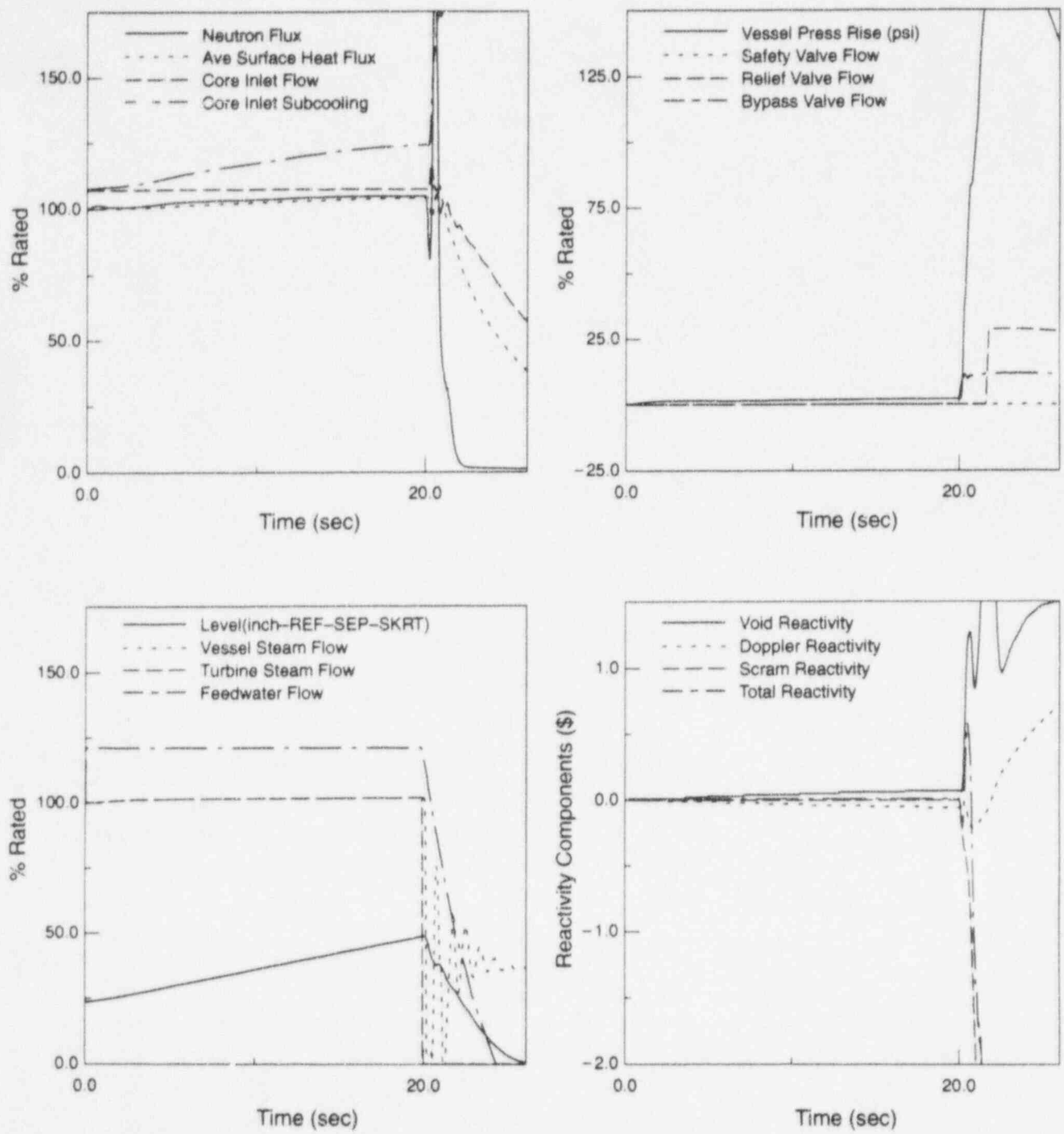


Figure 22 Plant Response to FW Controller Failure (BOC7 to EEOC7 WITH ICF – HALING)

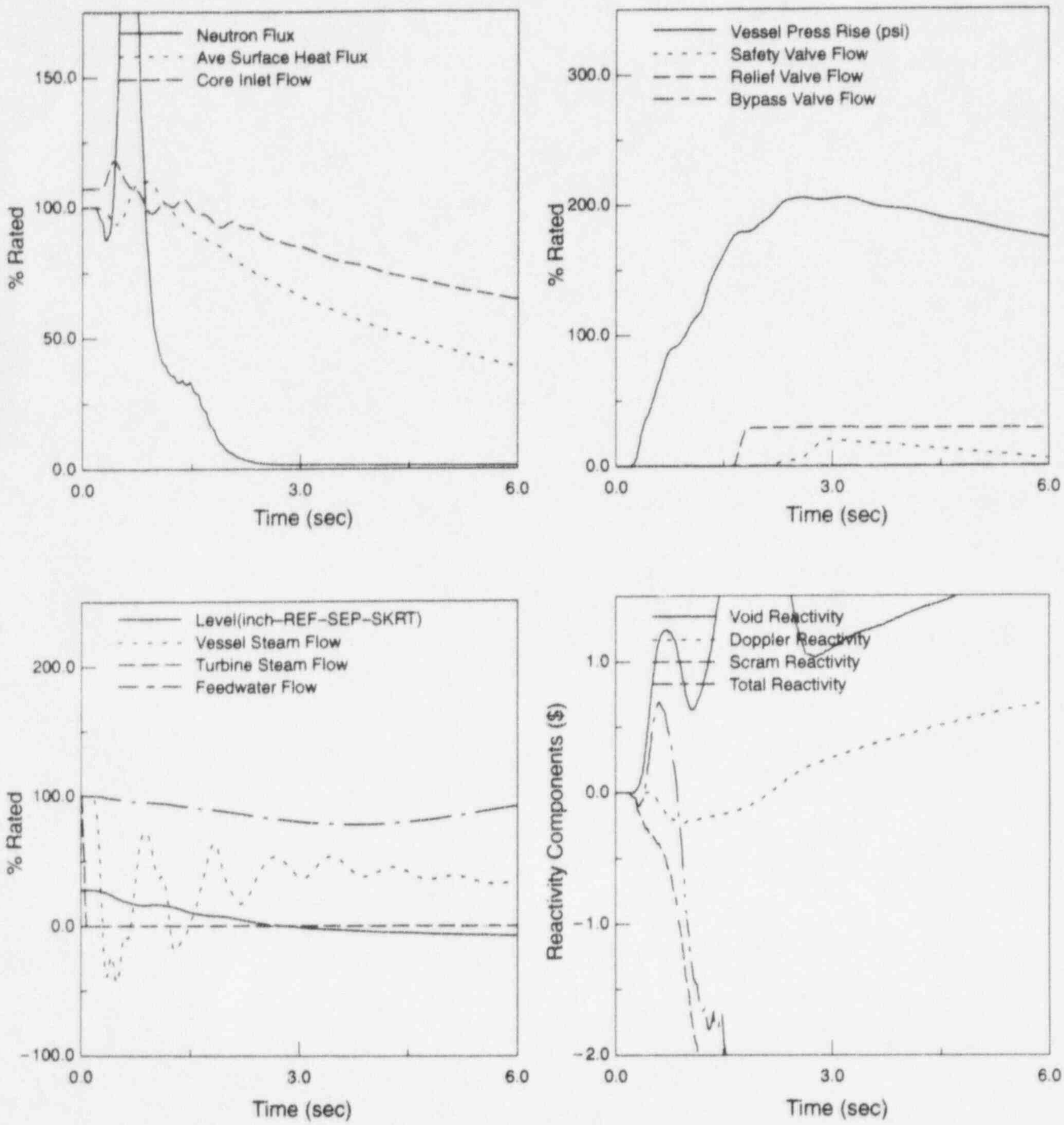


Figure 23 Plant Response to Load Reject w/o Bypass (BOC7 to EEOC7 WITH ICF – HALING)

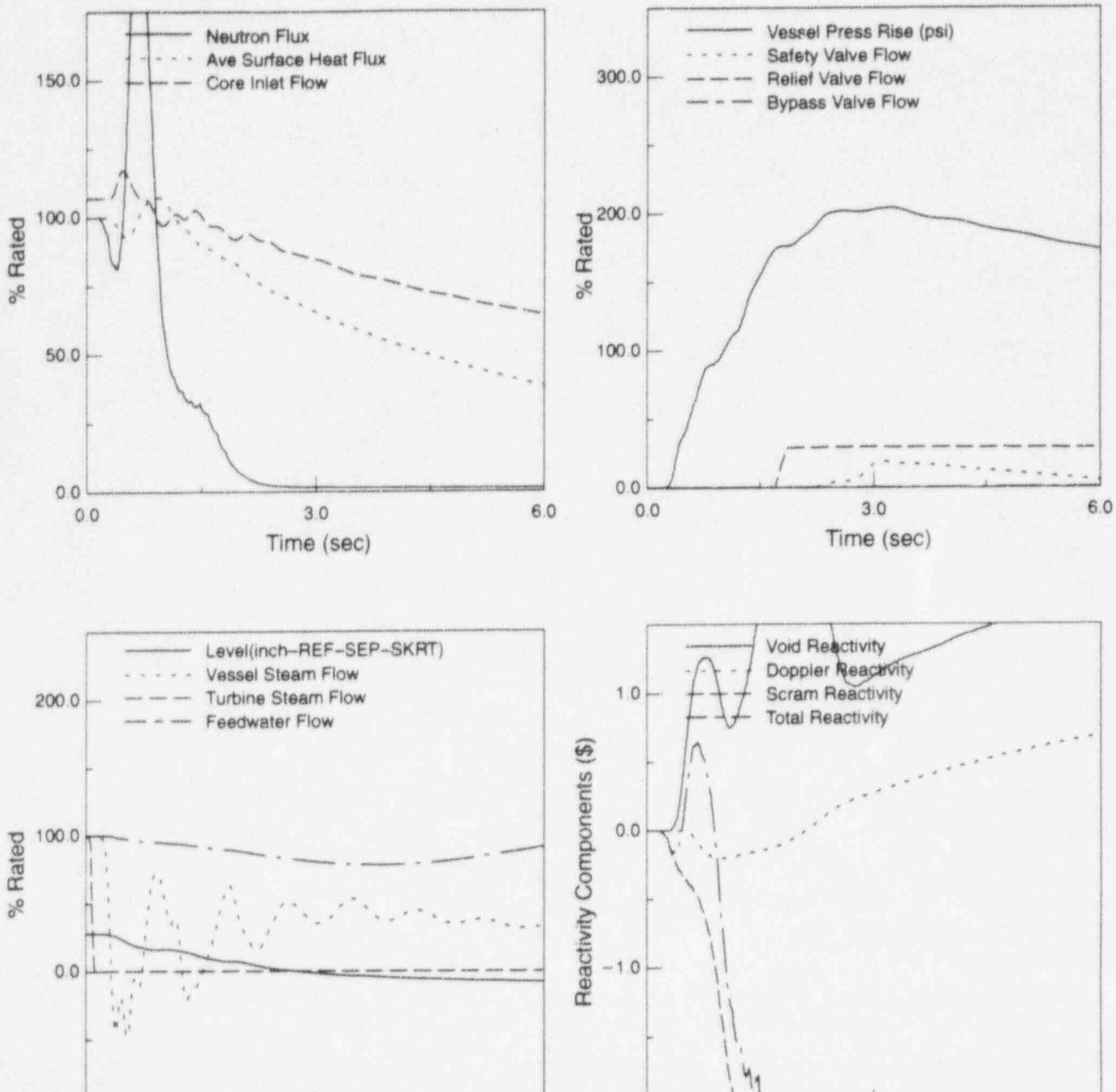


Figure 24 Plant Response to Turbine Trip w/o Bypass (BOC7 to EEOC7 WITH ICF – HALING)

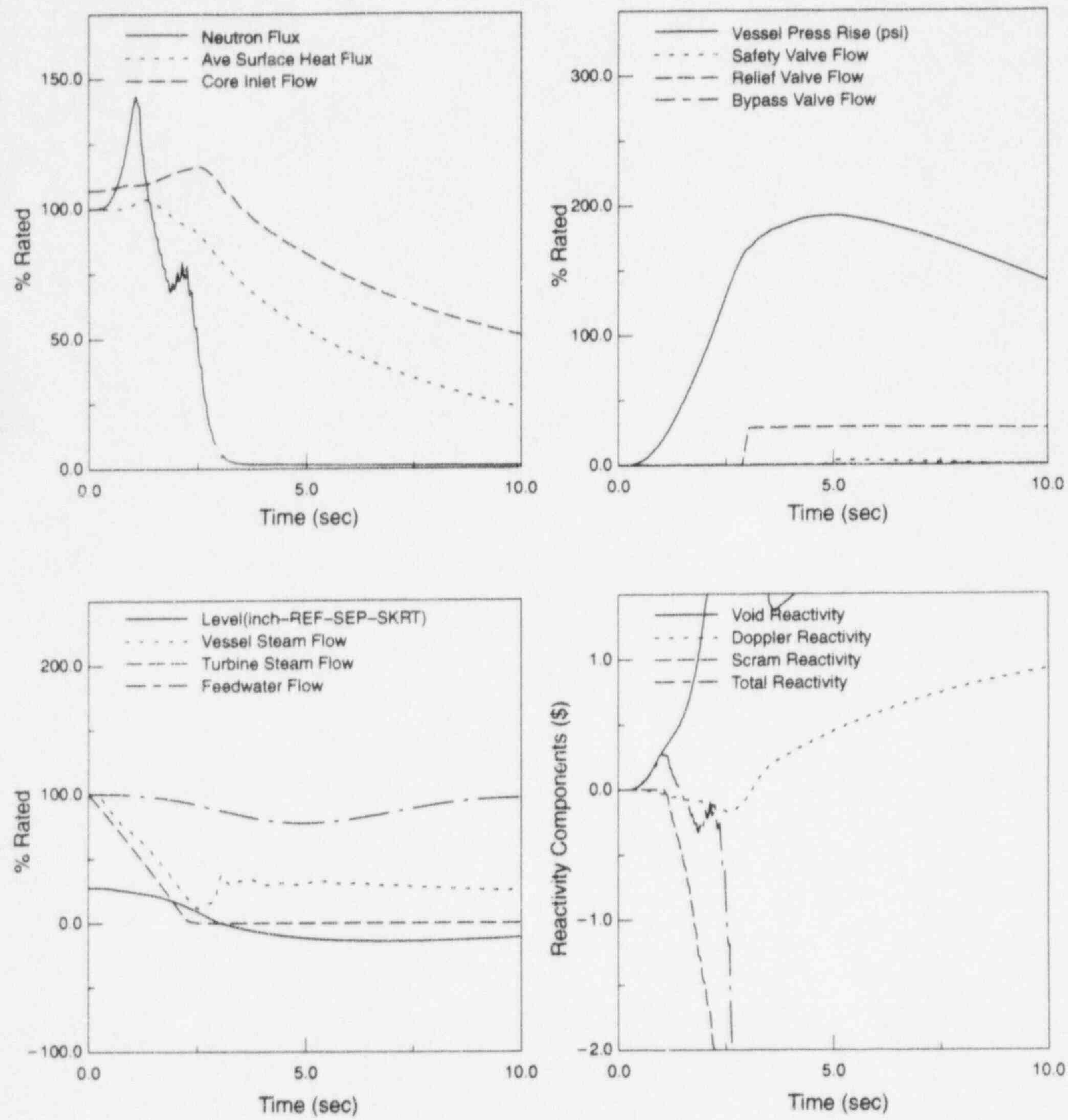


Figure 25 Plant Response to Press. Regulator Failure (BOC7 to EEOC7 WITH ICF – HALING)

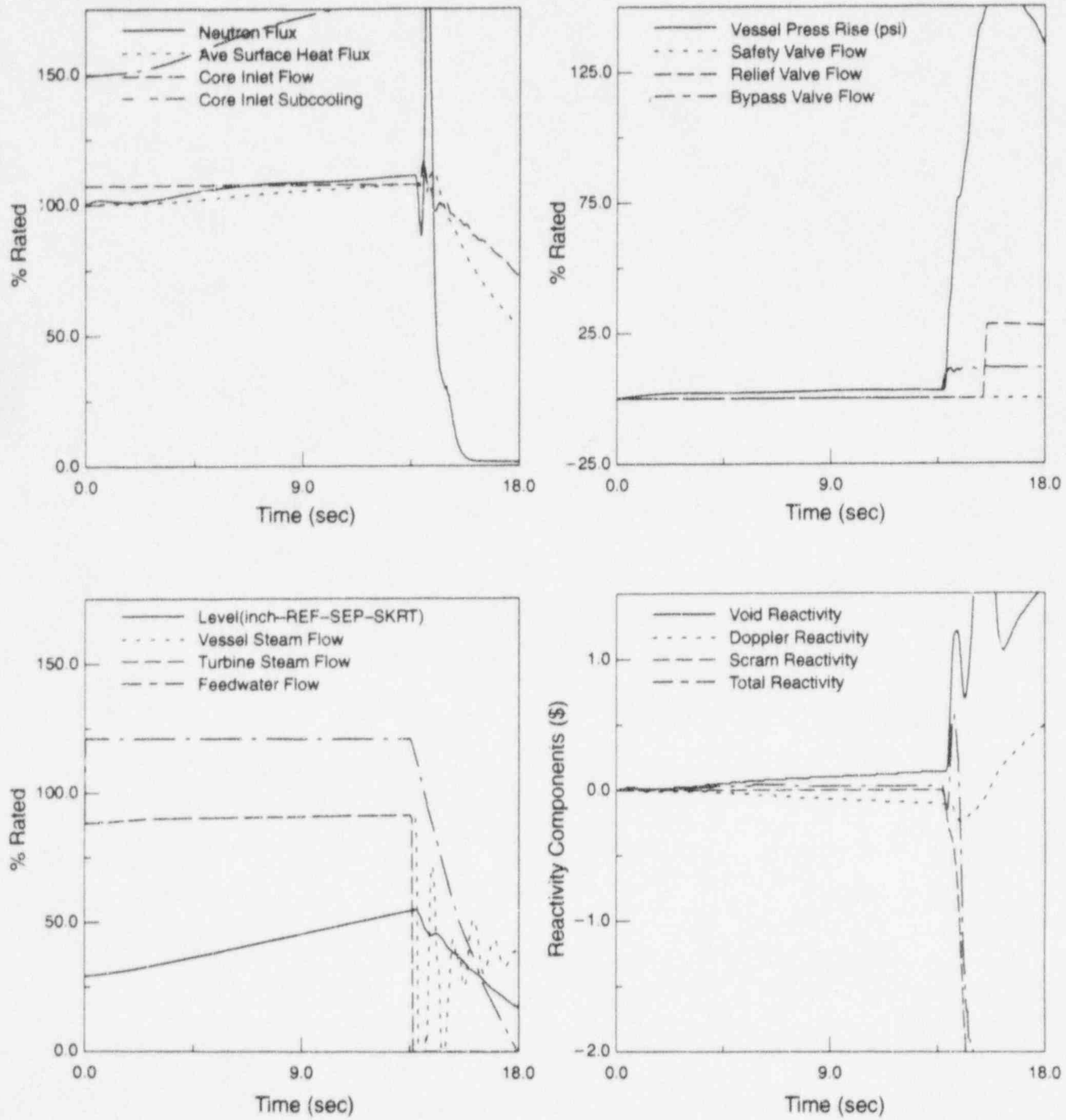


Figure 26 Plant Response to FW Controller Failure (BOC7 to EEEOC7 WITH ICF AND FFWTR HALING)

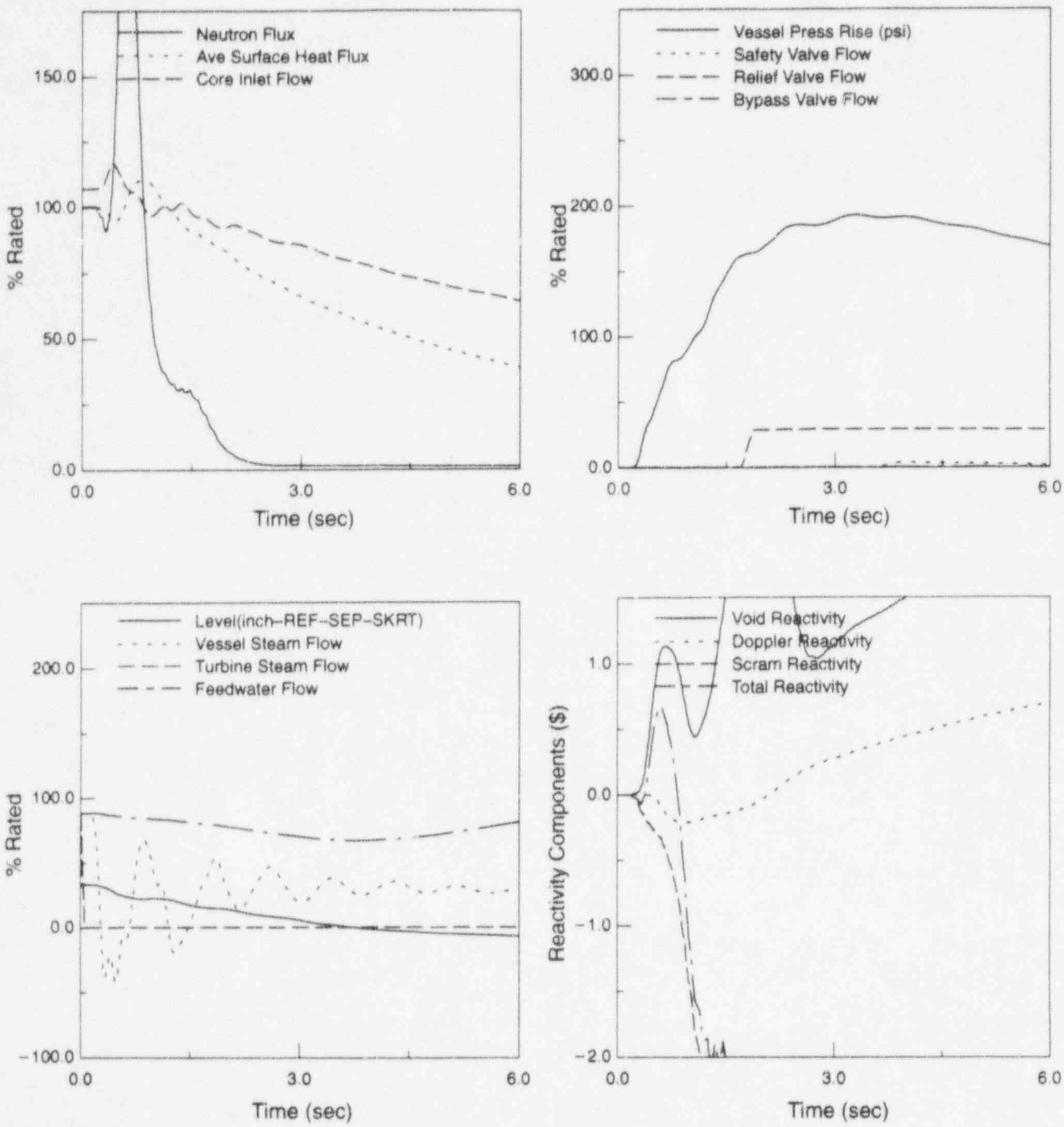


Figure 27 Plant Response to Load Reject w/o Bypass (BOC7 to EEEOC7 WITH ICF AND FFWTR HALING)

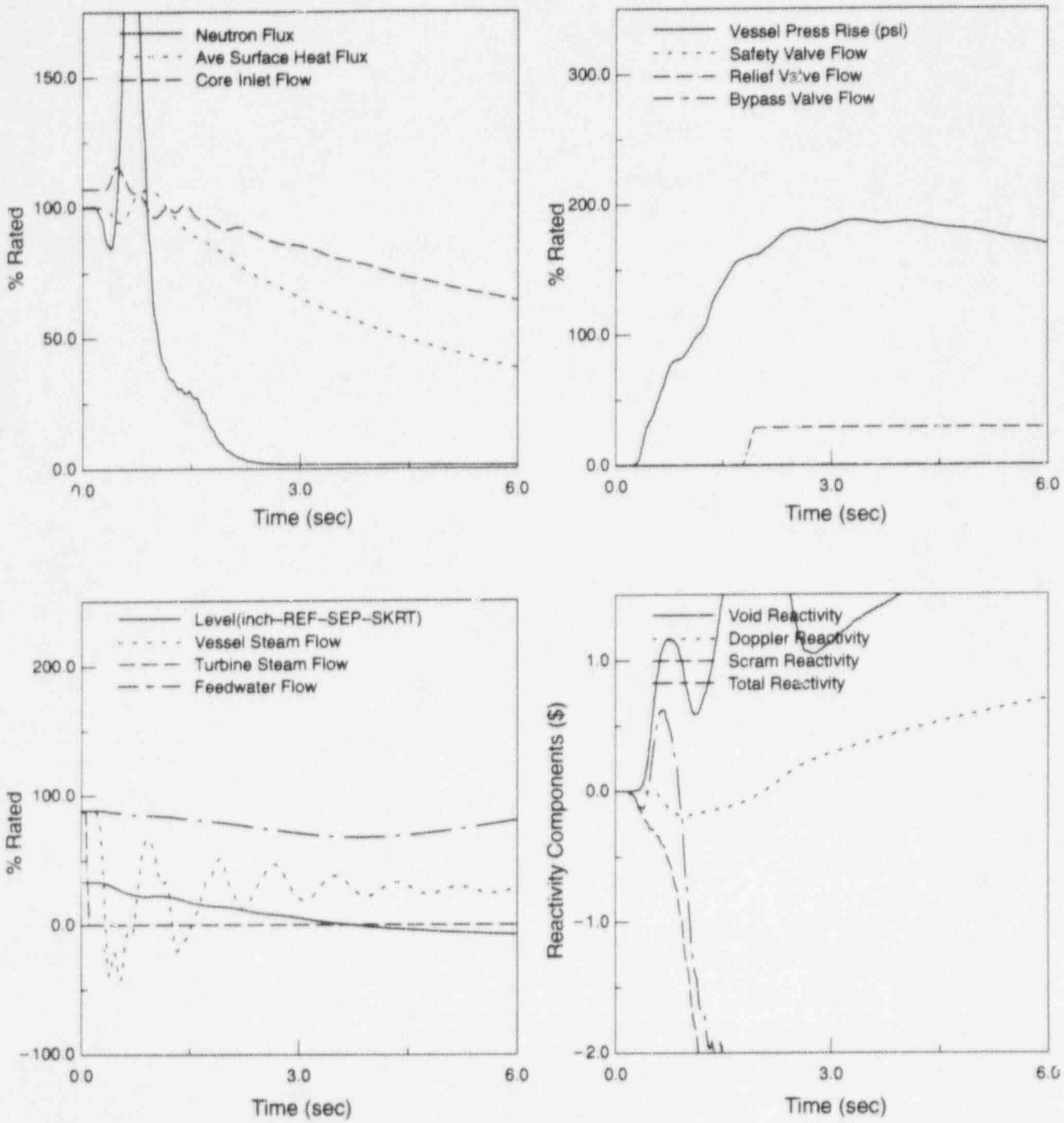


Figure 28 Plant Response to Turbine Trip w/o Bypass (BOC7 to EEEOC7 WITH ICF AND FFWTR HALING)

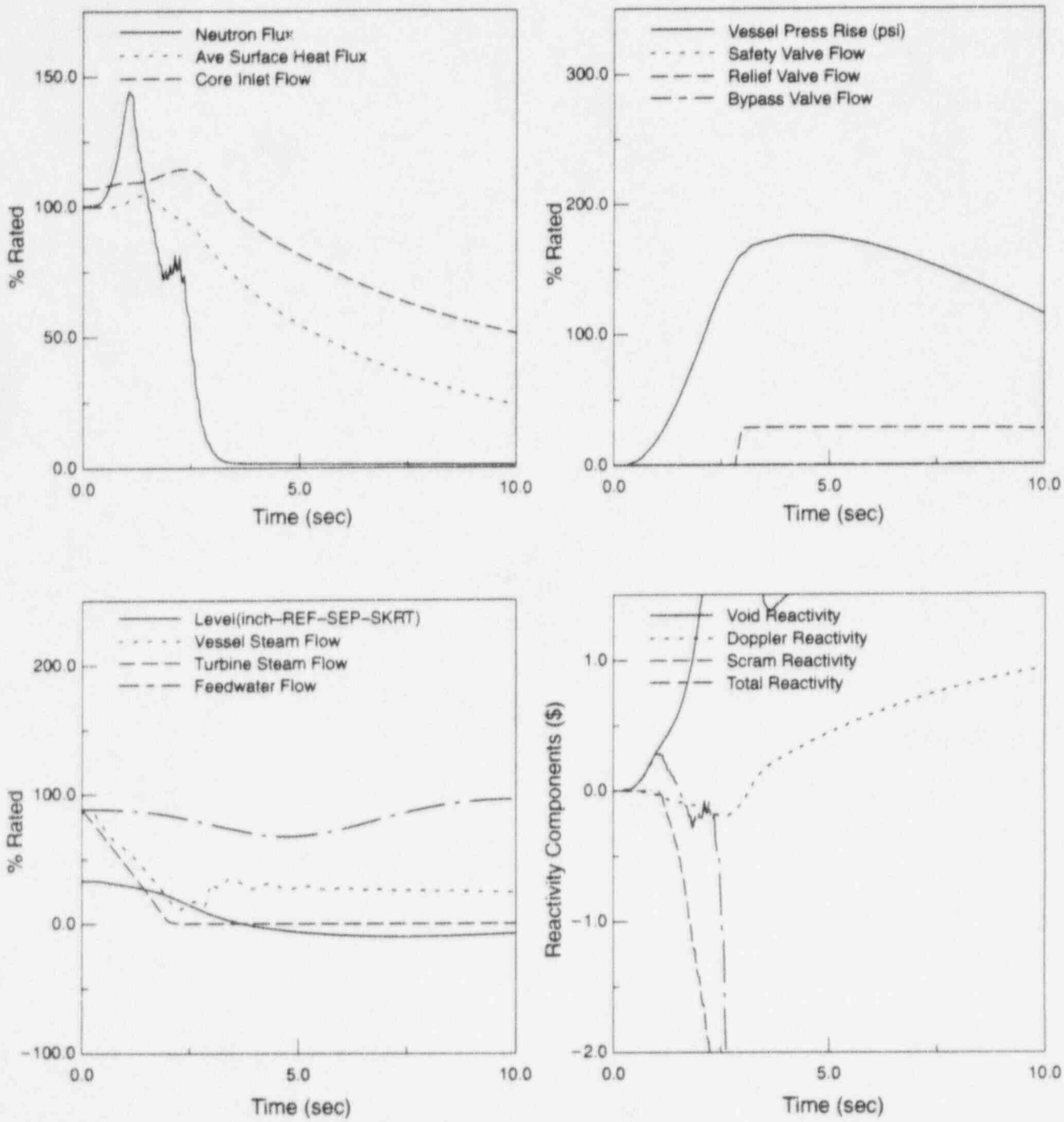


Figure 29 Plant Response to Press. Regulator Failure (BOC7 to EEEOC7 WITH ICF AND FFWTR HALING)

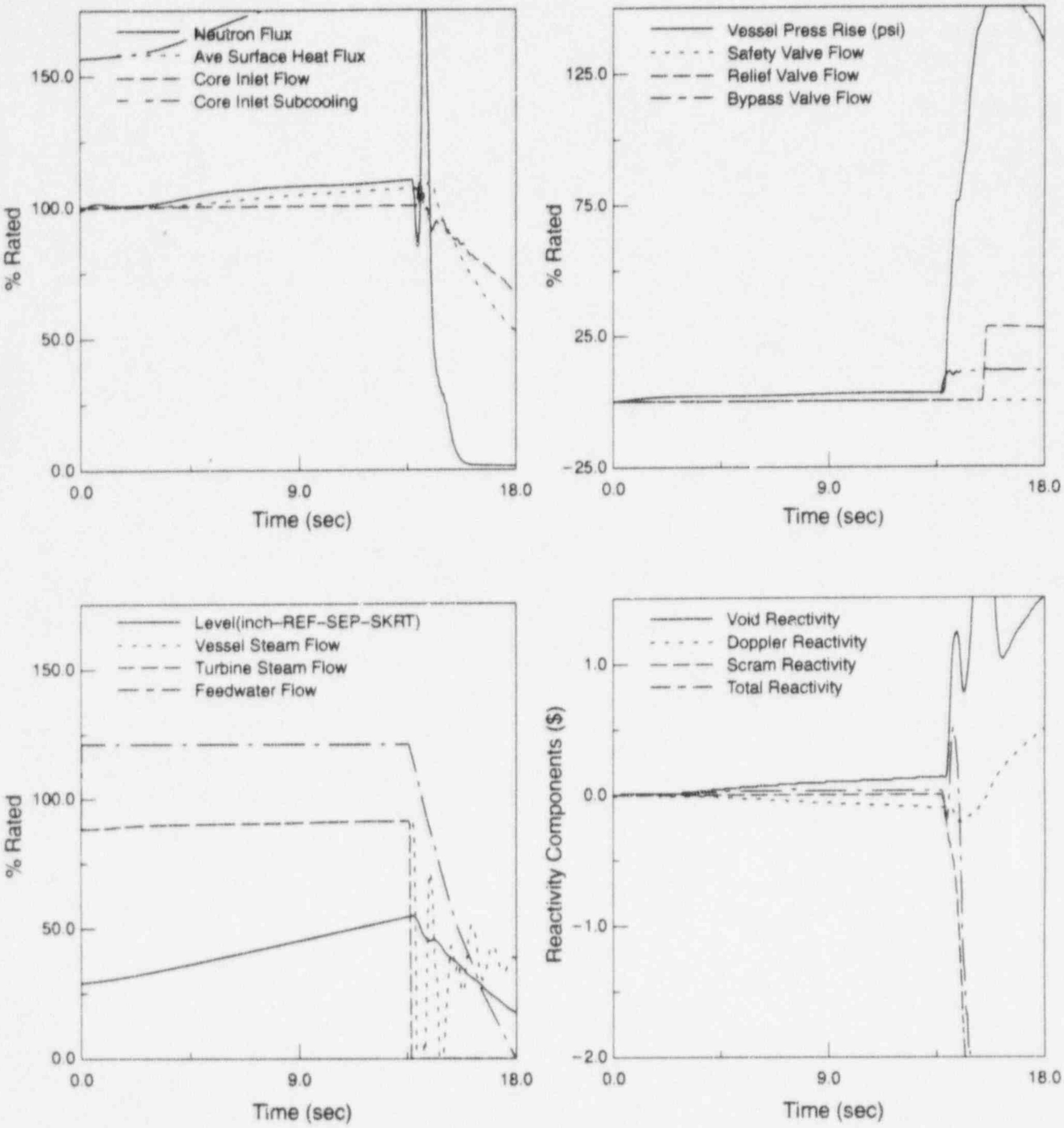


Figure 30 Plant Response to FW Controller Failure (BOC7 to EOC7 WITH FFWTR HALING–100%P/100%F)

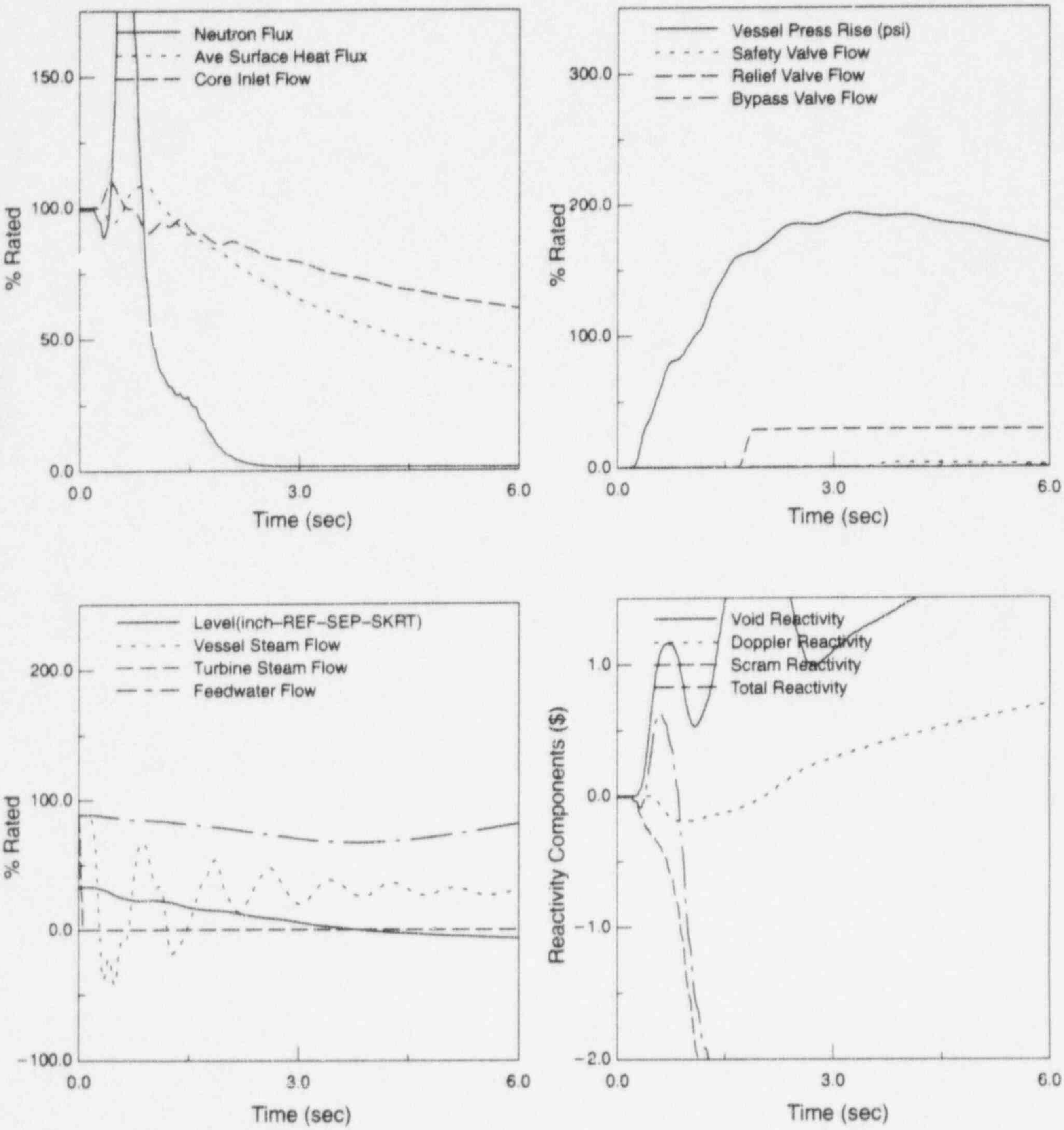


Figure 31 Plant Response to Load Reject w/o Bypass (BOC7 to EOC7 WITH FFWTR HALING–100%P/100%F)

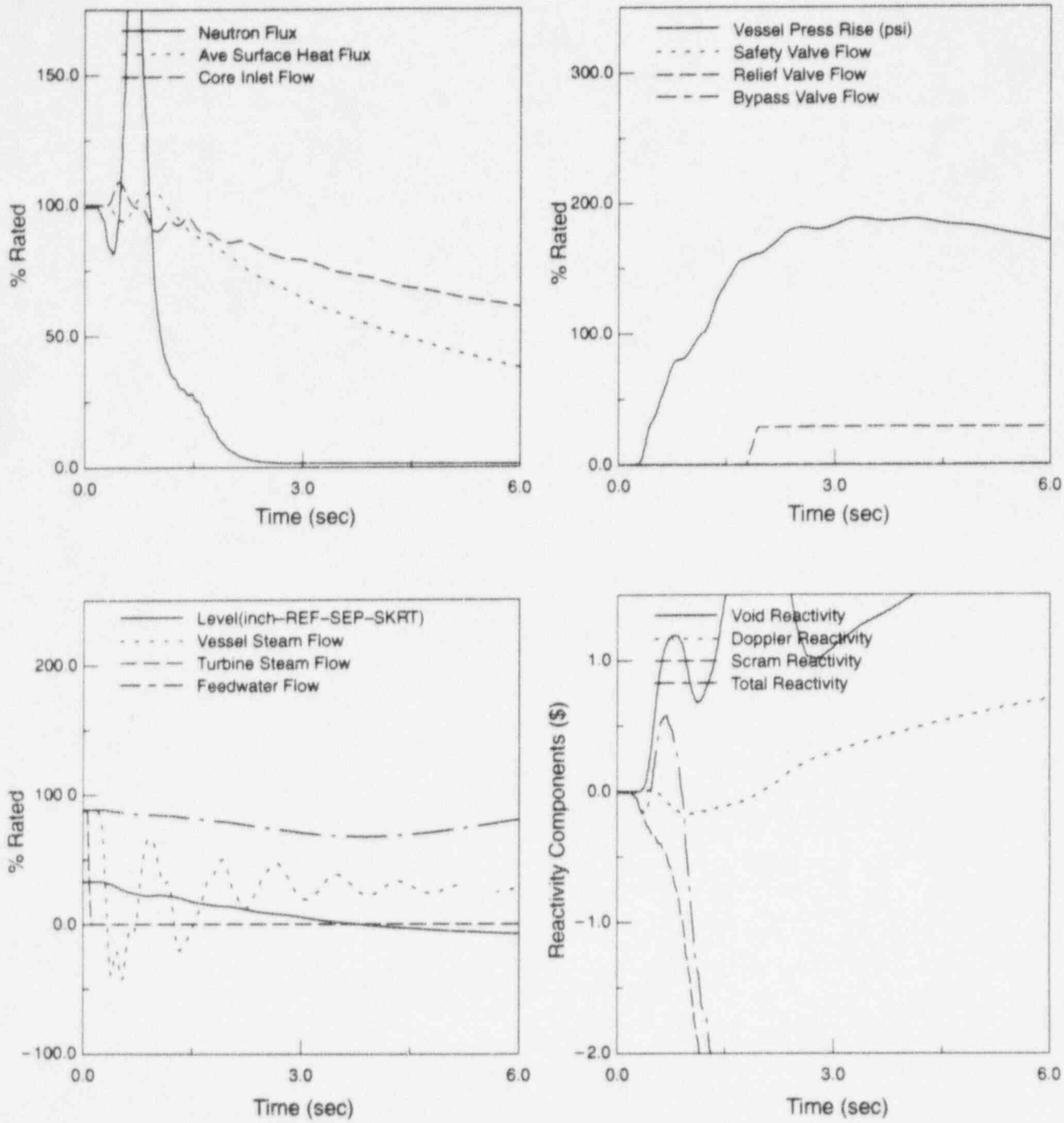


Figure 32 Plant Response to Turbine Trip w/o Bypass (BOC7 to EOC7 WITH FFWTR HALING–100%P/100%F)

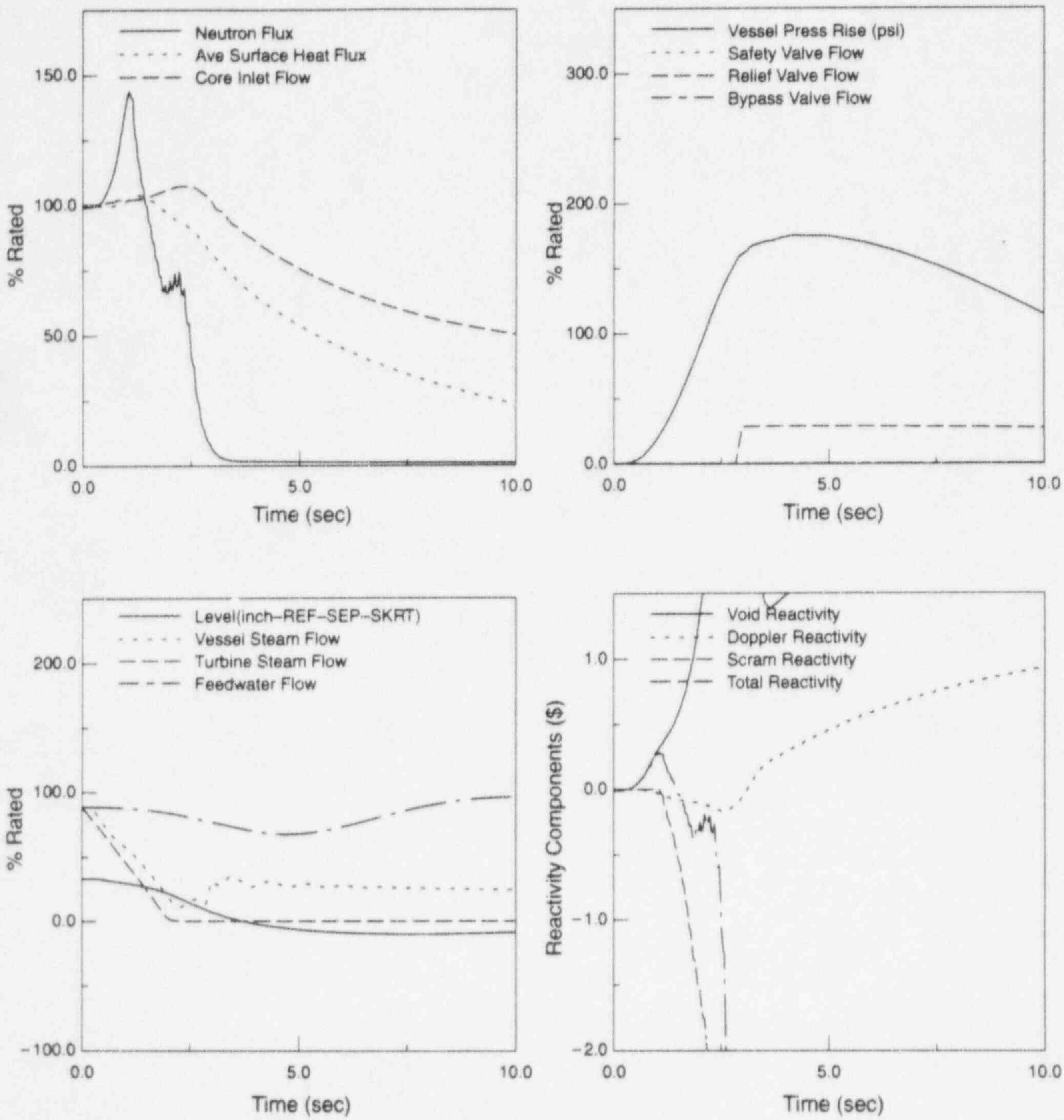


Figure 33 Plant Response to Press. Regulator Failure (BOC7 to EOC7 WITH FFWTR HALING–100%P/100%F)

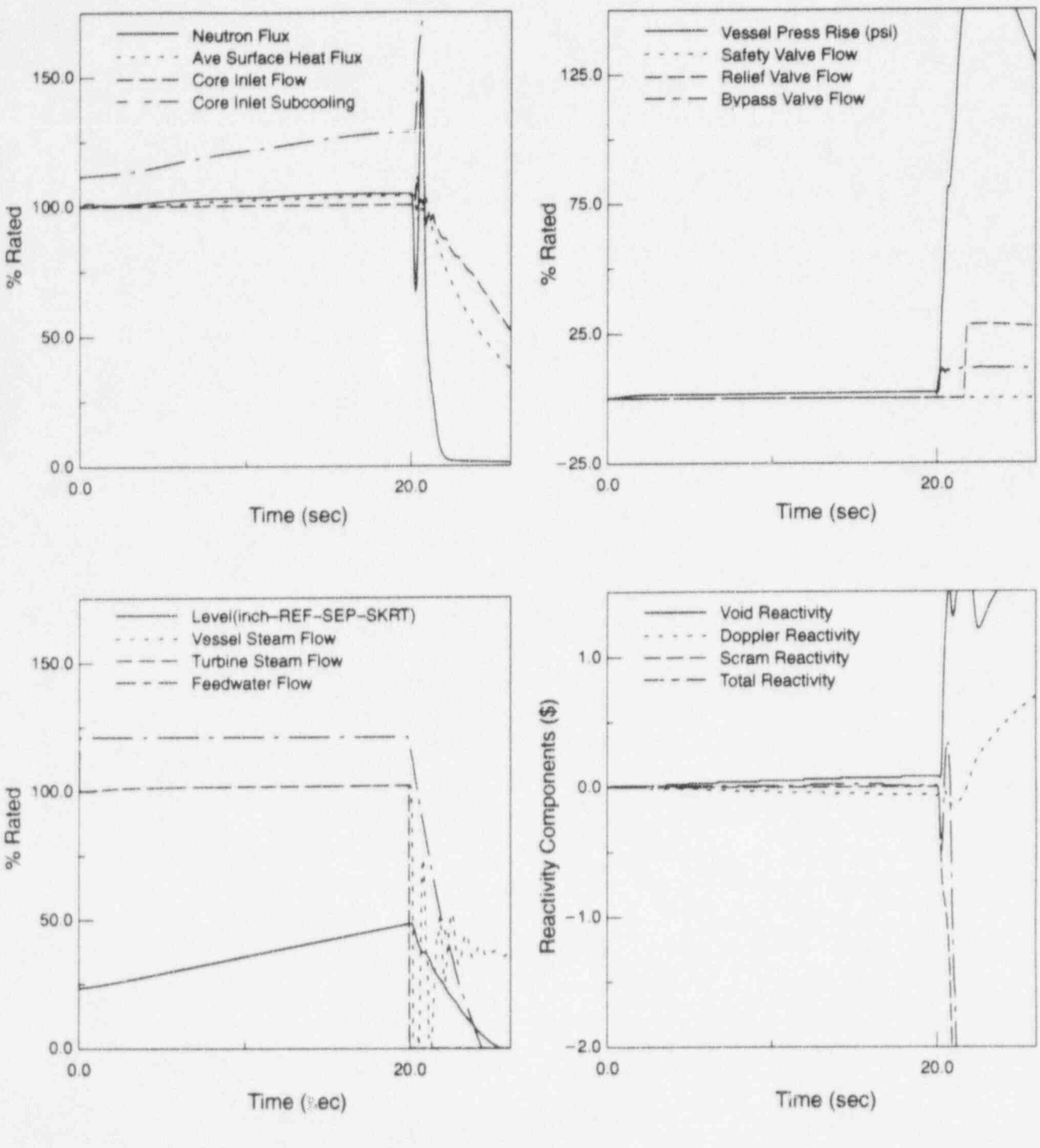


Figure 34 Plant Response to FW Controller Failure (BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) STANDARD)

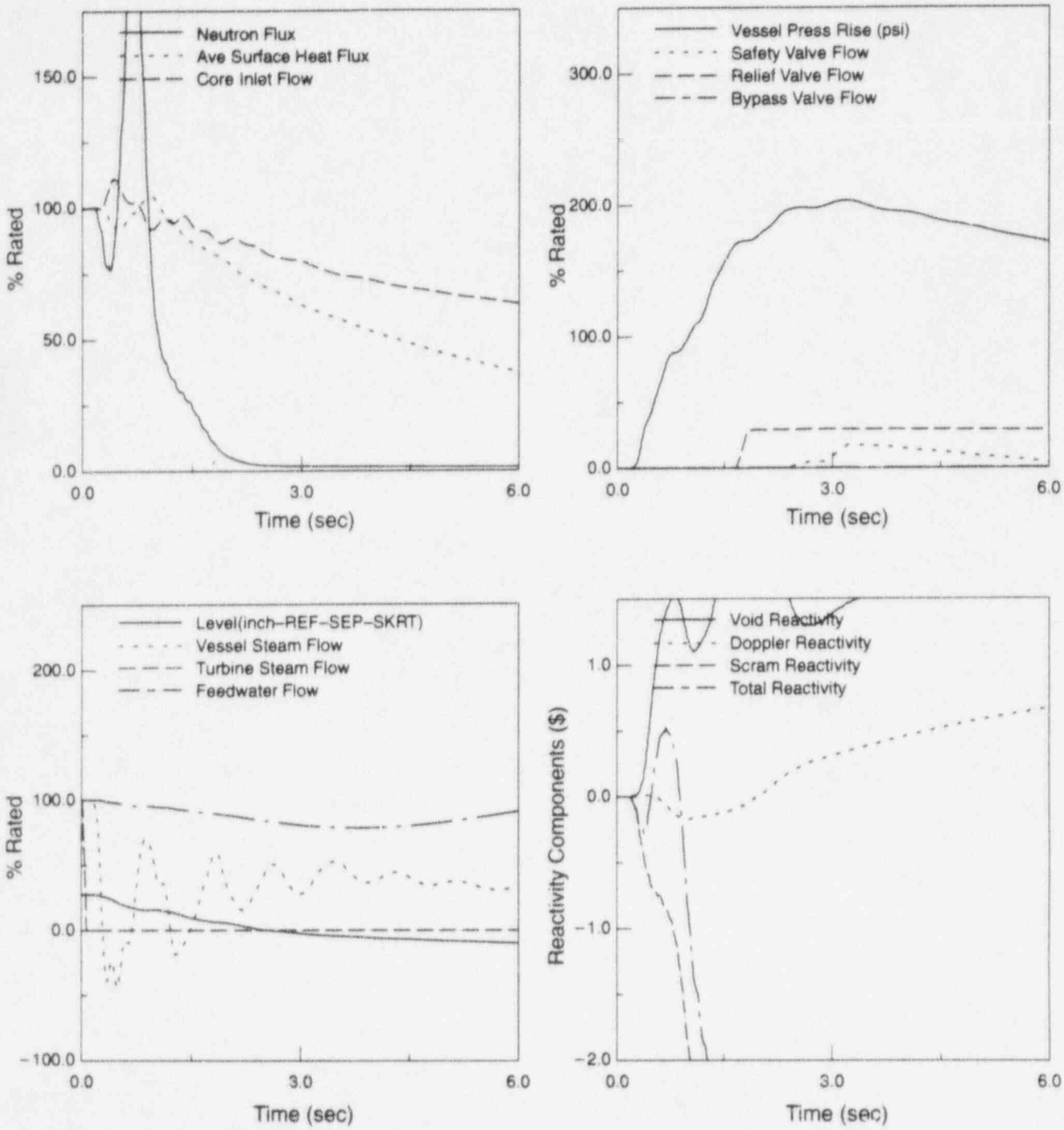


Figure 35 Plant Response to Load Reject w/o Bypass (BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) STANDARD)

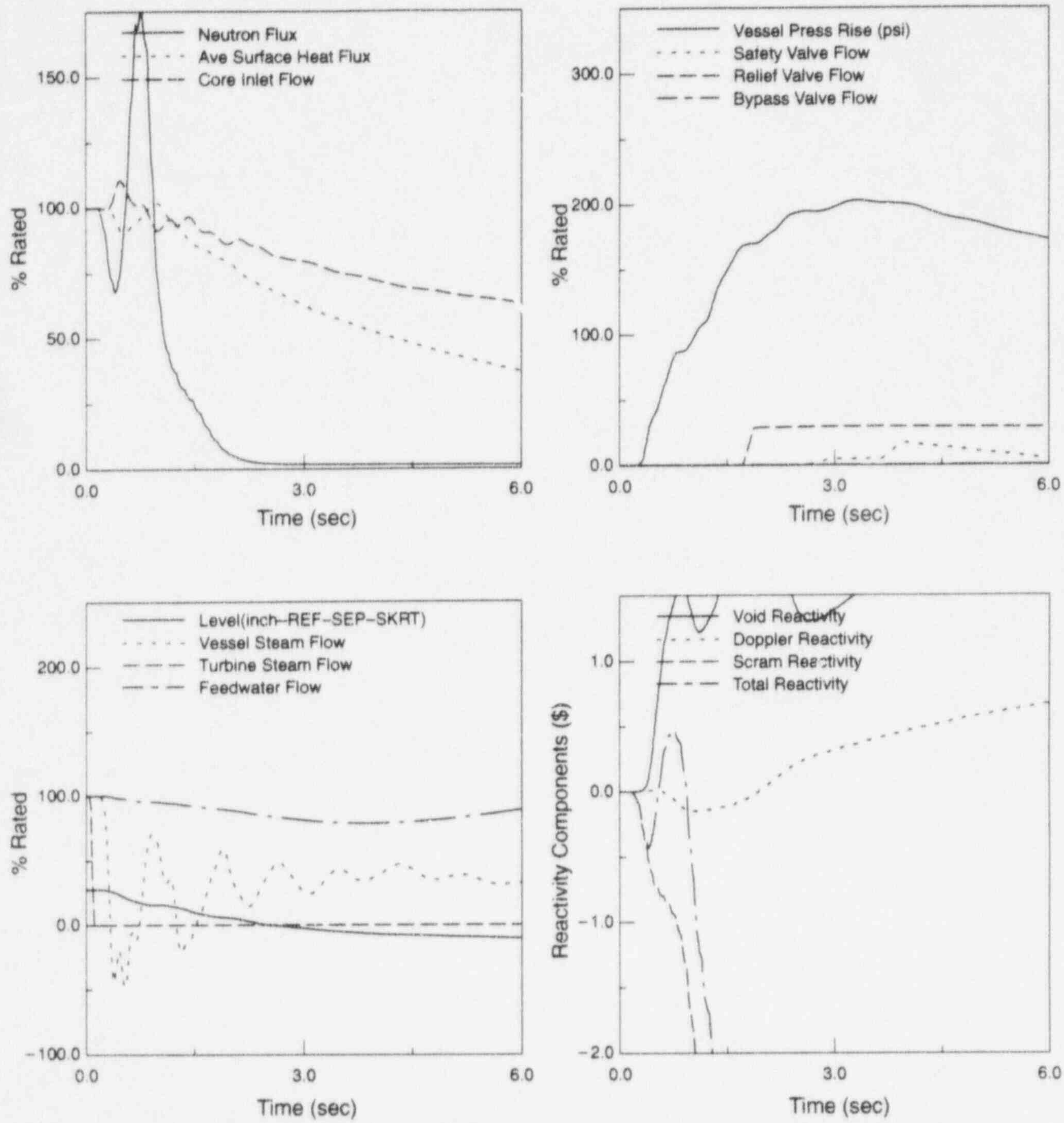


Figure 36 Plant Response to Turbine Trip w/o Bypass (BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) STANDARD)

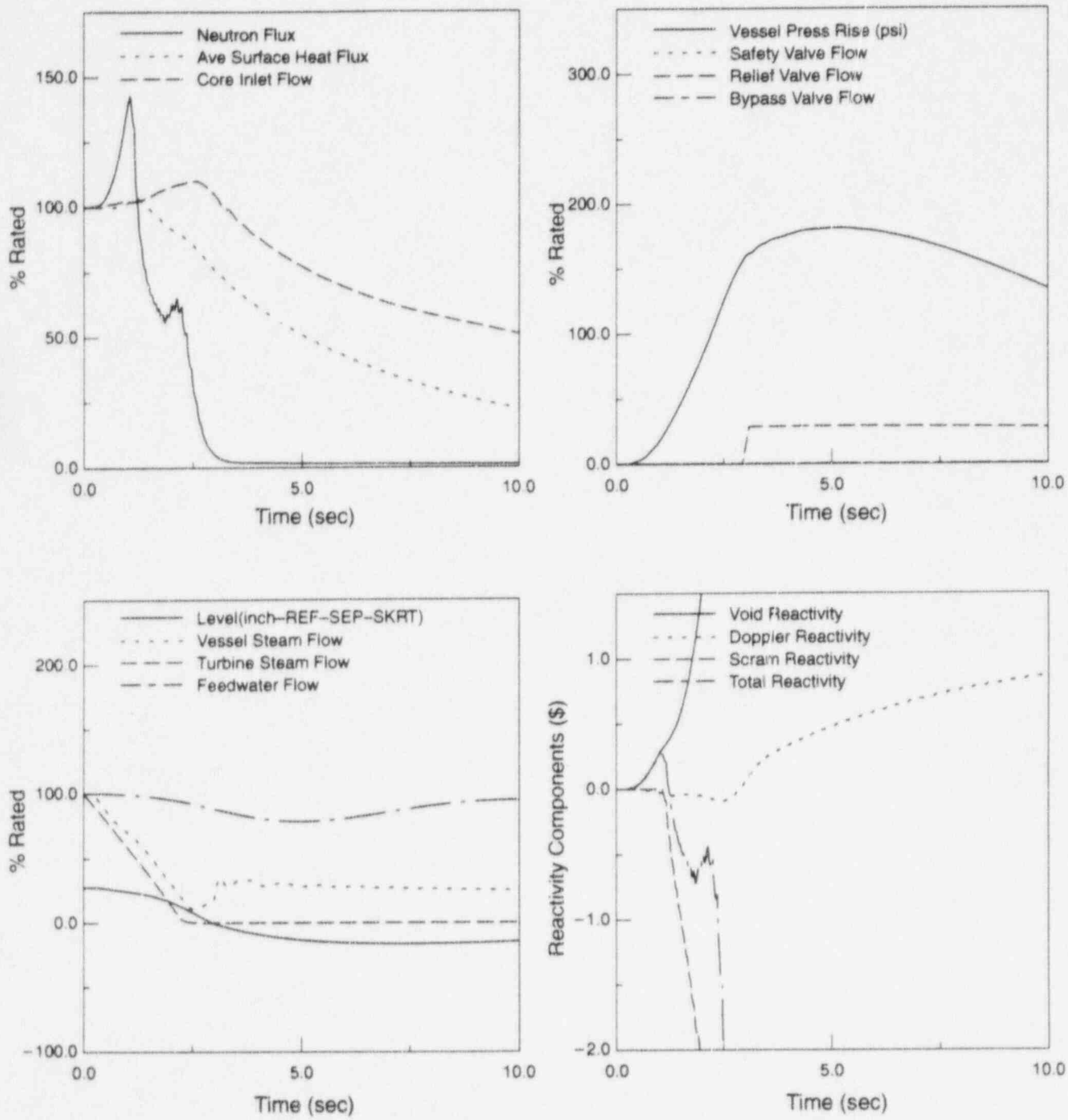


Figure 37 Plant Response to Press. Regulator Failure (BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) STANDARD)

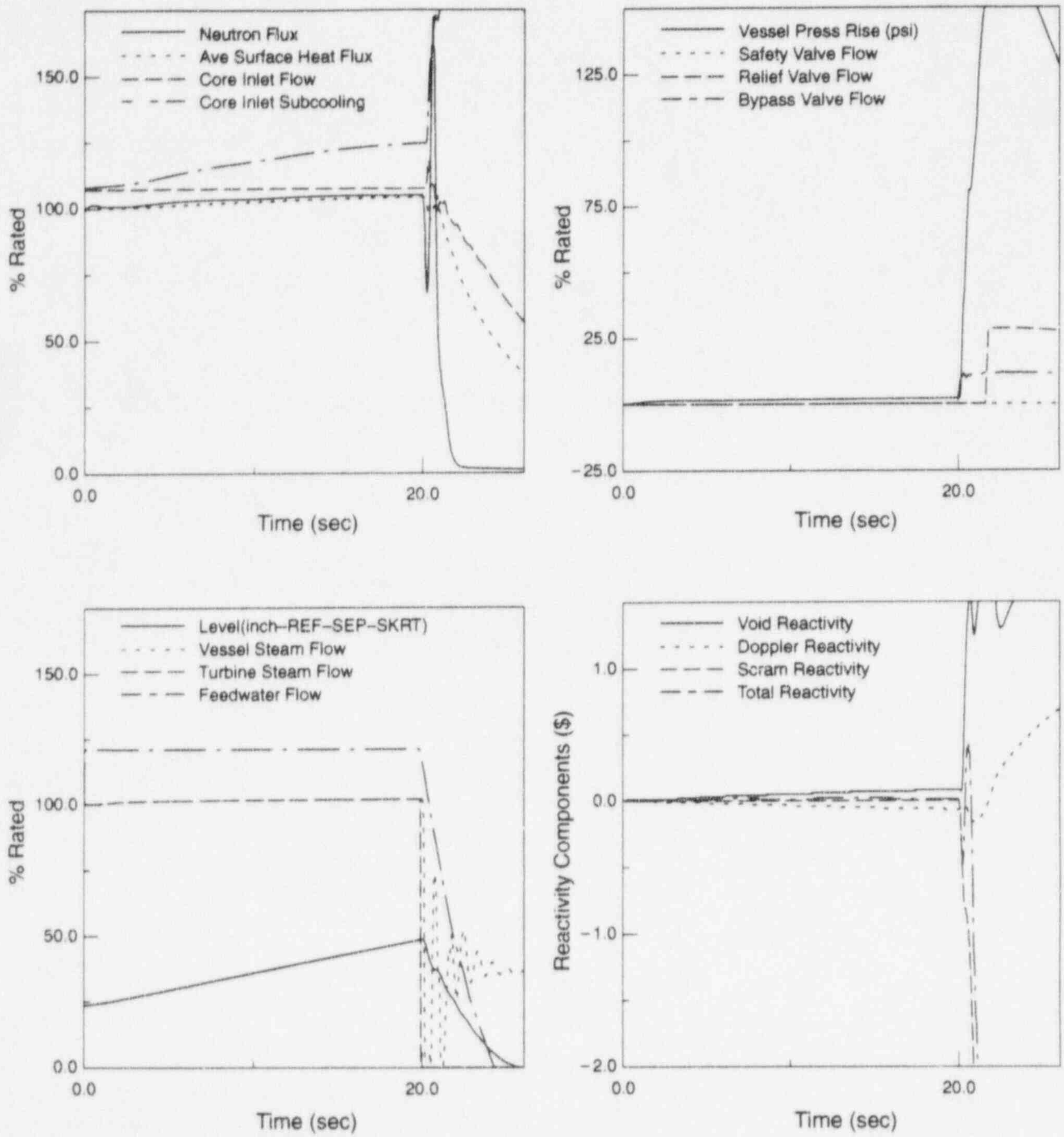


Figure 38 Plant Response to FW Controller Failure (BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) WITH ICF)

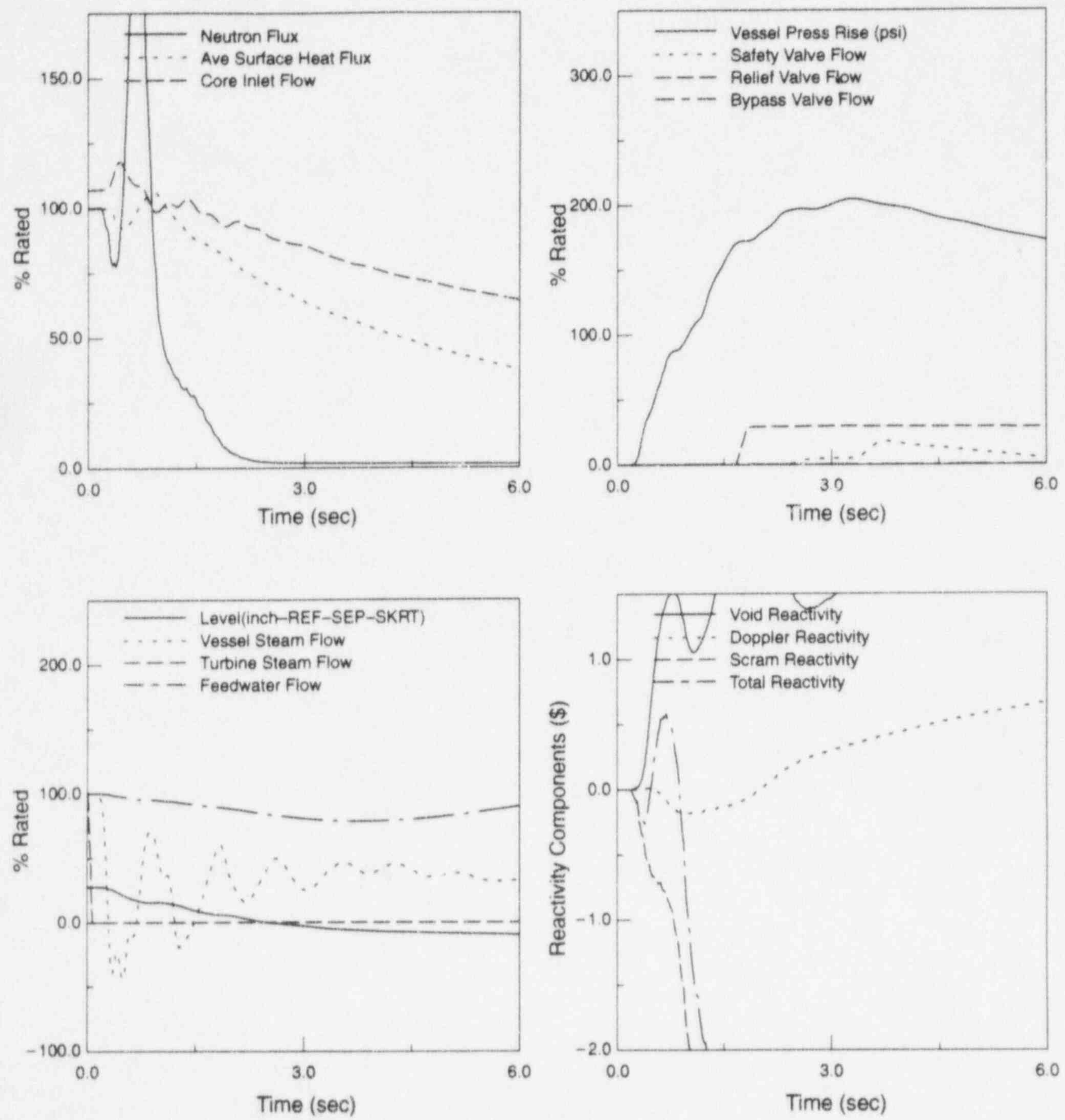


Figure 39 Plant Response to Load Reject w/o Bypass (BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) WITH ICF)

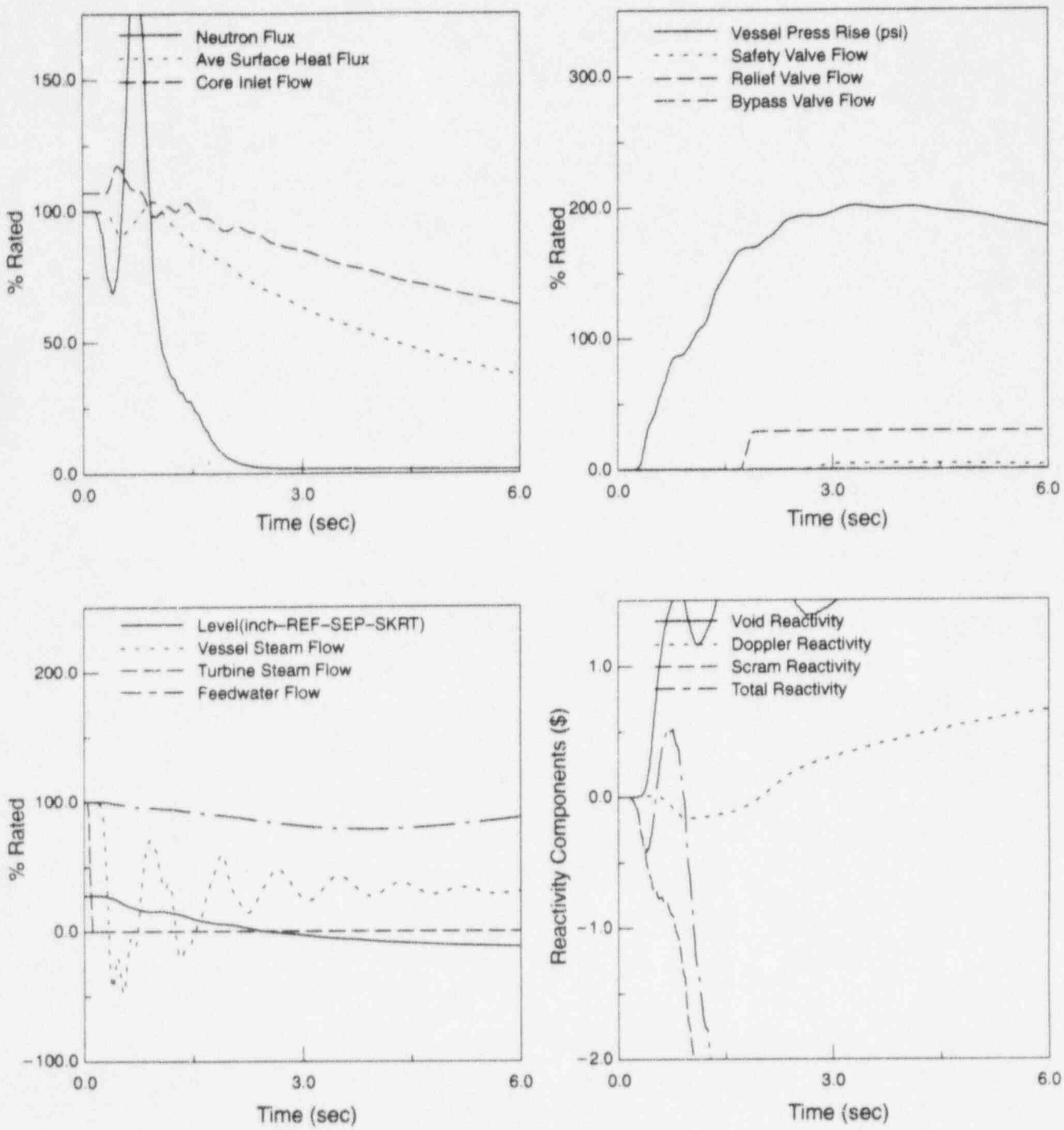


Figure 40 Plant Response to Turbine Trip w/o Bypass (BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) WITH ICF)

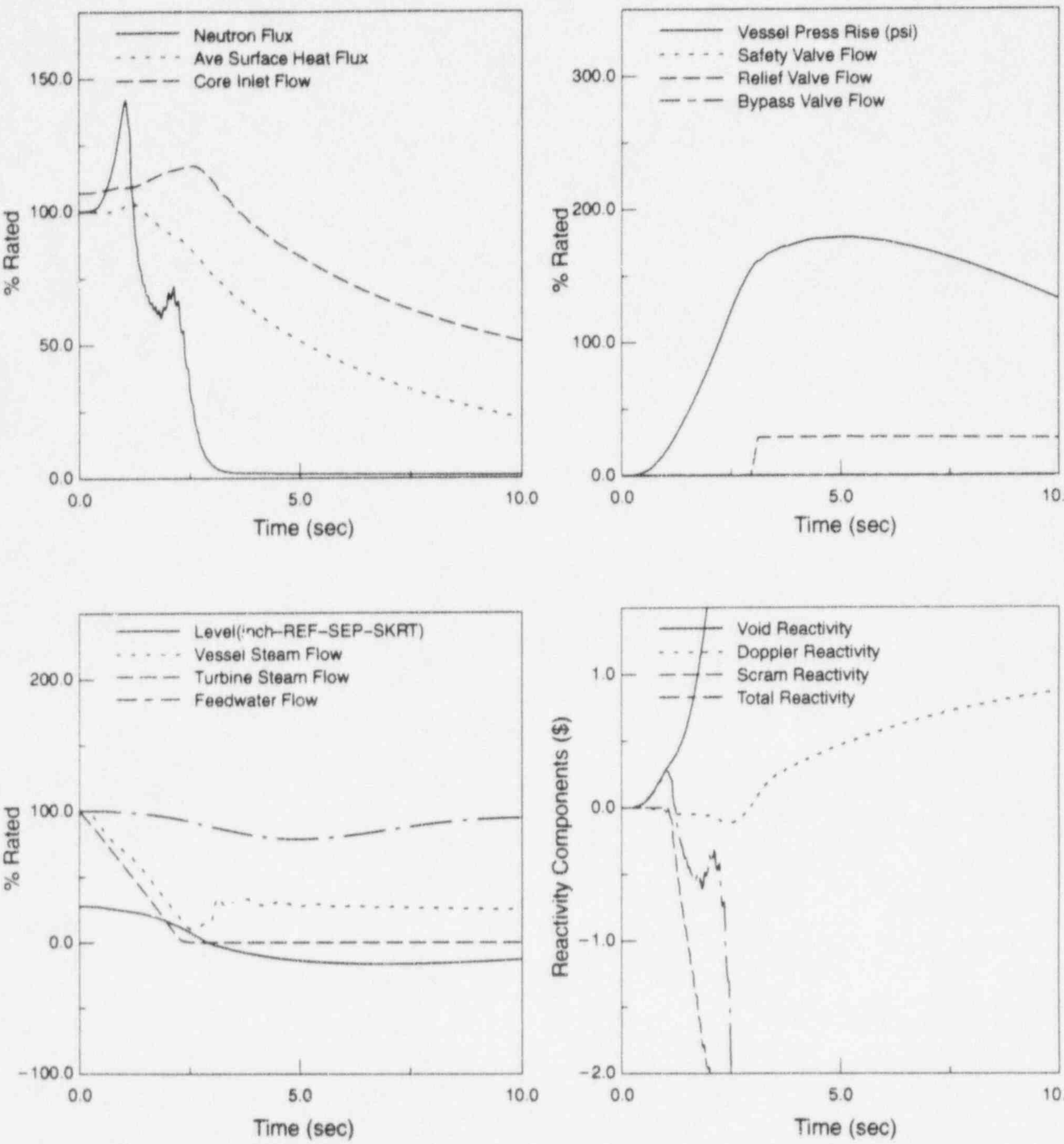


Figure 41 Plant Response to Press. Regulator Failure (BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) WITH ICF)

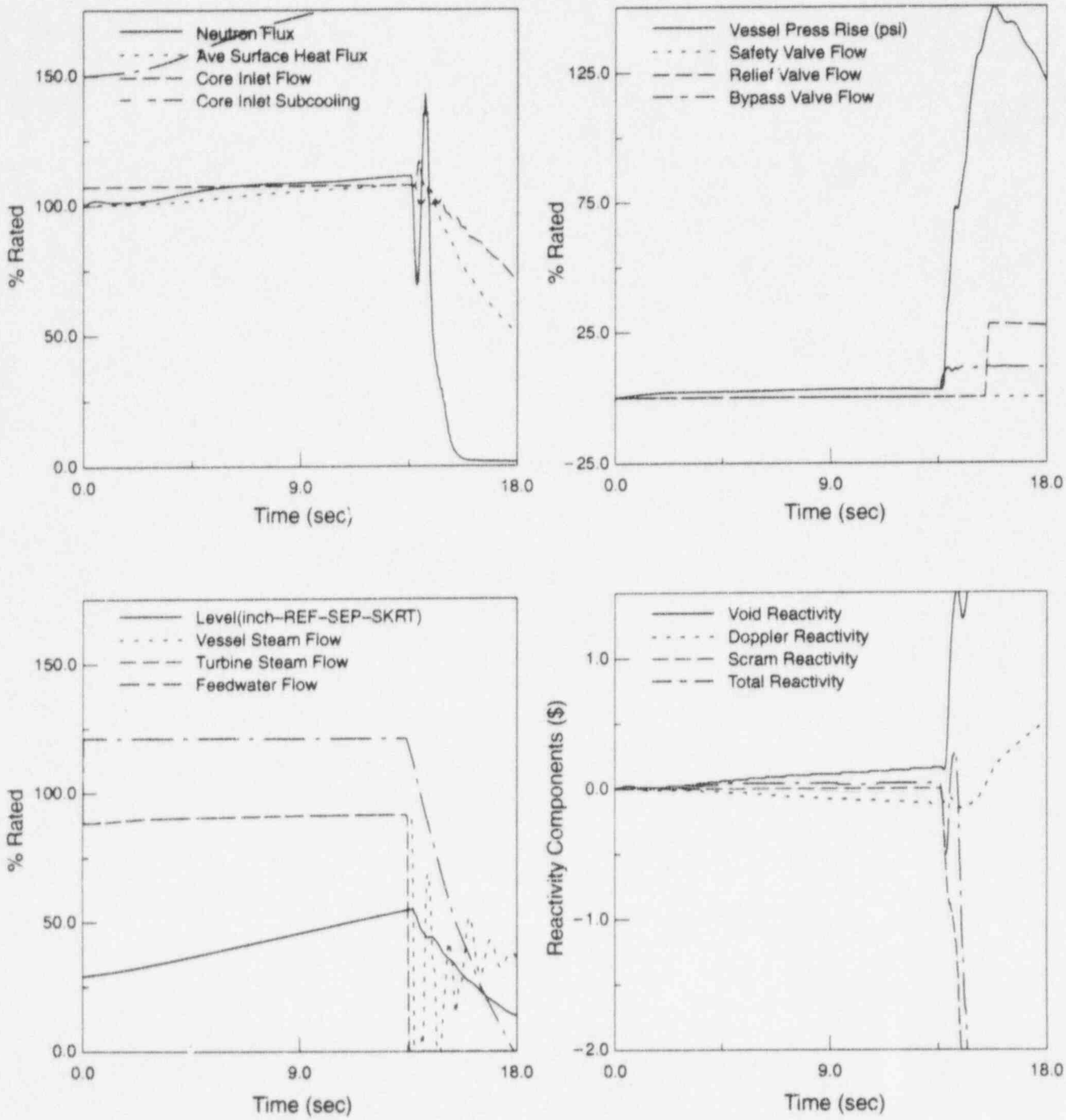


Figure 42 Plant Response to FW Controller Failure (BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) FWHOOS with ICF)

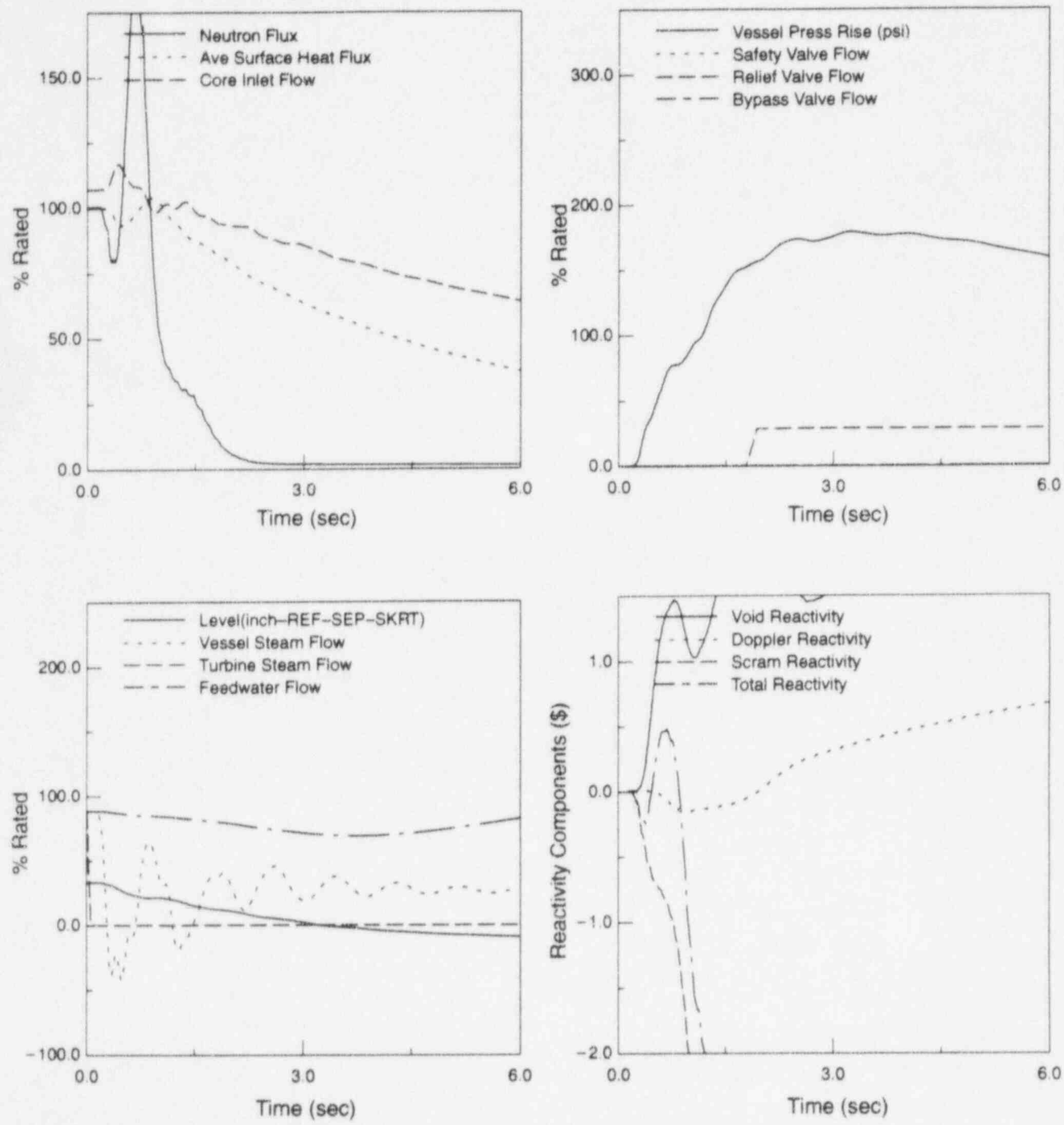


Figure 43 Plant Response to Load Reject w/o Bypass (BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) FWHOOS with ICF)

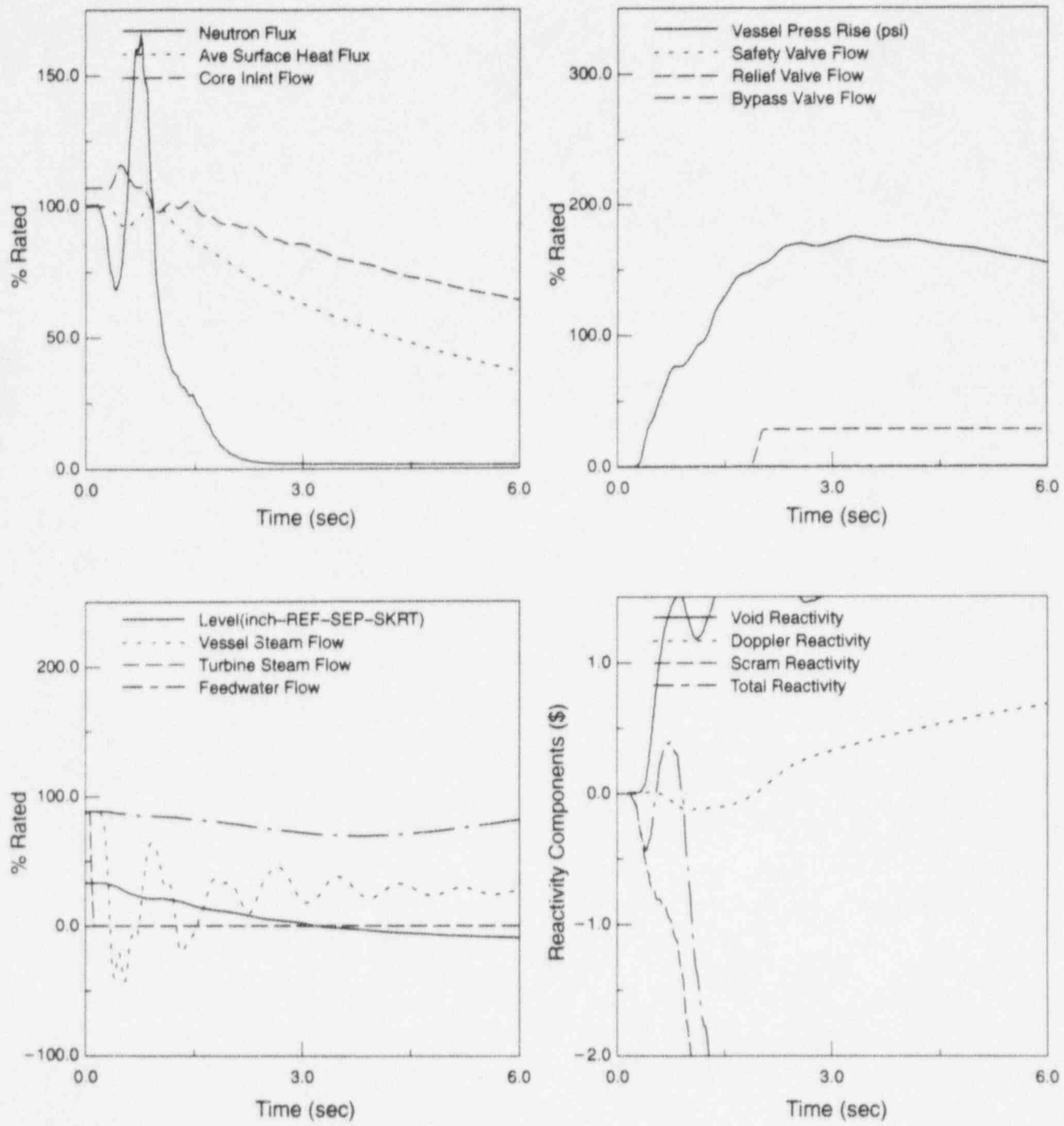


Figure 44 Plant Response to Turbine Trip w/o Bypass (BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) FWHOOS with ICF)

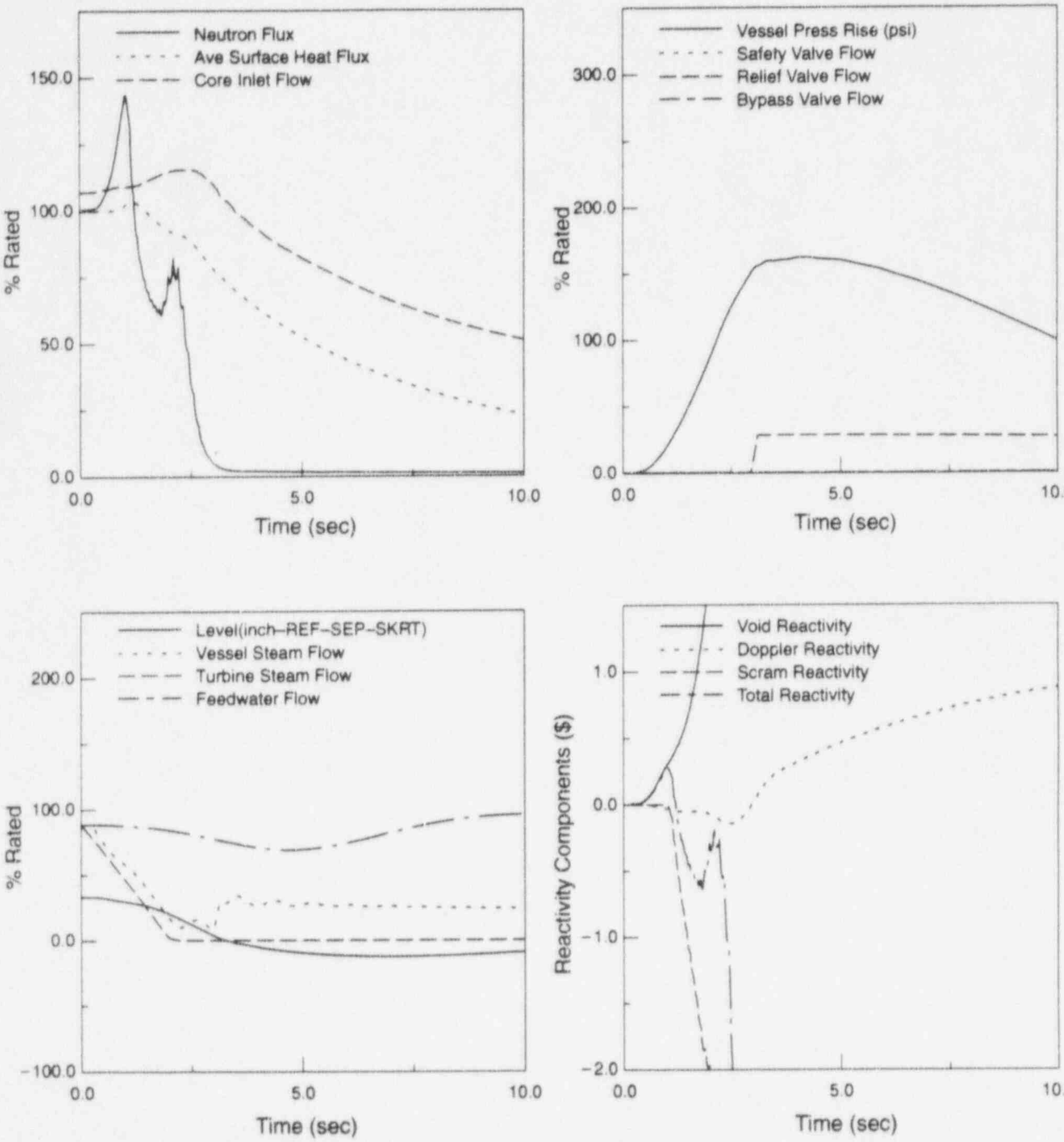


Figure 45 Plant Response to Press. Regulator Failure (BOC7 to EOC7-3693 MWd/MT (3350 MWd/ST) FWHOOS with ICF)

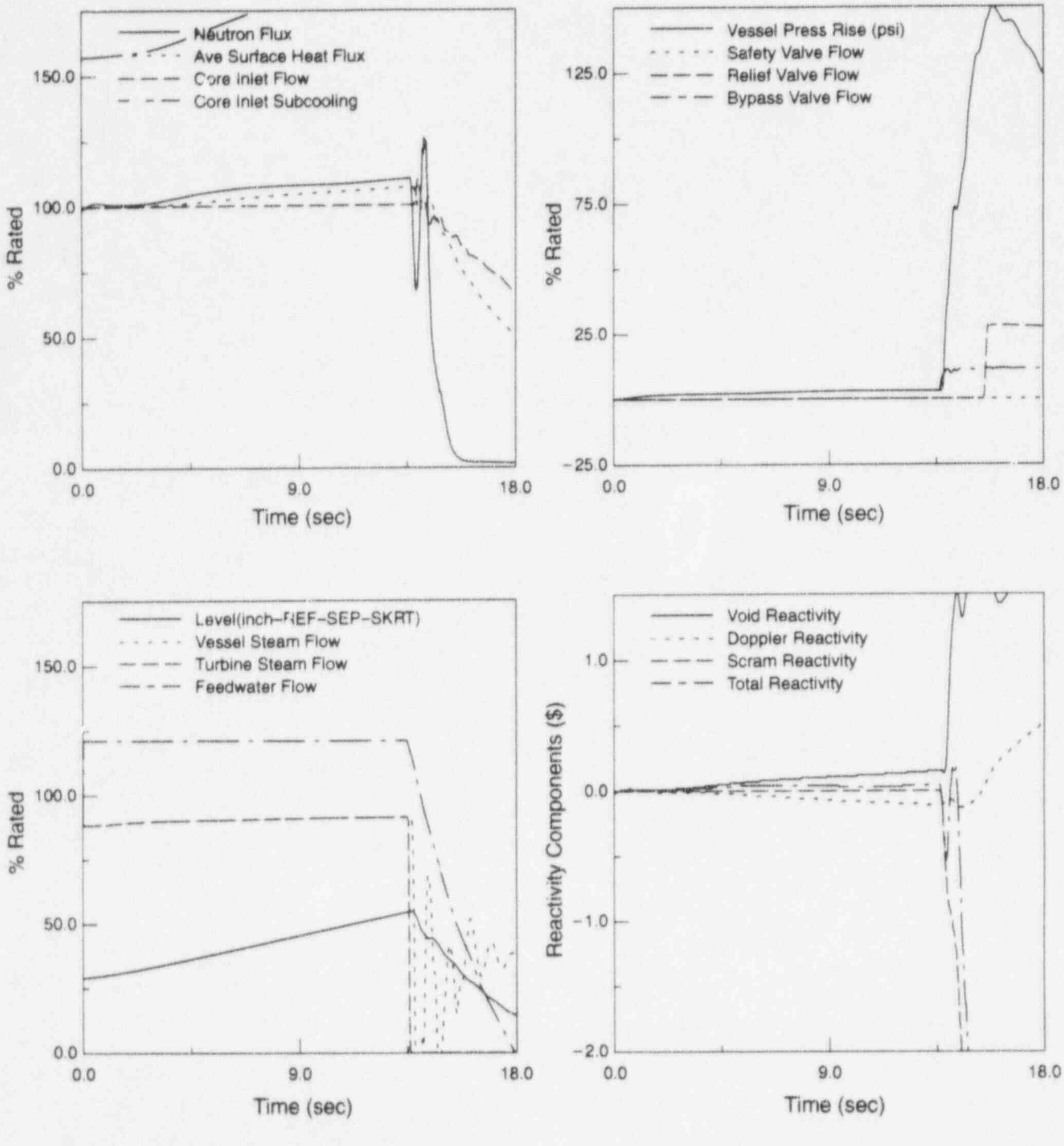


Figure 46 Plant Response to FW Controller Failure (BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) FWTR–100%P/100%F)

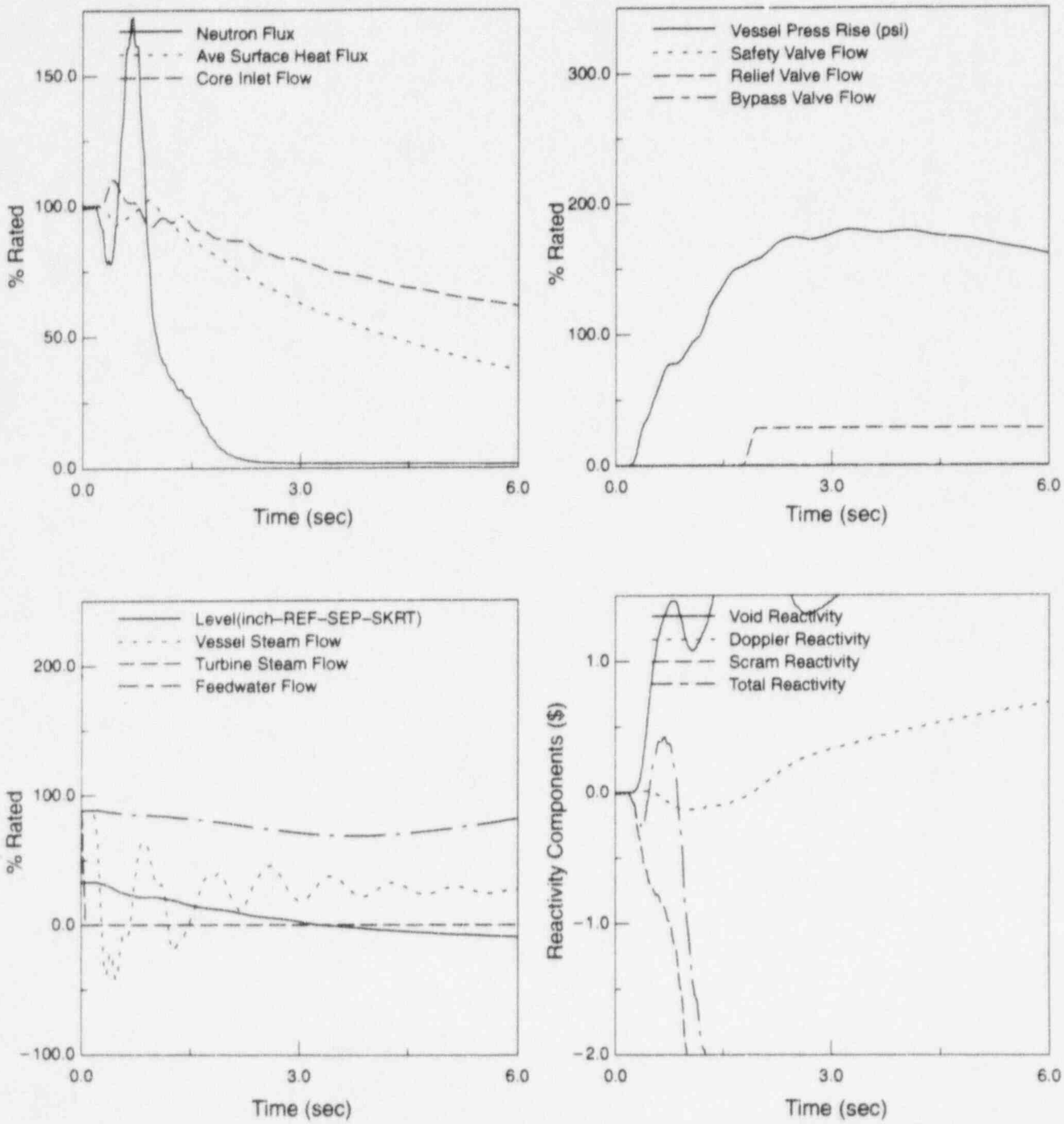


Figure 47 Plant Response to Load Reject w/o Bypass (BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) FWTR–100%P/100%F)

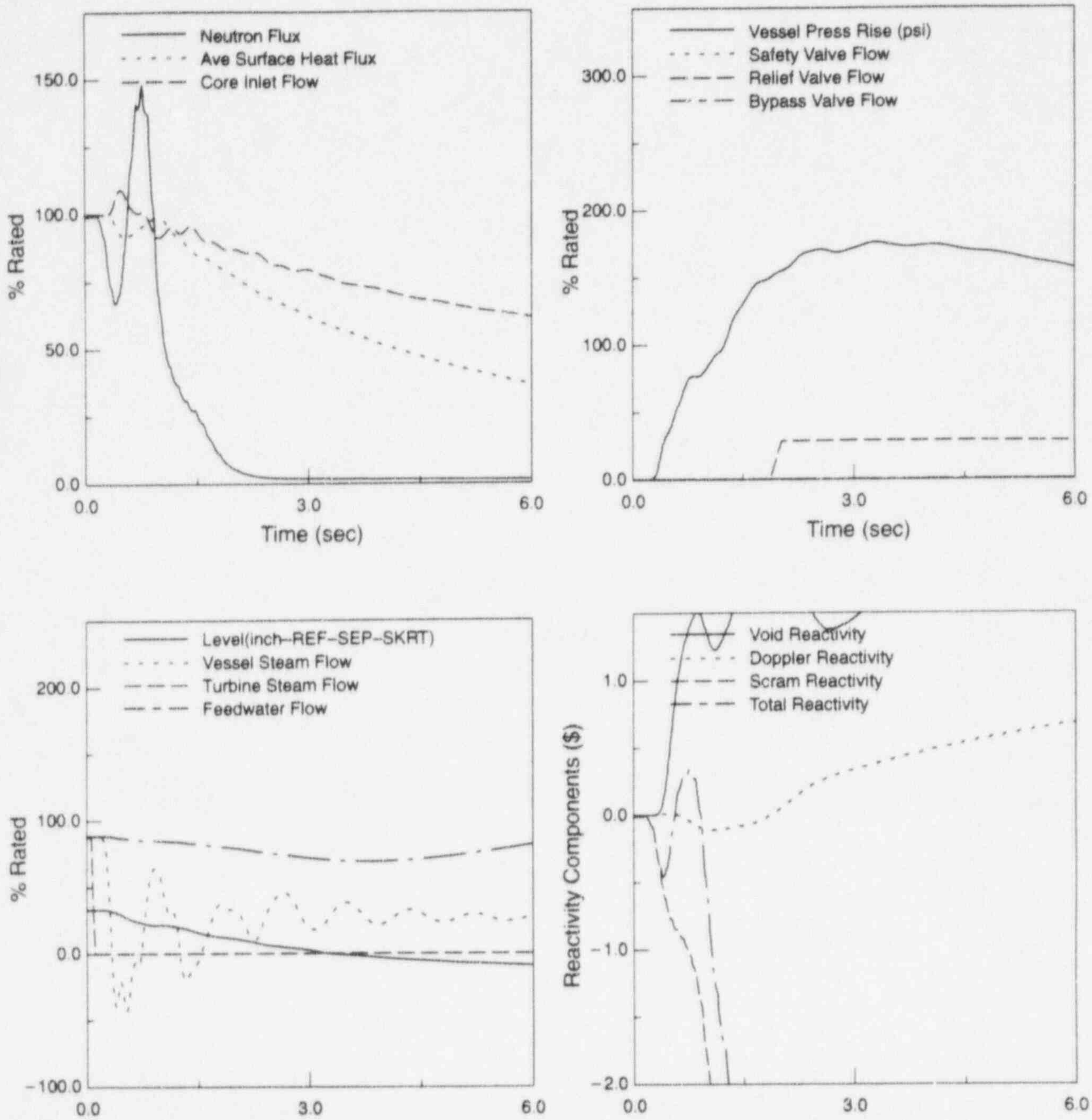


Figure 48 Plant Response to Turbine Trip w/o Bypass (BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) FWTR–100%P/100%F)

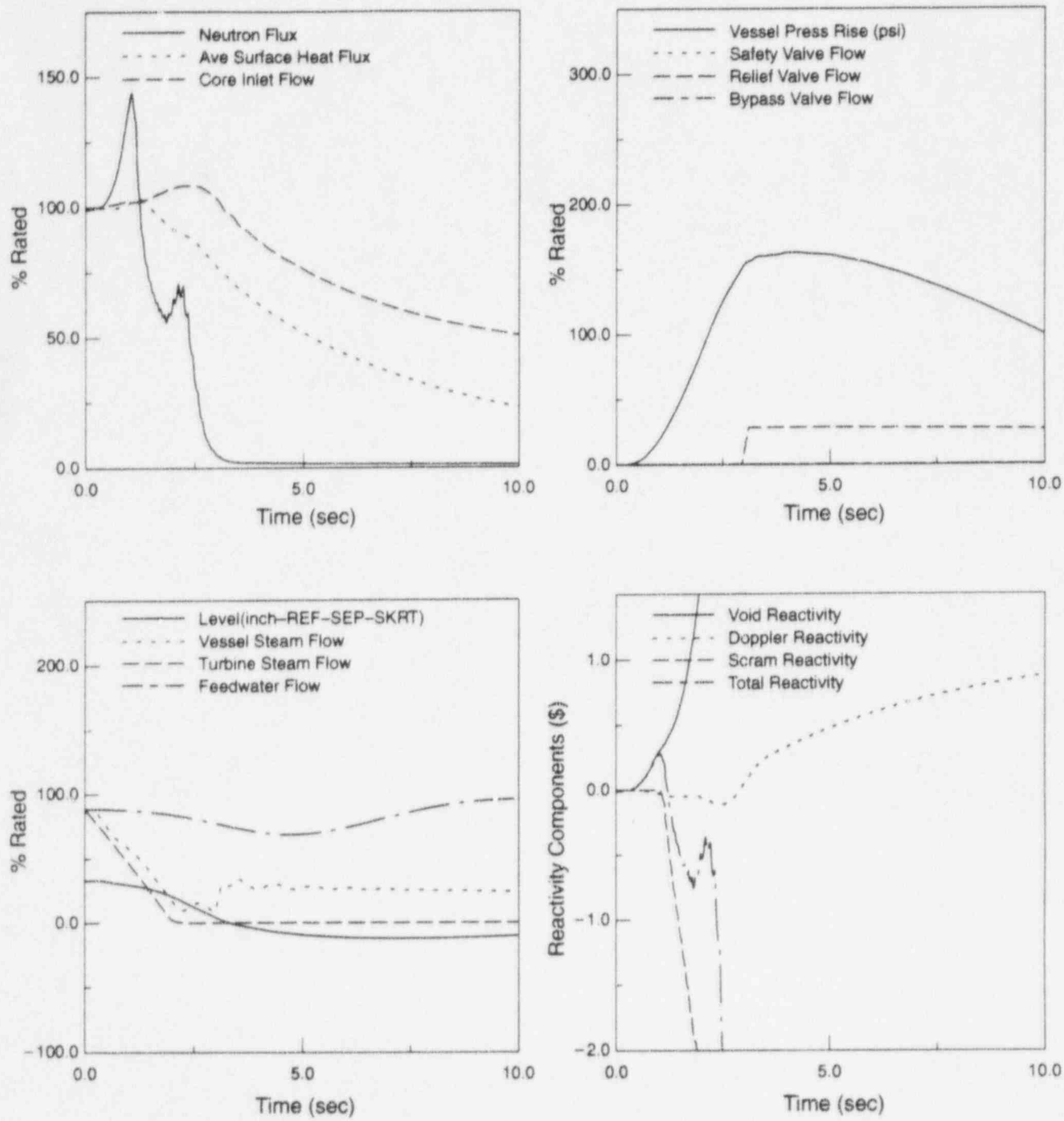


Figure 49 Plant Response to Press. Regulator Failure (BOC7 to EOC7–3693 MWd/MT (3350 MWd/ST) FWTR–100%P/100%F)

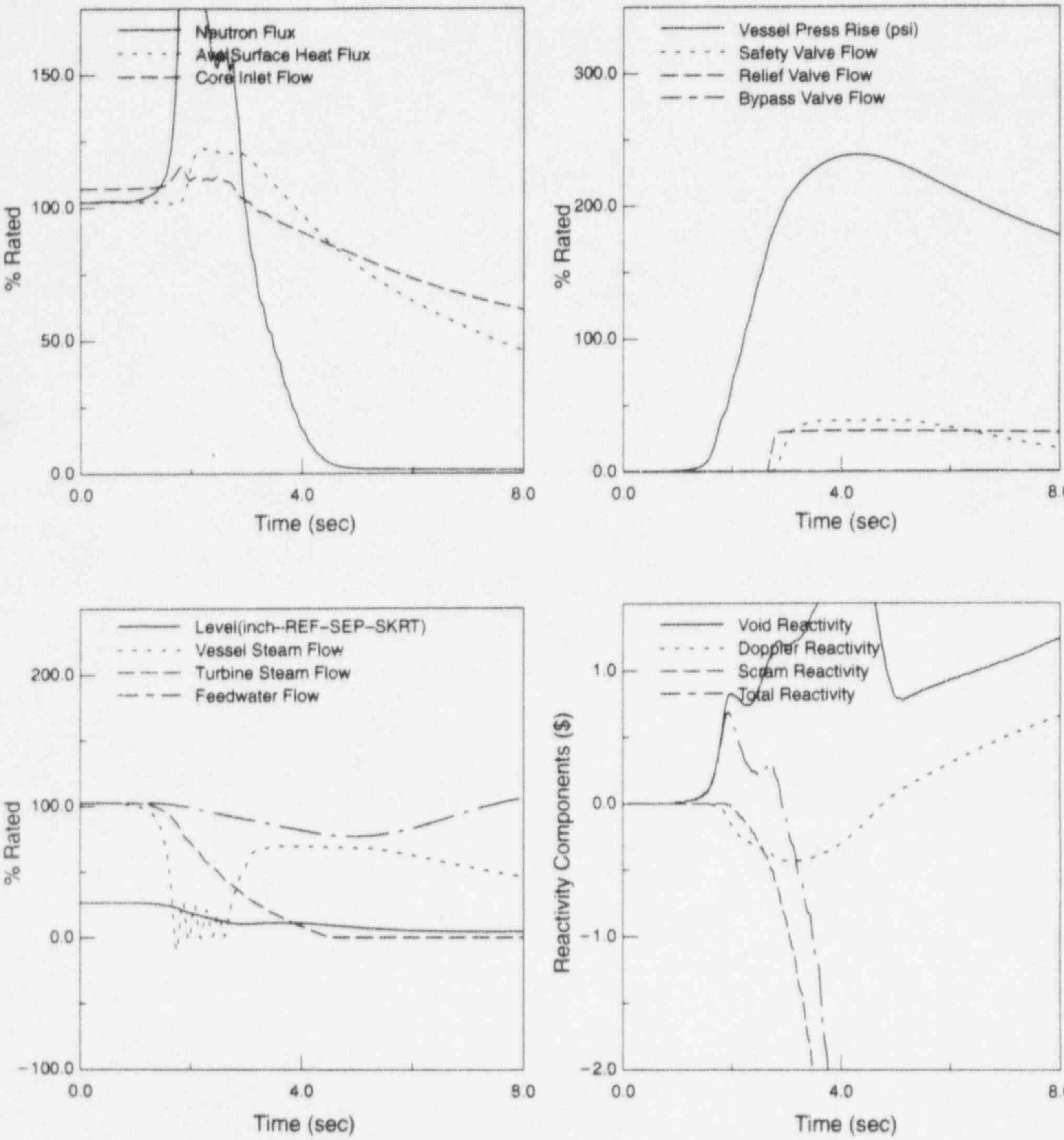


Figure 50 Plant Response to MSIV Closure (Flux Scram)

Appendix A
Analysis Conditions

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

Table A-1

STANDARD	
Parameter	**Analysis Value**
Thermal power, MWt	2894.0
Core flow, Mlb/hr	84.5
Reactor pressure, psia	1055.0
Inlet enthalpy, BTU/lb	527.9
Non-fuel power fraction	0.039
Steam flow analysis, Mlb/hr	12.46
Dome pressure, psig	1025.0
Turbine pressure, psig	985.9
No. of Dual Mode S/R Valves	9
Relief mode lowest setpoint, psig	1133.0
Safety mode lowest setpoint, psig	1200.0

EEOC WITH ICF	
Parameter	**Analysis Value**
Thermal power, MWt	2894.0
Core flow, Mlb/hr	90.4
Reactor pressure, psia	1056.4
Inlet enthalpy, BTU/lb	529.3
Non-fuel power fraction	0.039
Steam flow analysis, Mlb/hr	12.45
Dome pressure, psig	1025.0
Turbine pressure, psig	985.9
No. of Dual Mode S/R Valves	9
Relief mode lowest setpoint, psig	1133.0
Safety mode lowest setpoint, psig	1200.0

Appendix A
Analysis Conditions
(continued)

EEEOC WITH ICF AND FFWTR	
Parameter	**Analysis Value**
Thermal power, MWt	2894.0
Core flow, Mlb/hr	90.4
Reactor pressure, psia	1055.1
Inlet enthalpy, BTU/lb	519.0
Non–fuel power fraction	0.039
Steam flow analysis, Mlb/hr	11.00
Dome pressure, psig	1025.0
Turbine pressure, psig	994.7
No. of Dual Mode S/R Valves	9
Relief mode lowest setpoint, psig	1133.0
Safety mode lowest setpoint, psig	1200.0

FWTR–100%P/100%F	
Parameter	**Analysis Value**
Thermal power, MWt	2894.0
Core flow, Mlb/hr	84.5
Reactor pressure, psia	1053.9
Inlet enthalpy, BTU/lb	516.8
Non–fuel power fraction	0.039
Steam flow analysis, Mlb/hr	11.00
Dome pressure, psig	1025.0
Turbine pressure, psig	994.7
No. of Dual Mode S/R Valves	9
Relief mode lowest setpoint, psig	1133.0
Safety mode lowest setpoint, psig	1200.0

Appendix A
Analysis Conditions
(continued)

STANDARD–HALING	
Parameter	**Analysis Value**
Thermal power, MWt	2894.0
Core flow, Mlb/hr	84.5
Reactor pressure, psia	1055.0
Inlet enthalpy, BTU/lb	527.9
Non–fuel power fraction	0.039
Steam flow analysis, Mlb/hr	12.46
Dome pressure, psig	1025.0
Turbine pressure, psig	985.9
No. of Dual Mode S/R Valves	9
Relief mode lowest setpoint, psig	1133.0
Safety mode lowest setpoint, psig	1200.0

EEOC WITH ICF – HALING	
Parameter	**Analysis Value**
Thermal power, MWt	2894.0
Core flow, Mlb/hr	90.4
Reactor pressure, psia	1056.4
Inlet enthalpy, BTU/lb	529.3
Non–fuel power fraction	0.039
Steam flow analysis, Mlb/hr	12.45
Dome pressure, psig	1025.0
Turbine pressure, psig	985.9
No. of Dual Mode S/R Valves	9
Relief mode lowest setpoint, psig	1133.0
Safety mode lowest setpoint, psig	1200.0

Appendix A
Analysis Conditions
(continued)

EEEOC WITH ICF AND FFWTR HALING	
Parameter	**Analysis Value**
Thermal power, MWt	2894.0
Core flow, Mlb/hr	90.4
Reactor pressure, psia	1055.1
Inlet enthalpy, BTU/lb	519.0
Non-fuel power fraction	0.039
Steam flow analysis, Mlb/hr	11.00
Dome pressure, psig	1025.0
Turbine pressure, psig	994.7
No. of Dual Mode S/R Valves	9
Relief mode lowest setpoint, psig	1133.0
Safety mode lowest setpoint, psig	1200.0

EOC WITH FFWTR HALING-100%P/100%F	
Parameter	**Analysis Value**
Thermal power, MWt	2894.0
Core flow, Mlb/hr	84.5
Reactor pressure, psia	1053.9
Inlet enthalpy, BTU/lb	516.8
Non-fuel power fraction	0.039
Steam flow analysis, Mlb/hr	11.00
Dome pressure, psig	1025.0
Turbine pressure, psig	994.7
No. of Dual Mode S/R Valves	9
Relief mode lowest setpoint, psig	1133.0
Safety mode lowest setpoint, psig	1200.0

Appendix A
Analysis Conditions
(continued)

STANDARD–MOC	
Parameter	**Analysis Value**
Thermal power, MWt	2894.0
Core flow, Mlb/hr	84.5
Reactor pressure, psia	1055.0
Inlet enthalpy, BTU/lb	527.9
Non–fuel power fraction	0.039
Steam flow analysis, Mlb/hr	12.46
Dome pressure, psig	1025.0
Turbine pressure, psig	985.9
No. of Dual Mode S/R Valves	9
Relief mode lowest setpoint, psig	1133.0
Safety mode lowest setpoint, psig	1200.0

MOC WITH ICF	
Parameter	**Analysis Value**
Thermal power, MWt	2894.0
Core flow, Mlb/hr	90.4
Reactor pressure, psia	1056.4
Inlet enthalpy, BTU/lb	529.3
Non–fuel power fraction	0.039
Steam flow analysis, Mlb/hr	12.45
Dome pressure, psig	1025.0
Turbine pressure, psig	985.9
No. of Dual Mode S/R Valves	9
Relief mode lowest setpoint, psig	1133.0
Safety mode lowest setpoint, psig	1200.0

Appendix A
Analysis Conditions
(continued)

MOC –FWHOOS with ICF	
Parameter	**Analysis Value**
Thermal power, MWt	2894.0
Core flow, Mlb/hr	90.4
Reactor pressure, psia	1055.1
Inlet enthalpy, BTU/lb	519.0
Non–fuel power fraction	0.039
Steam flow analysis, Mlb/hr	11.00
Dome pressure, psig	1025.0
Turbine pressure, psig	994.7
No. of Dual Mode S/R Valves	9
Relief mode lowest setpoint, psig	1133.0
Safety mode lowest setpoint, psig	1200.0

MOC–FWTR 100%P/100%F	
Parameter	**Analysis Value**
Thermal power, MWt	2894.0
Core flow, Mlb/hr	84.5
Reactor pressure, psia	1053.9
Inlet enthalpy, BTU/lb	516.8
Non–fuel power fraction	0.039
Steam flow analysis, Mlb/hr	11.00
Dome pressure, psig	1025.0
Turbine pressure, psig	994.7
No. of Dual Mode S/R Valves	9
Relief mode lowest setpoint, psig	1133.0
Safety mode lowest setpoint, psig	1200.0

Appendix B
Alternate Analysis for Feedwater Temperature Reduction

To provide for improved operating flexibility and cycle extension for Cycle 7, expanded operating domain analyses were performed for Increased Core Flow (ICF) at 107% rated and intermittent use of Final Feedwater Temperature Reduction (FFWTR) to a temperature (at full power) of 320 degrees F. The analyses for cycle extension with ICF were performed at EEOC7[8] exposure point using appropriate thermal hydraulic conditions. The analyses for cycle extension with ICF and FFWTR was performed at EEEOC7[9] exposure point achieved with ICF and FFWTR using the appropriate thermal hydraulic conditions. Contained in this license submittal are results of all analyses evaluated for this licensing activity. The transient MCPR values for all analyses are given in Section 11. The analyses for ICF and FFWTR bound the intermittent concurrent use of FFWTR from BOC to EEEOC operation with ICF and FFWTR.

The Final Feedwater Temperature Reduction (FFWTR) extension flexibility option cannot be exercised until the GE Nuclear Service organization has completed their work and evaluation.

8. EEOC7 identifies the rated power operation exposure point attainable, using ICF only. For Cycle 7 the core average exposure for EEOC7 is 26,476 MWd/MTU.

9. EEEOC7 identifies the rated power operation exposure point attainable, using ICF and FFWTR. For Cycle 7 the core average exposure for EEEOC7 is 27,133 MWd/MTU.

Appendix C
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).

Appendix D
Basis for Analysis of Core–Wide and Overpressurization Transients

The Core–Wide and Overpressurization Transients were analyzed with four valves out of sixteen operable in relief mode and five valves out of sixteen operable in safety mode. The seven inoperable S/RV's are applicable only to the Vessel Overpressure ASME Code Compliance upset condition and fuel thermal performance criteria. The analyses performed reflect the River Bend Station Technical Specifications, which permit operation with 4 valves in relief mode and 5 valves in safety (spring) mode.

In addition , the core–wide pressurization transients and overpressurization transients were evaluated with new opening setpoints on the S/RV's. The GE Nuclear Services analysis is still not complete and these set points cannot be implemented until such time as their evaluation has been completed.

Appendix E
Basis for Analysis of Loss–of–Coolant Accident

The GE11 MAPLHGR's for Cycle 7 have been generated assuming a MCPR of $\geq$ 1.28 and a diesel startup time of 10 seconds, which is the same as the FSAR basis. By having generated the GE11 MAPLHGR's with the above assumptions the potentially lower OLMCPR MOC points reported in this submittal are not applicable until further analyses are performed or SAFER/GESTR is implemented.

Appendix F
Basis for Analysis of
Standby Liquid Control System Shutdown Capability

The minimum required boron shutdown margin is dependent on the fuel design type and the calculational method. The minimum required boron shutdown margin represents the biases and uncertainties needed to assure subcriticality. This is a GE recommended value and may be less restrictive than the River Bend specific technical specifications requirement for the liquid boron shutdown margin, in which case the technical specification value shall be used. For the analysis reported in this Supplemental Reload Licensing Submittal fuel specific borated libraries were generated using lattice physics methods at 160 deg. C and 724 ppm boron. A boron concentration of 724 ppm boron at 160 deg. C is equivalent to 660 ppm boron at 20 deg. C resulting from the change in water density and inventory. The margin requirements to satisfy for this method with GE11 in the core is 1.4%.

Appendix G

Plant Operation Above the Rated Load Line Up to Rated Power

For River Bend Station, Reload 6/ Cycle 7 analyses have been performed in addition to the standard reload analyses to support operation in the extended operation region. The consequences of the AOO's have been evaluated to determine if operating limits reported in Section 11 are bounding for operation in the extended operating range. The analyses were performed at 100% power and 91% flow with both normal feedwater temperature and reduced feedwater temperature. The results of the calculations are reported below and are bounded by the OLMCPR operating limits of 1.28 for the GE11 fuel and 1.22 for the GE8 fuel reported in Section 11 of the Supplemental Reload Licensing Report.

Exposure range: BOC7 to EOC7 100%P/91%F **Exposure point: EOC7**		
	GE11	**GE8x8EB**
FW Controller Failure	1.25	nc*
Load Reject w/o Bypass	1.27	nc
Turbine Trip w/o Bypass	1.25	nc
Press. Regulator Failure	1.17	nc

Exposure range: BOC7 to EOC7 100%P/91%F 320 Deg. F **Exposure point: EOC7**		
	GE11	**GE8x8EB**
FW Controller Failure	1.25	nc
Load Reject w/o Bypass	1.25	nc
Turbine Trip w/o Bypass	1.24	nc
Press. Regulator Failure	1.18	nc

* nc = not calculated

Appendix G (continued)

Plant Operation Above the Rated Load Line Up to Rated Power

Exposure range: BOC7 to EOC7-3693 MWd/MT (3350 MWd/ST) 100%P91%F Exposure point: EOC7-3693 MWd/MT (3350 MWd/ST)		
	GE11	**GE8x8EB**
FW Controller Failure	1.18	nc*
Load Reject w/o Bypass	1.20	nc
Turbine Trip w/o Bypass	1.19	nc
Press. Regulator Failure	1.14	nc

Exposure range: BOC7 to EOC7-3693 MWd/MT (3350 MWd/ST) 100%P/91%F 320 Deg.F. Exposure point: EOC7-3693 MWd/MT (3350 MWd/ST)		
	GE11	**GE8x8EB**
FW Controller Failure	1.16	nc
Load Reject w/o Bypass	1.17	nc
Turbine Trip w/o Bypass	1.15	nc
Press. Regulator Failure	1.14	nc

* nc = not calculated