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Molten Salt Destruction of Rubber and Chlorinated Solvents

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September 1994



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MOLTEN SALT DESTRUCTION OF RUBBER AND CHLORINATED SOLVENTS

Ravindra S. Upadhye and John G. Wilder
Lawrence Livermore National Laboratory

ABSTRACT

Molten Salt Destruction (MSD) is an alternative to, and offers several advantages over, incineration. We have demonstrated the viability of the MSD process to cleanly destroy rubber and chlorinated solvents.

INTRODUCTION

Acceptable methods for the treatment of mixed wastes are not currently available. We have investigated Molten Salt Destruction (MSD) as an alternative to incineration of mixed wastes. MSD was originally developed by Rockwell International as a single stage process for coal gasification, and later used for treatment of hazardous wastes such as PCB's. MSD differs from incineration in several ways: there is no evidence of open flames in MSD, the containment of actinides is accomplished by chemical means (wetting and dissolution), the operating temperature of MSD is much lower (700-950°C vs. 1000-1200°C) thus lowering the volatility of actinides. Furthermore, no acid gases are released from MSD. These advantages provide the main incentive for developing MSD as an alternative to incineration.

In MSD, wastes are introduced with air or oxygen into a bed of molten salt (typically alkali metal carbonate). In this environment, the organic components of the mixed waste are converted into CO₂ and H₂O, heteroatoms such as chlorine form stable salts (e.g., sodium chloride), and the actinides remain in the melt (either dissolved into the melt or as a separate phase). The lower operating temperature of the process (700-950°C, compared to 1000-1200°C for incineration) keeps the actinide volatility low. The products of the MSD process are some combination of benign gases (CO₂, H₂O), concentrated actinide oxides/salts, and low level waste, resulting in a large volume reduction from the original mixed waste. Treatable waste streams consist of organic liquids (including those containing chlorinated solvents and PCB's), greases, and combustible solids such as cellulosic matter, rubber and plastics. The experiments reported here were the first demonstration of solid waste and halogen solvent destruction by the MSD process.

SUMMARY

We have demonstrated the viability of the MSD process to cleanly destroy rubber and chlorinated solvents. A schematic of the apparatus which was designed and built at LLNL is shown in Figure 1. Vulcanized rubber was selected as the surrogate organic solid waste because of its relatively high chemical durability. It is also a constituent of glove box waste and other low level radioactive waste, and its decomposition products are environmentally offensive if not completely mineralized. Our supply was obtained from a local tire recapping shop. Rubber crumbs were fed into the vessel utilizing a gas-tight screw feed apparatus as shown in Figure 2. This equipment was modified at LLNL for handling oil shale and proved to be ideal for rubber, as well. The rubber crumbs were fed into the combustion air stream directly without the use of any liquid slurry intermediates.

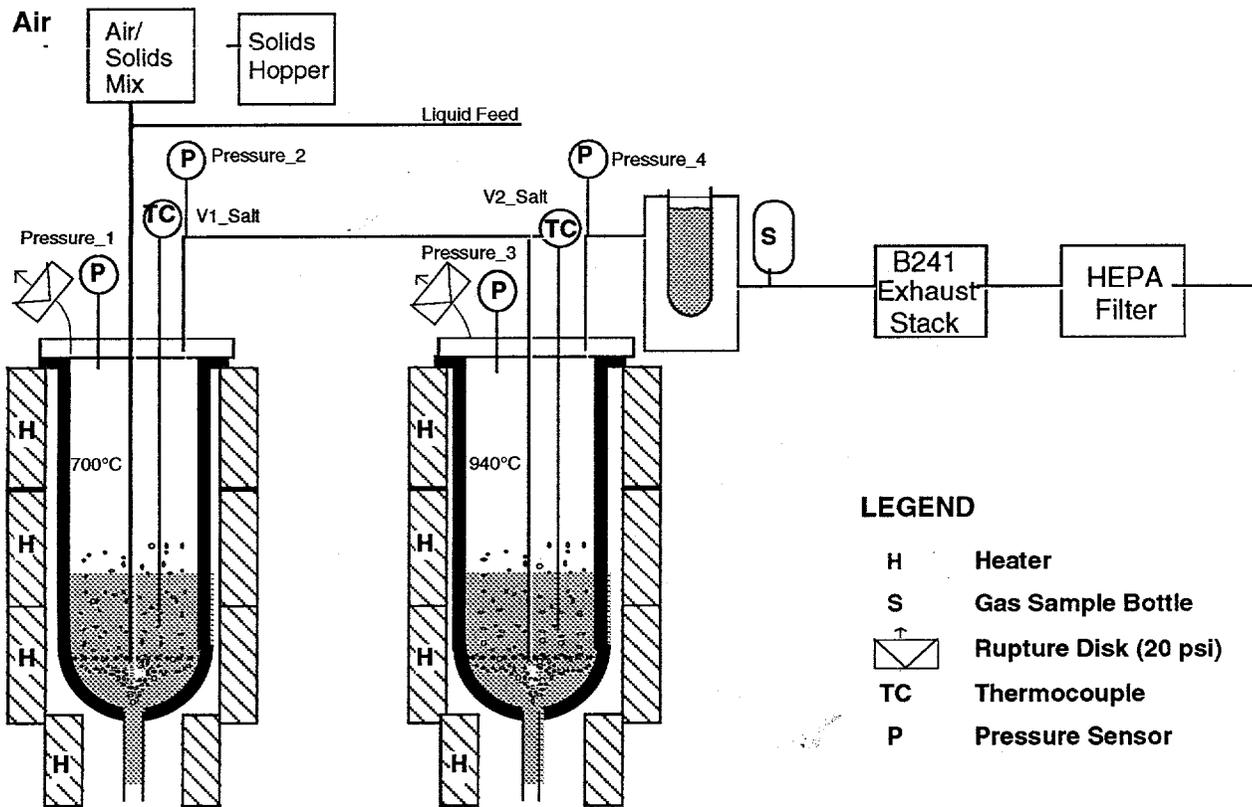


Figure 1. Schematic of Molten Salt Destruction apparatus.

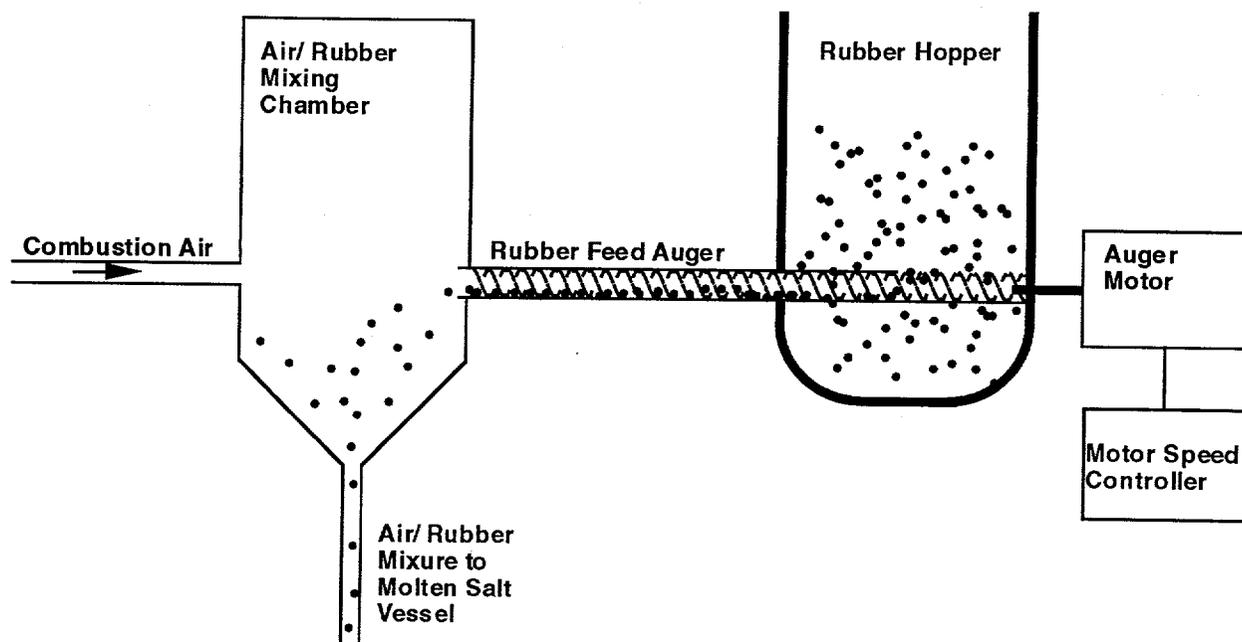


Figure 2. Schematic of screw feed apparatus.

A series of experiments were completed in September 1993 in which approximately 30 kilograms of rubber and a variety of chlorinated solvents were destroyed. The combustion gas/rubber mixture was injected directly into the molten salt. The destruction was completed using the apparatus in a two stage configuration under oxidizing conditions. The two stages were maintained at 700 °C and 940 °C, respectively. Exhaust gas samples were taken at four hour intervals. The longest continuous run operated for 85 hours consuming 12 kilograms of rubber. Gas analysis of the dry exhaust identified nitrogen, carbon dioxide, oxygen, and argon as the major components. Carbon monoxide, hydrogen, and nitric oxide were detected in minor quantities (0.4% maximum) in some samples. Minor constituents were undetected in about one third of the gas samples. Destruction of chlorinated solvents was also demonstrated. Trichloroethylene, chloroform, carbon tetrachloride, 1-chloronaphthalene, 1,2-dichloroethane, and chlorobenzene were destroyed. These compounds were selected primarily because of the immediate availability in local chemical storage cabinets. However, they also represent a good cross section of chlorinated solvents in industrial use. Exhaust gas analysis showed only carbon dioxide, nitrogen, argon, and oxygen. There was no trace of any other gas. The destruction of these materials appeared to be complete.

EXPERIMENT

MSD Equipment

The corrosive characteristic of molten salt coupled with uncertainty of the received waste form in a "real world" operation dictates a simple robust design. The two crucibles, physically identical, are made of 304 stainless steel. They are 5.76 inches inside diameter, 6.63 inches outside diameter, 37.75 inches long, and fitted with a drain pipe at the bottom and a flange on the top. The drain pipe leads to a retention bucket, large enough to contain the molten salt inventory, which is placed under each crucible. Three cylindrical electric heaters, each rated at 3 kW, surround each crucible. Waste and combustion air are introduced through a 1 3/8 inch diameter feed tube near the center of both crucibles. Each tube extends below the salt surface to about one inch above the crucible bottom. After percolating through the first crucible, the gaseous product is sent to the second crucible to assure complete oxidation. Additional combustion gas for the second crucible can be introduced separately into the second feed tube, if desired. All combustion gas was introduced into the first vessel during the rubber destruction experiments; while 25% of the combustion gas was utilized in stage one with the remainder going directly to stage two for the chlorinated solvent destruction experiments. Off-gas from the second crucible passes through a cold trap (i.e., water finger near room temperature) to capture entrained liquid droplets and salt vapor prior to discharge into a ventilation hood. Samples of the dry off-gas are collected via a sample port downstream of the cold trap.

The two vessels and the connecting piping are instrumented to monitor temperature and pressure. Thermocouple readouts monitor the salt temperature in each vessel and the temperature of each vessel wall at three elevations. The elevations (low, middle, and high) correspond to each heater. There are additional thermocouples employed in the automatic temperature controller feedback loop for each heater and are independent of the readout monitor. We use a data logger/controller program to continuously save the data and to control the operation of the unit. Because the temperature control units do not monitor the same thermocouple that the operator observes, there can be a discrepancy between the set point temperature of the controller and the observed steady state temperature of the vessel. The set points were subordinated to maintain the desired temperatures on the operator readouts. Four pressure transducers are employed. Pressure is monitored in each vessel and with in each exhaust line. The system is designed to

operate at near atmospheric pressure. Pressure increases indicate the location of impending blockages. Each vessel is fitted with an independent burst disk set at 22 psig. This disk will rupture and vent if the system becomes blocked and corrective action is neglected. Gas samples can be taken through a number of sampling ports for off-line analysis.

Experimental Procedure

All temperatures and pressures are timed stamped and recorded every 20 seconds. The heaters are used to raise the MSD vessel temperatures to the desired level. The procedure is to heat the vessels to melt the salt and bring the salt to the desired temperatures. This was 700 °C and 940 °C for vessels one and two, respectively. When the combustion gas was introduced, temperatures and gas flow were allowed to stabilize. At this point the waste feed was started. For the rubber destruction experiments, we sieved the rubber through a #10 sieve prior to loading it into the screw-feed hopper. The hopper capacity is about two kilograms. The screw-feed apparatus is controlled by a variable speed controller set to deliver three grams per minute. Combustion gas is supplied from the building compressed air source and was passed through a mass flow meter, a flow control valve, and into the screw-feed discharge chamber where it collects the rubber shavings from the feed discharge and blows the shavings into the MSD first stage injection tube. The airflow is set to 1.6 scfm (standard cubic feet per minute) or 120% of the stoichiometric requirement for theoretical complete combustion. We assumed the empirical chemical formula of a saturated hydrocarbon ((CH₂)_n) as the formula for rubber for this calculation. For the chlorinated solvent destruction experiments, the solvent was delivered into vessel one via a separate liquid feed line "teed" into the combustion air supply just above the injection line. The solvents were delivered by a positive displacement pump set at 3.4 ml/min (milliliters per minute). The combustion air was 0.5 scfm. An additional 1.5 scfm of combustion air was supplied to the first stage exhaust for injection into the second vessel. Time logs and gas samples were collected. Gas was sampled from a port downstream of the cold trap and held for later analysis.

Exhaust Gas Analysis

Exhaust gas samples were collected in 50 milliliter bottles and analyzed using mass spectroscopy. Collection bottles were 316 Stainless Steel fitted with a leak tight valve and tubing connection. The bottles were evacuated at elevated temperature, the valve shut, and stored until required for sample collection. Sample collection

was simply connecting the bottle via its tube fitting to the sample port, opening the valve for 10 seconds, shutting the valve, disconnecting the tube fitting, and transporting the filled bottle to the analytical laboratory. A gas mass spectrometer was used for all analysis. A broad range mass analysis for all species up to mass number 200 was performed. The detection limit for species of interest was 50 parts per million or 0.005%.

RESULTS

The data for all experiments can be found in Appendix B. Below is a brief description of the results for each experiment listed by the completion date.

22 June 1993 - Solvent Destruction

Experimental Conditions:

Combustion Air Flow (scfm)	Solvent feed (ml/min)	Exhaust Gas Samples Taken	First Stage Salt Temp. (°C)	Second Stage Salt Temp. (°C)
2.0	3.4	1 each	710	900

Results:

Solvent	%O ₂	%CO ₂	%CO	%NO _x	%N ₂	%Ar
Trichloroethylene	17.10	4.30	<.005	<.005	77.70	0.91
1,2-dichloroethane	15.49	5.41	<.005	<.005	78.18	0.91
Chlorobenzene	11.87	8.29	<.005	<.005	78.93	0.92
1-chloronaphthalene	14.19	5.28	<.005	<.005	79.60	0.93
Chloroform	18.10	3.49	<.005	<.005	77.50	0.91
Carbon tetrachloride	19.76	3.54	<.005	<.005	75.82	0.88

Discussion:

The above table gives the general conditions for six different chlorinated solvent destruction experiments. The solvent was either trichloroethylene, chloroform, carbon tetrachloride, 1-chloronaphthalene, 1,2-dichloroethane, or chlorobenzene. Each run lasted approximately 30 minutes. All gas analysis showed only nitrogen, oxygen, argon, and carbon dioxide. The oxygen was highest and the carbon dioxide lowest in the solvents having the least carbon content (carbon tetrachloride). There were no surprises here, only a confirmation of what was predicted. Destruction efficiency of these materials approaches 100%; no products of incomplete combustion were detected.

2 September 1993 - Rubber Destruction

Experimental Conditions:

Combustion Air Flow (scfm)	Rubber Feed (g/min)	Exhaust Gas Samples Taken	First Stage Salt Temp. (°C)	Second Stage Salt Temp. (°C)
2.5	5.5	1	705-758	705-730

Results:

Feed Material	%O ₂	%CO ₂	%CO	%NO _x	%N ₂	%Ar
Vulcanized Rubber	10.18	7.05	<.005	<.005	81.80	0.97

Discussion:

This short "shakedown" run was discontinued due to blockage of the air-rubber supply line. It was terminated after less than two hours. Gas analysis showed only the expected major components.

3 September 1993 - Rubber Destruction

Experimental Conditions:

Combustion Air Flow (scfm)	Rubber Feed (g/min)	Exhaust Gas Samples Taken	First Stage Salt Temp. (°C)	Second Stage Salt Temp. (°C)
2.5	5.5	4	785-688	721-744

Results:

Feed Material	%O ₂	%CO ₂	%CO	%NO _x	%N ₂	%Ar	%H ₂
Vulcanized Rubber	6.88	11.66	<.005	<.005	80.23	0.95	-
Vulcanized Rubber	6.55	11.92	<.005	<.005	80.25	0.95	-
Vulcanized Rubber	7.68	10.95	<.005	<.005	80.00	0.95	0.09
Vulcanized Rubber	13.05	6.39	<.005	<.005	79.61	0.94	-
Vulcanized Rubber	14.29	5.47	<.005	<.005	79.13	0.94	-

Discussion:

This experiment lasted five hours. There were no plugging problems. We initiated sieving the rubber crumbs to correct the blocking problem experienced in the previous day's run. The first stage vessel was operated above 780 °C for most of

the run. The second stage never exceeded 750 °C. All gas samples were found to contain carbon monoxide at up to 0.3% vol./vol. If destruction efficiency is defined as product detected in the exhaust stream divided by total product injected into the MSD unit, then destruction efficiency was 100%. (Rubber is not volatile and it is doubtful that any would be detected in an exhaust gas sample.) If, however, destruction efficiency includes all compounds of carbon other than carbon dioxide, and the quantity of these products is compared to that of carbon dioxide, then the destruction efficiency is approximately 97% for this run.

17 September 1993 - Rubber Destruction

Experimental Conditions:

Combustion Air Flow (scfm)	Rubber Feed (g/min)	Exhaust Gas Samples Taken	First Stage Salt Temp. (°C)	Second Stage Salt Temp. (°C)
1.8	4.7	1	675-850	540-920

Results:

Feed Material	%O ₂	%CO ₂	%CO	%NO _x	%N ₂	%Ar
Vulcanized Rubber	4.98	14.18	0.65	0.94	79.21	0.94

Discussion:

This experiment was intended to test the result of sub-stoichiometric (90%) air supply to the first stage vessel. The system was plagued by blockage problems in the rubber feed system that had not been experienced in the previous experiment. The gas analysis showed 0.65% carbon monoxide and, surprisingly, 0.044% nitrous oxide. Using the previous carbon compounds ratio to carbon dioxide, this equates to a destruction efficiency of 96%.

20 September 1993 - Rubber Destruction

Experimental Conditions:

Combustion Air Flow (scfm)	Rubber Feed (g/min)	Exhaust Gas Samples Taken	First Stage Salt Temp. (°C)	Second Stage Salt Temp. (°C)
1.5	3.0	10	670-710	926-936

Results:

Feed Material	%O ₂	%CO ₂	%CO	%NO _x	%N ₂	%Ar
Vulcanized Rubber	8.36	10.36	0.26	<.005	80.06	0.95
Vulcanized Rubber	8.76	9.98	0.22	<.005	80.08	0.95
Vulcanized Rubber	10.34	8.30	<.005	0.01	80.40	0.95
Vulcanized Rubber	17.94	2.89	<.005	0.01	78.22	0.93
Vulcanized Rubber	12.86	6.88	<.005	0.01	79.30	0.94
Vulcanized Rubber	10.62	8.55	0.20	0.07	79.81	0.95
Vulcanized Rubber	9.74	9.20	<.005	0.07	79.85	0.95
Vulcanized Rubber	10.57	8.71	<.005	<.005	79.77	0.94
Vulcanized Rubber	8.20	10.64	<.005	0.01	80.20	0.95
Vulcanized Rubber	10.74	8.46	<.005	0.01	79.84	0.94

Discussion:

This run lasted 39 hours. It was plagued in the early stages by routine plugging of the rubber particles in the supply line. This resulted in numerous short duration stops to unplug the line and continue the feed. Ten hours into the run the 1/4 inch feed line was replaced by a 3/8 inch line. This solved the plugging problem. The gas analysis results showed small amounts (up to 0.25%) of carbon monoxide in three of the ten gas samples. Trace amounts of nitrous and nitric oxide were also detected in some of the samples. The pressure in vessel one began to rise, prompting a controlled shutdown. Subsequent inspection showed salt buildup in the exhaust riser line of vessel one. Overall destruction efficiency exceeded 99%.

22 September 1993 - Rubber Destruction

Experimental Conditions:

Combustion Air Flow (scfm)	Rubber Feed (g/min)	Exhaust Gas Samples Taken	First Stage Salt Temp. (°C)	Second Stage Salt Temp. (°C)
1.6	3.0	19	690-722	930-937

Results:

Feed Material	%O ₂	%CO ₂	%CO	%NO _x	%N ₂	%Ar	%He
Vulcanized Rubber	9.64	8.48	0.18	0.01	80.78	0.91	-
Vulcanized Rubber	10.71	8.16	0.23	0.01	79.98	0.90	-

Vulcanized Rubber	8.99	9.28	0.27	<.005	80.55	0.91	-
Vulcanized Rubber	8.66	9.55	0.26	0.01	80.60	0.91	-
Vulcanized Rubber	10.24	8.17	0.23	<.005	80.45	0.91	-
Vulcanized Rubber	9.44	8.89	0.29	0.01	80.46	0.91	-
Vulcanized Rubber	7.19	10.30	0.40	0.01	81.18	0.92	-
Vulcanized Rubber	8.05	9.89	<.005	0.02	81.16	0.91	-
Vulcanized Rubber	11.16	7.33	<.005	<.005	80.61	0.89	-
Vulcanized Rubber	10.87	7.44	0.19	<.005	80.60	0.89	-
Vulcanized Rubber	5.59	11.52	<.005	<.005	81.98	0.91	-
Vulcanized Rubber	9.59	8.61	0.11	0.01	80.79	0.90	-
Vulcanized Rubber	11.28	7.37	0.12	<.005	80.33	0.89	-
Vulcanized Rubber	10.26	8.07	<.005	<.005	80.74	0.90	.030
Vulcanized Rubber	10.87	7.47	<.005	<.005	80.77	0.89	-
Vulcanized Rubber	11.66	6.94	<.005	<.005	80.51	0.89	-
Vulcanized Rubber	12.65	6.14	<.005	<.005	80.32	0.89	-
Vulcanized Rubber	11.25	7.13	<.005	<.005	80.71	0.89	-
Vulcanized Rubber	10.19	8.09	<.005	<.005	80.81	0.90	-

Discussion:

This experiment lasted 89 hours and was the longest continuous run of the series. The previous run was terminated sooner than intended due to salt buildup in the exhaust riser lines adjacent to the vessels. The plan was to "feel" the condition of the exhaust riser at periodic intervals using a tempered wire through an access port at the top of each riser. When a measurable quantity of salt was detected, the run would be stopped, an oxy-acetylene torch used to quickly melt the salt back into the vessel, and the run continued. This seemed reasonable in theory but was impractical in practice. The "wire feel" assessment was performed at four hour intervals but no salt build up was detected. The blockage that subsequently resulted was detected not by the wire, but rather by an increase in vessel pressure after about 86 hours into the run. The blockage seemed to occur over a very short time scale. Attempts to clear the line using the torch proved unsuccessful and the run was terminated. Analysis results of the gas samples followed the pattern established in the previous runs. Eight of the nineteen samples contained no detectable level of the minor constituent gases, the remaining samples showed small amounts of carbon monoxide, nitrous oxide, and nitric oxide in proportions found in earlier runs. Destruction efficiency equaled 98.6%.

27 September 1993 - Rubber Destruction

Experimental Conditions:

Combustion Air Flow (scfm)	Rubber Feed (g/min)	Exhaust Gas Samples Taken	First Stage Salt Temp. (°C)	Second Stage Salt Temp. (°C)
1.6	3.0	4	680-712	930-940

Results:

Feed Material	%O ₂	%CO ₂	%CO	%NO _x	%N ₂	%Ar
Vulcanized Rubber	11.45	7.77	<.005	0.06	79.78	0.93
Vulcanized Rubber	11.26	7.59	<.005	0.01	80.22	0.92
Vulcanized Rubber	18.22	2.25	<.005	0.01	78.62	0.90

Discussion:

The final experiment in this series ran 28 hours. A steel wire brush was installed in the top of each exhaust line riser. The brush was welded to a steel shaft that extended through a sleeve and seal in the top of the riser. The intent was to physically clear the riser of salt deposits at regular intervals by running the brush the length of the pipe and into the top of the reaction vessel. Previous runs made it clear that the all blockages occurred in this region of the apparatus. We reasoned that a stiff wire scraper (in this case the wire brush) running the length of the pipe at regular intervals to push the preliminary salt deposits from the riser should allow a run of indefinite duration. Both risers were scraped at four hour intervals. This procedure worked as intended and the lines did not become blocked until the apparatus failed. The final attempt to clear the risers resulted in significant resistance to the brush movement in the riser of vessel one. When greater force was applied, the brush became irretrievably stuck in the top of vessel blocking the exhaust line. The run was then terminated. Four gas samples were taken but only three are reported (the fourth was contaminated during analysis and disregarded). These three follow the trend established in the previous runs. There was no carbon monoxide detected in any of the samples. Destruction efficiency approached 100%.

Two Stage Molten Salt B-241 MSD 22 June 93 MSD:DATA:MSD 22 June 93
TIMING REFERENCES-- VAX Time = 22-JUN-1993 16:30:46.00, Decimal Hours =
16.5127778

6/23/93 9:10:13 AM 9.183056 General conditions for these experiments:

These experiments are to sample the combustion gases resulting from the destruction of dodecane, ethylene glycol, and a variety of chlorinated solvents.

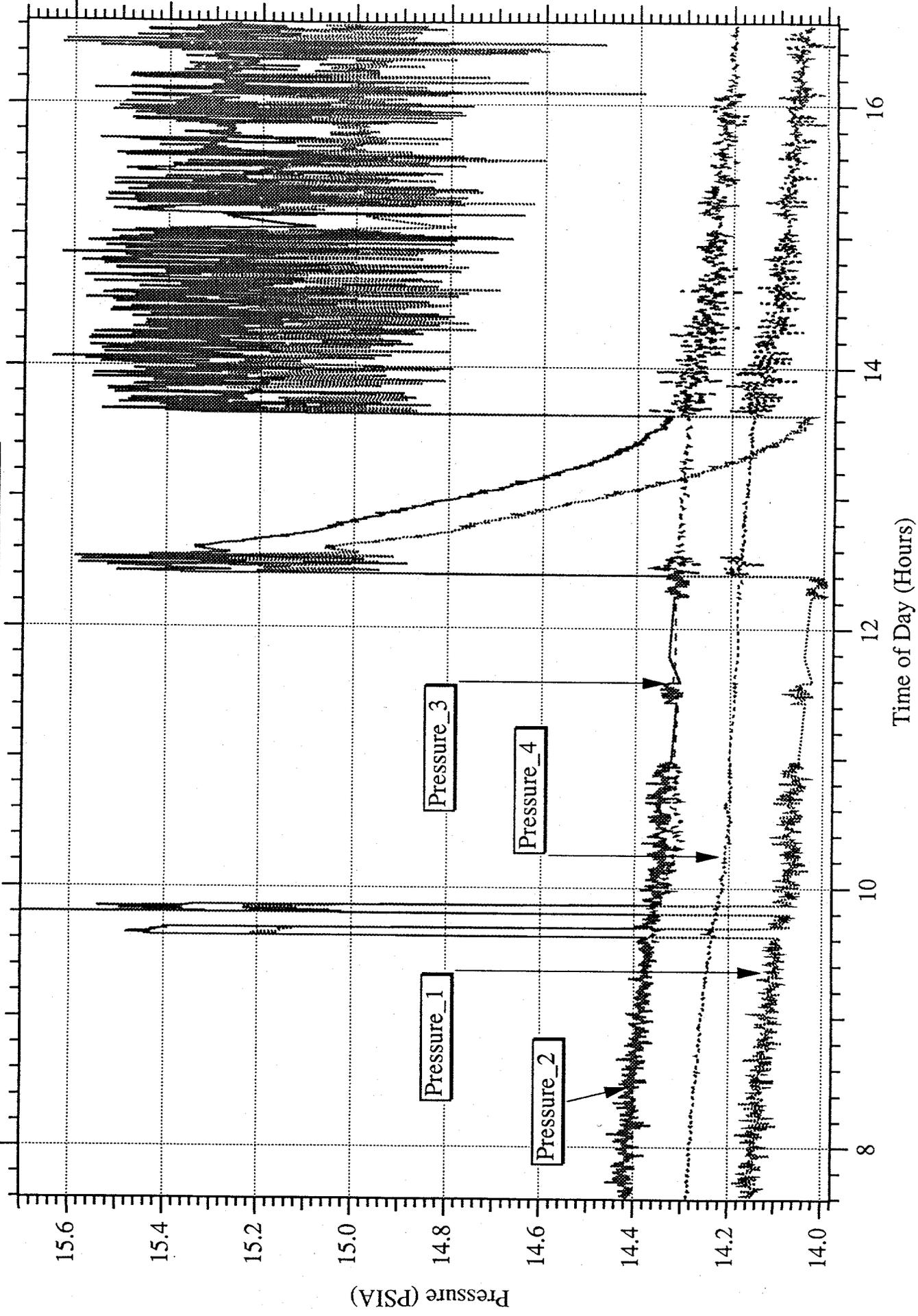
The unit will operate in the two stage mode with the first stage at 700° C and the second stage at 950° C. The first stage will be operated in a reducing mode and the second stage will be in an oxidizing mode. Combustion air to the first stage will be 0.5 scfm; air to the second stage will be 2.5 scfm. Fuel flow will be maintained at 5 cc per minute. An additional 3.5 kg sodium carbonate and 3.0 kg potassium carbonate was added to the second stage vessel. Total second stage salt capacity is thought to be 11.5 to 13.5 kg.

6/23/93 3:15:30 PM 15.286148 Change of plan: First stage injection is 0.5 scfm combustion air and 3.4 cc/min fuel. Second stage combustion air is 1.5 scfm. First stage is 710° C,

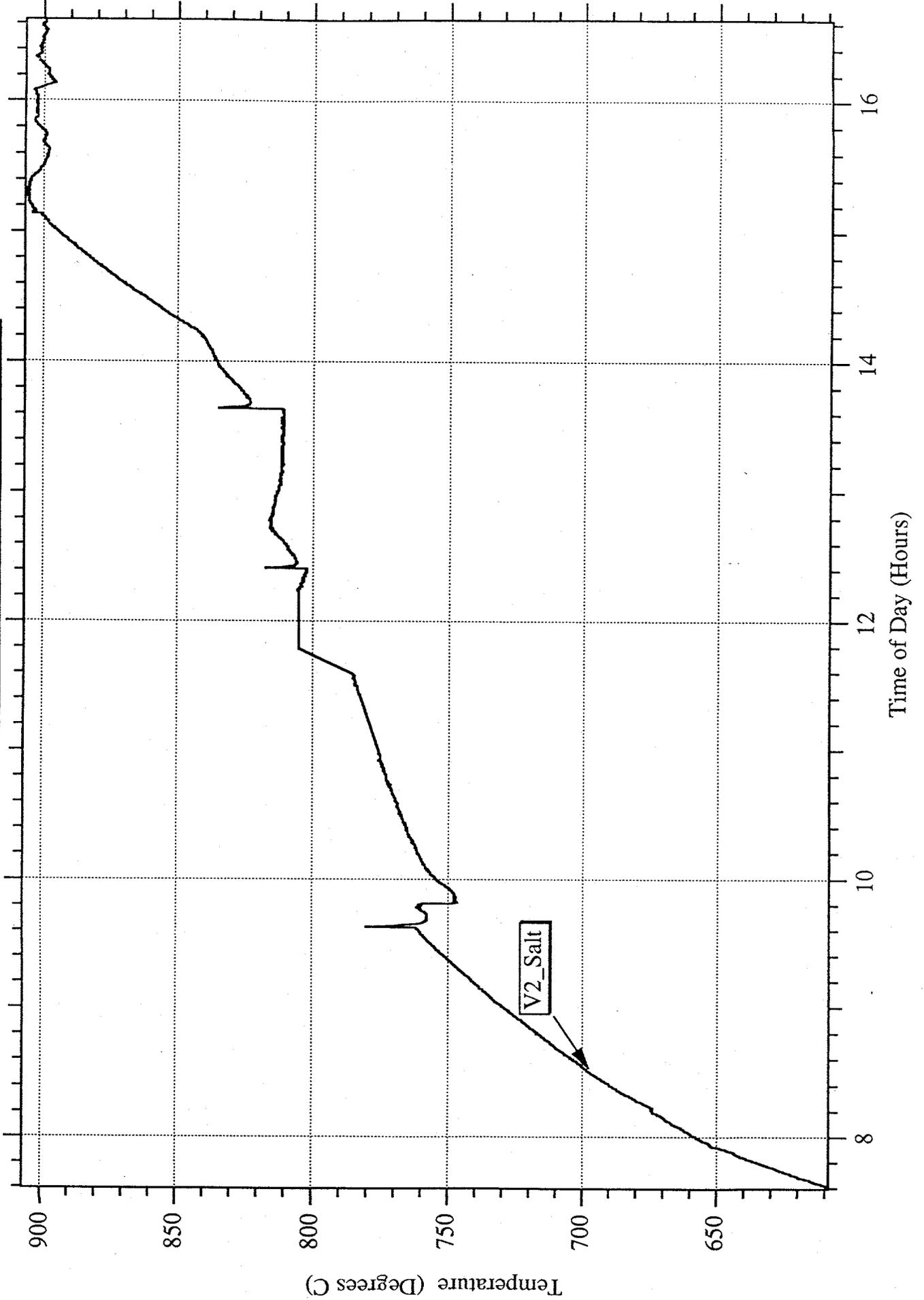
Second stage is 900° C.

6/23/93	3:16:35 PM	15.304167	Gas Sample #54: Dodecane
6/23/93	3:25:34 PM	15.454315	Gas Sample #4: Ethylene glycol.
6/23/93	3:34:57 PM	15.610731	Gas sample #43: Trichloroethylene.
6/23/93	3:42:24 PM	15.735454	Gas Sample #57: Chloroform
6/23/93	3:51:21 PM	15.885079	Gas Sample #3: Carbon tetrachloride.
6/23/93	4:00:26 PM	16.036491	Gas Sample #56: 1-chloronapthalene.
6/23/93	4:11:47 PM	16.226597	Sample #51: 1,2-dichloroethane
6/23/93	4:21:16 PM	16.385009	Sample #55: Chlorobenzene.
6/23/93	4:33:04 PM	16.581935	Secure Experiment.

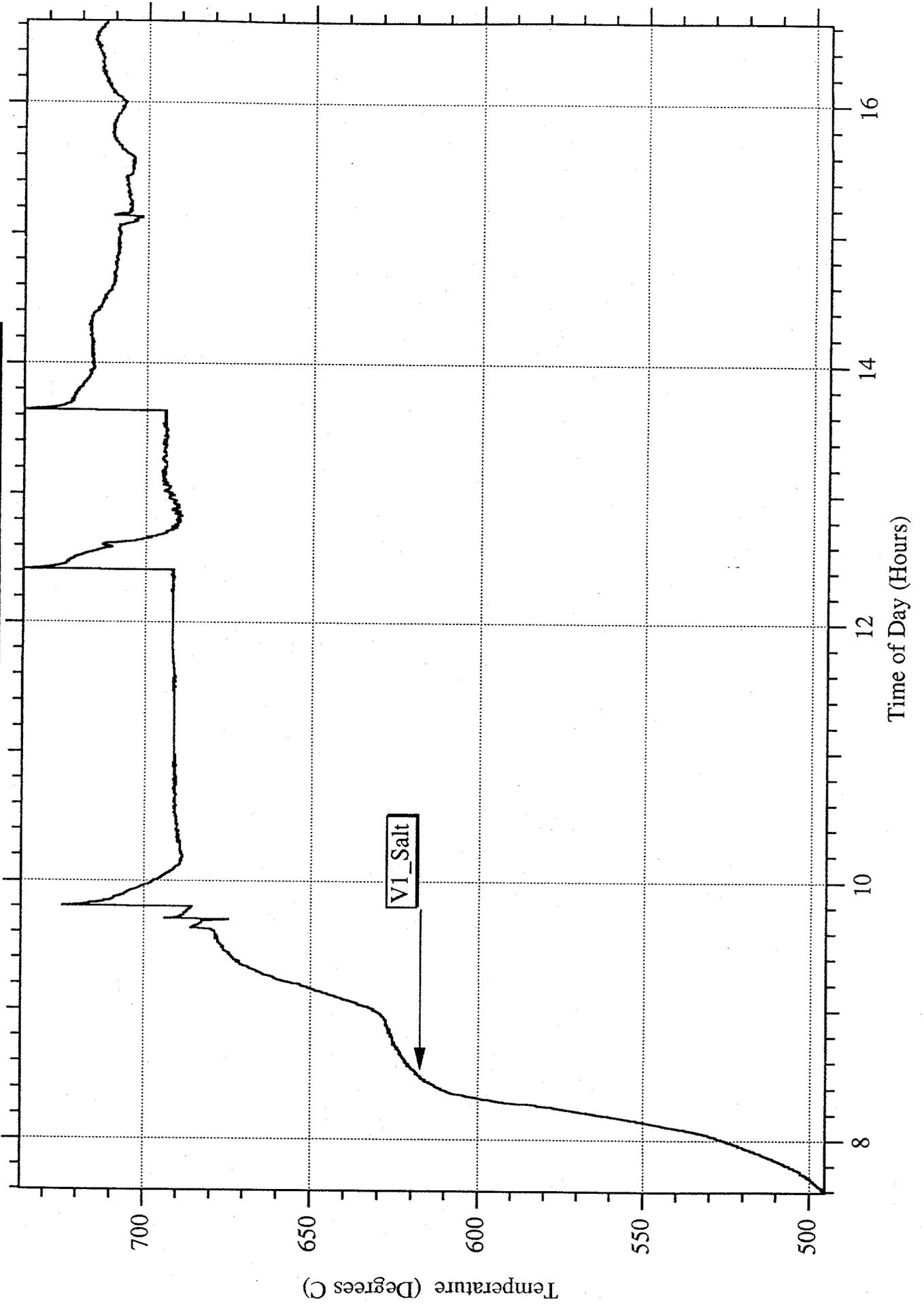
22 June 93 Pressures



22 June 93 Vessel Two Salt Temperature



22 June 93 Vessel One Salt Temperature



Propane @ 900°C

* TO: WILDER (8991-61) *

#54

MASS SPECTROMETRIC ANALYSIS NO. 12332.
DONE ON 24 Jun 93 AT 12:07:46 CALCULATED ON 24-JUN-93 AT 13:32

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	81.09	0.13
2	OXYGEN	O2	6.950	0.016
3	ARGON	AR	0.947	0.002
4	CARBON DIOXIDE	CO2	9.246	0.019
5	CARBON MONOXIDE	CO	1.64	0.06
6	HYDROGEN	H2	0.049	0.002
7	METHANE	CH4	0.071	0.001
	TOTAL		===== 99.99	

VARIANCE = 0.49 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION, ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.15 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Max Lindsay

Ethylene glycol @ 900°C

* TO: WILDER (8991-61) *

#4

MASS SPECTROMETRIC ANALYSIS NO. 12329.
DONE ON 24 Jun 93 AT 11:23:12 CALCULATED ON 24-JUN-93 AT 13:31

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	79.69	0.13
2	OXYGEN	O2	13.17	0.03
3	ARGON	AR	0.934	0.002
4	CARBON DIOXIDE	CO2	5.901	0.013
5	CARBON MONOXIDE	CO	0.31	0.06
			=====	
	TOTAL		100.00	

VARIANCE = 0.54 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.20 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Glax Lindsay

Trichloroethylene @ 900°C

* TO: WILDER (8991-61) *

#43

MASS SPECTROMETRIC ANALYSIS NO. 12330.
DONE ON 24 Jun 93 AT 11:38:04 CALCULATED ON 24-JUN-93 AT 13:32

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	77.70	0.011
2	OXYGEN	O2	17.10	0.003
3	ARGON	AR	0.906	0.002
4	CARBON DIOXIDE	CO2	4.296	0.008
			=====	
	TOTAL		100.00	

VARIANCE = 0.47 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION, ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.19 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.
(1) WATER H2O

Jan Lindsey

1,2-dichloroethane @ 410°C

* TO: WILDER (8991-61) *

#51

MASS SPECTROMETRIC ANALYSIS NO. 12331.
DONE ON 24 Jun 93 AT 11:52:56 CALCULATED ON 24-JUN-93 AT 13:32

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	78.18	0.13
2	OXYGEN	O2	15.49	0.03
3	ARGON	AR	0.914	0.002
4	CARBON DIOXIDE	CO2	5.408	0.012
			=====	
	TOTAL		100.00	

VARIANCE = 0.57 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION, ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.13 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.
(1) WATER H2O

Gear Lindsey

Chlorobenzene @ 900°C

* TO: WILDER (8991-61) *

#55

MASS SPECTROMETRIC ANALYSIS NO. 12333.
DONE ON 24 Jun 93 AT 12:22:31 CALCULATED ON 24-JUN-93 AT 13:32

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	78.93	0.17
2	OXYGEN	O2	11.87	0.04
3	ARGON	AR	0.919	0.003
4	CARBON DIOXIDE	CO2	8.29	0.02
			=====	
	TOTAL		100.00	

VARIANCE = 0.81 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.17 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Glax Lindsey

1-Chloronaphthalene @ 900°C

* TO: WILDER (8991-61) *

#56

MASS SPECTROMETRIC ANALYSIS NO. 12334.
DONE ON 24 Jun 93 AT 13:22:05 CALCULATED ON 24-JUN-93 AT 14:11

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	79.60	0.16
2	OXYGEN	O2	14.19	0.04
3	ARGON	AR	0.931	0.003
4	CARBON DIOXIDE	CO2	5.278	0.015
			=====	
	TOTAL		100.00	

VARIANCE = 0.69 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.02 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.
(1) WATER H2O

Alan Lindsey

Chloroform @ 900°C

* TO: WILDER (8991-61) *

#57

MASS SPECTROMETRIC ANALYSIS NO. 12335.
DONE ON 24 Jun 93 AT 13:37:00 CALCULATED ON 24-JUN-93 AT 14:11

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	77.50	0.13
2	OXYGEN	O2	18.10	0.04
3	ARGON	AR	0.908	0.002
4	CARBON DIOXIDE	CO2	3.488	0.008
	TOTAL		100.00	

VARIANCE = 0.55 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION, ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.19 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Alex Lindsay

Carbon tetrachloride 900°C

* TO: WILDER (8991-61) *

#3

MASS SPECTROMETRIC ANALYSIS NO. 12328.
DONE ON 24 Jun 93 AT 11:08:21 CALCULATED ON 24-JUN-93 AT 13:31

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	75.82	0.15
2	OXYGEN	O2	19.76	0.06
3	ARGON	AR	0.881	0.003
4	CARBON DIOXIDE	CO2	3.539	0.012
	TOTAL		100.00	

VARIANCE = 0.88 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.02 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Alan Lindsey

Two Stage Molten Salt B-241 MSD 2 Sept 93 MSD:DATA:MSD 2 Sept 93
TIMING REFERENCES-- VAX Time = 01-SEP-1993 16:26:31.00, Decimal Hours =
16.4419444

9/2/93 12:22:29 PM 12.390444 Start 2.5 scfm of air through system. The air originates through the screw feeder that will deliver about 5.5 gram/minute of old tyre particals.

9/2/93 12:23:27 PM 12.406681 Begin rubber (the waste) feed.

9/2/93 12:32:08 PM 12.551495 Take gas sample #3.

9/2/93 12:51:51 PM 12.881111 Secure experiment. The flow of rubber appears to have stopped.

9/2/93 12:55:55 PM 12.948870 A larger piece of rubber was found blocking the passage into the injection tube. I will go grab a bite to eat before continuing.

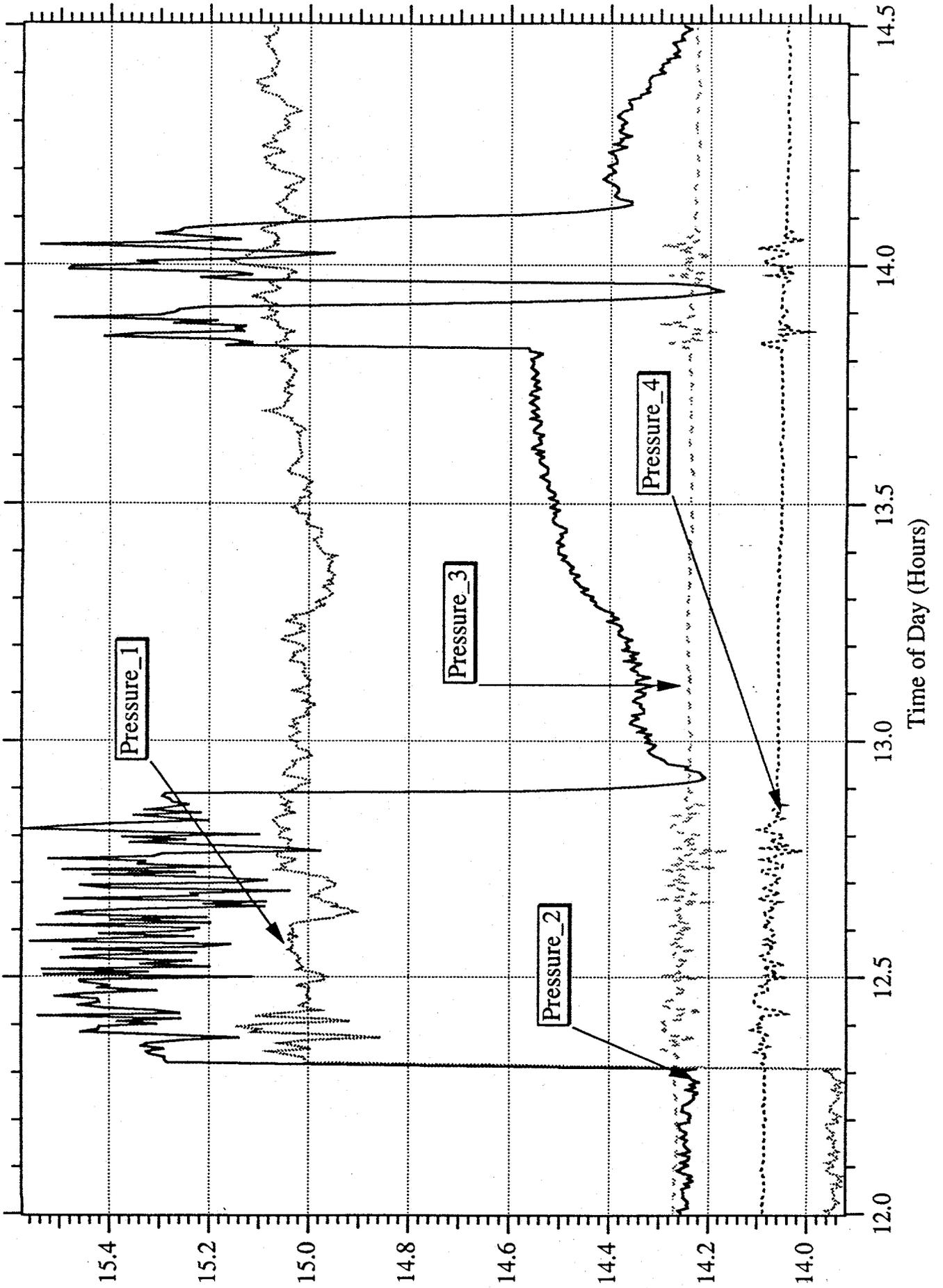
9/2/93 1:50:18 PM 13.857315 Begin injection of rubber with same conditions as before.

9/2/93 1:53:30 PM 13.911120 Secured, another block.

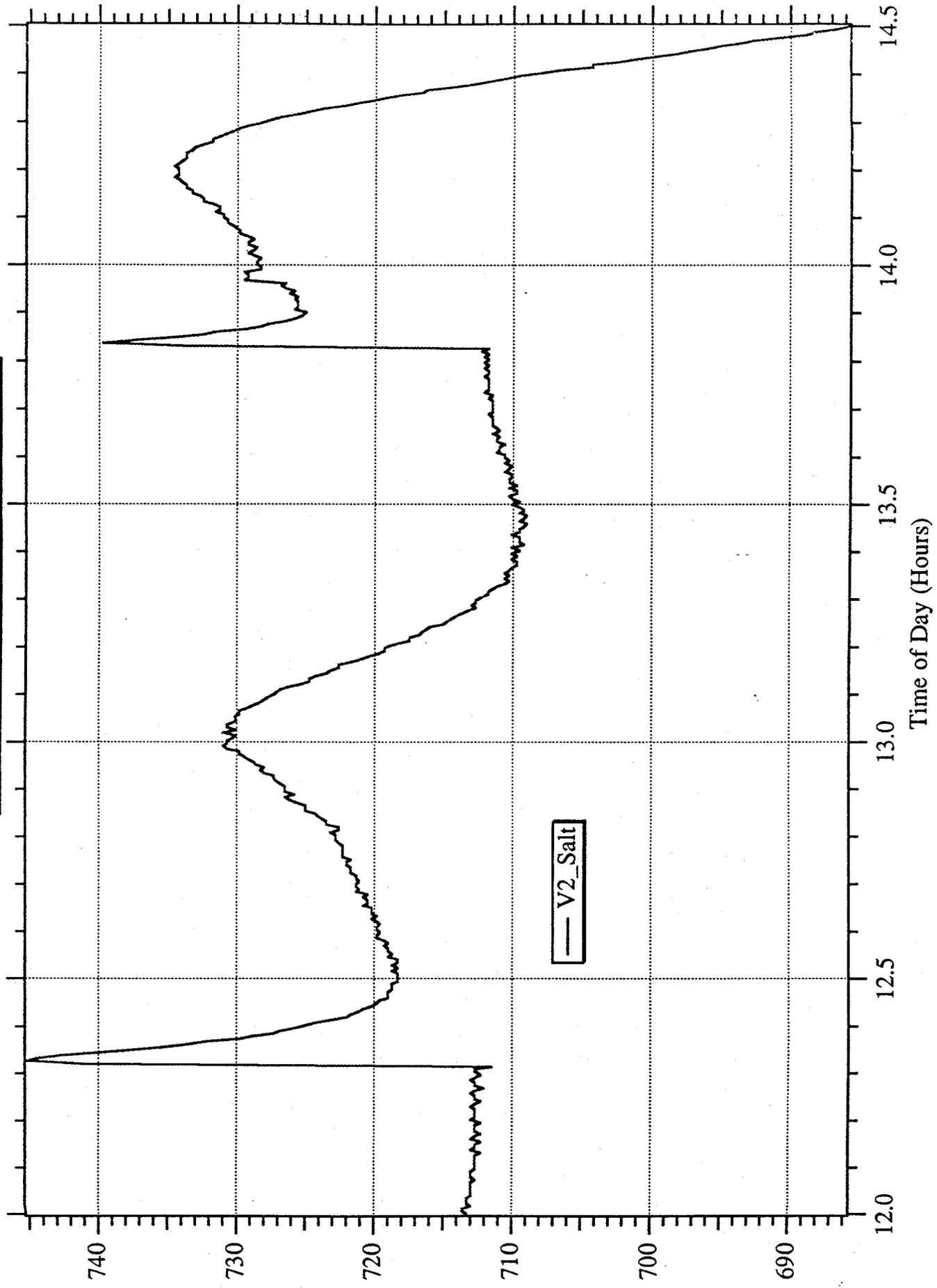
9/2/93 1:57:31 PM 13.978079 Restart as before.

9/2/93 2:04:07 PM 14.088315 Secured due to plugging.

2 Sep 93 Pressures

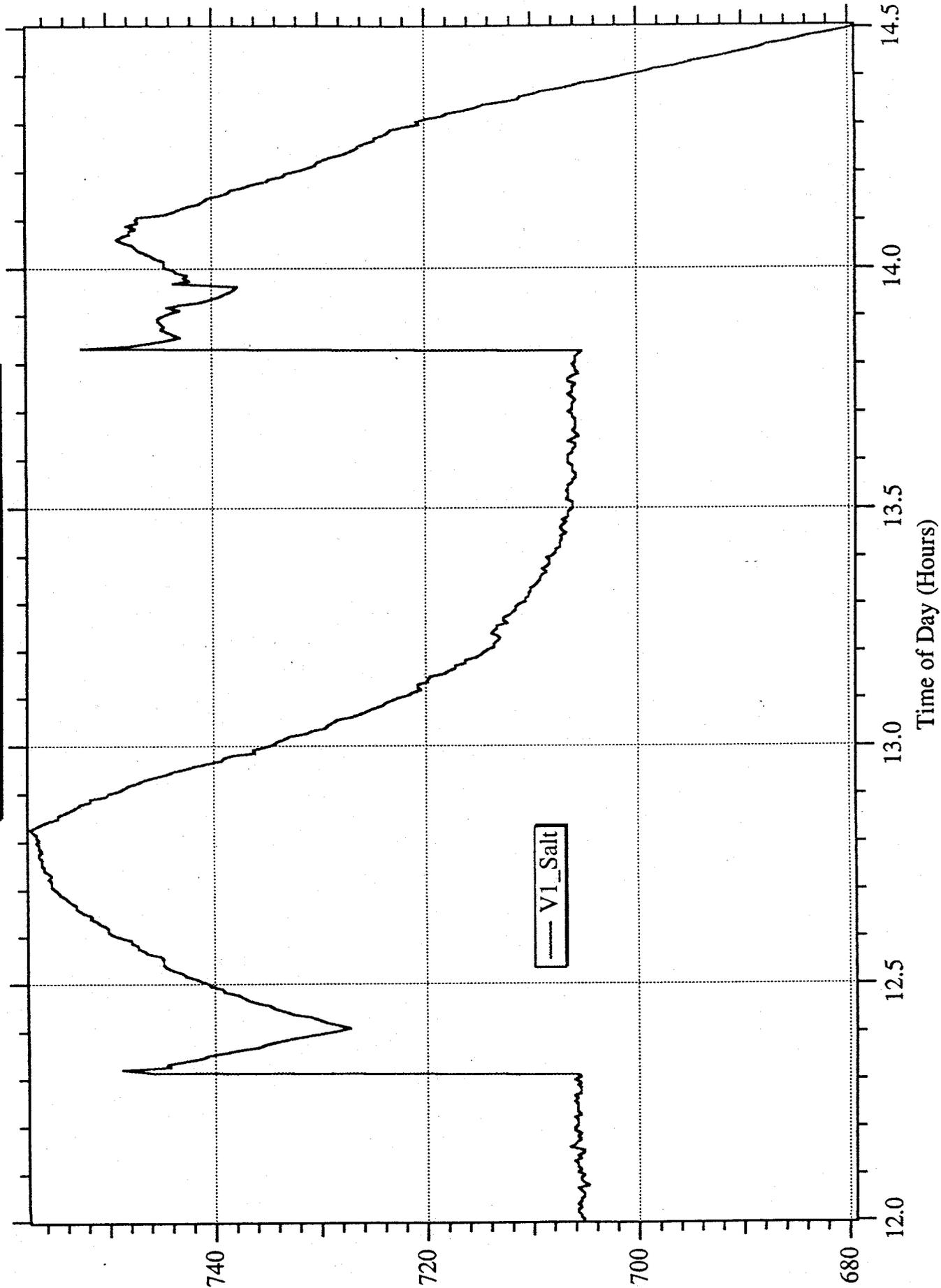


2 Sep 93 Vessel Two Salt Temperature



— V2_Salt

2 Sep 93 Vessel One Salt Temperature



* TO: WILDER (0252-26) *

#3

MASS SPECTROMETRIC ANALYSIS NO. 12510.
DONE ON 7 Sep 93 AT 11:17:44 CALCULATED ON 08-SEP-93 AT 13:52

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	81.80	0.17
2	OXYGEN	O2	10.18	0.03
3	ARGON	AR	0.969	0.003
4	CARBON DIOXIDE	CO2	7.05	0.02
			=====	
	TOTAL		100.00	

VARIANCE = 0.95 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.04 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Two Stage Molten Salt B-241 MSD 3 Sept 93 MSD:DATA:MSD 3 Sept 93
TIMING REFERENCES--VAX Time = 02-SEP-1993 14:41:40.00, Decimal Hours =
14.6944444

9/3/93 11:29:17 AM 11.501426 This is the continuation of the experiment begun yesterday. All of the rubber has been removed and sieved so as to prevent clogging of the combustion gas line at the screw feed injector. The purpose of this experiment is to demonstrate a long duration reliably controlled destruction of the used tyres!

9/3/93 11:34:00 AM 11.580292 Experimental conditions: 2.5 scfm combustion air and the feed speed of the screw feed apparatus set to maximum. This setting is about 5.6 g/min of chopped tyres. This value will be confirmed later.

9/3/93 11:34:31 AM 11.588819 Begin feed.

9/3/93 11:45:36 AM 11.773866 Take gas sample #54.

9/3/93 12:07:10 PM 12.134190 Take gas sample #56.

9/3/93 1:14:31 PM 13.259648 Take gas sample #55.

9/3/93 1:16:04 PM 13.285468 This experiment has been in continuous steady-state operation since it began about 11:30. Everything is very stable and quiet and I'm becoming bored with it!

9/3/93 1:43:05 PM 13.736940 Secure heater on first stage to reduce temperature to 700° C.

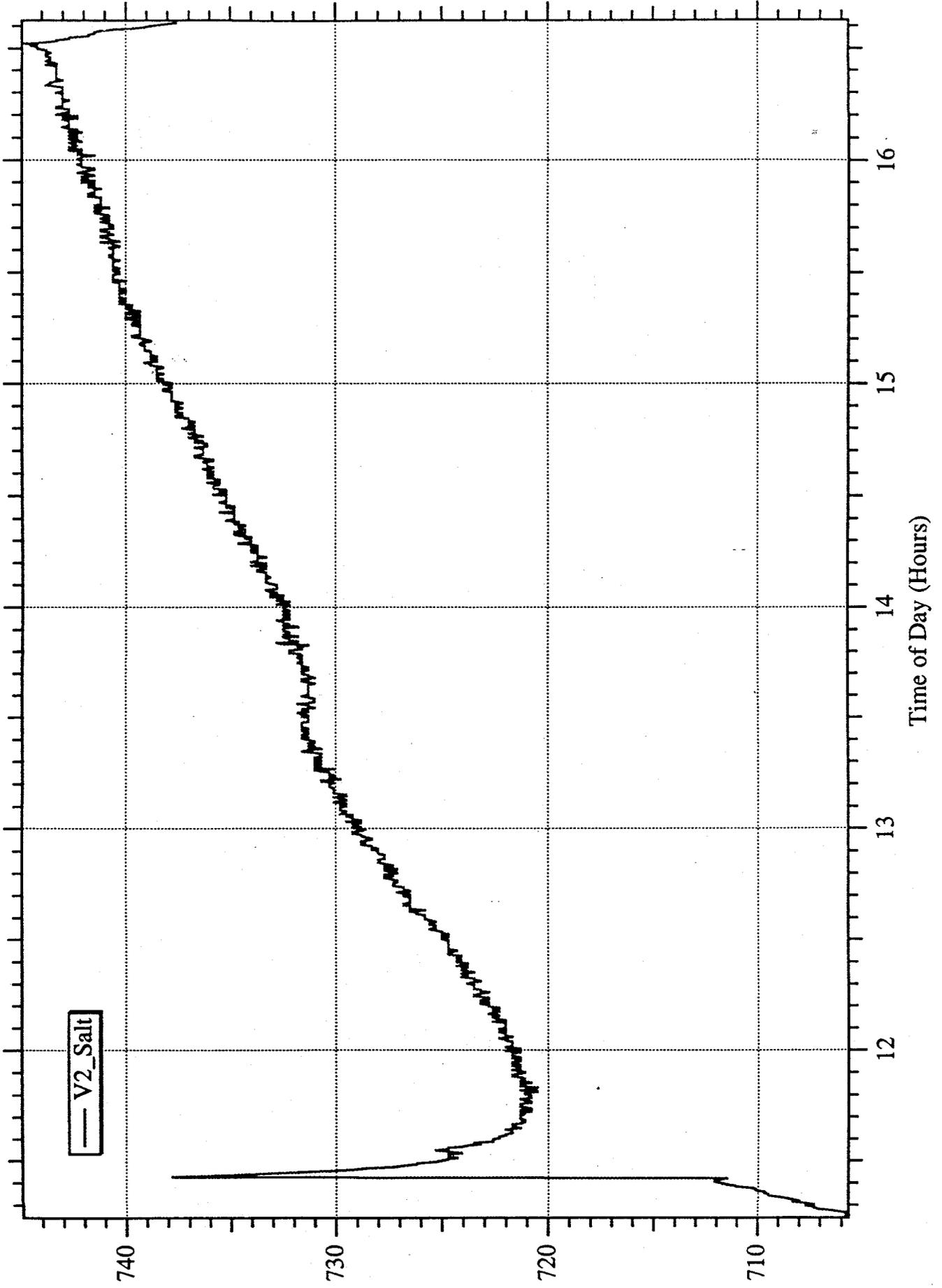
9/3/93 3:16:32 PM 15.297968 1st stage salt temperature declined to 690° C. Take gas sample #51.

9/3/93 4:06:21 PM 16.130560 The whole experiment has proceeded flawlessly. Take the final exhaust gas sample, gas sample #57.

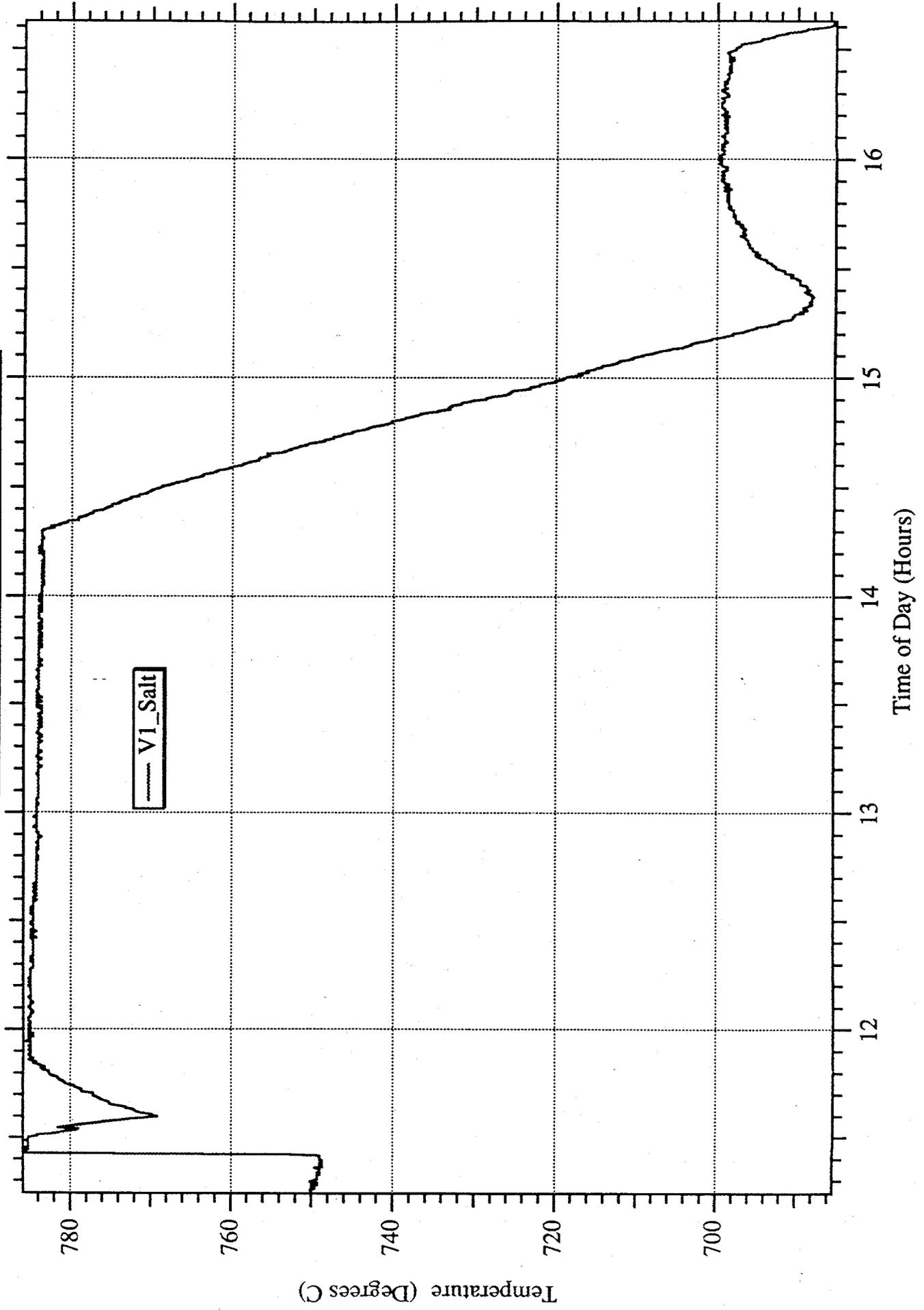
9/3/93 4:27:25 PM 16.482477 Salt temperature began to decline. I suspect we are out of rubber. Shut down experiment.

9/3/93 4:35:00 PM 16.609287 Hopper is not empty, though most of the rubber is gone. I was interpreting noise a bit too enthusiastically.

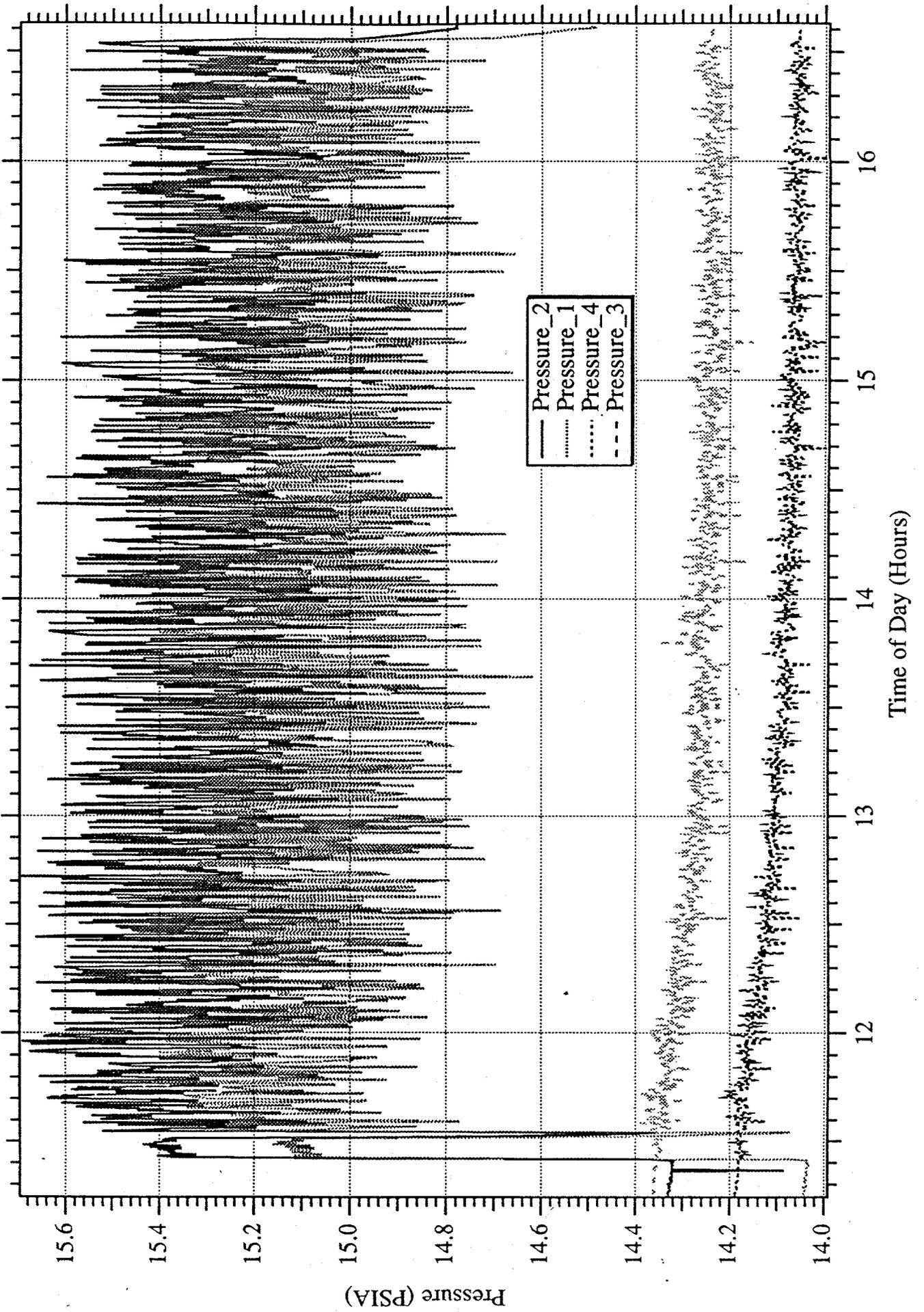
3 Sep 93 Vessel Two Salt Temperature



3 Sep 93 Vessel One Salt Temperature



3 Sep 93 Pressures



* TO: WILDER (0252-26) *

#54

MASS SPECTROMETRIC ANALYSIS NO. 12511.
DONE ON 7 Sep 93 AT 11:33:39 CALCULATED ON 08-SEP-93 AT 13:53

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.23	0.15
2	OXYGEN	O2	6.877	0.019
3	ARGON	AR	0.952	0.003
4	CARBON DIOXIDE	CO2	11.66	0.02
5	CARBON MONOXIDE	CO	0.27	0.08
			=====	
	TOTAL		100.00	

VARIANCE = 0.62 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.16 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

() WATER H2O

* TO: WILDER (0252-26) *

#55

MASS SPECTROMETRIC ANALYSIS NO. 12515.
DONE ON 7 Sep 93 AT 12:37:12 CALCULATED ON 08-SEP-93 AT 13:54

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.00	0.13
2	OXYGEN	O2	7.584	0.018
3	ARGON	AR	0.946	0.002
4	CARBON DIOXIDE	CO2	10.95	0.02
5	CARBON MONOXIDE	CO	0.33	0.07
6	HYDROGEN	H2	0.086	0.002
			=====	
	TOTAL		99.99	

VARIANCE = 0.52 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.10 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

* TO: WILDER (0252-26) *

#56

MASS SPECTROMETRIC ANALYSIS NO. 12514.
DONE ON 7 Sep 93 AT 12:21:16 CALCULATED ON 08-SEP-93 AT 13:53

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.25	0.15
2	OXYGEN	O2	6.551	0.018
3	ARGON	AR	0.951	0.003
4	CARBON DIOXIDE	CO2	11.92	0.03
5	CARBON MONOXIDE	CO	0.32	0.06
			=====	
	TOTAL		99.99	

VARIANCE = 0.60 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.11 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

* TO: WILDER (0252-26) *

#57

MASS SPECTROMETRIC ANALYSIS NO. 12513.
DONE ON 7 Sep 93 AT 12:05:23 CALCULATED ON 08-SEP-93 AT 13:53

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	79.13	0.13
2	OXYGEN	O2	14.29	0.03
3	ARGON	AR	0.936	0.002
4	CARBON DIOXIDE	CO2	5.473	0.013
5	CARBON MONOXIDE	CO	0.17	0.06
			=====	
	TOTAL		99.99	

VARIANCE = 0.60 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.11 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Two Stage Molten Salt B-241 17 Sep 93 Run MSD:DATA:17 Sep 93 Run
TIMING REFERENCES-- VAX Time = 16-SEP-1993 18:42:02.00, Decimal Hours =
18.7005556

9/16/93 6:45:57 PM 18.765926 Set timer to start heaters at 0500 hours, 17 Sep 93.
I hope I got it right.

9/17/93 10:17:42 AM 10.307847 This run to operate at 90% stoicheometric.
This is to test the tar buildup hypothesis. Combustion flow will be set at 1.8 scfm and the
rubber flow is 4.7 gram per minute. I will now wait for the second stage to reach
temperature (900°+ C) since this test is to examine the tar buildup phenomenon.

9/17/93 10:19:51 AM 10.343565 Combustion air feed begun. Start rubber
feed.

9/17/93 10:26:42 AM 10.458380 Rubber feed plugged. Stopped momentarily.

9/17/93 10:31:13 AM 10.533671 Rubber bridged. Clear and restart.

9/17/93 10:35:54 AM 10.612023 Rubber stopped again!!

9/17/93 11:52:03 AM 11.884236 Suspect pyrolyzed rubber is clogging up the
injection tube and/or the diffusion plate of the first vessel. Raised the temperature to 830°
C and purged through air only to burn out the char. I've no idea how clogged the exhaust
riser is. It is too hot to disassemble now. Will restart run using 120% combustion air and
the high temperature. The plan is to let the temperature creep down to 700° C.

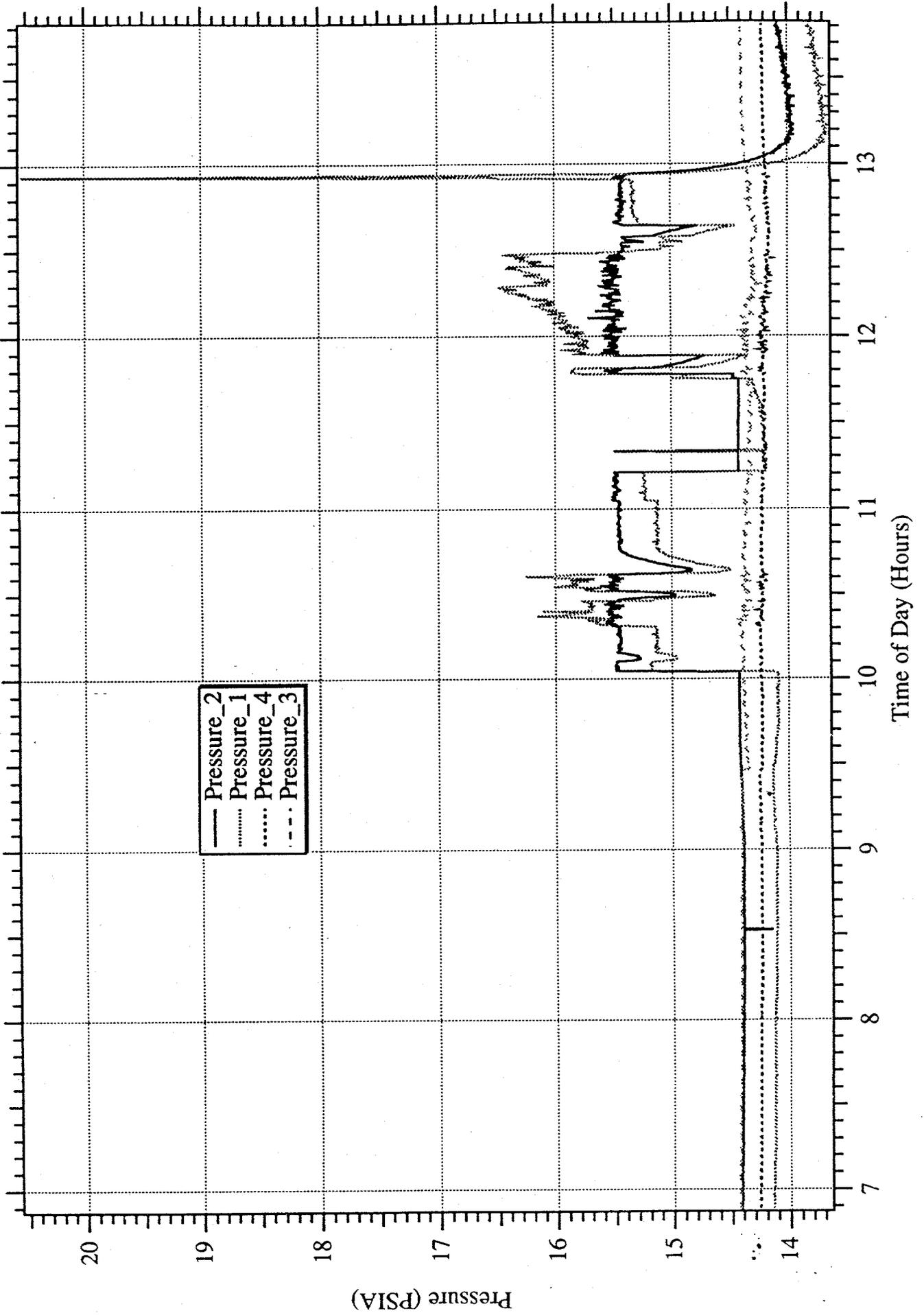
9/17/93 11:54:55 AM 11.932315 Start rubber feed. Combustion air flow is 2.4
scfm. Rubber feed is believed to be 4.7 gram per minute.

9/17/93 12:07:41 PM 12.145634 Take gas sample "A".

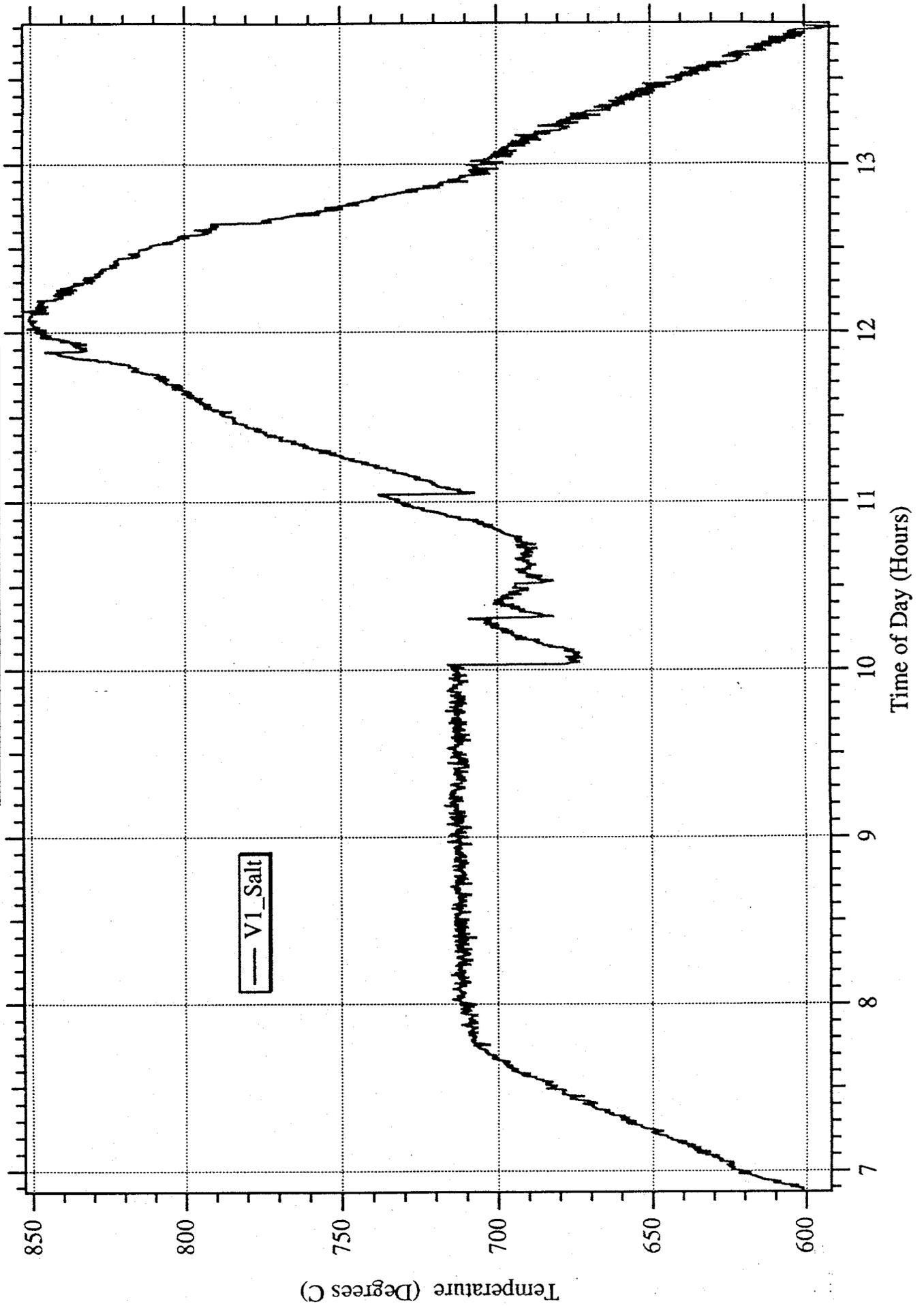
9/17/93 12:29:14 PM 12.505560 Injection plugged. Secure feed.

9/17/93 12:58:39 PM 12.996880 Shut down all power to heaters and secure
combustion air. Exhaust riser appears to be plugged.

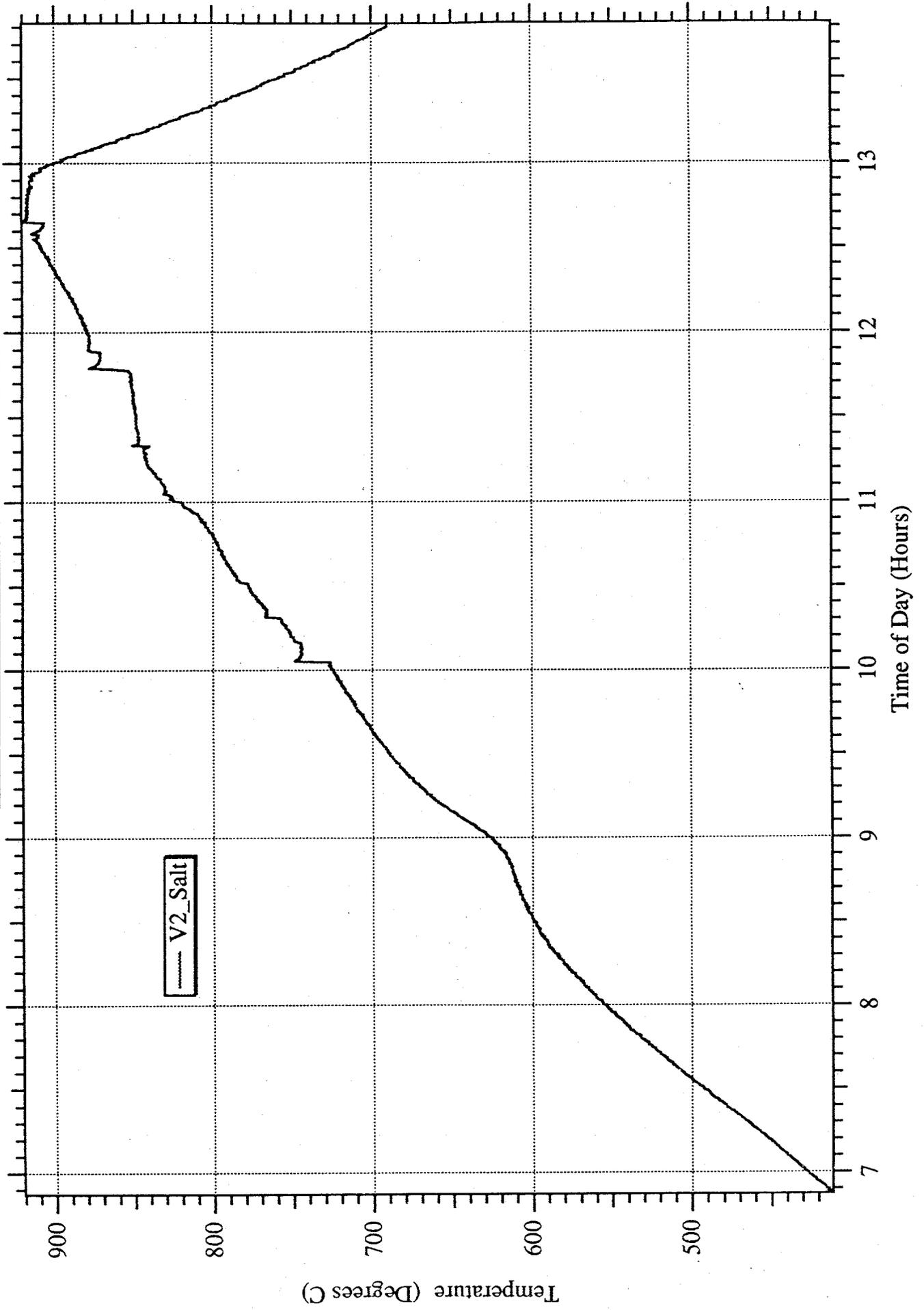
17 Sep 93 Pressures



17 Sep 93 Vessel One Salt Temperature



17 Sep 93 Vessel Two Salt Temperature



* TO: WILDER (0252-26) *

"A"

MASS SPECTROMETRIC ANALYSIS NO. 12542.
DONE ON 22 Sep 93 AT 09:31:51 CALCULATED ON 22-SEP-93 AT 11:22

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	79.21	0.07
2	OXYGEN	O2	4.978	0.006
3	ARGON	AR	0.939	0.001
4	CARBON DIOXIDE	CO2	14.177	0.014
5	CARBON MONOXIDE	CO	0.65	0.04
6	NITROUS OXIDE	N2O	0.044	0.006
			=====	
	TOTAL		100.00	

VARIANCE = 0.29 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.02 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Alan J. Sanders

Two Stage Molten Salt B-241 20 Sep 93 Run MSD:DATA:20 Sep 93 Run
TIMING REFERENCES-- VAX Time = 20-SEP-1993 10:38:39.00, Decimal Hours =
10.6441667

9/20/93 1:56:55 PM 13.956894 Restarted this experiment this morning. This program is up to its usual reliability. I am perpetually looking at the "Restart CAMAC", etc. and have no idea as to how to get rid of it. Anyway, the plan is to inject 3 g/min of rubber and 120% of stoicheometric air. This is 1.5 scfm (approximately).

9/20/93 2:07:08 PM 14.127551 This is a demonstration for Kelly and Bruce.

9/20/93 2:13:21 PM 14.231222 Begin injection of rubber.

9/20/93 2:25:53 PM 14.440722 we had to turn the system off for a couple of minutes but now were back on line

9/20/93 3:23:23 PM 15.401315 Installed a pneumatic vibrator on the rubber feed to, hopefully, stop the periodic plugging that has been plaguing us today. It seems to work, but the noise may drive us all mad.

9/20/93 3:57:11 PM 15.965968 Feed clogged, and unclogged, again.

9/20/93 4:10:38 PM 16.190935 Rubber feed bridged again, and was unclogged.

Vibrator quit working. Its demise is not a completely unwelcomed event.

9/20/93 4:33:12 PM 16.567551 Take gas sample "B"

9/20/93 4:44:49 PM 16.762083 this is a test

Two Stage Molten Salt B-241 20 Sep 93 Run Cont. MSD:DATA:20 Sep 93 Run Cont.

TIMING REFERENCES-- VAX Time = 20-SEP-1993 19:44:24.00, Decimal Hours = 19.7400000

9/20/93 7:50:02 PM 19.834208 This is a continuation of 20 Sep 93 Run. The computer inexplicably locked and was restarted. It inexplicably locked again. It was restarted again. This is that time.

Corrie!!!!

9/20/93 7:50:33 PM 19.842694 The time is now about 1950 hours, 20 Sep 93.

9/20/93 7:53:35 PM 19.893056 Take gas sample "C".

9/20/93 8:35:52 PM 20.599917 pop valve on hopper opened, line was clogged with large parts of rubber. also I turned the salt up one degree (733 from 732).

BB

9/20/93 10:32:12 PM 22.543444 Stopped feed, opened hopper, and added five (5) bottles of rubber crumbs. The bottles are emptied 500 g. sodium carbonate jars.

9/20/93 10:33:00 PM 22.556662 This is the first refill of the hopper since startup. Time was 2230 hours.

9/20/93 10:57:40 PM 22.969000 Take gas sample "D".

9/20/93 11:03:21 PM 23.064019

9/20/93 11:04:01 PM 23.075144 we are doing the shift change

9/21/93 12:16:58 AM 24.293977 note! with heater set at 734 degrees c, the salt temp. should remain at 700-699 degrees; however if a clog happens to the feed then the temp. will take a sudden drop to about 395 degrees.

9/21/93 12:39:10 AM 24.664866

9/21/93 1:19:29 AM 25.338444 for the last ten minutes or so the feed has been clogging more than in the past. Almost as if the feed material is a little damp.

9/21/93 2:31:05 AM 26.534741 we lost feed for a couple of minutes; the line (poly flow) became plugged.

9/21/93 2:57:31 AM 26.976259 pulling vial sample "E".

9/21/93 3:23:20 AM 27.407671 checking level of feed material in hopper.

9/21/93 3:28:04 AM 27.486356 added four jars of feed material to hopper.

9/21/93 4:35:22 AM 28.611218 having problems with the feeder again

9/21/93 6:42:14 AM 30.730727 we'll be taking sample "F" at 6:50

9/21/93 11:40:29 AM 35.713968 Take gas sample "G".

9/21/93 12:23:28 PM 36.431926 Shutdown feed for a short time to replace 1/4 inch injection tube with 3/8 inch tube.

9/21/93 12:27:22 PM 36.497264 Restart injector with 3/8 tube.

9/21/93 12:46:23 PM 36.814833 Stop feed to refill hopper.

9/21/93 12:47:45 PM 36.837593 Restart without adding additional rubber.

9/21/93 12:53:42 PM 36.936727 Note: For the last feed stoppage, I turned off the screw feed and opened the hopper without shutting down the combustion air or disconnecting the injection tubing. The vessel pressure log does not show the characteristic drop in pressure. I surmise that this indicates that the rubber entrained in the screw feed acts as a sufficient seal so as to maintain the pressure.

9/21/93 3:56:40 PM 39.993903 Take gas sample "H".

9/21/93 3:57:30 PM 40.007940 System has performed flawlessly for hours. I hope I'm not speaking prematurely.

9/21/93 4:03:54 PM 40.114741 Stop rubber feed to refill the hopper.

9/21/93 4:05:52 PM 40.147366 Restart rubber feed after adding two bottles of rubber crumbs.

9/21/93 7:50:38 PM 43.902940 dropped temp. down to 723 for awhile trying to get closer to 700 c on salt temp. result was to low. so I turned it up to 725 c until temp returned . Then I will put setting back to 724 c where it seems to run best.

B.B.

9/21/93 8:00:32 PM 44.068310 Removed sample "I" .

B.B.

9/21/93 10:15:13 PM 46.318843 At approx. 10:05 there was a pressure rise and I shut down air & rubber feed.

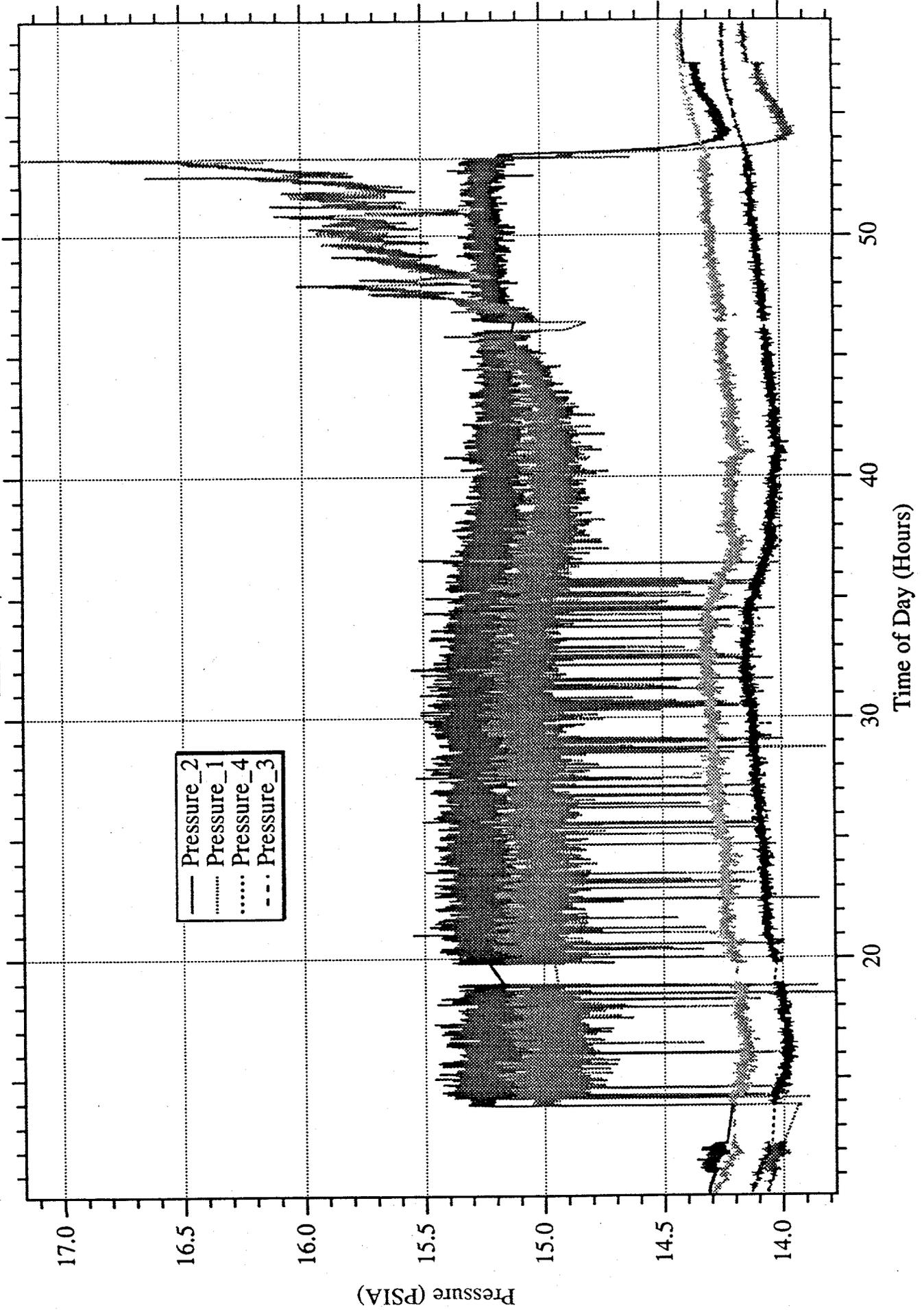
B.B.

9/21/93 10:27:02 PM 46.516111 This piece of crap software (Corrie!!) went ape and declared all pressures to be 1000 psi. The apparatus was shut down for awhile. The CAMAC crate was shutdown and restarted and this file continued but now we watch Corrie's "Restart CAMAC ..." because it won't go away.

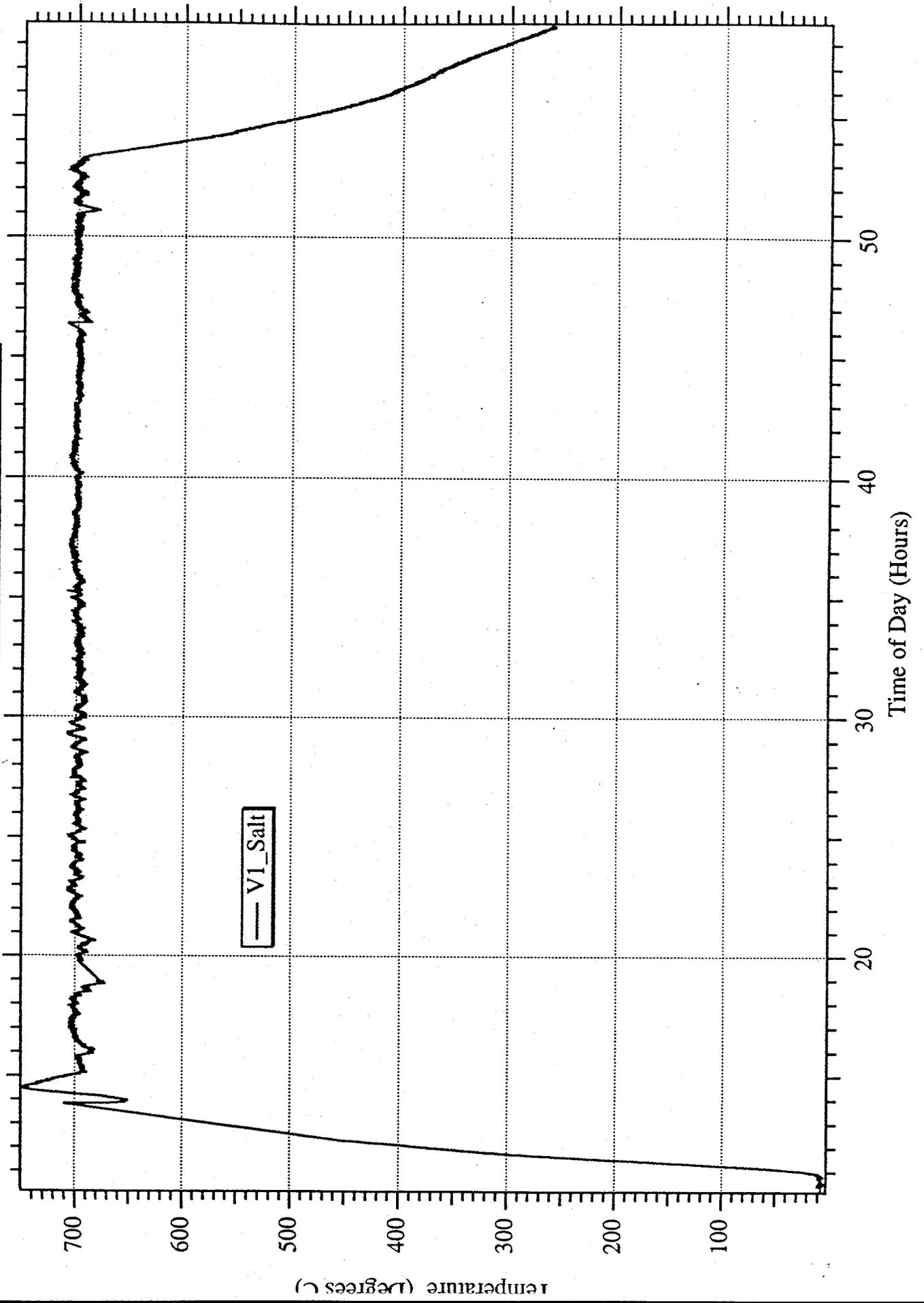
9/21/93 10:42:09 PM 46.768648 All pressure readings now say zero. I will reboot this computer and continue on a follow on file. File Name will be 20 Sep 93 (2)

9/21/93 10:44:22 PM 46.805731 Change my mind. Follow on file will be called 20 Sep 93a

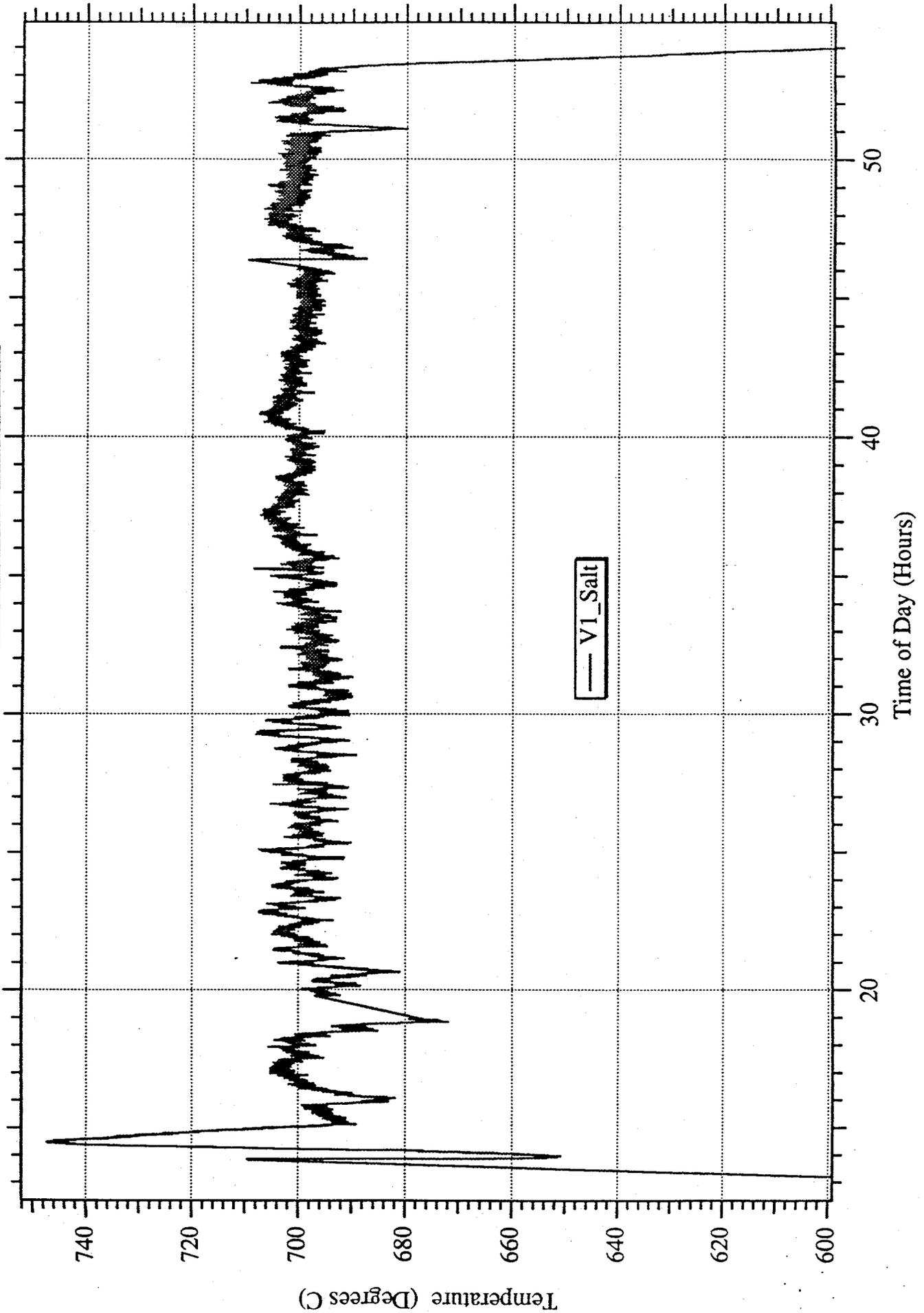
20 Sep 93 Pressures



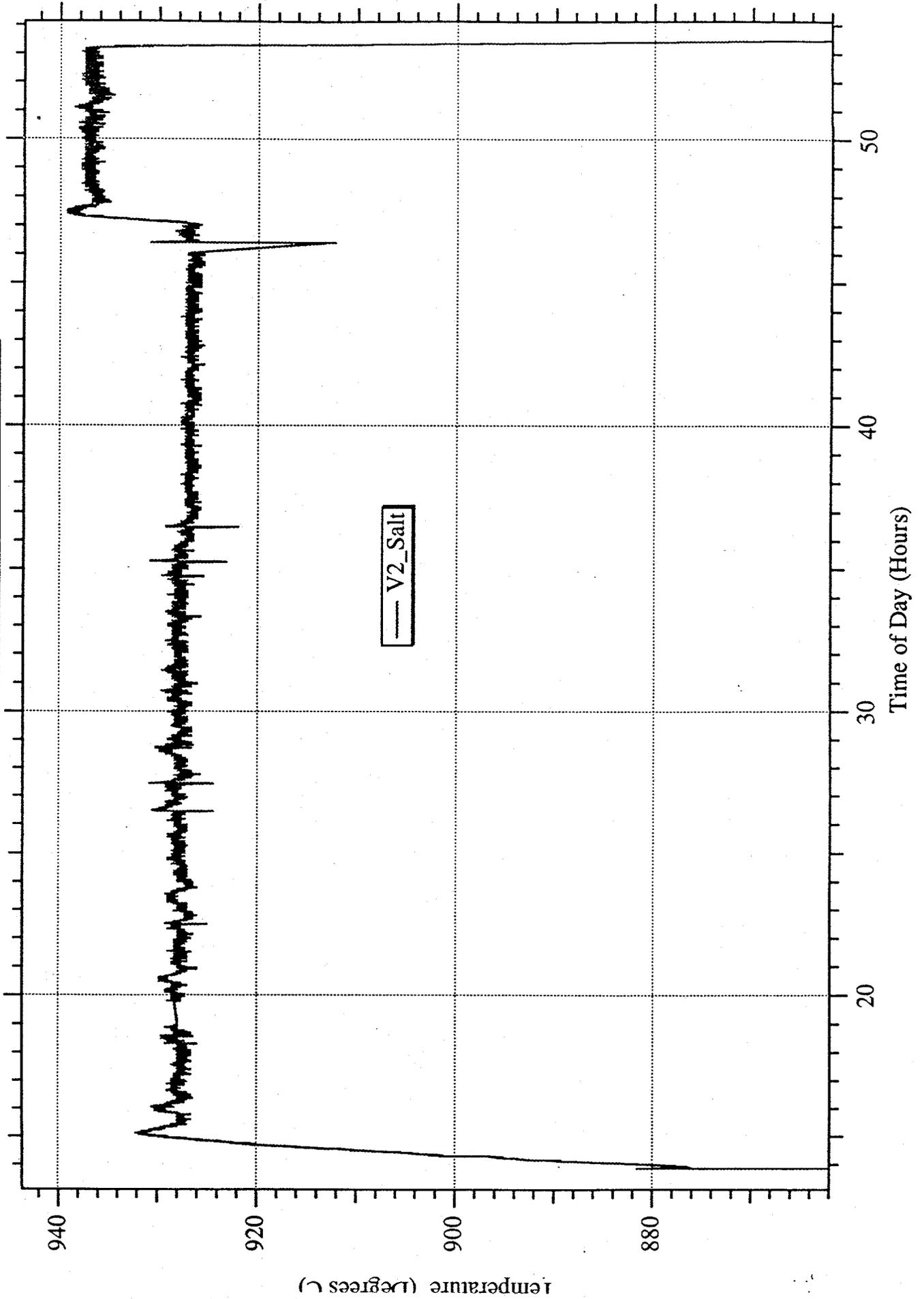
20 Sep 93 Vessel One Salt Temperature



20 Sep 93 Vessel One Salt Temperature



20 Sep 93 Vessel Two Salt Temperature



* TO: WILDER (0252-26) *

"A"

MASS SPECTROMETRIC ANALYSIS NO. 12542.
DONE ON 22 Sep 93 AT 09:31:51 CALCULATED ON 22-SEP-93 AT 11:22

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	79.21	0.07
2	OXYGEN	O2	4.978	0.006
3	ARGON	AR	0.939	0.001
4	CARBON DIOXIDE	CO2	14.177	0.014
5	CARBON MONOXIDE	CO	0.65	0.04
6	NITROUS OXIDE	N2O	0.044	0.006
			=====	
	TOTAL		100.00	

VARIANCE = 0.29 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.02 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

John Fendley

* TO: WILDER (0252-26) *

"B"

MASS SPECTROMETRIC ANALYSIS NO. 12543.
DONE ON 22 Sep 93 AT 09:47:05 CALCULATED ON 22-SEP-93 AT 11:22

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.06	0.10
2	OXYGEN	O2	8.363	0.015
3	ARGON	AR	0.949	0.002
4	CARBON DIOXIDE	CO2	10.364	0.015
5	CARBON MONOXIDE	CO	0.26	0.06
			=====	
	TOTAL		99.99	

VARIANCE = 0.42 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.12 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Jean Lindsey

* TO: WILDER (0252-26) *

"C" 8:00PM 9-20-93

MASS SPECTROMETRIC ANALYSIS NO. 12544.
DONE ON 22 Sep 93 AT 10:02:16 CALCULATED ON 22-SEP-93 AT 11:22

	COMPOUND		CONCENTRATION	STD. DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.08	0.13
2	OXYGEN	O2	8.76	0.02
3	ARGON	AR	0.948	0.002
4	CARBON DIOXIDE	CO2	9.983	0.020
5	CARBON MONOXIDE	CO	0.22	0.07
			=====	
	TOTAL		99.99	

VARIANCE = 0.54 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.16 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Max Lindseis

* TO: WILDER (0252-26) *

"D" 11:40 9-20-93

MASS SPECTROMETRIC ANALYSIS NO. 12545.
DONE ON 22 Sep 93 AT 10:17:29 CALCULATED ON 22-SEP-93 AT 11:22

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.40	0.12
2	OXYGEN	O2	10.34	0.02
3	ARGON	AR	0.947	0.002
4	CARBON DIOXIDE	CO2	8.298	0.016
5	NITRIC OXIDE	NO	0.011	0.002
			=====	
	TOTAL		100.00	

VARIANCE = 0.54 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.26 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

* TO: WILDER (0252-26) *

"E" 3:00AM 9-21-93

MASS SPECTROMETRIC ANALYSIS NO. 12546.
DONE ON 22 Sep 93 AT 10:32:46 CALCULATED ON 22-SEP-93 AT 11:23

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	78.22	0.15
2	OXYGEN	O2	17.94	0.04
3	ARGON	AR	0.926	0.002
4	CARBON DIOXIDE	CO2	2.893	0.008
5	NITRIC OXIDE	NO	0.011	0.002
			=====	
	TOTAL		100.00	

VARIANCE = 0.63 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.34 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

* TO: WILDER (0252-26) *

"F" 6:50AM 9-21-93

MASS SPECTROMETRIC ANALYSIS NO. 12547.
DONE ON 22 Sep 93 AT 10:47:57 CALCULATED ON 22-SEP-93 AT 11:40

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	79.30	0.16
2	OXYGEN	O2	12.86	0.04
3	ARGON	AR	0.938	0.003
4	CARBON DIOXIDE	CO2	6.882	0.020
5	NITRIC OXIDE	NO	0.012	0.002
			=====	
	TOTAL		100.00	

VARIANCE = 0.93 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.47 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

* TO: WILDER (0252-26) *

"G"

MASS SPECTROMETRIC ANALYSIS NO. 12548.
DONE ON 22 Sep 93 AT 11:29:54 CALCULATED ON 22-SEP-93 AT 13:11

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	79.81	0.16
2	OXYGEN	O2	10.62	0.03
3	ARGON	AR	0.945	0.003
4	CARBON DIOXIDE	CO2	8.55	0.02
5	NITROUS OXIDE	N2O	0.072	0.014
			=====	
	TOTAL		100.00	

VARIANCE = 0.69 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.30 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

* TO: WILDER (0252-26) *

"H"

MASS SPECTROMETRIC ANALYSIS NO. 12549.
DONE ON 22 Sep 93 AT 11:45:17 CALCULATED ON 22-SEP-93 AT 13:11

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	79.85	0.15
2	OXYGEN	O2	9.74	0.02
3	ARGON	AR	0.947	0.002
4	CARBON DIOXIDE	CO2	9.20	0.02
5	CARBON MONOXIDE	CO	0.20	0.08
6	NITROUS OXIDE	N2O	0.070	0.013
			=====	
	TOTAL		100.00	

VARIANCE = 0.60 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.43 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

* TO: WILDER (0252-26) *

"I" 9-21-93 8:00PM

MASS SPECTROMETRIC ANALYSIS NO. 12550.
DONE ON 22 Sep 93 AT 12:00:34 CALCULATED ON 22-SEP-93 AT 13:12

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	79.77	0.13
2	OXYGEN	O2	10.57	0.02
3	ARGON	AR	0.941	0.002
4	CARBON DIOXIDE	CO2	8.705	0.016
			=====	
	TOTAL		99.99	

VARIANCE = 0.52 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION, ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.36 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

* TO: WILDER (0252-26) *

"J." 9-21-93 12:00PM

MASS SPECTROMETRIC ANALYSIS NO. 12551.
DONE ON 22 Sep 93 AT 12:15:49 CALCULATED ON 22-SEP-93 AT 13:12

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.20	0.13
2	OXYGEN	O2	8.196	0.019
3	ARGON	AR	0.952	0.002
4	CARBON DIOXIDE	CO2	10.637	0.019
5	NITRIC OXIDE	NO	0.012	0.002
			=====	
	TOTAL		100.00	

VARIANCE = 0.54 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.37 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.
(1) WATER H2O

* TO: WILDER (0252-26) *

"K" 9-22-93 4:00AM

MASS SPECTROMETRIC ANALYSIS NO. 12552.
DONE ON 22 Sep 93 AT 12:31:06 CALCULATED ON 22-SEP-93 AT 13:12

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	79.84	0.11
2	OXYGEN	O2	10.74	0.02
3	ARGON	AR	0.943	0.002
4	CARBON DIOXIDE	CO2	8.464	0.016
5	NITRIC OXIDE	NO	0.012	0.002
			=====	
	TOTAL		100.00	

VARIANCE = 0.50 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.76 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Two Stage Molten Salt B-241 22 Sep 93 Run MSD:DATA:22 Sep 93 Run
TIMING REFERENCES-- VAX Time = 22-SEP-1993 18:21:50.00, Decimal Hours =
18.3638889

9/22/93 6:28:08 PM 18.469352 The time is 1325 hours, 22 Sep 93. We are restarting another "100" (this is wished for) run on the MSD 241 unit. Fuel feed will remain 3 g/min., combustion air feed will be set at 1.6 scfm. Our procedure will be to stop the combustion air and fuel once every 24 hours, heat the exhaust risers on both vessels with an oxy-acetylene "rosebud" until the accumulated salt is melted back into the vessel, and then continue the run.

The previous run was suspended after about 36 hours due to salt obstruction in the exhaust line.

9/22/93 10:29:50 PM 22.507588 It is 2230 hours, 22 Sep 93. All this time has been spent waiting for the 2nd vessel to reach a high enough temperature so we can start. It is not above 900° C but it is molten, so we can get started.

9/22/93 10:33:31 PM 22.558440 Start the combustion air.

9/22/93 10:36:53 PM 22.614796 Secure the top two heaters of vessel number one.

9/22/93 10:38:02 PM 22.633708 Begin rubber feed.

9/22/93 10:51:29 PM 22.858644 Take gas sample #54.

9/22/93 11:53:37 PM 23.896708

9/22/93 11:57:23 PM 23.959648 salt 2 plug thermal coupler is reading a very high temp. and has been since the restart. Please check the data from the first start up. The t/c is reading 3260 degrees.

9/23/93 4:00:03 AM 28.013792 pulling a gas sample; vial #55 we'll leave the vial open for 15 seconds and then secure the vial and the sample port.

9/23/93 7:22:25 AM 31.395190 Kelly told me that the rubber feed plugged once, at 0650 (about).

9/23/93 7:36:57 AM 31.638037 Added two jars of shedded rubber. This was don't without securing the combustion air or the rubber feed.

9/23/93 7:53:47 AM 31.919352 The salt temperature of vessel one rose about 5 degrees over the last ten minutes. This is abnormal. All other temperatures and pressures remain well within their normal limits. The lower heater current has not increased, in fact it has declined. I've reduced the set temperature 2 degrees. It would appear that the fuel increased somewhat. This is the only explanation I have.

9/23/93 8:01:11 AM 32.042931 Reduced vessel one set point one more degree to 724 degrees.

9/23/93 8:05:33 AM 32.115880 Take gas sample #3.

9/23/93 8:07:47 AM 32.153176 Reduced vessel one set point one more degree to 723.

9/23/93 3:06:45 PM 39.153046 At 1210 hours, gas sample #3 taken.

9/23/93 3:21:38 PM 39.401583 Shut down rubber feed and combustion air. Torch the riser of vessel #1 to clear it of salt.

9/23/93 3:29:12 PM 39.528051 Restart combustion air and rubber feed. No detectable salt buildup in riser, so no torching was necessary. Added three bottles of rubber crumbs to the hopper.

9/23/93 3:57:13 PM 39.996134

9/23/93 4:04:30 PM 40.117963 removed sample #55 B.B.

9/23/93 7:41:16 PM 43.739569 Note, gas sample #3 and #55 were taken twice. Assume that the first take is probably good but no gas samples have been taken in the last 8 hours.

9/23/93 7:48:02 PM 43.852676 Will take two gas samples at the same time. Sample number 56 is located after the 2nd vessel as all the previous samples were. Number 54 is located at the top of vessel one riser. Take both sample now.

9/23/93 10:57:18 PM 47.014833 feed was turned off while filling the hooper we put in 3 bottles of feed material.

9/24/93 12:00:07 AM 48.064019 taking gas sample lable reads 1 9-25-93
12:00 a.m.

9/24/93 3:58:58 AM 52.054889 taking gas sample #2; lable reads: #2 4:00 a.m.
9/24/93.

9/24/93 5:50:40 AM 53.921361 feeder sleeve became clogged about 05:30; we over shot the temp. we are slowly bringing it back down.

9/24/93 6:17:04 AM 54.362009

9/24/93 7:03:08 AM 55.131940 added 2 more jars of feed material.

9/24/93 7:08:29 AM 55.221306 The "Restart CAMAC" idiot sign just appeared an automatically stopped the program log. It is now restarted but we must look at the "Restart" sign forever.

9/24/93 7:28:45 AM 55.559569 Preparing to take two gas samples at 0800. #51 will be taken at the top of vessel one riser. #57 will be taken at the usual place, the exhaust line after the cold trap.

9/24/93 7:36:14 AM 55.684616 Salt temperature in vessel one began to rise a little so the set temperature was reduced to compensate. I believe this to be the result of an increased rubber feed rate entering the system. There does not seem to be the consistency from the screw feed that I desire.

9/24/93 7:57:16 AM 56.036486 Take gas samples #51 and #57.

9/24/93 8:16:10 AM 56.351801 I probed vessel one riser with my standard probe wire while removing the gas sample bottle. There was no indication of salt buildup.

9/24/93 8:54:11 AM 56.987389 I increased the set point 1 degree to 717

9/24/93 9:17:11 AM 57.371417 I increased the set point one degree to 718

9/24/93 9:58:27 AM 58.061065 I increased the set point one degree to 719

9/24/93 10:38:12 AM 58.724815 I increased the set point one degree to 720

9/24/93 11:00:50 AM 59.103218 I increased the set point one degree to 721

9/24/93 12:01:20 PM 60.113764 Gas sample - "A" 9-24-93 taken at 1200

9/24/93 12:10:44 PM 60.271190 I increased the set point one degree to 722

9/24/93 2:51:05 PM 62.950324 At 1445, the lift line had bridged and plugged in the reducing fittings. Cleared the blockage and reassembled.

9/24/93 4:06:31 PM 16.111667 Take gas sample "B"

9/24/93 4:06:56 PM 16.118565 Add three jars of rubber crumbs to hopper.

9/24/93 6:22:21 PM 18.381051 Feeder clogged B.B.

9/24/93 8:00:15 PM 20.016324 Removed sample "C". B.B.

9/24/93 8:41:22 PM 20.703463 Note : temp. dropped for no reason I could see feeder was feeding ? Turned temp. up to compensate. B.B.

9/24/93 8:45:50 PM 20.778282 Question : Are we using house air and if so ,is the water being filterd out ? This would expliane the clogging of feeder. B.B.

9/24/93 10:47:23 PM 22.809014 Checked top of the exhaust riser of vessel 1. Looked ok. No appreciable buildup of salt. Have decided to forgo melting it back until tomorrow.

9/24/93 10:56:46 PM 22.965907 Add three jars of rubber crumbs to feed hopper.

9/25/93 12:14:36 AM 24.266171 pulled gas sample at 12:05 a.m. vial reads #51.

9/25/93 3:02:05 AM 27.064444 lisening to the feed through the feed tube , the feed rate has slowed and tapping it with the hammer is not effecting it. Disassembly of the cluge apparati is in order.

9/25/93 3:05:41 AM 27.124676 some of the feed material was clinging on the second step from the bottom of the apparati; the material also appeared to be damp.

9/25/93 3:23:36 AM 27.423991 there is no feed material comming out of the hopper. opening the lid . material had packed, stiring material around and material is now moving again.

9/25/93 4:00:01 AM 28.032579 pulling 4:00 gas sample. lable reads #52 4:00 a.m. 9\25\93.

9/25/93 5:13:56 AM 29.267005 feed rate was slowing down and the temp. was dropping so I opened the lid to the hopper and stirred the material around.

9/25/93 7:34:57 AM 31.623519 just finished filling the hopper with 3 more jars of feed material.

9/25/93 7:58:35 AM 32.018245 pulling gas sample ,lable reads as: #53 8:00 a.m. 9\25\93.

9/25/93 11:58:53 AM 36.032986 Removed sample #1 . B.B.

9/25/93 4:00:03 PM 40.062287 Removed sample #2. B.B.

9/25/93 4:05:36 PM 40.155028 Added 3 jars of rubber. B.B.

9/25/93 5:45:31 PM 41.824606 Observation : it seems that as the hopper emptys , salt #1 temp. drops & the heater nee ds to be raised. After filling hopper I have noticed the salt #1 temp. gets hotter & I needed to drop heater temp..

My conclusion is

the added waight must help the worm feed

gear load fuel.

Two Stage Molten Salt B-241 22 Sep 93 Run Cont. MSD:DATA:22 Sep 93 Run Cont.

TIMING REFERENCES-- VAX Time = 25-SEP-1993 18:49:57.00, Decimal Hours = 18.8325000

9/25/93 6:55:31 PM 18.925042 This is the continuation of 22 Sep 93 Run. It is now 1855, Saturday.

9/25/93 6:56:21 PM 18.939319 I attempted to look at the data file with Word while the application was running. It caused the LabView application to shut down.

9/25/93 7:31:13 PM 19.521718 Hopper clogged at reducer . B.B.

9/25/93 8:00:04 PM 20.003792 pulled gas sample lable reads as : #3

9/25/93 11:57:46 PM 23.975292 pulling gas sample ;lable reads :#4 12:00 a.m.

9/26/93.

9/26/93 4:00:11 AM 28.025093 pulling gas sample, lable reads as:#5 4:00 a.m.

9/26/93.

9/26/93 6:02:03 AM 30.061583 filled up hopper with 3 jars of feed material time 6:02 a.m.

9/26/93 8:00:11 AM 32.035171 Take gas sample #6.

9/26/93 8:08:13 AM 32.169495 Bill Sawyer has just arrived and has been briefed on the operation.

9/26/93 1:22:22 PM 37.418046 Combustion air and fuel feed stopped due to excessive vessel pressure in vessel number one.

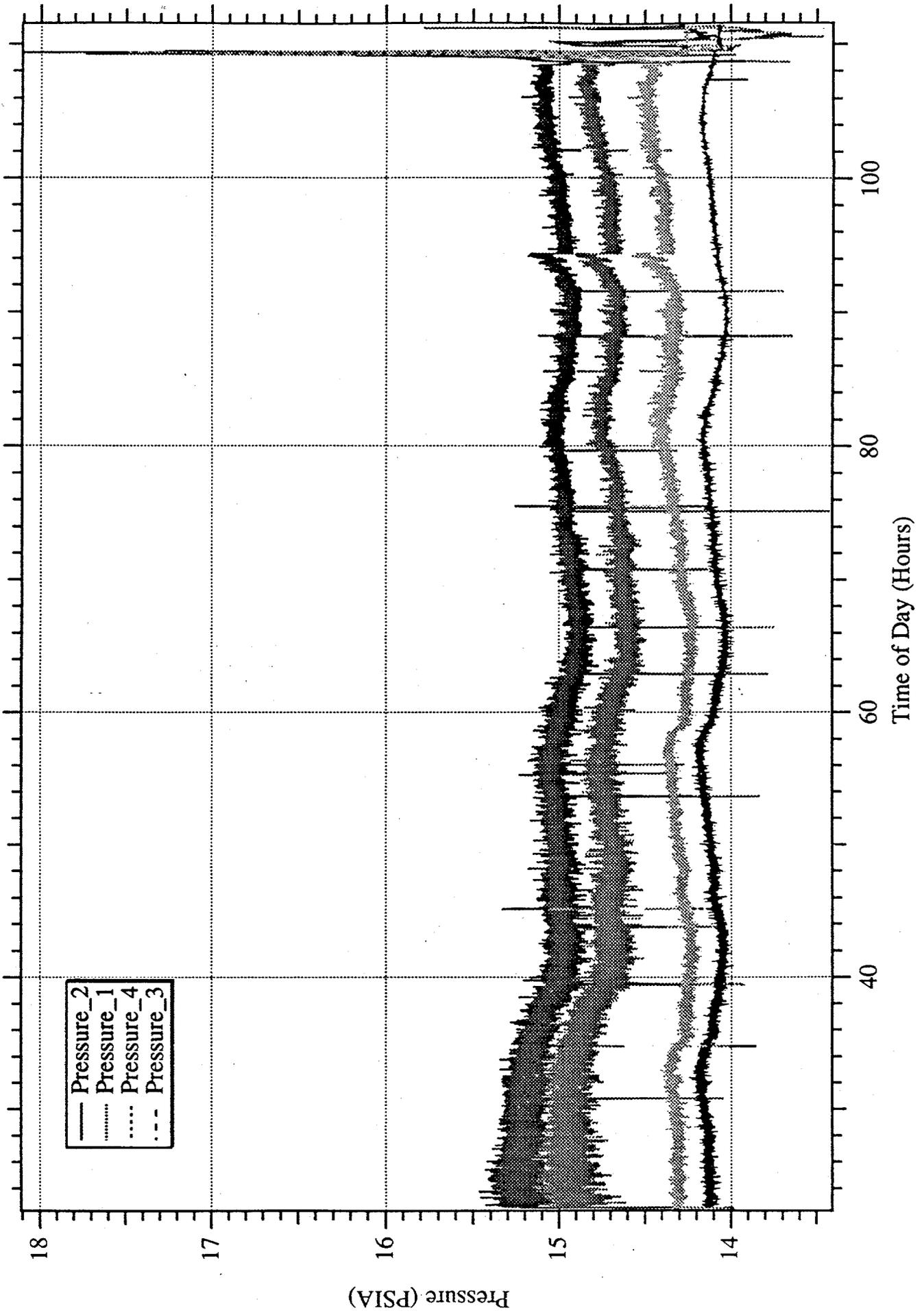
9/26/93 1:54:17 PM 37.951403 Completed heating the exhaust risers in both vessels. The riser of vessel two appears to have been the blocked passage. Restarted combustion air and rubber feed.

9/26/93 2:06:30 PM 38.155144 Secured fuel feed and combustion air flow. It appears that the exhaust riser in vessel one is still plugged.

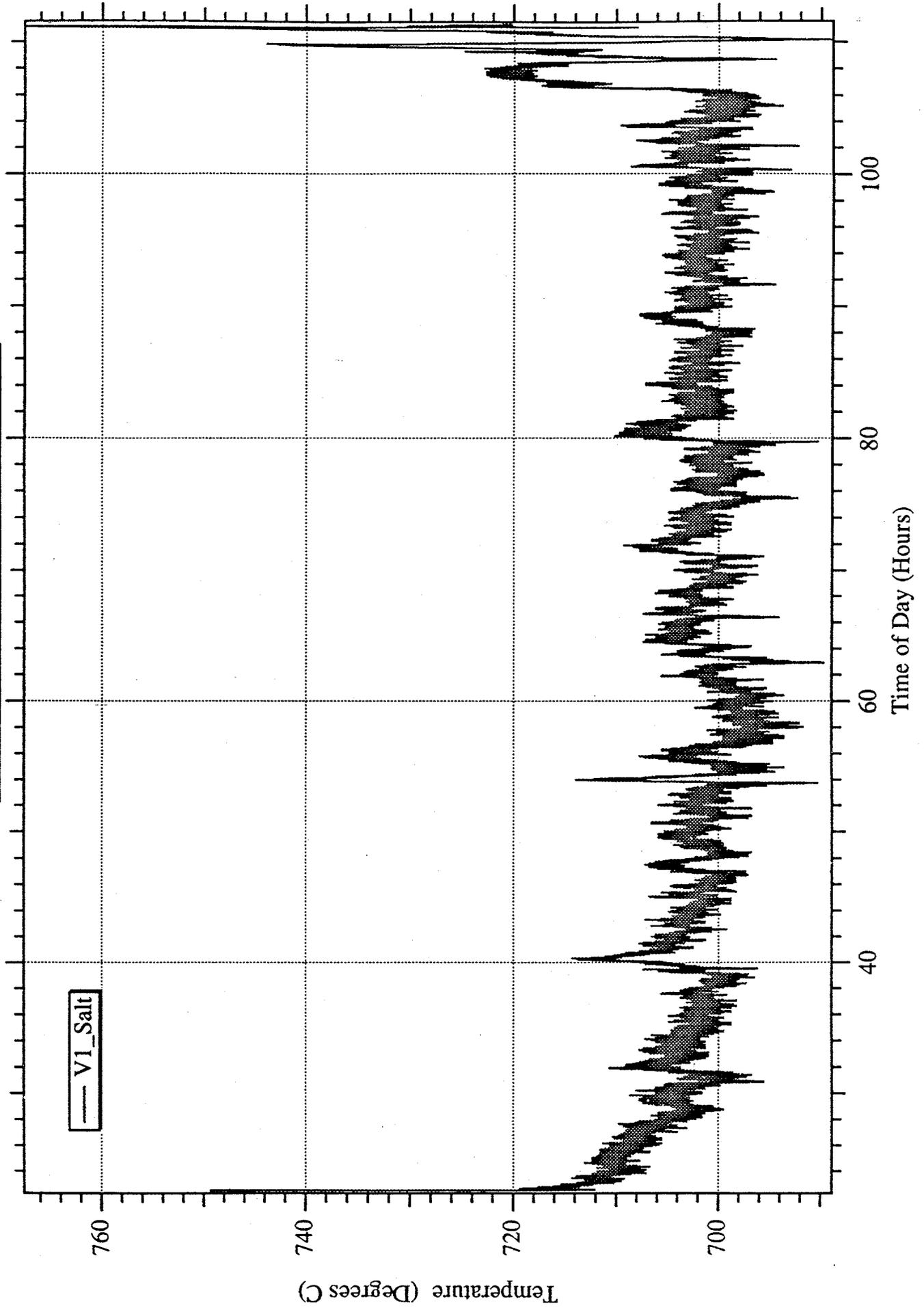
9/26/93 3:03:23 PM 39.105787 About an hour was used to melt out the riser. It appears as if a "blob" of salt was pushed up into the riser in a very short period of time. It is hoped that it is clear now.

9/26/93 3:09:27 PM 39.207333 There appears to still be a blockage in the exhaust line. I am shutting down the experiment. We will allow the units to cool and inspect.

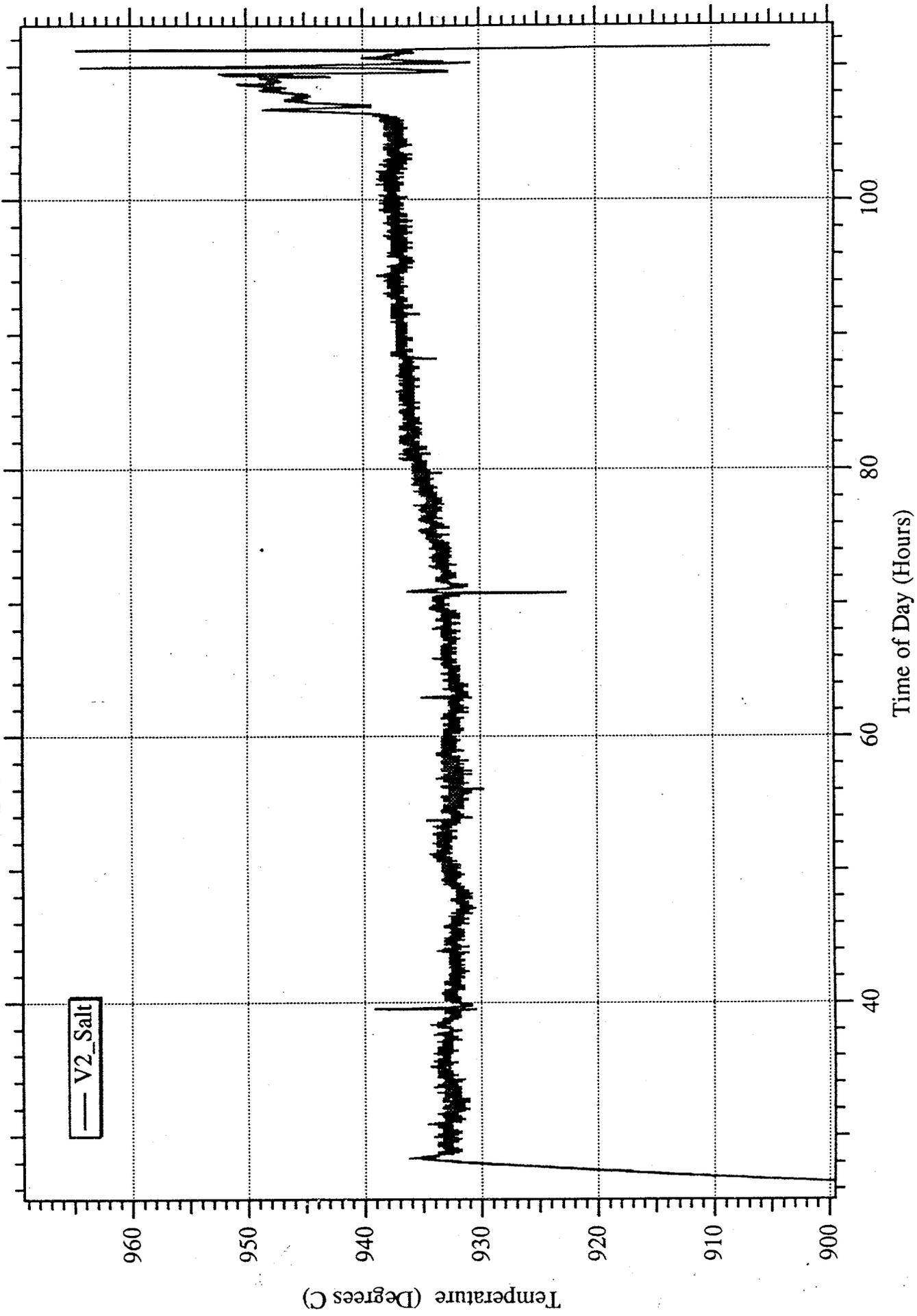
22 Sep 93 Pressures



22 Sep 93 Vessel One Salt Temperature



22 Sep 93 Vessel Two Salt Temperature



* TO: WILDER (0252-26) *

"54"

MASS SPECTROMETRIC ANALYSIS NO. 12564.
DONE ON 24 Sep 93 AT 10:36:09 CALCULATED ON 24-SEP-93 AT 13:37

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.78	0.14
2	OXYGEN	O2	9.64	0.02
3	ARGON	AR	0.912	0.002
4	CARBON DIOXIDE	CO2	8.481	0.018
5	CARBON MONOXIDE	CO	0.18	0.06
6	NITRIC OXIDE	NO	0.011	0.002
			=====	
	TOTAL		100.00	

VARIANCE = 0.58 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.22 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Jan Lindsey

* TO: WILDER (0252-26) *

"55"

MASS SPECTROMETRIC ANALYSIS NO. 12565.
DONE ON 24 Sep 93 AT 10:51:27 CALCULATED ON 24-SEP-93 AT 13:37

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	79.98	0.12
2	OXYGEN	O2	10.71	0.02
3	ARGON	AR	0.901	0.002
4	CARBON DIOXIDE	CO2	8.155	0.016
5	CARBON MONOXIDE	CO	0.23	0.06
6	NITRIC OXIDE	NO	0.011	0.001
			=====	
	TOTAL		100.00	

VARIANCE = 0.52 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.18 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.
(1) WATER H2O

Max Jendryg

* TO: WILDER (0252-26) *

"3"

MASS SPECTROMETRIC ANALYSIS NO. 12562.
DONE ON 24 Sep 93 AT 10:05:37 CALCULATED ON 24-SEP-93 AT 13:36

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.55	0.12
2	OXYGEN	O2	8.985	0.019
3	ARGON	AR	0.907	0.002
4	CARBON DIOXIDE	CO2	9.282	0.016
5	CARBON MONOXIDE	CO	0.27	0.06
			=====	
	TOTAL		99.99	

VARIANCE = 0.49 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE 'REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% 'OF THE.
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.13 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Max Jendryg

* TO: WILDER (0252-26) *

"56"

MASS SPECTROMETRIC ANALYSIS NO. 12566.
DONE ON 24 Sep 93 AT 11:23:15 CALCULATED ON 24-SEP-93 AT 13:47

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.60	0.12
2	OXYGEN	O2	8.663	0.018
3	ARGON	AR	0.912	0.002
4	CARBON DIOXIDE	CO2	9.553	0.017
5	CARBON MONOXIDE	CO	0.26	0.05
6	NITRIC OXIDE	NO	0.011	0.001
			=====	
	TOTAL		100.00	

VARIANCE = 0.49 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE 'REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.07 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Jan Lindsey

* TO: WILDER (0252-26) *

"1" 12:00AM 9/24/93

MASS SPECTROMETRIC ANALYSIS NO. 12560.
DONE ON 24 Sep 93 AT 09:35:05 CALCULATED ON 24-SEP-93 AT 13:36

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.45	0.13
2	OXYGEN	O2	10.24	0.02
3	ARGON	AR	0.906	0.002
4	CARBON DIOXIDE	CO2	8.174	0.017
5	CARBON MONOXIDE	CO	0.23	0.07
			=====	
	TOTAL		99.99	

VARIANCE = 0.56 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.02 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Jan Lindsey

* TO: WILDER (0252-26) *

"2" 4:00AM 9/24/93

MASS SPECTROMETRIC ANALYSIS NO. 12561.
DONE ON 24 Sep 93 AT 09:50:21 CALCULATED ON 24-SEP-93 AT 14:19

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.46	0.11
2	OXYGEN	O2	9.435	0.017
3	ARGON	AR	0.911	0.002
4	CARBON DIOXIDE	CO2	8.894	0.015
5	CARBON MONOXIDE	CO	0.29	0.06
6	NITRIC OXIDE	NO	0.011	0.001
			=====	
	TOTAL		100.00	

VARIANCE = 0.45 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.07 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.
(1) WATER H2O

John Sandberg

* TO: WILDER (0252-26) *

"51"

MASS SPECTROMETRIC ANALYSIS NO. 12563.
DONE ON 24 Sep 93 AT 10:20:52 CALCULATED ON 24-SEP-93 AT 13:36

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	81.18	0.11
2	OXYGEN	O2	7.185	0.015
3	ARGON	AR	0.918	0.002
4	CARBON DIOXIDE	CO2	10.300	0.017
5	CARBON MONOXIDE	CO	0.40	0.05
6	NITRIC OXIDE	NO	0.012	0.001
			=====	
	TOTAL		100.00	

VARIANCE = 0.48 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.19 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Jan L. nolsen

* TO: WILDER (0252-26) *

"57"

MASS SPECTROMETRIC ANALYSIS NO. 12567.
DONE ON 24 Sep 93 AT 11:38:31 CALCULATED ON 24-SEP-93 AT 14:30

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	81.16	0.16
2	OXYGEN	O2	8.05	0.03
3	ARGON	AR	0.911	0.003
4	CARBON DIOXIDE	CO2	9.87	0.02
5	NITRIC OXIDE	NO	0.015	0.002
			=====	
	TOTAL		100.00	

VARIANCE = 0.75 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.11 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Kan Lindsey

* TO: WILDER (7949-35) *

A 9/24/93

MASS SPECTROMETRIC ANALYSIS NO. 12597.
DONE ON 28 Sep 93 AT 11:20:55 CALCULATED ON 29-SEP-93 AT 08:48

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.61	0.11
2	OXYGEN	O2	11.16	0.02
3	ARGON	AR	0.894	0.002
4	CARBON DIOXIDE	CO2	7.330	0.014
			=====	
	TOTAL		99.99	

VARIANCE = 0.56 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.29 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.
(1) WATER H2O

Jan Linder

* TO: WILDER (7949-35) *

B 9/24/93

MASS SPECTROMETRIC ANALYSIS NO. 12598.
DONE ON 28 Sep 93 AT 11:36:05 CALCULATED ON 29-SEP-93 AT 08:49

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.60	0.09
2	OXYGEN	O2	10.870	0.016
3	ARGON	AR	0.892	0.001
4	CARBON DIOXIDE	CO2	7.444	0.011
5	CARBON MONOXIDE	CO	0.19	0.05
			=====	
	TOTAL		100.00	

VARIANCE = 0.37 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.34 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Max Lindsey

* TO: WILDER (7949-35) *

C

MASS SPECTROMETRIC ANALYSIS NO. 12599.
DONE ON 28 Sep 93 AT 12:31:04 CALCULATED ON 29-SEP-93 AT 08:49

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	81.98	0.11
2	OXYGEN	O2	5.587	0.012
3	ARGON	AR	0.907	0.002
4	CARBON DIOXIDE	CO2	11.520	0.017
			=====	
	TOTAL		100.00	

VARIANCE = 0.50 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.05 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Jan Lindsey

* TO: WILDER (7949-35) *

#52 4:00AM 9/25/93

MASS SPECTROMETRIC ANALYSIS NO. 12595.
DONE ON 28 Sep 93 AT 10:50:31 CALCULATED ON 29-SEP-93 AT 08:48

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.79	0.09
2	OXYGEN	O2	9.591	0.014
3	ARGON	AR	0.895	0.001
4	CARBON DIOXIDE	CO2	8.608	0.012
5	CARBON MONOXIDE	CO	0.11	0.04
6	NITRIC OXIDE	NO	0.011	0.001
			=====	
	TOTAL		100.00	

VARIANCE = 0.36 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.12 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Jan Lindsey

* TO: WILDER (7949-35) *

#53 8:00AM 9/25/93

MASS SPECTROMETRIC ANALYSIS NO. 12596.
DONE ON 28 Sep 93 AT 11:05:45 CALCULATED ON 29-SEP-93 AT 08:48

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.33	0.06
2	OXYGEN	O2	11.283	0.012
3	ARGON	AR	0.890	0.001
4	CARBON DIOXIDE	CO2	7.369	0.008
5	CARBON MONOXIDE	CO	0.12	0.03
			=====	
	TOTAL		99.99	

VARIANCE = 0.27 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.20 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Glax Lindsey

* TO: WILDER (7949-35) *

#1

MASS SPECTROMETRIC ANALYSIS NO. 12579.
DONE ON 27 Sep 93 AT 12:24:20 CALCULATED ON 29-SEP-93 AT 08:34

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.74	0.11
2	OXYGEN	O2	10.26	0.02
3	ARGON	AR	0.902	0.002
4	CARBON DIOXIDE	CO2	8.065	0.015
5	HELIUM	HE	0.030	0.008
			=====	
	TOTAL		100.00	

VARIANCE = 0.55 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.03 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Max Lindsey

* TO: WILDER (7949-35) *

#2

MASS SPECTROMETRIC ANALYSIS NO. 12580.
DONE ON 27 Sep 93 AT 12:39:40 CALCULATED ON 29-SEP-93 AT 08:34

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.77	0.11
2	OXYGEN	O2	10.87	0.02
3	ARGON	AR	0.891	0.002
4	CARBON DIOXIDE	CO2	7.465	0.014
			=====	
	TOTAL		100.00	

VARIANCE = 0.55 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.14 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Jean Lindsay

* TO: WILDER (7949-35) *

#3 8:00PM 9/25/93

MASS SPECTROMETRIC ANALYSIS NO. 12581.
DONE ON 27 Sep 93 AT 12:54:55 CALCULATED ON 29-SEP-93 AT 08:34

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.51	0.07
2	OXYGEN	O2	11.661	0.016
3	ARGON	AR	0.892	0.001
4	CARBON DIOXIDE	CO2	6.939	0.009
			=====	
	TOTAL		100.00	

VARIANCE = 0.36 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE 'REGRESSION',
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.19 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.
(1) WATER H2O

Jean Lindsey

* TO: WILDER (7949-35) *

#4 12:00AM 9/26/93

MASS SPECTROMETRIC ANALYSIS NO. 12582.
DONE ON 27 Sep 93 AT 13:10:09 CALCULATED ON 29-SEP-93 AT 08:35

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.32	0.07
2	OXYGEN	O2	12.648	0.017
3	ARGON	AR	0.888	0.001
4	CARBON DIOXIDE	CO2	6.143	0.008
			=====	
	TOTAL		100.00	

VARIANCE = 0.35 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.25 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Jan Lindsey

* TO: WILDER (7949-35) *

#5 4:00AM 9/26/93

MASS SPECTROMETRIC ANALYSIS NO. 12583.
DONE ON 27 Sep 93 AT 13:25:27 CALCULATED ON 29-SEP-93 AT 08:35

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.71	0.09
2	OXYGEN	O2	11.250	0.020
3	ARGON	AR	0.894	0.002
4	CARBON DIOXIDE	CO2	7.134	0.011
			=====	
	TOTAL		99.99	

VARIANCE = 0.43 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.33 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Jan Lindsig

* TO: WILDER (7949-35) *

#6 8:00AM 9/26/93

MASS SPECTROMETRIC ANALYSIS NO. 12584.
DONE ON 27 Sep 93 AT 13:40:42 CALCULATED ON 29-SEP-93 AT 08:36

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.81	0.04
2	OXYGEN	O2	10.191	0.009
3	ARGON	AR	0.897	0.001
4	CARBON DIOXIDE	CO2	8.085	0.006
			=====	
	TOTAL		99.98	

VARIANCE = 0.29 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.28 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

Jan Lindsiz

Two Stage Molten Salt B-241 27 Sep 93 Run MSD:DATA:27 Sep 93 Run
TIMING REFERENCES-- VAX Time = 27-SEP-1993 19:18:49.00, Decimal Hours =
19.3136111

9/27/93 7:23:38 PM 19.393907 This is another attempt to run 100 hours. We have installed wire brush cleaning devices on the exhaust riser of each vessel. The plan is to sweep the risers at periodic intervals to keep them clear. During the initial startup, the lower heating element of vessel #1 shorted and welded itself to the lower thermocouple well. The "weld" was broken. The system seems to be working.

9/27/93 8:30:28 PM 20.510593 Initial temperature on vessel one had to be raised quite high in order to free a salt plug in the injector tube. I will cool the vessel down a bit before starting the rubber feed.

9/27/93 8:34:42 PM 20.581306 Begin rubber feed. Feed rate is estimated to be about 3.0 g/min.

9/27/93 10:00:02 PM 22.007032 Removed sample #8. B.B.

9/27/93 10:21:29 PM 22.365495 Raised temp. to 729 10:25 pm B.B.

9/27/93 11:04:44 PM 23.088167 Stopped rubber feed and combustion air momentarily to "scrub" both riser with the new brushes. All worked well. Restarted combustion air and rubber feed with same conditions as before.

9/28/93 12:13:26 AM 24.235745 Corrie, the time scale of the data charts has gone completely ape. What happened?

9/28/93 12:14:58 AM 24.261444 Take gas sample #9.

9/28/93 3:33:43 AM 27.581958 This is a demonstration for Curly.

9/28/93 3:44:32 AM 27.762940 Shut down fuel and combustion air for a short time to scrape the two risers for the second time. They appear to be clear. Restarted air and fuel as before.

9/28/93 3:47:08 AM 27.805940 Added two bottles of rubber to hopper.

9/28/93 4:05:17 AM 28.109412 Took gas sample #10

9/28/93 4:14:44 AM 28.267245 Rubber feed plugged during last gas sample

9/28/93 4:45:58 AM 28.789148 Plugged feed 10min ago

PROBLEM WITH COMPUTER -OPERATER ERROR

9/28/93 5:15:40 AM 29.285426 Fuel feed plugged 5min ago

9/28/93 5:51:16 AM 29.880218 CAMAC restarted

9/28/93 7:37:54 AM 31.661722 P2 above 15psi , cleared both risers but did not help. Horizontal run ?

Will wait for Doug and see what he says.

9/28/93 7:50:28 AM 31.871866 Bumped set point up to 750c .

9/28/93 8:03:30 AM 32.089639 Pressure up to 15.25psi HOPE Doug gets here SOON !

9/28/93 8:25:08 AM 32.450620 Sample #11 taken at 0820.

Risers have been swept with wire brush, but pressure still rising slowly. The horizontal section is apparently filling with salt again.

9/28/93 8:33:35 AM 32.592097 At 0830, opened tap below pressure tap and rodded material out, pressure dropped. When tap was closed, pressure went back up.

9/28/93 9:45:24 AM 33.792000 Unexpected rise in pressures one and two. Stop experiment. Will determine cause.

9/28/93 9:47:45 AM 33.831157 This is a test.

9/28/93 11:01:38 AM 35.065685 The system pressure began to rise, so it was shut down for inspection. We found no evidence of blockage anywhere! We've reassembled the exhaust lines and are waiting for the salt temperature to return to the previous settings prior to continuance.

9/28/93 11:10:05 AM 35.206907 Begin feed. Temperatures are a bit low, but it is hoped that the burning rubber will accelerate the warmup.

9/28/93 11:11:39 AM 35.232907 Secured vessel one top heater.

9/28/93 11:16:15 AM 35.310005 Two jars of rubber were added prior to this resumption of fuel feed.

9/28/93 11:36:42 AM 35.651685 Power reading to the lower heater of vessel one is 72%, as compared to 48% earlier, yet the salt temperature appears to have stabilized at under 700° C. The pressure has stabilized (for now) at about 15.1 psi though I find no indication of blockage anywhere. We are further plagued by the PrintMonitor feature of this Mac no wanting to go away.

9/28/93 11:50:41 AM 35.885088 I'm beginning to believe that the recent abnormalities in pressure just may be caused by faulty readings. They may bear little resemblance to reality.

9/28/93 12:02:43 PM 36.086370

9/28/93 12:06:22 PM 36.147102

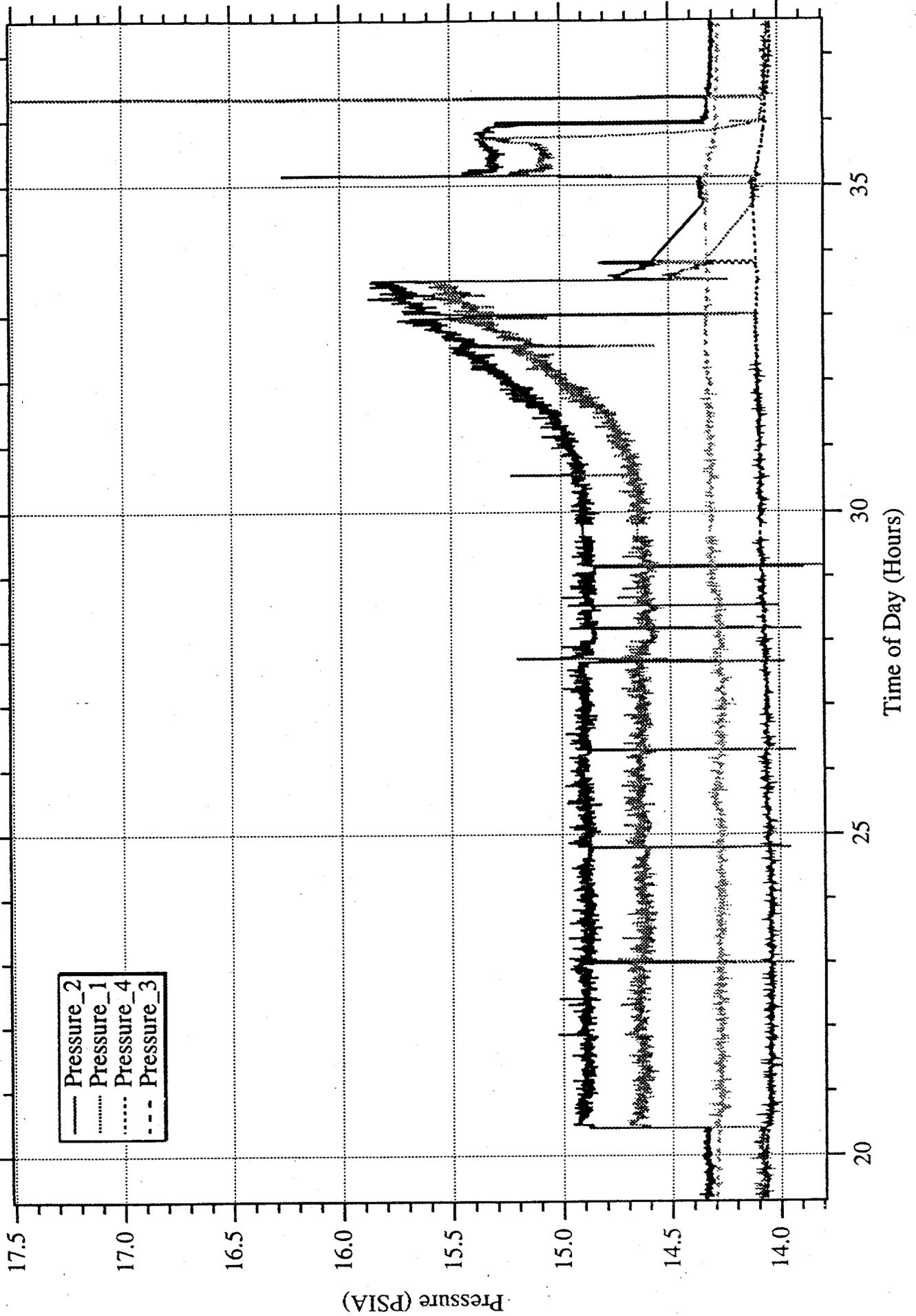
9/28/93 12:06:35 PM 36.150532

9/28/93 12:10:35 PM 36.217792

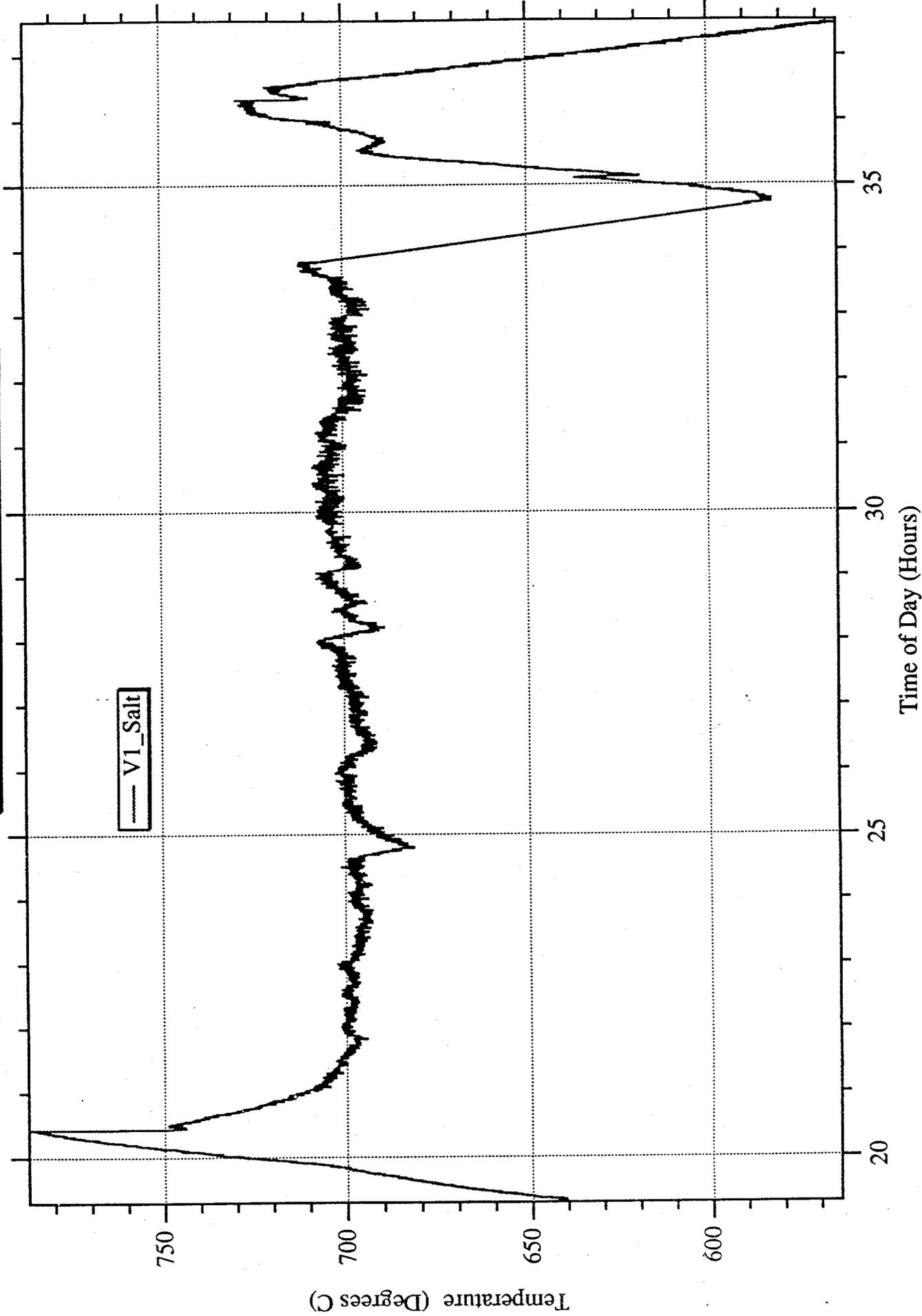
9/28/93 12:10:57 PM 36.223463

9/28/93 12:26:58 PM 36.491523 Run secured due to salt blockage at the riser/top junction in vessel #1. This blockage could not be dislodged with the brush. It appears as if it formed very fast.

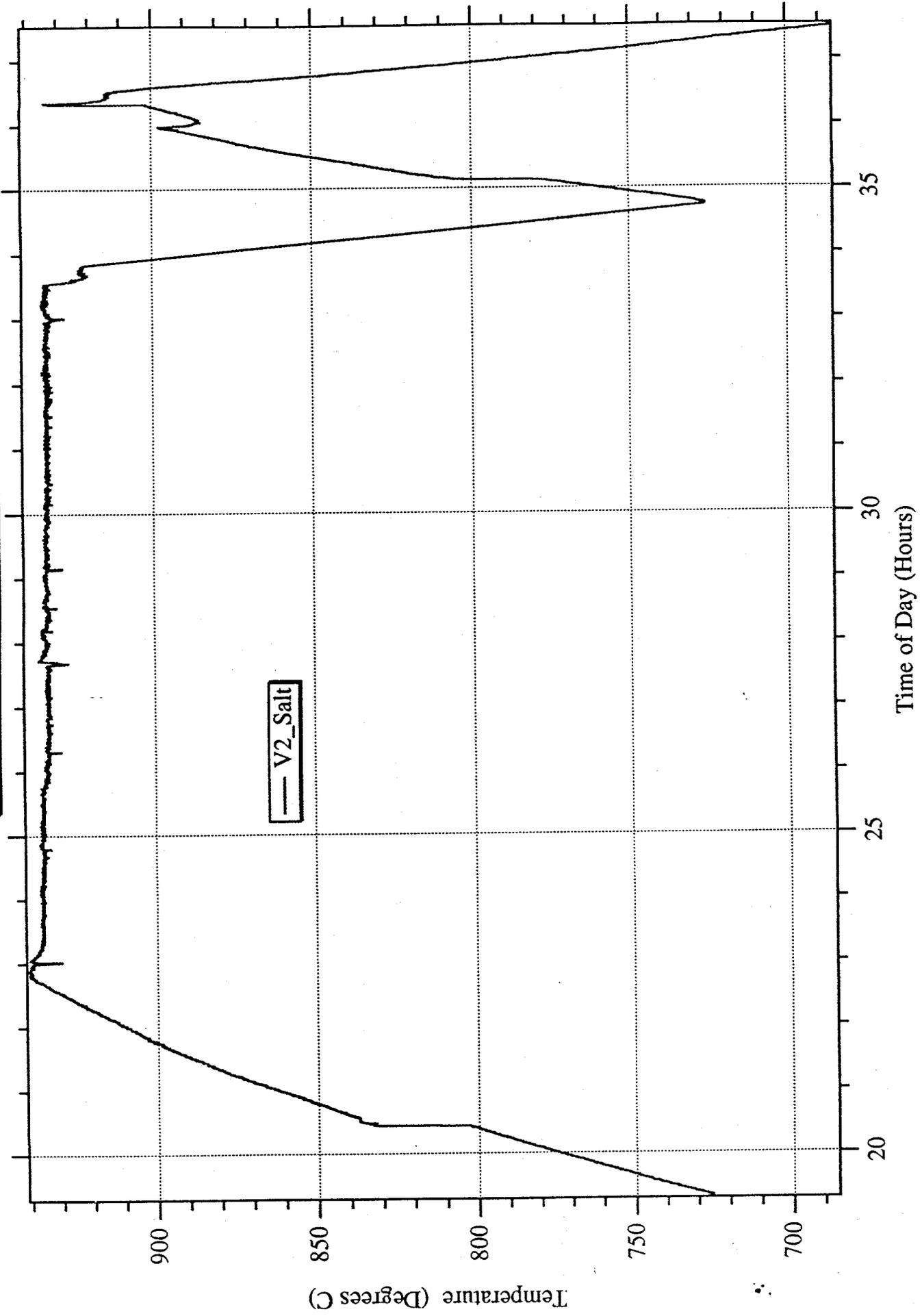
27 Sep 93 Pressures



27 Sep 93 Vessel One Salt Temperature



27 Sep 93 Vessel Two Salt Temperature



* TO: WILDER (7949-35) *

8

MASS SPECTROMETRIC ANALYSIS NO. 12613.
DONE ON 29 Sep 93 AT 15:19:20 CALCULATED ON 30-SEP-93 AT 08:25

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	79.78	0.26
2	OXYGEN	O2	11.45	0.05
3	ARGON	AR	0.931	0.004
4	CARBON DIOXIDE	CO2	7.77	0.03
5	NITROUS OXIDE	N2O	0.06	0.02
			=====	
	TOTAL		100.00	

VARIANCE = 1.13 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE 'REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.03 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

* TO: WILDER (7949-35) *

9

MASS SPECTROMETRIC ANALYSIS NO. 12614.
DONE ON 29 Sep 93 AT 15:34:41 CALCULATED ON 30-SEP-93 AT 08:41

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	80.22	0.16
2	OXYGEN	O2	11.26	0.03
3	ARGON	AR	0.922	0.003
4	CARBON DIOXIDE	CO2	7.59	0.02
5	NITROGEN DIOXIDE	NO2	0.011	0.002
			=====	
	TOTAL		100.00	

VARIANCE = 0.78 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.14 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.

(1) WATER H2O

* TO: WILDER (7949-35) *

10

MASS SPECTROMETRIC ANALYSIS NO. 12615.
DONE ON 29 Sep 93 AT 15:50:03 CALCULATED ON 30-SEP-93 AT 08:41

	COMPOUND		CONCENTRATION	STD DEV.
			MOLE (VOLUME) PCT.	
1	NITROGEN	N2	78.62	0.16
2	OXYGEN	O2	18.22	0.05
3	ARGON	AR	0.903	0.003
4	CARBON DIOXIDE	CO2	2.245	0.008
5	NITROGEN DIOXIDE	NO2	0.013	0.002
			=====	
	TOTAL		100.00	

VARIANCE = 0.84 PERCENT

NOTE: UNCERTAINTIES ARE ONE STD. DEV. FROM THE REGRESSION,
ANALYSIS AND DO NOT INCLUDE CONTRIBUTIONS DUE TO
INTENSITY MEASUREMENTS WHICH ADD ABOUT +/- .2% OF THE
CONCENTRATION.

COMPUTED VALUES LESS THAN 0.01 PERCENT HAVE BEEN OMITTED.

COMPONENTS OMITTED EQUAL TO 0.12 PERCENT OF THE SAMPLE

RESULTS ARE NORMALIZED AFTER THESE COMPOUNDS ARE REMOVED.
(1) WATER H2O