Table 15.6.1-1 **TIME SEQUENCE OF EVENTS FOR INCIDENTS THAT CAUSE A DECREASE IN REACTOR COOLANT INVENTORY**		
Accident	**Event**	**Time (seconds)**
Inadvertent opening of a pressurizer safety valve	Pressurizer safety valve opens fully	0.00
	Low pressurizer pressure reactor trip setpoint reached	15.50
	Rods begin to drop	17.50
	Minimum DNBR occurs	18.30
Inadvertent opening of two ADS Stage 1 trains	ADS valves begin to open	0.00
	Low pressurizer pressure reactor trip setpoint reached	17.83
	Rods begin to drop	19.83
	ADS valves fully open	20.00
	Minimum DNBR occurs	20.70

Comment [B64]: [15.6-62]

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Minimum DNBR occurs ... [18]

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ac power lost, reactor coolant pumps begin coasting dow... [20]

Table 15.6.2-1

PARAMETERS USED IN EVALUATING THE RADIOLOGICAL CONSEQUENCES OF A SMALL LINE BREAK OUTSIDE CONTAINMENT

Reactor coolant iodine activity	Initial activity equal to the design basis reactor coolant activity of 1.0 μCi/g dose equivalent I-131 with an assumed iodine spike that increases the rate of iodine release from fuel into the coolant by a factor of 500 (see Table 15A-2 in Appendix 15A)[a]
Reactor coolant noble gas activity	280 μCi/g dose equivalent Xe-133
Break flow rate (gpm)	130[b]
Fraction of reactor coolant flashing	0.47
Duration of accident (hr)	0.5
Atmospheric dispersion (χ/Q) factors	See Table 15A-5
Nuclide data	See Table 15A-4

Comment [B65]: [15.6-63]

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Notes:

a. Use of accident-initiated iodine spike is consistent with the guidance in the Standard Review Plan.

b. At density of 62.4 lb/ft^3.

Comment [B66]: [15.6-64]

Table 15.6.3-1 **STEAM GENERATOR TUBE RUPTURE SEQUENCE OF EVENTS**	
Events	**Time (seconds)**
Double-ended steam generator tube rupture	0
Loss of offsite power	0
Reactor trip	0
Reactor coolant pumps and main feedwater pumps assumed to trip and begin to coastdown	0
Two chemical and volume control pumps actuated and pressurizer heaters turned on	0
Low-2 pressurizer level signal generated	2,577
Ruptured steam generator power-operated relief valve fails open	2,577
Core makeup tank injection and PRHR operation begins (following maximum delay)	2,594
Ruptured steam generator power-operated relief valve block valve closes on low steam line pressure signal	3,157
Chemical and volume control system isolated on high-2 steam generator narrow range level setpoint	14,909
Break flow terminated	33,989

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Comment [B67]: [15.6-65]

Table 15.6.3-2 **STEAM GENERATOR TUBE RUPTURE MASS RELEASE RESULTS** **Total Mass Flow from Initiation of Event to Cooldown to RNS[(1)] Conditions**		
	Start of Event to Break Flow Termination (Pounds Mass)	**Break Flow Termination to Cut-in of RHR (Pounds Mass)**
Ruptured steam generator		
– Atmosphere	265,190	84,000
Intact steam generator		
– Atmosphere	196,000	1,015,000
Break flow	447,920	0

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<u>**Note:**</u>

1. RNS = normal residual heat removal

Comment [B68]: [15.6-66]

Table 15.6.3-3 **PARAMETERS USED IN EVALUATING THE RADIOLOGICAL CONSEQUENCES OF A STEAM GENERATOR TUBE RUPTURE**	
Reactor coolant iodine activity – Accident initiated spike – Preaccident spike	 Initial activity equal to the equilibrium operating limit for reactor coolant activity of 1.0 μCi/g dose equivalent I-131 with an assumed iodine spike that increases the rate of iodine release from fuel into the coolant by a factor of 335 (see Appendix 15A). Duration of spike is 8.0 hours. An assumed iodine spike that results in an increase in the reactor coolant activity to 60 μCi/g of dose equivalent I-131 (see Appendix 15A)
Reactor coolant noble gas activity	280 μCi/g dose equivalent Xe-133
Reactor coolant alkali metal activity	Design basis activity (see Table 11.1-2)
Secondary coolant initial iodine and alkali metal	10% of reactor coolant concentrations at maximum equilibrium conditions
Reactor coolant mass (lb)	3.7 E+05
Offsite power	Lost on reactor trip
Condenser	Lost on reactor trip
Time of reactor trip	Beginning of the accident
Duration of steam releases (hr)	15.94
Atmospheric dispersion factors	See Appendix 15A
Nuclide data	See Appendix 15A
Steam generator in ruptured loop – Initial secondary coolant mass (lb) – Primary-to-secondary break flow – Integrated flashed break flow (lb) – Steam released (lb) – Iodine partition coefficient – Alkali metals partition coefficient	 1.16 E+05 See Figure 15.6.3-5 See Figure 15.6.3-10 See Table 15.6.3-2 1.0 E-02[(a)] 3.0 E-03[(a)]
Steam generator in intact loop – Initial secondary coolant mass (lb) – Primary-to-secondary leak rate (lb/hr) – Steam released (lb) – Iodine partition coefficient – Alkali metals partition coefficient	 2.30 E+04 52.16[(b)] See Table 15.6.3-2 1.0 E-02[(a)] 3.0 E-03[(a)]

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Notes:

a. Iodine partition coefficient does not apply to flashed break flow.

b. Equivalent to 150 gpd at psia cooled liquid at 62.4 lb/ft^3.

Table 15.6.5-1 **CORE ACTIVITY RELEASES TO THE CONTAINMENT ATMOSPHERE**		
Nuclide	**Gap Release Released over 0.5 hr. (0.167 - 0.667 hr)(1)**	**Core Melt In-vessel Release (0.667 - 1.967 hr)(1)**
Noble gases	0.05	0.95
Iodines	0.05	0.35
Alkali metals	0.05	0.25
Tellurium group	–	0.05
Strontium and barium	–	0.02
Noble metals group	–	0.0025
Cerium group	–	0.0005
Lanthanide group	–	0.0002

Notes:

1. Releases are stated as fractions of the original core fission product inventory.
2. Dash (–) indicates not applicable.

Table 15.6.5-2 (Sheet 1 of 3)

ASSUMPTIONS AND PARAMETERS USED IN CALCULATING RADIOLOGICAL CONSEQUENCES OF A LOSS-OF-COOLANT ACCIDENT

Comment [B69]: [15.6-67]

Primary coolant source data	
– Noble gas concentration	280 μCi/g dose equivalent Xe-133
– Iodine concentration	1.0 μCi/g dose equivalent I-131
– Primary coolant mass (lb)	4.39 E+05
Containment purge release data	
– Containment purge flow rate (cfm)	16,000
– Time to isolate purge line (seconds)	30
– Time to blow down the primary coolant system (minutes)	10
– Fraction of primary coolant iodine that becomes airborne	0.5
Core source data	
– Core activity at shutdown	See Table 15A-3
– Release of core activity to containment atmosphere (timing and fractions)	See Table 15.6.5-1
– Iodine species distribution (%)	
• Elemental	4.85
• Organic	0.15
• Particulate	95
Containment leakage release data	
– Containment volume (ft^3)	2.06 E+06
– Containment leak rate, 0-24 hr (% per day)	0.10
– Containment leak rate, > 24 hr (% per day)	0.05
– Elemental iodine deposition removal coefficient (hr^{-1})	1.7
– Decontamination factor limit for elemental iodine removal	200
– Removal coefficient for particulates (hr^{-1})	See Appendix 15B
Main control room model	
– Main control room volume (ft^3)	35,700
– Volume of HVAC, including main control room and control support area (ft^3)	105,500
– Normal HVAC operation (prior to switchover to an emergency mode)	
• Air intake flow (cfm)	1925
• Filter efficiency	Not applicable
– Atmospheric dispersion factors (sec/m^3)	See Table 15A-6

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Table 15.6.5-2 (Sheet 2 of 3)

ASSUMPTIONS AND PARAMETERS USED IN CALCULATING RADIOLOGICAL CONSEQUENCES OF A LOSS-OF-COOLANT ACCIDENT

Main control room model (cont.)	
– Occupancy	
• 0 - 24 hr	1.0
• 24 - 96 hr	0.6
• 96 - 720 hr	0.4
– Breathing rate (m^3/sec)	3.5 E-04
Control room with emergency habitability system credited (VES Credited)	
– Main control room activity level at which the emergency habitability system actuation is actuated (Ci/m^3 of dose equivalent I-131)	2.0 E-06
– Response time to actuate VES based on radiation monitor response time and VBS isolation (sec)	180
– Interval with operation of the emergency habitability system	
• Flow from compressed air bottles of the emergency habitability system (cfm)	60
• Unfiltered inleakage via ingress/egress (scfm)	5
• Unfiltered inleakage from other sources (scfm)	10
• Recirculation flow through filters (scfm)	600
• Filter efficiency (%)	
○ Elemental iodine	90
○ Organic iodine	30
○ Particulates	99
– Time at which the compressed air supply of the emergency habitability system is depleted (hr)	72
– After depletion of emergency habitability system bottled air supply (>72 hr)	
• Air intake flow (cfm)	1700
• Intake flow filter efficiency (%)	Not applicable
• Recirculation flow (cfm)	Not applicable
– Time at which the compressed air supply is restored and emergency habitability system returns to operation (hr)	168

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Table 15.6.5-2 (Sheet 3 of 3) **ASSUMPTIONS AND PARAMETERS USED IN CALCULATING RADIOLOGICAL CONSEQUENCES OF A LOSS-OF-COOLANT ACCIDENT**	
Control room with credit for continued operation of HVAC (VBS Supplemental Filtration Mode Credited)	
– Time delay to switch from normal operation to the supplemental air filtration mode (sec)	60
– Unfiltered air inleakage (cfm)	25
– Filtered air intake flow (cfm)	860
– Filtered air recirculation flow (cfm)	2740
– Filter efficiency (%)	
• Elemental iodine	90
• Organic iodine	90
• Particulates	99
Miscellaneous assumptions and parameters	
– Offsite power	Not applicable
– Atmospheric dispersion factors (offsite)	See Table 15A-5
– Nuclide dose conversion factors	See Table 15A-4
– Nuclide decay constants	See Table 15A-4
– Offsite breathing rate (m^3/sec)	
0 - 8 hr	3.5 E-04
8 - 24 hr	1.8 E-04
24 - 720 hr	2.3 E-04

Table 15.6.5-3 **RADIOLOGICAL CONSEQUENCES OF A LOSS-OF-COOLANT ACCIDENT WITH CORE MELT**	
	TEDE Dose (rem)
Exclusion zone boundary dose (1.3 - 3.3 hr)[1]	23.6
Low population zone boundary dose (0 - 30 days)	22.4
Main control room dose (emergency habitability system in operation) – Airborne activity entering the main control room – Direct radiation from adjacent structures – Sky-shine – Spent fuel pool boiling – Total	 4.26 TBD TBD 0.01 ≤ 5 rem (TBD)
Main control room dose (normal HVAC operating in the supplemental filtration mode) – Airborne activity entering the main control room – Direct radiation from adjacent structures – Sky-shine – Spent fuel pool boiling – Total	 4.45 TBD TBD 0.01 ≤ 5 rem (TBD)

Note:

1. This is the 2-hour period having the highest dose.

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Table 15.6.5-4

MAJOR PLANT PARAMETER ASSUMPTIONS USED IN THE BEST-ESTIMATE LARGE-BREAK LOCA ANALYSIS

Parameter	Value
Plant Physical Configuration	
Steam generator tube plugging level	≤ 10% (10% tube plugging bounds 0%)
Hot assembly location	Under support column (Bounds under open hole or guide tube)
Pressurizer location	In intact loop (Bounds location in broken loop)
Initial Operating Conditions	
Reactor power	Core power < 1.01*3400 MWt
Peak linear heat rate	See Table 15.6.5-7
Hot rod assembly power	See Table 15.6.5-7
Hot assembly power	$P_{HA} \leq 1.654$
Axial power distribution[1]	See Figure 15.6.4A-13
Peripheral assembly power	$0.2 \leq P_{LOW} \leq 0.8$
Fluid Conditions	
Reactor coolant system average temperature	573.6 – 8.0°F ≤ T_{AVG} ≤ 573.6 + 8.0°F
Pressurizer pressure	2250 ± 50 psia
Pressurizer level (water volume)	1000 ft^3 (nominal)
Accumulator temperature	50°F ≤ T_{ACC} ≤ 120°F
Accumulator pressure	652 psia ≤ P_{ACC} ≤ 784 psia
Accumulator water volume	1666.8 ft^3 ≤ V_{ACC} ≤ 1732.3 ft^3
Reactor Coolant System Boundary Conditions	
Single failure assumption	Failure of one CMT isolation valve to open
Offsite power availability	Available (Bounds loss of offsite power at time zero)
Reactor coolant pump automatic trip delay time after receiving S-signal	5.3 s
Containment pressure	Bounded (minimum)

Note:

1. Treatment of axial power distribution consistent with WCAP-16009-P-A (Reference 32) methodology.

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Table 15.6.5-5

AP1000 LOCA CHRONOLOGY

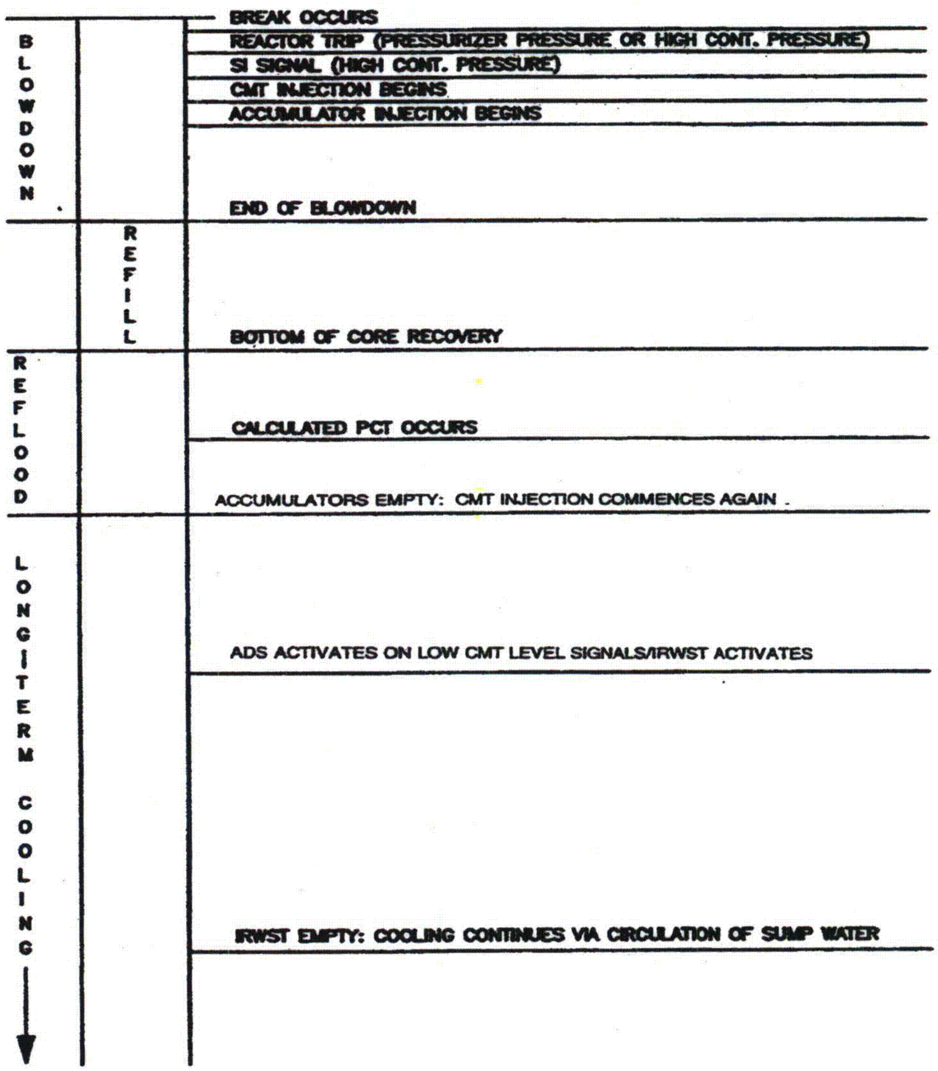

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Table 15.6.5-6

BEST-ESTIMATE LARGE-BREAK SEQUENCE OF EVENTS FOR THE LIMITING PCT CASE

Event	Time (seconds)
Break initiation	0.0
Safeguards signal	2.2
CMT isolation valves begin to open	4.2
Reactor coolant pumps trip	9.5
Accumulator injection begins	~13
End of blowdown	27.5
Bottom of core recovery	39.5
Calculated PCT occurs	~58
Core quench occurs	~240
CMT injection resumes	~200
End of transient	265

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Table 15.6.5-7 **SUMMARY OF PEAKING FACTOR BURNDOWN SUPPORTED BY AP1000 PLANT BEST ESTIMATE LARGE BREAK LOCA CRR UPDATED ANALYSIS CONSIDERING TCD**			
Hot Rod Burnup (GWd/MTU)	**Fdh (includes uncertainties)[1]**	**FQ Transient (Max FQ, includes uncertainties)**	**FQ SS Baseload (without uncertainties)**
0	1.72	2.60	2.10
30	1.72	2.60	2.10
49	1.55	2.30	1.85
55	1.55	2.30	1.85
62	1.40	1.90	1.45

Note:

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1. Hot assembly power follows the same burndown, since it is a function of FdH.

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Table 15.6.5-8

BEST-ESTIMATE LARGE-BREAK LOCA RESULTS

10 CFR 50.46 Requirement	Value	Criteria
Calculated 95th percentile PCT (°F)	1936*	≤ 2200
Maximum local cladding oxidation (%)	4.2	≤ 17
Maximum core-wide cladding oxidation (%)	0.30	≤ 1
Coolable geometry	Core remains coolable	Core remains coolable
Long-term cooling	Core remains cool in long term	Core remains cool in long term

*Value contains 2°F bias for PCT sensitivity to PRHR isolation

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Table 15.6.5-9

INITIAL CONDITIONS FOR AP1000 SMALL-BREAK LOCA ANALYSIS

Condition	Calculation	Nominal Steady-state
Pressurizer pressure (psia)	2300.1	2300
Vessel inlet temperature (°F)	534.03	534.59
Vessel outlet temperature (°F)	612.16	612.61
Vessel flow rate (lbm/sec)	31118	31118
Steam generator pressure (psia)	794.76	794.59

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Table 15.6.5-10 **AP1000 ADS PARAMETERS**					
Actuation Signal [percentage of core makeup tank level]		**Actuation Time (seconds)**	**Minimum Valve Flow Area (for each path, in^2)**	**Number of Paths**	**Valve Opening Time (seconds)**
Stage 1 – Control Low 1	67.5	32 after CMT-Low 1	4.6	2 out of 2	≤ 40
Stage 2 – Control		48 after Stage 1	21	2 out of 2	≤ 100
Stage 3 – Control		120 after Stage 2	21	2 out of 2	≤ 100
Stage 4A	20	128 after Stage 3(1)	67	1 out of 2	≤ 4(2)
Stage 4B		60 after Stage 4A	67	2 out of 2	≤ 4(2)

Notes:

1. The interlock requires coincidence of CMT Low-2 level as well as 128 seconds after the Stage 3 actuation signal is generated.
2. This includes "arm-fire" processing delay and the assumed valve opening time.

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1. . The valve stroke times reflect the design basis of the AP1000. The applicable DCD Chapter 15 accidents were evaluated for the design basis valve stroke times. The results of this evaluation have shown that there is a small impact on the analysis and the conclusions remain valid. The output provided for the analyses is representative of the transient phenomenon.¶
2. . The interlock requires coincidence of CMT Low-2 level as well as 128 seconds after the Stage 3 actuation signal is generated.¶
3. . This includes "arm-fire" processing delay and the assumed valve opening time. ... [21]

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Table 15.6.5-11

INADVERTENT ADS DEPRESSURIZATION SEQUENCE OF EVENTS

Event	AP1000 Time (seconds)
Inadvertent opening of ADS valves	0.0
Reactor trip signal	46.7
ADS Stage 2	48.0
Steam turbine stop valves close	52.1
"S" signal	53.3
Main feed isolation valves begin to close	60.3
Reactor coolant pumps start to coast down	60.6
ADS Stage 3	168.0
Accumulator injection starts	258.3
Accumulator tank empties (1 / 2)	702.1 / 701.9
ADS Stage 4	1598.8
Core makeup tank empties (1 / 2)	1972.3 / 1984.4
Core uncovery begins	2513.7
IRWST injection starts*	2609.9
Core uncovery ends	2738.1

Note:

*Continuous injection period

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Table 15.6.5-12	
2-INCH COLD LEG BREAK IN CLBL LINE SEQUENCE OF EVENTS	
Event	**AP1000 Time (seconds)**
Break opens	0.0
Reactor trip signal	55.8
Steam turbine stop valves close	61.2
"S" signal	63.3
Main feed isolation valves begin to close	70.3
Reactor coolant pumps start to coast down	70.6
ADS Stage 1	1322.7
ADS Stage 2	1370.7
Accumulator injection starts	1391.3
ADS Stage 3	1490.7
Accumulator tank empties (1 / 2)	1912.3 / 1909.2
ADS Stage 4	2338.9
Core makeup tank empty (1 / 2)	2780.2 / 2706.2
Core uncovery begins	3067.3
IRWST injection starts*	3196.5
Core uncovery ends	3287.7

Note:

*Continuous injection period

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Table 15.6.5-13 **DOUBLE-ENDED INJECTION LINE BREAK SEQUENCE OF EVENTS – 20 psia**	
Event	**AP1000 Time (seconds)**
Break opens	0.0
Reactor trip signal	13.5
"S" signal	18.6
Steam turbine stop valves close	18.9
Main feed isolation valves begin to close	25.6
Reactor coolant pumps start to coast down	25.9
ADS Stage 1	179.4
ADS Stage 2	227.4
Accumulator injection starts	240.1
ADS Stage 3	347.4
ADS Stage 4	475.4
Accumulator empties(1 / 2)	449.2 / 583.3
IRWST injection starts*	1766.3
Core makeup tank empties(1 / 2)	500.7 / 1893.8

Note:

*Continuous injection period

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Table 15.6.5-13A **DOUBLE-ENDED INJECTION LINE BREAK SEQUENCE OF EVENTS – 14.7 psia**	
Event	**AP1000 Time (seconds)**
Break opens	0.0
Reactor trip signal	13.5
"S" signal	18.8
Steam turbine stop valves close	18.9
Main feed isolation valves begin to close	25.8
Reactor coolant pumps start to coast down	26.1
ADS Stage 1	179.4
ADS Stage 2	227.4
Accumulator injection starts	239.2
ADS Stage 3	347.4
Accumulator empties(1 / 2)	447.6 / 581.6
ADS Stage 4	475.4
Core makeup tank empties(1 / 2)	478.7 / 1851.0
Core uncovery begins	2212.9
IRWST injection starts*	2253.9
Core uncovery ends	2625.6

Note:
*Continuous injection period

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Table 15.6.5-14 **10-INCH COLD LEG BREAK SEQUENCE OF EVENTS**	
Event	**AP1000 Time (seconds)**
Break opens	0.0
Reactor trip signal	5.3
"S" signal	6.5
Steam turbine stop valves close	10.7
Main feed isolation valves begin to close	13.5
Reactor coolant pumps start to coast down	13.8
Accumulator injection starts	78.1
Accumulator tank empties (1 / 2)	516.5 / 517.0
ADS Stage 1	774.4
ADS Stage 2	822.4
ADS Stage 3	942.4
ADS Stage 4	1406.0
IRWST injection starts**	1683.0
Core makeup tank empties (1 / 2)	2127.3* / 1861.0*

Note:

*The CMTs never truly empty although they cease to discharge at these times.

**Continuous injection period.

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Table 15.6.5-15 **DOUBLE-ENDED INJECTION LINE BREAK SEQUENCE OF EVENTS (ENTRAINMENT SENSITIVITY)**	
Event	**AP1000 Time (seconds)**
Break opens	0.0
Reactor trip signal	13.46
"S" signal	18.84
Steam turbine stop valves close	18.87
Main feed isolation valves begin to close	25.84
Reactor coolant pumps start to coast down	26.14
ADS Stage 1	194.15
ADS Stage 2	242.16
Intact accumulator injection starts	255
ADS Stage 3	362.16
ADS Stage 4	490.16
Accumulator tank empties (1 / 2)	442.08 / 608.45
Intact loop IRWST injection starts*	1804
Core makeup tank empties (1 /2)	253 / 2095

Note:
*Continuous injection period

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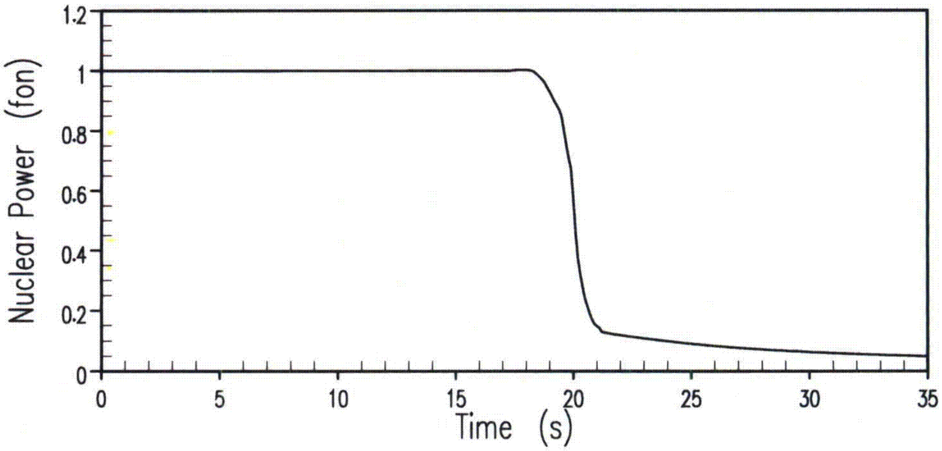

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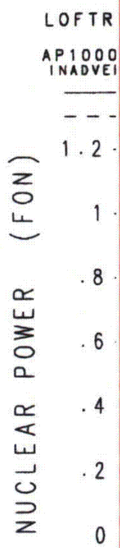

Figure 15.6.1-1

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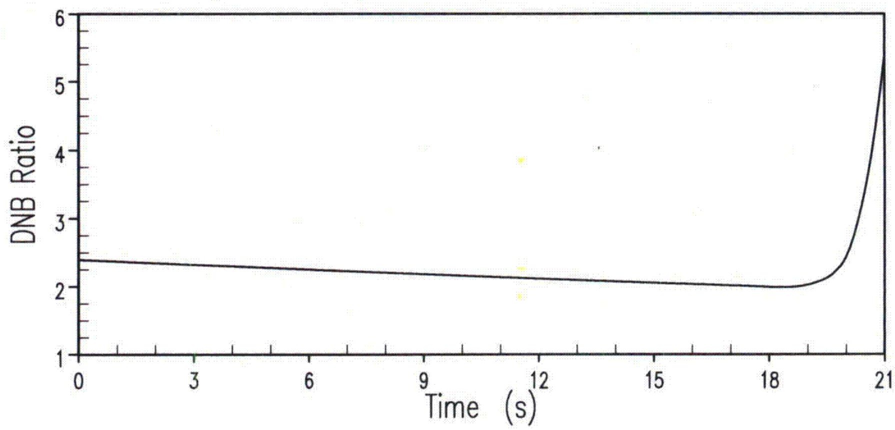
Nuclear Power Transient
Inadvertent Opening of a Pressurizer Safety Valve



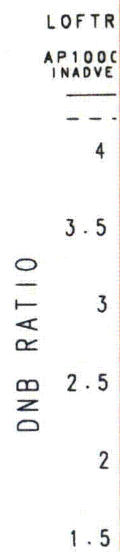


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Figure 15.6.1-2

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DNBR Transient
Inadvertent Opening of a Pressurizer Safety Valve

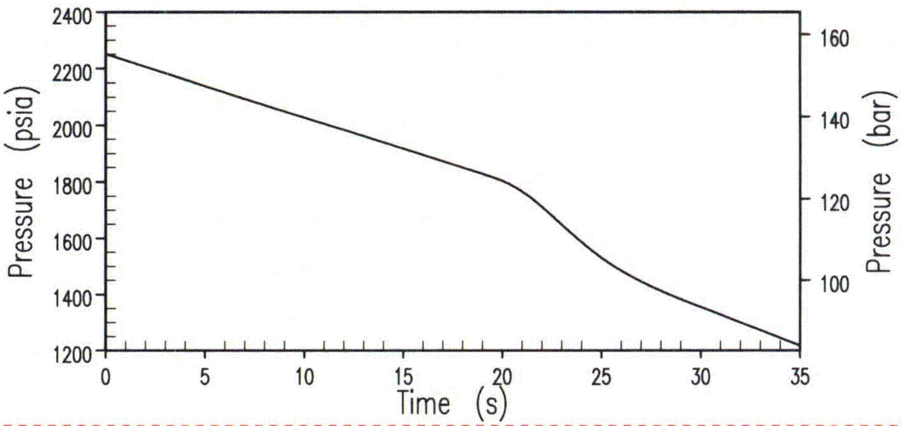
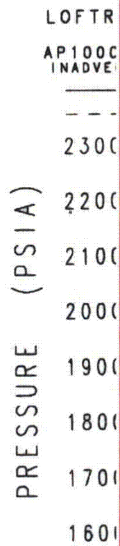


Figure 15.6.1-3

Pressurizer Pressure Transient
Inadvertent Opening of a Pressurizer Safety Valve



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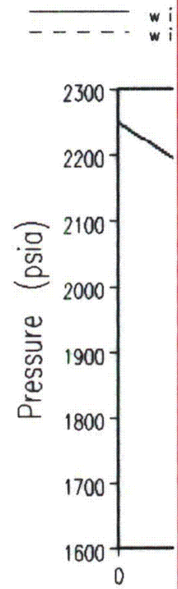

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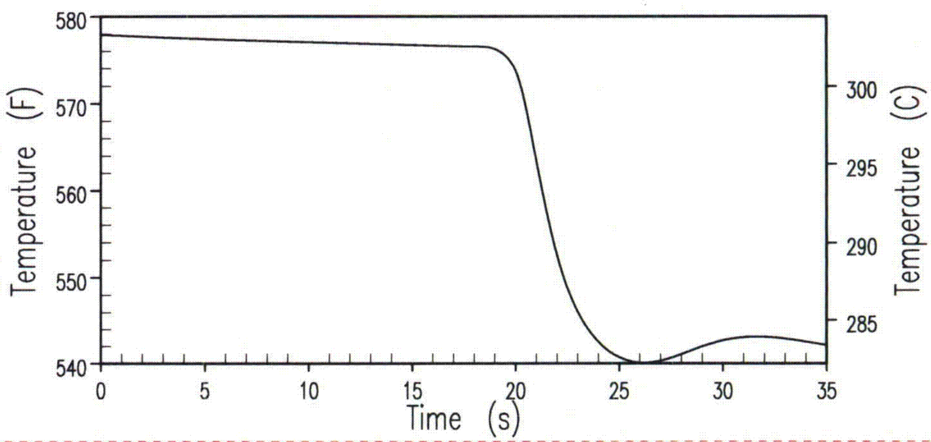
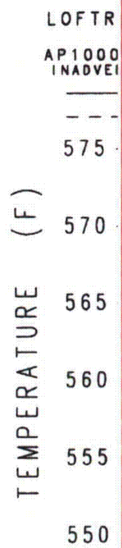


Figure 15.6.1-4

Core Average Temperature Transient
Inadvertent Opening of a Pressurizer Safety Valve



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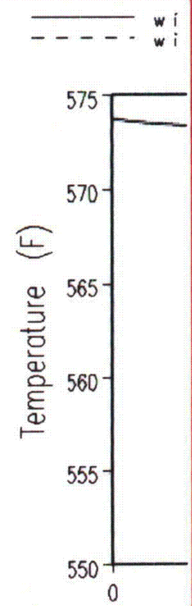

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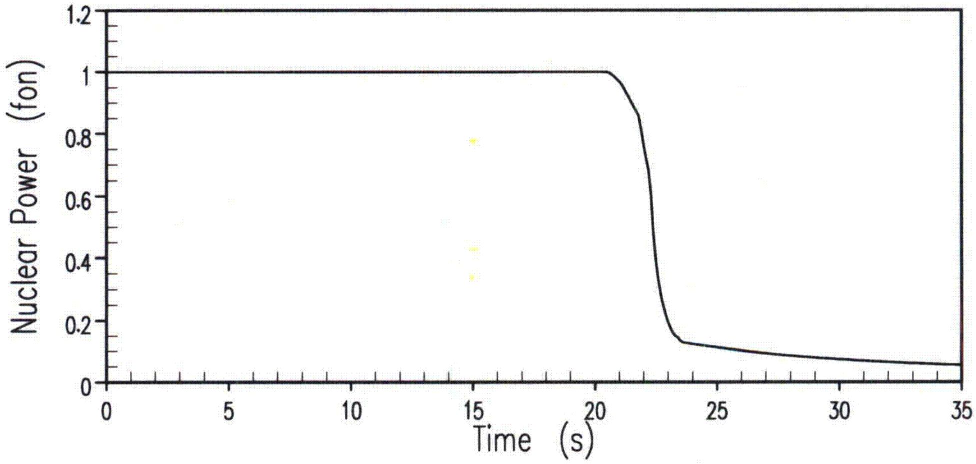

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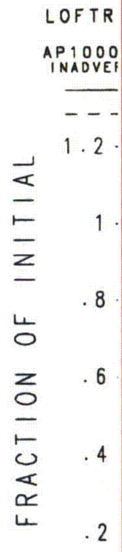

Figure 15.6.1-5

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Nuclear Power Transient
Inadvertent Opening of Two ADS Stage 1 Trains

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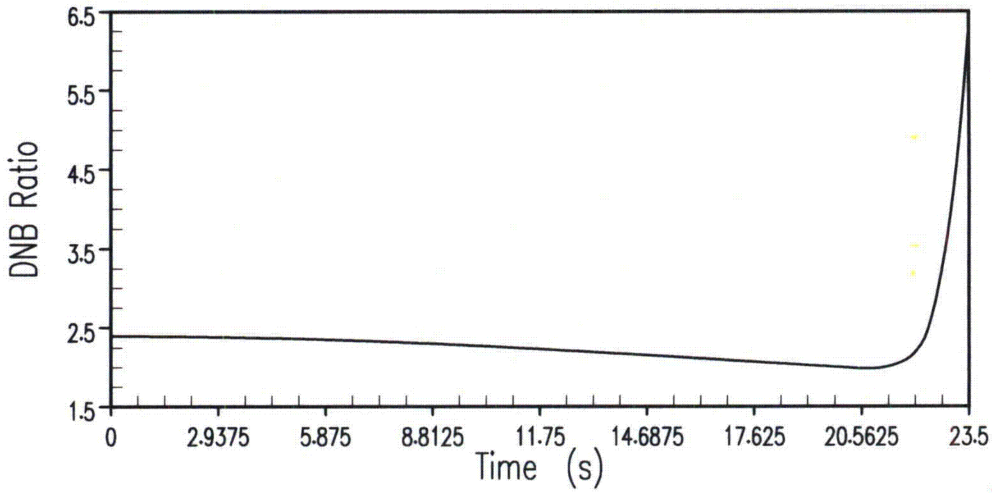

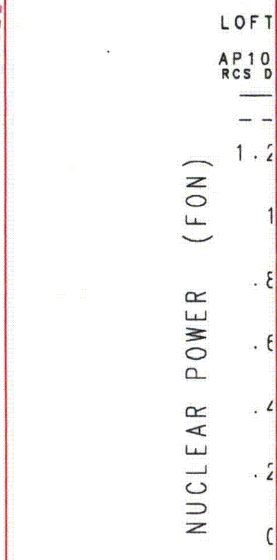

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Figure 15.6.1-6

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DNBR Transient

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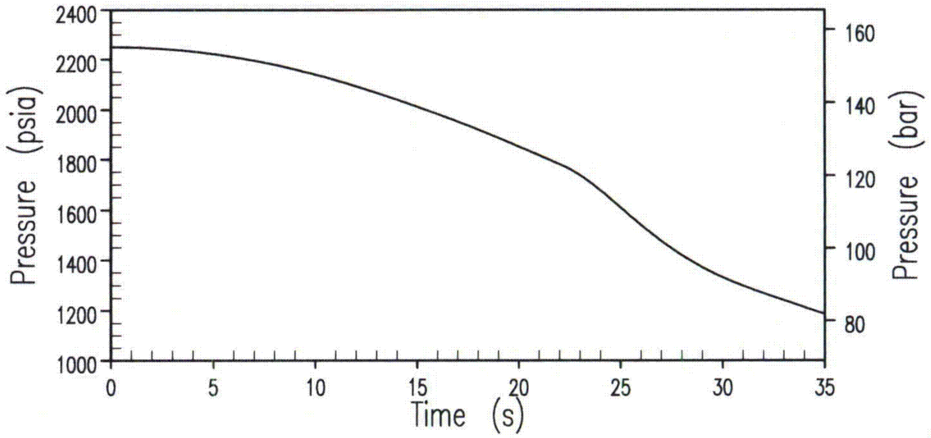
Inadvertent Opening of Two ADS Stage 1 Trains



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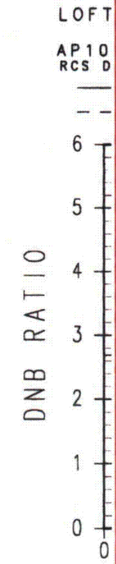

Figure 15.6.1-7

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Pressurizer Pressure Transient

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Inadvertent Opening of Two ADS Stage 1 Trains

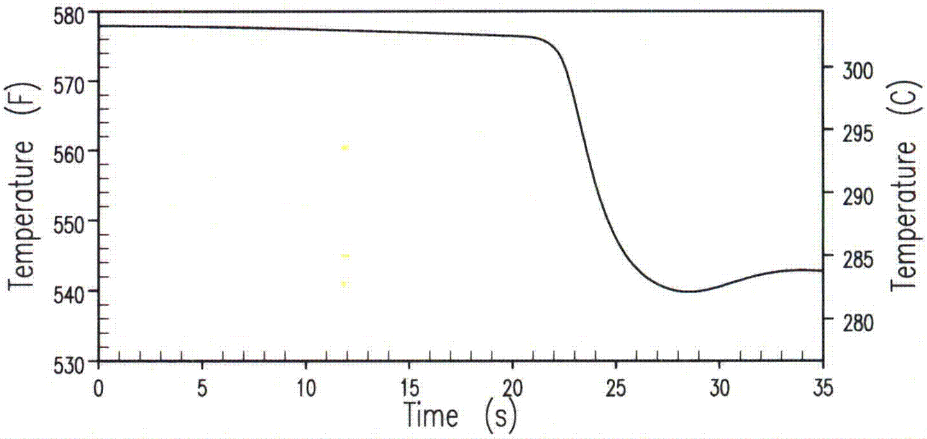

Figure 15.6.1-8

Core Average Temperature Transient
Inadvertent Opening of Two ADS Stage 1 Trains

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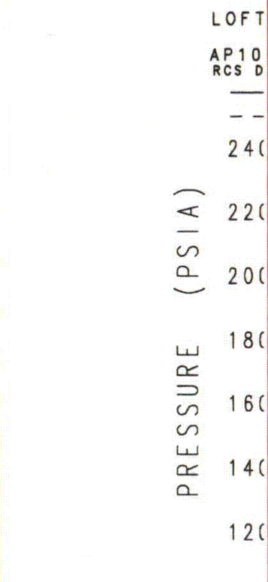

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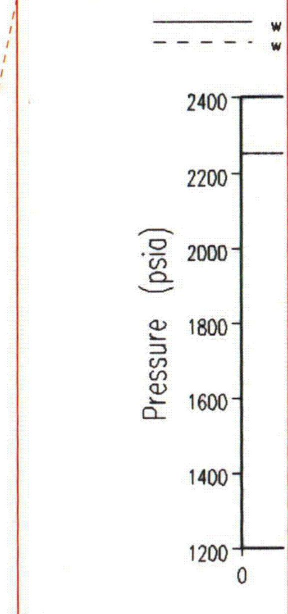

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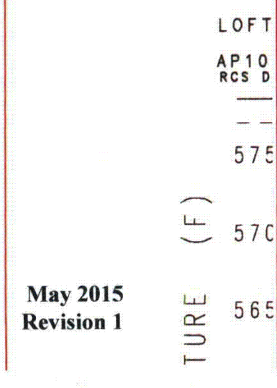

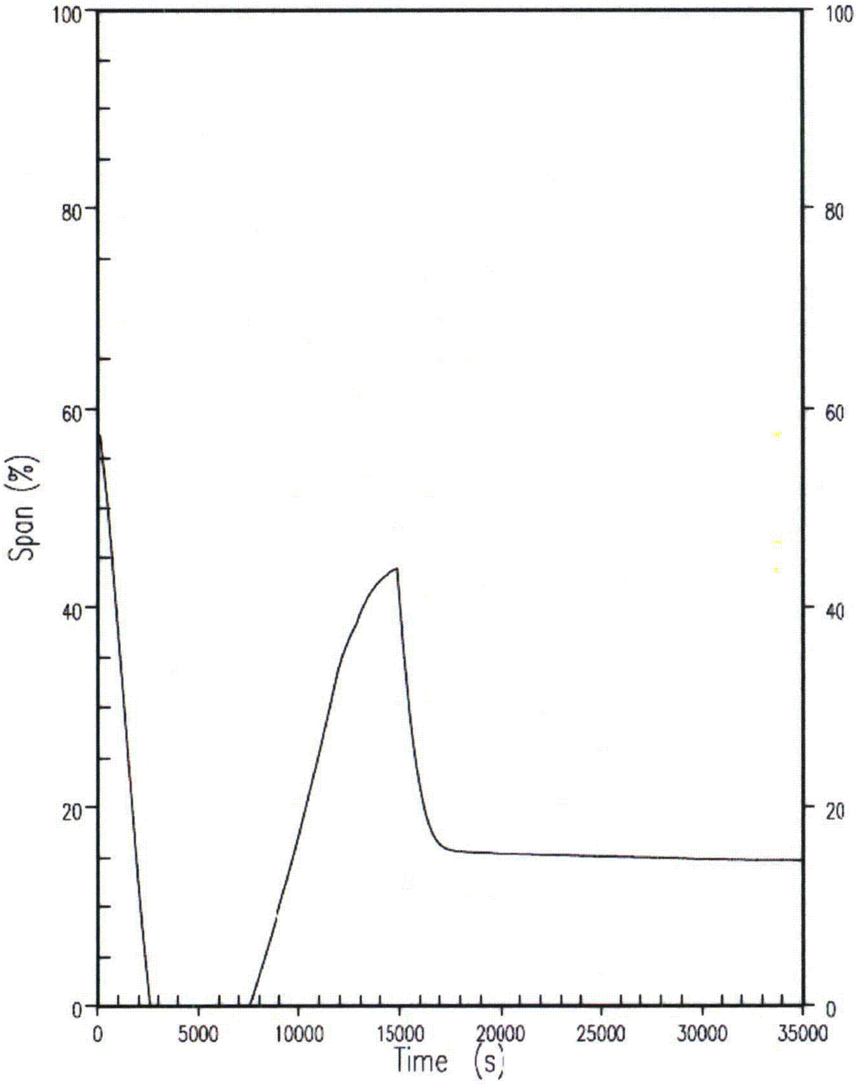

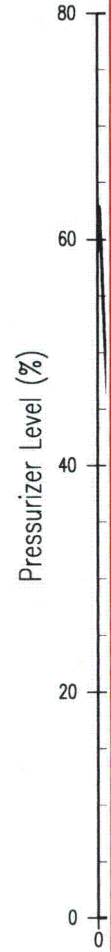

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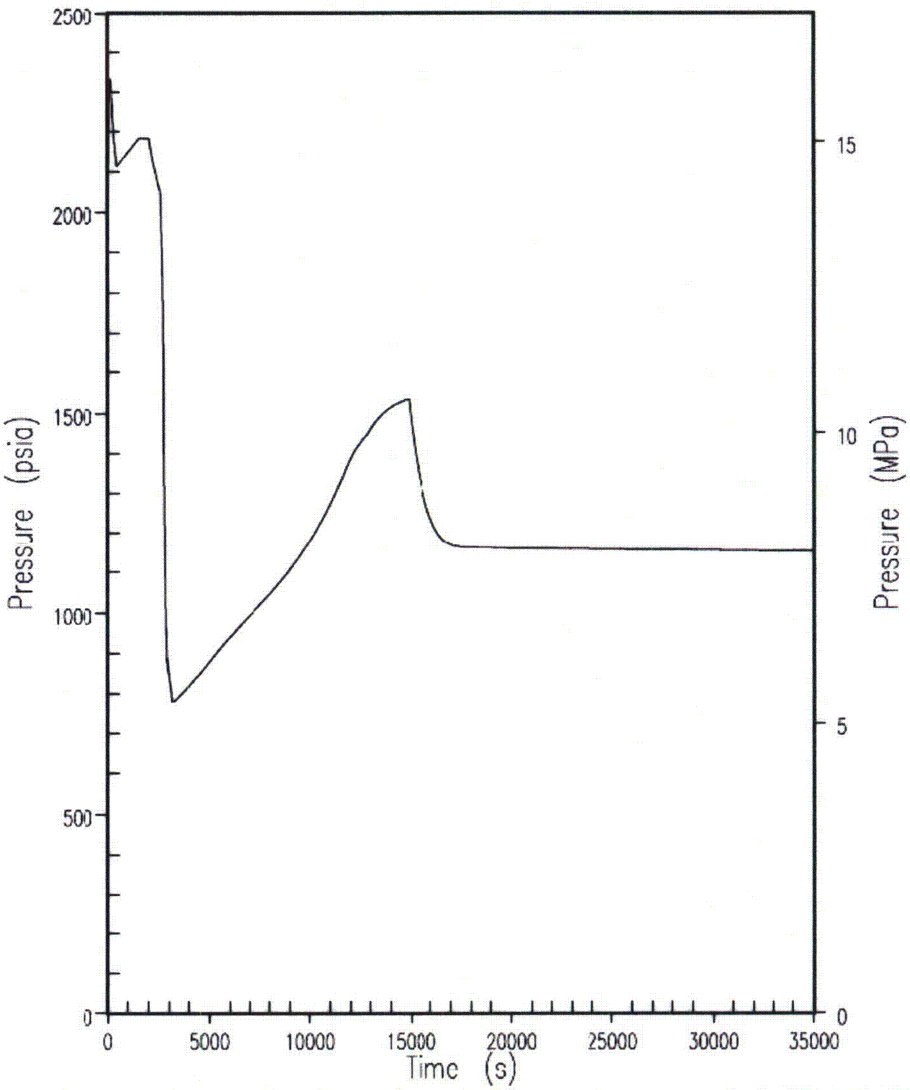
Figure 15.6.3-1

Comment [B71]: [15.6-69]

Pressurizer Level for SGTR



2400
2200
2000
1800
1600
1400
1200
1000
800
RCS Pressure (psia)
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Figure 15.6.3-2

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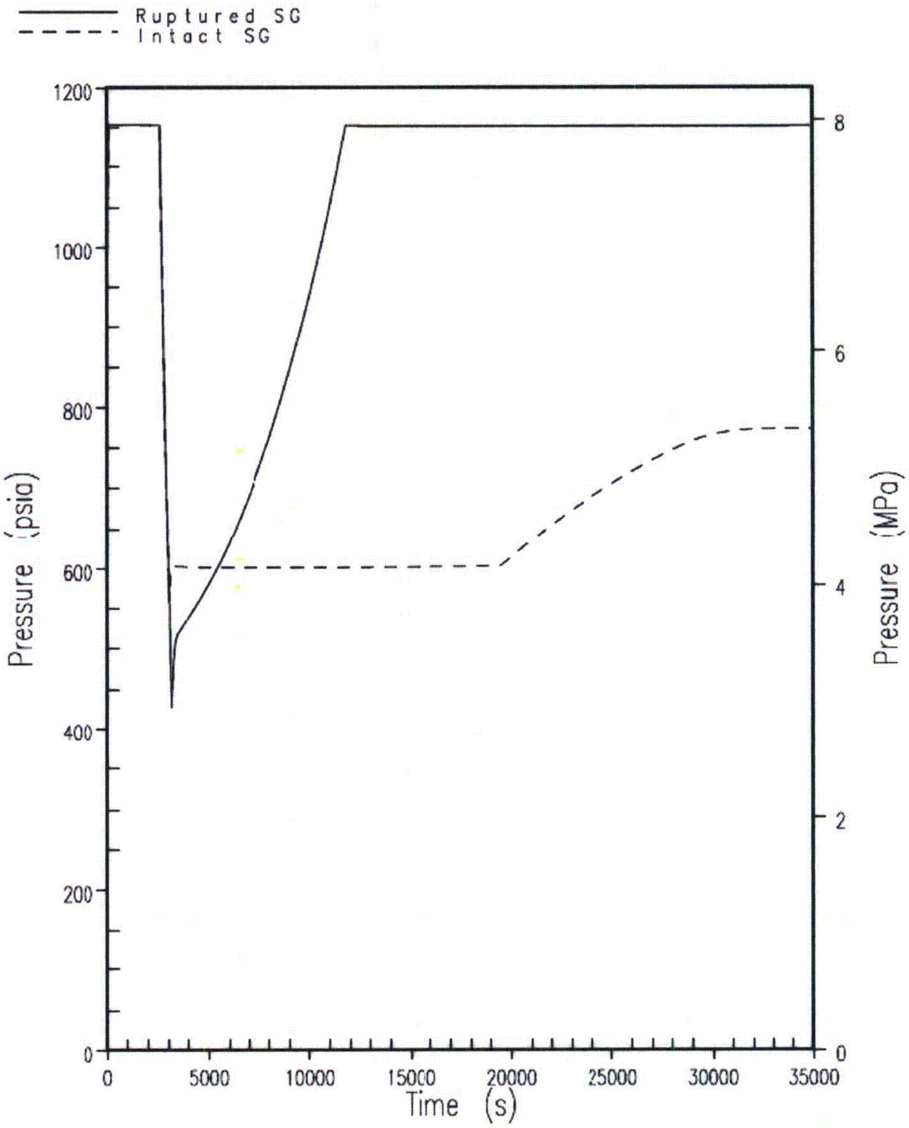
Reactor Coolant System Pressure for SGTR



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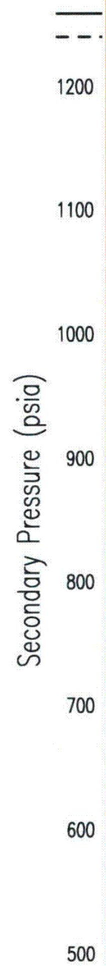
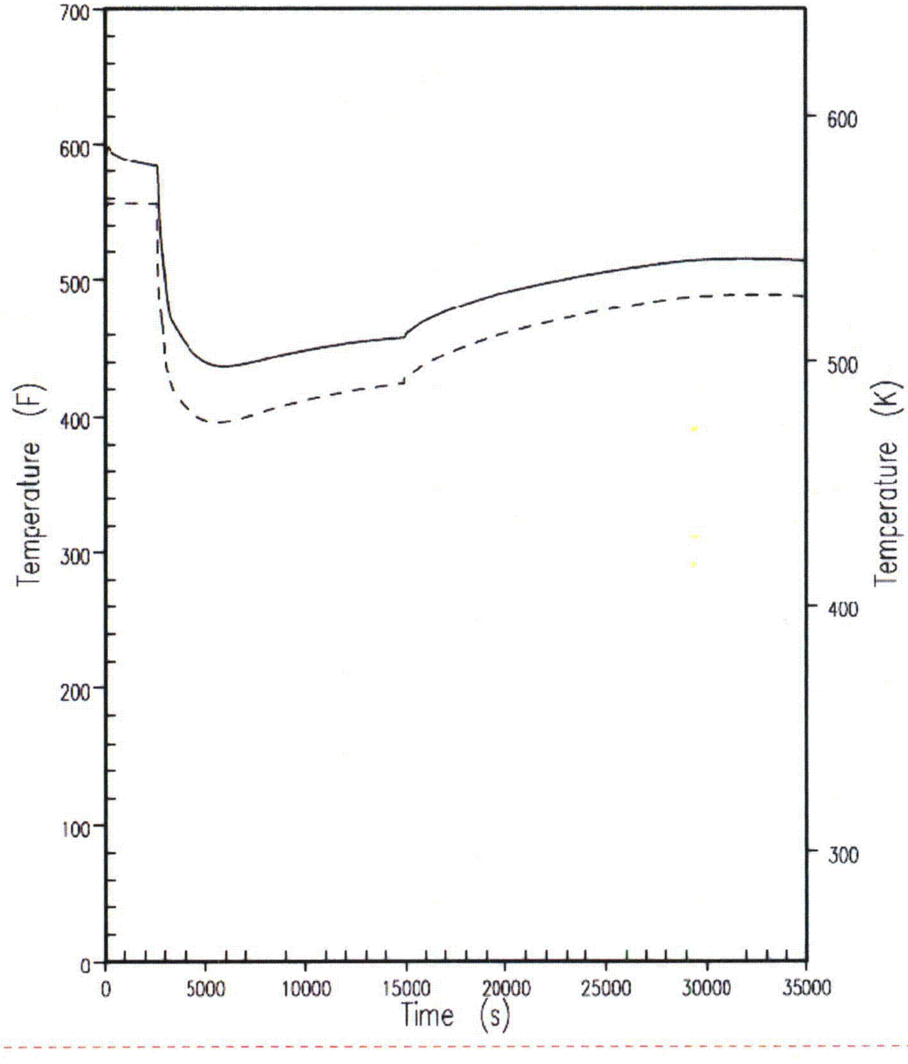


Figure 15.6.3-3

Secondary Pressure for SGTR



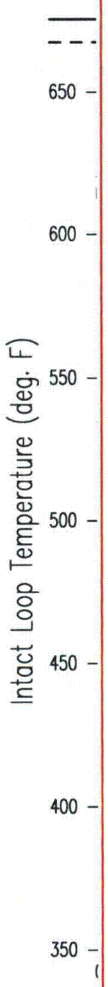


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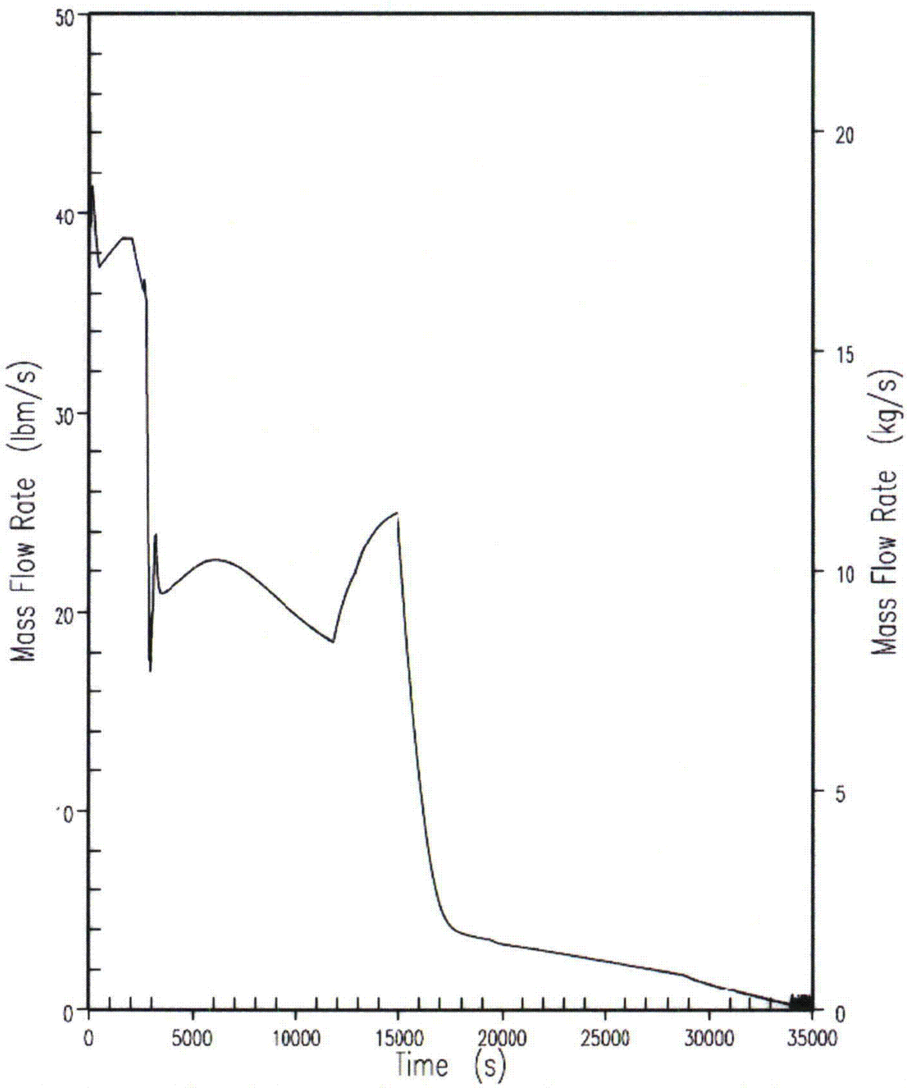
Figure 15.6.3-4

Intact Loop Hot and Cold Leg
Reactor Coolant System Temperature for SGTR



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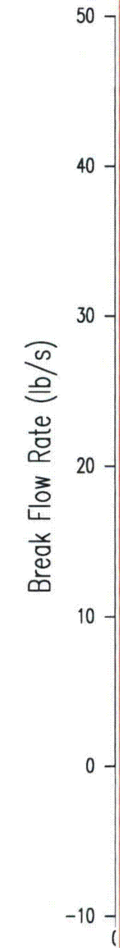
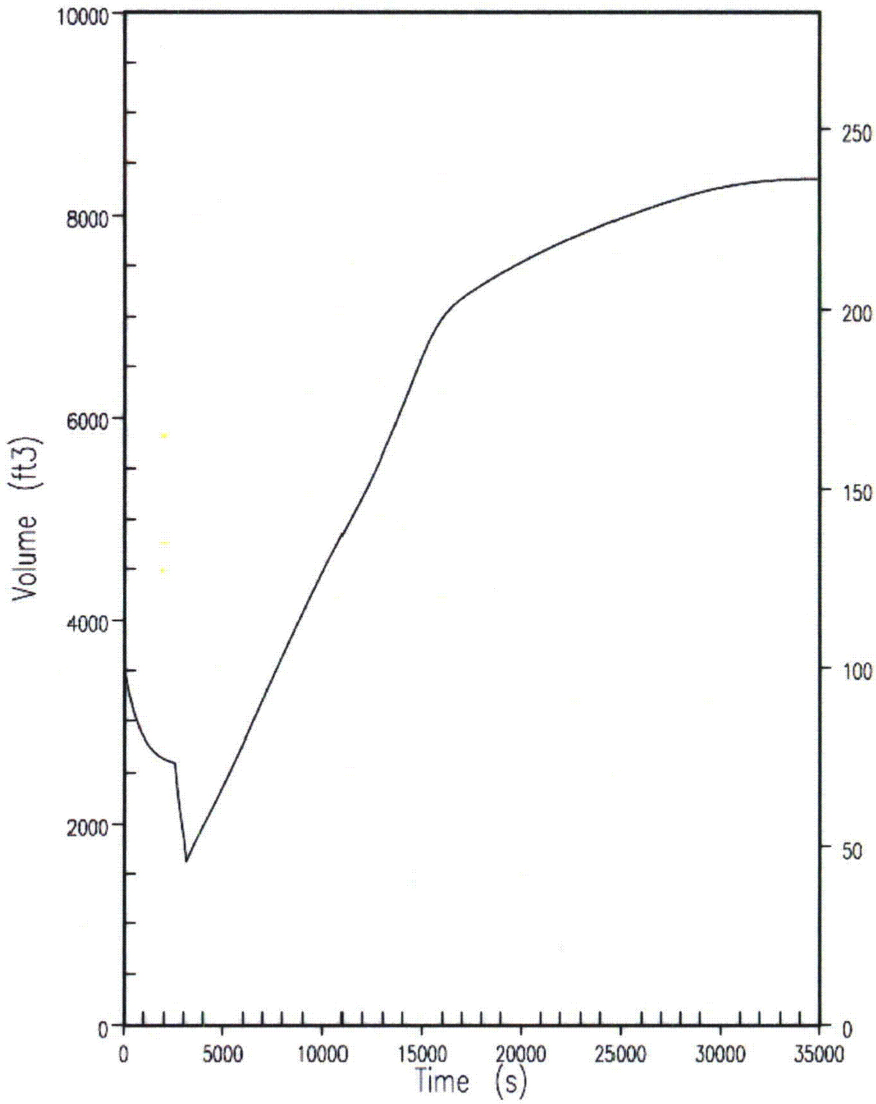


Figure 15.6.3-5

Primary-to-Secondary Break Flow Rate for SGTR



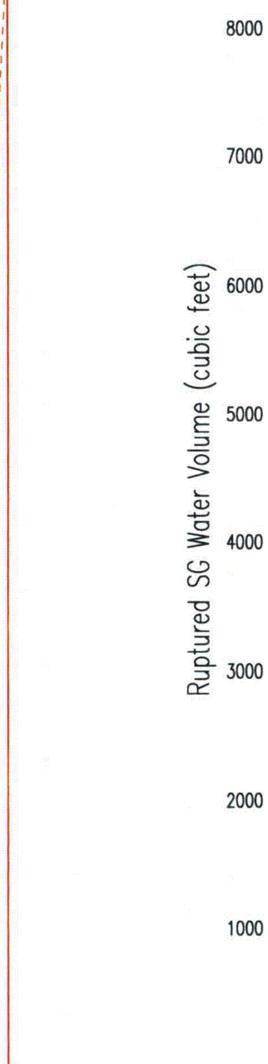


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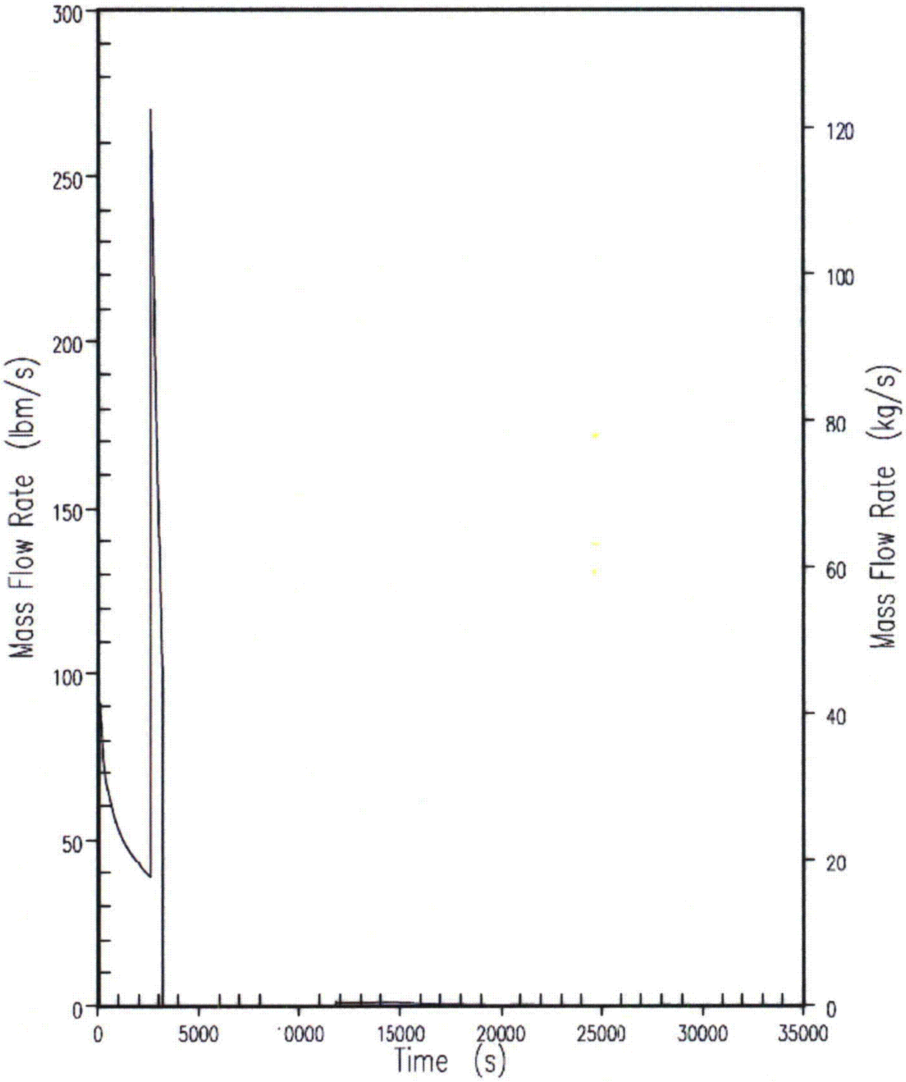
Figure 15.6.3-6

Ruptured Steam Generator Water Volume for SGTR



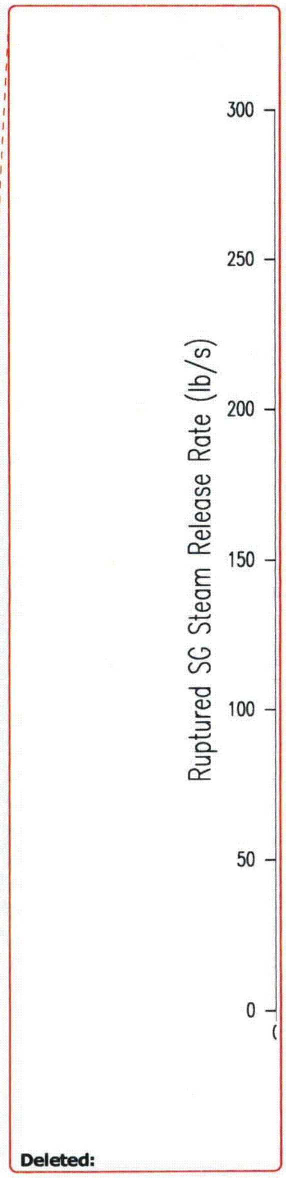
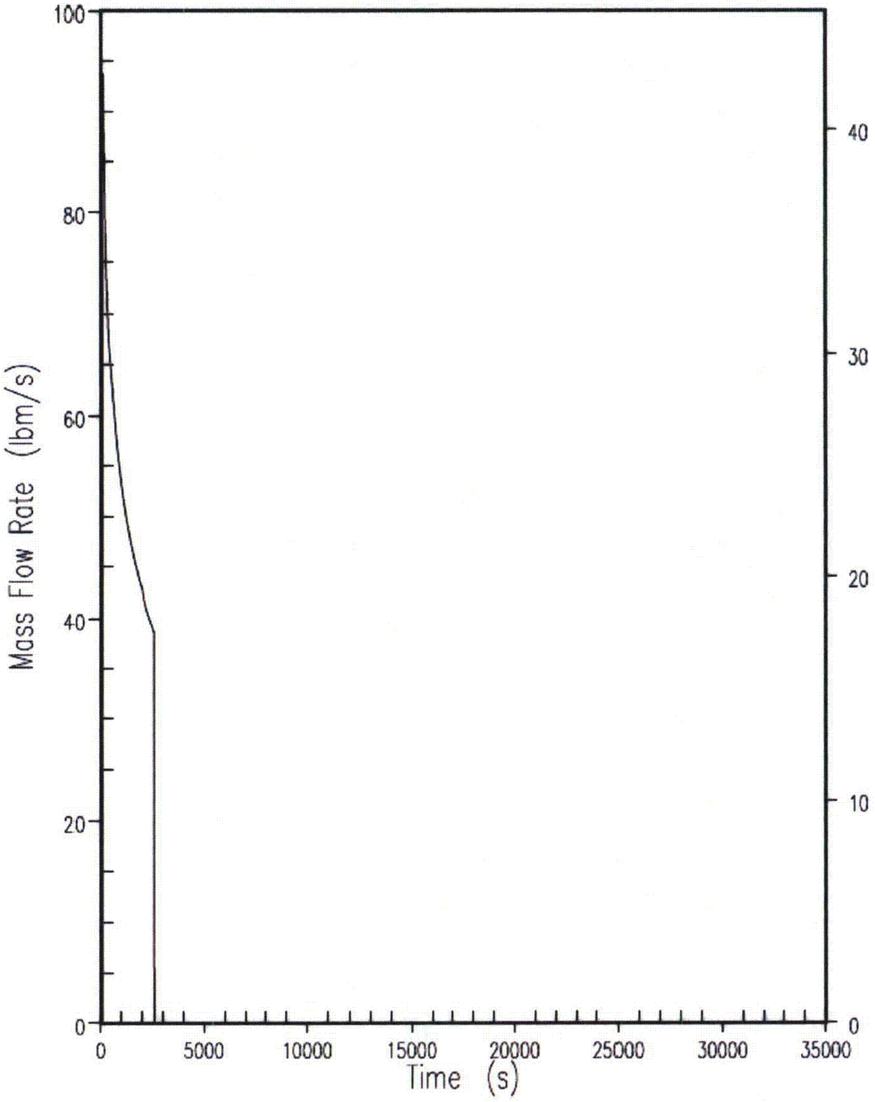


Figure 15.6.3-7

Ruptured Steam Generator Mass Release Rate to the Atmosphere for SGTR



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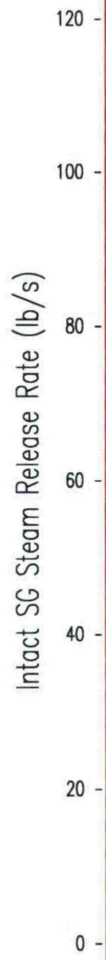
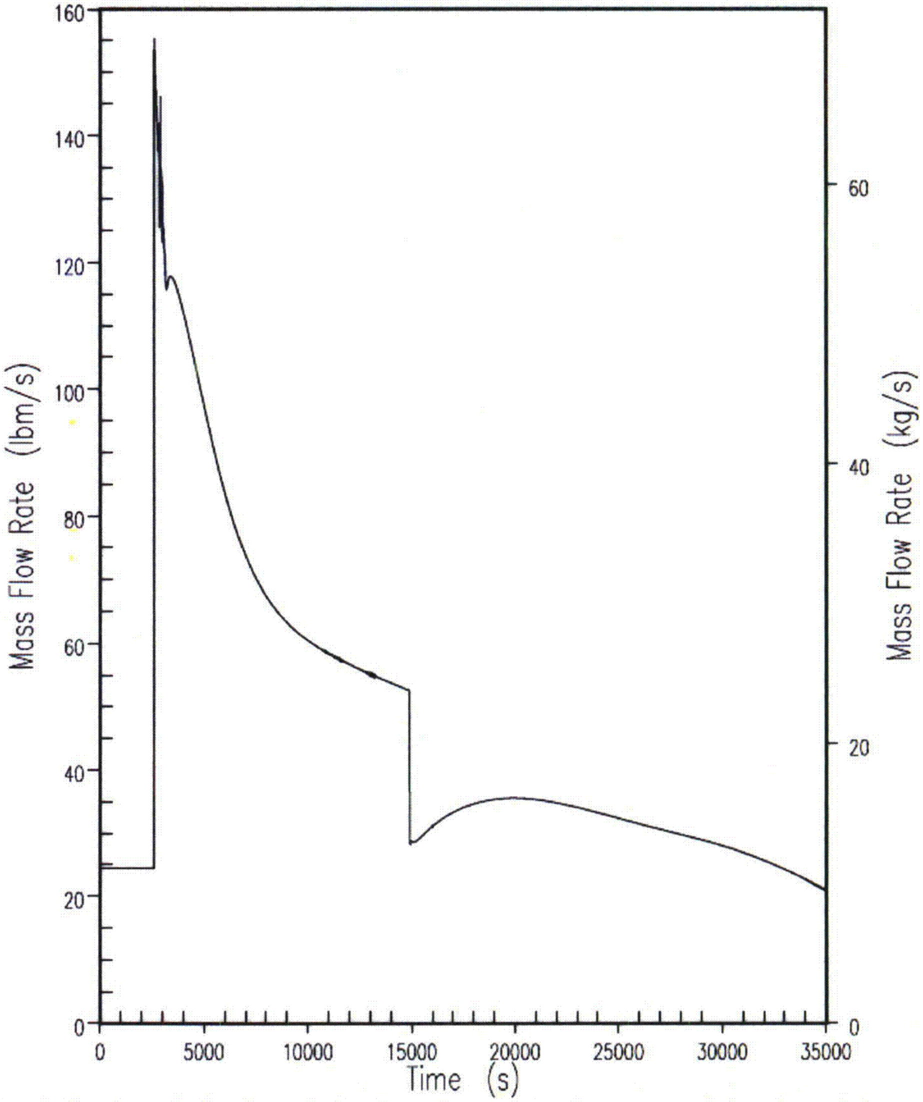


Figure 15.6.3-8

Intact Steam Generator Mass Release Rate to the Atmosphere for SGTR



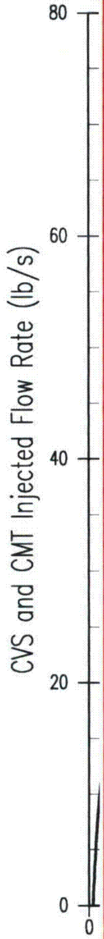


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Figure 15.6.3-9

Ruptured Loop Chemical and Volume Control System and Core Makeup Tank Injection Flow for SGTR

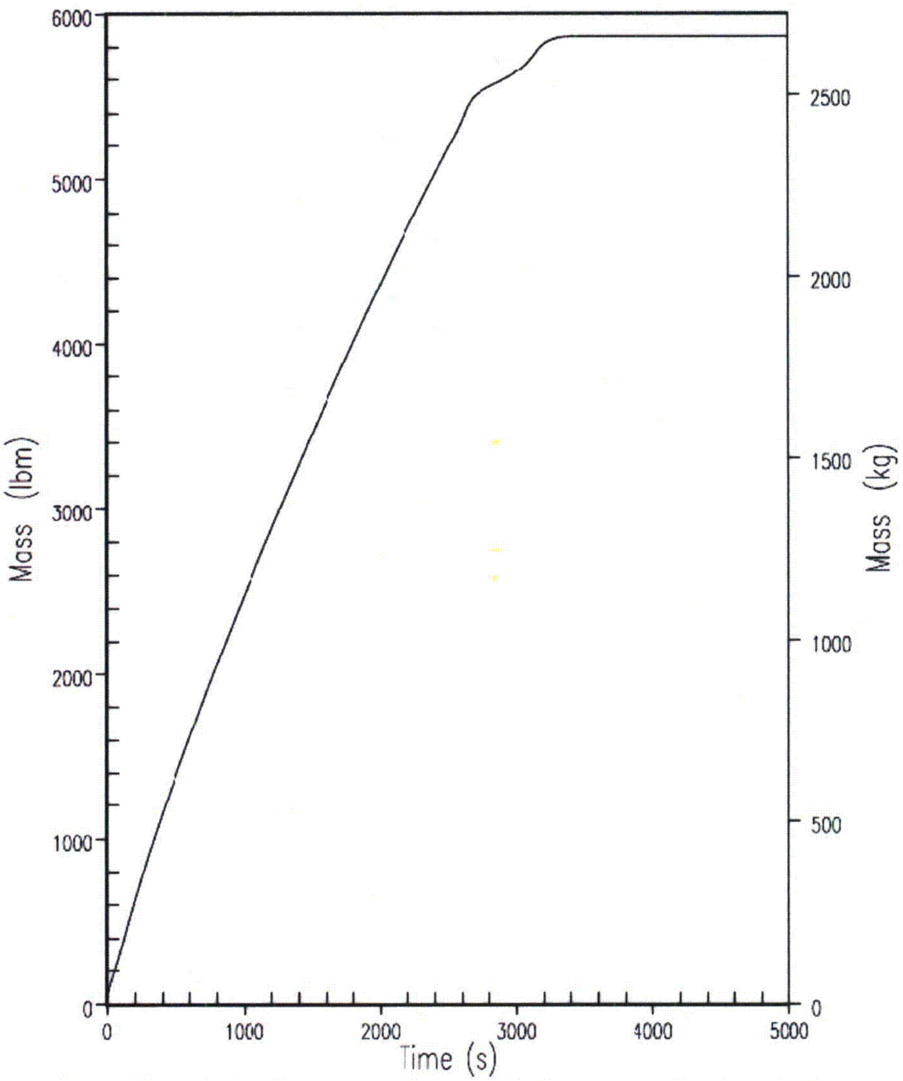

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Figure 15.6.3-10

Integrated Flashed Break Flow for SGTR

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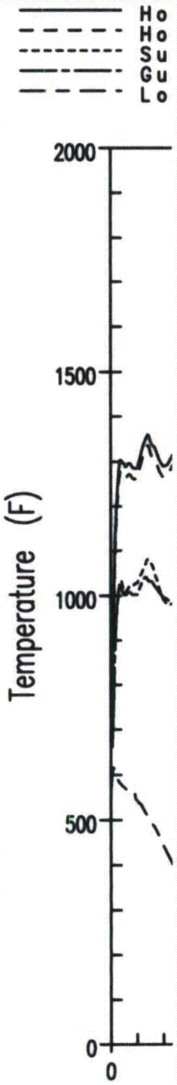

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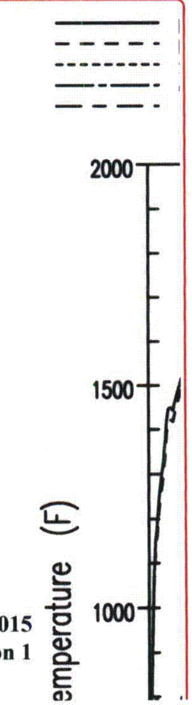


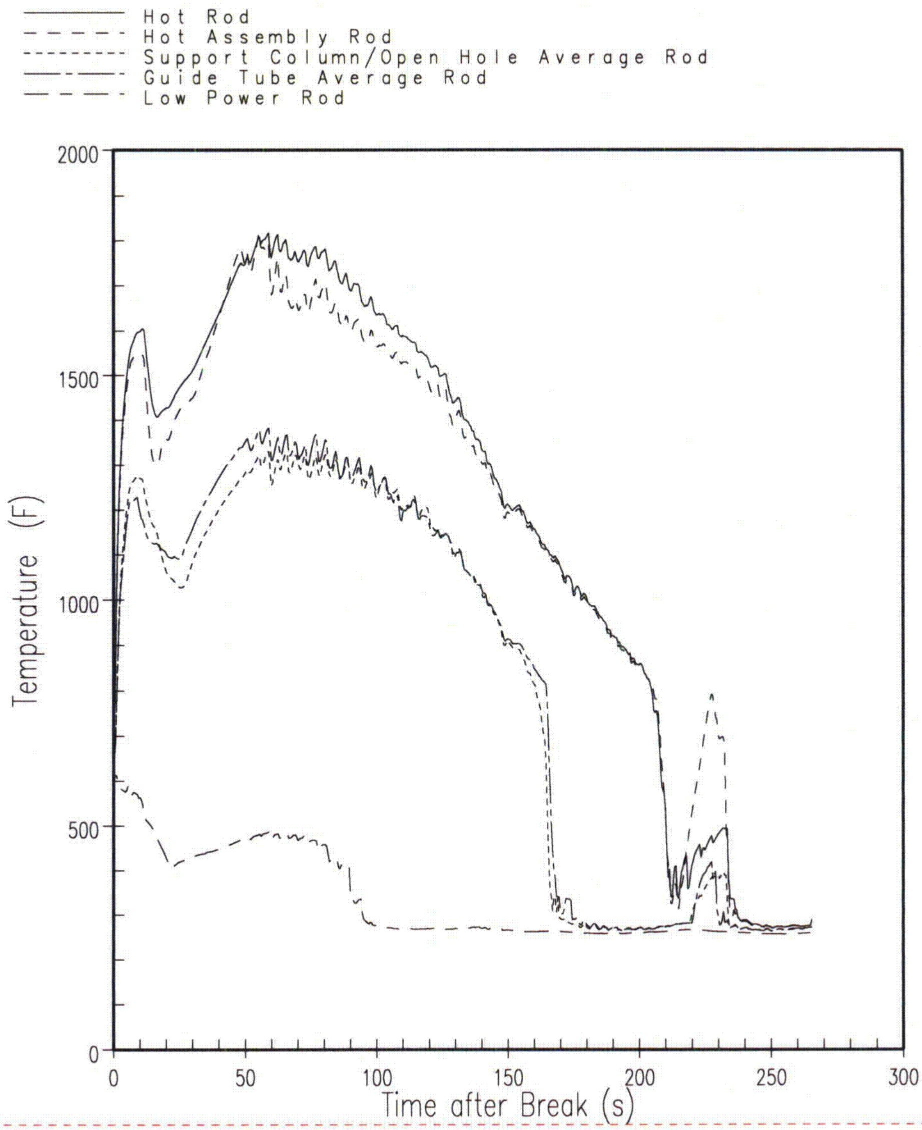


Figure 15.6.5.4A-1

WCOBRA/TRAC Peak Cladding Temperature for All Five Rod Groups for 95th Percentile Estimator PCT Case

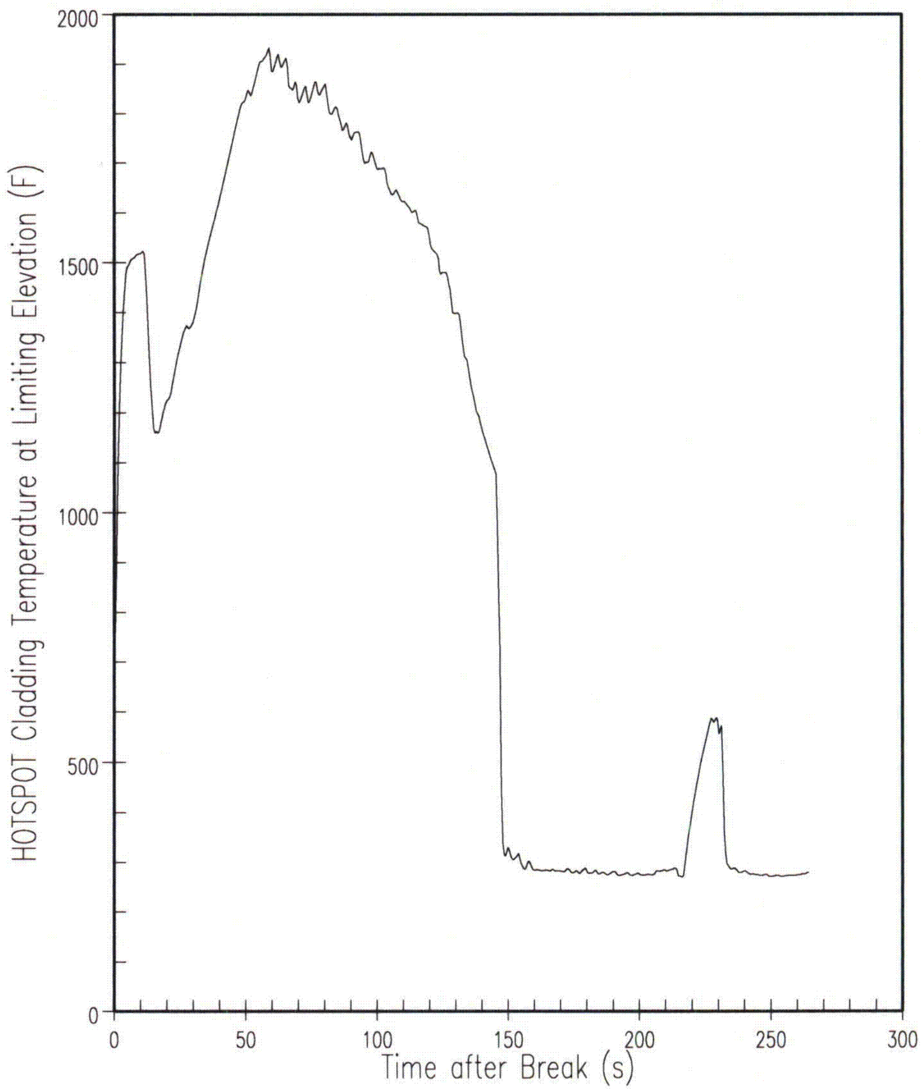
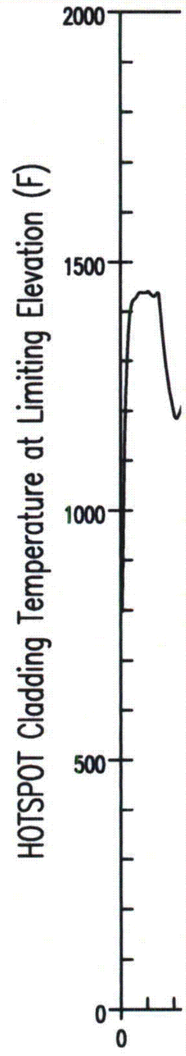


Figure 15.6.5.4A-2

HOTSPOT Cladding Temperature Transient at Limiting Elevation for 95th Percentile Estimator PCT Case



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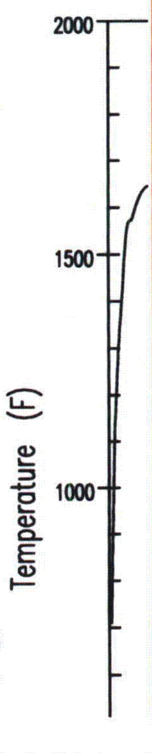


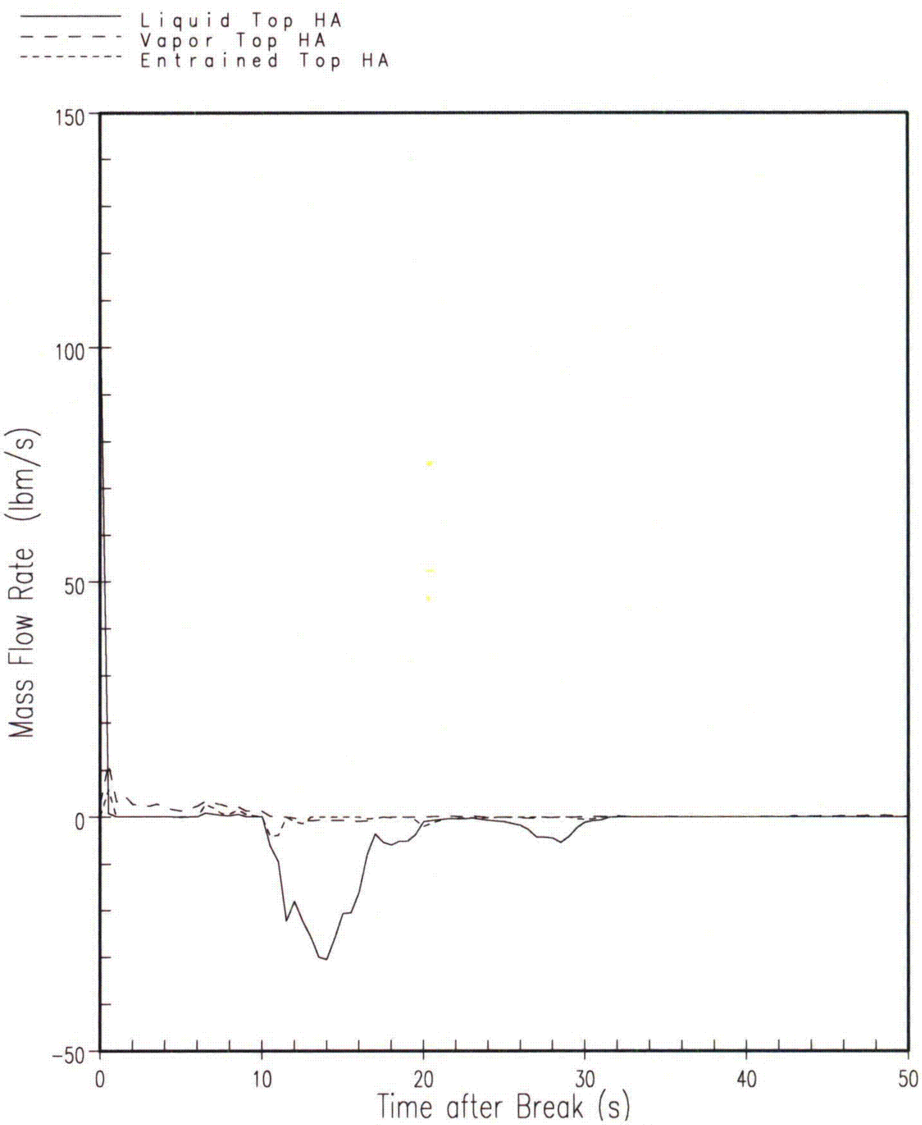
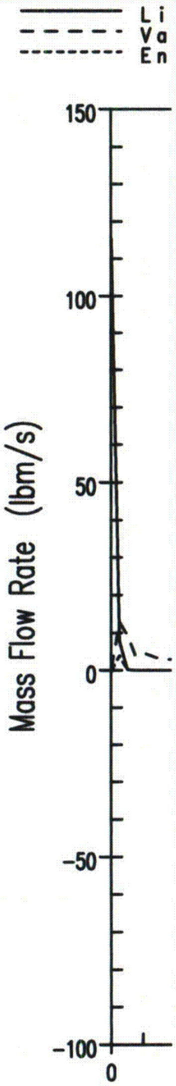


Figure 15.6.5.4A-3

Mass Flow at Top of Hot Assembly Channel for 95th Percentile Estimator PCT Case



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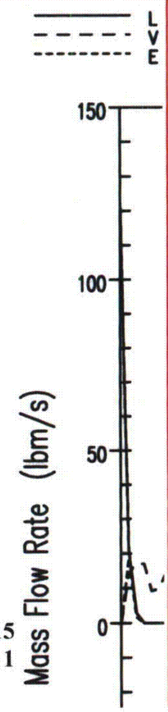


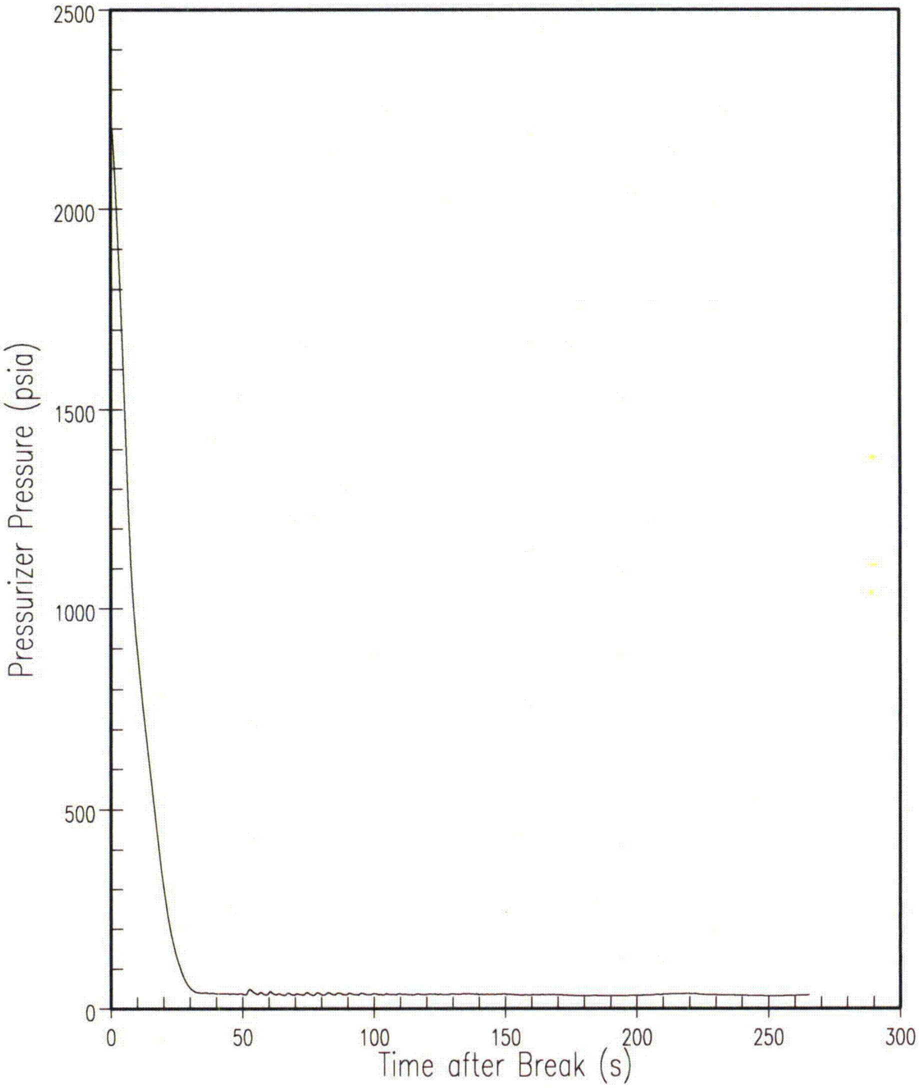
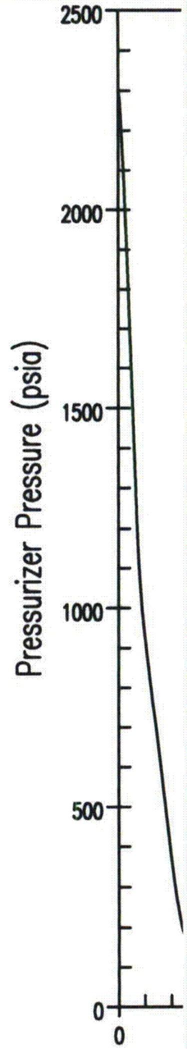


Figure 15.6.5.4A-4

Pressurizer Pressure for
95th Percentile Estimator PCT Case



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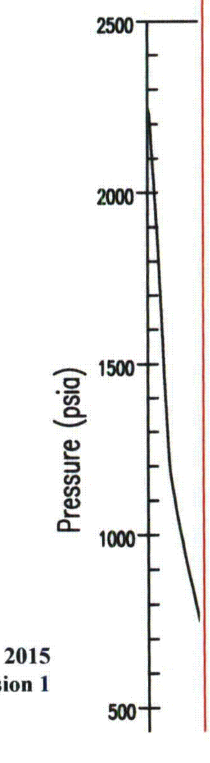


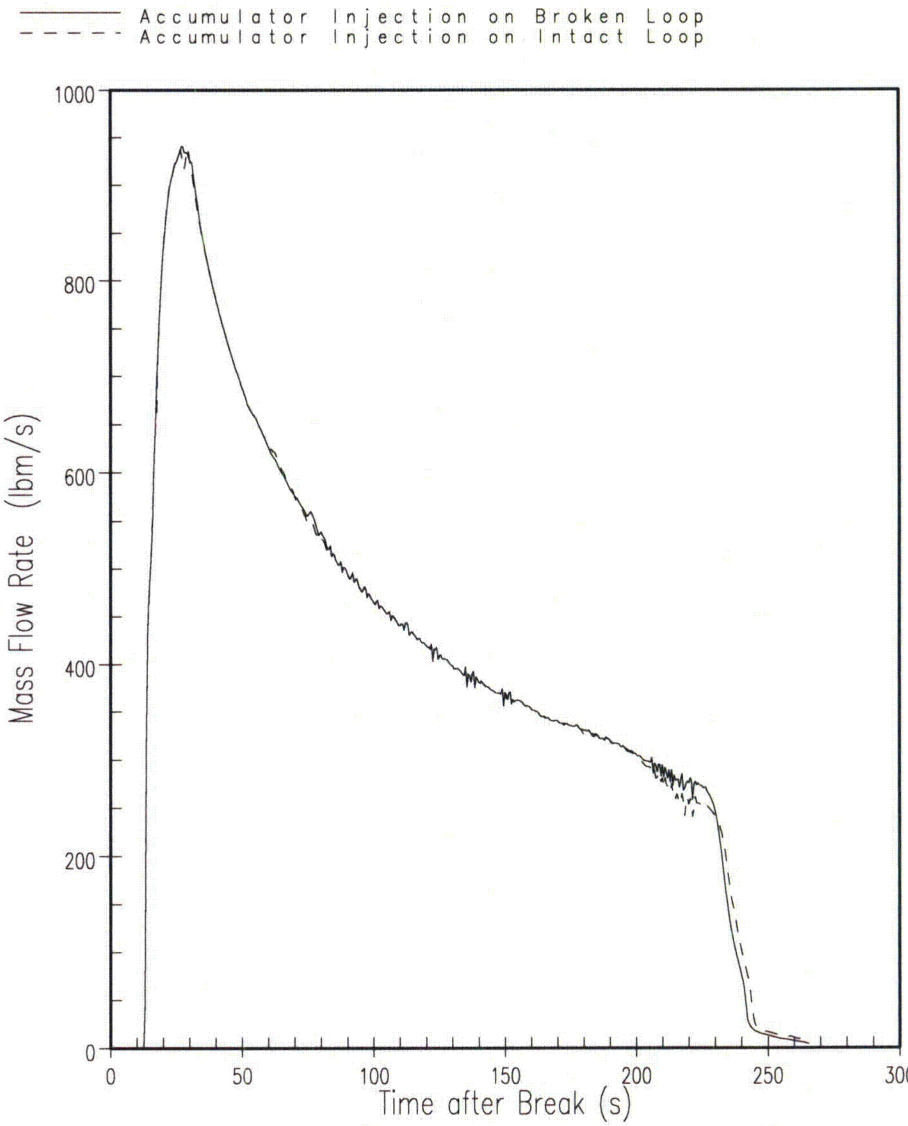
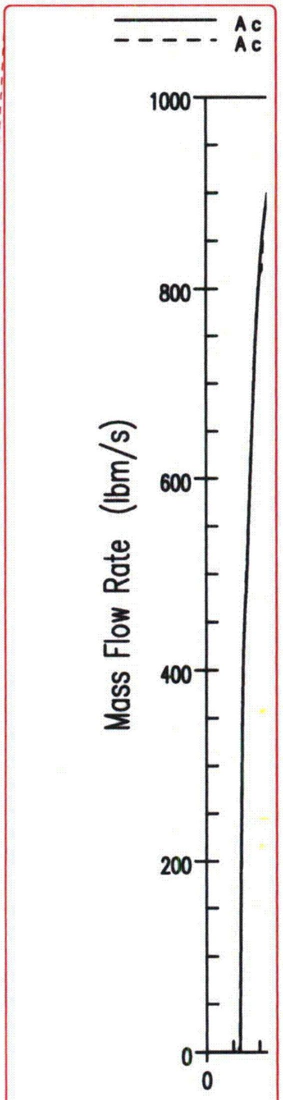


Figure 15.6.5.4A-5

Accumulator Injection Flow for
95th Percentile Estimator PCT Case



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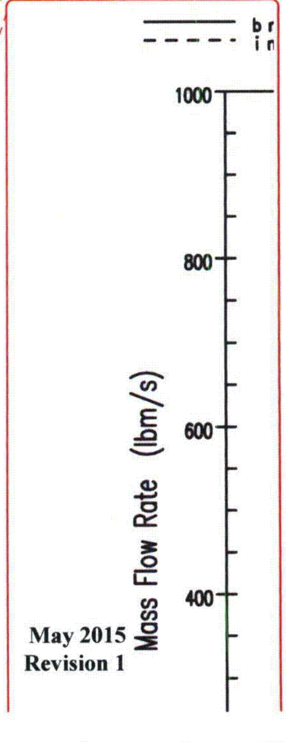


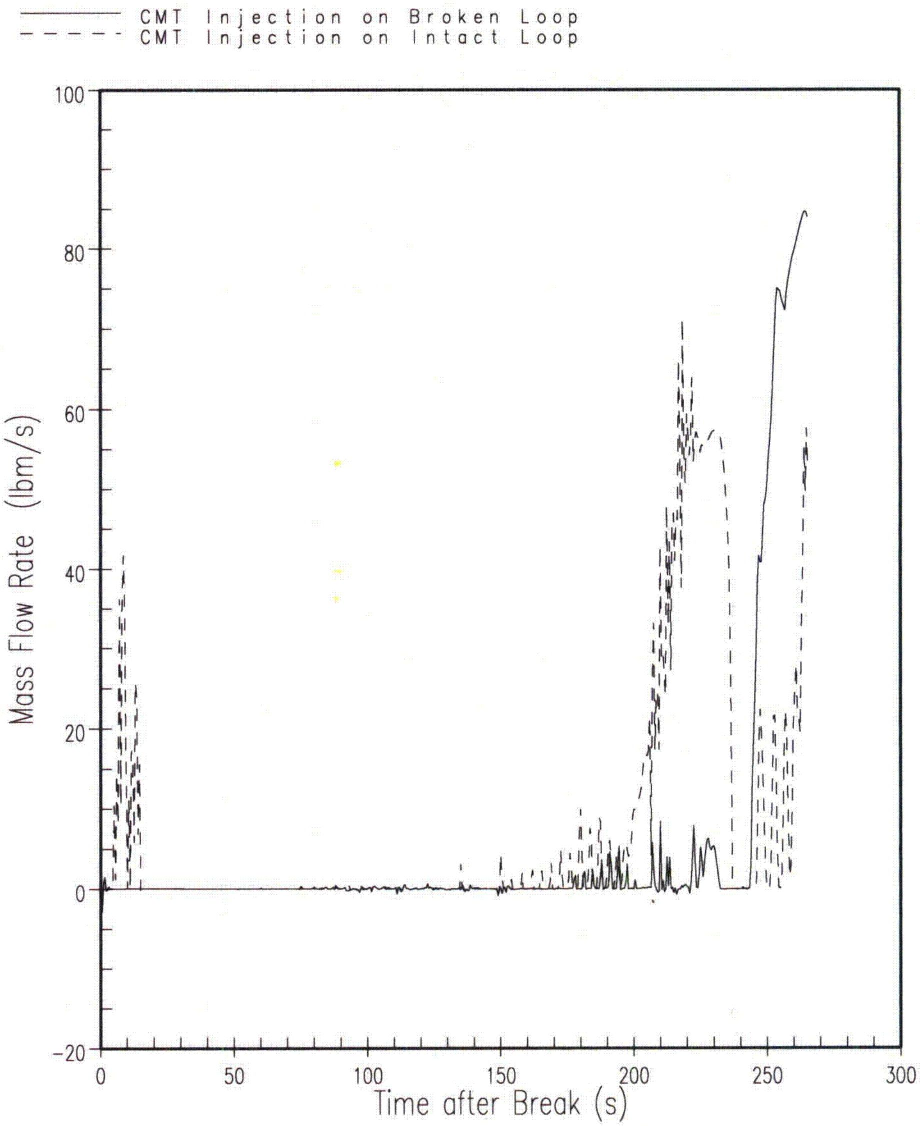
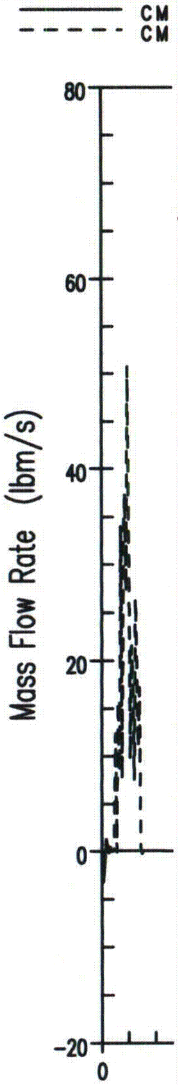


Figure 15.6.5.4A-6

Core Makeup Tank Injection Flow
for 95th Percentile Estimator PCT Case



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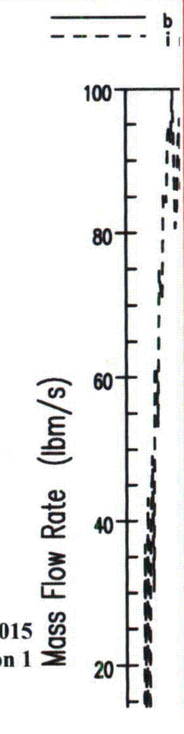


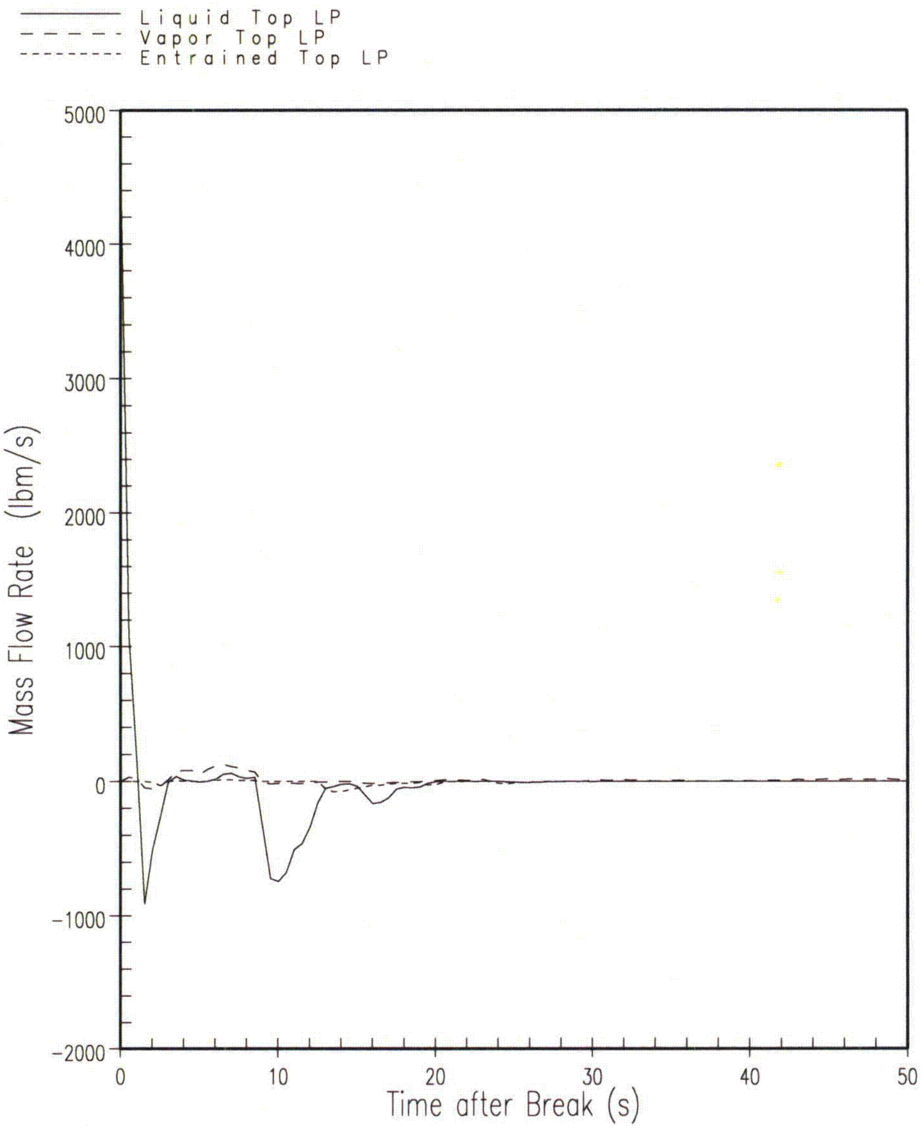
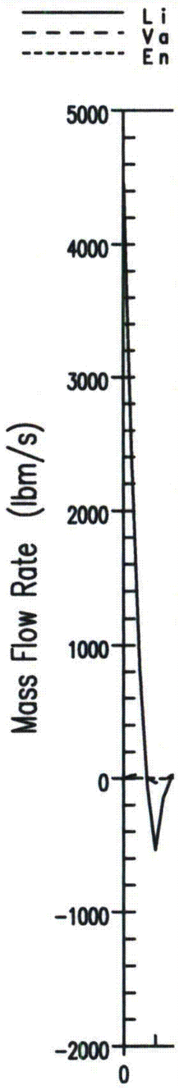


Figure 15.6.5.4A-7

Mass Flow at Top of Peripheral Assemblies Channel for 95th Percentile Estimator PCT Case

15.6-113



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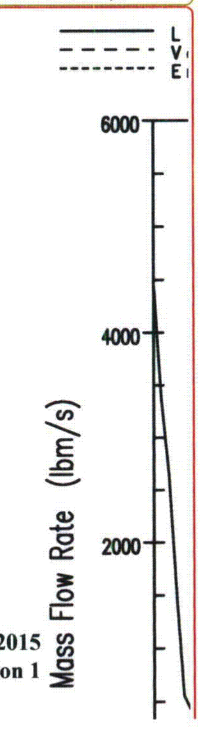


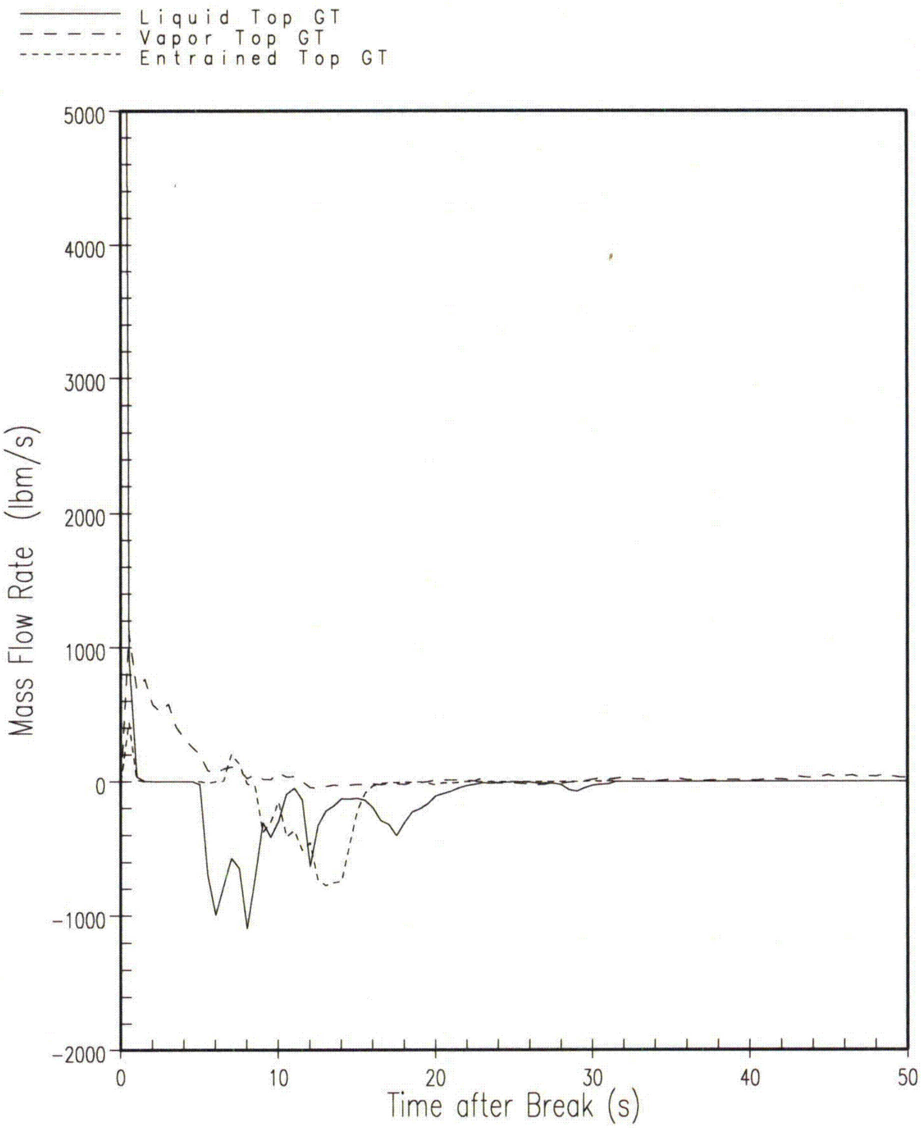
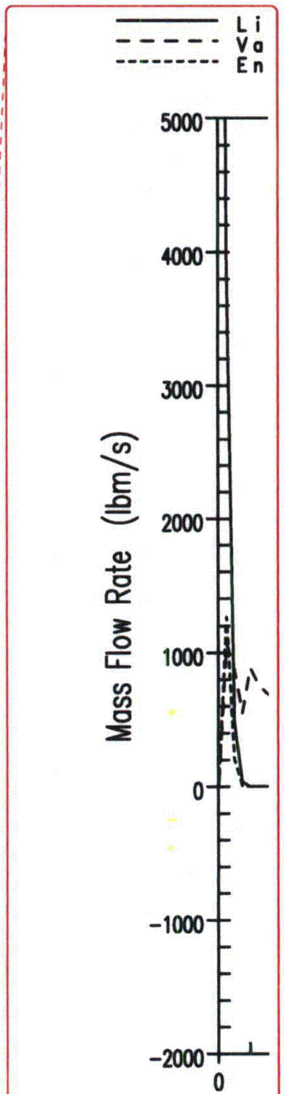


Figure 15.6.5.4A-8

Mass Flow at Top of Guide Tube Assemblies Channel for 95th Percentile Estimator PCT Case

15.6-114



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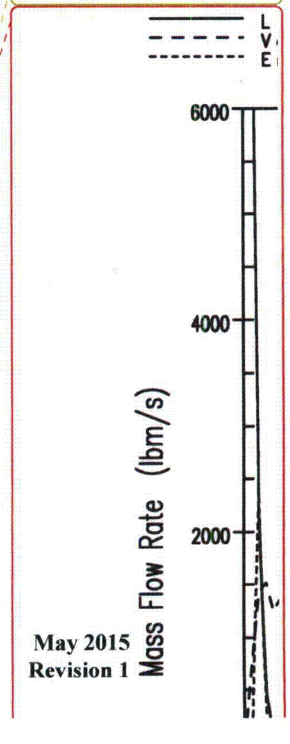


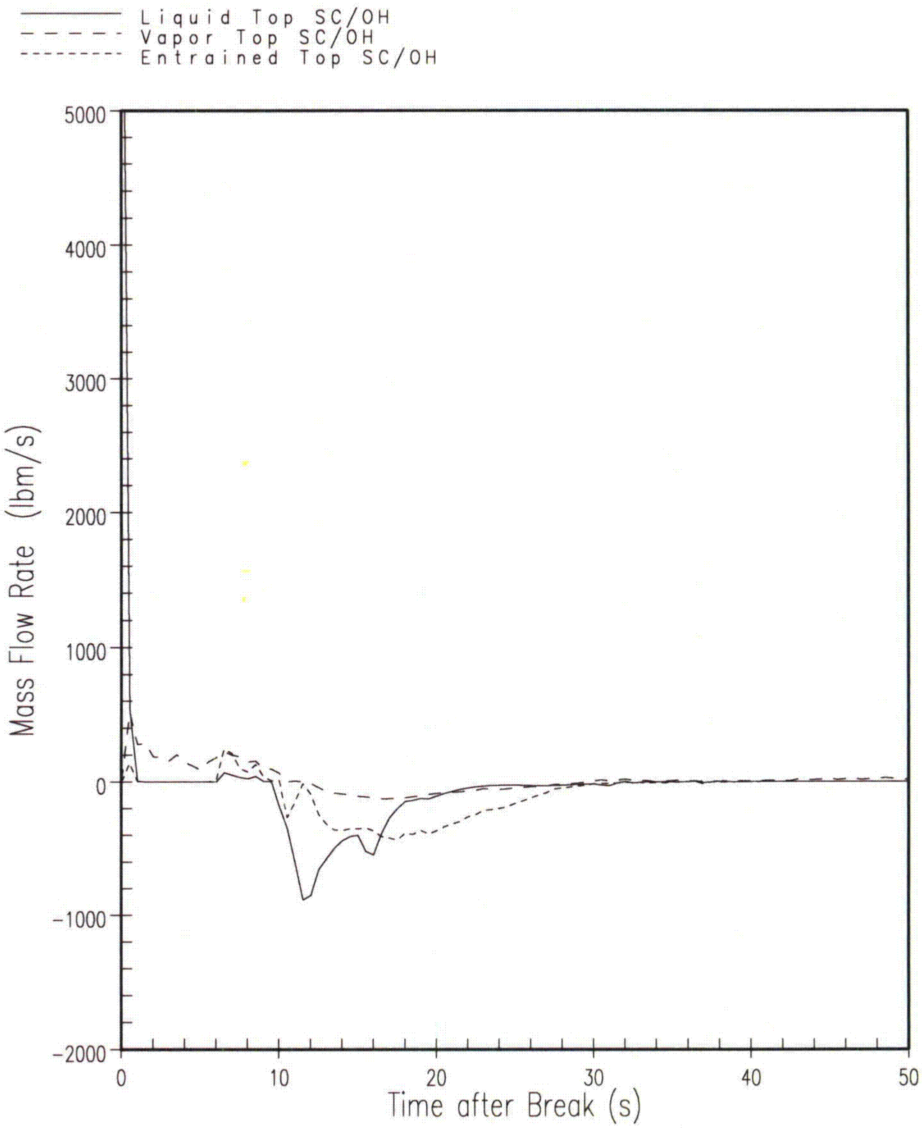
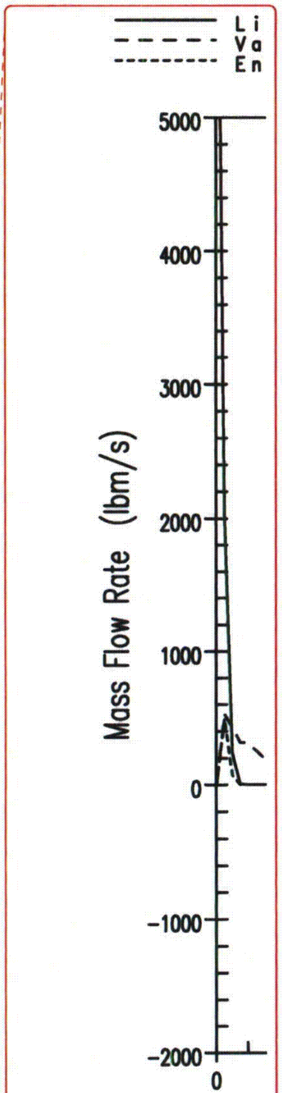


Figure 15.6.5.4A-9

Mass Flow at Top of Support Column/Open Hole Assemblies Channel for 95th Percentile Estimator PCT Case



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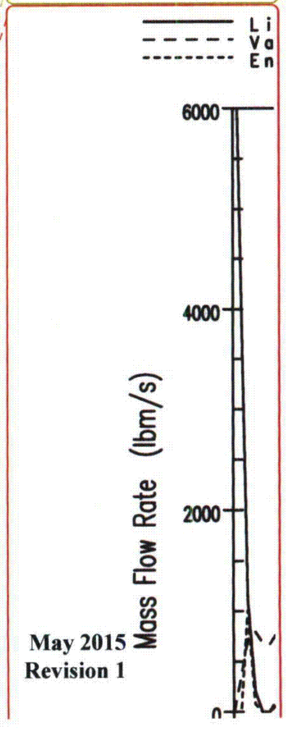


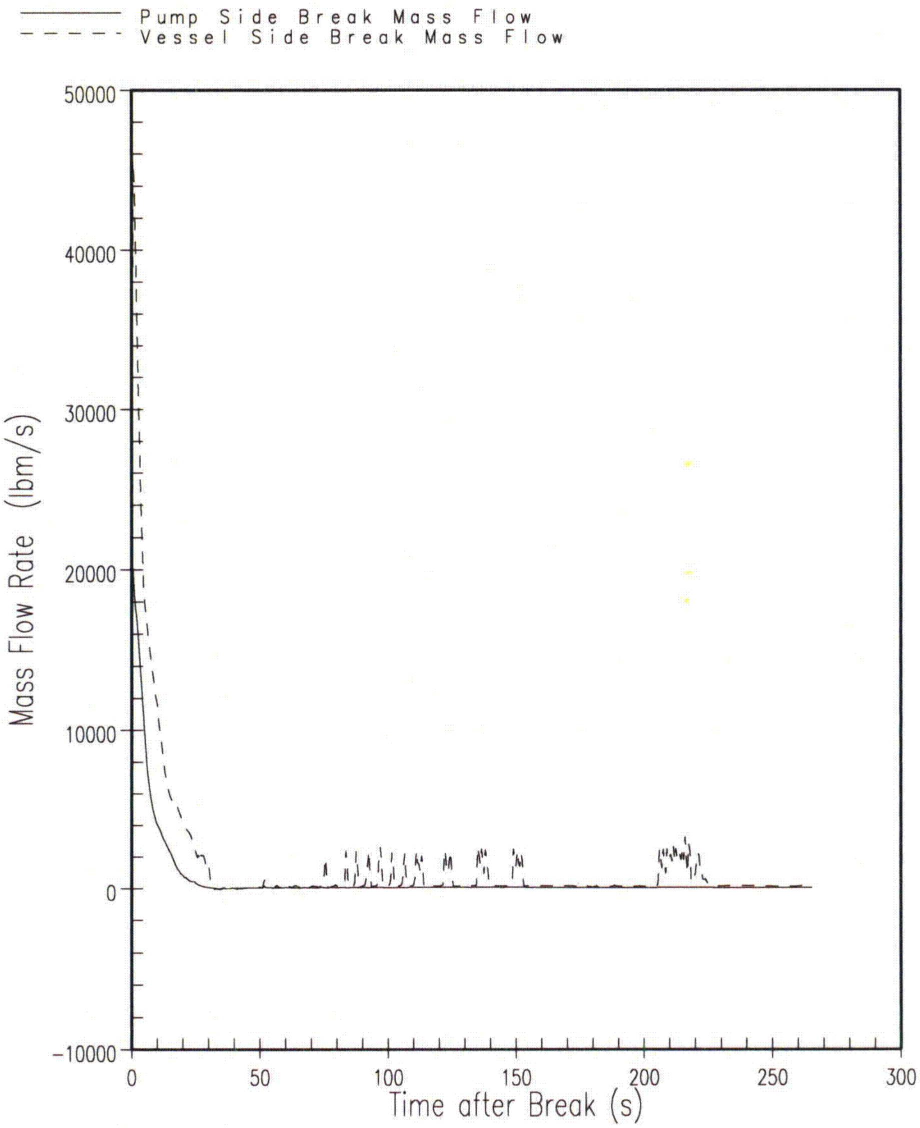
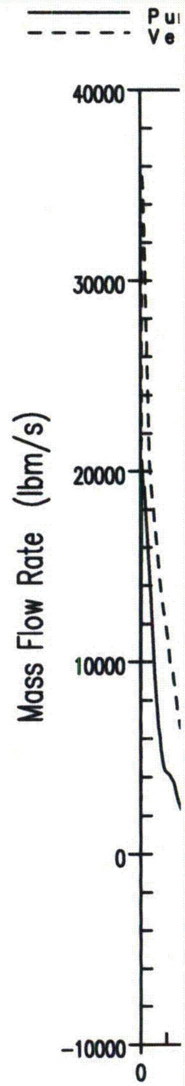


Figure 15.6.5.4A-10

Break Mass Flow for
95[th] Percentile Estimator PCT Case



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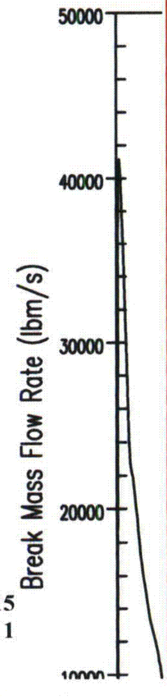


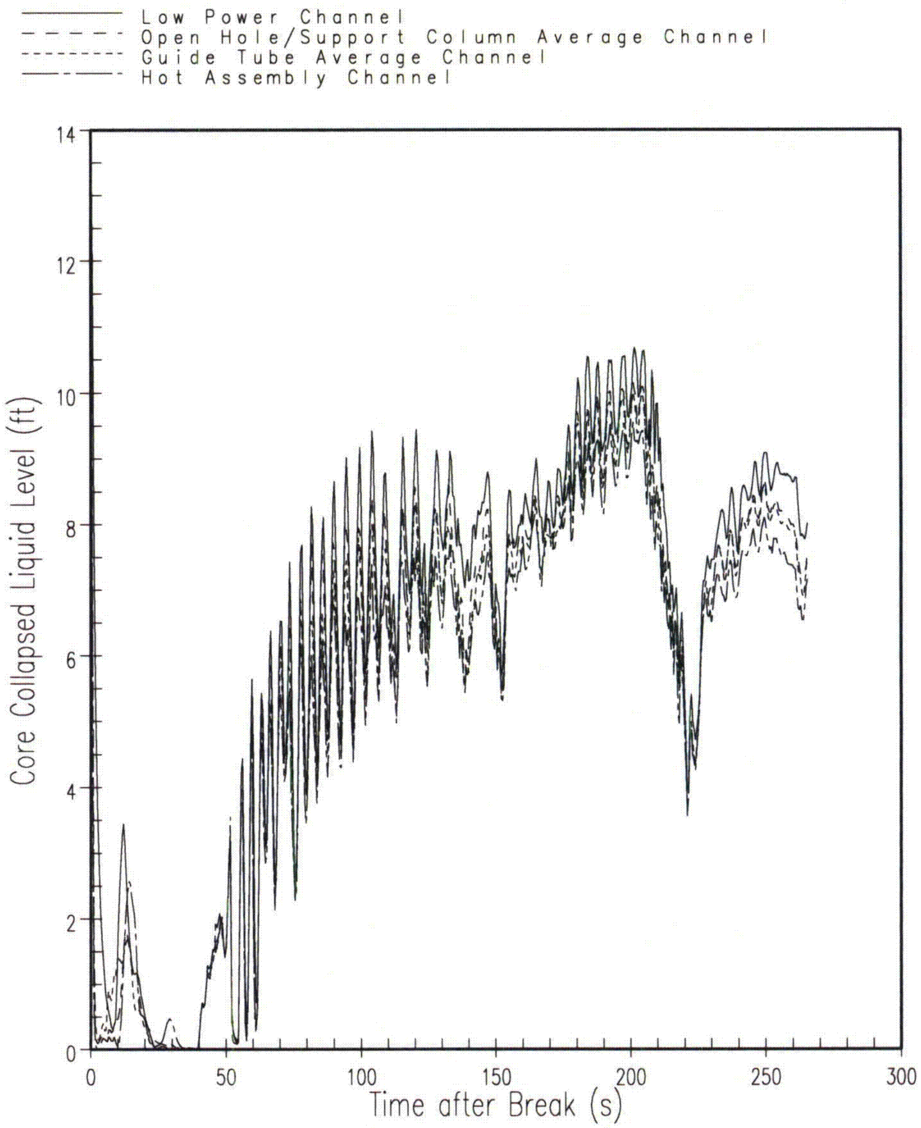
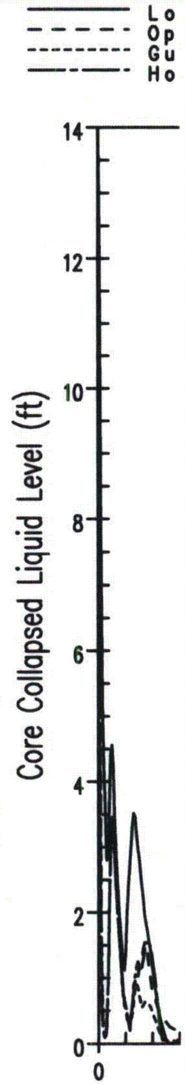


Figure 15.6.5.4A-11

Core Channel Collapsed Liquid Levels for 95th Percentile Estimator PCT Case
(Reference Point: Bottom of Active Fuel)



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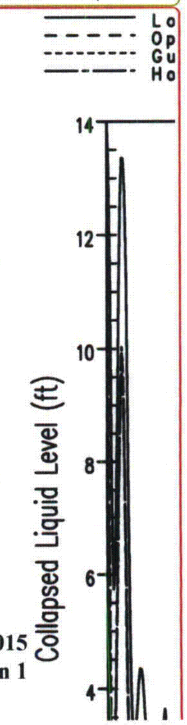


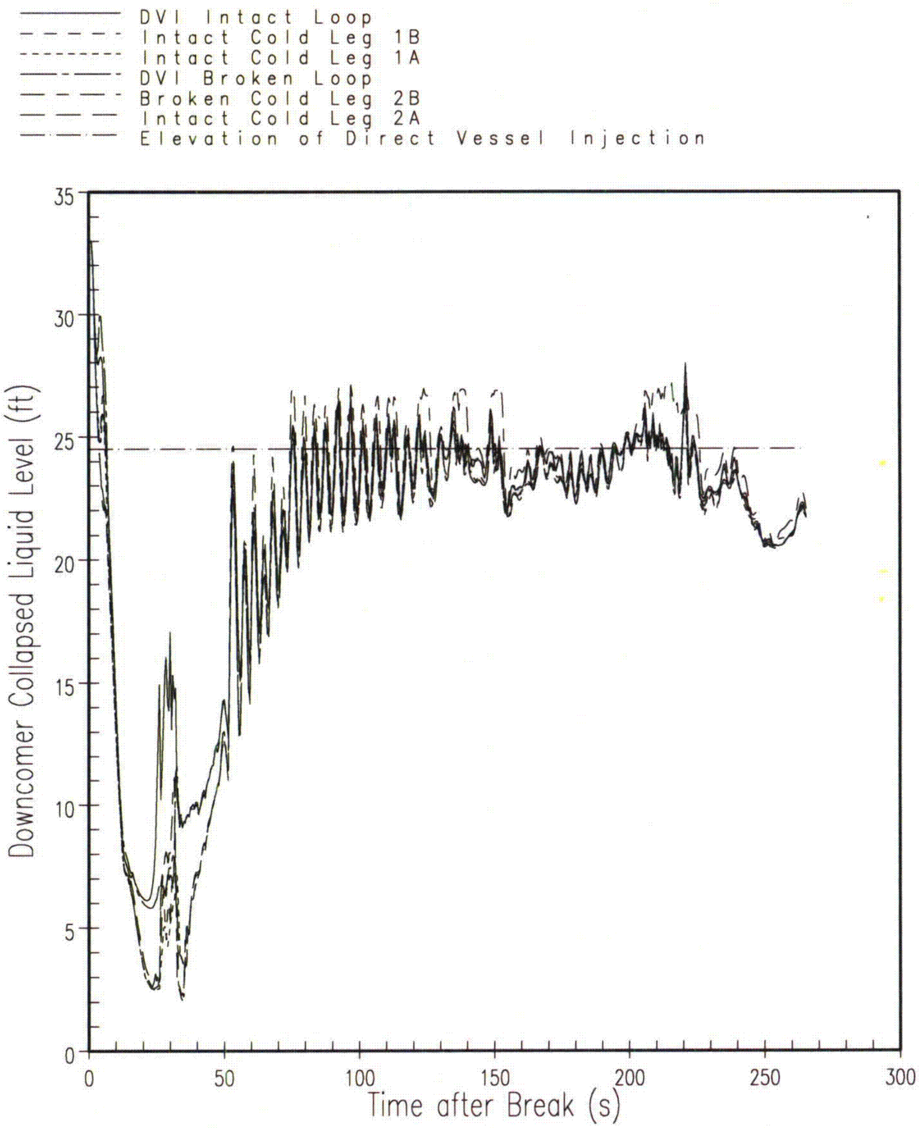
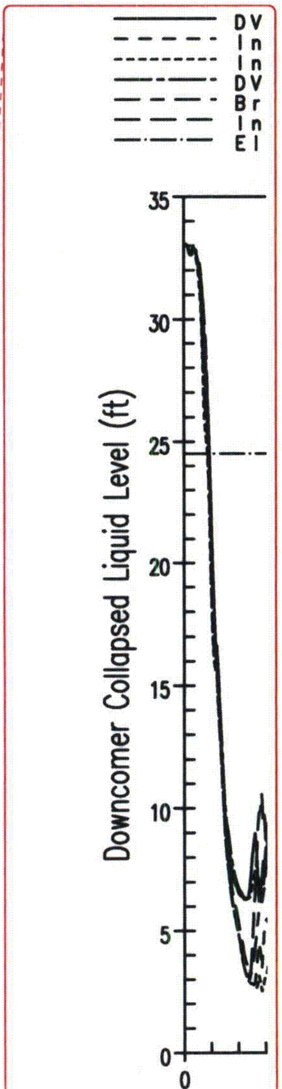


Figure 15.6.5.4A-12

Downcomer Channel Collapsed Liquid Levels
for 95th Percentile Estimator PCT Case
(Reference Point: Inside Bottom of Vessel)



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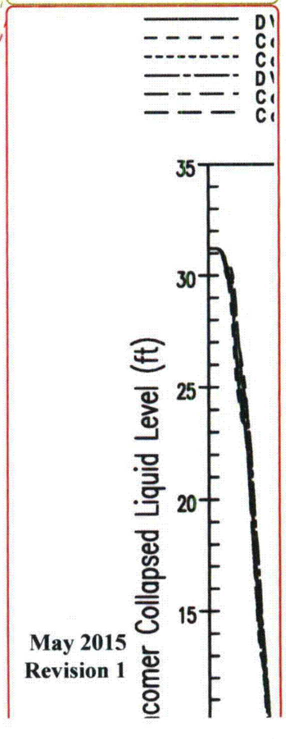

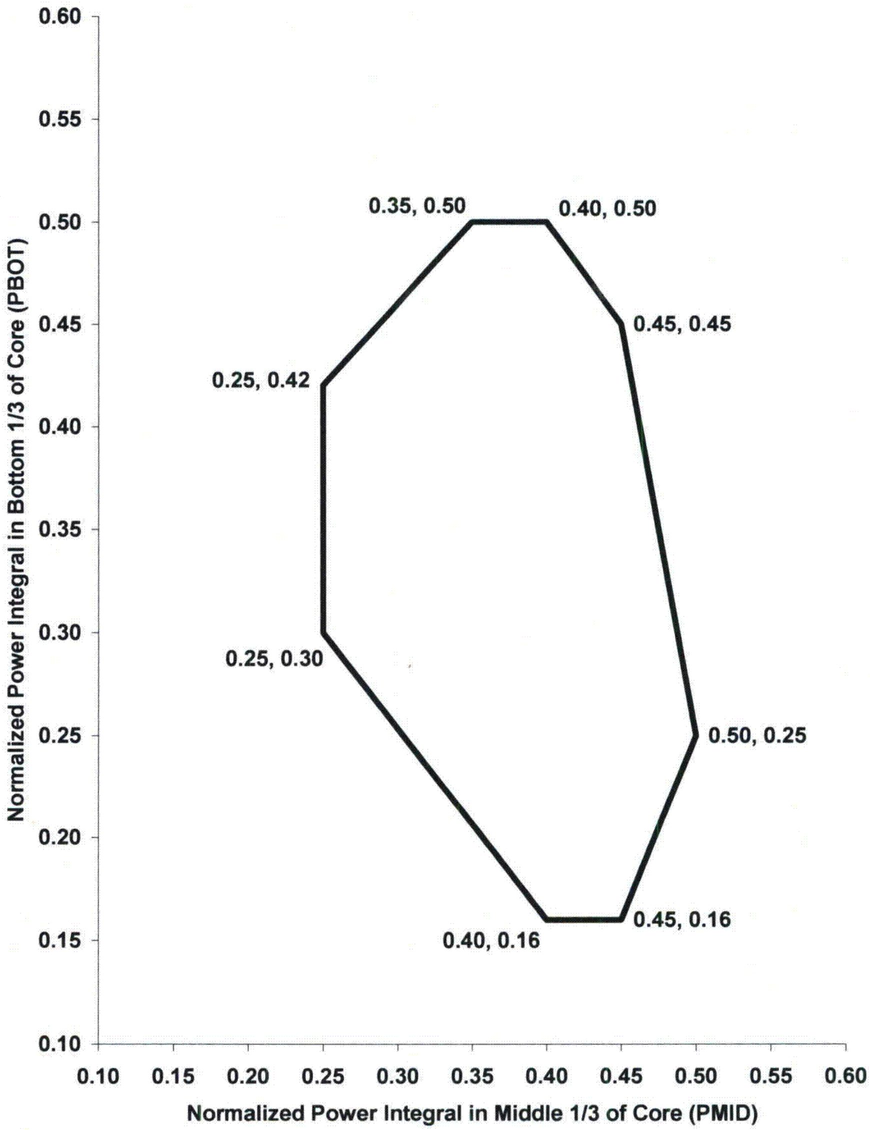

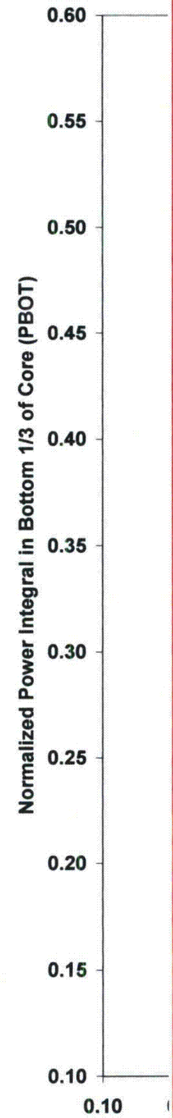

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Figure 15.6.5.4A-13

PBOT/PMID Box Supported by AP1000 ASTRUM Analysis

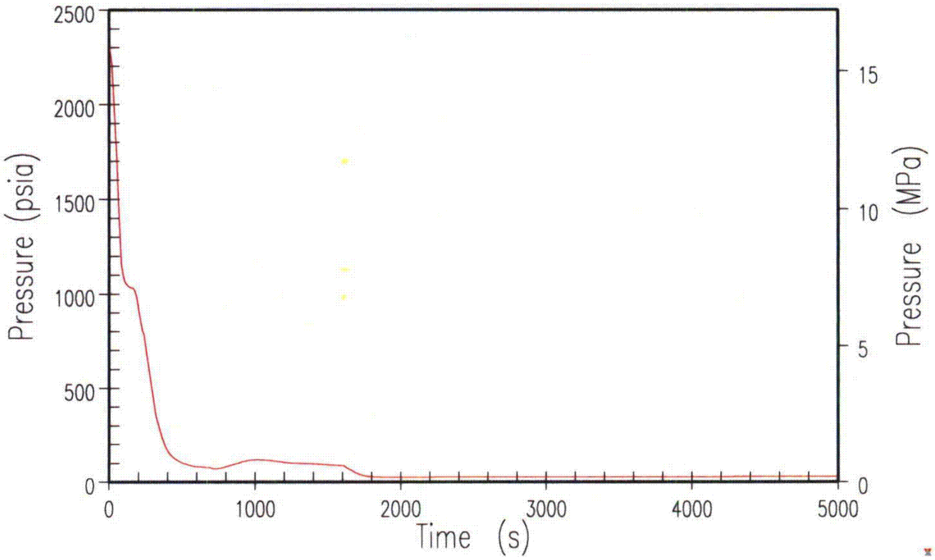
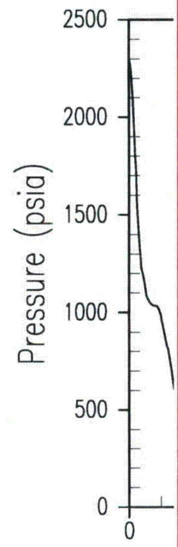


Figure 15.6.5.4B-1(a)

Inadvertent ADS – RCS Pressure



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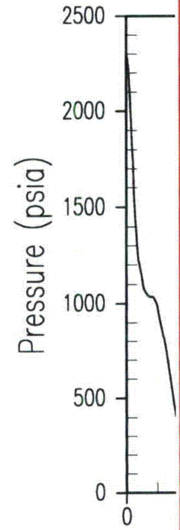

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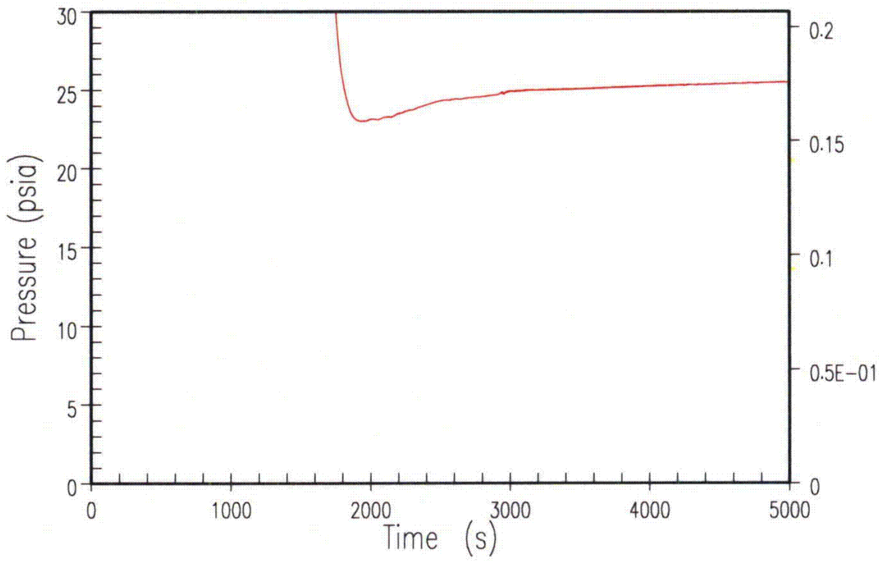
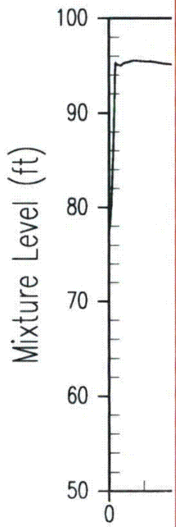


Figure 15.6.5.4B-1(b)

Inadvertent ADS – RCS Pressure (Zoomed)



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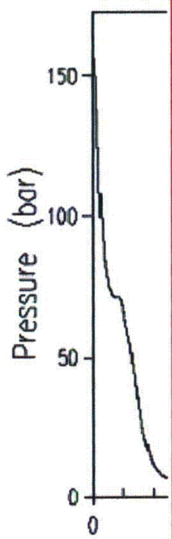

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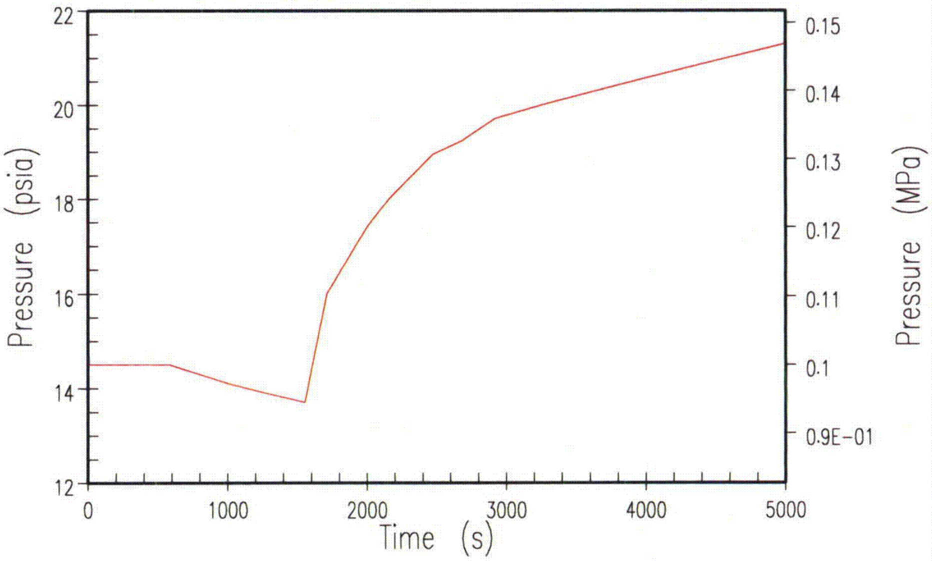
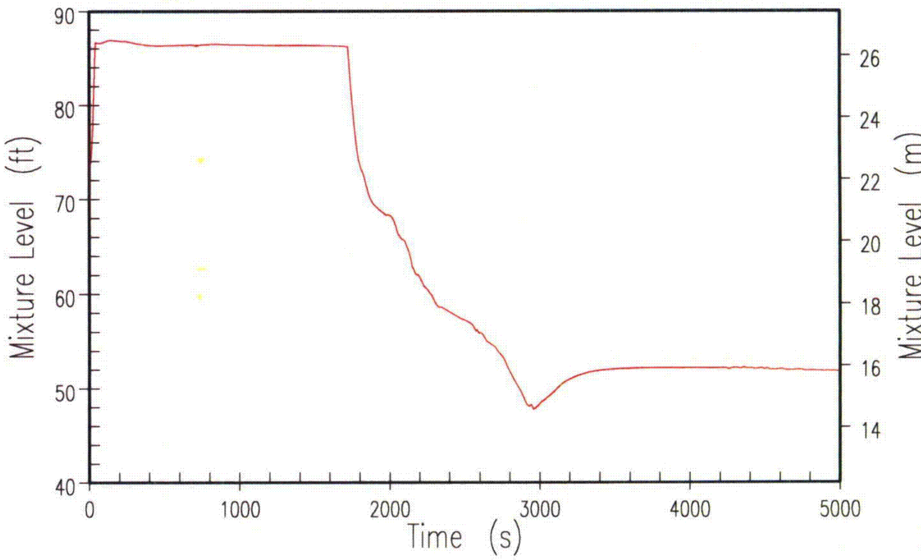
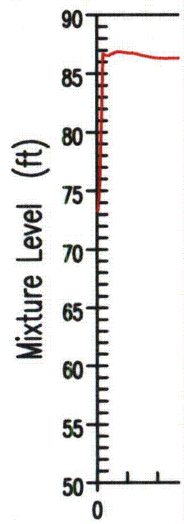


Figure 15.6.5.4B-1(c)

Inadvertent ADS – Containment Pressure





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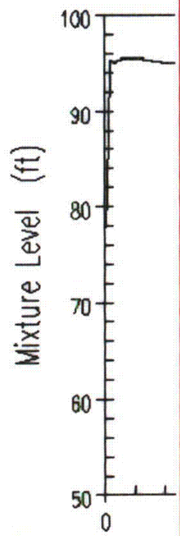

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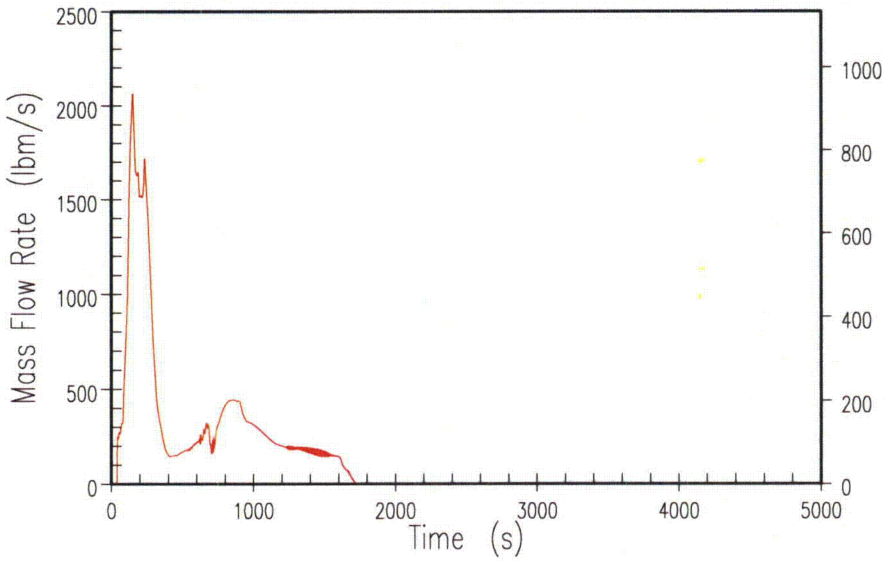
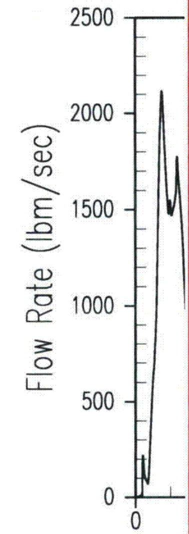
Figure 15.6.5.4B-2

Inadvertent ADS – Pressurizer Mixture Level





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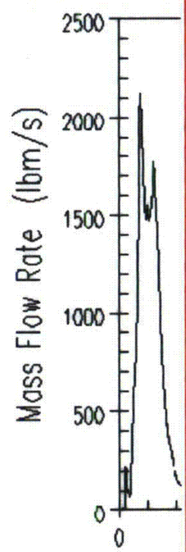

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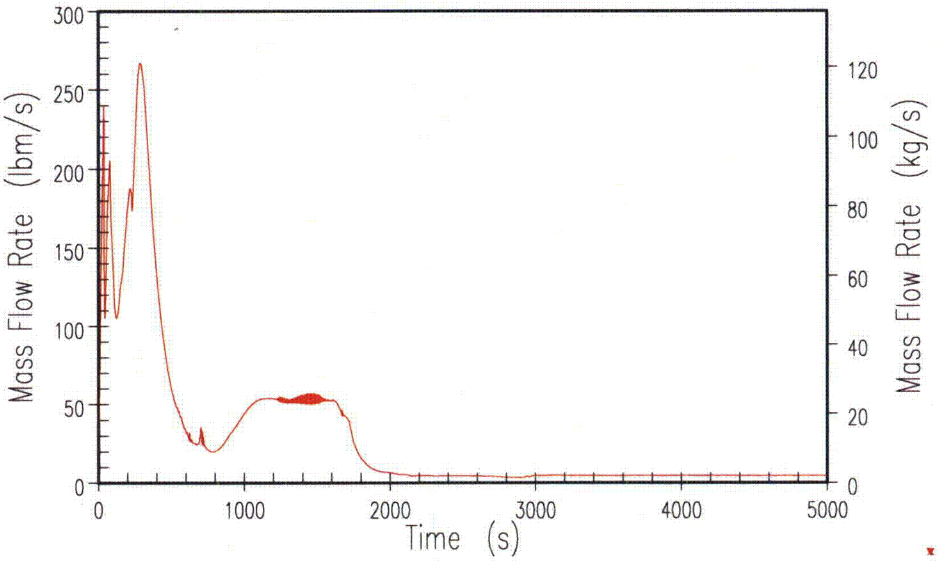
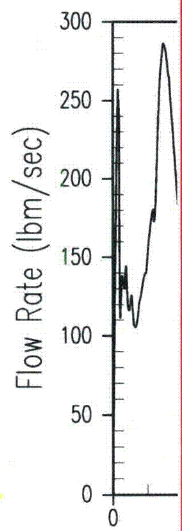
Figure 15.6.5.4B-3

Inadvertent ADS – ADS 1-3 Liquid Discharge





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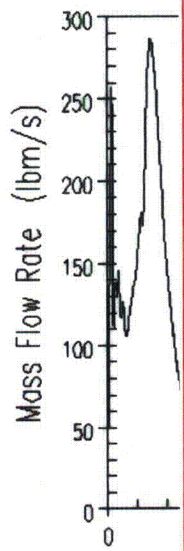

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Figure 15.6.5.4B-4(a)

Inadvertent ADS – ADS 1-3 Vapor Discharge

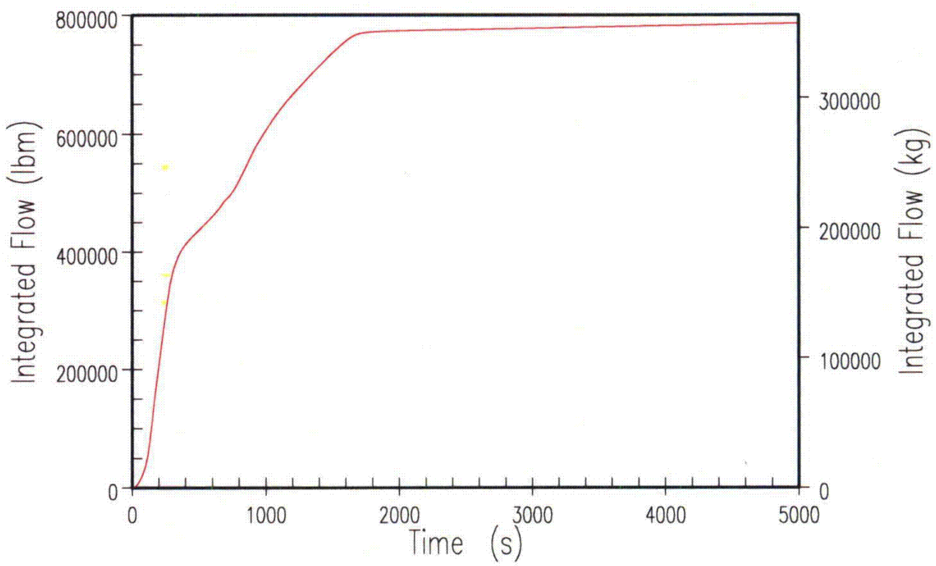

Figure 15.6.5.4B-4(b)

Inadvertent ADS – ADS 1-3 Integrated Discharge

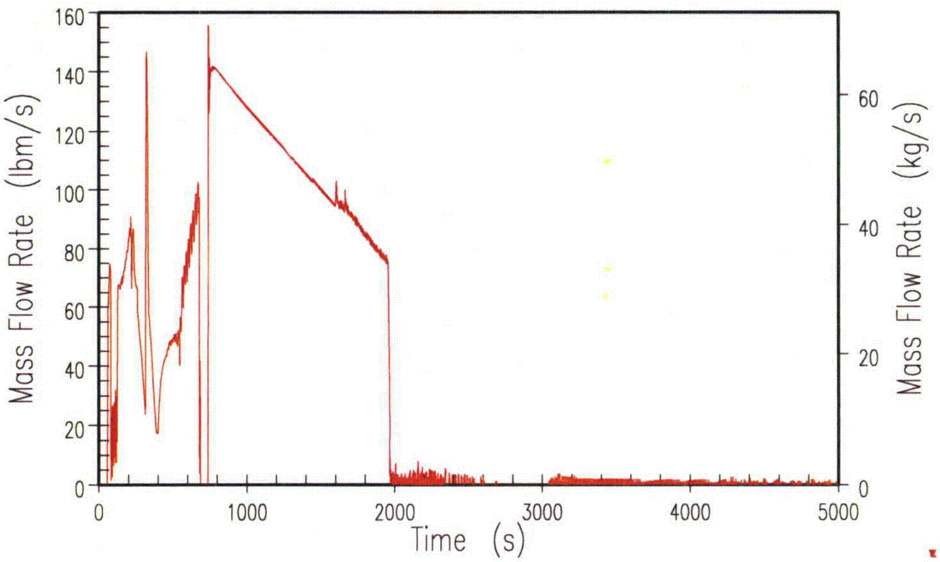

Figure 15.6.5.4B-5

Inadvertent ADS – CMT-1 Injection Rate

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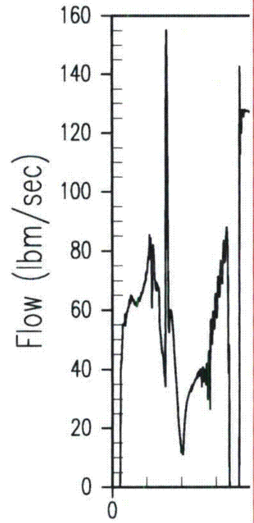

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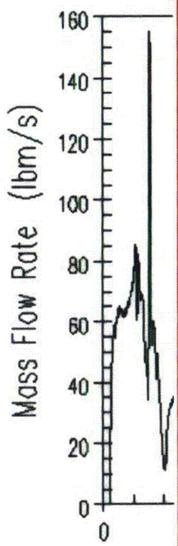

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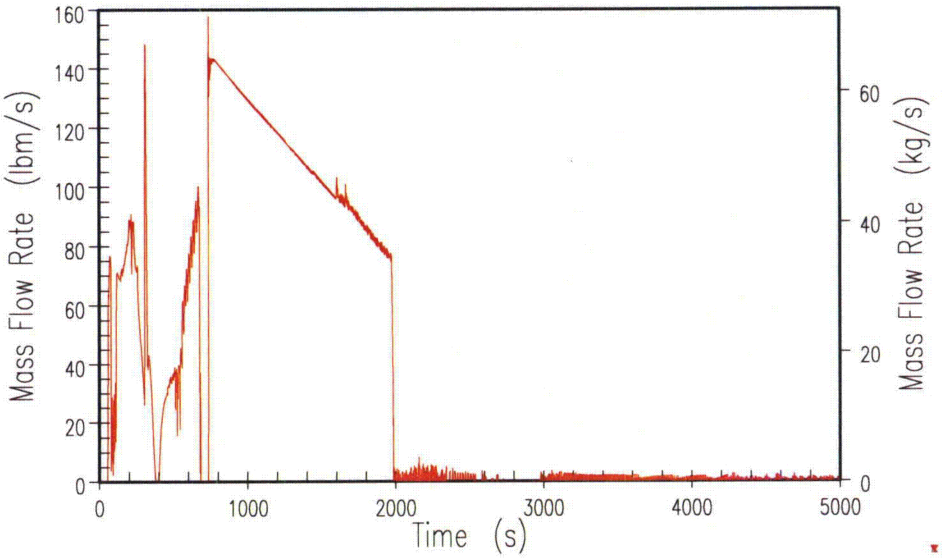
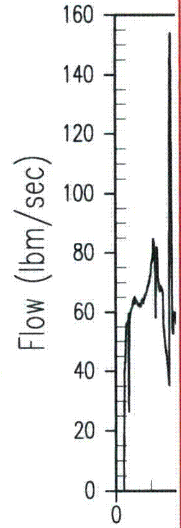


Figure 15.6.5.4B-6

Inadvertent ADS – CMT-2 Injection Rate



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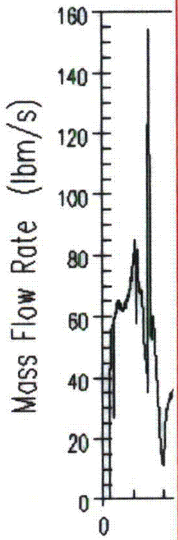

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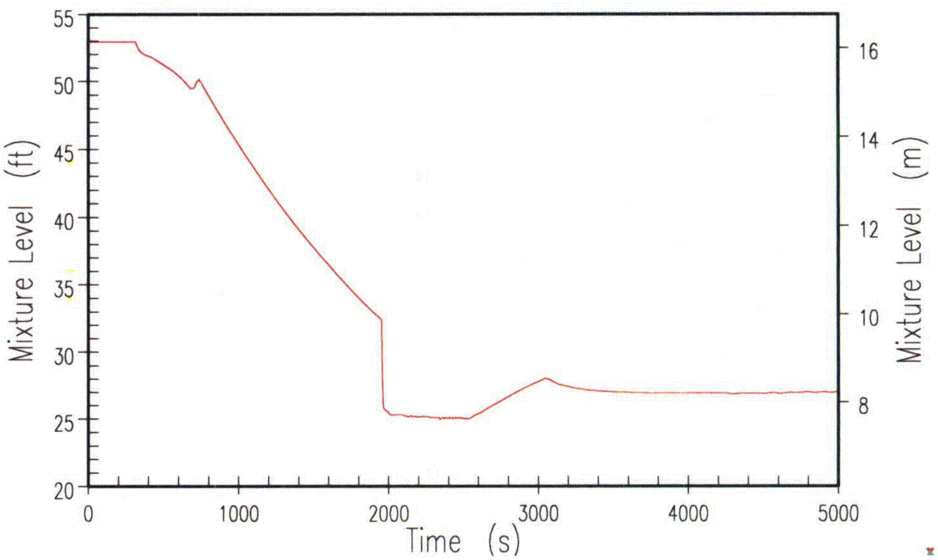
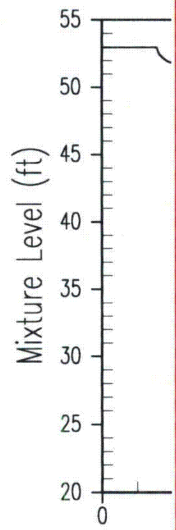


Figure 15.6.5.4B-7

Inadvertent ADS – CMT-1 Mixture Level



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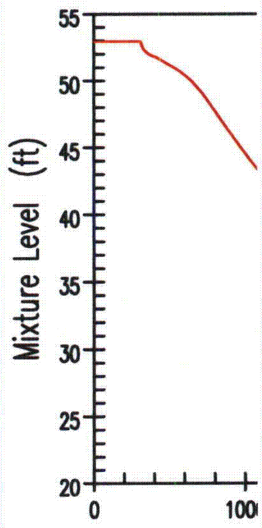

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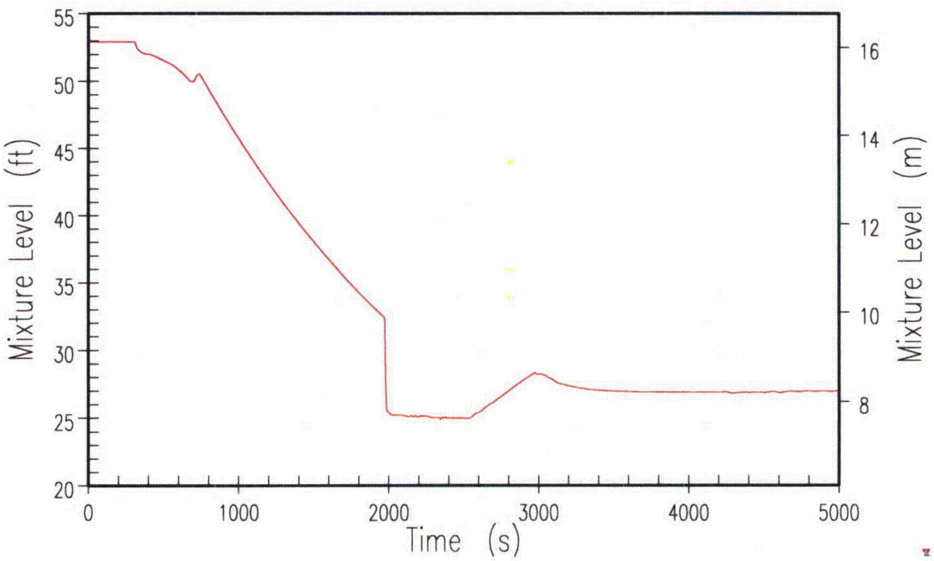

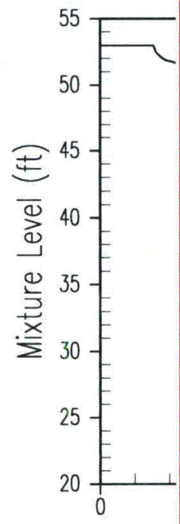

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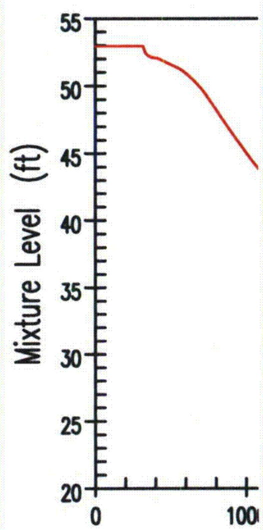

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Figure 15.6.5.4B-8

Inadvertent ADS – CMT-2 Mixture Level

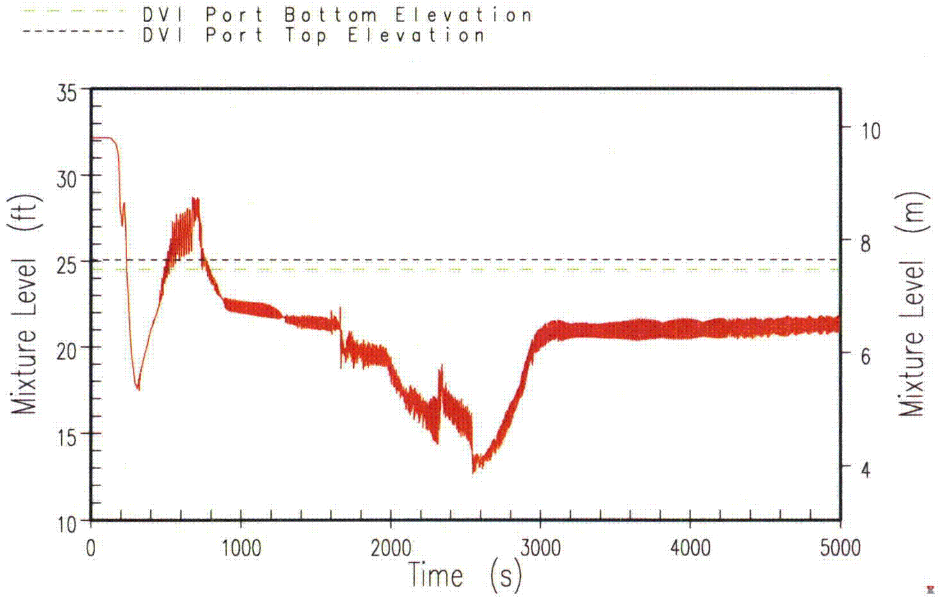
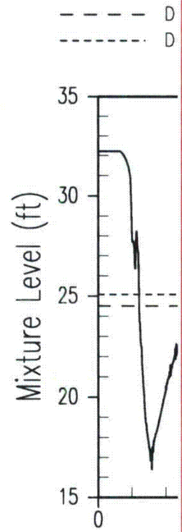


Figure 15.6.5.4B-9

Inadvertent ADS – Downcomer Mixture Level



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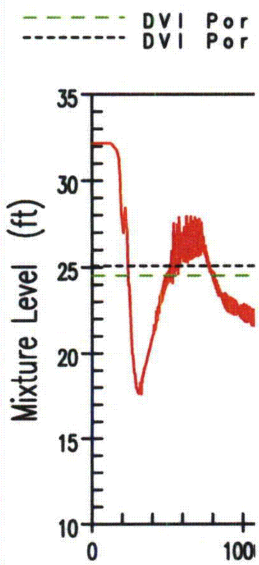

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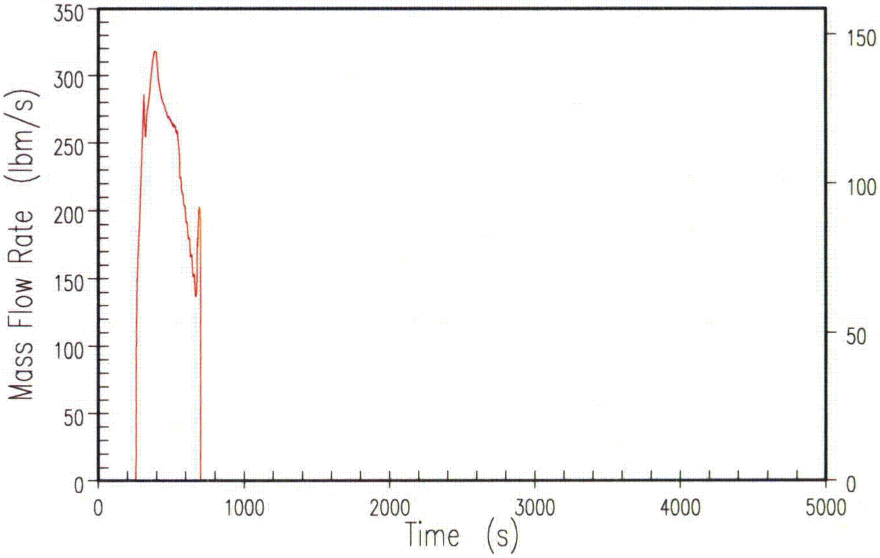

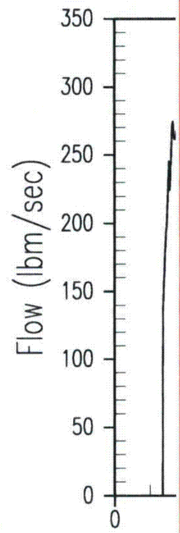

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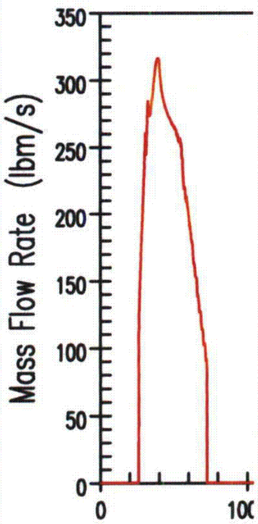

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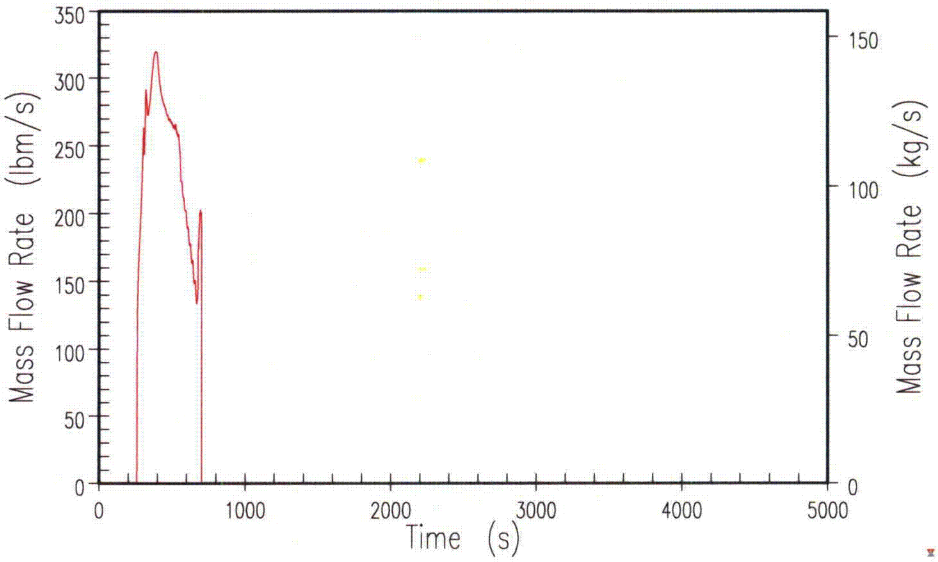
Figure 15.6.5.4B-10

Inadvertent ADS – Accumulator-1 Injection Rate



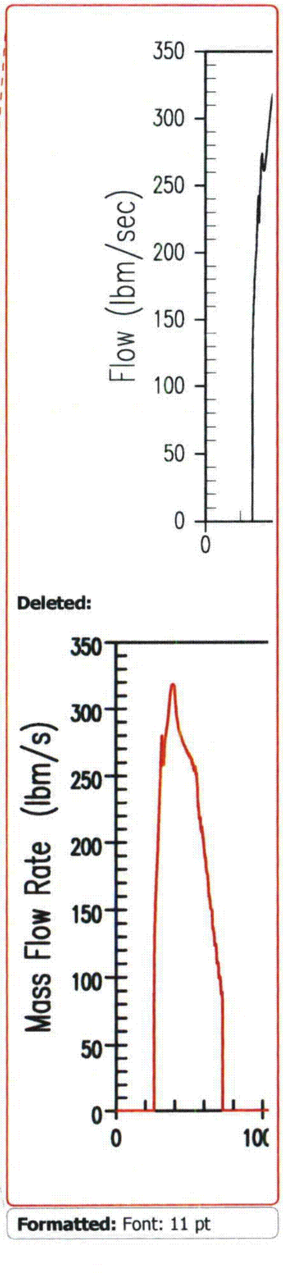
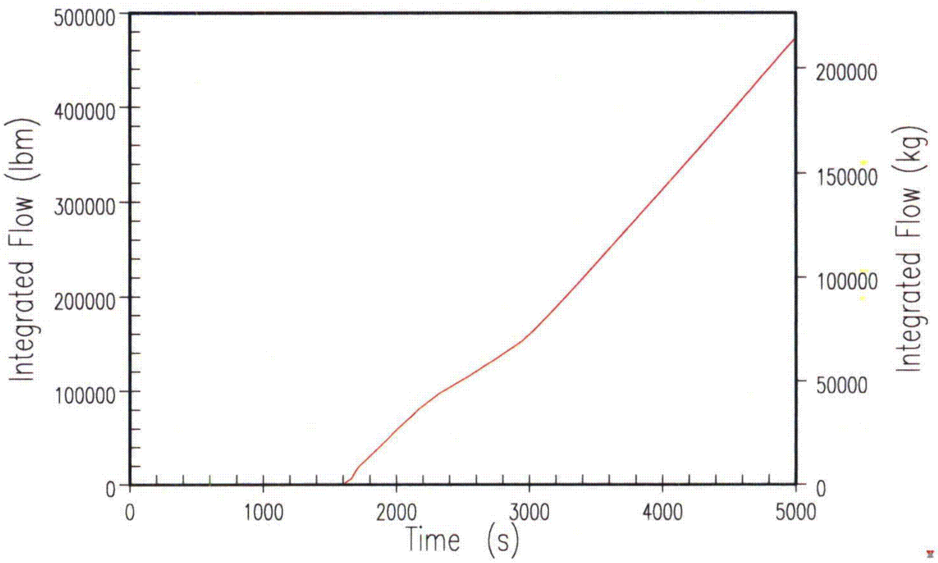
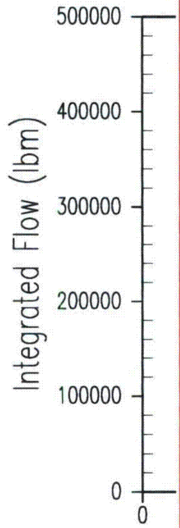


Figure 15.6.5.4B-11

Inadvertent ADS – Accumulator-2 Injection Rate





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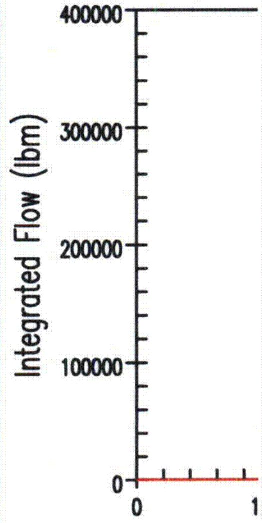

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Figure 15.6.5.4B-12(a)

Inadvertent ADS – ADS-4 Integrated Discharge

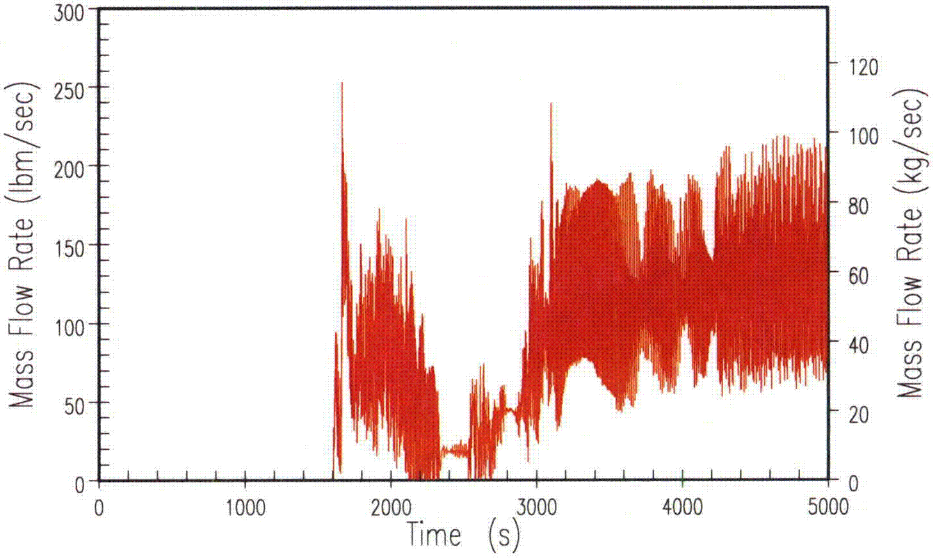


Figure 15.6.5.4B-12(b)

Inadvertent ADS – ADS-4 Liquid Discharge

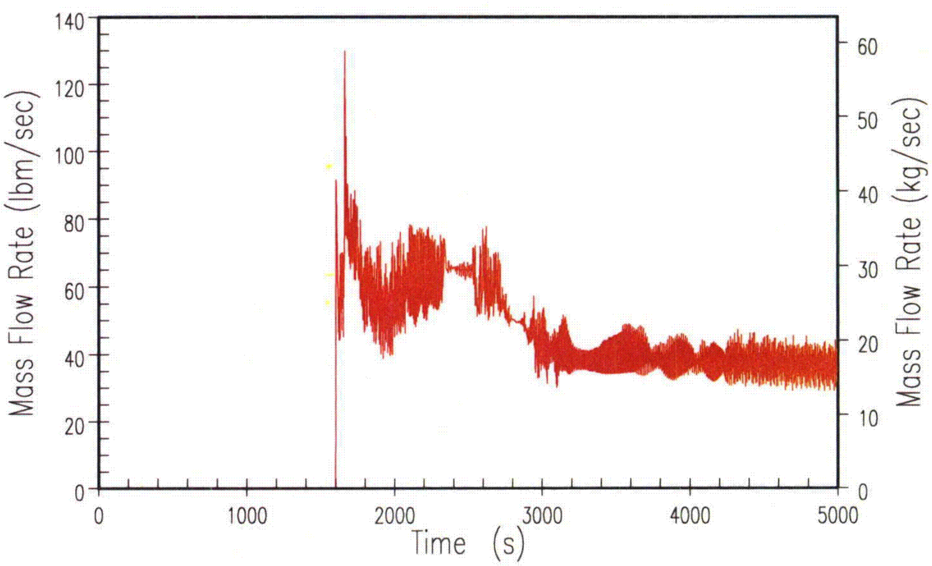
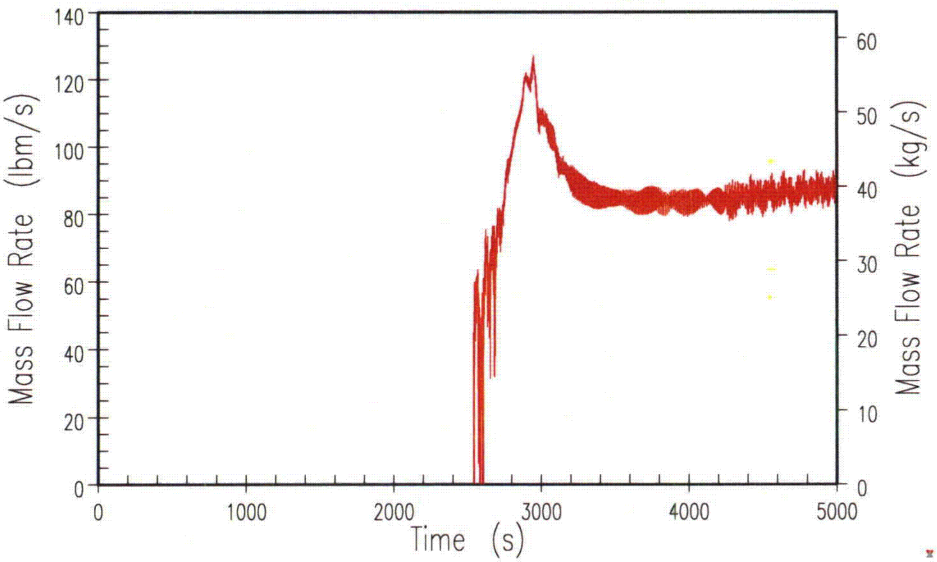


Figure 15.6.5.4B-12(c)

Inadvertent ADS – ADS-4 Vapor Discharge



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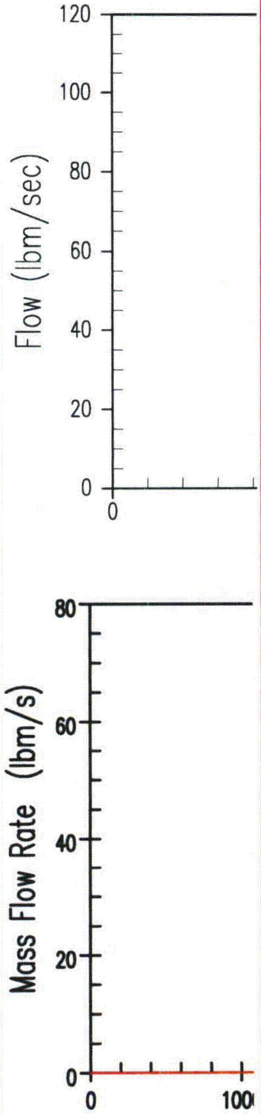

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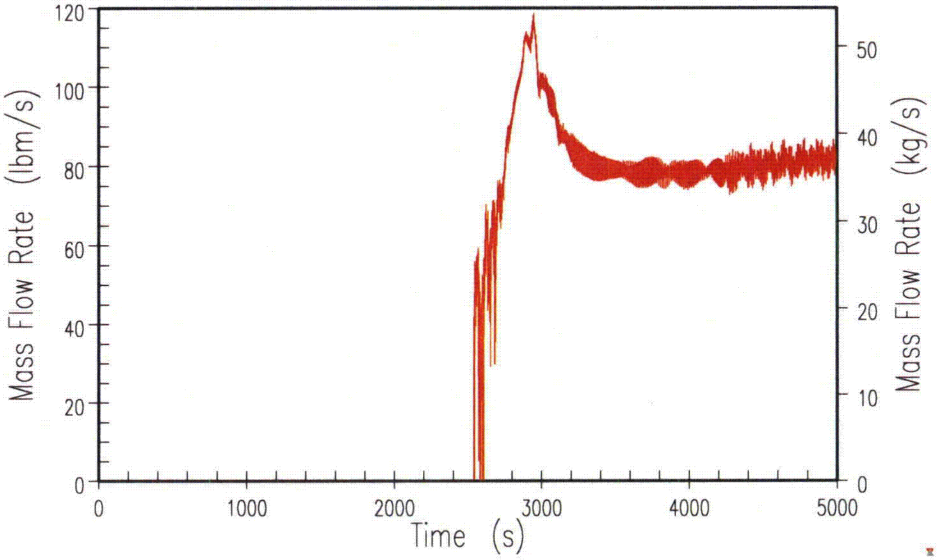
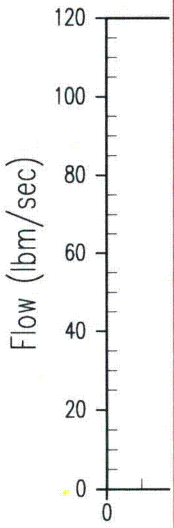
Figure 15.6.5.4B-13

Inadvertent ADS – IRWST-1 Injection Rate





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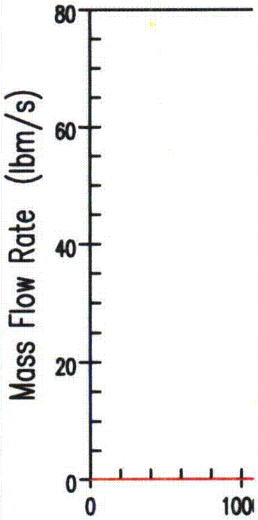

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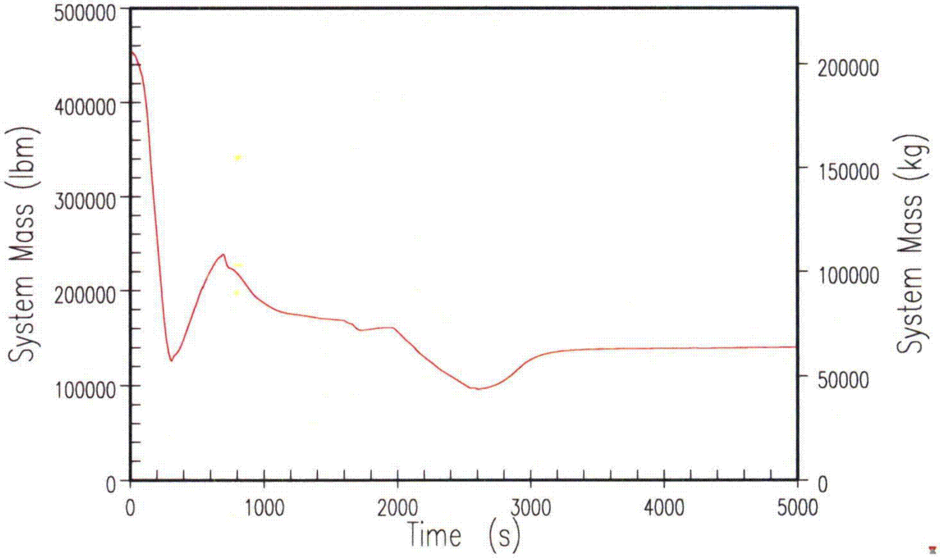
Inadvertent ADS – IRWST-2 Injection Rate



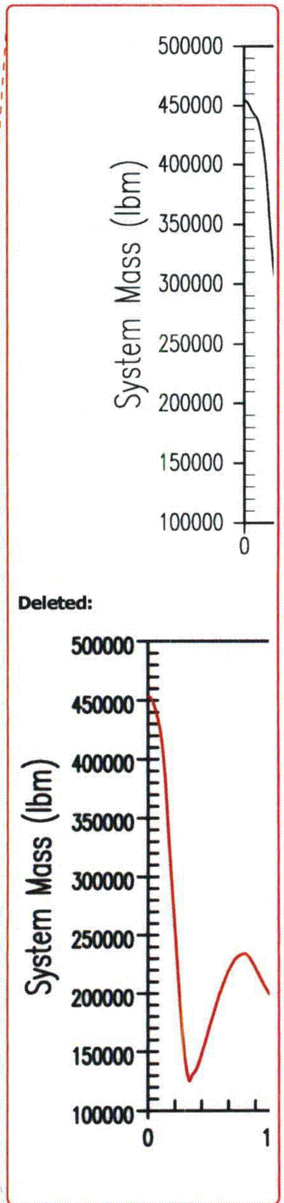


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Figure 15.6.5.4B-15(a)

Inadvertent ADS – RCS System Inventory

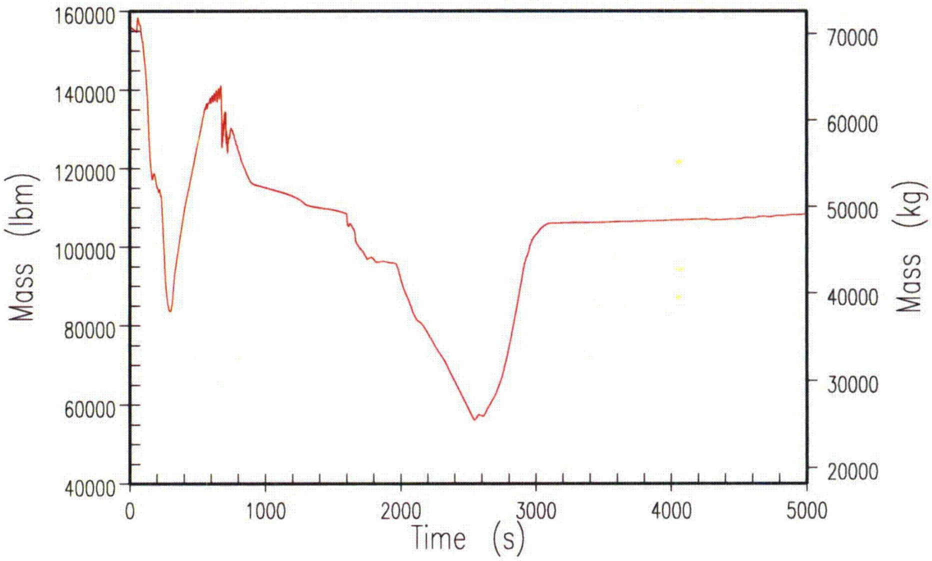


Figure 15.6.5.4B-15(b)

Inadvertent ADS –Reactor Vessel Mixture Inventory

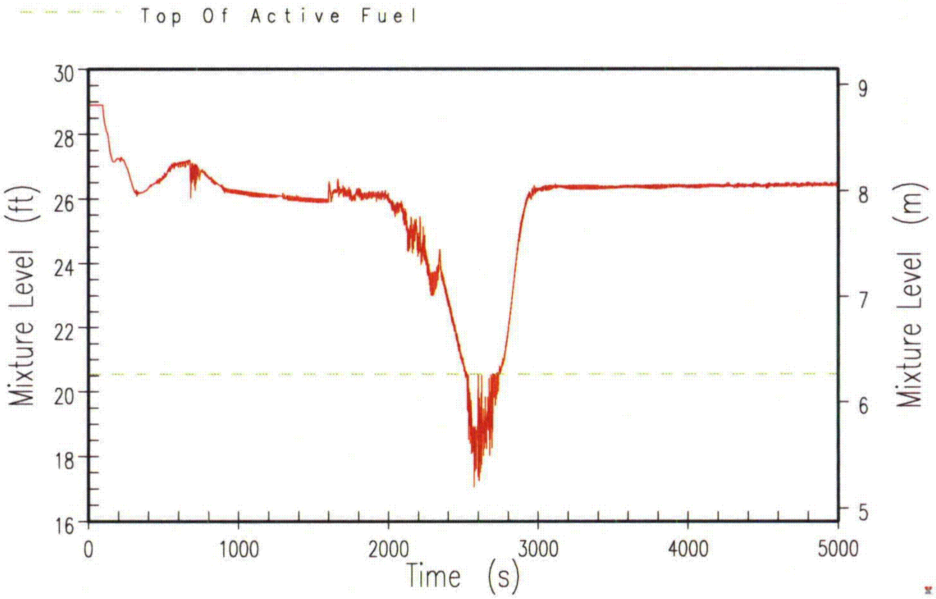
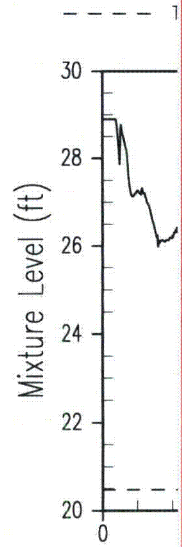


Figure 15.6.5.4B-16(a)

Inadvertent ADS – Core/Upper Plenum Mixture Level



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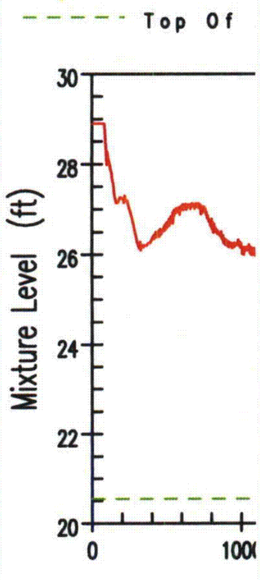

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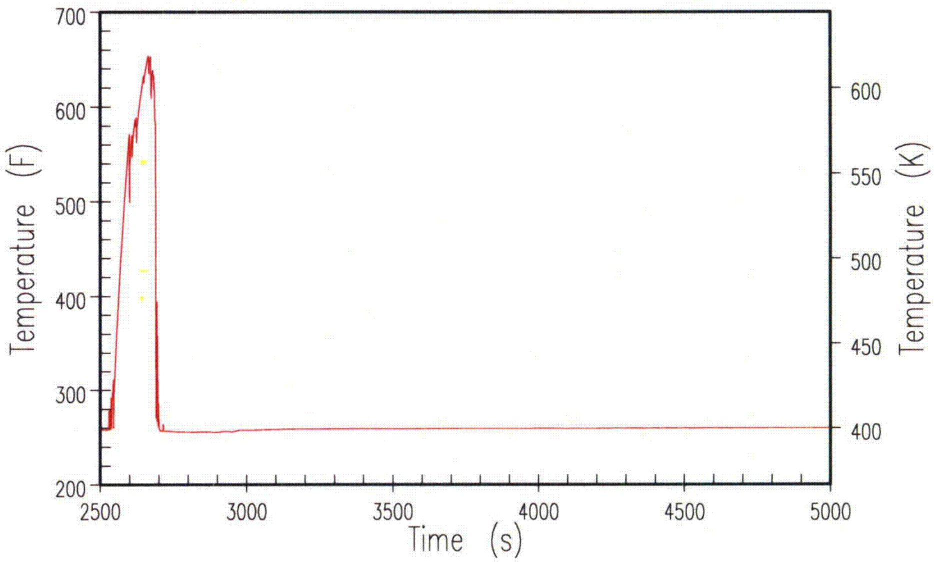


Figure 15.6.5.4B-16(b)

Inadvertent ADS – Peak Cladding Temperature

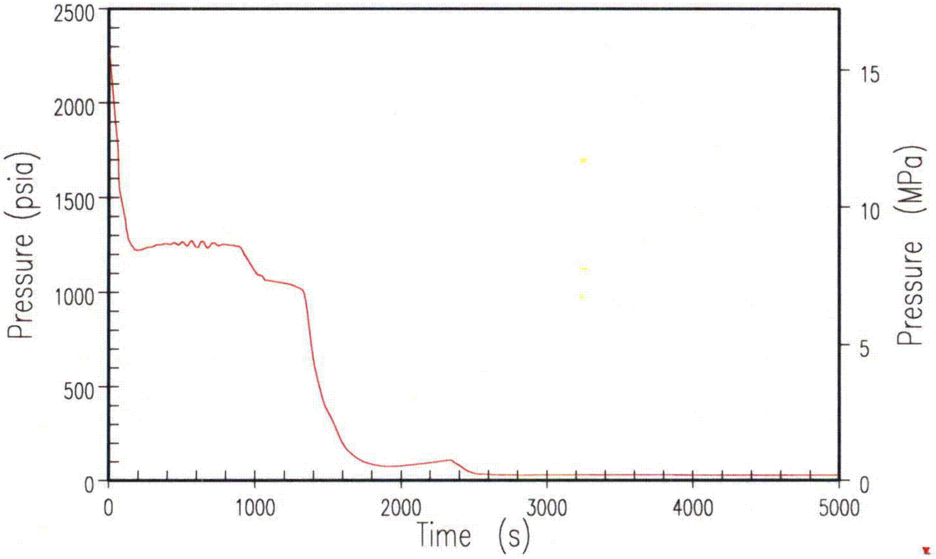
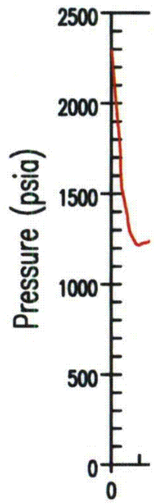


Figure 15.6.5.4B-17(a)

2-Inch Cold Leg Break – RCS Pressure



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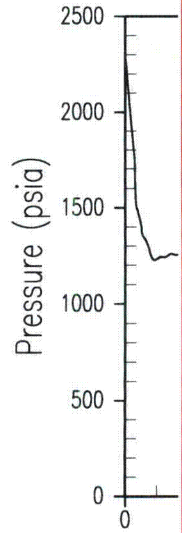

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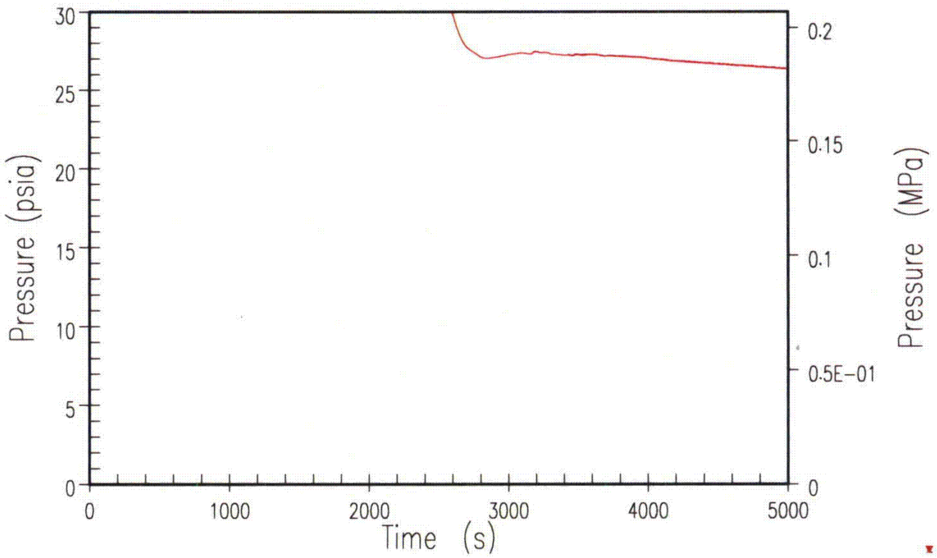
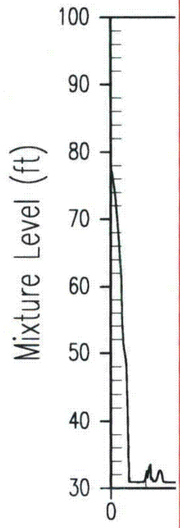


Figure 15.6.5.4B-17(b)

2-Inch Cold Leg Break – RCS Pressure (Zoomed)



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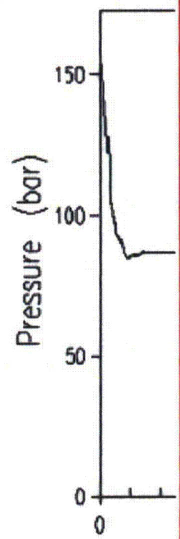

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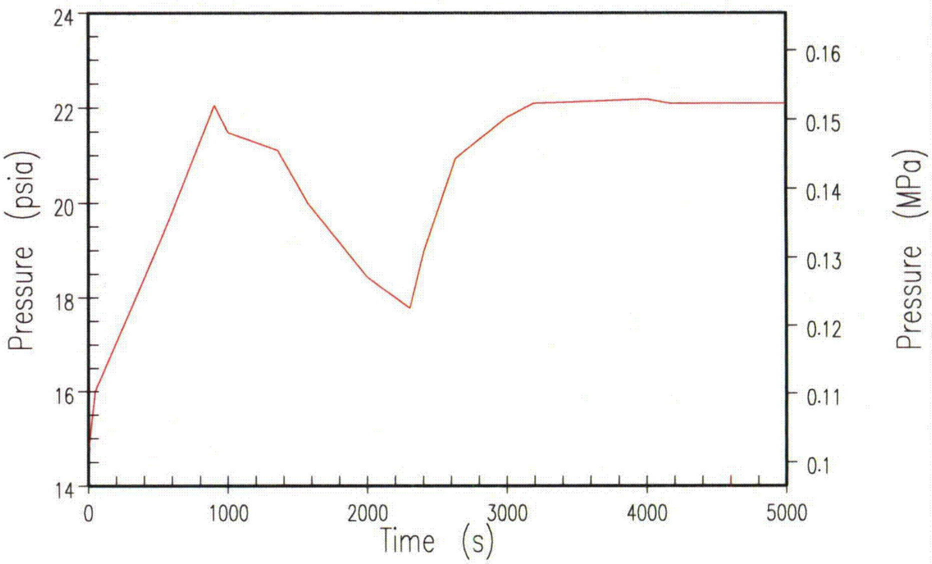
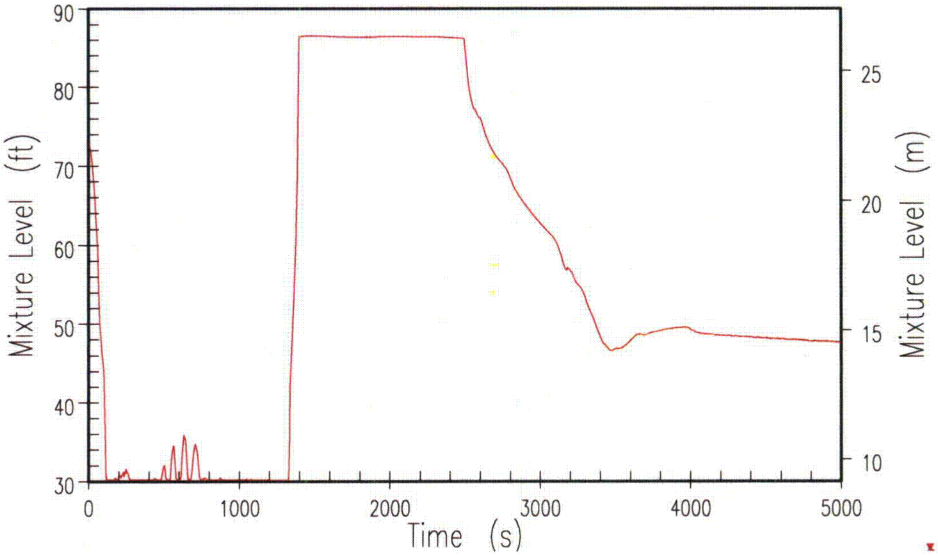
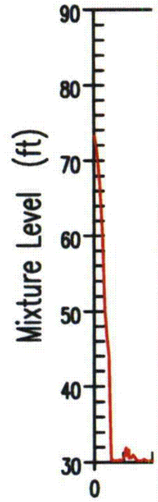


Figure 15.6.5.4B-17(c)

2-Inch Cold Leg Break – Containment Pressure





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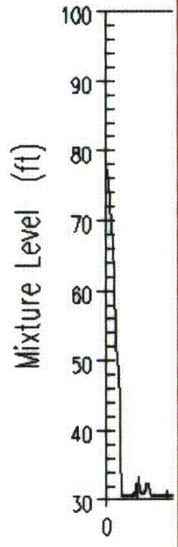

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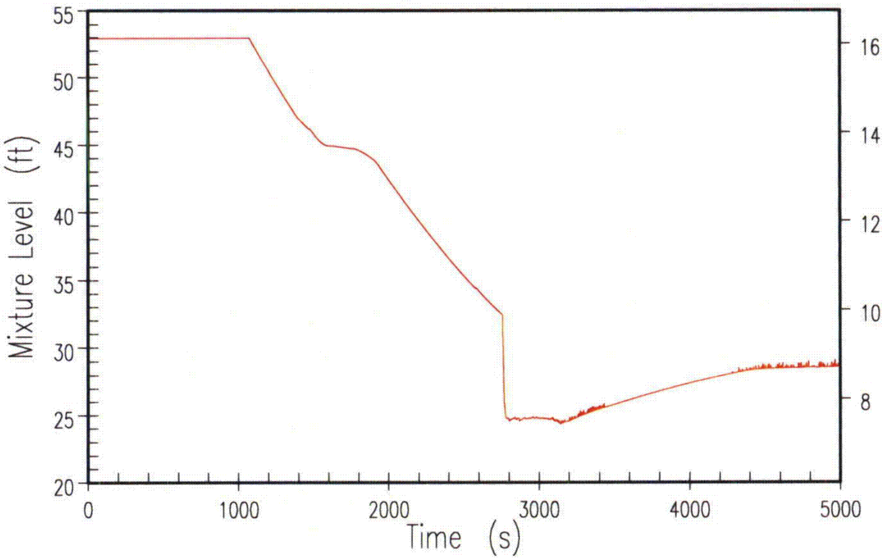
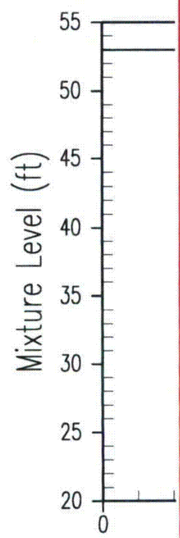
Figure 15.6.5.4B-18

2-Inch Cold Leg Break – Pressurizer Mixture Level





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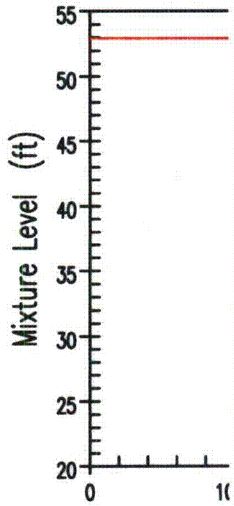

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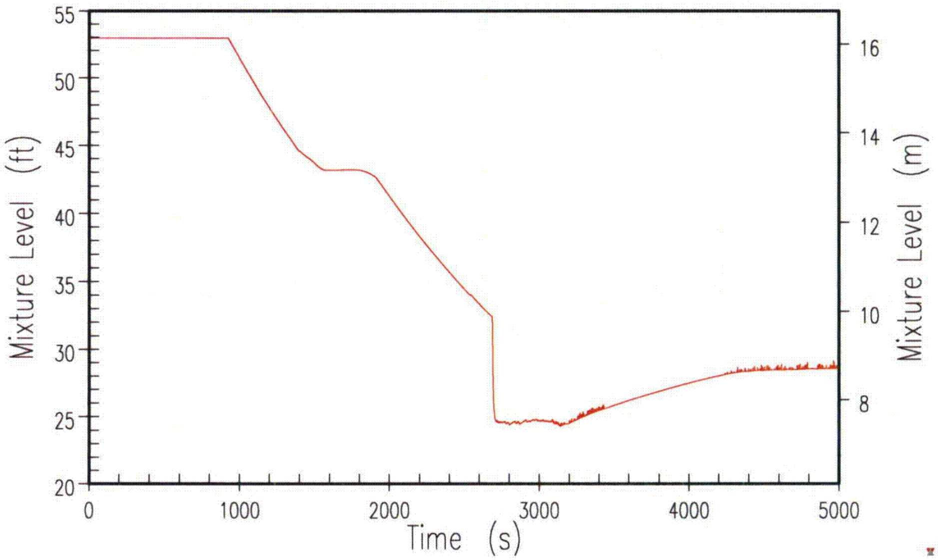
Figure 15.6.5.4B-19

2-Inch Cold Leg Break – CMT-1 Mixture Level



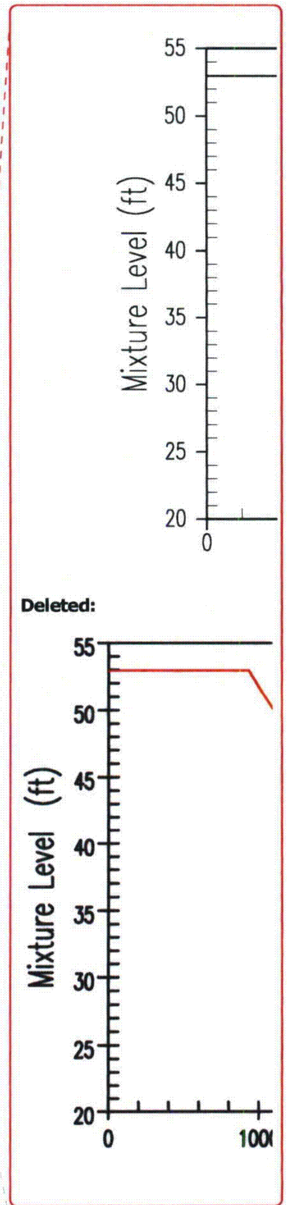
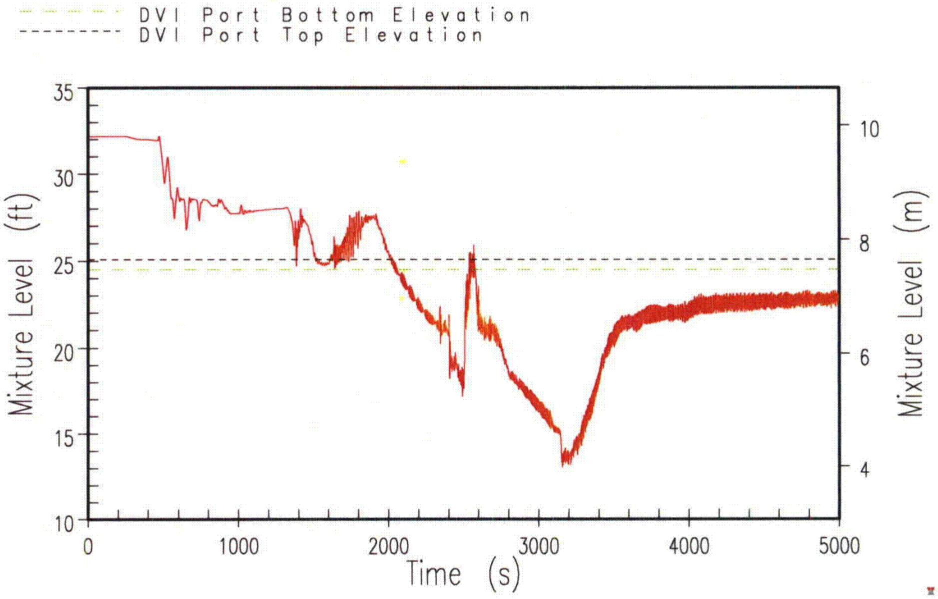
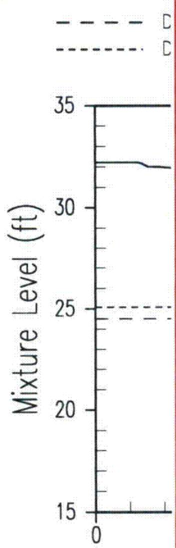


Figure 15.6.5.4B-20

2-Inch Cold Leg Break – CMT-2 Mixture Level





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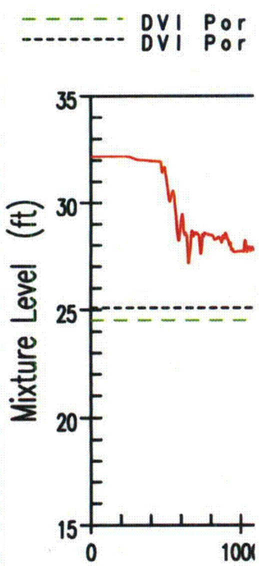

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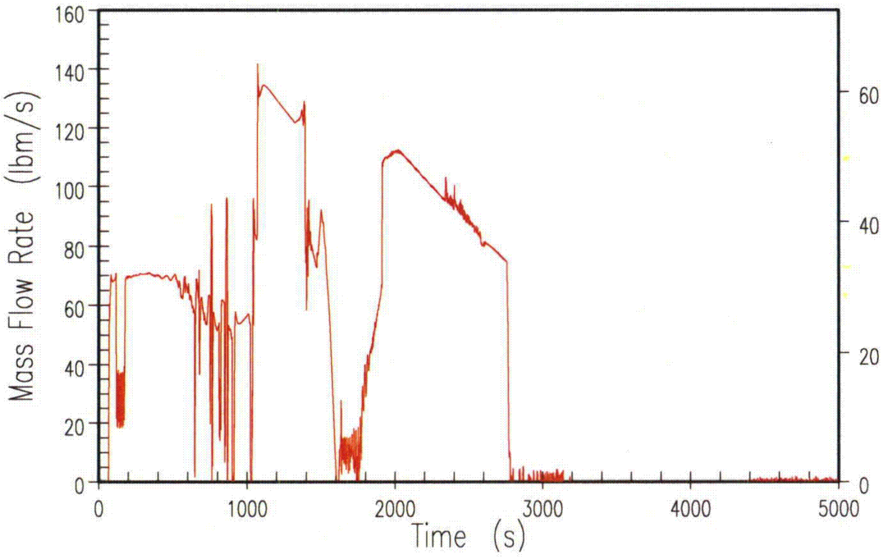
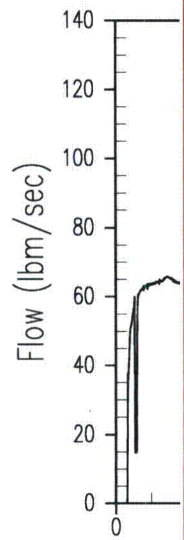
Figure 15.6.5.4B-21

2-Inch Cold Leg Break – Downcomer Mixture Level





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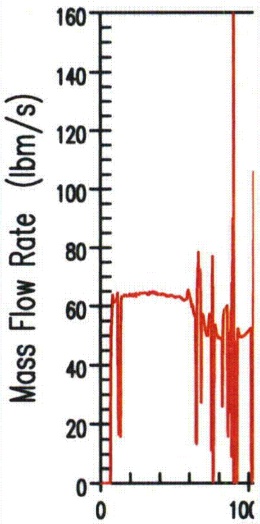

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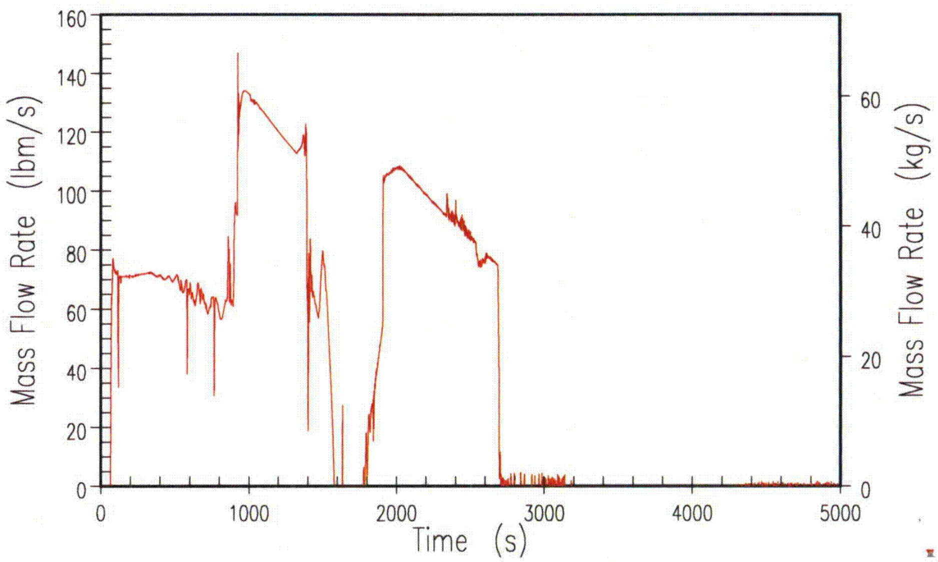
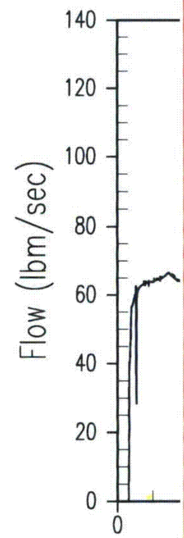
Figure 15.6.5.4B-22

2-Inch Cold Leg Break – CMT-1 Injection Rate





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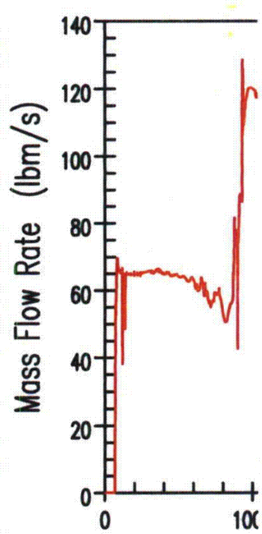

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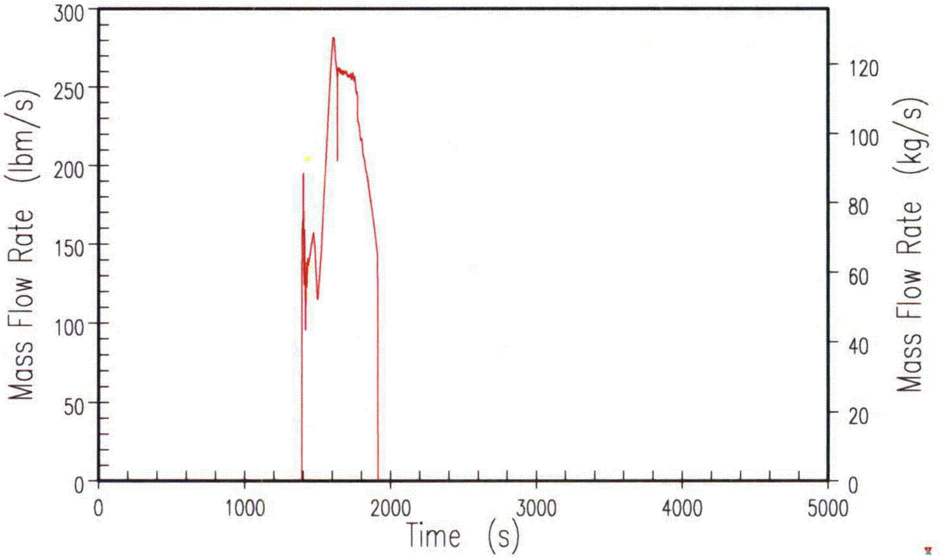
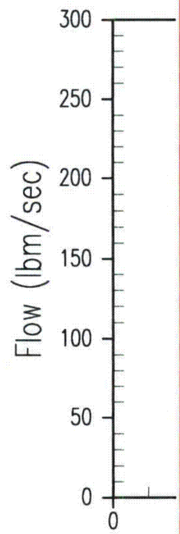
Figure 15.6.5.4B-23

2-Inch Cold Leg Break – CMT-2 Injection Rate





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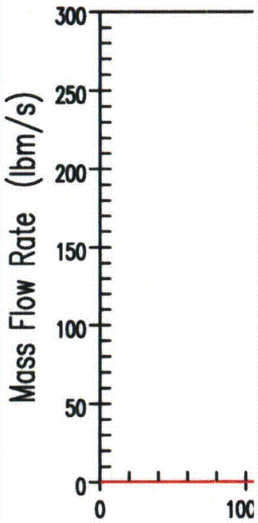

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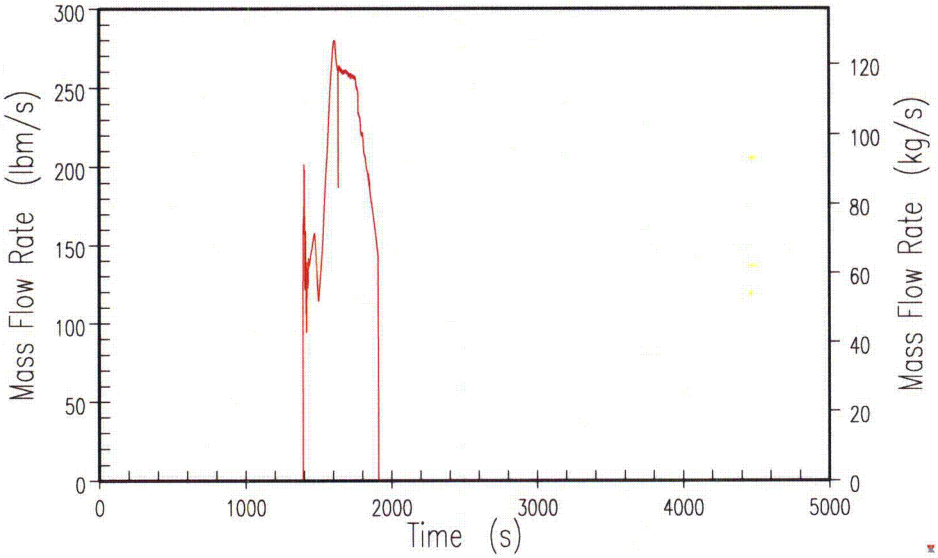
Figure 15.6.5.4B-24

2-Inch Cold Leg Break – Accumulator-1 Injection Rate



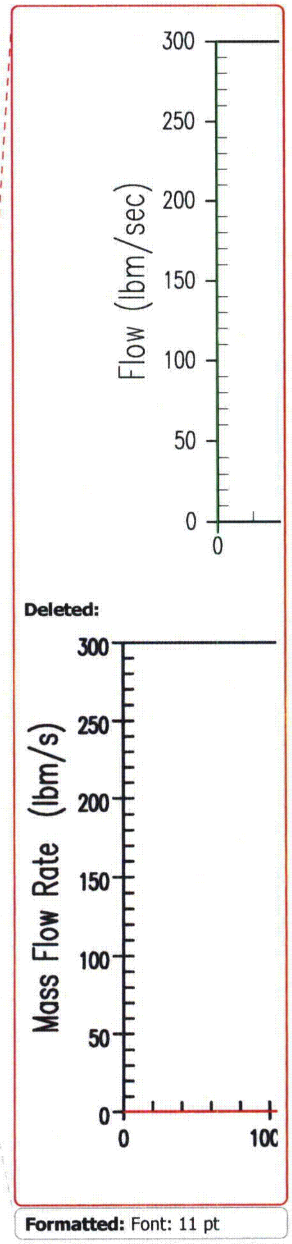
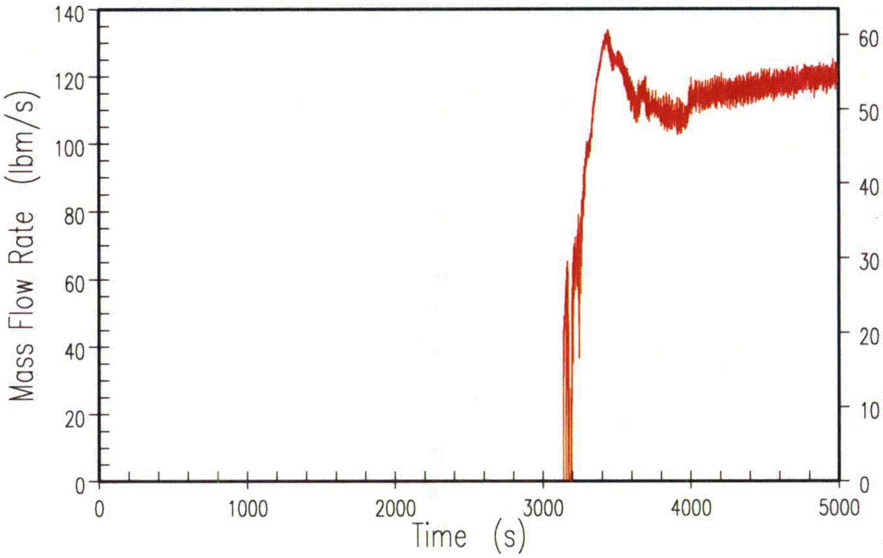
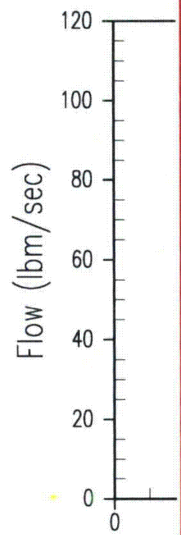


Figure 15.6.5.4B-25

2-Inch Cold Leg Break – Accumulator-2 Injection Rate





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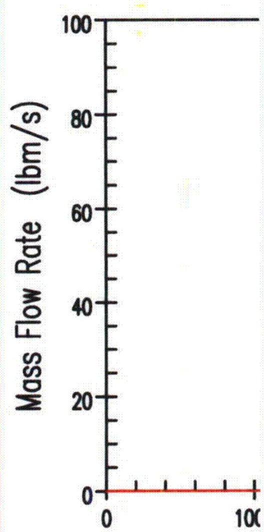

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Figure 15.6.5.4B-26

2-Inch Cold Leg Break – IRWST-1 Injection Rate

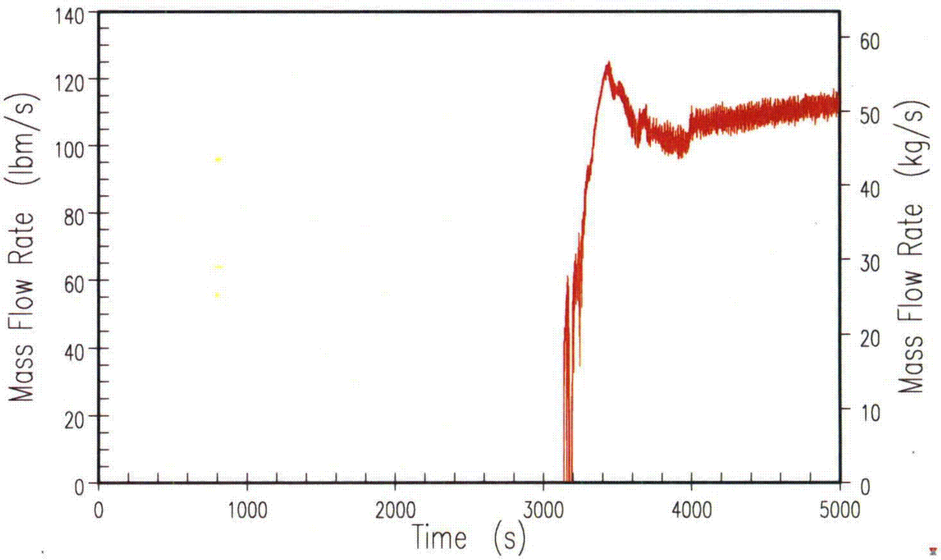
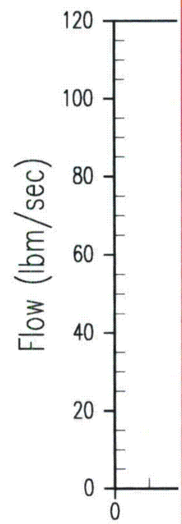


Figure 15.6.5.4B-27

2-Inch Cold Leg Break – IRWST-2 Injection Rate



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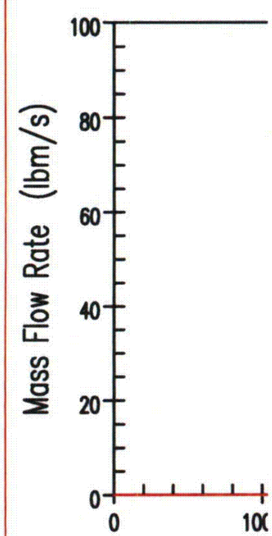

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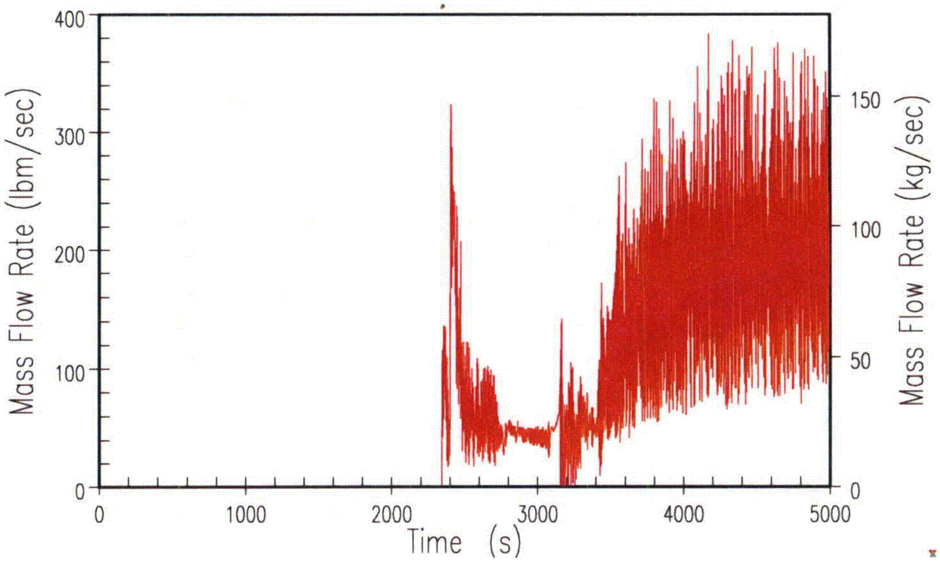

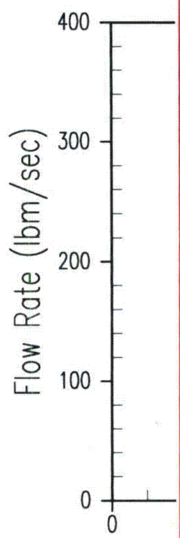

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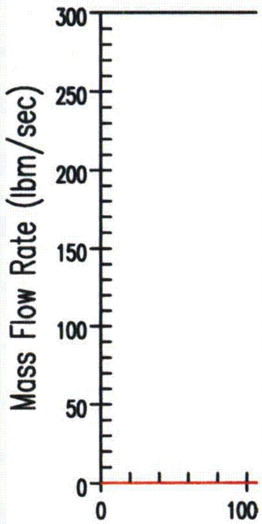

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Figure 15.6.5.4B-28(a)

2-Inch Cold Leg Break – ADS-4 Liquid Discharge

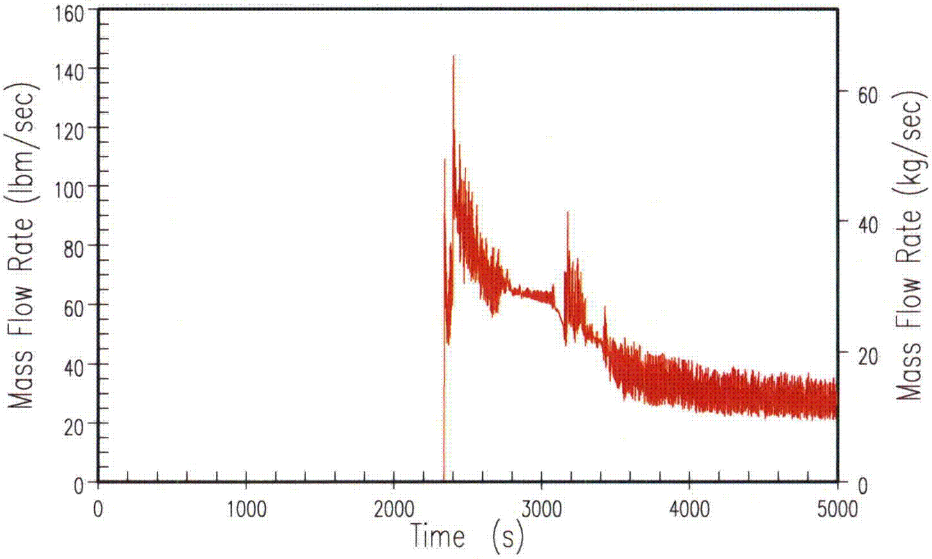


Figure 15.6.5.4B-28(b)

2-Inch Cold Leg Break – ADS-4 Vapor Discharge

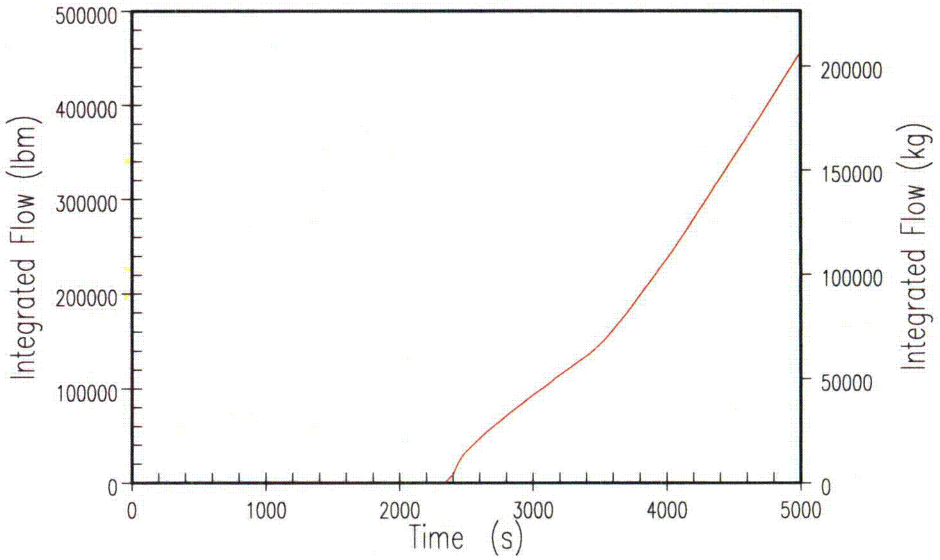
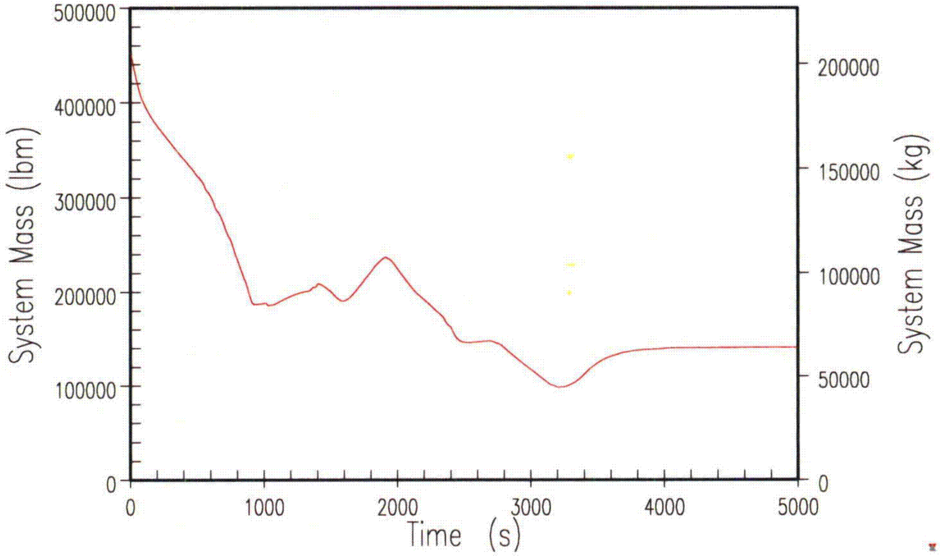
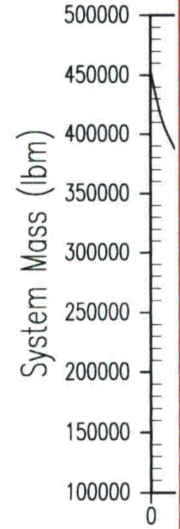


Figure 15.6.5.4B-28(c)

2-Inch Cold Leg Break – ADS-4 Integrated Discharge





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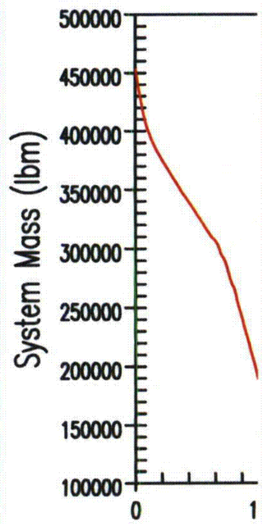

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Figure 15.6.5.4B-29(a)

2-Inch Cold Leg Break – RCS System Inventory

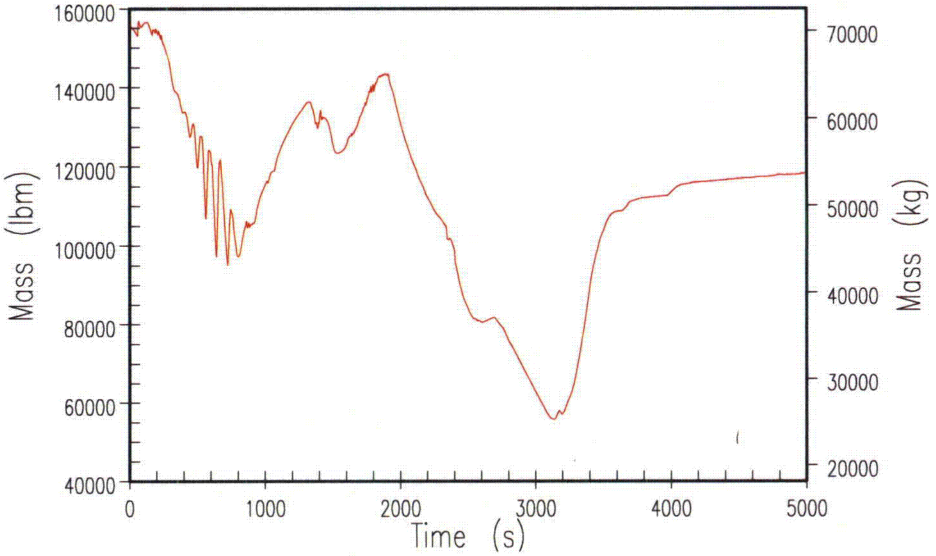
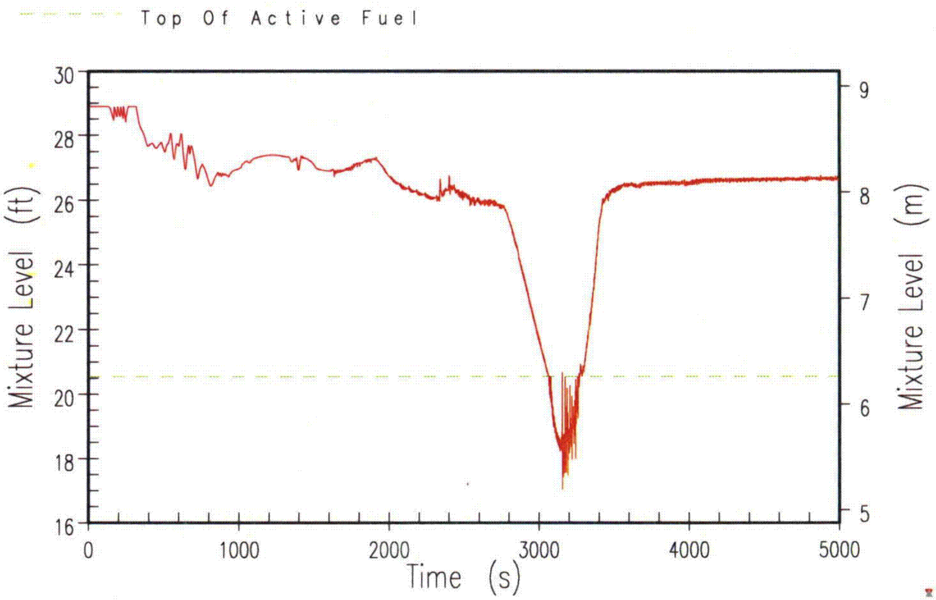
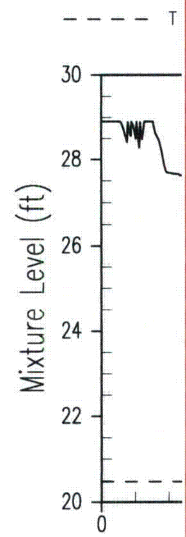


Figure 15.6.5.4B-29(b)

2-Inch Cold Leg Break – Reactor Vessel Mixture Inventory





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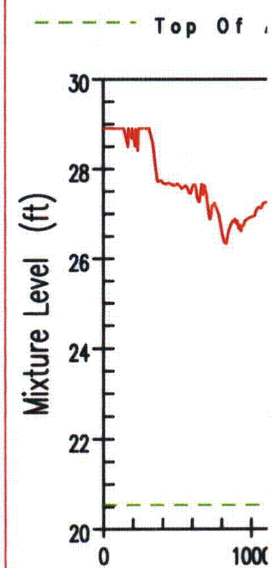

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Figure 15.6.5.4B-30(a)

2-Inch Cold Leg Break – Core/Upper Plenum Mixture Level

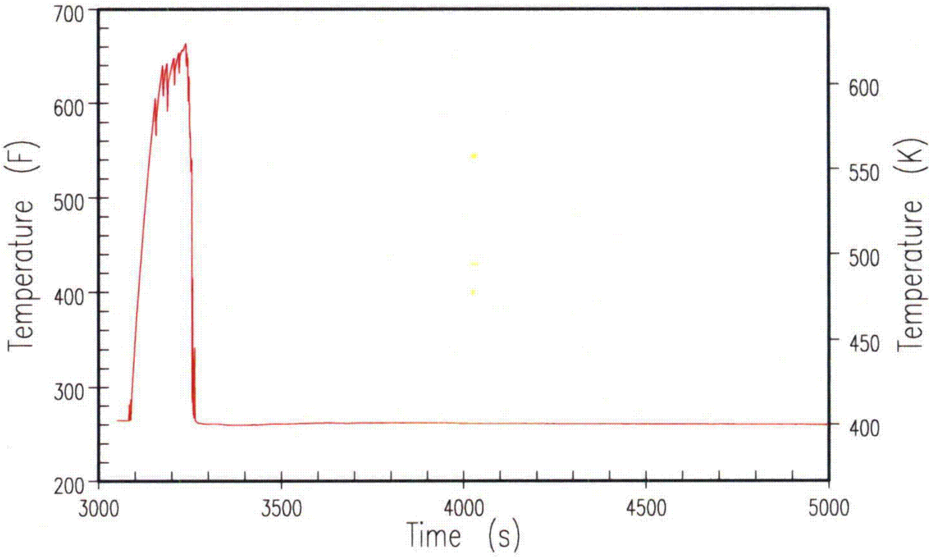
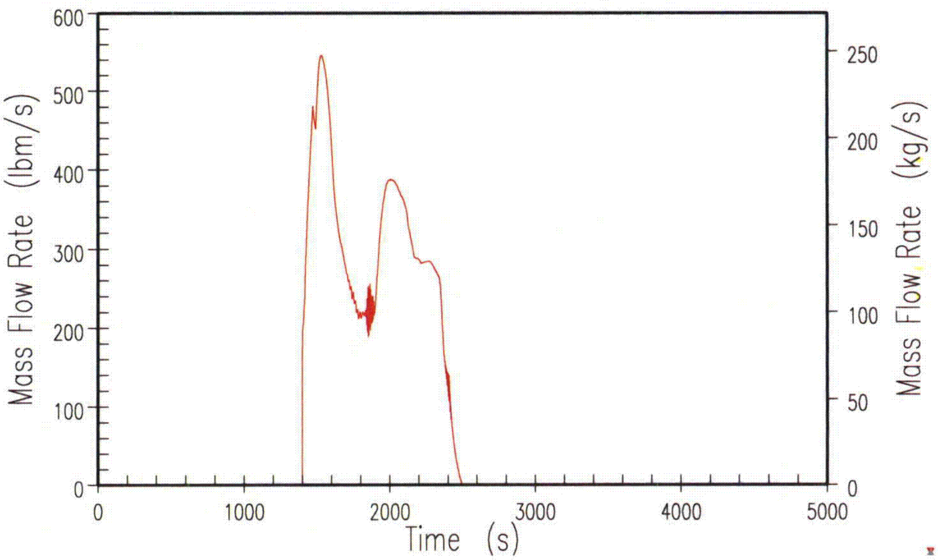
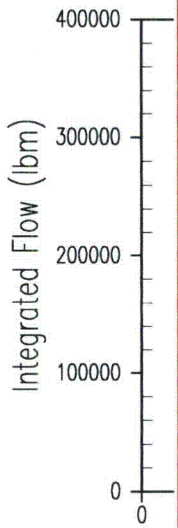


Figure 15.6.5.4B-30(b)

2-Inch Cold Leg Break – Peak Cladding Temperature





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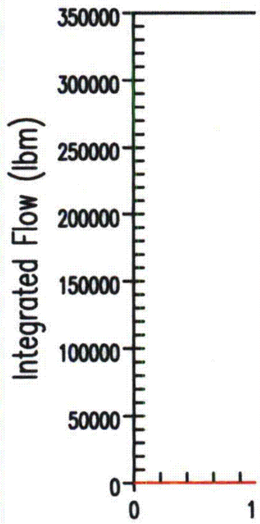

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Figure 15.6.5.4B-31(a)

2-Inch Cold Leg Break – ADS 1-3 Liquid Discharge

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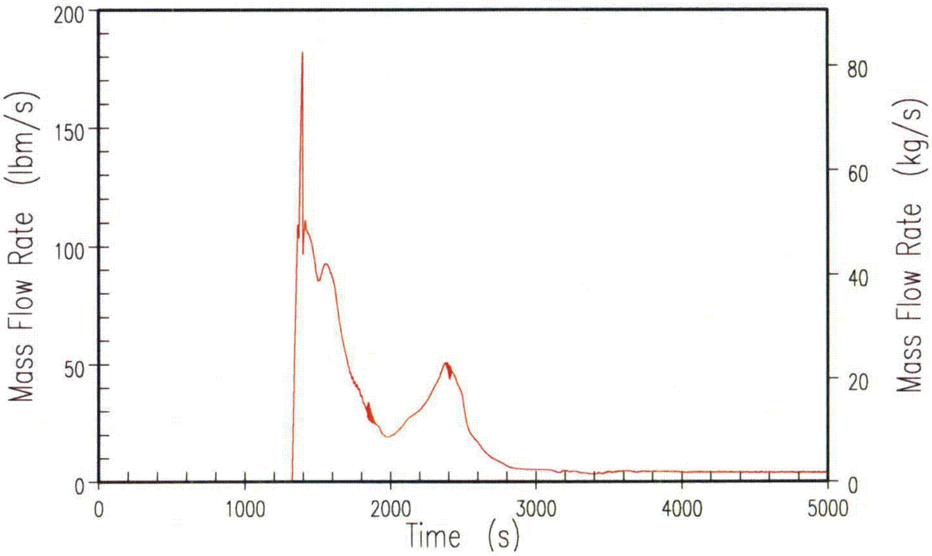


Figure 15.6.5.4B-31(b)

2-Inch Cold Leg Break – ADS 1-3 Vapor Discharge

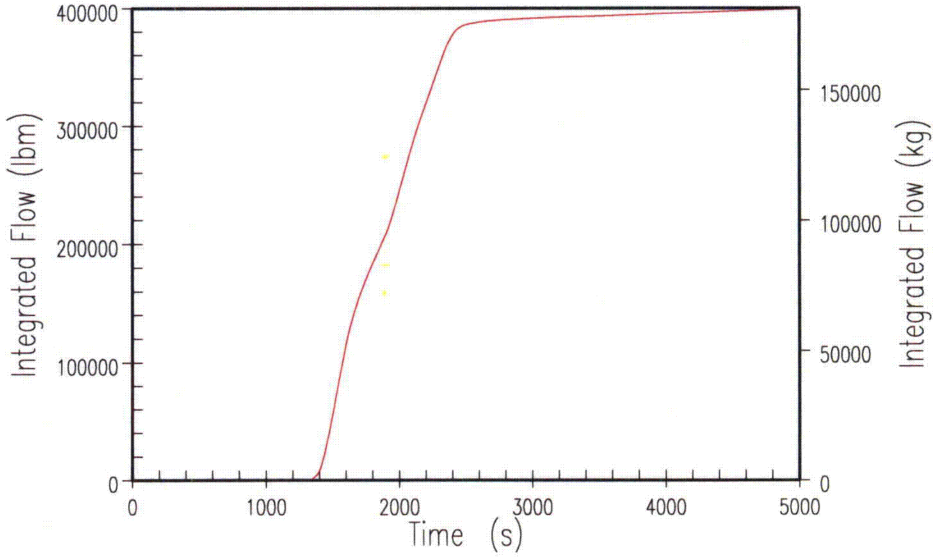
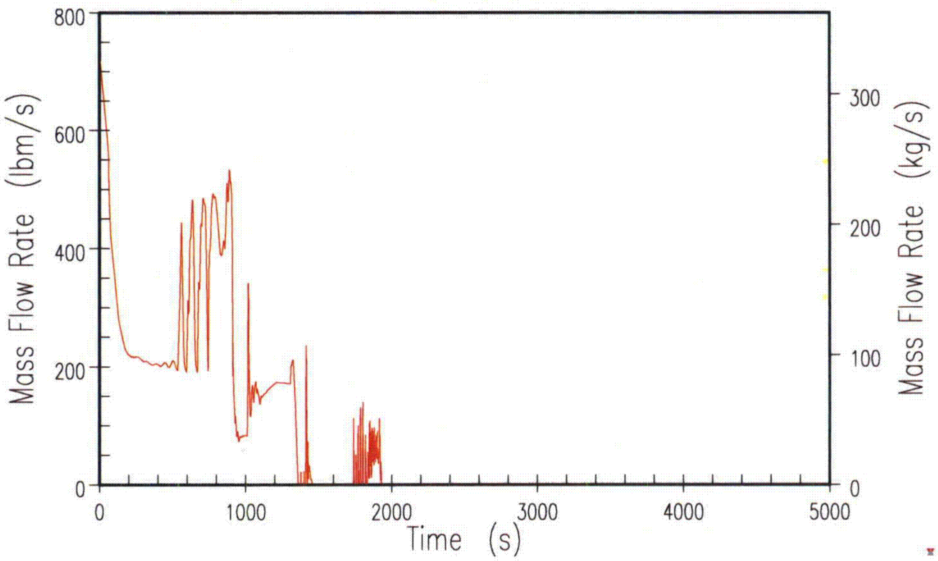
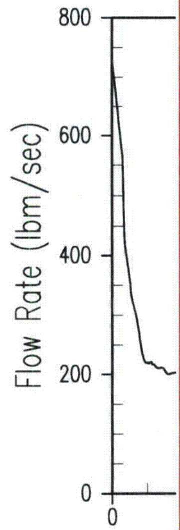


Figure 15.6.5.4B-31(c)

2-Inch Cold Leg Break – ADS 1-3 Integrated Discharge





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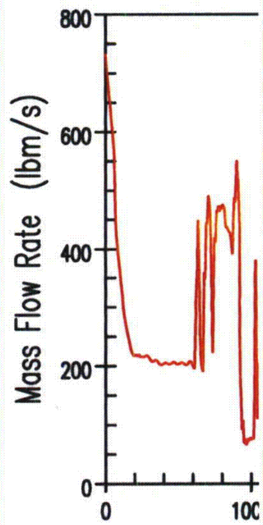

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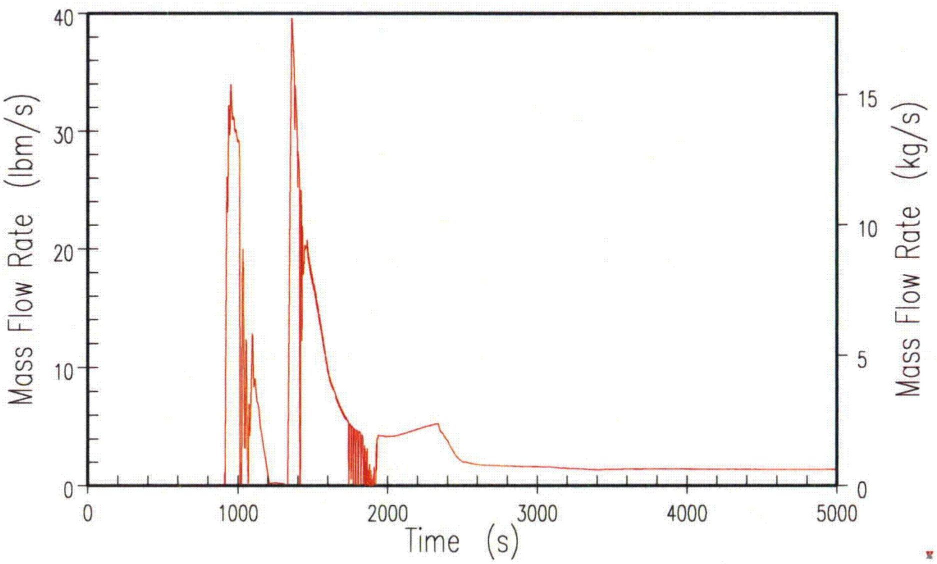
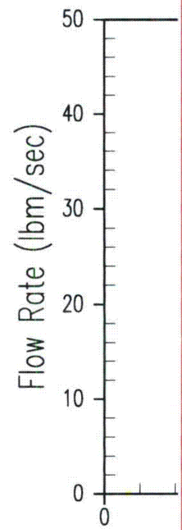
Figure 15.6.5.4B-32

2-Inch Cold Leg Break – Liquid Break Discharge





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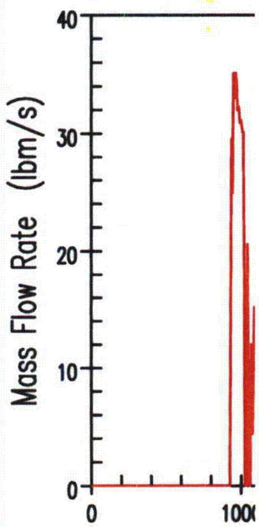

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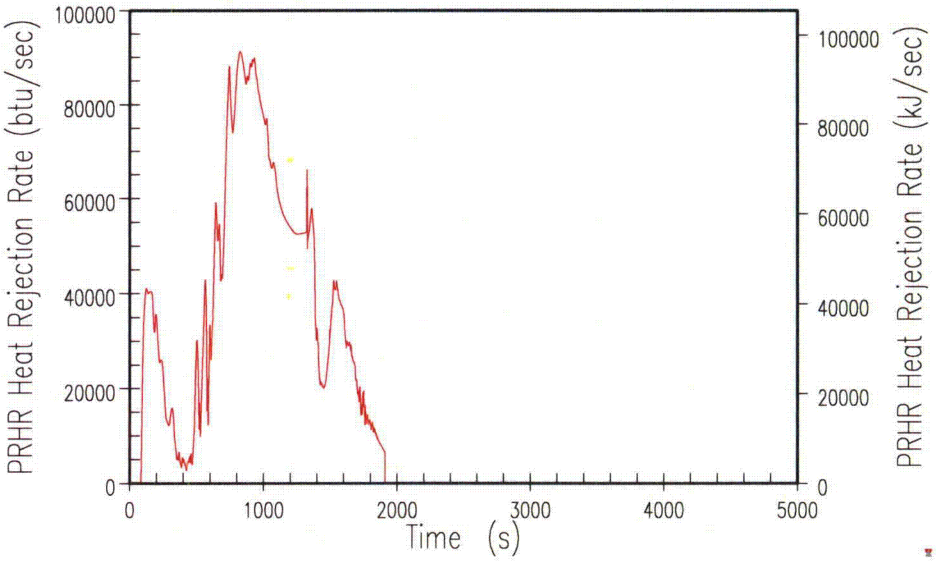
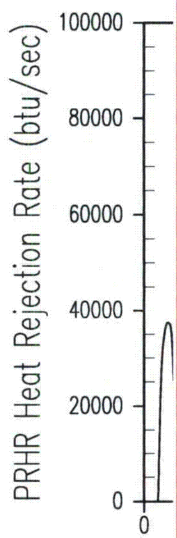
Figure 15.6.5.4B-33

2-Inch Cold Leg Break – Vapor Break Discharge





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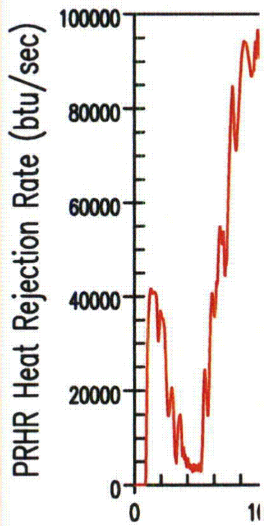

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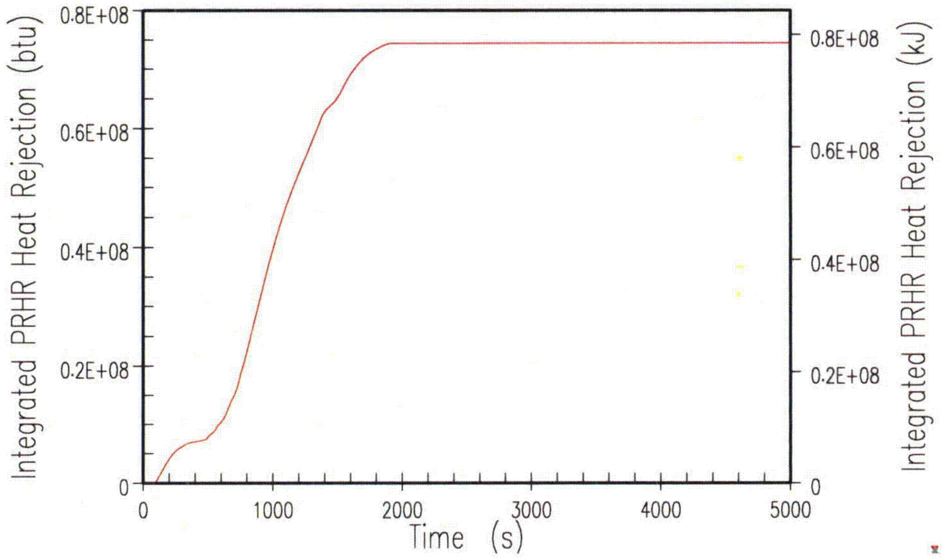
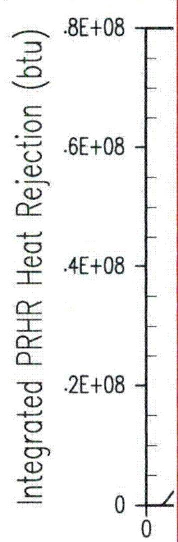
Figure 15.6.5.4B-34

2-Inch Cold Leg Break – PRHR Heat Removal Rate





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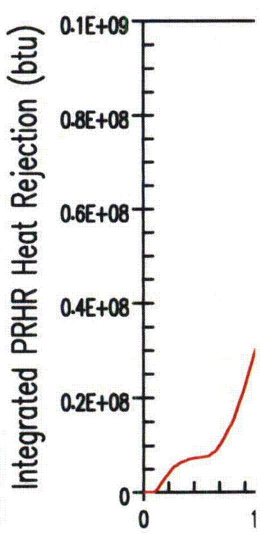

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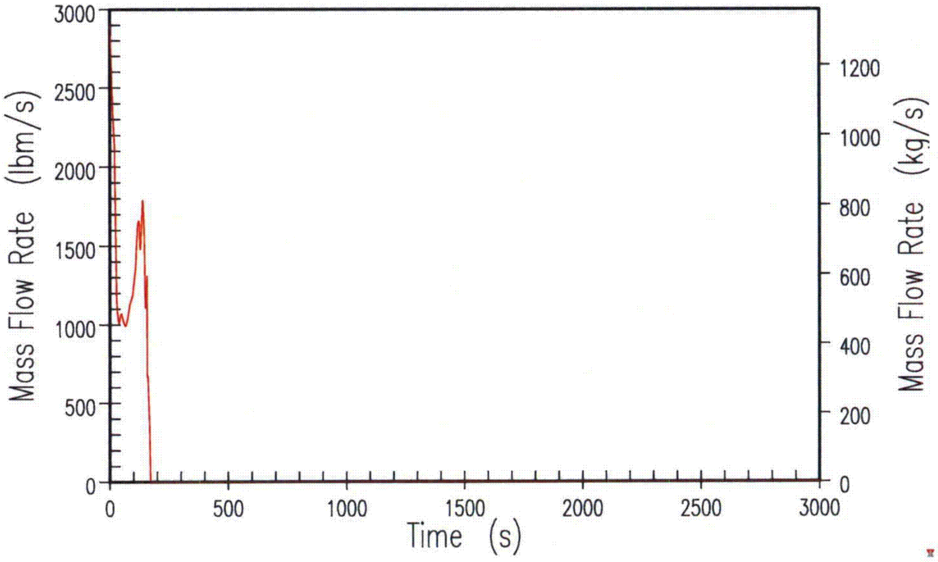
Figure 15.6.5.4B-35

2-Inch Cold Leg Break – Integrated PRHR Heat Removal



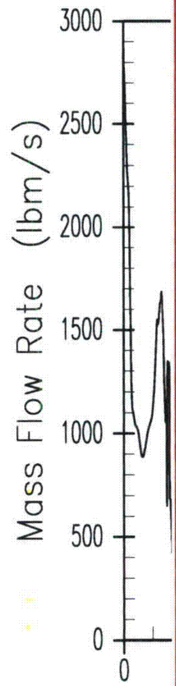


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Figure 15.6.5.4B-36

20 psia DEDVI – Vessel Side Liquid Break Discharge

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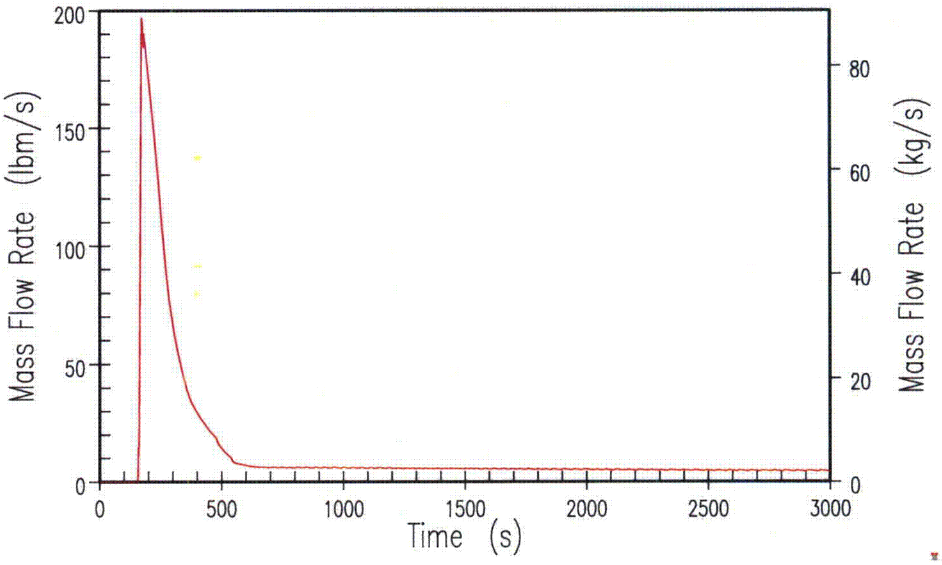

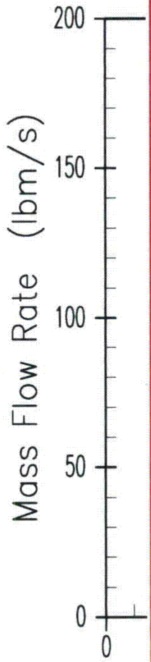

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Figure 15.6.5.4B-37

20 psia DEDVI – Vessel Side Vapor Break Discharge

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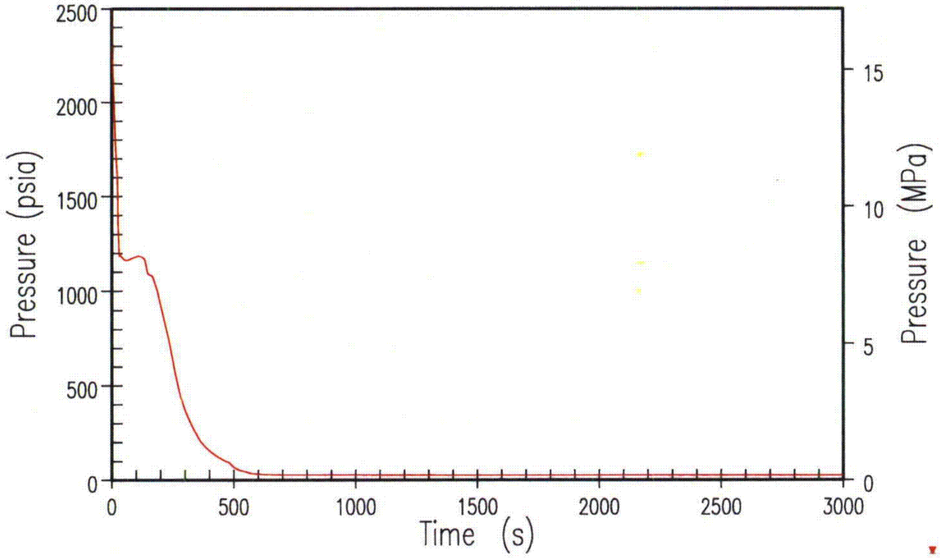
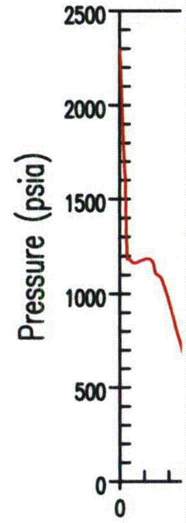


Figure 15.6.5.4B-38(a)

20 psia DEDVI – RCS Pressure



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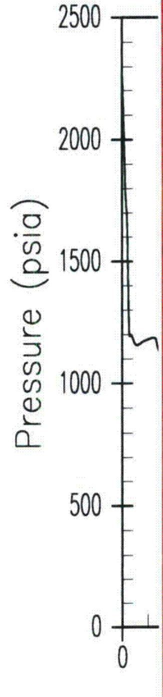

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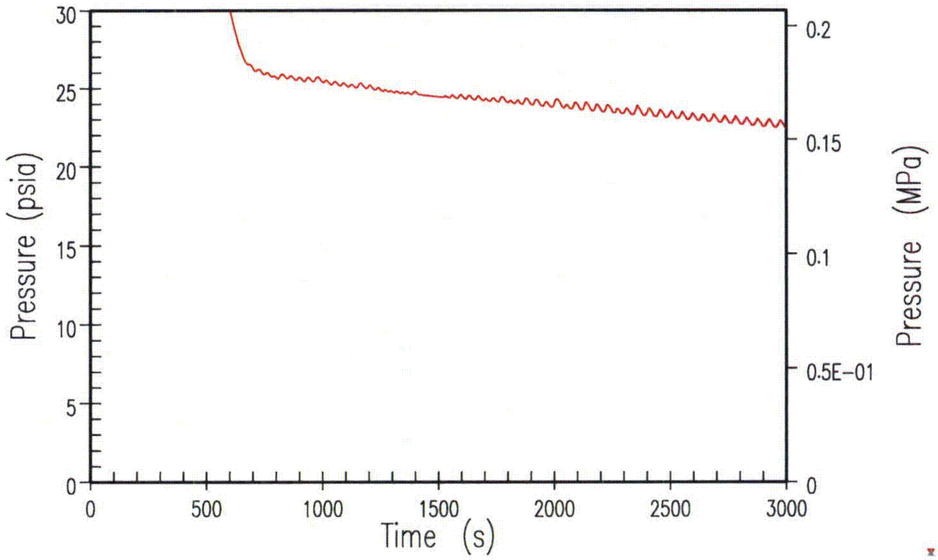

Figure 15.6.5.4B-38(b)

20 psia DEDVI – RCS Pressure (Zoomed)

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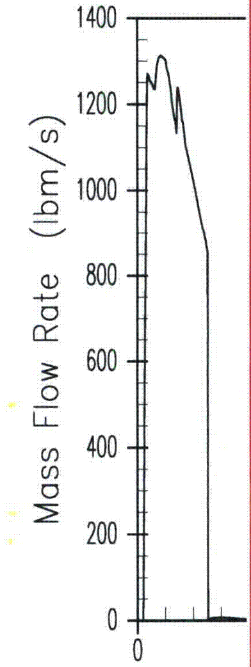

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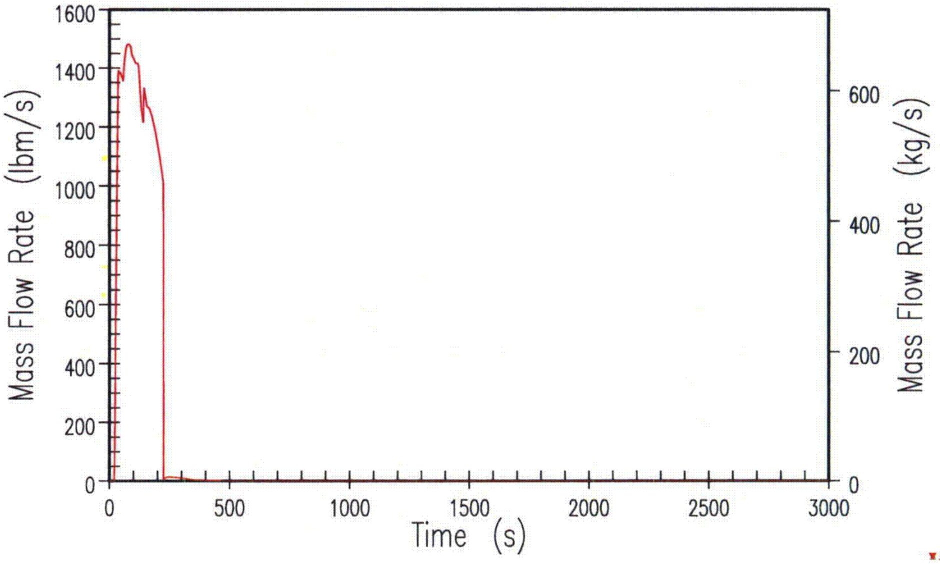

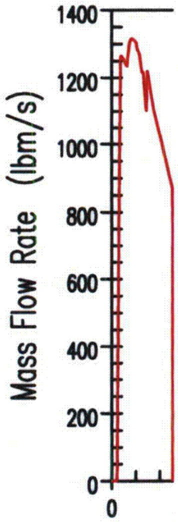

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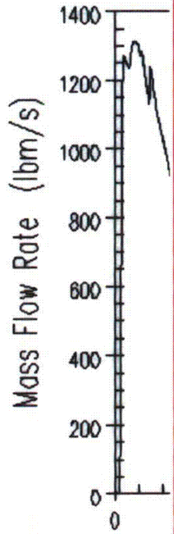

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Figure 15.6.5.4B-39

20 psia DEDVI – Broken CMT Injection Rate

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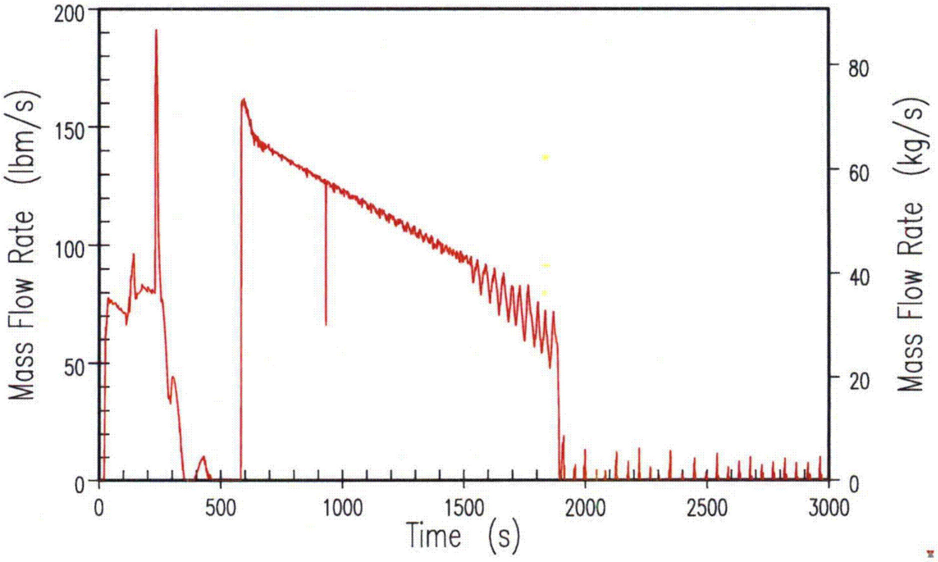

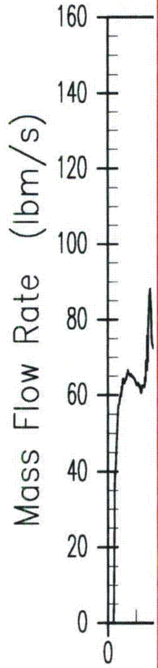

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Figure 15.6.5.4B-40

20 psia DEDVI – Intact CMT Injection Rate

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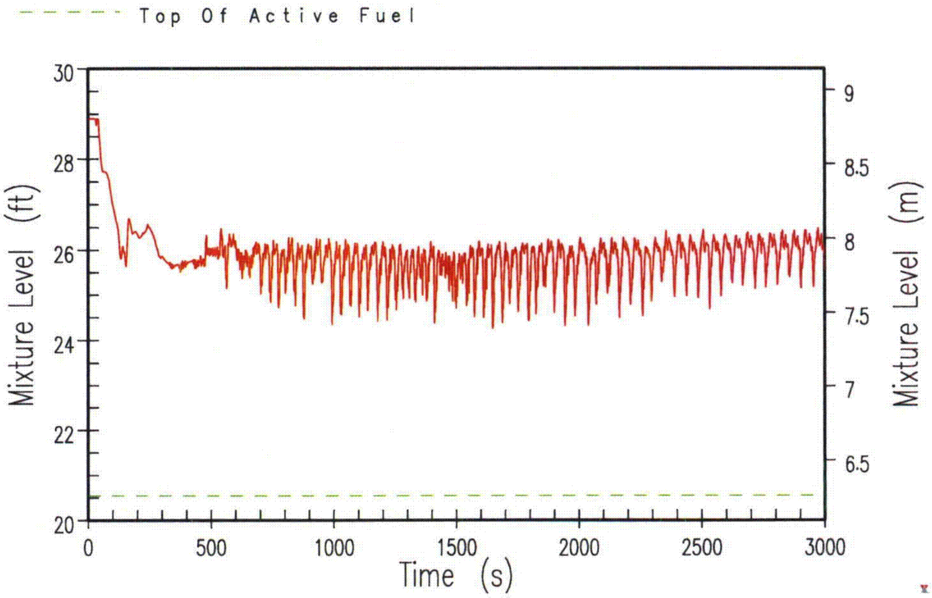

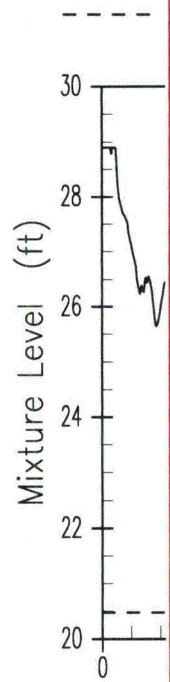

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Figure 15.6.5.4B-41

20 psia DEDVI – Core/Upper Plenum Mixture Level

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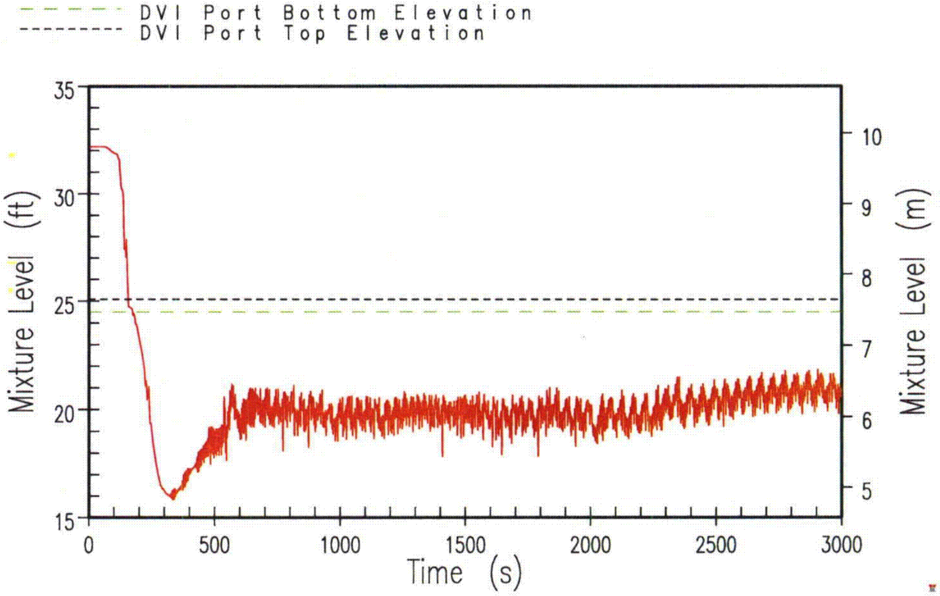

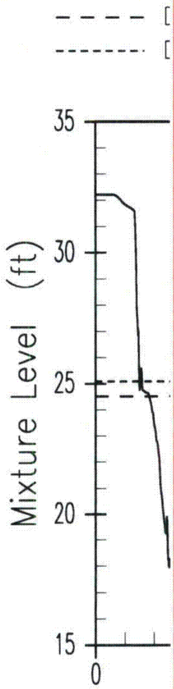

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Figure 15.6.5.4B-42

20 psia DEDVI – Downcomer Mixture Level

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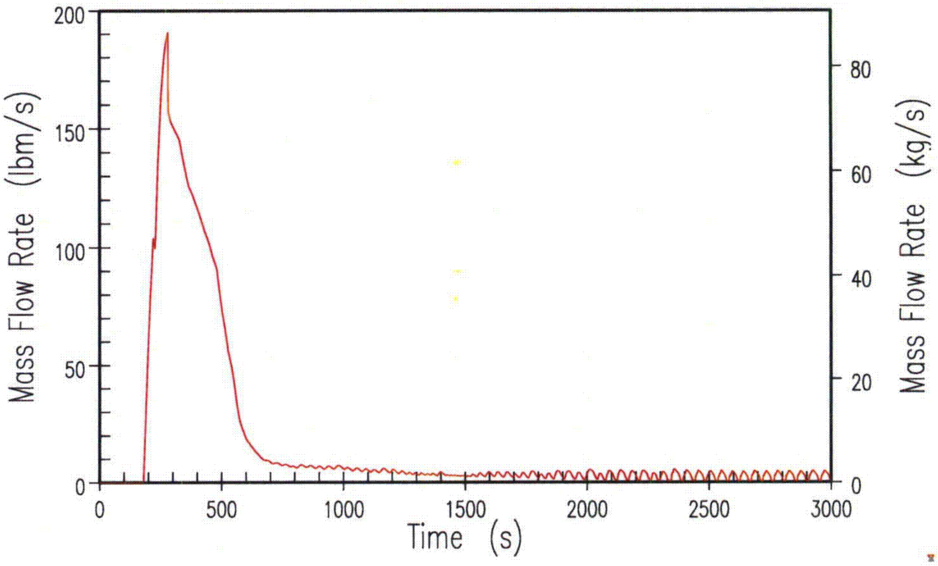

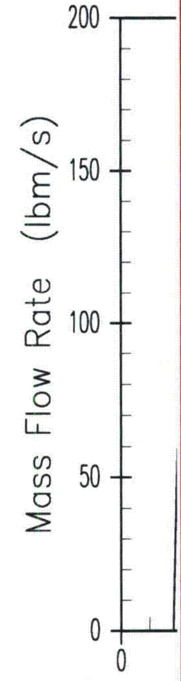

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Figure 15.6.5.4B-43(a)

20 psia DEDVI – ADS 1-3 Vapor Discharge

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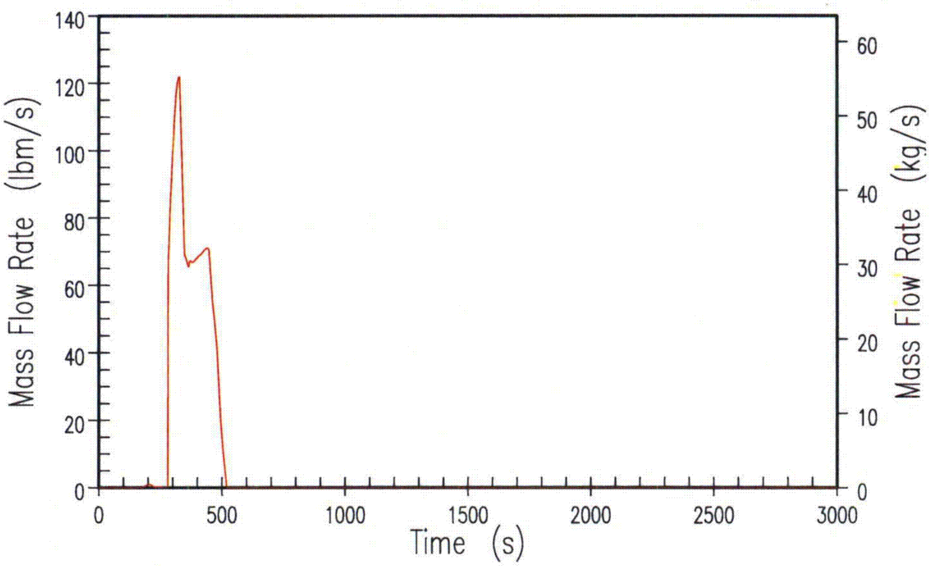


Figure 15.6.5.4B-43(b)

20 psia DEDVI – ADS 1-3 Liquid Discharge

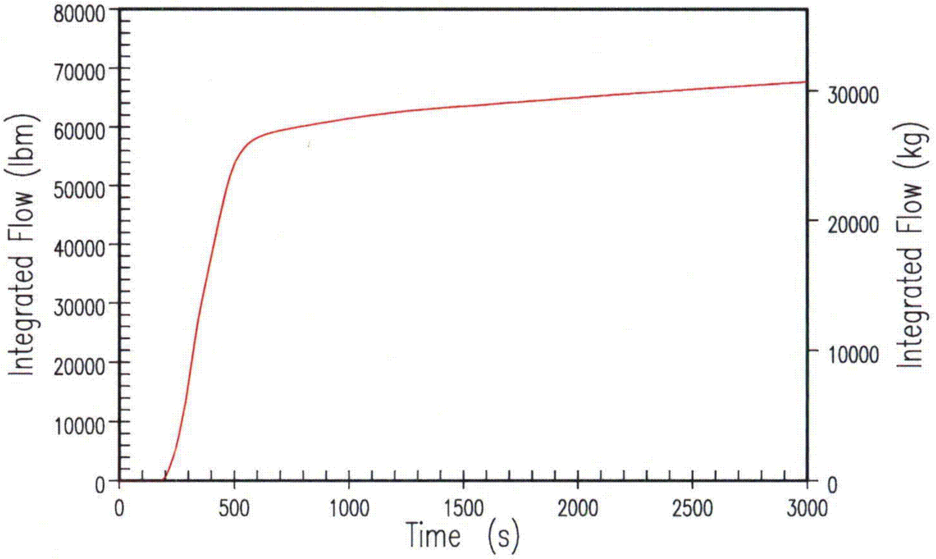
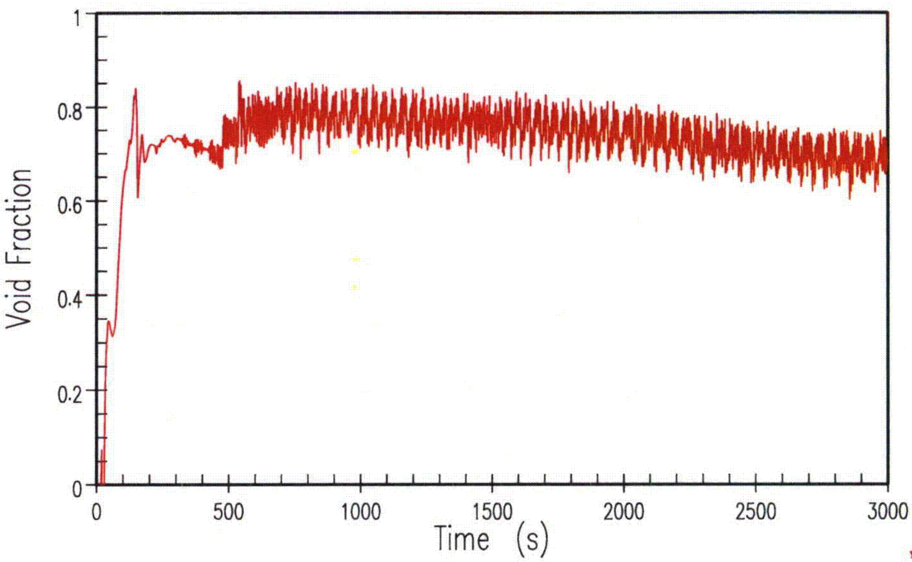
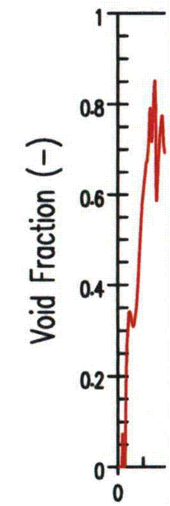


Figure 15.6.5.4B-43(c)

20 psia DEDVI – ADS 1-3 Integrated Discharge





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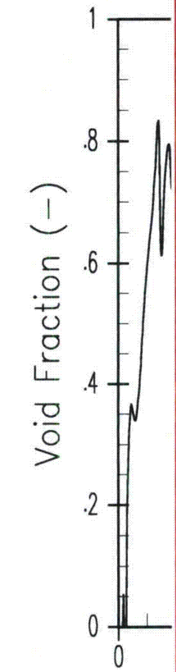

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Figure 15.6.5.4B-44

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20 psia DEDVI – Core Exit Void Fraction

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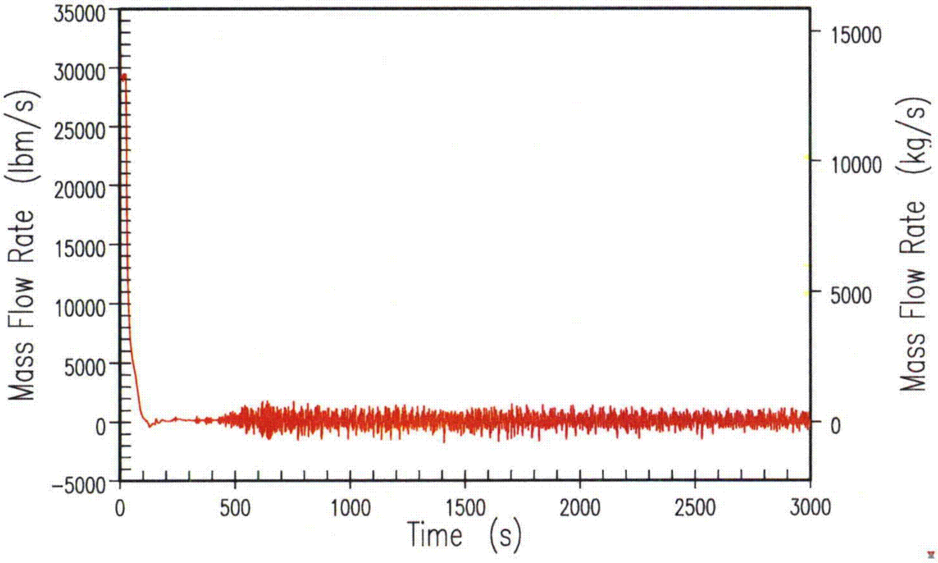

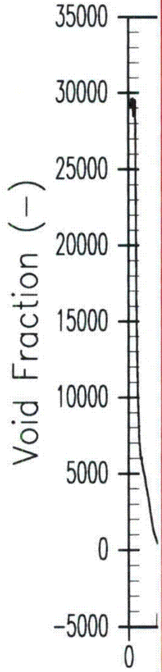

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Figure 15.6.5.4B-45

20 psia DEDVI – Core Exit Liquid Flow Rate

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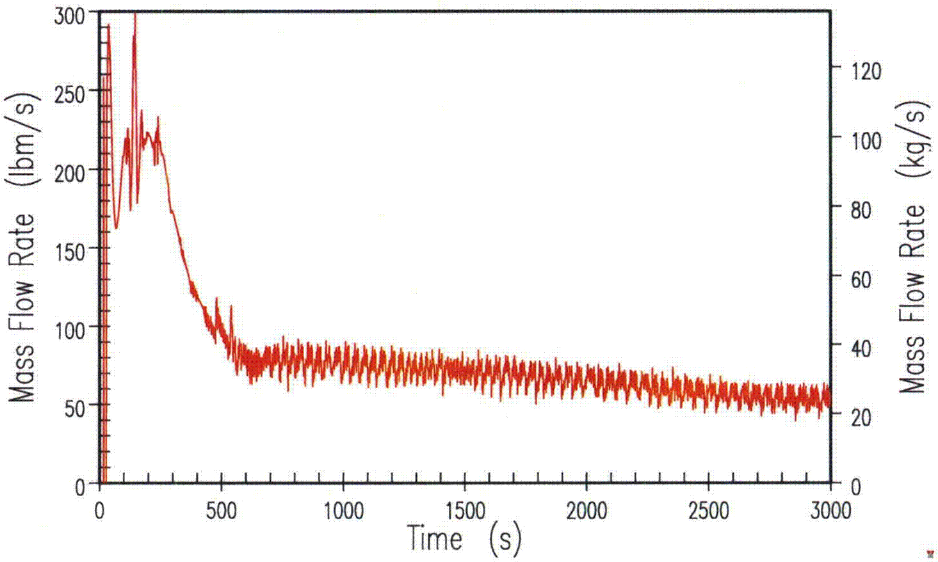

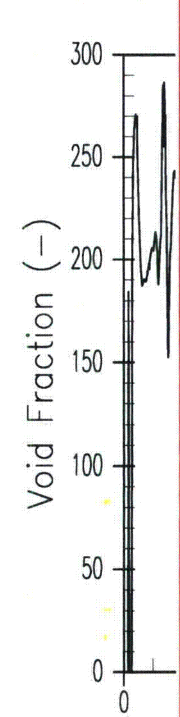

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Figure 15.6.5.4B-46

20 psia DEDVI – Core Exit Vapor Flow Rate

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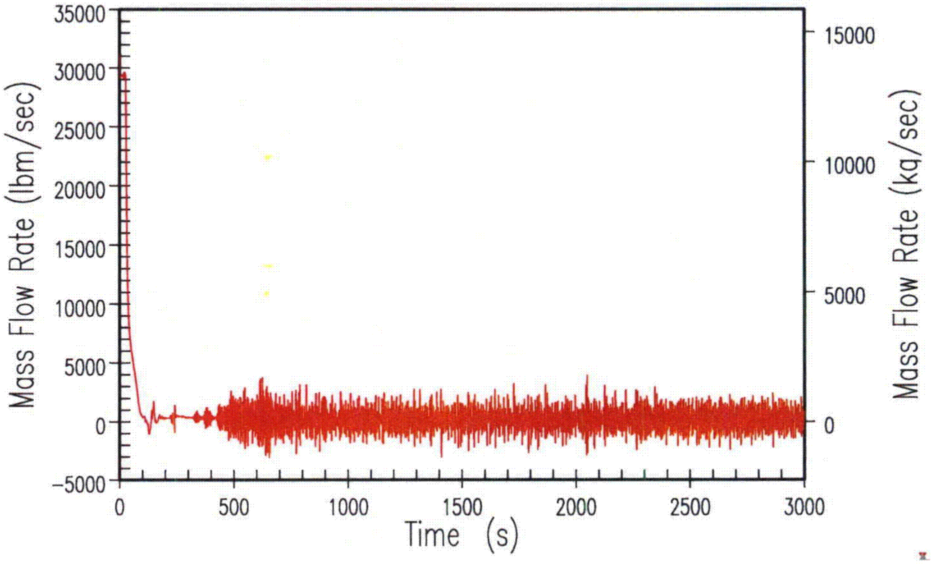

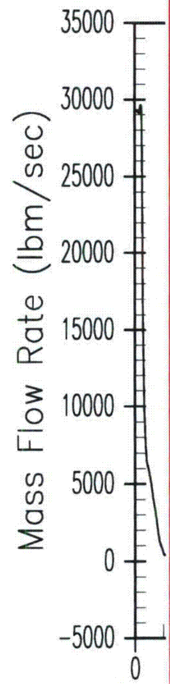

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Figure 15.6.5.4B-47

20 psia DEDVI – Lower Plenum to Core Flow Rate

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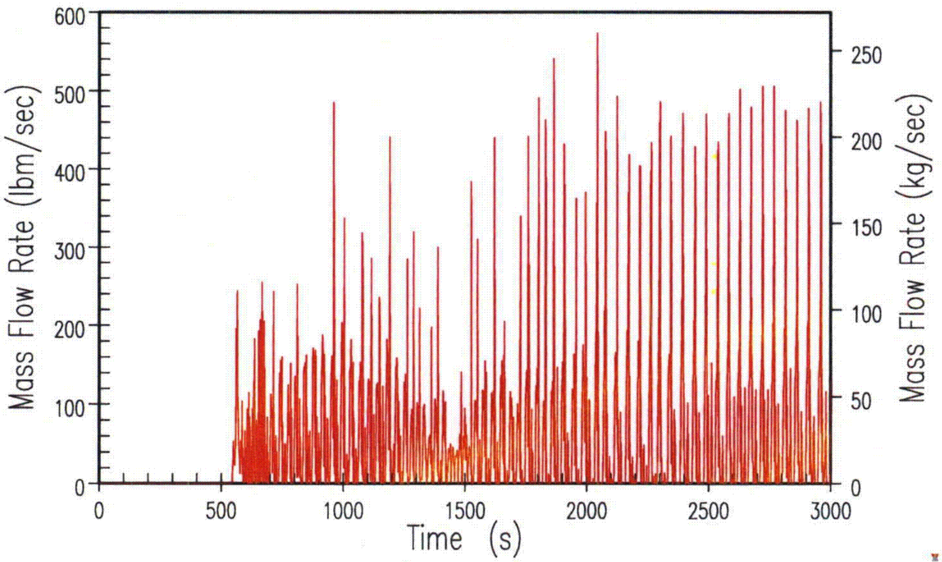

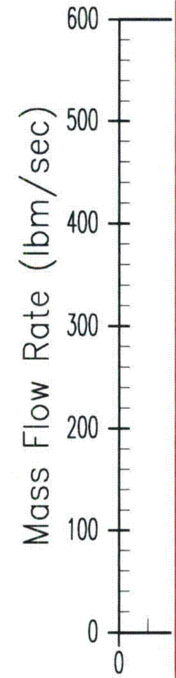

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Figure 15.6.5.4B-48(a)

20 psia DEDVI – ADS-4 Liquid Discharge

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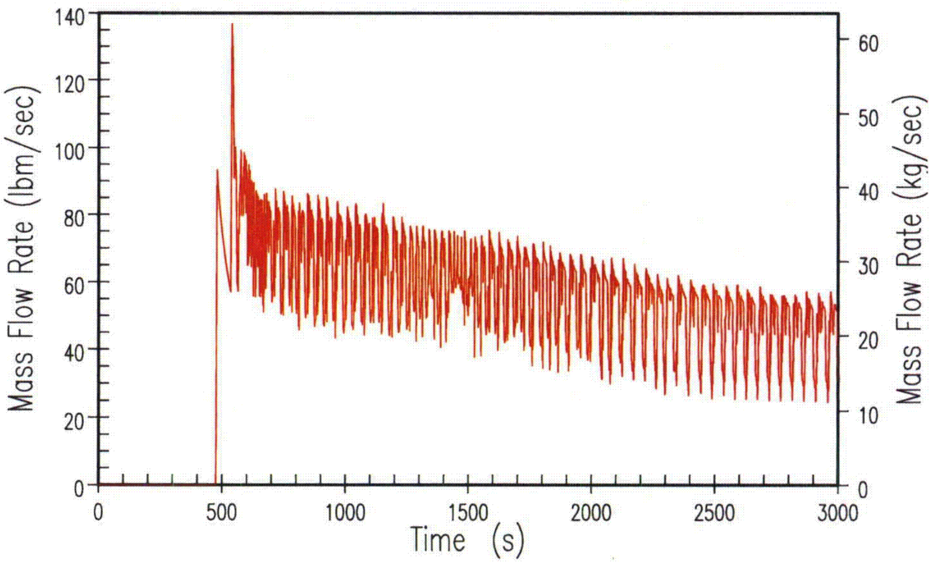
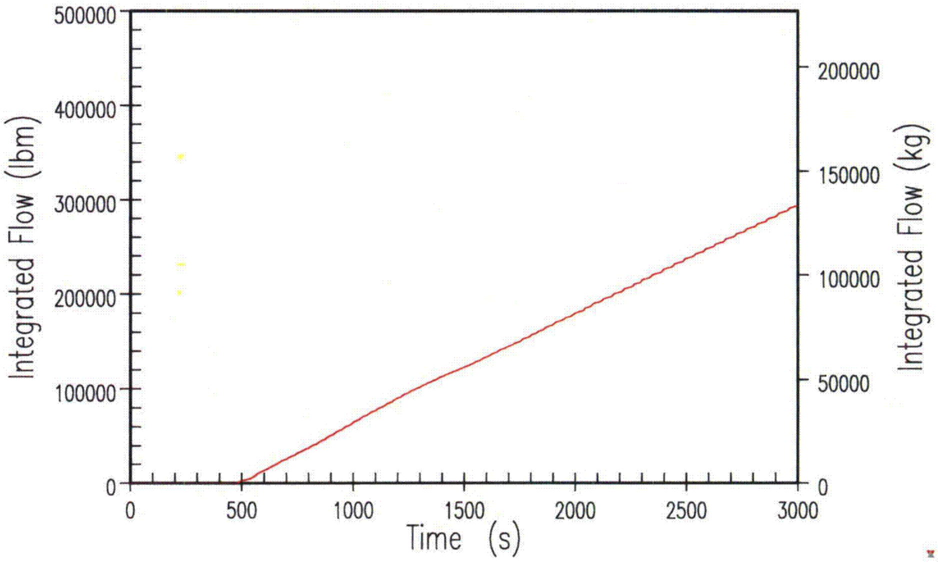


Figure 15.6.5.4B-48(b)

20 psia DEDVI – ADS-4 Vapor Discharge



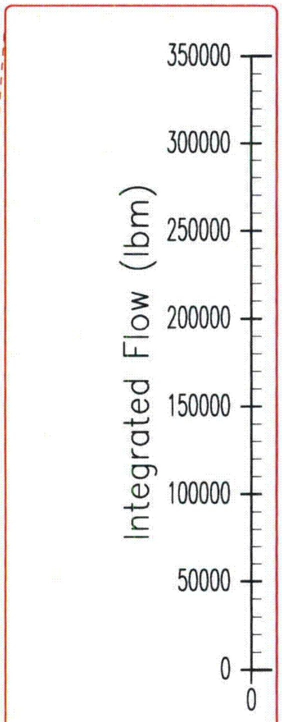


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Figure 15.6.5.4B-49

20 psia DEDVI – ADS-4 Integrated Discharge

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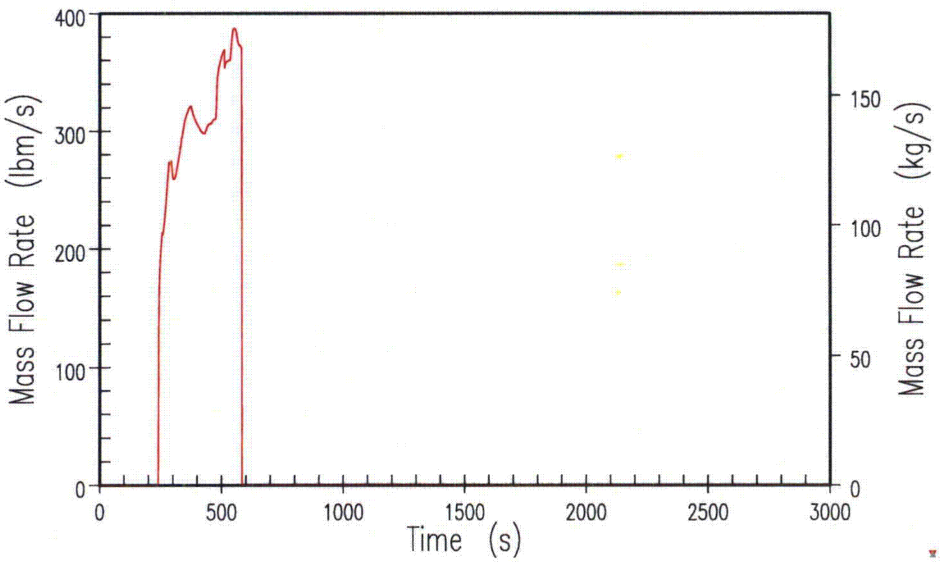

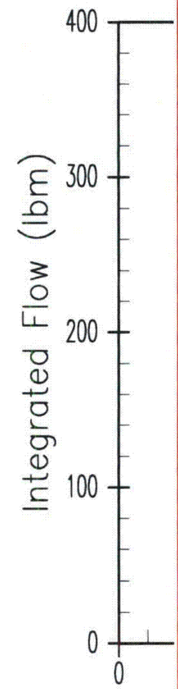

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Figure 15.6.5.4B-50

20 psia DEDVI – Intact Accumulator Flow Rate

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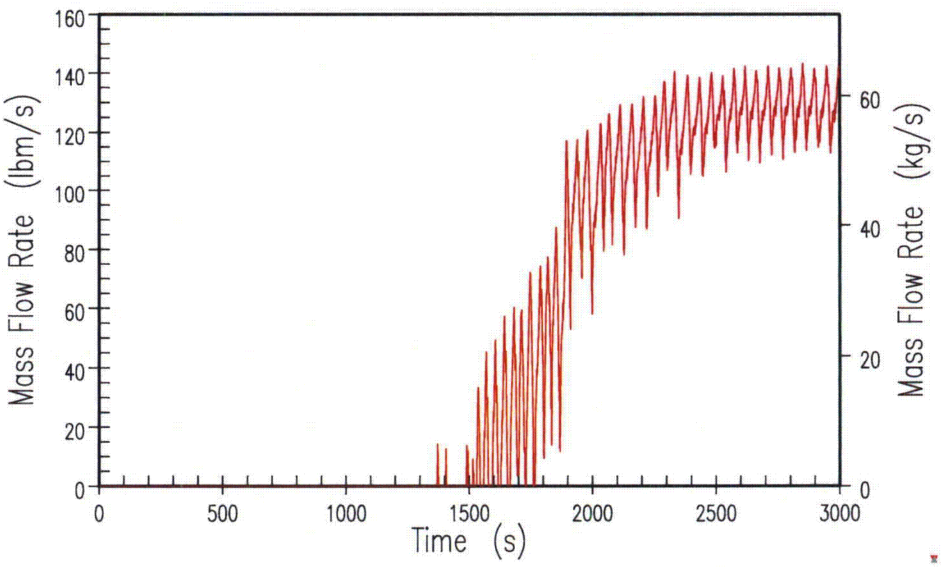

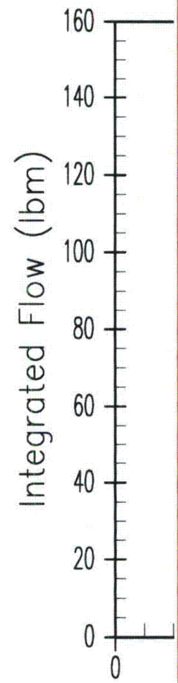

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Figure 15.6.5.4B-51

20 psia DEDVI – Intact IRWST Injection Rate

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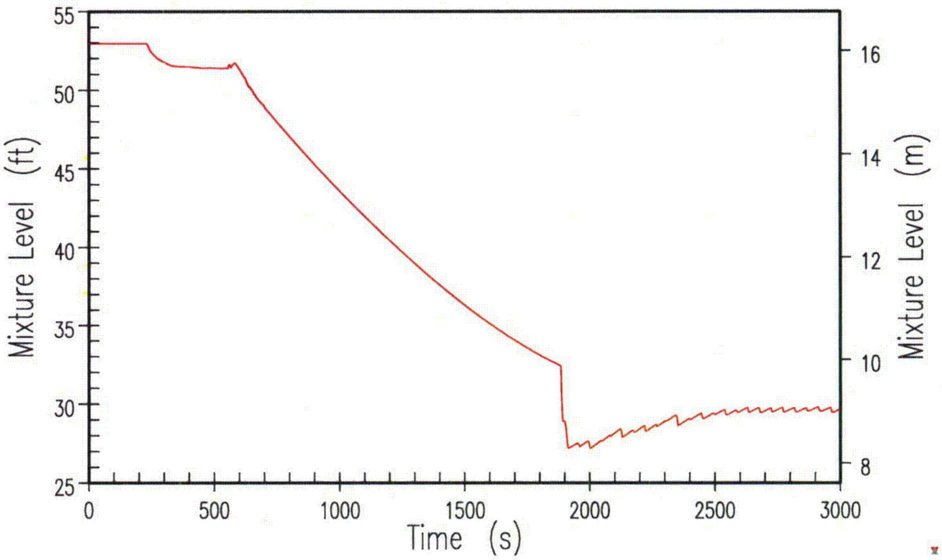

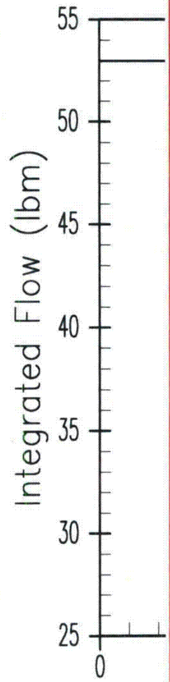

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Figure 15.6.5.4B-52

20 psia DEDVI – Intact CMT Mixture Level

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