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SUPPLEMENTAL RELOAD LICENSING SUBMITTAL
FOR
VERMONT YANKEE NUCLEAR POWER STATION
RELOAD NO. 7

8008250693

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2. RELOAD FUEL BUNDLES (1.0, 2.0, 3.3.1, and 4.0)[1]

	Fuel Type	Number	Number Drilled
Irradiated	8DB274L	24	24
Irradiated	8DB274H	96	96
Irradiated	8DB219L	12	12
Irradiated	8DPB289	60	60
Irradiated	P8DPB289	96	96
New	P8DPB289	80	80
Total		368	368

3. REFERENCE CORE LOADING PATTERN (3.3.1)

Nominal previous cycle exposure: 15.75 GWd/t. Assumed reload cycle exposure: 16.80 GWd/t. Core loading pattern: Figure 1.

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

BOC k_{eff}	
Uncontrolled	1.105
Fully Controlled	0.948
Strongest Control Rod Out	0.981
R, Maximum Increase in Cold Core Reactivity with Exposure Into Cycle, Δk	0.005

*( ) refers to areas of discussion in Reference 1.
Reference 1: "General Electric Boiling Water Reactor Generic Reload Fuel Application", NEDE-24011-P-A, August 1979.

5. STANDBY LIQUID CONTROL SYSTEM SHUTDOWN CAPABILITY (3.3.2.1.3)

ppm	Shutdown Margin (Δk) (20°C, Xenon Free)
800	0.057

6. RELOAD UNIQUE TRANSIENT ANALYSIS INPUTS (3.3.2.1.5 AND 5.2)

	EOC8	EOC8-1	EOC8-2
Void Coefficient N/A* (-c/% Rg)	8.03/10.03	8.58/10.73	8.52/10.65
Void Fraction (%)	40.13	40.13	40.13
Doppler Coefficient N/A (-c/°F)	0.?28/0.217	0.224/0.213	0.218/0.207
Average Fuel Temperature (°F)	1342	1342	1342
Scram Worth N/A (-$)	36.27/29.02	35.49/28.40	34.27/27.42
Scram Reactivity versus Time	Figure 2a	Figure 2b	Figure 2c

7. RELOAD UNIQUE GETAB TRANSIENT ANALYSIS INITIAL CONDITION PARAMETERS (5.2)

	EOC8			EOC8-1 GWd/t			EOC8-2 GWd/t		
Exposure	8x8	8x8R	P8x8R	8x8	8x8R	P8x8R	8x8	8x8R	P8x8R
Peaking factors (local, radial axial)	1.22 1.36 1.40	1.20 1.50 1.40	1.20 1.48 1.40	1.22 1.40 1.40	1.20 1.54 1.40	1.20 1.52 1.40	1.22 1.44 1.40	1.20 1.58 1.40	1.20 1.58 1.40
R-Factor	1.098	1.052	1.052	1.098	1.052	1.052	1.098	1.052	1.052
Bundle Power (MWt)	5.763	6.346	6.275	5.911	6.495	6.426	6.105	6.680	6.688
Bundle Flow (10^3 lb/hr)	109.3	110.0	110.9	108.2	109.0	110.0	106.9	107.8	108.2
Initial MCPR	1.29	1.29	1.31	1.26	1.26	1.28	1.21	1.21	1.21

8. SELECTED MARGIN IMPROVEMENT OPTIONS (5.2.2)

Exposure-dependent limits: EOC8-1 GWd/t to EOC8

EOC8-2 GWd/t to EOC8-1 GWd/t

BOC8 to EOC8-? GWd/t

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

9. CORE-WIDE TRANSIENT ANALYSIS RESULTS (5.2.1)

Transient	Exposure	Power (%)	Core Flow (%)	$\bar{\phi}$ (% NBR)	Q/A (% NBR)	P_{SL} (psig)	P_v (psig)	ΔCPR 8x8/8x8R/P8x8R	Plant Response
Load Rejection without Bypass	EOC8	104.5	100	295	119	1242	1261	0.22/0.22/0.24	Figure 3a
	EOC8-1 GWd/t	104.5	100	265	116	1237	1254	0.19/0.19/0.21	Figure 3b
	EOC8-2 GWd/t	104.5	100	172	109	1210	1228	0.09/0.09/0.09	Figure 3c
Loss of 100°F FW Heater	BOC8 to EOC8	104.5	100	123	122	-	-	0.14/0.14/0.14	Figure 4
Feedwater Controller Failure	BOC8 to EOC8	104.5	100	113	110	1022	1065	0.05/0.05/0.05	Figure 5

10. LOCAL ROD WITHDRAWAL ERROR (WITH LIMITING INSTRUMENT FAILURE) TRANSIENT SUMMARY (5.2.1)

Rod Block Reading(%)	Rod Position (Feet Withdrawn)	ΔCPR 8x8/8x8R/P8x8R	LHGR 8x8/8x8R and P8x8R	Limiting Rod Pattern
104	4.0	0.09/0.12/0.13	12.0/14.0	Figure 6
105*	4.0	0.09/0.12/0.13	12.0/14.0	↓
106	4.5	0.10/0.14/0.15	12.4/14.5	↓
107	5.0	0.11/0.15/0.16	12.8/15.1	↓
108	6.0	0.14/0.19/0.20	13.3/16.1	↓
109	7.0	0.18/0.22/0.23	13.6/16.7	↓

11. OPERATING MCPR LIMIT (5.2)

See Appendix A.

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*Indicates setpoint selected.

12. OVERPRESSURIZATION ANALYSIS SUMMARY (5.3)

Transient	Power (%)	Core Flow (%)	P_{sl} (psig)	P_v (psig)	Plant Response
MSIV Closure (Flux Scram)	104.5	100	1267	1290	Figure 7

13. STABILITY ANALYSIS RESULTS (5.3)

Decay Ratio: Figure 8

Reactor Core Stability:

Decay Ratio, x_2/x_o (Natural Circulation - 105% Rod Line)	0.84

Channel Hydrodynamic Performance

	Decay Ratio (Natural Circulation - 105% Rod Line)
8x8 channel	0.39
8x8R channel	0.29
P8x8R channel	0.29

14. LOSS-OF-COOLANT ACCIDENT RESULTS (5.5.2)

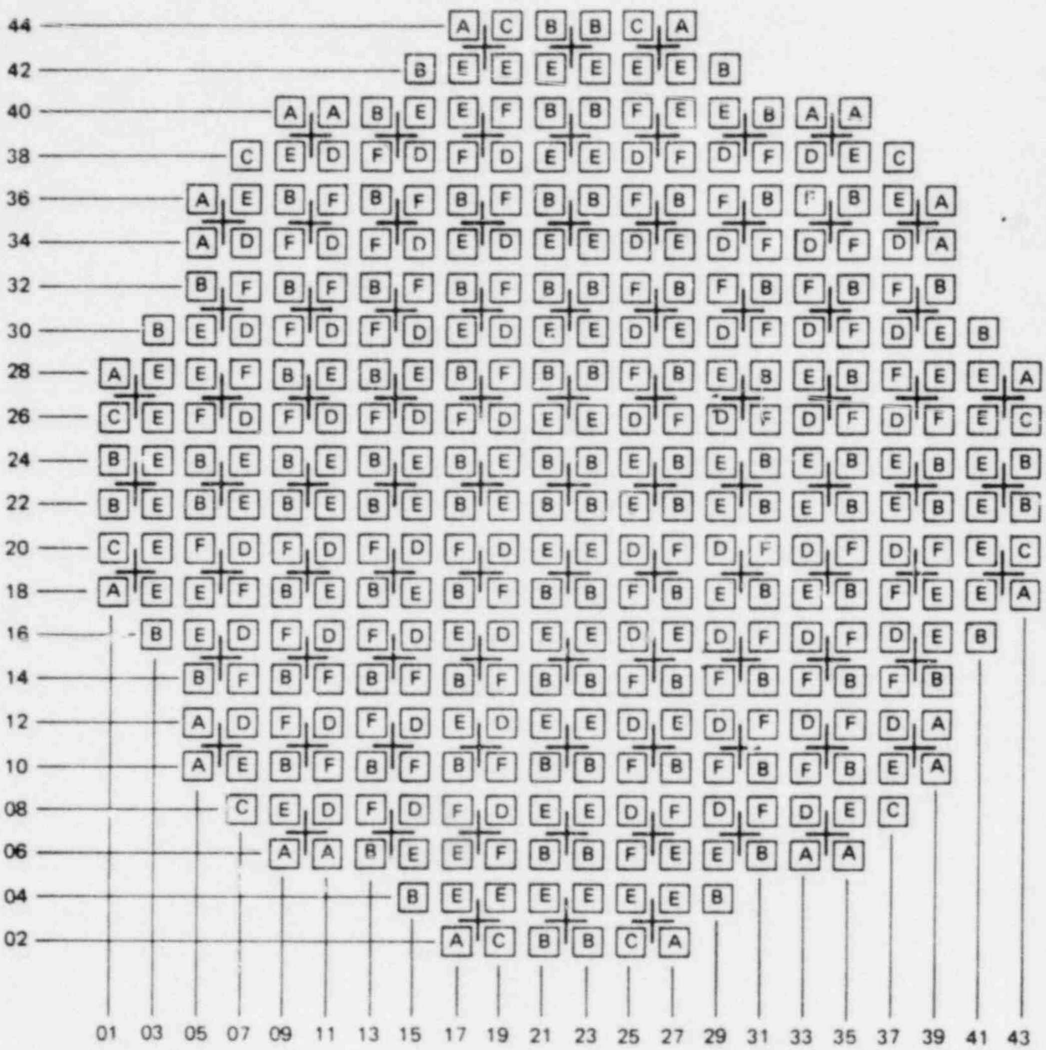
Fuel type P8DPB289 was introduced in Reload 6.

15. LOADING ERROR RESULTS (5.5.4)

See Appendix A.

16. CONTROL ROD DROP ANALYSIS RESULTS (5.5.1)

Maximum incremental rod worth 0.76% Δk.



FUEL TYPE	
A = 8DB274L	D = 8DPB289
B = 8DB274H	E = P8DPB283, R6
C = 8DB219L	F = P8DPB289, R7

Figure 1. Core Loading Pattern

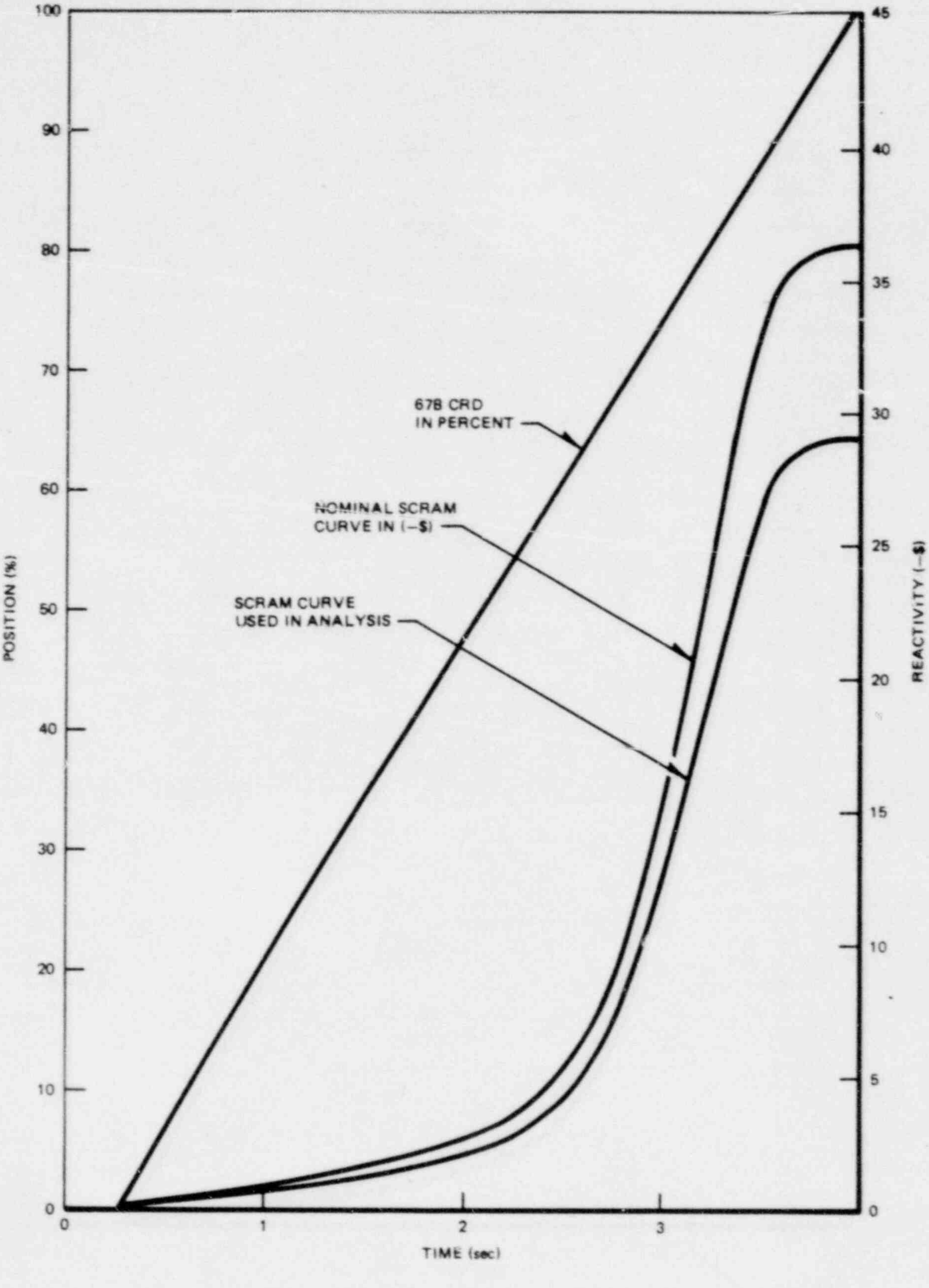


Figure 2a. Scram Reactivity and CRD Specifications, EOC8

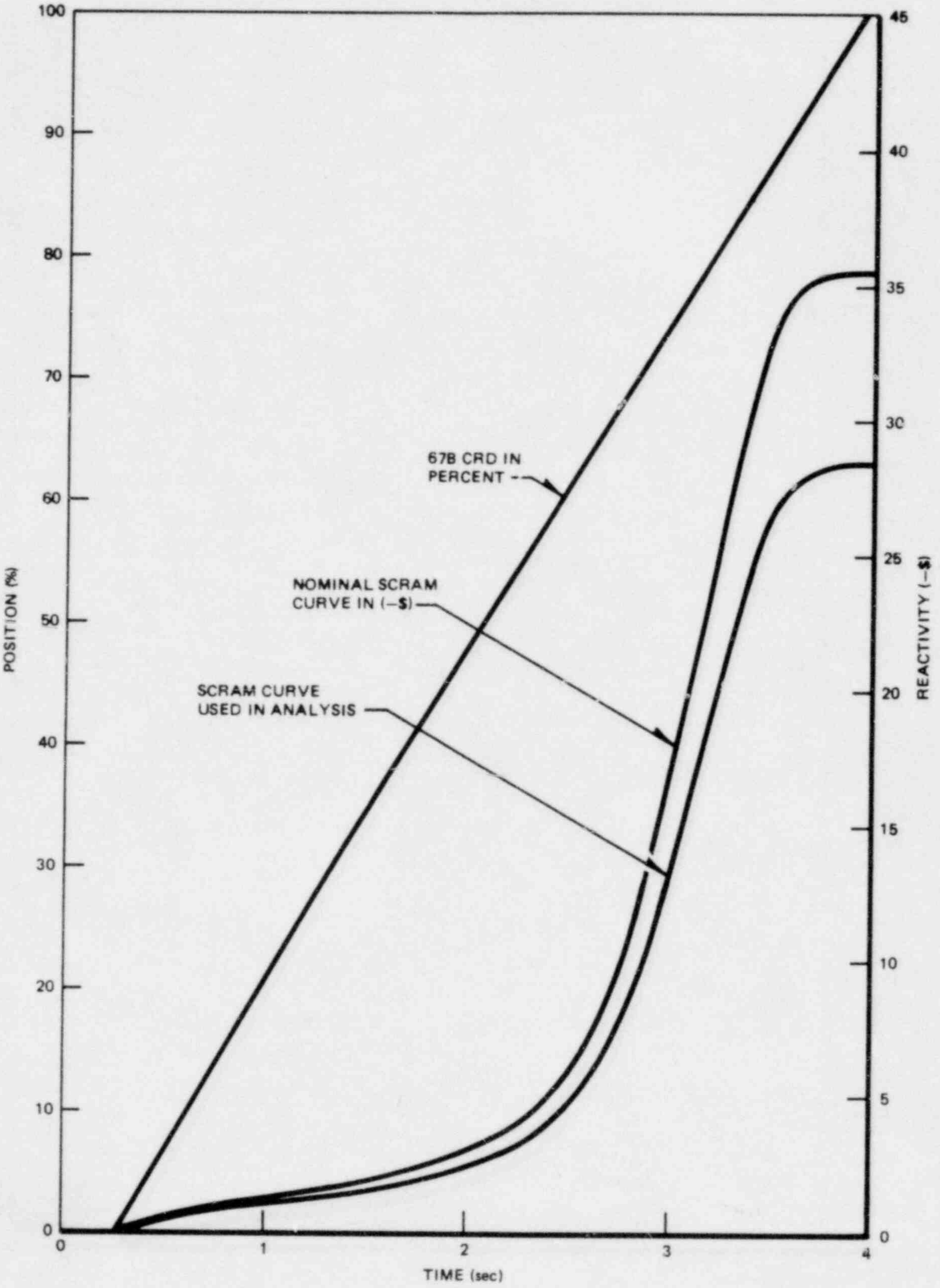


Figure 2b. Scram Reactivity and CRD Specifications, EOC8-1

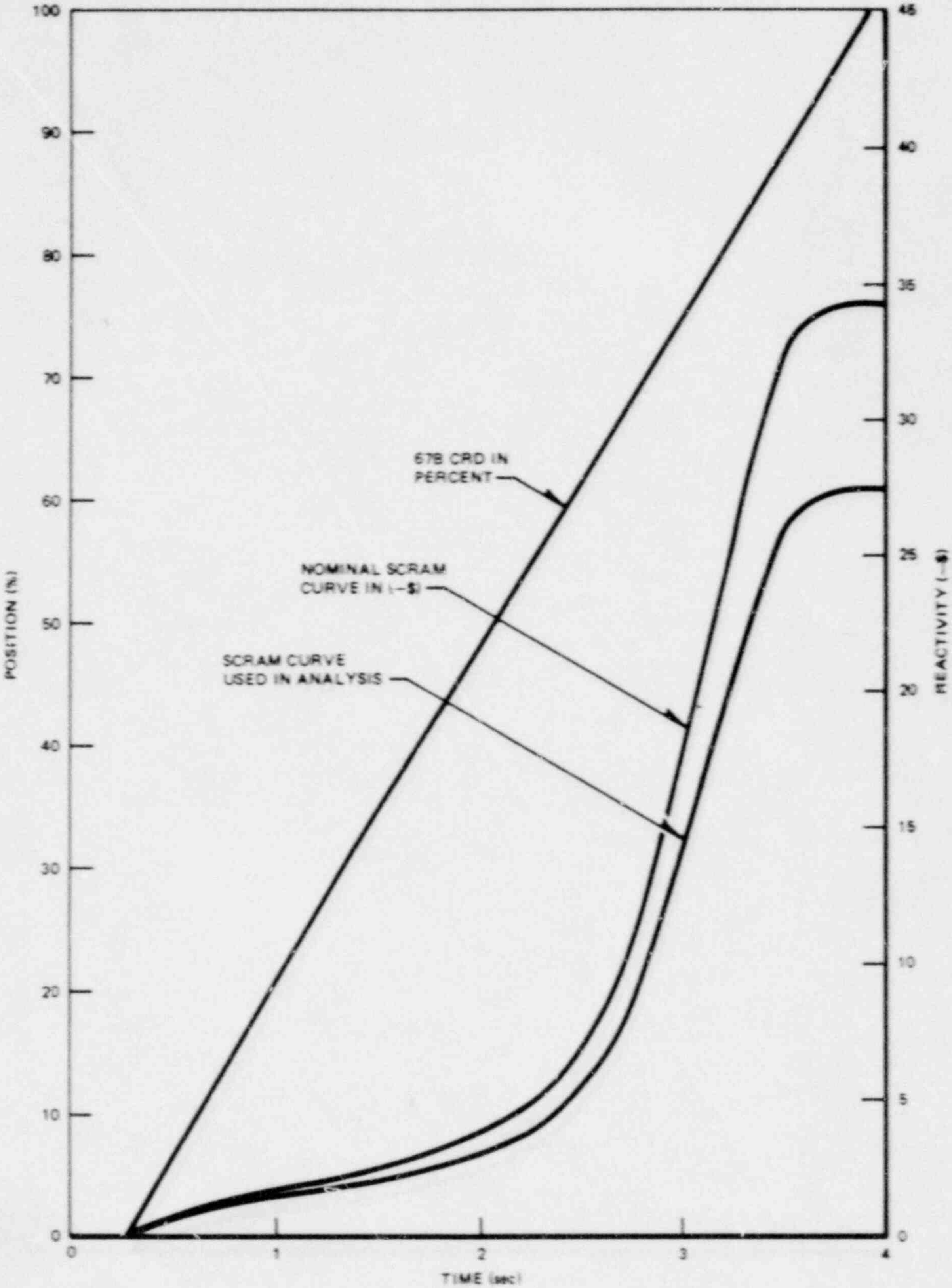


Figure 2c. Scram Reactivity and CRD Specifications, EOC8-2

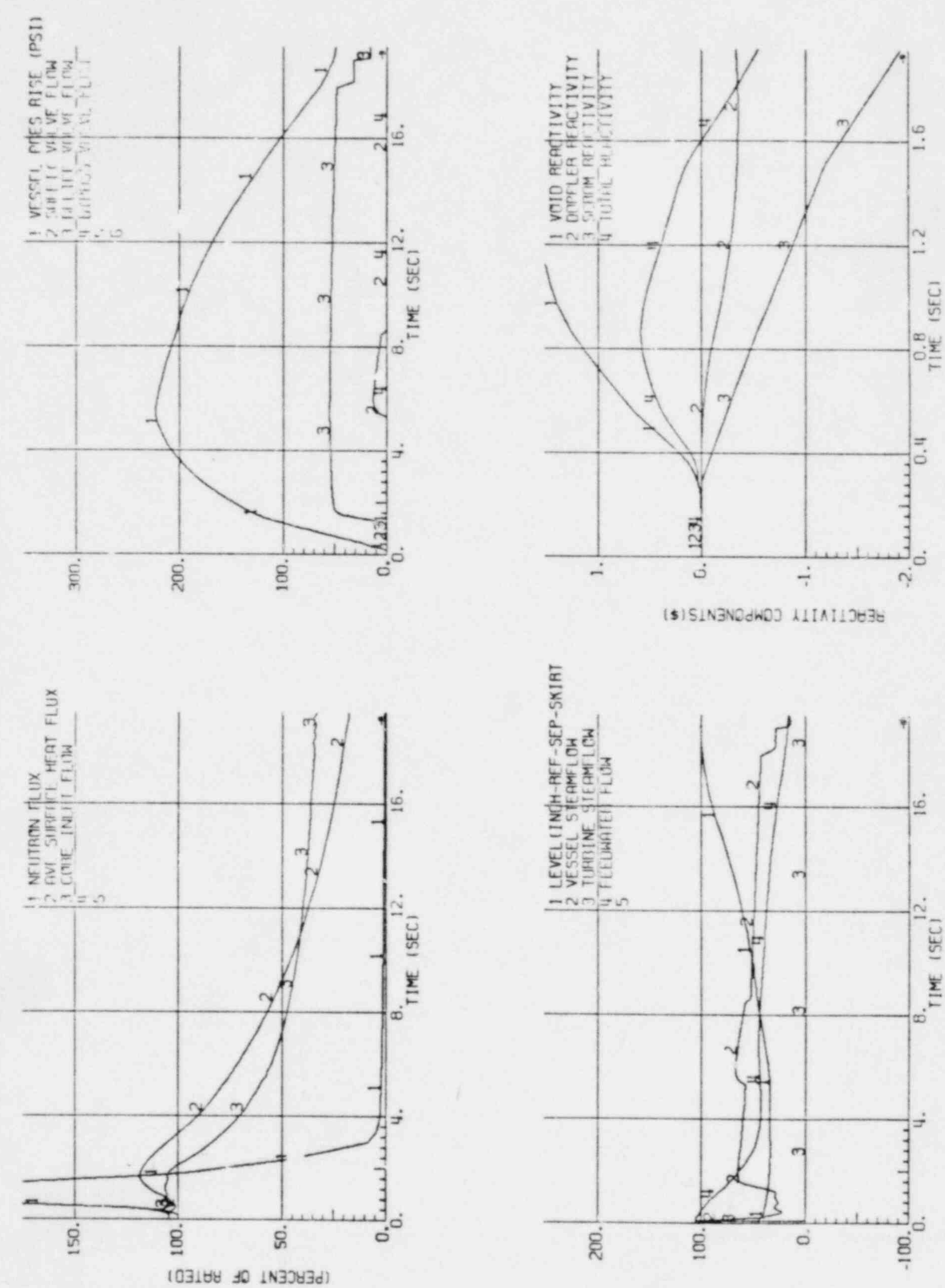


Figure 3a. Generator Load Rejection, EOC8

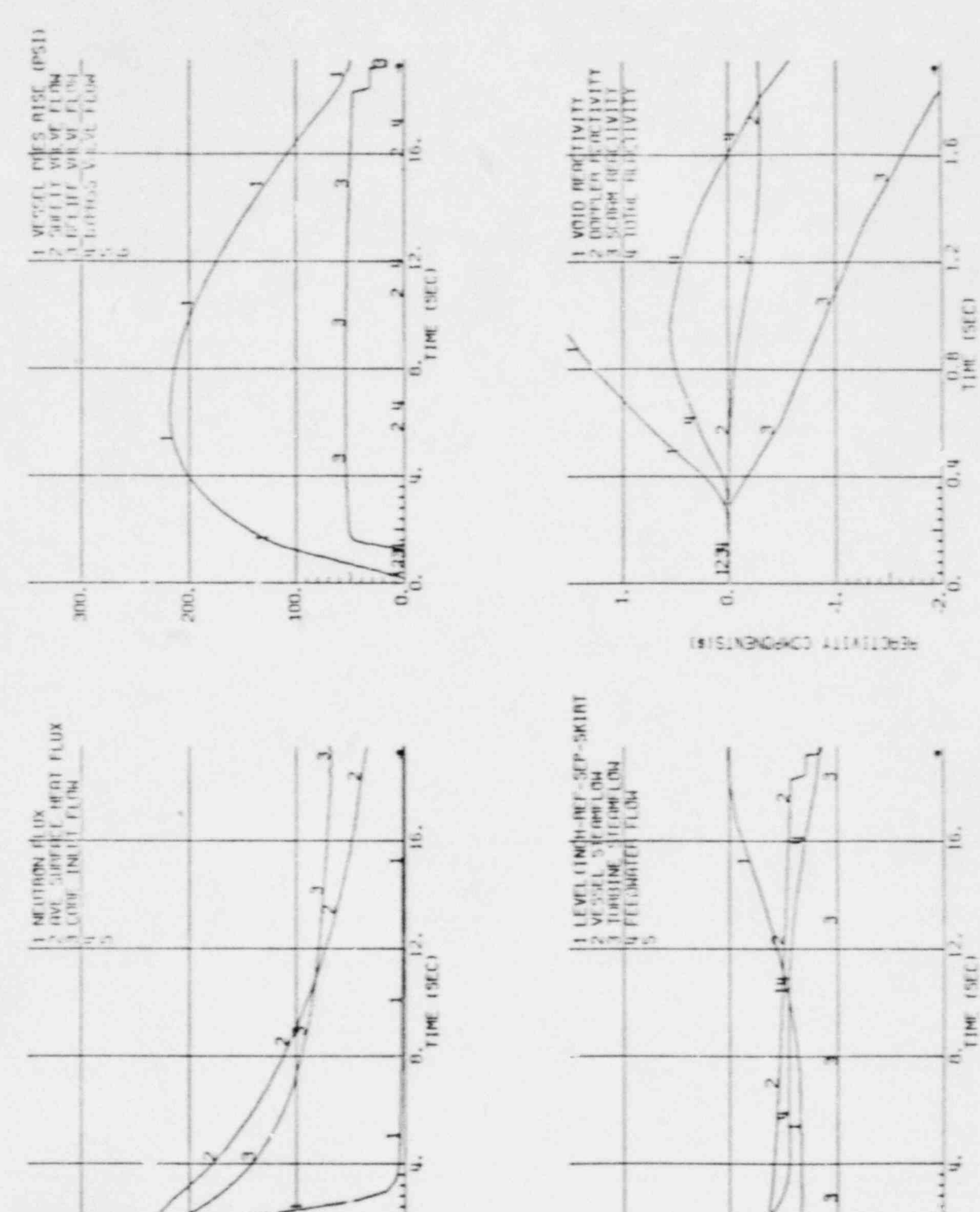


Figure 3b. Generator Load Rejection, Without Bypass, EOC8-1 GWd/t

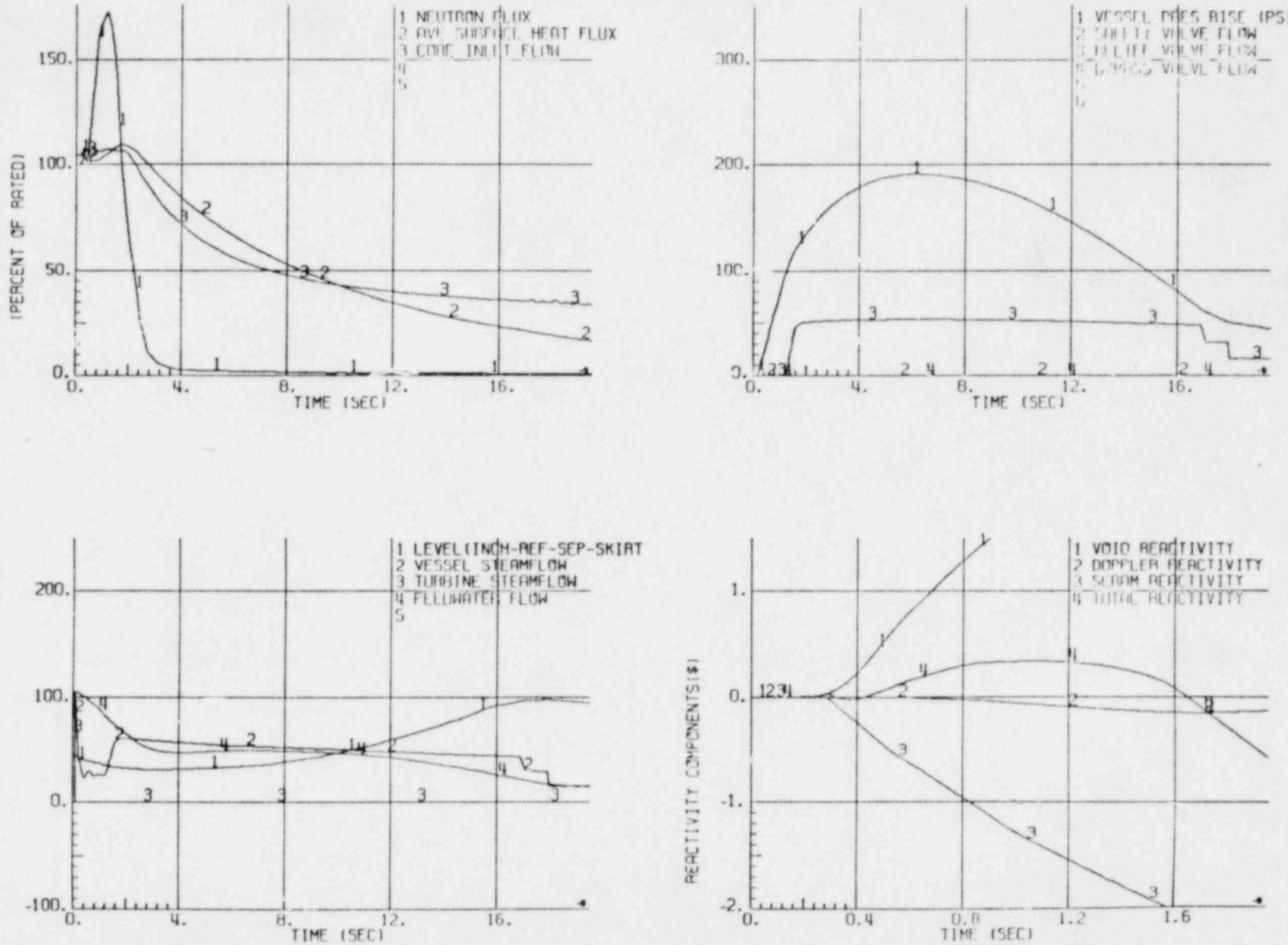


Figure 3c. Generator Load Rejection, Without Bypass, EOC8-2 GWd/t

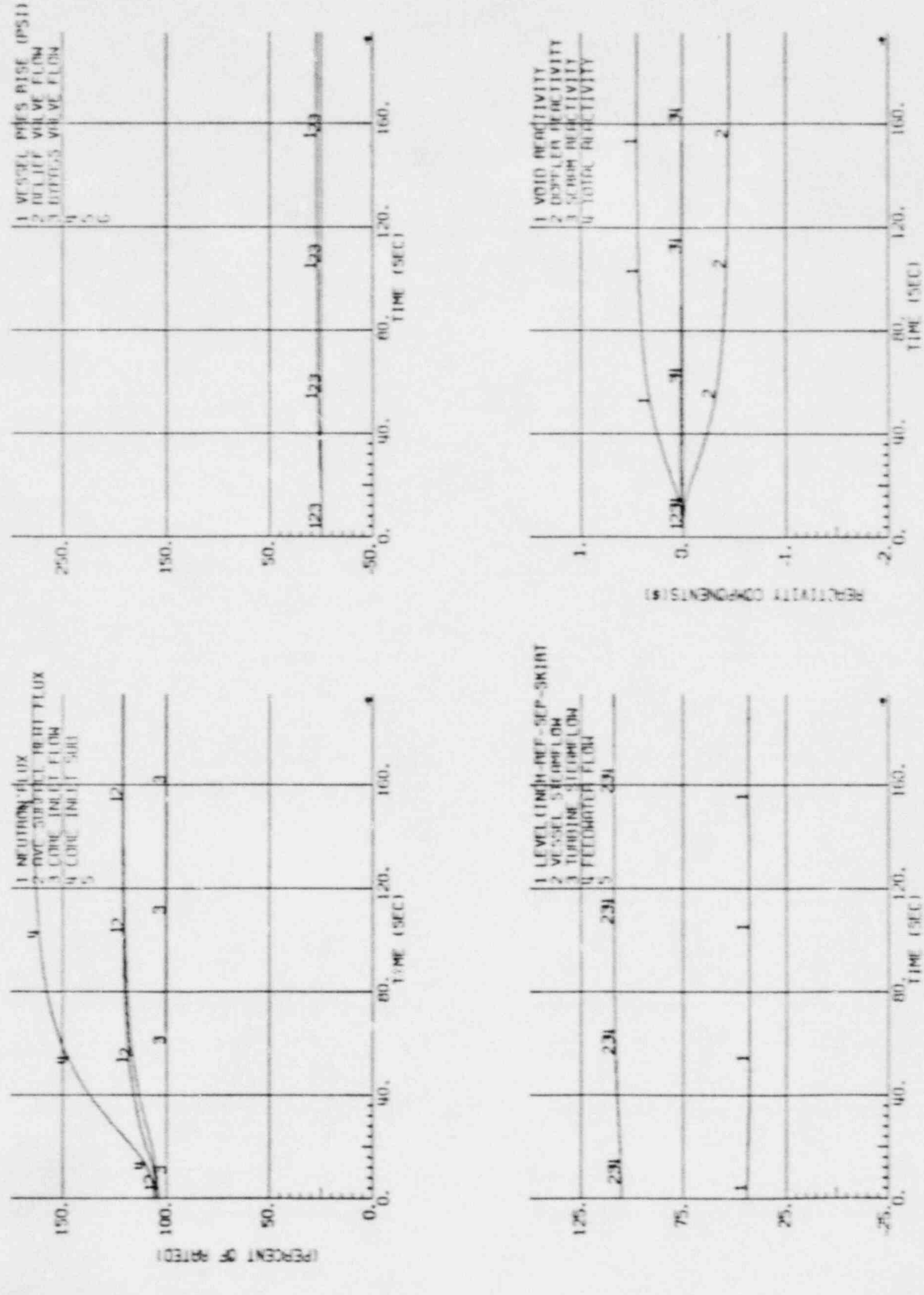


Figure 4. Loss of 100°F Feedwater Heating

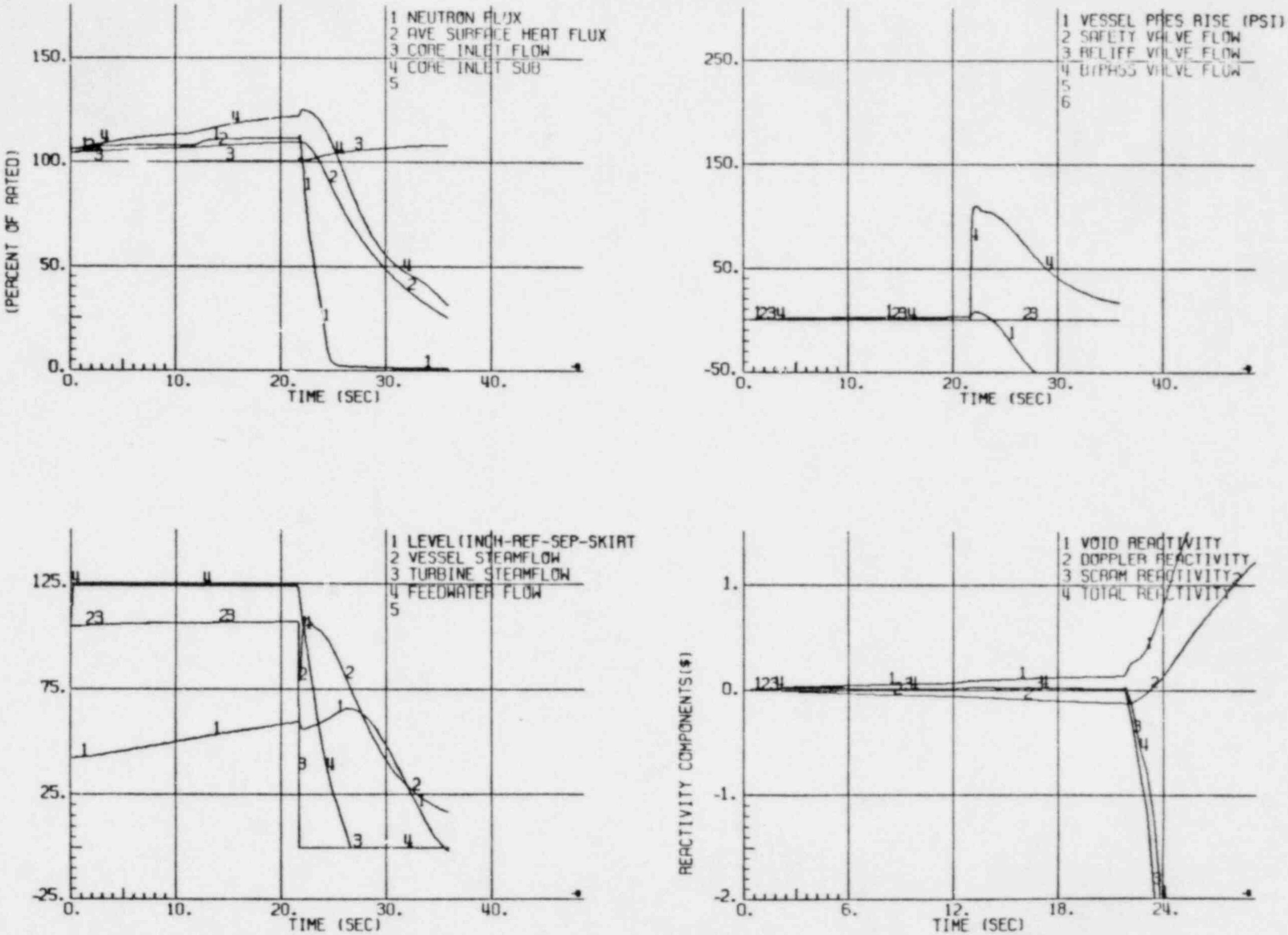


Figure 5. Feedwater Controller Failure

	02	06	10	14	18	22
43						12
39			16		32	
35		40		30		0
31			32		44	
27		12		0		0
23	16		32		44	

Notes: 1. Rod pattern is 1/4 core mirror symmetric. Upper left quadrant shown on map.

2. Numbers indicate number of notches withdrawn out of 48. Blank is a withdrawn rod.

3. Error rod is at 22,27 (reactor coordinates).

Figure 6. Limiting Rod Pattern

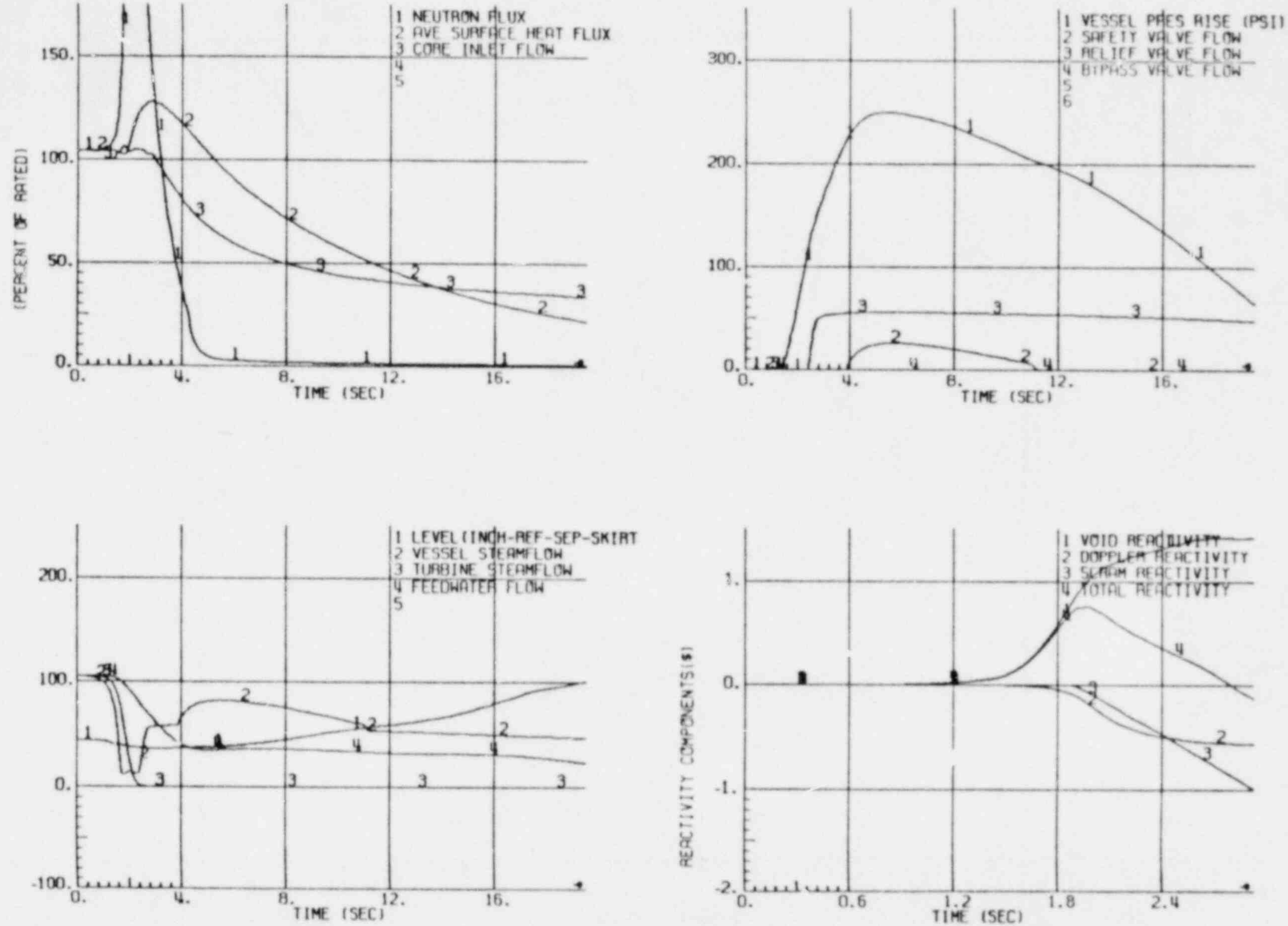


Figure 7. MSIV Closure, Flux Scram

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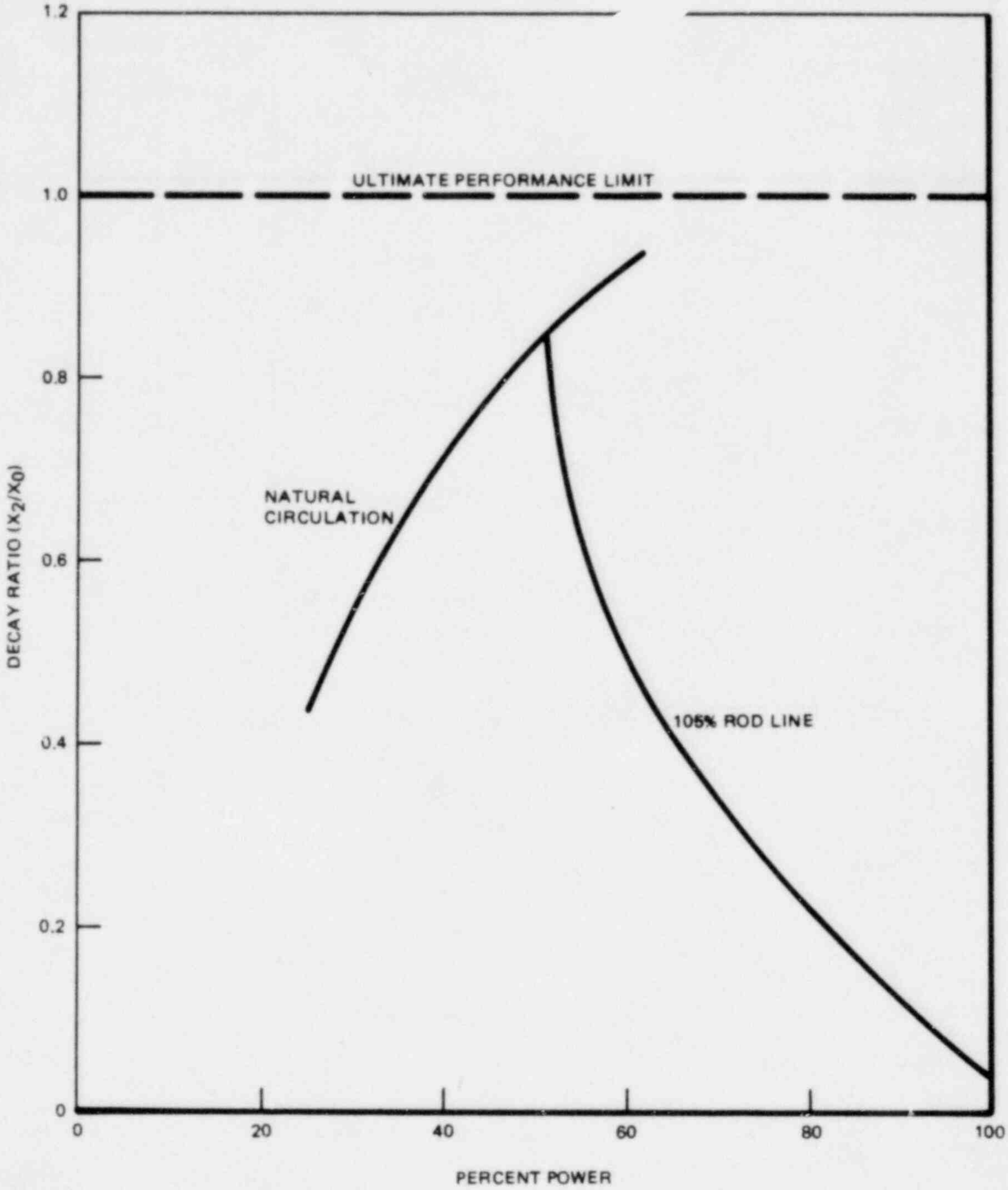

Figure 8. Reactor Core Decay Ratio vs Power

APPENDIX A

OPERATING MCPR LIMIT

If, during steady-state operation, the offgas activity as measured at the SJAE's exceeds 236,000 µCi/sec for fifteen (15) minutes of 1.18 Ci/sec for one (1) minute, the operating MCPR limit shall be as follows:

Exposure Range	MCPR Operating Limit 8x8	8x8R	P8x8R
E08-1 GWd/t to EOC8	1.29	1.29	1.31
EOC8-2 GWd/t to EOC8-1 GWd/t	1.26	1.26	1.28
BOC8 to EOC8-2 GWd/t	1.21	1.26	1.26

If, during steady-state operation, the offgas activity as measured at the SJAE's is less than specified above, the operating limit shall be as follows:

Exposure Range	MCPR Operating Limit 8x8	8x8R	P8x8R
EOC8-1 GWd/t to EOC8	1.29	1.29	1.31
EOC8-2 GWd/t to EOC8-1 GWd/t	1.26	1.26	1.28
BOC8 to EOC8-2 GWd/t	1.21	1.21	1.21

APPENDIX B
LOADING ERROR RESULTS
(NEW BUNDLE LOADING ERROR EVENT ANALYSES PROCEDURES)

The bundle loading error analyses results presented in Section 15 in this supplement are based on new analyses procedures for both the rotated bundle and the mislocated bundle loading error events. The use of these new analyses procedures is discussed below.

B.1 NEW ANALYSIS PROCEDURE FOR THE ROTATED BUNDLE LOADING ERROR EVENT

The rotated bundle loading error event analysis results presented in this supplement are based on the new analysis procedure described and approved in **Reference B-1.** This new method of performing the analysis is based on a more accurate detailed analytical model.

The principle difference between the previous analysis procedure and the new analysis procedure is the modeling of the water gap along the axial length of the bundle. The previous analysis used a uniform water gap, whereas the new analysis utilizes a variable water gap which is more representative of the actual condition, since the interfacing between the top guide and the fuel spacer buttons, caused by misorientation, causes the bundle to lean. The effect of the variable water gap is to reduce the power peaking and the R-factor in the upper regions of the limiting fuel rod. This results in the calculation of a reduced CPR for the rotated bundle. The calculation was performed using the same analytical models as were previously used. The only change is in the simulation of the water gap, which more accurately represents the actual geometry.

The results of the analysis indicate the P8DPB289 bundle a 17.7 kW/ft LHGR (includes densification spiking penalty of 2.2%) and 0.19 ΔCPR (includes a 0.02 penalty due to variable water gap R-factor uncertainty) with a minimum CPR of 1.07.

B.2 NEW ANALYSIS PROCEDURE FOR THE MISLOCATED BUNDLE LOADING ERROR EVENT

The mislocated bundle loading error event analyses results presented in this supplement are based on the new analysis procedure described in Reference A-1. This new method of performing the analysis employs a statistically corrected Haling procedure and analyzes every bundle in the core.

The use of the statistically corrected Haling analyses procedure indicates that the LHGR is 16.6 and that minimum CPR for mislocated bundles (e.g., P8x8R into P8x8R) is greater than the safety limit (1.07) for all exposures throughout Cycle 8.

REFERENCES

B-1 Safety Evaluation Report (letter), D. G. Eisenhut (NRC) to R. E. Engel (GE), MFN-200-78, dated May 8, 1978.

APPENDIX C

MARGIN-TO-SPRING SAFETY VALVES

The rationale for changing the basis for providing pressure margin to the spring safety valves is presented in Reference C-1. This change has been accepted by the NRC (Reference C-2).

On this basis the plant can operate at full power throughout the cycle.

The core response to the limiting anticipated event is given in Table C-1 and Figure C-1

Table C-1

CORE-WIDE TRANSIENT ANALYSIS RESULTS

Transient	Exposure	Power (%)	Flow (%)	P_{sl} (psig)	P_v (psig)	Plant Response
MSIV Closure Trip Scram	BOC-EOC	104	100	1162	1183	Figure B-1

REFERENCES

C-1. J. F. Quirk (GE) letter to Olan D. Parr (NRC), "General Electric Licensing Topical Report NEDE-24011-P-A, 'Generic Reload Fuel Application', Appendix D, Second Submittal," dated February 28, 1979.

C-2. Letter, T. A. Ippolito (NRC) to D. L. Peoples (Commonwealth Edison Co.), enclosing Safety Evaluation Supporting Amendment No. 42 to Operating License No. DPR-25, Dresden Nuclear Power Station, Unit 3, April 16, 1980.

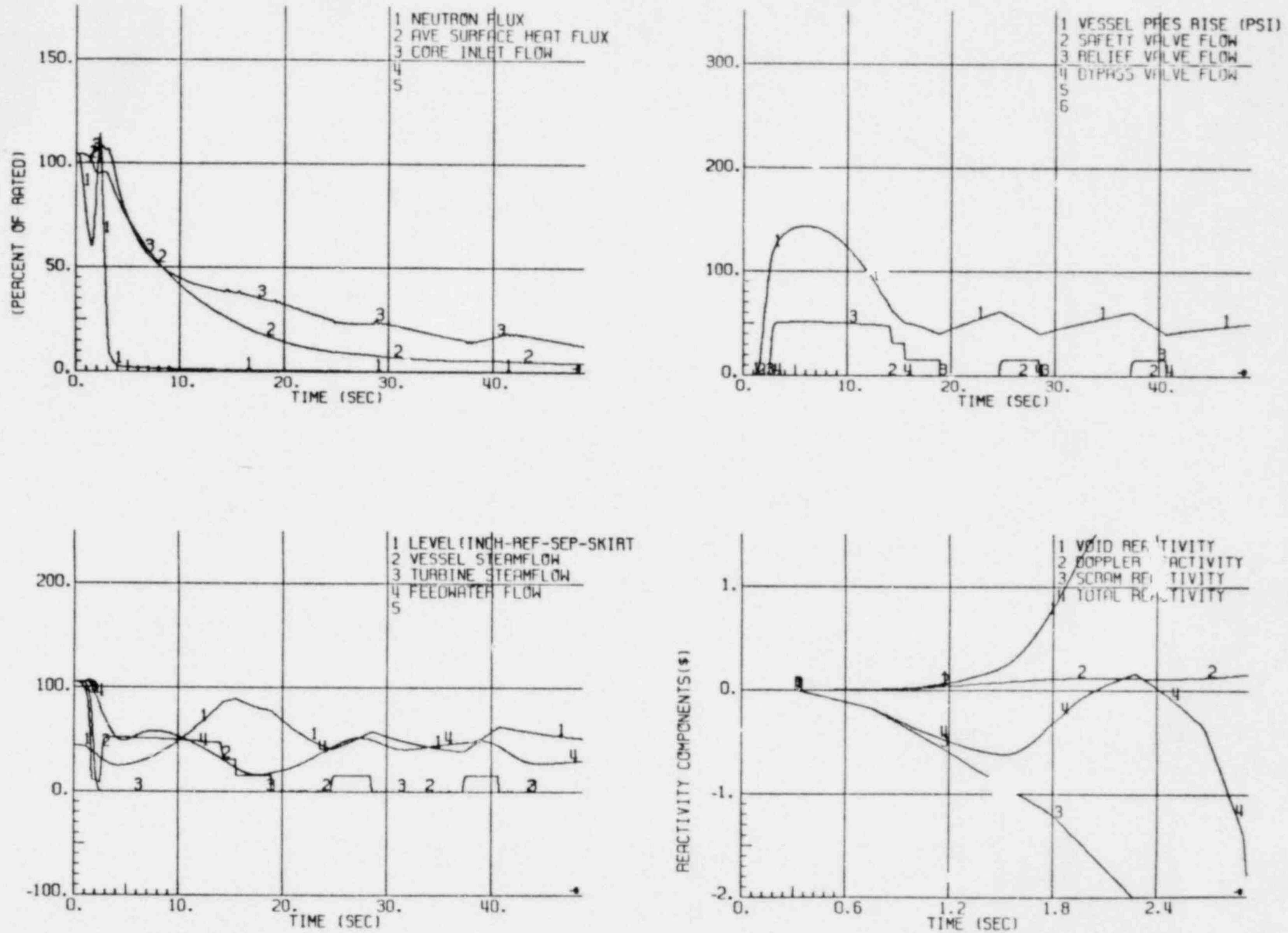

Figure C-1. MSIV Closure, Position Scram

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