ENCLOSURE 2

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

LICENSE AMENDMENT REQUEST 261
EXTENDED POWER UPRATE

NON-PROPRIETARY RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

64 pages follow

WEP-09-133 NP-Attachment

Point Beach Unit 1 and Unit 2 (WEP/WIS) Extended Power Uprate (EPU) License Amendment Request (LAR) Responses to Request for Additional Information (RAI)

December, 2009

Westinghouse Electric Company LLC
P.O. Box 355
Pittsburgh, PA 15230-0355

Point Beach Unit 1 and Unit 2 (WEP/WIS) Extended Power Uprate (EPU) License Amendment Request (LAR) Responses to Request for Additional Information (RAI)

1) **Page 2.8.5.6.3-6 of the Point Beach Extended Power Uprate (EPU) Licensing Report (Enclosure 5 to Reference 1) indicates that the small-break loss-of-coolant accident analysis was performed using the NOTRUMP evaluation model. Please provide a copy of the NOTRUMP analysis report that supports the EPU application.**

The NRC reviewer provided clarification of this RAI during a teleconference held between Westinghouse, FP&L, and the NRC. It was concluded that the transient response results of the non-limiting breaks, which are not provided in the LAR, will be provided. Transient response results for the limiting 3-inch break for both Point Beach Units 1 and 2 are provided in the small break LOCA LAR Section 2.8.5.6.3. The same response results for the non-limiting breaks are provided below. The following comments apply:

- Peak cladding temperature transients are not provided for the 6- and 8.75-inch breaks as these breaks experienced little to no core uncovery.
- Low head safety injection flow figures are provided only for the 6- and 8.75-inch breaks. LHSI was only modeled for the 6- and 8.75-inch breaks (during RWST injection phase only). Breaks less than 6-inches in equivalent diameter did not reach the LHSI cut-in pressure.

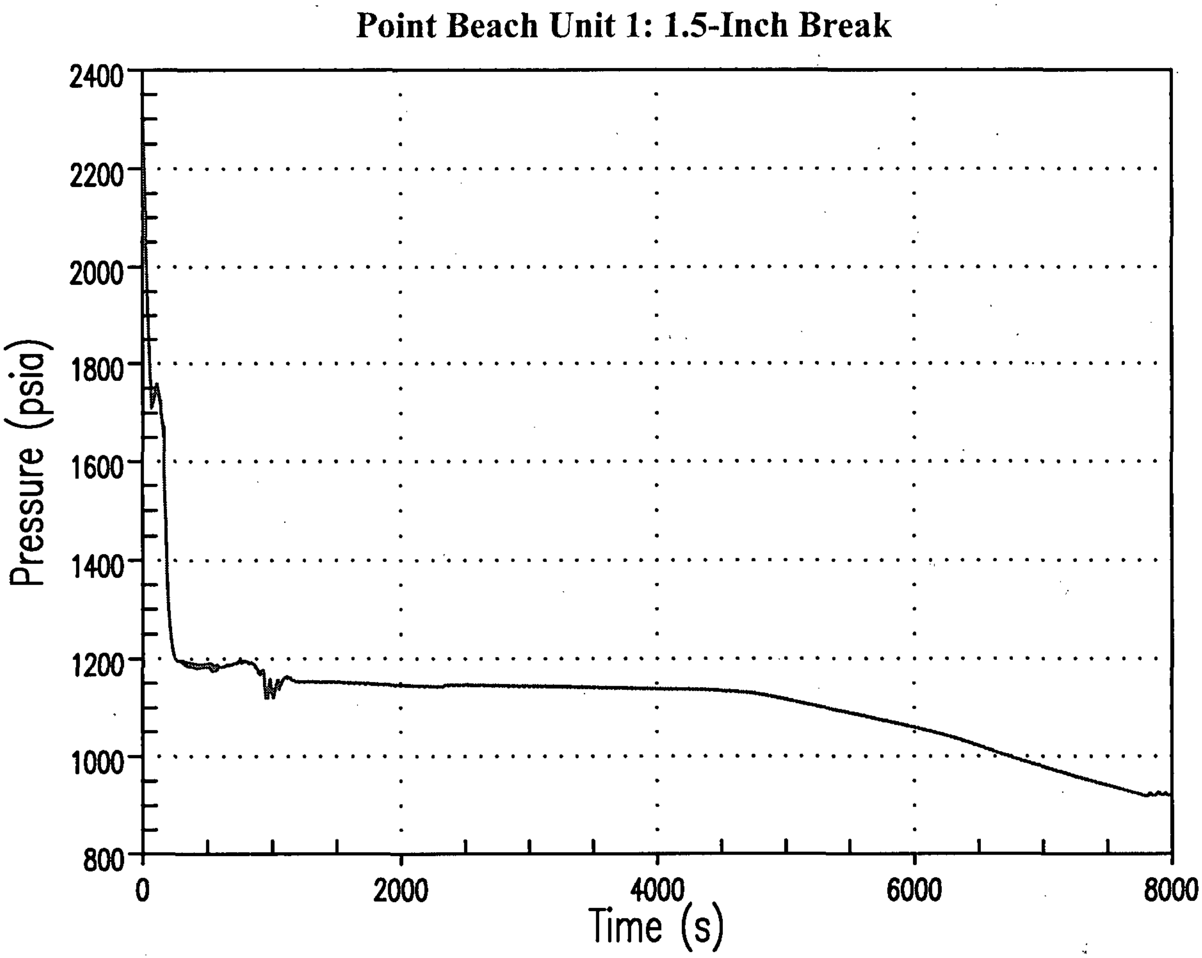


Figure 1a: Pressurizer Pressure

Point Beach Unit 2: 1.5-Inch Break

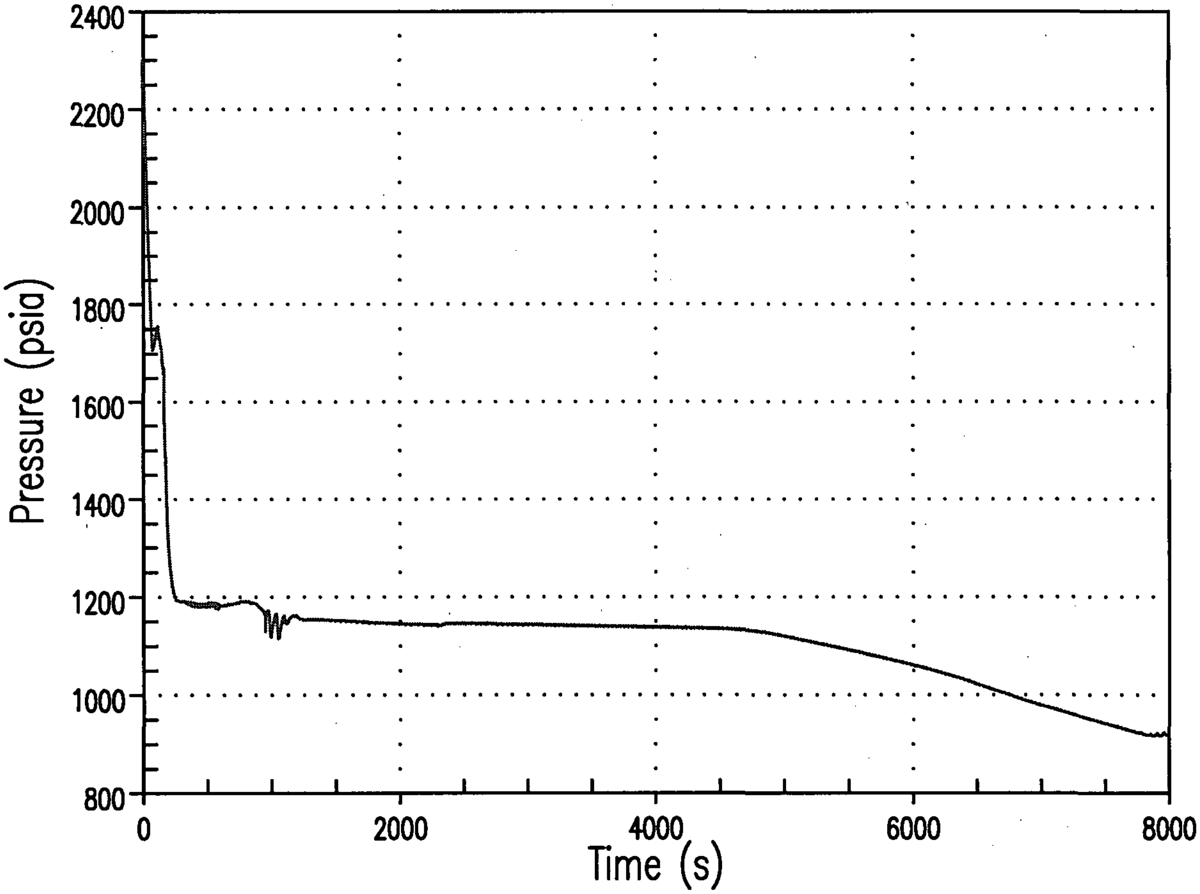


Figure 1b: Pressurizer Pressure

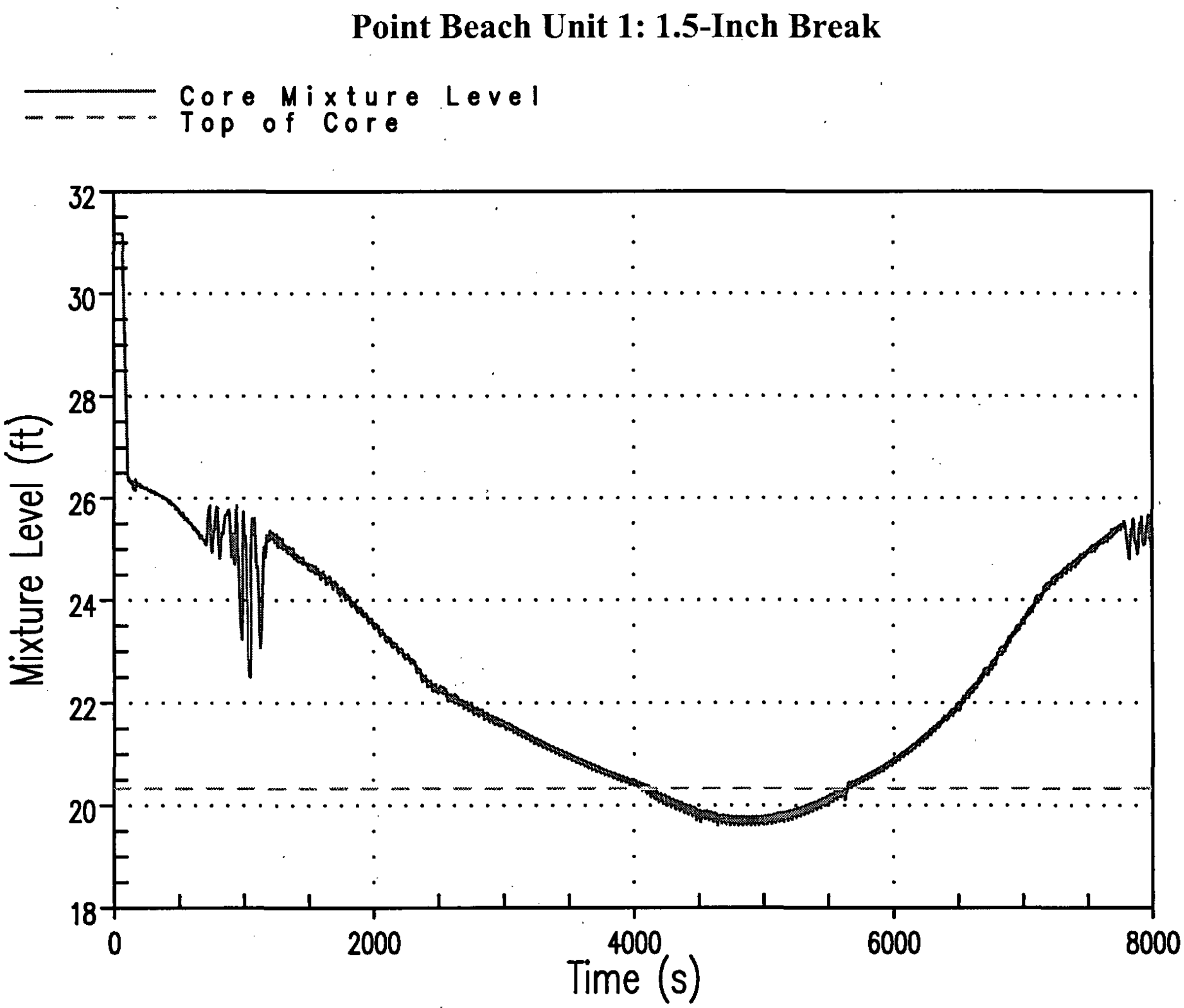


Figure 2a: Core Mixture Level

Point Beach Unit 2: 1.5-Inch Break

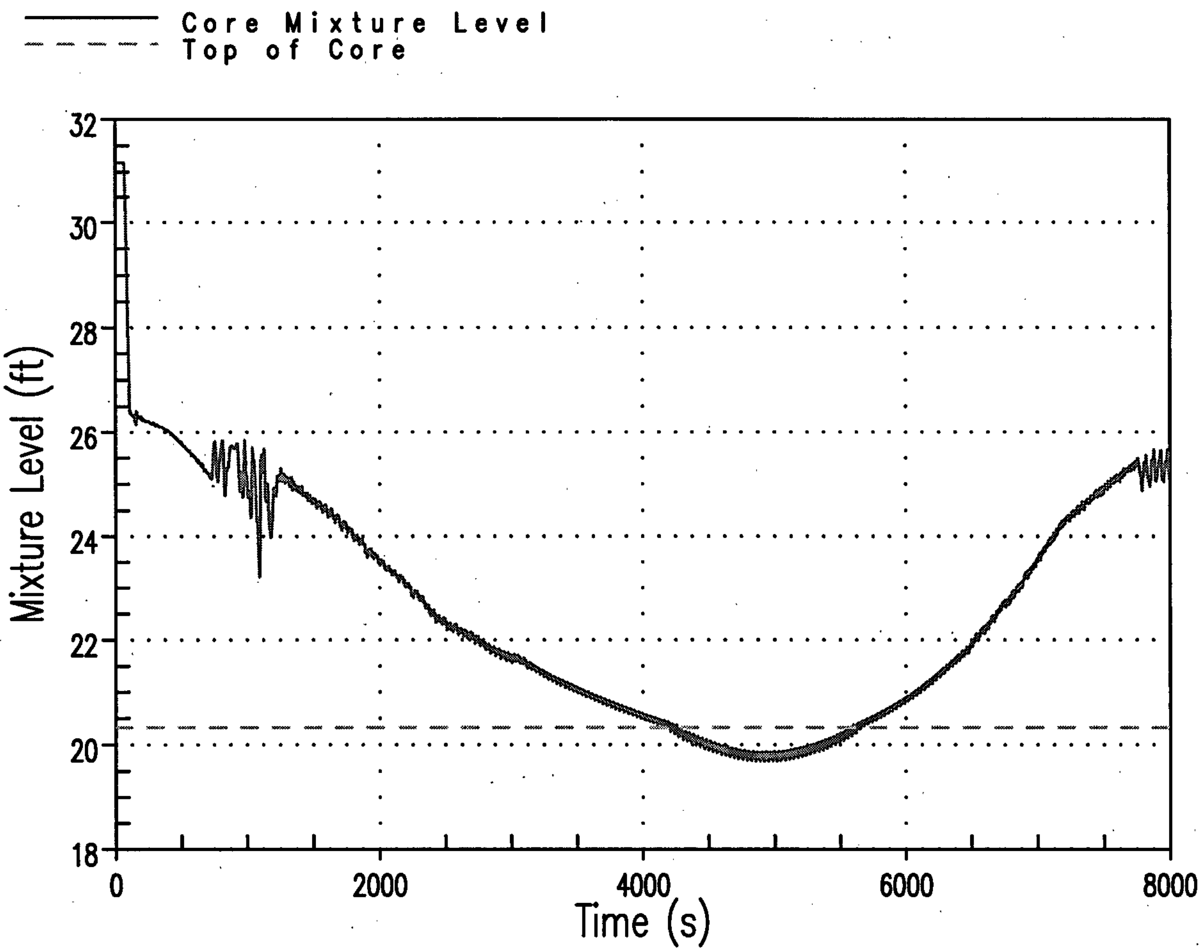


Figure 2b: Core Mixture Level

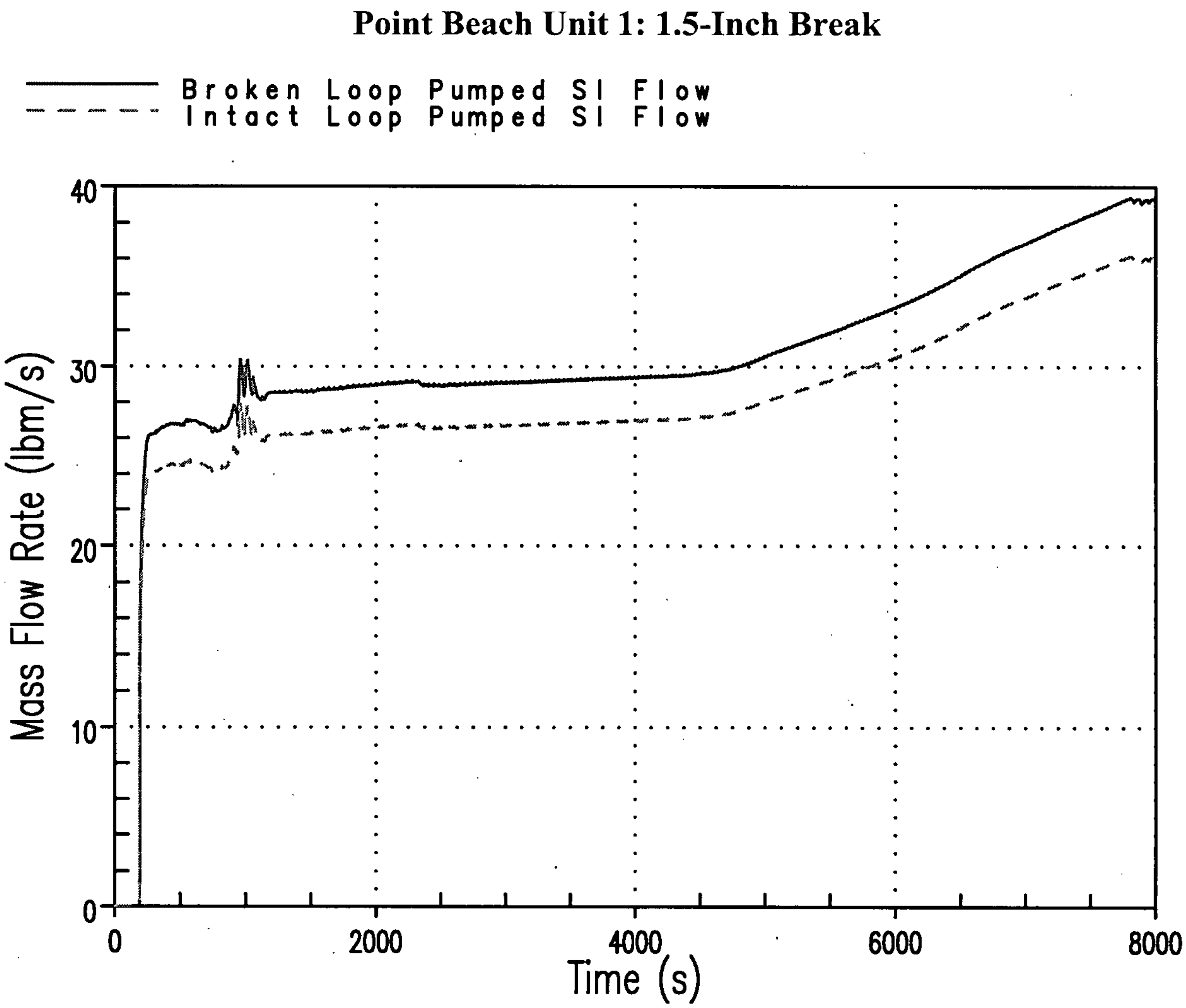


Figure 3a: Broken Loop and Intact Loop Pumped SI Flow

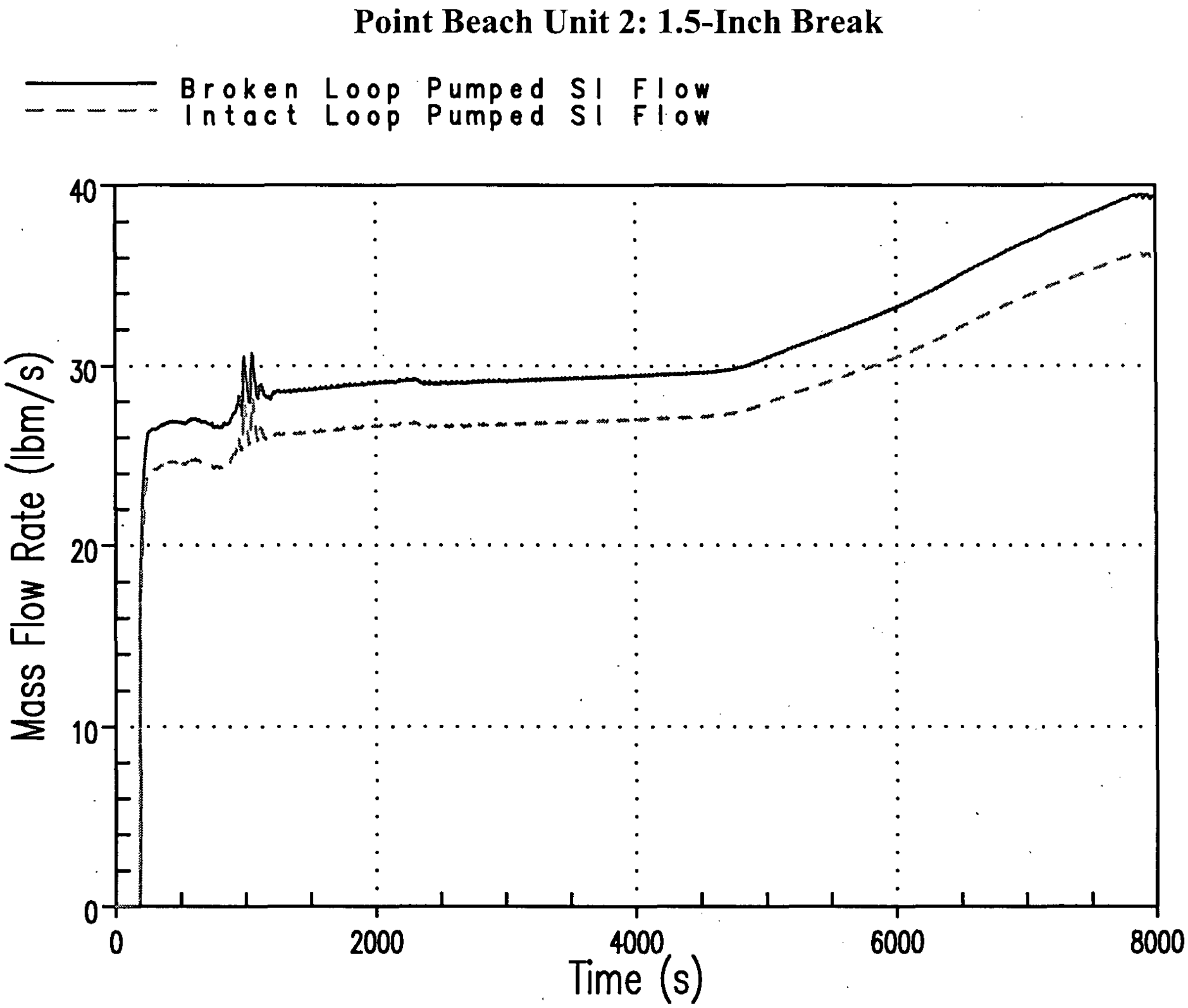


Figure 3b: Broken Loop and Intact Loop Pumped SI Flow

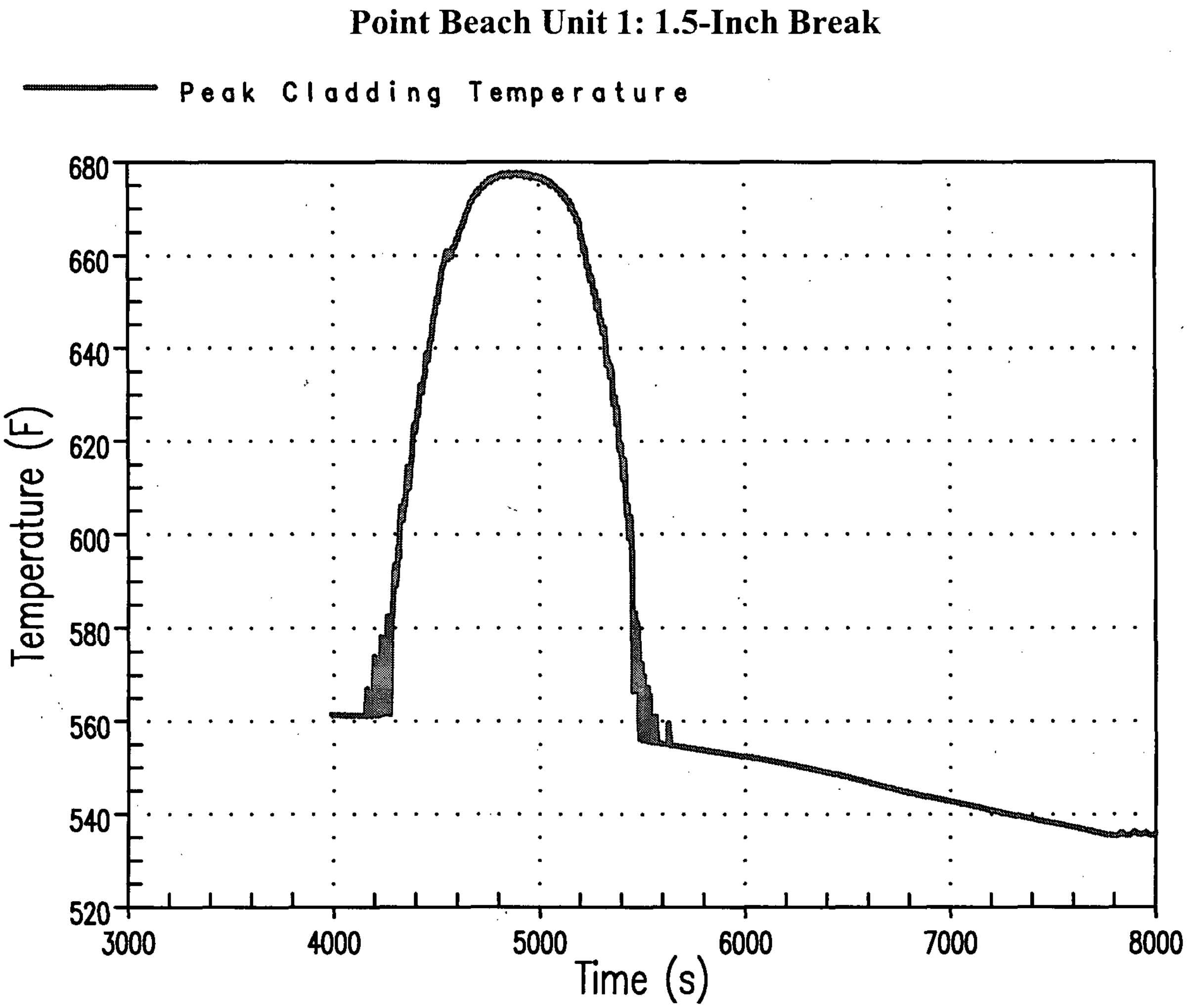


Figure 4a: Cladding Temperature at PCT Elevation (11.75 ft)

Point Beach Unit 2: 1.5-Inch Break

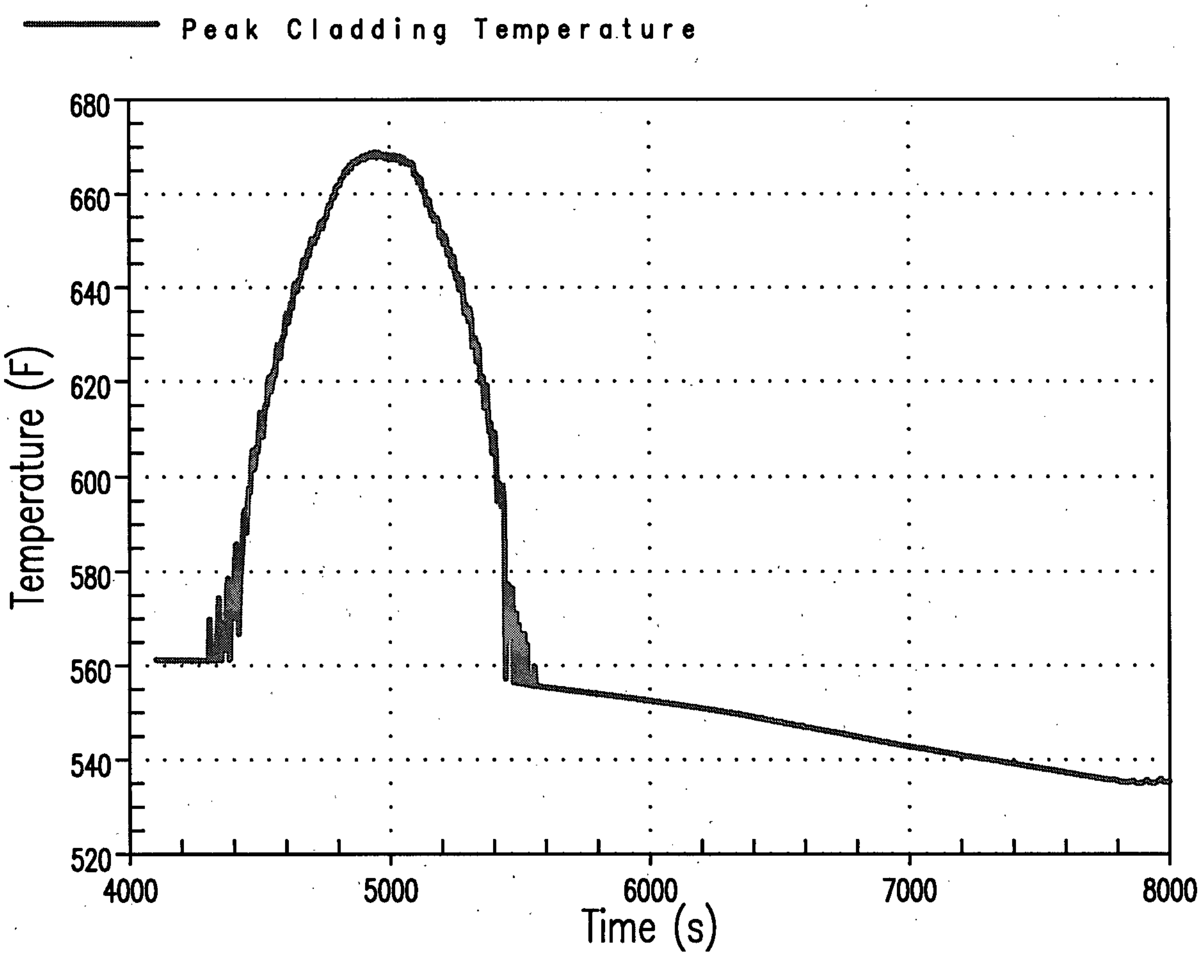


Figure 4b: Cladding Temperature at PCT Elevation (11.75 ft)

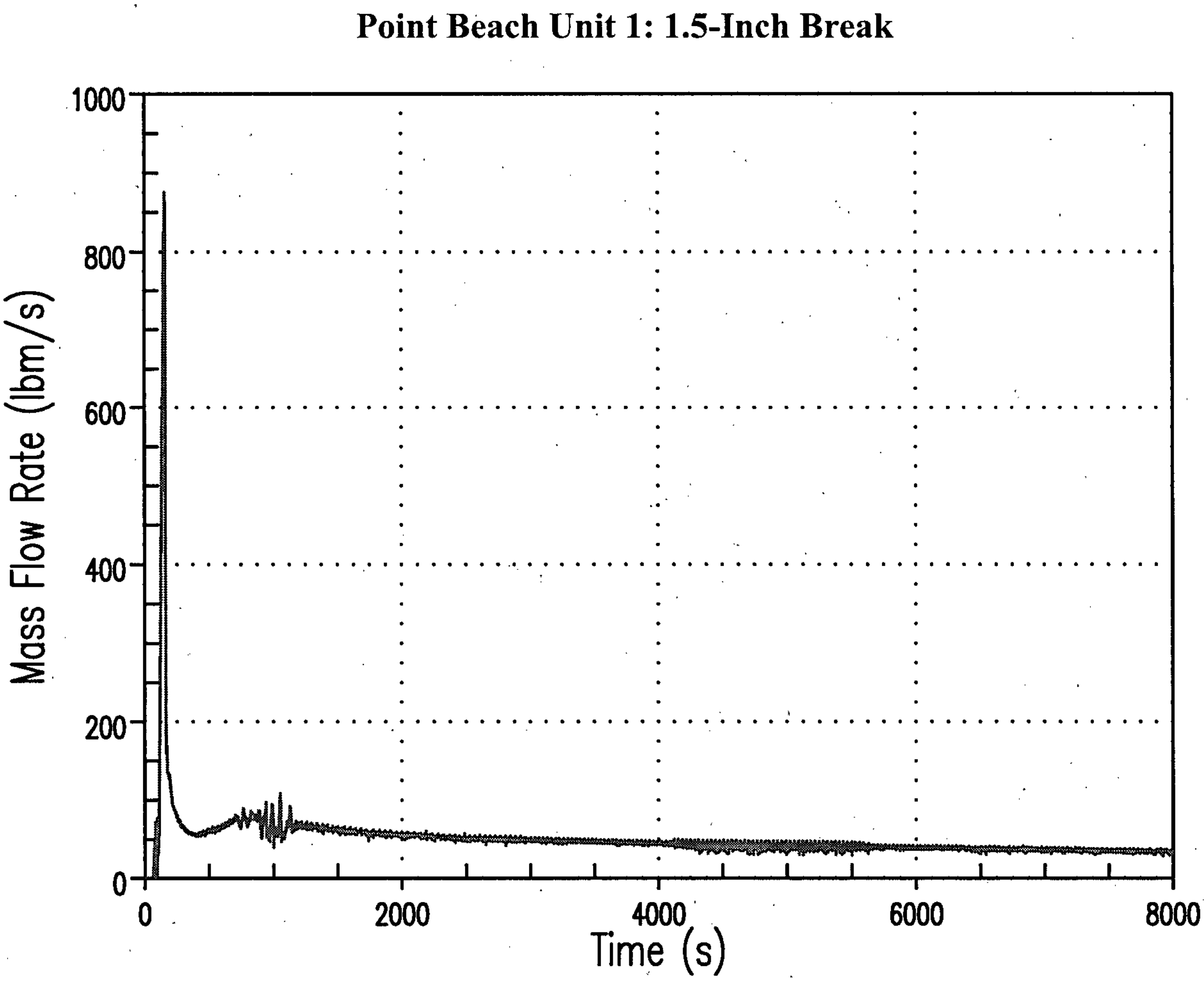


Figure 5a: Core Exit Vapor Flow

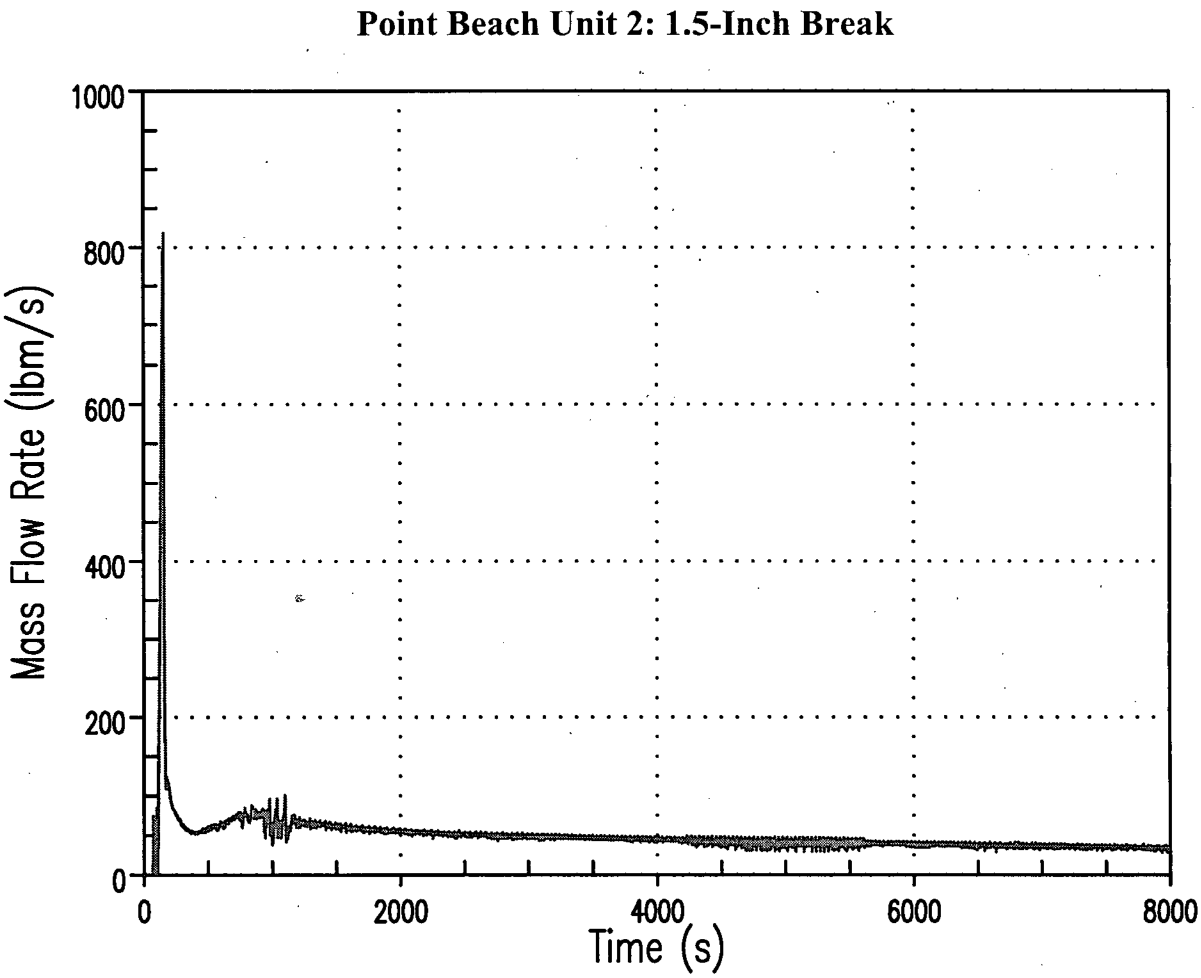


Figure 5b: Core Exit Vapor Flow

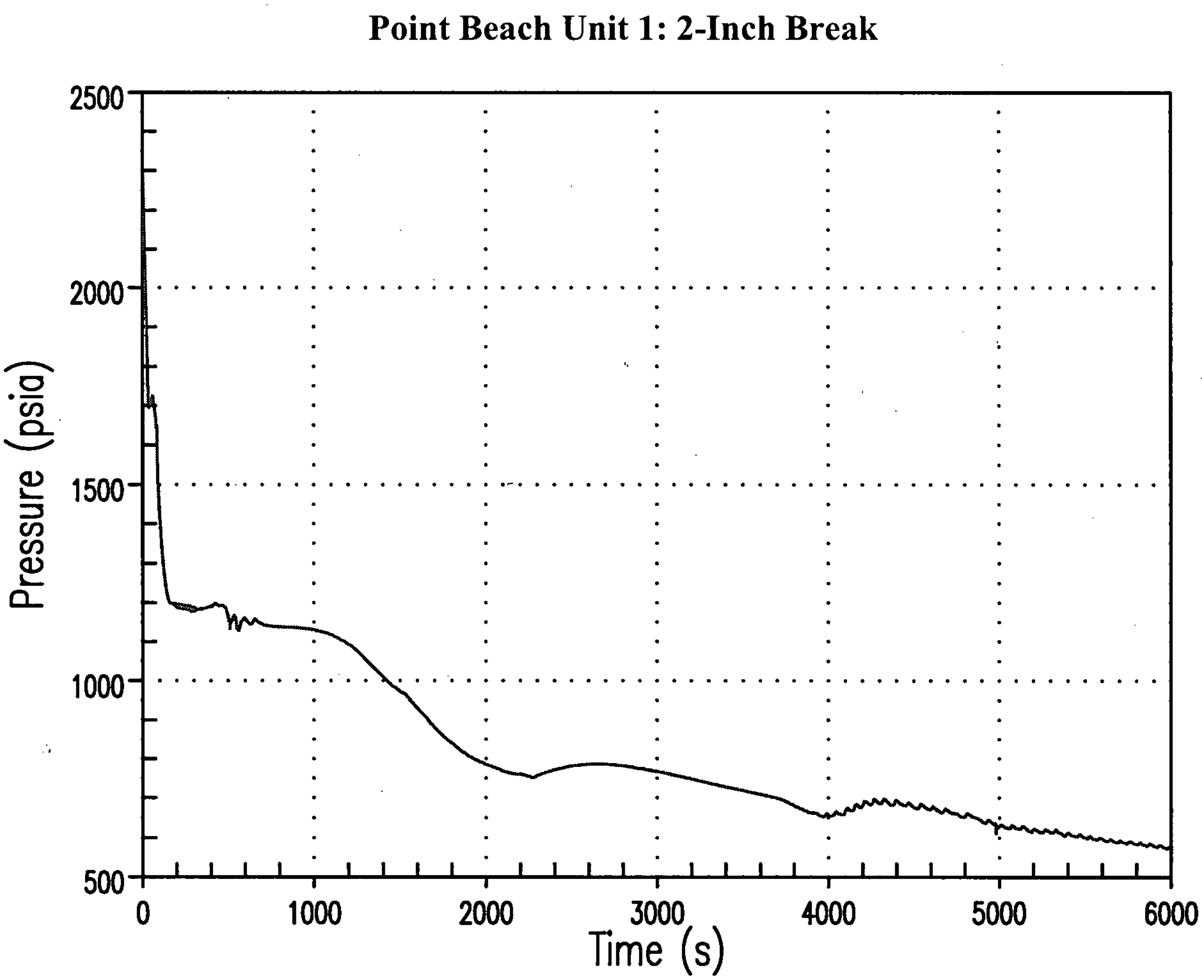


Figure 6a: Pressurizer Pressure

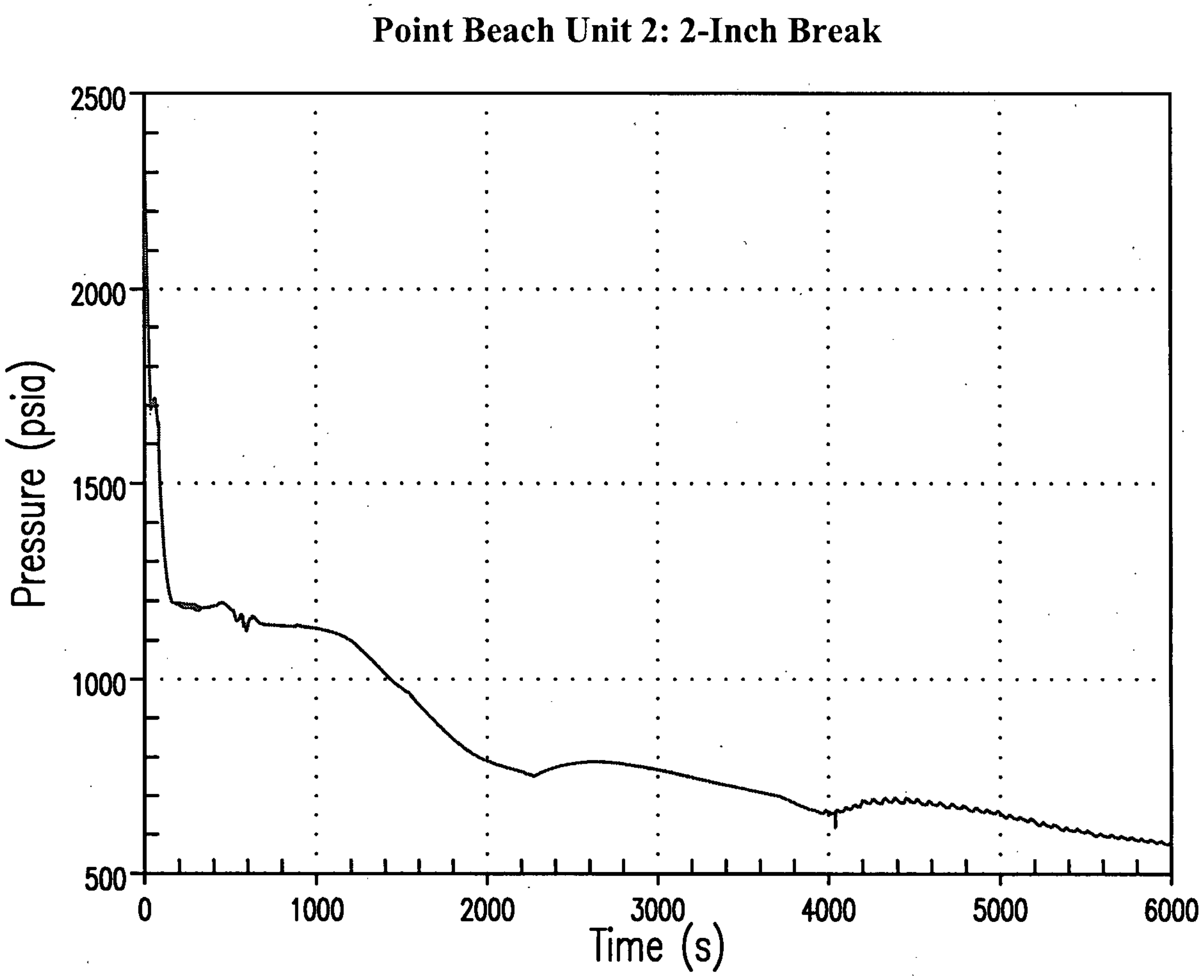


Figure 6b: Pressurizer Pressure

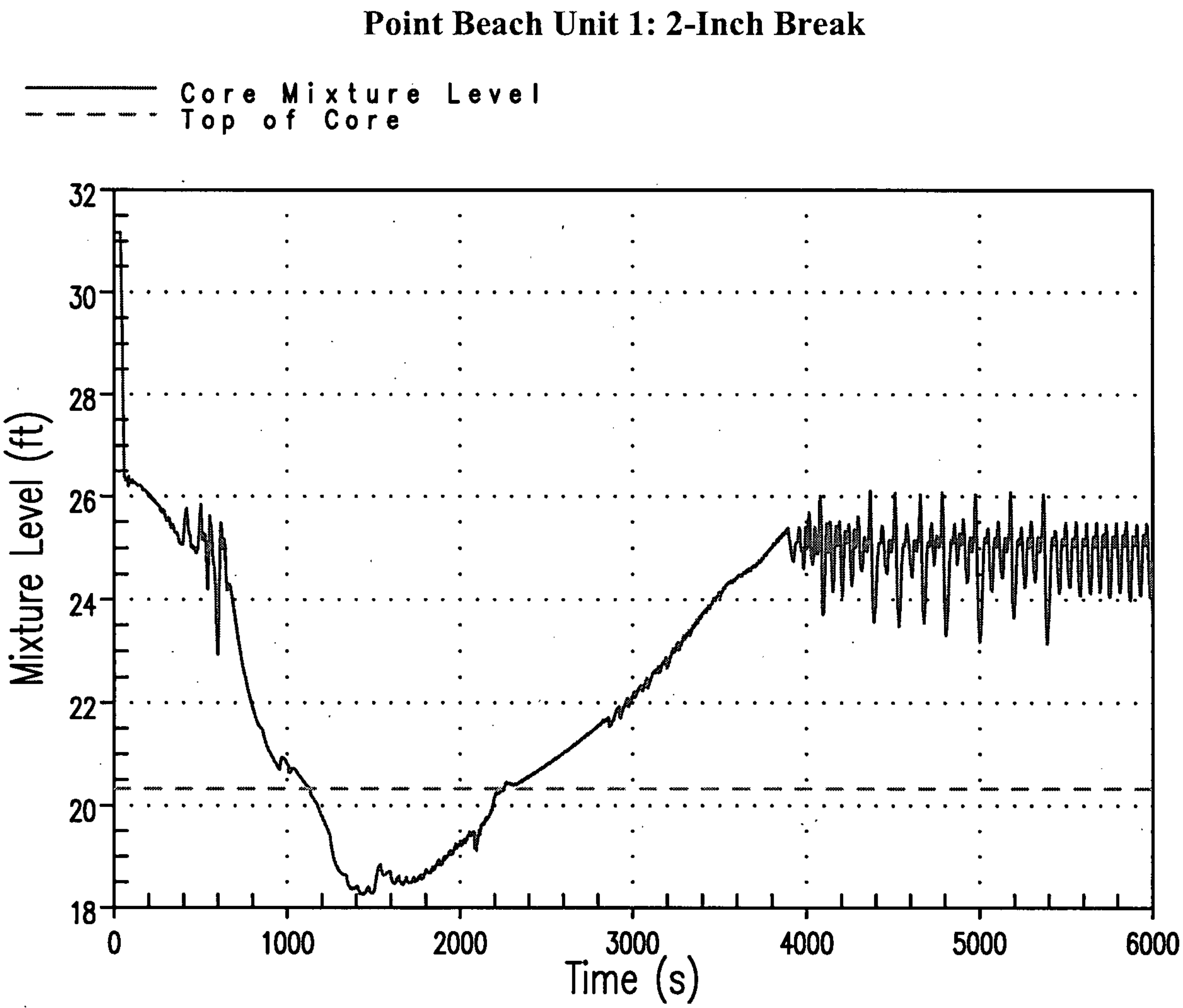


Figure 7a: Core Mixture Level

Point Beach Unit 2: 2-Inch Break

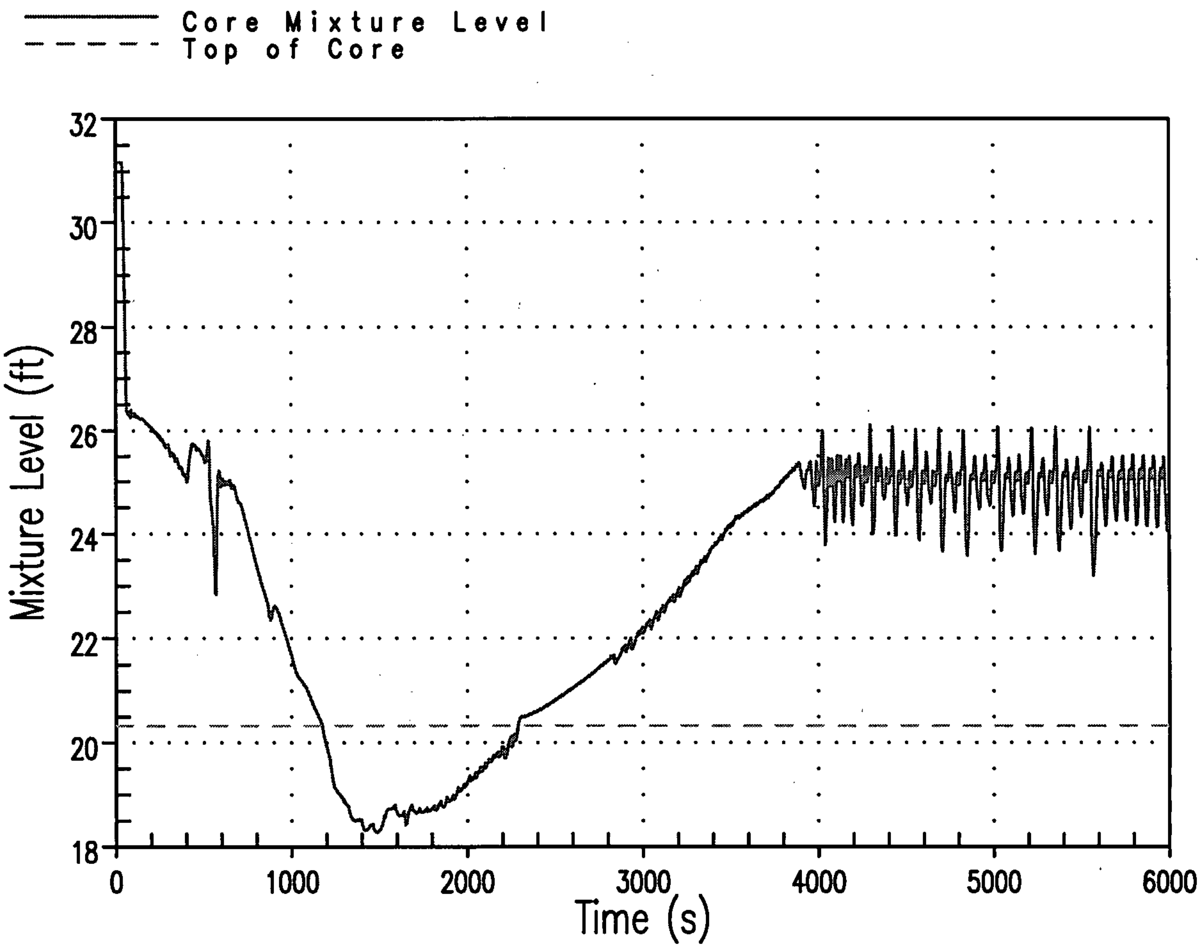


Figure 7b: Core Mixture Level

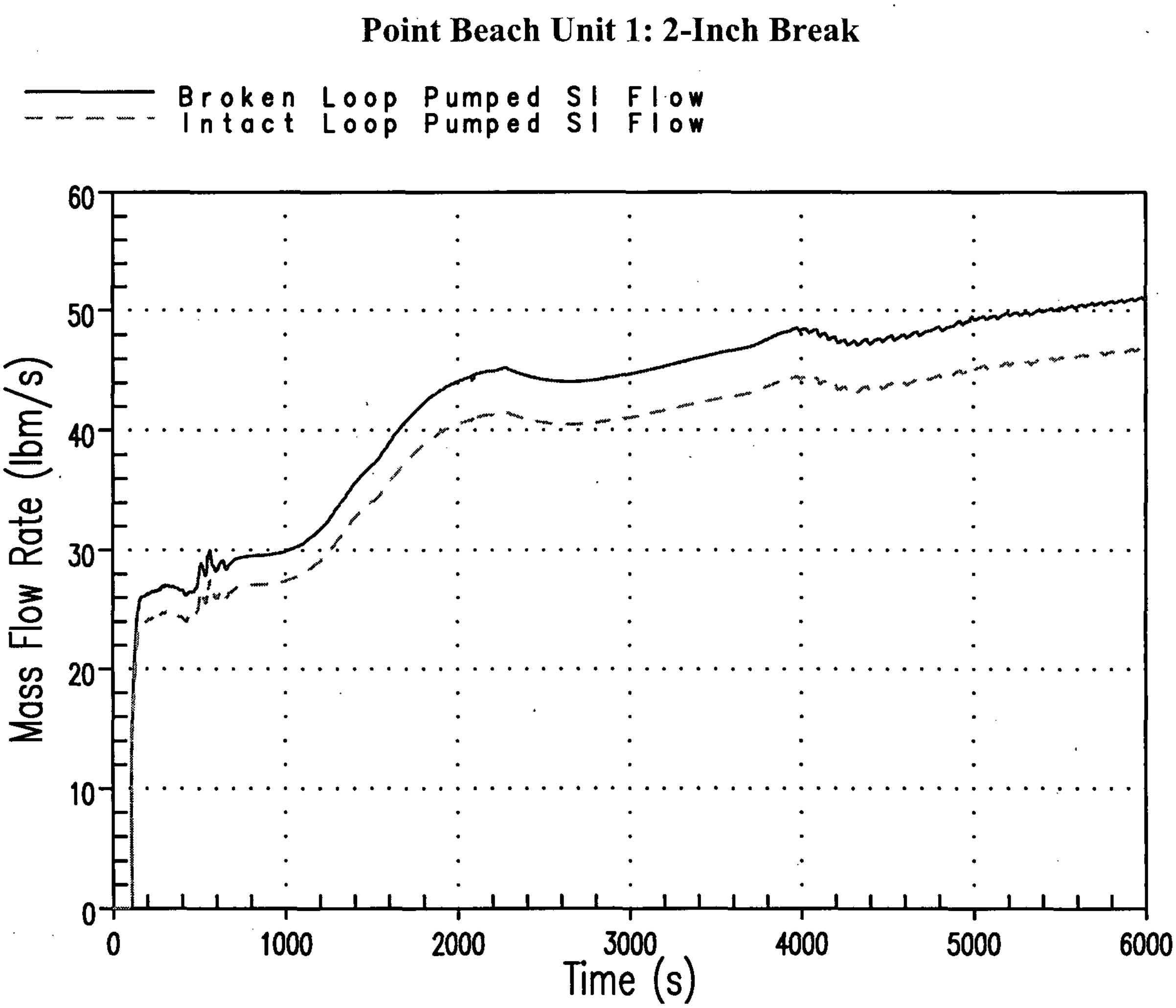


Figure 8a: Broken Loop and Intact Loop Pumped SI Flow

Point Beach Unit 2: 2-Inch Break

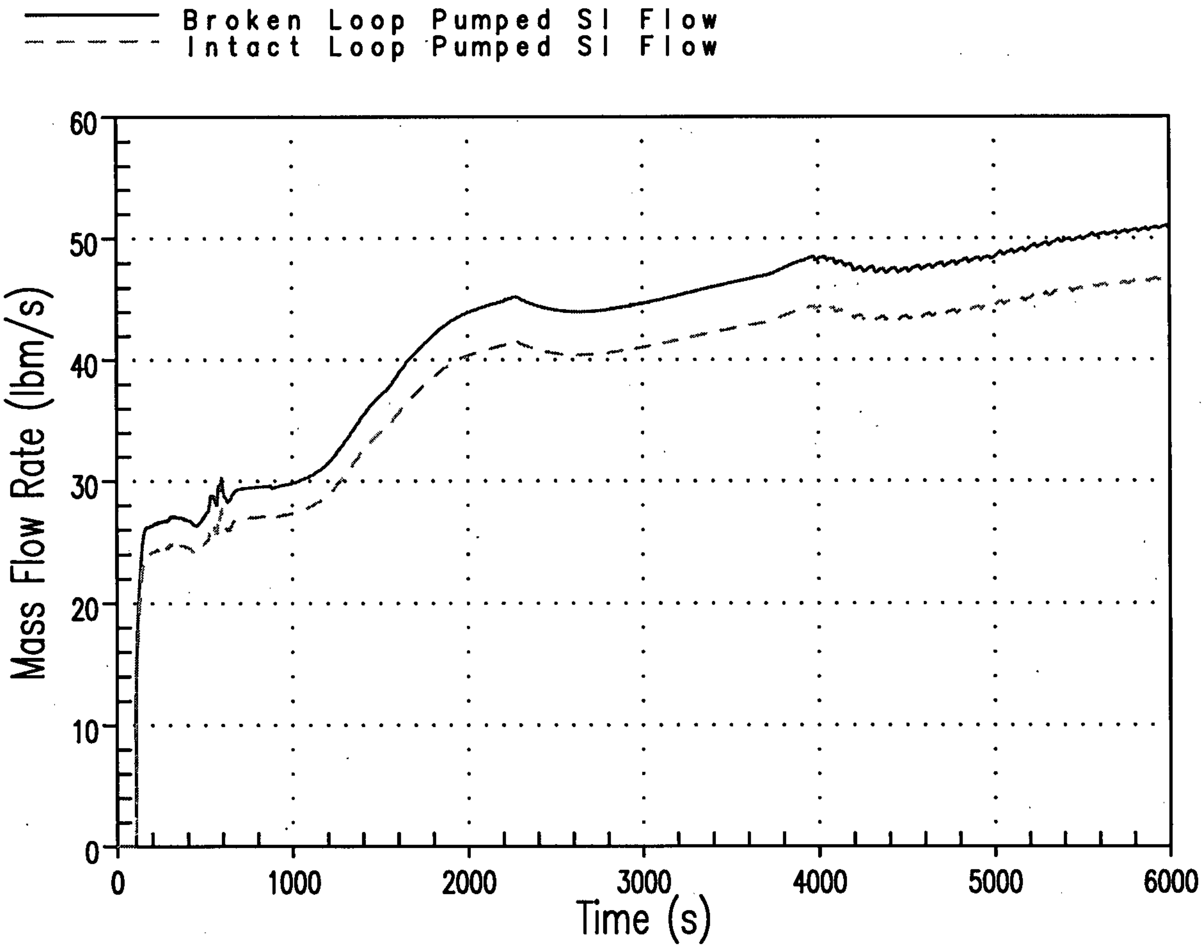


Figure 8b: Broken Loop and Intact Loop Pumped SI Flow

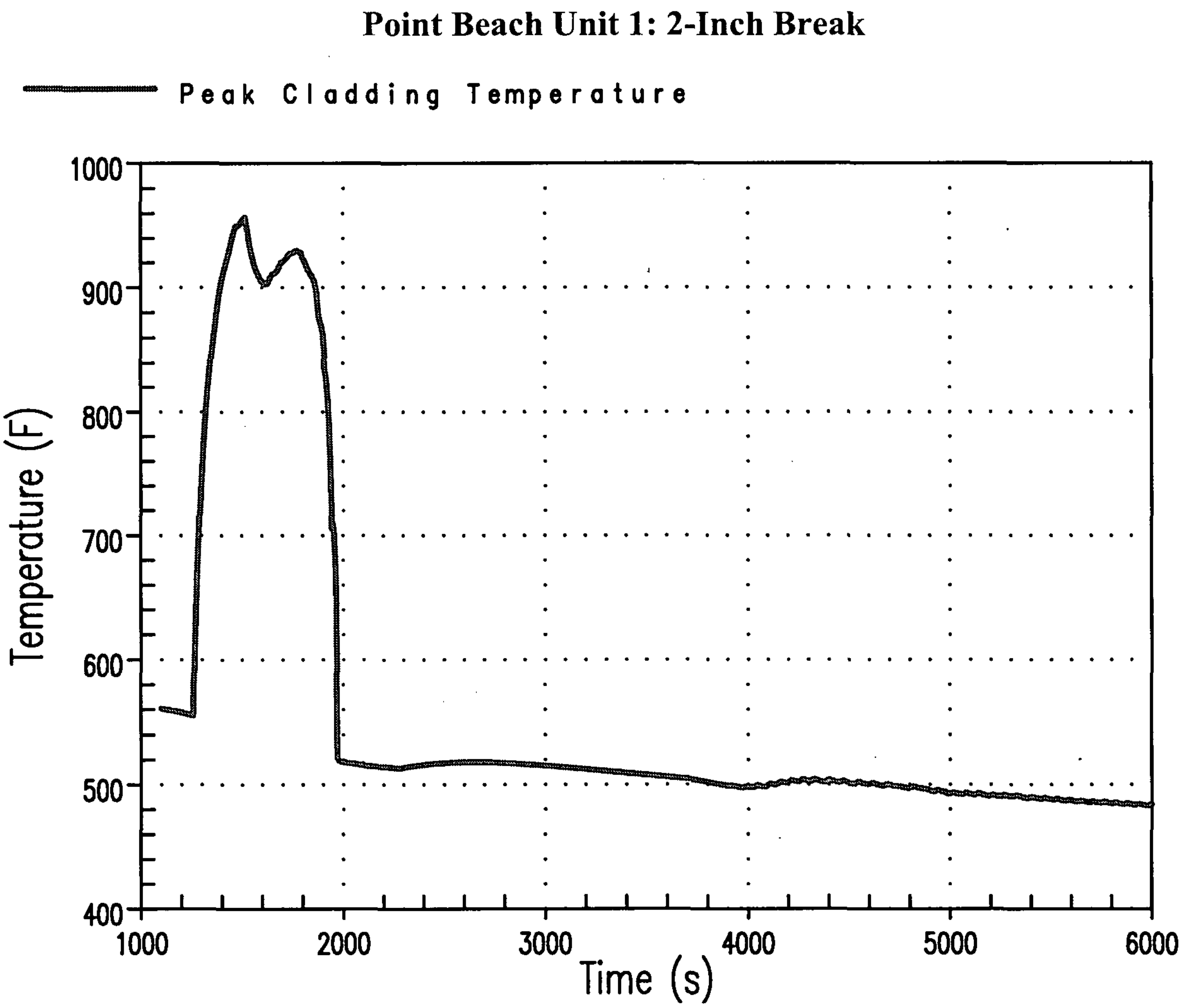


Figure 9a: Cladding Temperature at PCT Elevation (10.75 ft)

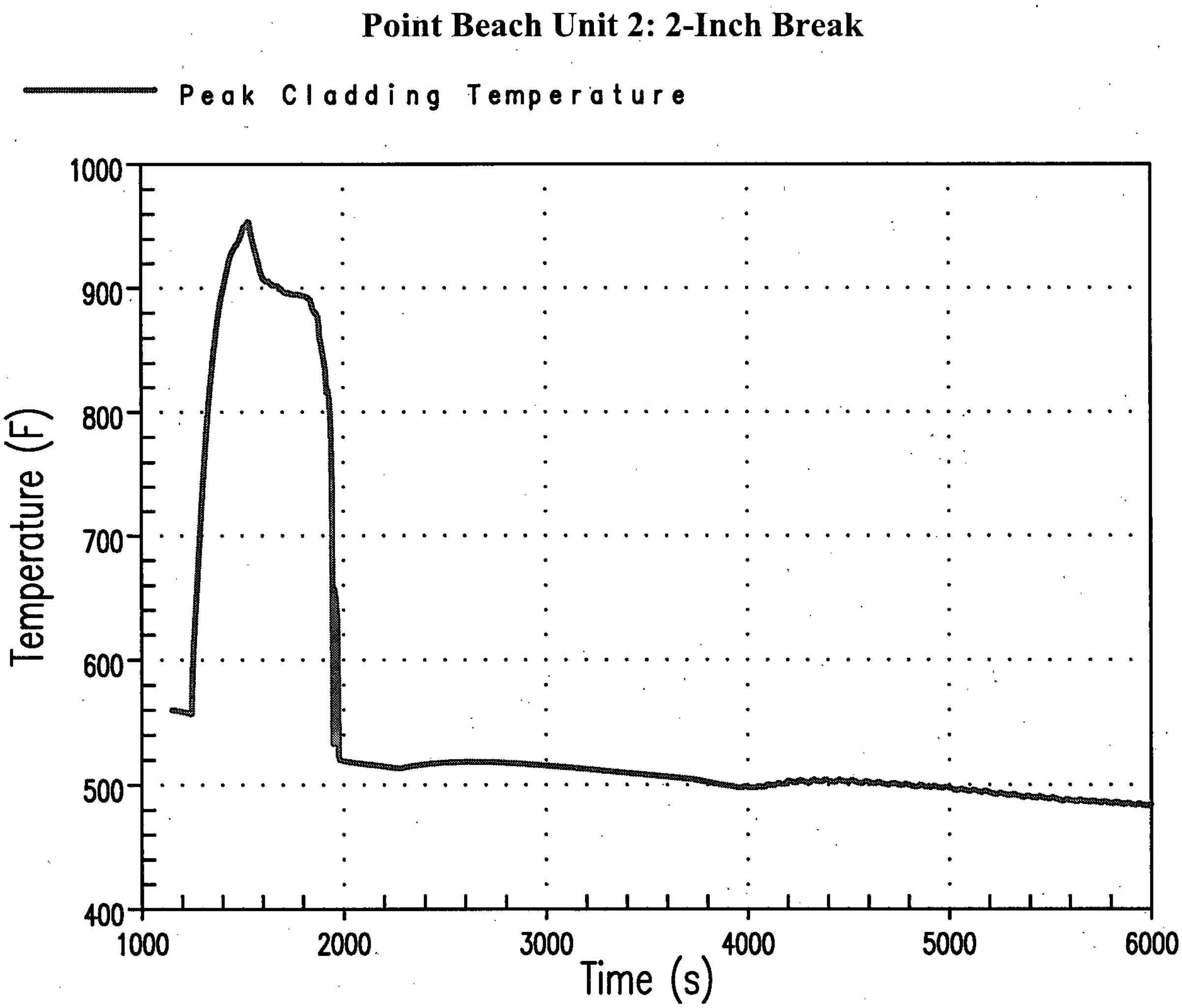


Figure 9b: Cladding Temperature at PCT Elevation (10.75 ft)

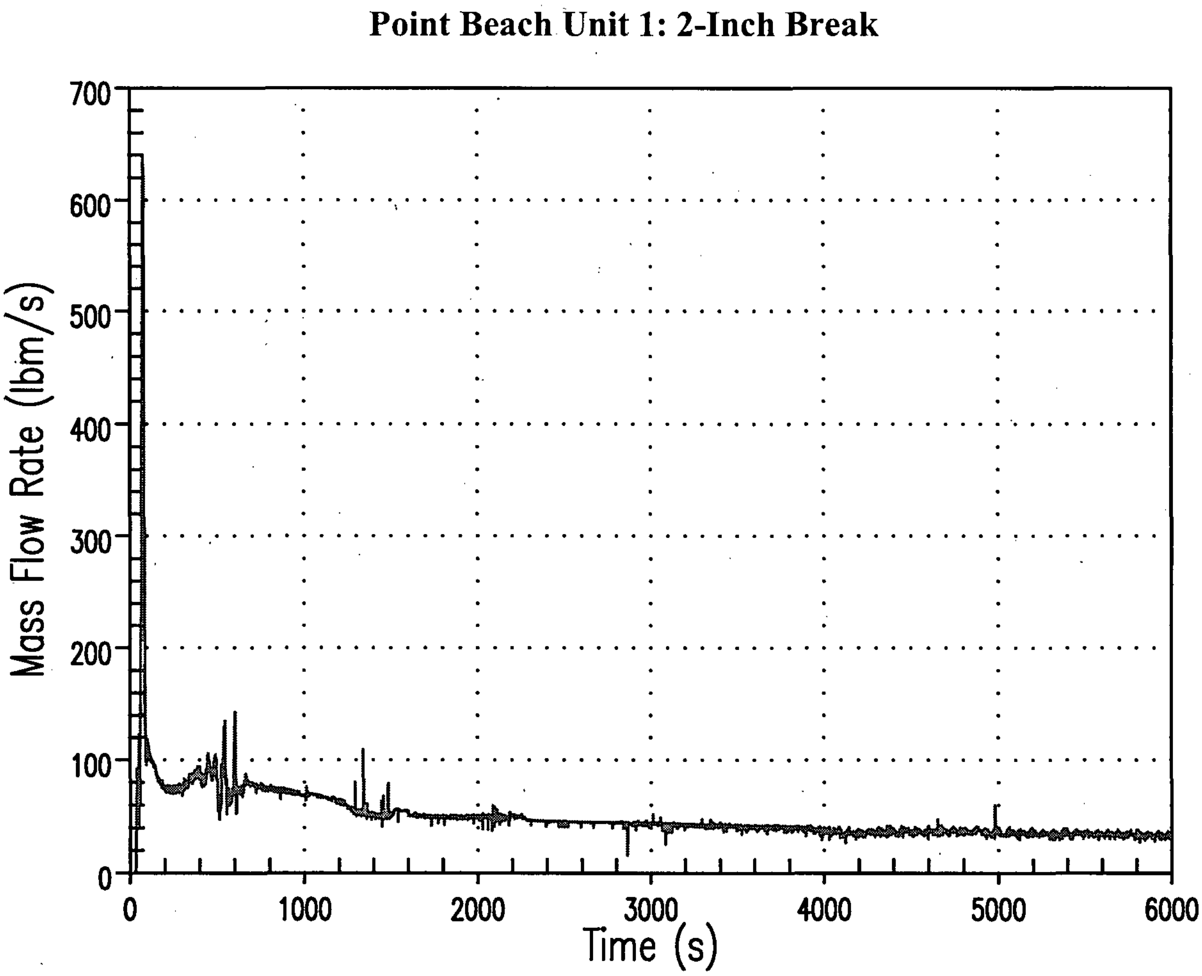


Figure 10a: Core Exit Vapor Flow

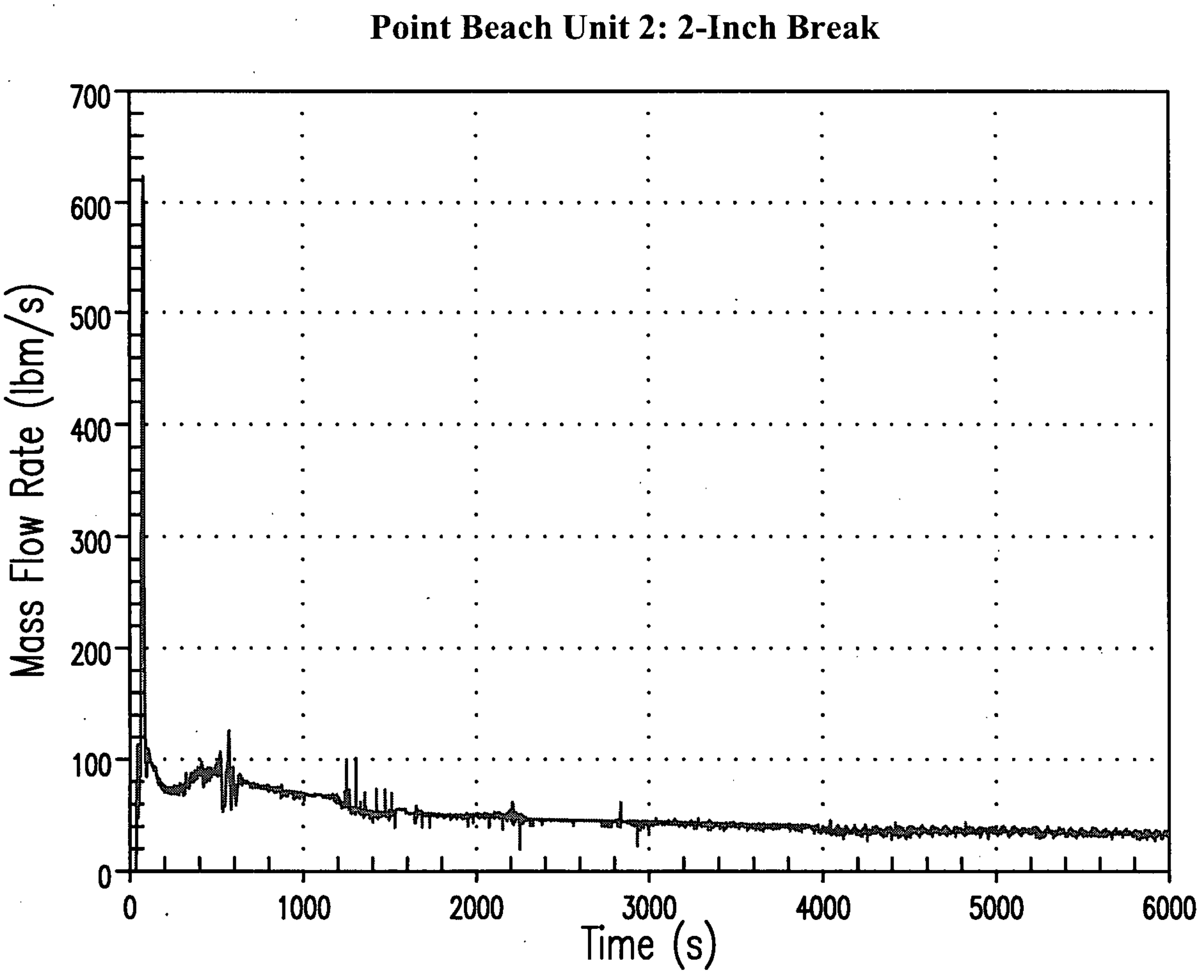


Figure 10b: Core Exit Vapor Flow

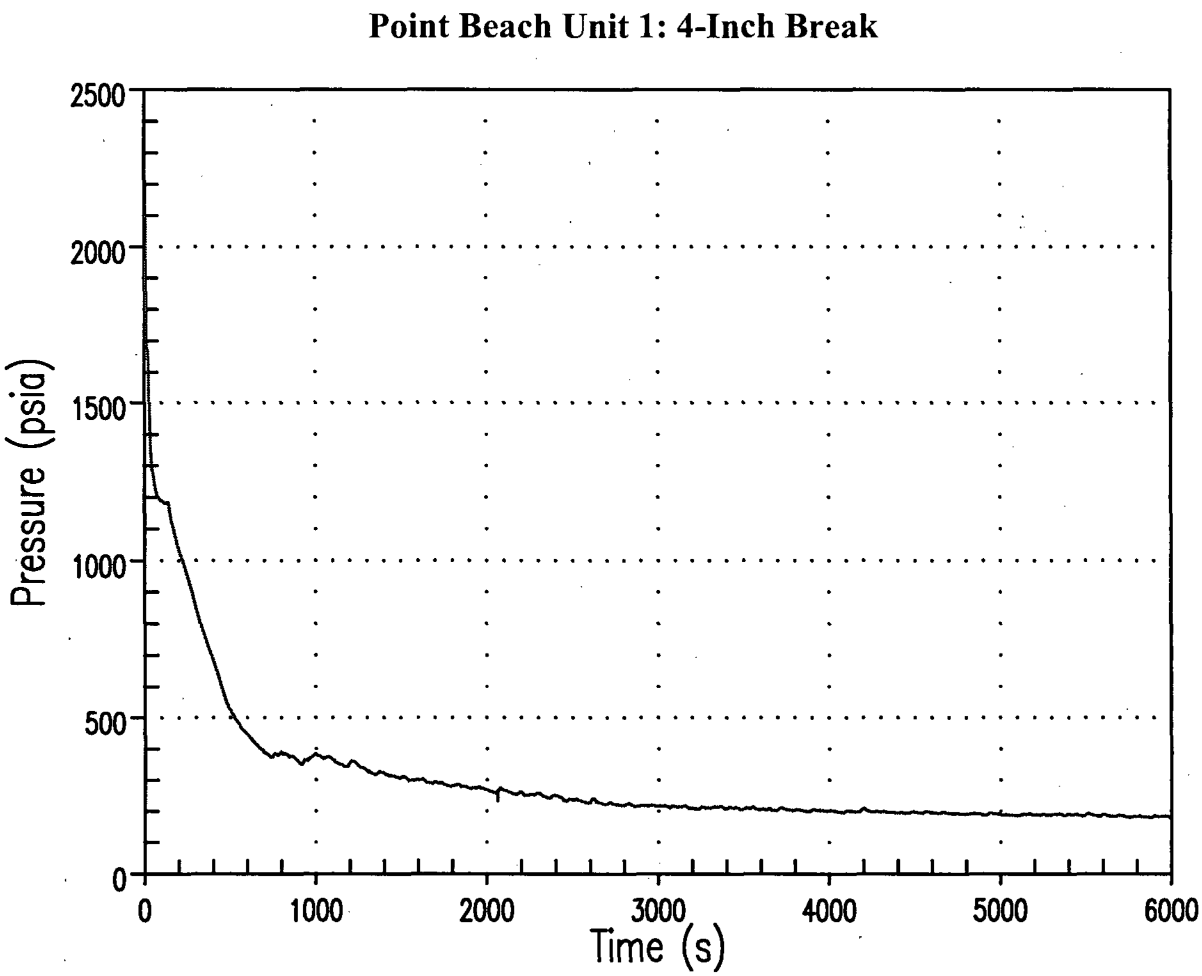


Figure 11a: Pressurizer Pressure

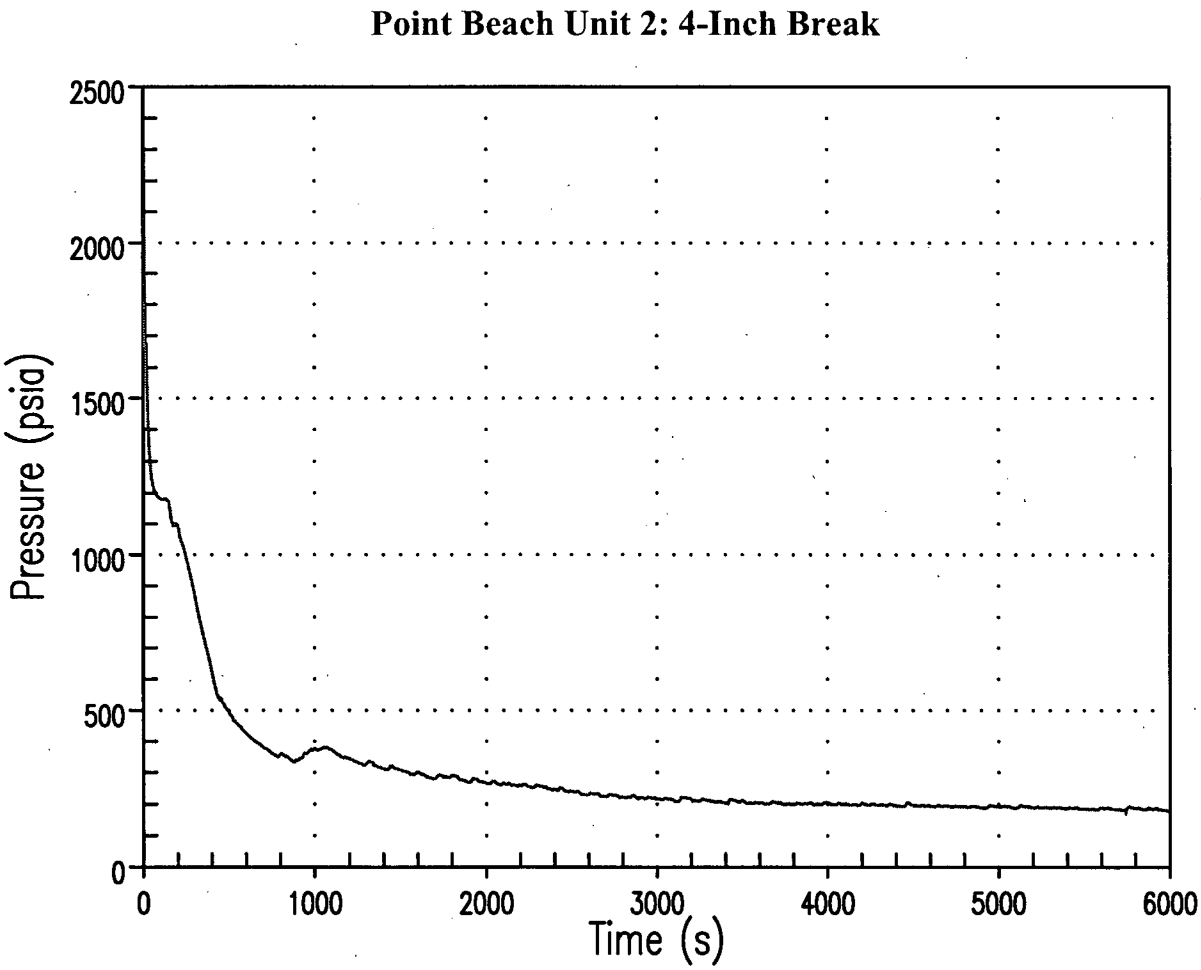


Figure 11b: Pressurizer Pressure

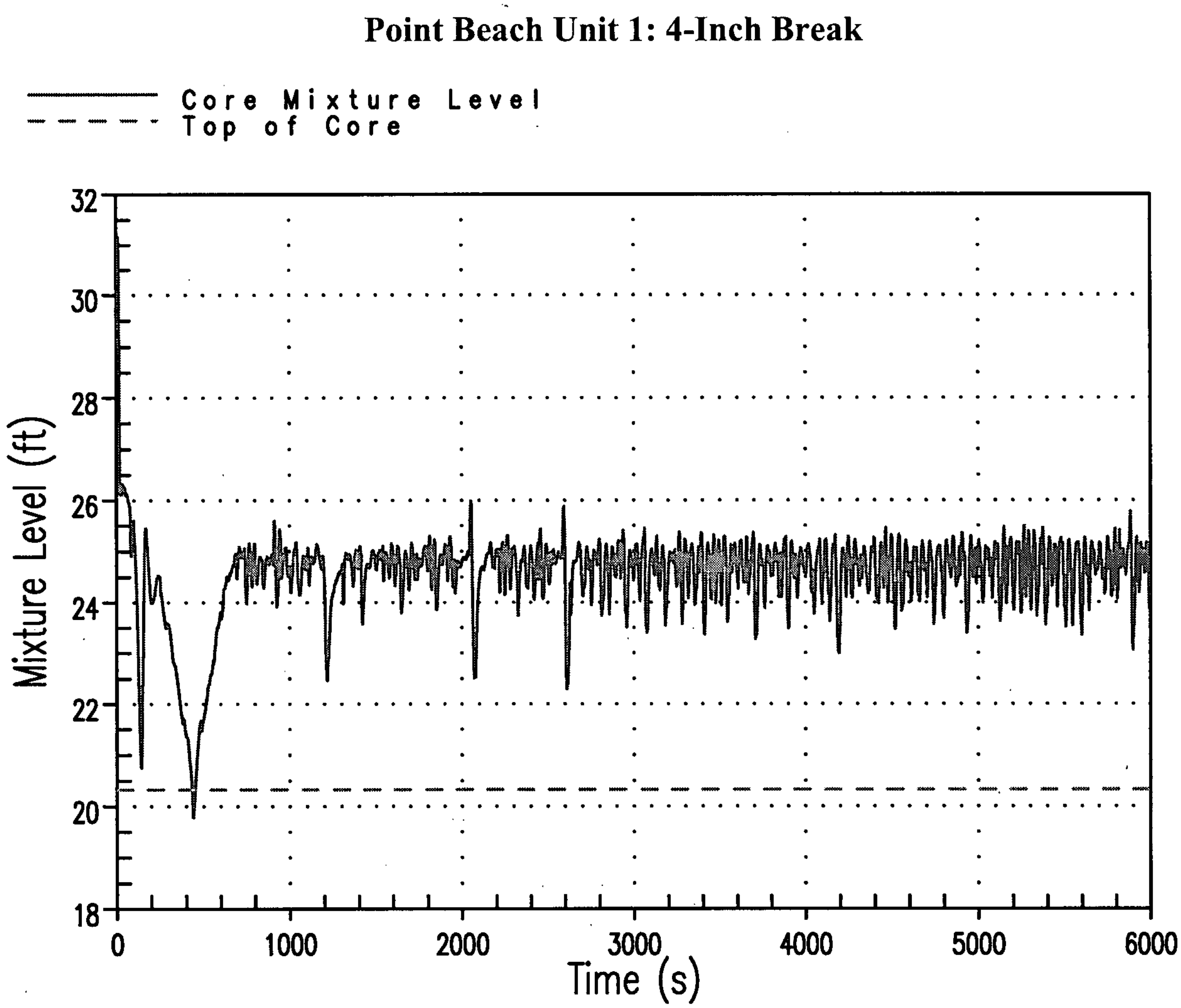


Figure 12a: Core Mixture Level

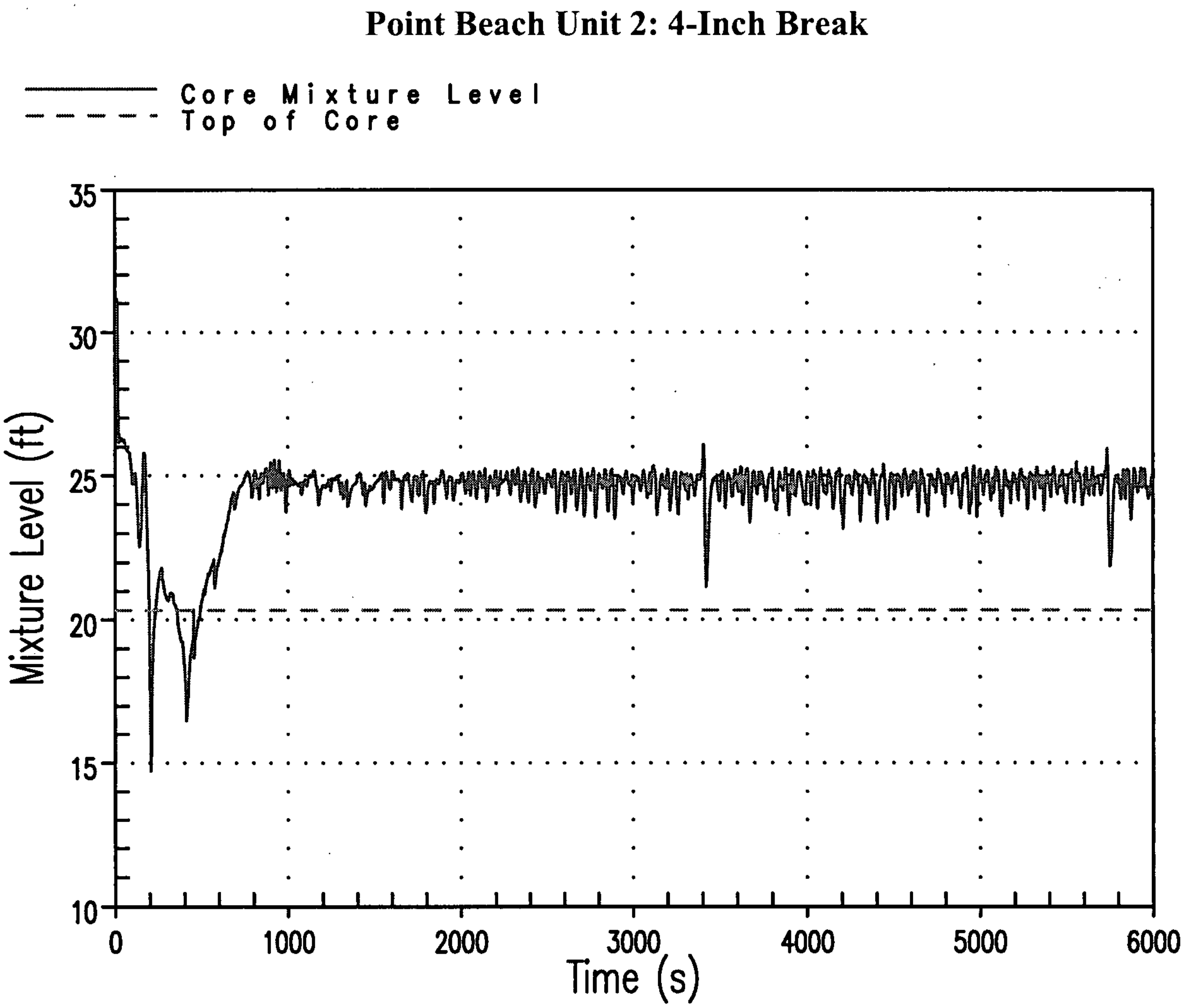


Figure 12b: Core Mixture Level

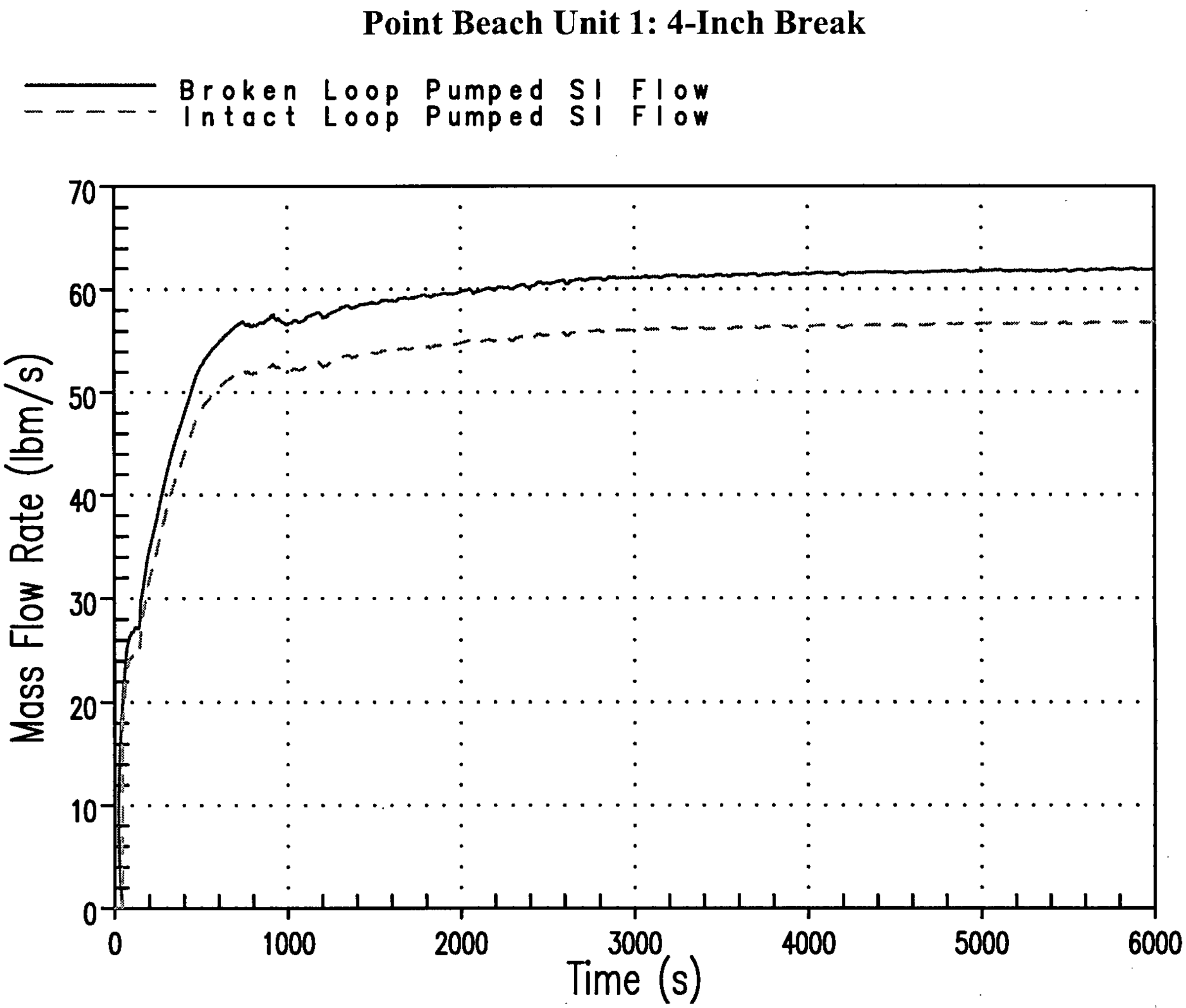


Figure 13a: Broken Loop and Intact Loop Pumped SI Flow

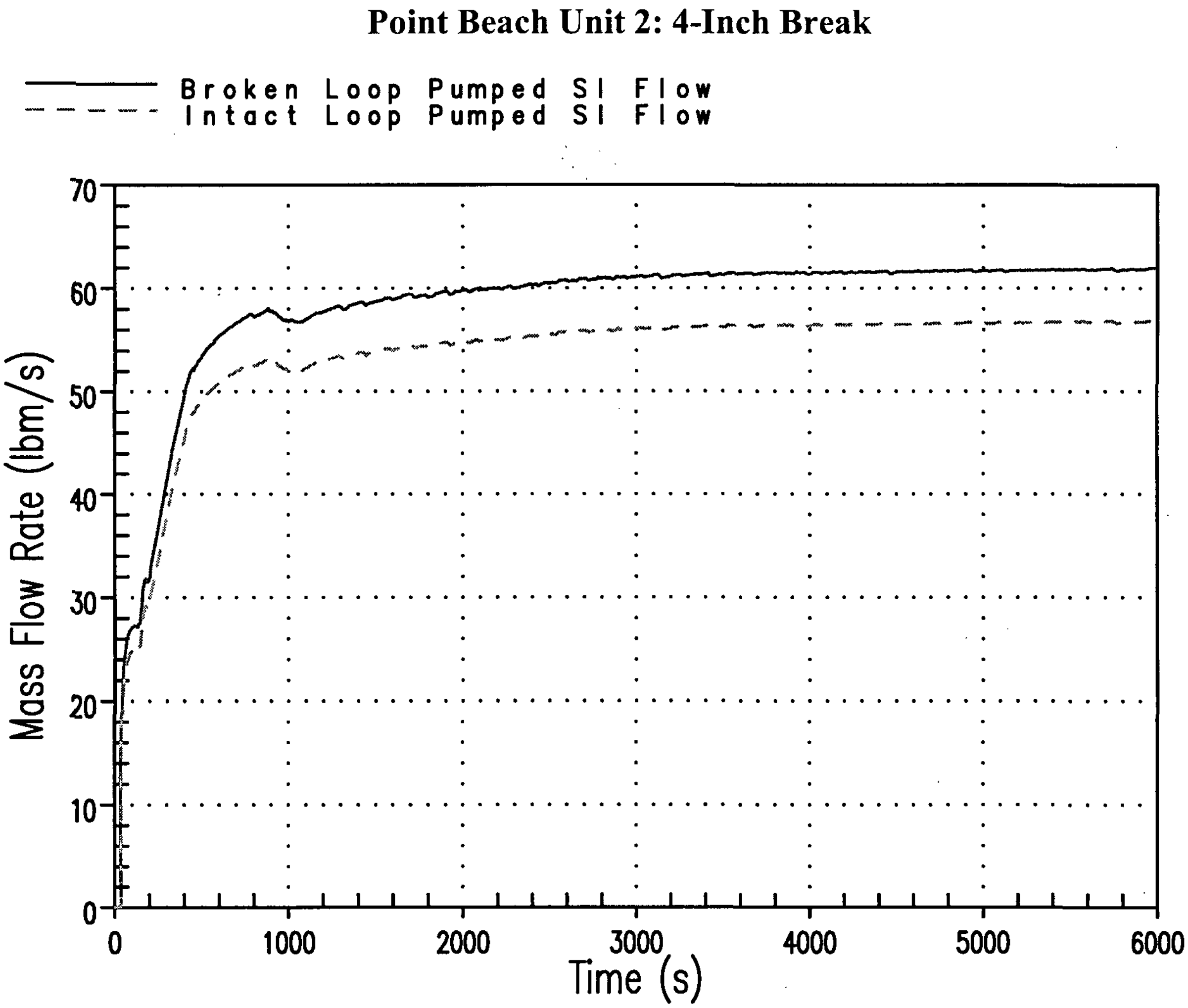


Figure 13b: Broken Loop and Intact Loop Pumped SI Flow

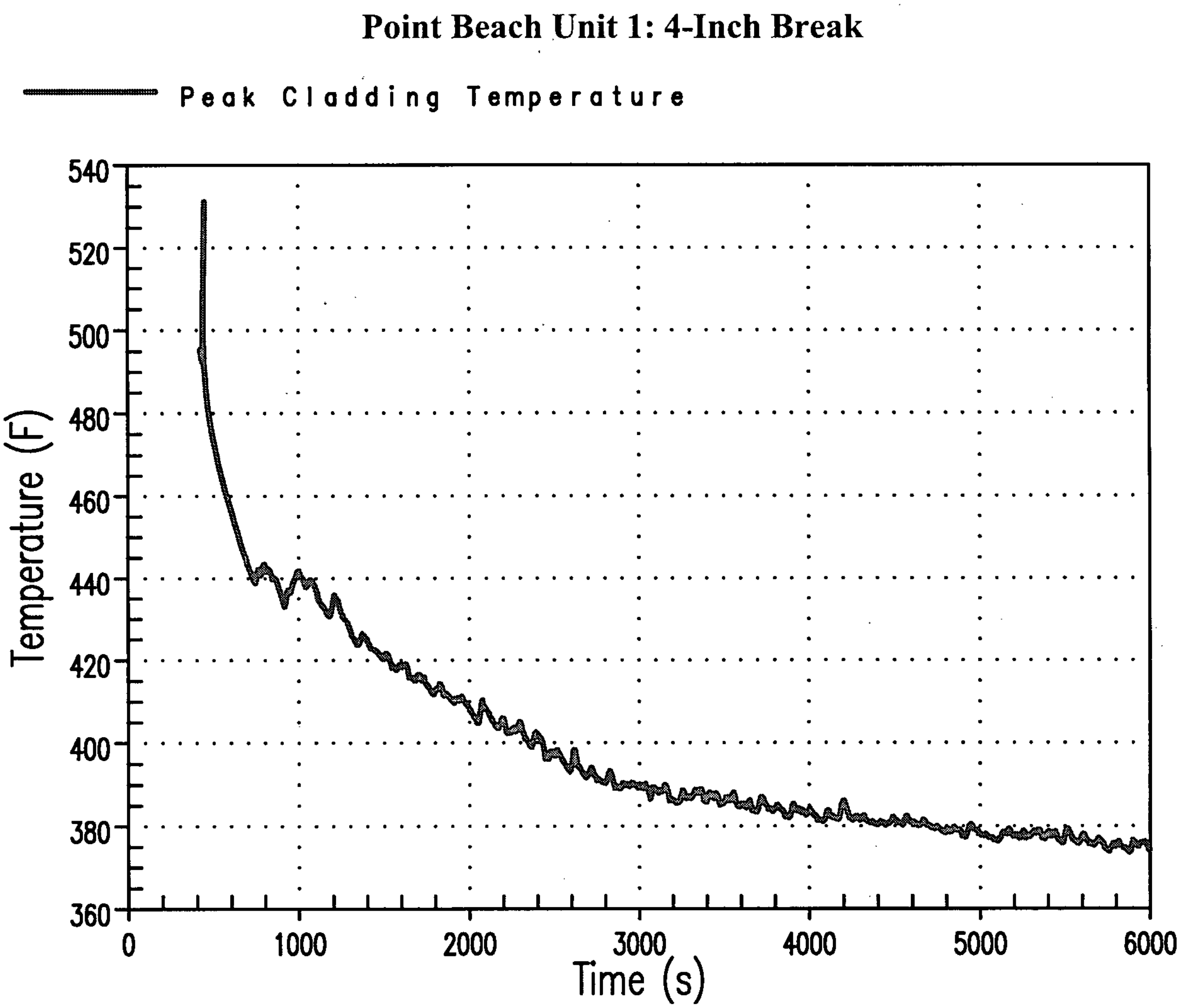


Figure 14a: Cladding Temperature at PCT Elevation (11.75 ft)

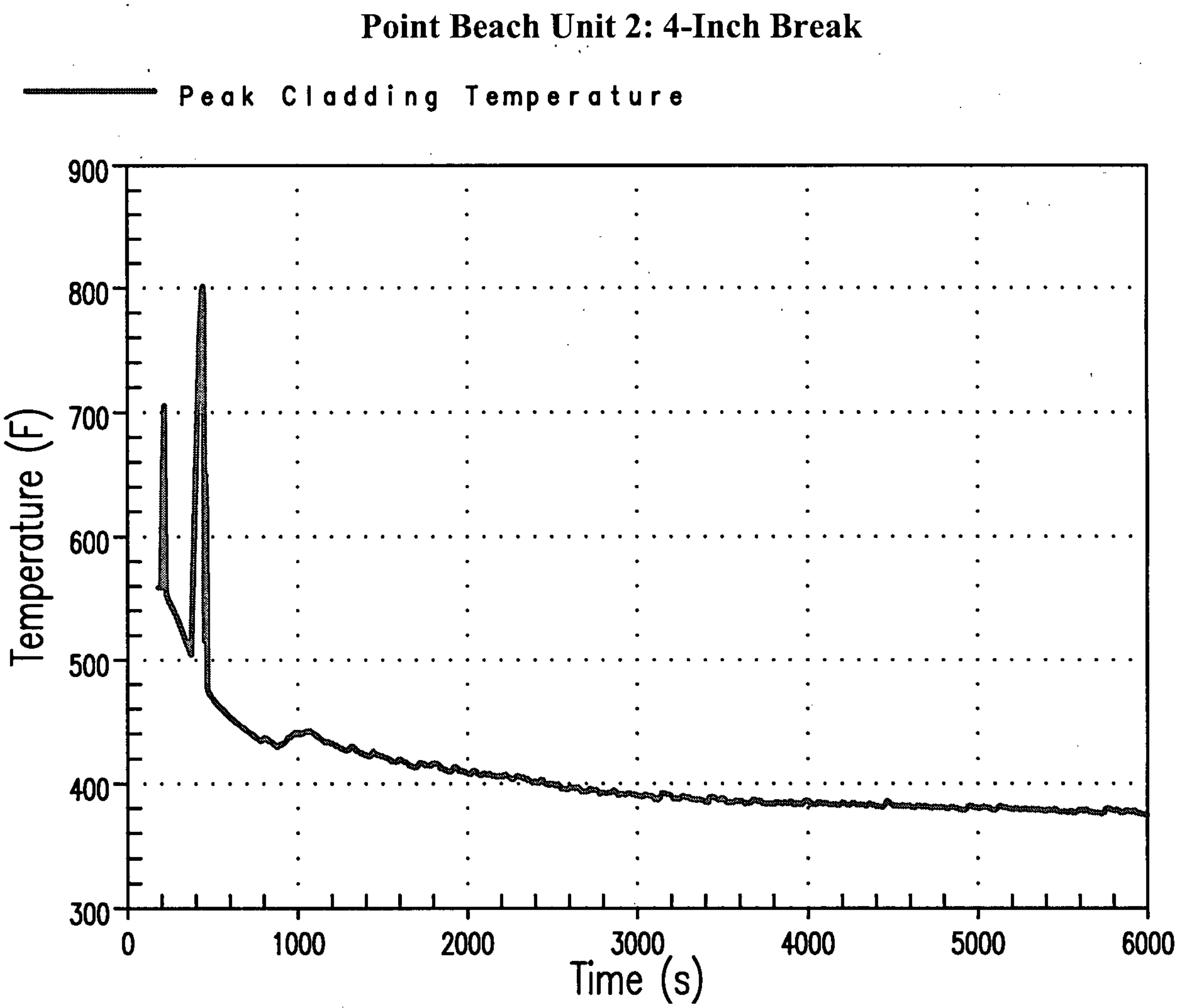


Figure 14b: Cladding Temperature at PCT Elevation (11.00 ft)

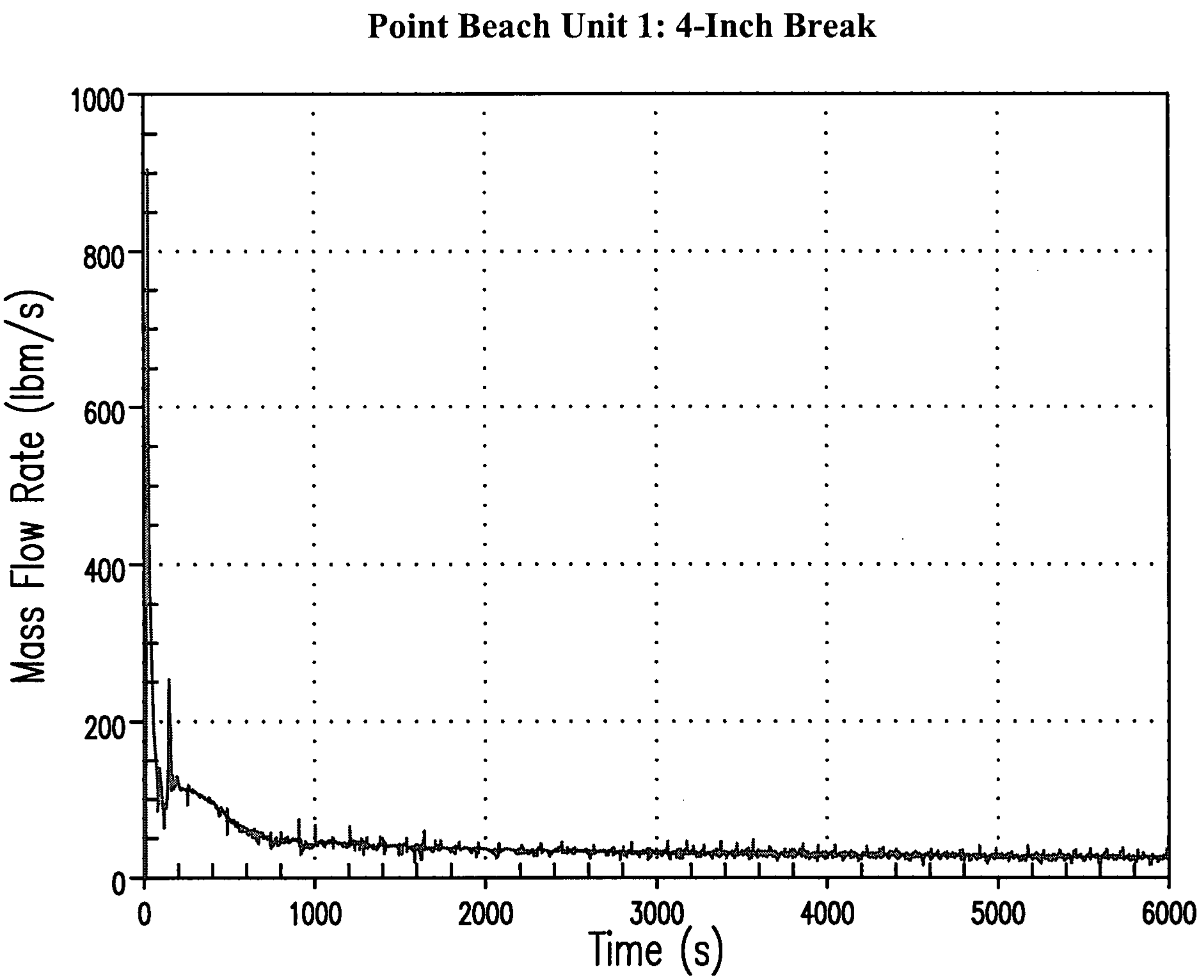


Figure 15a: Core Exit Vapor Flow

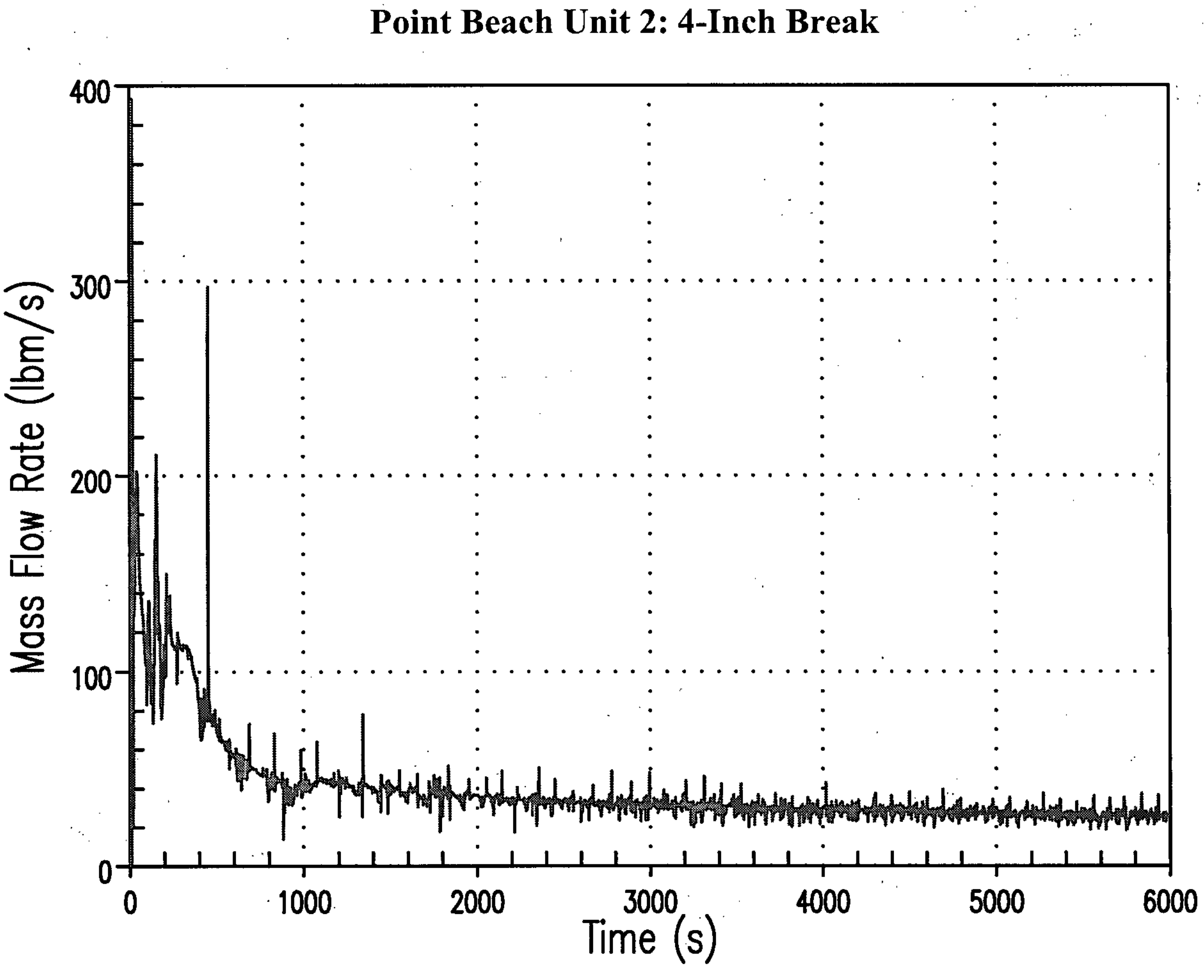


Figure 15b: Core Exit Vapor Flow

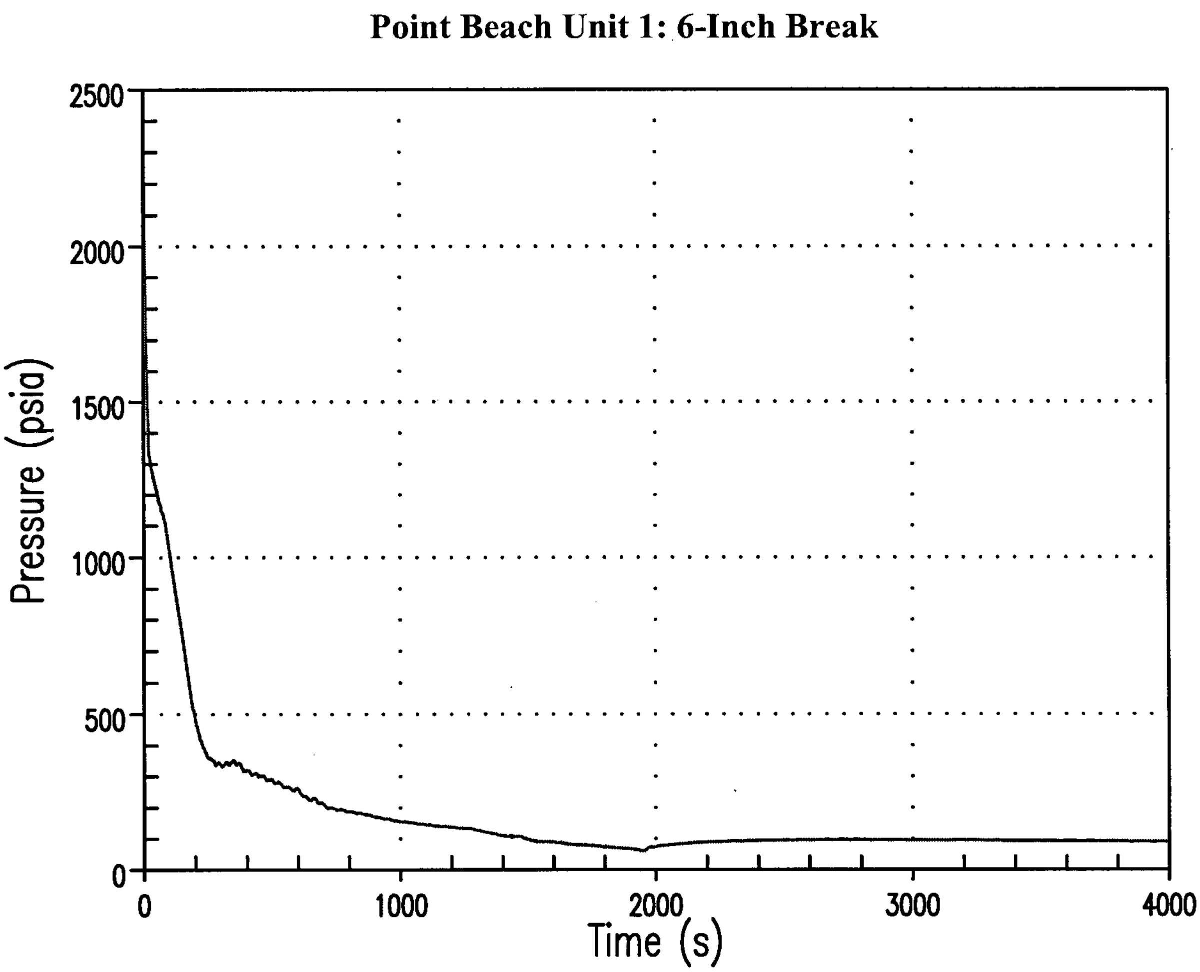


Figure 16a: Pressurizer Pressure

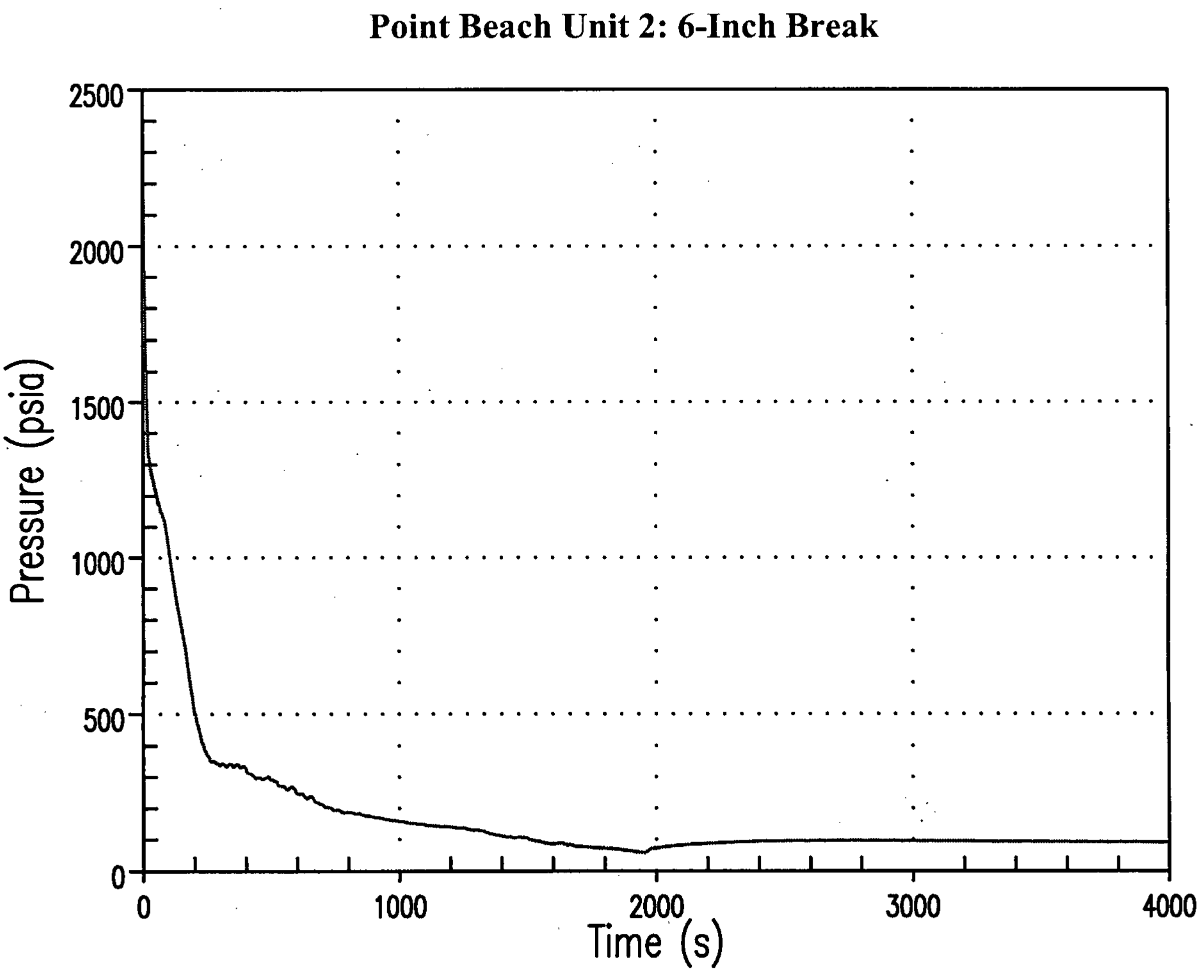


Figure 16b: Pressurizer Pressure

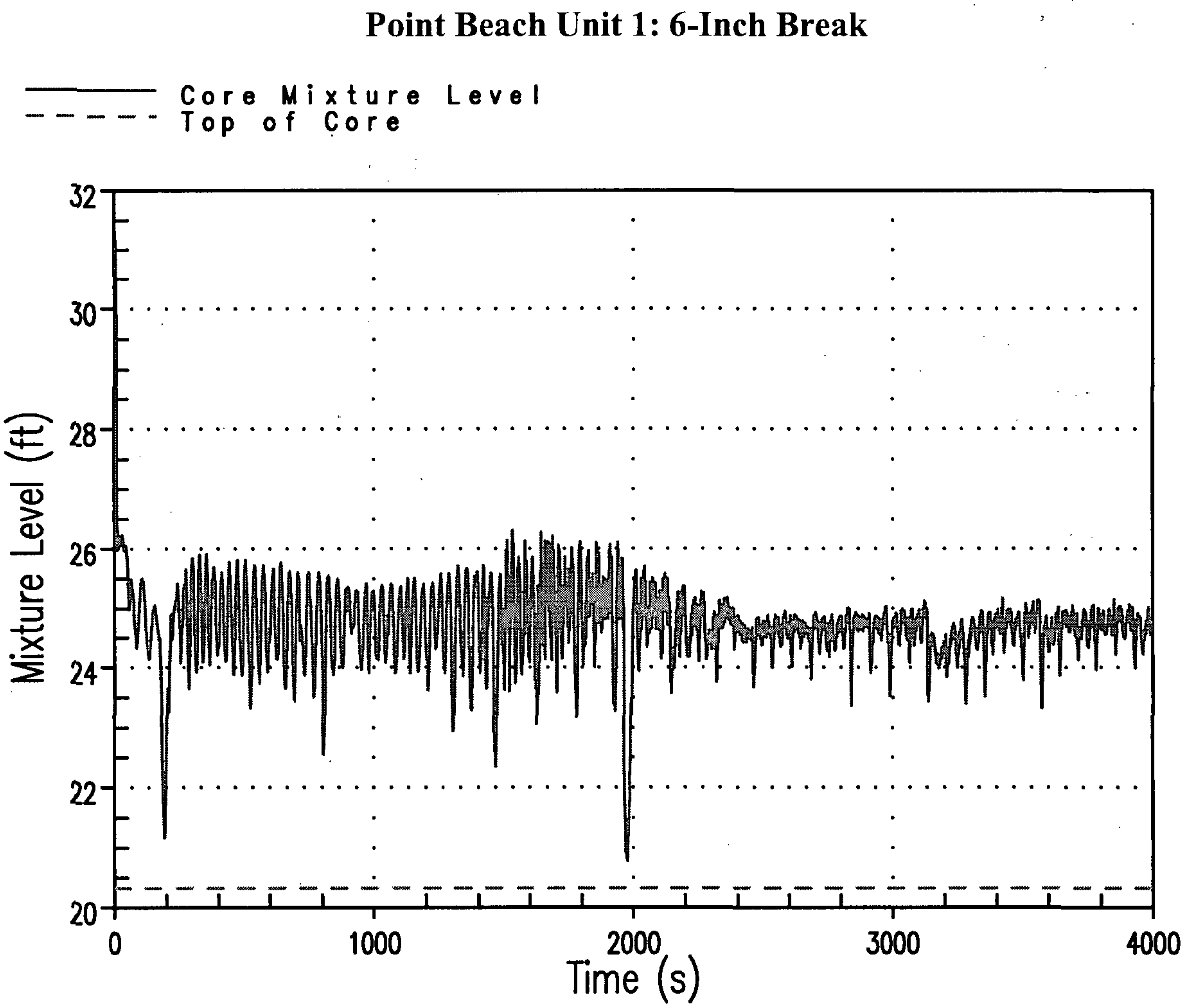


Figure 17a: Core Mixture Level

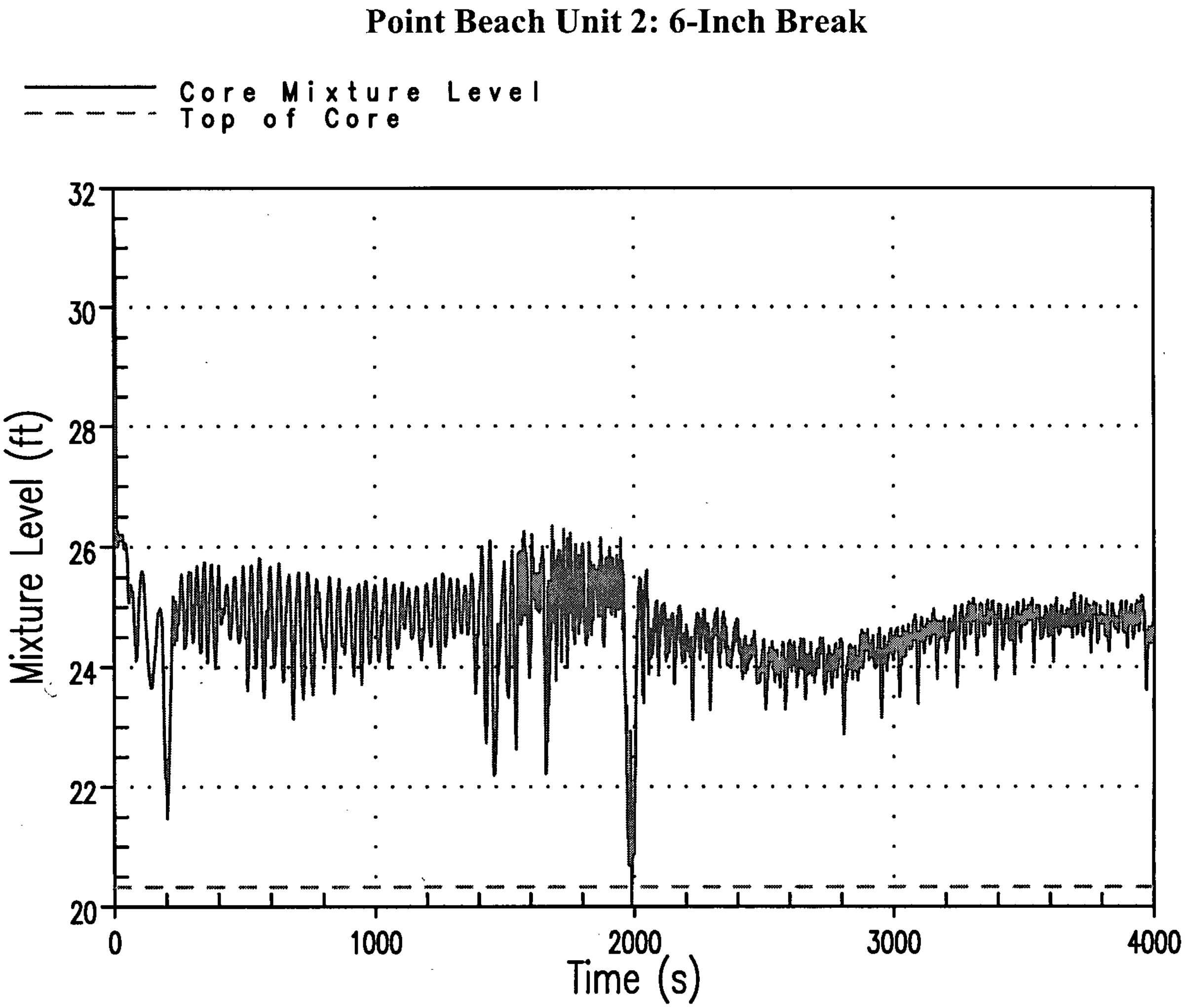


Figure 17b: Core Mixture Level

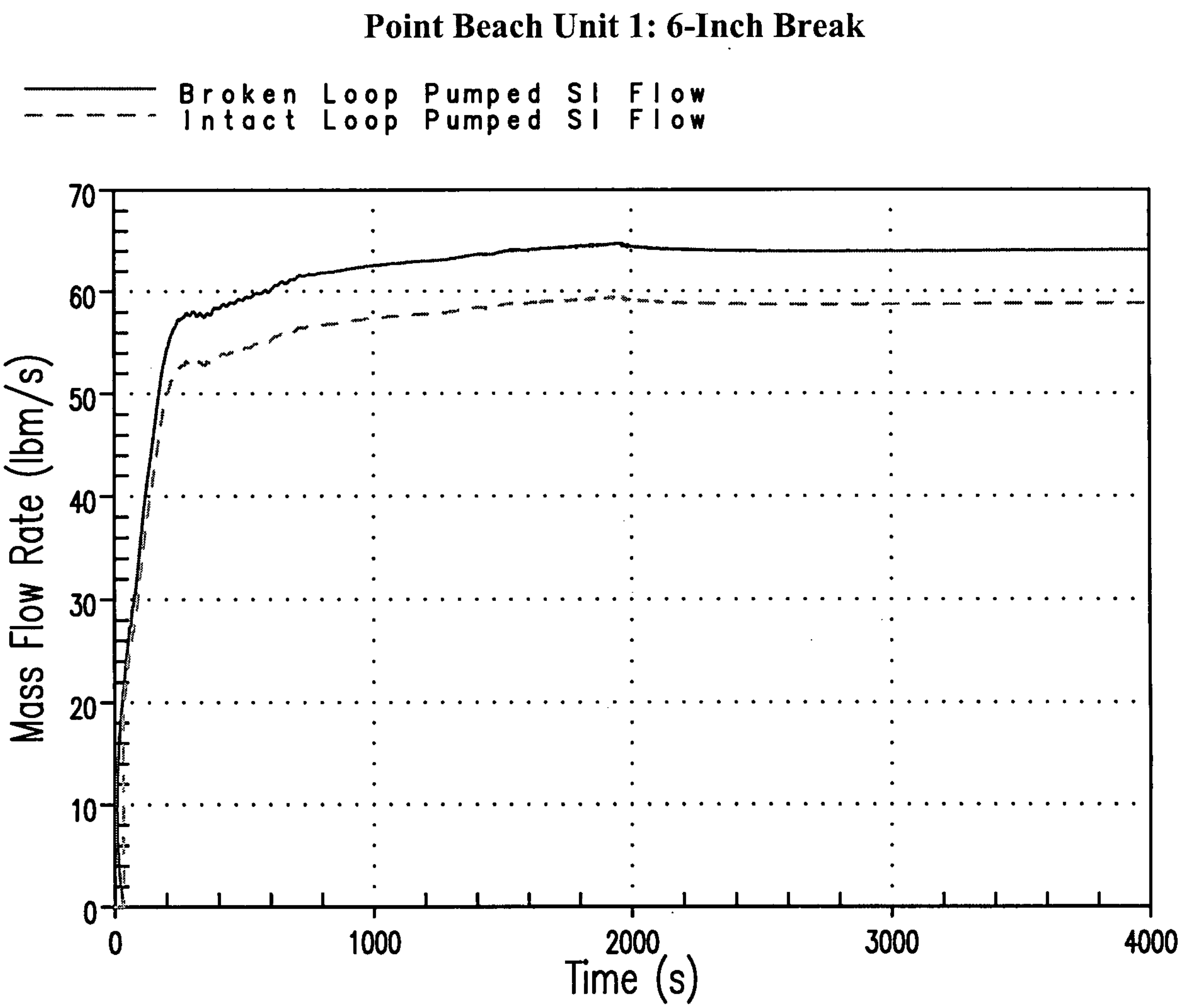


Figure 18a: Broken Loop and Intact Loop Pumped High Head SI Flow

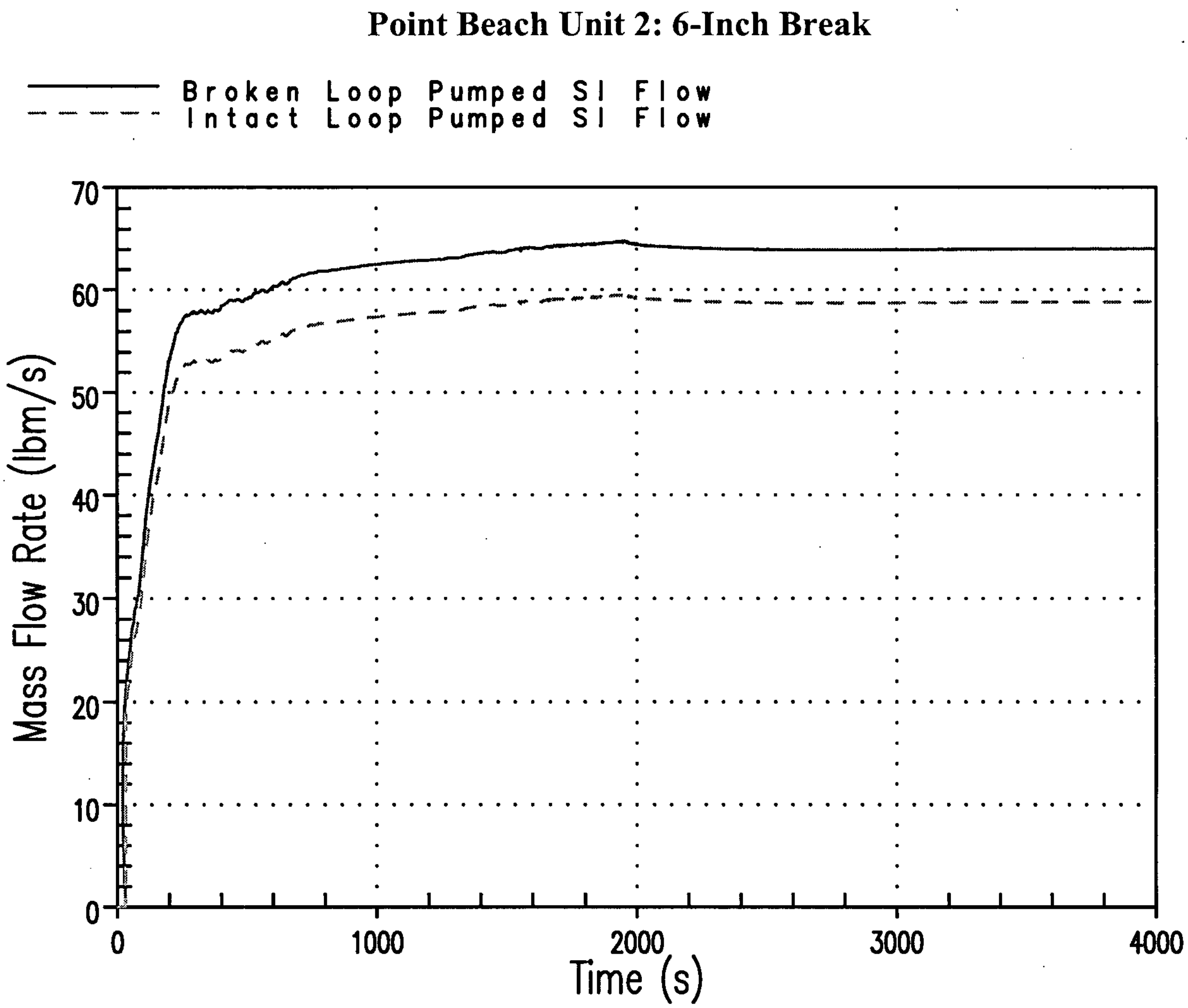


Figure 18b: Broken Loop and Intact Loop Pumped High Head SI Flow

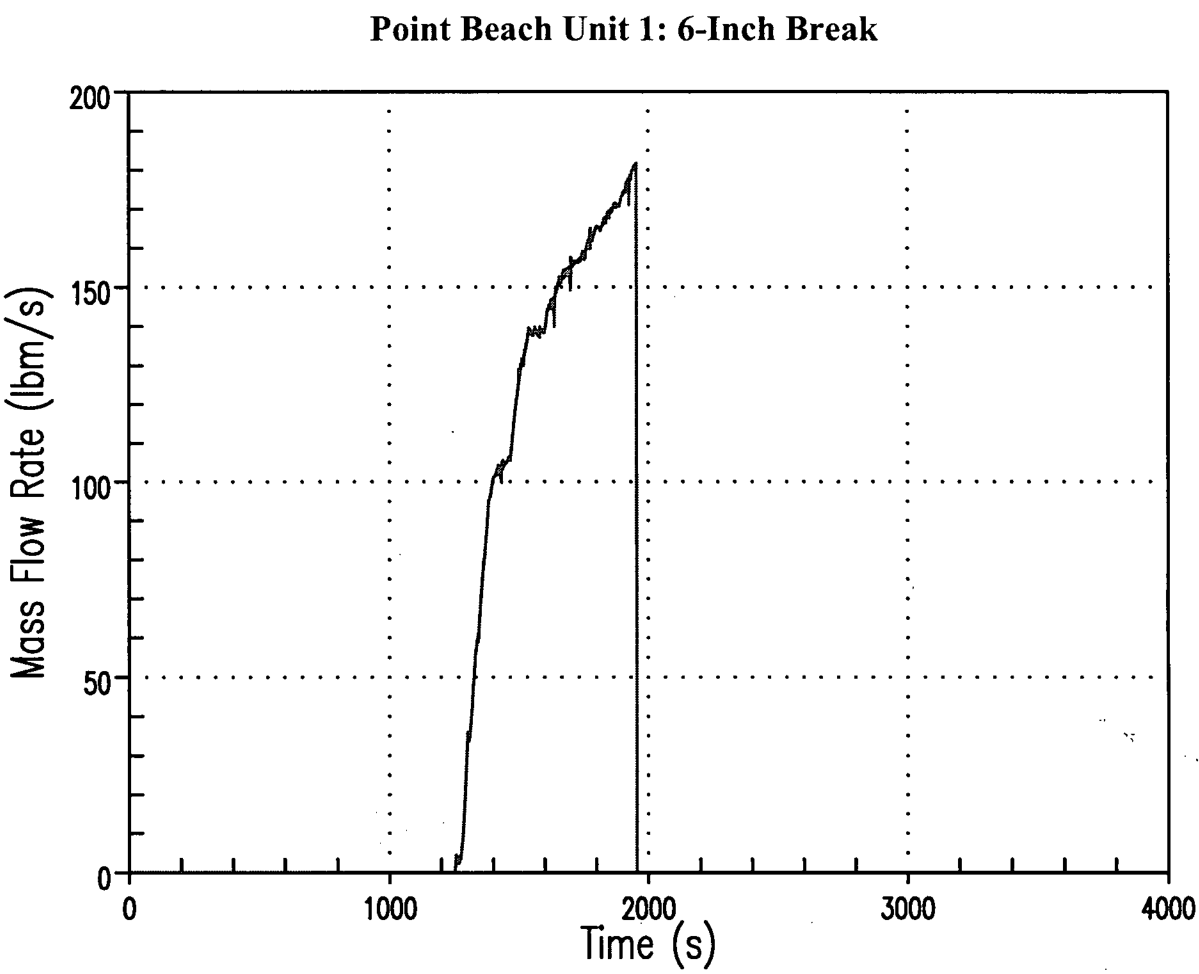


Figure 19a: Low Head Safety Injection Flow

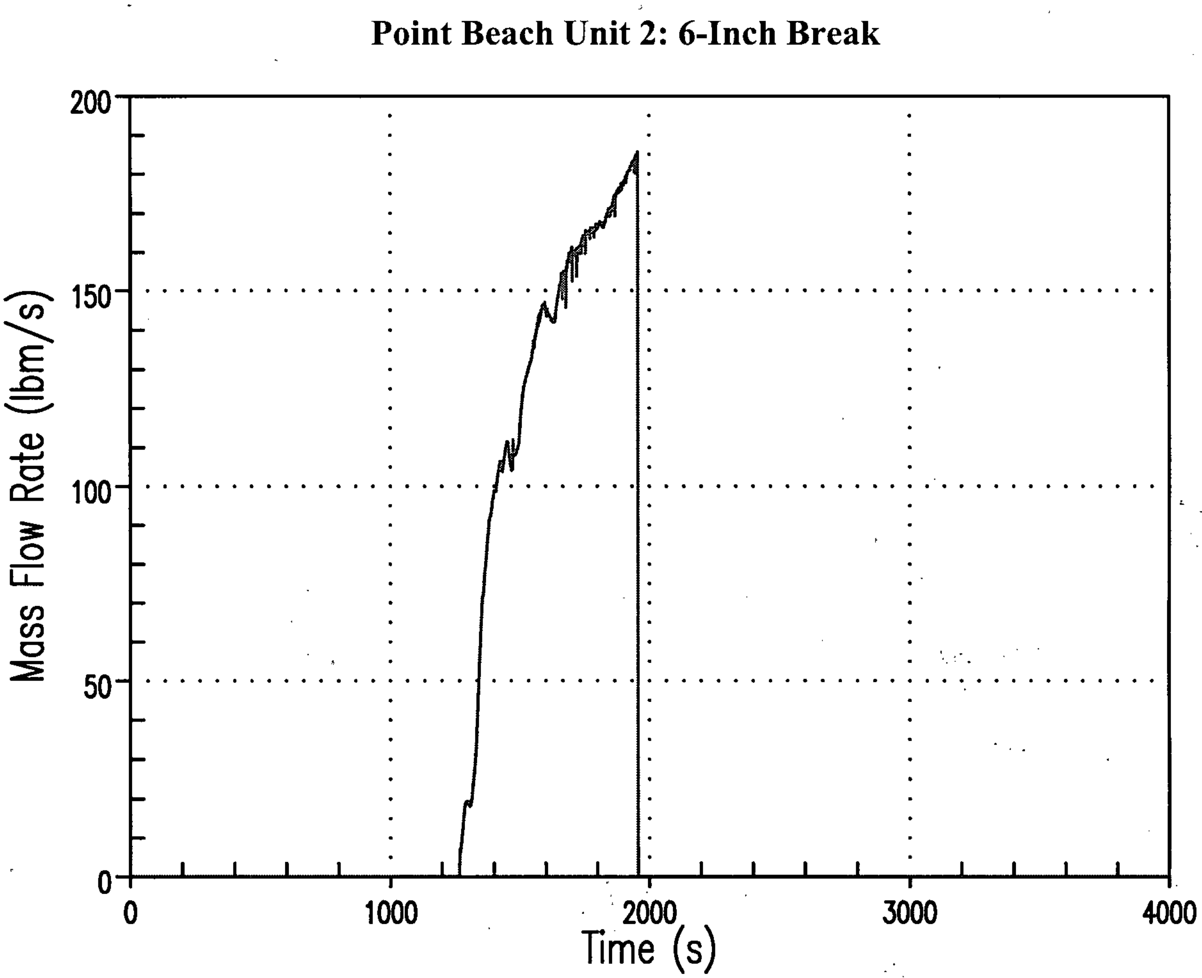


Figure 19b: Low Head Safety Injection Flow

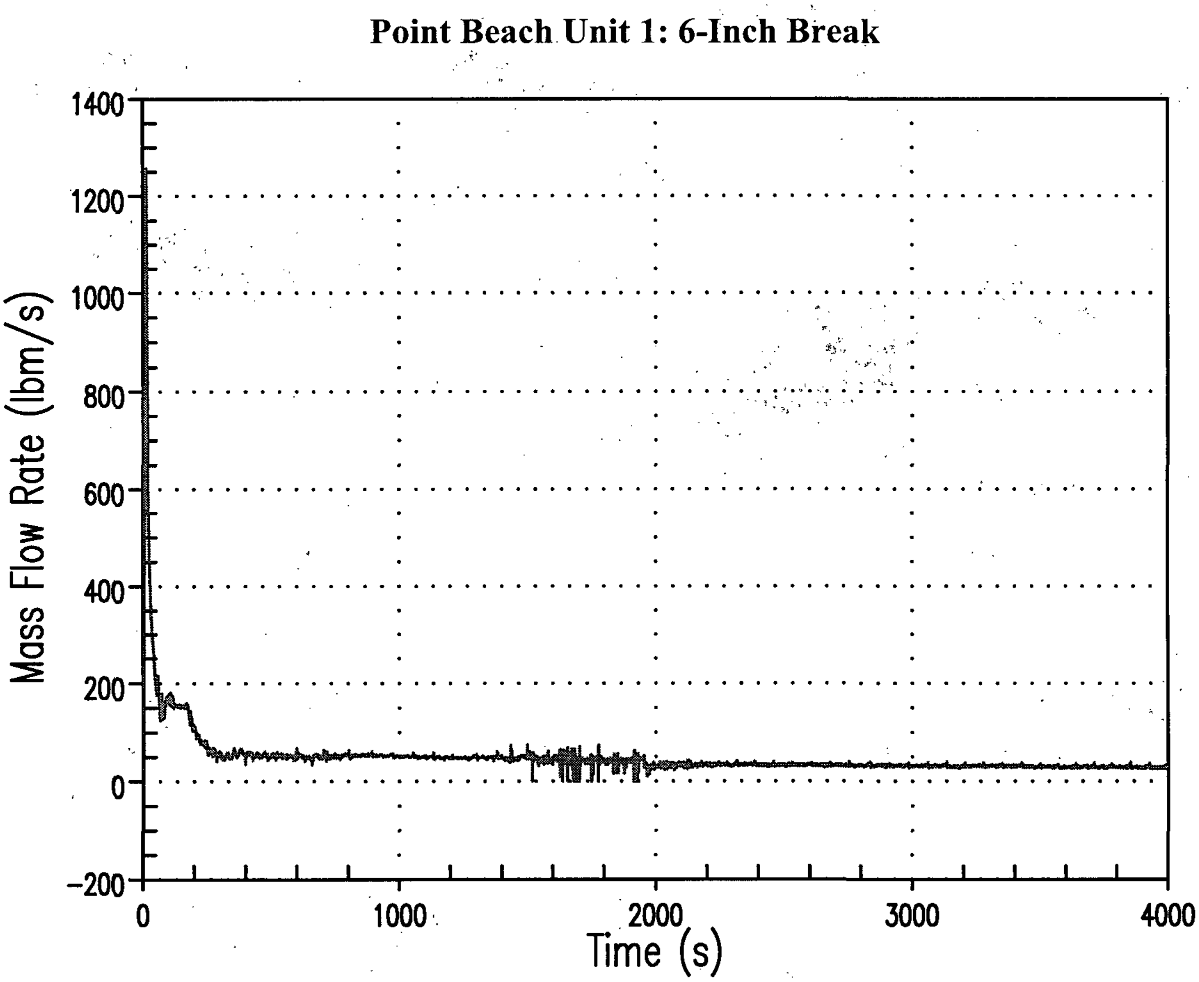


Figure 20a: Core Exit Vapor Flow

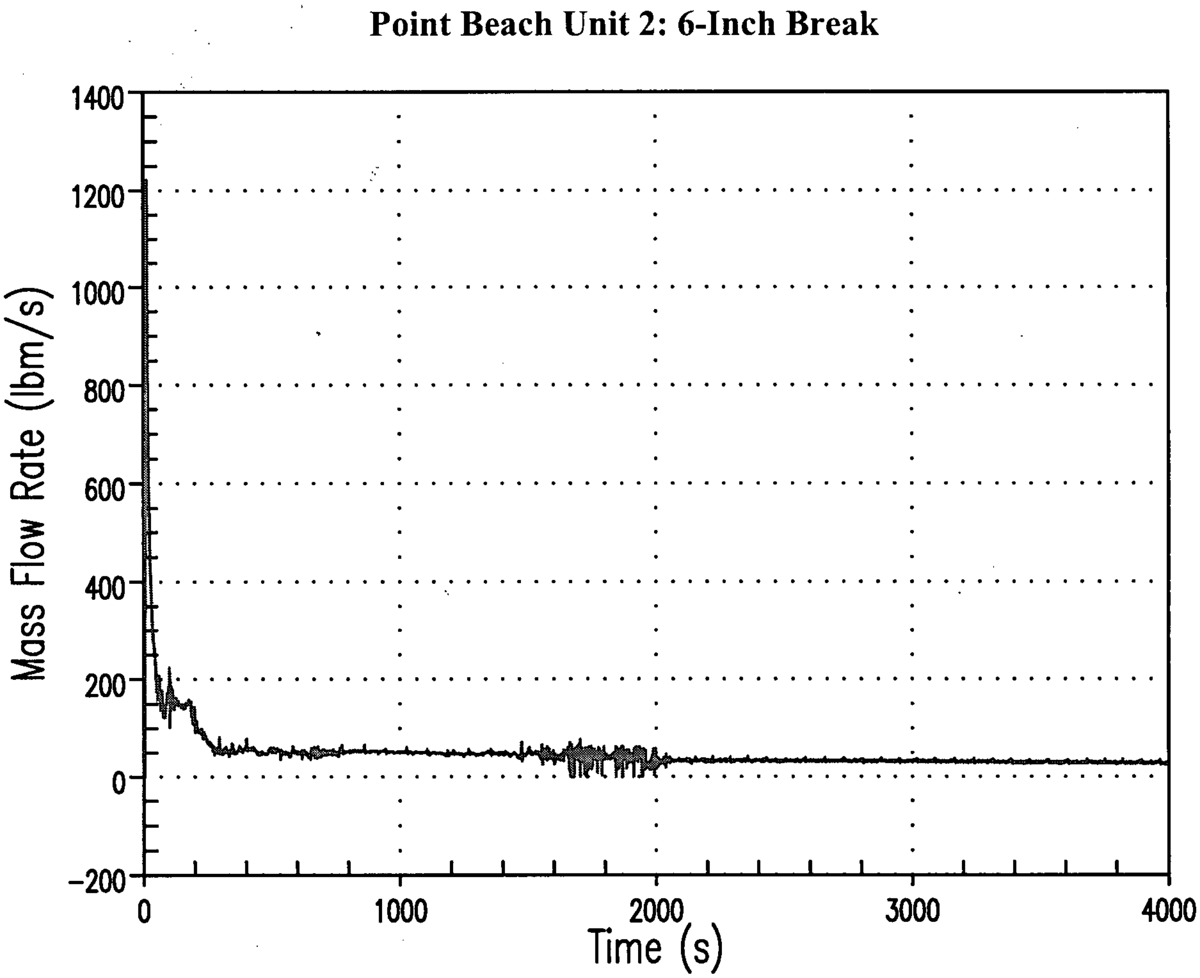


Figure 20b: Core Exit Vapor Flow

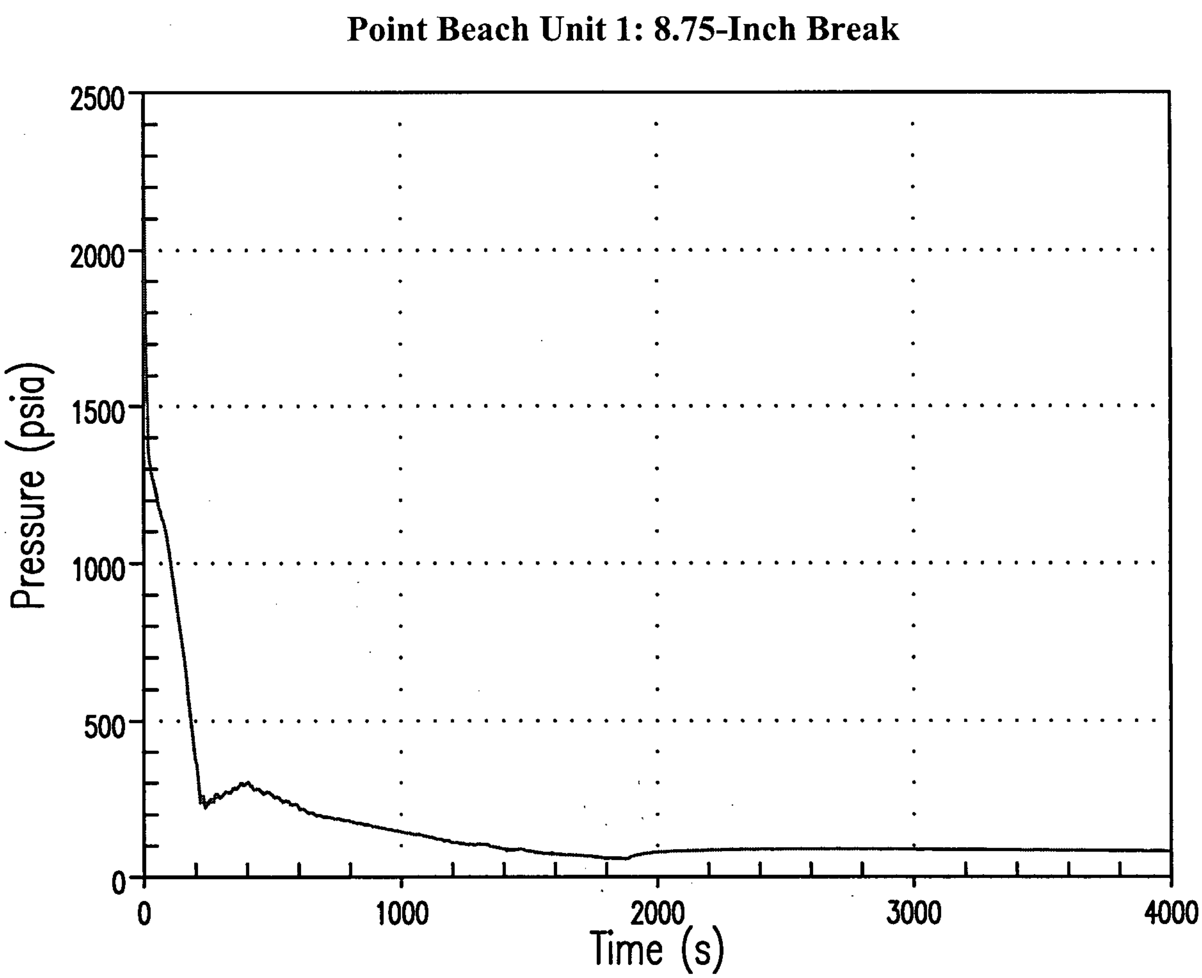


Figure 21a: Pressurizer Pressure

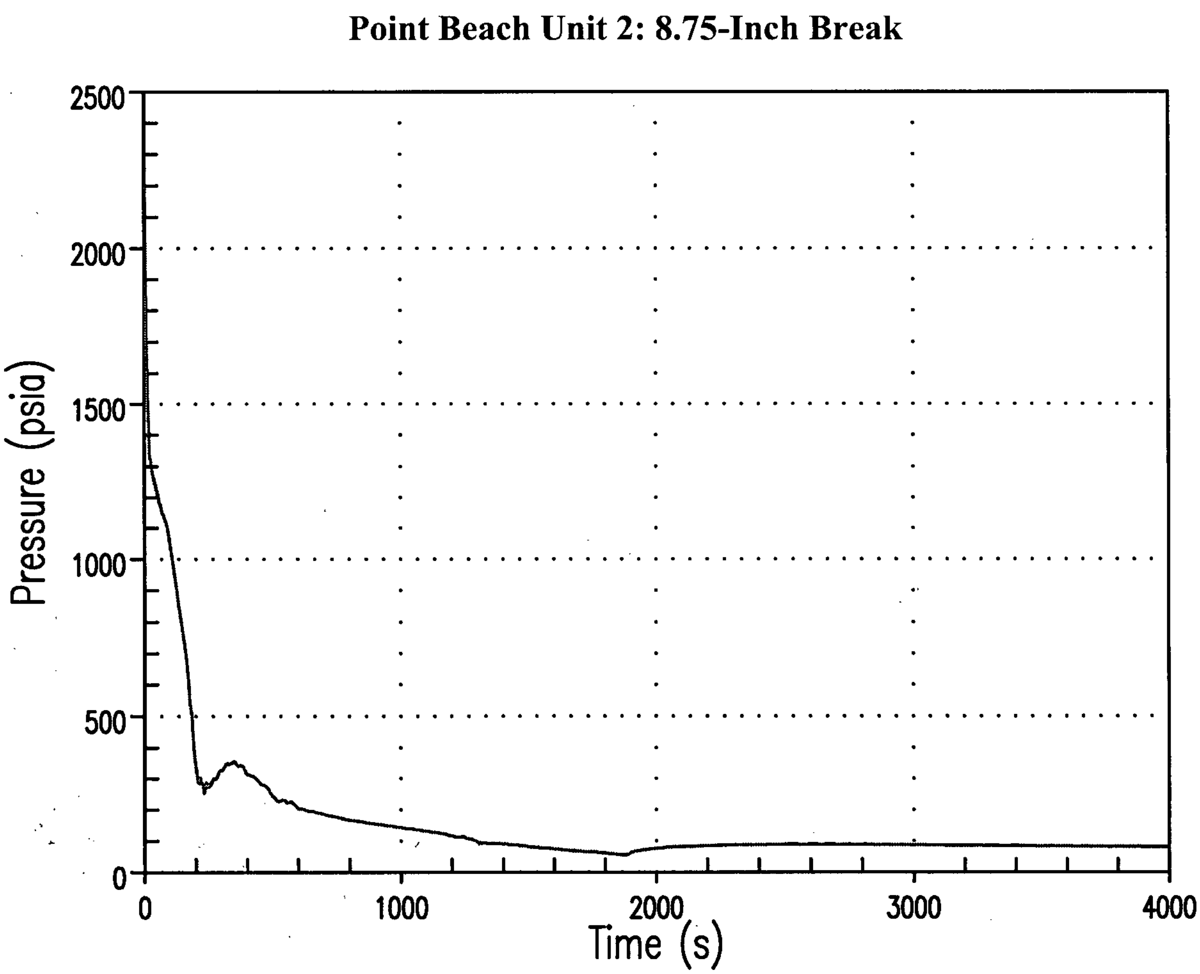


Figure 21b: Pressurizer Pressure

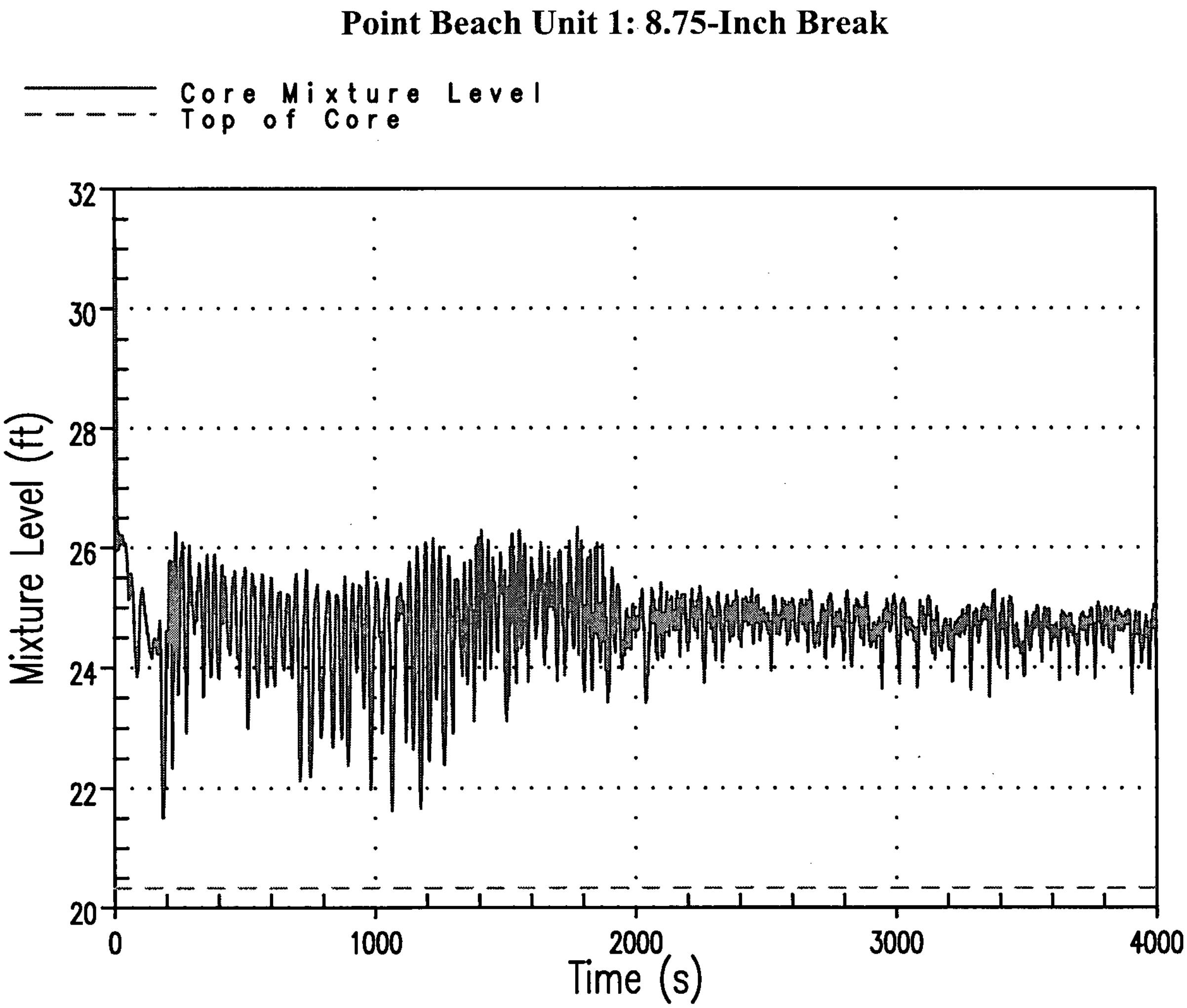


Figure 22a: Core Mixture Level

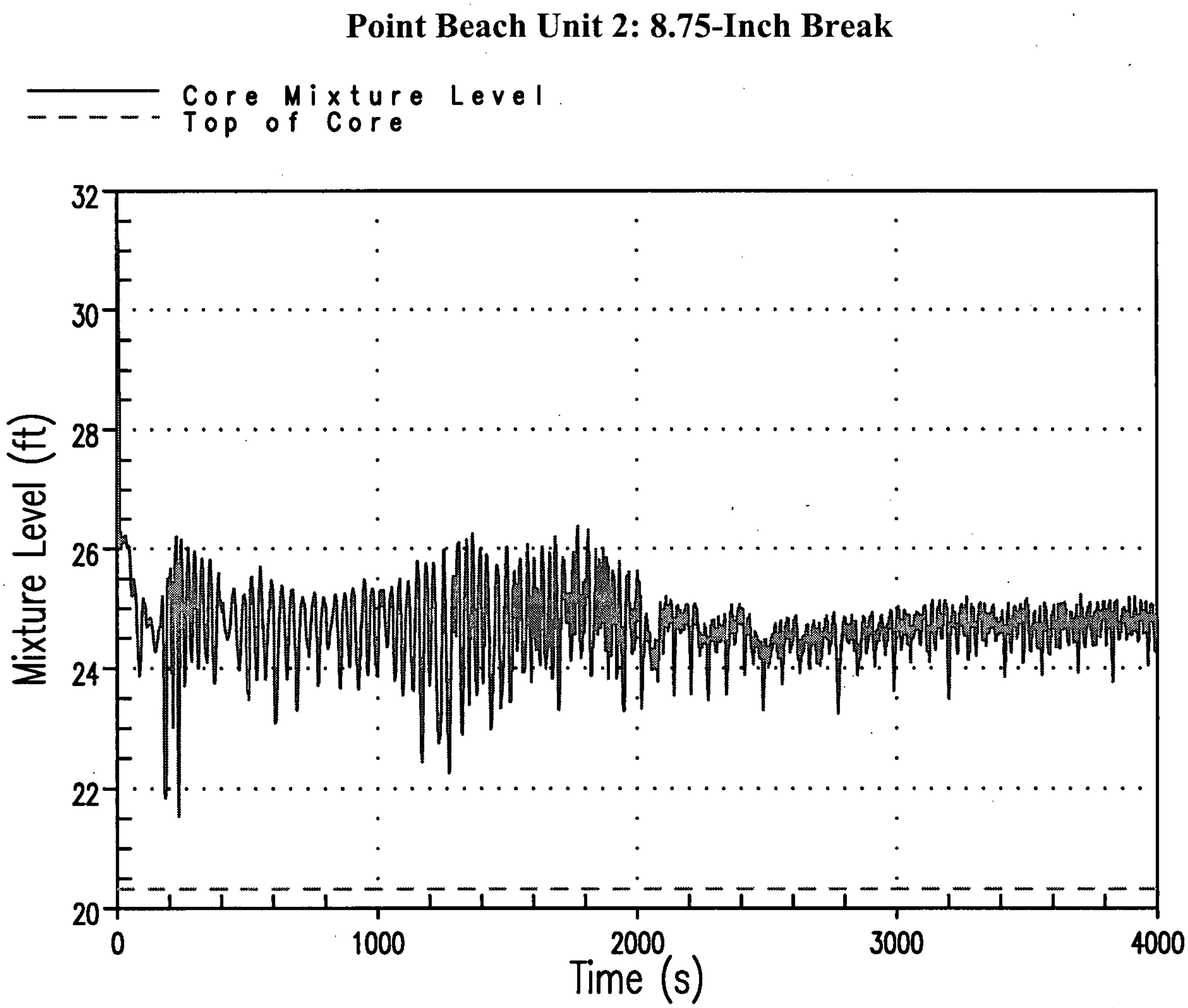


Figure 22b: Core Mixture Level

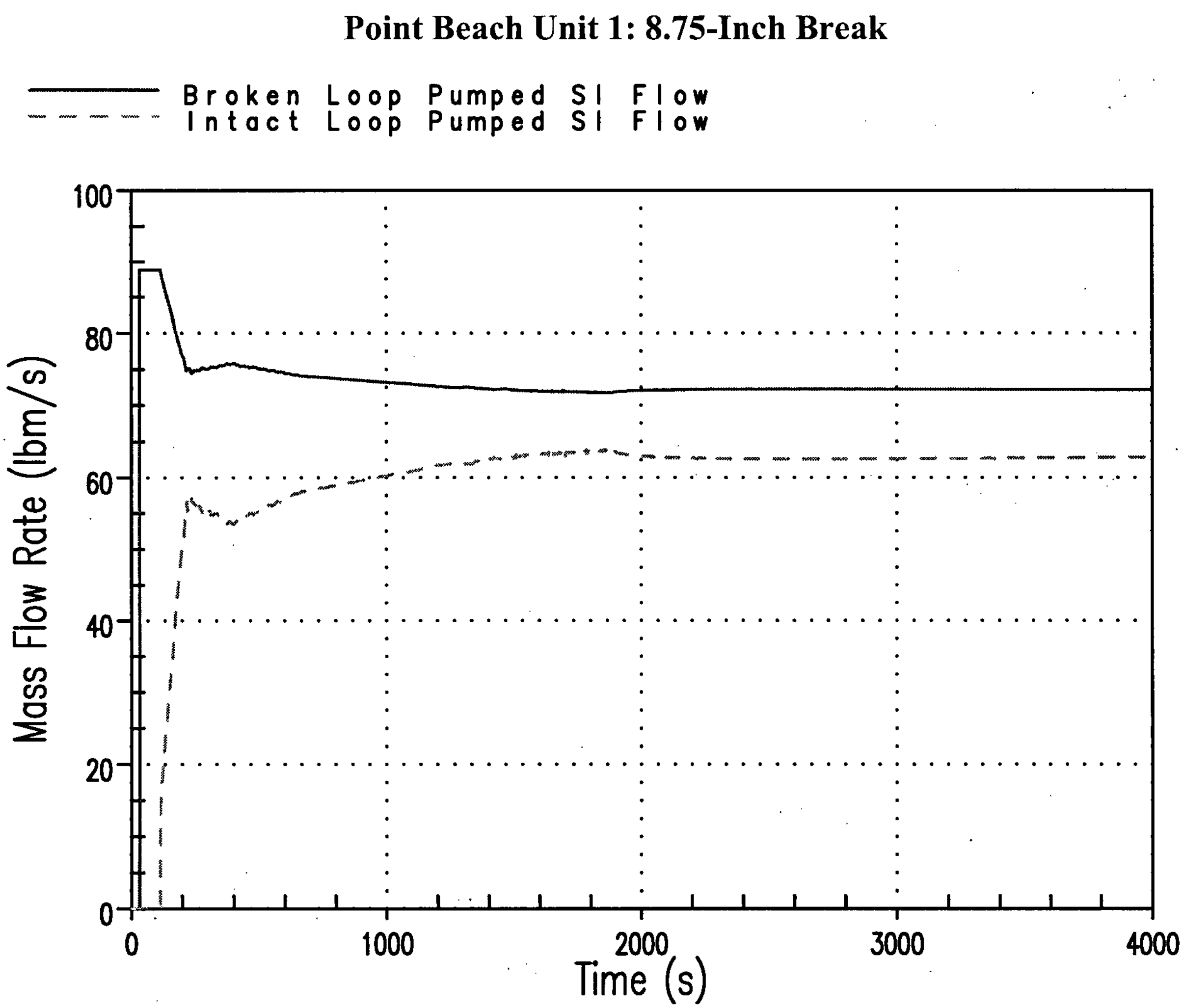


Figure 23a: Broken Loop and Intact Loop Pumped High Head SI Flow

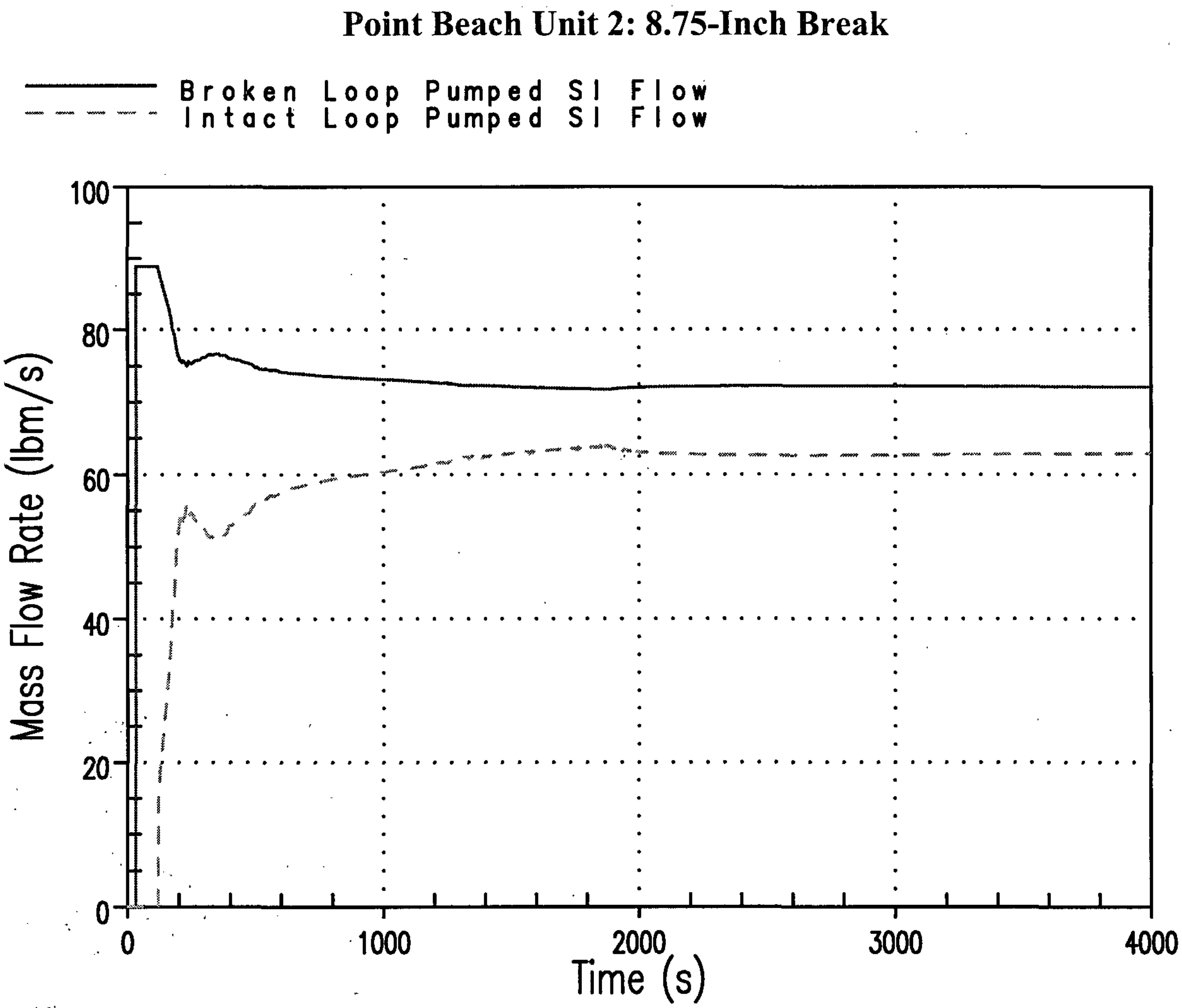


Figure 23b: Broken Loop and Intact Loop Pumped High Head SI Flow

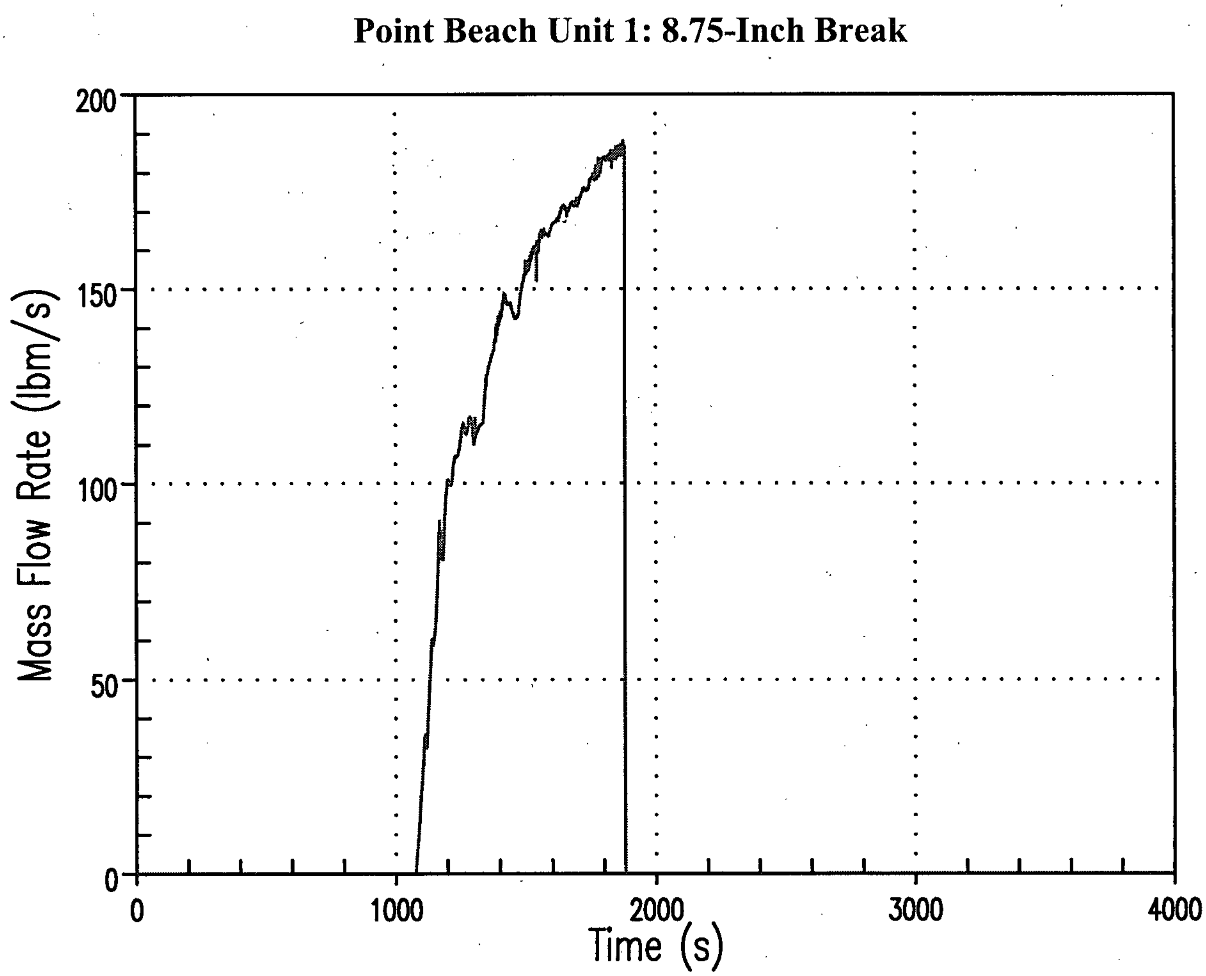


Figure 24a: Low Head Safety Injection Flow

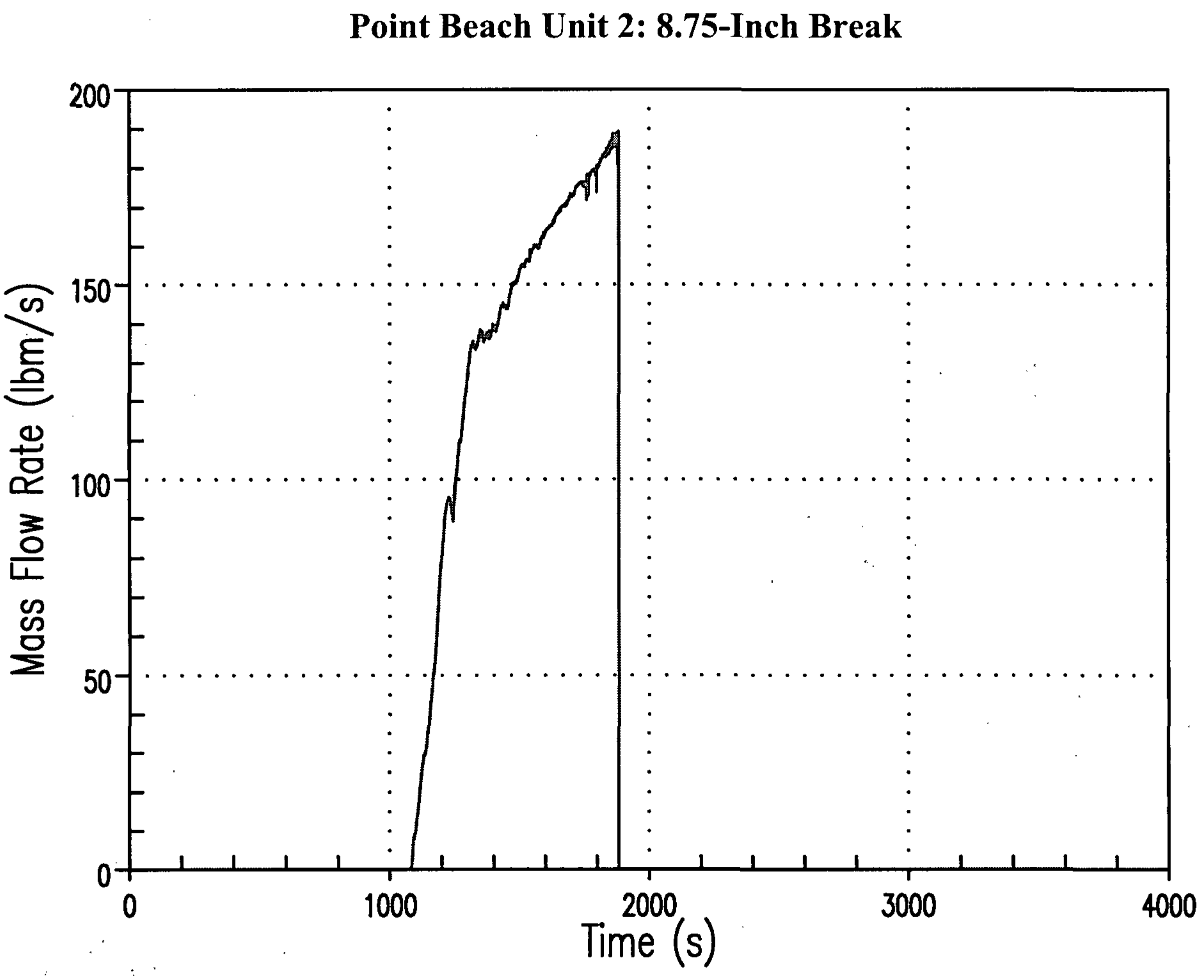


Figure 24b: Low Head Safety Injection Flow

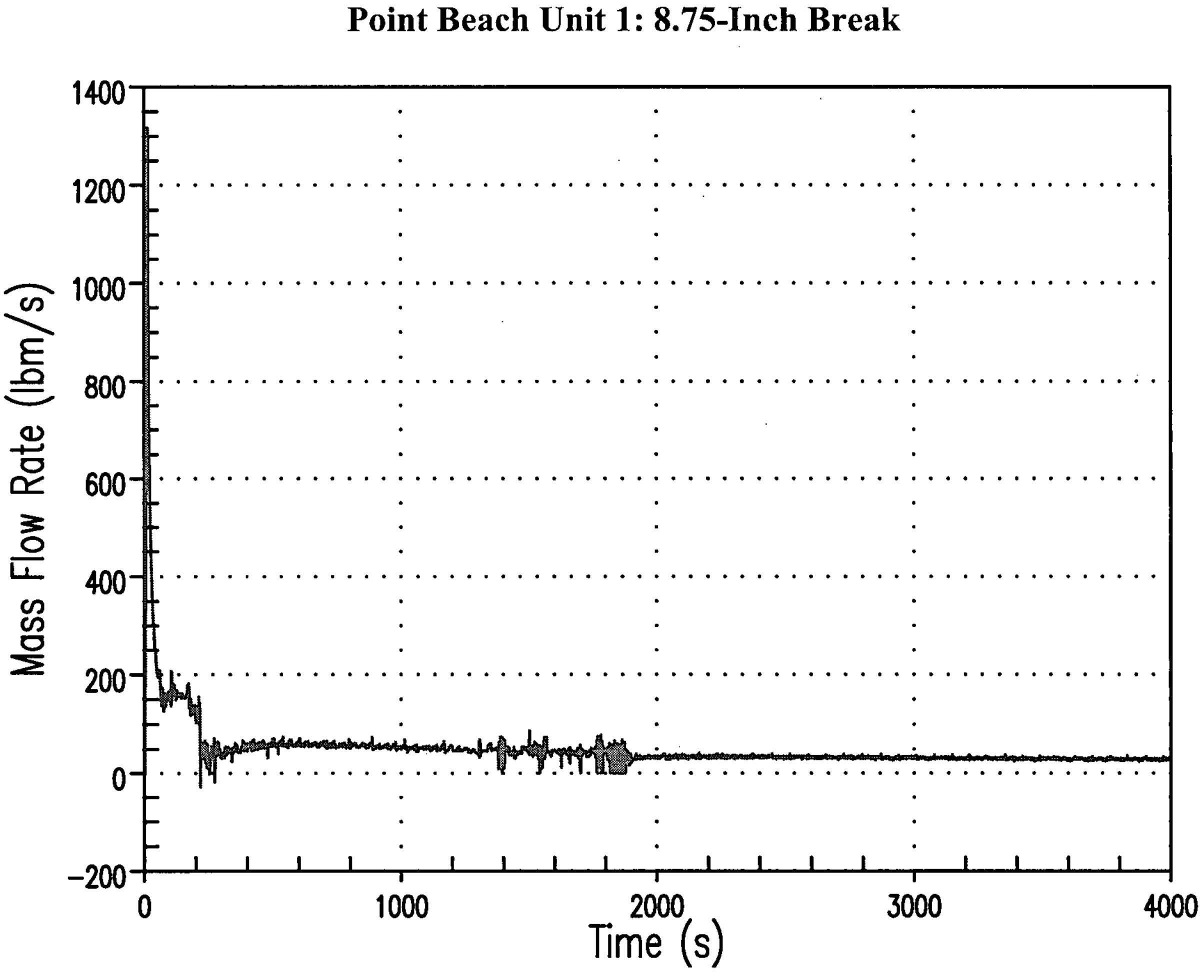


Figure 25a: Core Exit Vapor Flow

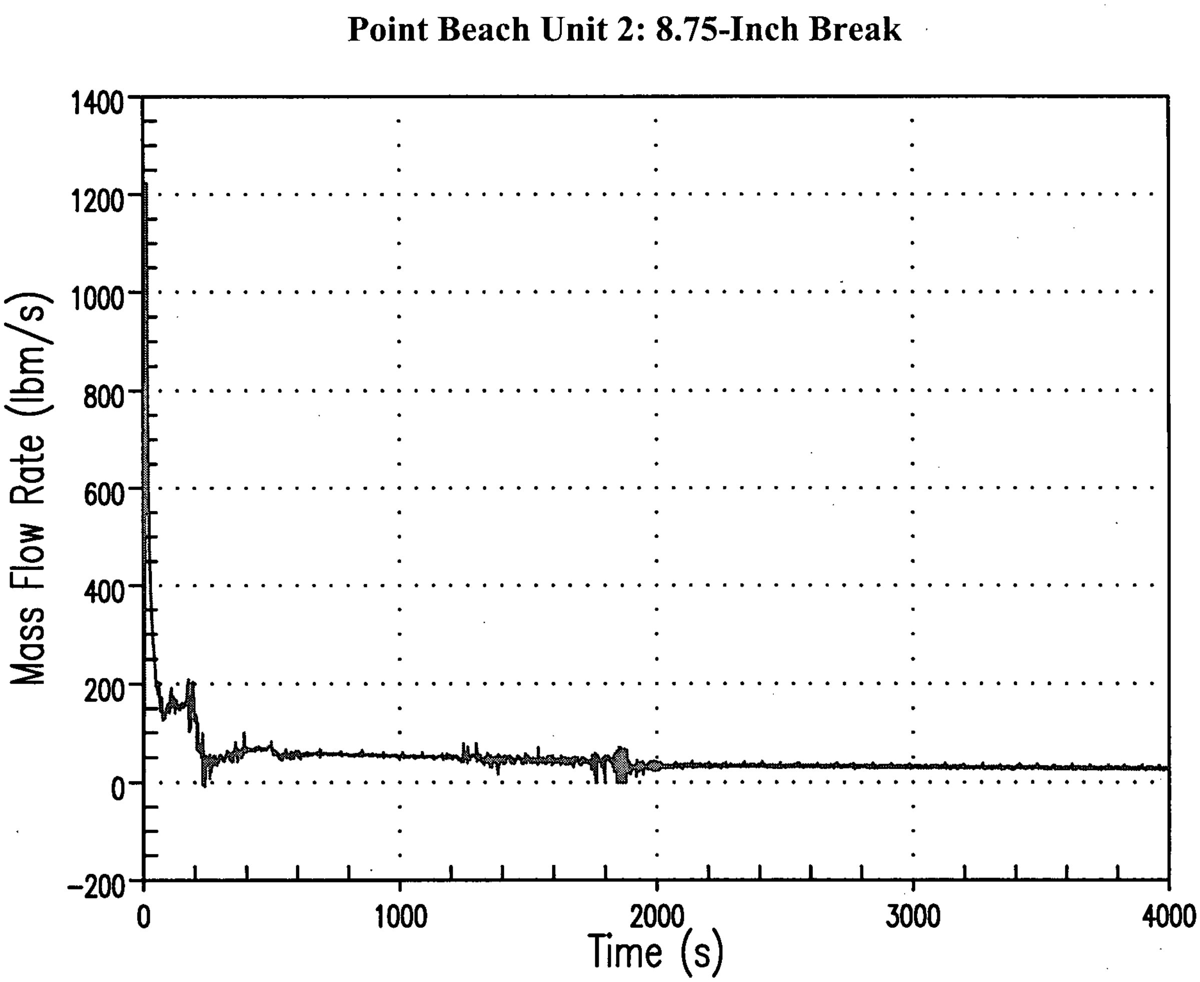


Figure 25b: Core Exit Vapor Flow

2) For the Point Beach nuclear steam supply system, please provide the following information:

a) Core Rated Thermal Power

Core Rated Thermal Power	1800 MWt

b) Power uncertainty, %

Power Uncertainty	0.6 %

c) Total Core Peaking Factor, F_Q

F_Q	2.6

d) Hot channel enthalpy rise factor, $F_{\Delta H}$

$F_{\Delta H}$	1.68

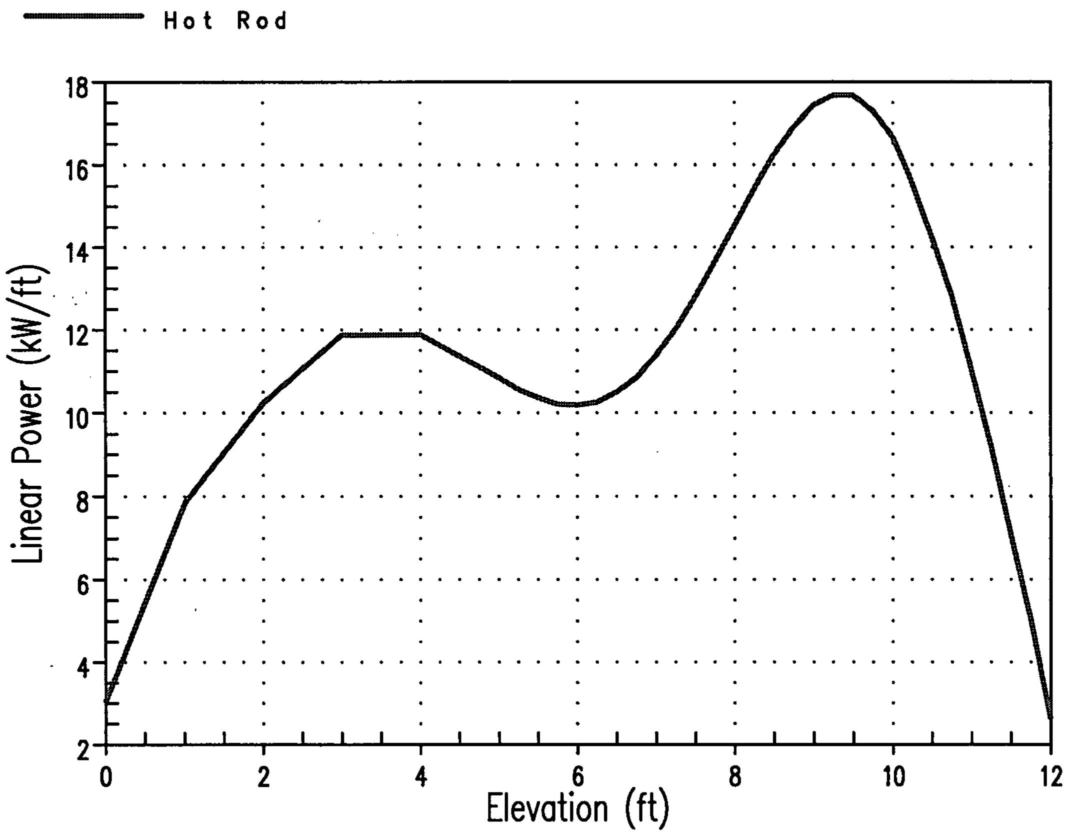
e) Hot assembly average power factor, P HA

P_{HA}	1.62

f) Most limiting top and bottom skewed axial power shapes

The Point Beach EPU SBLOCA analysis analyzed a limiting top skewed 13% axial offset axial power shape. Bottom skewed power shapes are more favorable in SBLOCA analyses as the core does not uncover to these regions. Further, bottom skewed power shapes result in more voiding and therefore increased core level swell. As such, bottom skewed axial power shapes are not analyzed in SBLOCA analyses.

The hot rod axial power shape analyzed in the Point Beach EPU SBLOCA analysis is provided in the figure below.



g) Full power loop mass flow rate, lb[m]/sec

Full Power Mass Flow Rate	9391.2 lbm/sec per loop

h) Core mass flow rate, lb[m]/sec

The percent core bypass flow analyzed is 6.5% (reflects thimble plugs removed). Therefore, the core mass flow rate can be calculated by subtracting the bypass flow from the total system flow (18782.4 lbm/sec x 0.935 = 17561.544 lbm/sec).

Core Mass Flow Rate	17561.544 lbm/sec

i) T_{hot}, °F

T_{hot}	611.327 °F

j) T_{cold}, °F

T_{cold}	542.673 °F

k) Safety injection Flow delay time, sec

SI Delay Time	28 sec

I) **High pressure safety injection (HPSI) flow rate (lb[m]/sec) vs reactor coolant system (RCS) pressure (psia)**

Table I-1

High Head Safety Injection (HHSI) Flows vs. Pressure, Minimum Safeguards, Spill to RCS Pressure (Breaks < 8.75 in. diameter)

RCS Pressure (psia)	Spilled Flow (lbm/sec)	Injected Flow (lbm/sec)
14.7	65.79	60.40
114.7	63.49	58.29
214.7	61.13	56.12
314.7	58.47	53.68
414.7	55.73	51.16
514.7	52.86	48.52
614.7	49.76	45.67
714.7	46.54	42.72
814.7	43.14	39.60
914.7	39.59	36.33
1014.7	35.38	32.46
1114.7	30.70	28.16
1214.7	25.22	23.10
1314.7	18.32	16.74
1364.7	13.53	12.29

Table I-2

High Head Safety Injection (HHSI) Flows vs. Pressure, Minimum Safeguards, Spill to 0 psig Containment Pressure (Breaks 8.75 in. diameter)

RCS Pressure (psia)	Spilled Flow (lbm/sec)	Injected Flow (lbm/sec)
14.7	71.09	65.46
114.7	72.75	61.48
214.7	74.45	57.31
314.7	76.10	52.79
414.7	77.81	48.00
514.7	79.61	42.87
614.7	81.53	37.32
714.7	83.56	31.16
814.7	85.78	24.17
914.7	88.33	15.96
934.7	88.90	14.10
934.71	88.90	0.00

m) HPSI runout flow rate

A specific runout flow value was not required for input in the small break LOCA analysis; however, estimated runout flow can be determined by summing the injected and spilled flows at 14.7 psia from the tables provided in Item l.

n) Low pressure safety injection flow rate (lb[m]/sec) vs RCS pressure (psia)

Low Head Safety Injection (LHSI) Flows vs. Pressure, Minimum Safeguards, (Upper Plenum Injection)

RCS Pressure (psia)	Injected Flow (lbm/sec)
14.7	235.2
24.7	224.8
34.7	214.2
44.7	202.8
54.7	190.8
64.7	178.3
74.7	164.9
84.7	150.7
94.7	133.3
104.7	113.9
114.7	90.9
134.7	0.0

o) If charging flow is part of the emergency core cooling system (ECCS), provide the flow vs pressure for this pump curve also

Only high head and low head safety injection flows were analyzed in the Point Beach EPU SBLOCA analysis. The charging pumps at Point Beach are not part of the ECCS.

p) Head flow curves for the ECCS pumped injection assuming a severed injection line.

High head safety injection flows for a severed accumulator line are provided in Item l, Table l-2.

q) Active Core height, ft

Active fuel Height	[ ]a,c

r) Peak linear heat generation rate, kw/ft

Peak Linear Heat Generation Rate	17.6888 kW/ft

s) Average linear heat generation rate, kw/ft

Core Average linear heat generation Rate	6.7995 kW/ft

t) Number of fuel rods

Number of Fuel Rods per Assembly	179
Total Number of Fuel Rods in the Core	21659

u) Number of fuel assemblies

Number of Fuel Assemblies	121

v) Fuel rod pellet diameter and inside and outside radius of cladding

	Radius	Diameter
Pellet	0.18295 in	0.3659 in
Cladding Inner	0.1867 in	0.3734 in
Cladding Outer	0.211 in	0.4220 in

w) Radiological waste[(1)] storage tank (RWST) max temperature, °F

	Temperature (°F)
RWST, Maximum	100
RWST, SBLOCA Analysis	100

[(1)] It is assumed that the NRC intended to request the Refueling Water Storage Tank (RWST) temperature.

x) RWST capacity, gallons, and boron concentration

	Boron Concentration (ppm)
RWST, Minimum	2800
RWST, Maximum	3200

	Capacity (gal)
RWST, Post-LOCA Analysis	289,504
RWST, SBLOCA Analysis	164,624

y) Accumulator minimum pressure (psia)

	Pressure (psia)
Accumulator, Minimum	700(1)
Accumulator, SBLOCA Analysis	695

(1) Without uncertainties.

z) Accumulator minimum liquid volume, ft^3, and maximum boric acid concentration

	Liquid Volume (ft^3)	Boron Concentration (ppm)
Accumulator, Minimum	1100	N/A
Accumulator, Maximum	N/A	3100
Accumulator, SBLOCA Analysis	1118	N/A

aa) **Volumes and heights of the following regions, each identified separately:**

i) **Lower Plenum**
ii) **Core**
iii) **Upper plenum below the bottom elevation of the hot-leg**

	Volume (ft^3)
Lower Plenum	[ ]^{a,c}
Core	[ ]^{a,c}
Upper Plenum Below the Bottom Elevation of the Hot Leg	[ ]^{a,c}

	Height (ft)
Lower Plenum	[ ]^{a,c}
Core	11.9375
Upper Plenum Below the Bottom Elevation of the Hot Leg	[ ]^{a,c}

bb) **Elevation data**

i) **Bottom elevation of suction leg horizontal leg piping**
ii) **Top elevation of cold-leg at reactor coolant pump discharge**
iii) **Top elevation of the core (also core height)**
iv) **Bottom elevation of the downcomer**

	Elevation (ft)
Bottom of Suction Leg Horizontal Piping	[ ]^{a,c}
Top of Cold Leg at Reactor Coolant Pump Discharge	[ ]^{a,c}
Top of the Core (also Core Height)	[ ]^{a,c}(11.9375)
Bottom of the Downcomer	[ ]^{a,c}

(1) All elevations referenced from the bottom of the reactor vessel.

cc) **Loop friction and geometry pressure losses from the core exit through the steam generators to the inlet nozzle of the reactor vessel**

	0% SGTP Loss Coefficient (ft/gpm^2)	10% SGTP Loss Coefficient (ft/gpm^2)
Upper Plenum to Hot Leg Nozzle	[ ]^{a,c}	SAME
Hot Leg Nozzle	[ ]^{a,c}	SAME
Hot Leg	[ ]^{a,c}	SAME
Steam Generator Inlet	[ ]^{a,c}	SAME
Steam Generator Tubes, Inlet to U-Bend	[ ]^{a,c}	[ ]^{a,c}
Steam Generator U-Bend	[ ]^{a,c}	[ ]^{a,c}
Steam Generator Tubes, U-Bend Outlet	[ ]^{a,c}	[ ]^{a,c}
Steam Generator Outlet	[ ]^{a,c}	SAME
Pump Suction Leg	[ ]^{a,c}	SAME
Cold Leg	[ ]^{a,c}	SAME
Cold Leg Nozzle	[ ]^{a,c}	SAME
Intact Cold Leg to Broken Cold Leg	[ ]^{a,c}	SAME

dd) **Locked rotor reactor coolant pump (RCP) k-factor**

	0% SGTP Loss Coefficient (ft/gpm^2)
Locked Rotor (Forward Flow)	[ ]^{a,c}
Locked Rotor (Reverse Flow)	[ ]^{a,c}

ee) **Mass flow rates, flow areas, k-factors, and coolant temperatures for the pressure losses provided (upper plenum, hot-legs, steam generators, suction legs, RCPs, and discharge legs). Please include the reduced SG flow areas due to plugged tubes. Please also provide the loss from each of the intact cold-legs through the annulus to a single broken cold-leg. Please also provide the equivalent loop resistance for the broken loop and separately for the intact loop.**

#		Mass Flow Rate (lbm/hr)	0% SGTP Flow Area (in^2)	10% SGTP Flow Area (in^2)	k-factor (ft/gpm^2)	Coolant Temperature (°F)
1	Upper Plenum to Hot Leg Nozzle	[ ]a,c	[ ]a,c	SAME	[ ]a,c	611.1
2	Hot Leg Nozzle	[ ]a,c	[ ]a,c	SAME	[ ]a,c	611.1
3	Hot Leg	[ ]a,c	[ ]a,c	SAME	[ ]a,c	611.1
4	Steam Generator Inlet	[ ]a,c	[ ]a,c	SAME	[ ]a,c	611.1
5	Steam Generator Tubes, Inlet to U-Bend	[ ]a,c	[ ]a,c	[ ]a,c	[ ]a,c	577.0
6	Steam Generator U-Bend	[ ]a,c	[ ]a,c	[ ]a,c	[ ]a,c	577.0
7	Steam Generator Tubes, U-Bend Outlet	[ ]a,c	[ ]a,c	[ ]a,c	[ ]a,c	577.0
8	Steam Generator Outlet	[ ]a,c	[ ]a,c	SAME	[ ]a,c	542.7
9	Pump Suction Leg	[ ]a,c	[ ]a,c	SAME	[ ]a,c	542.7
10	Cold Leg	[ ]a,c	[ ]a,c	SAME	[ ]a,c	542.9
11	Cold Leg Nozzle	[ ]a,c	[ ]a,c	SAME	[ ]a,c	542.9
12	Intact Cold Leg to Broken Cold Leg	Not Modeled	[ ]a,c	SAME	[ ]a,c	542.9

Loop Resistance Data		
Analysis	Parameter	Loss Coefficient (ft/gpm^2)
Large Break – The conditions that could lead to a buildup and potential precipitation of boric acid in the core only exist for a hot leg break when cold leg SI injection is terminated.	Broken Loop: Upper Plenum to Hot Leg	[(1)]a,c
	Broken Loop: Hot Leg to Downcomer at Cold Leg Inlet	[(2)]a,c
	Intact Loop: Upper Plenum to Downcomer at Cold Leg Inlet	[(3)]a,c
Small Break – The conditions that could lead to a buildup and potential precipitation of boric acid in the core only exist for a cold leg break while the system pressure remains above the LHSI cut-in pressure.	Broken Loop: Upper Plenum to Cold Leg	[(4)]a,c
	Intact Loop: Upper Plenum to Downcomer at Cold Leg Inlet	[(3)]a,c

(1) Summation of #1 - #3 from Q2.ee response.
(2) Summation of #4 - #11 from Q2.ee response.
(3) Summation of #1 - #11 from Q2.ee response.
(4) Summation of #1 - #10 from Q2.ee response.

ff) Capacity of the condensate storage tank

	Volume (ft^3)
Condensate Storage Tank, SBLOCA Analysis(1)	Not Modeled
Condensate Storage Tank, Post-LOCA Analysis(1)	Not Modeled

(1) Point Beach has an unlimited water supply to the Auxiliary Feedwater pumps from Service Water (Lake Michigan).

gg) **Flushing flow rate at the time of switch to simultaneous injection**

	Flushing Flow Rate[1] (lbm/sec)
Flushing Flow at HLSO, SBLOCA	18
Flushing Flow at HLSO, LBLOCA	40

[1] Flushing flow is calculated as $\dot{m}_{SI} - \dot{m}_{boil}$

hh) **Capacities and boron concentrations for high concentrate boric acid storage tanks**

	Capacity (ft^3)	Boron Concentration (ppm)
Boron Injection Tank, Minimum[1]	N/A	N/A
Boron Injection Tank, Maximum[1]	N/A	N/A
Boron Injection Tank, SBLOCA Analysis[1]	N/A	N/A

[1] BASTs at Point Beach are not used for ECCS injection.

3) **Please provide the sump temperature vs. time following recirculation. How does this impact precipitation? Is the boric acid concentration in the vessel below the precipitation limit based on the minimum sump temperature at the time the switch to simultaneous injection is performed? Please explain.**

Consistent with the interim methodology agreed upon with the NRC staff, all calculations are conservatively done at [ ]a,c temperatures and pressures for aqueous boric acid solution. Performing the boric acid calculations at [ ]a,c temperatures and pressures maximizes boil-off, and thus maximizes the rate of concentration of boric acid in the inner vessel region. Taking credit for a [ ]a,c sump temperature would create [ ]a,c conditions in the core. This would reduce boil-off and slow the rate of concentration of boric acid in the core region. Additional details of long term cooling (LTC) analysis are provided in Section 2.8.5.6.3.4: Post-LOCA Subcriticality and Long-Term Cooling of the LAR.