INITIAL CONDITIONS FOR THE STEAM GENERATOR TUBE RUPTURE WITH A LOSS OF OFFSITE POWER

PARAMETER	ASSUMED VALUE
Initial core power level, MWt	2600.6
Core inlet coolant temperature, °F	550.65
Core mass flow rate, 10^6 lbm/hr	138.*
Reactor coolant system pressure, psia	2,110
Steam generator pressure, psia	770
Initial pressurizer liquid volume, ft^3	800
Steam generator level, ft above tube sheet	31.74

* Lower core flowrate dispositioned in Reference 6.

SETPOINTS FOR THE STEAM GENERATOR TUBE RUPTURE WITH A LOSS OF OFFSITE POWER

Parameter	Setpoint
Steam generator MSSV setpoint, psia	1000
AFW actuation on steam generator level AFAS signal generation, % NR	23.7
SIAS setpoint, psia	1605
Shutdown cooling entry conditions:	
Hot leg temperature, °F	300
Pressurizer pressure, psia	270

SEQUENCE OF EVENTS FOR THE STEAM GENERATOR TUBE RUPTURE WITH A LOSS OF OFFSITE POWER

Time (second)	Event	Setpoint or Value
1.0	Tube rupture occurs	----
32.9	Proportional heaters are fully energized, psia	2085
105.7	Backup heaters are energized, psia	2035
211.3	Heaters are de-energized on low level in the pressurizer, ft^3	558.6
703.7	Pressurizer pressure reaches low pressurizer pressure setpoint (TM/LP floor), psia	1700.
704.8	Trip signal is generated	
705.2	Trip breakers open	
706.1	Turbine Valves begin to close	
707.1	Turbine valves are completely closed	
708.2	Loss of offsite power	
714.8	Feedwater flow begins ramping down at a rate of 5%/second	
715.9	SIAS setpoint is reached, psia	1605
720.3	MSSVs begin to open, psia	1000
725.8	Pressurizer empties	
733.9	Safety Injection pumps reach full speed	
735.0	Upper head void begins to appear	
811.5	Safety Injection flow to RCS begins, psia	1237.7
995.0	Maximum upper head void fraction	0.271
1107.0	Minimum PCS pressure, psia	1107.8
1370.5	Upper head void disappears	

SEQUENCE OF EVENTS FOR THE STEAM GENERATOR TUBE RUPTURE WITH A LOSS OF OFFSITE POWER

Time (second)	Event	Setpoint or Value
1372.0	Pressurizer begins to refill	
1466.6	Low steam generator level signal for Auxiliary feedwater actuation, ft	25.7
1586.6	Auxiliary feedwater reaches the steam generators, lbm/sec/SG	27.0
1800.0	Operator takes action, opens ADVs to initiate cooldown	
3000.0	Operator isolates the affected SG, below setpoint loop temperatures, °F	525.0
13000.0	Operator initiates steaming the affected generator to avoid overfilling, percent SG wide range span	90
23300.0	Shutdown Cooling entry condition is reached, PCS pressure, psia/temperature, °F	270/300
28800.0	PCS pressure and temperature demonstrated to be stabilized, transient terminated.	

INTEGRATED PARAMETERS FOR THE STEAM GENERATOR TUBE RUPTURE WITH A LOSS OF OFFSITE POWER

Parameter	0-2 hr	0-8 hr
Integrated primary to secondary leak, lbm	183,202	605,101
Integrated Steam release, lbm		
a. Through affected SG ADV	37,382	313,736
b. Through affected SG MSSV	44,654	44,654
c. Through intact SG ADV	185,000	719,448
d. Through intact SG MSSV	44,645	44,645

STEAM GENERATOR TUBE RUPTURE (SGTR) RADIOLOGICAL ANALYSIS – INPUTS AND ASSUMPTIONS

Input/Assumption	Value
Core Power Level	2703 MW_{th}
Initial PCS Equilibrium Activity	1.0 μCi/gm DE I-131 and 100/E-bar gross activity
Initial Secondary Side Equilibrium Iodine Activity	0.1 μCi/gm DE I-131
Maximum pre-accident spike iodine concentration	40 μCi/gm DE I-131
Maximum equilibrium iodine concentration	1.0 μCi/gm DE I-131
Duration of accident-initiated spike	8 hours
Steam Generator Tube Leakage Rate	0.3 gpm per SG
Time to establish shutdown cooling and terminate steam release	8 hours
PCS Mass	529,706 lb_m for pre-accident iodine spike case 459,445 lb_m for concurrent iodine spike case
SG Secondary Side Mass	141,065 lb_m per SG (minimum mass used to maximize concentration from tube leakage)
Integrated Mass Release	Table 14.15-6
Secondary Coolant Iodine Activity prior to accident	0.1 μCi/gm DE I-131
Steam Generator Secondary Side Partition Coefficients	Faulted SG (flashed tube flow) – Table 14.15-11 Faulted SG (non-flashed tube flow) – 100 Intact SG – 100
Break Flow Flash Fraction	Table 14.15-7
Atmospheric Dispersion Factors Offsite Onsite	 Section 2.5.5.2 Tables 14.24-2 and 14.24-3
Control Room Ventilation System Time of manual control room normal intake isolation and switch to emergency mode	 20 minutes
Breathing Rates Offsite Control Room	 RG 1.183, Section 4.1.3 RG 1.183, Section 4.2.6
Control Room Occupancy Factor	RG 1.183 Section 4.2.6

SGTR RADIOLOGICAL ANALYSIS – INTEGRATED MASS RELEASES [1]

Time (hours)	Break Flow in Ruptured SG (lb_m)	Steam Release from Ruptured SG (lb_m)	Steam Release from Unaffected SG (lb_m)
0 – 0.196417	24,011.15	0	0
0.196417 - 0.5	37,111.85	44,654	53,574
0.5 - 1.388889	81,281	22,152.3	109,629.6
1.388889 - 2	40,798	15,229.7	75,370.4
2 - 3.638889	64,773	75,485.6	145,983.5
3.638889 - 8	357,126	200,868.4	388,464.5
8 - 720	0	0	0

[1] Flowrate assumed to be constant within time period

SGTR RADIOLOGICAL ANALYSIS – FLASHING FRACTION FOR FLOW FROM BROKEN TUBE

Time (seconds)	Flashing Fraction
0	0.110
707.1	0.065
736	0.031
859	0.023
1090	0.006
1800	0.006

SGTR RADIOLOGICAL ANALYSIS – 40 µCI/GM D.E. I-131 ACTIVITIES

Isotope	Activity (µCi/gm)
Iodine-131	33.2194
Iodine-132	7.6660
Iodine-133	34.4971
Iodine-134	3.0025
Iodine-135	14.6932

SGTR RADIOLOGICAL ANALYSIS – IODINE EQUILIBRIUM APPEARANCE ASSUMPTIONS

Input Assumption	Value
Maximum Letdown Flow	40 gpm
Assumed Letdown Flow *	44 gpm at 120°F, 2060 psia
Maximum Identified PCS Leakage	10 gpm
Maximum Unidentified PCS Leakage	1 gpm
PCS Mass	459,445 lb_m
I-131 Decay Constant	5.986968E-5 min^{-1}
I-132 Decay Constant	0.005023 min^{-1}
I-133 Decay Constant	0.000555 min^{-1}
I-134 Decay Constant	0.013178 min^{-1}
I-135 Decay Constant	0.001748 min^{-1}

* maximum letdown flow plus 10% uncertainty

SGTR RADIOLOGICAL ANALYSIS – CONCURRENT (335 X) IODINE SPIKE APPEARANCE RATE

Isotope	Appearance Rate (Ci/min)	Time of Depletion (hours)
Iodine-131	58.0966961	> 8
Iodine-132	79.8319317	> 8
Iodine-133	90.1310904	> 8
Iodine-134	74.0318685	> 8
Iodine-135	68.9790622	> 8

SGTR RADIOLOGICAL ANALYSIS – AFFECTED STEAM GENERATOR WATER LEVEL AND DECONTAMINATION FACTORS FOR FLASHED FLOW

Time (seconds)	Water Level Above U-Tubes (feet)	Calculated Decontamination Factor	Decontamination Factor Used in Analysis
0	0.0 (assumed)*	1.0	1.0
707.1	0.0 (assumed)*	1.0	1.0
736	0.11	1.002299	1.002299
859	0.55	1.045037	1.045037
1090	1.39	1.452436	1.452436
1800	3.97	1.467378	1.467378
5000	6.79	60.03443	1.467378
7200	9.43	38.01867	1.467378
13100	12.34	553073.5	58.16008
28800	15.16	58.16008	58.16008

*It is conservatively assumed that no scrubbing occurs until after the reactor trip at 707.1 seconds. Since the U-tubes remain covered throughout the event, it is also conservatively assumed that at the time of trip the water level is just above the top of the U-tubes. The time-dependent water level after the trip is a function of the allowable primary to secondary leakage, broken tube flow, and MSSV/ADV releases from the affected steam generator. To minimize the water level available for scrubbing, the location of the tube break is assumed to be at the top of the U-tubes.

EVENT SUMMARY FOR THE EOC HZP CONTROL ROD EJECTION

EVENT	VALUE	TIME (sec)
Ejection of a Single Control Rod	-------	0.0
Core Power Reached VHP Trip Setpoint	36.86% RTP	0.309
Core Power Peaked	1,903%RTP	0.410
Core Average Rod Surface Heat Flux Peaked	101.9% RTP	0.507
Minimum DNBR Occurred	see Table 14.1-5	0.507
Scram Rod Insertion Begins	-------	1.409

CONTROL ROD EJECTION RADIOLOGICAL ANALYSIS – INPUTS AND ASSUMPTIONS

Input/Assumption	Value
Core Power Level	2703 MW_{th}
Core Average Fuel Burnup	39,300 MWD/MTU
Fuel Enrichment	3.0 – 5.0 w/o
Maximum Radial Peaking Factor	2.04
% DNB Fuel	14.7%
% Fuel Centerline Melt	0.5%
LOCA Source Term	Table 14.22-3
Initial PCS Equilibrium Activity	1.0 μCi/gm DE I-131 and 100/E-bar gross activity
Initial Secondary Side Equilibrium Iodine Activity	0.1 μCi/gm DE I-131
Release From DNB Fuel	Section 1 of Appendix H to RG 1.183
Release From Fuel Centerline Melt Fuel	Section 1 of Appendix H to RG 1.183
Steam Generator Secondary Side Partition Coefficient	100
Steam Generator Tube Leakage	0.3 gpm per SG
Time to establish shutdown cooling	8 hours
PCS Mass	432,976.8 lb_m
SG Secondary Side Mass	minimum – 141,065 lb_m (per SG) Minimum mass used for SGs to maximize steam release nuclide concentration.
Chemical Form of Iodine Released to Containment	Particulate – 95% Elemental – 4.85% Organic – 0.15%
Chemical Form of Iodine Released from SGs	Particulate – 0% Elemental – 97 % Organic – 3%
Atmospheric Dispersion Factors Offsite Onsite	 Section 2.5.5.2 Tables 14.24-2 and 14.24-3
Time of Control Room Ventilation System Isolation	20 minutes
Breathing Rates	RG 1.183 Sections 4.1.3 and 4.2.6
Control Room Occupancy Factor	RG 1.183 Section 4.2.6

CONTROL ROD EJECTION RADIOLOGICAL ANALYSIS – INPUTS AND ASSUMPTIONS

Input/Assumption	Value
Containment Volume Containment Leakage Rate 0 to 24 hours after 24 hours	1.64E+06 ft^3 0.10% (by weight)/day 0.05% (by weight)/day
Containment Natural Deposition Coefficients	Aerosols – 0.1 hr^{-1} Elemental Iodine – 1.3 hr^{-1} Organic Iodine – None

CONTROL ROD EJECTION RADIOLOGICAL ANALYSIS – STEAM RELEASE

Time	SG Steam Release (lb_m)
0 – 1100 sec	107,158.8
1100 sec – 0.5 hours	31,336.8
0.5 hr – 8 hr	1,007,100
>8 hr	0

SAMPLED LBLOCA PARAMETERS

Phenomenological	
	Time in cycle (peaking factors, axial shape, rod properties and burnup)
	Break type (guillotine versus split)
	Break size
	Critical flow discharge coefficients (break)
	Decay heat
	Critical flow discharge coefficients (surgeline)
	Initial upper head temperature
	Film boiling heat transfer
	Dispersed film boiling heat transfer
	Critical heat flux
	T_{min} (intersection of film and transition boiling)
	Initial stored energy
	Downcomer hot wall effects
	Steam generator interfacial drag
	Condensation interphase heat transfer
	Metal-water reaction
Plant[1]	
	Offsite power availability
	Core power and power distribution
	Pressurizer pressure
	Pressurizer liquid level
	SIT pressure
	SIT liquid level
	SIT temperature (based on containment temperature)
	Containment temperature
	Containment volume
	Initial flow rate
	Initial operating temperature
	Diesel start (for loss of offsite power only)

[1] Uncertainties for plant parameters are based on plant-specific values with the exception of "Offsite power availability," which is a binary result that is specified by the analysis methodology.

PLANT OPERATING RANGE SUPPORTED BY THE LOCA ANALYSIS

	Event	Operating Range
1.0	**Plant Physical Description**	
	1.1 Fuel	
	a) Cladding outside diameter	0.417 in
	b) Cladding inside diameter	0.367 in
	c) Cladding thickness	0.025 in
	d) Pellet outside diameter	0.360 in
	e) Pellet density	96.0% of theoretical
	f) Active fuel length	132.6 in
	g) Resinter densification	[2%]
	h) Gd_2O_3 concentrations	2, 4, 6 and 8 w/o
	1.2 RCS	
	a) Flow resistance	Analysis considers plant-specific form and friction losses
	b) Pressurizer location	Analysis assumes location giving most limiting PCT (broken loop)
	c) Hot assembly location	Anywhere in core
	d) Hot assembly type	15x15 AREVA NP
	e) SG tube plugging	15%
2.0	**Plant Initial Operating Conditions**	
	2.1 Reactor Power	
	a) Nominal reactor power	2,565.4 MWt
	b) LHR	$\leq$ 15.28 kW/ft[1]
	c) F_r^T	$\leq$ 2.04[2]
	2.2 Fluid Conditions	
	a) Loop flow	130 Mlbm/hr $\leq$ M $\leq$ 145 Mlbm/hr
	b) PCS inlet core temperature	537 $\leq$ T $\leq$ 544 °F[3]
	c) Upper head temperature	< core outlet temperature
	d) Pressurizer pressure	2,010 $\leq$ P $\leq$ 2,100 psia[4]
	e) Pressurizer liquid level	46.25% $\leq$ L $\leq$ 67.8%
	f) SIT pressure	214.7 $\leq$ P $\leq$ 239.7 psia
	g) SIT liquid volume	1,040 $\leq$ V $\leq$ 1,176 ft^3
	h) SIT temperature	80 $\leq$ T $\leq$ 140 °F (coupled to containment temperature)
	i) SIT resistance (fL/D)	As-built piping configuration
	j) Minimum ECCS boron	$\geq$ 1,720 ppm

1 Includes a 5% local LHR measurement uncertainty, a 3% engineering uncertainty and a 0.5925% thermal power measurement uncertainty.
2 Includes a 4.25% measurement uncertainty.
3 Sampled range of +7 °F includes both operational tolerance and measurement uncertainty.
4 Based on representative plant values, including measurement uncertainty.

PLANT OPERATING RANGE SUPPORTED BY THE LOCA ANALYSIS

	Event	Operating Range
3.0	**Accident Boundary Conditions**	
	a) Br eak location	Cold leg pump discharge piping
	b) Br eak type	Double-ended guillotine or split
	c) Break size (each side, relative to CL pipe)	$0.05 \leq A \leq 0.5$ full pipe area (split) $0.5 \leq A \leq 1.0$ full pipe area (guillotine)
	d) Wo rst single-failure	Loss of one ECCS pumped injection train
	e) Off site power	On or Off
	f) LPSI flow	Minimum flow
	g) HPSI flow	Minimum flow
	h) ECCS pumped injection temperature	100 °F
	i) HPSI delay time	30 (w/ offsite power) 40 seconds (w/o offsite power)
	j) LPSI delay time	30 (w/ offsite power) 40 seconds (w/o offsite power)
	k) Co ntainment pressure	14.7 psia, nominal value
	l) Con tainment temperature	$80 \leq T \leq 140$ °F
	m) Containment spray/fan cooler delays	0/0 seconds

STATISTICAL DISTRIBUTION USED FOR PROCESS PARAMETERS

Parameter	Operational Uncertainty Distribution	Parameter Range
Core Power Operation (%)	Uniform	100.0 - 100.5
Pressurizer Pressure (psia)	Uniform	2,010 – 2,100
Pressurizer Liquid Level (%)	Uniform	46.25 – 67.8
SIT Liquid Volume (ft^3)	Uniform	1,040 – 1,176
SIT Pressure (psia)	Uniform	214.7 – 239.7
Containment/SIT Temperature (°F)	Uniform	80 – 140
Containment Volume[1] ($x10^6$ ft^3)	Uniform	1.64 – 1.80
Initial Flow Rate (Mlbm/hr)	Uniform	130 – 145
Initial Operating Temperature (°F)	Uniform	537 – 544
SIRWT Temperature (°F)	Point	100
Offsite Power Availability[2]	Binary	0,1
Delay for Containment Sprays (s)	Point	0
Delay for Containment Fan Coolers (s)	Point	0
HPSI Delay (s)	Point	30 (w/ offsite power) 40 (w/o offsite power)
LPSI Delay (s)	Point	30 (w/ offsite power) 40 (w/o offsite power)

[1] Uniform distribution for parameter with demonstrated PCT importance conservatively produces a wider variation of PCT results relative to a normal distribution. Treatment consistent with approved RLBLOCA evaluation model (Reference 5).

[2] No data are available to quantify the availability of offsite power. During normal operation, offsite power is available. Since the loss of offsite power is typically more conservative (loss in coolant pump capacity), it is assumed that there is a 50 percent probability the offsite power is unavailable.

SUMMARY OF MAJOR PARAMETERS FOR THE LIMITING PCT CASE

	6.0 % Gad Rod
Core Average Burnup (EFPH)	7,381.22
Core Power (MWt)	2,572.79
Hot Rod LHR, kW/ft	14.60
Total Hot Rod Radial Peak (F_r^T)	2.040
Axial Shape Index (ASI)	0.1602
Break Type	Guillotine
Break Size (ft^2/side)	3.339
Offsite Power Availability	Not Available
Decay Heat Multiplier	1.01073

SUMMARY OF HOT ROD LIMITING PCT RESULTS

	15 x 15 AREVA NP
Fuel Type	w/o Gd_2O_3
Case Number	22
PCT	
Temperature	1,740 °F
Time	27.2 s
Elevation	2.151 ft
Metal-Water Reaction	
Oxidation Maximum	0.59%
Total Oxidation	< 0.01%

CALCULATED EVENT TIMES FOR THE LIMITING PCT CASE

Event	Time (sec)
Break Opened	0
PCP Trip	0
SIAS Issued	0.6
Start of Broken Loop SIT Injection	14.9
Start of Intact Loop SIT Injection (loops 1B, 2A and 2B, respectively)	17.1, 17.1 and 17.1
Beginning of Core Recovery (Beginning of Reflood)	27.2
PCT Occurred	27.2
Start of HPSI	40.6
LPSI Available	40.6
Broken Loop LPSI Delivery Began	40.6
Intact Loop LPSI Delivery Began (loops 1B, 2A and 2B, respectively)	40.6, 40.6 and 40.6
Broken Loop HPSI Delivery Began	40.6
Intact Loop HPSI Delivery Began (loops 1B, 2A and 2B, respectively)	40.6, 40.6, 40.6
Broken Loop SIT Emptied	50.7
Intact Loop SIT Emptied (loops 1B, 2A and 2B, respectively)	50.8, 54.6 and 53.1
Transient Calculation Terminated	300

CONTAINMENT HEAT SINK DATA

Heat Sink		Surface Area (ft^2)	Total thickness (ft)	Material
1	Containment Dome and Upper Wall	69,630.20	0.0208	Carbon steel liner; no coatings
			4.2625	Concrete; no coating
2	Containment Wainscot	2,200.20	0.0208	Carbon steel liner; no coating
			4.2625	Concrete; no coatings
3	Containment Floor Slab	7,567.80	1.5	Concrete; no paint
			0.0208	Carbon steel; no paint
			15.971	Concrete; no paint
4	Containment Sump Slab	380.10	0.0156	Stainless steel
			1.5	Concrete; no coating
			0.0208	Carbon steel; no paint
			28.3	Concrete; no coating
5	Reactor Cavity Slab	380.10	0.0208	Stainless steel
			1.4792	Concrete; no coating
6	Lower Biological Shield	243.4 (Inner surface of cylindrical shape)	0.015625	Stainless steel; no paint
			7.9167	Concrete; no coating
7	Internal Concrete with Carbon Steel Liner Plate	2,048.40	0.0208	Carbon steel
			3.8958	Concrete; no coating
8	Internal Concrete with Stainless Steel Liner Plate	4,712.70	0.0417	Stainless steel
			2.4083	Concrete; no coating
9	Internal Concrete with Decking	2,672.90	0.004	Carbon steel liner; no coating
			2.4833	Concrete; no coatings
10	Internal Concrete	62,870.90	1.708	Concrete; no coating
11	Gravel Pit	384.50	4.208	Concrete; no coating
12	Equipment Tanks and Heat Exchangers	18,011.00	0.0364	Carbon steel; no paint
13	Miscellaneous Equipment	18,344.80	0.0112	Carbon steel; no coating
14	Polar Crane	8,241.50	0.1258	Carbon steel; no coating
15	Ductwork plus Electrical Panels	31,127.50	0.0026	Carbon steel; no coating
16	Grating	16,812.20	0.00692	Carbon steel; no coating
17	quarter inch Structural Steel	35,812.90	0.0217	Carbon steel; no coating
18	half inch Structural Steel	48,705.20	0.0433	Carbon steel; no coating
19	Sump Strainer and Piping	3,750.00	0.00645	Stainless steel

CONTAINMENT INITIAL AND BOUNDARY CONDITIONS

Parameter	Parameter Value	
Containment free volume range, ft^3	1.64E+06 to 1.80E+06	
Initial relative humidity	100.0 %	
Initial compartment pressure, psia	14.7, nominal value	
Initial compartment temperature, °F	$80 \leq T \leq 140$	
Containment spray time of delivery, sec	0.0	
Containment spray flow rate, lb/sec	576.7	
Containment spray temperature, °F	40.0	
Fan cooler heat removal as a function of temperature	Temp (°F)	Heat Removal (BTU/sec)
	284	-196242.0
	264	-157899.0
	244	-118137.0
	224	-82197.0
	204	-53190.0
	184	-32475.0
	164	-19533.0
	144	-11559.0
	124	-6735.0
	104	-3831.0
	35	0.0

SYSTEM PARAMETERS AND INITIAL CONDITIONS USED IN THE PALISADES SBLOCA ANALYSIS

Parameter	Palisades Analysis Value
Primary Heat Output, Mwth	2580.6
Primary Coolant Flow, gpm	341,400
Operating Pressure, psia	2060
Inlet Coolant Temperature, °F	544
SIT Pressure, psia	215
SIT Fluid Temperature, °F	100
Steam Generator Tube Plugging, %	15
SG Secondary Pressure, psia	763
SG Main Feedwater Temperature, °F	439.5
SG Auxiliary Feedwater Temperature, °F	120
HPSI Fluid Temperature, °F	100
Reactor Scram Low Pressure Setpoint (TM/LP floor), psia	1585
Reactor Scram Delay Time on TM/LP, s	0.8
Scram CEA Holding Coil Release Delay Time, s	0.5
SIAS Activation Setpoint Pressure, psia	1450
HPSI Pump Delay Time on SIAS, s	40
Main Steam Safety Valve Setpoint Pressure, psia	
MSSV-1	1029.3
MSSV-2	1049.9
MSSV-3	1070.5

PCT RESULTS OF THE PALISADES SBLOCA ANALYSIS

Break Size (ft^2)	PCT (°F)
0.04	1296
0.05	1451
0.06	1479
0.08	1734
0.10	1654
0.15	1356

SEQUENCE OF EVENTS FOR THE PALISADES SBLOCA EVENT

Event	Time (s)
Break in Cold Leg 2B opened 0.0	
Pressurizer Pressure reached TM/LP setpoint	16.98
Reactor scram	18.28
Loss of off-site power 18.	28
MFW terminated 18.	28
Turbine tripped 18.	28
Pressurizer pressure reaches SIAS setpoint (1450 psia)	24.86
Minimum SG level reaches AFAS setpoint (23.7% span)	25
HPSI pump ready for delivery 6	4.86
Cold Leg pressure reaches HPSI shutoff head (1200.7 psia)	96
Motor-driven AFW delivery begins 14	5
Loop seal in Cold Leg 1B cleared	282
Break uncovered	300
PCT occurs	1690
SIT discharge begins	1690
Reactor vessel mass inventory reaches minimum value	1698

SBLOCA ANALYSIS CALCULATION RESULTS

Peak Cladding Temperature	
Temperature (°F)	1734
Time (s)	1690
Elevation (ft) 10.2	
Metal-Water Reaction	
Local Maximum (%)	2.0
Elevation of Local Maximum (ft)	10.2
Total Core Wide (%)	<1.0

MAXIMUM STRESSES, PRESSURES AND DEFLECTIONS IN CRITICAL REACTOR INTERNALS FOLLOWING A MAJOR LOSS OF COOLANT ACCIDENT

Structural Component	Failure Mode and Loading Condition	Location of Failure	Failure Condition(a)	Allowable Condition(b)	Calculated Condition
Core Barrel	Tension - Axial Load	Middle Section of Core Barrel	54,000 psi	29,300 psi	3,200 psi
	Buckling - External Pressure	Upper Portion of Core Barrel (Arch)	Δp = 572 psi	Δp = 381 psi	Δp = 380 psi
	Tension - Internal Pressure	Middle Section of Core Barrel	54,000 psi	29,300 psi	26,750 psi
Lower Core Support	Bending - Transverse Load	Beam Flange	54,000 psi	43,950 psi	22,510 psi
	Shear - Transverse Load	Junction of Flange to Web	32,400 psi	17,580 psi	7,710 psi
Control Rod Shrouds 1st Row (Near Nozzle)	Bending - Axial and Transverse Load	Lower End of Shroud	54,000 psi	32,230 psi	70,310 psi
	Deformation - Axial and Transverse Load	Center of Shroud	Defl = 0.76"	Defl = 0.51"	Defl > 0.51"

(a) The figures in this column represent the estimated stress, pressure or deflection limits at which the component will no longer perform its function.
(b) The figures in this column represent the allowable stress, pressure or deflection limits in accordance with the design bases established in Chapter 3 of this FSAR.

MAXIMUM STRESSES, PRESSURES AND DEFLECTIONS IN CRITICAL REACTOR INTERNALS FOLLOWING A MAJOR LOSS OF COOLANT ACCIDENT

Structural Component	Failure Mode and Loading Condition	Location of Failure	Failure Condition(a)	Allowable Condition(b)	Calculated Condition
Control Rod Shrouds 2nd Row	Bending - Axial and Transverse Load	Lower End of Shroud	54,000 psi	32,230 psi	28,090 psi
	Deformation - Axial and Transverse Load	Center of Shroud	Defl = 0.76"	Defl = 0.51"	Defl - 0.279"
Upper Grid Beam	Bending - Transverse Load	Center of Beam	54,000 psi	43,950 psi	12,980 psi
Upper Structure Flange	Bending - Axial Load	Junction of Flange and Barrel Cylinder	54,000 psi	43,950 psi	40,630 psi

(a) The figures in this column represent the estimated stress, pressure or deflection limits at which the component will no longer perform its function.
(b) The figures in this column represent the allowable stress, pressure or deflection limits in accordance with the design bases established in Chapter 3 of this FSAR.

ASYMMETRIC LOADS ANALYSIS - REACTOR VESSEL INTERNAL COMPONENT STRESS MARGINS

Component	Location	Percent Margin (%)*
Core Support Barrel	Upper Flange	6
	Upper Cylinder	7
	Center Cylinder	11
Lower Support Structure	Support Columns	2
	Beams	3
	Core Support Plate	13
Upper Guide Structure	Grid Beams	1

*Percent margin is computed as $(S_{allow} - S_{calc})$ (100%) / S_{allow}, where S_{calc} is the calculated component stress and S_{allow} is the ASME Code allowable stress.

LOCA ANALYSIS CONTAINMENT BUILDING HEAT SINKS/SOURCES

HEAT SINK	SURFACE AREA (ft^2)
1. Containment Wall and Dome	69,630.2
Carboline 3912	
Carbo Zinc 11	
Carbon Steel Liner	
Air Gap	
Concrete	
2. Containment Wainscot	2,200.2
Phenoline 305	
Carbo Zinc 11	
Carbon Steel Liner	
Air Gap	
Concrete	
3. Containment Floor Slab	7,567.8
Phenoline 305	
Carboline 195	
Concrete	
Air Gap	
Carbon Steel	
Air Gap	
Concrete	
4. Containment Sump Slab	380.1
Stainless Steel	
Air Gap	
Concrete	
Air Gap	
Carbon Steel Liner	
Air Gap	
Concrete	
5. Reactor Cavity Slab (Note 1)	380.1
Stainless Steel	
Air Gap	
Concrete	
Air Gap	
Unibestos	
Stainless Steel	

LOCA ANALYSIS CONTAINMENT BUILDING HEAT SINKS/SOURCES

HEAT SINK	SURFACE AREA (ft^2)
6. Lower Biological Shield (Note 2) Stainless Steel Air Gap Concrete	417.8
7. Internal Concrete Phenoline 305 Carboline 195 Concrete	61,337.5
8. Internal Concrete with Carbon Steel Liner Plate Stainless Steel Wool Carbon Steel Air Gap Concrete	2,048.4
9. Internal Concrete with Stainless Steel Liner Plate Stainless Steel Air Gap Concrete	4,712.7
10. Internal Concrete with Decking (Note 3) Carbon Steel Air Gap Concrete Carboline 195 Carboline 305	2,672.9
11. Gravel Pit Phenoline 305 Carboline 195 Concrete/Gravel Mixture	375.1
12. Structural Steel Adjacent to the Liner Plate Carboline 3912 Carbo Zinc 11 Carbon Steel	30,609.3
13. Structural Steel Carbo Zinc 11 Carbon Steel	41,628.4

LOCA ANALYSIS CONTAINMENT BUILDING HEAT SINKS/SOURCES

HEAT SINK	SURFACE AREA (ft^2)
14. Polar Crane Carboline 3912 Carbo Zinc 11 Carbon Steel	7,044
15. Pressurizer Quench Tank (Note 4) Carbon Steel Carbo Zinc 11	679
16. Safety Injection Tanks (Note 5) Stainless Steel Carbon Steel Carbo Zinc 11	4,098.4
17. Clean Waste Receiver Tanks (Note 6) Carbon Steel Carbo Zinc	9,255.6
18. Clean Waste Receiver Tank Skirts (Note 7) Carbon Steel Carbo Zinc 11	3,577.2
19. Shield Cooling Surge Tank (Note 8) Carbon Steel Carbo Zinc 11	112.2
20. Deleted	
21. Letdown Heat Exchanger Phenoline 305 Carbo Zinc 11 Carbon Steel	101.8
22. Shield Cooling Heat Exchanger Carbo Zinc 11 Carbon Steel Water	25

LOCA ANALYSIS CONTAINMENT BUILDING HEAT SINKS/SOURCES

HEAT SINK	SURFACE AREA (ft^2)
23. Head Lift Rig and Containment Air Coolers Phenoline 305 Carbon Steel	14,308.2
24. Electrical Panels Carbo Zinc 11 Carbon Steel	2,141.4
25. Refueling Mast and Grapple Stainless Steel	1,371.1
26. Grating Carbon Steel	14,369.4
27. Ductwork Carbon Steel	24,463.3
28. PCS Metal Wall #1 Reactor Vessel and Internals	35,539.2
29. PCS Metal Wall #2 Reactor Vessel and Internals	12,441.8
30. PCS Metal Wall #3 Reactor Core	10,378.8

LOCA ANALYSIS CONTAINMENT BUILDING HEAT SINKS/SOURCES

Notes:

1 The reactor cavity slab heat conductor is in contact with the containment atmosphere on both sides.

2 The lower biological shield heat conductor is a tube. While the surface area specified above represents the outside surface area, only the inside surface area is in contact with the containment atmosphere.

3 The internal concrete with decking heat conductor is in contact with the containment atmosphere on both sides.

4 The pressurizer quench tank heat conductor is a tube. The surface area specified above represents the outside surface area, which is the carbo zinc 11 side and which is in contact with the containment atmosphere.

5 The safety injection tanks heat conductor is a tube. The surface area specified above represents the outside surface area, which is the carbo zinc 11 side and which is in contact with the containment atmosphere.

6 The clean waste receiver tanks heat conductor is a tube. The surface area specified above represents the outside surface area, which is the carbo zinc 11 side and which is in contact with the containment atmosphere.

7 The clean waste receiver tank skirts heat conductor is a tube. The surface area specified above represents the outside surface area, which is the carbo zinc 11 side and which is in contact with the containment atmosphere.

8 The shield cooling surge tank heat conductor is a tube. The surface area specified above represents the outside surface area, which is the carbo zinc 11 side and which is in contact with the containment atmosphere.

LOCA ANALYSIS ENGINEERED SAFEGUARDS EQUIPMENT ALIGNMENT

	D/G 1-2 Failure Equipment Operated	D/G 1-1 Failure Equipment Operated
Containment Sprays	P-54B & P54C	P-54A
LPSI	P-67B	P-67A
HPSI	P-66B	P-66A
Containment Air Coolers		VHX-1, VHX-2 & VHX-3
Component Cooling Water	P-52A & P-52C	P-52B
Service Water	P-7B	P-7A & P-7C

LOCA INITIAL CONDITIONS

Containment Free Volume	1.64×10^6 ft^3
Containment Temperature	145°F
Containment Pressure	15.7 Psia
Relative Humidity	30%
SIRW Tank Temperature	100°F

CONTAINMENT BUILDING RESPONSE TO LOCA DOUBLE ENDED GUILLOTINE BREAK IN A HOT LEG

Case	Peak Pressure (Psig)	Time (Sec)
D/G 1-2 Failure	54.2	13.2
D/G 1-1 Failure	54.2	13.2

The peaks for both cases are the same because they occurred so early in the transient that the differences in safeguards equipment used had not yet taken effect.

LOCA ANALYSIS PARAMETER ASSUMPTIONS

Initial Containment Air Temp	145°F
Initial Containment Pressure	15.7 Psia (1.0 Psig)
Relative Humidity	30%
CCWHX Tube Fouling Coefficient	.001 hr-ft^2-°F/BTU
Service Water Temperature	85°F
D/G 1-2 (RCF) Failure Data	
ECCS Injection Flow pre-RAS (1 HPSI, 1 LPSI pump)	3,471 gpm
ECCS Injection Flow post-RAS (1 HPSI pump)	705 gpm
1 SW Pump Flow Rate to CCWHXs	4,214 gpm
1 CCW Pump Flow Rate to SDCHXs	4,480 gpm
2 CS Pump Flow Rate to Containment (pre RAS)	2,472 gpm
2 CS Pump Flow Rate to Containment (post RAS-HLI)	1,684 gpm
Post-RAS Spillage after Initiation of Hot Leg Injection	328 gpm
ECCS Injection Flow after Initiation of Hot Leg Injection	273 gpm
D/G 1-1 (LCF) Failure Data	
ECCS Injection Flow pre-RAS (1 HPSI, 1 LPSI pump)	3,443 gpm
ECCS Injection Flow post-RAS (1 HPSI pump)	703 gpm
2 SW Pump Flow Rate to CCWHXs	4,286 gpm
2 SW Pump Flow Rate to 3 Containment Air Coolers	1, 600 gpm/Air Cooler
1 CCW Pump Flow Rate to SDCHXs	4,480 gpm
1 CS Pump Flow Rate to Containment (pre RAS)	1,781 gpm
1 CS Pump Flow Rate to Containment, 1 header (pre RAS)	1,233 gpm
1 CS Pump Flow Rate to Containment (post RAS-HLI)	788 gpm
Post-RAS Spillage after Initiation of Hot Leg Injection	308 gpm
ECCS Injection Flow after Initiation of Hot Leg Injection	279 gpm

INITIAL CONDITIONS FOR THE MSLB CONTAINMENT ANALYSIS

Parameter	Assumed Value
Containment Free Volume, ft^3	1.64×10^6
Initial Containment Temperature, °F	145.0
Initial Containment Pressure, psig	1.0*
Initial Containment Humidity, %	30
Containment Spray Water Temperature, °F	100.0
Main Feedwater Regulating Valve Closure Time, sec	22
Main Steam Isolation Valve Closure Time, sec	2

* Zero power cases assumed 1.5 psig

INITIAL CONDITIONS FOR THE MSLB CONTAINMENT ANALYSIS
Power- and Case-Dependent Parameters for CONTRANS Code

Case	Power %	Power MWTh*	Cold Leg Temp, °F	S/G Pressure psia	PCS Flow Rate, lbm/hr#
102%	102	2600.6	550.65	770.0	$144.6x10^6$
75%	75	1917.5	548.70	784.0	$144.6x10^6$
0%	0	20.0	539.00	900.0	$144.6x10^6$
EEQ	102	2600.6	550.65	770.0	$144.6x10^6$

* This power level includes an assumed contribution of 20 MWTh from the primary coolant pumps.

\# Lower PCS flowrate dispositioned in Reference 25.

MSLB CONTAINMENT ANALYSIS RESULTS

Case Description	Power Level	Peak Pressure (psig)
Limiting Pressure - Relay 5P-7 Failure w/Open MSIV Bypass Valves	0%	53.5

MSLB ANALYSIS CONTAINMENT BUILDING HEAT SINKS/SOURCES

	HEAT SINK	SURFACE AREA (ft^2)
1.	Containment Wall and Dome Carboline 3912 Carbo Zinc 11 Carbon Steel Liner Air Gap Concrete	69,630.2
2.	Containment Wainscot Phenoline 305 Carbo Zinc 11 Carbon Steel Liner Air Gap Concrete	2,200.2
3.	Containment Floor Slab Phenoline 305 Carboline 195 Concrete Air Gap Carbon Steel Air Gap Concrete	7,567.8

MSLB ANALYSIS CONTAINMENT BUILDING HEAT SINKS/SOURCES

	HEAT SINK	SURFACE AREA (ft^2)
4.	Containment Sump Slab	380.1
	Stainless Steel	
	Air Gap	
	Concrete	
	Air Gap	
	Carbon Steel Liner	
	Air Gap	
	Concrete	
5.	Reactor Cavity Slab (Note 1)	380.1
	Stainless Steel	
	Air Gap	
	Concrete	
	Air Gap	
	Unibestos	
	Stainless Steel	
6.	Lower Biological Shield (Note 2)	417.8
	Stainless Steel	
	Air Gap	
	Concrete	
7.	Internal Concrete	61,337.5
	Phenoline 305	
	Carboline 195	
	Concrete	
8.	Internal Concrete with Carbon Steel Liner Plate	2,048.4
	Stainless Steel	
	Wool	
	Carbon Steel	
	Air Gap	
	Concrete	
9.	Internal Concrete with Stainless Steel Liner Plate	4,712.7
	Stainless Steel	
	Air Gap	
	Concrete	

MSLB ANALYSIS CONTAINMENT BUILDING HEAT SINKS/SOURCES

	HEAT SINK	SURFACE AREA (ft^2)
10.	Internal Concrete with Decking (Note 3) Carbon Steel Air Gap Concrete Carboline 195 Carboline 305	2,672.9
11.	Gravel Pit Phenoline 305 Carboline 195 Concrete/Gravel Mixture	375.1
12.	Structural Steel Adjacent to the Liner Plate Carboline 3912 Carbo Zinc 11 Carbon Steel	30,609.3
13.	Structural Steel Carbo Zinc 11 Carbon Steel	41,628.4
14.	Polar Crane Carboline 3912 Carbo Zinc 11 Carbon Steel	7,044
15.	Pressurizer Quench Tank (Note 4) Carbon Steel Carbo Zinc 11	679
16.	Safety Injection Tanks (Note 5) Stainless Steel Carbon Steel Carbo Zinc 11	4,098.4
17.	Clean Waste Receiver Tanks (Note 6) Carbon Steel Carbo Zinc	9,255.6
18.	Clean Waste Receiver Tank Skirts (Note 7) Carbon Steel Carbo Zinc 11	3,577.2

MSLB ANALYSIS CONTAINMENT BUILDING HEAT SINKS/SOURCES

	HEAT SINK	SURFACE AREA (ft^2)
19.	Shield Cooling Surge Tank (Note 8) Carbon Steel Carbo Zinc 11	112.2
20.	Deleted	
21.	Letdown Heat Exchanger Phenoline 305 Carbo Zinc 11 Carbon Steel	101.8
22.	Shield Cooling Heat Exchanger Carbo Zinc 11 Carbon Steel Water	25
23.	Head Lift Rig and Containment Air Coolers Phenoline 305 Carbon Steel	14,308.2
24.	Electrical Panels Carbo Zinc 11 Carbon Steel	2,141.4
25.	Refueling Mast and Grapple Stainless Steel	1,371.1
26.	Grating Carbon Steel	14,369.4
27.	Ductwork Carbon Steel	24,463.3

MSLB ANALYSIS CONTAINMENT BUILDING HEAT SINKS/SOURCES

Notes:

1 The reactor cavity slab heat conductor is in contact with the containment atmosphere on both sides.

2 The lower biological shield heat conductor is a tube. While the surface area specified above represents the outside surface area, only the inside surface area is in contact with the containment atmosphere.

3 The internal concrete with decking heat conductor is in contact with the containment atmosphere on both sides.

4 The pressurizer quench tank heat conductor is a tube. The surface area specified above represents the outside surface area, which is the carbo zinc 11 side and which is in contact with the containment atmosphere.

5 The safety injection tanks heat conductor is a tube. The surface area specified above represents the outside surface area, which is the carbo zinc 11 side and which is in contact with the containment atmosphere.

6 The clean waste receiver tanks heat conductor is a tube. The surface area specified above represents the outside surface area, which is the carbo zinc 11 side and which is in contact with the containment atmosphere.

7 The clean waste receiver skirts heat conductor is a tube. The surface area specified above represents the outside surface area, which is the carbo zinc 11 side and which is in contact with the containment atmosphere.

8 The shield cooling surge tank heat conductor is a tube. The surface area specified above represents the outside surface area, which is the carbo zinc 11 side and which is in contact with the containment atmosphere.

REACTOR CAVITY GEOMETRIC FACTORS

Volume of Cavity	6,653 ft^3
Volume of Sump	1,364 ft^3
Mass of Upper Seal	3,000 lb
Refueling Pool Seal Breaks and Begins To Lift at	5.8 Psi

	Total Flow Area (ft^2)	Forward Loss Coefficient (ft^2)
Refueling Pool Seal		
Before Breaking Away	4.77	0.57
After Broken Away	82.23	1.42
Annulus Around Coolant Pipes	24.2	1.45
30-Inch Access Tube	4.75	2.37
6 Pipes Into Sump	10.1	1.19

GEOMETRY AND PEAK PRESSURES IN STEAM GENERATOR COMPARTMENTS

Steam Generator Compartment	Volume (ft^3)	Vent Area (ft^2)	Peak Pressure (Psi)
North	55,210	1,043.3	24.8
South	62,090	1,091.3	22.4

DIFFERENTIAL PRESSURES AT VARIOUS LOCATIONS

		Calculated Pressure (Psi)	Design Pressure (Psi)
1.	Maximum Uplift Differential Pressure Across the Reactor Cavity Floor for a 42-Inch Pipe Double-Ended Rupture Outside the Reactor Cavity	0.4	7.3
2.	Maximum Differential Pressure Across the Primary Shield Walls Due To a Break of a 42-Inch Pipe Within the Reactor Cavity	52.4	72
3.	Maximum Differential Pressure Across the Primary Shield Walls Due To a Break of a 30-Inch Pipe Within the Reactor Cavity	67.7	72
4.	Maximum Differential Pressure Across Secondary Shield Walls of the North Steam Generator Compartment Due To a 42-Inch Pipe Double-Ended Rupture Within the Compartment	24.8	31
5.	Maximum Differential Pressure Across the Secondary Shield Walls of the South Steam Generator Compartment Due To a 42-Inch Pipe Double-Ended Rupture Within the Compartment	22.4	27

FUEL HANDLING ACCIDENT (FHA) RADIOLOGICAL ANALYSIS – INPUTS AND ASSUMPTIONS

Input/Assumption	Value
Core Power Level Before Shutdown	2703 MW_{th}
Core Average Fuel Burnup	39,300 MWD/MTU
Discharged Fuel Assembly Burnup	39,300 – 58,900 MWD/MTU
Fuel Enrichment	3.0 – 5.0 w/o
Maximum Radial Peaking Factor	2.04
Number of Fuel Assemblies Damaged	1 fuel assembly
Delay Before Spent Fuel Movement	48 hours
FHA Source Term for a Single Assembly	Table 14.19-2
Water Level Above Damaged Fuel Assembly	22.5 feet minimum
Iodine Decontamination Factors	Elemental – 252 Organic – 1 Overall – 183.07
Noble Gas Decontamination Factor	1
Chemical Form of Iodine In Pool	Elemental – 99.85% Organic – 0.15%
Atmospheric Dispersion Factors Offsite Onsite	 Section 2.5.5.2 Tables 14.24-2 and 14.24-3
Time of Control Room Ventilation System Isolation	20 minutes
Breathing Rates	RG 1.183 Sections 4.1.3 and 4.2.6
Control Room Occupancy Factor	RG 1.183 Section 4.2.6
FHB Ventilation Filter Efficiencies	Elemental iodine – 94% Organic iodine – 94% Noble gas – n/a

FUEL HANDLING ACCIDENT RADIOLOGICAL ANALYSIS – SOURCE TERM

Nuclide	Activity (Curies)	Nuclide	Activity (Curies)	Nuclide	Activity (Curies)
Co-58	0.0000E+00	I-135	0.8949E+04	Sb-126	0.9900E+03
Co-60	0.0000E+00	Xe-133	0.1298E+07	Te-131	0.8307E+04
Kr-85	0.1052E+05	Xe-135	0.8201E+05	Te-133	0.2034E-10
Kr-85m	0.1174E+03	Cs-134	0.2034E+06	Te-134	0.2217E-14
Kr-87	0.1647E-05	Cs-136	0.5284E+05	Te-125m	0.3417E+04
Kr-88	0.4302E+01	Cs-137	0.1100E+06	Te-133m	0.1213E-09
Rb-86	0.1819E+04	Ba-139	0.4861E-04	Ba-141	0.0000E+00
Sr-89	0.7020E+06	Ba-140	0.1130E+07	Ba-137m	0.1041E+06
Sr-90	0.8456E+05	La-140	0.1235E+07	Pd-109	0.2825E+05
Sr-91	0.2679E+05	La-141	0.2730E+03	Rh-106	0.5771E+06
Sr-92	0.4453E+01	La-142	0.5794E-03	Rh-103m	0.1097E+07
Y-90	0.8623E+05	Ce-141	0.1168E+07	Tc-101	0.0000E+00
Y-91	0.9107E+06	Ce-143	0.4100E+06	Eu-154	0.1246E+05
Y-92	0.3229E+03	Ce-144	0.1014E+07	Eu-155	0.8442E+04
Y-93	0.4137E+05	Pr-143	0.1071E+07	Eu-156	0.1935E+06
Zr-95	0.1210E+07	Nd-147	0.4211E+06	La-143	0.0000E+00
Zr-97	0.1684E+06	Np-239	0.1023E+08	Nb-97	0.1692E+06
Nb-95	0.1248E+07	Pu-238	0.4494E+04	Nb-95m	0.8748E+04
Mo-99	0.8264E+06	Pu-239	0.3578E+03	Pm-147	0.1296E+06
Tc-99m	0.7956E+06	Pu-240	0.5406E+03	Pm-148	0.1659E+06
Ru-103	0.1216E+07	Pu-241	0.1522E+06	Pm-149	0.2481E+06
Ru-105	0.5426E+03	Am-241	0.1897E+03	Pm-151	0.5012E+05
Ru-106	0.5771E+06	Cm-242	0.5649E+05	Pm-148m	0.2899E+05
Rh-105	0.3958E+06	Cm-244	0.1339E+05	Pr-144	0.1015E+07
Sb-127	0.6450E+05	I-130	0.2546E+04	Pr-144m	0.1217E+05
Sb-129	0.1176E+03	Kr-83m	0.3727E+00	Sm-153	0.2171E+06
Te-127	0.7344E+05	Xe-138	0.0000E+00	Y-94	0.0000E+00
Te-127m	0.1222E+05	Xe-131m	0.8276E+04	Y-95	0.0000E+00
Te-129	0.2383E+05	Xe-133m	0.3403E+05	Y-91m	0.1702E+05
Te-129m	0.3637E+05	Xe-135m	0.1434E+04	Br-82	0.2060E+04
Te-131m	0.3690E+05	Cs-138	0.0000E+00	Br-83	0.8833E-01
Te-132	0.6852E+06	Cs-134m	0.5122E+00	Br-84	0.0000E+00
I-131	0.6424E+06	Rb-88	0.4804E+01	Am-242	0.1138E+05
I-132	0.7060E+06	Rb-89	0.0000E+00	Np-238	0.2238E+06
I-133	0.3019E+06	Sb-124	0.1663E+04	Pu-243	0.5681E+03
I-134	0.2087E-09	Sb-125	0.1566E+05		

MHA SEQUENCE OF EVENTS FOR THE DOSE CONSEQUENCE ANALYSIS

Time (minutes)	Event/Action
t = 0.0	Release of radionuclides to the containment atmosphere starts and the containment atmosphere begins leaking at the T.S. leak rate limit. Loss of Off-Site Power occurs. CHP and CHR signals are generated. The control room is depressurized. Control room inleakage occurs at the base infiltration rate.
t = 1.0	Full spray flow is delivered to the containment atmosphere by the Containment Spray System. Removal of particulate and elemental iodine species begins at this time. No credit is taken for the removal of organic iodine species.
t = 1.5	The control room is pressurized to > 1/8 " H2O and running in the E-HVAC mode with one train operational due to the loss of one safety train. Control room unfiltered inleakage past the normal intake isolation dampers and the smoke purge dampers begins.
t = 19.0	The initial SIRWT inventory is depleted and containment spray suction is aligned to the containment sump. Leakage from ESF components and via the SIRWT begins. This assumes runout flows on 2 HPSI's, 2 LPSI's, 3 Containment Spray Pumps, minimum inventory of the SIRWT, and a containment backpressure of 55 psig.
t = 150.9	The elemental iodine decontamination factor reaches 200 at this time.
t = 203.1	The aerosol iodine decontamination factor reaches 50 at this time.
t = 600.0	Containment spray flow is conservatively assumed to be terminated. However SIRWT leakage is assumed to continue as if the CSS pumps continued to operate.
t = 1440.0	The containment design leak rate is assumed to decrease to one-half (t = 24 hours) the T.S. leakrate.
t = 43200	Low Population Zone (LPZ) doses are integrated over the interval (t = 30 days) from the initiation of the incident to 30 days. Site Boundary (SB) doses are integrated over the worst 2 hour period. Control Room doses are integrated over the interval (t = 30 days) from the initiation of the incident to 30 days.

MAXIMUM HYPOTHETICAL ACCIDENT / LOSS OF COOLANT ACCIDENT (MHA/LOCA) RADIOLOGICAL ANALYSIS – INPUTS AND ASSUMPTIONS

Input/Assumption	Value
Release Inputs:	
Core Power Level	2703 MW_{th}
Core Average Fuel Burnup	39,300 MWD/MTU
Fuel Enrichment	3.0 – 5.0 w/o
Initial PCS Equilibrium Activity	1.0 μCi/gm DE I-131 and 100/E-bar gross activity
Core Fission Product Inventory	Table 14.22-3
Containment Leakage Rate 0 to 24 hours after 24 hours	 0.10% (by weight)/day 0.05% (by weight)/day
MHA release phase timing and duration	Table 14.22-4
Core Inventory Release Fractions (gap release and early in-vessel damage phases)	RG 1.183, Sections 3.1, 3.2, and Table 2
ECCS Systems Leakage (from 19 minutes to 30 days) Sump Volume (minimum) ECCS Leakage (2 times allowed value) Flashing Fraction Chemical form of the iodine released from the ECCS leakage Iodine Decontamination Factor No credit taken for dilution or holdup	39,054 $ft.^3$ 0.053472 ft^3/min Calculated – 0.03 to 0.06 Used for dose determination – 0.10 97% elemental, 3% organic 2 (current design basis)

MAXIMUM HYPOTHETICAL ACCIDENT / LOSS OF COOLANT ACCIDENT (MHA/LOCA) RADIOLOGICAL ANALYSIS – INPUTS AND ASSUMPTIONS

Input/Assumption	Value
SIRWT Back-leakage (from 19 minutes to 30 days)	
Sump Volume	292,143 gallons (minimum valve for ECCS leakage, maximizes sump iodine concentration)
ECCS Leakage to SIRWT (2 times allowed value)	430,708 gallons (maximum value for SIRWT backleakage to be consist with assumption of minimum water level in SIRWT)
Flashing Fraction (elemental iodine assumed to be released into tank space based upon partition factor)	7.2 gpm until 1 hours after RAS, then 0.0125 gpm
SIRWT liquid/vapor elemental iodine partition factor	0% based on temperature of fluid reaching SIRWT
Elemental Iodine fraction in SIRWT	Table 14.22-9
	Table 14.22-8
Initial SIRWT Liquid Inventory (minimum at time of recirculation)	4,144 gallons
Release from SIRWT Vapor Space	Table 14.22-10
Removal Inputs:	
Containment Aerosol/Particulate Natural Deposition (only credited in unsprayed regions)	0.1/hour
Containment Elemental Iodine Wall Deposition	2.3/hour
Containment Spray Coverage	>90%
Spray Removal Rates:	
Elemental Iodine	4.8/hour
Time to reach DF of 200	2.515 hours
Aerosol	1.8/hour (reduced to 0.18 at 3.385 hours)
Time to reach DF of 50	3.385 hours

MAXIMUM HYPOTHETICAL ACCIDENT / LOSS OF COOLANT ACCIDENT (MHA/LOCA) RADIOLOGICAL ANALYSIS – INPUTS AND ASSUMPTIONS

Input/Assumption	Value
Spray Initiation Time	60 seconds (0.016667 hours)
Control Room Ventilation System Time of automatic control room isolation and switch to emergency mode Control Room Unfiltered Inleakage	Table 14.24-1 90 seconds 16 cfm
Transport Inputs:	
Containment Leakage Release	Containment closest point
ECCS Leakage	Plant stack
SIRWT Backleakage	SIRWT vent
Personnel Dose Conversion Inputs:	
Atmospheric Dispersion Factors Offsite Onsite	Section 2.5.5.2 Tables 14.24-2 and 14.24-3
Breathing Rates	RG 1.183 Sections 4.1.3 and 4.2.6
Control Room Occupancy Factor	RG 1.183 Section 4.2.6

MHA/LOCA SOURCE TERM

Nuclide	Curies	Nuclide	Curies
Co-58	0.0000E+00	Pu-239	0.3558E+05
Co-60	0.0000E+00	Pu-240	0.5406E+05
Kr-85	0.1052E+07	Pu-241	0.1522E+08
Kr-85m	0.1948E+08	Am-241	0.1884E+05
Kr-87	0.3756E+08	Cm-242	0.5669E+07
Kr-88	0.5286E+08	Cm-244	0.5943E+06
Rb-86	0.1959E+06	I-130	0.3743E+07
Sr-89	0.7213E+08	Kr-83m	0.9119E+07
Sr-90	0.8458E+07	Xe-138	0.1211E+09
Sr-91	0.8874E+08	Xe-131m	0.8346E+06
Sr-92	0.9557E+08	Xe-133m	0.4659E+07
Y-90	0.8737E+07	Xe-135m	0.2999E+08
Y-91	0.9264E+08	Cs-138	0.1340E+09
Y-92	0.9596E+08	Cs-134m	0.4920E+07
Y-93	0.1101E+09	Rb-88	0.5369E+08
Zr-95	0.1236E+09	Rb-89	0.6895E+08
Zr-97	0.1206E+09	Sb-124	0.1702E+06
Nb-95	0.1249E+09	Sb-125	0.1567E+07
Mo-99	0.1368E+09	Sb-126	0.1107E+06
Tc-99m	0.1198E+09	Te-131	0.6601E+08
Ru-103	0.1260E+09	Te-133	0.8639E+08
Ru-105	0.9451E+08	Te-134	0.1220E+09
Ru-106	0.5794E+08	Te-125m	0.3413E+06
Rh-105	0.8741E+08	Te-133m	0.5406E+08
Sb-127	0.9111E+07	Ba-141	0.1188E+09
Sb-129	0.2568E+08	Ba-137m	0.1043E+08
Te-127	0.9047E+07	Pd-109	0.3327E+08
Te-127m	0.1223E+07	Rh-106	0.6285E+08
Te-129	0.2528E+08	Rh-103m	0.1135E+09
Te-129m	0.3772E+07	Tc-101	0.1261E+09
Te-131m	0.1113E+08	Eu-154	0.1247E+07
Te-132	0.1048E+09	Eu-155	0.8448E+06
I-131	0.7483E+08	Eu-156	0.2023E+08
I-132	0.1068E+09	La-143	0.1108E+09
I-133	0.1462E+09	Nb-97	0.1216E+09
I-134	0.1602E+09	Nb-95m	0.8835E+06
I-135	0.1372E+09	Pm-147	0.1292E+08
Xe-133	0.1466E+09	Pm-148	0.2144E+08

MHA/LOCA SOURCE TERM

Nuclide	Curies	Nuclide	Curies
Xe-135	0.4692E+08	Pm-149	0.4541E+08
Cs-134	0.2037E+08	Pm-151	0.1606E+08
Cs-136	0.5873E+07	Pm-148m	0.2999E+07
Cs-137	0.1100E+08	Pr-144	0.1025E+09
Ba-139	0.1307E+09	Pr-144m	0.1224E+07
Ba-140	0.1260E+09	Sm-153	0.4423E+08
La-140	0.1299E+09	Y-94	0.1105E+09
La-141	0.1193E+09	Y-95	0.1183E+09
La-142	0.1156E+09	Y-91m	0.5151E+08
Ce-141	0.1212E+09	Br-82	0.5282E+06
Ce-143	0.1115E+09	Br-83	0.9102E+07
Ce-144	0.1020E+09	Br-84	0.1591E+08
Pr-143	0.1111E+09	Am-242	0.9062E+07
Nd-147	0.4770E+08	Np-238	0.4306E+08
Np-239	0.1830E+10	Pu-243	0.4690E+08
Pu-238	0.3927E+06		

MHA/LOCA RELEASE PHASES

Phase	Onset	Duration
Gap Release	30 seconds	0.5 hours
Early In-Vessel	0.5 hours	1.3 hours

* From Regulatory Guide 1.183, Table 4

MHA/LOCA TIME DEPENDENT SIRWT PH

Time (hours)	SIRWT pH
0.3167	4.500
0.50	4.508
1.3167	4.544
1.3167	4.544
2.00	4.544
4.00	4.545
8.00	4.546
16.00	4.548
24.00	4.550
48.00	4.557
72.00	4.563
96.00	4.570
120.00	4.576
144.00	4.583
168.00	4.589
192.00	4.595
240.00	4.607
288.00	4.618
336.00	4.630
384.00	4.641
432.00	4.651
528.00	4.672
624.00	4.692
720.00	4.711

MHA/LOCA TIME DEPENDENT SIRWT TOTAL IODINE CONCENTRATION

Time (hours)	SIRWT Iodine Concentration (gm-atom/liter)
0.3167	0.00E+00
0.50	9.60E-07
1.3167	4.82E-06
1.3167	4.82E-06
2.00	4.84E-06
4.00	4.90E-06
8.00	5.02E-06
16.00	5.25E-06
24.00	5.48E-06
48.00	6.16E-06
72.00	6.82E-06
96.00	7.46E-06
120.00	8.08E-06
144.00	8.68E-06
168.00	9.26E-06
192.00	9.83E-06
240.00	1.09E-05
288.00	1.20E-05
336.00	1.29E-05
384.00	1.39E-05
432.00	1.48E-05
528.00	1.64E-05
624.00	1.79E-05
720.00	1.93E-05

MHA/LOCA TIME DEPENDENT SIRWT LIQUID TEMPERATURE

Time (hr)	Temperature (°F)
0.3167	100.0
0.50	100.0
1.3167	100.0
1.3167	100.0
2.00	100.0
4.00	100.5
8.00	101.3
16.00	102.4
24.00	103.2
48.00	104.7
72.00	105.0
96.00	105.0
120.00	104.9
144.00	104.8
168.00	104.8
192.00	104.7
240.00	104.6
288.00	104.6
336.00	104.5
384.00	104.5
432.00	104.5
528.00	104.4
624.00	104.4
720.00	104.4

MHA/LOCA Time Dependent SIRWT Elemental Iodine Fraction

Time (hr)	Elemental Iodine Fraction
0.3167	0.00E+00
0.50	2.02E-02
1.3167	7.93E-02
1.3167	7.93E-02
2.00	7.95E-02
4.00	8.02E-02
8.00	8.16E-02
16.00	8.42E-02
24.00	8.68E-02
48.00	9.38E-02
72.00	1.00E-01
96.00	1.06E-01
120.00	1.11E-01
144.00	1.15E-01
168.00	1.19E-01
192.00	1.23E-01
240.00	1.29E-01
288.00	1.34E-01
336.00	1.38E-01
384.00	1.41E-01
432.00	1.44E-01
528.00	1.47E-01
624.00	1.49E-01
720.00	1.49E-01

MHA/LOCA TIME DEPENDENT SIRWT PARTITION COEFFICIENT

Time (hr)	Elemental Iodine Partition Coefficient
0.3167	45.65
0.50	45.65
1.3167	45.65
1.3167	45.65
2.00	45.65
4.00	45.21
8.00	44.53
16.00	43.61
24.00	42.95
48.00	41.74
72.00	41.50
96.00	41.50
120.00	41.58
144.00	41.66
168.00	41.66
192.00	41.74
240.00	41.82
288.00	41.82
336.00	41.89
384.00	41.89
432.00	41.89
528.00	41.97
624.00	41.97
720.00	41.97

MHA/LOCA ADJUSTED RELEASE RATE FROM SIRWT

Time (hours)	Adjusted Iodine Release Rate (cfm)
0.3167	9.1718E-04
1.3167	1.1922E-05
8.00	1.2895E-05
24.00	1.4921E-05
72.00	1.7737E-05
168.00	1.9907E-05
240.00	2.1376E-05
336.00	2.2501E-05
432.00	2.3366E-05
624.00	2.3737E-05

SMALL LINE BREAK OUTSIDE OF CONTAINMENT RADIOLOGICAL ANALYSIS – INPUTS AND ASSUMPTIONS

Input/Assumption	Value
PCS Equilibrium Activity	1.0 μCi/gm DE I-131 and 100/E-bar gross activity
Break Flow Rate	160 gpm
Break Temperature	135°F
Break Pressure	35 psia
Time required to isolate break	60 minutes
Maximum equilibrium iodine concentration	1.0 μCi/gm DE I-131
Iodine appearance rate for concurrent iodine spike (500x)	Table 14.23-2
Iodine fraction released from break flow	10%
Auxiliary building ventilation system filtration	None
Atmospheric Dispersion Factors Offsite Onsite	 Section 2.5.5.2 Tables 14.24-2 and 14.24-3
Control Room Ventilation System Time of manual control room normal intake isolation and switch to emergency mode	 20 minutes
Breathing Rates Offsite Onsite	 RG 1.183 Section 4.1.3 RG 1.183 Section 4.2.6
Control Room Occupancy Factor	RG 1.183 Section 4.2.6

SMALL LINE BREAK OUTSIDE OF CONTAINMENT RADIOLOGICAL ANALYSIS – CONCURRENT (500 X) IODINE SPIKE APPEARANCE RATE

Isotope	Appearance Rate (Ci/min)
Iodine-131	86.7114868
Iodine-132	119.152137
Iodine-133	134.524016
Iodine-134	110.495326
Iodine-135	102.953824

TIME DEPENDENT CONTROL ROOM PARAMETERS

(For TID-14844 based analyses.)

			X/Q Containment Releases (Ventilation Stack/Aux Bldg)		X/Q SIRWT Releases	
Time Interval	Breathing Rates [m^3/s]	Occupancy Factors	Normal Intake [s/m^3]	Emergency Intake [s/m^3]	Normal Intake [s/m^3]	Emergency Intake [s/m^3]
0 - 8 hr	3.470×10^{-4}	1.0	7.72×10^{-4}	2.56×10^{-4}	1.32×10^{-2}	6.35×10^{-4}
8 - 24 hr	1.750×10^{-4}	1.0	4.55×10^{-4}	1.51×10^{-4}	7.78×10^{-3}	3.74×10^{-4}
1 - 4 days	2.320×10^{-4}	0.6	2.90×10^{-4}	9.60×10^{-5}	4.95×10^{-3}	2.38×10^{-4}
4 - 30 days	2.320×10^{-4}	0.4	1.27×10^{-4}	4.22×10^{-5}	2.18×10^{-3}	1.05×10^{-4}

Atmospheric Dispersion Coefficient for Unfiltered Air Inleakage = same as normal intake

BOUNDING CR-HVAC FLOWS

Emergency Mode Total Filtered Flow	= 2827.2 cfm
Emergency Mode Fresh Air Make-up Flow	= 1413.6 cfm
Emergency Mode Recirculation Flow	= 1413.6 cfm
Emergency Mode Unfiltered Inleakage Flow	= 16 cfm (1)
Normal Mode Fresh Air Make-up Flow	= 660.0 cfm
Base Infiltration Leak Rate (Depressurized)	= 384.2 cfm

CR-HVAC FILTER EFFICIENCIES

CR-HVAC Emergency Mode Charcoal Filter Efficiencies	= 99% for iodine and particulates = 0% for noble gas

(1) See specific events for actual Control Room envelope unfiltered inleakage assumed.

TIME DEPENDENT CONTROL ROOM PARAMETERS

(For TID-14844 based analyses.)

ACCIDENT TIMING SCENARIOS

Event	Abbreviation	FSAR Section	SRP Section	Accident Scenario †
Cask Drop Accident	SFCD	14.11	15.7.5	1
Main Steam Line Break	MSLB	14.14	15.1.5	2
Steam Generator Tube Rupture	SGTR	14.15	15.6.3	2
Control Rod Ejection	CRE	14.16	15.4.8	3,2‡
Loss of Coolant Accident	LOCA	14.17	15.6.5	3
Fuel Handling Accident	FHA	14.19	15.7.4	1
Liquid Waste Incident	LWI	14.20	15.7.2*	1
Gas Decay Tank Rupture	GDTR	14.21.1	15.7.1*	1
Volume Control Tank Rupture	VCTR	14.21.2	15.7.3	1
Small Line Break Outside Containment	SLBOC	14.23	15.6.2	1
Maximum Hypothetical Accident	MHA	14.22	15.6.5	3

† The four types of accident scenarios (1-4) are described below.

‡ The Control Rod Ejection has two release scenarios, an induced LOCA and a S/G-ADV release. The accident scenario type for these release scenarios are listed respectively, in the table above.

* The section has been deleted from the Standard Review Plan, however, it remains part of the licensing basis for Palisades.

TIME DEPENDENT CONTROL ROOM PARAMETERS

(For TID-14844 based analyses.)

The CR-HVAC flow mode, flow rates, and the time that these items change following accident initiation, are important parameters for determining control room radiological consequences. The time to CR-HVAC emergency mode of operation is particularly important, and depends mainly on whether a Loss of Offsite Power (LOOP) occurs coincident with an accident and whether a Containment High Pressure (CHP) or Containment High Radiation signal (CHR) is generated at accident initiation. Events that do not generate a CHP or CHR are collectively referred to as "Non-CHP/CHR Events;" whereas those that do, are referred to as "CHP/CHR Events." Four different accident scenarios result from the combination of these two items and encompass most FSAR Chapter 14 events:

1. Non-CHP/CHR Events Without a LOOP
2. Non-CHP/CHR Events With a LOOP
3. CHP/CHR Events With a LOOP
4. CHP/CHR Events Without a LOOP

Note: No FSAR Chapter 14 events utilize scenario 4.

CONTROL ROOM ATMOSPHERIC DISPERSION (*X/Q*) FACTORS FOR AST ANALYSIS EVENTS

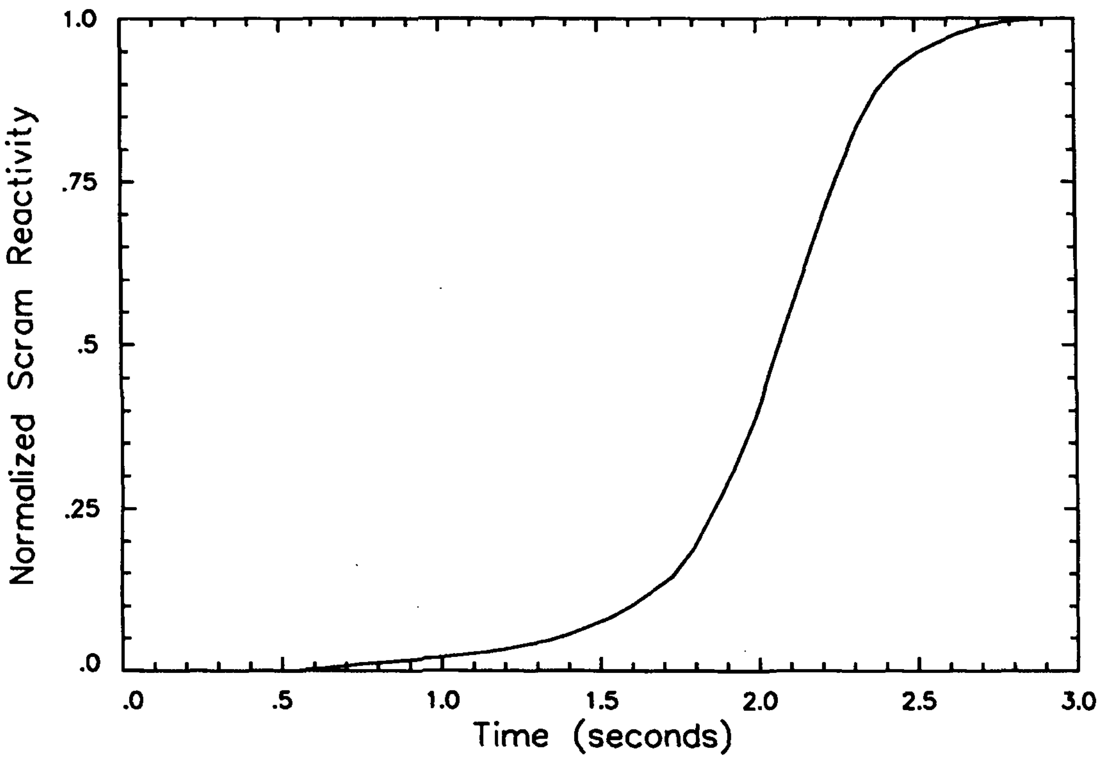
Release – Receptor Pair	Release Point	Receptor Point	0-2 hr X/Q	2-8 hr X/Q	8-24 hr X/Q	1-4 days X/Q	4-30 days X/Q
A	Containment Closest Point	Normal Intake 'B'	9.16E-03 7	17E-03 2	68E-03 2	07E-03	1.57E-03
B	Containment Closest Point	Emergency Intake	7.26E-04 6	18E-04 2	47E-04 1	77E-04	1.30E-04
C	SIRWT Vent	Normal Intake 'B'	9.57E-02 7	59E-02 2	87E-02 2	19E-02	1.65E-02
D	SIRWT Vent	Emergency Intake	9.66E-04 7	92E-04 3	13E-04 2	20E-04	1.64E-04
E	Plant Stack	Normal Intake 'B'	5.29E-03[1] 3	.8 9E-03[1] 1	.5 1E-03[1] 1	.1 3E-03[1]	8.41E-04[1]
F	Plant Stack	Emergency Intake	8.32E-04 7	69E-04 2	83E-04 2	15E-04	1.57E-04
G	Closest ADV	Normal Intake 'A'	9.95E-03[2] 7	.9 6E-03[2] 3	.2 7E-03[2] 2	.3 9E-03[2]	1.80E-03[2]
H	Closest ADV	Emergency Intake	7.36E-04 6	42E-04 2	43E-04 1	75E-04	1.28E-04
I	Closest SSRV	Normal Intake 'A'	1.24E-02[2]	-	-	-	-
J	Closest SSRV	Emergency Intake	7.96E-04	-	-	-	-
K	Containment Equipment Door	Normal Intake 'B'	1.25E-02 9	83E-03 3	62E-03 2	86E-03	2.28E-03
L	Containment Equipment Door	Emergency Intake	7.32E-04 6	13E-04 2	45E-04 1	75E-04	1.29E-04
M	Feedwater Area Exhauster V-22A	Normal Intake 'A'	2.20E-02 1	75E-02 7	10E-03 5	24E-03	3.87E-03
N	Feedwater Area Exhauster V-22A	Emergency Intake	8.65E-04 7	56E-04 2	81E-04 2	04E-04	1.47E-04

(1) bounding X/Q values used for FHA, SLBOC and SFCD
(2) bounding X/Q values used for SGTR

RELEASE-RECEPTOR POINT PAIRS ASSUMED FOR AST ANALYSIS EVENTS

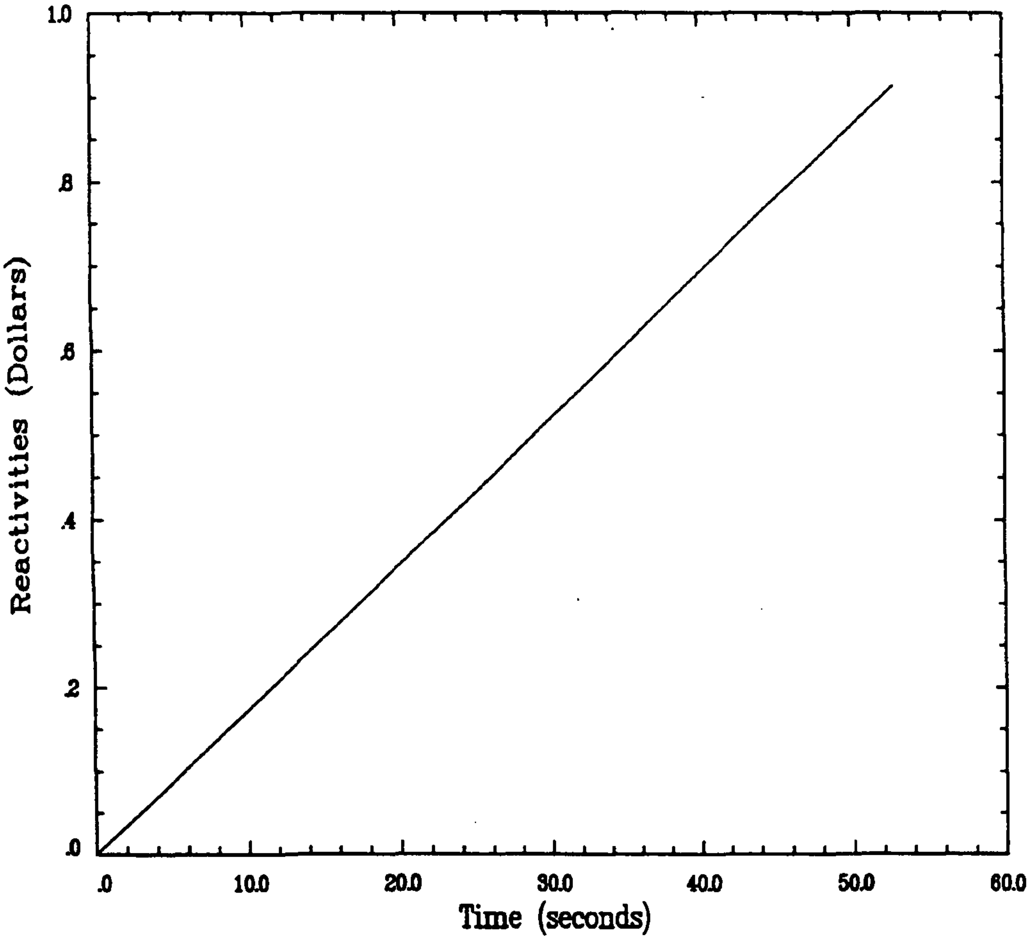
Event		
MHA	Normal Intake & Unfiltered Inleakage	Emergency Intake
Containment Leakage	A	B
ECCS Leakage	E	F
SIRWT Backleakage	C	D
FHA		
Containment Release	K	L
FHB Release	E	F
SFCD		
Filtered Release	E	F
Unfiltered Release	K	L
MSLB		
Break Release	M	N
MSSV/ADV Release	G	H
SGTR	I & G Initial release via SSRVs switching to ADVs	J & H Initial release via SSRVs switching to ADVs
CRE		
Containment Leakage	A	B
Secondary Side Release	I & G Initial release via SSRVs switching to ADVs	J & H Initial release via SSRVs switching to ADVs
SLBOC	E	F

PALISADES SCRAM CURVE

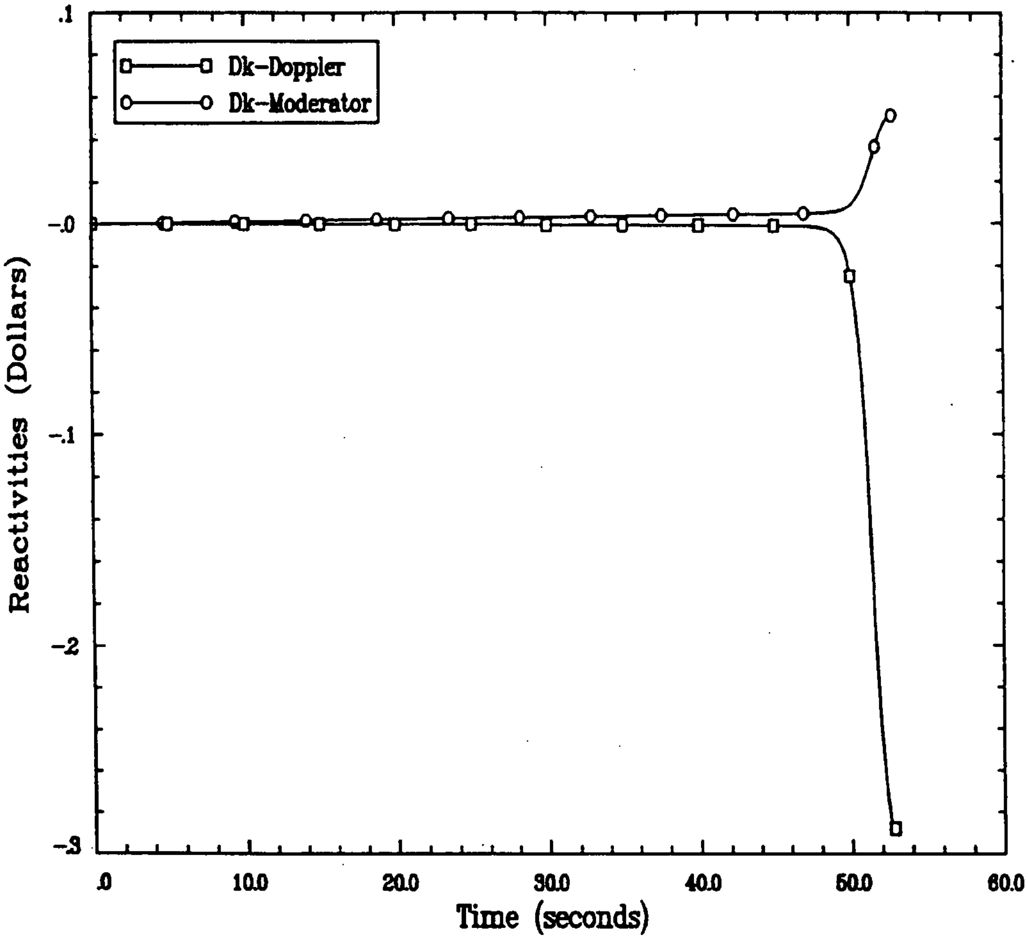


Note: Time measured from the point at which the control rod drive clutch receives the signal to release the control rods.

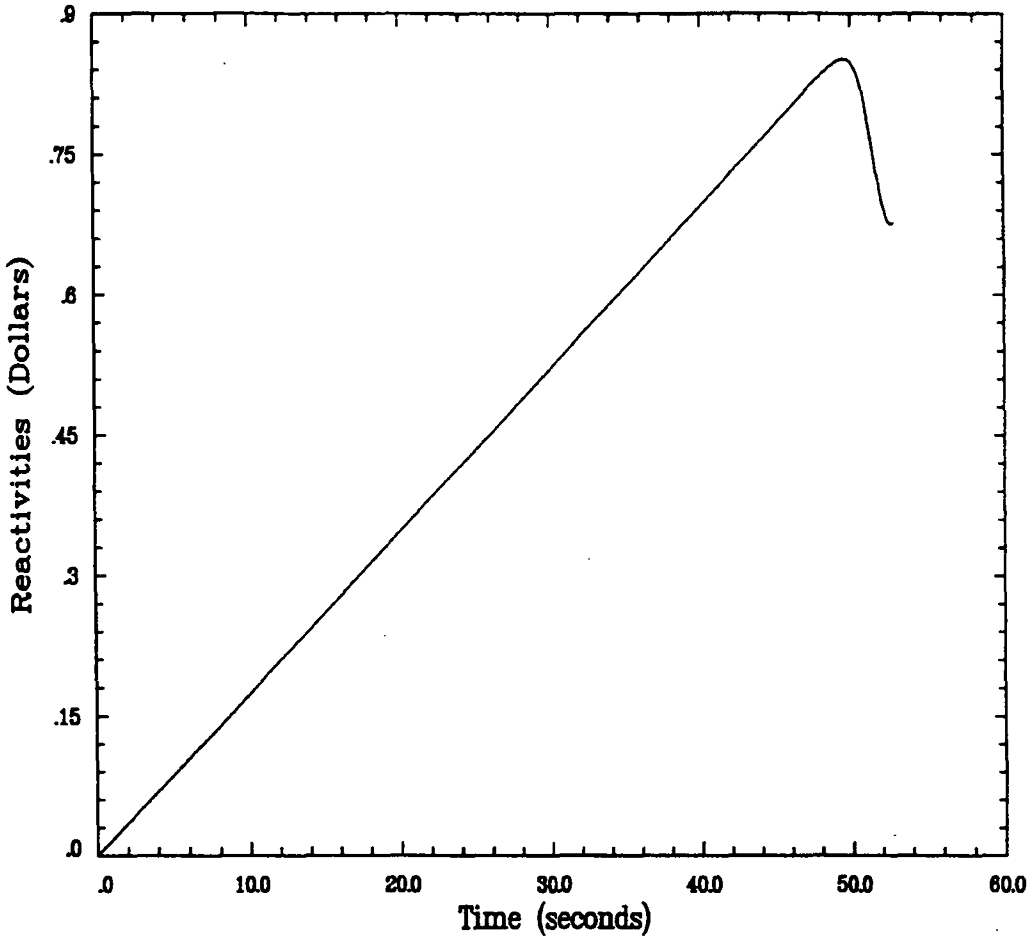
CONTROL ROD WITHDRAWAL INCIDENT HZP REACTIVITY INSERTION CURVE



CONTROL ROD WITHDRAWAL INCIDENT HZP REACTIVITY FEEDBACKS

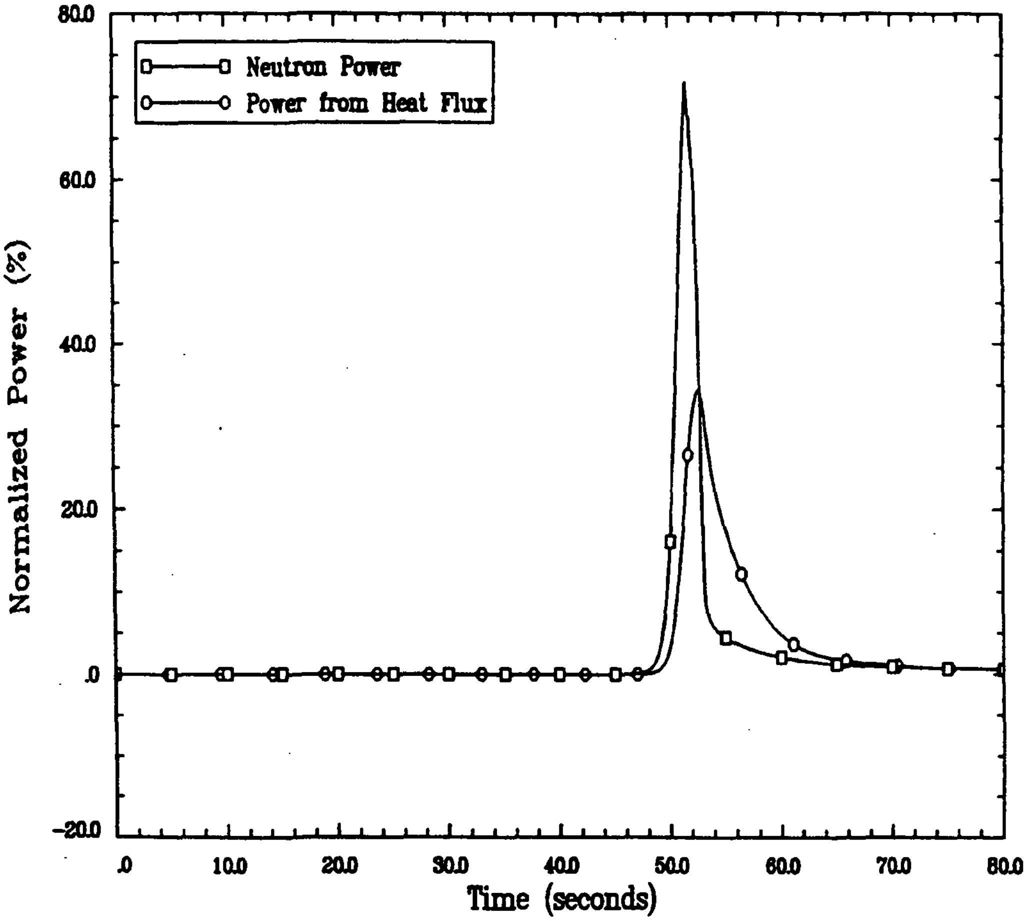


CONTROL ROD WITHDRAWAL INCIDENT HZP TOTAL REACTIVITY

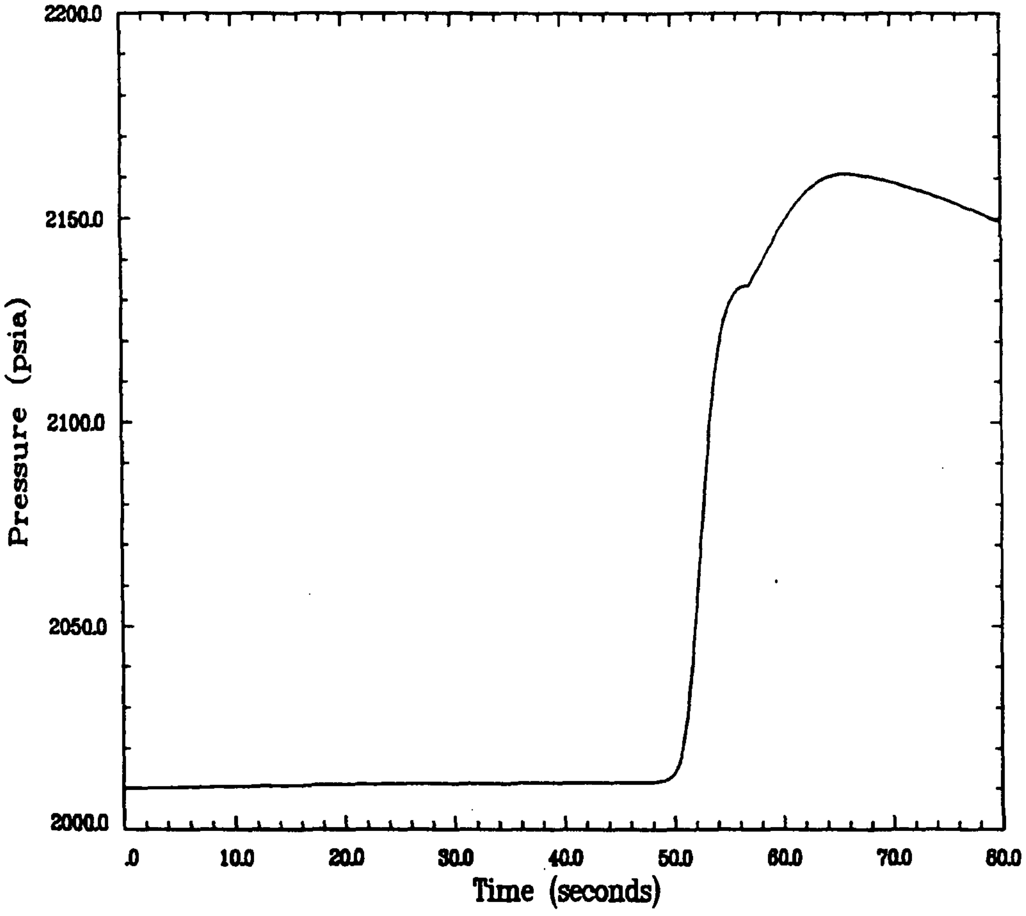


Total Reactivity

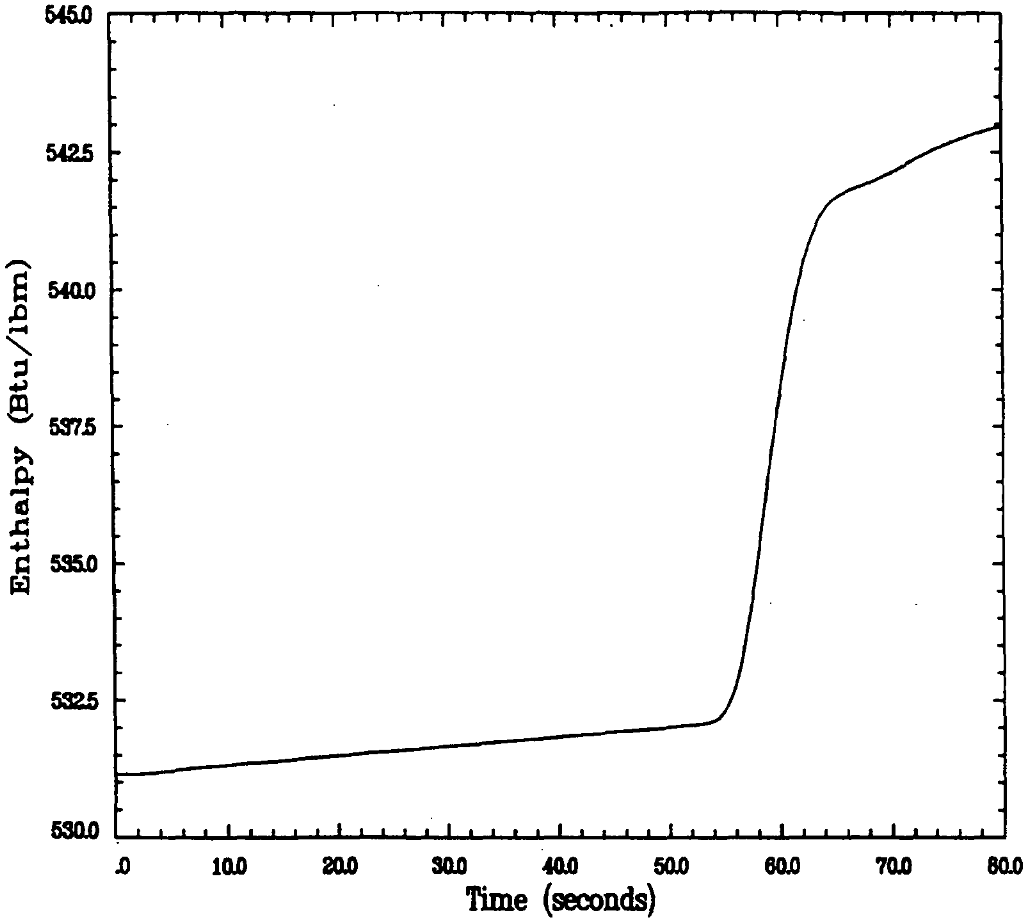
CONTROL ROD WITHDRAWAL INCIDENT HZP POWER AND HEAT FLUX



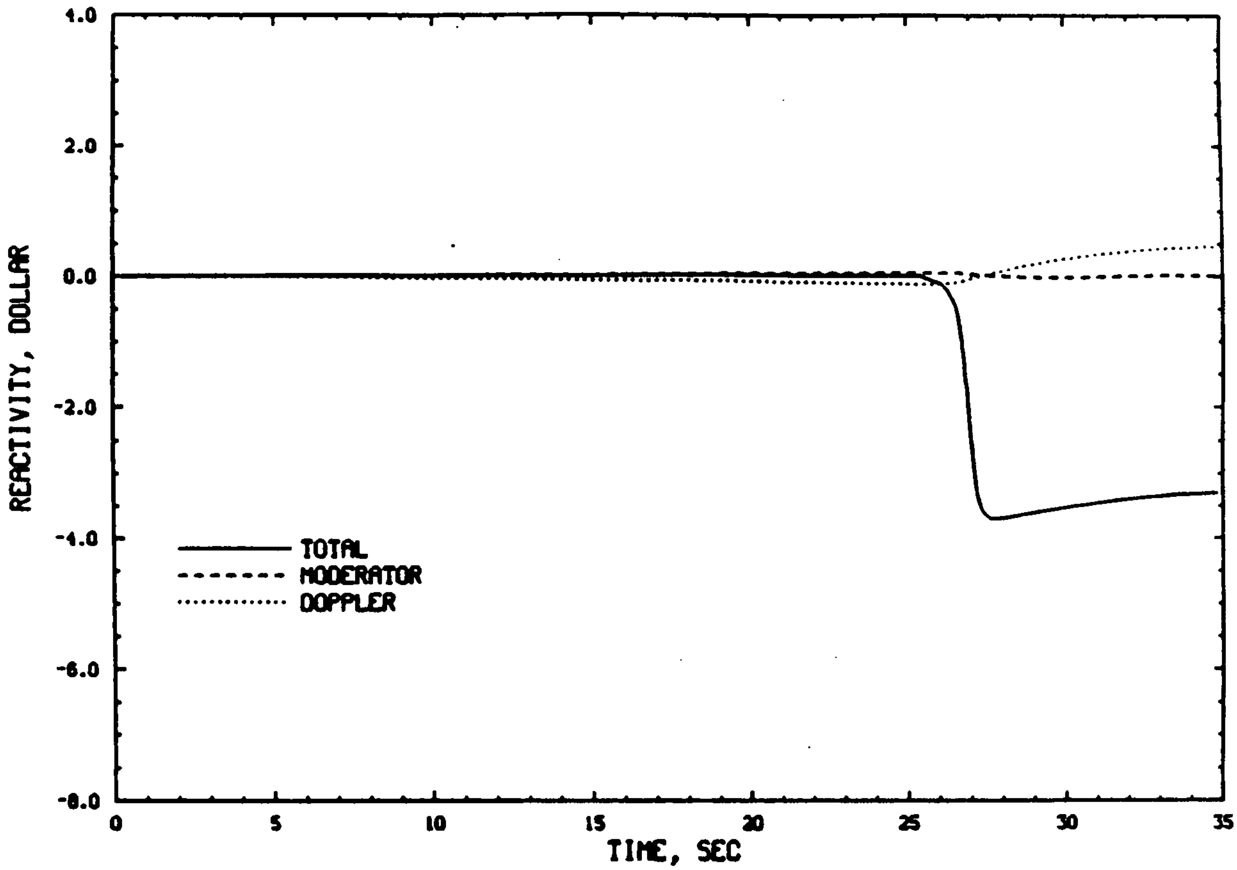
CONTROL ROD WITHDRAWAL INCIDENT HZP SYSTEM PRESSURE



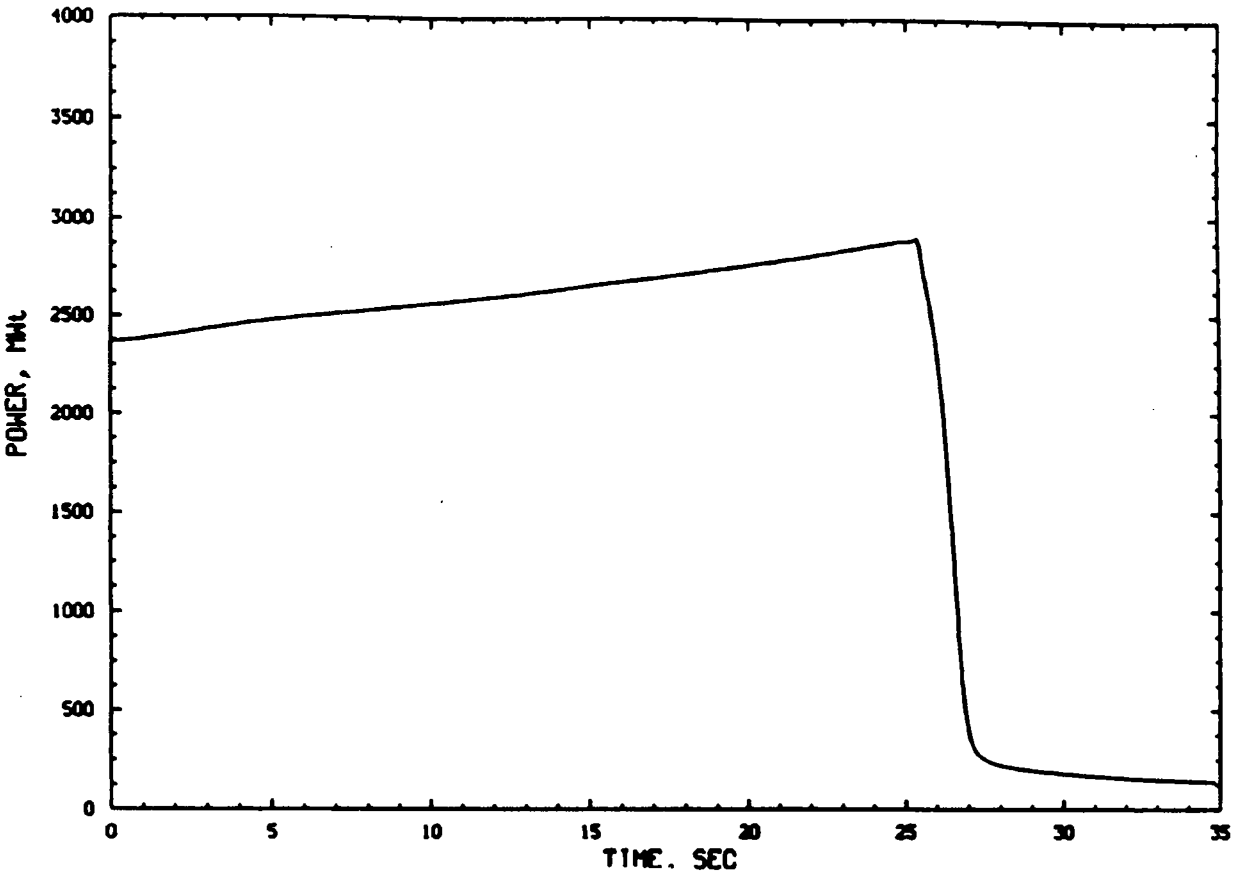
CONTROL ROD WITHDRAWAL INCIDENT HZP INLET ENTHALPY



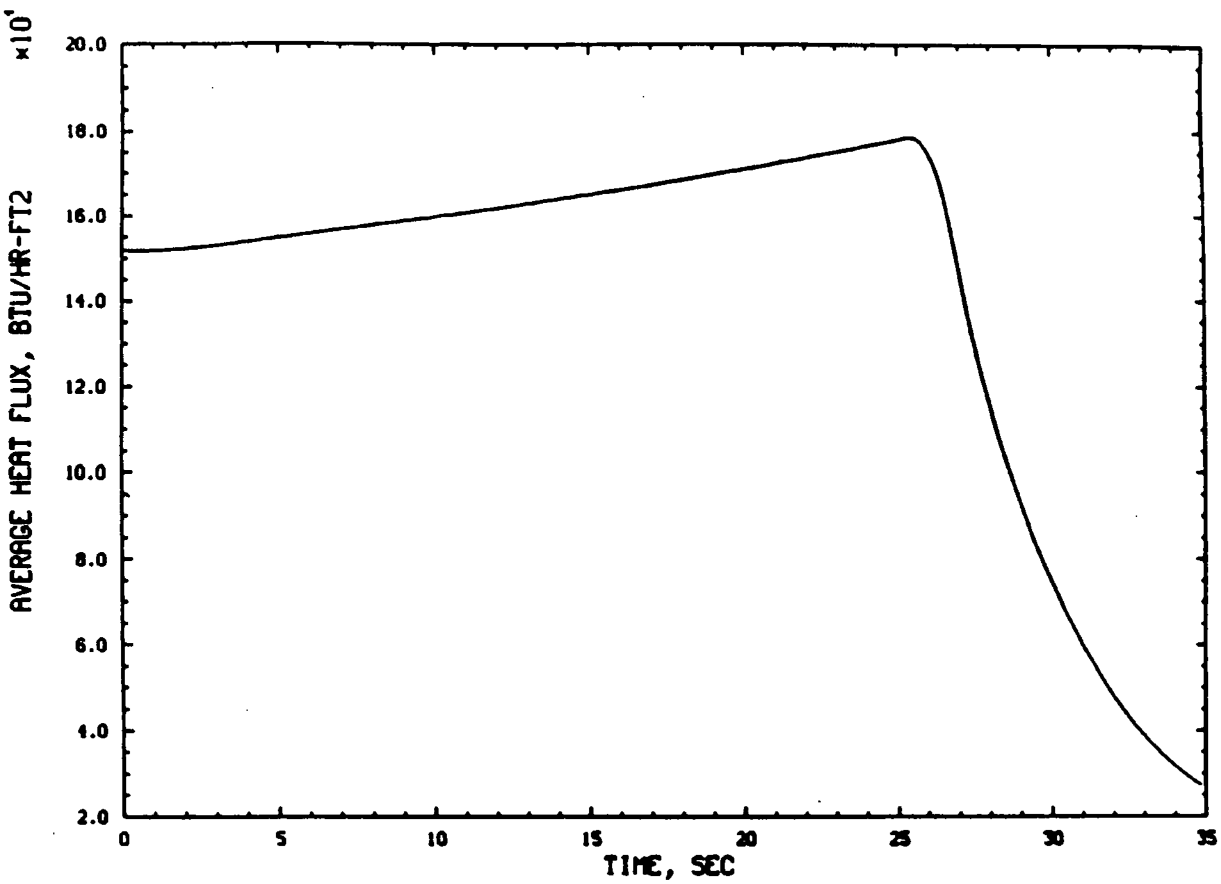
REACTIVITIES FOR UNCONTROLLED BANK WITHDRAWAL AT FULL POWER



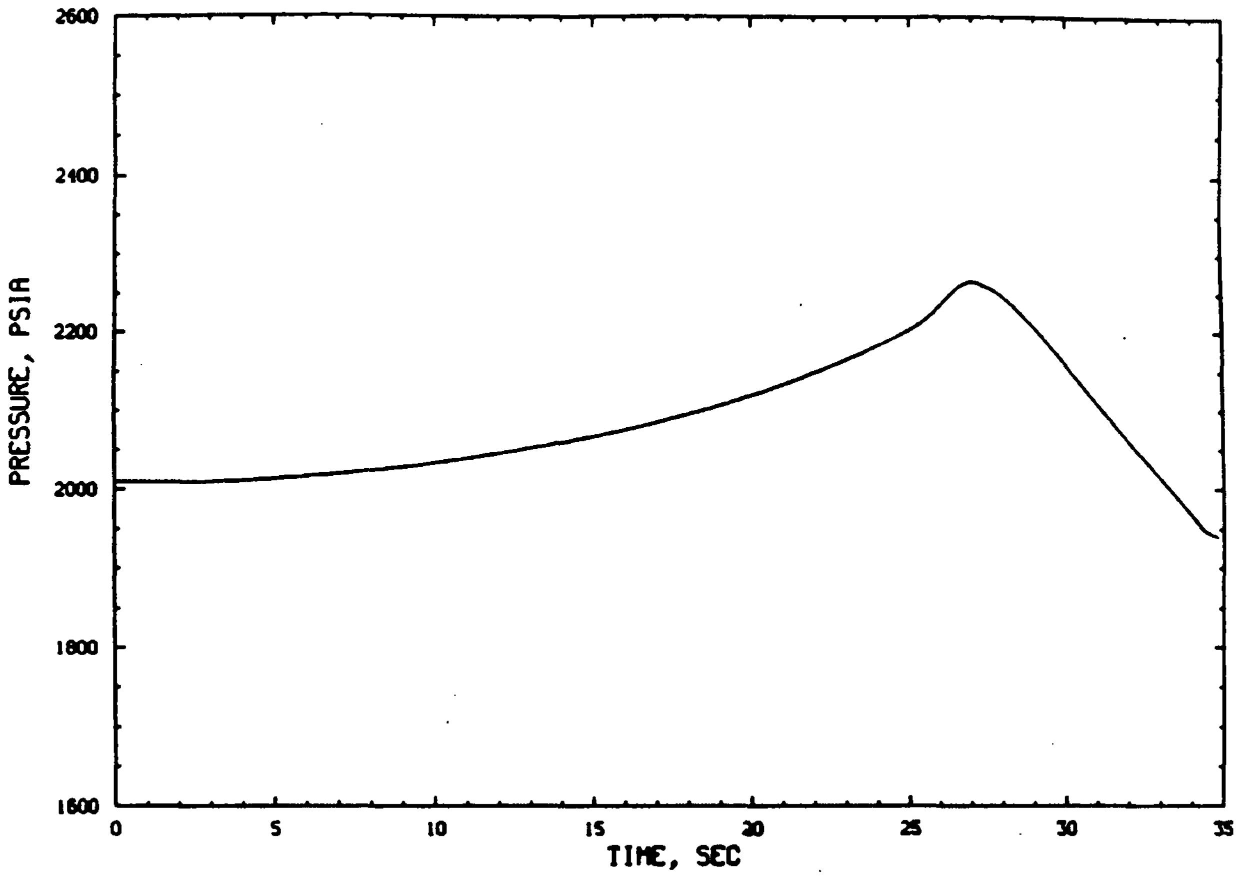
REACTOR POWER LEVEL FOR UNCONTROLLED BANK WITHDRAWAL FULL POWER



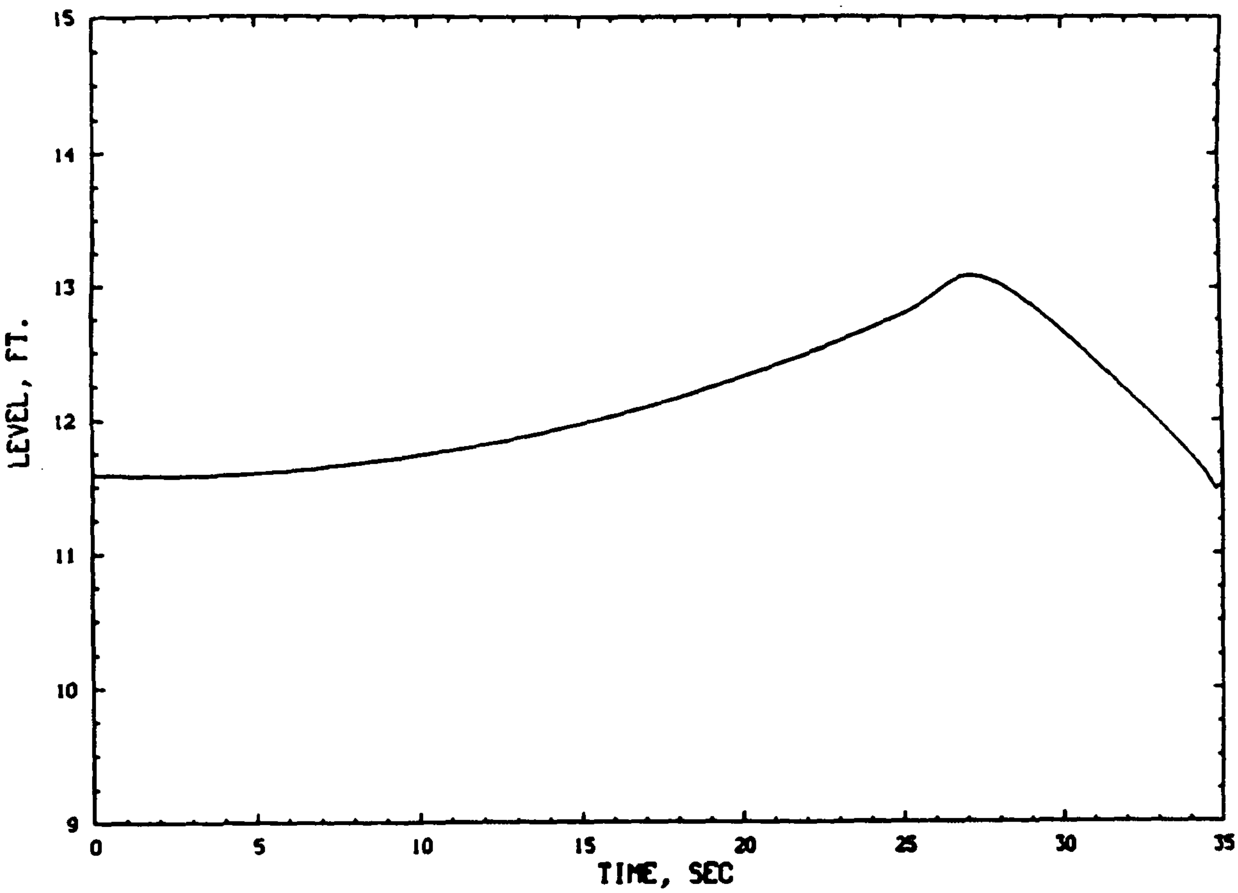
CORE AVERAGE HEAT FLUX FOR UNCONTROLLED BANK WITHDRAWAL AT FULL POWER



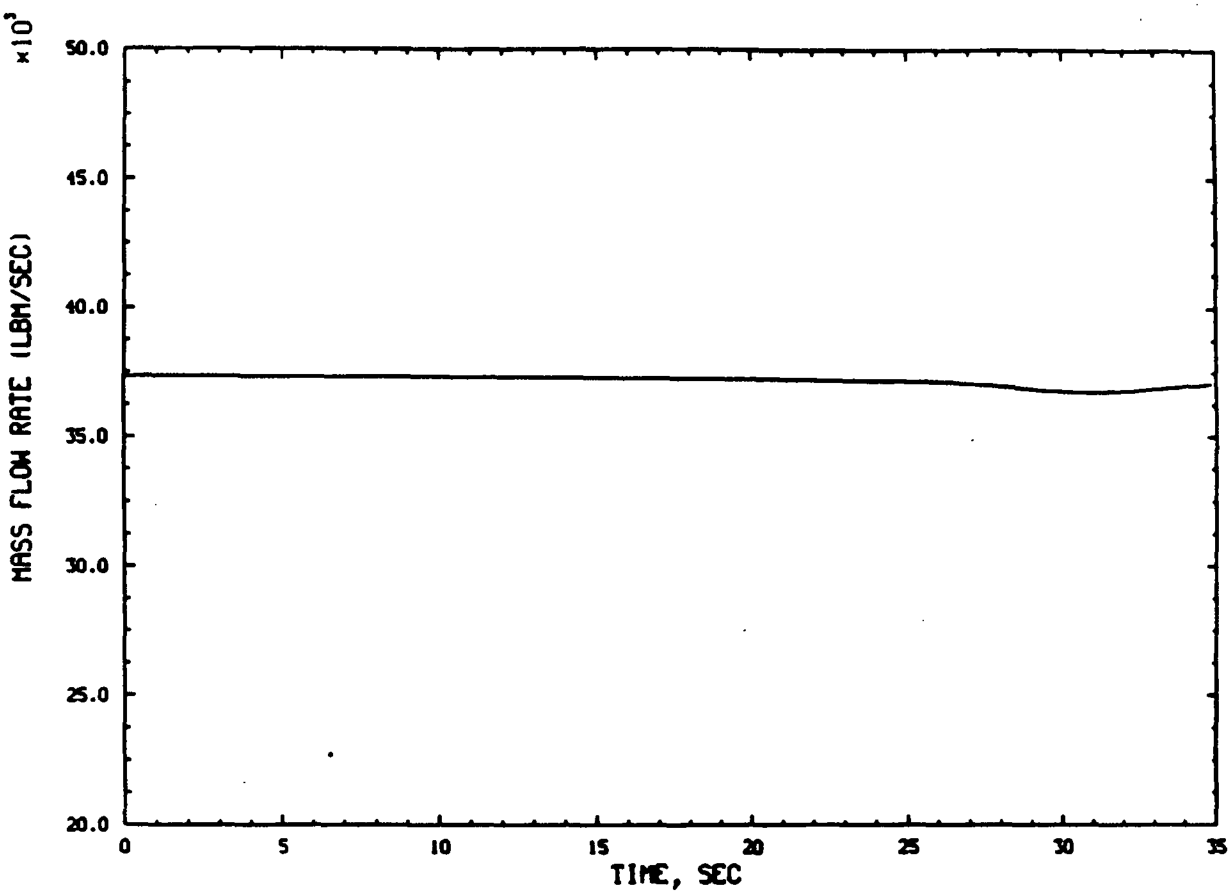
PRESSURIZER PRESSURE FOR UNCONTROLLED BANK WITHDRAWAL AT FULL POWER



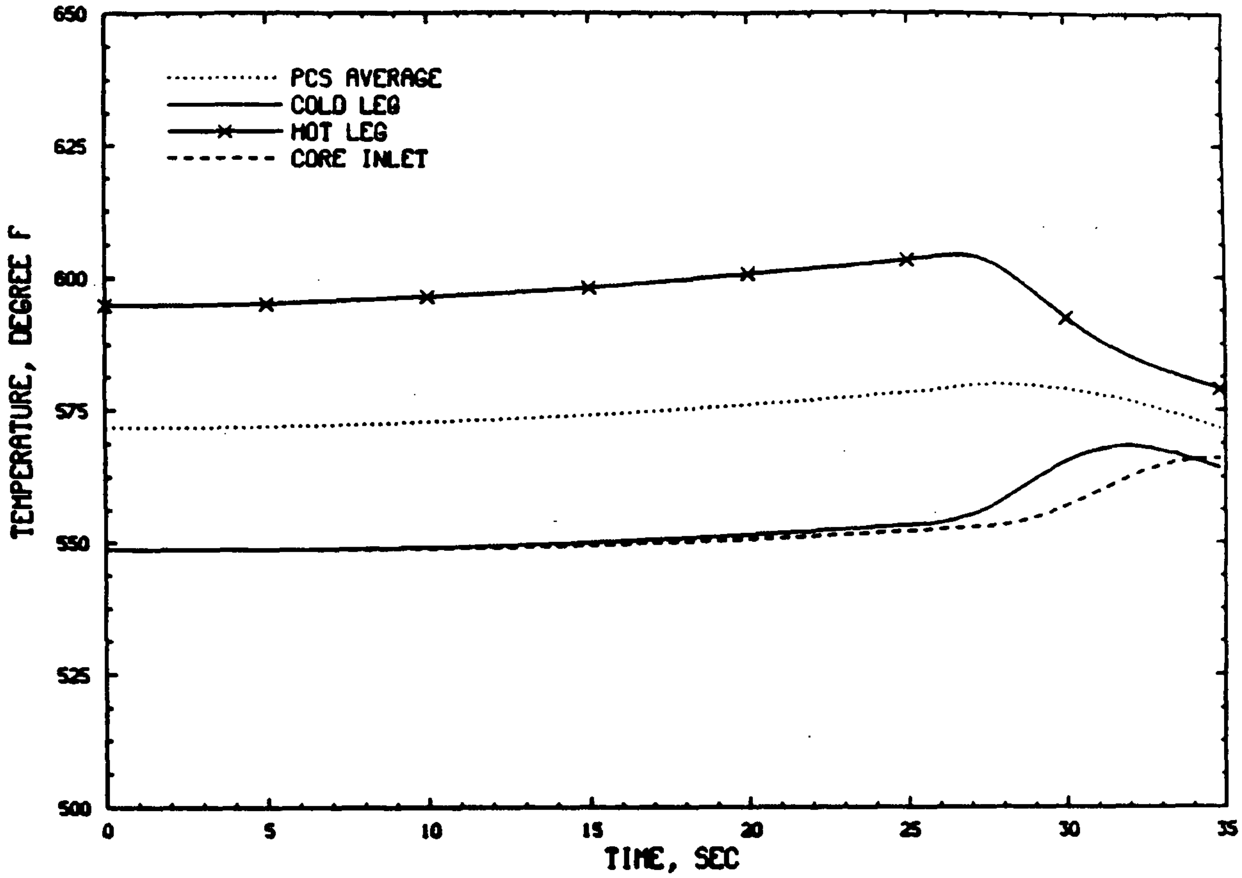
PRESSURIZER LIQUID LEVEL FOR UNCONTROLLED BANK WITHDRAWAL AT FULL POWER



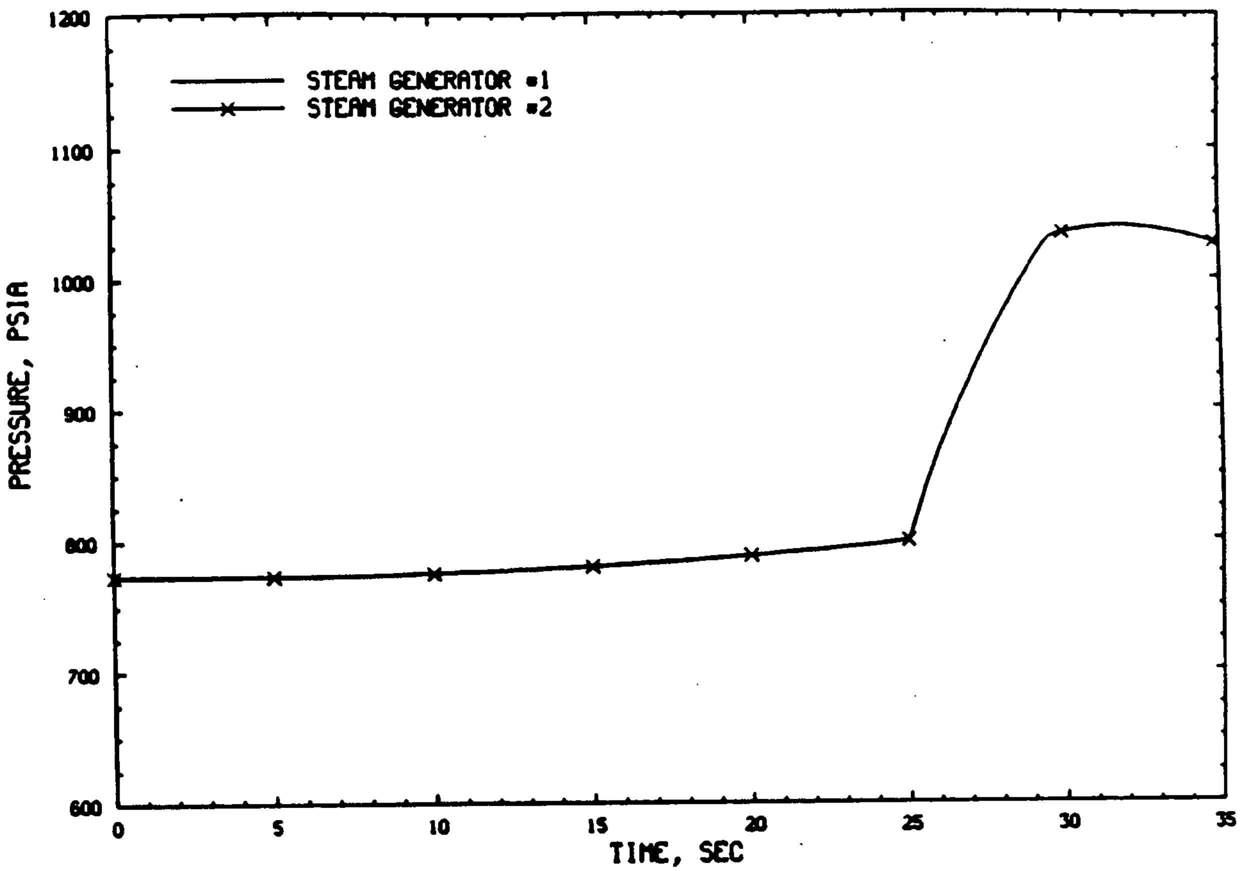
PCS MASS FLOW RATE FOR UNCONTROLLED BANK WITHDRAWAL AT FULL POWER



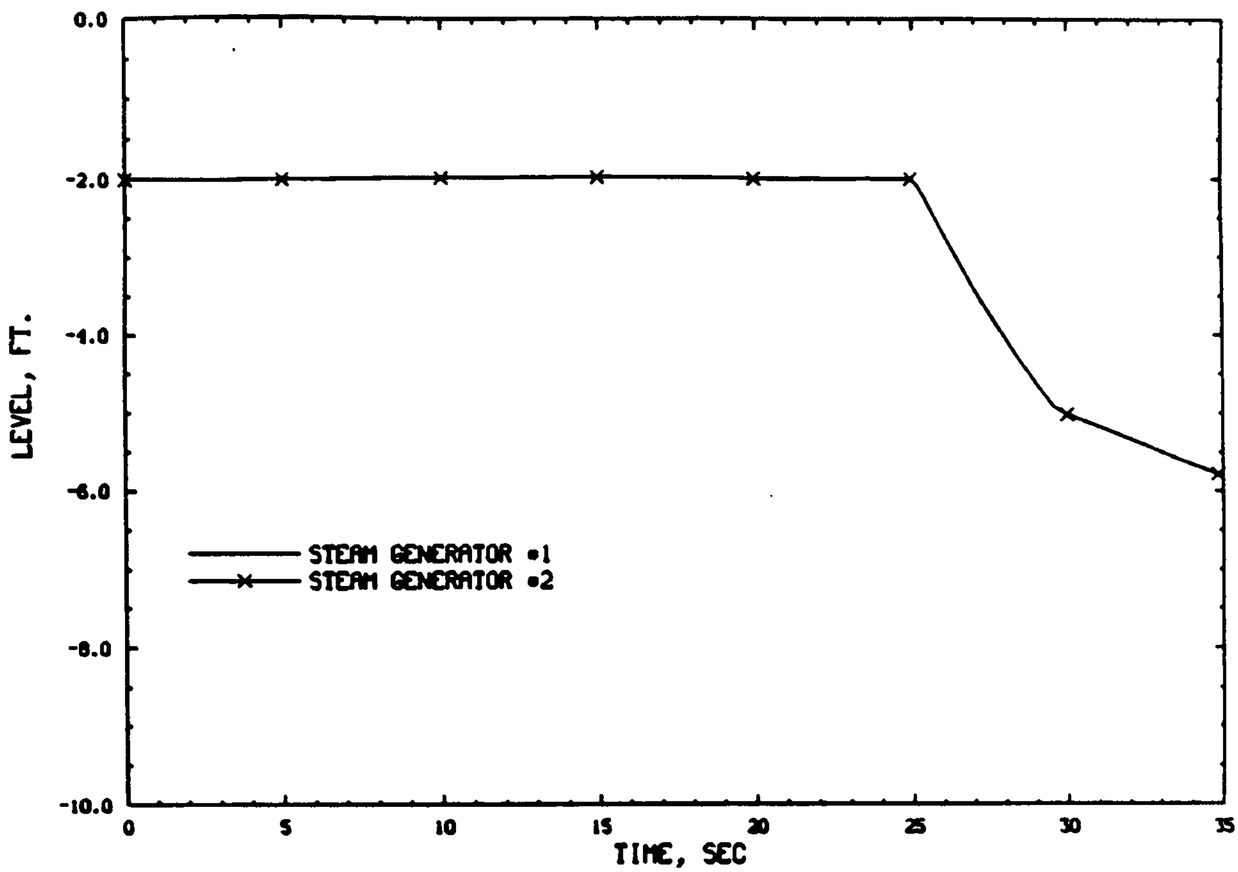
PCS TEMPERATURES FOR UNCONTROLLED BANK WITHDRAWAL AT FULL POWER



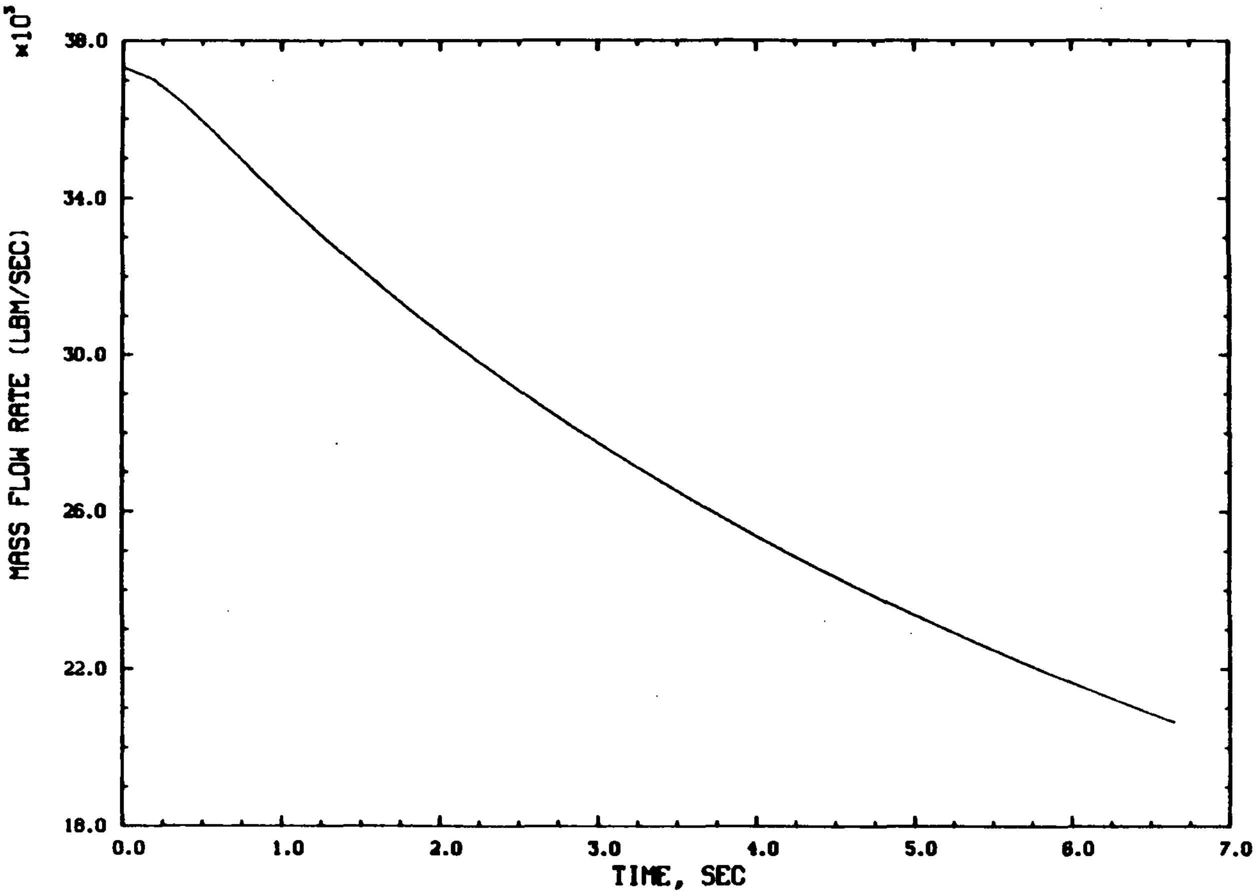
SECONDARY PRESSURE FOR UNCONTROLLED BANK WITHDRAWAL AT FULL POWER



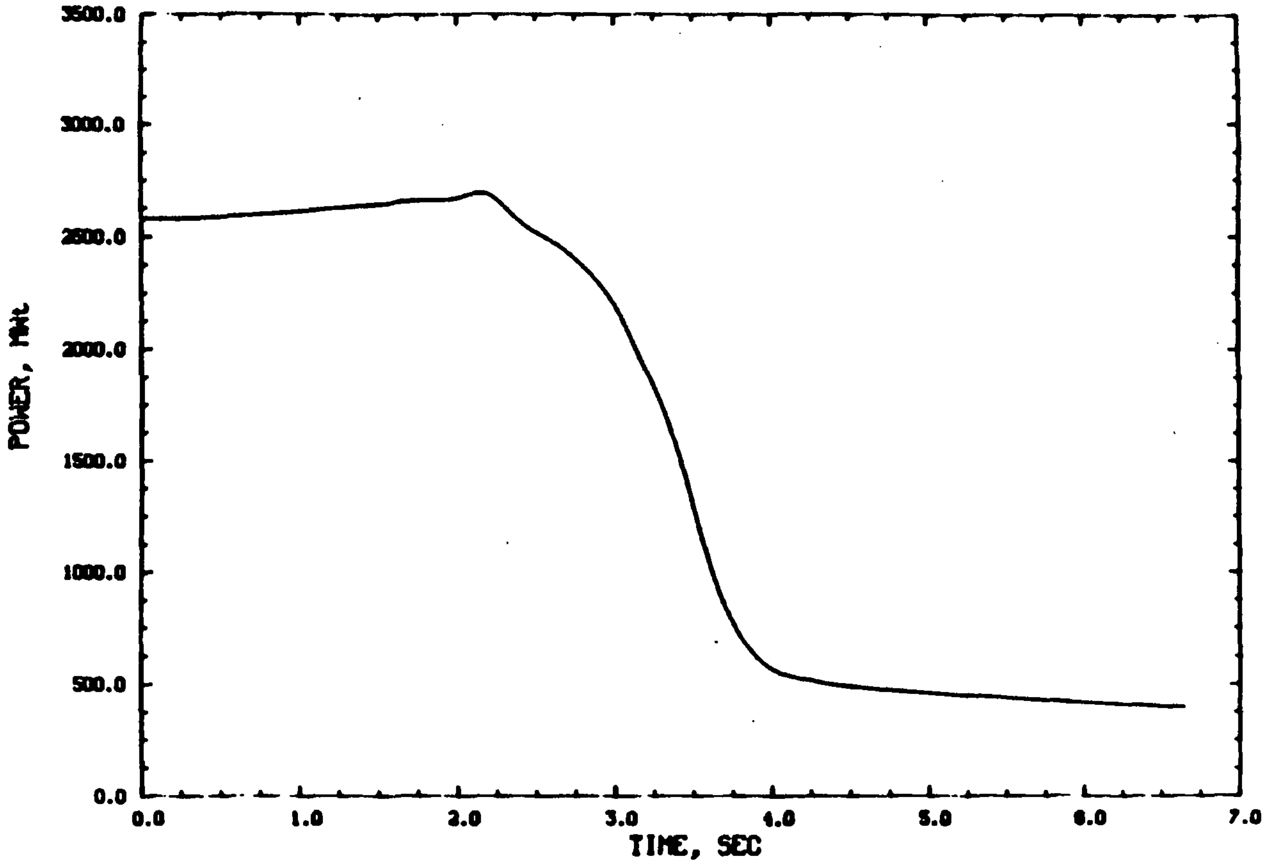
S/G LIQUID LEVEL FOR UNCONTROLLED BANK WITHDRAWAL AT FULL POWER



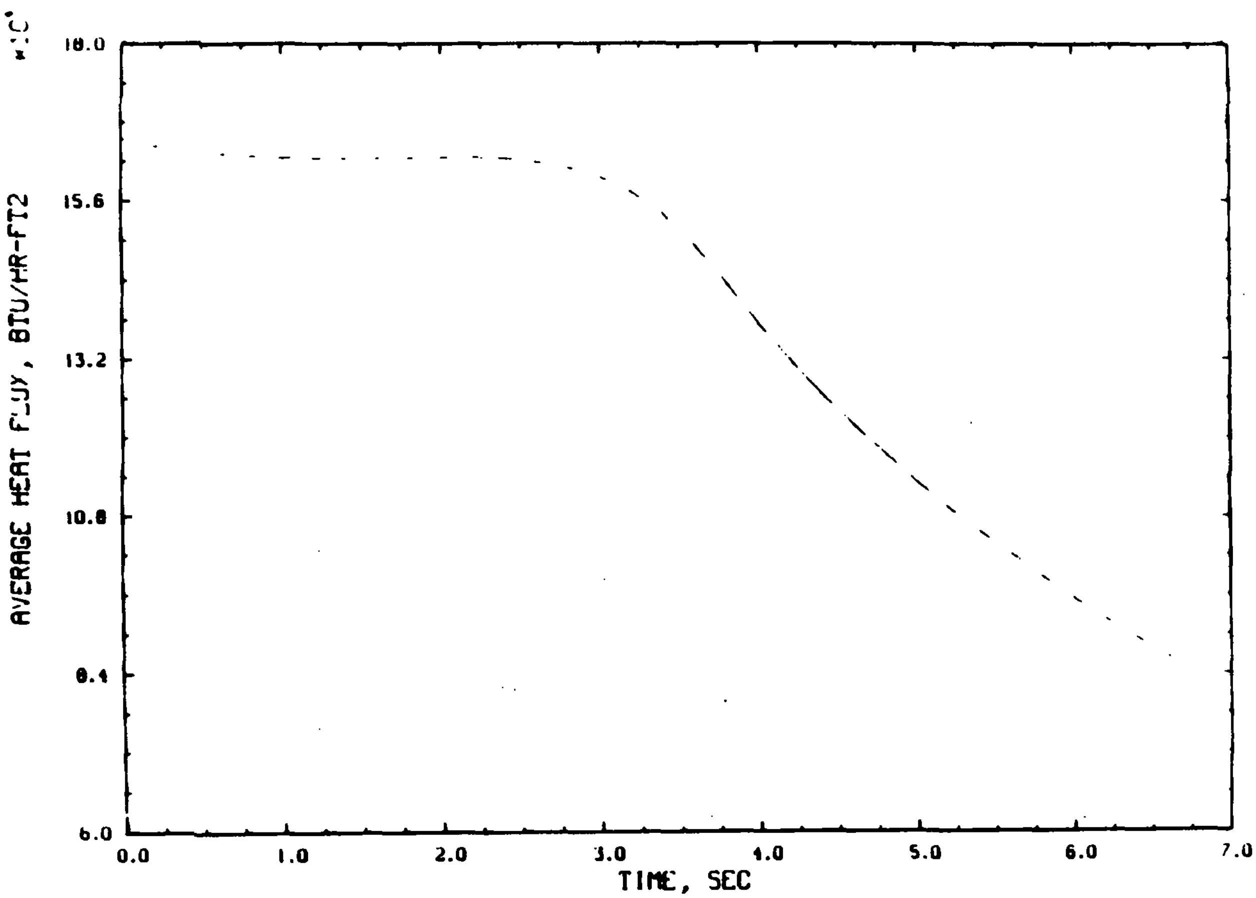
PRIMARY COOLANT SYSTEM MASS FLOW RATE FOR LOSS OF FORCED FLOW



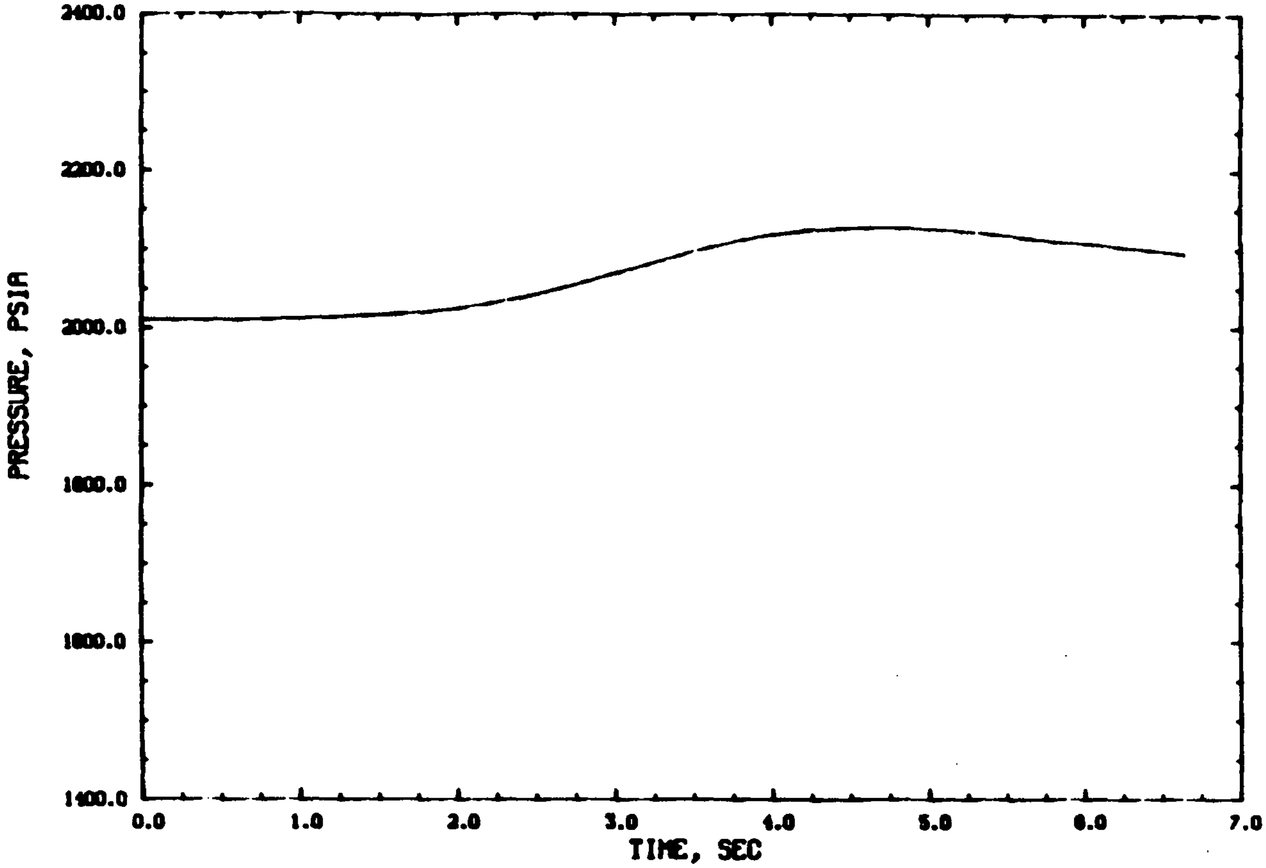
REACTOR POWER LEVEL FOR LOSS OF FORCED FLOW



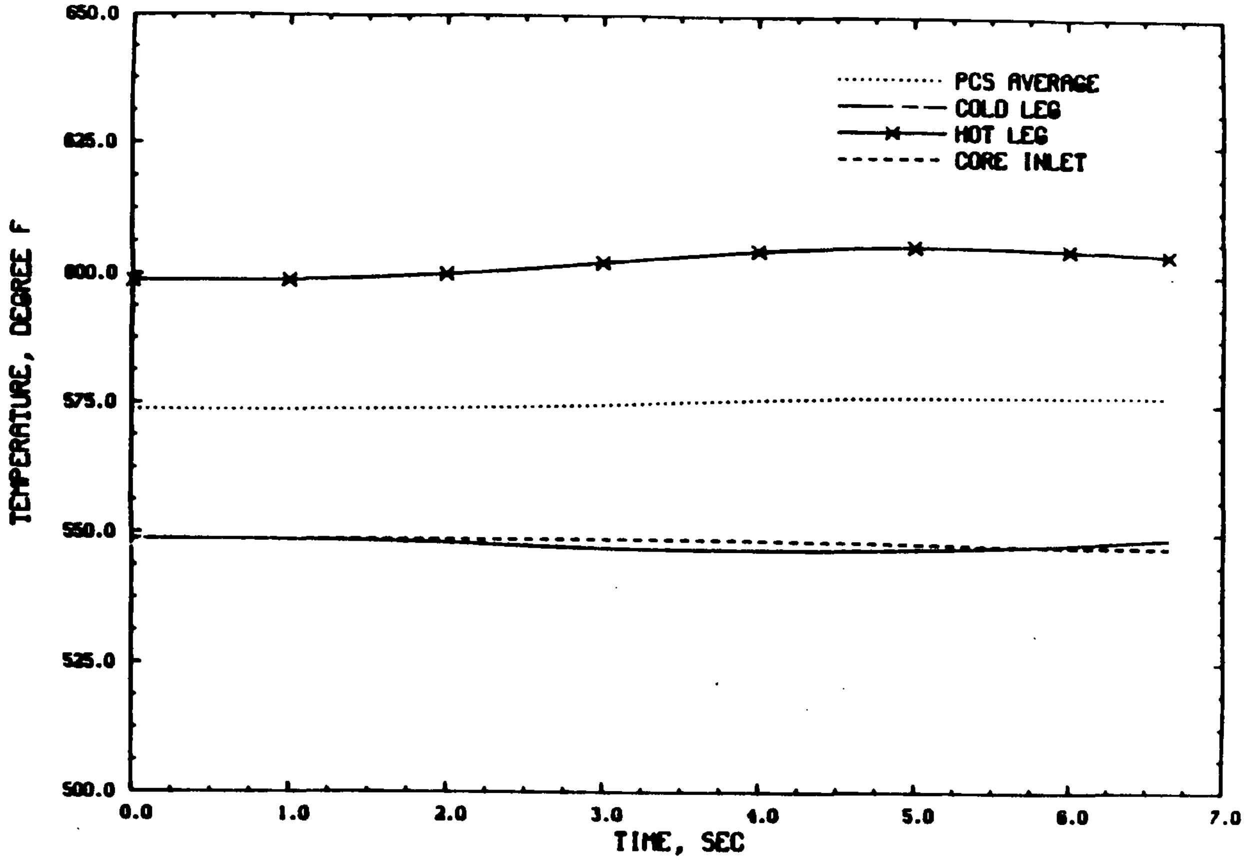
CORE AVERAGE HEAT FLUX FOR LOSS OF FORCED FLOW



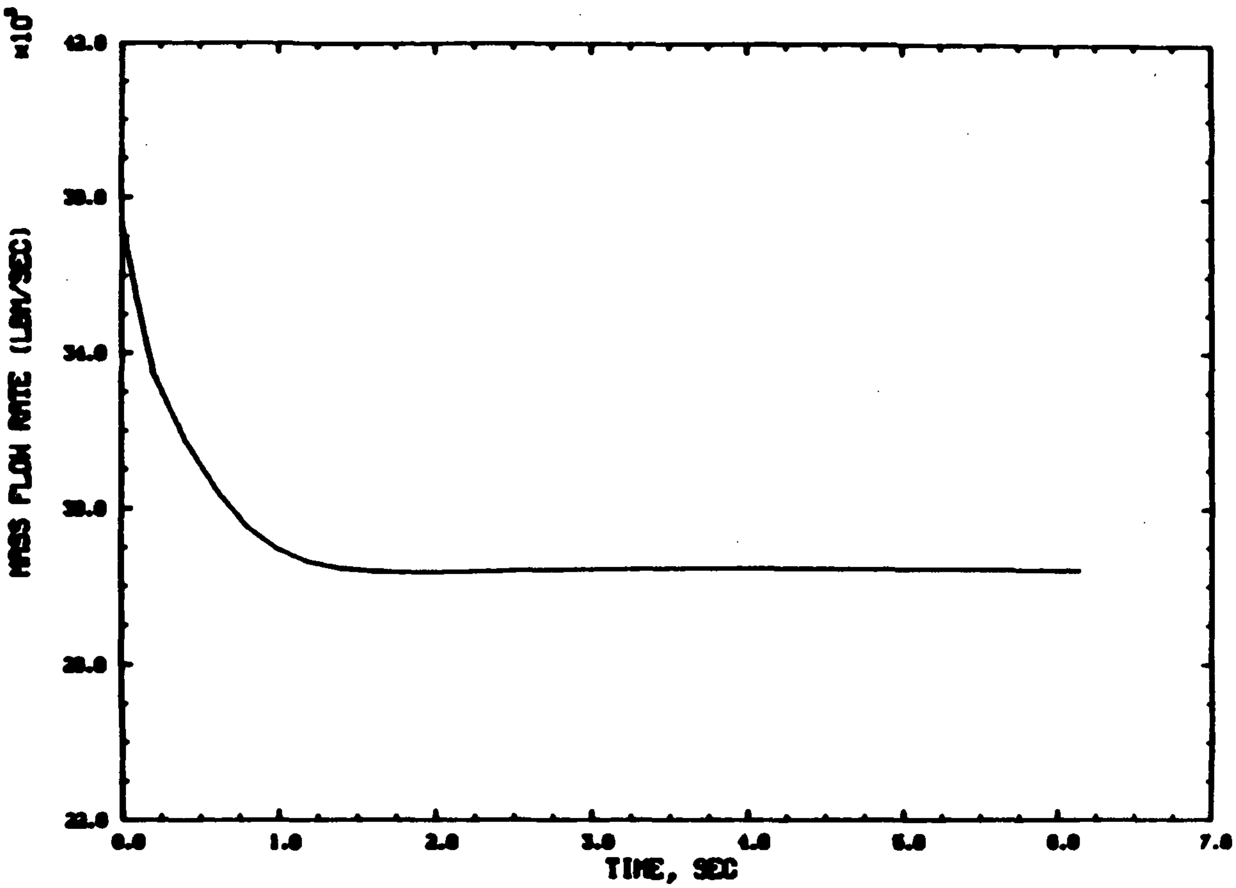
PRESSURIZER PRESSURE FOR LOSS OF FORCED FLOW



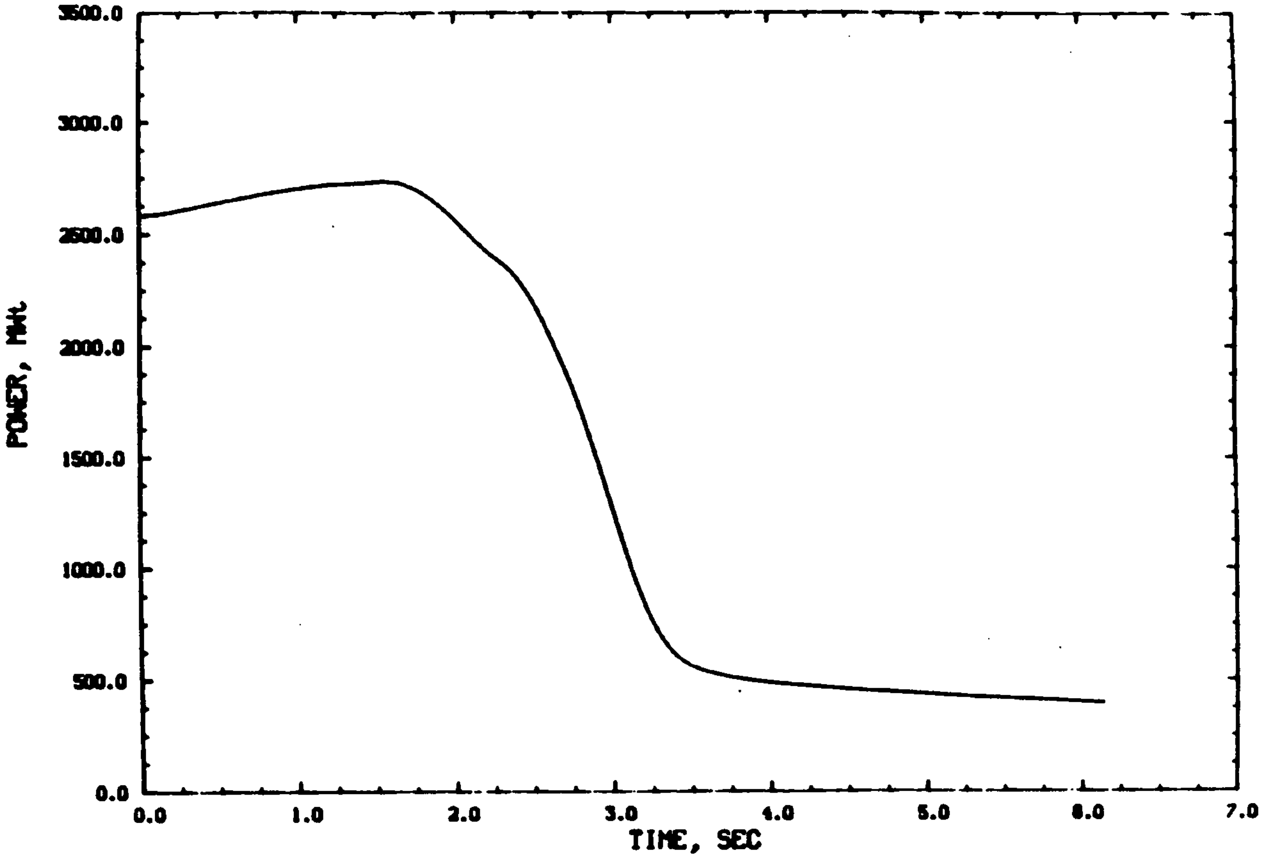
PRIMARY COOLANT SYSTEM TEMPERATURES FOR LOSS OF FORCED FLOW



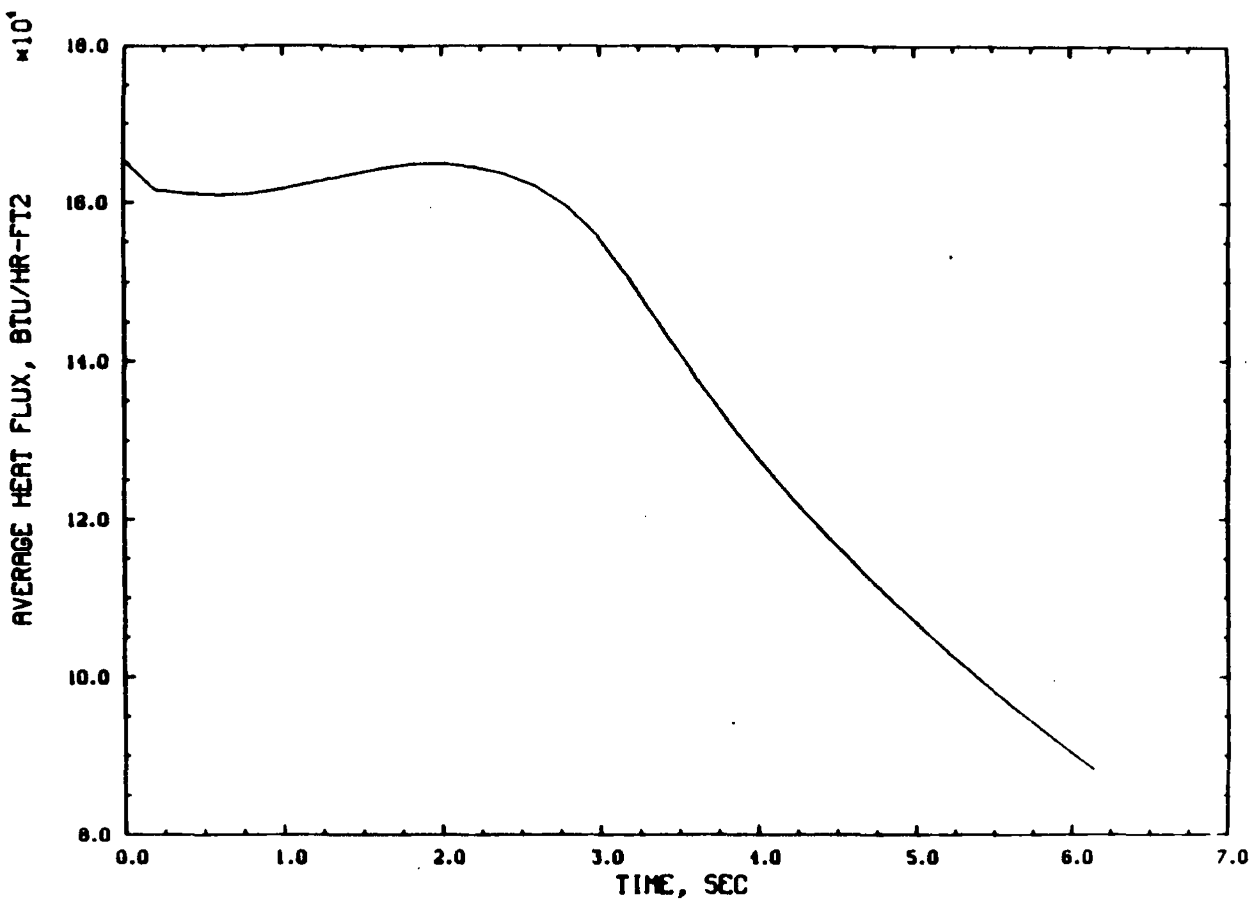
PRIMARY COOLANT SYSTEM MASS FLOW RATE FOR REACTOR COOLANT PUMP ROTOR SEIZURE



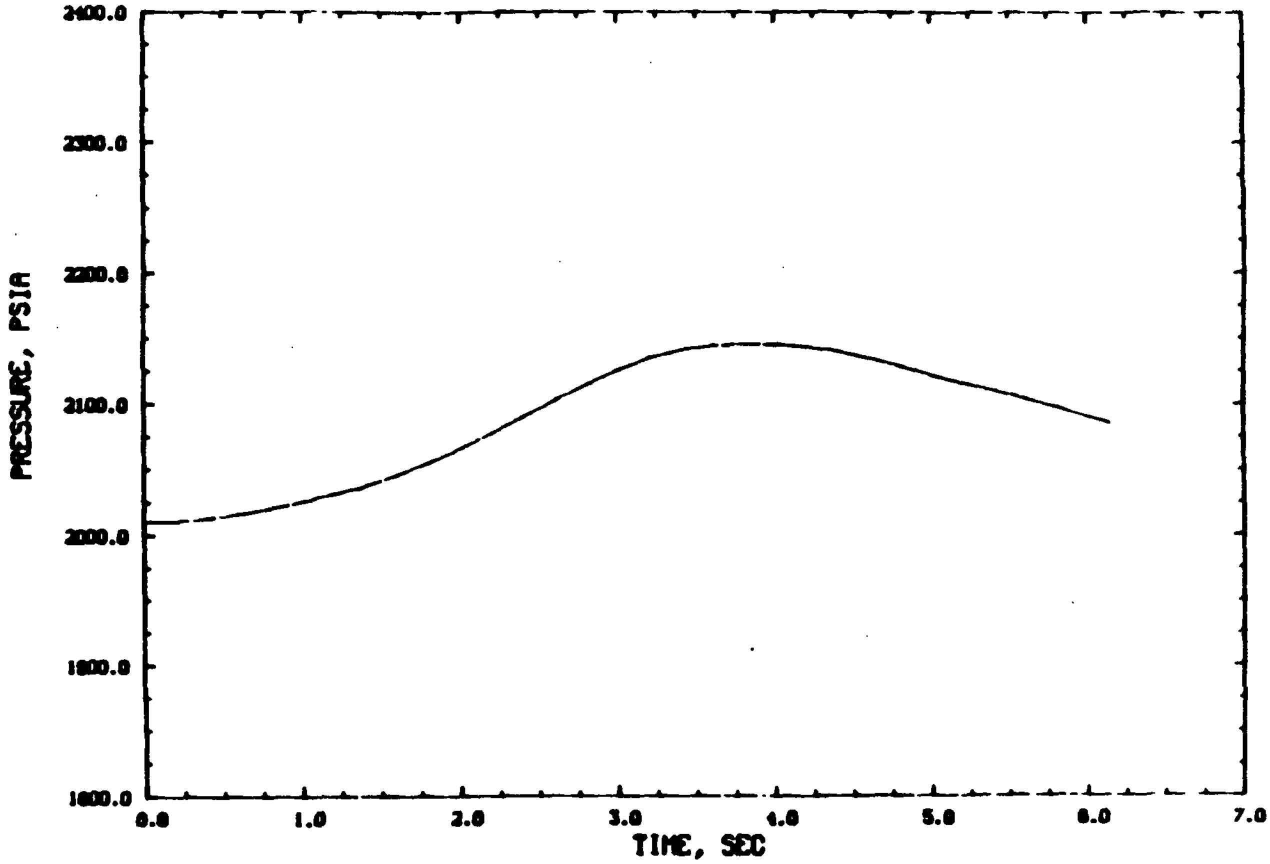
REACTOR POWER LEVEL FOR REACTOR COOLANT PUMP ROTOR SEIZURE



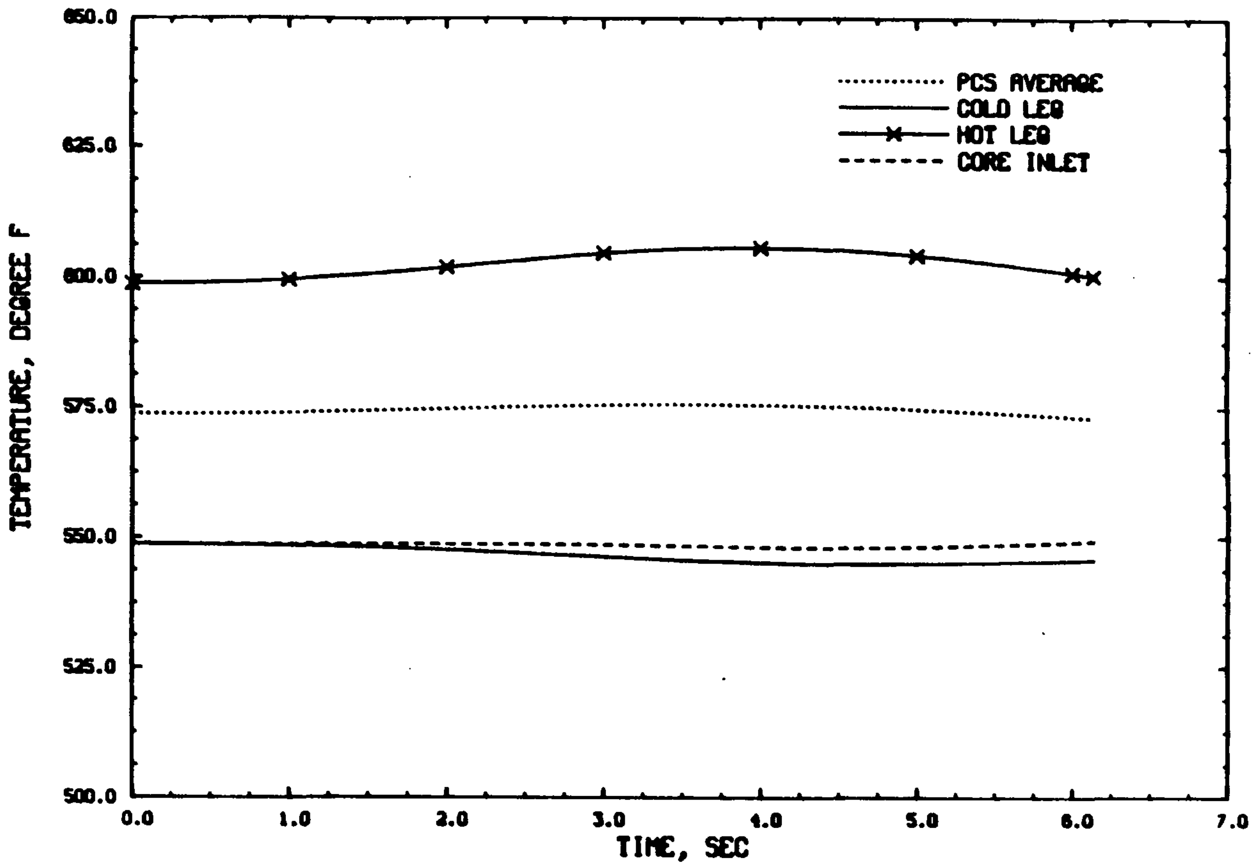
CORE AVERAGE HEAT FLUX FOR REACTOR COOLANT PUMP ROTOR SEIZURE



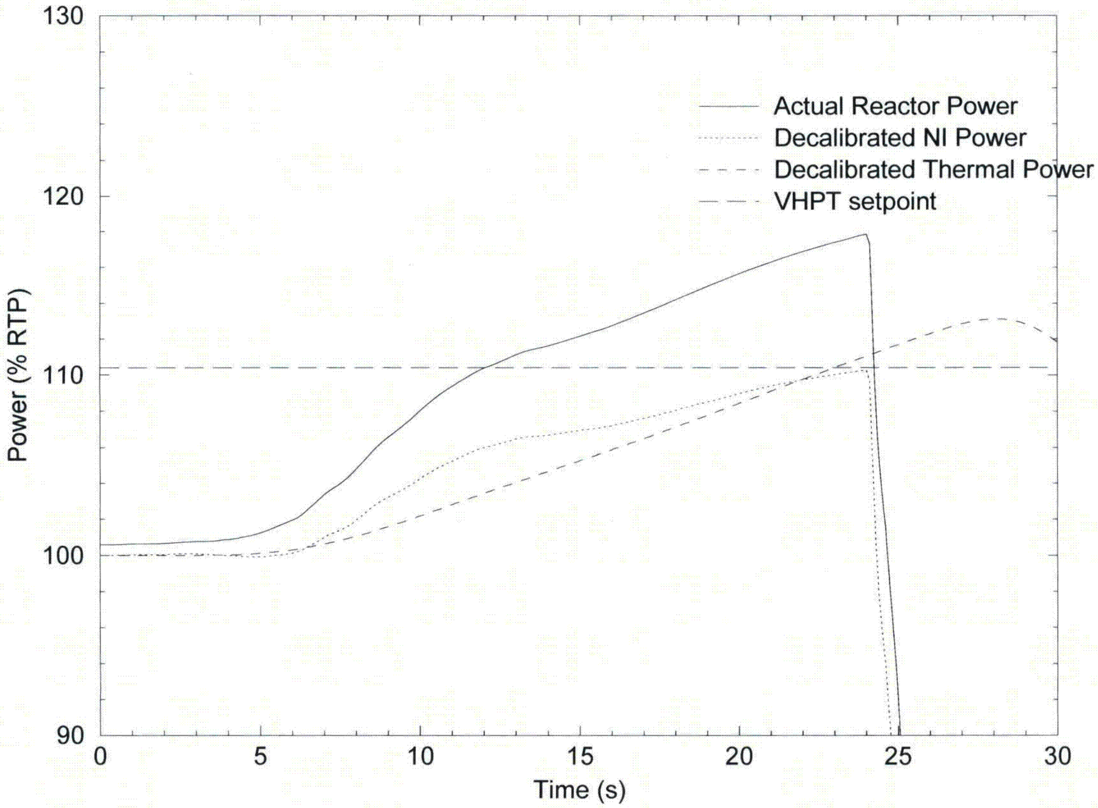
PRESSURIZER PRESSURE FOR REACTOR COOLANT PUMP ROTOR SEIZURE



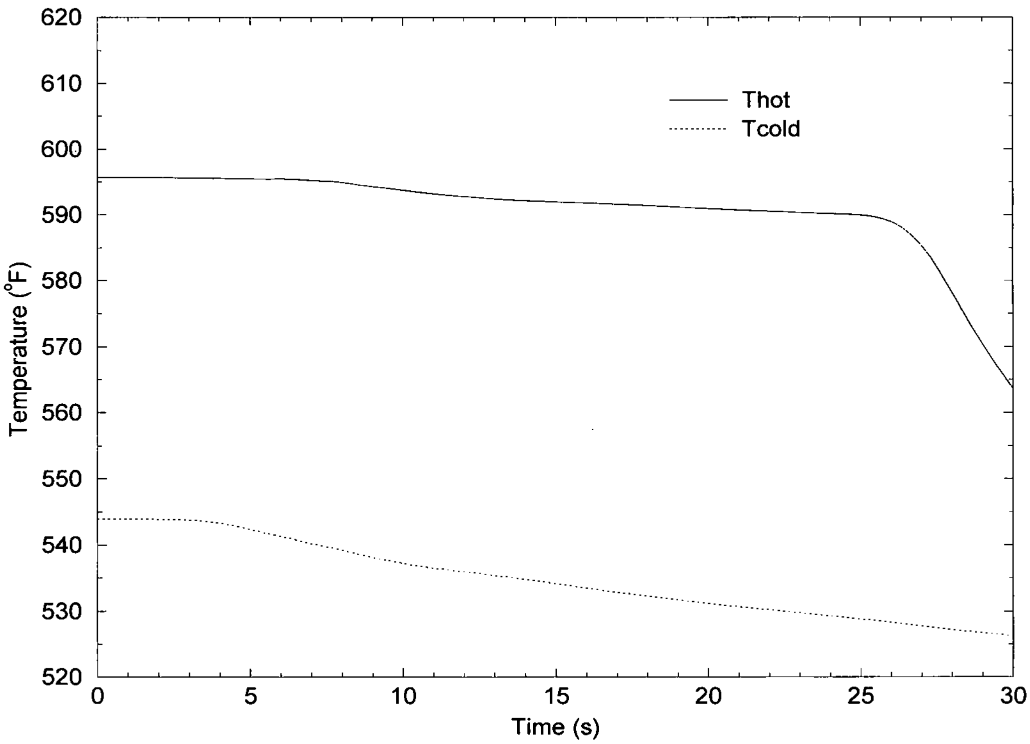
PRIMARY COOLANT SYSTEM TEMPERATURES FOR REACTOR COOLANT PUMP ROTOR SEIZURE



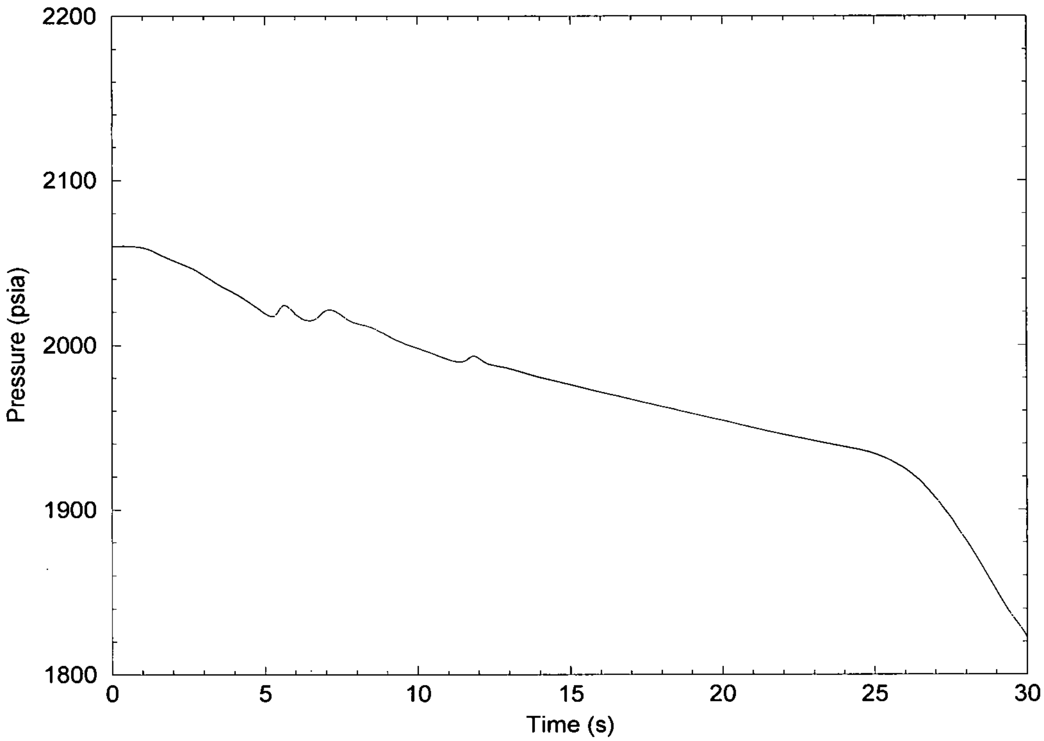
POWER COMPARISONS – EXCESS LOAD



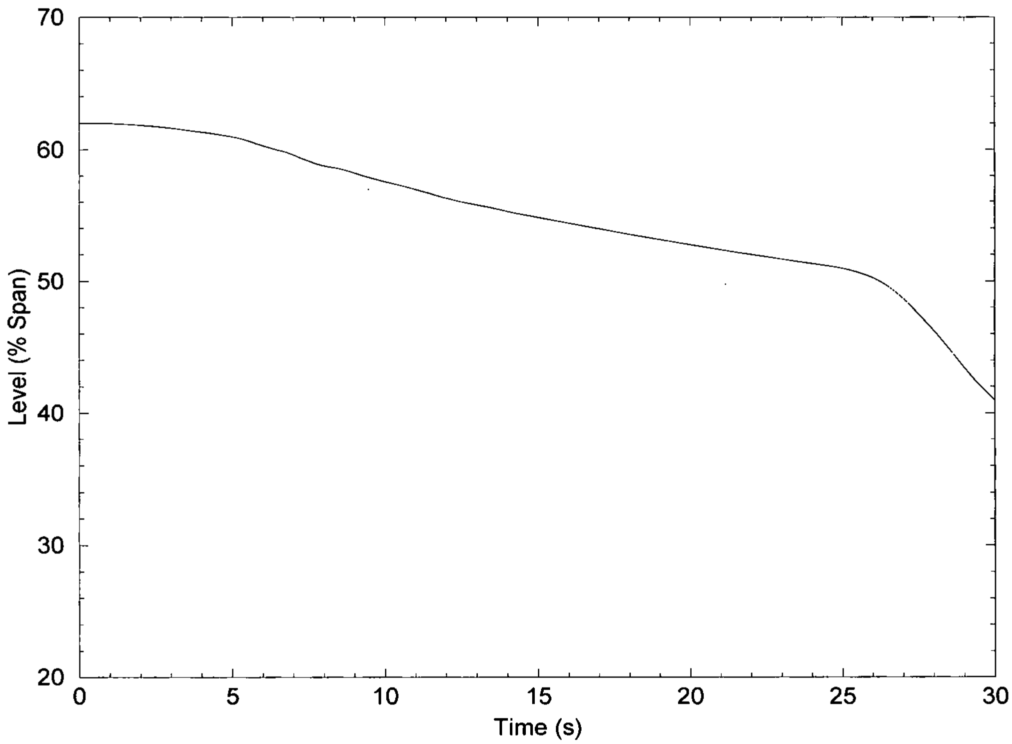
PCS COOLANT TEMPERATURE – EXCESS LOAD



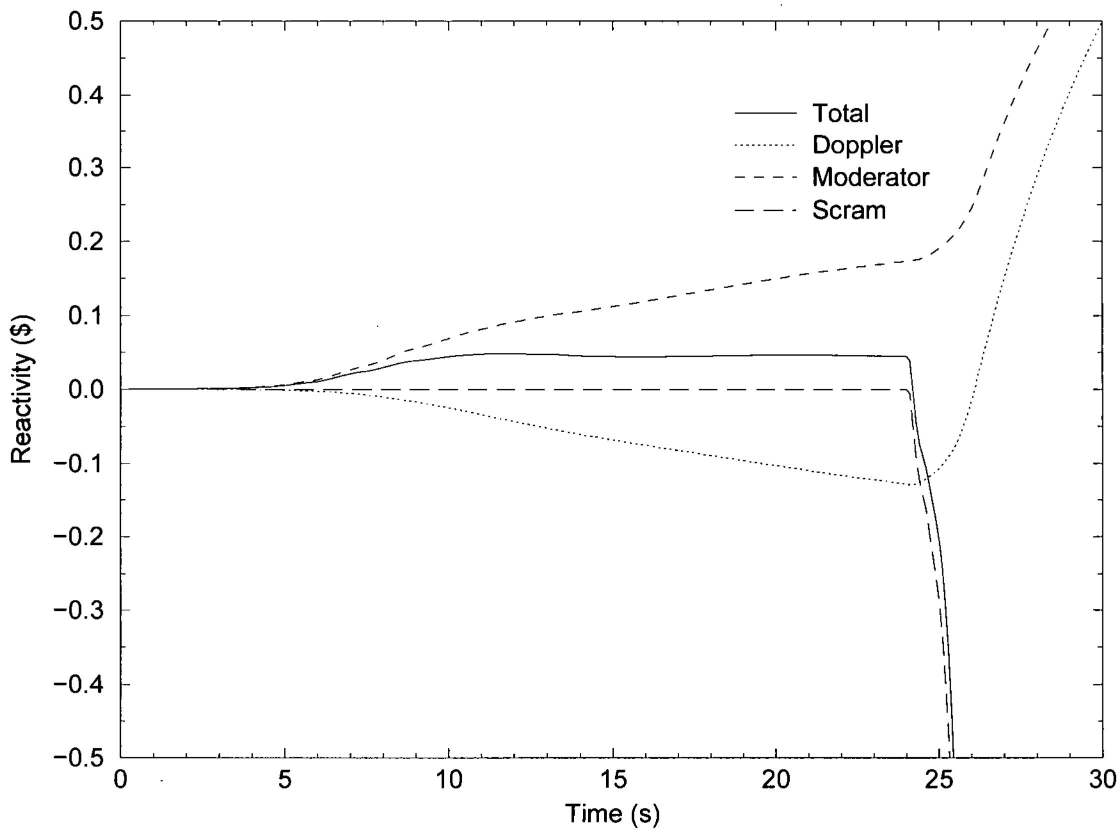
PRESSURIZER PRESSURE – EXCESS LOAD



PRESSURIZER COLLAPSED LIQUID LEVEL – EXCESS LOAD



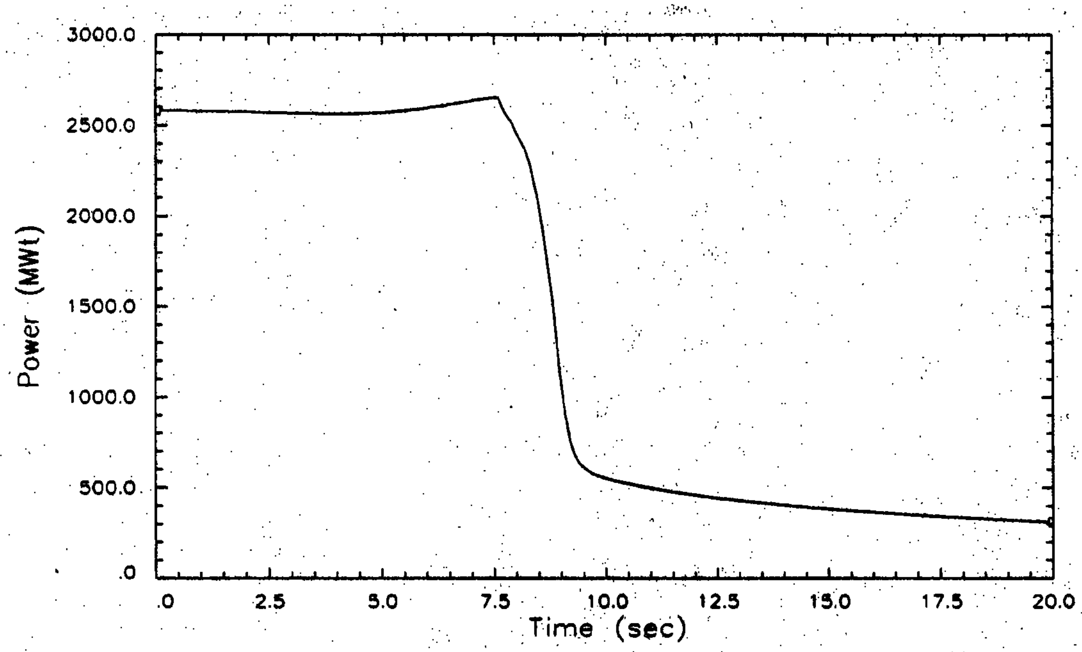
COMPONENTS OF REACTIVITY – EXCESS LOAD



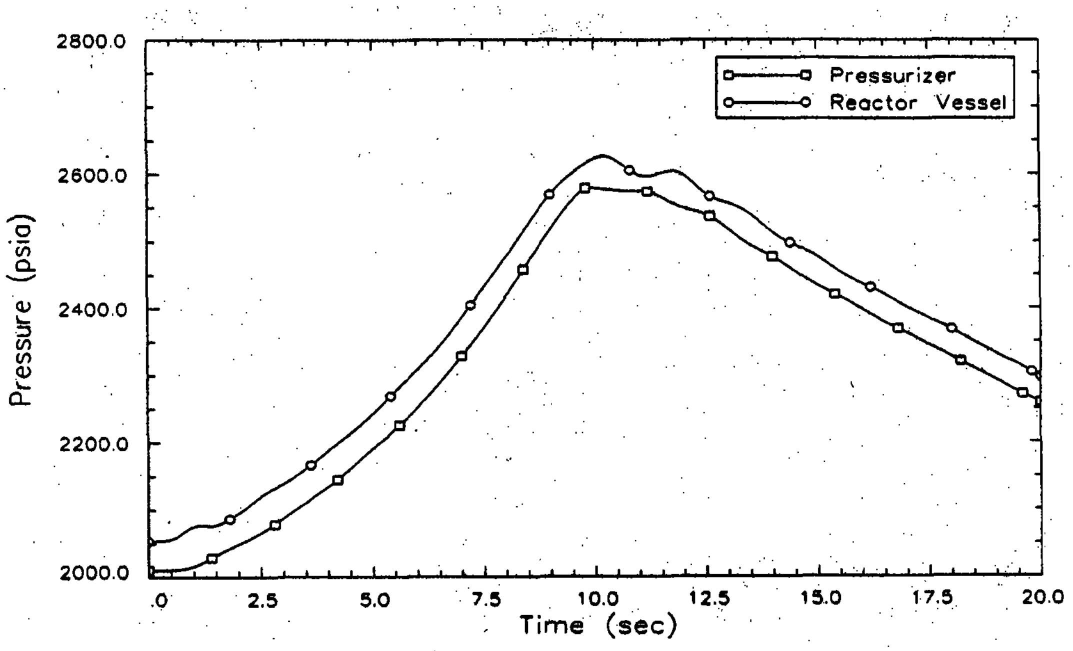
PARTIAL OPERATING FLOOR PLAN EL 649'-0"

Withheld under 10 CFR 2.390

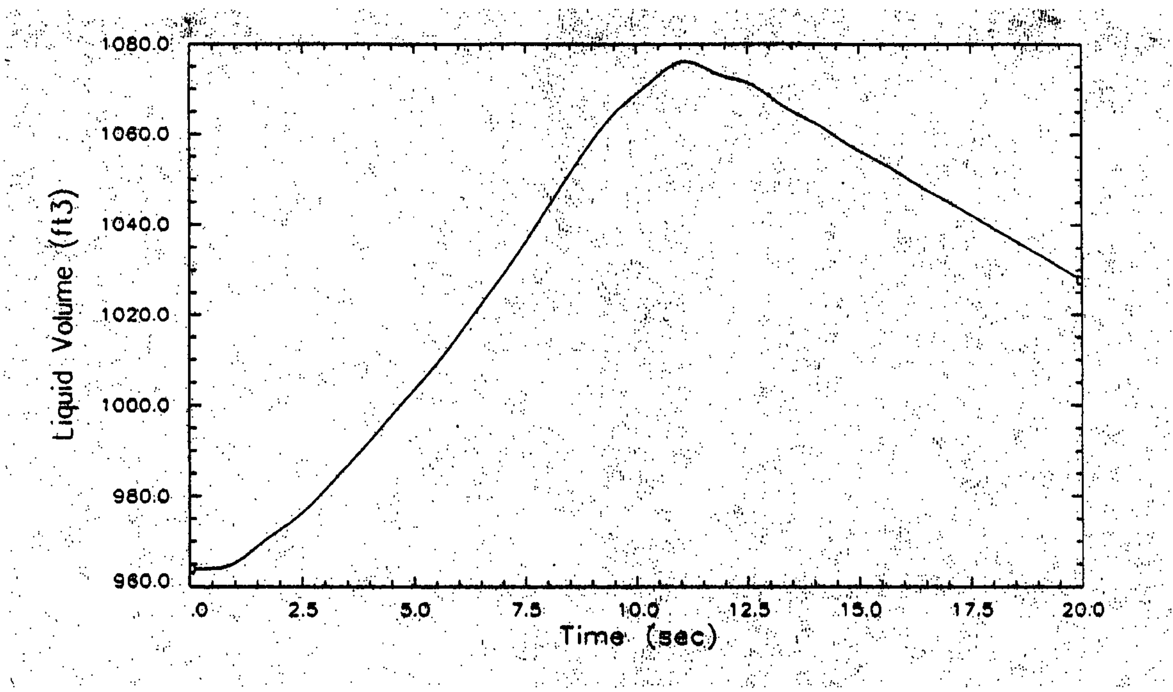
REACTOR POWER LEVEL FOR LOSS OF EXTERNAL LOAD EVENT



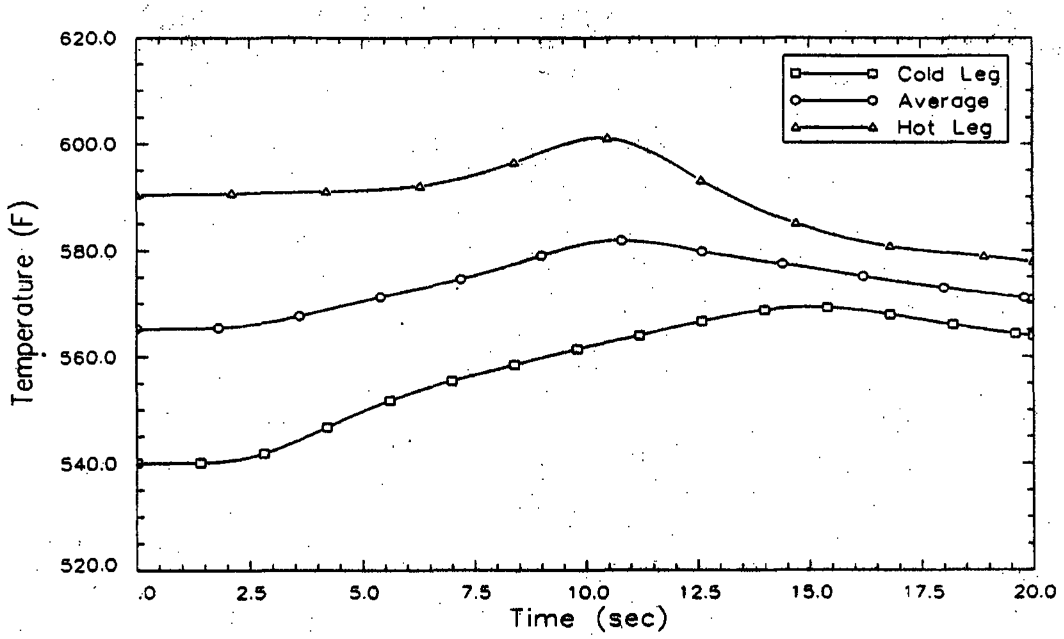
PRIMARY PRESSURES FOR LOSS OF EXTERNAL LOAD EVENT



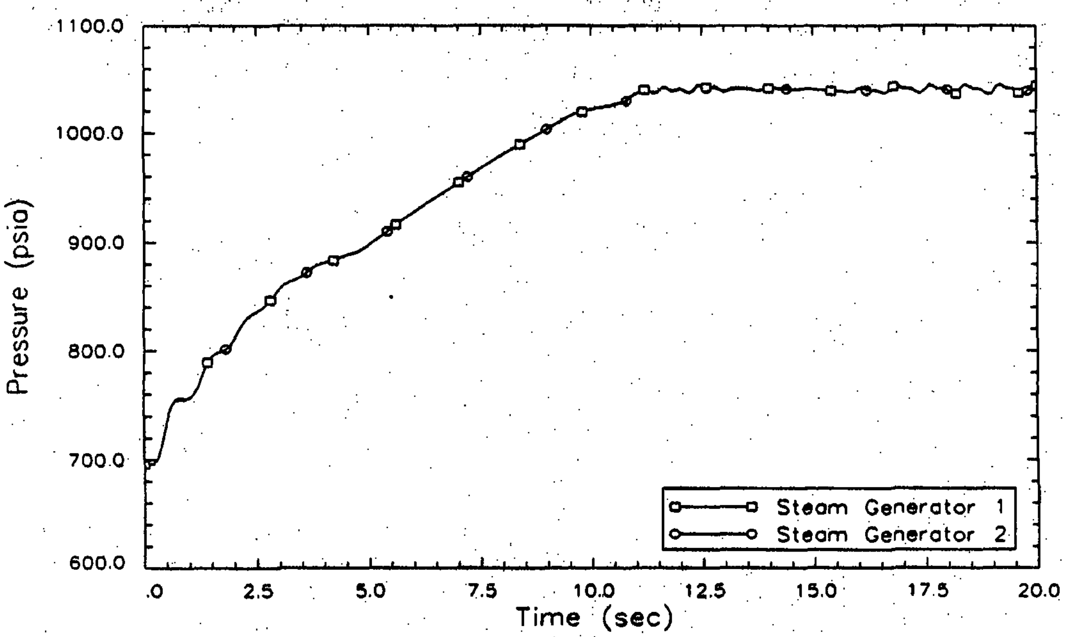
PRESSURIZER LIQUID VOLUME FOR LOSS OF EXTERNAL LOAD EVENT



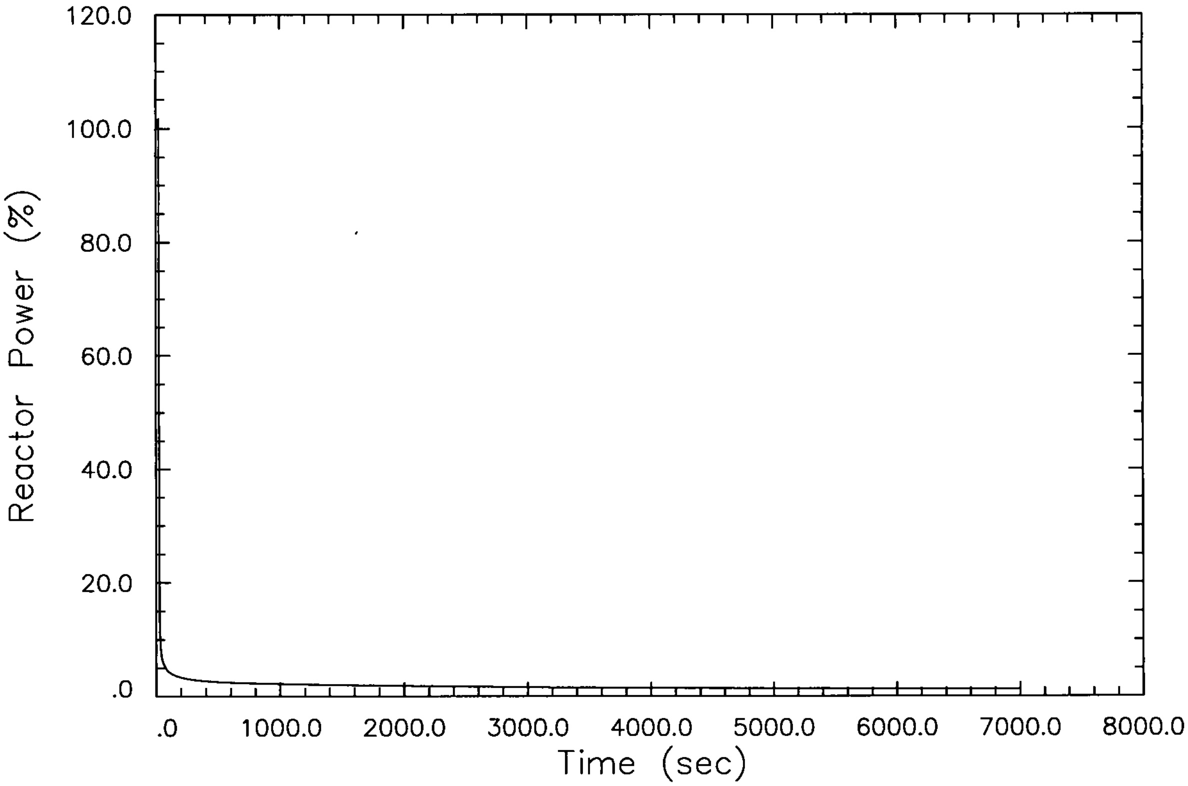
PRIMARY COOLANT SYSTEM TEMPERATURES FOR LOSS OF EXTERNAL LOAD EVENT



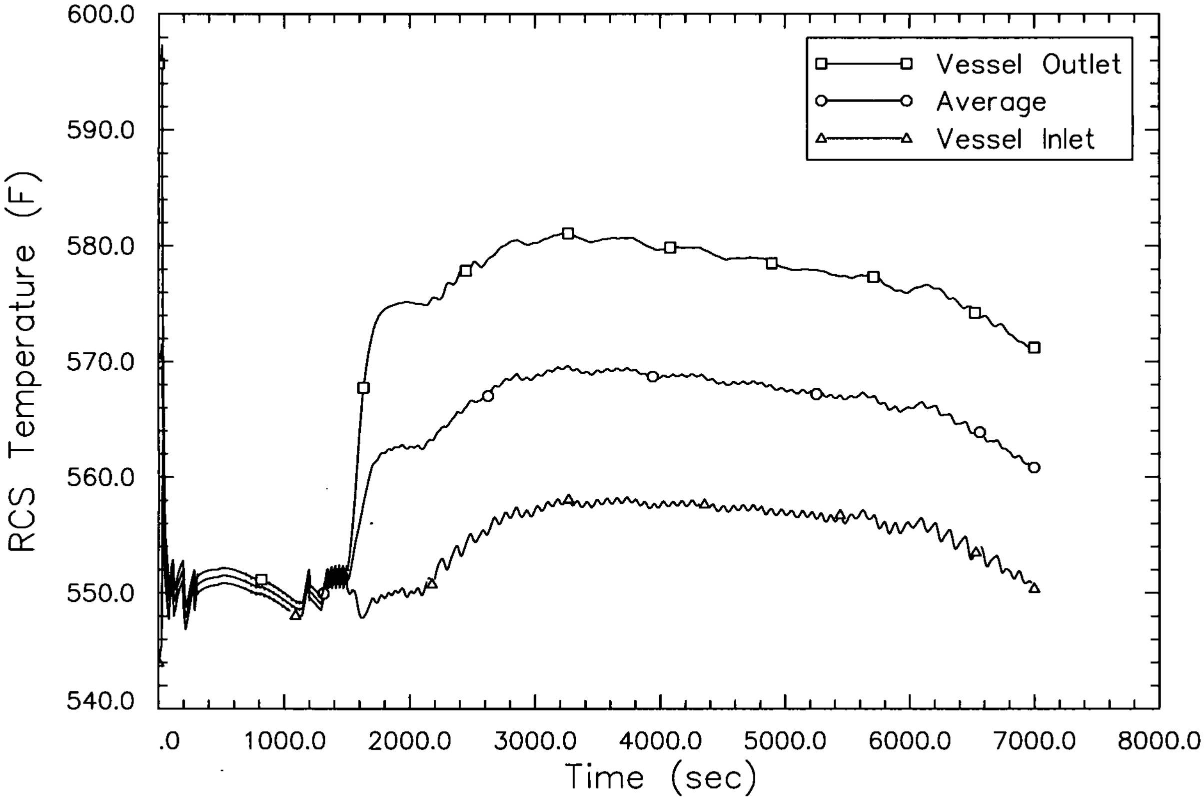
SECONDARY PRESSURES FOR LOSS OF EXTERNAL LOAD EVENT



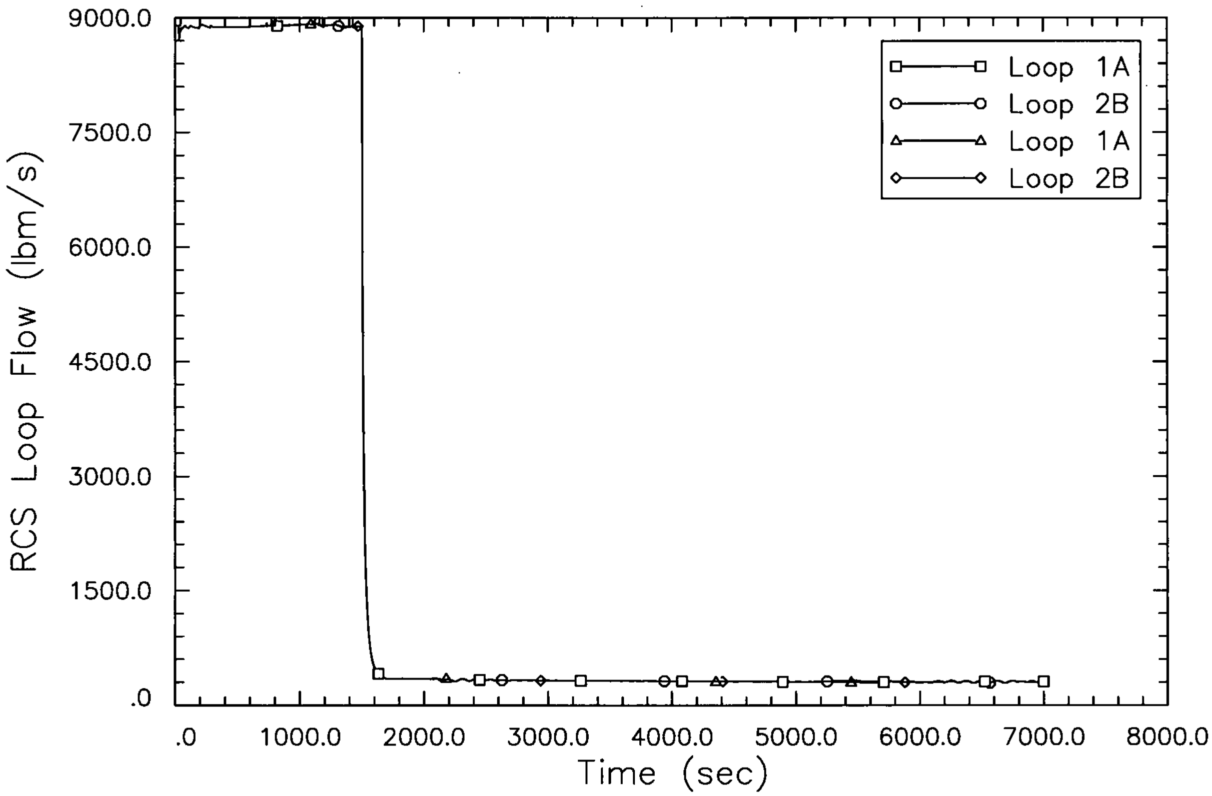
Reactor Power, LNFF Analysis with Off-Site Power Available and Steam Dump System Disabled



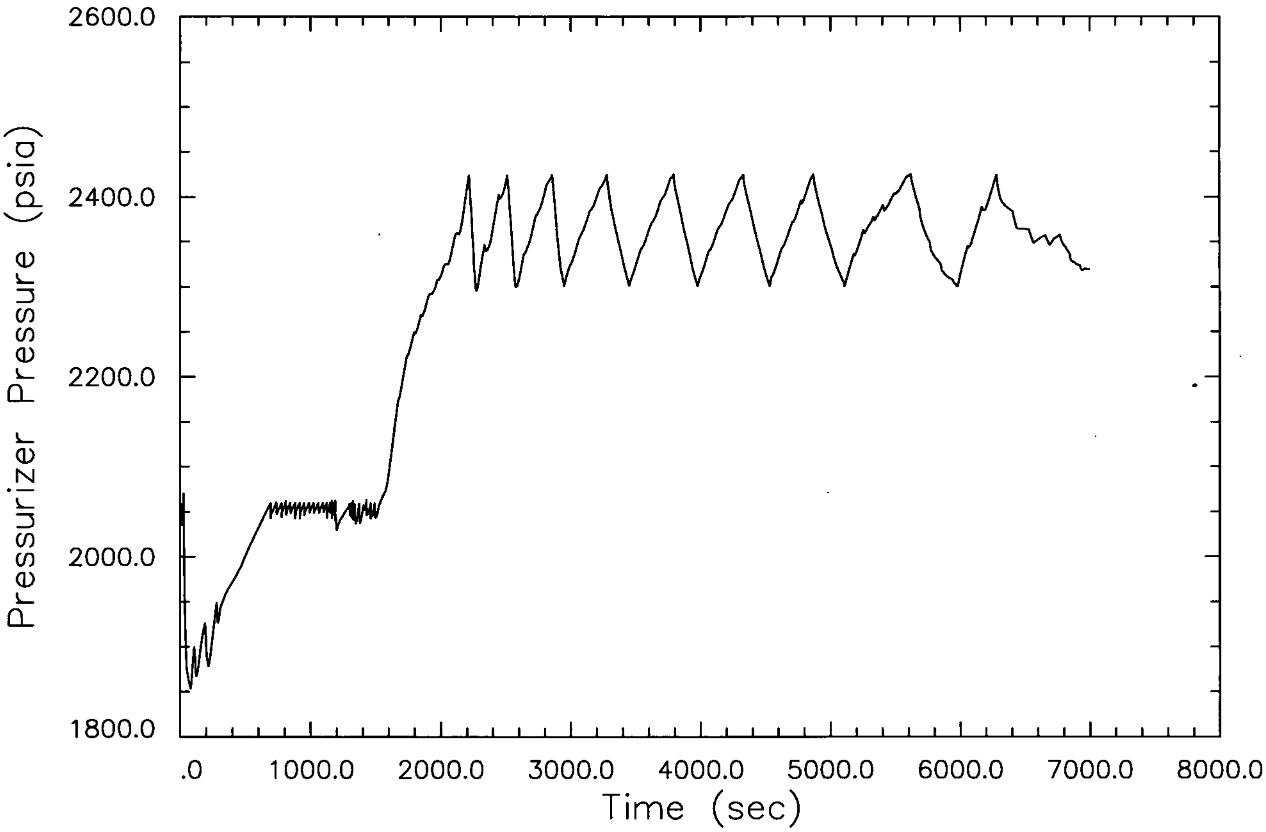
Primary Coolant System Loop Temperatures, LNFF Analysis with Off-Site Power Available and Steam Dump System Disabled



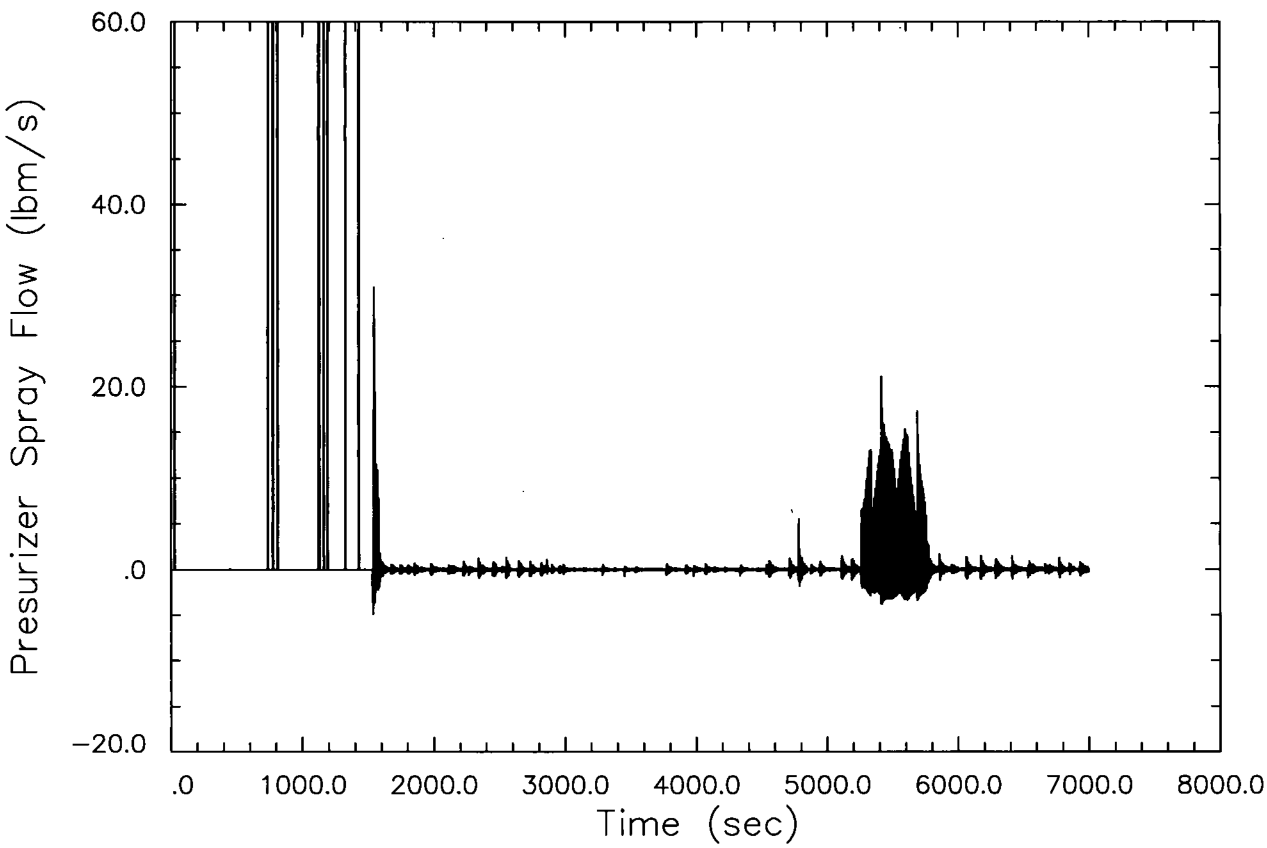
Primary Coolant System Loop Flow, LNFF Analysis with Off-Site Power Available and Steam Dump System Disabled



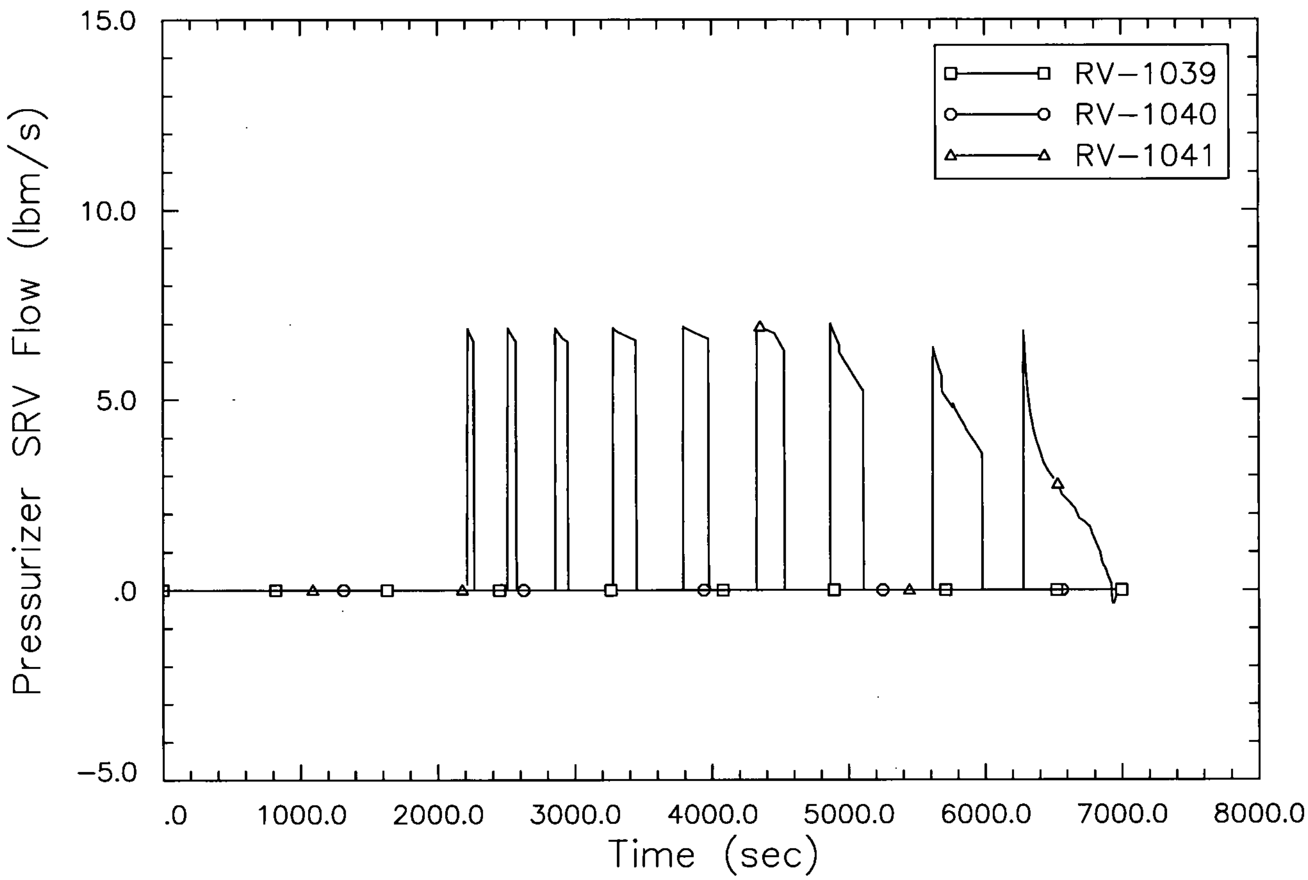
Pressurizer Pressure, LNFF Analysis with Off-Site Power Available and Steam Dump System Disabled



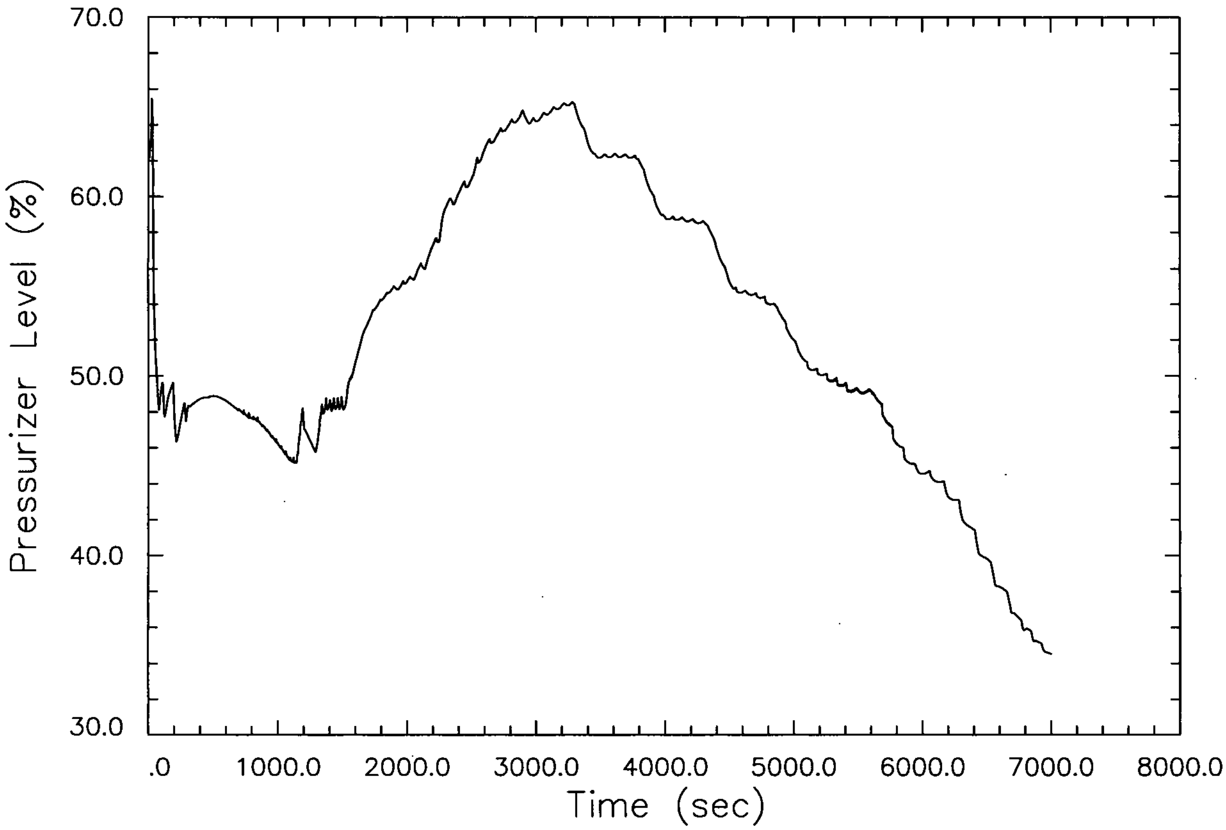
Pressurizer Spray Flow, LNFF Analysis with Off-Site Power Available and Steam Dump System Disabled



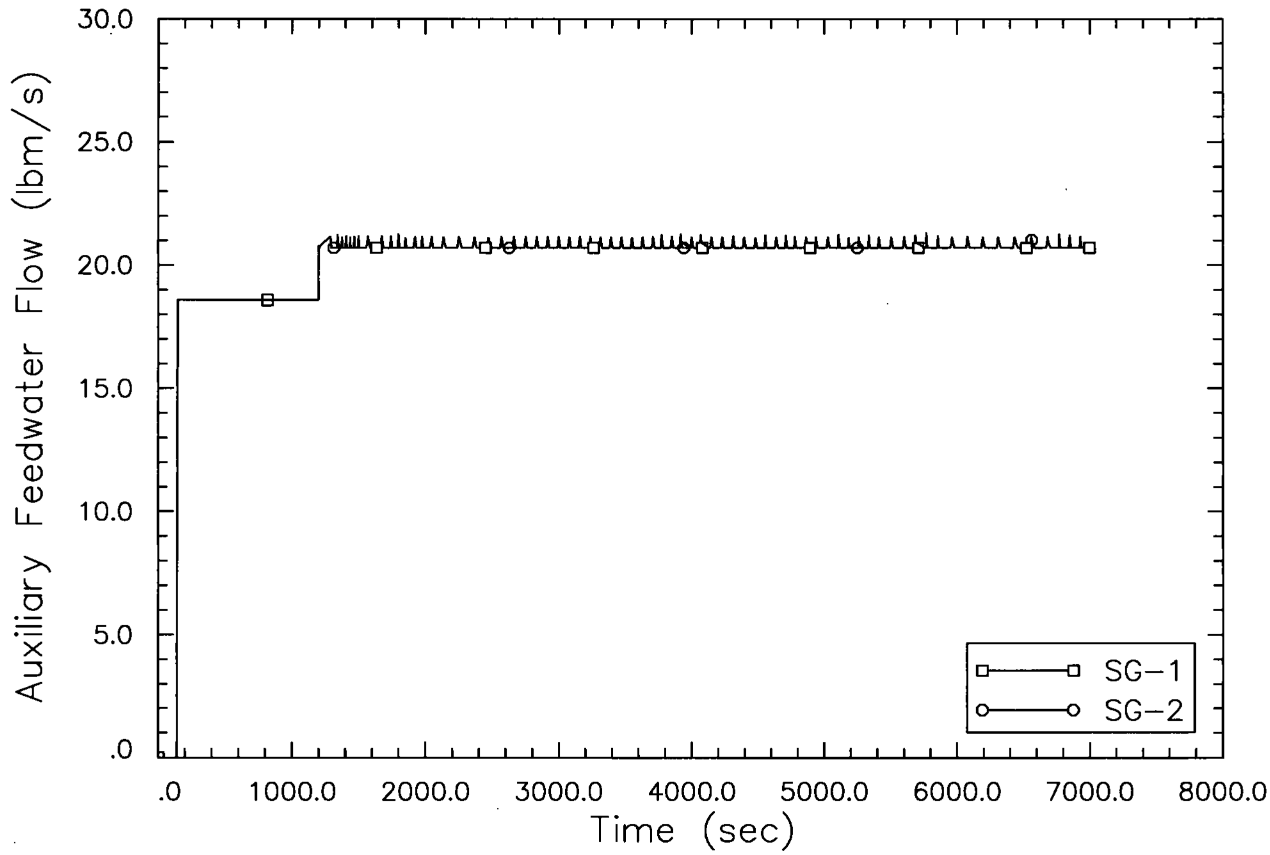
Pressurizer SRV Flow, LNFF Analysis with Off-Site Power Available and Steam Dump System Disabled



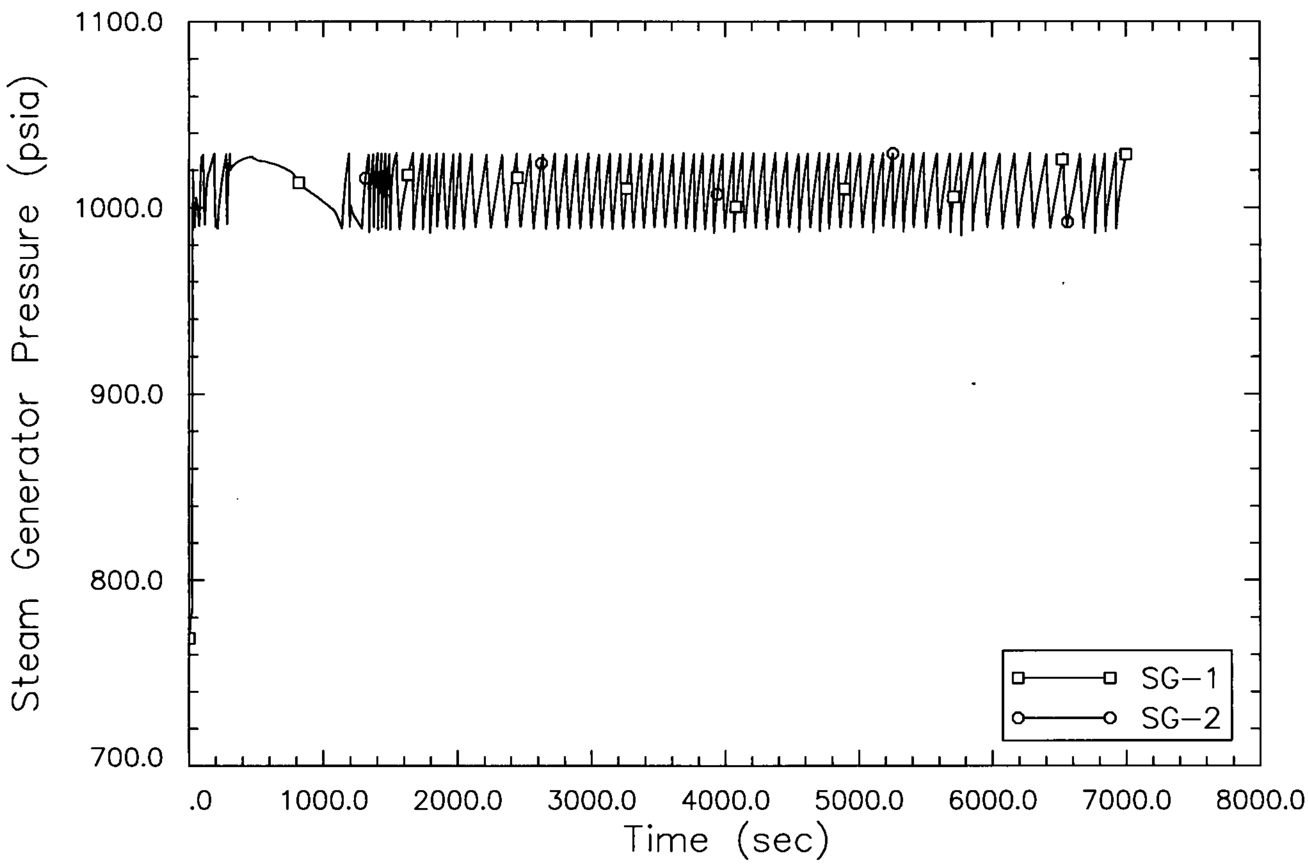
Pressurizer Level, LNFF Analysis with Off-Site Power Available and Steam Dump System Disabled



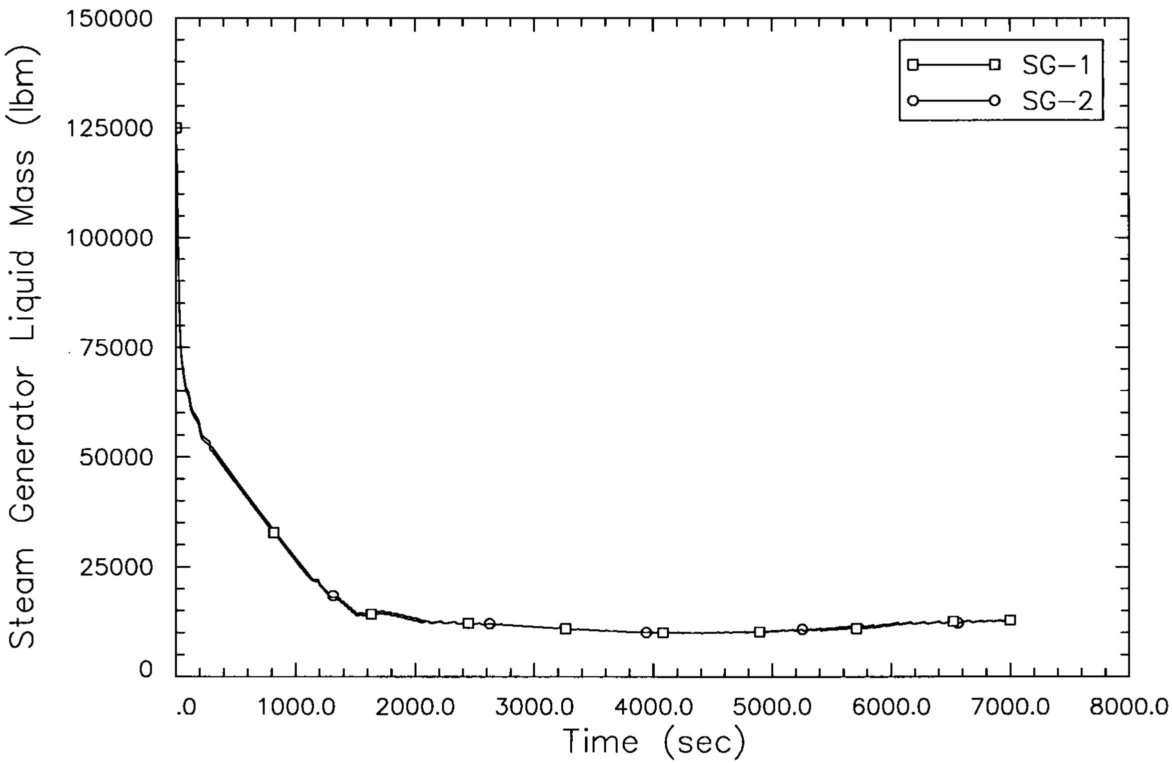
SG Auxiliary Feedwater Flow, LNFF Analysis with Off-Site Power Available and Steam Dump System Disabled



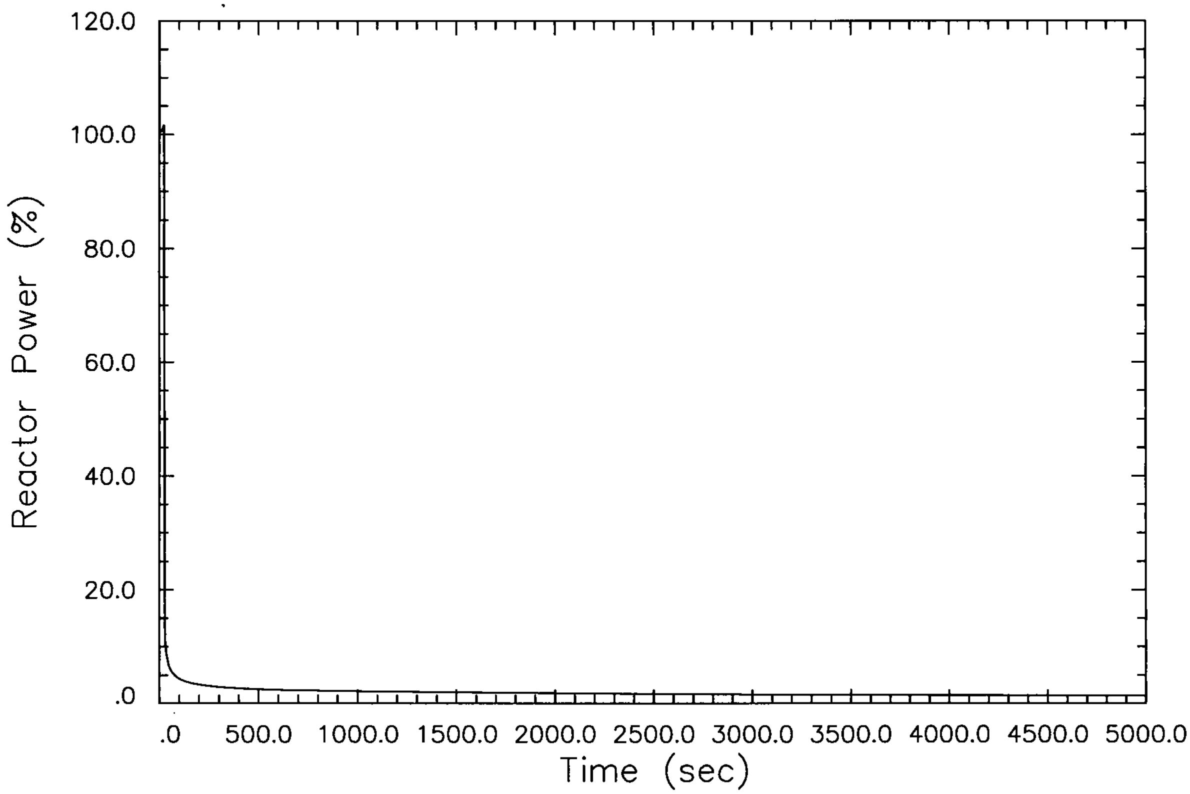
SG Dome Pressure, LNFF Analysis with Off-Site Power Available and Steam Dump System Disabled



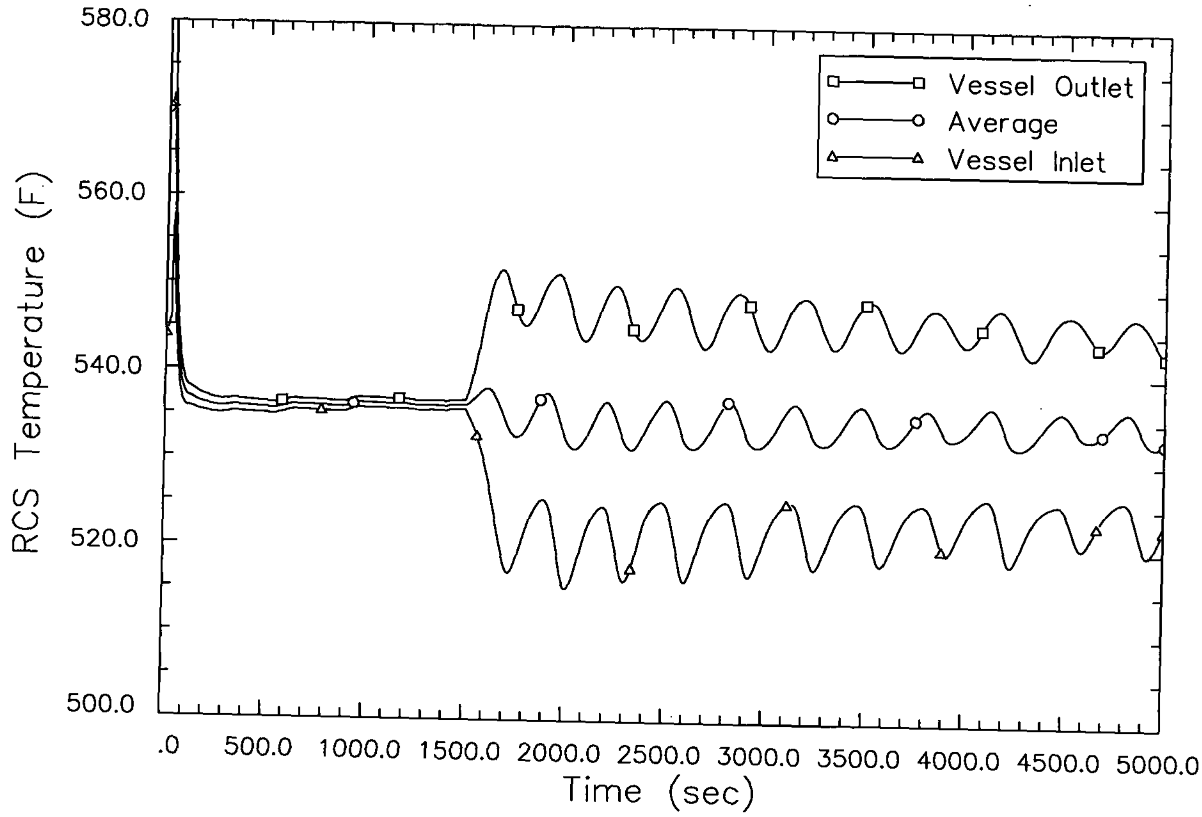
SG Liquid Mass Inventory, LNFF Analysis with Off-Site Power Available and Steam Dump System Disabled



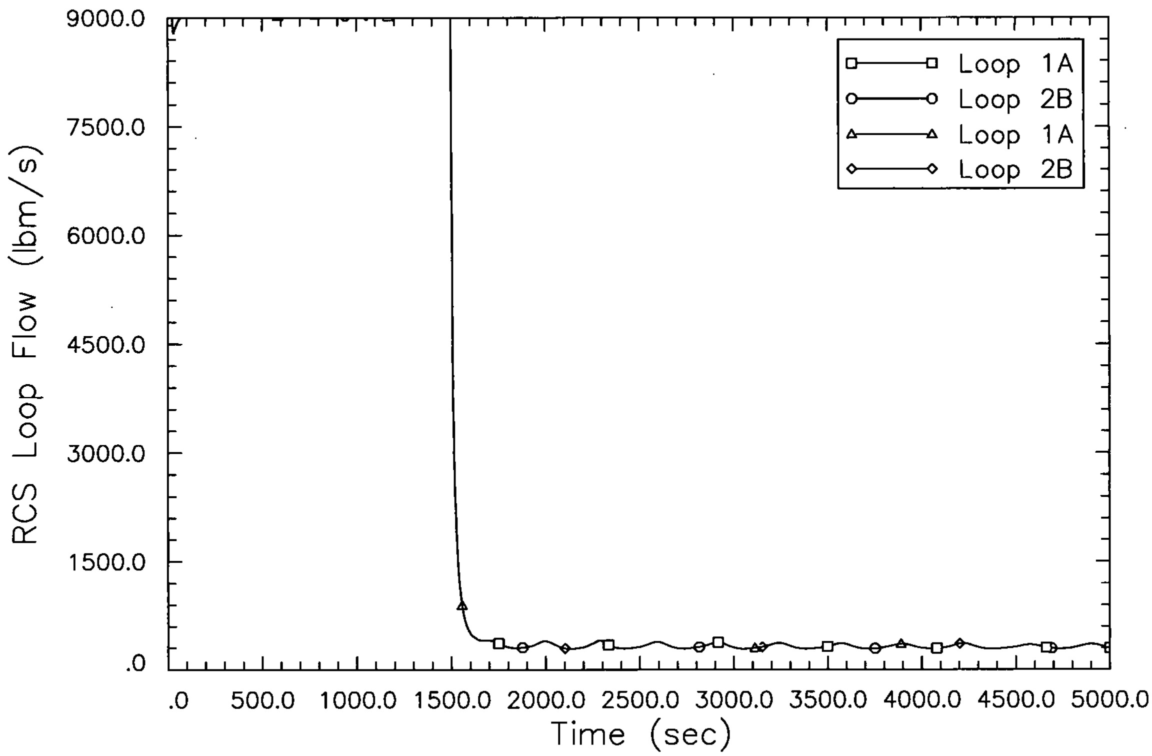
Reactor Power, LNFF Analysis with Off-Site Power Available and Steam Dump System Available



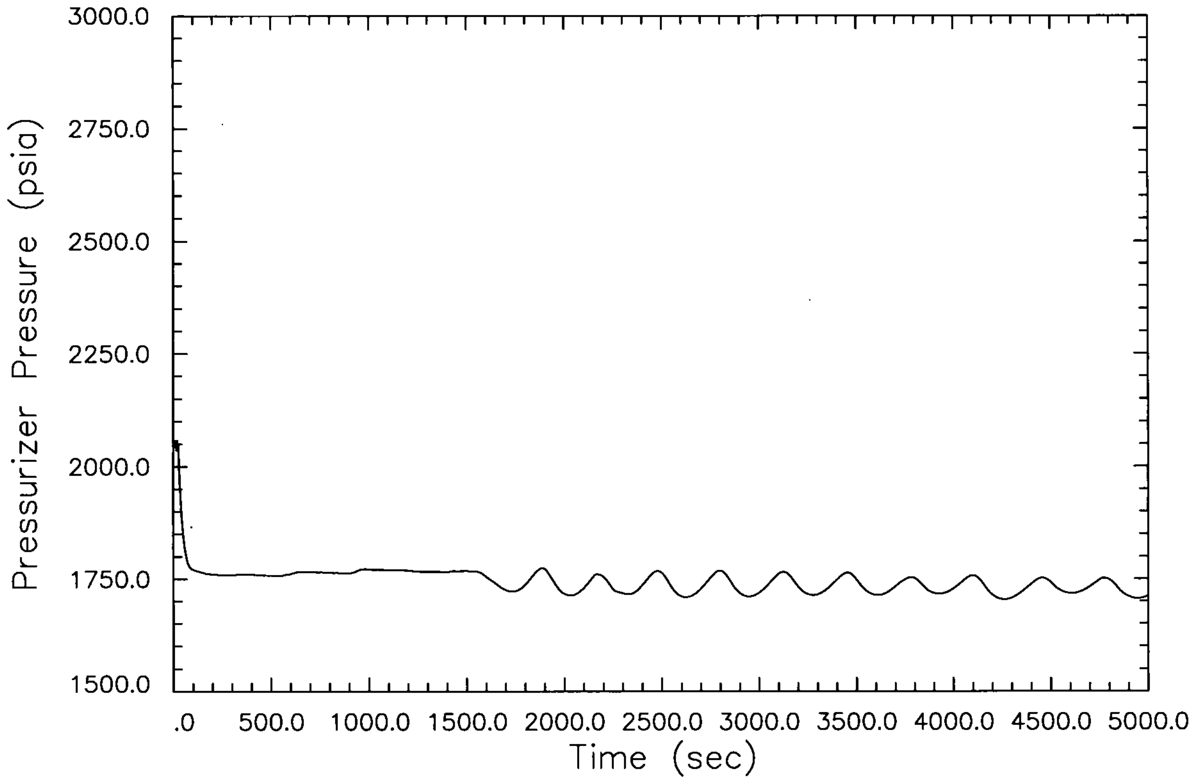
Primary Coolant System Loop Temperatures, LNFF Analysis with Off-Site Power Available and Steam Dump System Available



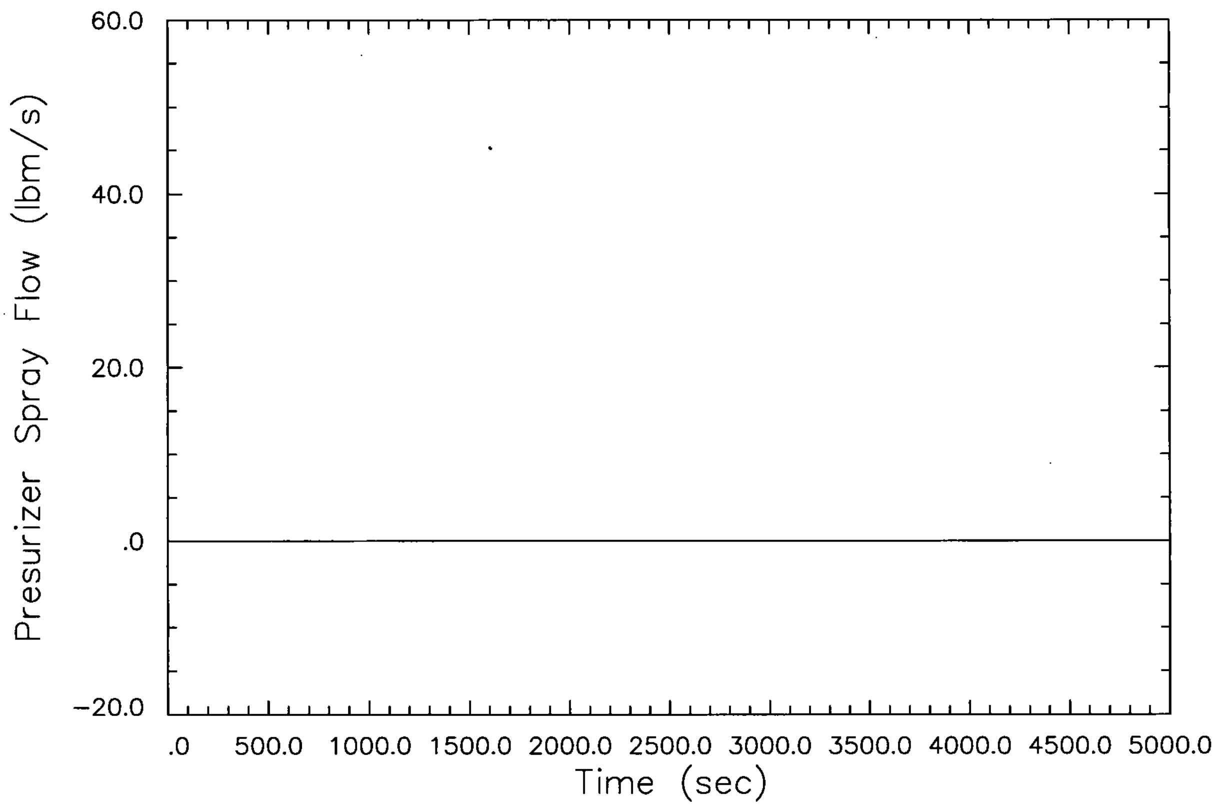
Primary Coolant System Loop Flow, LNFF Analysis with Off-Site Power Available and Steam Dump System Available



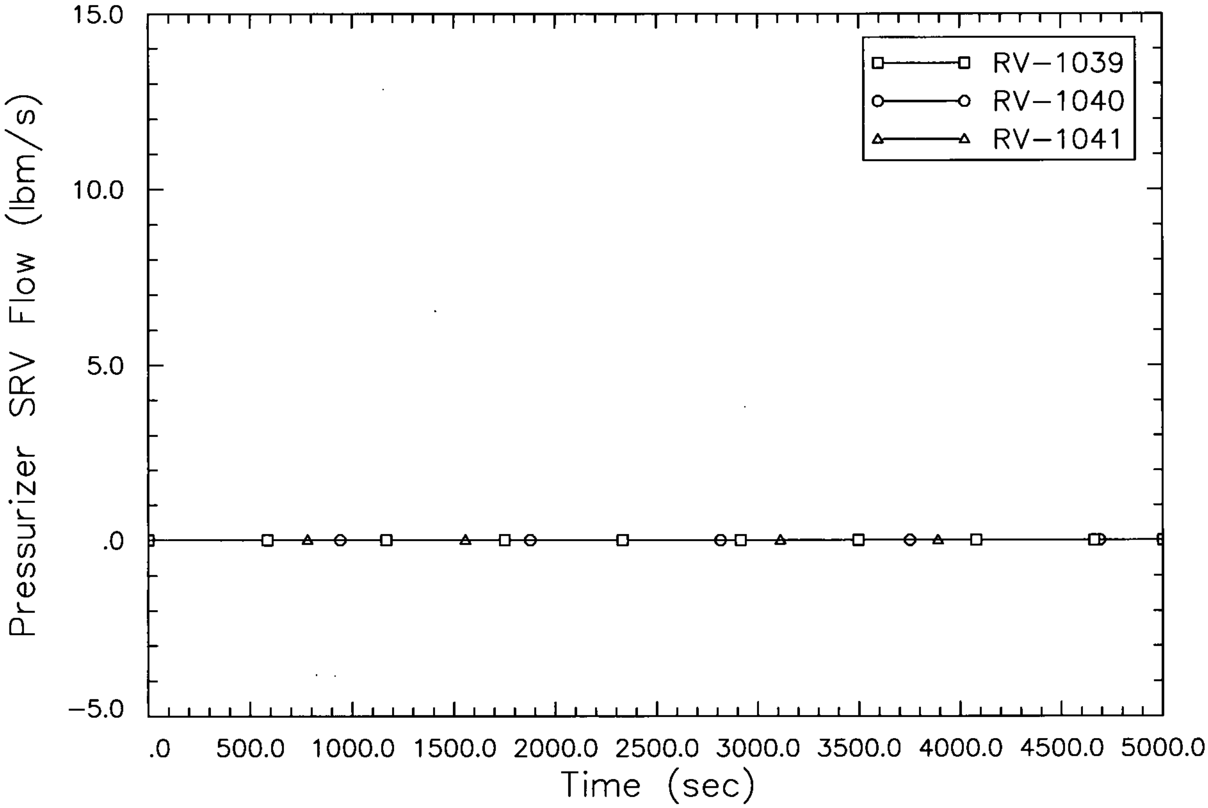
Pressurizer Pressure, LNFF Analysis with Off-Site Power Available and Steam Dump System Available



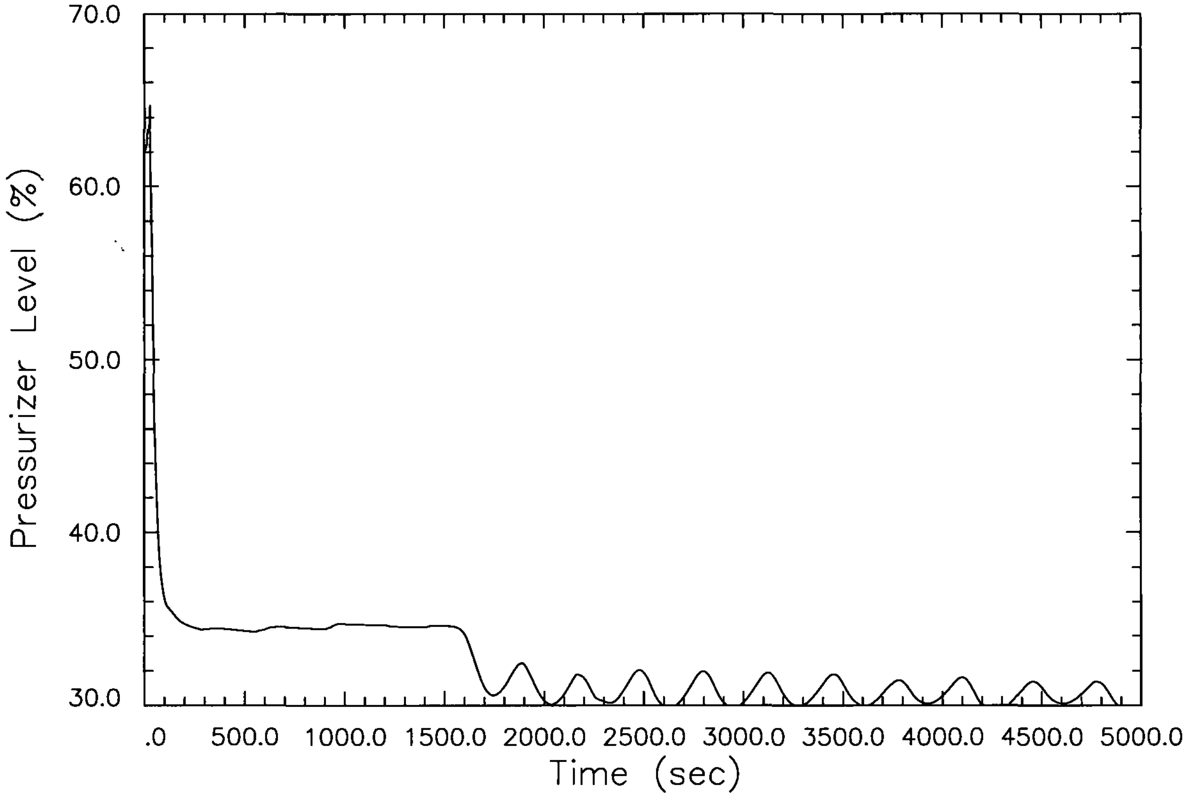
Pressurizer Spray Flow, LNFF Analysis with Off-Site Power Available and Steam Dump System Available



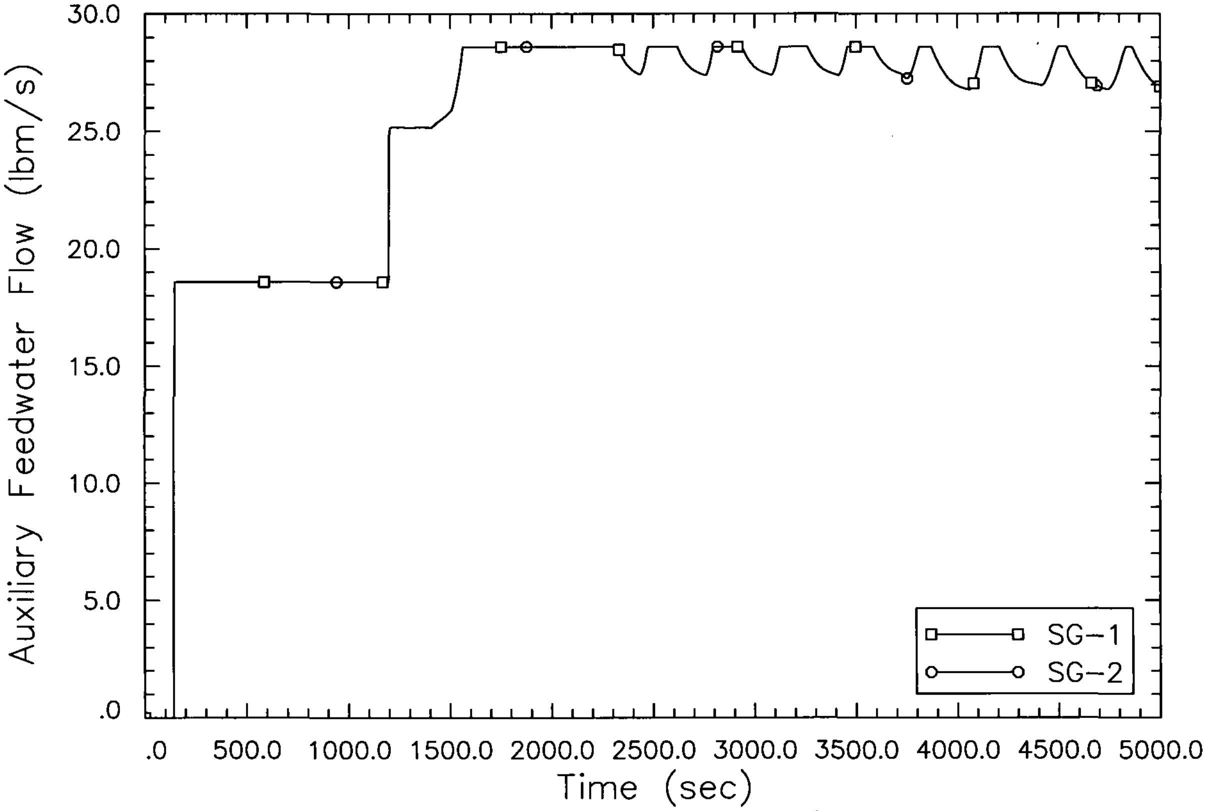
Pressurizer SRV Flow, LNFF Analysis with Off-Site Power Available and Steam Dump System Available



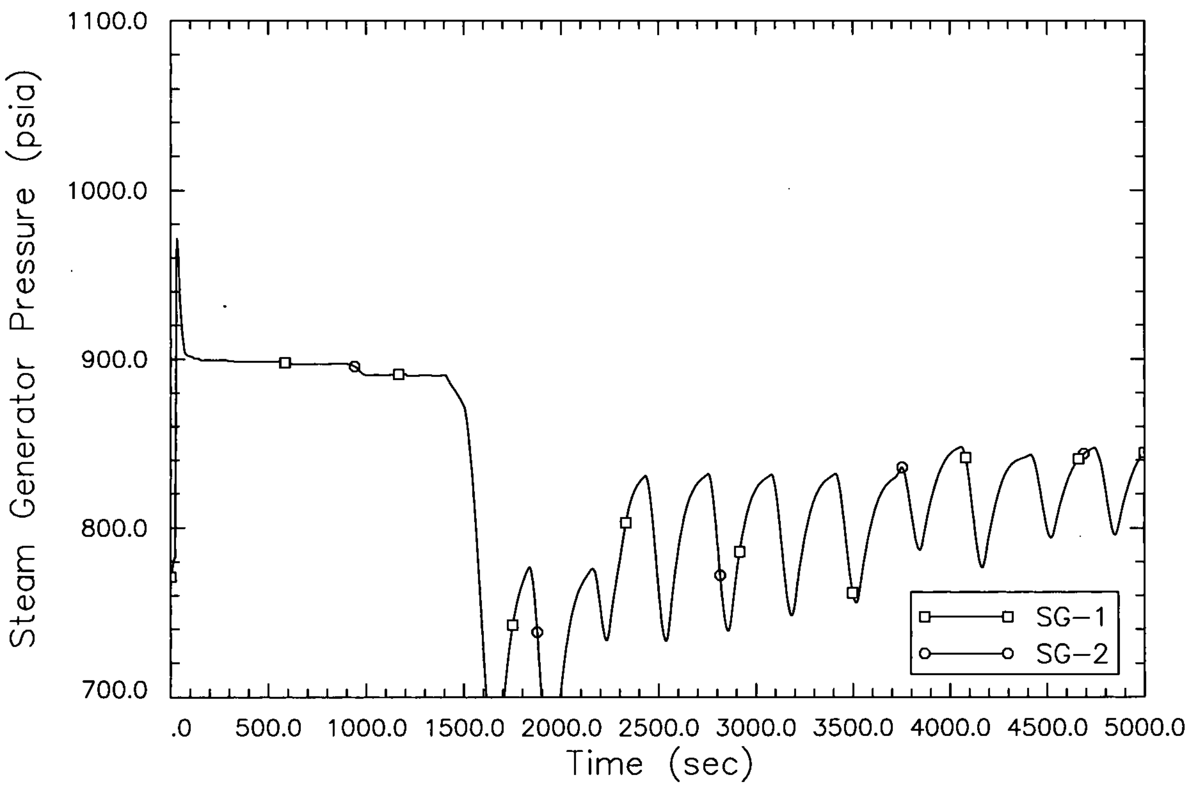
Pressurizer Level, LNFF Analysis with Off-Site Power Available and Steam Dump System Available



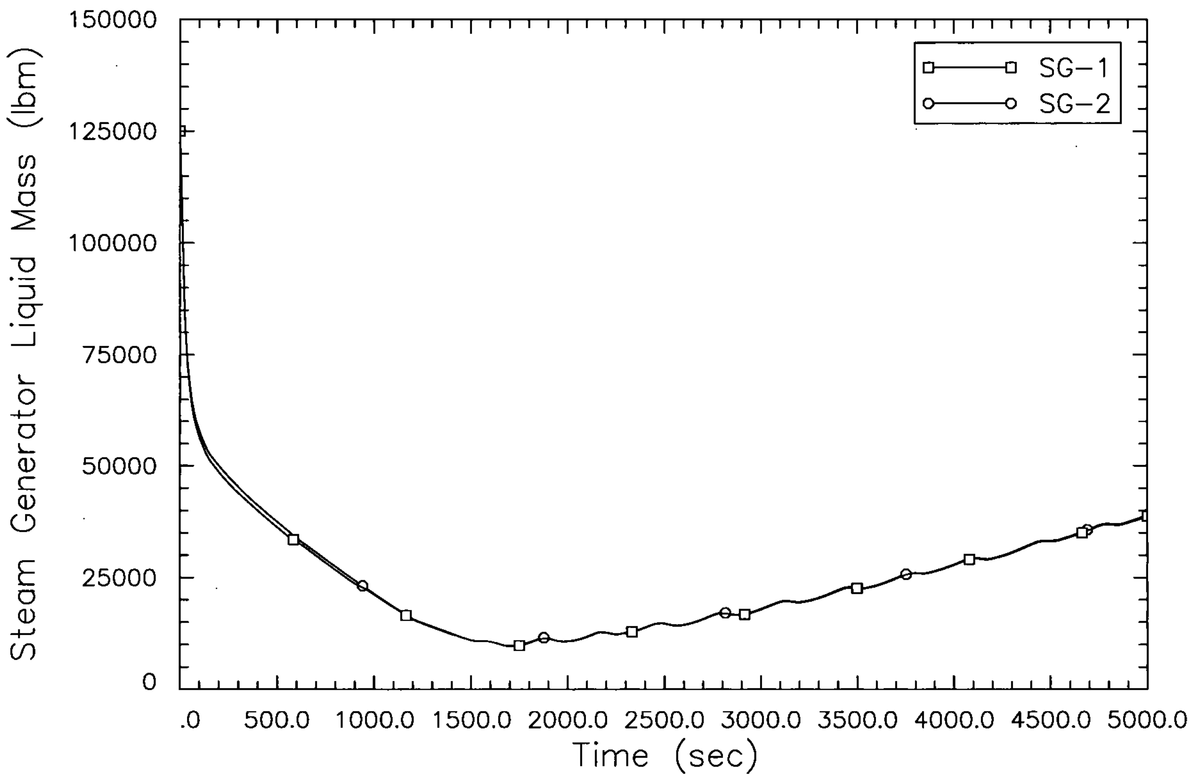
SG Auxiliary Feedwater Flow, LNFF Analysis with Off-Site Power Available and Steam Dump System Available



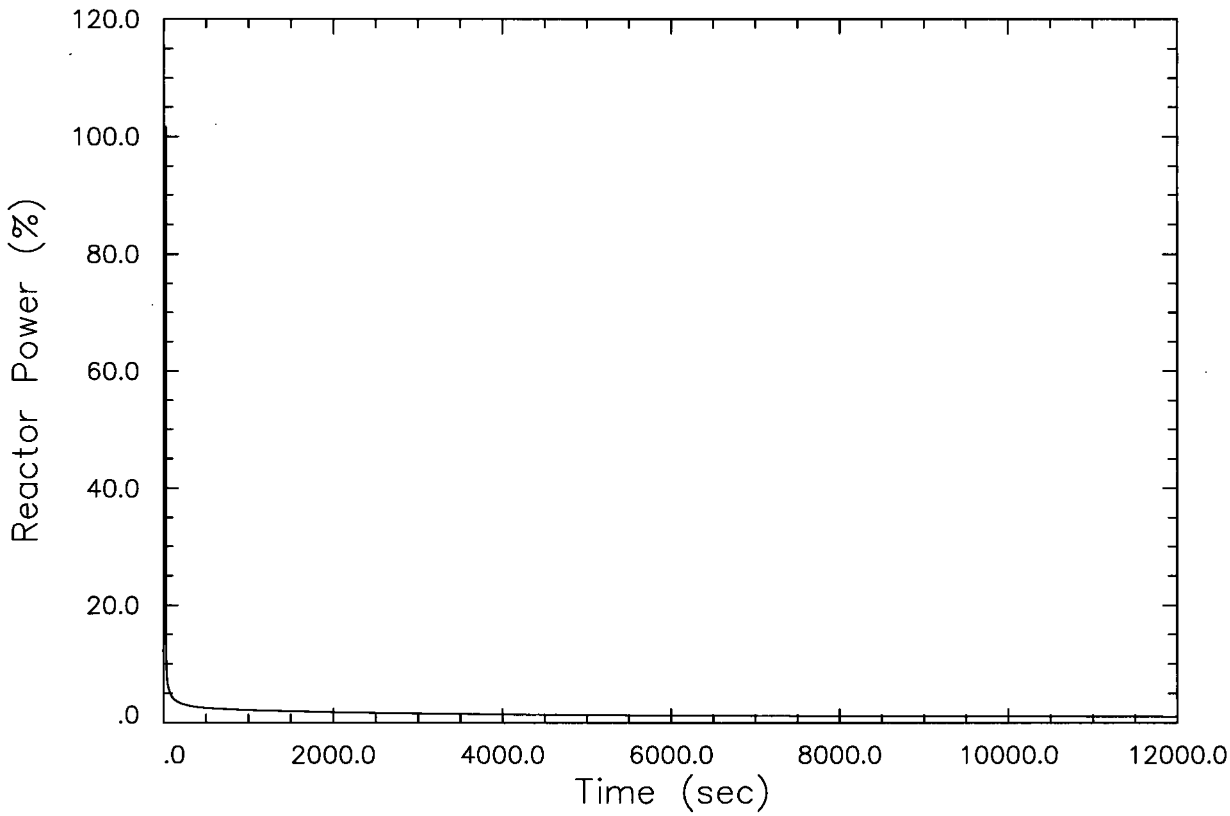
SG Dome Pressure, LNFF Analysis with Off-Site Power Available and Steam Dump System Available



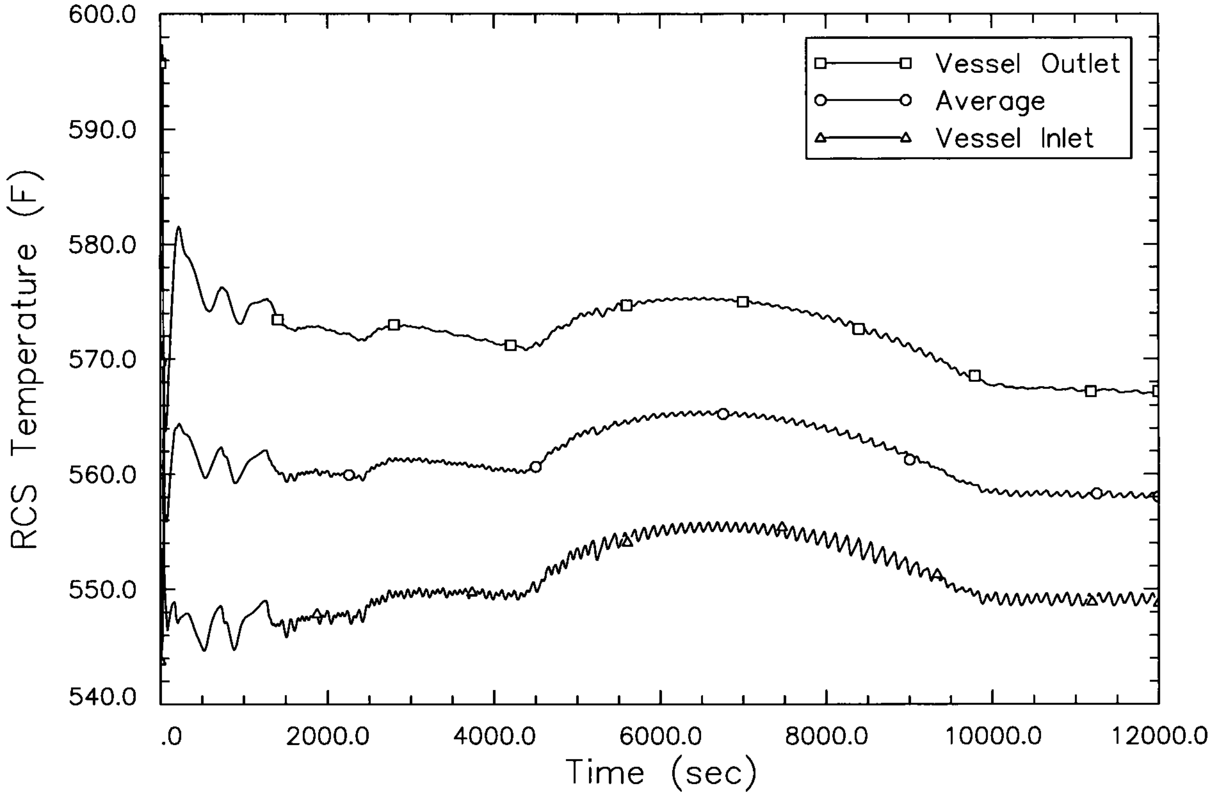
SG Liquid Mass Inventory, LNFF Analysis with Off-Site Power Available and Steam Dump System Available



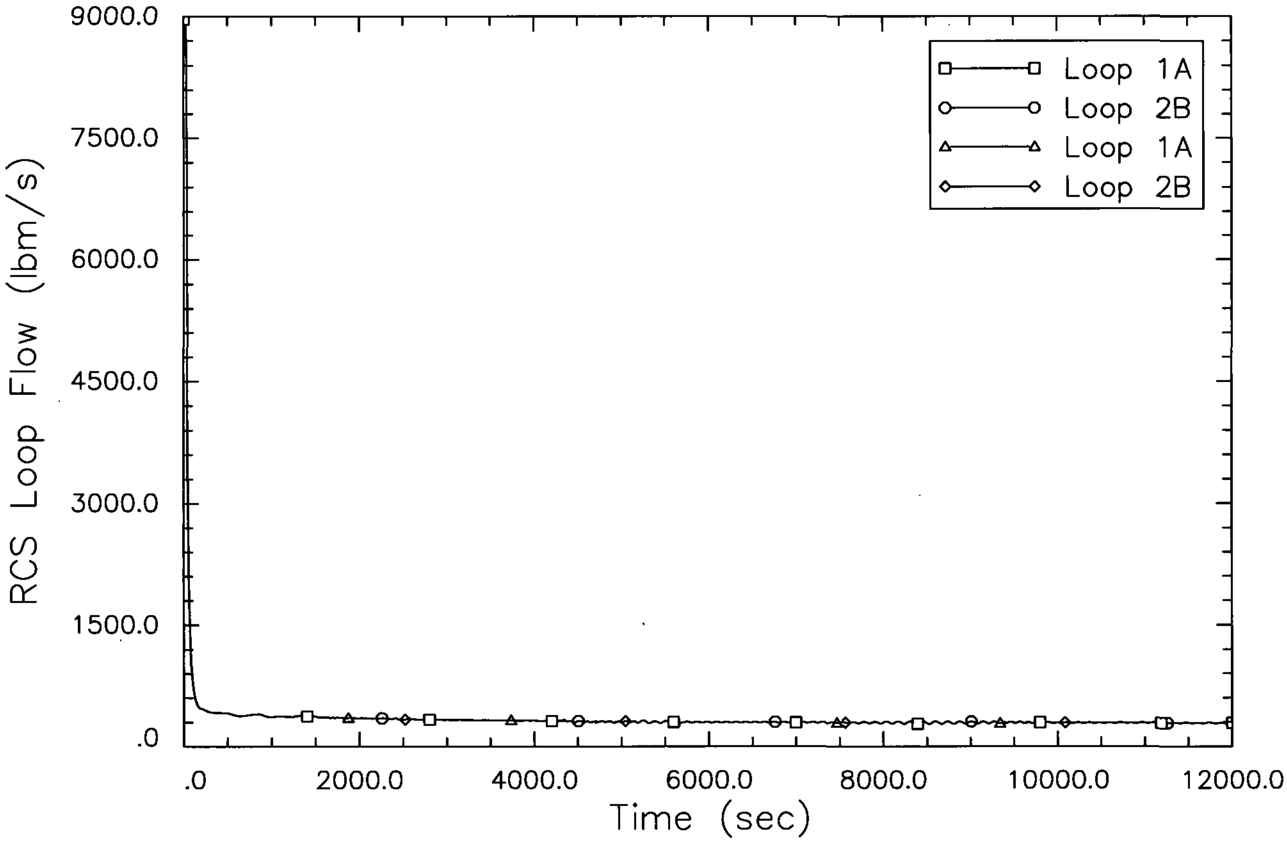
Reactor Power, LNFF Analysis without Off-Site Power Available and Steam Dump Systems Disabled



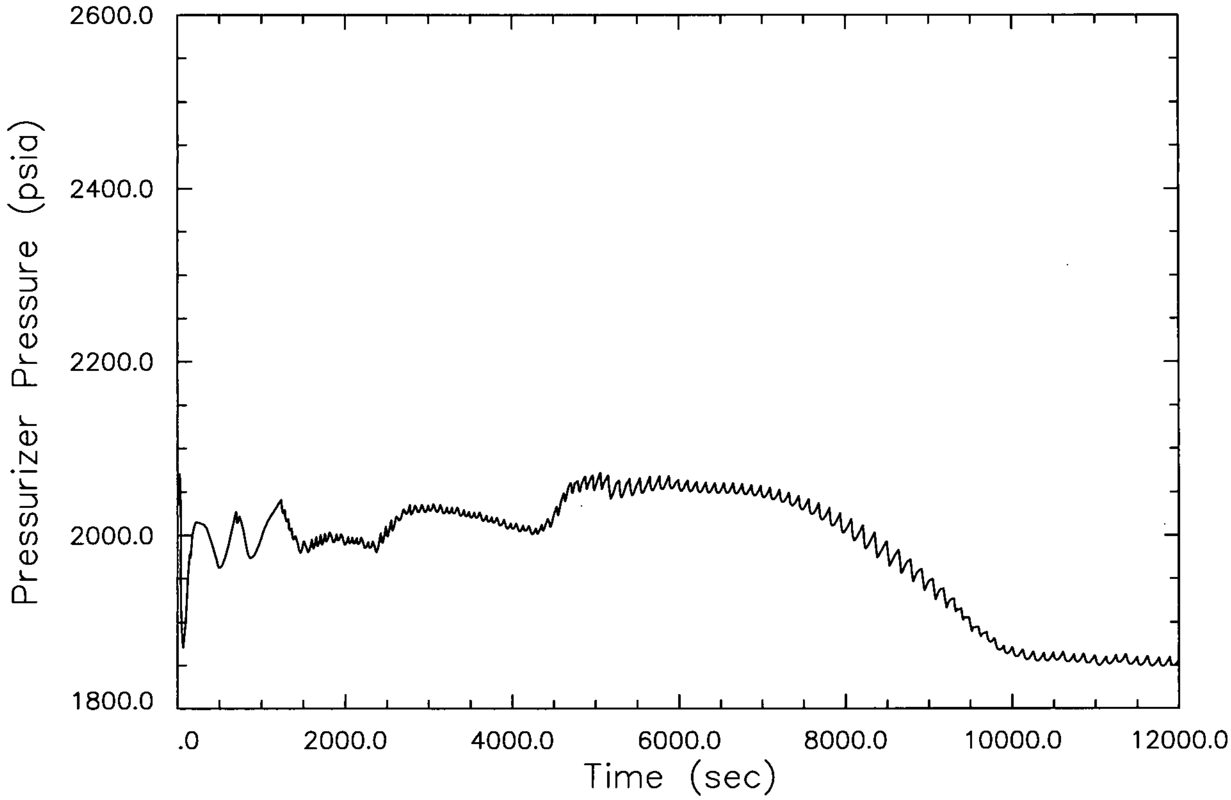
Primary Coolant System Loop Temperatures, LNFF Analysis without Off-Site Power Available and Steam Dump Systems Disabled



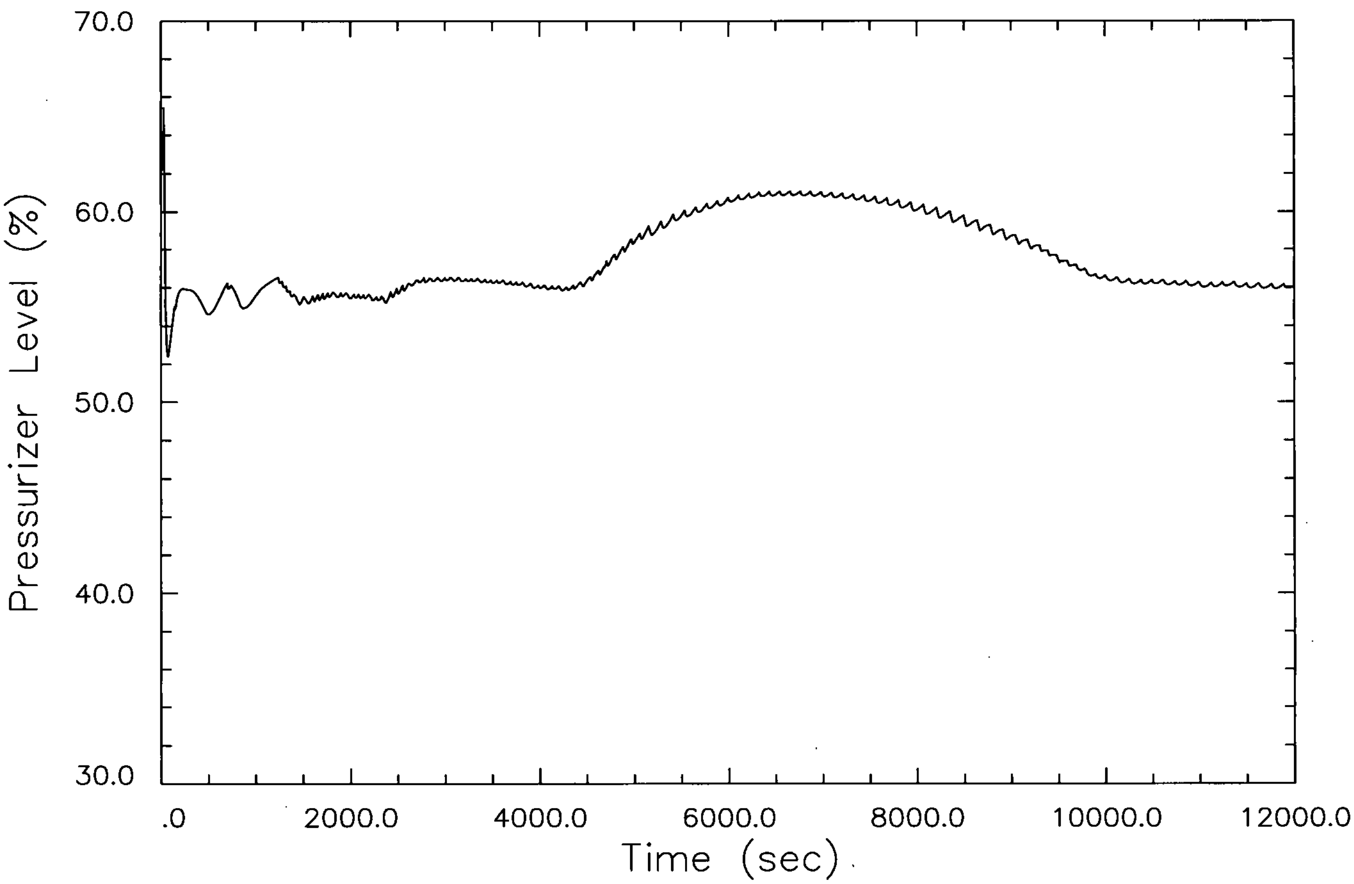
Primary Coolant System Loop Flow, LNFF Analysis without Off-Site Power Available and Steam Dump Systems Disabled



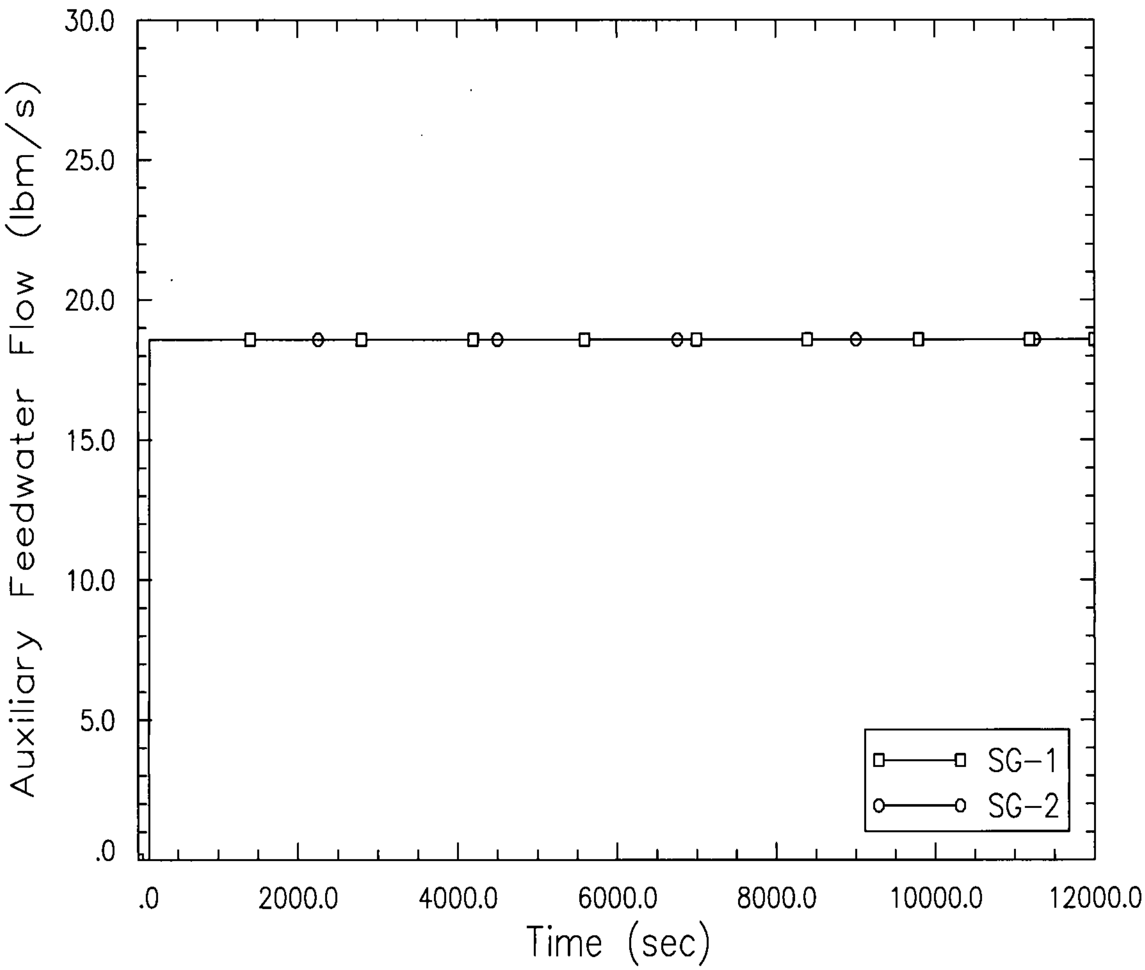
Pressurizer Pressure, LNFF Analysis without Off-Site Power Available and Steam Dump Systems Disabled



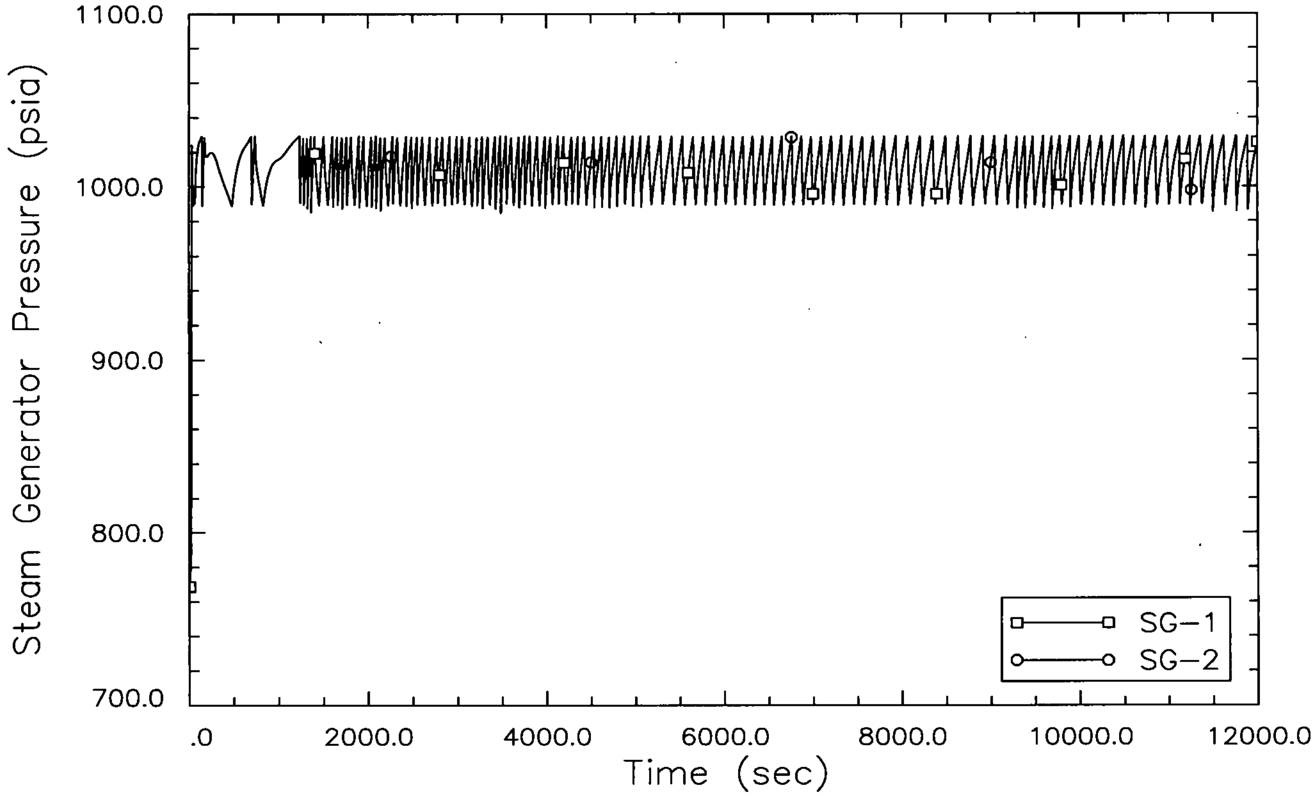
Pressurizer Level, LNFF Analysis without Off-Site Power Available and Steam Dump Systems Disabled



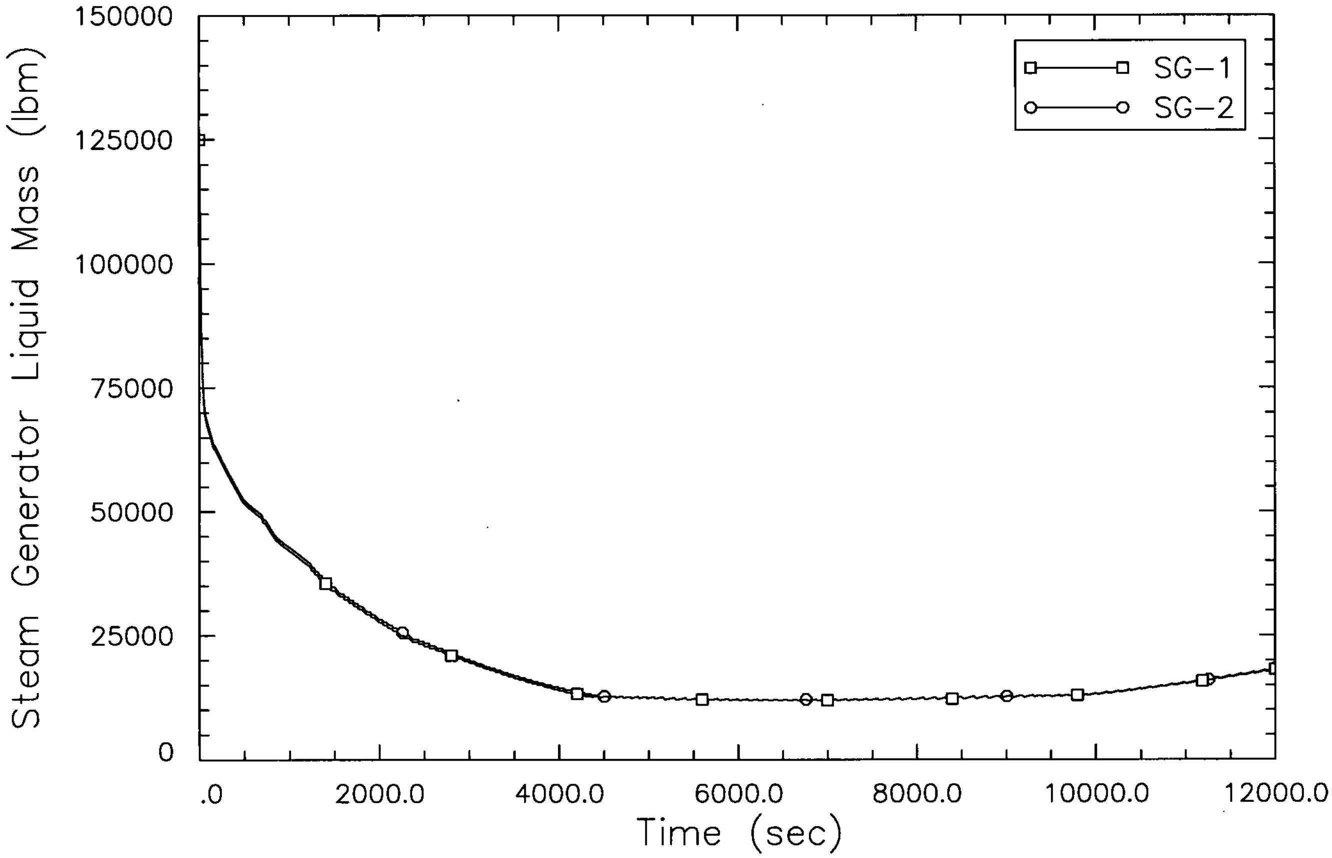
SG Auxiliary Feedwater Flow, LNFF Analysis without Off-Site Power Available and Steam Dump Systems Disabled



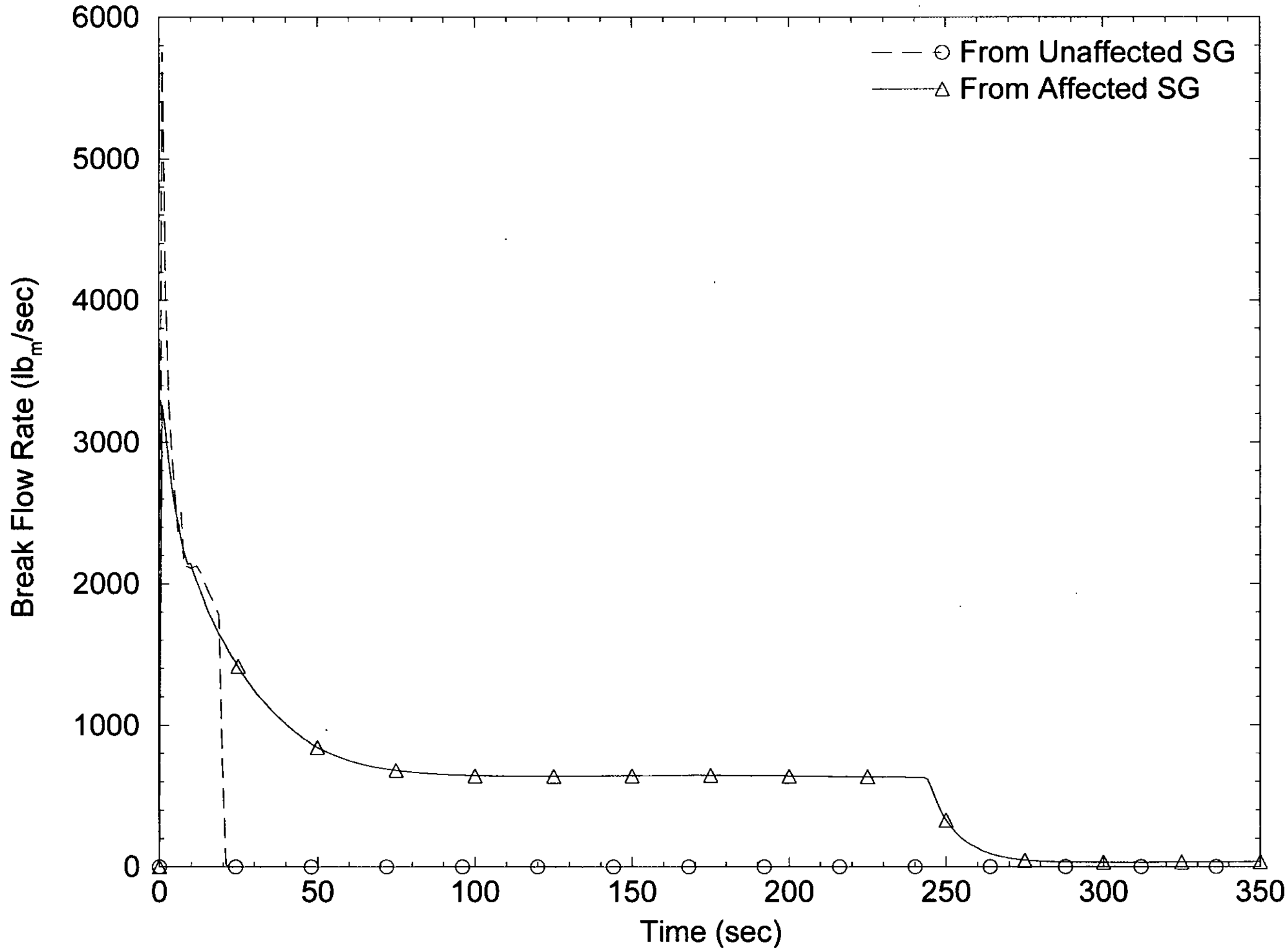
SG Dome Pressure, LNFF Analysis without Off-Site Power Available and Steam Dump Systems Disabled



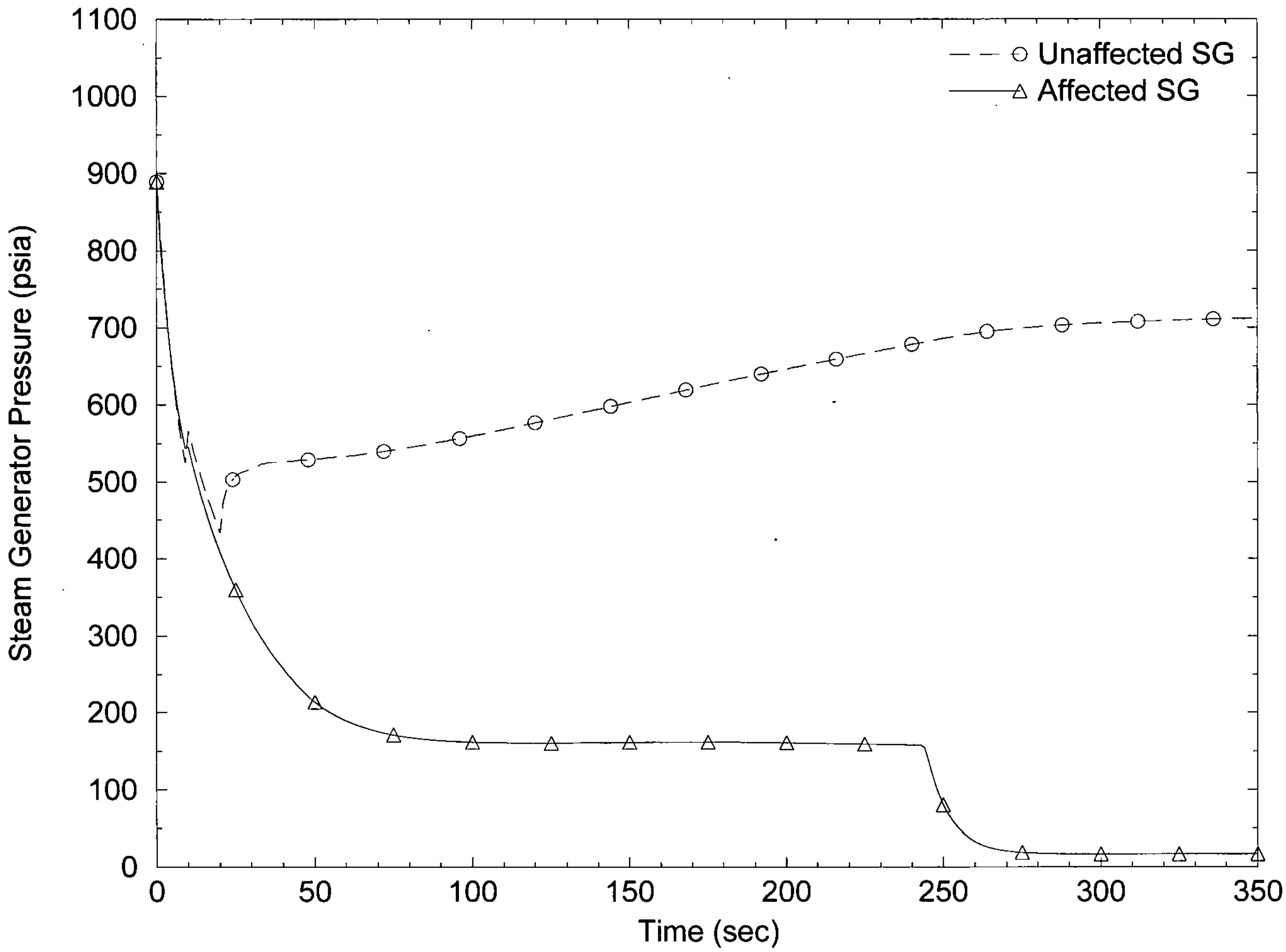
SG Liquid Mass Inventory, LNFF Analysis without Off-Site Power Available and Steam Dump Systems Disabled



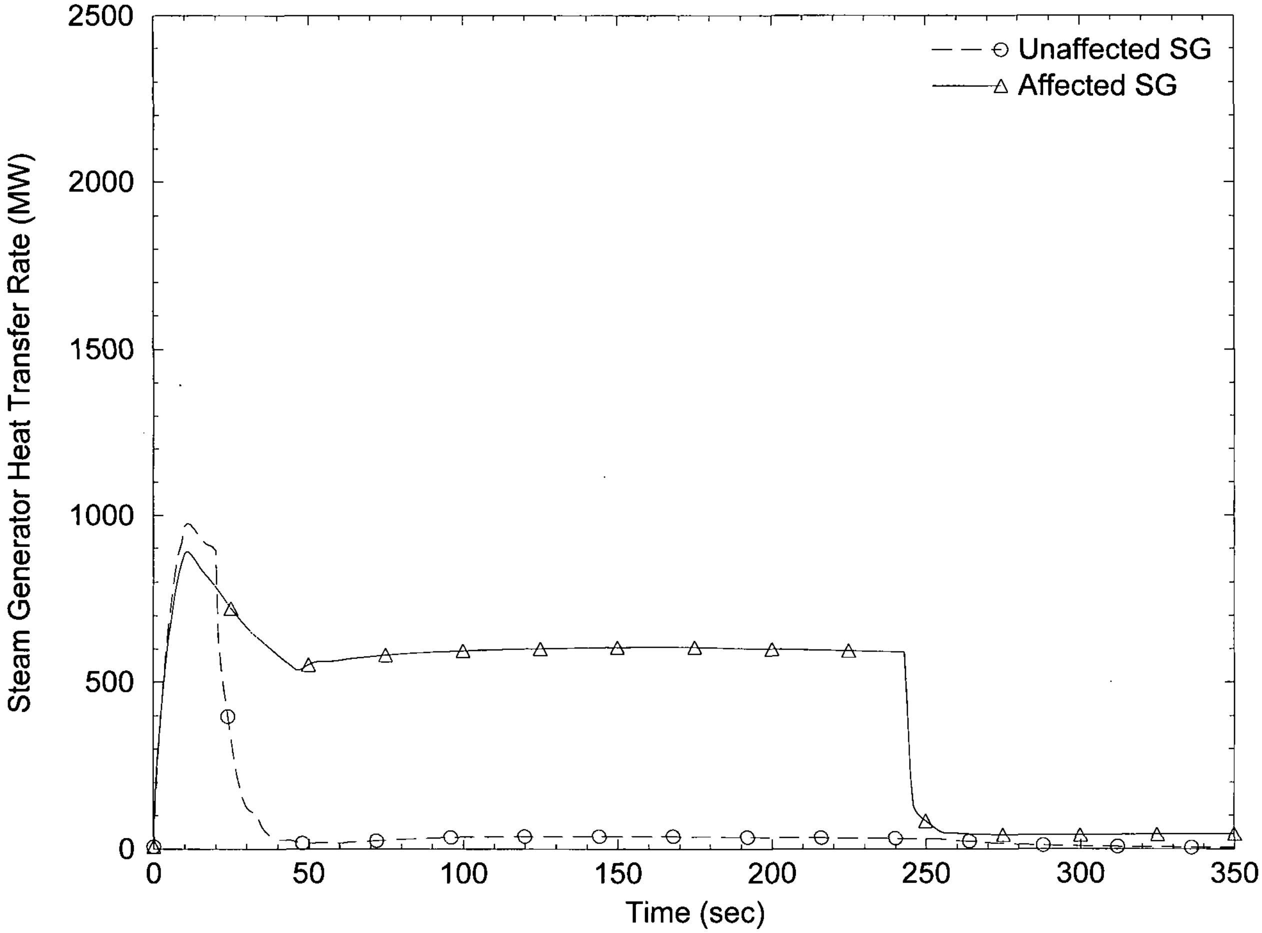
Break Flow Rates During LHR-Limiting Transient



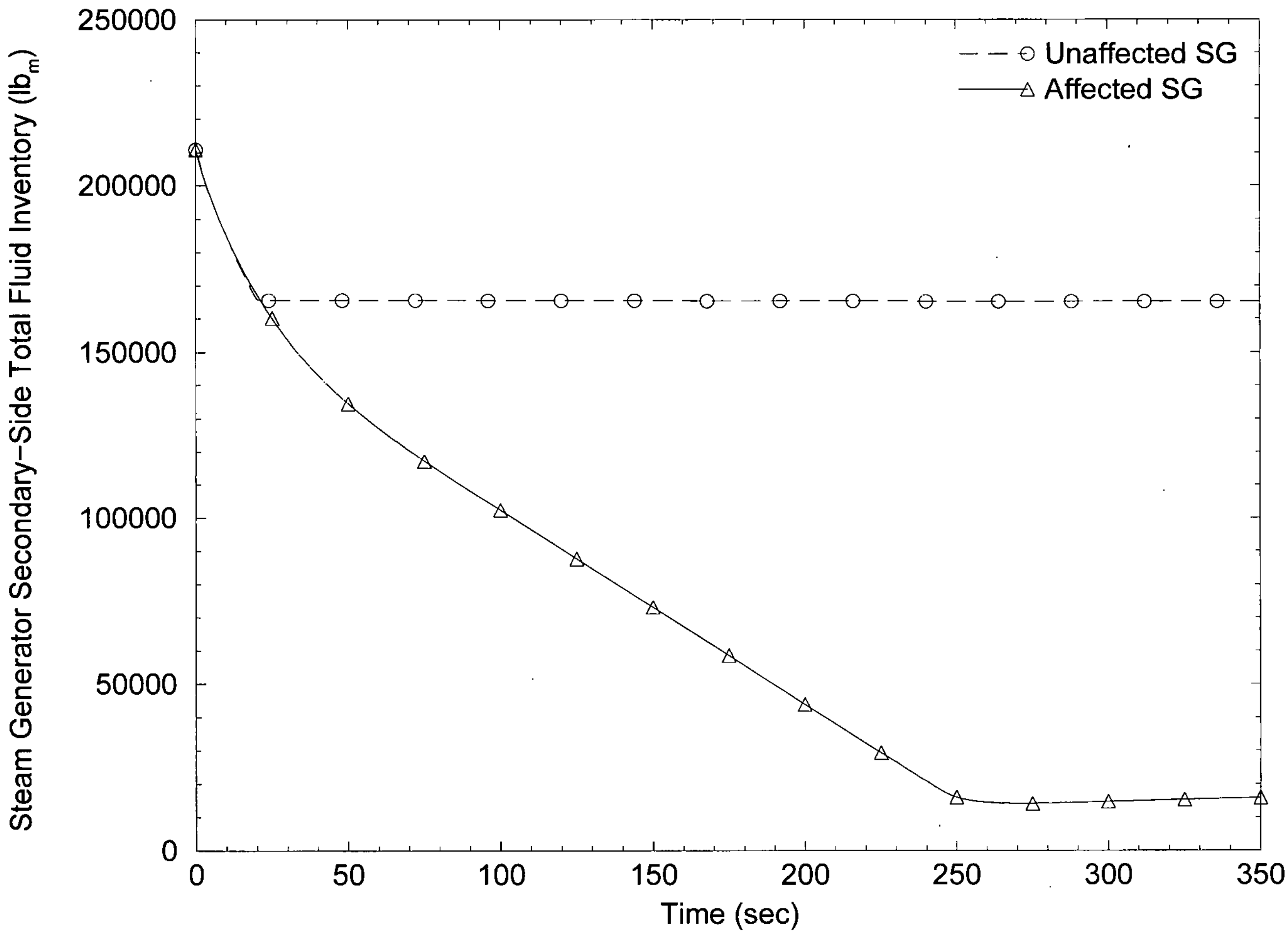
Steam Generator Pressures During LHR-Limiting Transient



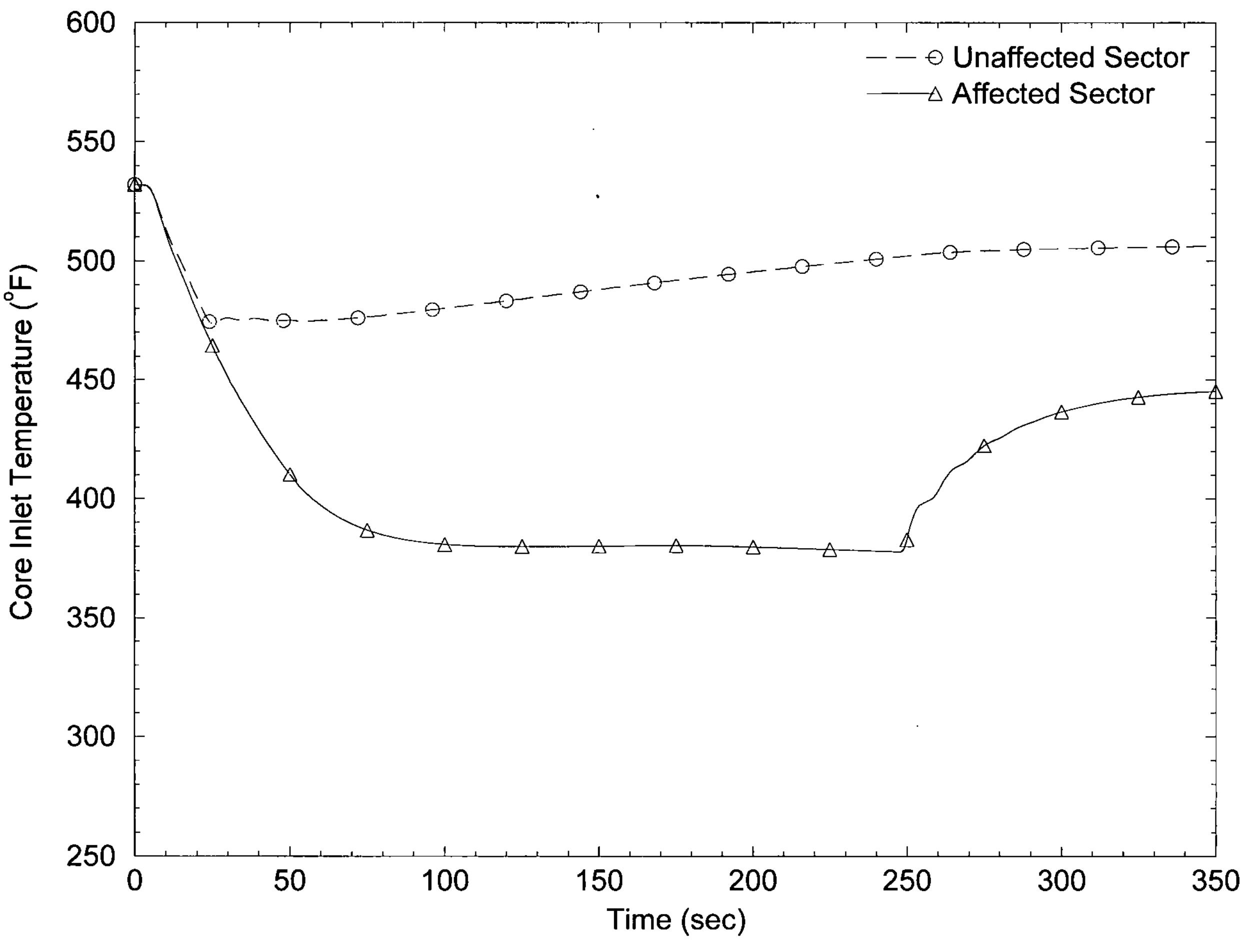
Steam Generator Heat Transfer Rates During LHR-Limiting Transient



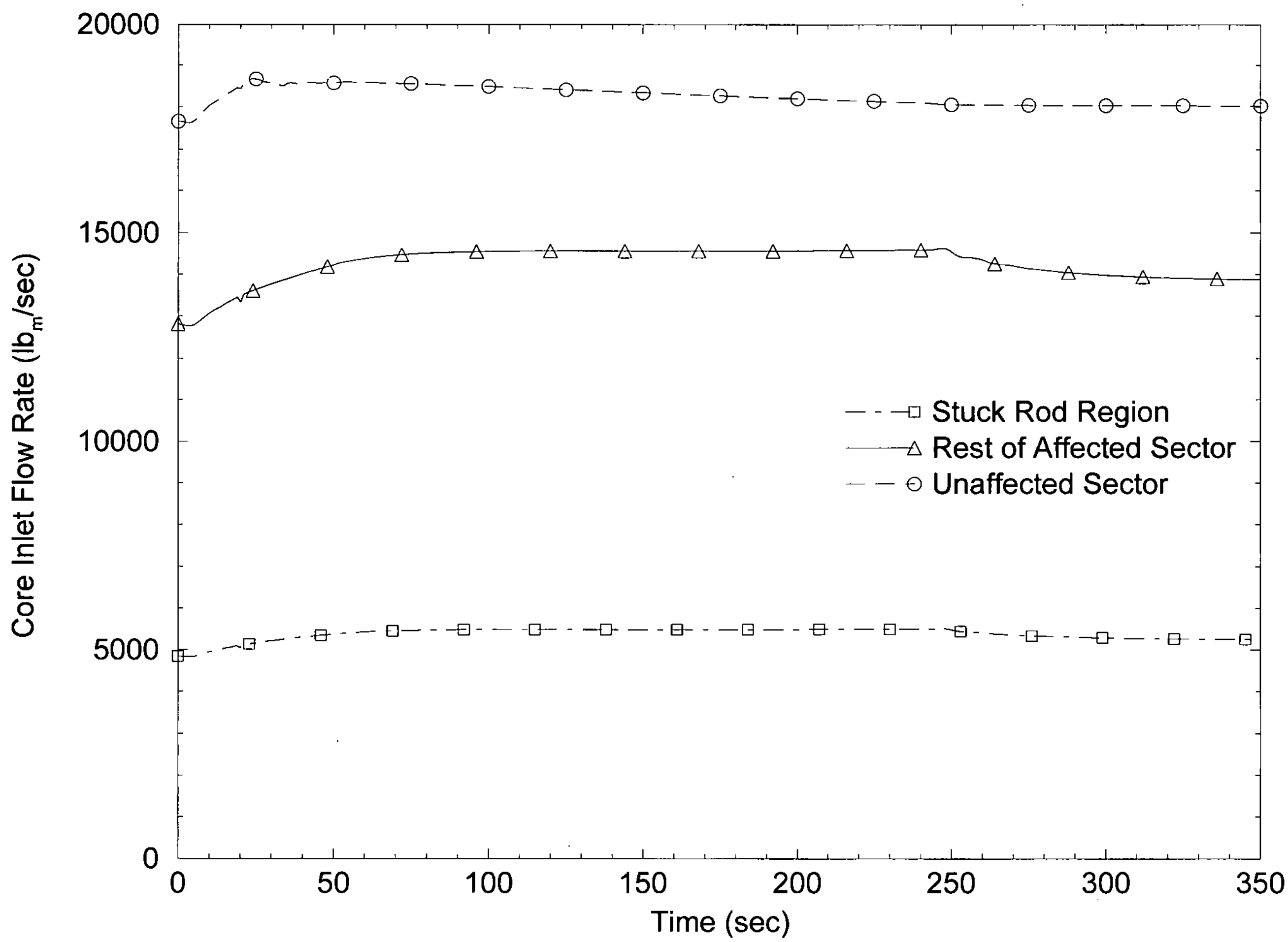
Steam Generator Secondary-Side Total Fluid Inventories During LHR-Limiting Transient



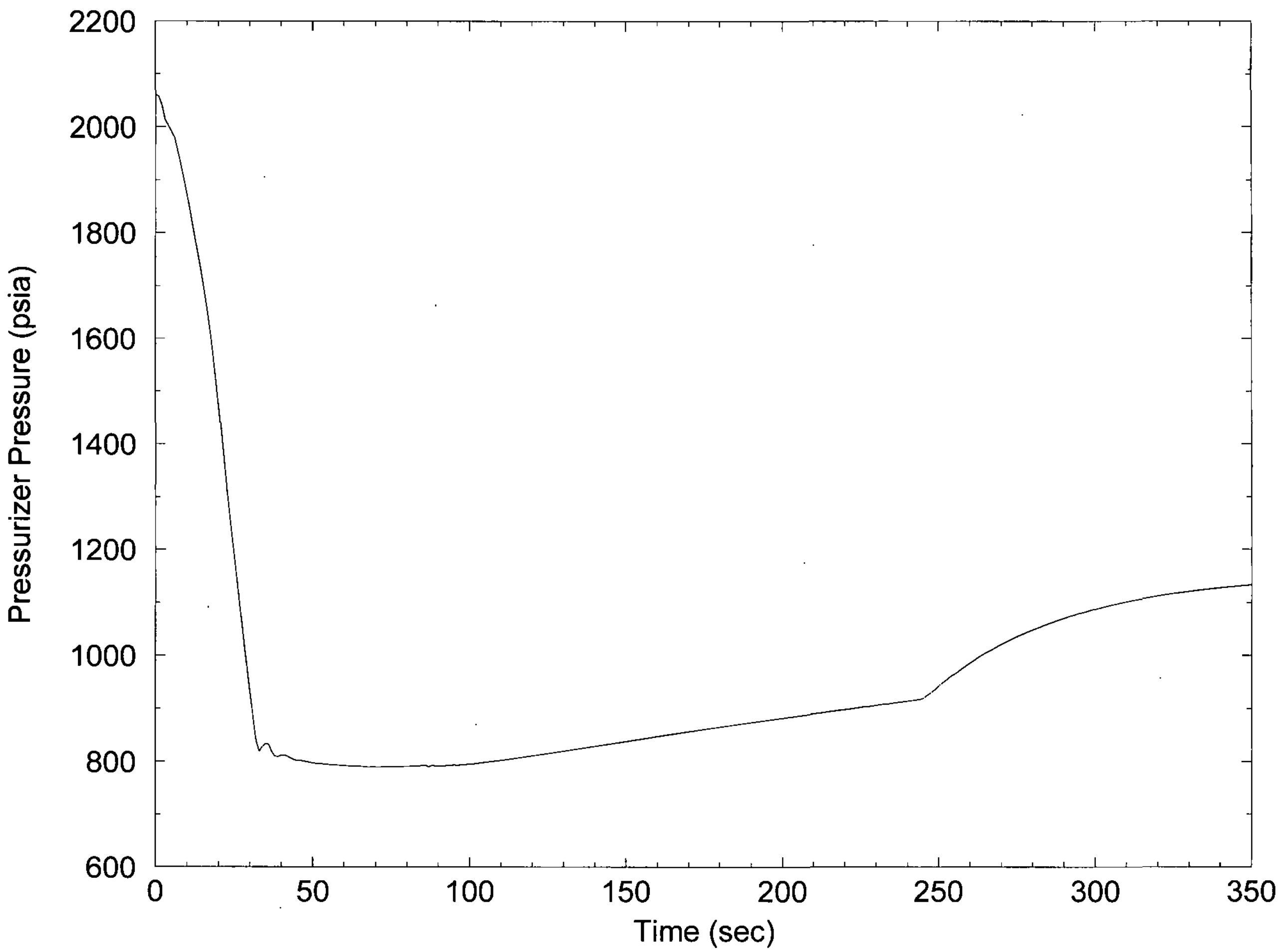
Core Inlet Temperatures During LHR-Limiting Transient



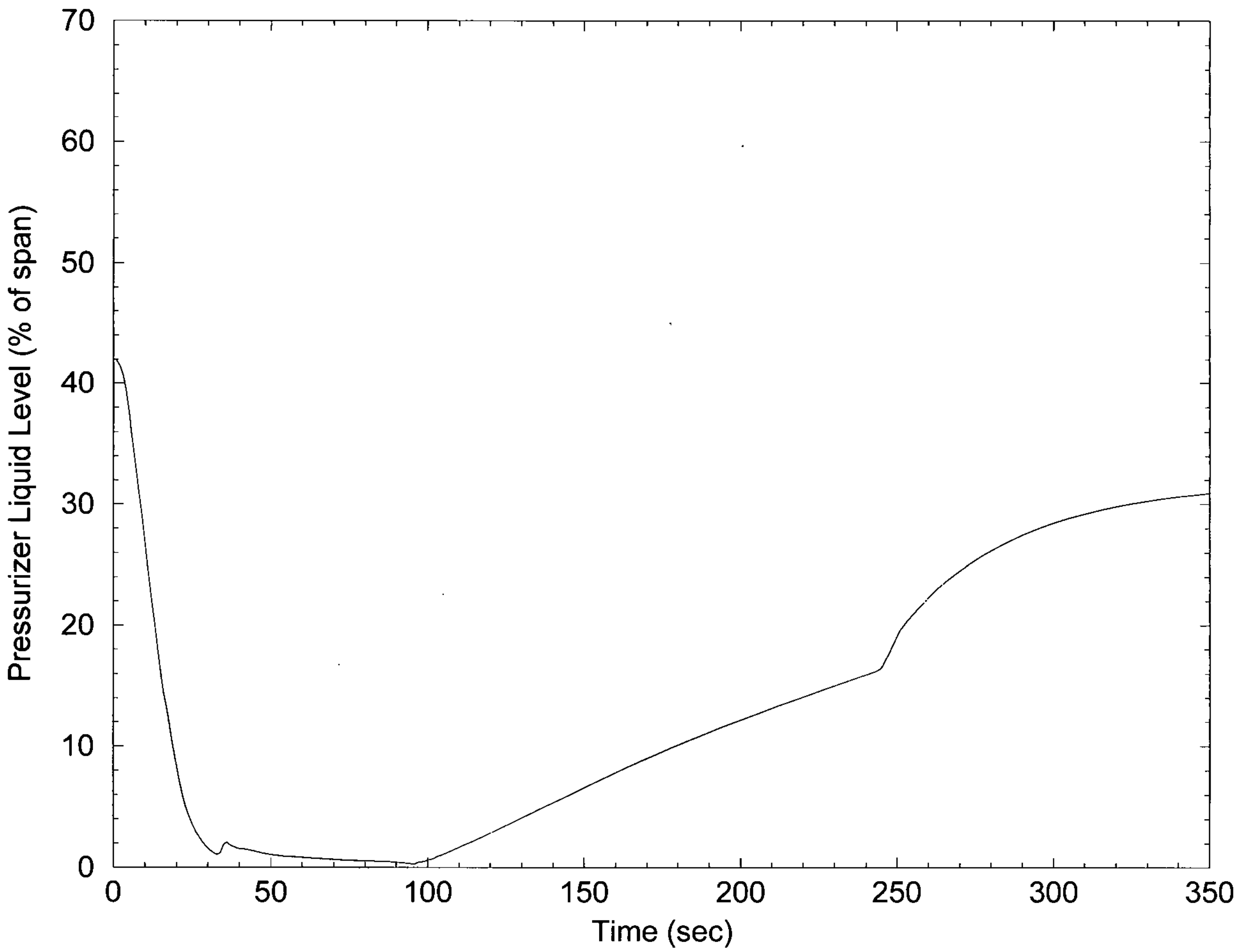
Core Inlet Flow Rates During LHR-Limiting Transient



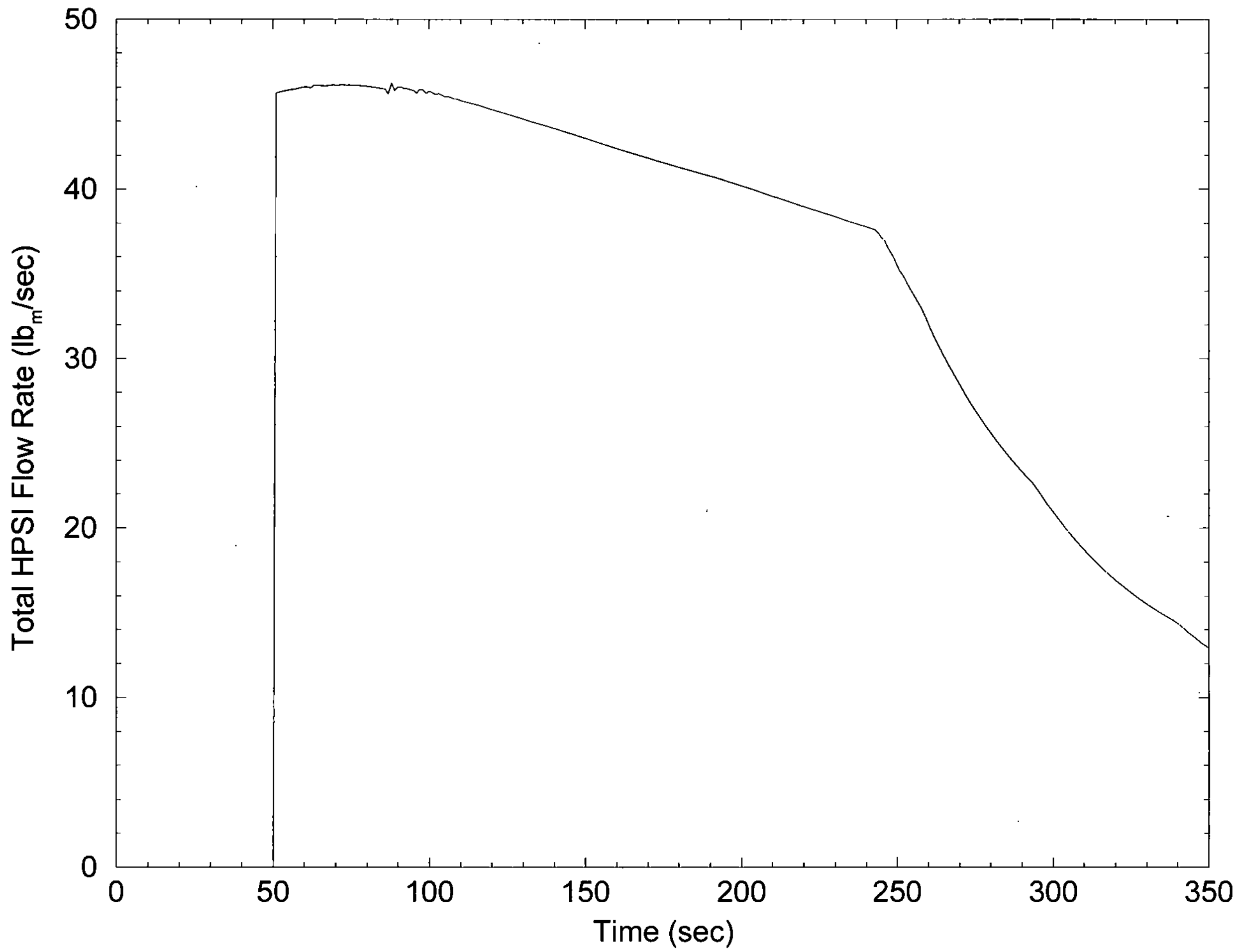
Pressurizer Pressure During LHR-Limiting Transient



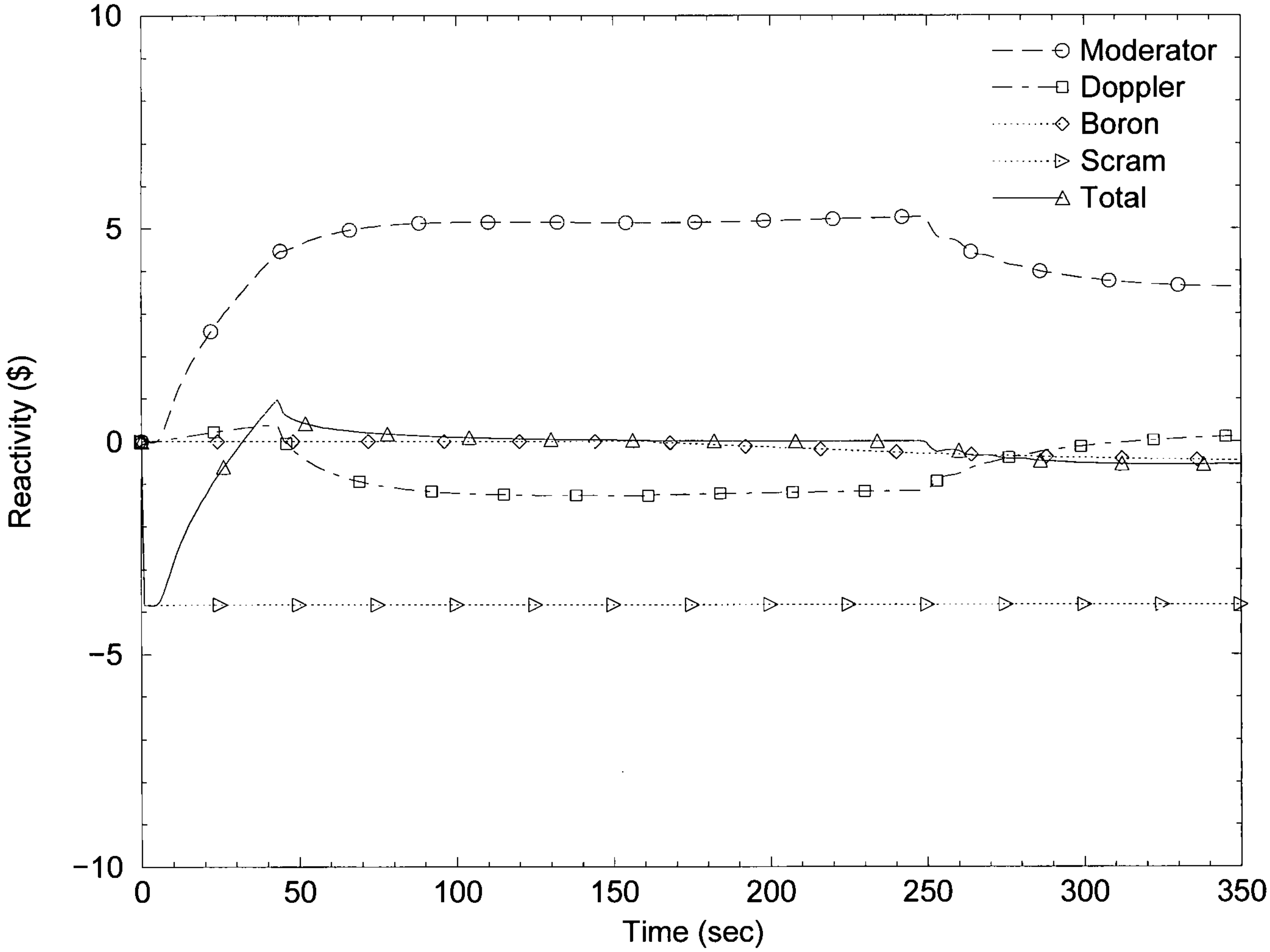
Pressurizer Liquid Level During LHR-Limiting Transient



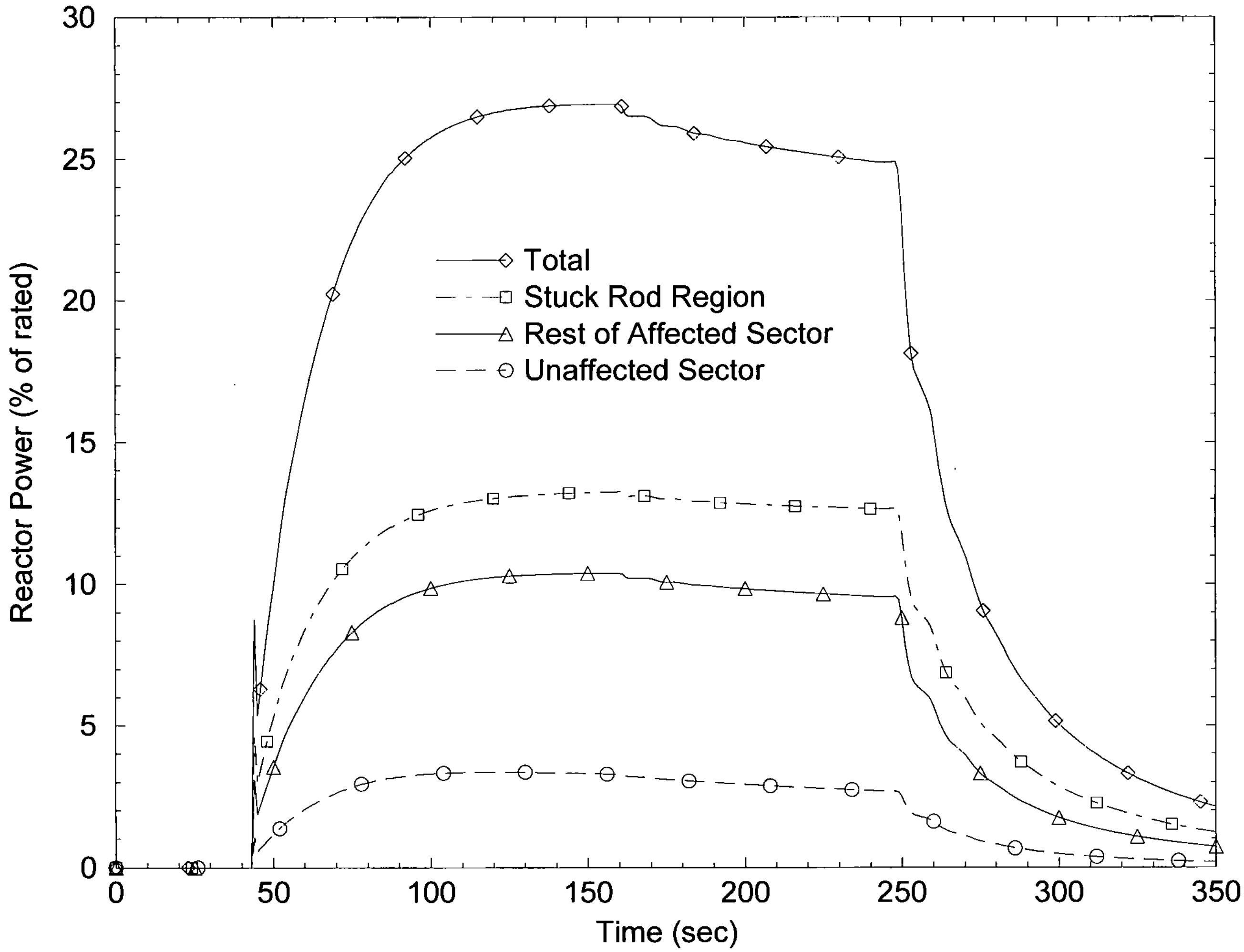
Total HPSI Flow Rate During LHR-Limiting Transient



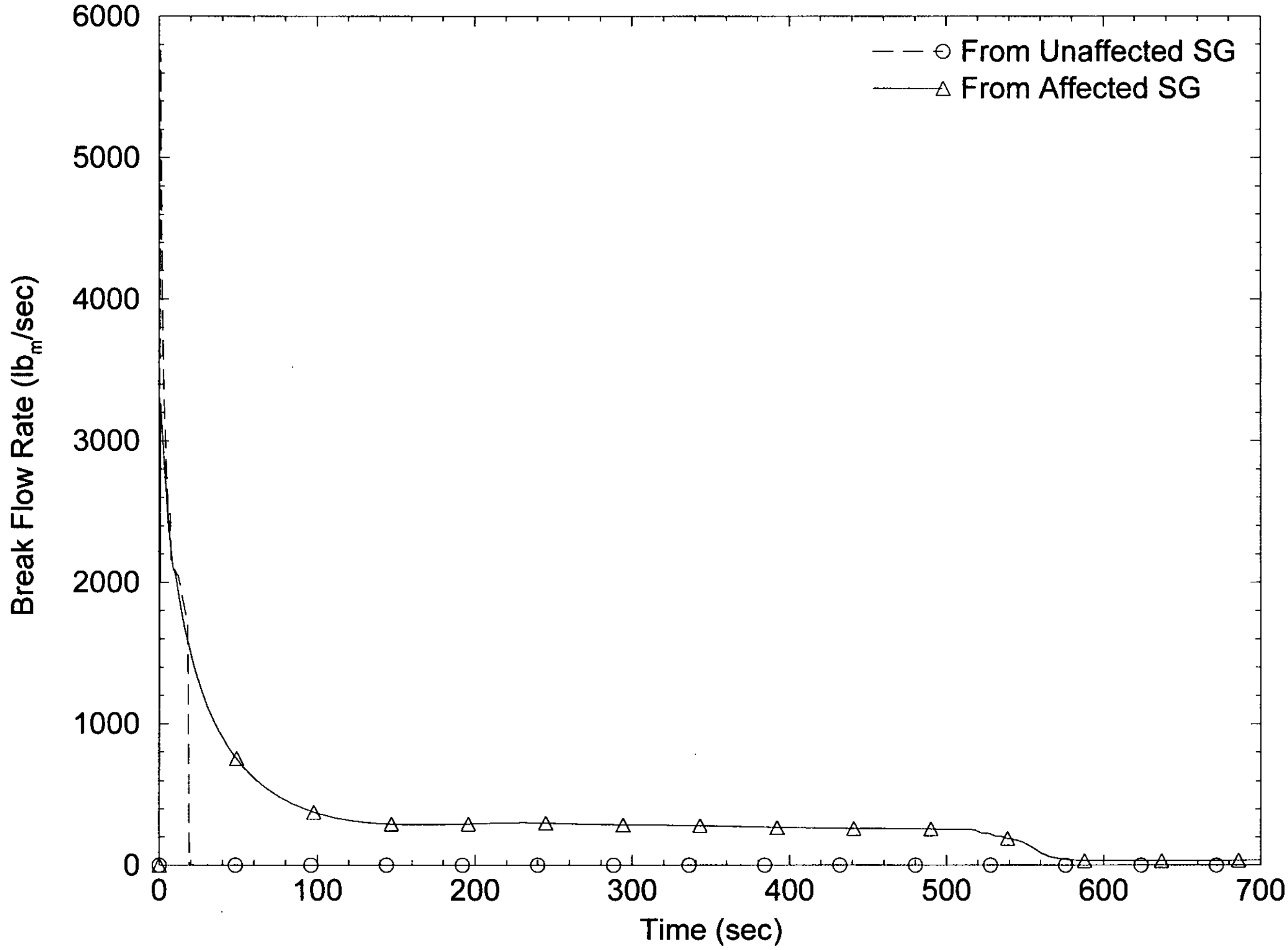
Reactivity During LHR-Limiting Transient



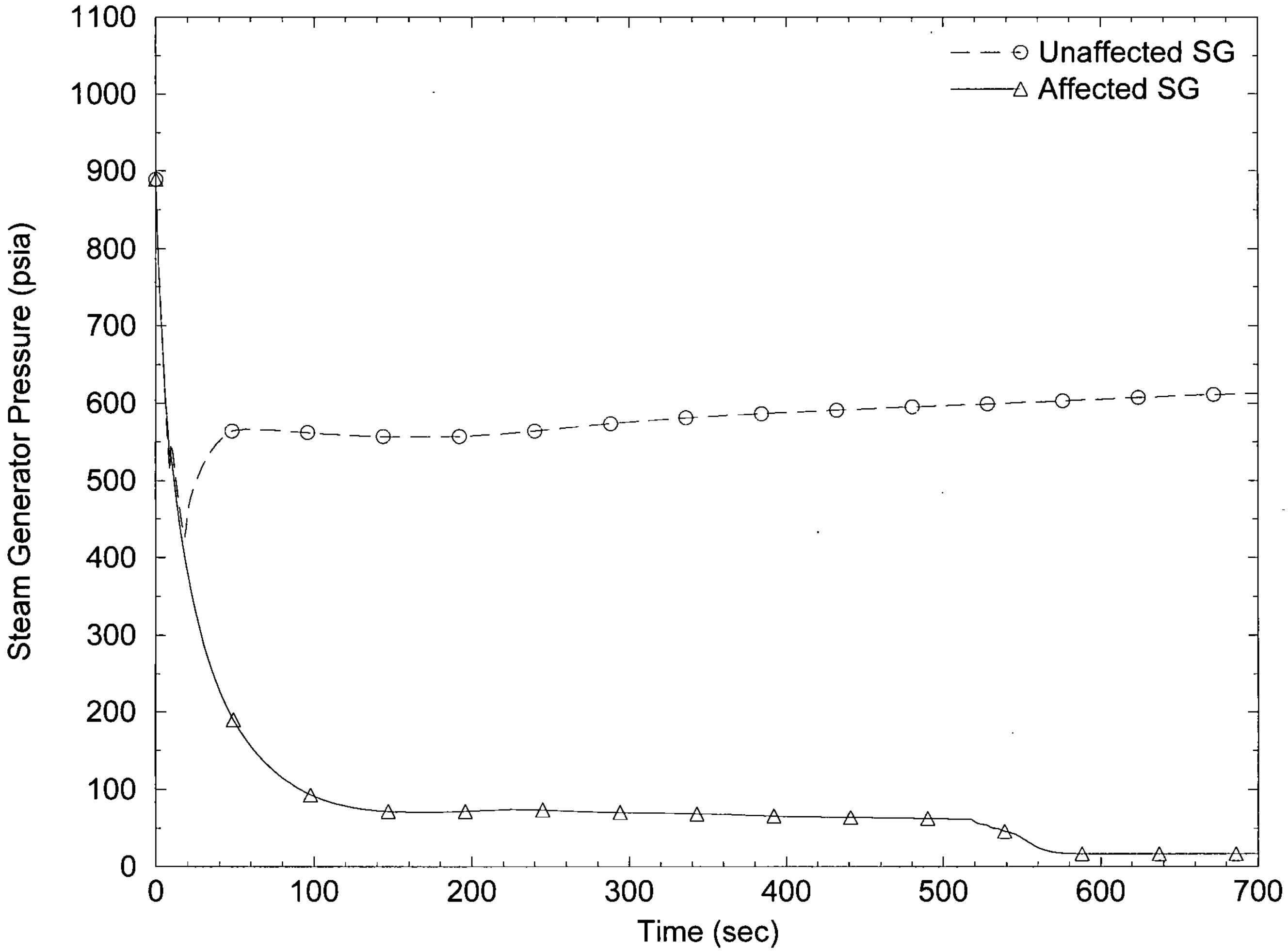
Reactor Power During LHR-Limiting Transient



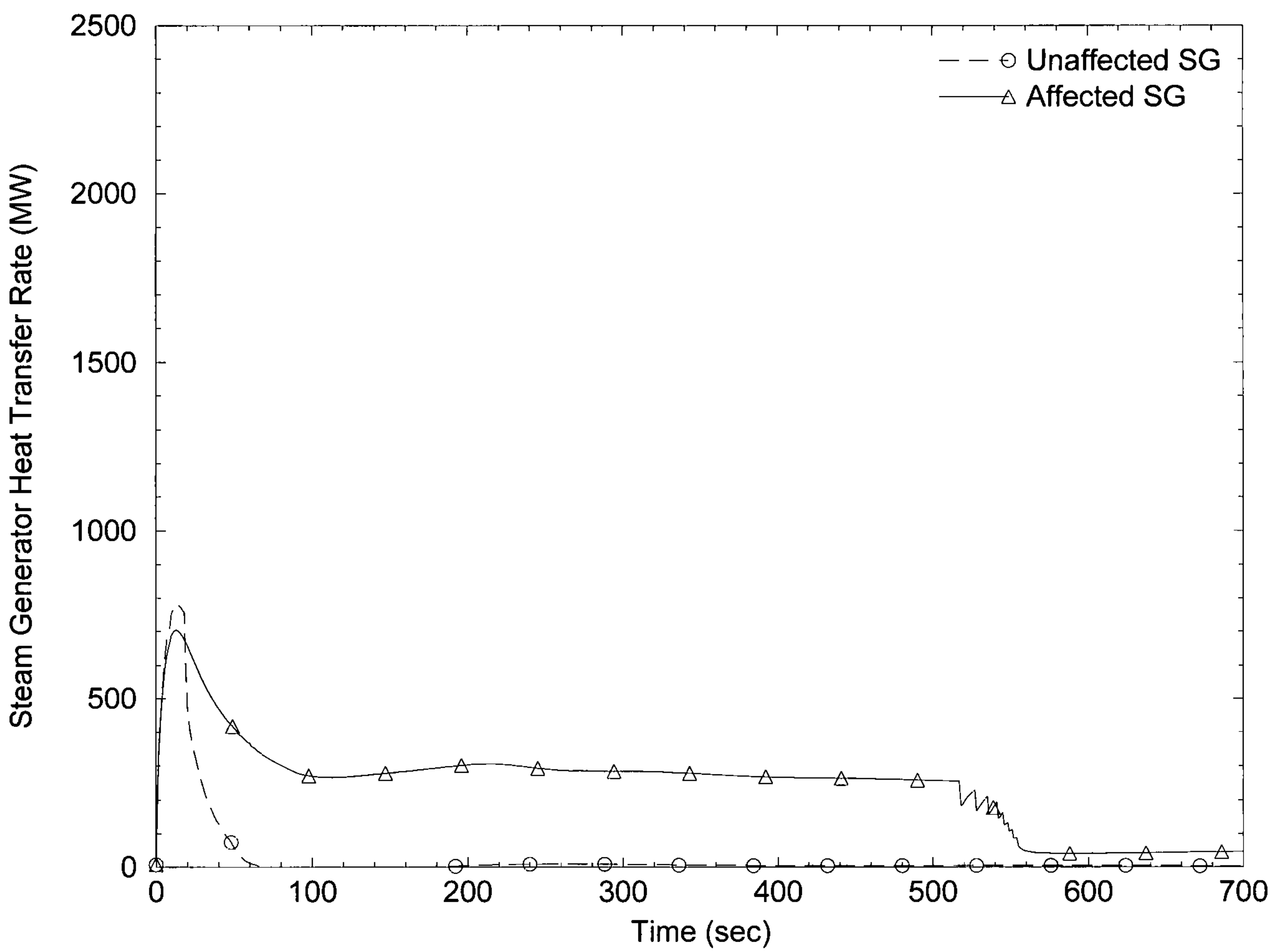
Break Flow Rates During DNBR-Limiting Transient



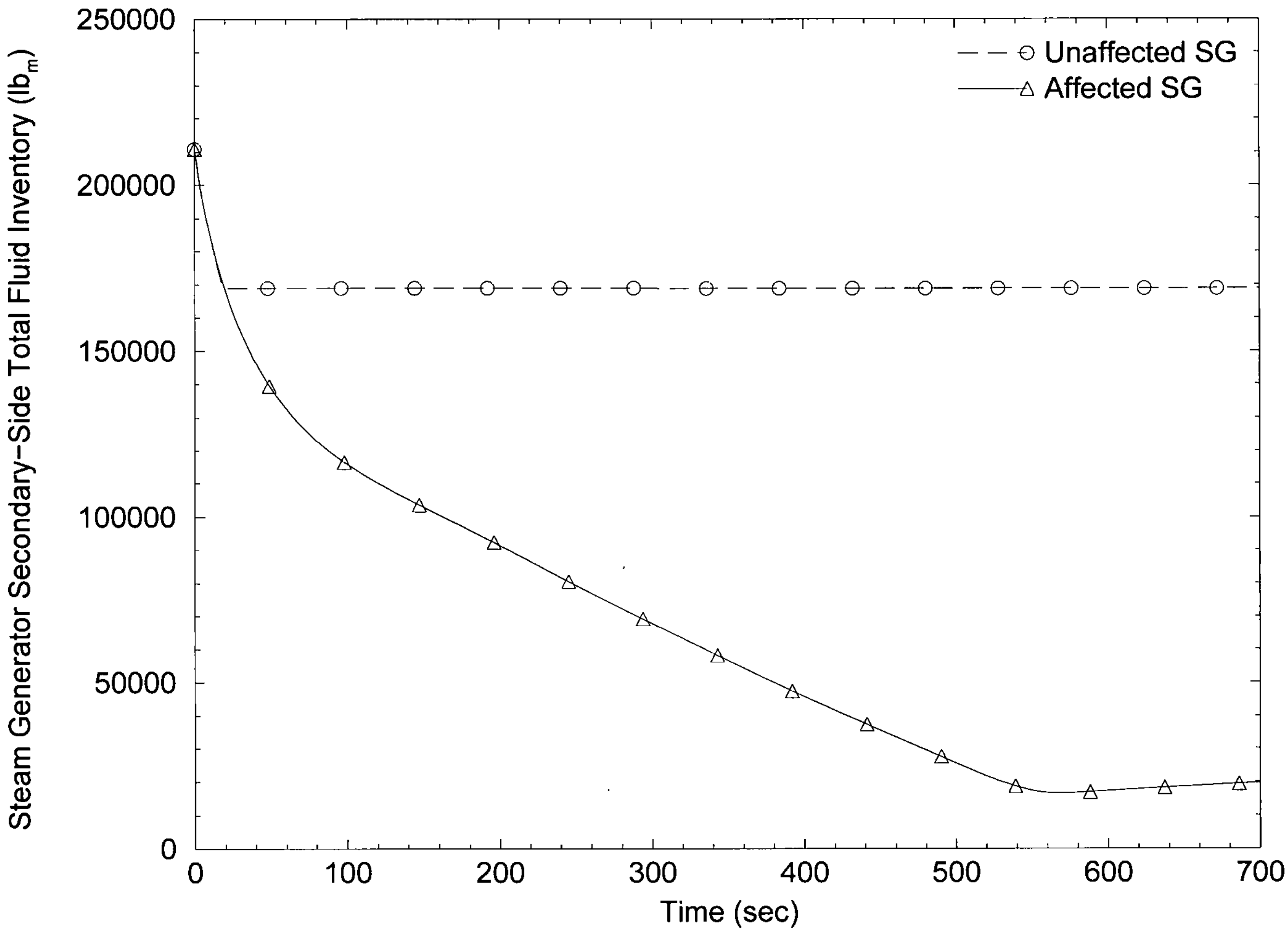
Steam Generator Pressures During DNBR-Limiting Transient



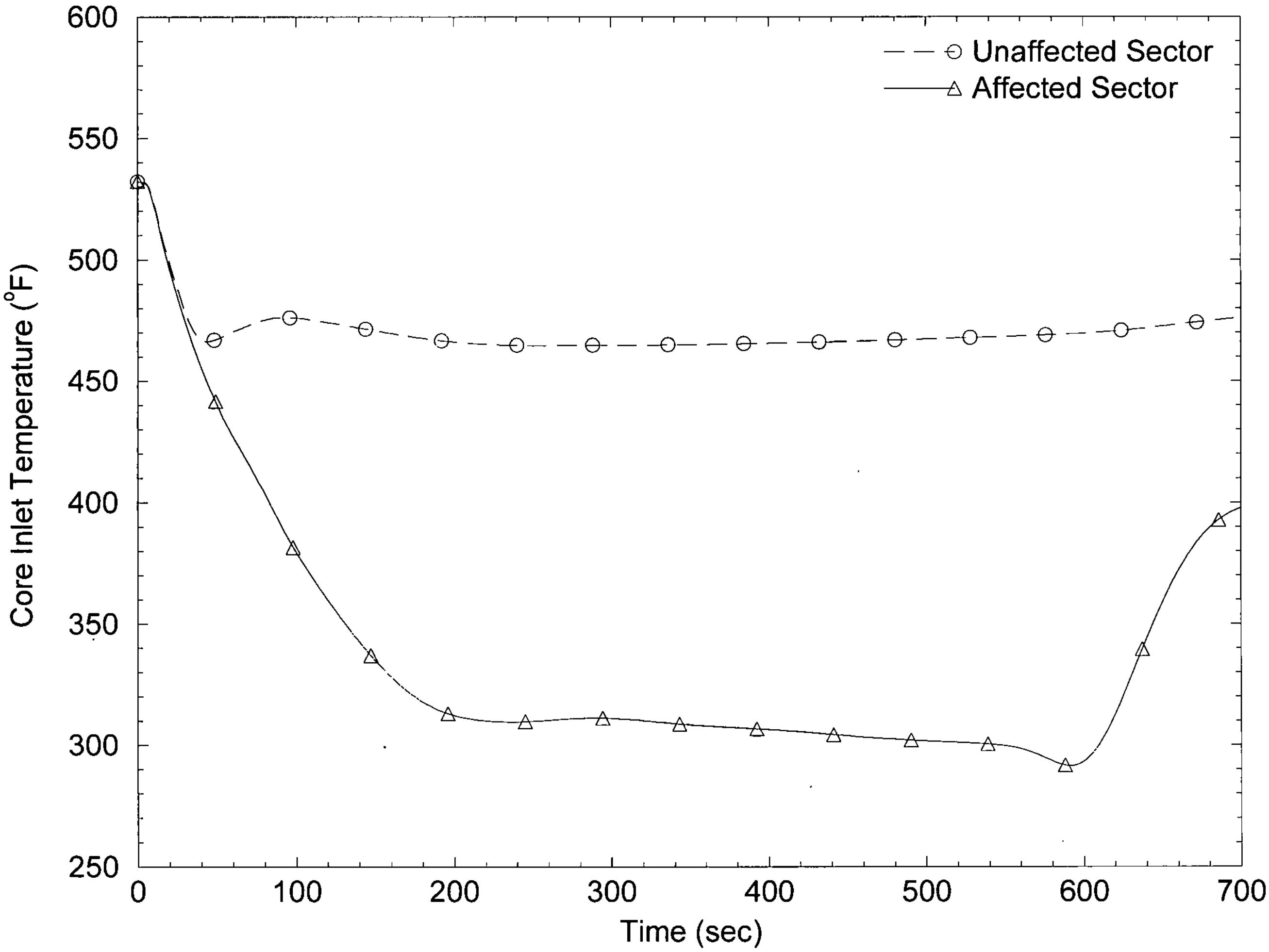
Steam Generator Heat Transfer Rates During DNBR-Limiting Transient



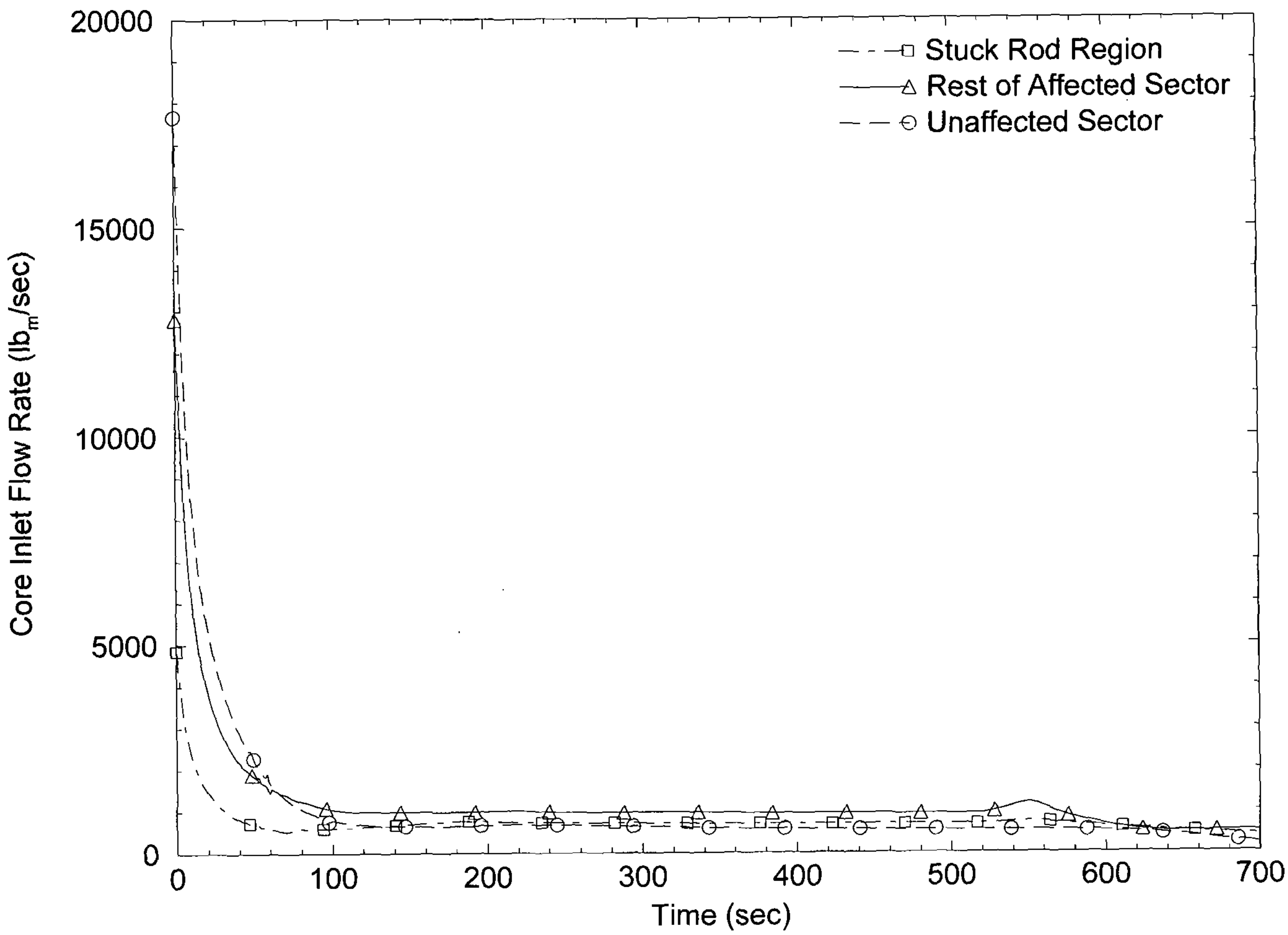
Steam Generator Secondary-Side Total Fluid Inventories During DNBR-Limiting Transient



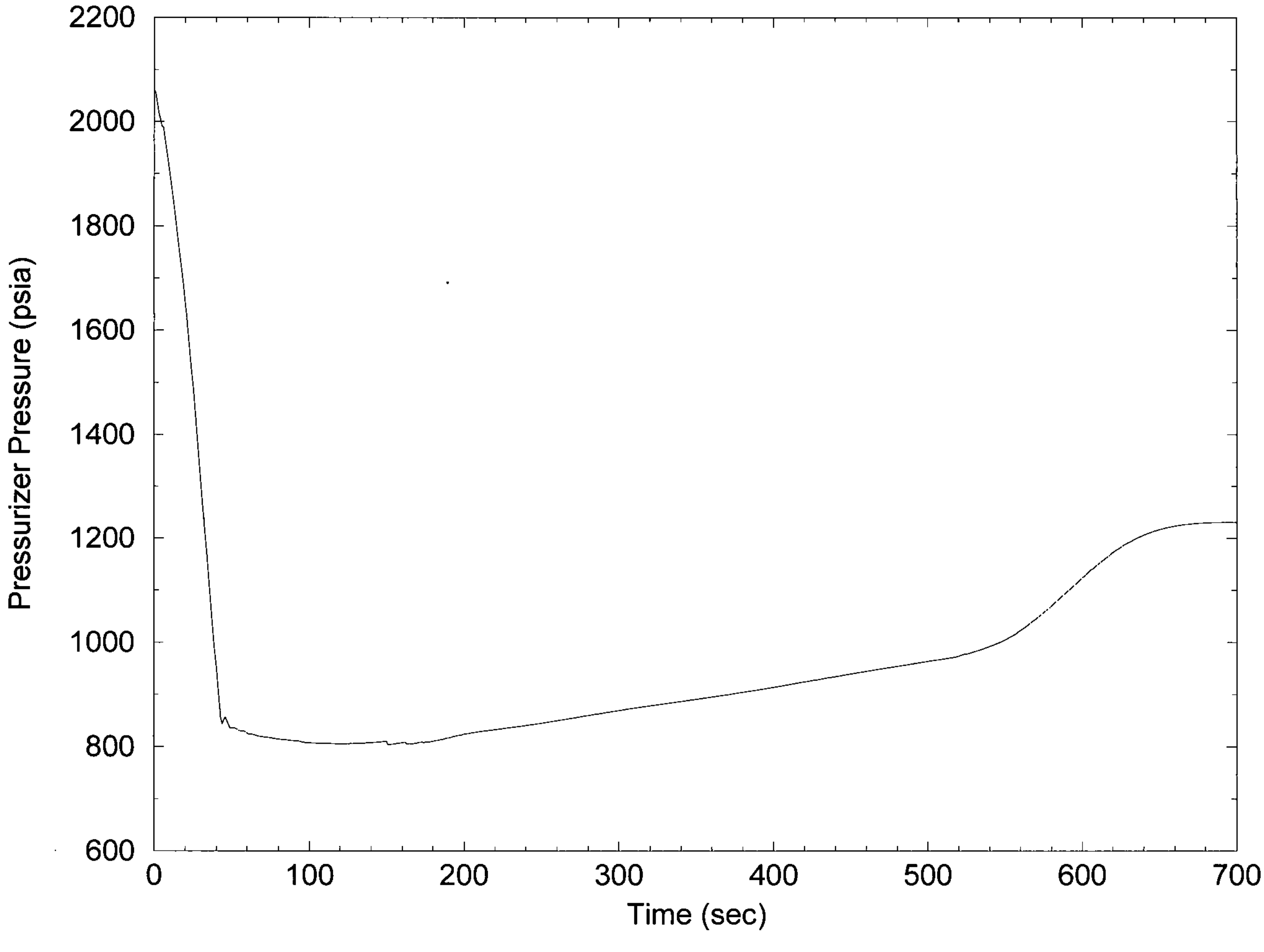
Core Inlet Temperatures During DNBR-Limiting Transient



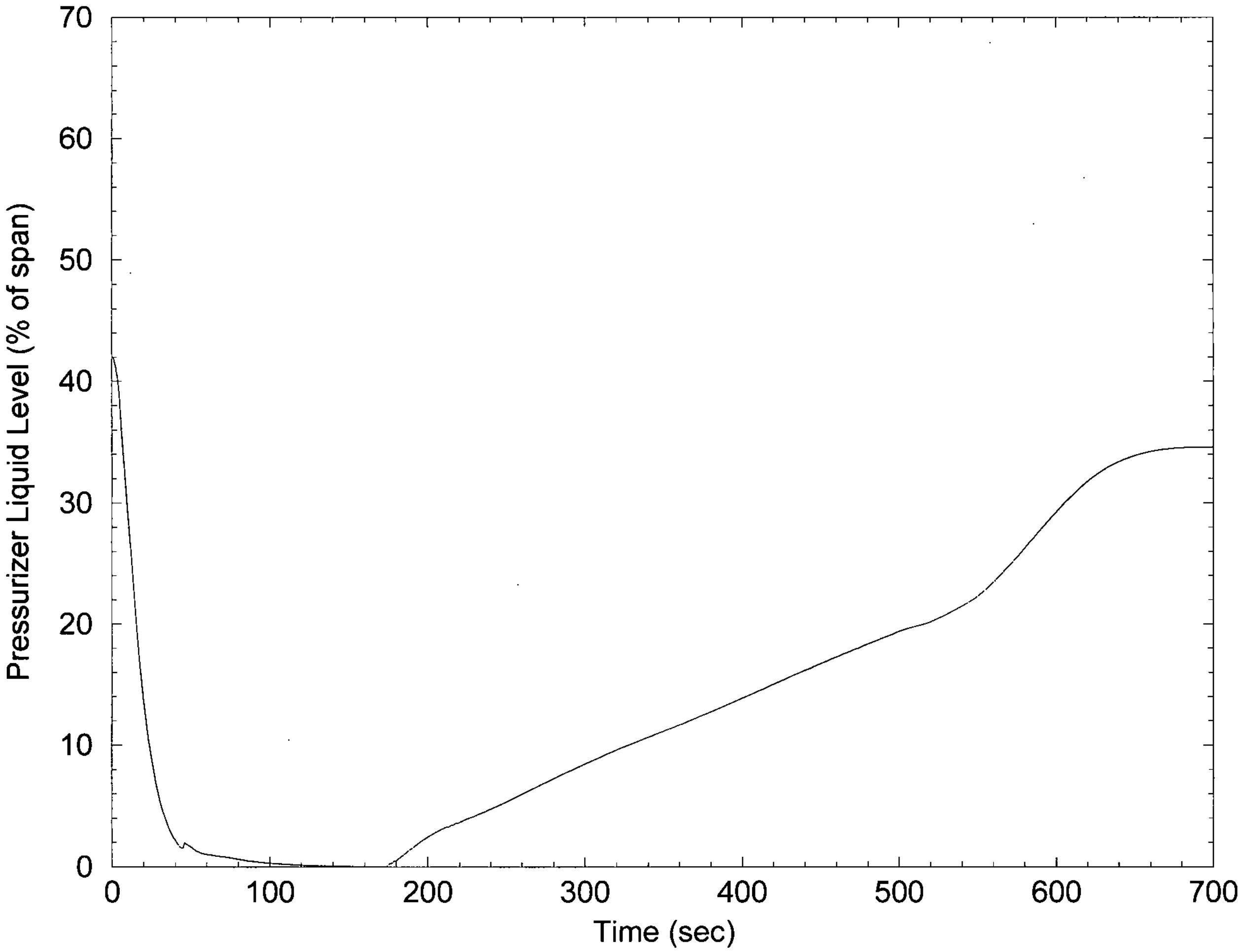
Core Inlet Flow Rates During DNBR-Limiting Transient



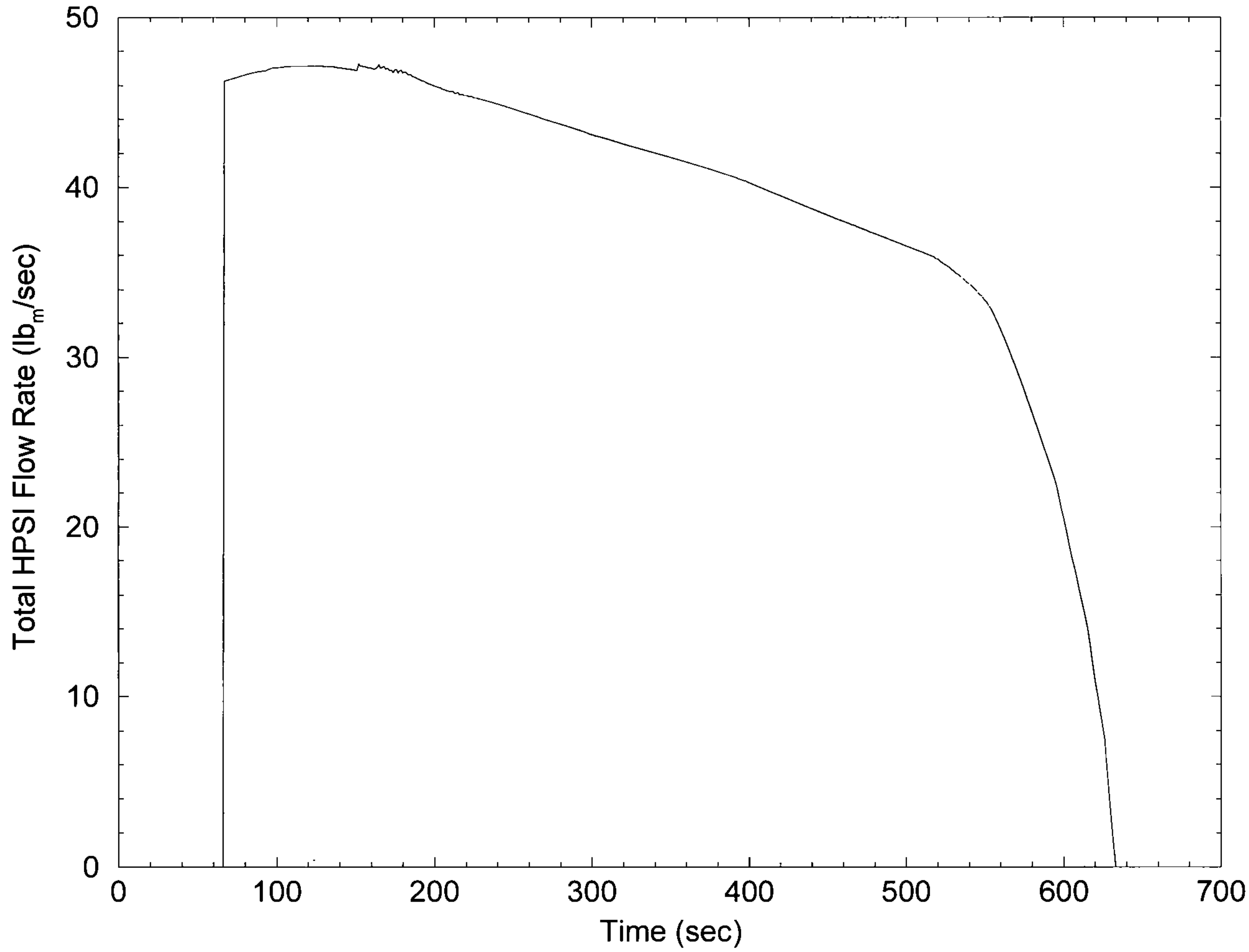
Pressurizer Pressure During DNBR-Limiting Transient



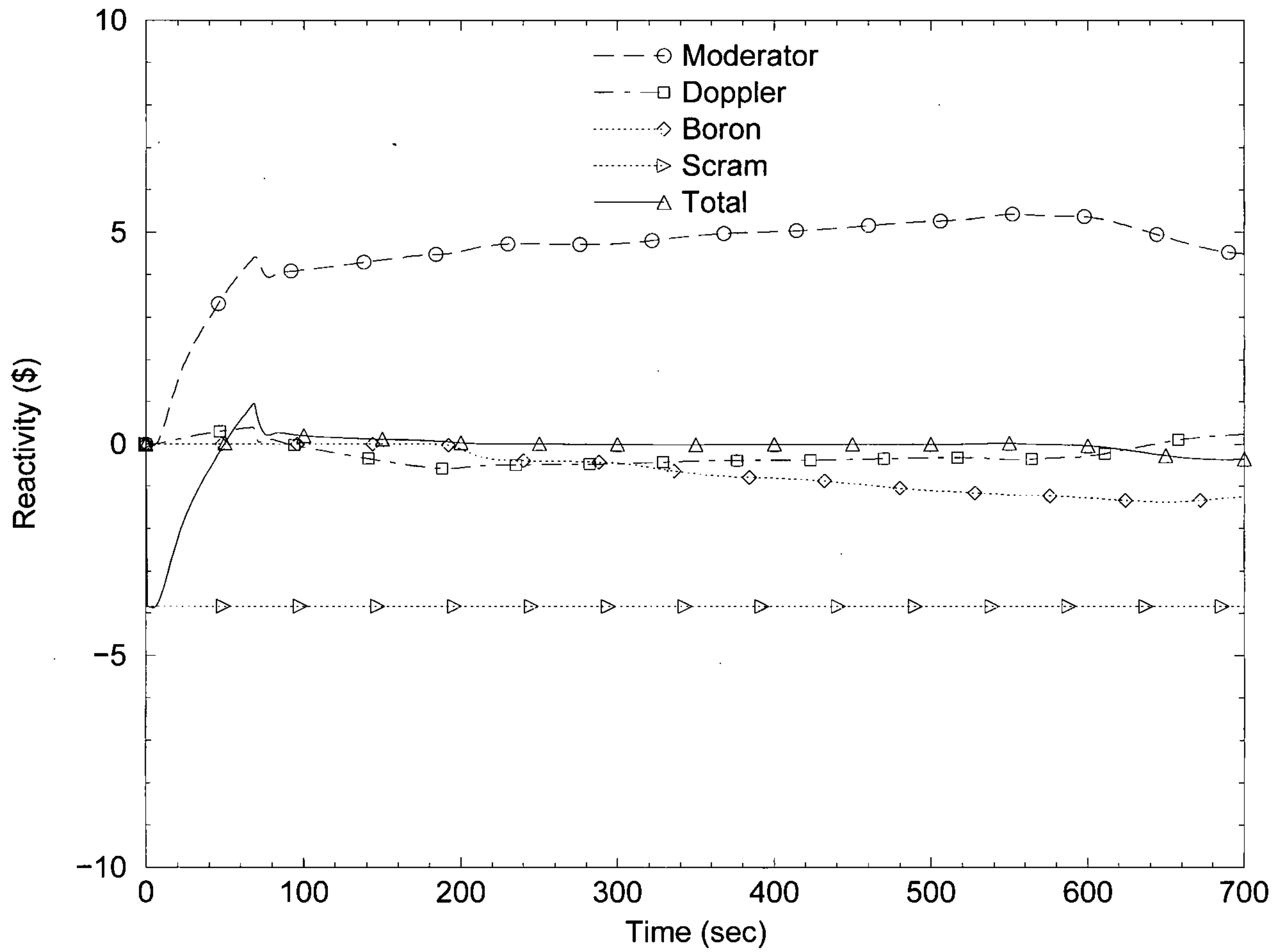
Pressurizer Liquid Level During DNBR-Limiting Transient



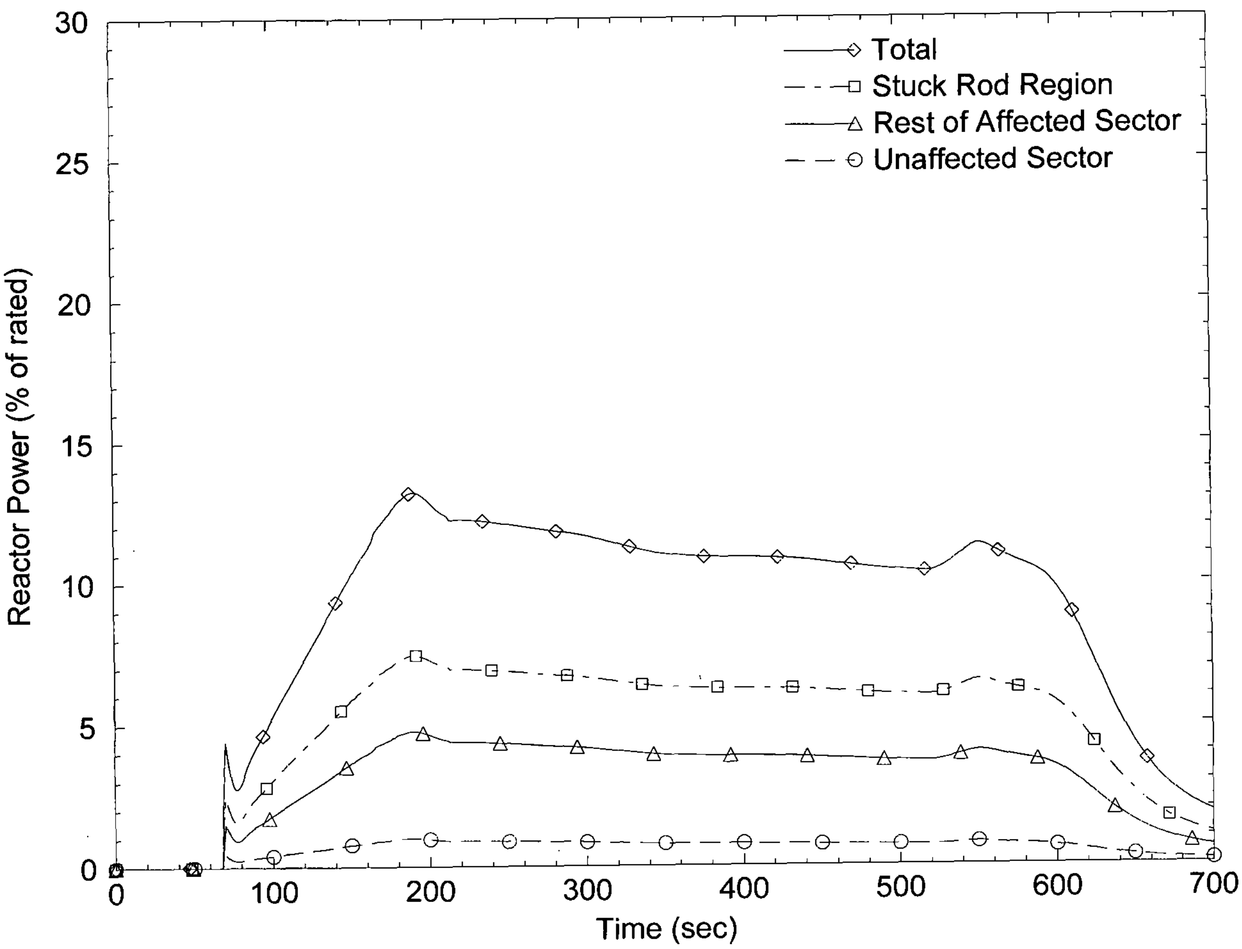
Total HPSI Flow Rate During DNBR-Limiting Transient



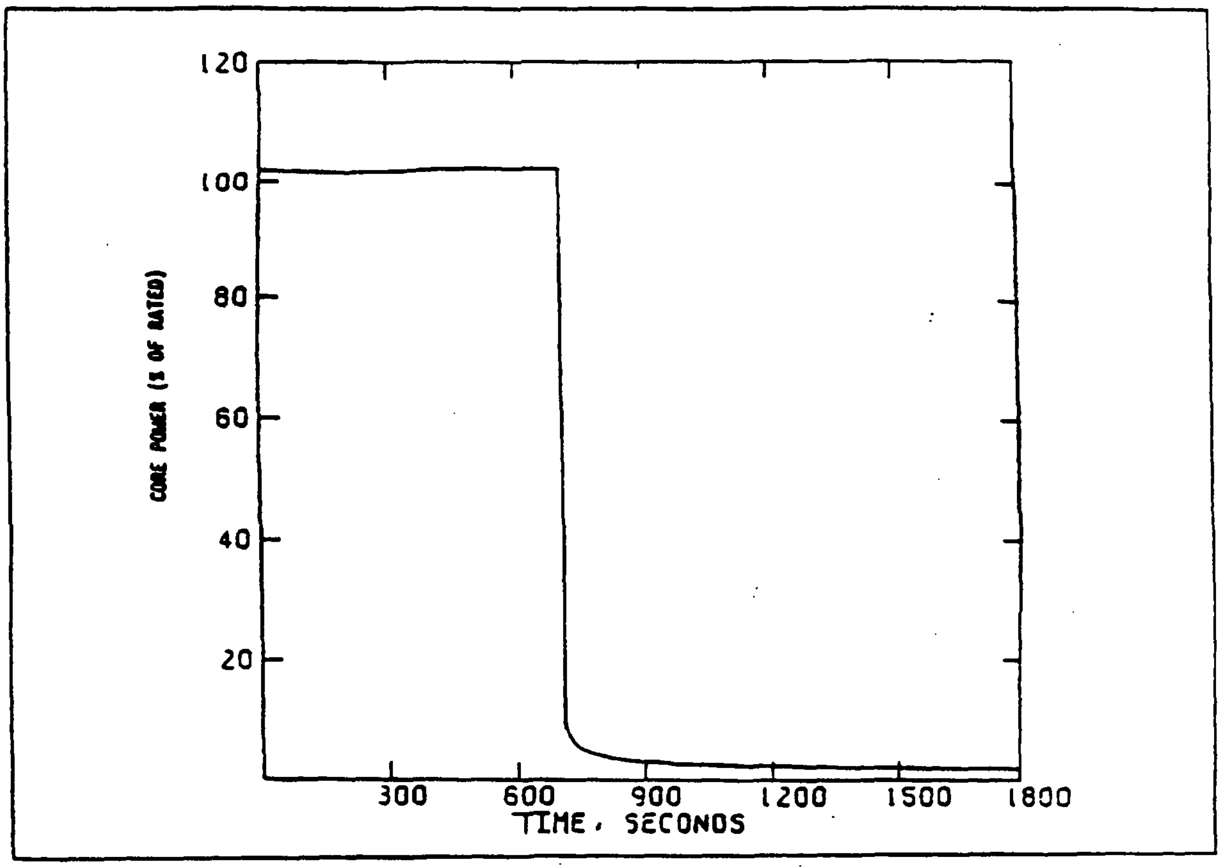
Reactivity During DNBR-Limiting Transient



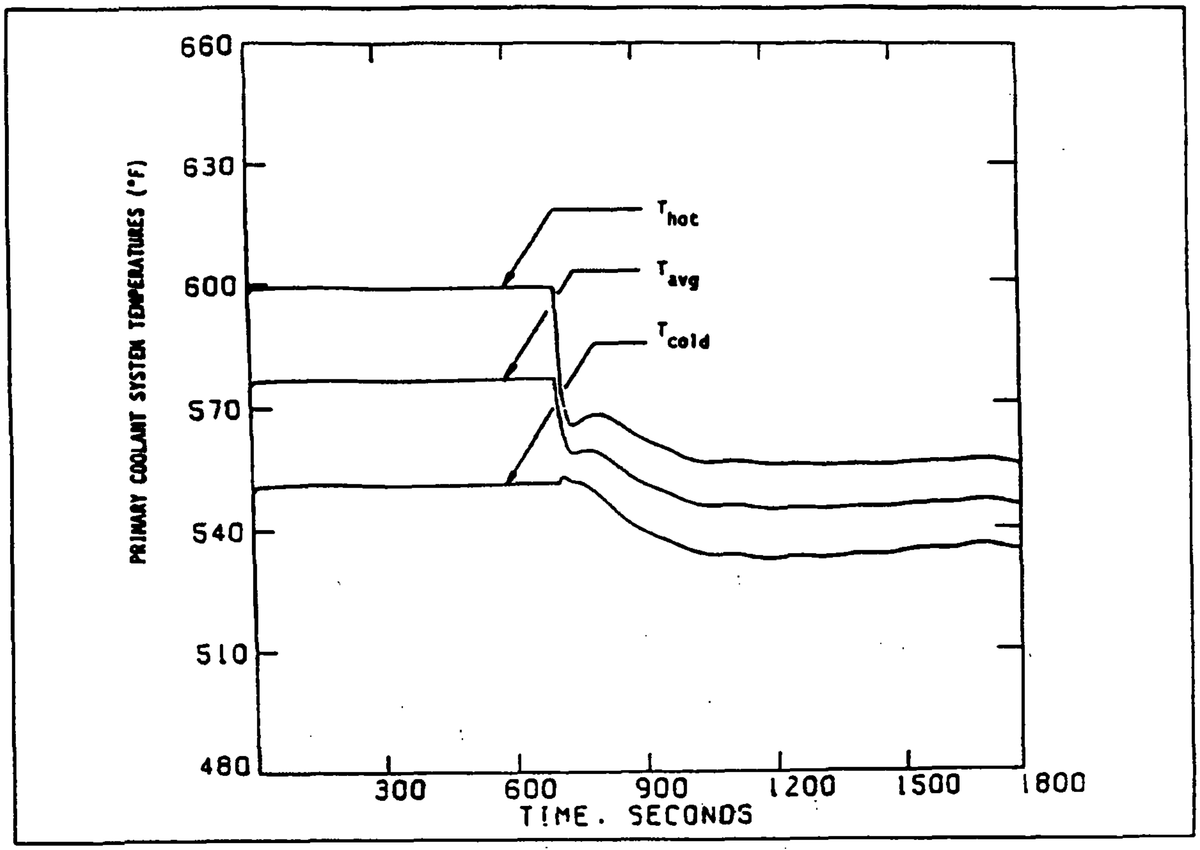
Reactor Power During DNBR-Limiting Transient



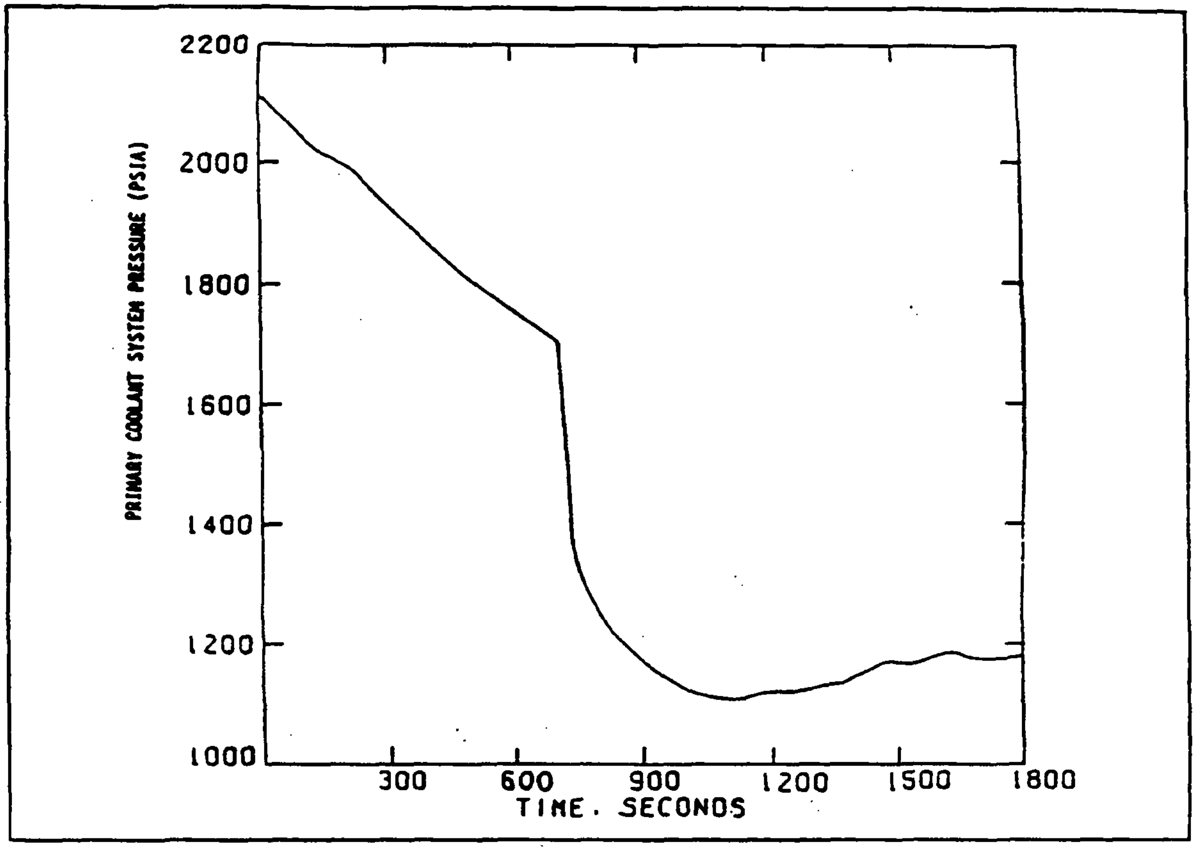
SGTR WITH LOAC: CORE POWER vs TIME



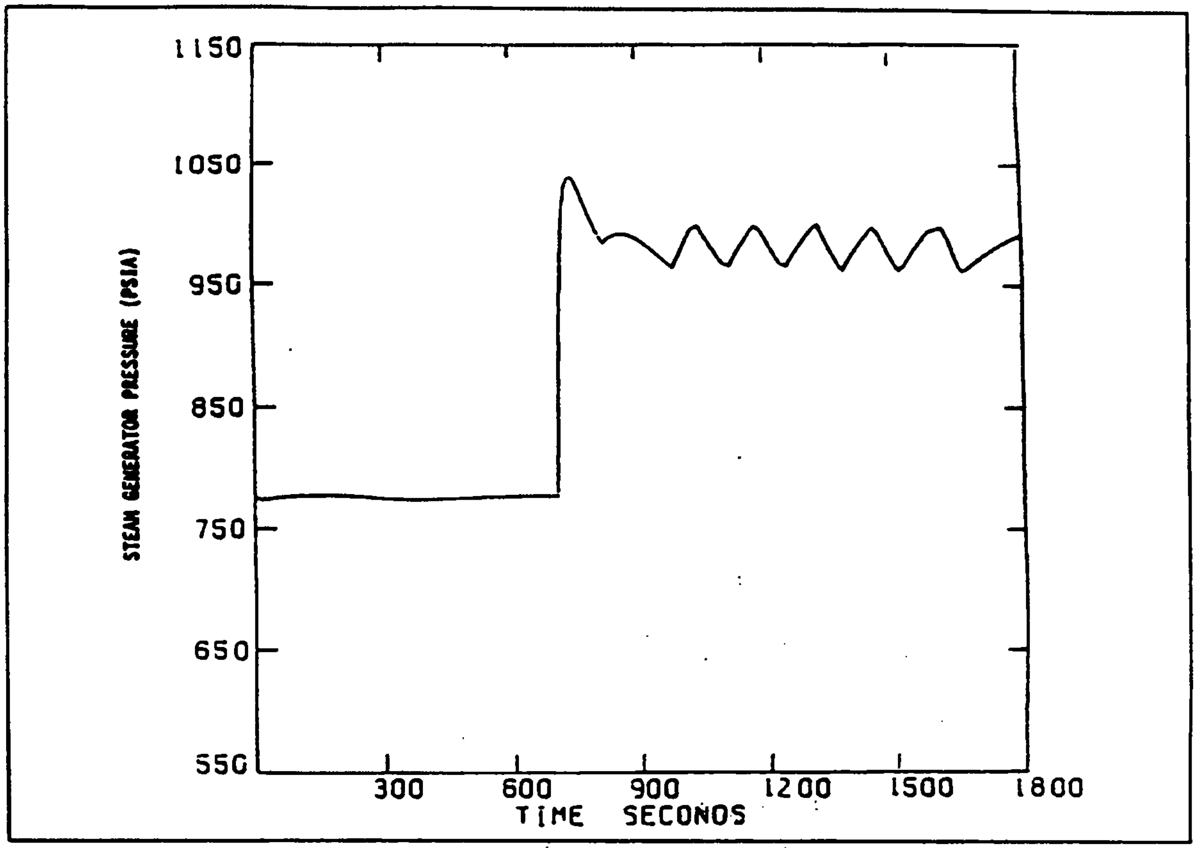
SGTR WITH LOAC: CORE COOLANT TEMPERATURE vs TIME



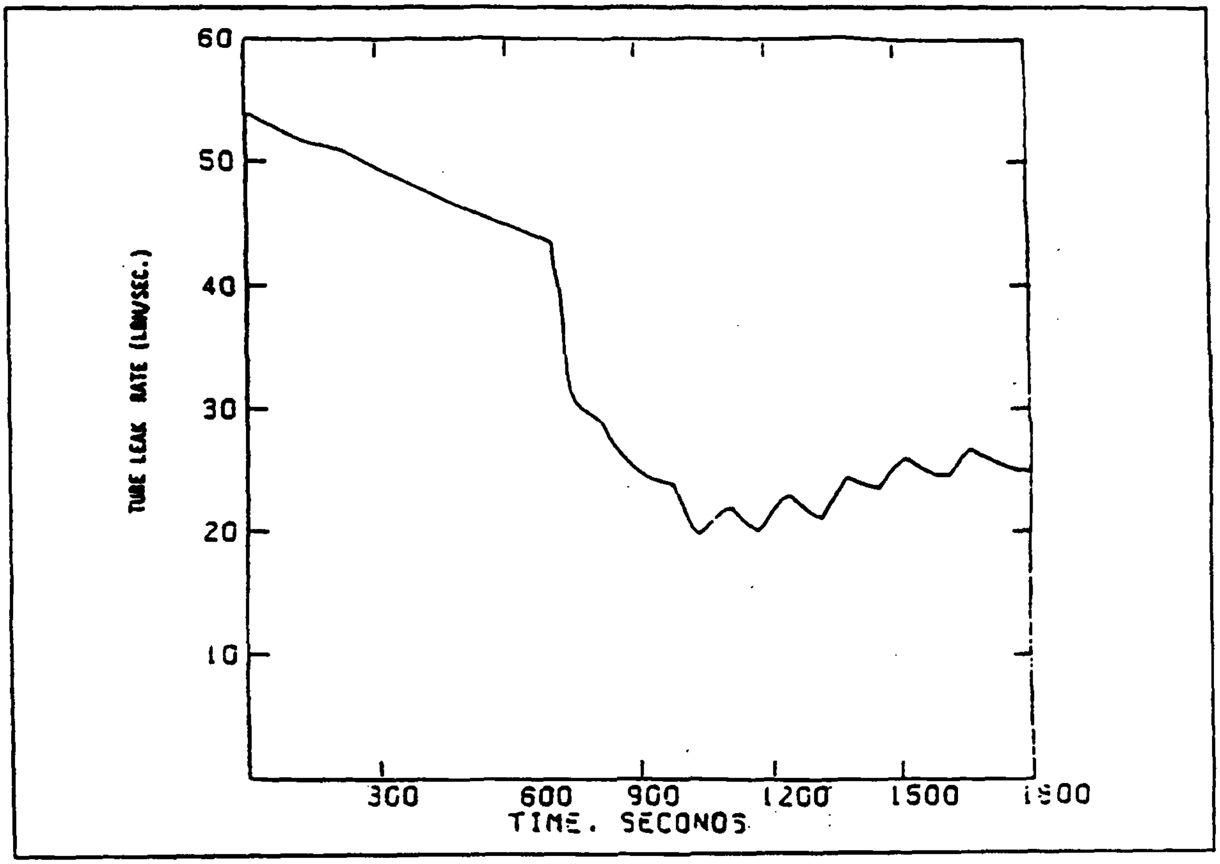
SGTR WITH LOAC: PRIMARY COOLANT SYSTEM PRESSURE vs TIME



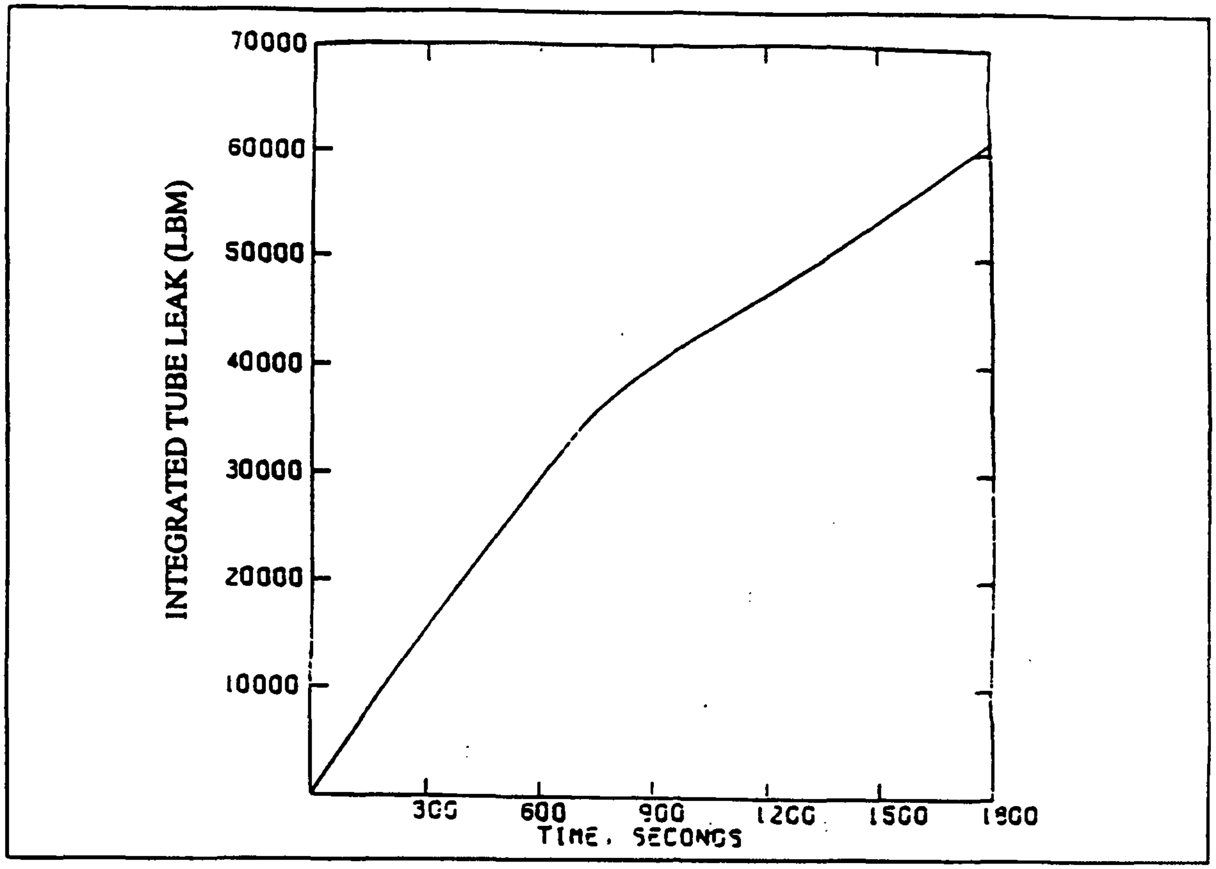
SGTR WITH LOAC: STEAM GENERATOR PRESSURE vs TIME



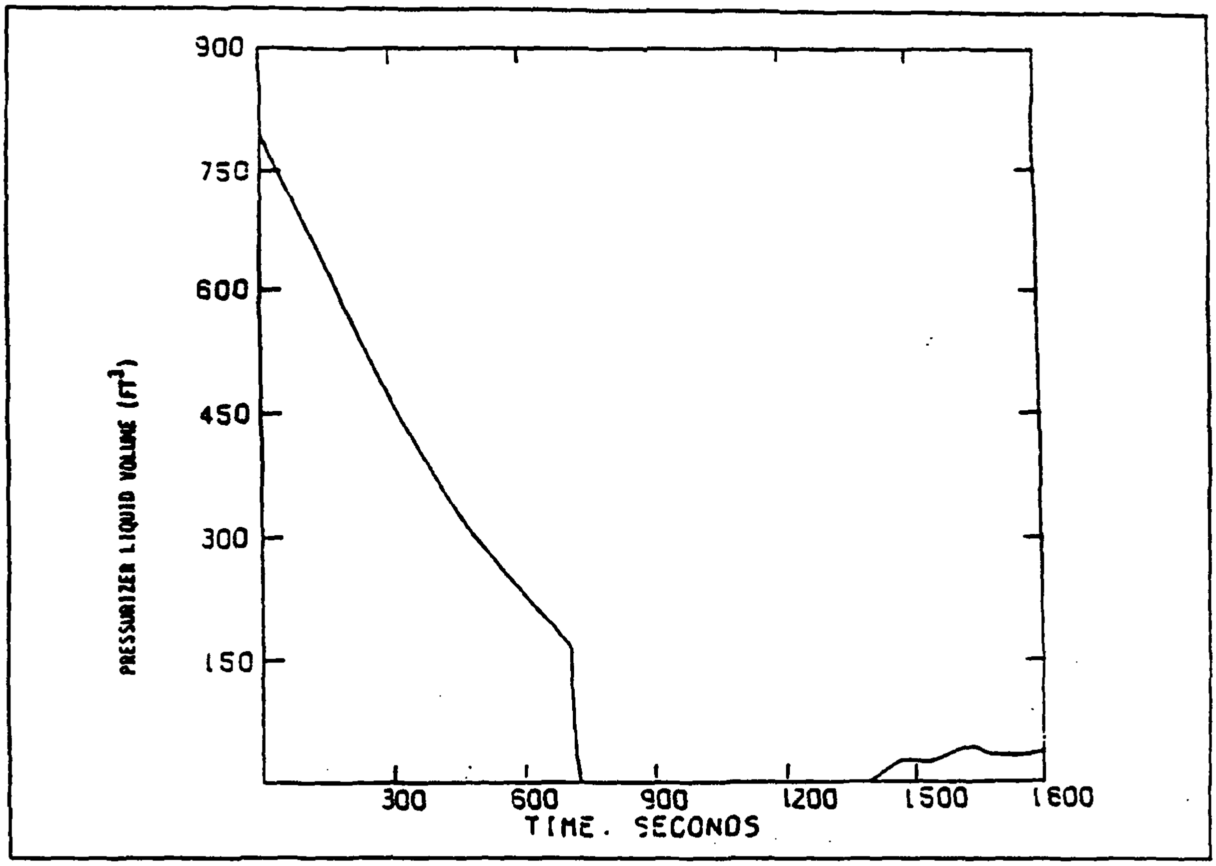
SGTR WITH LOAC: TUBE LEAK FLOW RATE vs TIME



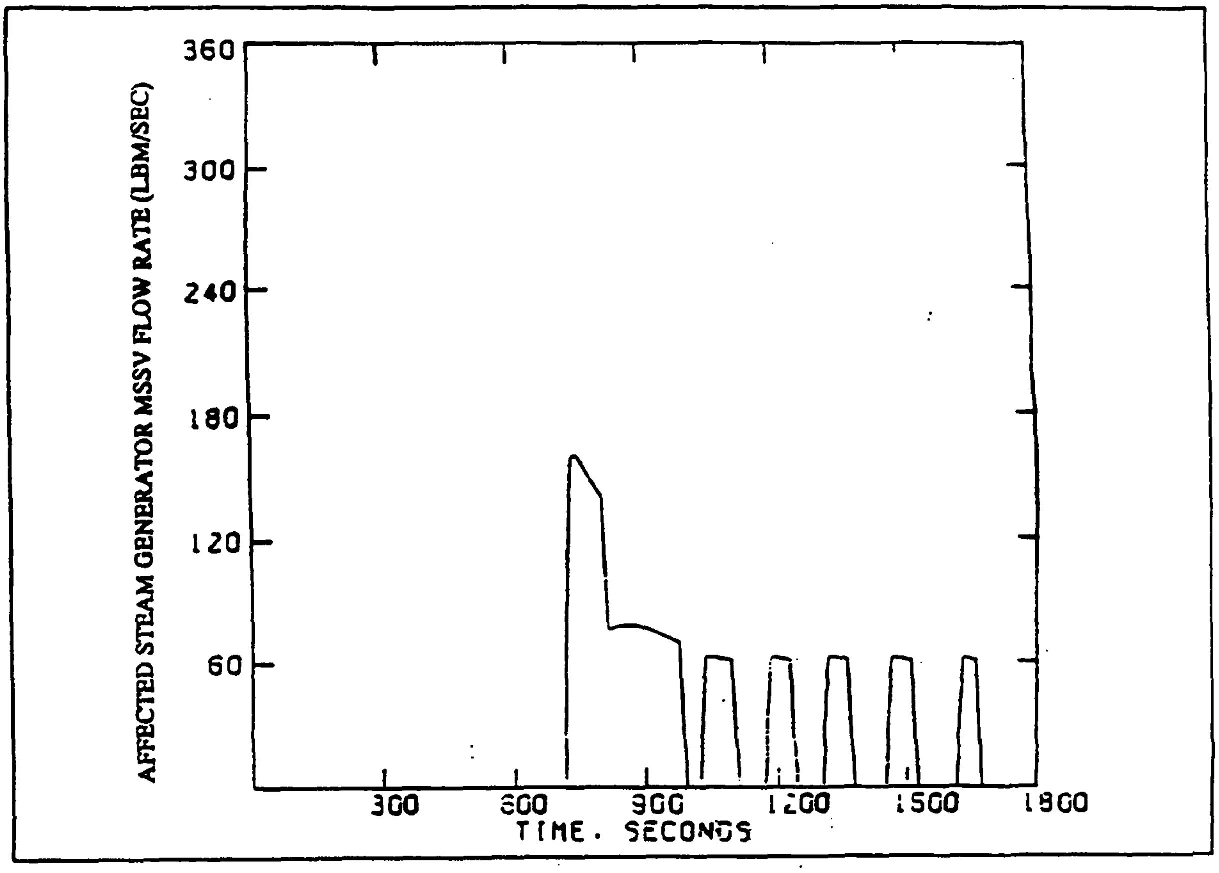
SGTR WITH LOAC: INTEGRATED TUBE LEAK FLOW vs TIME



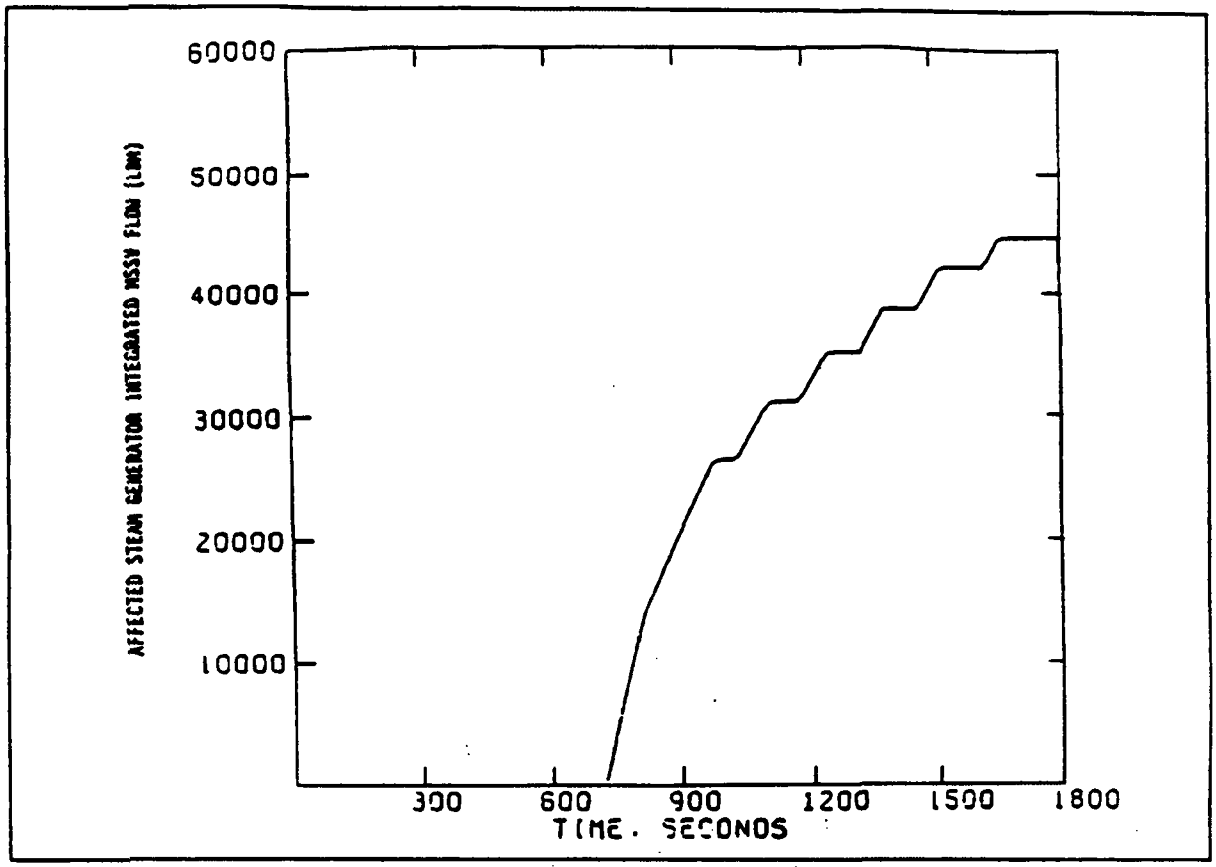
SGTR WITH LOAC: PRESSURIZER LIQUID VOLUME vs TIME



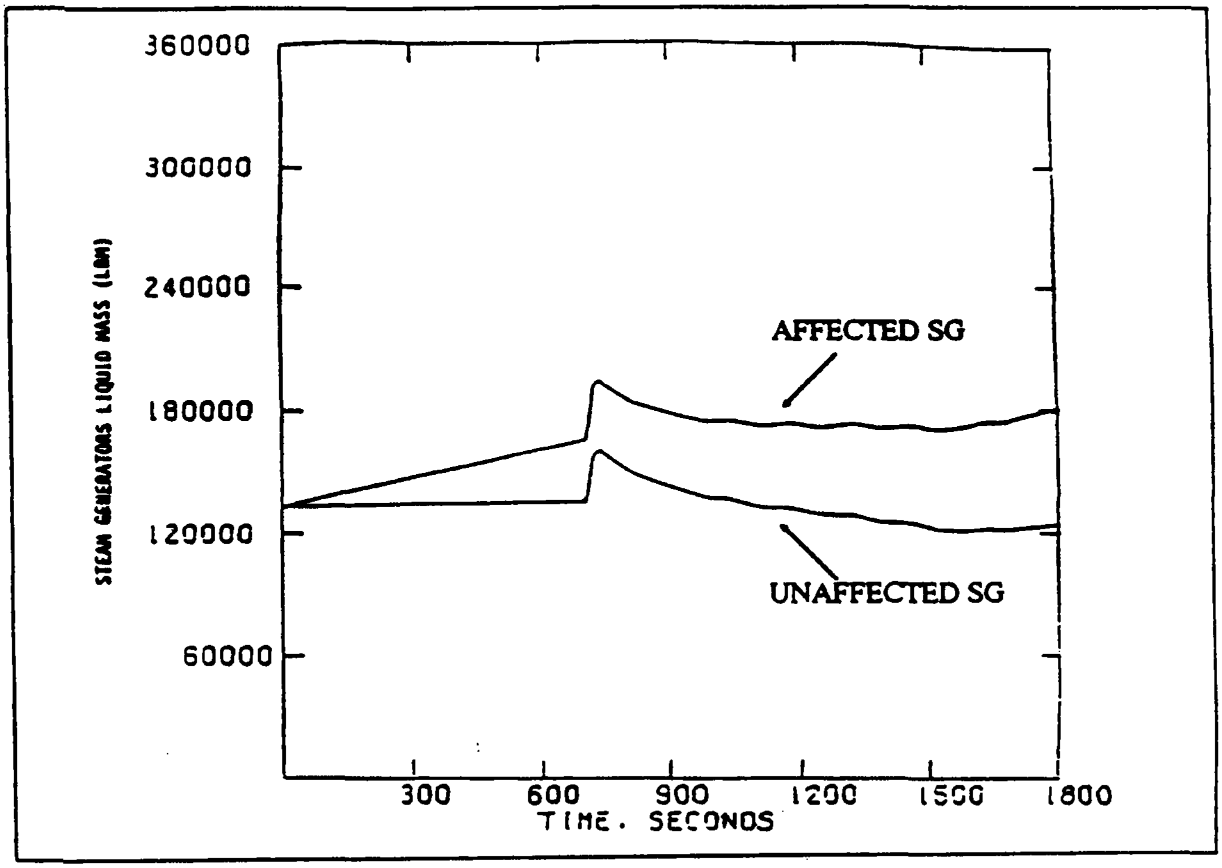
SGTR WITH LOAC: AFFECTED STEAM GENERATOR SAFETY VALVE (MSSV) FLOW RATE vs TIME



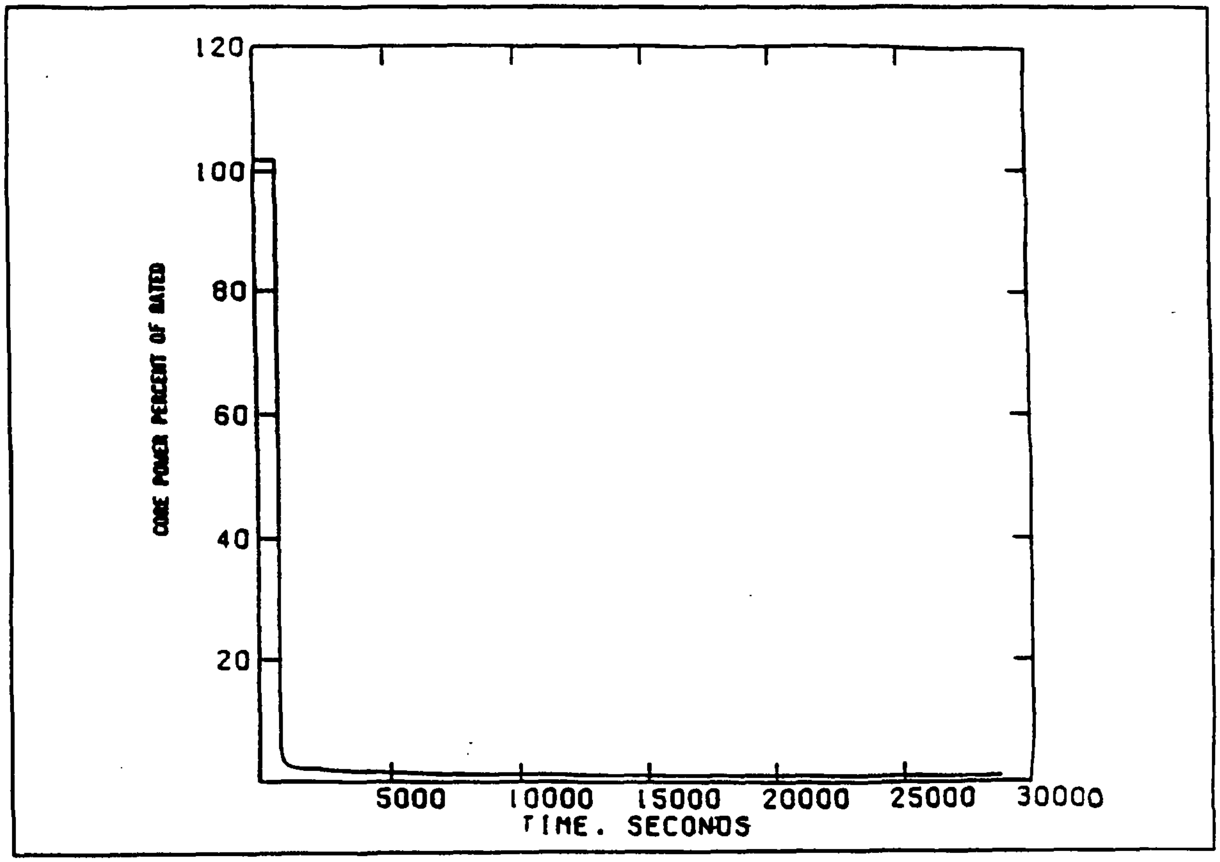
SGTR WITH LOAC: AFFECTED STEAM GENERATOR SAFETY VALVE (MSSV) INTEGRATED FLOW vs TIME



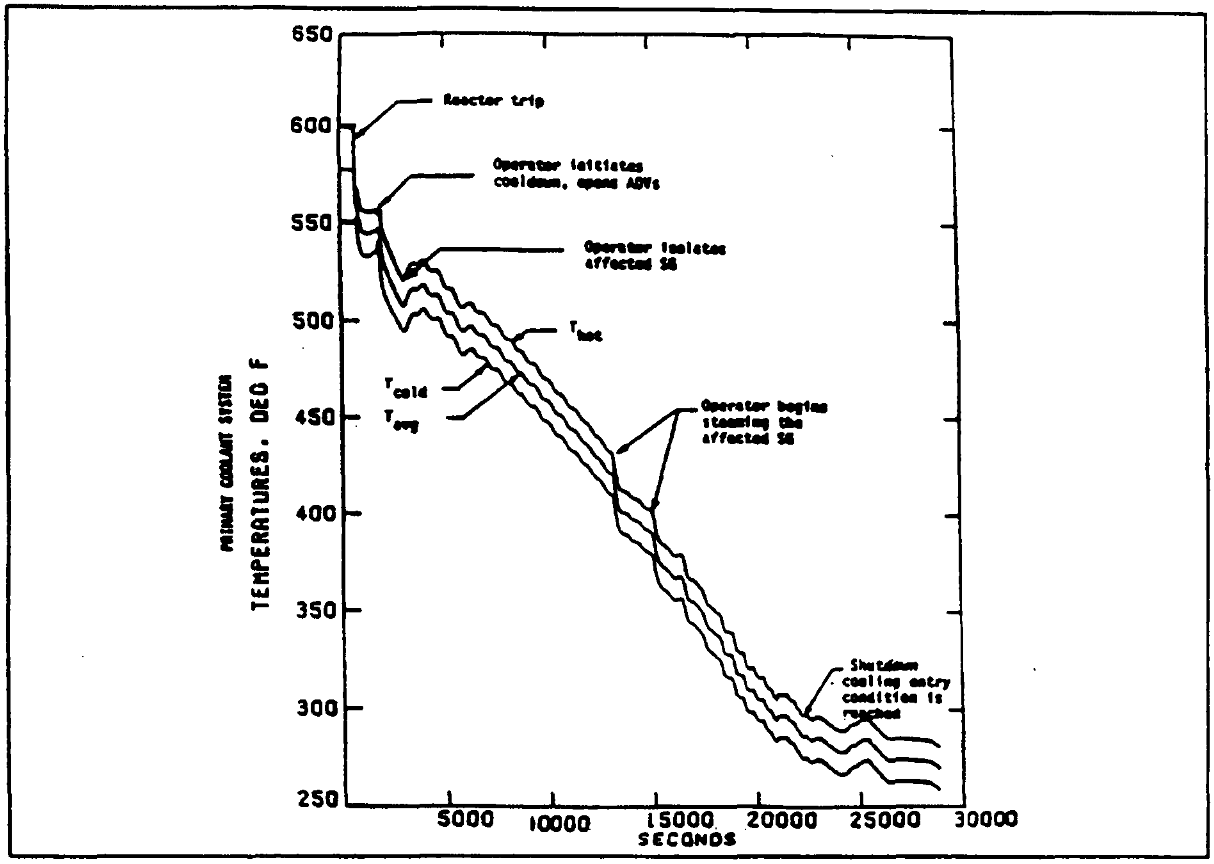
SGTR WITH LOAC: STEAM GENERATORS LIQUID MASS vs TIME



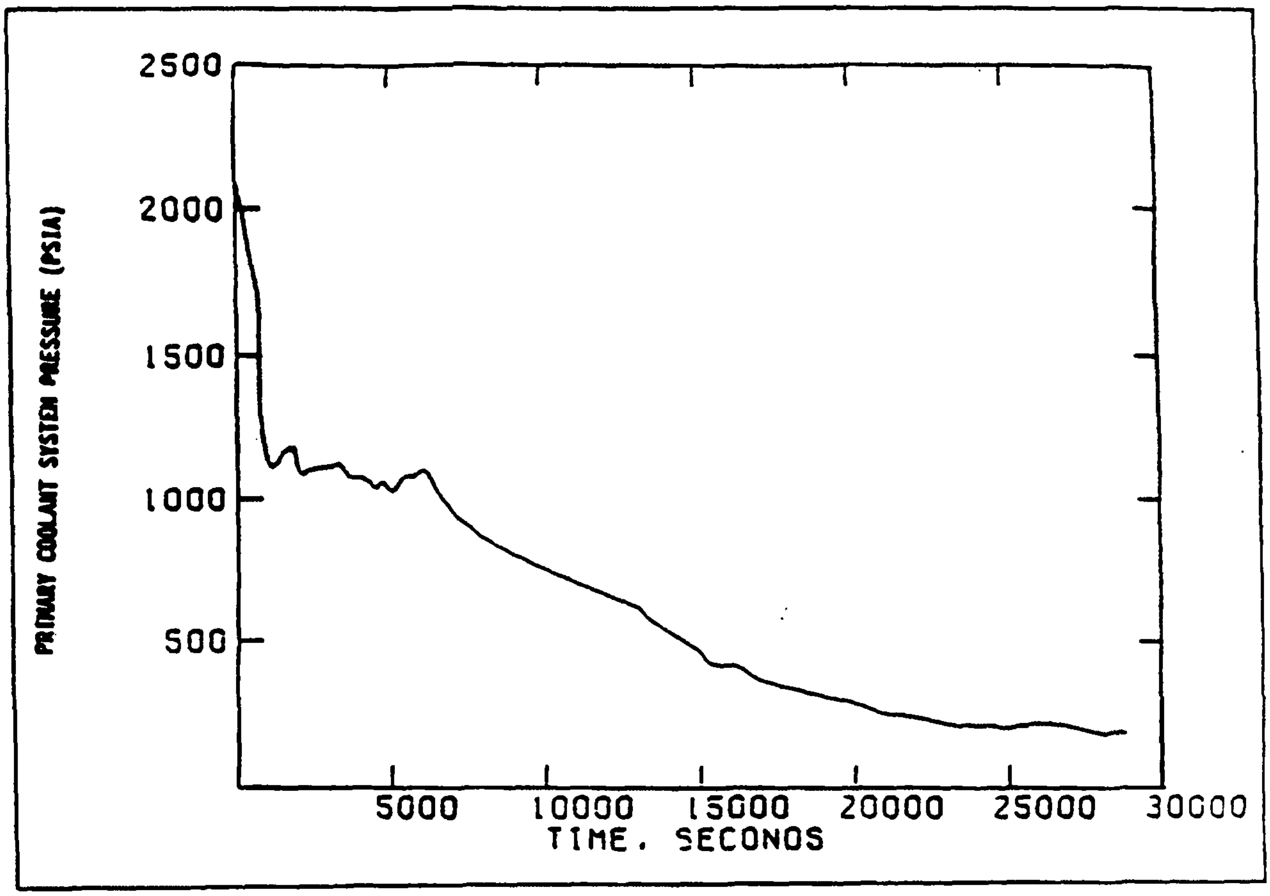
SGTR WITH LOAC: CORE POWER vs TIME



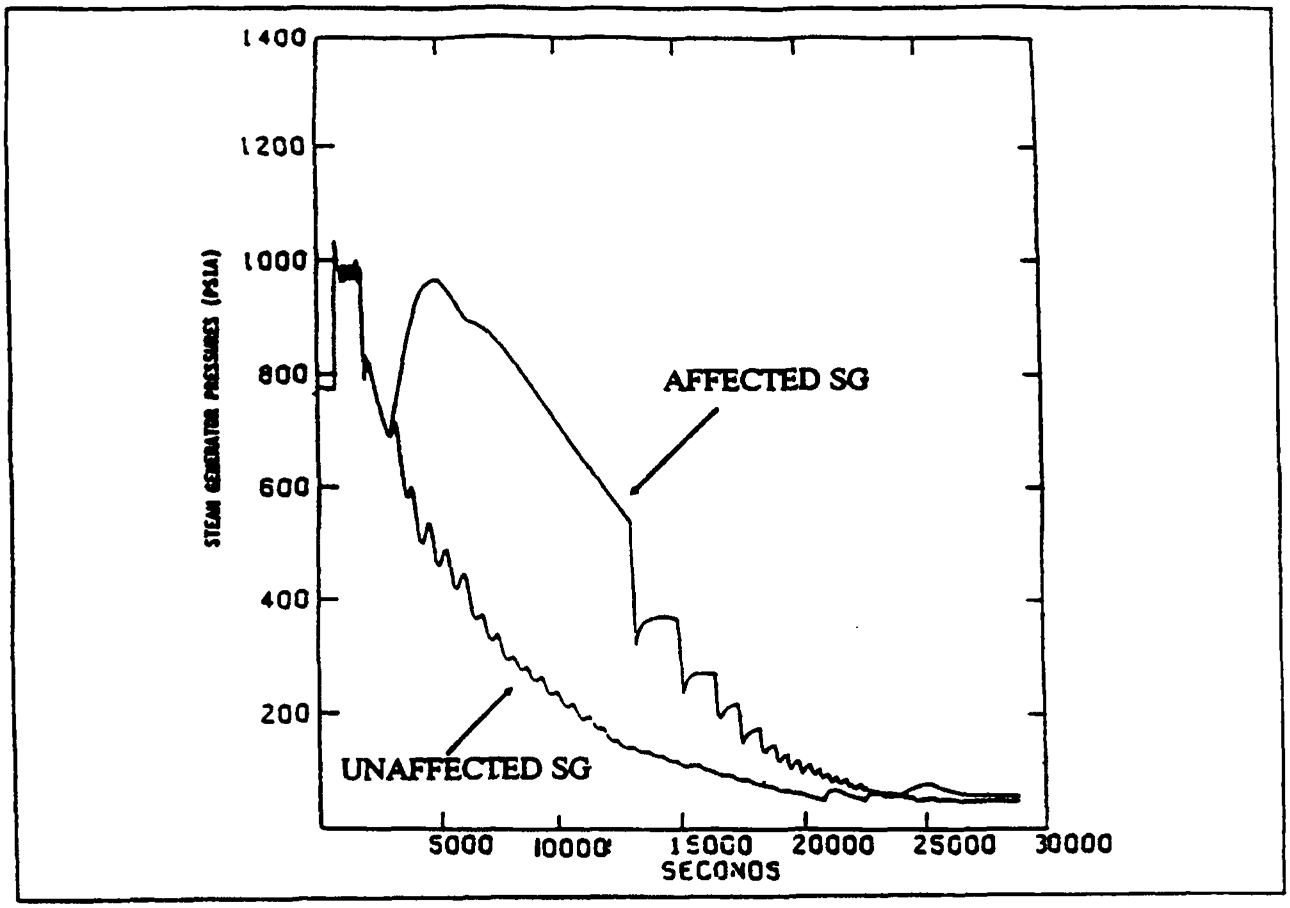
SGTR WITH LOAC: CORE COOLANT TEMPERATURES vs TIME



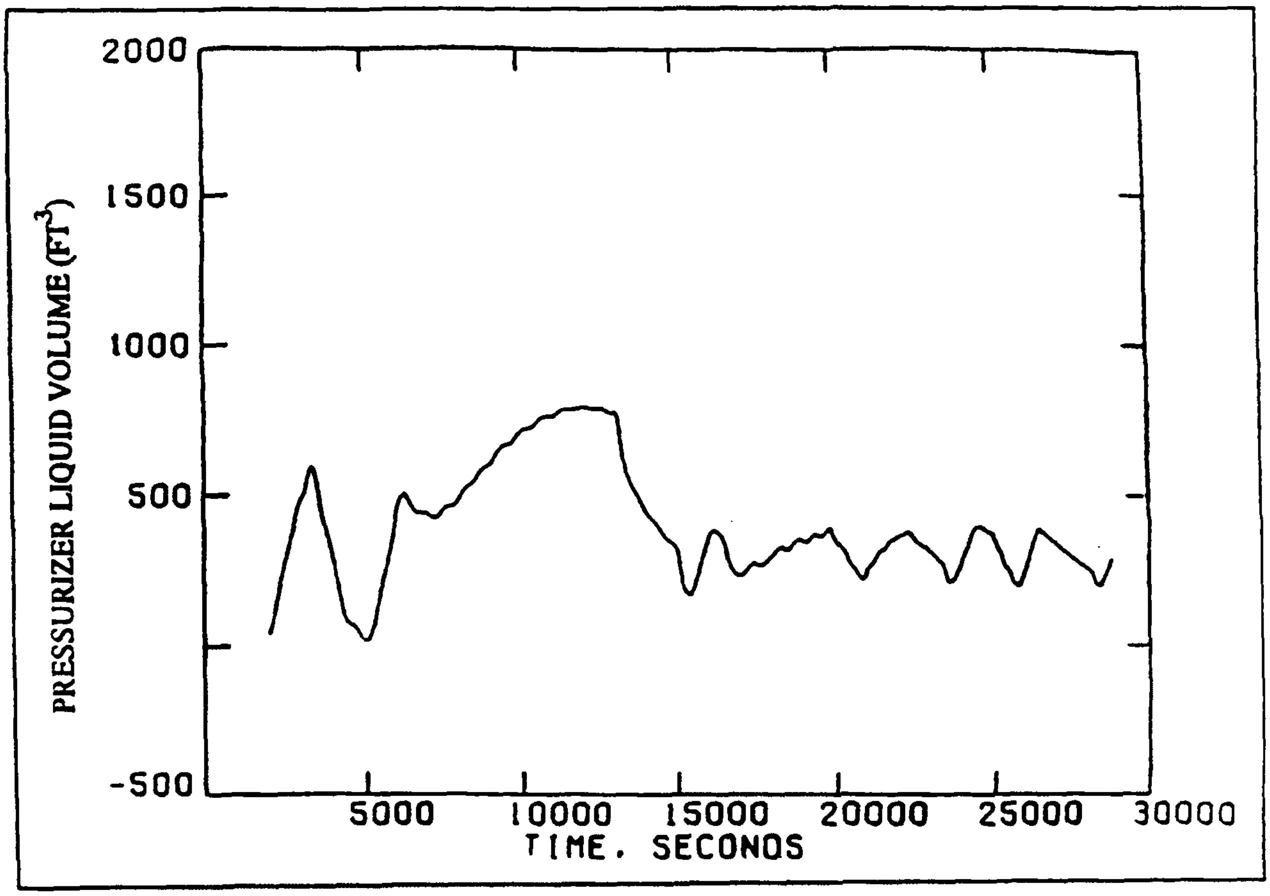
SGTR WITH LOAC: PRIMARY COOLANT SYSTEM PRESSURE vs TIME



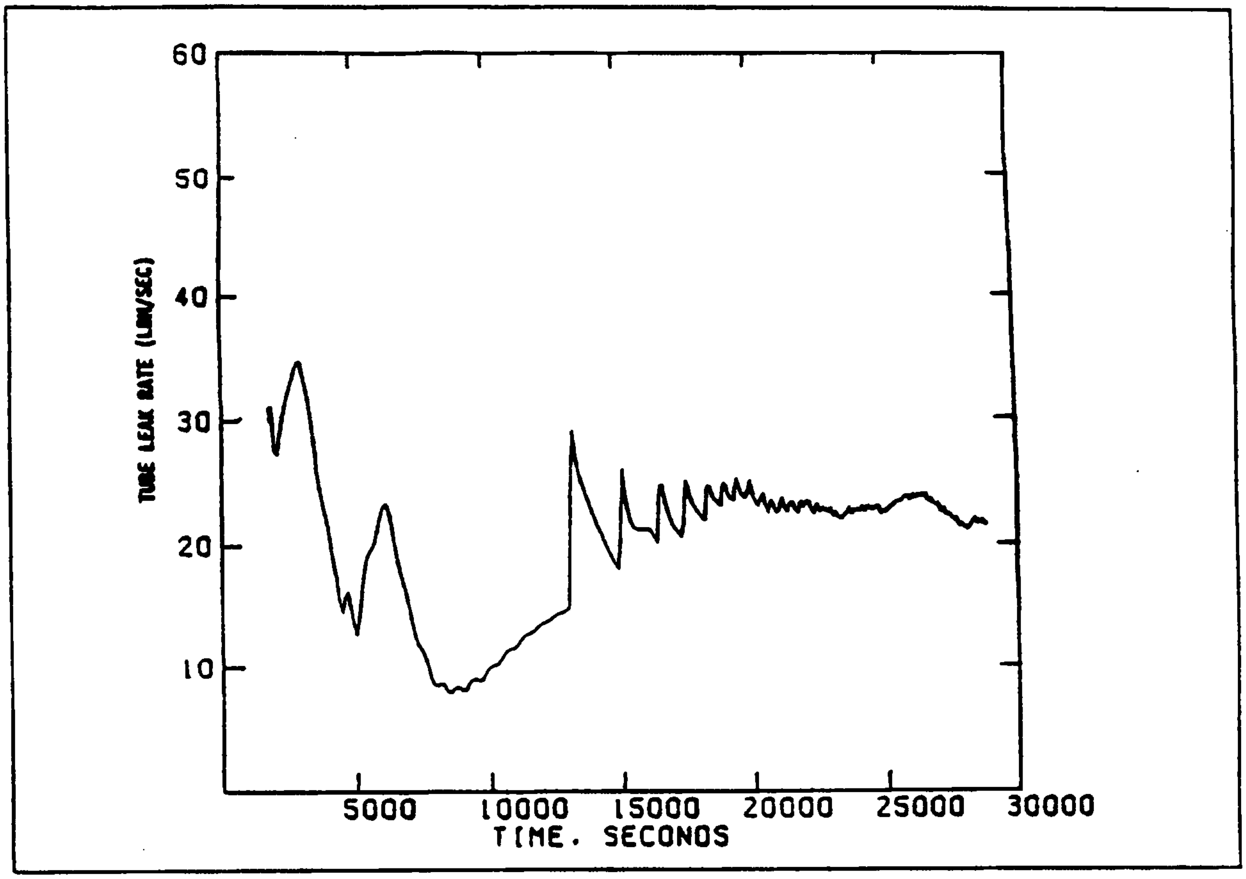
SGTR WITH LOAC: STEAM GENERATORS PRESSURE vs TIME



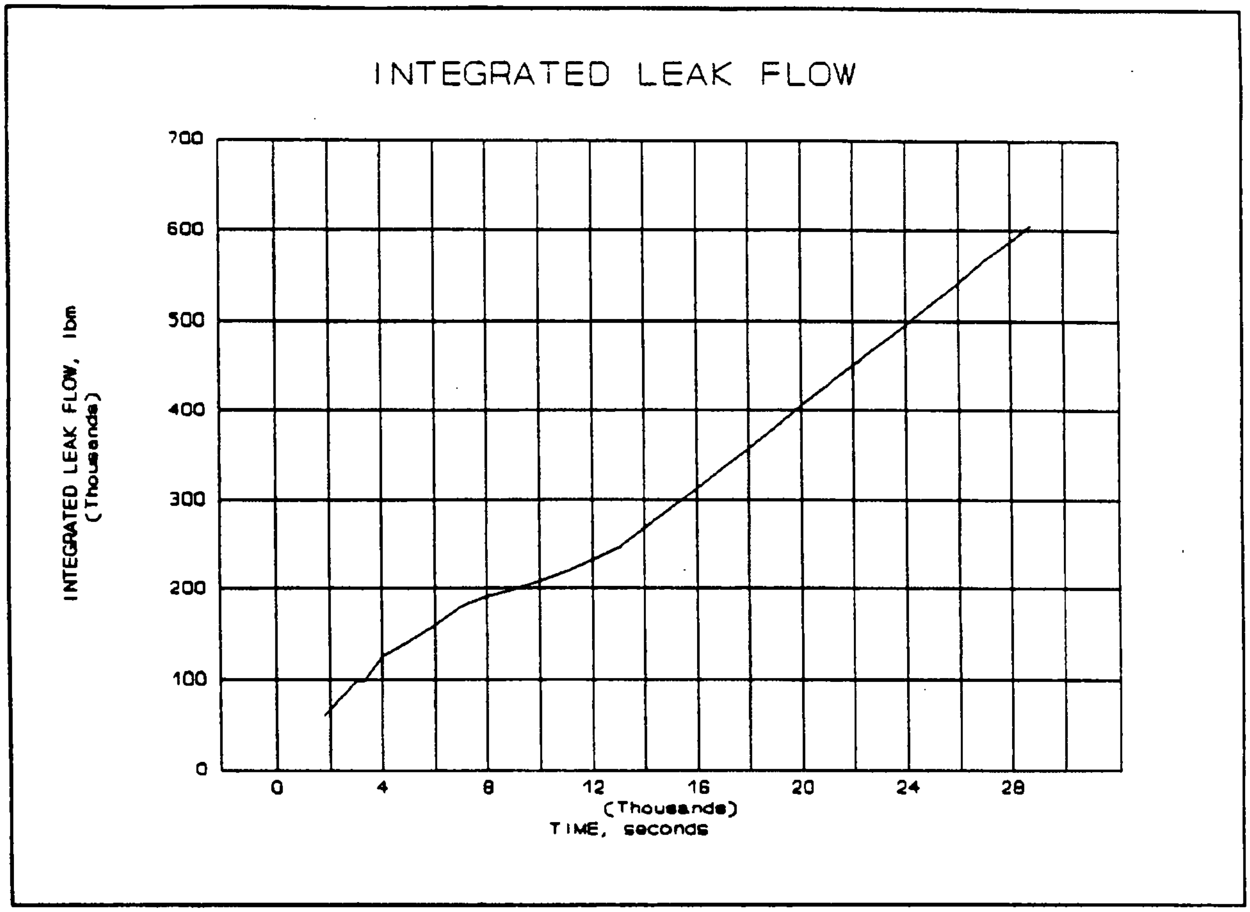
SGTR WITH LOAC: PRESSURIZER LIQUID VOLUME vs TIME



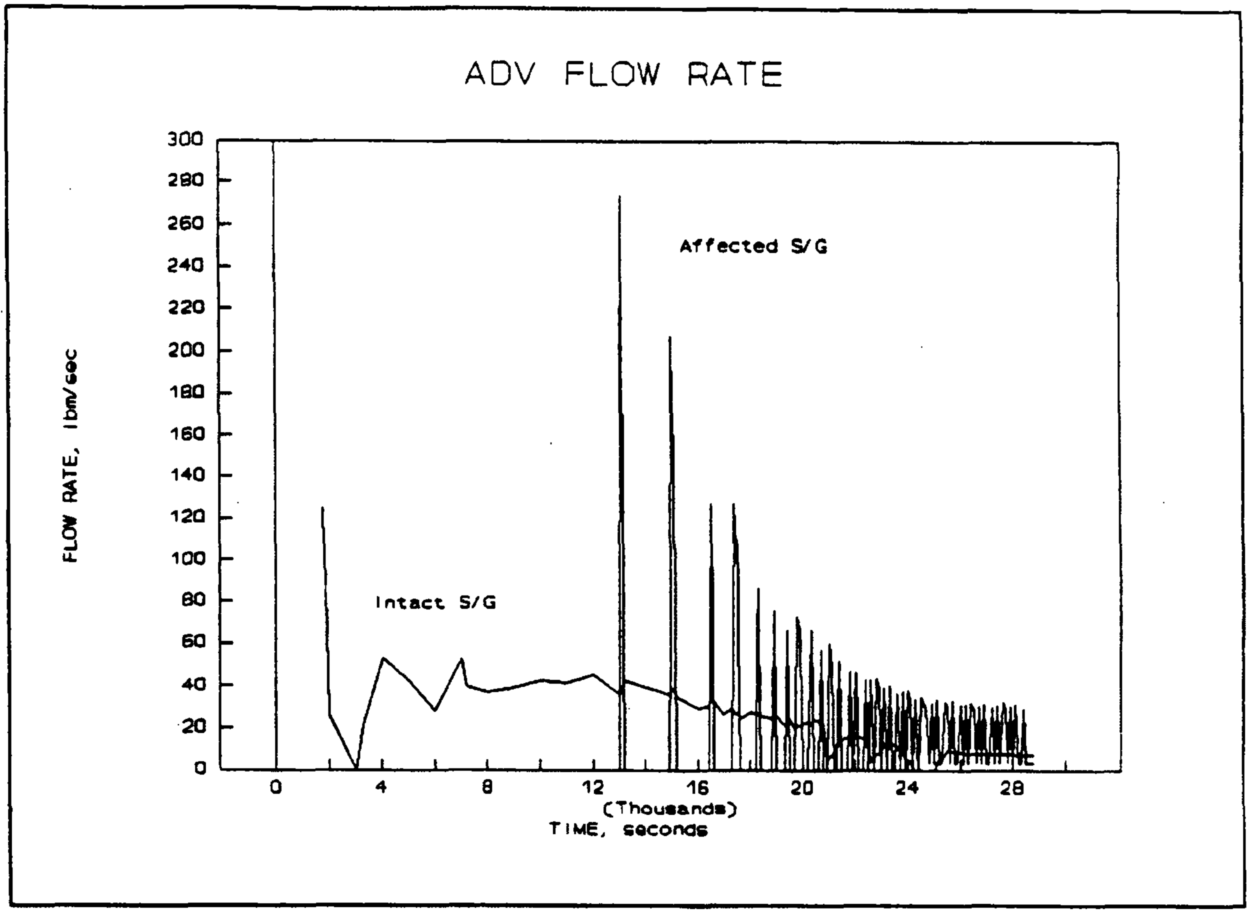
SGTR WITH LOAC: TUBE LEAK FLOW RATE vs TIME



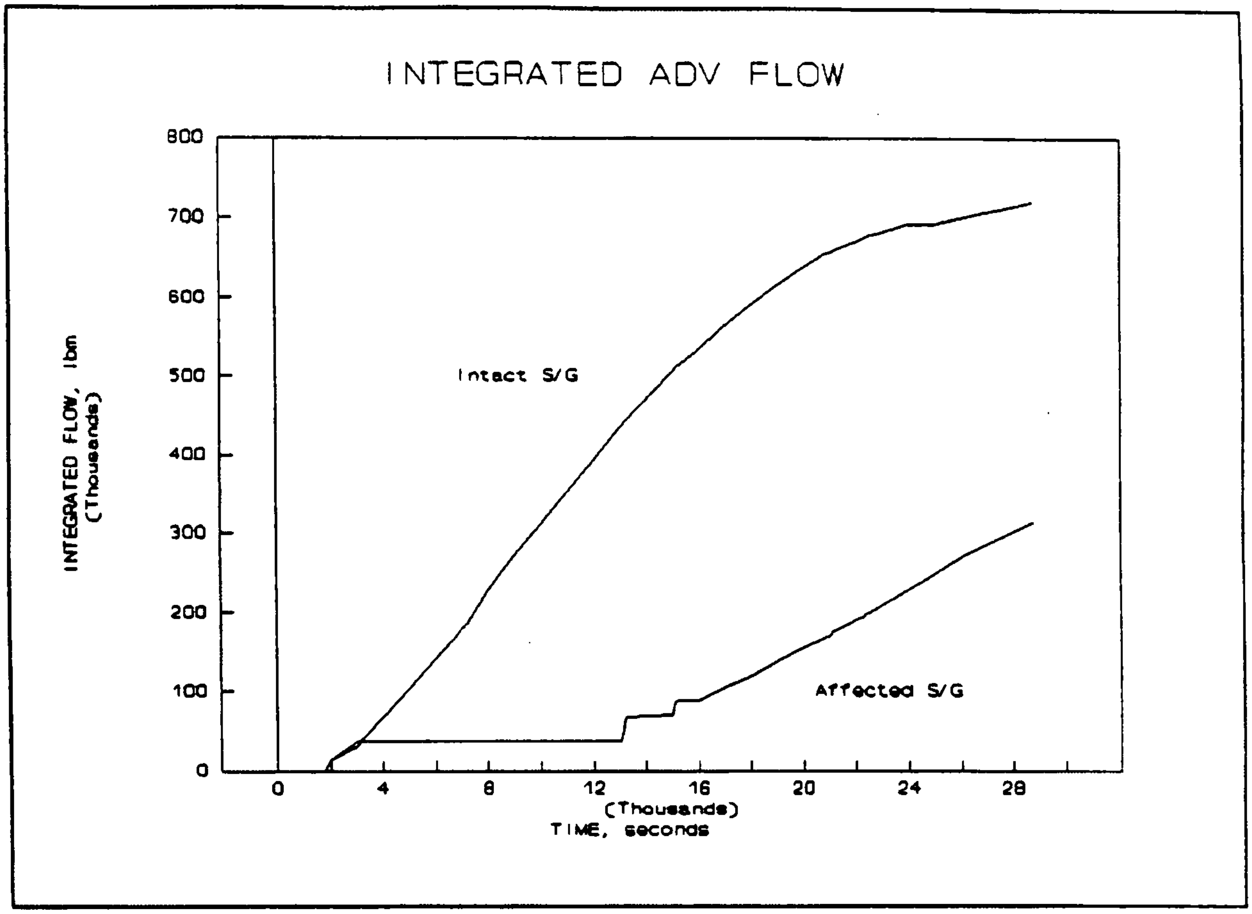
SGTR INTEGRATED LEAK FLOW vs TIME



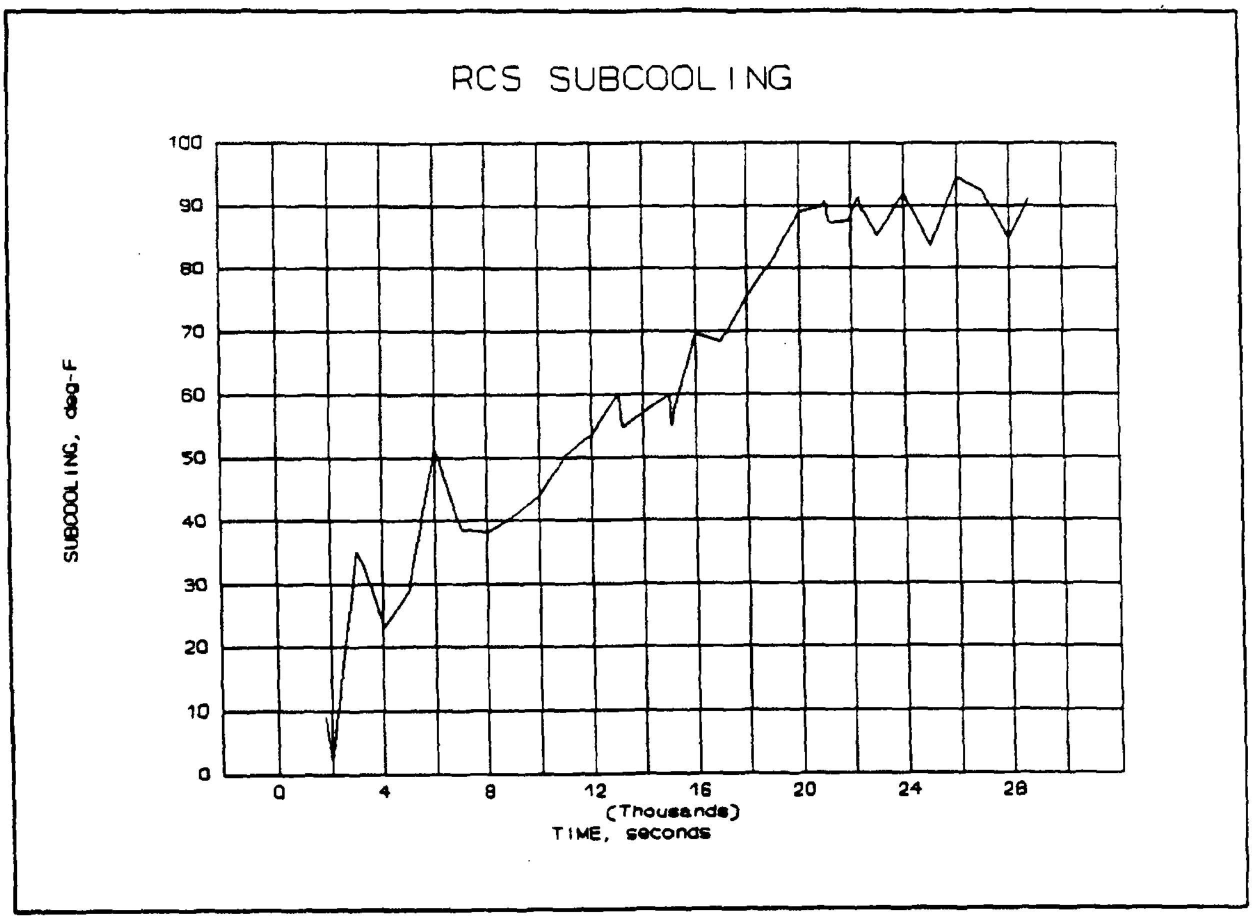
SGTR ADV FLOW RATE vs TIME



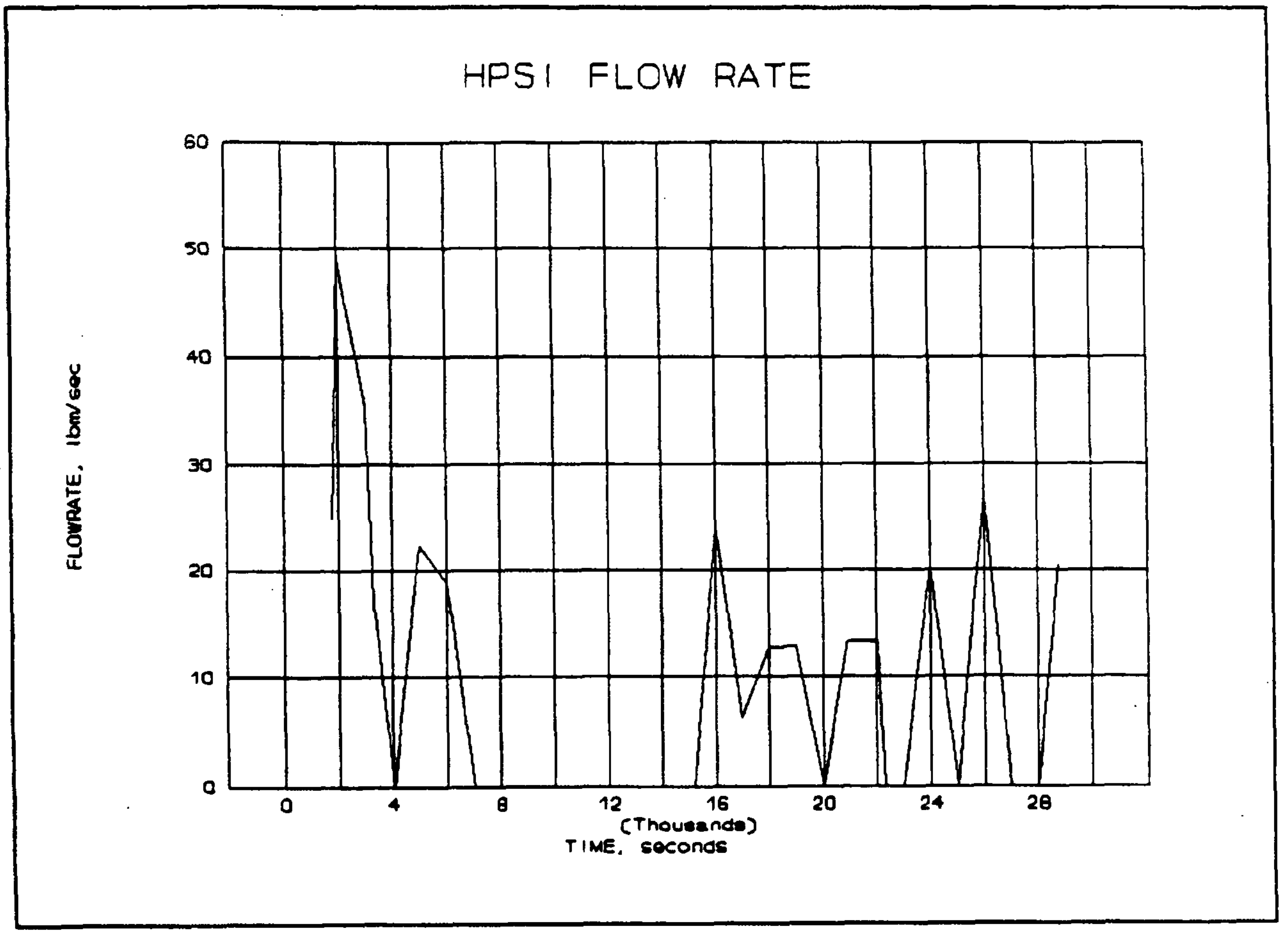
SGTR INTEGRATED ADV FLOW vs TIME



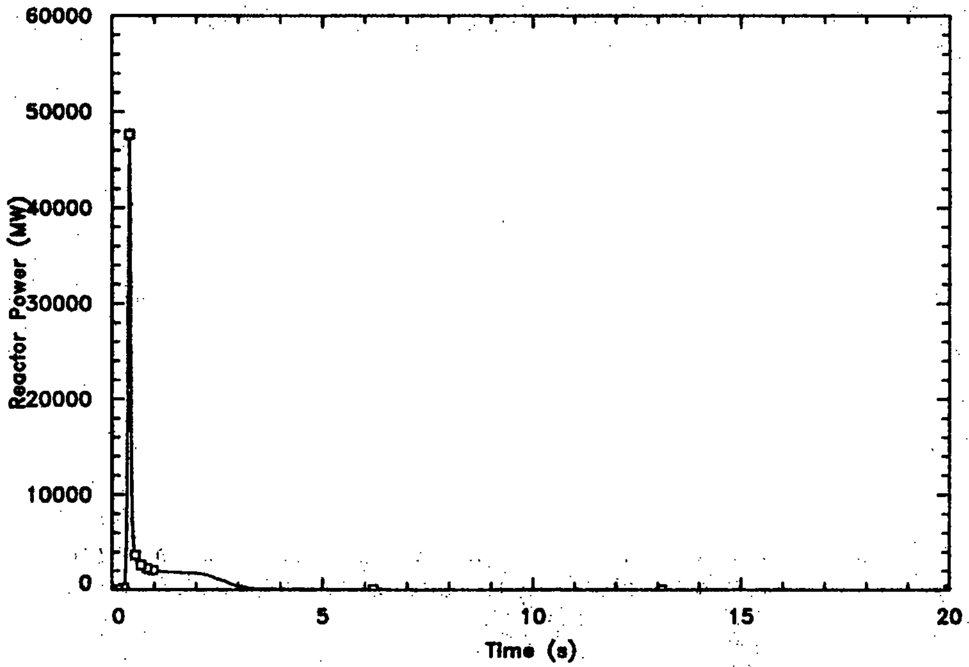
SGTR PCS SUBCOOLING vs TIME



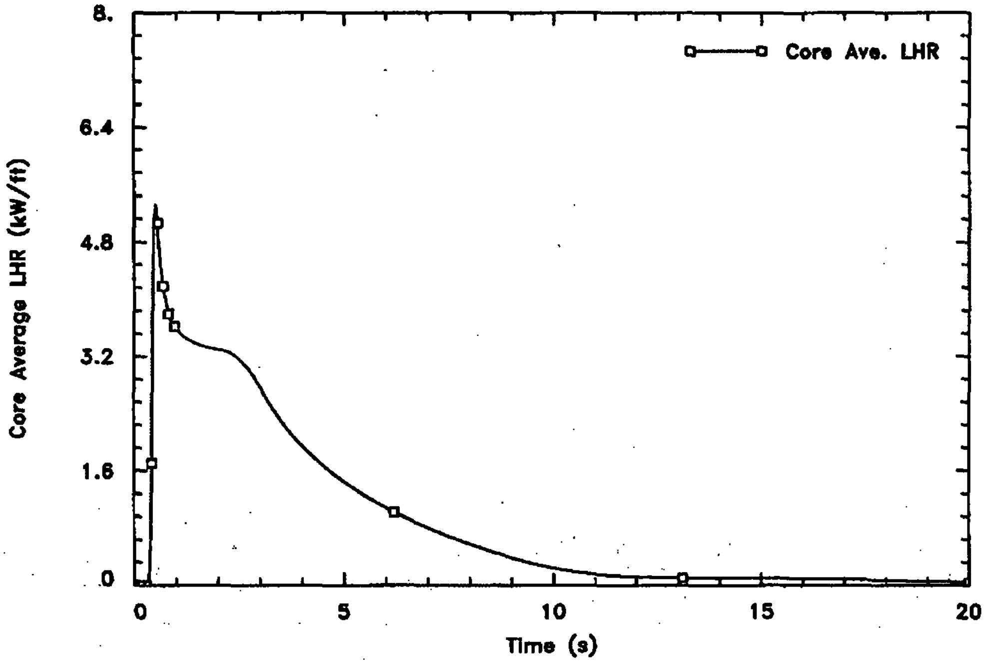
SGTR HPSI FLOW RATE vs TIME



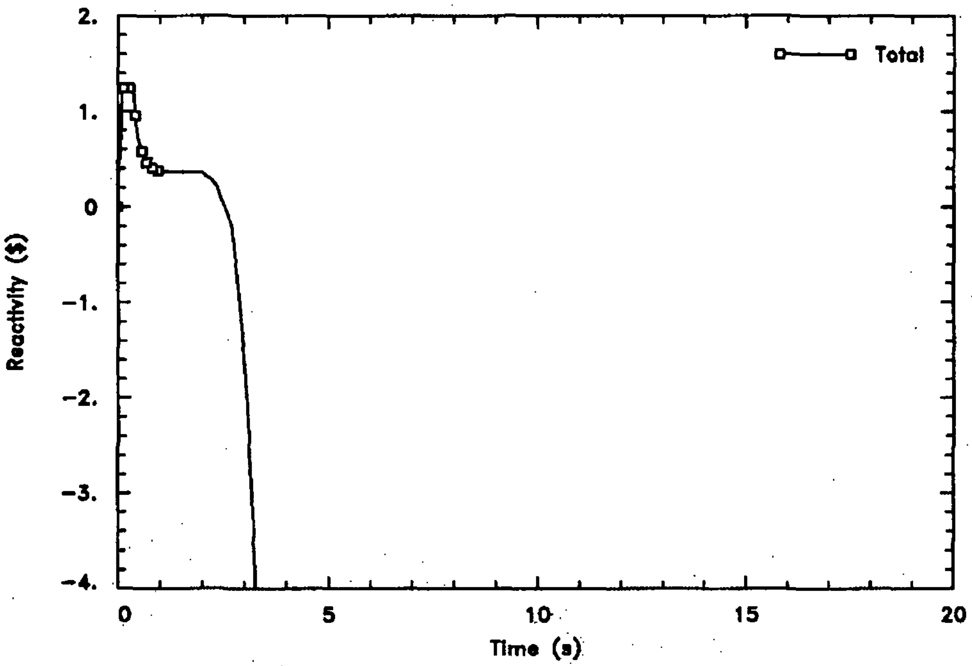
CONTROL ROD EJECTION, EOC HZP CASE: CORE POWER



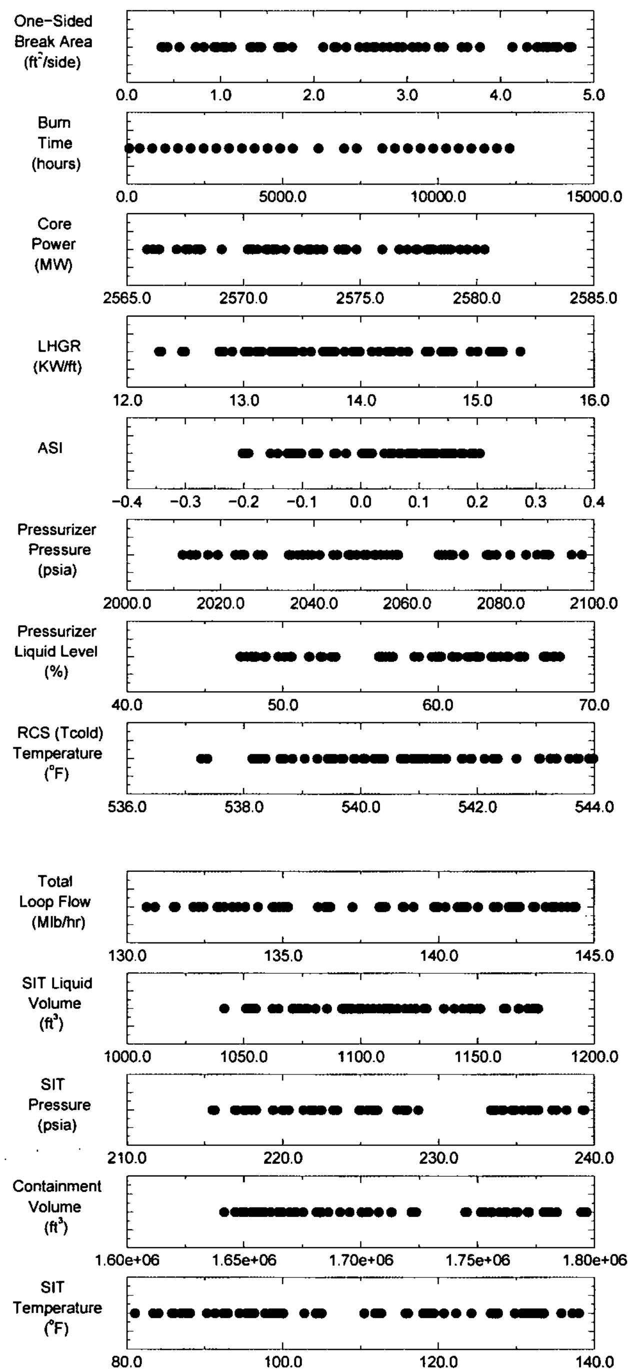
CONTROL ROD EJECTION, EOC HZP CASE: CORE AVERAGE HEAT-FLUX-BASED LHR



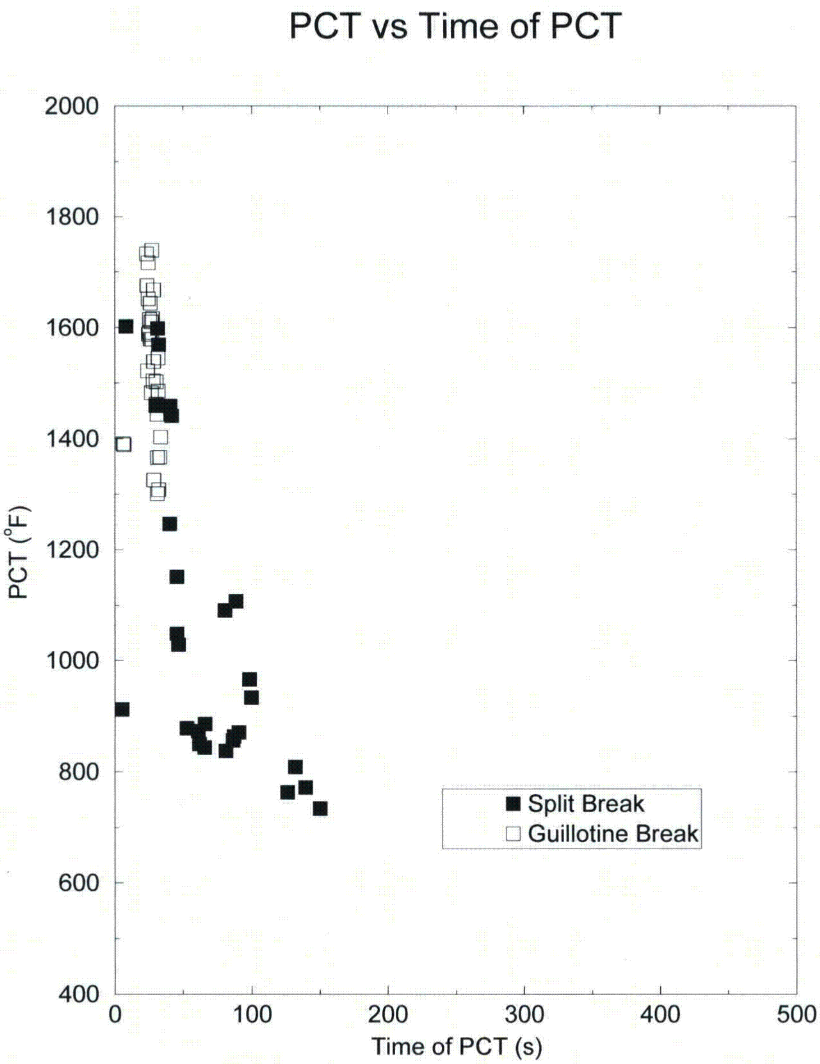
CONTROL ROD EJECTION, EOC HZP CASE: TOTAL CORE REACTIVITY



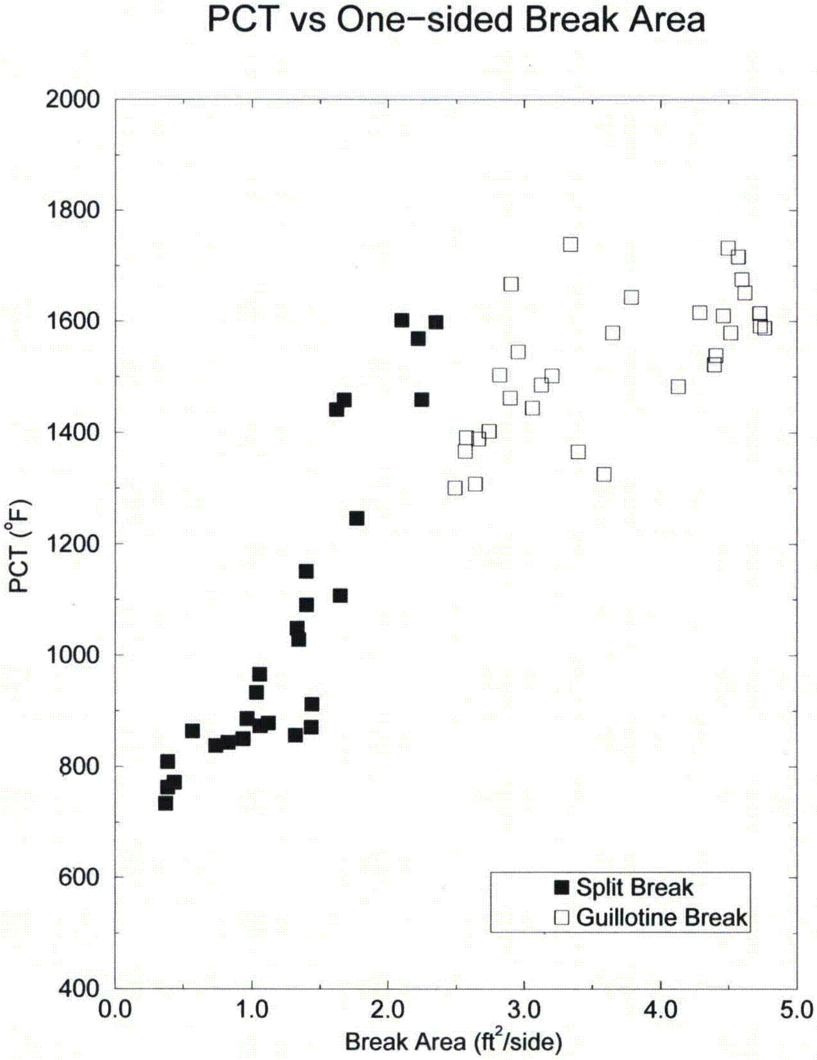
SCATTER PLOT OF OPERATIONAL PARAMETERS



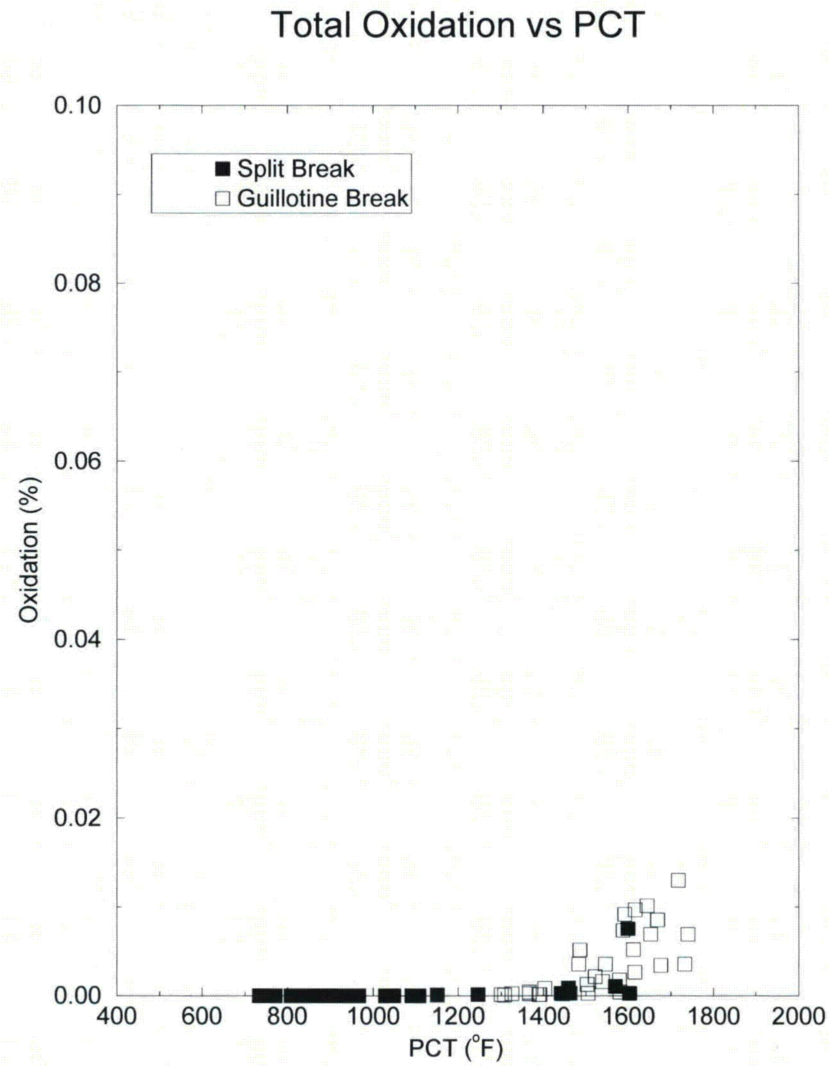
PCT VERSUS PCT TIME SCATTER PLOT FROM TRANSIENT CALCULATIONS



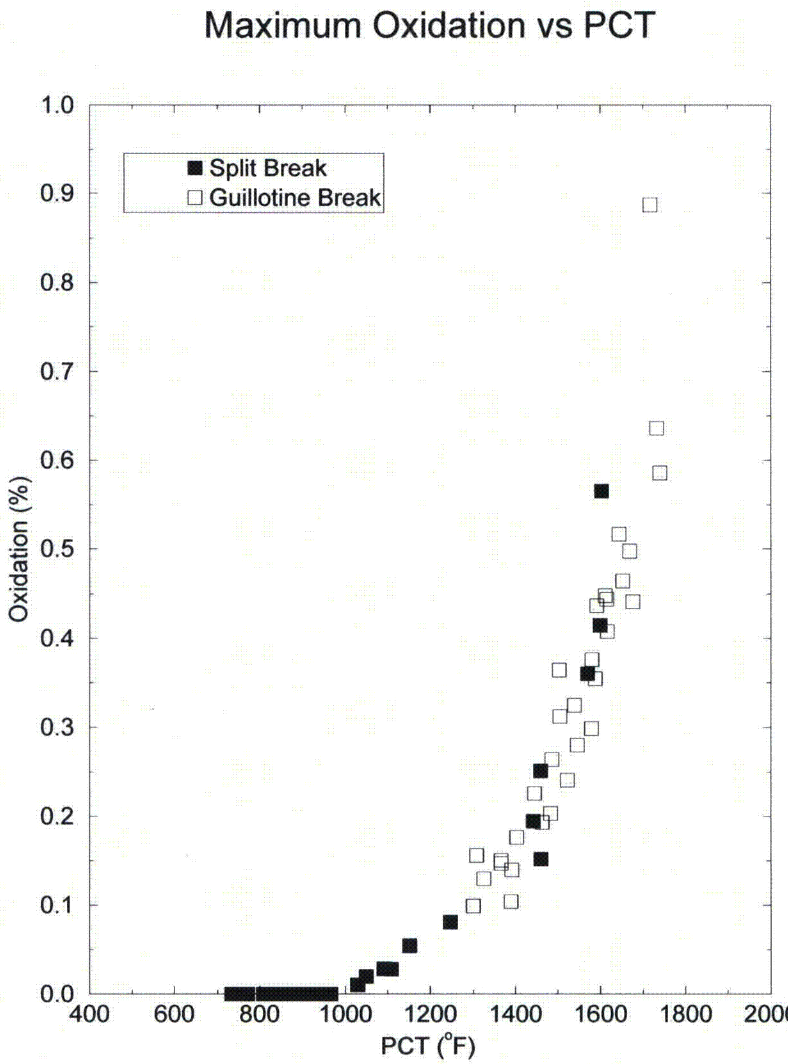
PCT VERSUS BREAK SIZE SCATTER PLOT FROM TRANSIENT CALCULATIONS



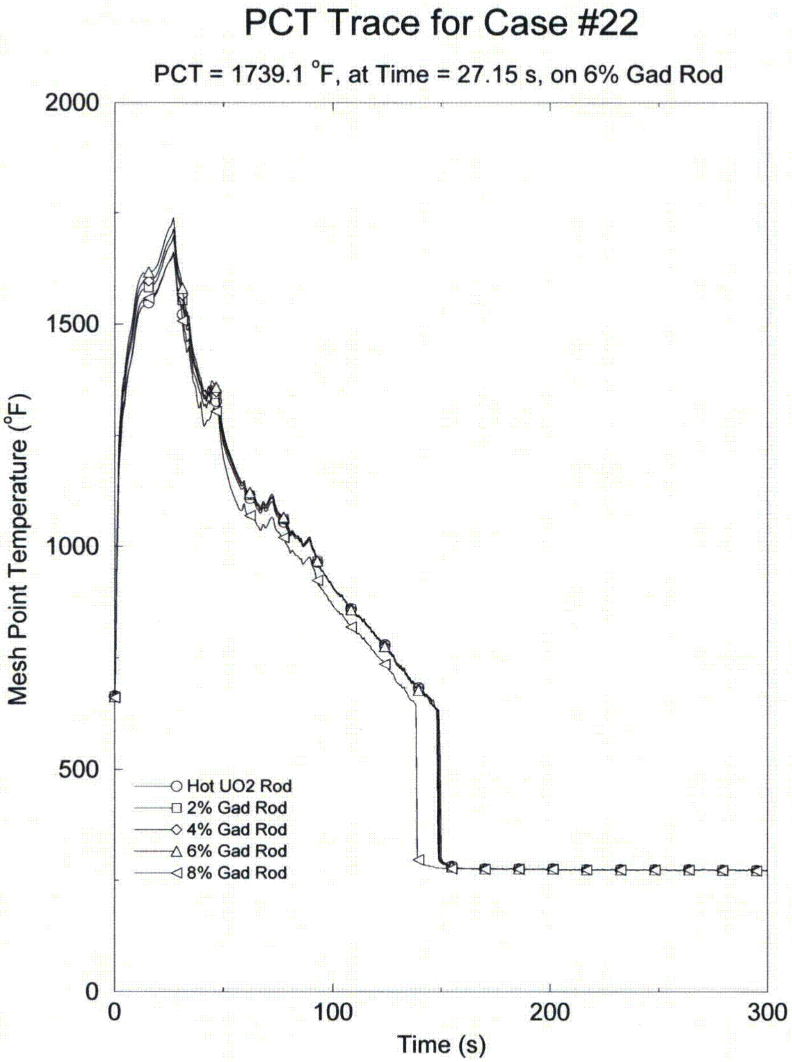
TOTAL OXIDATION VS. PCT SCATTER PLOT FROM TRANSIENT CALCULATIONS



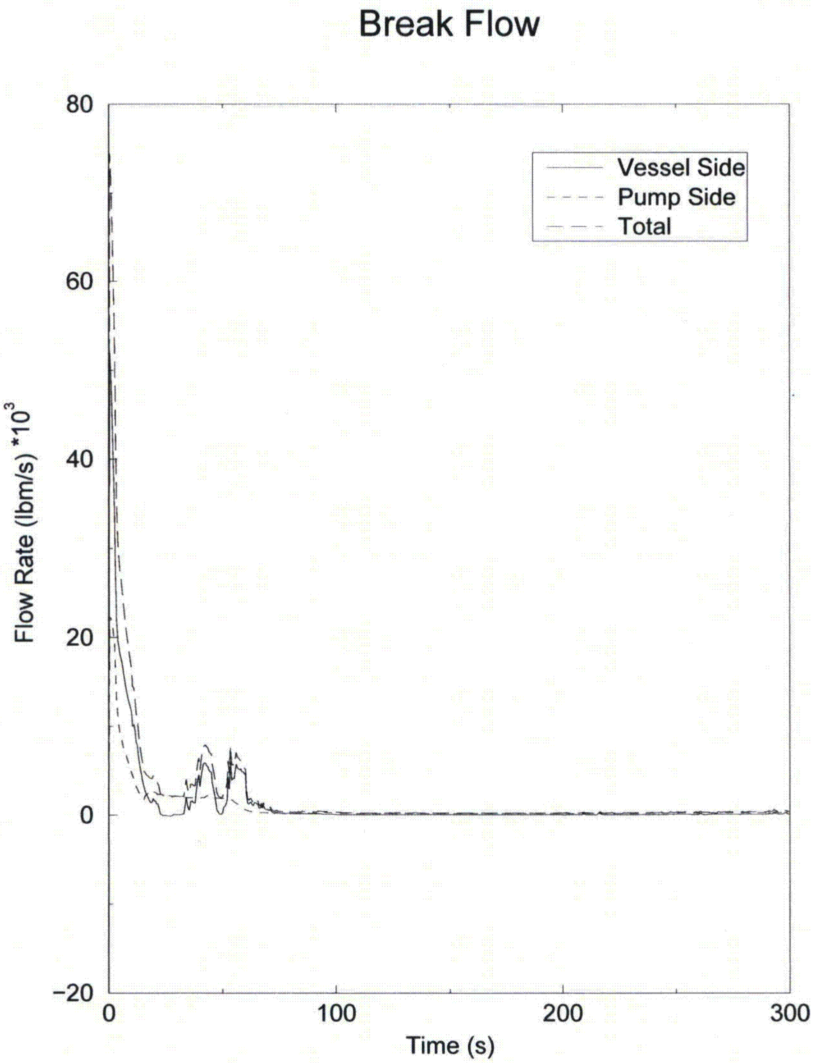
**MAXIMUM OXIDATION VERSUS PCT SCATTER PLOT
FROM TRANSIENT CALCULATIONS**



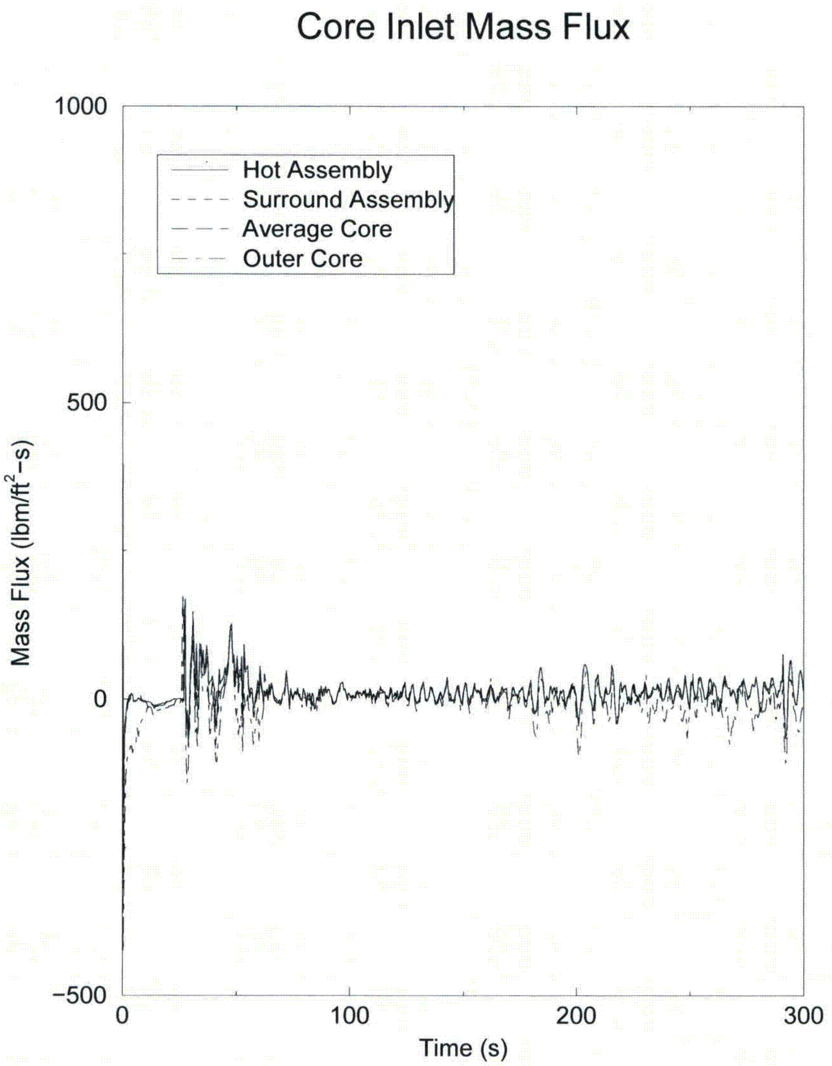
PEAK CLADDING TEMPERATURE FOR THE LIMITING CASE



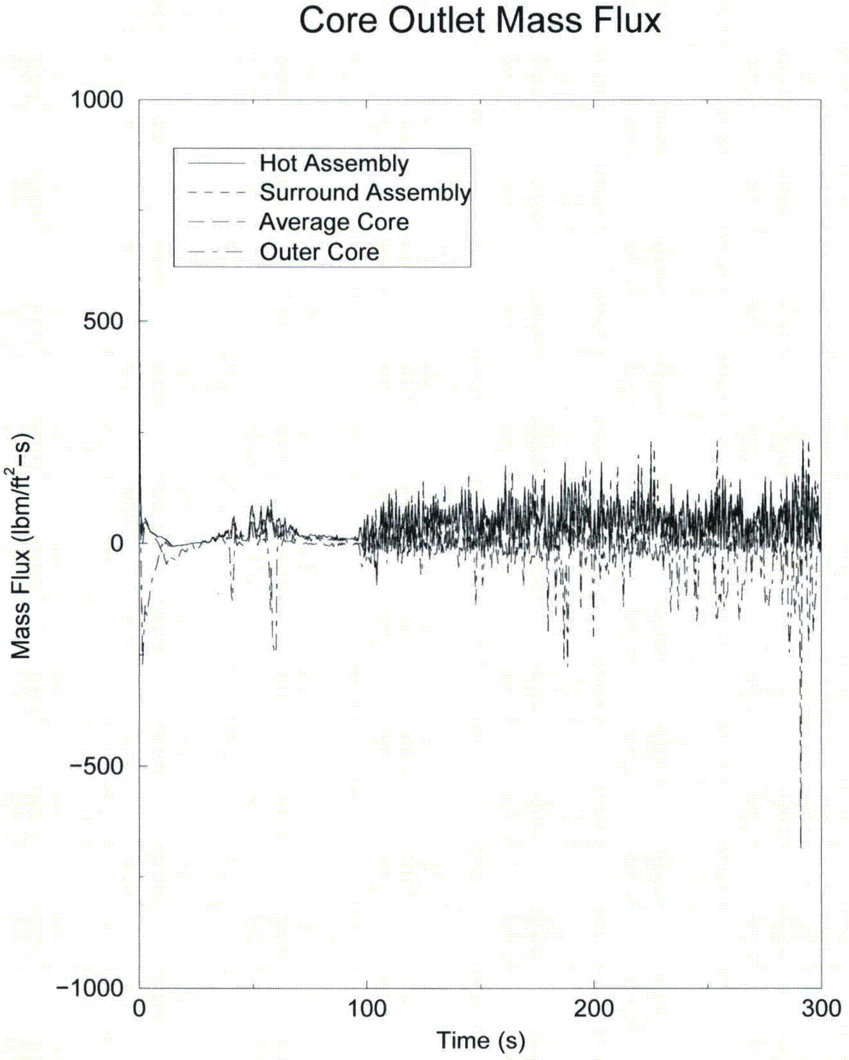
BREAK FLOW FOR THE LIMITING CASE



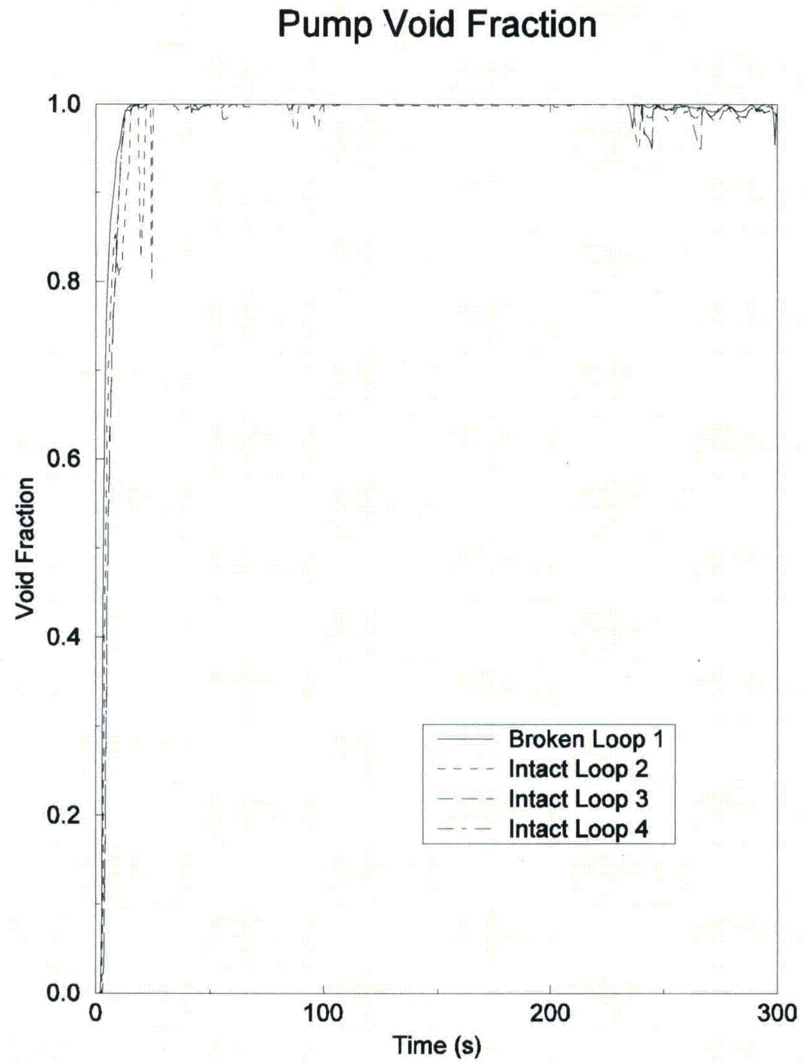
CORE INLET MASS FLUX FOR THE LIMITING CASE



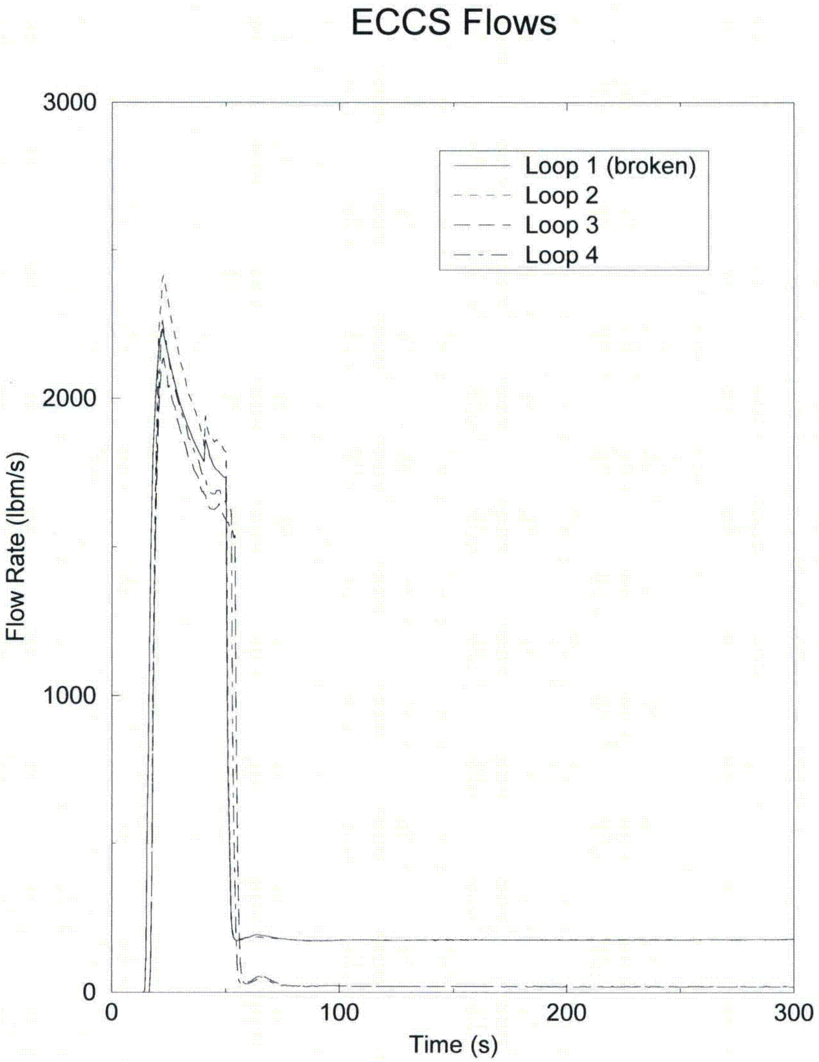
CORE OUTLET MASS FLUX FOR THE LIMITING CASE



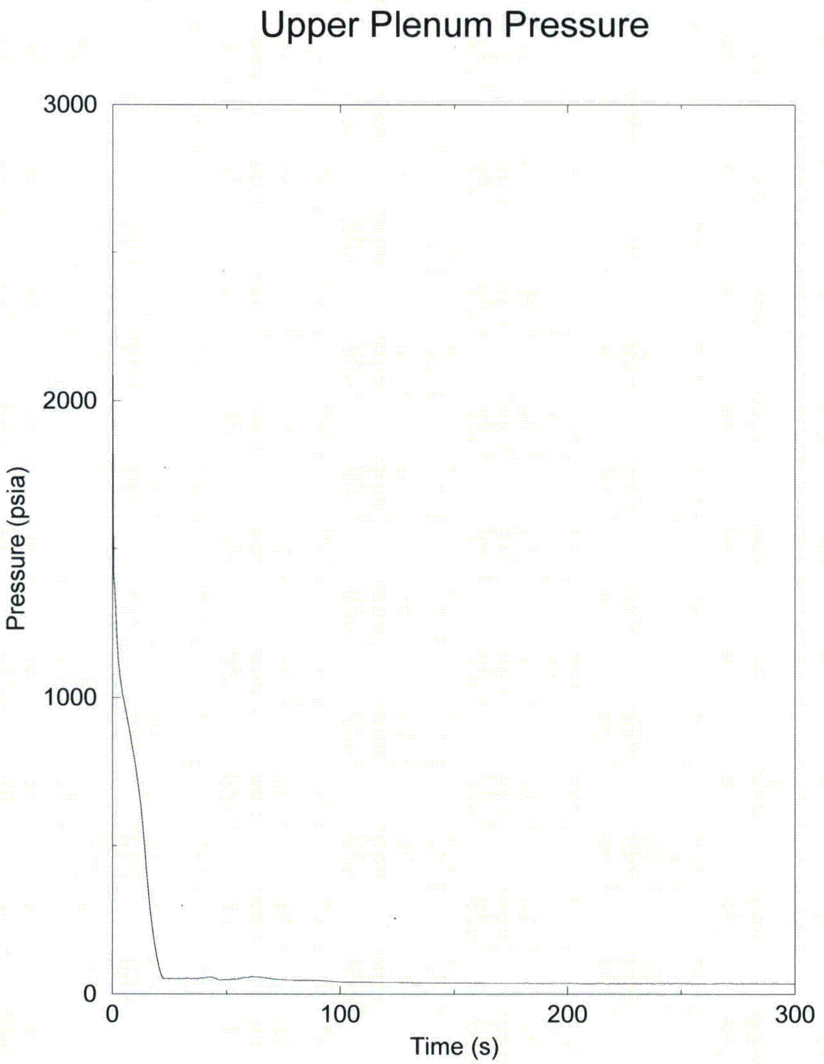
VOID FRACTION AT PCS PUMPS FOR THE LIMITING CASE



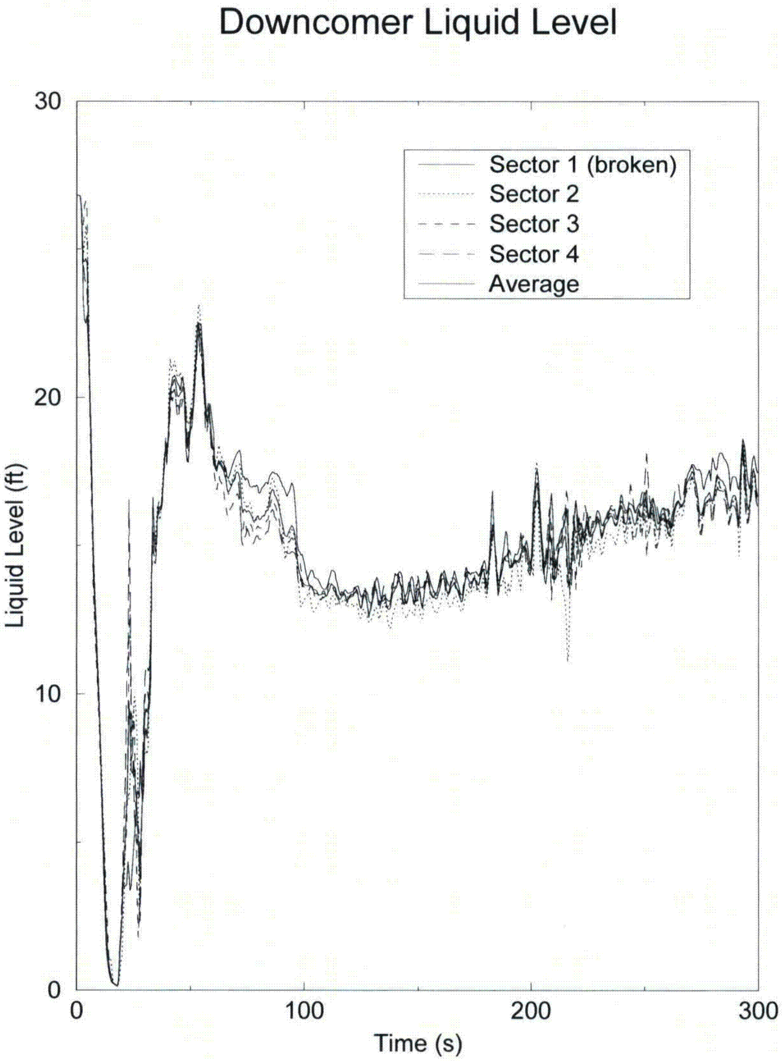
ECCS FLOW (INCLUDES SIT, HPSI, AND LPSI) FOR THE LIMITING CASE



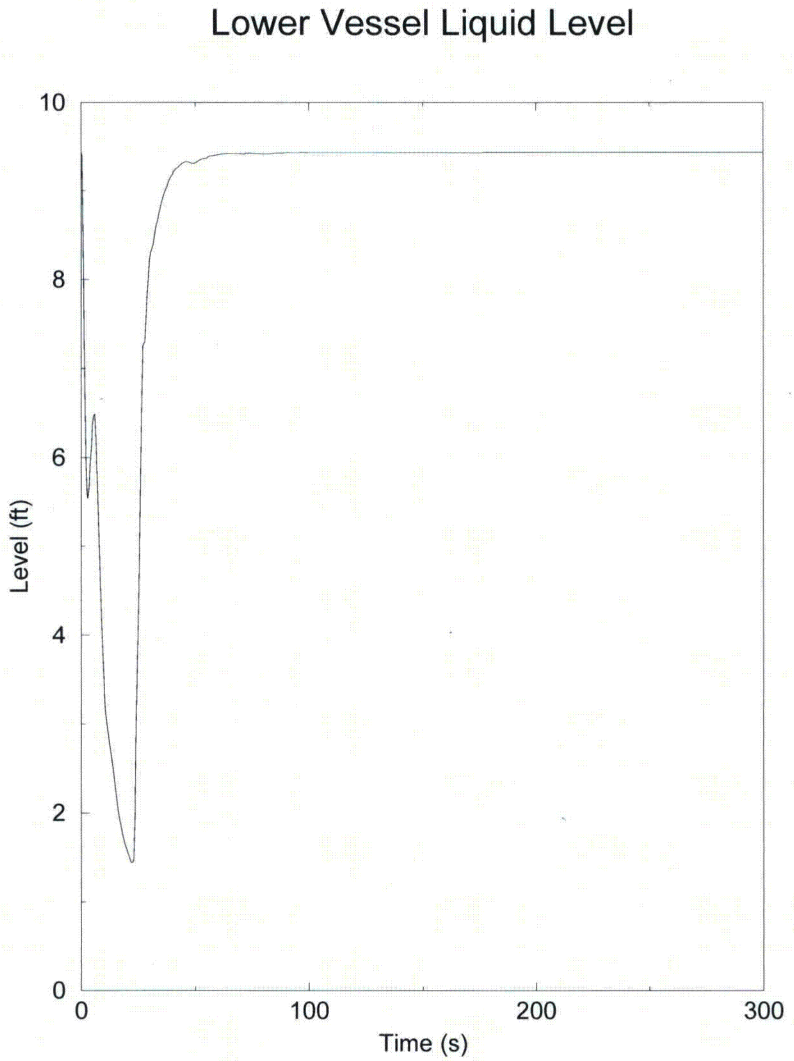
UPPER PLENUM PRESSURE FOR THE LIMITING CASE



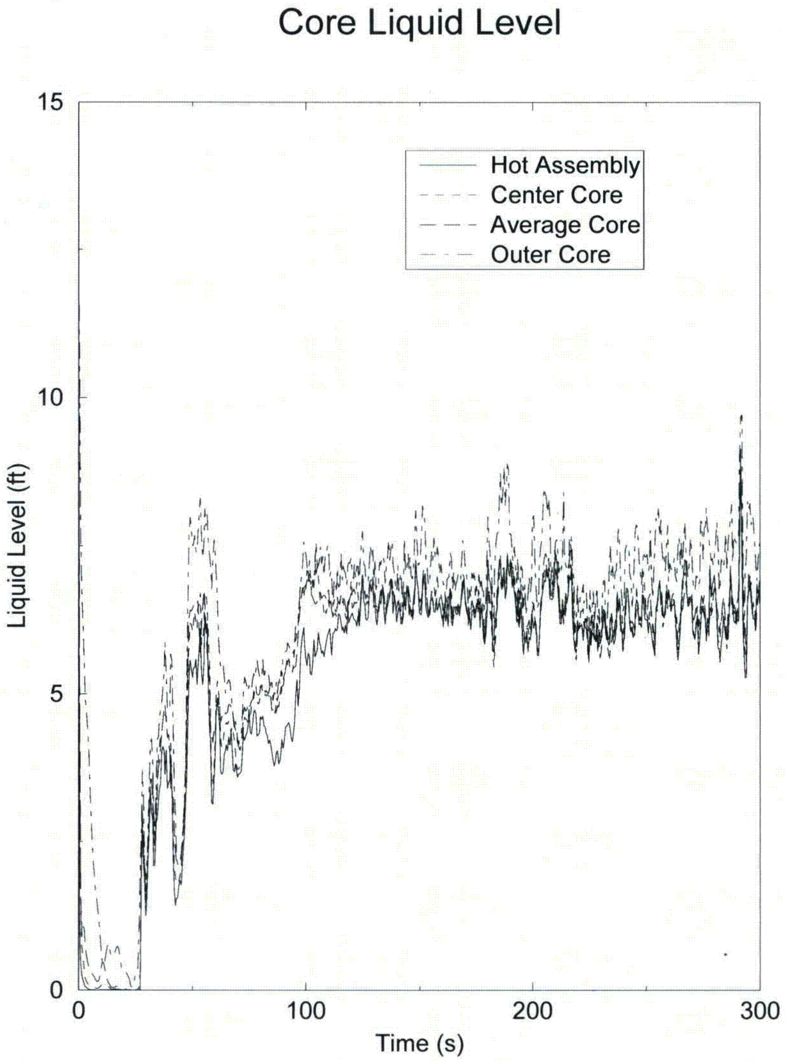
COLLAPSED LIQUID LEVEL IN THE DOWNCOMER FOR THE LIMITING CASE



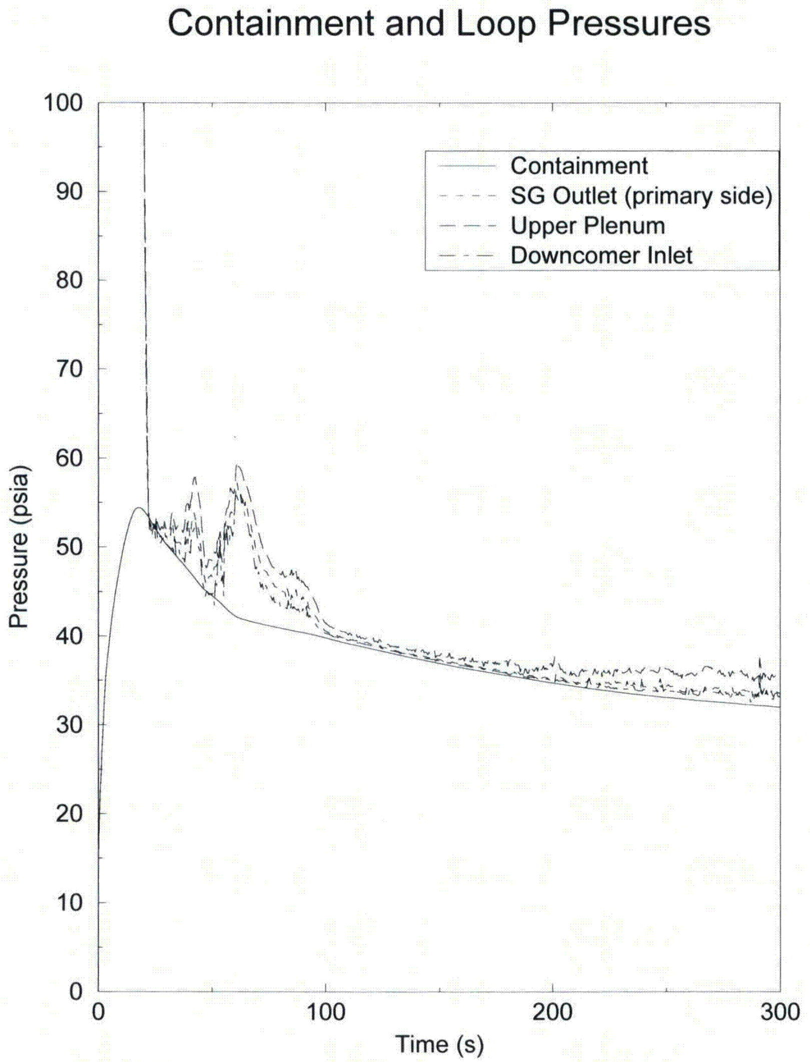
COLLAPSED LIQUID LEVEL IN THE LOWER PLENUM FOR THE LIMITING CASE



COLLAPSED LIQUID LEVEL IN THE CORE FOR THE LIMITING CASE



CONTAINMENT AND LOOP PRESSURES FOR THE LIMITING CASE



CORE EFFECTIVE FLOODING RATE

DELETED in Revision 28

CORE COLLAPSED LIQUID LEVEL

DELETED in Revision 28

CORE QUENCH LEVEL

DELETED in Revision 28

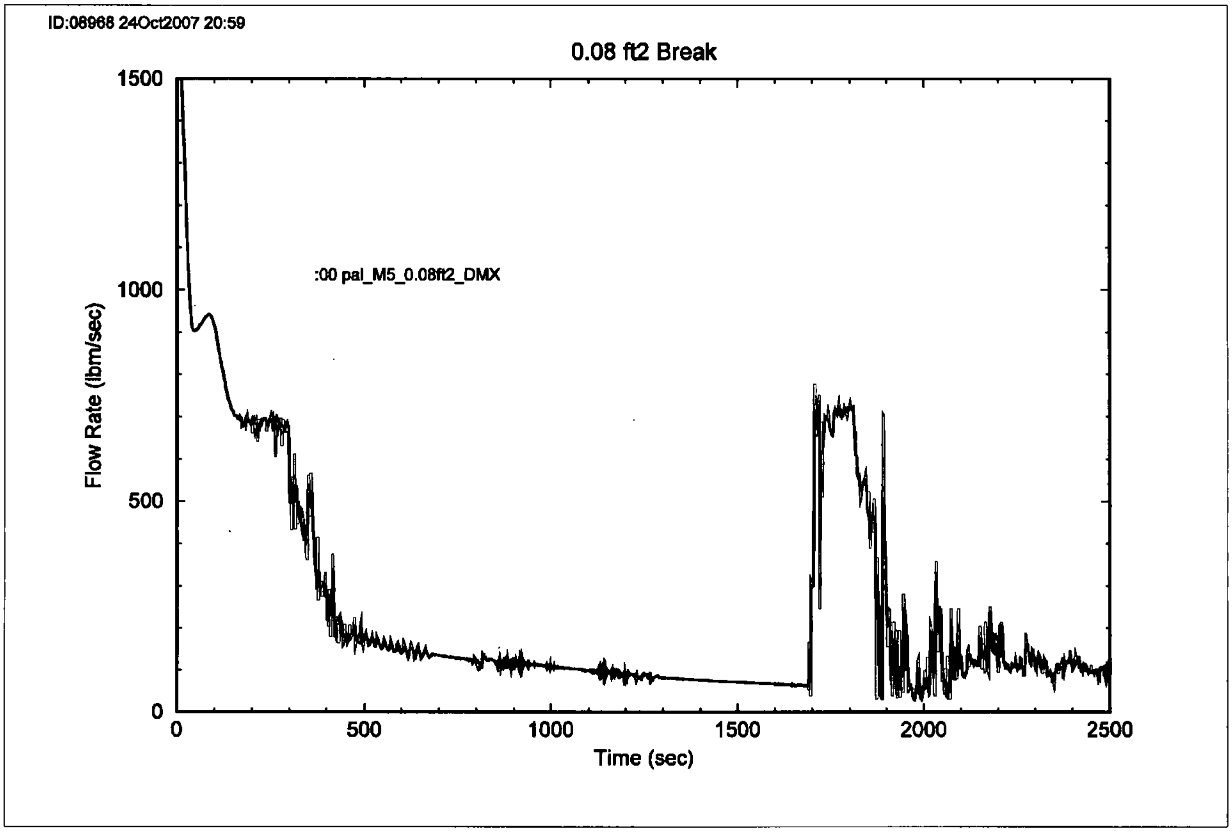
PCT-NODE HEAT TRANSFER COEFFICIENT

DELETED in Revision 28

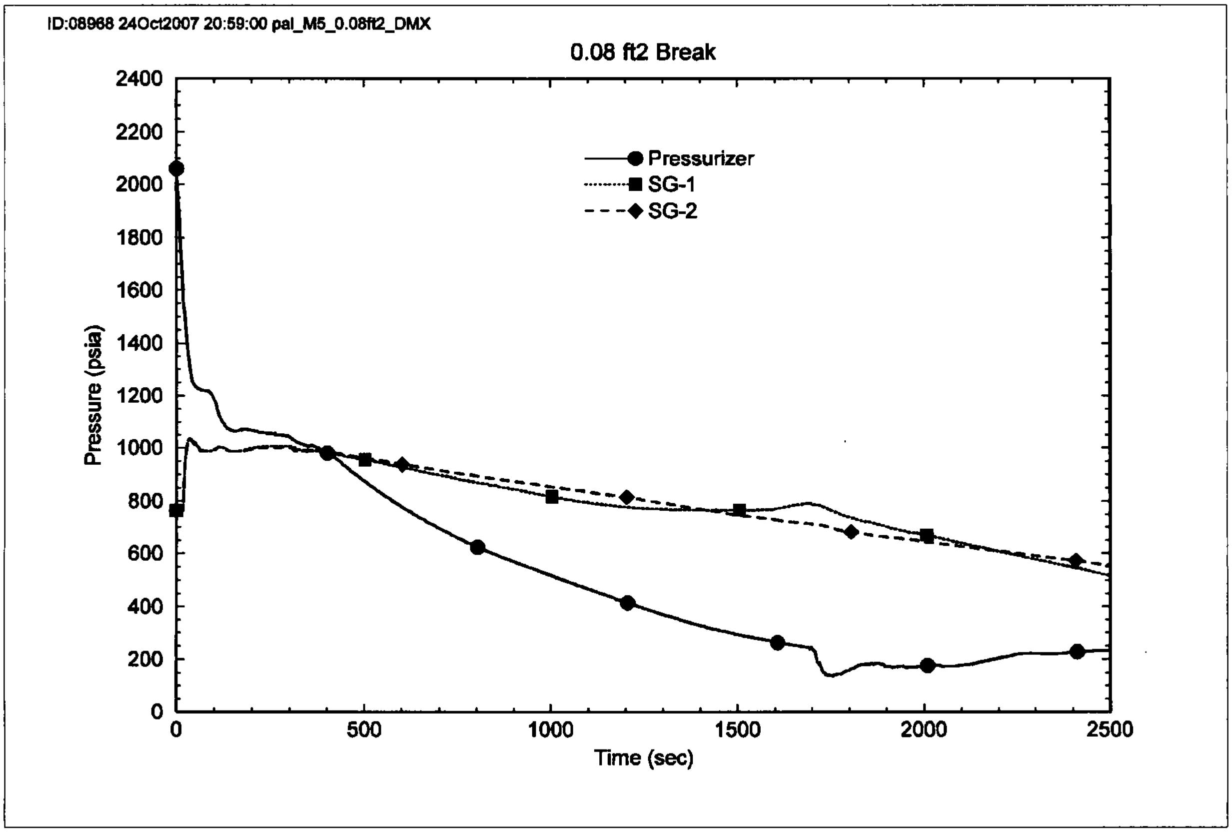
PEAK CLADDING AND RUPTURE LOCATION CLADDING TEMPERATURE FOR THE LIMITING CASE

DELETED in Revision 28

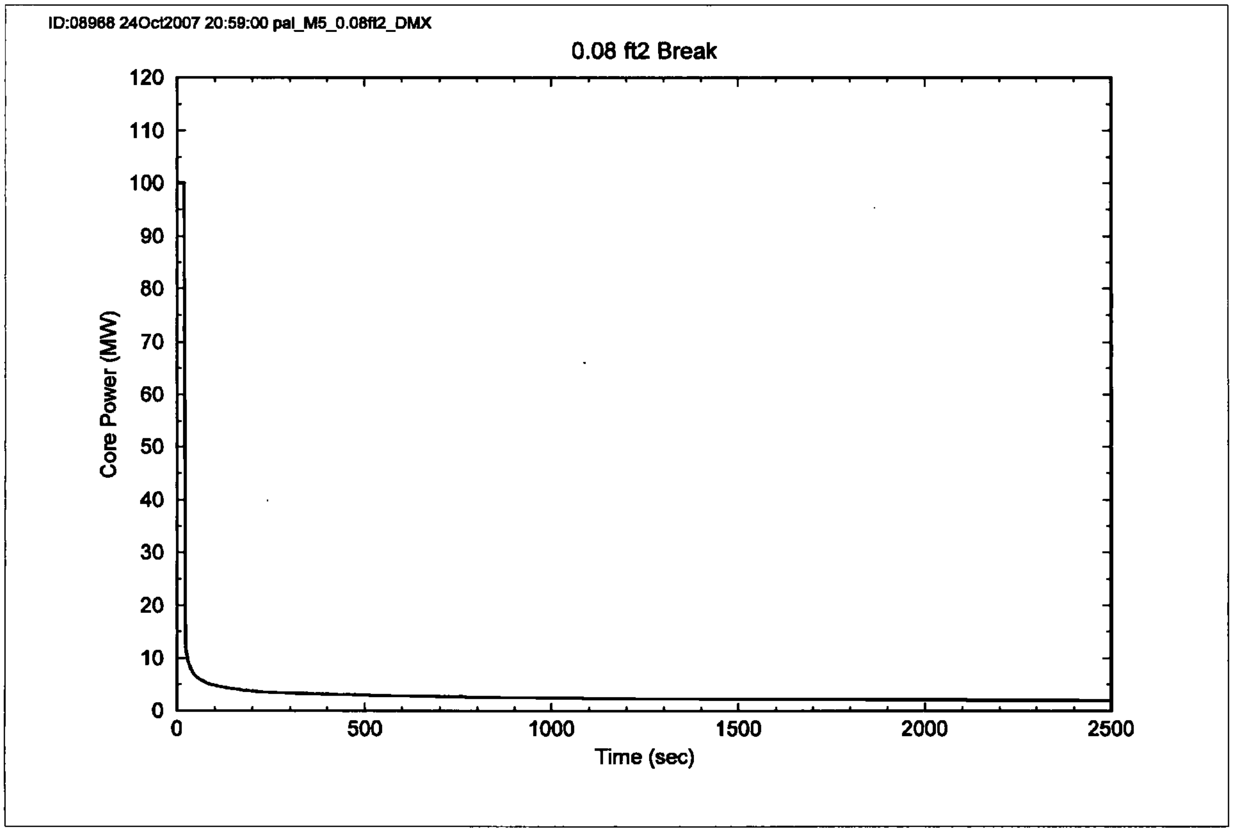
Break Mass Flow Rate (Limiting Case)



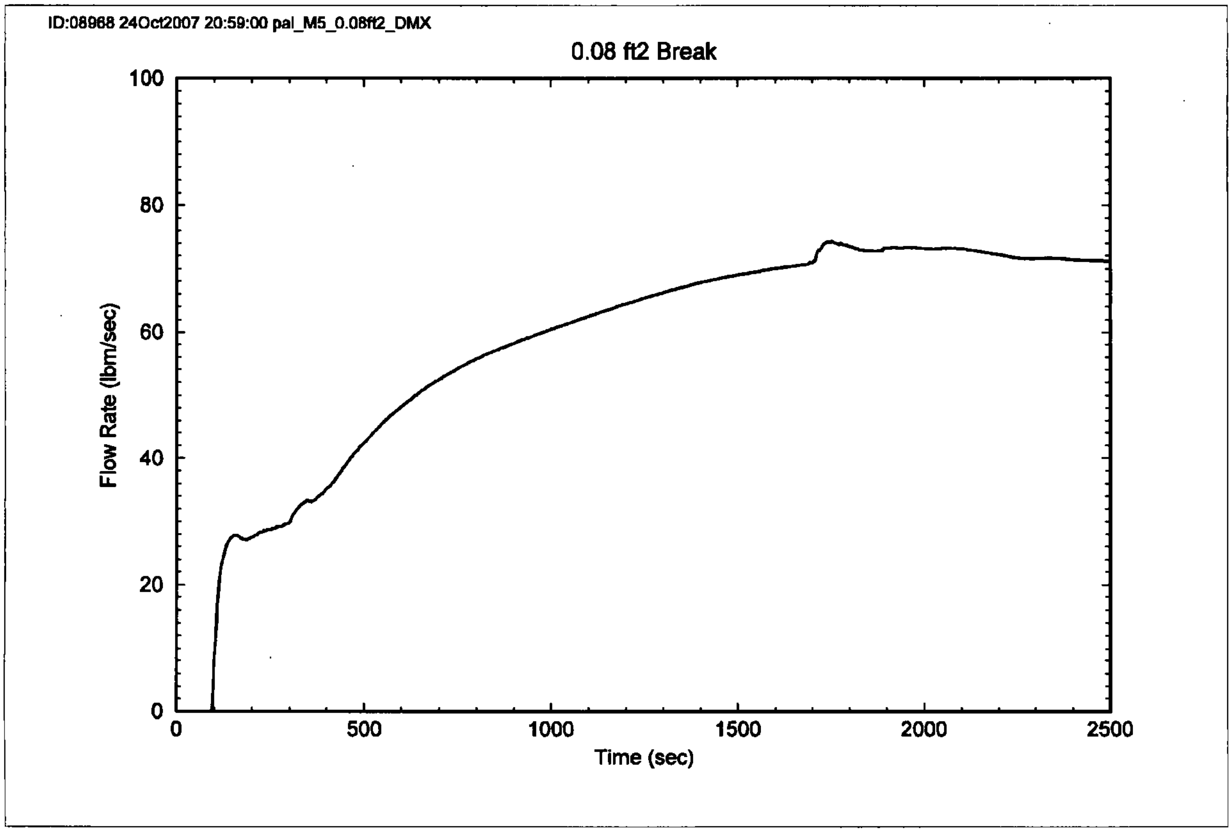
Primary and Secondary Pressures (Limiting Case)



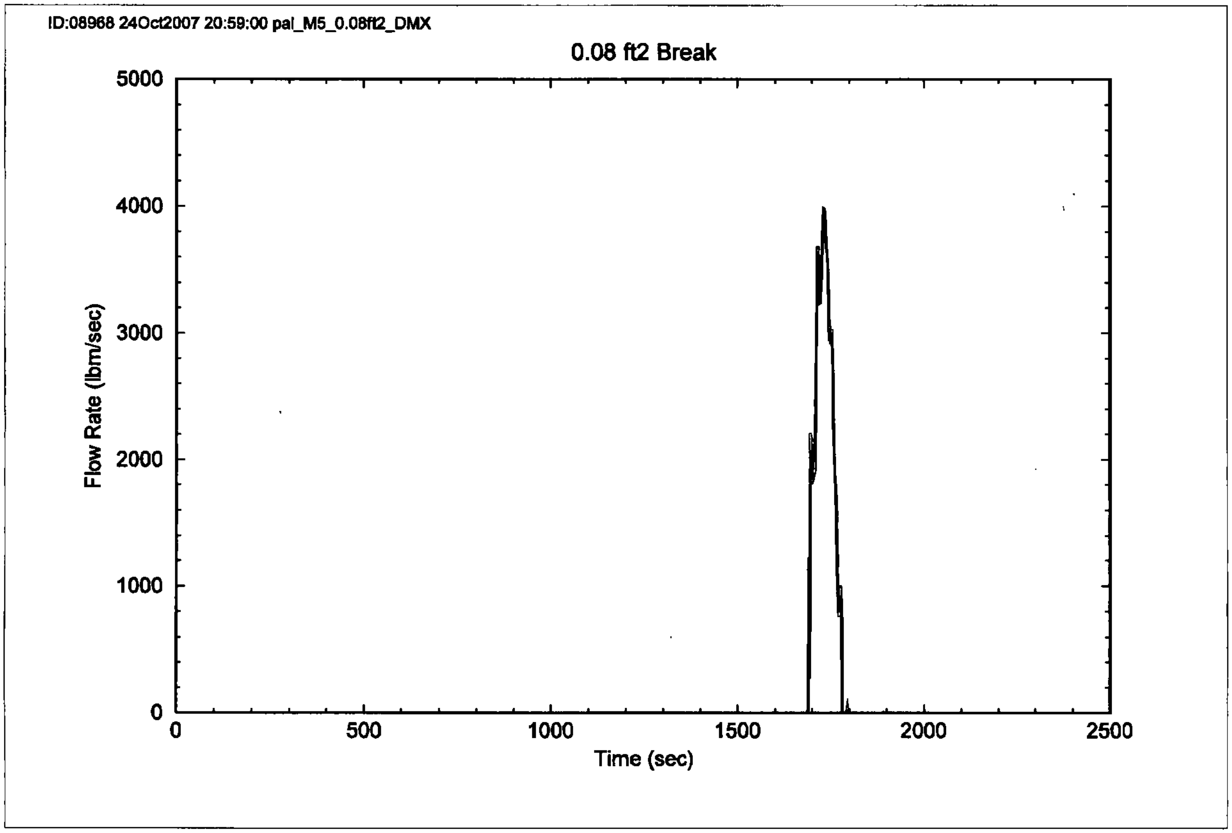
Normalized Reactor Power (Limiting Case)



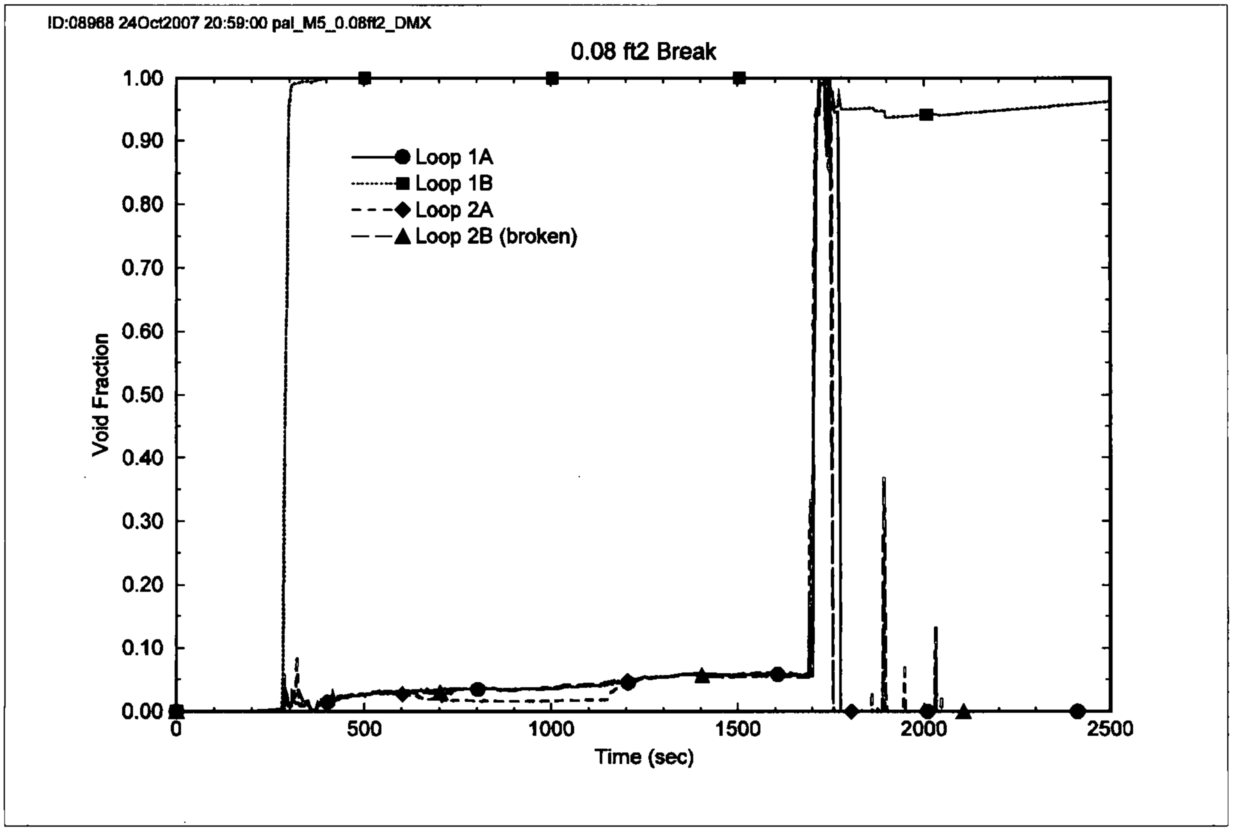
Total HPSI Mass Flow Rate (Limiting Case)



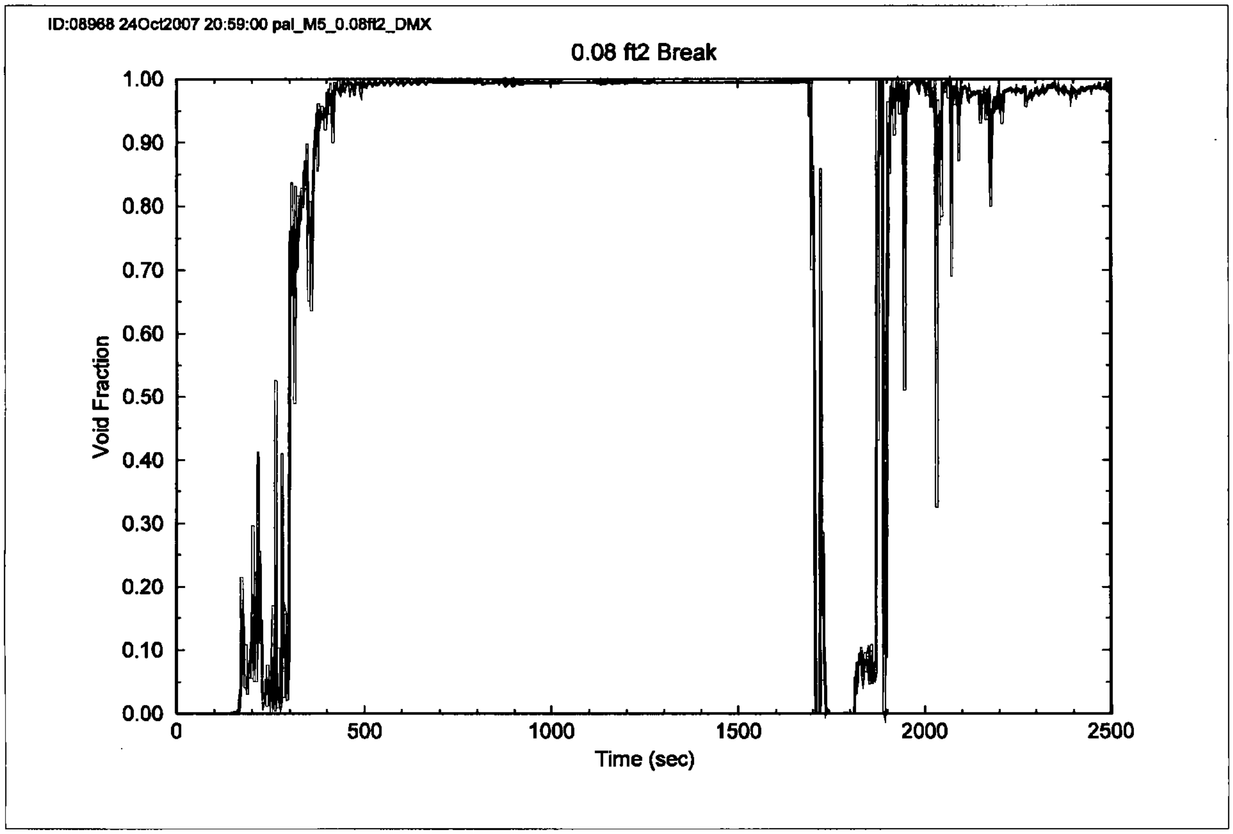
Total SIT Mass Flow Rate (Limiting Case)



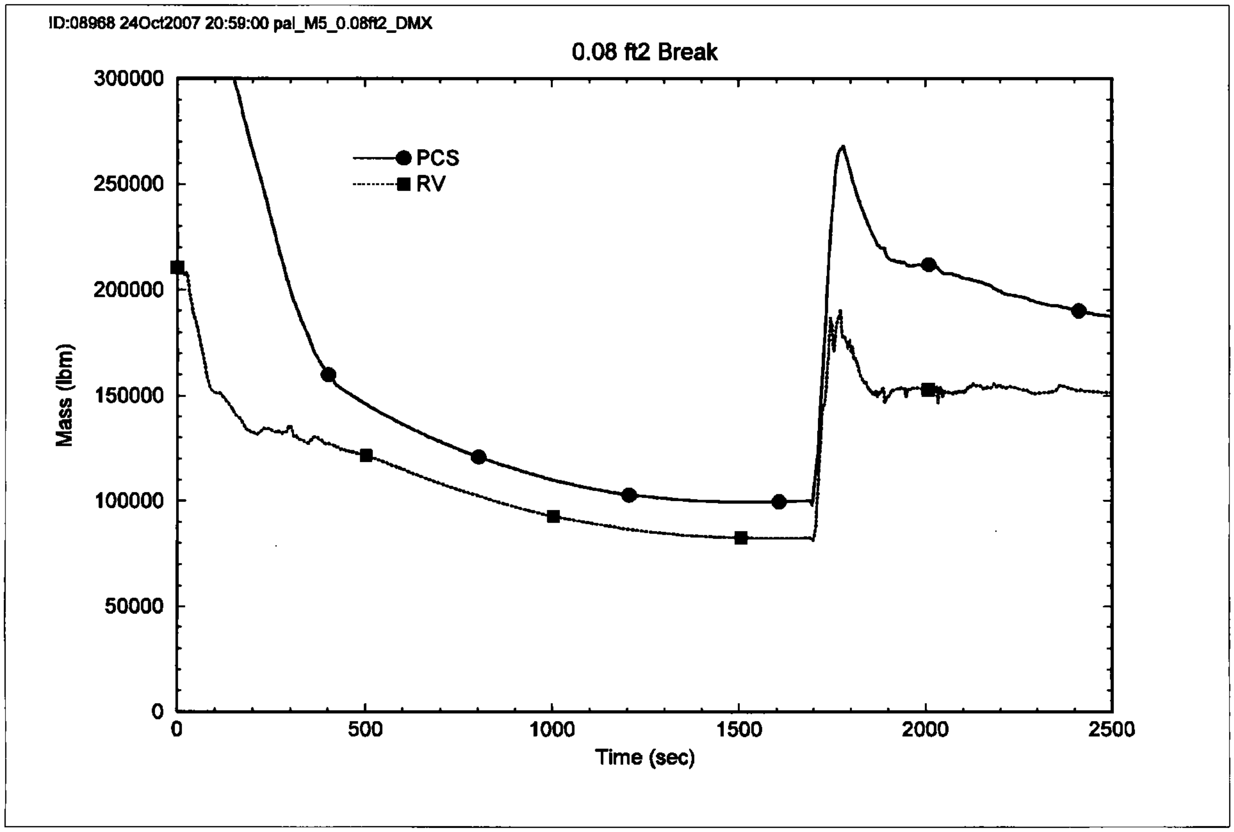
Loop Seal Void Fractions (Limiting Case)



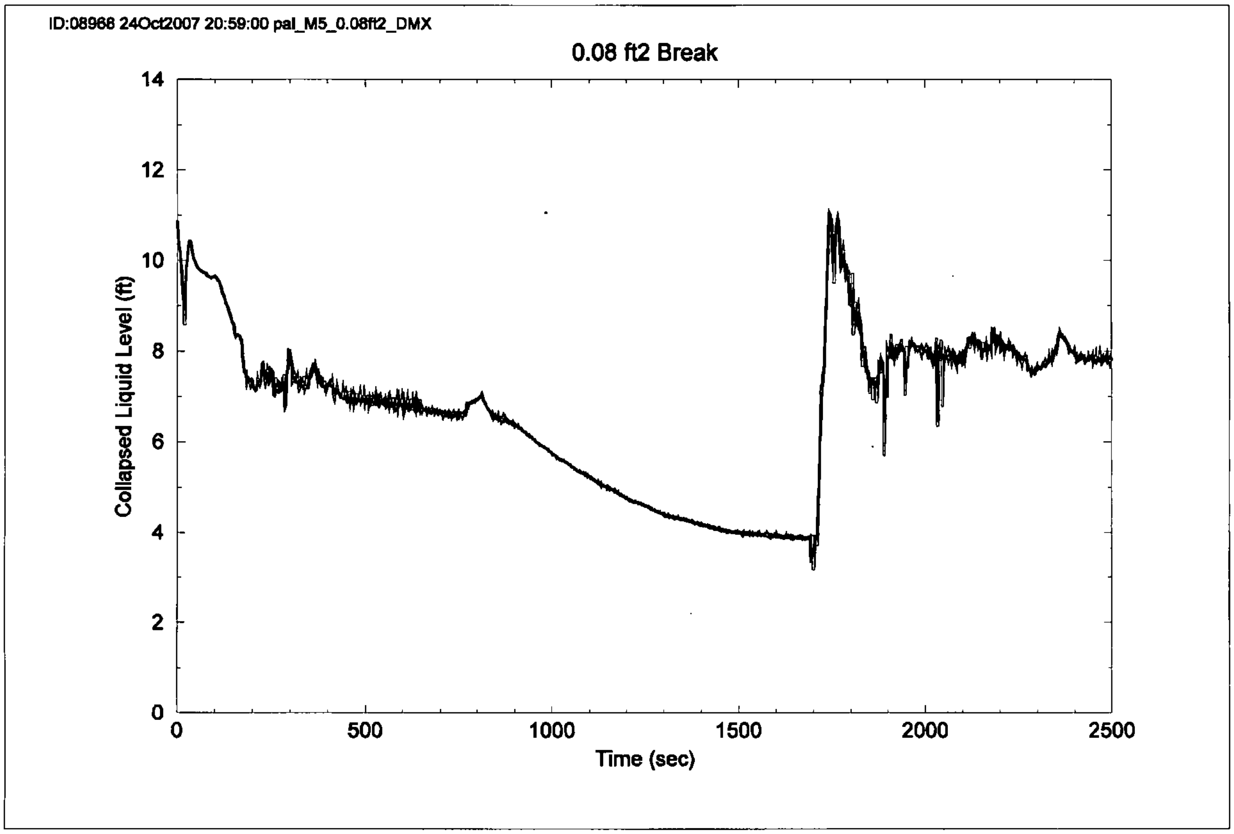
Break Void Fraction (Limiting Case)



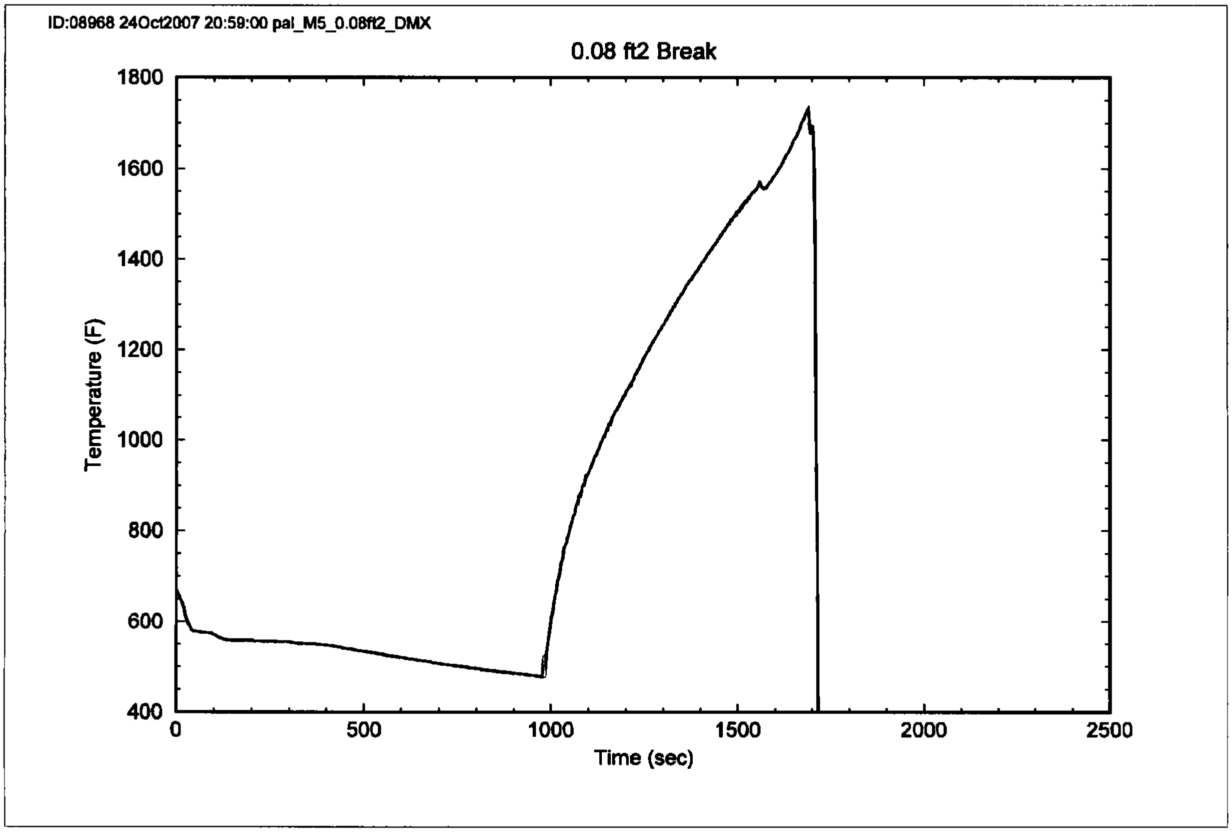
Reactor Vessel and PCS Mass Inventories (Limiting Case)



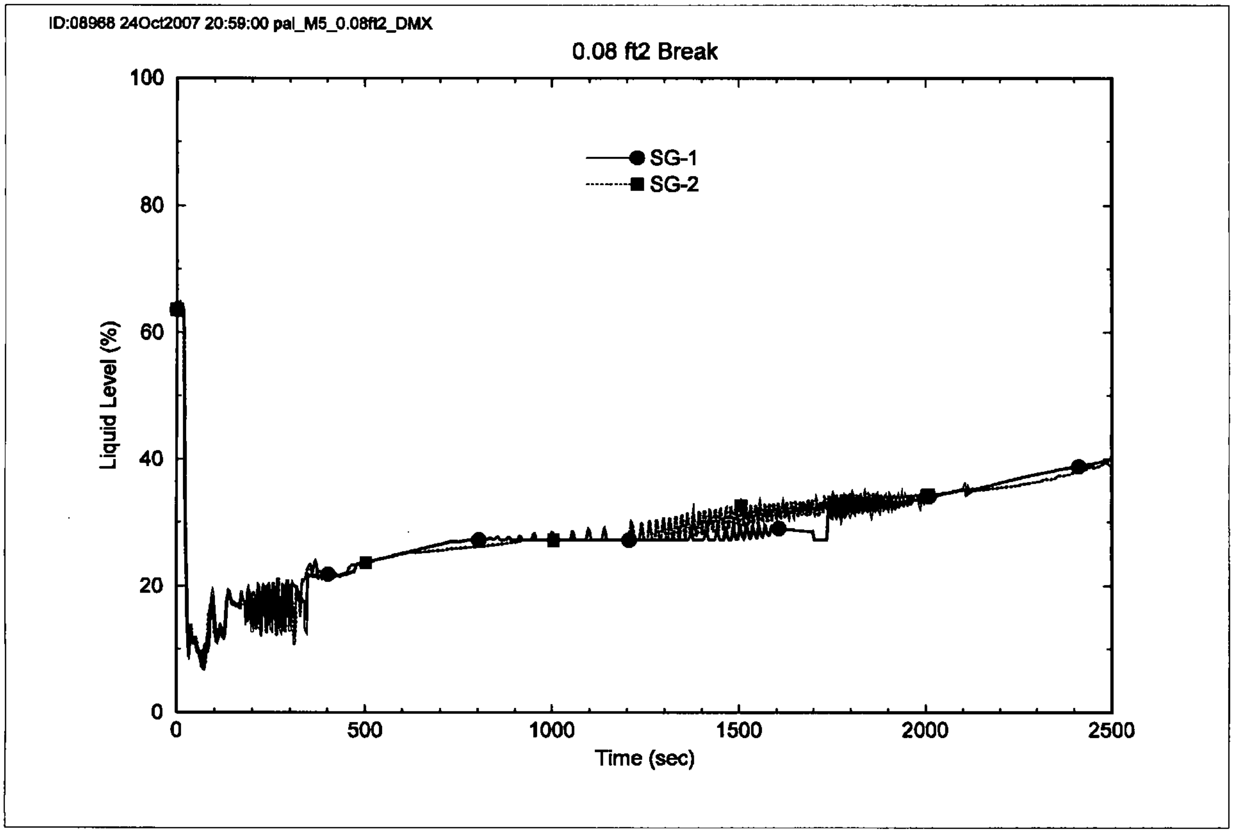
Hot Channel Collapsed Level (Limiting Case)



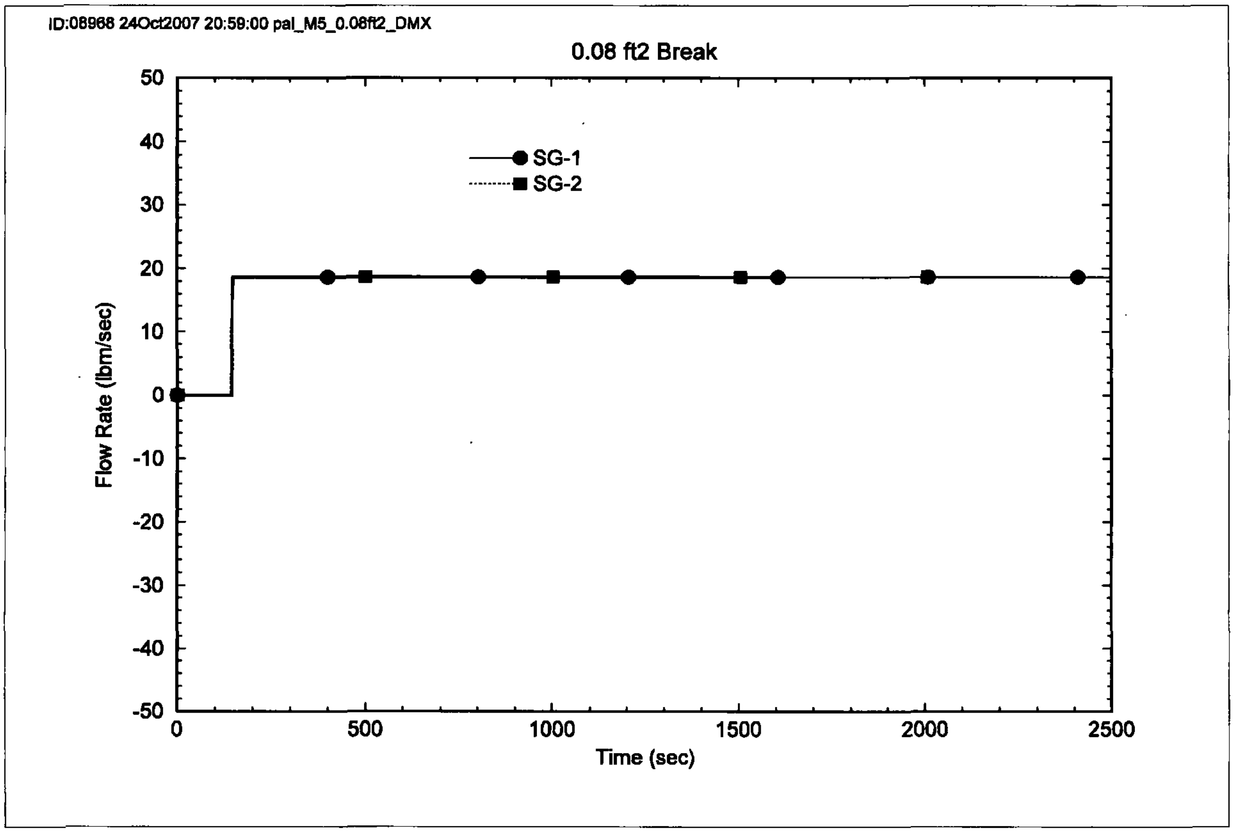
Fluid and Cladding Temperatures (Limiting Case)



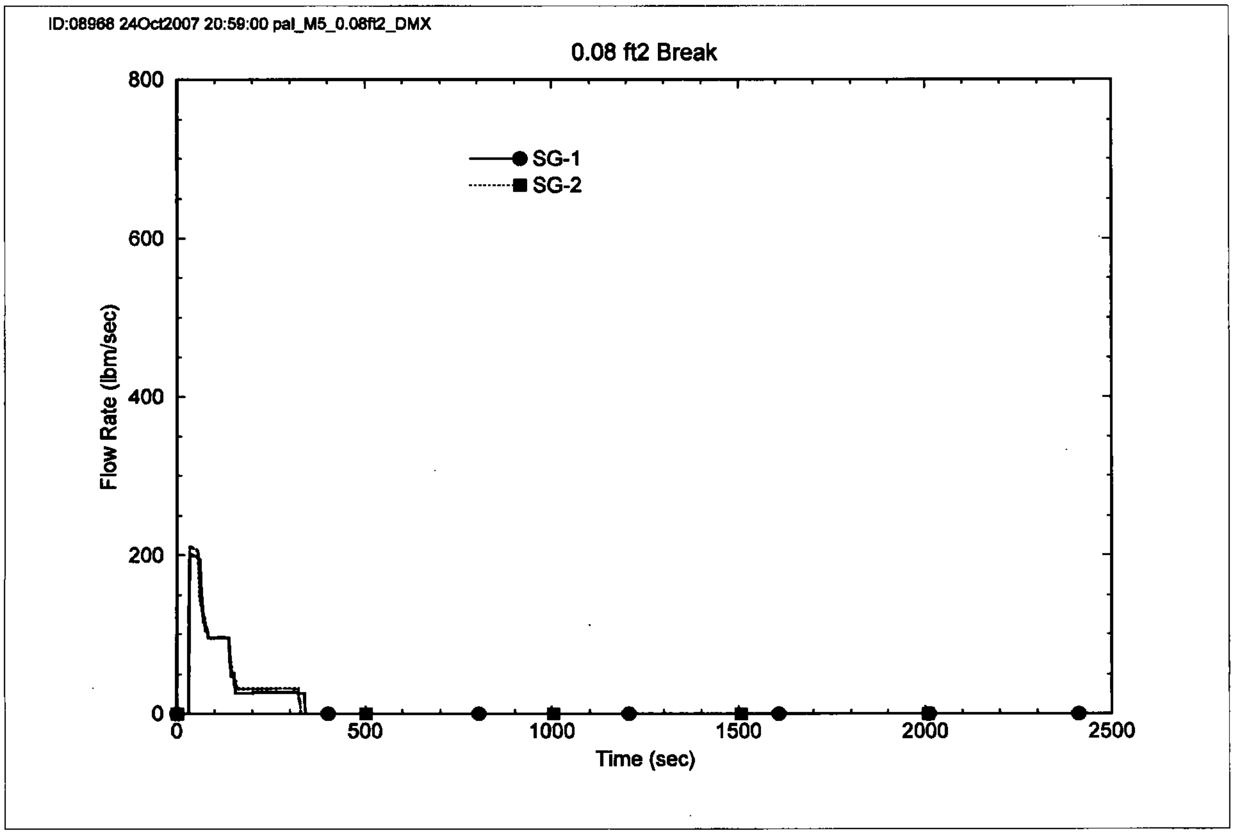
SG Narrow Range Liquid Levels (Limiting Case)



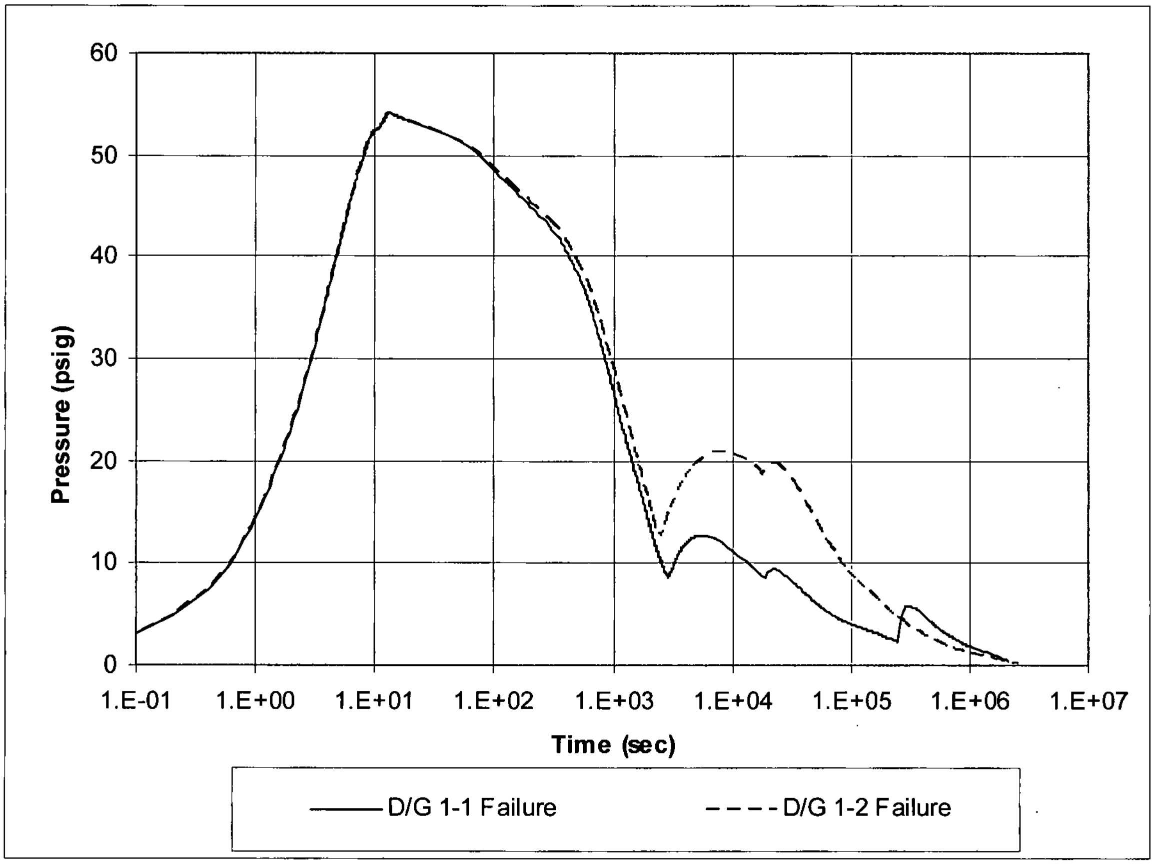
AFW Flow Rates (Limiting Case)



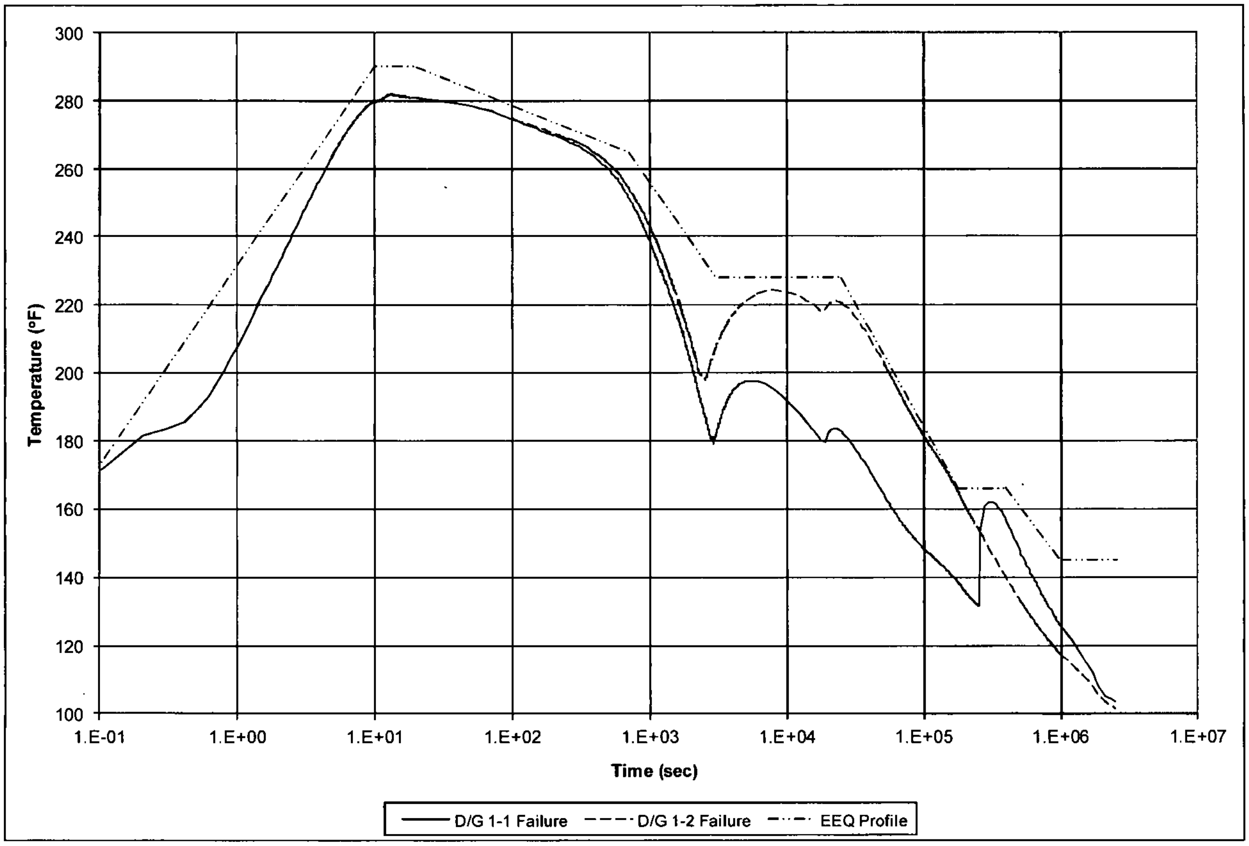
Total MSSV Flow (Limiting Case)



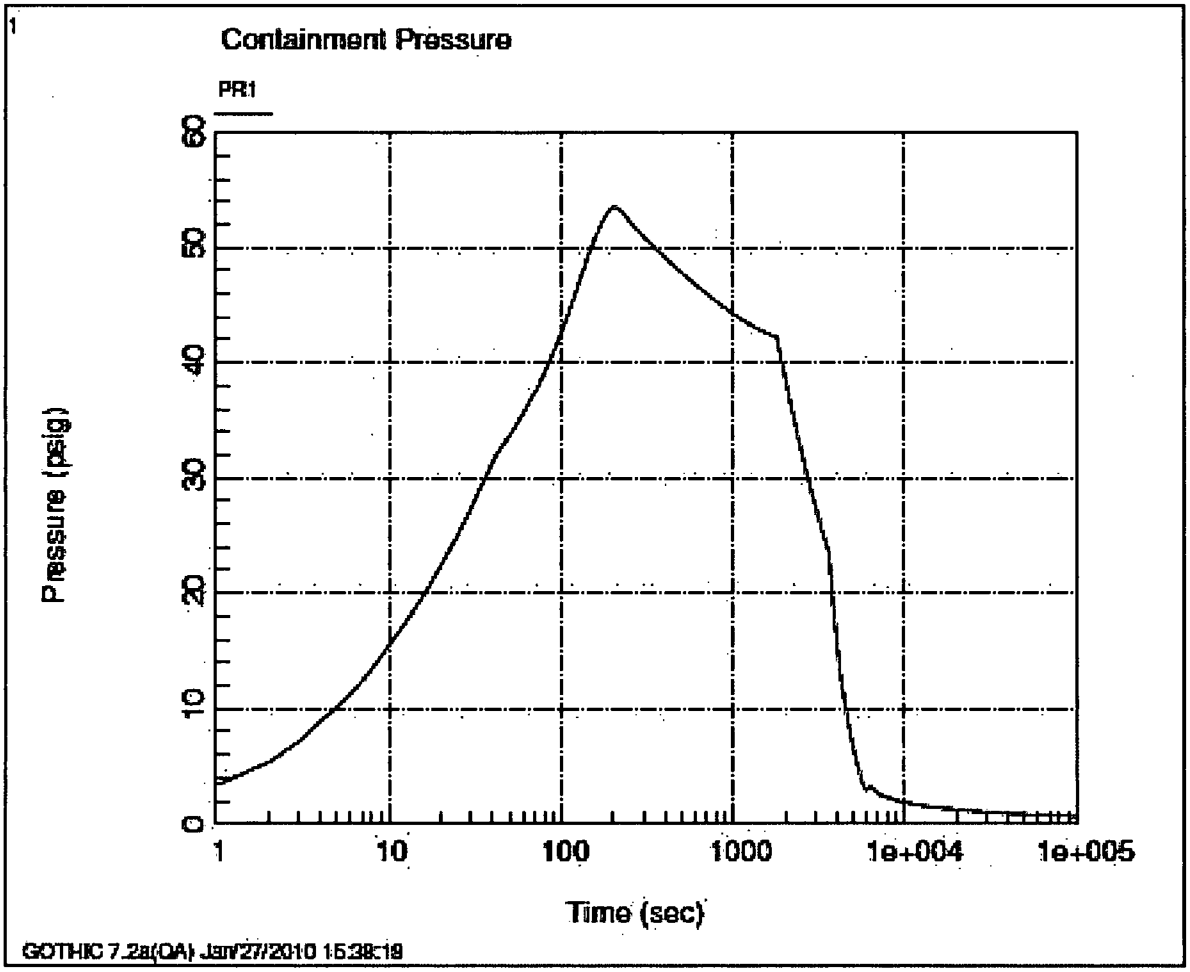
LOCA CONTAINMENT PRESSURE PROFILE



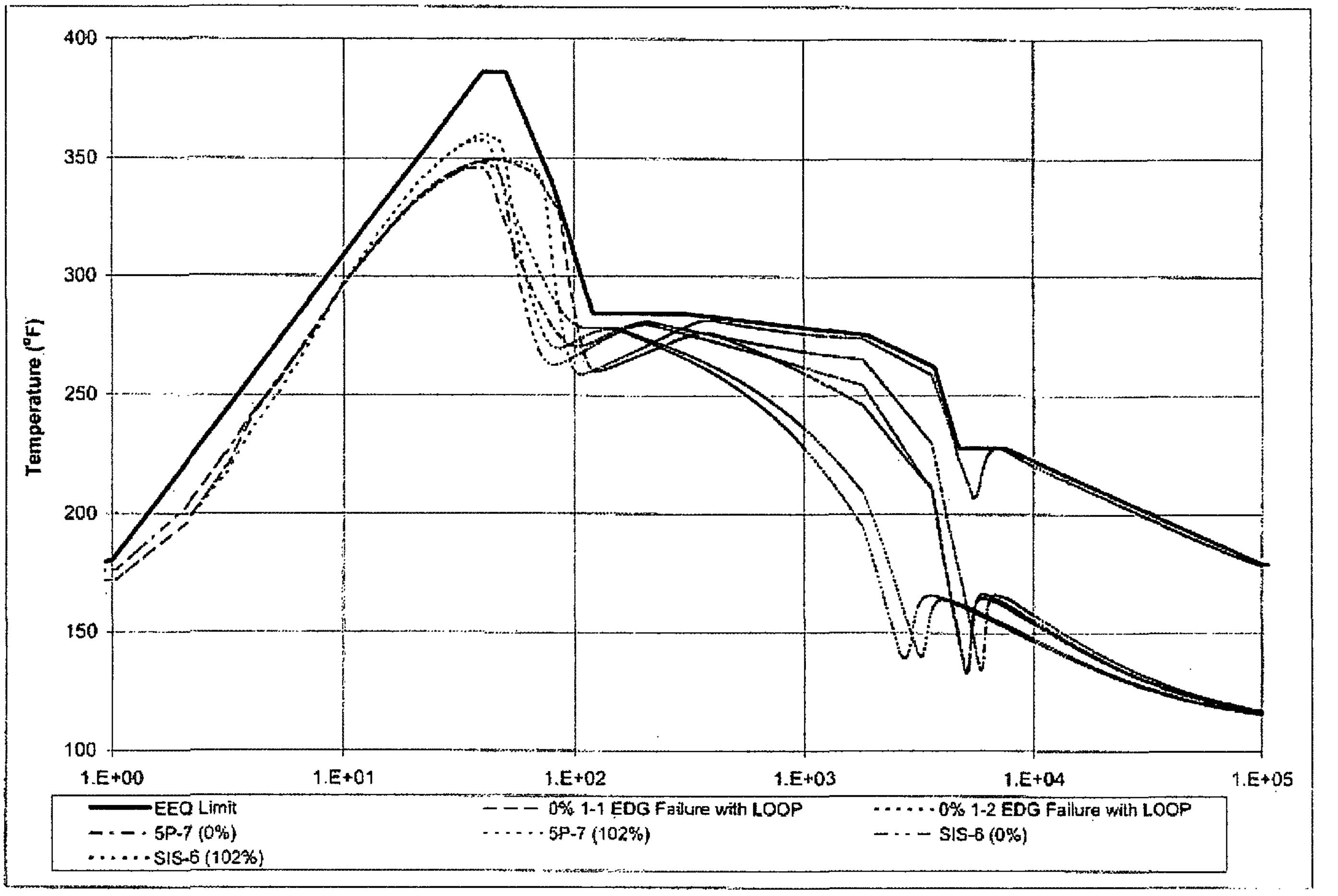
LOCA CONTAINMENT TEMPERATURE PROFILE



MSLB CONTAINMENT RESPONSE
MAXIMUM PRESSURE PROFILE



MSLB CONTAINMENT RESPONSE
ENVIRONMENTAL QUALIFICATION PROFILE



PALISADES CONTAINMENT HYDROGEN ANALYSIS

Deleted per FSAR-2479

CONTAINMENT TEMPERATURE FOR H2 GENERATION

Deleted per FSAR-2479