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GENERAL ELECTRIC BOILING WATER REACTOR
SUPPLEMENTAL RELOAD LICENSING SUBMITTAL

FOR

PILGRIM NUCLEAR POWER STATION
RELOAD 7

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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 E. G. Thacker II, of the Nuclear Fuel Engineering Department.

1. PLANT UNIQUE ITEMS (1.0)*

GENEISIS Physics Used with GEMINI ODYN

Appendix A: Increased Core Flow Throughout the Cycle

Appendix B: Initial Conditions:

2. RELOAD FUEL BUNDLES (1.0, 2.0, 3.3.1 AND 4.0)

<u>Fuel Designation</u>	<u>Cycle Loaded</u>	<u>Number</u>
Irradiated		
P8DRB282	5	24
P8DRB265H	6	60
P8DRB282	6	112
BP8DRB282	7	32
P8DRB282	7	160
New		
BP8DRB300	8	<u>192</u>
Total		580

3. REFERENCE CORE LOADING PATTERN (3.3.1)

	<u>MWd/MT</u>	<u>MWd/ST</u>
Nominal previous cycle core average exposure at end of cycle:	18362	16658
Minimum previous cycle core average exposure at end of cycle from cold shutdown considerations:	18362	16658
Assumed reload cycle core average exposure at end of cycle:	20593	18682

Core loading pattern:

Figure 1

* () Refer to area of discussion in "General Electric Standard Application for Reactor Fuel," NEDE-24011-P-A-8, May 1986. A letter "S" preceding the number refers to the U.S. Supplement, NEDE-24011-P-A-8-US, May 1986.

4. CALCULATED CORE EFFECTIVE MULTIPLICATION AND CONTROL SYSTEM WORTH - NO VOIDS, 20°C (3.3.2.1.1 and 3.3.2.1.2)

Minimum Shutdown Margin, BOC, k_{eff}

Uncontrolled	1.116
Fully Controlled	0.962
Strongest Control Rod Out	0.990
R, Maximum Increase in Cold Core Reactivity with Exposure into Cycle, Δk	0.000

5. STANDBY LIQUID CONTROL SYSTEM SHUTDOWN CAPABILITY (3.3.2.1.3)

<u>ppm</u>	<u>Shutdown Margin (Δk) (20°C, Xenon Free)</u>
700	0.044

6. RELOAD UNIQUE TRANSIENT ANALYSIS INPUT (3.3.2.1.5 AND S.2.2)

(COLD WATER INJECTION EVENTS ONLY)

Void Fraction (%)	36.2
Average Fuel Temperature (°F)	1147
Void Coefficient N/A* ($\$/\%$ Rg)	-5.76/-7.20
Doppler Coefficient N/A* ($\$/^\circ\text{F}$)	-0.175/-0.166
Scram Worth N/A* ($\$$)	**

*N = Nuclear Input Data, A = Used in Transient Analysis

**Generic exposure independent values are used as given in "General Electric Application for Reactor Fuel," NEDE-24011-P-A-8-US, May 1986.

7. RELOAD UNIQUE GETAB TRANSIENT ANALYSIS INITIAL CONDITION PARAMETER (S.2.2)

Fuel Design	Peaking Factors			R-Factor	Bundle Power (MWt)	Bundle Flow (1000 lb/hr)	Initial MCPR
	Local	Radial	Axial				
<u>BOC8 to BOC8+8282 MWd/MT (BOC8+7513 MWd/ST)</u>							
BP/P8x8R	1.20	1.78	1.40	1.051	5.982	105.2	1.30
<u>BOC8+8282 MWd/MT (BOC8+7513 MWd/ST) to EOC8</u>							
BP/P8x8R	1.20	1.69	1.40	1.051	5.685	107.1	1.38

8. SELECTED MARGIN IMPROVEMENT OPTIONS (S.2.2.2)

Transient Recategorization:	No
Recirculation Pump Trip:	No
Rod Withdrawal Limiter:	No
Thermal Power Monitor:	No
Measured Scram Time:	No
Number of Exposure Points:	2

9. OPERATING FLEXIBILITY OPTIONS (S.2.2.3)

Single Loop Operation:	Yes
Load Line Limit:	Yes
Extended Load Line Limit:	Yes
Increased Core Flow:	Yes
Flow Point Analyzed:	107.5%
Feedwater Temperature Reduction:	No
ARTS Program:	No
Maximum Extended Operating Domain:	No

10. CORE-WIDE TRANSIENT ANALYSIS RESULTS (S.2.2.1)

<u>Transient</u>	<u>Flux (% NBR)</u>	<u>Q/A (% NBR)</u>	<u>Δ CPR BP/P8x8R</u>	<u>Figure</u>
Exposure: BOC8 to EOC8				
Loss of Feedwater Heating	117	114	0.14	2
Exposure: BOC8 to BOC8+8282 MWd/MT (BOC8+7513 MWd/ST)				
Load Rejection w/o Bypass	471	118	0.23	3
Feedwater Controller Failure	257	115	0.16	4
Exposure: BOC8+8282 MWd/MT (BOC8+7513 MWd/ST) to EOC8				
Load Rejection w/o Bypass	561	123	0.31	5
Feedwater Controller Failure	317	122	0.25	6

11. LOCAL ROD WITHDRAWAL ERROR (WITH LIMITING INSTRUMENT FAILURE) TRANSIENT SUMMARY (S.2.2.1)

(Generic Bounding Analysis Results)

<u>Rod Block Reading (%)</u>	<u>Δ CPR BP/P8x8R</u>
104	0.13
105	0.16
106	0.19
107	0.22
108	0.28
109	0.32
110	0.36

Setpoint Selected is: 107

12. CYCLE MCPR VALUES (S.2.2 and S.2.5.4)

Non-Pressurization Events:

Exposure Range: BOC8 to EOC8

	<u>BP/P8x8R</u>
Loss of Feedwater Heating	1.21*
Fuel Loading Error	1.26
Rod Withdrawal Error	1.29

Pressurization Events:

	<u>Option A</u>	<u>Option B</u>
	<u>BP/P8x8R</u>	<u>BP/P8x8R</u>
Exposure Range: BOC8 to BOC8+8282 MWd/MT (BOC+7513 MWd/ST)		
Load Rejection Without Bypass	1.36	**
Feedwater Controller Failure	1.28	**
Exposure Range: BOC8+8282 MWd/MT (BOC8+7513 MWd/ST) to EOC8		
Load Rejection Without Bypass	1.44	1.39
Feedwater Controller Failure	1.37	1.29

13. OVERPRESSURIZATION ANALYSIS SUMMARY (S.2.3)

<u>Transient</u>	<u>P_{sl}</u> <u>(psig)</u>	<u>P_v</u> <u>(psig)</u>	<u>Plant Response</u>
MSIV Closure (Flux Scram)	1299	1315	Figure 7

*The minimum MCPR value required by the ECCS analysis is 1.24.

**Option B is not available for this exposure.

14. LOADING ERROR RESULTS (S.2.5.4)

Variable Water Gap Misoriented Bundle Analysis: Yes

<u>Event</u>	<u>ΔCPR</u>
Misoriented	0.19

15. CONTROL ROD DROP ANALYSIS RESULTS (S.2.5.1)

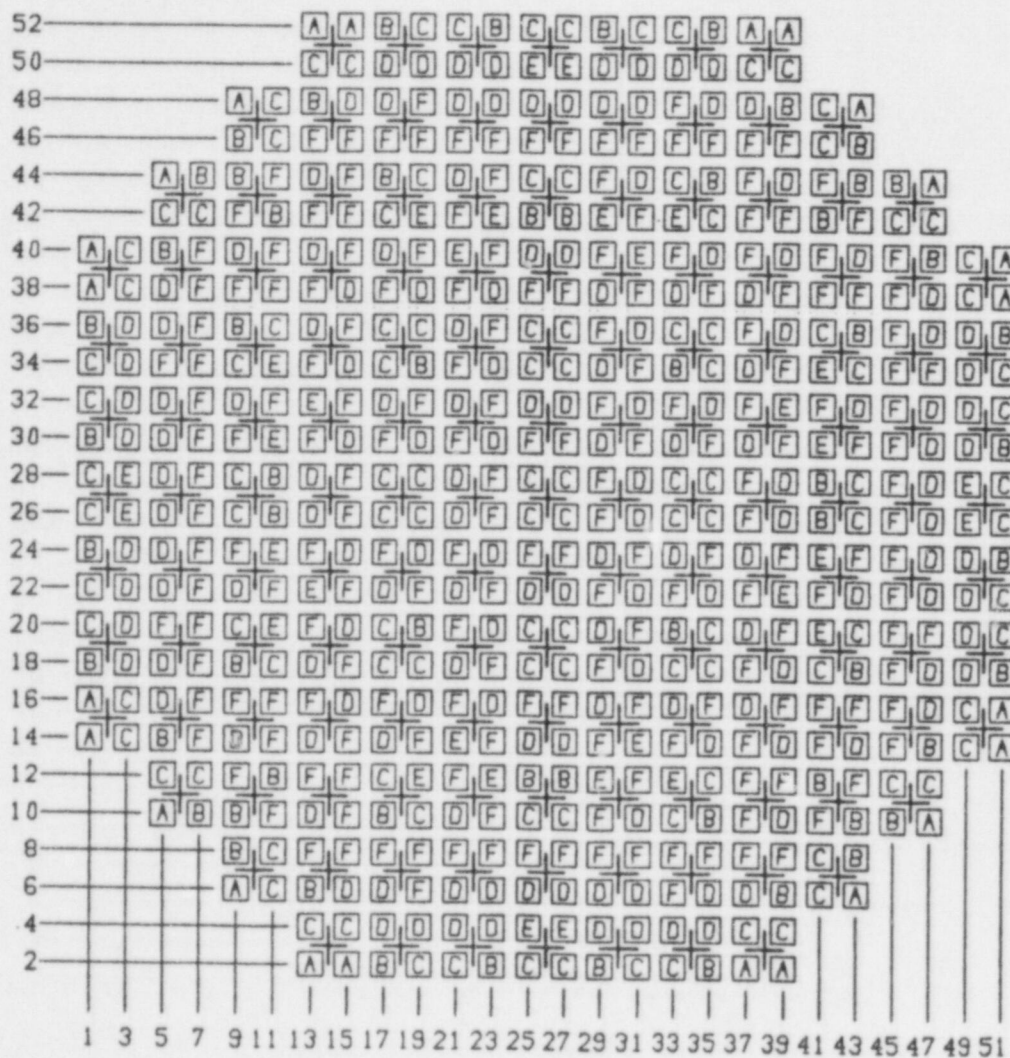
Banked Position Withdrawal Sequence has been implemented at the Pilgrim Nuclear Power Station, so the Control Rod Drop Accident Analysis is not required. NRC approval is documented in NEDE-24011-P-A-8-US, May 1986.

16. STABILITY ANALYSIS RESULTS (S.2.4)

GE BWR 2/3 plants are exempt from performing cycle specific stability analyses. NRC approval is documented in NEDE-24011-P-A-8-US, May 1986.

17. LOSS-OF-COOLANT ACCIDENT RESULTS, NEW FUEL (S.2.5.2)

See "Loss-of-Coolant Accident Analysis Report for Pilgrim Nuclear Power Station," August 1977, NEDO-21696, as amended.



FUEL TYPE	
A = P8DRB282	D = P8DRB282
B = P8DRB265H	E = BP8DRB282
C = P8DRB282	F = BP8DRB300

Figure 1. Reference Core Loading Pattern

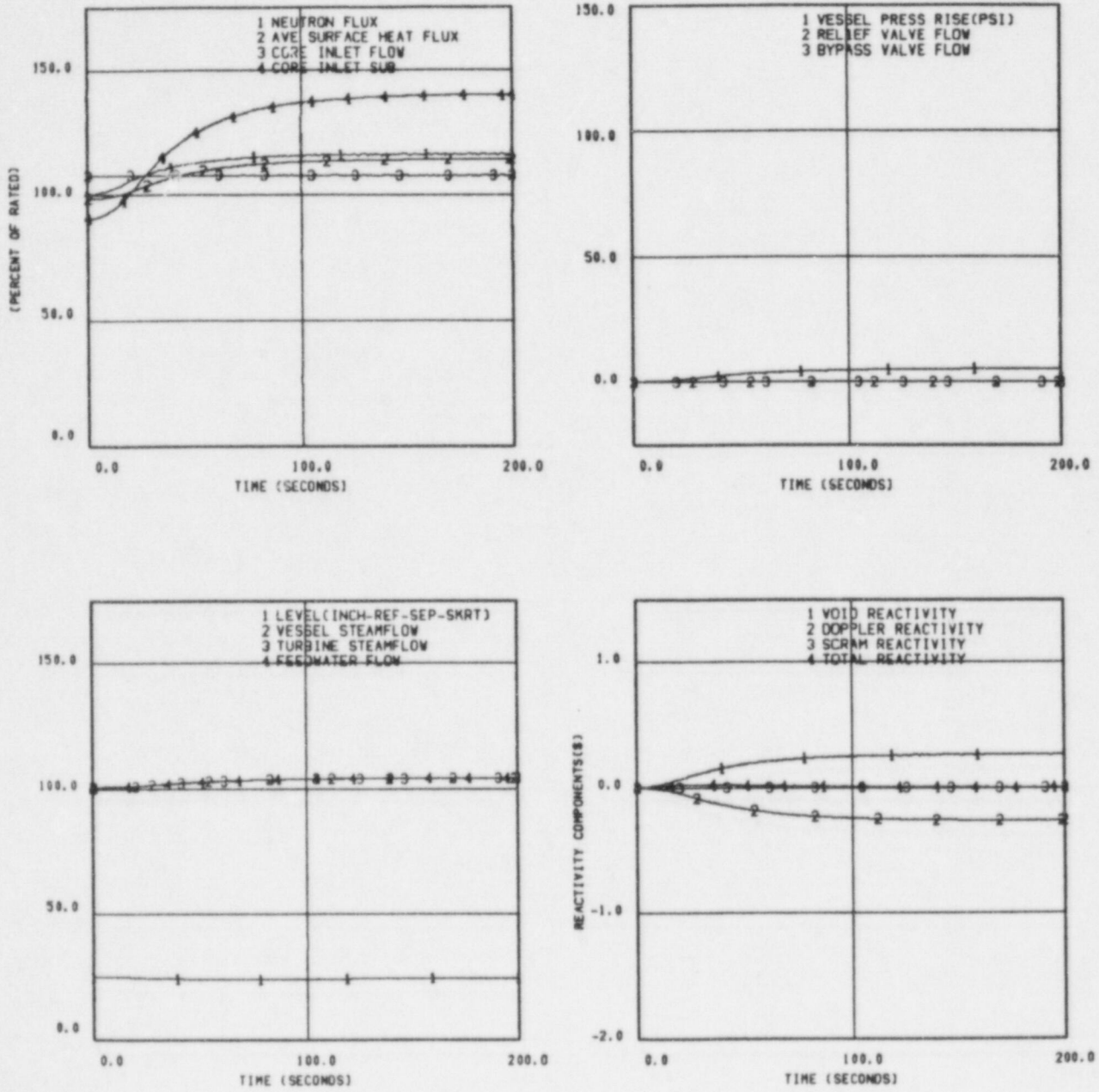


Figure 2. Plant Response to Loss of Feedwater Heating (BOC8 to EOC8)

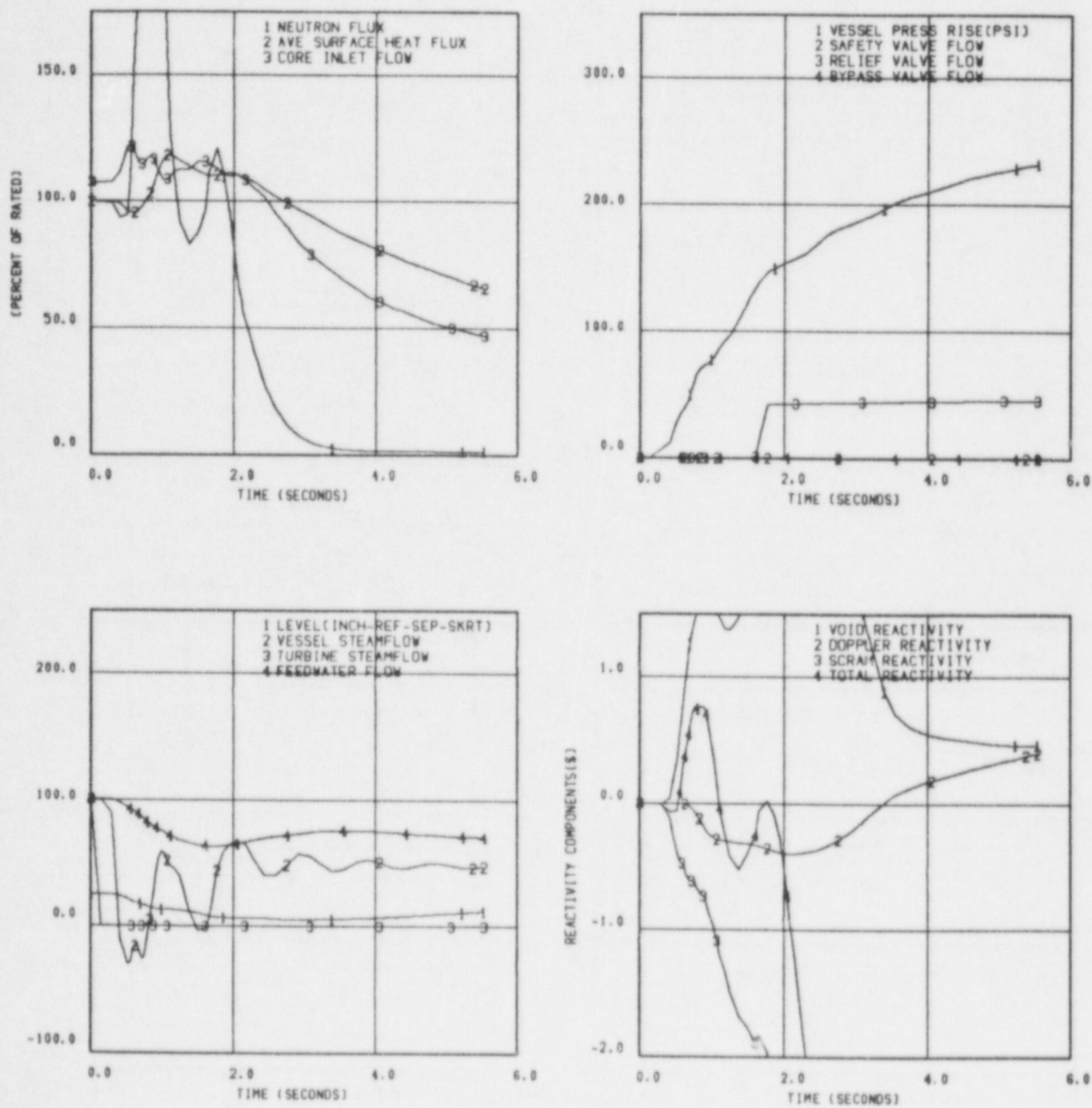


Figure 3. Plant Response to Generator Load Rejection Without Bypass
(BOC8 to BOC8+8282 MWd/MT [BOC+7513 MWd/ST])

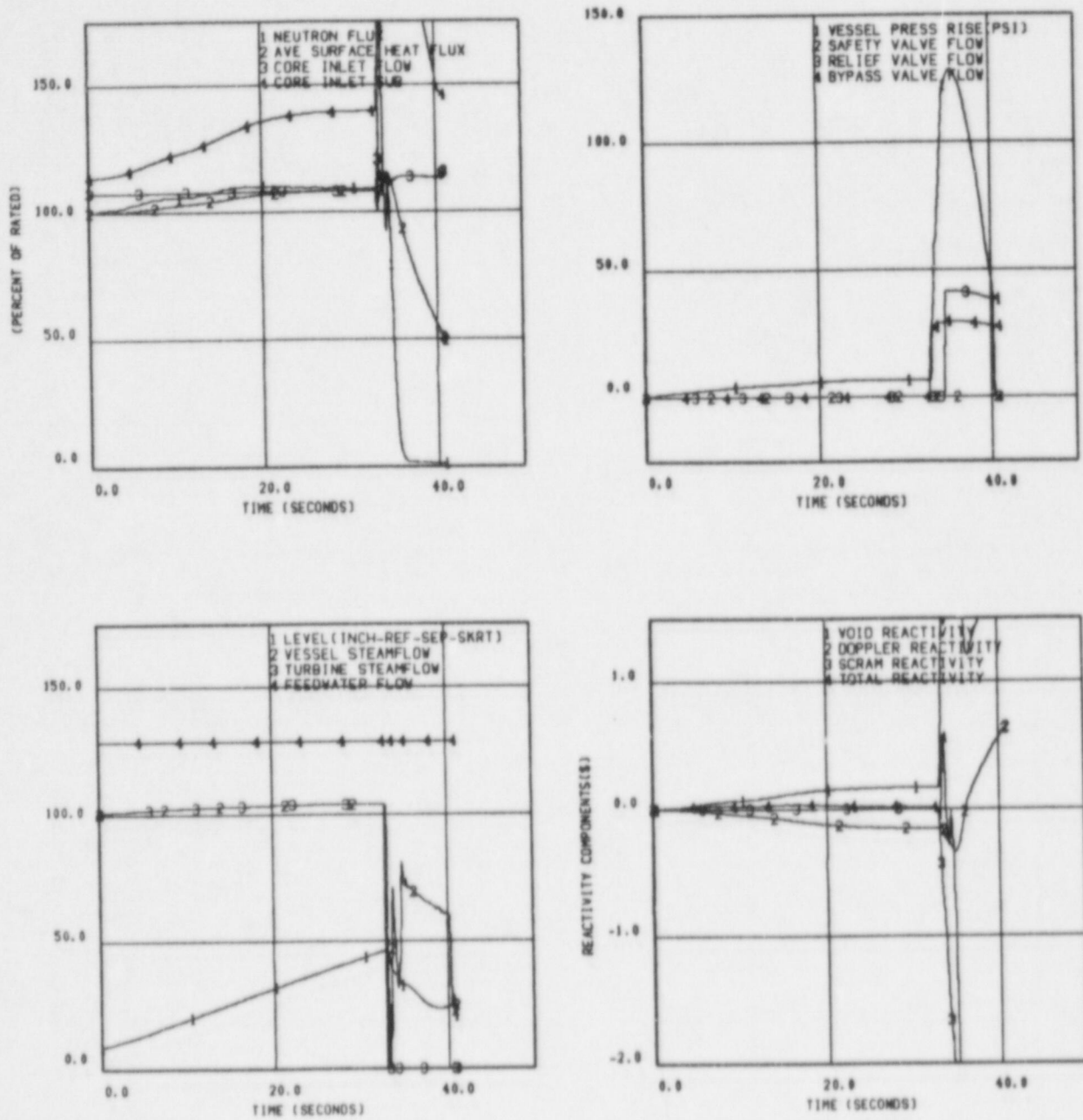


Figure 4. Plant Response to Feedwater Controller Failure
(BOC8 to BOC8+8282 MWd/MT [BOC8+7513 MWd/ST])

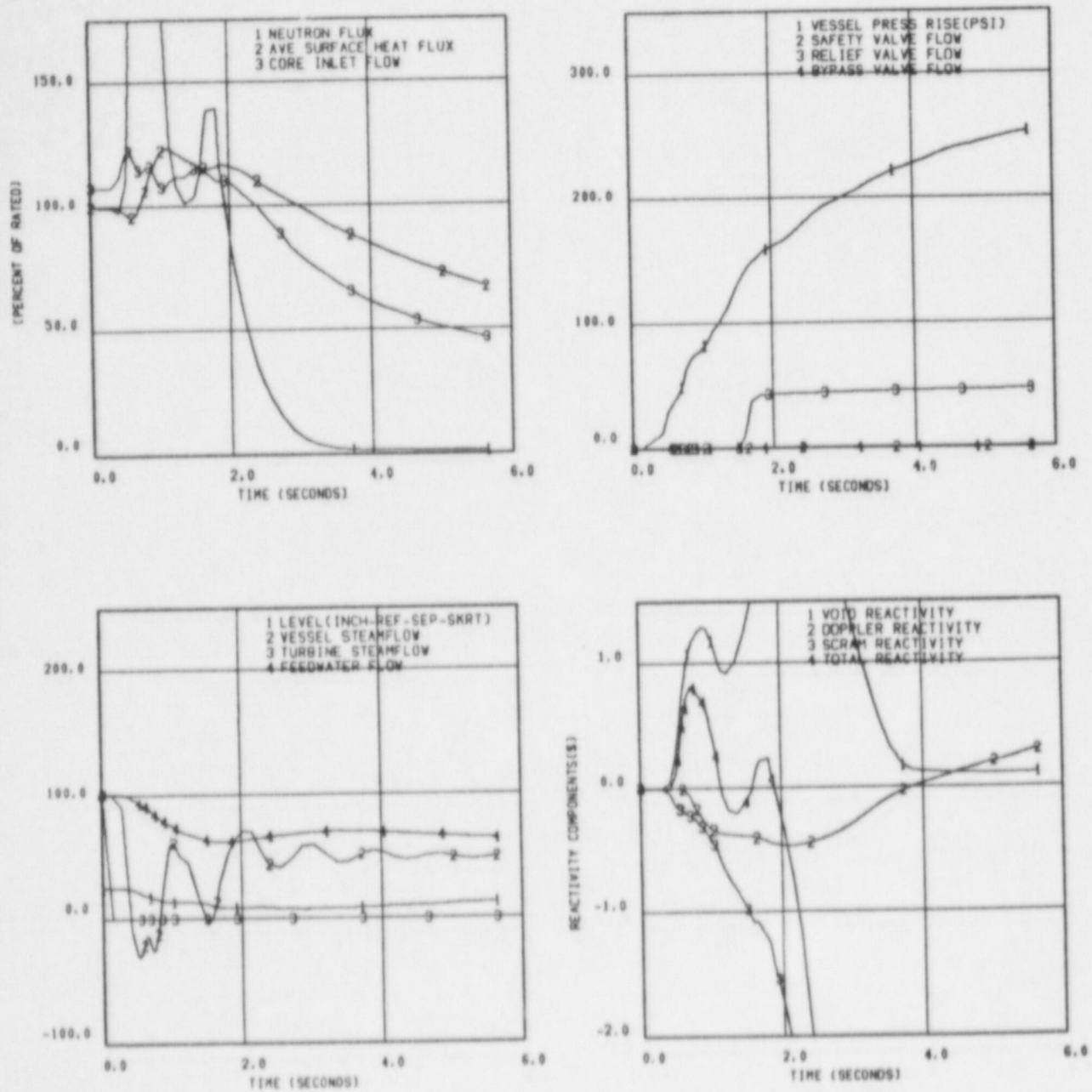


Figure 5. Plant Response to Generator Load Rejection Without Bypass
(BOC8+8282 MWd/MT [BOC8+7513 MWd/ST] to EOC8)

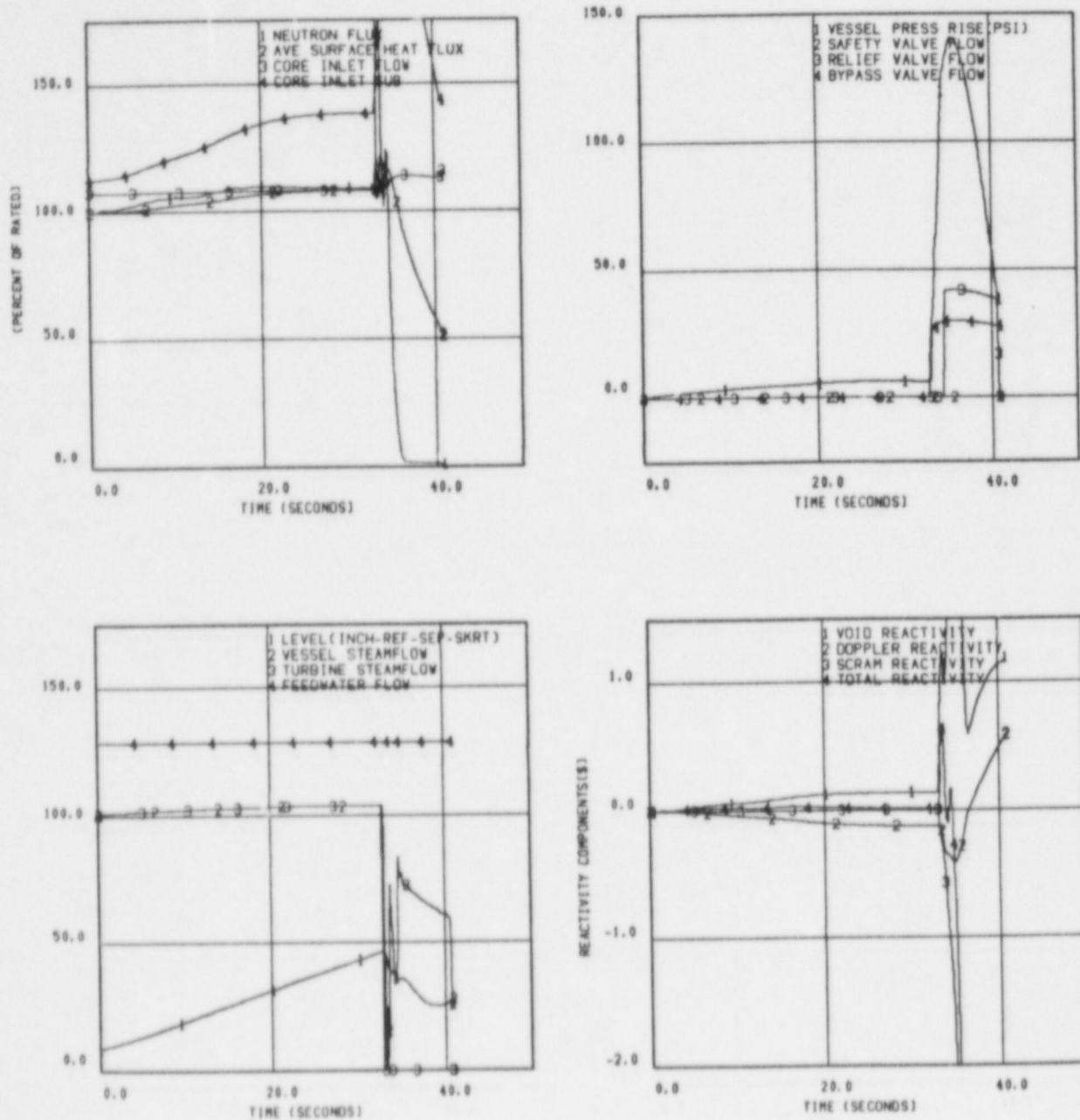


Figure 6. Plant Response to Feedwater Controller Failure
(BOC8+8282 MWD/MT [BOC8+7513 MWD/ST] to EOC8)

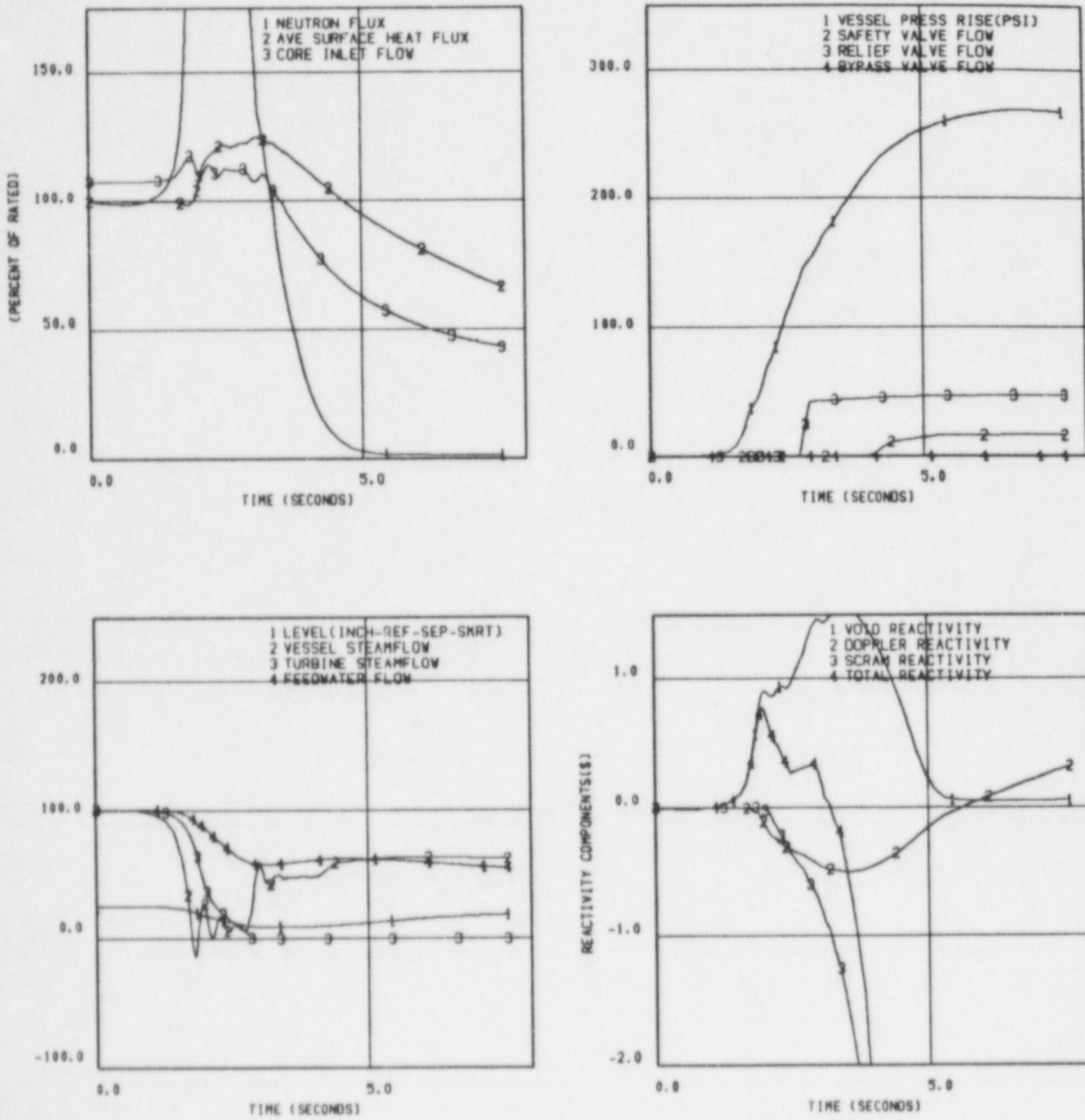


Figure 7. Plant Response to MSIV Closure (Flux Scram)

APPENDIX A
INCREASE CORE FLOW THROUGHOUT CYCLE

The analyses performed for Cycle 8 included increased core flow throughout the cycle. There are no concerns regarding reactor internals pressure drop or flow-induced vibration as discussed in the increased core flow analysis document for the EOC-6 (NEDO-30242).

The flow-biased instrumentation for the rod block monitor should be signal clipped for a setpoint of 107%, since flow rates higher than rated would otherwise result in a Δ CPR higher than reported for the rod withdrawal error.

APPENDIX B
INITIAL CONDITIONS

Transient Analysis Conditions:

<u>Initial Condition Parameter</u>	<u>Analysis Value</u>	<u>NEDE-24011 Value</u>
Core Flow, Mlb/hr <u>+0.2%</u>	74	69

GETAB Analysis Initial Conditions:

<u>Initial Condition Parameter</u>	<u>Analysis Value</u>	<u>NEDE-24011 Value</u>
Core Flow, Mlb/hr	74	69
Reactor Core Pressure, psia	1067	1057
Inlet Enthalpy, Btu/lb	528.4	526.1