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Title: Vegetable Oil Manufacturing Emission Test Report A. E. Staley Manufacturing Co., Des Moines, Iowa

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July 1979

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United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EMB Report 78-VEG-3
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Emission Test Report A. E. Staley Manufacturing Company Des Moines, Iowa

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EMISSION TEST REPORT

A. E. STALEY CO.
VEGETABLE OIL EXTRACTION PLANT
DES MOINES, IOWA

MARCH 1979

DRAFT COPY

Prepared by:

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Contract No. 68-02-2811
Task No. 14
PN 3333-N

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY
EMISSION MEASUREMENT BRANCH

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DALLAS, TEXAS
KANSAS CITY, MISSOURI

COLUMBUS, OHIO
DURHAM, NORTH CAROLINA

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1.0 INTRODUCTION

This emission study was conducted during the week of March 11-16, 1979, at the A. E. Staley Company vegetable oil extraction plant in Des Moines, Iowa. Tests were conducted by personnel from PEDCo Environmental, Inc. of Cincinnati, Ohio and Pollution Control Science, Inc. of Miamisburg, Ohio.

Vegetable oil is obtained from soybean meal by a solvent extraction process employing hexane as the extraction solvent. The A. E. Staley plant operates a single meal flake extractor and a single desolventizer-toaster (DT). A single mineral oil scrubber (MOS) system handles solvent emissions from the extractor and desolventizer-toaster. Meal from the desolventizer-toaster is then processed through a drying and cooling cycle. Exhaust streams from the dryer and cooler are vented through separate ducts to the atmosphere.

The purpose of this testing was to characterize the flow of solvent vapor through the process and to determine the extent of solvent losses through vapor emissions to the atmosphere, fugitive emissions, processed meal, oil from the mineral oil scrubber, and plant wastewater.

Hexane emissions to the atmosphere were measured by two test methods conducted simultaneously. Personnel from PEDCo Environmental used an impinger train employing carbon disulfide (CS_2) as the collecting media for hexane. These samples were analyzed on site using a gas chromatograph with a flame ionization detector. Results are reported as part per million n-hexane. Pollution Control Science, Inc. personnel used a Total Carbon Analysis train in which the sample is collected in a dry-ice freeze trap and evacuated cylinder. These samples were analyzed in the laboratory using an oxidation-reduction method which measures the total gaseous non-methane carbon. Results are reported as part per million carbon (C_1). These tests were conducted at the following sites:

(1) Mineral oil scrubber inlet

(2) Mineral oil scrubber outlet

(3) Meal dryer exhaust to atmosphere

(4) Meal cooler exhaust to atmosphere.

To determine the amount of hexane remaining in the meal at various stages of the process, meal samples were collected at the following sites during each of the cooler and dryer tests:

(1) Exit from desolventizer-toaster (DT)

(2) Exit from meal dryer

(3) Exit from meal cooler

(4) Exit from milling process.

Triplicate samples were obtained at each point.

Mineral oil samples were taken at the inlet and outlet of the scrubber during each of the tests on the scrubber. At the same time, a sample of vegetable oil was obtained from the product storage tank. These oil samples are being analyzed by Scott Environmental Laboratories and will be reported when available.

A sample of wastewater from the plant was taken during each day of testing. These results are included in this report.

Fugitive emissions in the extraction area were measured with a Century Model OVA-128 portable Organic Vapor Analyzer. Data on fugitive emissions was reported earlier and is not repeated in this report.

2.0 SUMMARY AND DISCUSSION OF RESULTS

2.1 Gas Stream Conditions and CS_2 Impinger Train Tests

Procedures for the CS_2 Impinger Train tests are outlined in Table 1. Total Carbon Analysis tests were run at the same time at each of the test sites. Three tests are marked invalid due to leak-check problems or problems with pump calibration. The results of these tests are not reported. At each test site, one test was conducted to check the collection efficiency of the impinger train. This was done by adding an extra impinger to the train and analyzing this impinger separately. The amount of hexane collected in the last impinger was then compared to the amount collected in the normal train to determine a collection efficiency.

Table 2 is a summary of measured gas stream conditions and the ambient conditions in which the tests were conducted. At the cooler and dryer sites gas flow measurements were taken according to Federal Register* reference Methods 1 and 2 using a S-type pitot tube. The mineral oil scrubber ducts were too small to accommodate a S-type or standard type pitot tube and gas velocity was measured with a vane anometer at the point where the gas stream enters the atmosphere. Attempts to measure moisture with silica gel tubes were not successful and values for gas stream moisture content are estimated.

*Federal Register, Vol. 42, No. 160, August 18, 1977.

TABLE 1. CS_2 IMPINGER TRAIN - TEST PROCEDURE

Test Site	Run #	Date	Clock Time		Test Description
			Start	Finish	
Mineral Oil Scrubber Inlet	1 A & B	3/13/79	11:24	12:09	A & B run simultaneously.
	2 A & B	3/13/79	15:17	16:02	A & B run simultaneously. 2B voided - pump disconnected.
	3 A & B	3/13/79	17:00	17:45	Extra impinger added to check collection efficiency.
Mineral Oil Scrubber Outlet	1 A & B	3/13/79	11:24	12:09	A & B run simultaneously.
	2 A & B	3/13/79	15:17	16:02	A & B run simultaneously.
	3	3/13/79	17:00	17:45	Extra impinger added to check collection efficiency. Leak in pumpline - test void.
Cooler Exhaust	C-1	3/15/79	8:41	9:50	Extra impinger added to check collection efficiency.
	C-2 A&B	3/15/79	14:10	15:40	A & B run simultaneously.
	C-3 A&B	3/15/79	16:45	18:15	A & B run simultaneously.
Dryer Exhaust	D-1	3/15/79	8:36	9:36	Extra impinger added to check collection efficiency.
	D-2 A&B	3/15/79	14:06	15:21	A & B run simultaneously.
	D-3 A&B	3/15/79	16:48	17:48	A & B run simultaneously. 3B pump calibration off - test results voided.

TABLE 2. SAMPLING CONDITIONS

Test Site	Run #	Ambient Conditions		Gas Stream Conditions			Gas Stream Flow Rate	
		Temp °F	Press. in. Hg.	Temp °F	Static Press in H_2O	Assumed Moisture %	acfm	dscfm
Mineral Oil Scrubber Inlet	1	40	28.93	125	-[b]	13.7[a]	74.6	56.2
	2	40	28.97	90	-	4.9	86.9	76.8
	3	35	28.97	90	-	4.9	87.5	77.3
Mineral Oil Scrubber Outlet	1	40	28.93	95	-	5.7	61.8	56.2
	2	40	28.97	90	-	4.9	73.7	65.7
	3	35	28.97	90	-	4.9	73.7	65.7
Meal Cooler Exhaust	1	25	29.83	120	-2.58	4.0	52938.6	44441
	2	50	29.83	120	-2.54	4.0	50486	43566
	3	50	29.83	120	-2.56	4.0	50486	43566
Meal Dryer Exhaust	1	25	29.83	170	-.03	41.0[a]	8604	4227
	2	50	29.83	187	-.03	59.9[a]	8854	2879
	3	50	29.83	181	-0.02	52.6[a]	8636	3350

[a]Saturation level

[b]Not measured

Results of the CS_2 Impinger Train tests are listed in Table 3. Based on the average hexane mass flow rate into and out of the scrubber, the scrubber efficiency is about 95 percent. Inlet concentration averaged 19.5 percent by volume and the outlet concentration averaged 1.1 percent by volume hexane.

Due to the wide variation of the results, no average value is reported for the meal cooler. A bag sample drawn from the cooler duct with a two way squeeze bulb was analyzed on site and found to be 35 ppm n-hexane (Table 4).

The average concentration in the dryer duct was 6302 ppm. Bag samples drawn from the dryer ducts in the morning and afternoon showed concentrations of 6400 ppm and 2804 ppm respectively. These values are in Table 4.

The collection efficiency values of the impinger train are shown in Table 5. The data shows better than a 99 percent removal of hexane by the carbon disulfide in all cases.

2.2 TCA Train Data

Data from the total carbon analysis tests is presented in Table 6. Results are listed as part per million carbon. In order to compare these values to the values of part per million n-hexane, the part per million carbon number must be divided by the ratio of the molecular weight of n-hexane to the molecular weight of carbon, i.e., $\frac{86 \text{ g/gmole}}{12 \text{ g/gmole}} = 7.17$. The average values for each site are compared in Table 7 as ppm n-hexane.

TABLE 3. CS_2 IMPINGER TRAIN - TEST RESULTS

Test Site	Run #	Hexane Concentration in Source		Gas Flow Rate		Hexane Mass Flow Rate	
		g/m^3	ppm[a]	m^3/min[b]	dscfm[b]	kg/h	lb/h
Mineral Oil Scrubber Inlet	1 A	756.34	211000	1.59	56.2	72.22	170.24
	1 B	723.96	201984	1.59	56.2	69.07	152.27
	2 A	642.25	179177	2.17	76.8	83.62	184.35
	3	672.61	187756	2.19	77.3	88.38	194.84
	Average	698.79	194979	1.98	70.1	78.32	175.43
Mineral Oil Scrubber Outlet	1 A	38.45	10713	1.59	56.2	3.67	8.09/680 = 0.012
	1 B	36.10	10071	1.59	56.2	3.44	7.58/680 = 0.011
	2 A	36.43	10155	1.86	65.7	4.07	8.97/660 = 0.013
	2 B	53.84	15010	1.86	65.7	6.01	13.25/680 = 0.019
	Average	41.20	11487	1.73	61.0	4.30	9.47/680 = 0.014
Meal Cooler Exhaust	C-1	1.36	380	1258.4	44441	102.69	226.39/680 = 0.33
	C-2 A	0.13	37	1233.7	43566	9.62	21.21/680 = 0.03
	C-2 B	0.07	19	1233.7	43566	5.18	11.42/680 = 0.017
	C-3 A	0.16	45	1233.7	43566	11.84	26.10/680 = 0.038
	C-3 B	0.05	14	1233.7	43566	3.70	8.16/680 = 0.012
	Average[c]			1246.1	44003		
Meal Dryer Exhaust	D-1	12.11	3348	119.7	4227	86.97	191.73/680 0.29
	D-2 A	31.68	8835	81.5	2879	154.92	341.54/680 = 0.50
	D-2 B	26.80	7478	81.5	2879	131.05	288.91/680 = 0.43
	D-3 A	19.88	5545	94.9	3350	113.20	249.56/680 = 0.367
	Average	22.62	6302	98.7	3485	121.53	267.94

[a]ppm - part per million by volume

[b]dscfm - dry standard cubic feet per minute, 68°F, 29.92 in. Hg.

[c]average conc. not reported due to wide variance in data.

TABLE 4. BAG SAMPLES - COOLER AND DRYER

Site	Time of Sample	Hexane Concentration ppm[a]
Cooler	16:08 - 16:16	35
Dryer	11:00 - 11:15	6400
Dryer	17:42 - 17:50	3804

[a]ppm - part per million by volume

TABLE 5. RESULTS OF COLLECTION EFFICIENCY RUNS

Test Site	Hexane Collected		% Collection Efficiency
	Normal Impinger Train	4th Bubbler	
Mineral Oil Scrubber Inlet	6.2093 g	0.0040 g	99.94
Mos Outlet	153.07 mg	No detectable hexane	∿100.00
Dryer Exhaust	114.20 mg	0.17 mg	99.86
	14.57 mg	None detectable	∿100.00

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Work Assignment No. 14
PN 3333-N
Subcontract No. 230-79

TABLE 6
TCA DATA SUMMARY

SAMPLE ID	TANK #	ppm C_1 TANK *	mg C_1 TANK	TRAP #	ppm C_1 TRAP *	mg C_1 TRAP	TOTAL ppm C_1 [1]	SAMPLE VOLUME (ℓ)
MOS-I1 [2]	34	10150	13.71	43	471000	625.7	481200	2.704
MOS-I2 [2]	26	14300	18.07	19	486000	604.0	500300	2.529
MOS-I3 [2]	25	45100	58.46	25	to high ~50% C_1 (5 X 10^5 ppm @ source C_1)			2.592
MOS-01	32	2040	2.29	83	35320	39.1	37360	2.253
MOS-02	27	1623	1.88	18	90480	103	92100	2.315
MOS-03	43	648	0.750	36	78960	89.8	79608	2.315
DRYER-1	47	949	1.74	12	13830	24.9	15400	3.664
				1	626	1.13		
DRYER-2	39	594	0.959	17	12910	20.5	14200	3.232
				52	700	1.11		
COOLER-1	31	105	0.175	26	184	0.303	289	3.344
COOLER-2	35	204	0.325	9	105	0.293	461	3.194
	38	552	0.688					
COOLER-3	17	229	0.375	23	408	1.304	693	2.491
	22	342	0.550					3.282
REG BLK-PRE	23	<10	<0.016					3.219
REG BLK-POST	24	2720	3.58					3.156
BLANK TRAP				28		0.022		2.635
								-

* ppm @ source
1 for samples with two tanks, the weighted mean for the two tank concentrations was calculated.
2 analysis of these samples was very difficult due to the extremely high concentrations in the trap portion of sample.

TABLE 7. AVERAGE CONCENTRATIONS MEASURED BY CS_2 IMPINGER TRAIN TESTS AND TCA TESTS

(Expressed as ppm[a] n-hexane)

Test Site	Average Hexane Conc. ppm n-Hexane	
	TCA Train	CS_2 Impinger Train
MOS Inlet	68445[b]	194979
MOS Outlet	9720	11487
Dryer Vent	2064	6302
Cooler Vent	67	99

[a]ppm - part per million by volume

[b]Quantity of material collected too great to allow accurate analysis by TCA method.

2.3 Meal Sample Analysis

The results of meal sample analysis are presented in Table 8. Hexane concentration is given as μg/g which is equivalent to parts per million by weight. The average values for all samples are:

DT Exit	3266.5 μg/g
Dryer Exit	1690.5 μg/g
Cooler Exit	1502.6 μg/g
Milling Exit	903.1 μg/g

2.4 Wastewater Analysis

Wastewater samples from March 12 and 13 were lost when bottles, left out overnight, froze and broke. However, samples from March 14 and 15 were analyzed. The sample from March 14 had a hexane concentration of 0.0128 μg/μℓ which is equivalent to 19.4 part per million by volume. The March 15 sample had a hexane concentration of 0.00741 μg/μℓ, equivalent to 11.2 part per million by volume.

TABLE 8.
Hexane Analysis of Meal Samples
Collected at A. E. Staley Co., Des Moines, Iowa

Sample #	Lab #	Test Site	Date	Time	Hexane Conc.[1] (μg/g)
01	AK181	DT Exit[2]	3/15/79	9:10 am	3695.5
02	AK182	DT Exit	3/15/79	9:10 am	2725.8
03	AK183	DT Exit	3/15/79	9:10 am	2581.7
04	AK184	Dryer Exit	3/15/79	9:10 am	1592.4
05	AK185	Dryer Exit	3/15/79	9:10 am	Broken Bottle
06	AK186	Dryer Exit	3/15/79	9:10 am	1396.3
07	AK187	Cooler Exit	3/15/79	9:10 am	1407.8
08	AK188	Cooler Exit	3/15/79	9:10 am	1347.2
09	AK189	Cooler Exit	3/15/79	9:10 am	1373.7
10	AK190	Milling Exit	3/15/79	9:10 am	736.1
11	AK191	Milling Exit	3/15/79	9:10 am	832.1
12	AK192	Milling Exit	3/15/79	9:10 am	699.1
13	AK193	DT Exit[2]	3/15/79	2:25 pm	3559.9
14	AK194	DT Exit	3/15/79	2:25 pm	2788.2
15	AK195	DT Exit	3/15/79	2:25 pm	3120.3
16	AK196	Dryer Exit	3/15/79	2:25 pm	1469.0
17	AK197	Dryer Exit	3/15/79	2:25 pm	1294.5
18	AK198	Dryer Exit	3/15/79	2:25 pm	1826.8
19	AK199	Cooler Exit	3/15/79	2:25 pm	829.0
20	AK200	Cooler Exit	3/15/79	2:25 pm	965.9
21	AK201	Cooler Exit	3/15/79	2:25 pm	841.0
22	AK202	Milling Exit	3/15/79	2:25 pm	667.8
23	AK203	Milling Exit	3/15/79	2:25 pm	493.4
24	AK204	Milling Exit	3/15/79	2:25 pm	728.9
25	AK205	DT Exit[2]	3/15/79	3:10 pm	5940.2
26	AK206	DT Exit	3/15/79	3:10 pm	4015.3
27	AK207	DT Exit	3/15/79	3:10 pm	3782.5
28	AK208	Dryer Exit	3/15/79	3:10 pm	1664.8
29	AK209	Dryer Exit	3/15/79	3:10 pm	2799.5
30	AK210	Dryer Exit	3/15/79	3:10 pm	1925.3
31	AK211	Cooler Exit	3/15/79	3:10 pm	1552.7
32	AK212	Cooler Exit	3/15/79	3:10 pm	1397.6
33	AK213	Cooler Exit	3/15/79	3:10 pm	1448.6

Continued

TABLE 8. (Continued)
Hexane Analysis of Meal Samples
Collected at A. E. Staley Co., Des Moines, Iowa

Sample #	Lab #	Test Site	Date	Time	Hexane Conc. (1) (μg/g)
34	AK214	Milling Exit	3/15/79	3:10 pm	921.1
35	AK215	Milling Exit	3/15/79	3:10 pm	834.3
36	AK216	Milling Exit	3/15/79	3:10 pm	933.9
37	AK217	DT Exit (2)	3/15/79	5:05 pm	4627.8
38	AK218	DT Exit	3/15/79	5:05 pm	3568.8
39	AK219	DT Exit	3/15/79	5:05 pm	2378.2
40	AK220	Dryer Exit	3/15/79	5:05 pm	1557.9
41	AK221	Dryer Exit	3/15/79	5:05 pm	1636.0
42	AK222	Dryer Exit	3/15/79	5:05 pm	1833.5
43	AK223	Cooler Exit	3/15/79	5:05 pm	1571.0
44	AK224	Cooler Exit	3/15/79	5:05 pm	1835.8
45	AK225	Cooler Exit	3/15/79	5:05 pm	2009.5
46	AK226	Milling Exit	3/15/79	5:05 pm	1062.5
47	AK227	Milling Exit	3/15/79	5:05 pm	1188.6
48	AK228	Milling Exit	3/15/79	5:05 pm	1009.3
49	AK229	DT Exit (2)	3/15/79	5:50 pm	3106.9
50	AK230	DT Exit	3/15/79	5:50 pm	1827.6
51	AK231	DT Exit	3/15/79	5:50 pm	1278.9
52	AK232	Dryer Exit	3/15/79	5:50 pm	1432.3
53	AK233	Dryer Exit	3/15/79	5:50 pm	1548.2
54	AK234	Dryer Exit	3/15/79	5:50 pm	Sample Discarded
55	AK235	Cooler Exit	3/15/79	5:50 pm	2909.2
56	AK236	Cooler Exit	3/15/79	5:50 pm	1369.2
57	AK237	Cooler Exit	3/15/79	5:50 pm	1681.1
58	AK238	Milling Exit	3/15/79	5:50 pm	1595.4
59	AK239	Milling Exit	3/15/79	5:50 pm	Sample Discarded
60	AK240	Milling Exit	3/15/79	5:50 pm	941.5

(1) Reported as n-Hexane

(2) Desolvatizer Toaster

3.0 PROCESS DESCRIPTION AND LOCATION OF SAMPLING POINTS

The A. E. Staley plant processes vegetable oil from soybeans by solvent extraction with hexane. Figure 1 is a process flow diagram for this plant. Solvent vapors from the extractor and desolventizer-toaster and other associated processes are controlled through the use of a condenser and mineral oil scrubber. The condenser collects about 80 percent of the hexane, leaving the gas stream entering the scrubber with about 20 percent v/v hexane. Based on the test data, the mineral oil scrubber is about 95 percent efficient in removing hexane. The gas exiting the scrubber is about 1 percent v/v hexane.

Temperatures, pressures, and concentrations listed in Figure 1 are based on measurements taken during the emission testing. A more detailed study of process flows and conditions was conducted by personnel from Research Triangle Institute during the test period. This data will be available in a separate report.

Sampling points are indicated in Figure 1 by number. Vapor emission tests were conducted at sites 1, 2, 3, and 4. Meal samples were taken at sites 5, 6, 7, and 8. Figures 2, 3, and 4 are close up drawings of the mineral oil scrubber, the meal dryer, and the meal cooler. Sampling at the scrubber was done through the ports closest to the scrubber itself. Sampling at the dryer vent was done using the lower of the two sets of sampling ports.

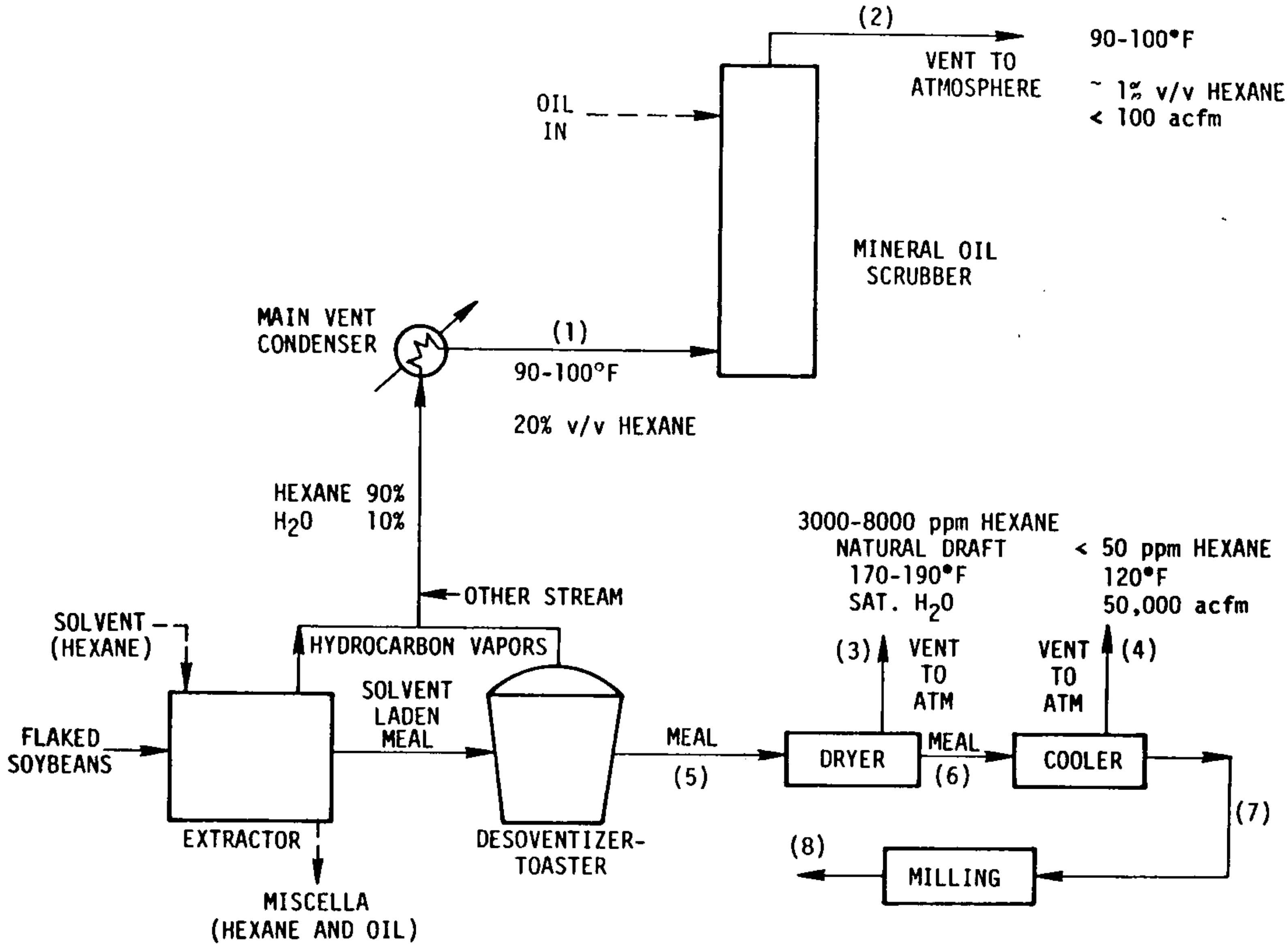

FIGURE 1. PROCESS FLOW DIAGRAM A.E. STALEY CO. DESMOINES, IOWA

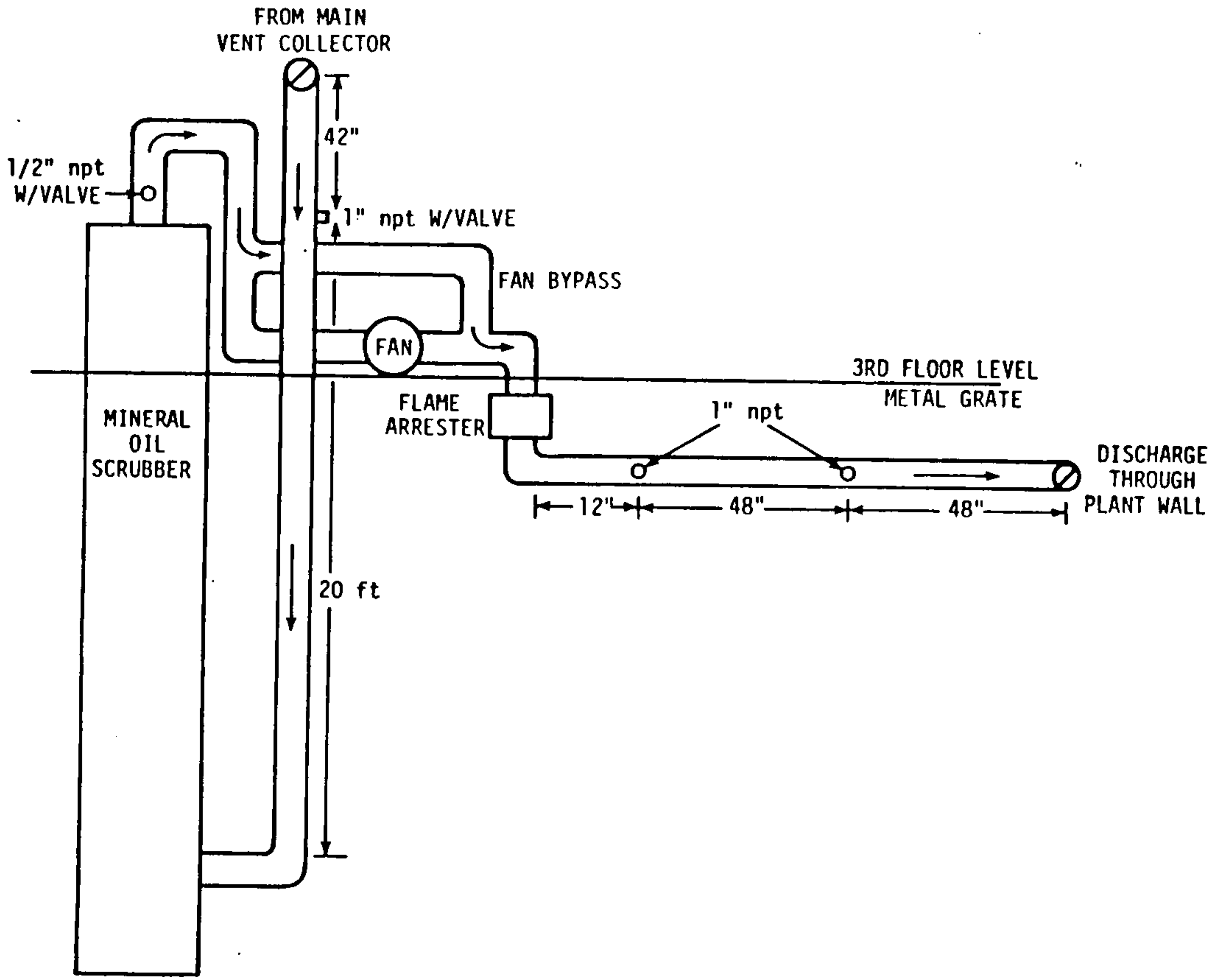

FIGURE 2. MINERAL OIL SCRUBBER

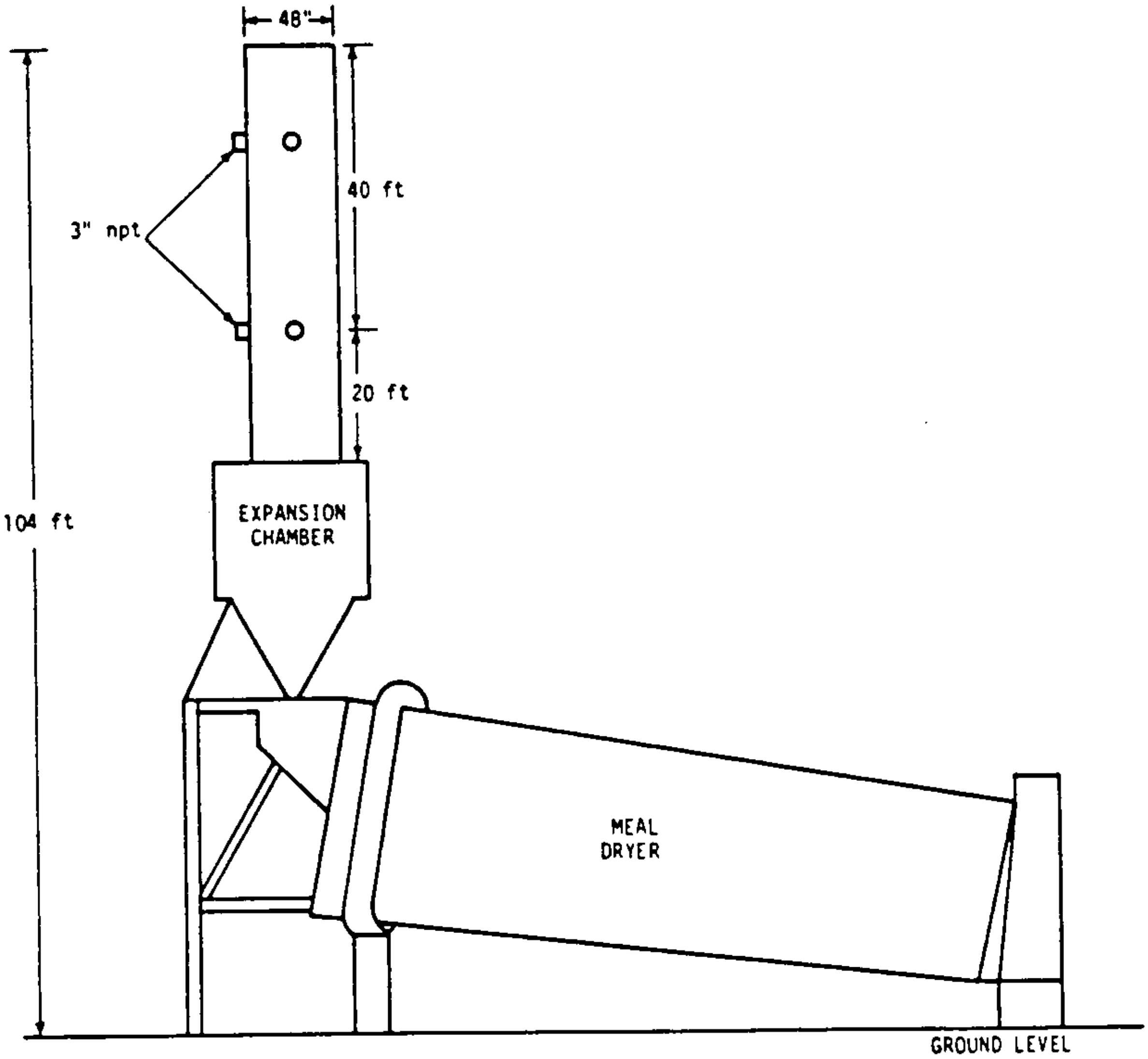

FIGURE 3. MEAL DRYER DISCHARGE

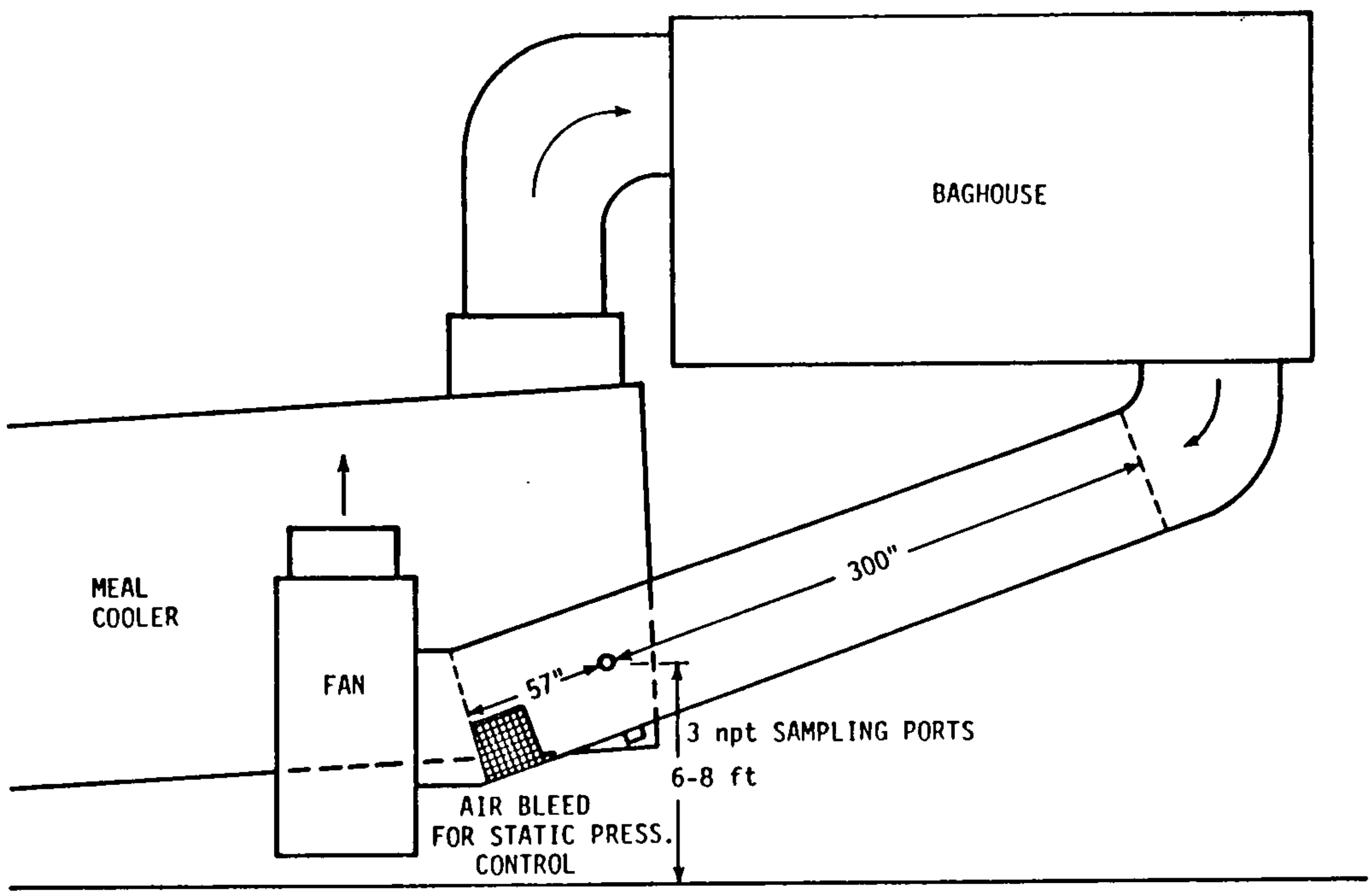

FIGURE 4. MEAL COOLER

4.0 SAMPLING AND ANALYTICAL PROCEDURES

Air flow in the dryer and cooler sites (Figures 3 and 4) was measured by reference methods 1 and 2 of the Federal Register.* The dryer duct is 47 inches in diameter and a total of 24 traverse points were used for the velocity profile. The cooler duct is 60 inches in diameter and 48 traverse points were used. The velocity of gas through the mineral oil scrubber system was measured with the use of a vane anometer at the point where the gas is discharged to the atmosphere. Sampling ports in the MOS ducts were too small to accommodate an S-type or standard type pitot tube.

Attempts to measure moisture in the gas streams with silica gel tubes were not successful and moisture content was estimated. Saturation level was assumed at the dryer and mineral oil scrubber sites.

The midget impinger hexane sampling train used by personnel from PEDCo Environmental, Inc. is shown in Figure 5. Carbon disulfide is the collecting media for hexane. The sample is drawn at a constant rate. The sampling period is variable depending on source concentration. A 45-minute period was used at the mineral oil scrubber sites. Dryer and cooler sites were sampled for 90 minutes. The sample is then recovered by rinsing the probe with

*Federal Register, Vol. 42, No. 160, August 18, 1977.

15 ml of carbon disulfide and rinsing the train glassware with two separate 15 ml portions of CS_2. The recovered sample is then weighed to determine the amount of solution present and analyzed for hexane concentration using a gas chromatograph with a flame ionization detector (FID). The instrument used in this test was a Hewlett-Packard model 5830-A gas chromatograph. Conditions were as follows:

Column	20 ft. x 1/8 in. stainless steel
Column packing	10% SP1000 on 80/100 suplecoport
Column temperature	70°C
Injection temperature	100°C
Carrier gas	N_2 at 20 cc/min.

Calibration for gas samples was done with 483 ppm and 1450 ppm Hexane in air standards certified by the supplier to be within ±2 percent of the stated concentration. In addition, two audit cylinders were provided by the EPA to check the instrument response. Analysis of these audit cylinders is included in the appendix to this report.

Meal samples, obtained on site, were analyzed in the laboratory using a volitilization, head-space sampling technique.[1] The sample containers were prepared just prior to sampling. Preparation involves adding two layers of filter paper to the bottom of the container, wetting the filter paper with 0.5 ml of water, and weighing the container and contents to the nearest 0.1 g. Ideally a 2 gram sample should be added to each bottle. However, sampling had to be done quickly to prevent evaporation losses, and the actual sample

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[1]P. J. Wan, M. Chittwood, C. M. Cater, "Determination of Residual Hexane in Solvent Extracted Meal", Food Protein R&D Center, Texas A & M University.

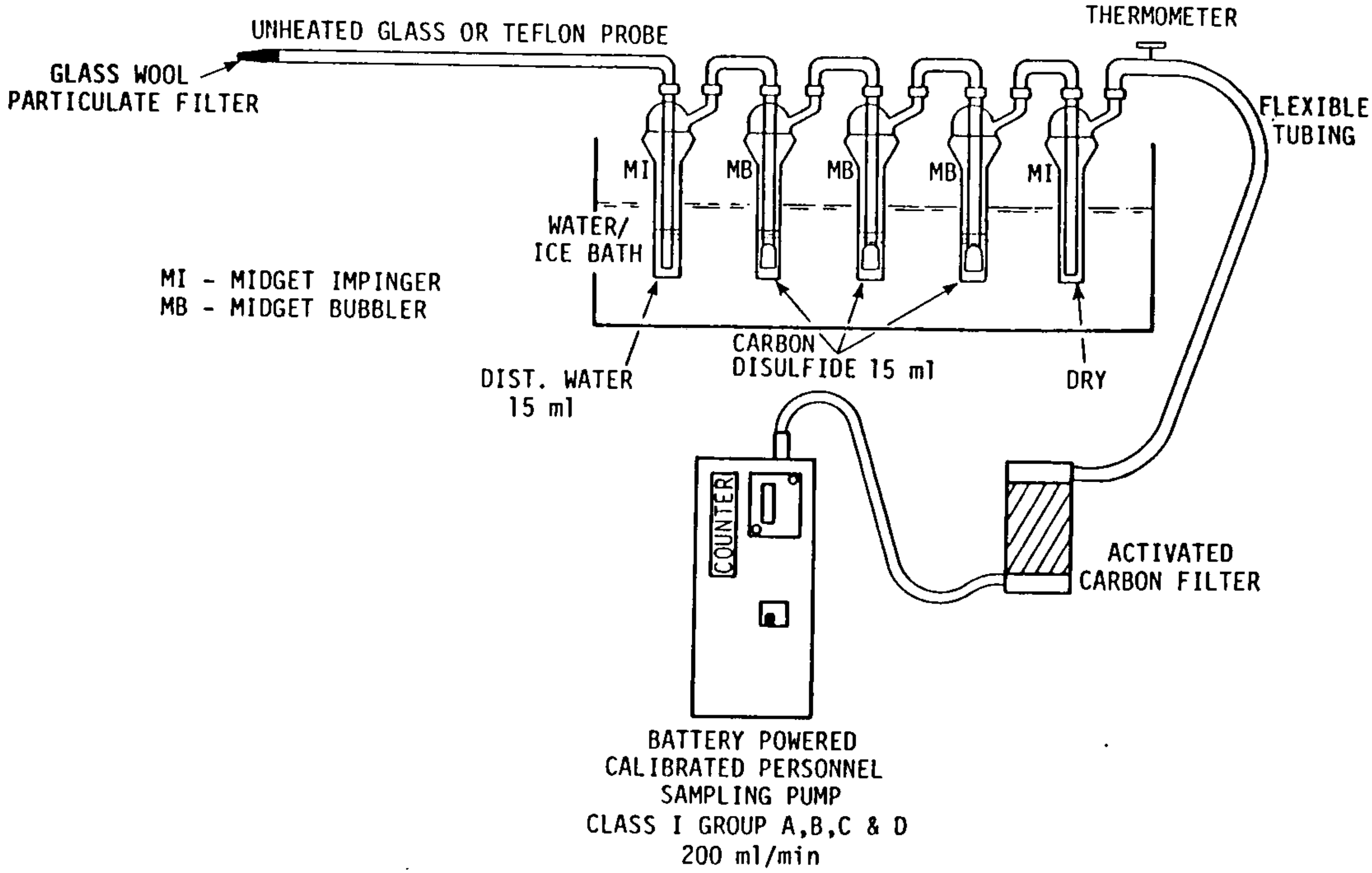

FIGURE 5. HEXANE SAMPLING APPARATUS

weight varied from one to three grams each. Bottles were sealed with a septum cap and an aluminum cap crimped tightly over the septum. Analysis is done by placing the sample into a sand bath at 125°C for two hours. The bottle is gradually cooled to room temperature, and 1.0 ml of head-space sample is injected into the gas chromatograph. The method is sensitive to concentration as low as 10 ppm hexane.

The total carbon analysis train consists of a dry-ice freeze trap followed by an evacuated tank. The vacuum in the tank provides the driving force to draw the sample through the system. A flow control valve at the tank controls the sampling rate. Any material that is not condensed in the freeze trap will be automatically captured in the evacuated tank. Thus the collection efficiency is 100 percent. The freeze trap is analyzed by completely oxidizing the contents of the trap and then methanating a portion of oxidized sample. The concentration of methane is then measured with a flame ionization detector. The tank contents are injected into a gas chromatograph column to separate methane, carbon monoxide, and carbon dioxide from the non-methane organics. The non-methane portion is then oxidized, reduced to methane, and measured with an FID.

Wastewater samples were analyzed by direct injection into a gas chromatograph with a flame ionization detector. The instrument conditions were as follows:

Column	20 ft. x 1/8 in. stainless steel
Column packing	10% SP1000 on 80/100 suplecoport
Column temperature	70°C
Injection temperature	100°C
Carrier gas	N_2 at 20 cc/min.

A description of the portable organic vapor analyzer used to measure fugitive emissions in the extraction area is included in the appendix of this report.

PEDCo ENVIRONMENTAL, INC.
11499 CHESTER ROAD
CINCINNATI, OHIO 45246
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DRAFT

APPENDICES FOR THE
EMISSION TEST REPORT
A. E. STALEY CO.
VEGETABLE OIL EXTRACTION PLANT
DES MOINES, IOWA

MARCH 1979

Prepared by:

PEDCo ENVIRONMENTAL, INC.
11499 Chester Road
Cincinnati, Ohio 45246

Contract No. 68-02-2811
Task No. 14
PN 3333-N

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY
EMISSION MEASUREMENT BRANCH

Project Technical Manager: Nancy McLaughlin

BRANCH OFFICES

CHESTER TOWERS

DALLAS, TEXAS
KANSAS CITY, MISSOURI

COLUMBUS, OHIO
DURHAM, NORTH CAROLINA

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APPENDIX A

ANALYTICAL DATA AND PROCEDURES

1A. ON SITE ANALYSIS OF CS_2 IMPINGER TRAIN SAMPLES

LABORATORY DATA

Client A.E. STALEY CO.
PN 3333 N. Date 3/13/79
Analyst
Analysis
Method Number
Checker

Sample I.D.	mL injected	Retention Time min.	AREA	AREA / mL	CONC mg/mL	CONC corrected for Dilution
MOS INLET 1A.	1.55	2.20	631600	407484	1.2143	61.9293
DILUTION: 1/51		2.62	87060	56168	0.1674	8.5374
					TOTAL:	70.467
MOS INLET 1B.	1.95	2.19	774600	397231	1.1837	60.3687
DILUTION 1/51		2.62	106200	54462	0.1623	8.2773
						68.646
MOS OUTLET 1A.	2.0	2.20	2135000	1067500	3.1811	
		2.65	325900	162950	0.4856	
					3.667	
						AVG of TWO RUNS
	1.3	2.19	1446000		3.3147	3.741
		2.62	218700		0.5013	
					3.8153	
MOS OUTLET 1B	1.8	2.19	39380	21878	0.06519	3.3248
DILUTION: 1/51		2.62	5367	2982	0.00889	0.4532
						3.778
	2.9	2.19	60630	20907	0.0623	3.1774
		2.64	7996	2757	0.0082	0.4190
						3.596
MOS INLET 2A.	1.95	2.21	735600	377231	1.1241	57.3315
DILUTION: 1/51		2.65	102300	52462	0.1563	7.9731
						65.30
MOS INLET 2B	1.90	2.20	305200	160632	0.478	24.4127
DILUTION 1/51		2.63	41190	21679	0.0646	3.2948
						27.70

LABORATORY DATA

Client A.E. STALEY CO

PN 3333 N. Date 3/13/79

Analyst

Analysis

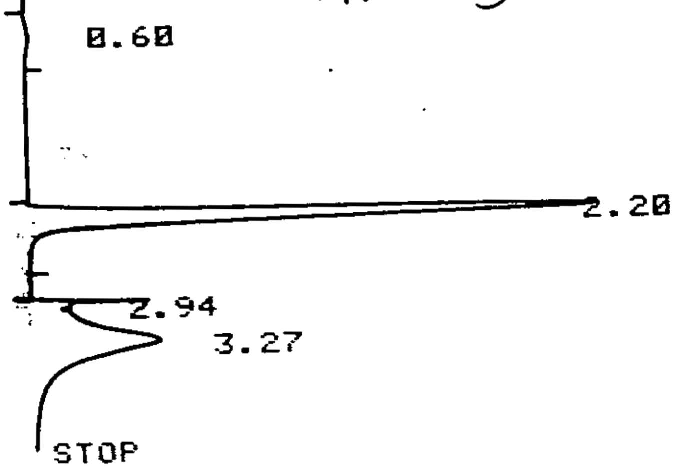
Method Number

Checker

Sample ID.	ml Injected	Retention Time min.	Area	Area / ml	Conc. mg / ml	Conc. Corrected for Dilution
MOS OUTLET 2A.	2.05	2.20	387900	189220	0.5639	3.3832
Dilution : 1/6		2.63	46980	22917	0.0683	0.4098
						3.793
MOS OUTLET 2B	1.95.	2.20	507600	260308	0.7757	4.6543
Dilution : 1/6		2.63	61890	31739	0.0946	0.5675
						5.222
	1.95	2.19	501300	257077	0.7661	4.5965
		2.63	60450	31000	0.0924	0.5543
						5.151
					mg/Area	
HEXANE	2.1	2.20	198000	94286	2.97×10^{-6}	
CALIBRATION	2.1	2.20	204500	97381	2.88×10^{-6}	
STANDARD	1.95	2.21	184900	94890	2.95×10^{-6}	
	1.95	2.21	175200	89846	3.12×10^{-6}	
				AVG RESPONSE:	2.98×10^{-6} mg/Ar.	

XF: 1.0000 E+ 0

START 2.1 ml Standd Hexane 0.2801 µg/ul

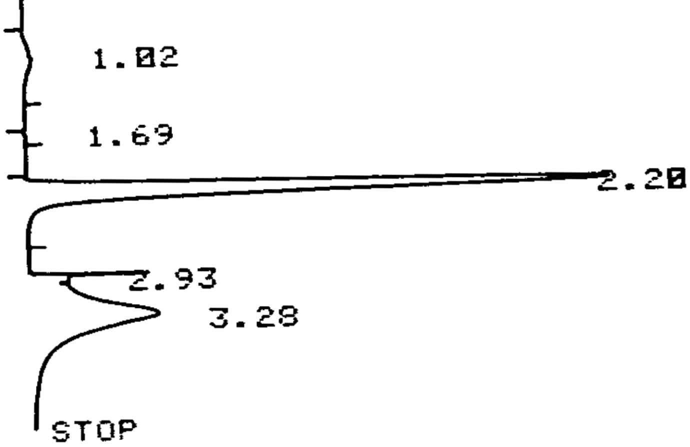


hp 5830A
AREA %

RT	AREA	AREA %
0.60	3247	0.887
2.20	198000	54.097
2.94	10660	2.913
3.27	154100	42.103

XF: 1.0000 E+ 0

START 2.1 ml Standard Hexane 0.2801 µg/ul

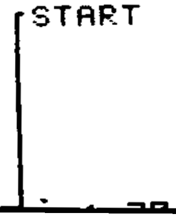


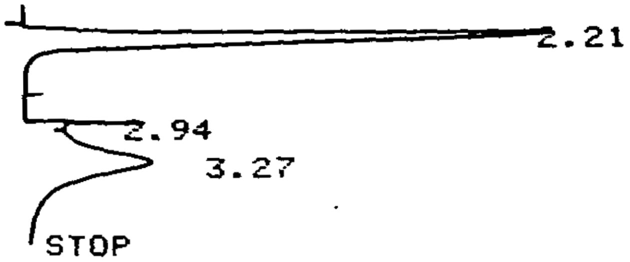
hp 5830A
AREA %

RT	AREA	AREA %
1.02	7218	1.925
1.69	158	0.042
2.20	204500	54.551
2.93	10700	2.854
3.28	152300	40.627

XF: 1.0000 E+ 0

START





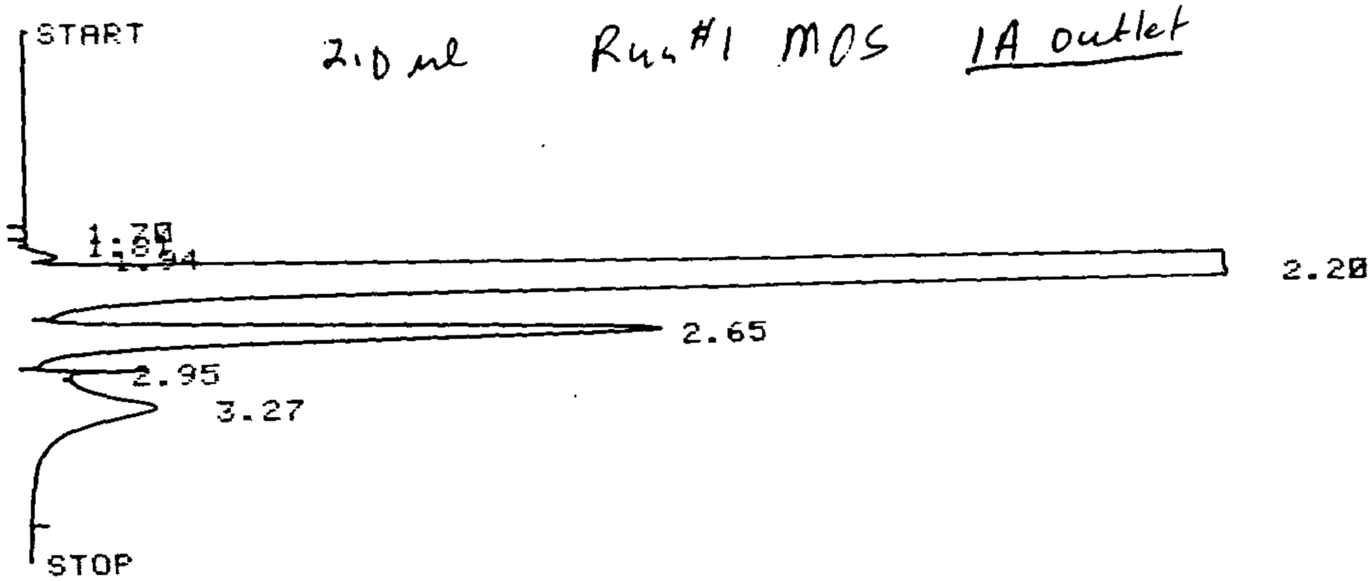
2.1 ml Hexane
0.2801 mg/ml

hp 5830A
AREA %

RT	AREA	AREA %
1.70	117	0.034
2.21	184900	54.046
2.94	11000	3.215
3.27	146100	42.705

XF: 1.0000 E+ 0

2.0 ml Run #1 MOS 1A outlet

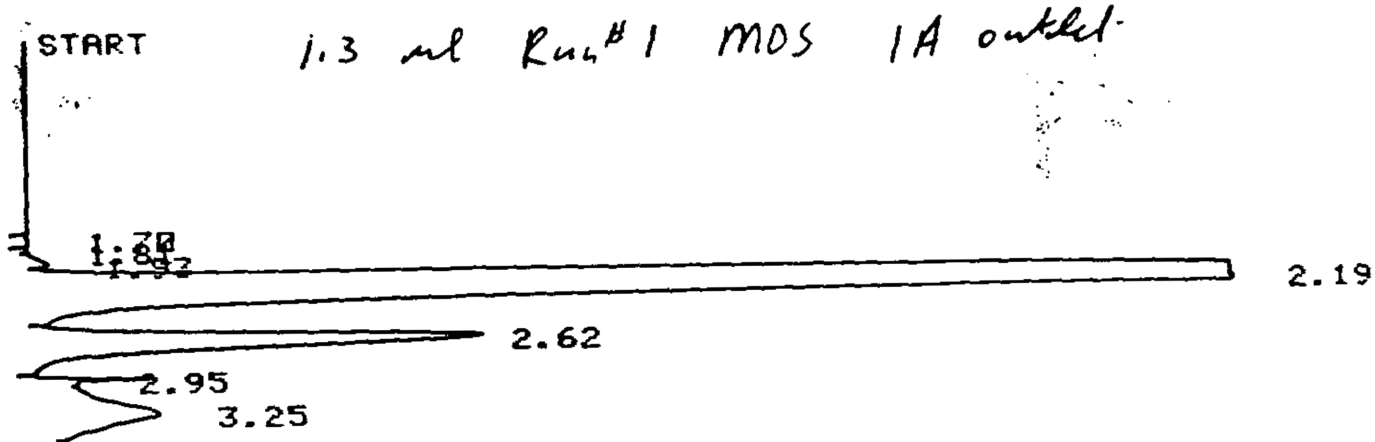


hp 5830A
AREA %

RT	AREA	AREA %
1.70	284	0.011
1.81	302	0.011
1.94	8926	0.339
2.20	2135000	81.063
2.65	325900	12.374
2.95	12330	0.468
3.27	151000	5.733

XF: 1.0000 E+ 0

1.3 ml Run #1 MOS 1A outlet



STOP
hp 5830A
AREA %

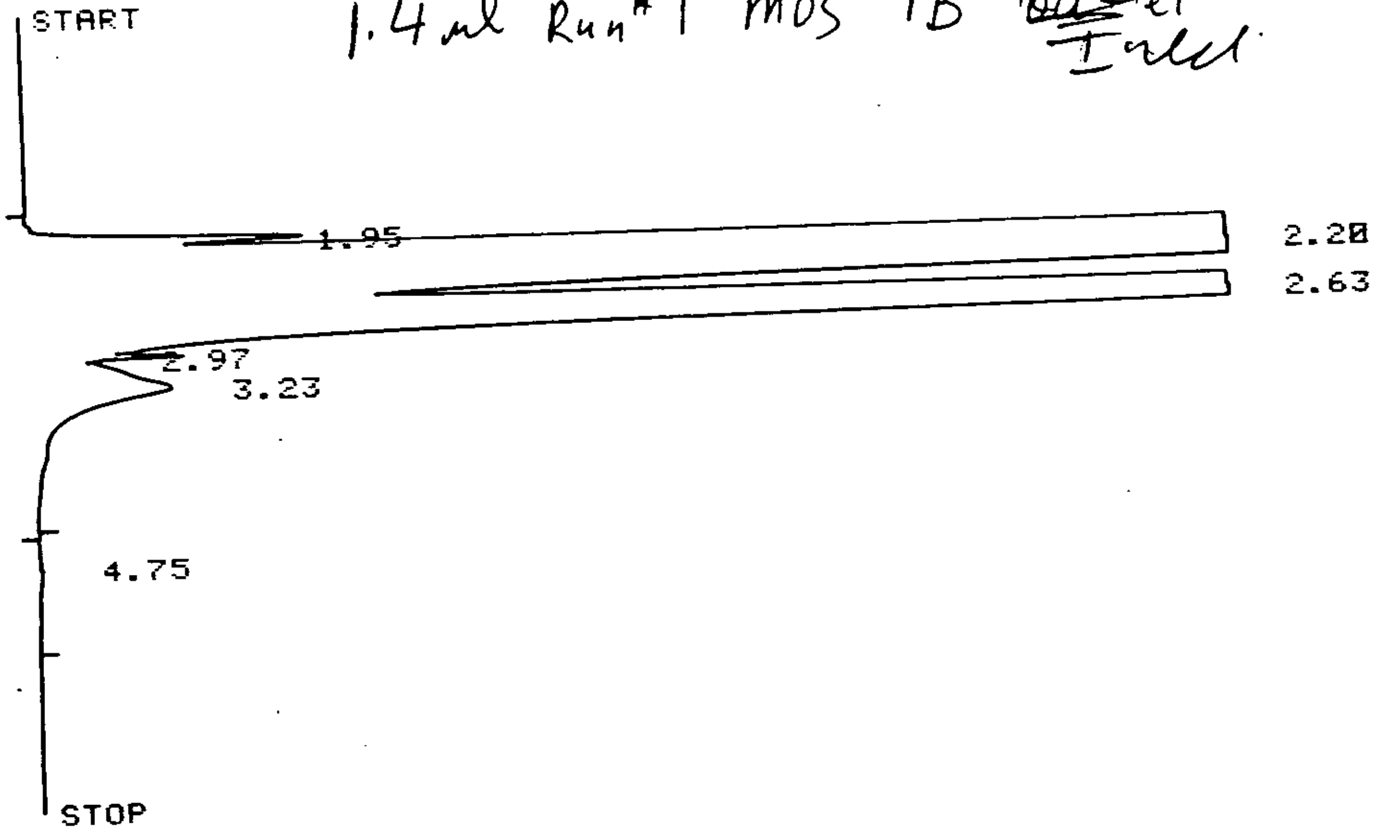
Run #1

1.3 ml MOS 1A outlet

RT	AREA	AREA %
1.70	201	0.011
1.81	174	0.009
1.93	5917	0.323
2.19	1446000	78.875
2.62	218700	11.929
2.95	13400	0.731
3.25	148900	8.122

XF: 1.0000 E+ 0

1.4 ml Run#1 MOS 1B ~~outlet~~ Inlet



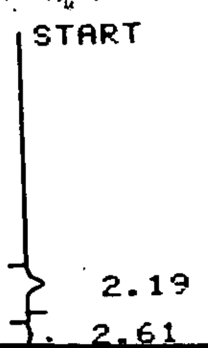
hp 5830A
AREA %

RT	AREA	AREA %
1.95	70600	0.272
2.20	21710000	83.497
2.63	4015000	15.442
2.97	23660	0.091
3.23	177900	0.684
4.75	3811	0.015

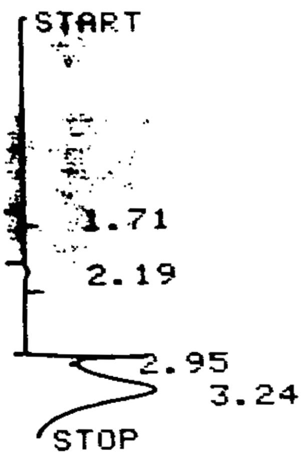
XF: 1.0000 E+ 0

1.9 ml CS2 Only

This is to check if the syringe is contaminated from the previous Run which is 1.4 ml MOS 1B outlet.



2.0 ml CS_2 Only
Perm..



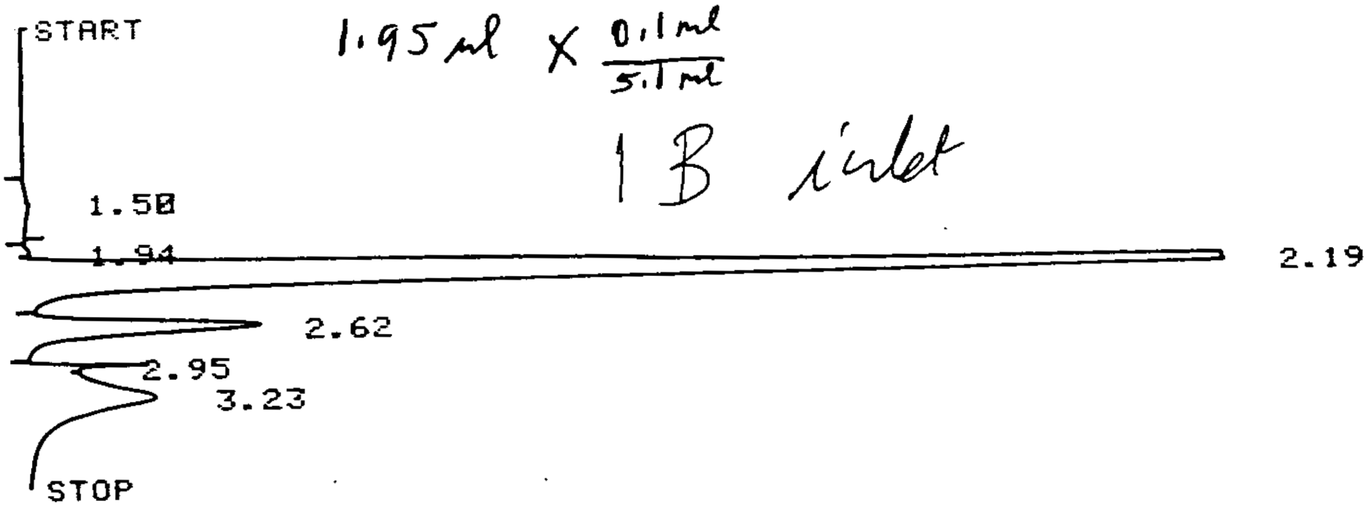
hp 5830A
AREA %

RT	AREA	AREA %
1.71	157	0.106
2.19	1394	0.945
2.95	14200	9.624
3.24	131800	89.325

XF: 1.0000 E+ 0

$1.95\ \mu l \times \frac{0.1\ ml}{5.1\ ml}$

1B inlet



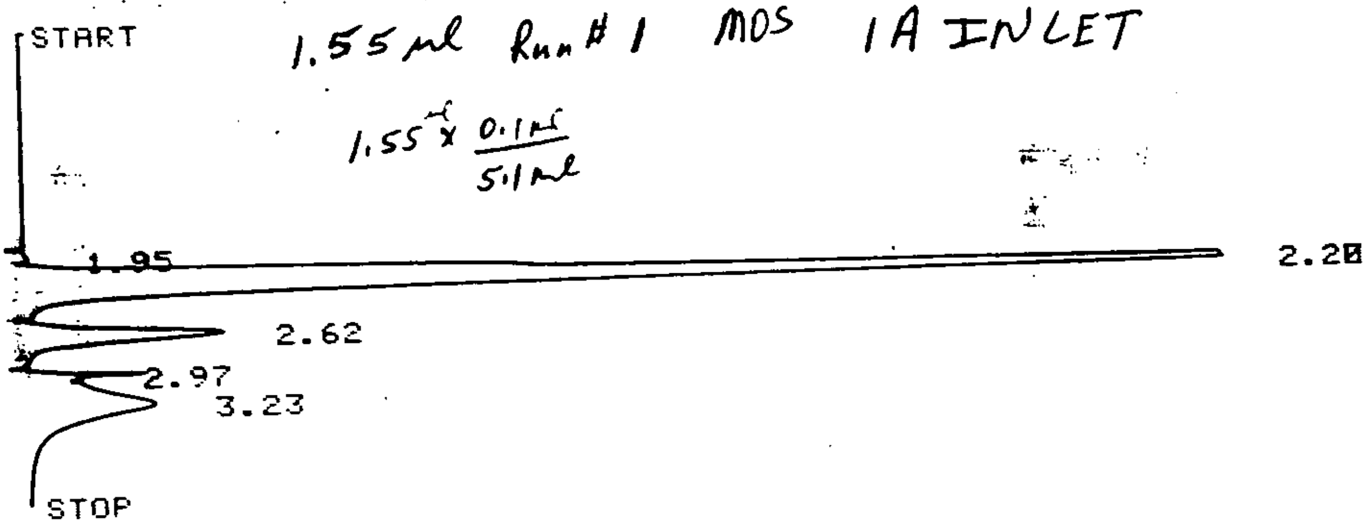
hp 5830A
AREA %

RT	AREA	AREA %
1.50	3931	0.377
1.94	1449	0.139
2.19	774600	74.365
2.62	106200	10.196
2.95	14540	1.396
3.23	140900	13.527

XF: 1.0000 E+ 0

1.55 µl Run # 1 MOS 1A INLET

$1.55\,\mu l \times \frac{0.1\,\mu l}{5.1\,\mu l}$

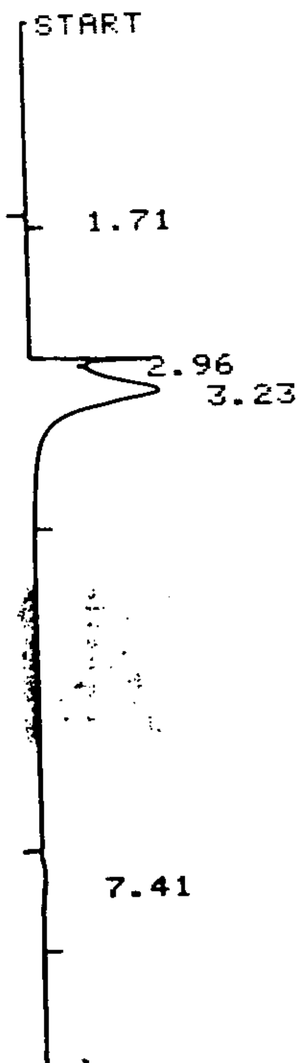


hp 5830A
AREA %

RT	AREA	AREA %
1.95	1284	0.147
2.20	631600	72.362
2.62	87060	9.974
2.97	15890	1.821
3.23	137000	15.696

XF: 1.0000 E+ 0

1.8 µl CS_2 Only

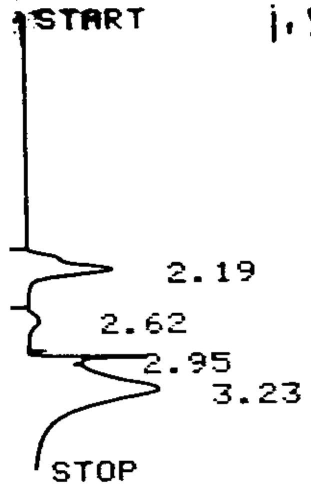


hp 5830A
AREA %

RT	AREA	AREA %
1.71	132	0.081
2.96	15640	9.542
3.23	143900	87.791
7.41	4241	2.587

XF: 1.0000 E+ 0

$1.8\ \mu l \times \frac{0.1\ ml}{5.1\ ml}$ Run#1 MOS 1B outlet

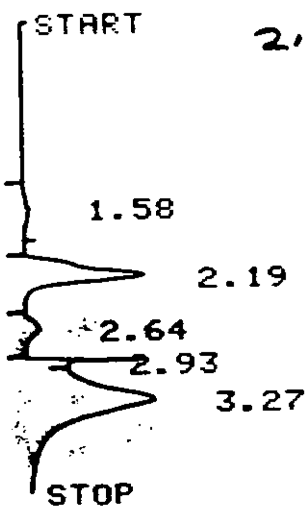


hp 5830A
AREA %

RT	AREA	AREA %
2.19	39380	19.712
2.62	5367	2.687
2.95	14530	7.273
3.23	140500	70.328

XF: 1.0000 E+ 0

$2.9\ \mu l \times \frac{0.1\ ml}{5.1\ ml}$ Run#1 1B outlet

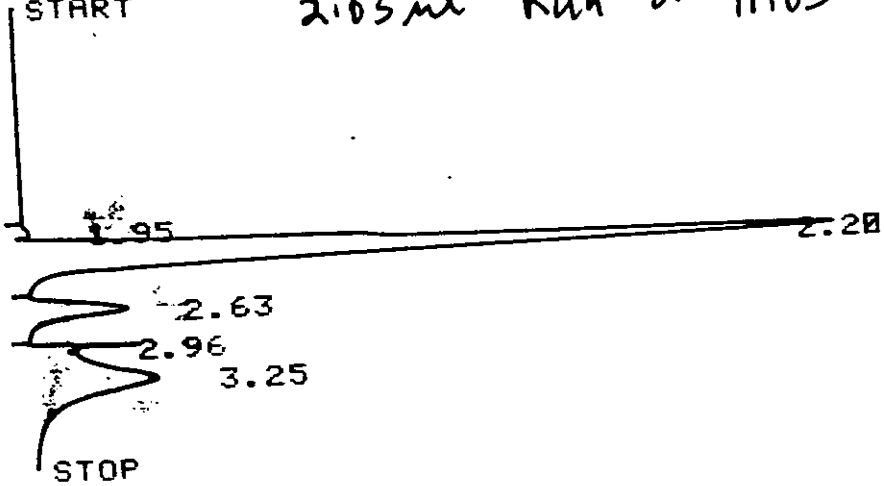


hp 5830A
AREA %

RT	AREA	AREA %
1.58	3838	1.638
2.19	60630	25.882
2.64	7996	3.413
2.93	11290	4.820
3.27	150500	64.247

XF: 1.0000 E+ 0

2.05 ml Run #2 MOS 2A outlet x 1/6

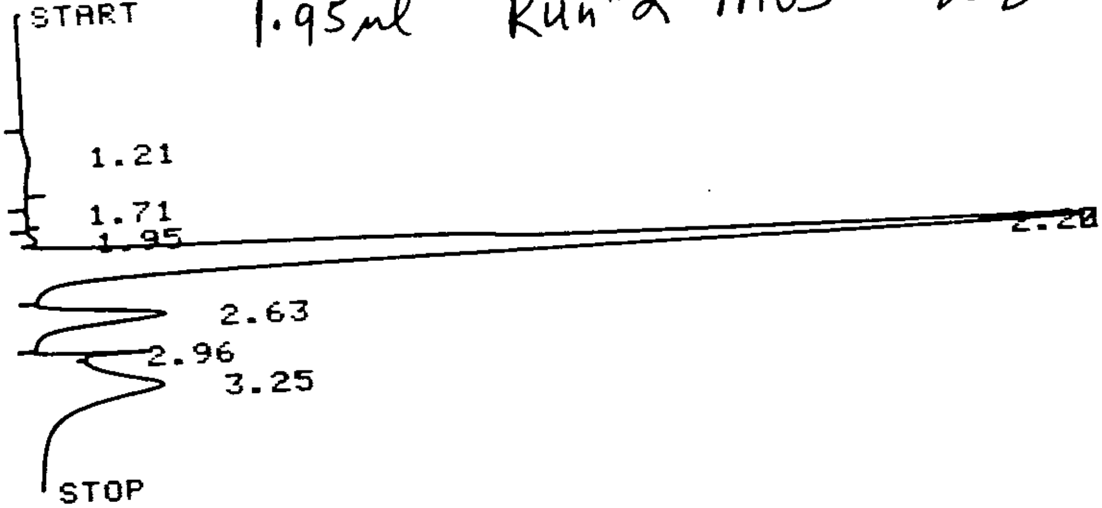


hp 5830A
AREA %

RT	AREA	AREA %
1.95	1821	0.309
2.20	387900	65.849
2.63	46980	7.975
2.96	12470	2.117
3.25	139900	23.749

XF: 1.0000 E+ 0

1.95 ml Run #2 MOS 2B outlet x 1/6



hp 5830A
AREA %

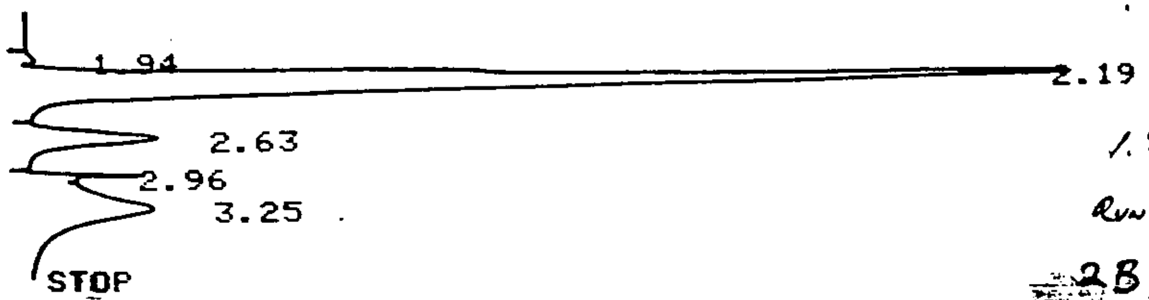
RT	AREA	AREA %
1.21	4702	0.644
1.71	188	0.026
1.95	2356	0.322
2.20	507600	69.478
2.63	61890	8.471
2.96	13160	1.801
3.25	140700	19.258

XF: 1.0000 E+ 0

1.95 ml Run #2 MOS 2B outlet x 1/6

START

Rerun



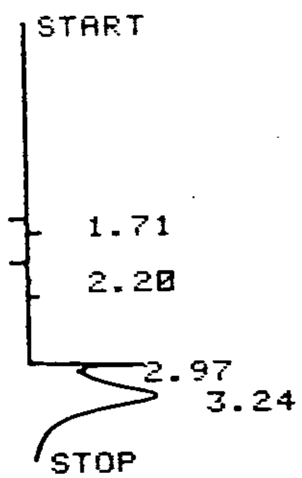
1.95 ml
Run#2 MOS
2B outlet
Dilution: 1/6

hp 5830A
AREA %

RT	AREA	AREA %
1.94	2327	0.327
2.19	501300	70.422
2.63	60450	8.492
2.96	13470	1.892
3.25	134300	18.866

XF: 1.0000 E+ 0

2.0 µl CS_2 Only.

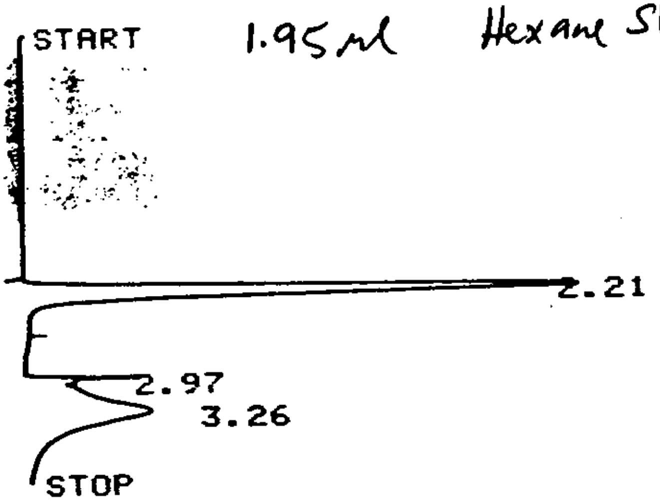


hp 5830A
AREA %

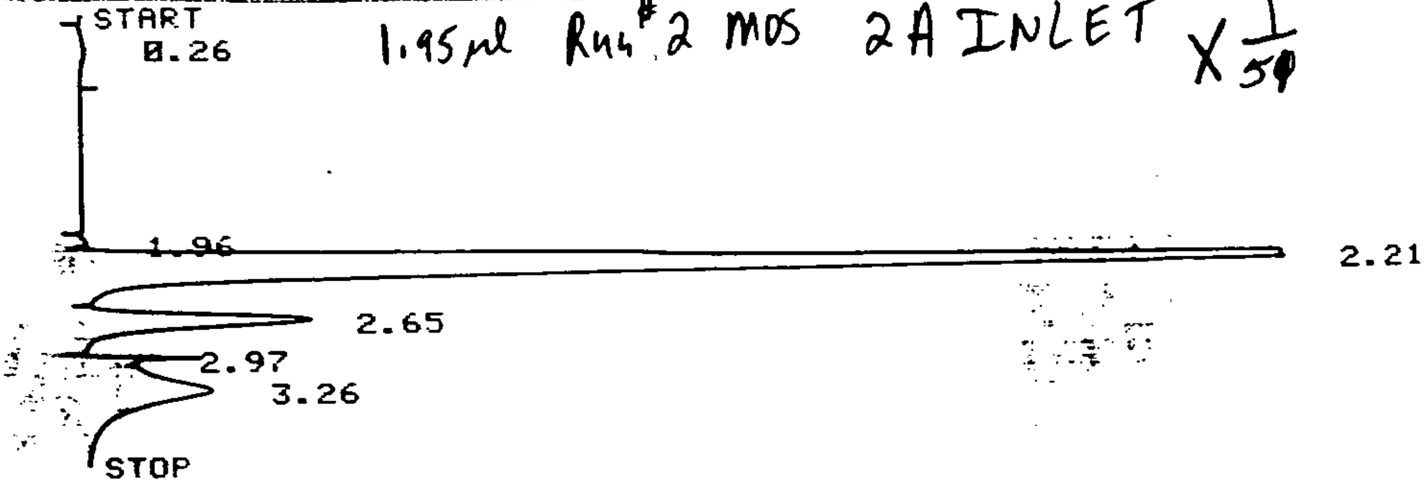
RT	AREA	AREA %
1.71	167	0.114
2.20	727	0.495
2.97	14830	10.094
3.24	131200	89.298

XF: 1.0000 E+ 0

1.95 µl Hexane Std $\times \frac{1.7 \mu l}{4001.7} \times \frac{659.37 \mu g}{ml}$



1.95 µl Run #2 MOS 2A INLET X 1/50



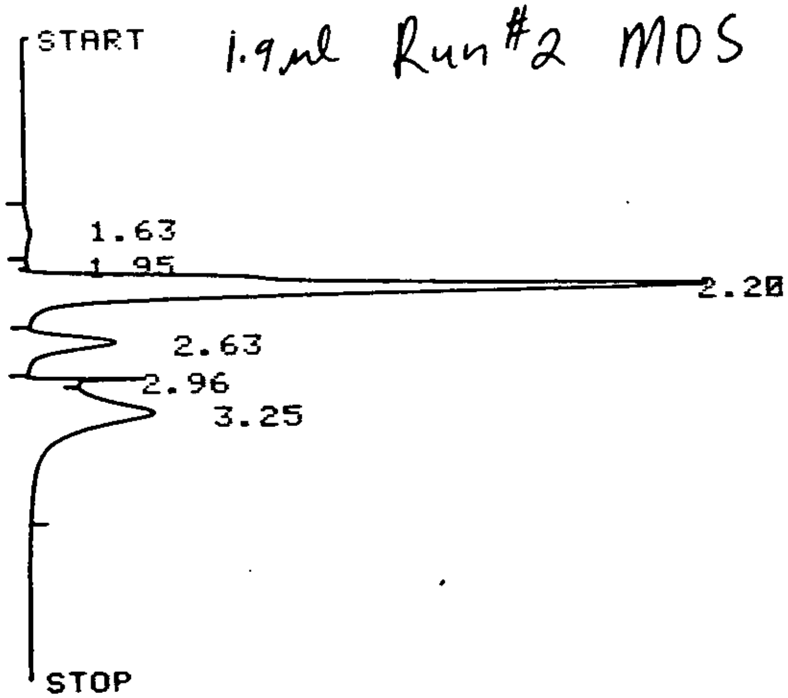
hp 5830A
AREA %

RT	AREA	AREA %
0.26	4585	0.463
1.96	1372	0.138
2.21	735600	74.223
2.65	102300	10.322
2.97	13610	1.373
3.26	133600	13.480

XF: 1.0000 E+ 0

1.9 µl Run #2 MOS 2B Inlet X 1/51

160631



hp 5830A
AREA %

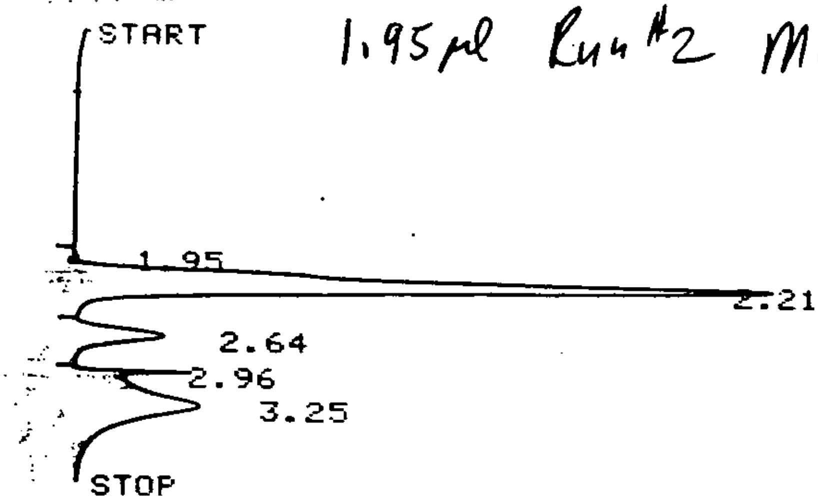
RT	AREA	AREA %
1.63	3864	0.764
1.95	498	0.098
2.20	305200	60.329
2.63	41190	8.142
2.96	13540	2.676
3.25	141600	27.990

XF: 1.0000 E+ 0

1.95 µl Run #2 MOS 2B Inlet x $\frac{1}{51}$

Rerun

166923 A.U



hp 5830A

AREA %

RT	AREA	AREA %
1.95	571	0.113
2.21	313800	61.922
2.64	42440	8.375
2.96	13360	2.636
3.25	136600	26.955

XF: 1.0000 E+ 0

LABORATORY DATA

Client SALEY
PN 3333N Date 3-14-79
Analyst M.A. KHALIFA

Analysis Hexane
Method Number GC
Checker

Run #	Spl ID	μl Inj	RT	Area unit	Area Unit / ml	mg / ml	mg/ml aft corred. for dil.	average of duplicate Runs
1	CS_2 Blank	1.9	2.25	891	468.9	0.001426		
2	Run # 3 MOS outlet 4th Bubbler	1.8	2.13	2437	473.3	undetectable compare to Blank		
			2.24	609				
3	Run # 3 MOS Inlet 4th Bubbler	1.85	2.13	22400	12108.1	0.03683	0.07323	
			2.21	22140	11967.6	0.03640		0.07533
4	Run # 3 MOS Inlet 4th Bubbler	1.9	2.13	24100	12684.2	0.03858	0.07744	
			2.21	24270	12773.7	0.03886		
5	Run # 3 MOS outlet dilution 1/6	1.95	2.21	221600	113641.0	0.3457	2.0742	2.1189
6	Run # 3 MOS outlet dil 1/6	2.0	2.13	44566	22280	0.06777	2.1637	
			2.23	192500	96250	0.29279		
7	Run # 3 MOS Inlet dil 1/51	1.9	2.23	805600	424000	1.2900	74.954	75.438
			2.67	112200	59052.6	0.17967		
8	Run # 3 MOS Inlet dil 1/51	1.85	2.13	130900	70756.7	1.3079		
			2.23	664400	359135		75.923	
			2.67	109900	59405.4	0.18074		

Run # 3 Inlet MOS

wt of Solution = 98.29 grams

average $\frac{\mu g \text{ Hexane}}{ml \text{ Solution}}$ = 75.438

density of pure CS_2 = 1263.2 $\frac{\mu g}{ml}$

$\frac{75.438}{659.37} = 0.1144$

1263.2 × 0.8856 = 1118.69 + 75.44 = 1194.13 μg/ml density of solution

volume of solution = $\frac{1\,ml}{1194.13\,\mu g}$ × 9.829 × 10^7 μg = 8.231 × 10^4 ml

Total μg of Hexane in the solution = 8.23 × 10^4 ml × 75.438 $\frac{\mu g}{ml}$ =

6.209 × 10^6 μg Hexane

CALIBRATION STANDARD

3/14/79

Run #	RT	Area Unit	$\mu\ell$ Inj.	$\frac{A.U.}{\mu\ell}$	$\frac{\mu g}{A.U.}$
1	2.23	208500	1.90	109736.8	2.93×10^{-6}
2	2.23	188900	1.95	966871.8	3.32×10^{-6}
3	2.24	204000	1.80	113333.3	2.83×10^{-6}
4	2.23	202800	1.95	104000	3.09×10^{-6}

$$\frac{\text{Average } \mu g \text{ Hexane}}{\text{Unit Area}} = 3.042 \times 10^{-6} \ \mu g/\text{A.U.} = \pm 0.21$$

Standard of Hexane in CS_2

$$\frac{1.95 \ \mu\ell \text{ Hexane}}{4001.95 \ \mu\ell \text{ solution}} \times \frac{659.37 \ \mu g \text{ Hexane}}{\mu\ell \text{ Hexane}} = \frac{0.3213 \ \mu g \text{ Hexane}}{\mu\ell \text{ solution}}$$

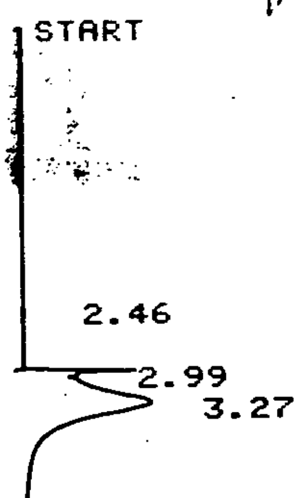
3/14/79

TEMP1	70	70
TIME1	10.0	
INJ TEMP	100	100
FID TEMP	250	250
TCD TEMP	0	40
AUX TEMP	0	28
OVEN MAX	280	
CHT SPD	1.50	
ATTN 2↑	9	
FID SGNL	A	
SLP SENS	0.30	
AREA REJ	100	
FLOW A	29	
FLOW B	5	
OPTN	0	

TEMP1	70	70
TIME1	10.0	
INJ TEMP	100	100
FID TEMP	250	250
TCD TEMP	0	40
AUX TEMP	0	27
OVEN MAX	280	
CHT SPD	1.50	
ATTN 2↑	9	
FID SGNL	A	
SLP SENS	0.30	
AREA REJ	100	
FLOW A	28	
FLOW B	4	
OPTN	0	

1.9μl CS_2 Only

This CS_2 has been used as flush solvent



hp 5830A
AREA %

RT	AREA	AREA %
2.99	13510	8.599
3.27	143600	

POWER FAIL

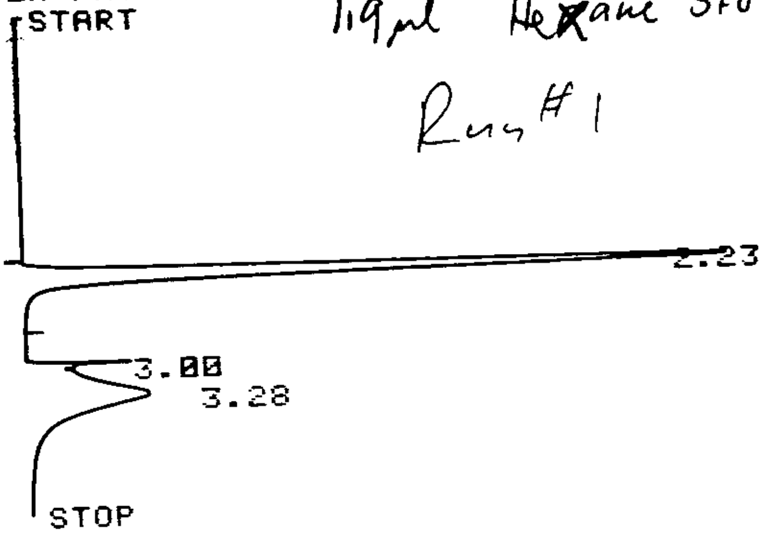
POWER FAIL

POWER FAIL

1.9 µl Hexane Std

$\frac{1.95}{4001.95} \times \frac{654.37\ \mu g}{ml}$

Run #1



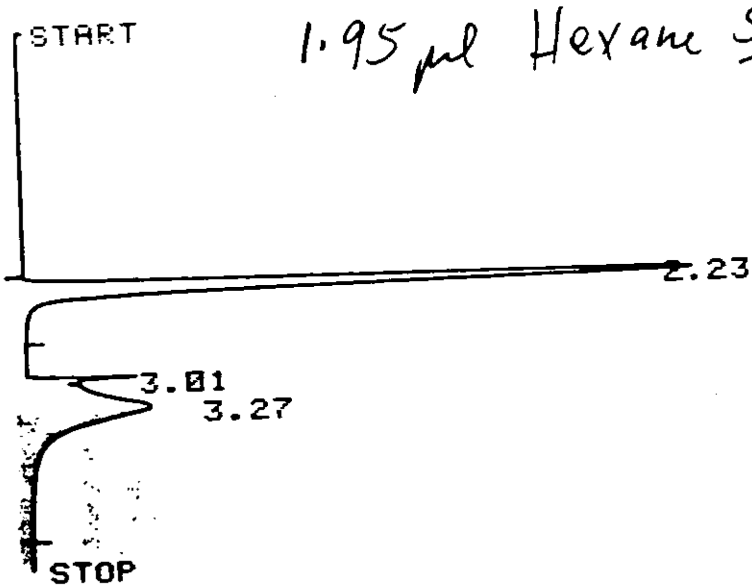
hp 5830A
AREA %

RT	AREA	AREA %
2.23	208500	57.824
3.00	10780	2.990
3.28	141300	39.187

XF: 1.0000 E+ 0

Run # 2

1.95 µl Hexane Std

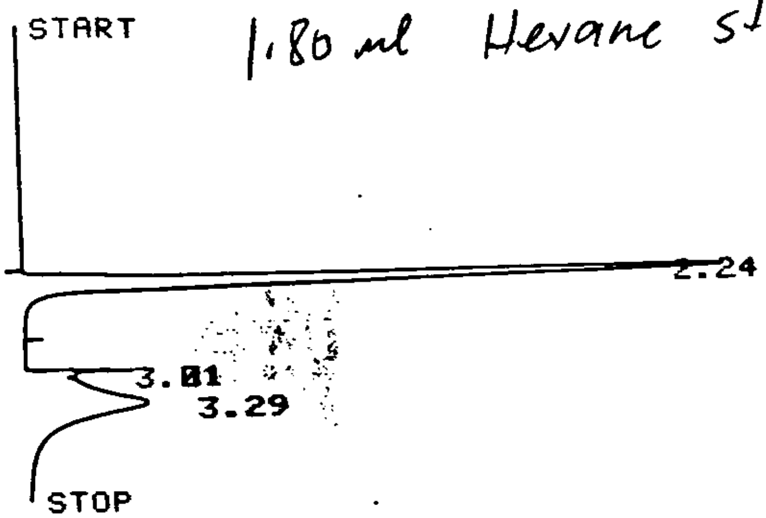


hp 5830A
AREA %

RT	AREA	AREA %
2.23	188900	55.840
3.01	12390	3.663
3.27	137000	40.498

XF: 1.0000 E+ 0

1.80 ml Hexane std Run #3

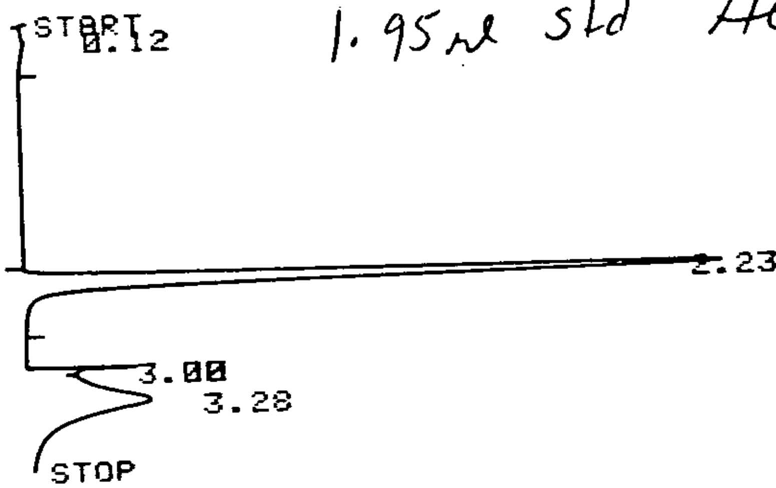


hp 5830A
AREA %

RT	AREA	AREA %
2.24	204000	57.996
3.01	11650	3.312
3.29	136100	38.692

XF: 1.0000 E+ 0

1.95 ml std Hexane Run # 4

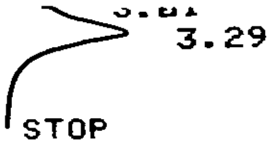


hp 5830A
AREA %

RT	AREA	AREA %
0.12	2509	0.721
2.23	202800	58.238
3.00	11720	3.366
3.28	131200	37.676

XF: 1.0000 E+ 0

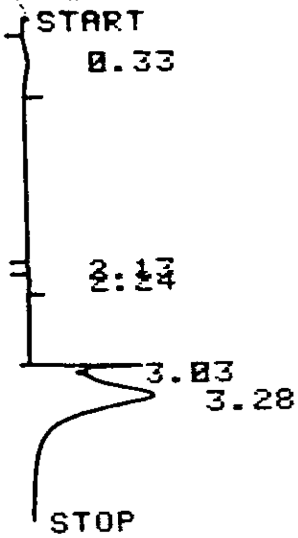
1.9 μl CS_2 Only



5830A
AREA %

RT	AREA	AREA %
2.25	891	0.601
3.01	11420	7.705
3.29	135900	91.694

XF: 1.0000 E+ 0

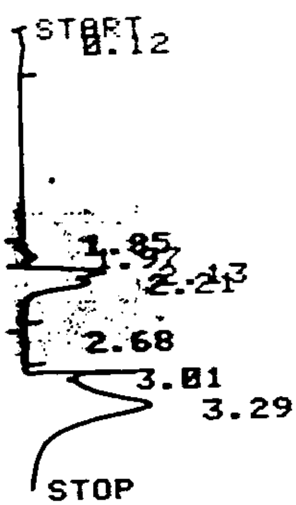


1.8 ml Run # 3 MOS outlet
4th BUBBLER

5830A
AREA %

RT	AREA	AREA %
0.33	4002	2.629
2.13	243	0.160
2.24	609	0.400
3.03	13370	8.783
3.28	134000	88.028

XF: 1.0000 E+ 0



1.85 ml Run # 3 MOS INLET
4 th Bubbler

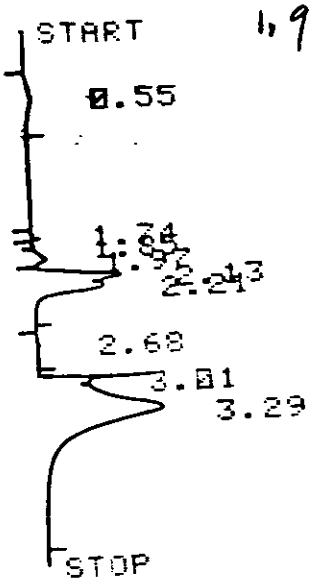
5830A
AREA %

RT AREA AREA %

[illegible]	1921	[illegible]
1.85	239	0.121
1.97	3767	1.905
2.13	22400	11.328
2.21	22140	11.197
2.68	618	0.313
3.01	11150	5.639
3.29	135500	68.526

XF: 1.0000 E+ 0

1.9 μl Run #3 MOS INLET 4th Bubbler

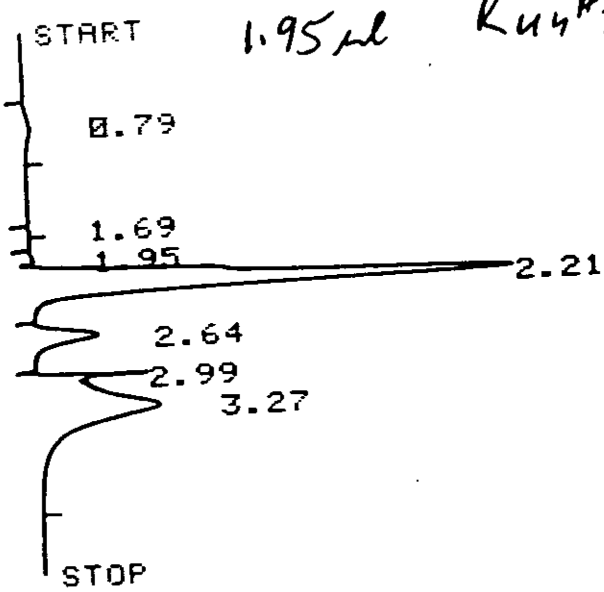


hp 5830A
AREA %

RT	AREA	AREA %
0.55	4663	2.201
1.85	261	0.123
1.97	4064	1.918
2.13	24100	11.375
2.21	24270	11.456
2.68	724	0.342
3.01	11480	5.419
3.29	142300	67.166

XF: 1.0000 E+ 0

1.95 μl Run #3 MOS Outlet × 1/6 dilution



911 367.AU / ml

hp 5830A
AREA %

RT	AREA	AREA %
		1.077

LABORATORY DATA

Client STALEY. Co.
PN 3333 N. Date 3/15/79
Analyst M. A. K

Analysis HEXANE
Method Number
Checker

Gas Spl

# Run	SPL ID	µl Inj	RT	Area Unit	Area Unit / ml	mg/ml	PPM	
1	DRYER 17:42 - 17:50	200	2.18	753200	4488	0.0142	3962	
			2.59	144400				
2	DRYER 17:42 - 17:50	200	2.17	773400	4601	0.0145	4045	3804
			2.57	146900				
3	DRYER 17:42 - 1750	200	2.18	647800	3849	0.0122	3404	
			2.58	122000				
4	Cooler Grab bag 16:08 - 16:15	300	2.18	10380	39	0.00012	33	
			2.59	1369				35
5	Cooler Grab bag 16:08 - 16:15	700	2.19	25860	42	0.00013	36	
			2.59	3868				

for response factor use 3.168×10^{-6} mg/A.U

HEXANE STD.	ml Inj	RT	AREA	AREA / ml	mg/Area
2.695 mg/ml	2.0	2.24	1702	851	3.167×10^{-6}
	2.45	2.24	2095	855	3.152×10^{-6}
	2.15	2.24	1846	858	3.141×10^{-6}
	1.9	2.15	1579	831	3.243×10^{-6}
	2.2	2.13	1891	858	3.137×10^{-6}

AVG Response 3.168×10^{-6} mg/Area

LABORATORY DATA

Client STALEY
PN 3333N Date 3-15-79
Analyst M.A.K

Analysis Hexane
Method Number G C
Checker

Run #	SPL ID	μl Inj	RT	Area Unit	Area Unit/μl	mg/μl		
1	DRYER Run#1 4th Bubbler	3.1	2.15	1036				
			2.26	2759	1291.3	0.00408		
			2.72	208				
2	DRYER Run#1 4th Bubbler	2.85	2.16	909				
			2.27	2511	1260.7	0.00399		
			2.72	173				
3	DRYER Run#1 - D-1	2.0	2.27	528900	311690	0.9466		
			2.72	94480				
4	Cooler Run#1 4th Bubbler	1.3	2.29	147	113.1	0.00035 undetectable		
5	Cooler Run#1 C-1	2.8	2.28	138900	57739.3	0.1753		
			2.74	22770				
						mg/AREA		
	HEXANE IN CS_2					3.106×10^{-6}		
	CALIBRATION STD	1.8	2.16	791200		2.969×10^{-6}		
	1.3653 mg/μl	1.9	2.16	873600				
					AVG -	3.037×10^{-6} mg/A.U.		

Notes * Response factor use 3.037×10^{-6} mg/A.U.

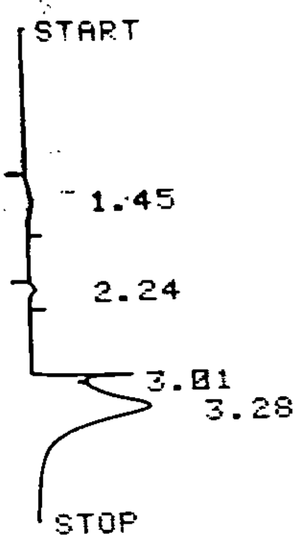
O use Response factor as 3.168×10^{-6} mg/AU

hp 5830A
AREA %

RT	AREA	AREA %
2.24	321	0.212
3.28	151300	99.788

3/15/79

XF: 1.0000 E+ 0



2.0 µl Hexane std

2.695 mg/µl

hp 5830A
AREA %

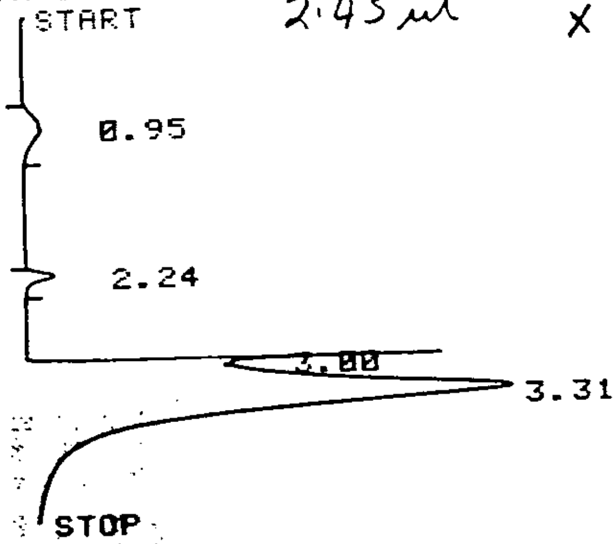
RT	AREA	AREA %
1.45	4167	2.637
2.24	1702	1.077
3.01	12350	7.816
3.28	139800	88.470

$\frac{851\ A.U}{\mu l}$

XF: 1.0000 E+ 0

ATTN 2↑ 7 @

2.45 µl × 2.695 mg/µl Hexane std



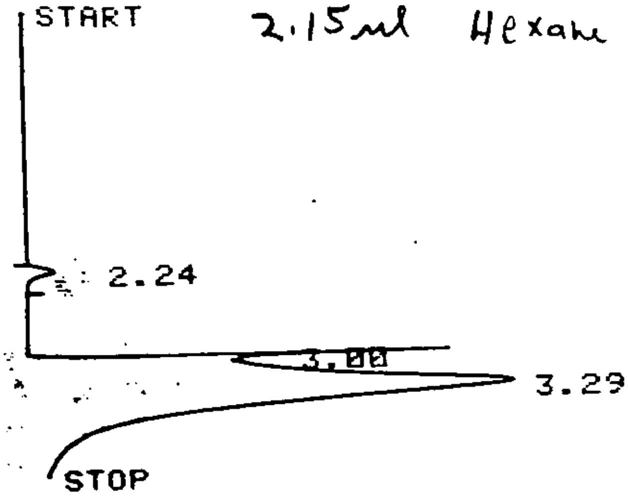
hp 5830A
AREA %

RT	AREA	AREA %
0.95	3701	2.246
2.24	2095	1.271
3.00	10680	6.482
3.31	148300	90.001

$\frac{855\ AU}{\mu l}$

XF: 1.0000 E+ 0

2.15 µl Hexane std × 2.695 ng/µl



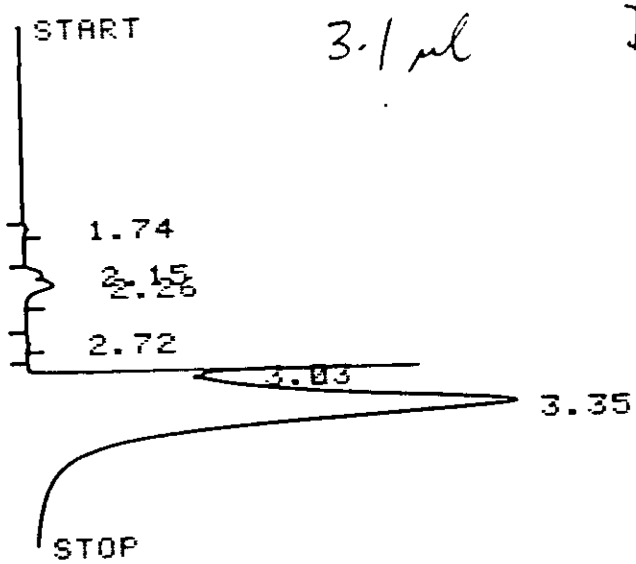
hp 5830A
AREA %

RT	AREA	AREA %
2.24	1846	1.208
3.00	11270	7.375
3.29	139700	91.417

858 AU/µl

XF: 1.0000 E+ 0

3.1 µl Dryer Run #1 4th Bubbler

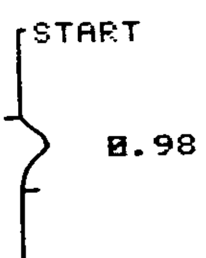


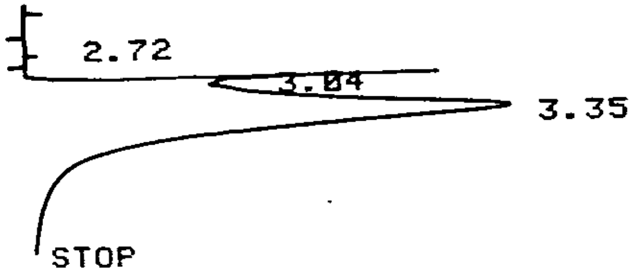
hp 5830A
AREA %

RT	AREA	AREA %
1.74	212	0.131
2.15	1036	0.638
2.26	2759	1.698 → 890 A.U/µl
2.72	208	0.128
3.03	9436	5.809
3.35	148800	91.597

XF: 1.0000 E+ 0

2.85 µl DRYER Run #1 4th Bubbler





DRYER Run 2 4th Bubbler
2.85 ml

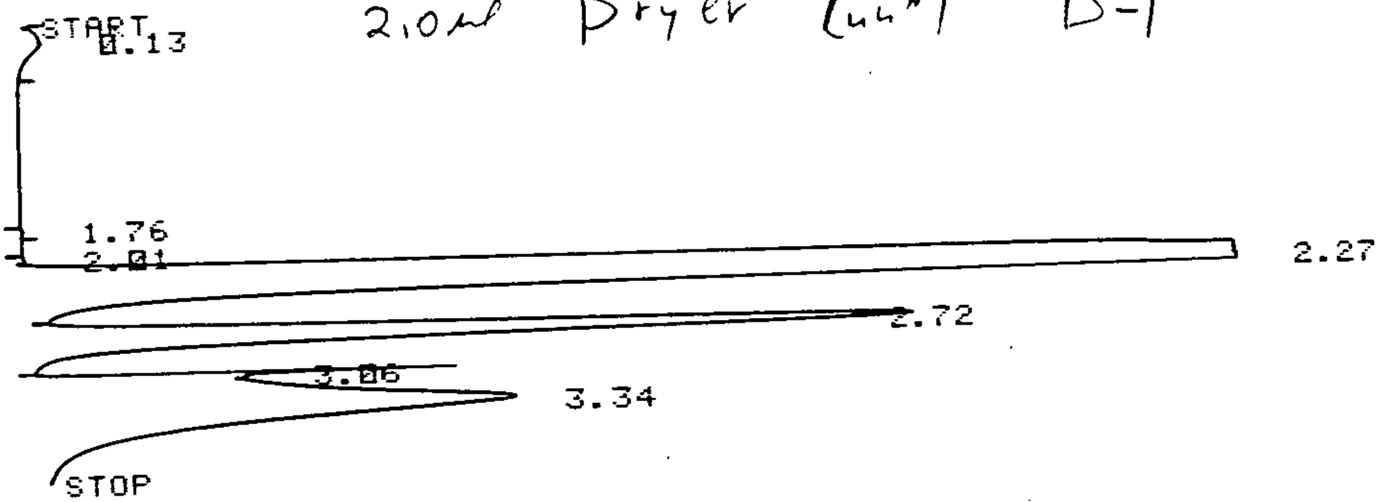
hp 5830A
AREA %

RT	AREA	AREA %
0.98	6051	3.560
2.16	909	0.535
2.27	2511	1.477
2.72	173	0.102
3.04	10120	5.954
3.35	150200	88.372

→ 881 µ / ul

XF: 1.0000 E+ 0

2.0 ml Dryer Run #1 D-1

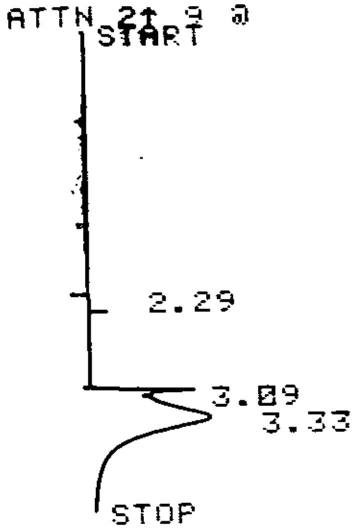


hp 5830A
AREA %

RT	AREA	AREA %
0.13	2874	0.374
2.27	528900	68.796
2.72	94480	12.289
3.06	11340	1.475
3.34	131200	17.066

XF: 1.0000 E+ 0

1.3 µl of Cooler Run #1 4th Bubbler

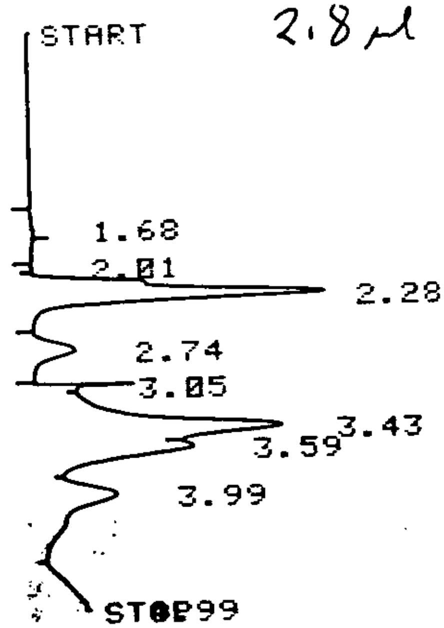


hp 5830A
AREA %

RT	AREA	AREA %
2.29	147	0.101
3.09	14940	10.248
3.33	130700	89.651

XF: 1.0000 E+ 0

2.8 µl Cooler Run #1 C-1

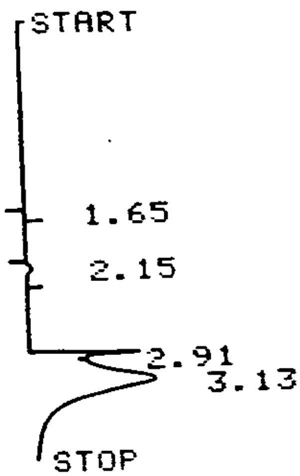


hp 5830A
AREA %

RT	AREA	AREA %
1.68	783	0.133
2.28	138900	23.615
2.74	22770	3.871
3.05	9544	1.623
3.43	187500	31.878
3.59	91120	15.492
3.99	88780	15.094
[illegible]	48790	8.295

A 27
27

POWER FAIL
A 39
A 36
A 32
A 31



1.9 µl Std Hexane 2.695 mg/µl

831 AU / µl

hp 5830A
AREA %

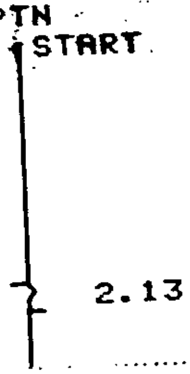
RT	AREA	AREA %
1.65	108	0.076
2.15	1579	1.115 *
2.91	15400	10.877
3.13	124500	87.932

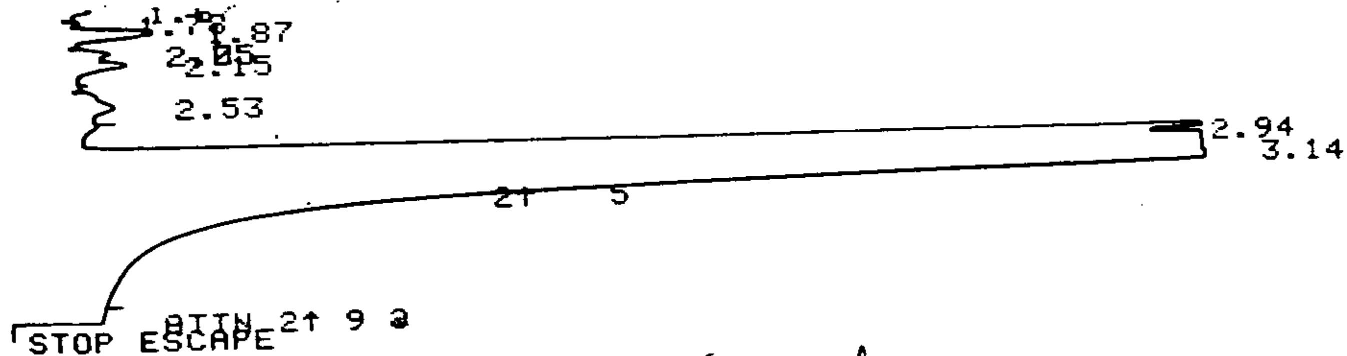
XF: 1.0000 E+ 0

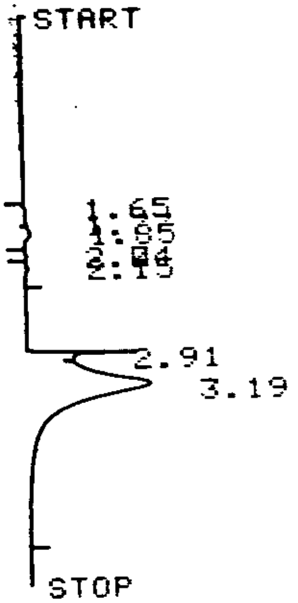
TEMP1	70	70
TIME1	10.0	
INJ TEMP	100	100
FID TEMP	250	250
TCD TEMP	0	31
AUX TEMP	0	34
OVEN MAX	280	

CHT SPD	1.50
ATTN 2↑	9
FID SGNL	A
SLP SENS	0.30
AREA REJ	100
FLOW A	30
FLOW B	5
OPTN	0

2.20 µl std Hexane 2.695 mg/µl







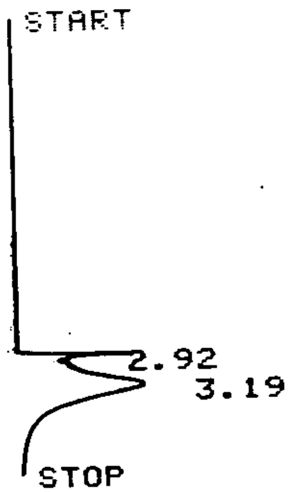
2.3 µl CS_2 Only

hp 5830A
AREA %

RT	AREA	AREA %
1.77	1217	0.790
1.85	2224	1.443
2.04	629	0.408
2.15	1214	0.788
2.91	12630	8.195
3.19	136200	88.376

XF: 1.0000 E+ 0

2.1µl CS_2 Only

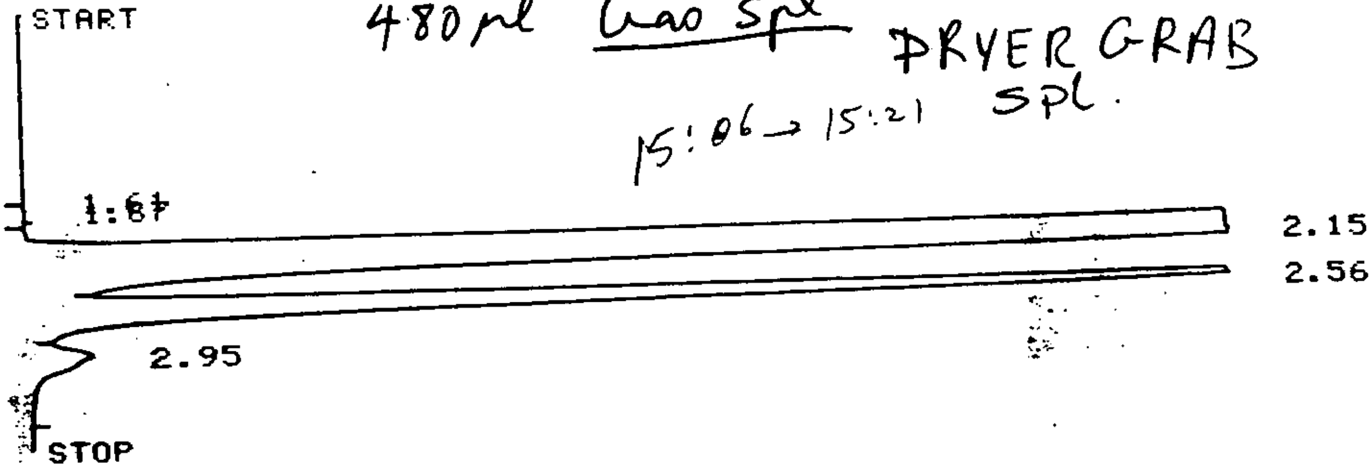


hp 5830A
AREA %

RT	AREA	AREA %
2.92	12940	8.855
[illegible]	[illegible]	91.146

480 µl Gas spl DRYER GRAB spl.

15:06 → 15:21



hp 5830A
AREA %

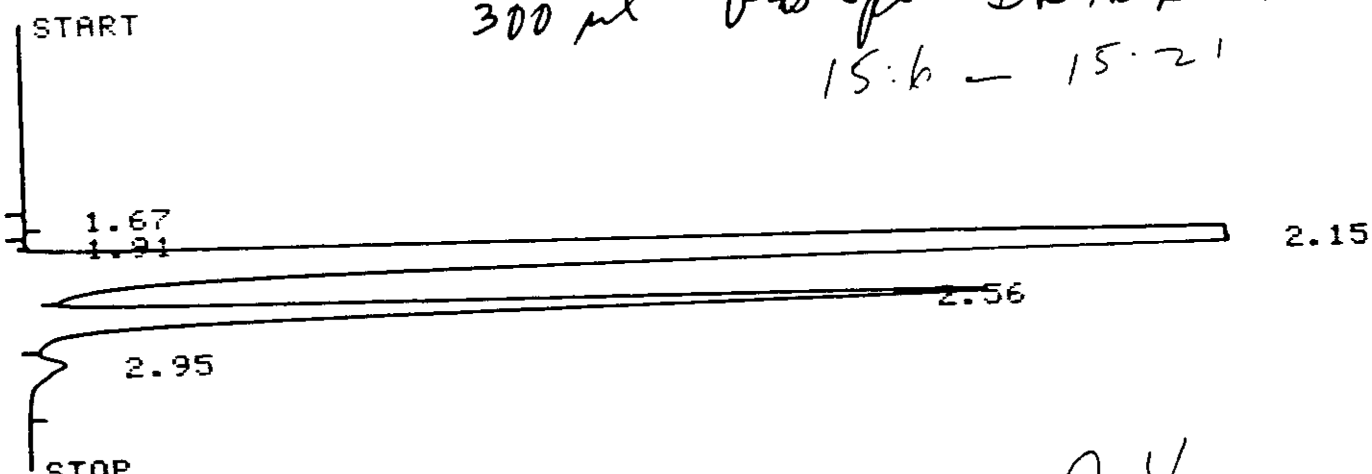
6020.8

RT	AREA	AREA %
1.67	344	0.010
2.15	2890000	81.665
2.56	598200	16.904
2.95	50290	1.421

XF: 1.0000 E+ 0

300 µl Gas spl DRYER GRAB

15:6 – 15:21



6116.6 A.V / ml

hp 5830A
AREA %

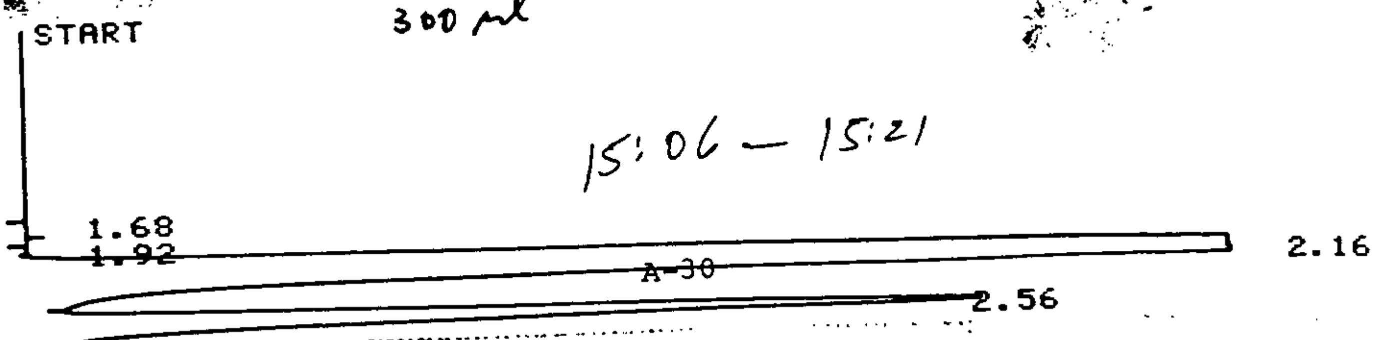
RT	AREA	AREA %
1.67	249	0.011
1.91	487	0.022
2.15	1835000	82.320
2.56	368400	16.527
2.95	24980	1.121

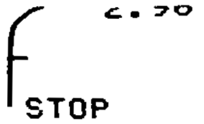
15:06 – 15:21

XF: 1.0000 E+ 0

300 µl

15:06 – 15:21





hp 5830A
AREA %

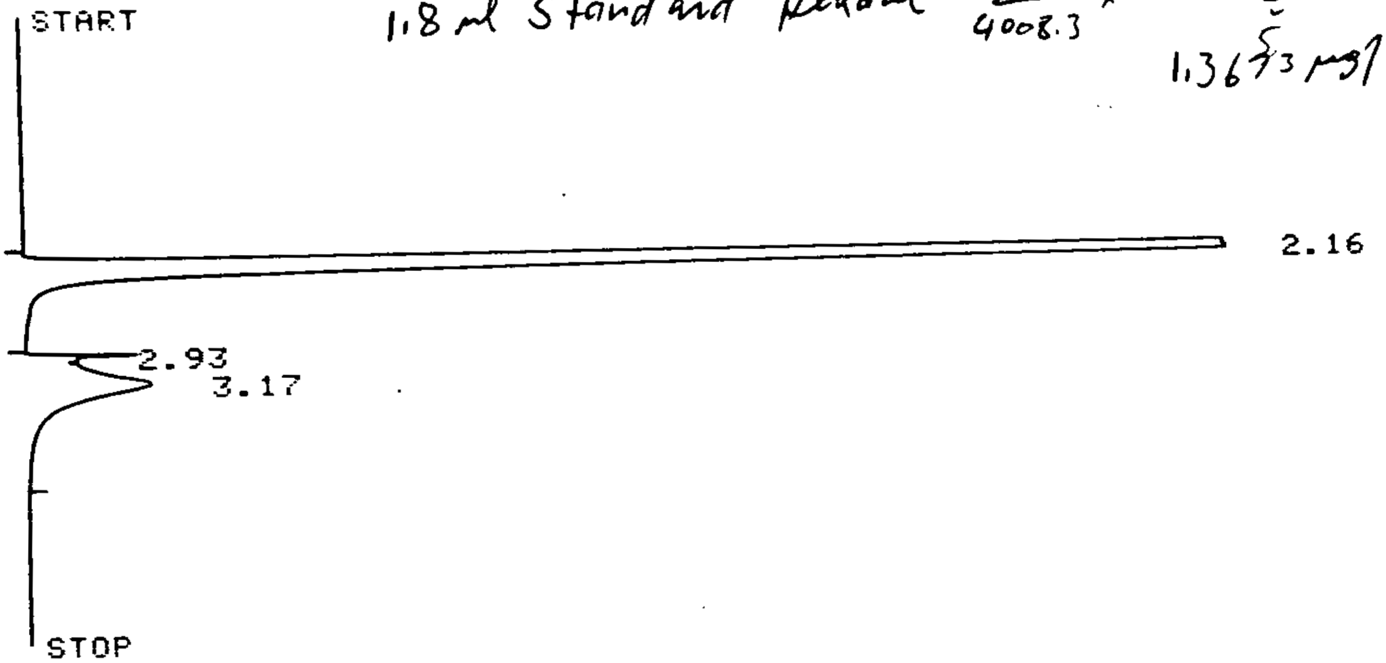
RT	AREA	AREA %
1.68	232	0.010
1.92	439	0.020
2.16	1845000	82.232
2.56	372900	16.620
2.96	25080	1.118

$\frac{.150\ \mu l}{ml}$

639.77

XF: 1.0000 E+ 0

1.8 ml Standard Hexane $\frac{8.3}{4008.3} \times 660.3 = 1.3673$ mg/ml



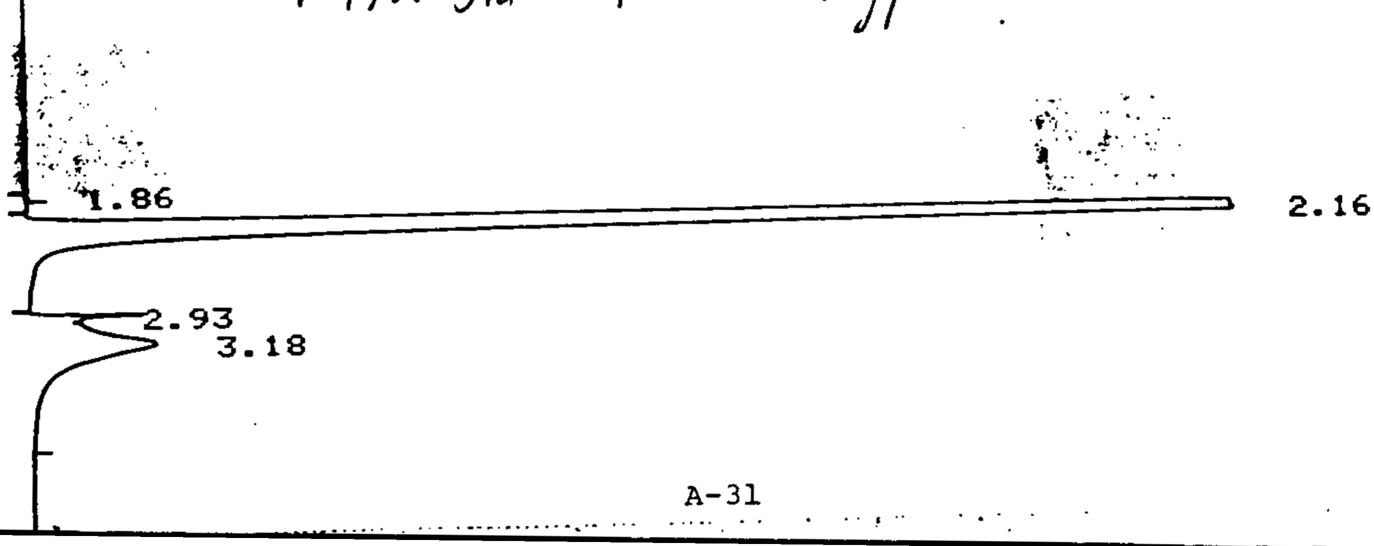
hp 5830A
AREA %

RT	AREA	AREA %
2.16	791200	84.641
2.93	13470	1.441
3.17	130100	13.918

XF: 1.0000 E+ 0

START

1.9 ml Std 1.3673 mg/ml Hexane std



STOP
hp 5830A
AREA %

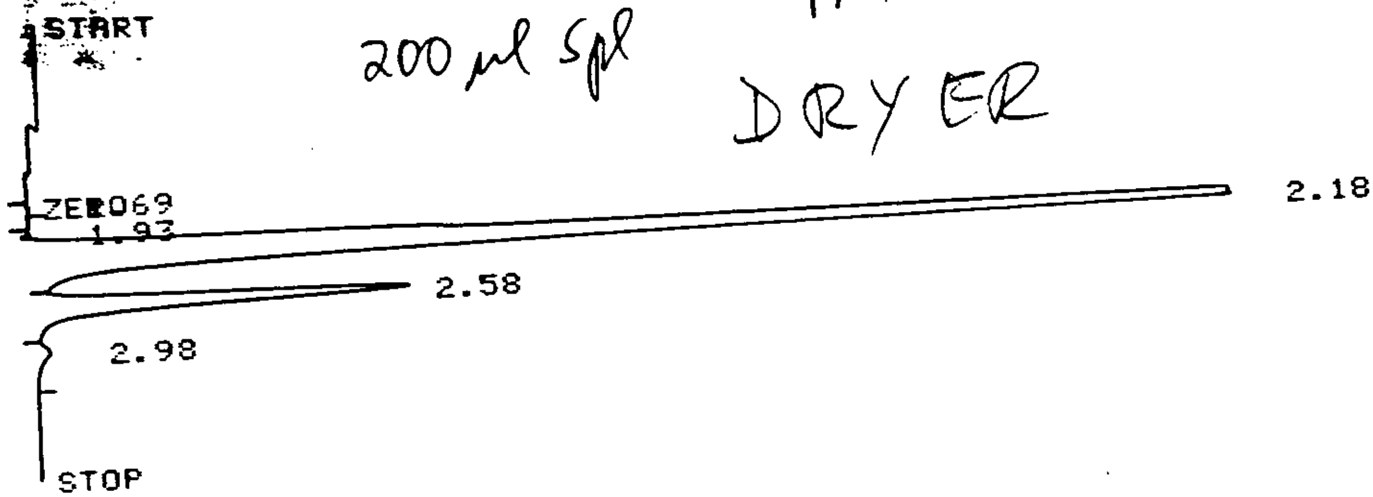
RT	AREA	AREA %
2.16	873600	85.735
2.93	13260	1.301
3.18	132100	12.964

XF: 1.0000 E+ 0

17:42 – 17:50

200 µl Spl

DRYER



hp 5830A
AREA %

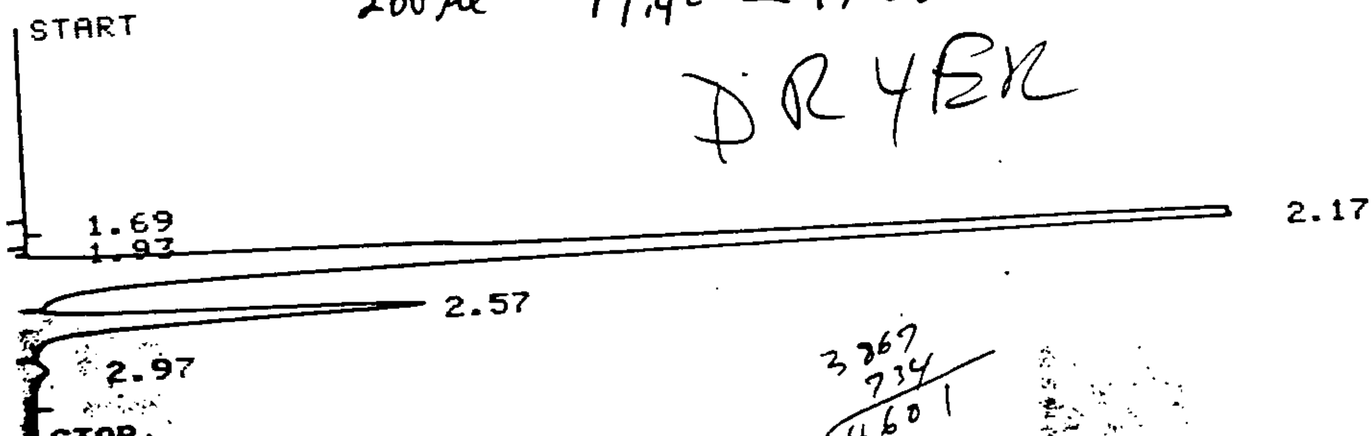
RT	AREA	AREA %
1.69	162	0.018
1.93	137	0.015
2.18	753200	83.059
2.58	144400	15.924
2.98	8922	0.984

3766
722
4488

XF: 1.0000 E+ 0

200 µl 17:42 – 17:50

DRYER



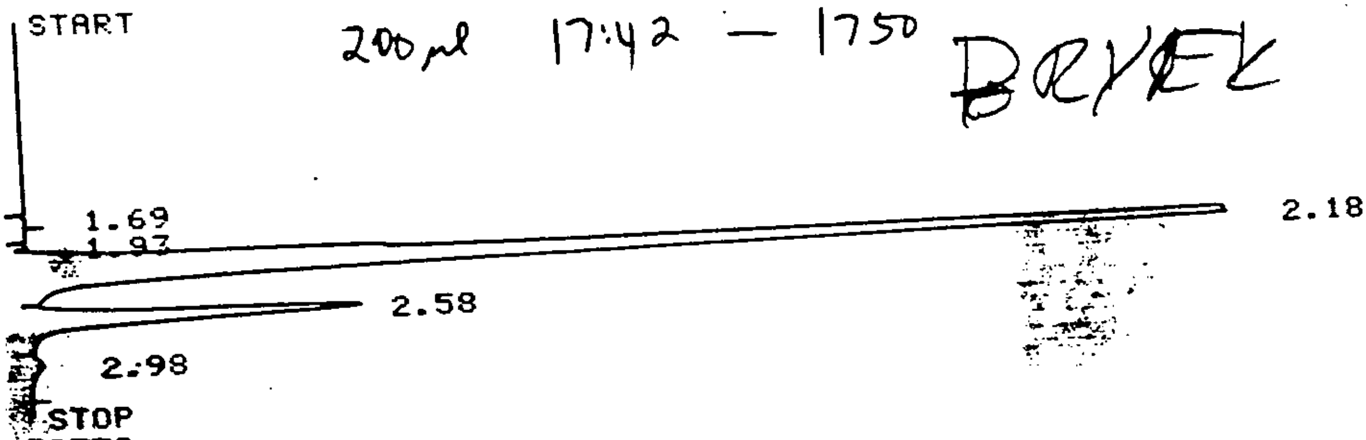
3867
734
4601

hp 5830A
AREA %

RT	AREA	AREA %
1.69	190	0.020
1.93	151	0.016
2.17	773400	83.229
2.57	146900	15.809
2.97	8604	0.926

XF: 1.0000 E+ 0

200 µl 17:42 — 1750 DRYER



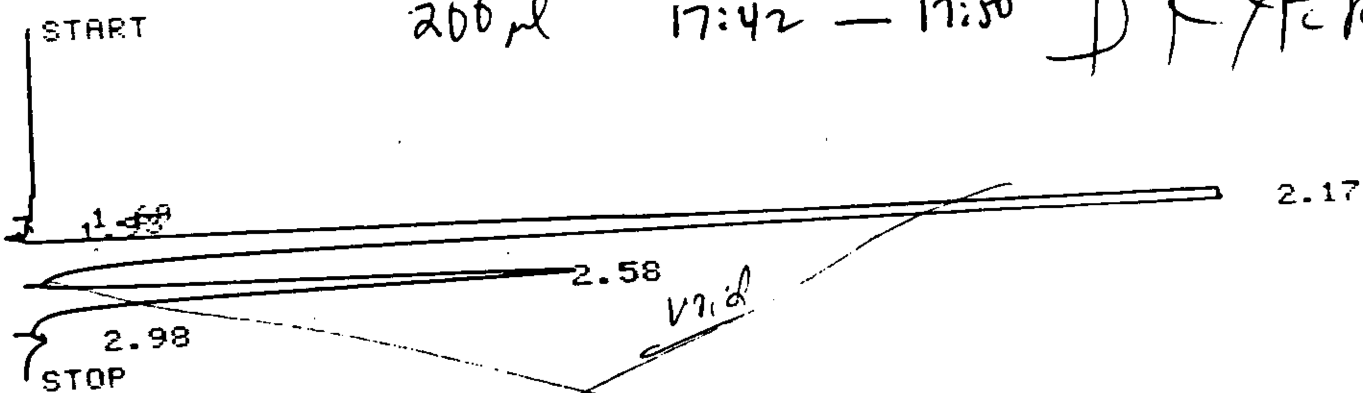
hp 5830A
AREA %

RT	AREA	AREA %
1.69	168	0.022
1.93	120	0.015
2.18	647800	83.377
2.58	122000	15.702
2.98	6870	0.884

3239
610
3849

XF: 1.0000 E+ 0

200 µl 17:42 — 17:50 DRYER



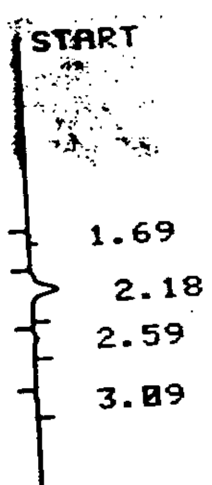
Void

hp 5830A
AREA %

RT	AREA	AREA %
1.69	223	0.017
1.93	228	0.018
2.17	1080000	83.165
2.58	206300	15.886
2.98	11870	0.914

XF: 1.0000 E+ 0

300 µl cooler grab bag 16:08 – 16:18



34.6
4.6

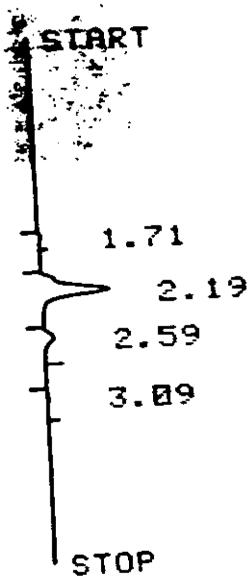
hp 5830A

AREA %

RT	AREA	AREA %
1.69	127	1.041
2.18	10380	85.047
2.59	1369	11.217
3.09	329	2.696

XF: 1.0000 E+ 0

700 μl Cooler Grab spl 16:08 – 16:18



hp 5830A

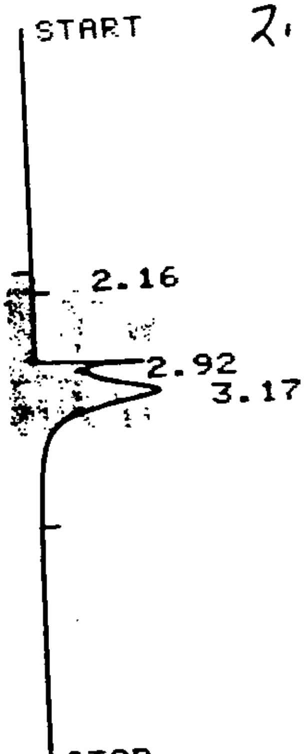
AREA %

RT	AREA	AREA %
1.71	484	1.579
2.19	25860	84.364
2.59	3868	12.619
3.09	441	1.439

36.94
5.52

XF: 1.0000 E+ 0

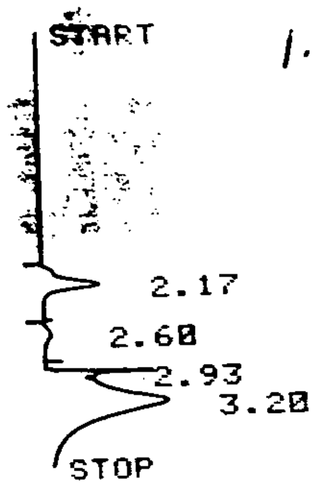
2.0 μl CS_2 Only



RT	AREA	AREA %
2.16	387	0.264
2.92	13690	9.333
3.17	132600	90.403

XF: 1.0000 E+ 0

1.9 μl Cooler Run #2 C-2A



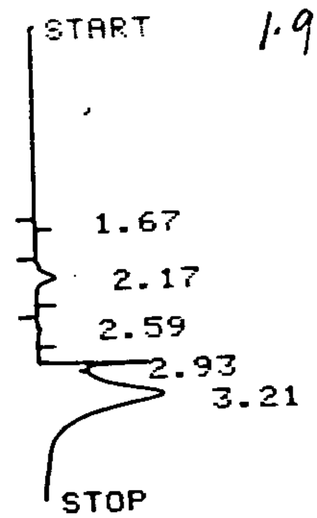
wt of sol = 91.8 g of CS_2 and Hexane solution

hp 5830A
AREA %

RT	AREA	AREA %
2.17	21950	13.512
2.60	3288	2.024
2.93	13010	8.009
3.20	124200	76.455

XF: 1.0000 E+ 0

1.9 μl Cooler C-2B

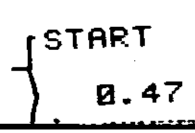


hp 5830A
AREA %

RT	AREA	AREA %
1.67	118	0.075
2.17	7812	4.973
2.59	978	0.623
2.93	13170	8.384
3.21	135000	85.945

XF: 1.0000 E+ 0

2.3 μl DRYER RUN#2 2A *



LABORATORY DATA

Client STALEY

PN 3333 N Date 3/16/79

Analyst

Analysis

Method Number

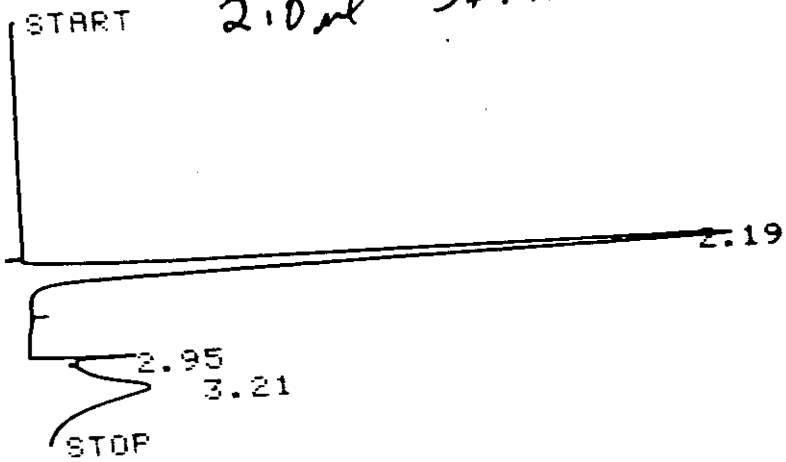
Checker

Response factor 3.033 x 10⁻⁶ mg/A U.

Run	SPL ID	RT	µl Inj	Area Unit	Area/ml	mg/ml	mg/ml corrected for dilution	average Run
1	Cooler Run #2 A	2.19	2.2	20980	10995	0.03335		
		2.61		3210				
2	Cooler Run #2 B	2.19	3.1	11140	4056	0.01230		
		2.63		1434				
3	DRYER Run #2 A dil 1/51	2.18	1.95	22020	28169	0.08544	4357	
		2.59		32910				
4	DRYER Run #2 B dil 1/51	2.19	2.2	39110	28291	0.08581	4.376	
		2.61		23130				
~~5~~	~~DRYER Run #2B dil 1/51~~	~~2.19~~	~~2.13~~	~~49620~~	~~36100~~ void			4526
		2.61		33410				
6	DRYER Run 2B dil 1/51	2.19	2.125	42220	30240	0.09172	4.677	
		2.61		25820				
						mg/A.U.		
	HEXANE STD.	2.19	2.0	201900	100950	3.019×10^{-6}		
	0.3048 mg/ml	2.19	2.1	210000	100000	3.048×10^{-6}		
	Hexane in CS_2	2.19	1.9	191000	100526	3.032×10^{-6}		
				AVG RESPONSE:		3.033×10^{-6}		mg/Area unit

2.0 ml Standard Hexane $\frac{1.85 \times 660.3}{4001.85}$

3/16/79

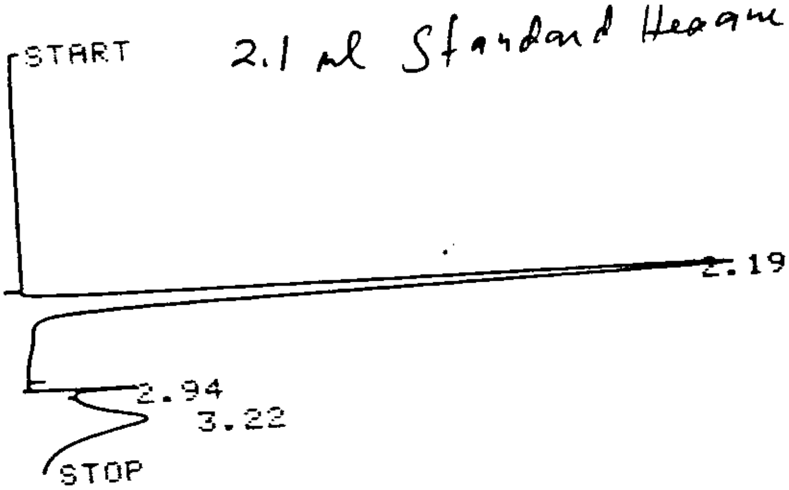


hp 5830A
AREA %

RT	AREA	AREA %
2.19	201900	61.045
2.95	11440	3.459
3.21	117400	35.496

XF: 1.0000 E+ 0

2.1 ml Standard Hexane Run#2 $\frac{1.85 \times 660.3}{4001.85}$



100950
100000
100526

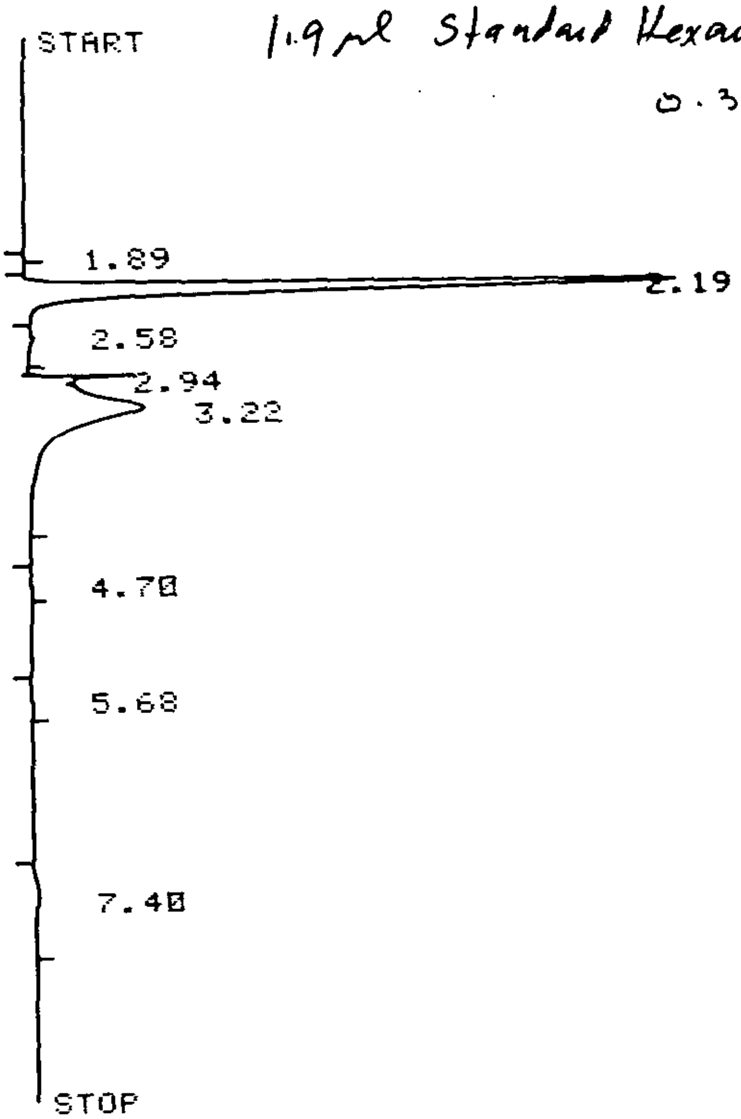
hp 5830A
AREA %

RT	AREA	AREA %
2.19	210000	62.825
2.94	11460	3.428
3.22	112800	33.746

XF: 1.0000 E+ 0

1.9 μl Standard Hexane Run #3 $\frac{1.85 \times 160-3}{2400 | .85}$

0.3052 μg/μl

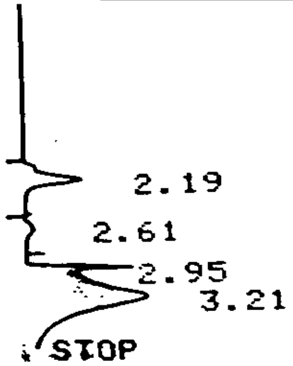


hp 5830A
AREA %

RT	AREA	AREA %
2.19	191000	55.395
2.58	4682	1.358
2.94	12070	3.501
3.22	130800	37.936
4.70	449	0.130
5.68	408	0.118
7.40	5385	1.562

XF: 1.0000 E+ 0

START 2.2 μl Cooler Run # 2 A



2.2 ml cooler

RUN # 2A.

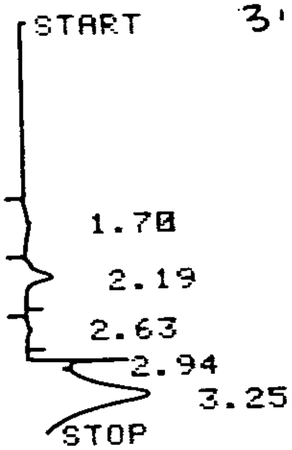
hp 5830A

AREA %

RT	AREA	AREA %
2.19	20980	13.855
2.61	3210	2.120
2.95	13140	8.677
3.21	114100	75.348

XF: 1.0000 E+ 0

3.1 ml Cooler 2 B



hp 5830A

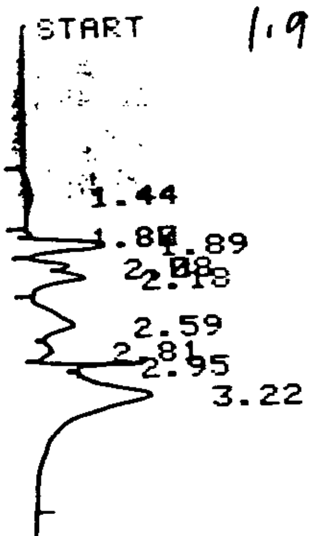
AREA %

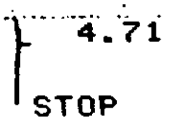
RT	AREA	AREA %
1.70	3826	2.834
2.19	11140	8.251
2.63	1434	1.062
2.94	10220	7.569
3.25	108400	80.284

XF: 1.0000 E+ 0

1.95 ml DRYER RUN. 2A

dilution X $\frac{1}{51}$





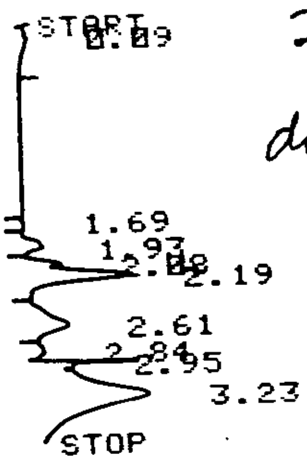
hp 5830A
AREA %

RT	AREA	AREA %
1.44	5503	2.098
1.80	919	0.350
1.89	25430	9.694
2.08	10850	4.136
2.18	22020	8.394
2.59	32910	12.545
2.81	10910	4.159
2.95	13150	5.013
3.22	140100	53.405
4.71	544	0.207

1.95 ml
DRYER RUN 2A
DILUTION: 1/51

XF: 1.0000 E+ 0

2.2 ml DRYER Run 2B
dilution $\times \frac{1}{51}$



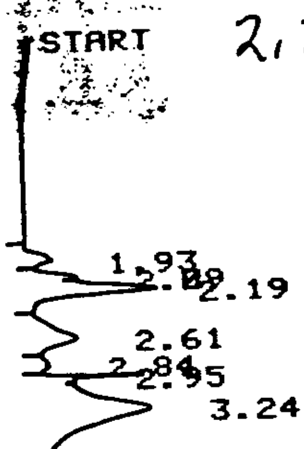
hp 5830A
AREA %

RT	AREA	AREA %
0.09	1849	0.919
1.69	106	0.053
1.93	6732	3.346
2.08	8034	3.994
2.19	39110	19.441
2.61	23130	11.498
2.84	4174	2.075
2.95	10040	4.991
3.23	108000	53.685

17777 A.V
10511.7

XF: 1.0000 E+ 0

2.3 ml DRYER RUN #2B Rerun



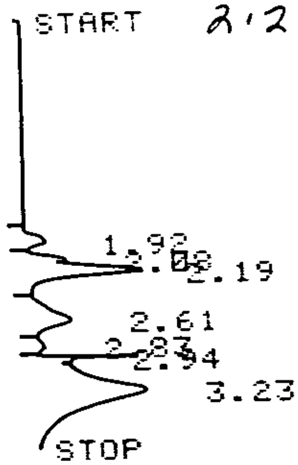
STOP

hp 5830A
AREA %

RT	AREA	AREA %		
1.93	9928	3.728		DRYER 2B
2.09	12060	4.528	21533	2.3 ml.
2.19	49620	18.631		
2.61	33410	12.545	14526	
2.84	9044	3.396		
2.95	11670	4.382		
3.24	140600	52.791		

XF: 1.0000 E+ 0

2.25 µl DRYER RUN 2B Rerun



hp 5830A
AREA %

RT	AREA	AREA %	
1.92	7220	3.388	
2.08	8788	4.124	
2.19	42220	19.814	18764
2.61	25820	12.117	15475
2.83	5169	2.426	
2.94	10070	4.726	
3.23	113800	53.405	

XF: 1.0000 E+ 0

1B. EXAMPLE CALCULATIONS: CS_2 IMPINGER TRAIN TESTS

Inlet MOS Run #1A

Solution Conc.: 70.467 μg/μℓ hexane in CS_2

Solution Density:

$$\% \text{ Hexane} = \frac{70.467\ \mu g/\mu\ell}{659.37\ \mu g/\mu\ell} = 0.10687$$

$$CS_2 \text{ density} = 1263.2\ \mu g/\mu\ell$$

$$\text{Solution Density} = 1263.2\ (1-0.10687) + 70.467$$
$$= 1198.67\ \mu g/\mu\ell$$

$$\text{Solution Volume:}\ \frac{106.73\ g \times 10^6\ \frac{\mu g}{g}}{1198.669\ \mu g/\mu\ell} = 8.904 \times 10^4\ \mu\ell$$

Hexane Collected:

$$8.904 \times 10^4\ \mu\ell \times 70.467\ \mu g/\mu\ell = 6.274 \times 10^6\ \mu g$$

Sample Volume:

7000 mℓ at 94F, 28.93 in Hg
8295.18 mℓ at S.T.P.

Source Conc.:

6.274 g ÷ 8.295 ℓ = 0.756 g/ℓ
~ 756.34 g/M^3
~ 211000 ppm by volume

Outlet MOS Run #1A

Solution Conc.: 3.741 μg/μℓ hexane in 110.18 g CS_2 solution

Solution Density:

$$1263.2\ (1 - \frac{3.741}{659.37}) + 3.741 \quad = \quad 1259.77\ \mu g/\mu\ell$$

Solution Volume:

$$110.18\ g \div 1.25977\ g/m\ell \quad = \quad 87.46\ m\ell$$

Hexane Collected:

$$3.741\ mg/m\ell \times 87.46\ m\ell \quad = \quad 327.19\ mg$$

Sample Volume: 8510.24 mℓ at S.T.P.

Source Conc.:

$$\frac{327.19\ mg}{8.51024\ \ell} \times \frac{10^{-3} g}{mg} \quad = \quad 0.0384\ g/\ell$$

$$\sim 38.45\ g/m^3$$

$$\sim 10713\ ppm$$

Cooler Run #C-1

Solution Conc.: 0.1753 μg/μℓ hexane in CS_2

Solution Density:

$$1263.2\ (1 - \frac{0.1753}{659.37}) + 0.1753 \quad = \quad 1263.0\ \mu g/\mu\ell$$

Solution Volume:

$$104.94\ g \times 1.263\ g/m\ell \quad = \quad 83.09\ m\ell$$

Hexane Collected: 14.57 mg

Sample Volume:

9762.5 mℓ at 20°F, 29.83 in Hg
10708 mℓ at S.T.P.

Source Conc.:

$$0.01457\ g \div 10{,}708\ \ell \quad = \quad 0.0014\ g/\ell$$

$$\sim 1.36\ g/m^3$$

~380 ppm by volume

Dryer Run #D-1

Solution Conc.: 0.9466 μg/μℓ hexane in CS_2

Solution Density:

$$1263.2\ (1 - \frac{.9466}{659.37}) + .9466 = 1262.3\ \mu g/\mu \ell$$

Solution Volume:

$$152.28\ g \times 1.2623\ g/m\ell = 120.64\ m\ell$$

Hexane Collected:

$$0.9466\ mg/m\ell \times 120.64\ m\ell = 114.2\ mg$$

4th Bubbler: 0.004 μg/μℓ in 52.97 g CS_2

Density: 1263.2 μg/μℓ

Volume: 41.93 mℓ

Hexane Collected: 0.17 mg

Total Hexane Collected: 114.37 mg

Sample Volume: 9447370 mℓ

Source Conc.: $114.37\ mg \div 9.447\ \ell \times 10^{-3}\ g/mg = 0.012\ g/\ell$

$\sim 12.11\ g/m^3$

~ 3348 ppm

2. MEAL SAMPLE ANALYSIS

Reproducibility of Hexane Analysis of Meal Samples
Collected at A. E. Staley Co., Des Moines, Iowa

Sample #	PEDCo #	Date of Analysis	Hexane Conc. (μg/g)	% Difference
08	AK188	3-27-79	1347.2	0.2
08	AK188	3-27-79	1344.1	
09	AK189	3-30-79	1373.7	3.2
09	AK189	3-30-79	1331.4	
13	AK193	3-25-79	3559.9	0.1
13	AK193	3-25-79	3562.4	
17	AK197	4-2-79	1331.3	2.8
17	AK197	4-2-79	1294.5	
22	AK202	4-2-79	594.7	12.2
22	AK202	4-2-79	667.8	
24	AK204	4-2-79	732.5	0.5
24	AK204	4-2-79	728.9	
27	AK207	3-26-79	3782.5	0.6
27	AK207	3-26-79	3804.9	
29	AK209	4-3-79	2799.5	0.4
29	AK209	4-2-79	2810.9	
30	AK210	3-27-79	1925.3	0.2
30	AK210	3-27-79	1929.5	
31	AK211	4-2-79	1552.7	2.2
31	AK211	3-30-79	1587.1	
37	AK217	3-25-79	4692.5	1.5
37	AK217	3-25-79	4624.7	
40	AK220	4-2-79	1518.8	2.6
40	AK220	4-2-79	1557.9	
42	AK222	4-2-79	1833.5	3.9
42	AK222	4-3-79	1764.7	
47	AK227	4-2-79	1317.8	10.9
47	AK227	4-2-79	1188.6	
52	AK232	4-2-79	1432.3	7.0
52	AK232	4-3-79	1339.2	
60	AK240	4-2-79	942.9	0.1
60	AK240	4-2-79	941.5	

Hexane Analysis of Meal Samples
Collected at A. E. Staley Co., Des Moines, Iowa

Sample #	Lab #	Test Site	Date	Time	Hexane Conc.[1] (µg/g)
01	AK181	DT Exit[2]	3/15/79	9:10 am	3695.5
02	AK182	DT Exit	3/15/79	9:10 am	2725.8
03	AK183	DT Exit	3/15/79	9:10 am	2581.7
04	AK184	Dryer Exit	3/15/79	9:10 am	1592.4
05	AK185	Dryer Exit	3/15/79	9:10 am	Broken Bottle
06	AK186	Dryer Exit	3/15/79	9:10 am	1396.3
07	AK187	Cooler Exit	3/15/79	9:10 am	1407.8
08	AK188	Cooler Exit	3/15/79	9:10 am	1347.2
09	AK189	Cooler Exit	3/15/79	9:10 am	1373.7
10	AK190	Milling Exit	3/15/79	9:10 am	736.1
11	AK191	Milling Exit	3/15/79	9:10 am	832.1
12	AK192	Milling Exit	3/15/79	9:10 am	699.1
13	AK193	DT Exit[2]	3/15/79	2:25 pm	3559.9
14	AK194	DT Exit	3/15/79	2:25 pm	2788.2
15	AK195	DT Exit	3/15/79	2:25 pm	3120.3
16	AK196	Dryer Exit	3/15/79	2:25 pm	1469.0
17	AK197	Dryer Exit	3/15/79	2:25 pm	1294.5
18	AK198	Dryer Exit	3/15/79	2:25 pm	1826.8
19	AK199	Cooler Exit	3/15/79	2:25 pm	829.0
20	AK200	Cooler Exit	3/15/79	2:25 pm	965.9
21	AK201	Cooler Exit	3/15/79	2:25 pm	841.0
22	AK202	Milling Exit	3/15/79	2:25 pm	667.8
23	AK203	Milling Exit	3/15/79	2:25 pm	493.4
24	AK204	Milling Exit	3/15/79	2:25 pm	728.9
25	AK205	DT Exit[2]	3/15/79	3:10 pm	5940.2
26	AK206	DT Exit	3/15/79	3:10 pm	4015.3
27	AK207	DT Exit	3/15/79	3:10 pm	3782.5
28	AK208	Dryer Exit	3/15/79	3:10 pm	1664.8
29	AK209	Dryer Exit	3/15/79	3:10 pm	2799.5
30	AK210	Dryer Exit	3/15/79	3:10 pm	1925.3
31	AK211	Cooler Exit	3/15/79	3:10 pm	1552.7
32	AK212	Cooler Exit	3/15/79	3:10 pm	1397.6
33	AK213	Cooler Exit	3/15/79	3:10 pm	1448.6

Hexane Analysis of Meal Samples
Collected at A. E. Staley Co., Des Moines, Iowa

Sample #	Lab #	Test Site	Date	Time	Hexane Conc. ① (µg/g)
34	AK214	Milling Exit	3/15/79	3:10 pm	921.1
35	AK215	Milling Exit	3/15/79	3:10 pm	834.3
36	AK216	Milling Exit	3/15/79	3:10 pm	933.9
37	AK217	DT Exit②	3/15/79	5:05 pm	4627.8
38	AK218	DT Exit	3/15/79	5:05 pm	3568.8
39	AK219	DT Exit	3/15/79	5:05 pm	2378.2
40	AK220	Dryer Exit	3/15/79	5:05 pm	1557.9
41	AK221	Dryer Exit	3/15/79	5:05 pm	1636.0
42	AK222	Dryer Exit	3/15/79	5:05 pm	1833.5
43	AK223	Cooler Exit	3/15/79	5:05 pm	1571.0
44	AK224	Cooler Exit	3/15/79	5:05 pm	1835.8
45	AK225	Cooler Exit	3/15/79	5:05 pm	2009.5
46	AK226	Milling Exit	3/15/79	5:05 pm	1062.5
47	AK227	Milling Exit	3/15/79	5:05 pm	1188.6
48	AK228	Milling Exit	3/15/79	5:05 pm	1009.3
49	AK229	DT Exit②	3/15/79	5:50 pm	3106.9
50	AK230	DT Exit	3/15/79	5:50 pm	1827.6
51	AK231	DT Exit	3/15/79	5:50 pm	1278.9
52	AK232	Dryer Exit	3/15/79	5:50 pm	1432.3
53	AK233	Dryer Exit	3/15/79	5:50 pm	1548.2
54	AK234	Dryer Exit	3/15/79	5:50 pm	Sample Discarded
55	AK235	Cooler Exit	3/15/79	5:50 pm	2909.2
56	AK236	Cooler Exit	3/15/79	5:50 pm	1369.2
57	AK237	Cooler Exit	3/15/79	5:50 pm	1681.1
58	AK238	Milling Exit	3/15/79	5:50 pm	1595.4
59	AK239	Milling Exit	3/15/79	5:50 pm	Sample Discarded
60	AK240	Milling Exit	3/15/79	5:50 pm	941.5

① Reported as n-Hexane

② Desolvatizer Toaster

3. FUGITIVE EMISSION MEASUREMENT PORTABLE ORGANIC VAPOR ANALYZER

PORTABLE ORGANIC VAPOR ANALYZER

The Century Model OVA-128 Portable Organic Vapor Analyzer (OVA) is a highly sensitive instrument designed to measure trace quantities of organic materials in air. It is essentially a hydrogen flame ionization detector such as utilized in laboratory gas chromatographs and has similar analytical capabilities. The flame ionization detector is an almost universal detector for organic compounds with the sensitivity to analyze for them in the parts per million range (V/V) in air, in the presence of moisture, nitrogen oxides, carbon monoxide and carbon dioxide. The instrument has broad application, since it has a continuous, chemically resistant air sampling system and can be readily calibrated to measure almost all organic vapors. It has a single linearly scaled read out from 0 ppm to 10 ppm with a x1, x10, x100 range switch. It is ideal for the determination of many organic air pollutants and for the monitoring of air in potentially contaminated areas. The OVA-128 is certified intrinsically safe by Factory Mutual Research Corporation (FM) for use in Class 1, Division 1, Groups A, B, C and D hazardous environments.

For the A.E. Staley Plant test, the OVA-128 was equipped with an adjustable sample dilutor assembly that expanded the linear range 10 times enabling direct measurements to 10,000 ppm. Ambient air was drawn into the OVA from a distance of approximately four feet from the pickup probe via tygon tubing. The dilution air stream passed through an activated charcoal scrubber to remove heavy organic vapors. An adjustable screw clamp, installed over the tygon tubing, was used to adjust the back pressure (vacuum) present at the pickup probe. The dilutor fitting is essentially a T-fitting with one leg of the T going to the OVA, one leg to the dilution air supply and the other to the dilutor orifice. The OVA was calibrated with two concentrations of n-Hexane in hydrocarbon free air (483 ppm and 1450 ppm) as described in the operating manual.

4. U.S. EPA AUDIT CYLINDER ANALYSIS AND GAS STANDARD CERTIFICATION

AUDIT CYLINDER ANALYSIS 3/13/79

HEXANE STANDARD

The concentration of the cylinder is 1540 ppm.

Run #	Retention time in minutes	Area units	ppm/Area units
1	2.61	762,400	0.0020199
2	2.63	753,000	0.002045
3	2.64	749,600	0.002054
4	2.63	753,600	0.002043
Average		754,650	0.002040

The response factor used for the following Audit Std. is

2.040×10^{-3} ppm/Area unit

Audit # XL-391 (Pressure ≅ 150 psi)

			[illegible]
1	2.63	1,001,000	2042.04
2	2.65	995,600	2031.02
3	2.63	1,005,000	2050.20
Average			2041.09

Audit # BAL 544 (Pressure ≅ 1800 psi)

			[illegible]
1	2.63	44,230	90.229
2	2.63	43,340	88.414
3	2.64	43,080	87.883
Average			88.842

STOP
hp 5830A
ESCAPE
VLV/EXT 1 0 . 2 @
START

1.10

1.86

2.64

AUDIT CYLINDER ANALYSIS

4.66

STOP ESCAPE
VLV/EXT 1 MIN? 0 . 2 @
START
VE

Run #1

1.18

2.05 Hexane std 1540 PPM

2.61

3.03

STOP
hp 5830A
AREA %

RT	AREA	AREA %
2.05	123	0.016
2.61	762400	99.118
3.03	6662	0.866

XF: 1.0000 E+ 0

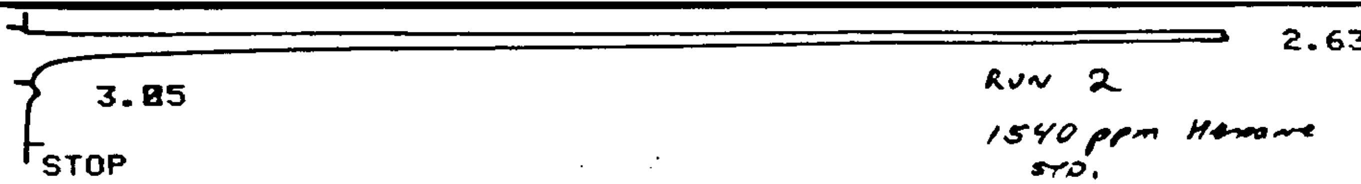
ATTN 2↑ 9 @
START
VE

std Hexane 1540 ppm

Run #2

RUN 2

1540 ppm Hexane STD.

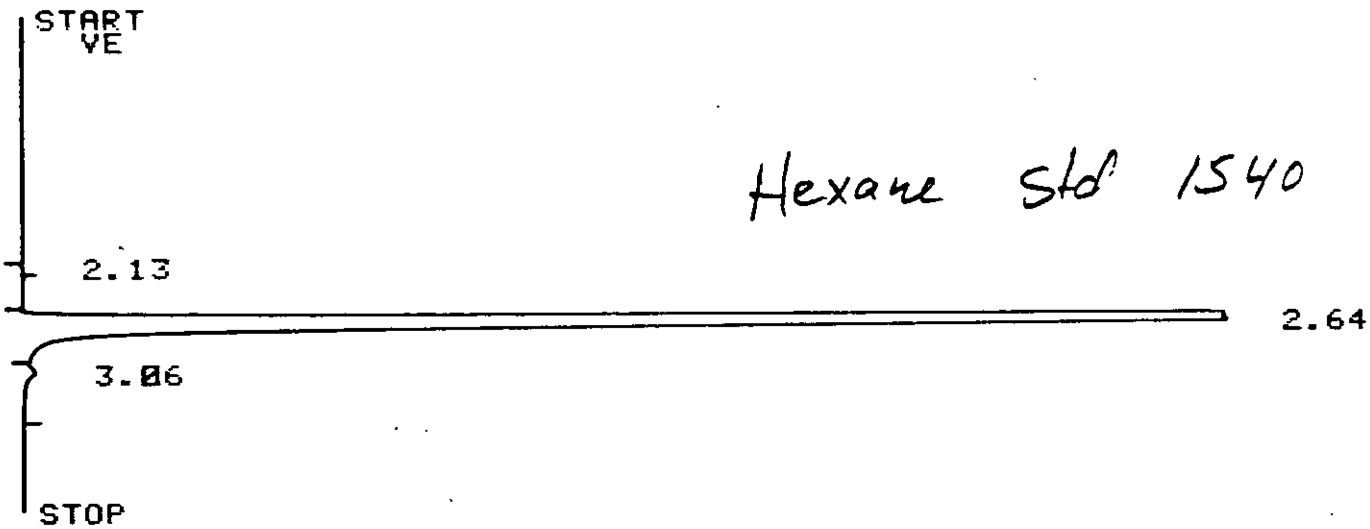


hp 5830A
AREA %

RT	AREA	AREA %
2.63	753000	99.135
3.05	6568	0.865

XF: 1.0000 E+ 0

Hexane Std 1540

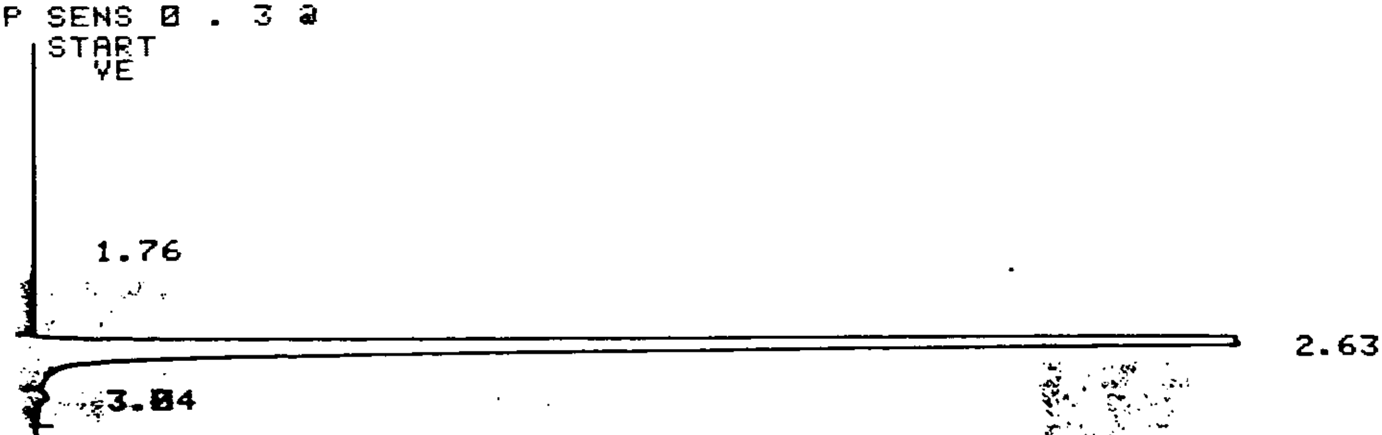


hp 5830A
AREA %

RT	AREA	AREA %
2.64	749600	99.153
3.06	6400	0.847

XF: 1.0000 E+ 0

SLP SENS 0 . 3 @

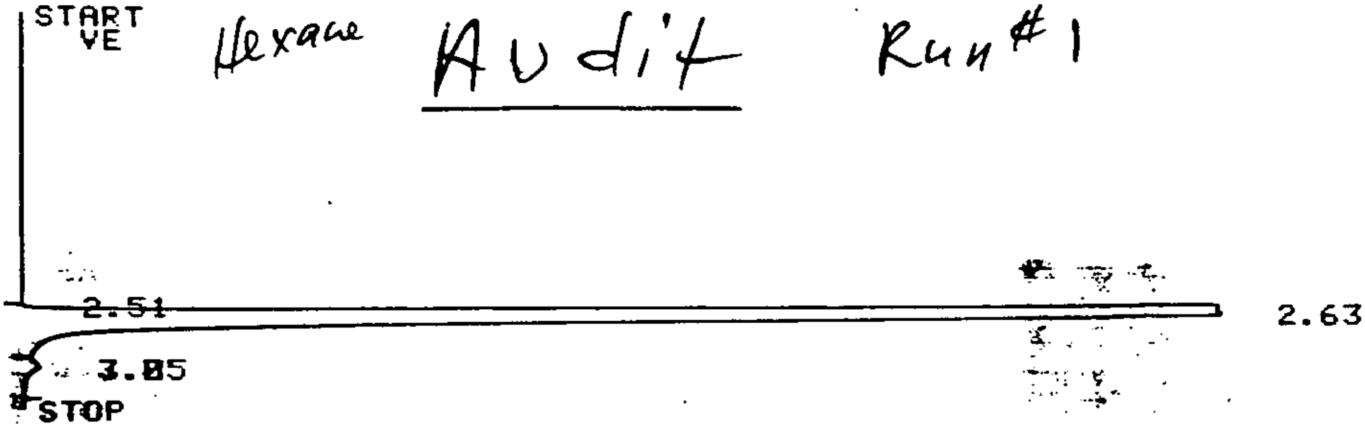


hp 5830A
AREA %

RT	AREA	AREA %
2.63	753600	99.279
3.04	5477	0.722

XF: 1.0000 E+ 0

Hexane Audit Run#1

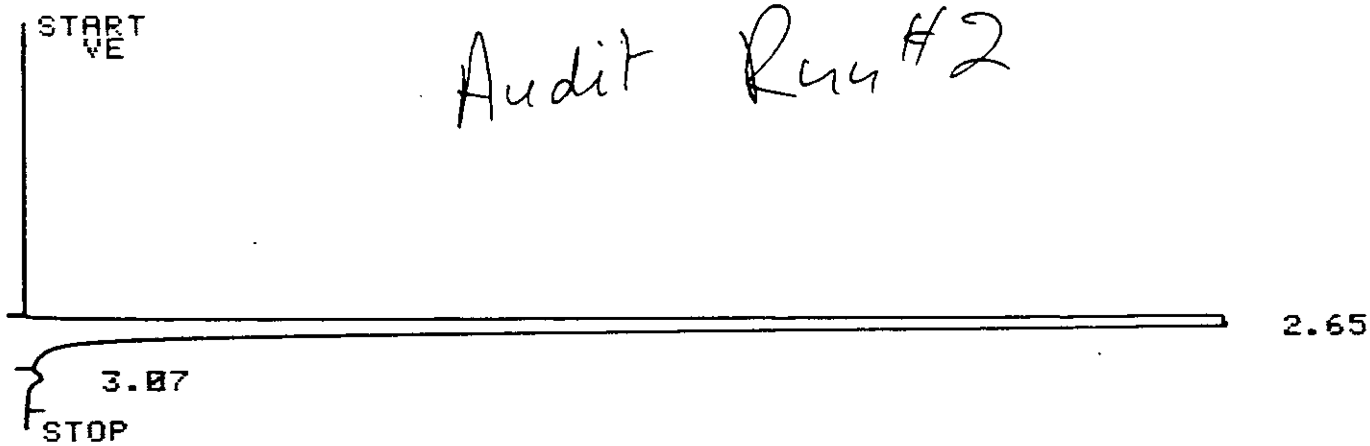


hp 5830A
AREA %

RT	AREA	AREA %
2.63	1001000	99.240
3.05	7668	0.760

XF: 1.0000 E+ 0

Audit Run#2

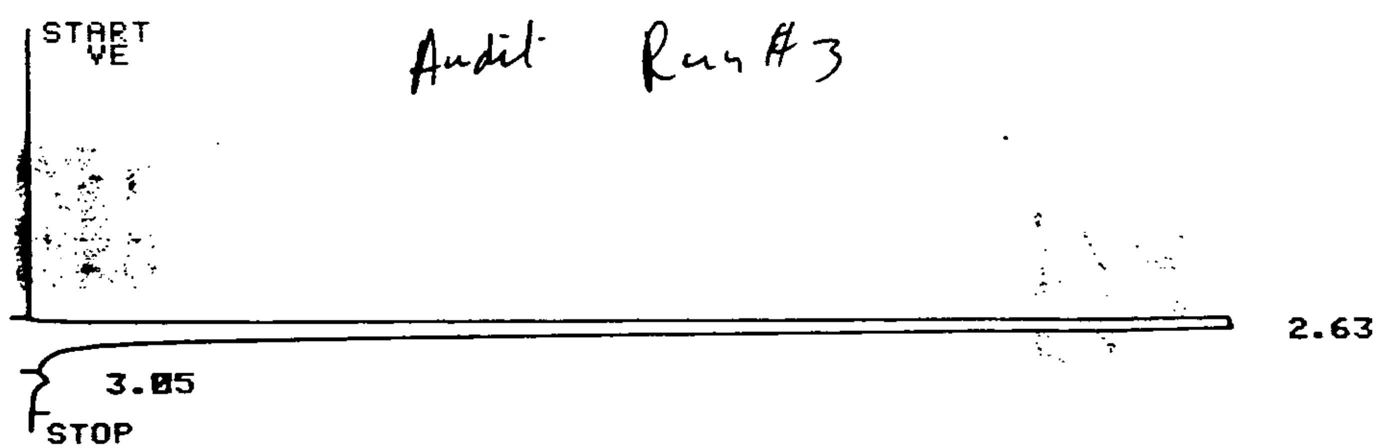


hp 5830A
AREA %

RT	AREA	AREA %
2.65	995600	99.268
3.07	7346	0.732

XF: 1.0000 E+ 0

Audit Run#3



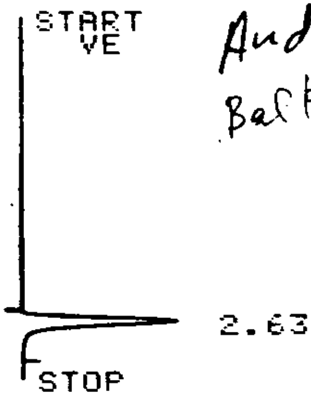
hp 5830A
AREA %

RT	AREA	AREA %
2.63	1005000	99.257

3.05	7528	0.743

XF: 1.0000 E+ 0

Audit #2 Run #1
Bal # 544

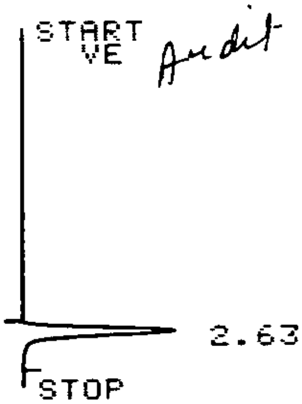


hp 5830A
AREA %

RT	AREA	AREA %
2.63	44230	100.000

XF: 1.0000 E+ 0

Audit # Bal # 544 Run# 2

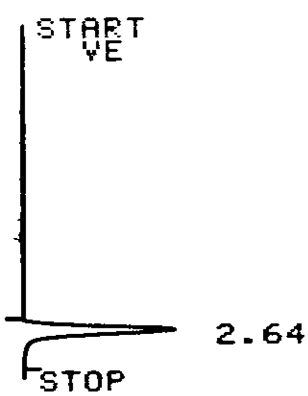


hp 5830A
AREA %

RT	AREA	AREA %
2.63	43340	100.000

XF: 1.0000 E+ 0

Audit# Bal 544 Run#3



hp 5830A
AREA %

RT	AREA	AREA %
2.64	43080	100.000

Scott Environmental Technology Inc

Plumsteadville, PA 18949
(215) 766-8861

Madison Heights, MI 48071
(313) 544-0625

San Bernardino, CA 92411
(714) 887-2571

SPECIALTY GAS DIVISION

RECEIVED
2 1979
PEDCO ENVIRONMENTAL
By

Date: January 3, 1979

Our Project No.: 306052

Your P.O. No.: 6331-3333G

PEDCO ENVIRONMENTAL
11499 CHESTER ROAD
CINCINNATI, OH 45246

ATTENTION: DALE HERSHEY

Gentlemen:

Thank you for choosing Scott for your Specialty Gas needs. The analyses for the gases ordered, as reported by our laboratory, are listed below. Results are in volume percent, unless otherwise indicated.

ANALYTICAL REPORT

Cyl. No. A-12712 — Analytical Accuracy ±2%

Component	Concentration
HEXANE	483 ppm
HYDROCARBON FREE AIR	BALANCE

Cyl. No. XL-423 — Analytical Accuracy ±2%

Component	Concentration
HEXANE	1450 ppm
HYDROCARBON FREE AIR	BALANCE

Cyl. No. — Analytical Accuracy

Component	Concentration

Cyl. No. — Analytical Accuracy

Component	Concentration

CERTIFIED

Analyst Francis Nevill

Approved By Robert B. Denyszyn

5. WASTEWATER ANALYSIS

STANDARDS CALCULATIONS

Compound density: 0.659[illegible]

Volume or weight of cpd. used: 1.35

Final volume: 3001.35

Standard Solvent: CS_2

Standard Concentration: 0.29658 mg/ml

$$\frac{1.35\ \mu\ell.\ \text{std.}}{3001.35\ \mu\ell.\ \text{solvent}} \times \frac{\text{gm.}}{\text{ml}}\ (0.65[illegible]) \times 10^3 = \quad \mu g/\mu\ell. \quad 0.29658\ \mu g/\mu\ell$$

Standard #	μℓ. inj.	Area Units	Area Units/μℓ.	Area Units/μg	or μg/Area Unit
[illegible]	2.7	[illegible]400	139777.8	4.713 x 10^5	2.122 x 10^-6
	2.65	398[illegible]	150226.4	5.065 x 10^5	1.9[illegible] x 10^-[illegible]
	2.65	4513[illegible]	170[illegible]1.9	5.742 x 10^5	1.7[illegible] x 10^-6
	[illegible]	449[illegible]	157649.1	5.316 x 10^5	1.[illegible]1 x 10^-6
	2.[illegible]	448000	160,000	5.395 x 10^5	1.853 x 10^-6
	2.9	499300	172172.4	5.805 x 10^5	1.723 x 10^-6

Standard Equations

$$\frac{\text{Area}}{\mu\ell} \div \frac{\mu g}{\mu\ell} = \text{Area Units/microgram}$$

$$\frac{\mu g}{\mu\ell} \div \frac{\text{Area}}{\mu\ell} = \text{micrograms/Area Unit}$$

1.8346×10^{-6}

LABORATORY DATA

Client U.S. EPA.

PN 3333 N Date 4/9/79

Analyst Khalifa

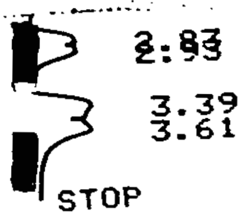
Analysis

Method Number

Checker

WASTEWATER SAMPLES. A.E. STALEY CO.

	SAMPLE I.D.	Pedco LAB NO.	ml inject.	Area.	Conc. mg/ml	AVERAGE mg/ml	
	#4 WASTEWATER	AK267	2.9	12885	0.00815	0.00741	
			3.2	11640	0.00667		
	WASTEWATER #3	AK266	3.05	23756	0.0144	0.0128	
			2.80	17078	0.0122		



5830A
AREA %

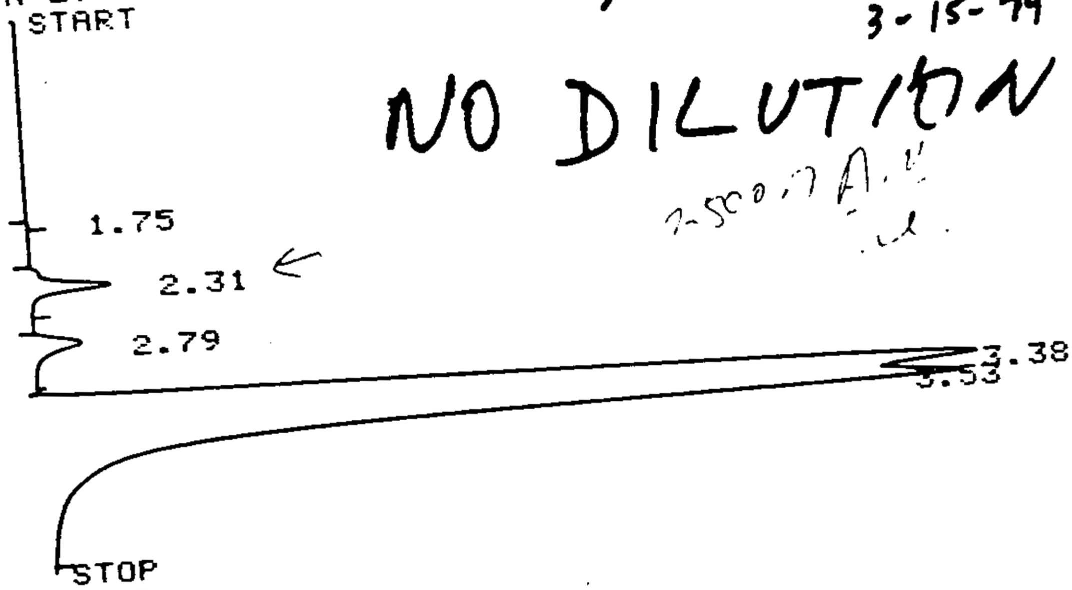
RT	AREA	AREA %
[illegible].01	2466	0.151
[illegible].19	191800	11.735
2.32	976000	59.717
2.83	75440	4.616
2.93	85160	5.211
3.39	150900	9.233
3.61	152600	9.337

XF: 1.0000 E+ 0

69.93

2.9 µl #4 Wastewater AK 267
3-15-79
NO DILUTION

ATTN 2↑ 7 @



5830A
AREA %

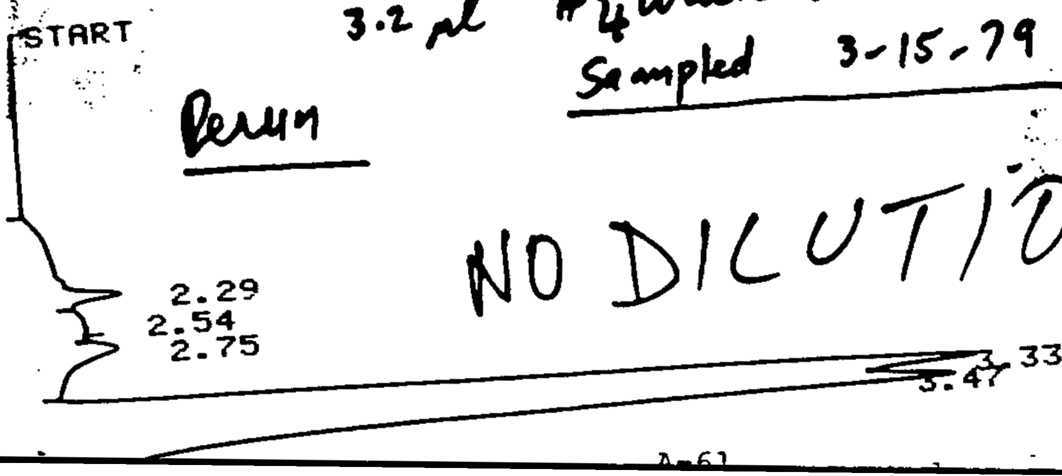
RT	AREA	AREA %
2.31	7252	2.481
2.79	5633	1.927
3.38	125000	42.767
3.53	154400	52.825

XF: 1.0000 E+ 0

3.2 µl #4 Waste water AK 267
Sampled 3-15-79

[illegible]

NO DILUTION



STOP

hp 5830A
AREA %

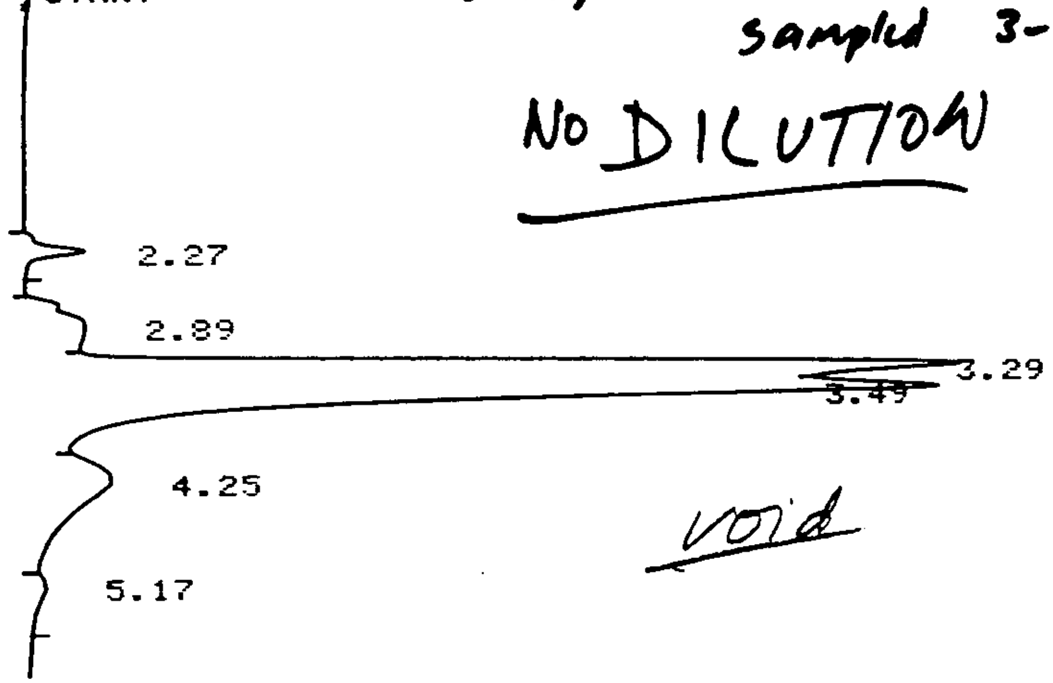
RT	AREA	AREA %
2.29	6722	2.498
2.54	1039	0.386
2.75	3879	1.441
3.33	113200	42.060
3.47	144300	53.615

XF: 1.0000 E+ 0

2.85 μl #4 waste water AK 267
sampled 3-15-79
5:15 PM

NO DILUTION

START



void

hp 5830A
AREA %

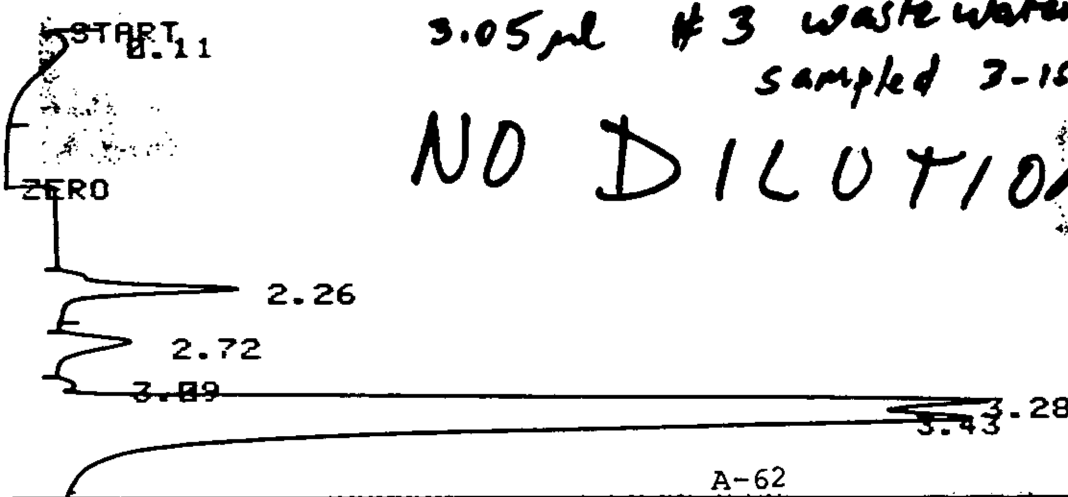
RT	AREA	AREA %
2.27	5471	1.521
2.89	18240	5.072
3.29	135200	37.597
3.49	156900	43.632
4.25	39860	11.085
5.17	3931	1.093

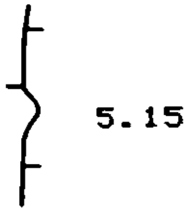
XF: 1.0000 E+ 0

3.05 μl #3 waste water AK 266
sampled 3-15-79 at 2:25 PM

NO DILUTION

START

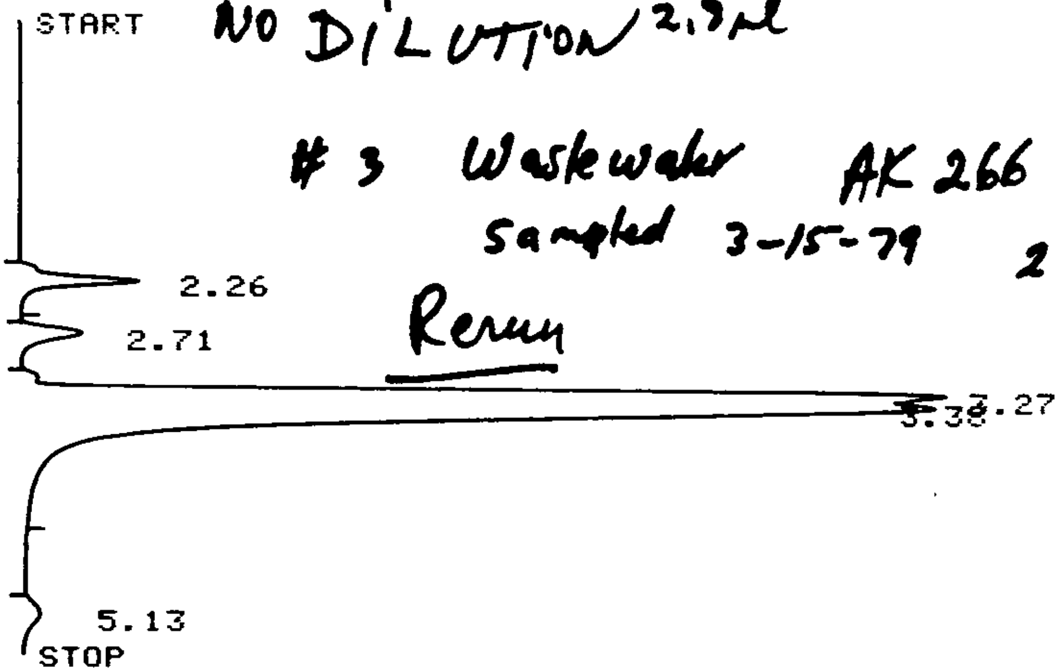




hp 5830A
AREA %

RT	AREA	AREA %
0.11	3188	1.124
2.26	15740	5.552
2.72	8216	2.898
3.09	1377	0.486
3.28	107300	37.845
3.43	144200	50.860
5.15	3501	1.235

XF: 1.0000 E+ 0



NO DILUTION 2.9 μl

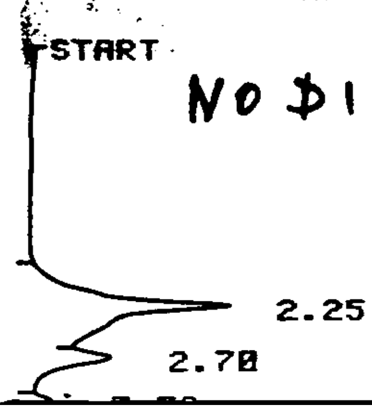
#3 Wastewater AK 266
sampled 3-15-79 2 25 PM

Rerun

hp 5830A
AREA %

RT	AREA	AREA %
2.26	10530	4.243
2.71	6548	2.638
3.27	91520	36.875
3.38	136600	55.038
5.13	2995	1.207

XF: 1.0000 E+ 0



NO DILUTION 3.1 μl #3 wastewater AK 266
sampled 3-15-79 2:25 PM

6. REANALYSIS OF IMPINGER TRAIN SAMPLES AND SAMPLE STABILITY CHECK

CS_2 IMPINGER SAMPLE STABILITY CHECK

	Data Obtained		
Sample I.D.	In Field µg/µℓ	% Recovery $\frac{\text{Data in lab}}{\text{Data in field}}$	In Lab µg/µℓ
Cooler 2A	0.0335	111.0	0.0372
Cooler 2B	0.0123	99.0	0.01218
Dryer 2A	4.357	92.7	4.04
Dryer 2B	4.526	114.4	5.18
Dryer 1 4th Bubbler	0.00403	95.8	0.00386
Dryer 1	0.9466	105.8	1.002
Cooler 1	0.1753	95.8	0.1679
Cooler 1 4th Bubbler	0.00035 undetectable	107.4	0.000376 undetectable
1A MOS Inlet	70.467	99.2	69.890
1B MOS Inlet	68.646	110.0	75.55
1A MOS Outlet	3.741	101.1	3.780
1B MOS Outlet	3.596	125.0	4.5
2A MOS Inlet	65.3	110.6	72.255
2B MOS Inlet	27.76	100.0	27.77
2A MOS Outlet	3.793	107.9	4.095
2B MOS Outlet	5.151	108.1	5.57
3 MOS Inlet 4th Bubbler	0.07533	102.7	0.077
3 MOS Outlet 4th Bubbler	undetectable	-	0.000950
3 MOS Inlet	75.438	108.7	82.0
3 MOS Outlet	2.119	109.9	2.33

Average percentage 105.5 percent $\pm$ 7.72 percent of 19 runs.

DATA ANALYSIS REPORT FORM

Client: U.S. E.P.A.

Analysis For: Hexanes

Analysis performed 4-9-79

Project Number: 3373N

Requisition Number: 867

Analyses Completion Date: 4-9-79

Analyst: MAK

Projected Hours:

Actual Hours:

Method Used:

Analytical Conditions

GC used: 5830 A

Column: SP 1000

Detector: FID

Initial Col. Temp: 70

Hold Time: [illegible]

Final Col. Temp: 70

Hold Time:

Program Rate:

Carrier Gas: N_2

Flow Rate: 29 ml/min

Injector Temp: 150

Detector Temp: 250

Chart Speed: 1.5 cm/min

Attenuation:

Range:

STANDARDS CALCULATIONS

Compound density: 0.65937

Volume or weight of cpd. used: 1.35

Final volume: 3001.35

Standard Solvent: CS_2

Standard Concentration: 0.29658 μg/μl

$$\frac{1.35\ \mu\ell.\ \text{std.}}{3001.35\ \mu\ell.\ \text{solvent}} \times \frac{0.65937\ \text{gm.}}{\text{ml}} \times 10^3 = \mu g/\mu\ell. \quad 0.29658\ \mu g/\mu l$$

Standard #	μℓ. inj.	Area Units	Area Units/μℓ.	Area Units/μg	or μg/Area Unit
[illegible]	2.7	377400	139777.8	4.713×10^5	2.122×10^{-6} μg
	2.65	398100	150226.4	5.065×10^5	1.974×10^{-6}
	2.65	451300	170301.9	5.742×10^5	1.742×10^{-6}
	2.85	449300	157649.1	5.316×10^5	1.881×10^{-6}
	2.8	448000	160,000	5.395×10^5	1.853×10^{-6}
	2.9	499300	172172.4	5.805×10^5	1.723×10^{-6}

Standard Equations

$$\frac{\text{Area}}{\mu\ell} \div \frac{\mu g}{\mu\ell} = \text{Area Units/microgram}$$

$$\frac{\mu g}{\mu\ell} \div \frac{\text{Area}}{\mu\ell} = \text{micrograms/Area Unit} \qquad \underline{1.8746 \times 10^{-6}}$$

SAMPLE CALCULATIONS

Final Sample Volume: Response Factor:

Sample Solvent: μg/area unit:

μg to μl. conversion factor:

Sample #	PEDCo #	μl. inj.	Area Units	μg/μl	average ~~μg Front~~	μg Back	Total ppm
DRYER Run #1 4th bubbler	AK 252	2.95	1691 4513	3.859×10^{-3}			
Run # 1B MOS outlet dil 1/31	AK 242	2.85	37330 181500 8406	4.5			
DRYER Run #2B dil 1/31	AK 251	2.80	36820 190800 7840 19280	5.177			
A MOS outlet dil 1/31	AK 241	2.90	32520 152200 9058	3.78			
B MOS outlet dil 1/31	AK 244	2.9	50970 223200 10100	5.57			
DRYER #2A dil 1/31	AK 250	2.9	53230, 12140 21000 117100	4.04			
DRYER Run #1 dil 1/31	AK 247	2.9	50050 1015	1.002			
Run # 1B MOS INLET dil 1/31	AK 254	2.9	3752000 206400	77.6	75.55		
Run # 1B MOS INLET dil 1/31	AK 254	1.5	351500 1804000 135100 164700	73.5			
DRYER #3A dil 1/31	AK 248	1.95	97480 10590 7308	3.36			
DRYER 3B dil 1/31	AK 249	2.2	32450 4179 469	0.964			
Run #3 MOS AK256 Inlet 4th bubbler dil 1/31	AK256	2.8	721	0.0241	void		
Run #3 MOS Inlet 4th bubbler no dilution	AK256	2.5	118500	0.086	0.077		
Run #3 MOS Inlet 4th bubbler no dilution	AK 256	2.0	35160 37520	0.067			
Run #3 MOS outlet dil 1/31	AK 255	2.55	340200 1908000 100800	82	82.0		
Run #3 MOS outlet dil. 1/31	AK 255	1.50	197200 1041000 75860	81.99			

Sample Eq. $\frac{\text{Peak Area}}{\mu\ell.\ \text{inj.}} \times \frac{\text{Response Factor}}{1} \times \frac{\text{Sample Vol}(\mu\ell)}{1} = \text{Total micrograms}$

Additonal Sample Calculations:

Quality Control Calculations

PRECISION

Parameter	Sample No.	Values Obtained

ACCURACY

Date	Theor. Val.	Exp. Val.	% of Theor.

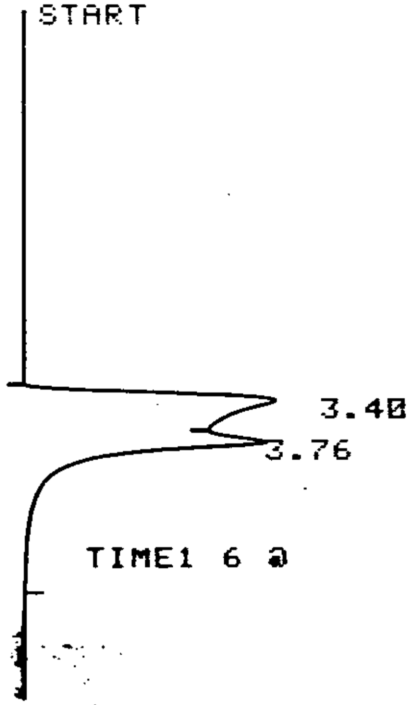
ESCAPE

TEMP1	70	70
TIME1	10.0	
INJ TEMP	150	150
FID TEMP	250	250
TCD TEMP	50	50
AUX TEMP	200	199
OVEN MAX	270	

CHT SPD	1.50
ATTN 2↑	9
FID SGNL	A
SLP SENS	0.30
AREA REJ	100
FLOW A	28
FLOW B	2
OPTN	0

START

2.9 µl CS_2 only 4-9-79



hp 5830A
AREA %

RT	AREA	AREA %
3.40	241700	56.684
3.76	184700	43.316

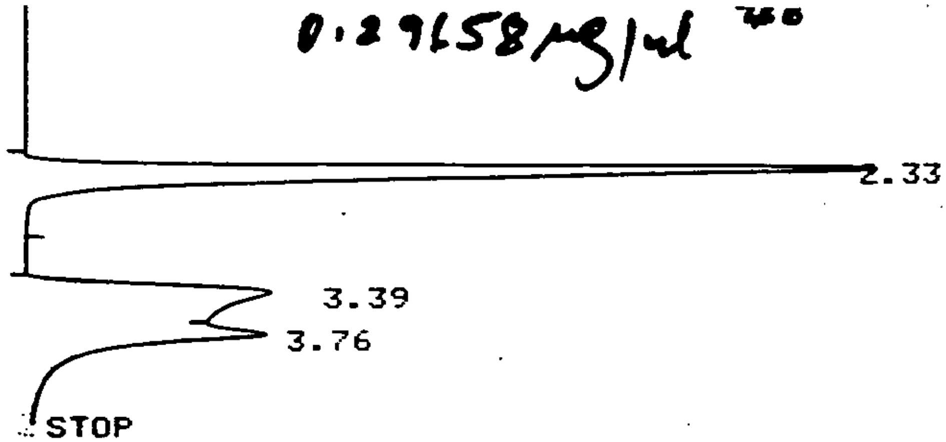
XF: 1.0000 E+ 0

START

2.7 µl Std n-Hexane

0.29658 µg/µl

2.7 µl n-Hexane STD

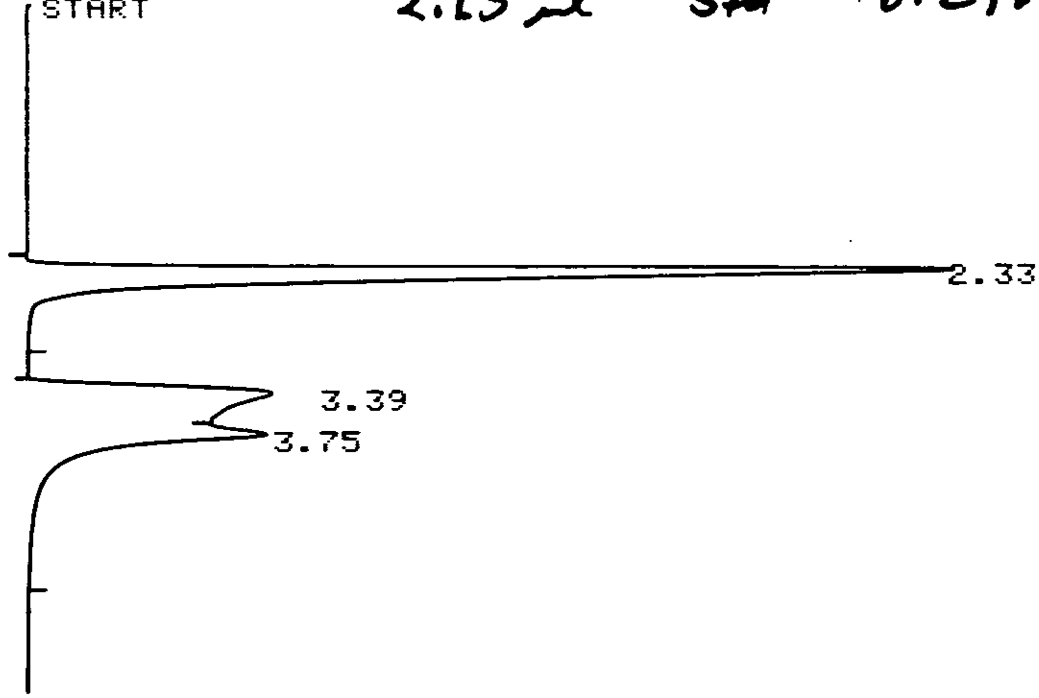


hp 5830A
AREA %

RT	AREA	AREA %
2.33	377400	47.228
3.39	241300	30.197
3.76	180400	22.575

XF: 1.0000 E+ 0

START 2.15 µl Std 0.29658 µg/µl

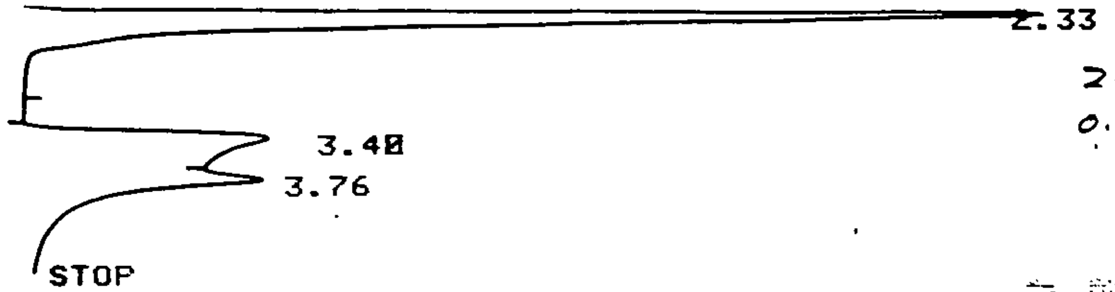


hp 5830A
AREA %

RT	AREA	AREA %
2.33	398100	48.656
3.39	235900	28.832
3.75	184200	22.513

XF: 1.0000 E+ 0

START 2.65 µl Std 0.29658 µg/µl n-Hexane



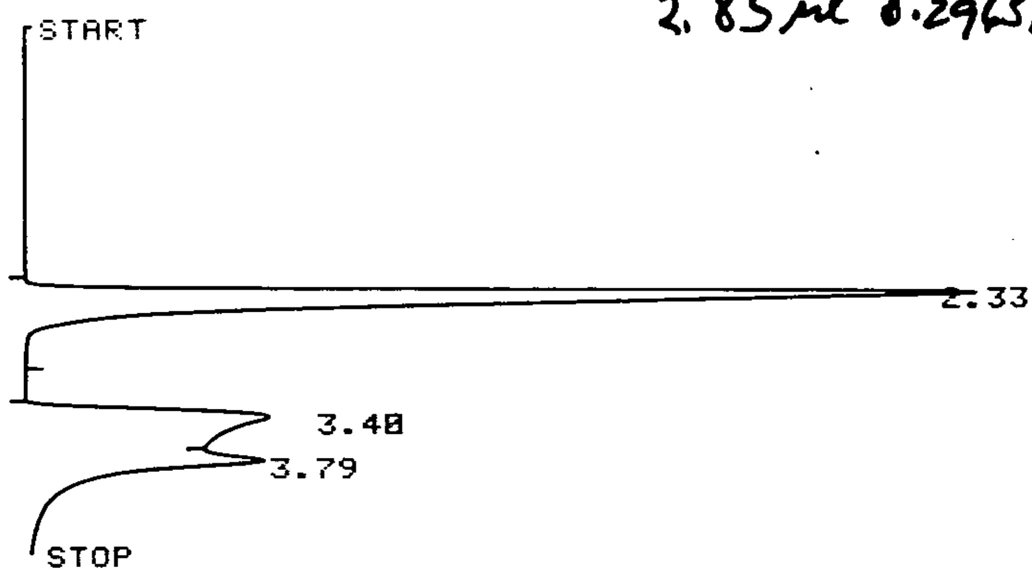
2.65 ml
0.29658 Mg/ml n-Hex

hp 5830A
AREA %

RT	AREA	AREA %
2.33	451300	51.378
3.40	238200	27.118
3.76	188900	21.505

XF: 1.0000 E+ 0

2.85 ml 0.29658

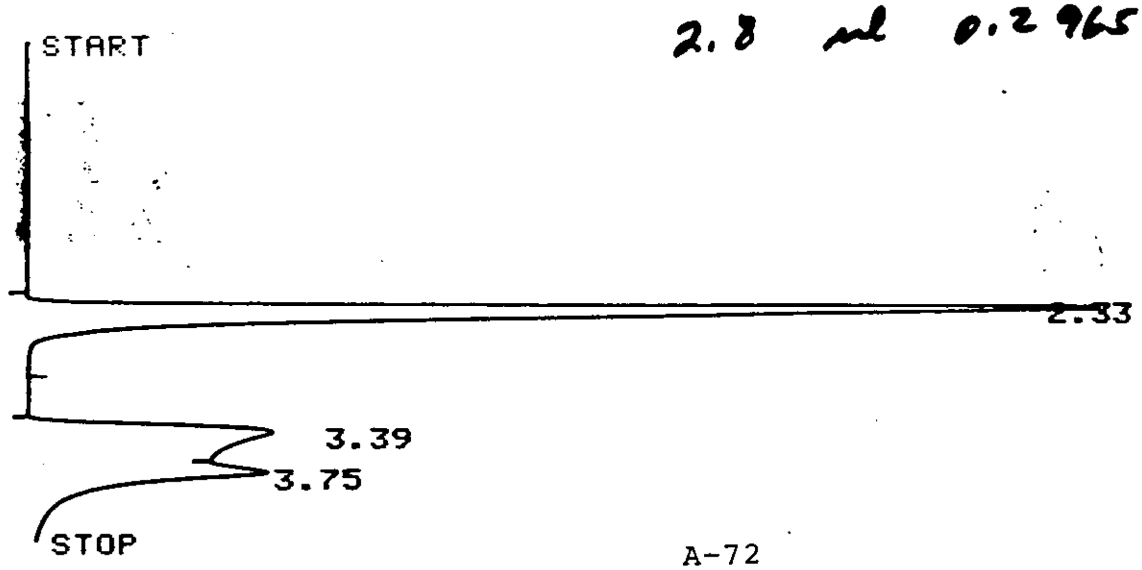


hp 5830A
AREA %

RT	AREA	AREA %
2.33	449300	51.010
3.40	250200	28.406
3.79	181300	20.584

XF: 1.0000 E+ 0

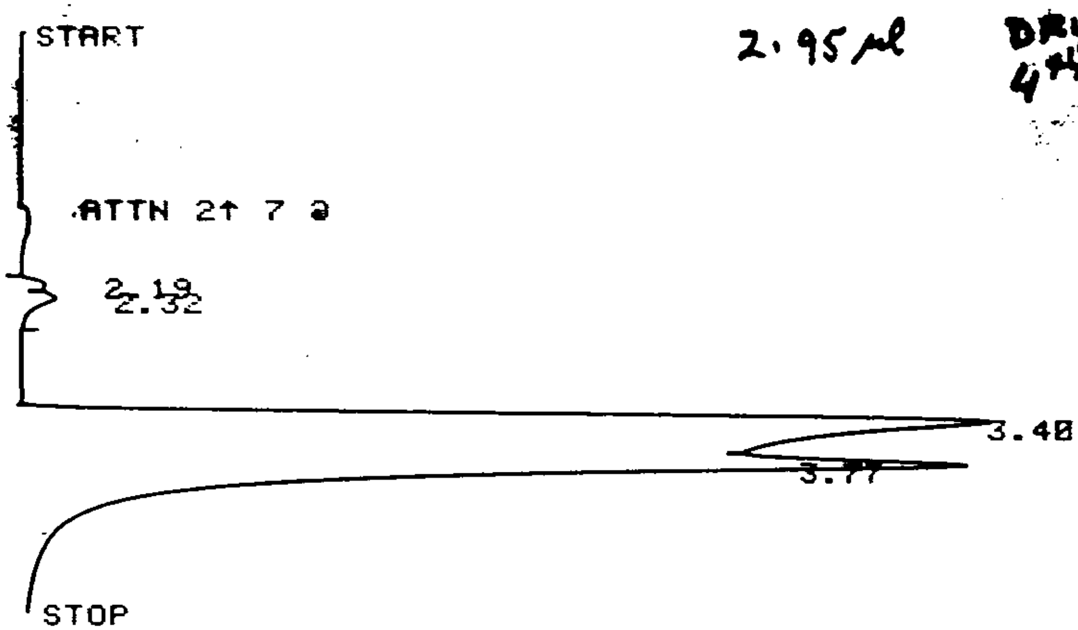
2.8 ml 0.29658 mg/ml



RT	AREA	AREA %
2.33	448000	53.163
3.39	229100	27.186
3.75	165600	19.651

XF: 1.0000 E+ 0

2.95 μl DRYER Run #1
4th Bubbler AK 252

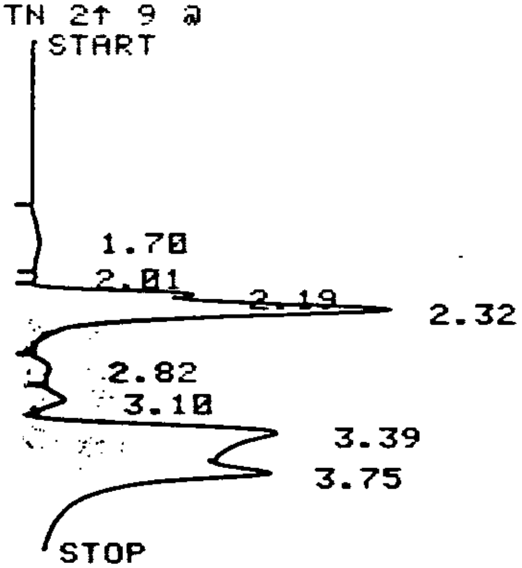


hp 5830A
AREA %

RT	AREA	AREA %
2.19	1691	0.388
2.32	4513	1.036
3.40	245500	56.372
3.77	183800	42.204

XF: 1.0000 E+ 0

ATTN 2↑ 9 @



2.95 μl Run #1B MOS outlet
AK 242
dil. 1/31

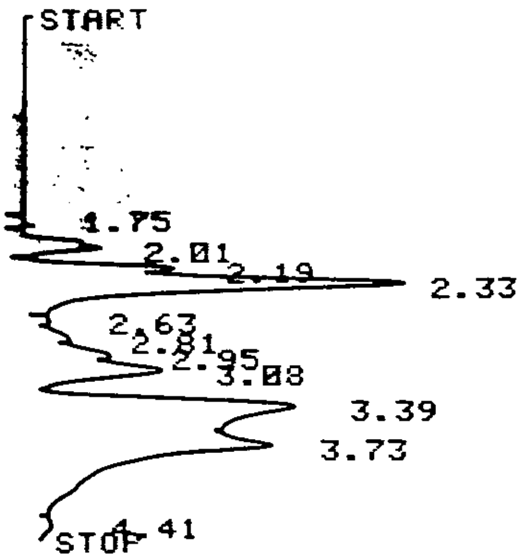
hp 5830A
AREA %

RT	AREA	AREA %
1.70	8066	1.235
2.01	1317	0.202
2.19	37330	5.714

2.32	181500	27.783
2.82	8406	1.287
3.10	16470	2.521
3.39	225800	34.564
3.75	174400	26.696

XF: 1.0000 E+ 0

2.8 µl DRYER Run #2B
AK 251
dil. 1/31

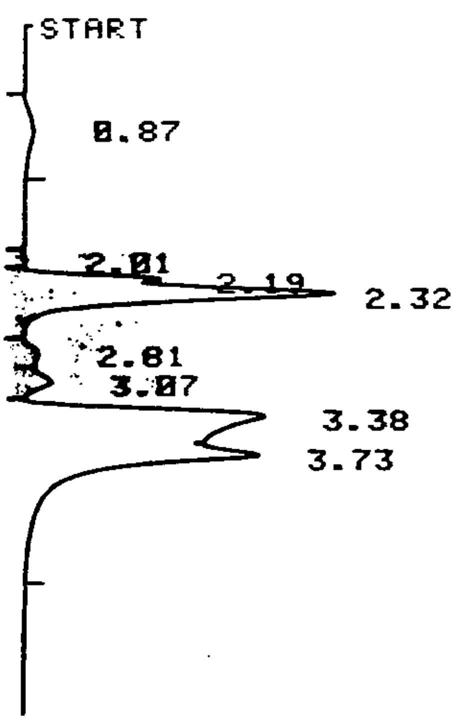


hp 5830A
AREA %

RT	AREA	AREA %
2.01	27620	3.278
2.19	36820	4.370
2.33	190800	22.646
2.63	7870	0.934
2.81	19280	2.288
2.95	35080	4.164
3.08	70520	8.370
3.39	218100	25.887
3.73	229300	27.216
4.41	7134	0.847

XF: 1.0000 E+ 0

2.9 µl 1A MOS outlet
AK 241 dilution 1/31



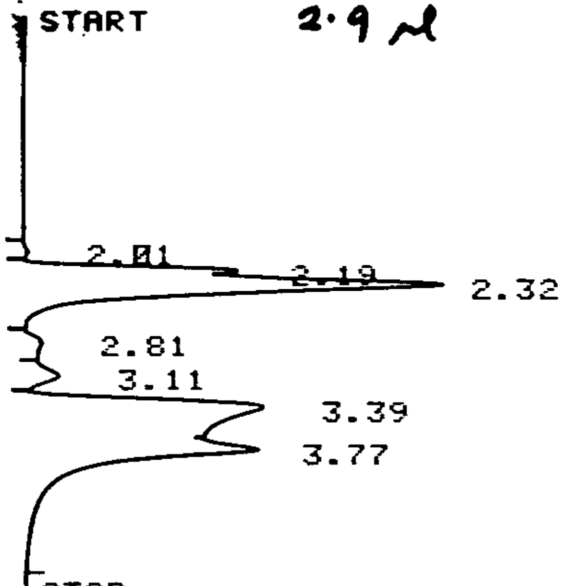
AREA %

RT	AREA	AREA %
0.87	10200	1.638
2.01	614	0.099
2.19	32520	5.224
2.32	152200	24.448
2.81	8058	1.294
3.07	16360	2.628
3.38	220100	35.355
3.73	182500	29.315

XF: 1.0000 E+ 0

2.9 µl

Run # 2B MAS outlet AK 244
dil. 1/31

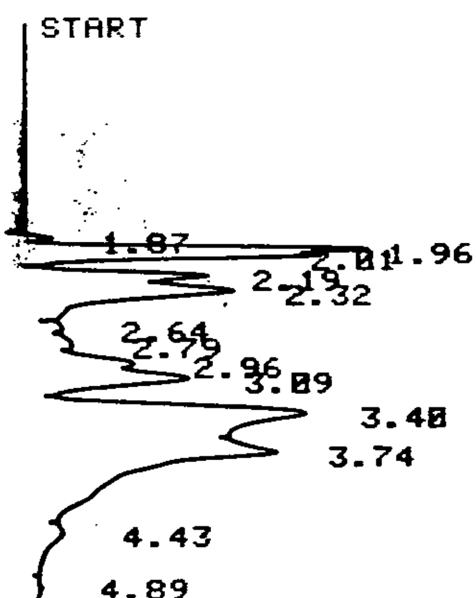


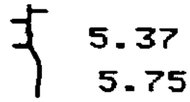
HP 5830A
AREA %

RT	AREA	AREA %
2.01	1378	0.190
2.19	50970	7.016
2.32	223200	30.725
2.81	10100	1.390
3.11	20690	2.848
3.39	239000	32.900
3.77	181100	24.930

XF: 1.0000 E+ 0

2.9 µl AK 257 DRYER #2A
dilution 1/31





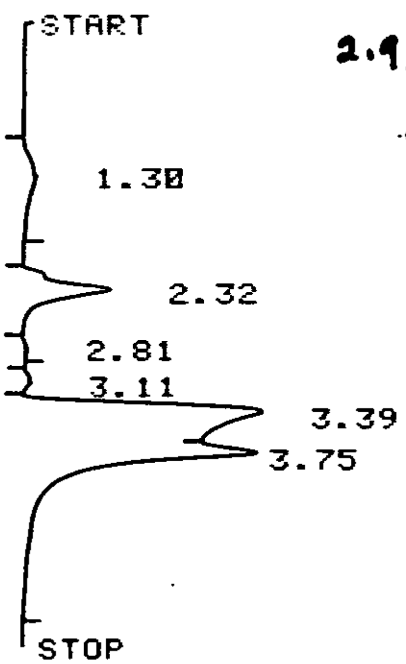
hp 5830A
AREA %

RT	AREA	AREA %
1.87	4498	0.442
1.96	66440	6.533
2.01	56940	5.599
2.19	53230	5.234
2.32	117100	11.515
2.64	12840	1.263
2.79	23000	2.262
2.96	45590	4.483
3.09	86080	8.464
3.40	230900	22.705
3.74	279300	27.464
4.43	28700	2.822
4.89	6794	0.668
5.37	122	0.012
5.75	5427	0.534

XF: 1.0000 E+ 0

2.9 µl DRYER Run #1 AK 247

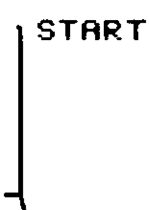
dil 1/31



hp 5830A
AREA %

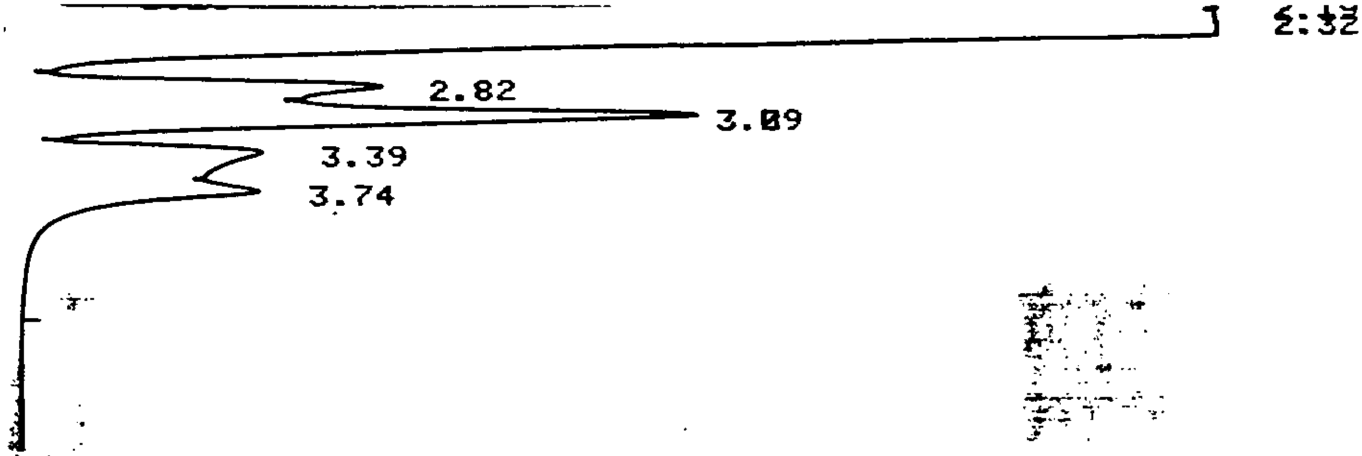
RT	AREA	AREA %
1.30	15720	3.229
2.32	50050	10.279
2.81	1015	0.208
3.11	2828	0.581
3.39	232300	47.709
3.75	185000	37.995

XF: 1.0000 E+ 0



2.9 µl Run #1B
MDS INLET

dil 1/31



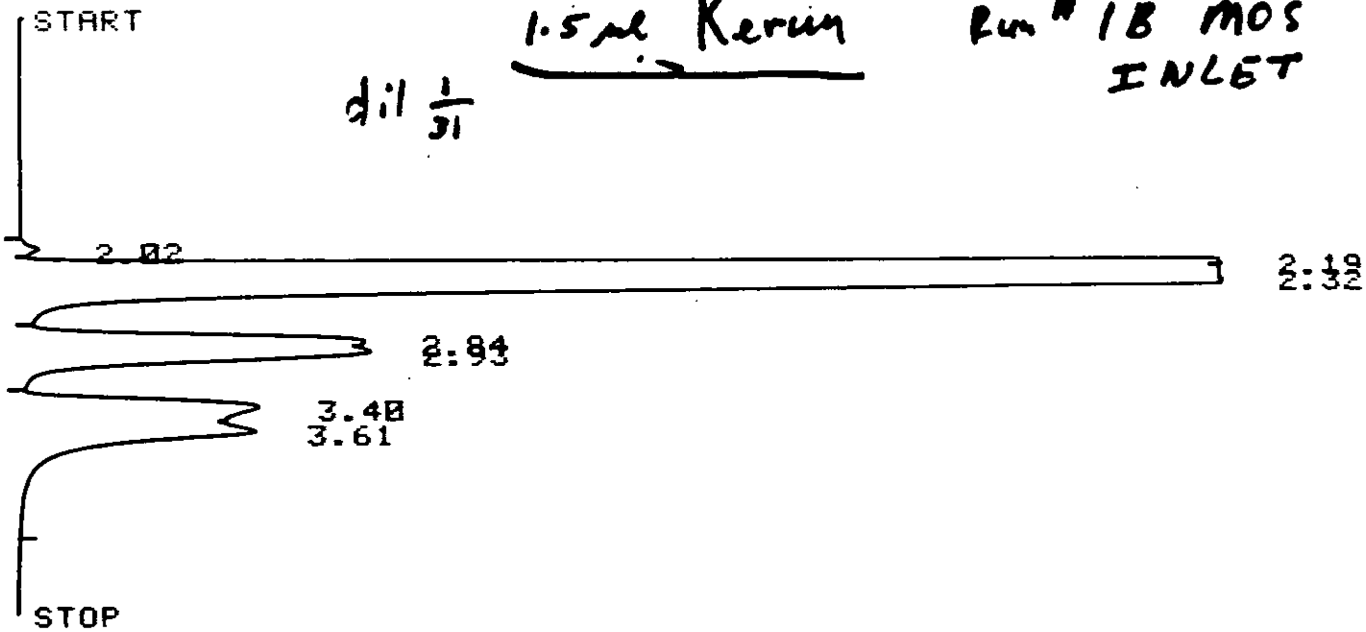
hp 5830A
AREA %

RT	AREA	AREA %
2.01	45050	0.818
2.19	686800	12.477
2.32	3752000	68.159
2.82	206400	3.749
3.09	402200	7.306
3.39	221500	4.024
3.74	190800	3.466

XF: 1.0000 E+ 0

RT
use only 2.32
2.82

1.5 μl Rerun
Run # 1B MOS INLET
dil 1/31



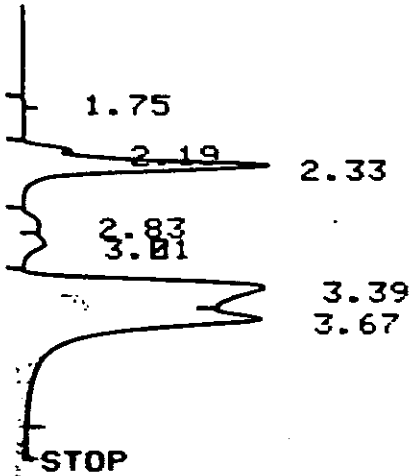
hp 5830A
AREA %

RT	AREA	AREA %
2.02	4974	0.179
2.19	351500	12.671
2.32	1804000	65.031
2.84	135100	4.870
2.93	164700	5.937
3.40	152100	5.483
3.61	161700	5.829

XF: 1.0000 E+ 0

START

1.95 μl dryer # 3A
dil 1/
AK 248

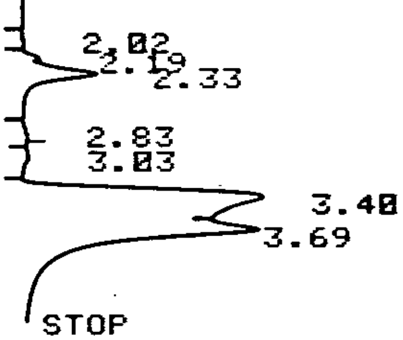


hp 5830A
AREA %

RT	AREA	AREA %
2.19	10590	2.183
→ 2.33	97480	20.090
→ 2.83	7308	1.506
3.01	11930	2.459
3.39	188200	38.788
3.67	169700	34.975

XF: 1.0000 E+ 0

2.2 µl DRYER #3B AK 249
dil. $\frac{1}{31}$



hp 5830A
AREA %

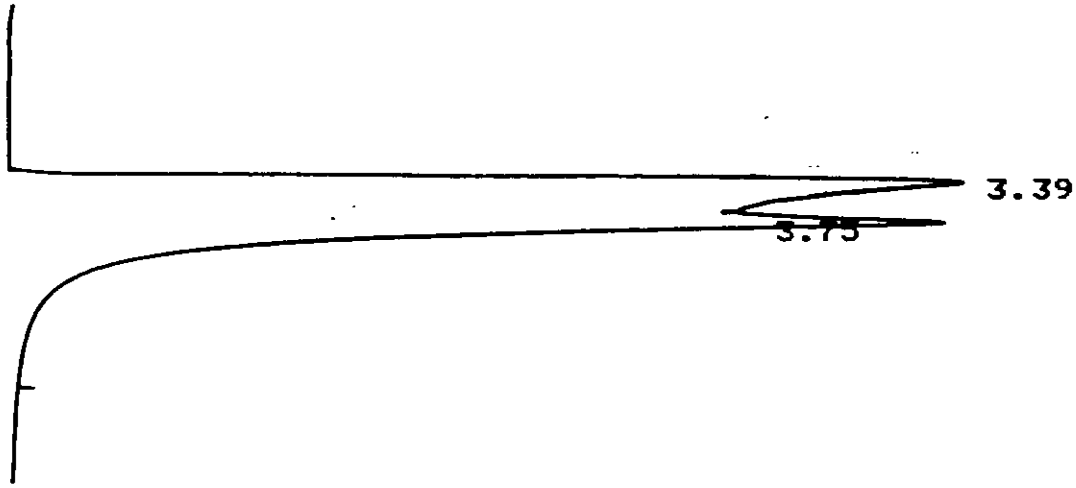
RT	AREA	AREA %
2.02	361	0.089
2.19	4179	1.028
→ 2.33	32450	7.983
→ 2.83	669	0.165
3.03	1733	0.426
3.40	198800	48.906
3.69	168300	41.403

XF: 1.0000 E+ 0

START

2.8 µl CS_2 Only to check if the syringe is clean enough ~~to~~ before running a std

ATTN 2↑ 7 @



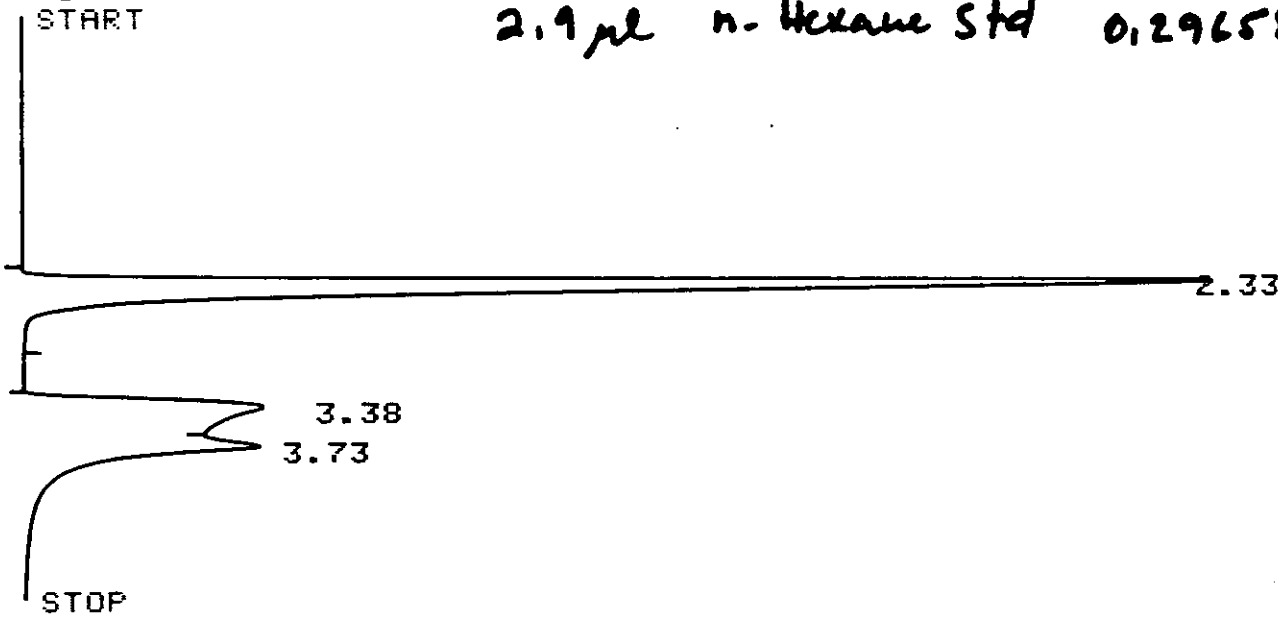
hp 5830A
AREA %

RT	AREA	AREA %
3.39	230300	55.030
3.75	188200	44.970

XF: 1.0000 E+ 0

ATTN 2↑ 9 @

2.9 μl n-Hexane std 0.29658 μg/μl



hp 5830A
AREA %

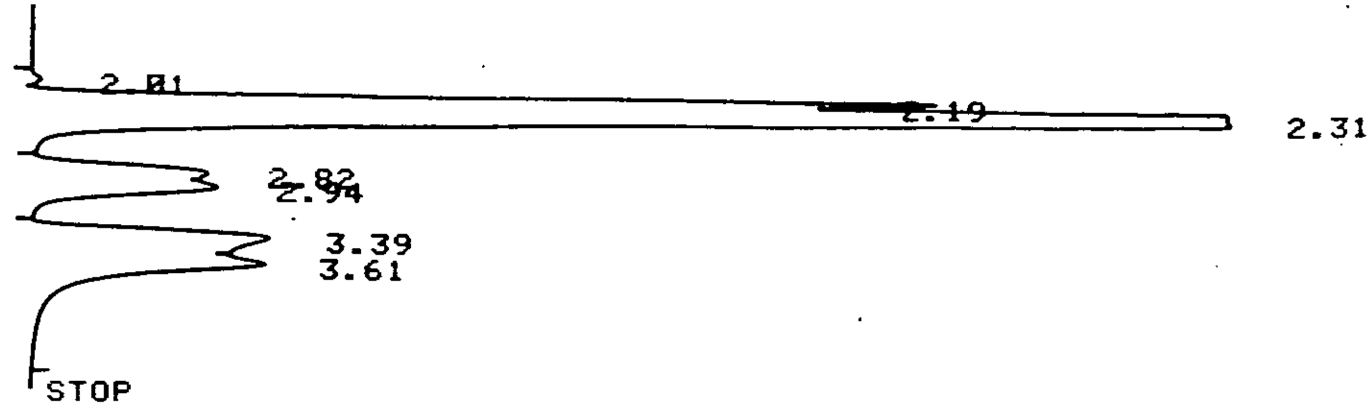
RT	AREA	AREA %
2.33	499300	54.634
3.38	226800	24.817
3.73	187800	20.549

XF: 1.0000 E+ 0

START

2.8 μl Run #3 MOS INLET
4th Bubbler AK 256
dil 1/31

ATTN 2↑ 7 @

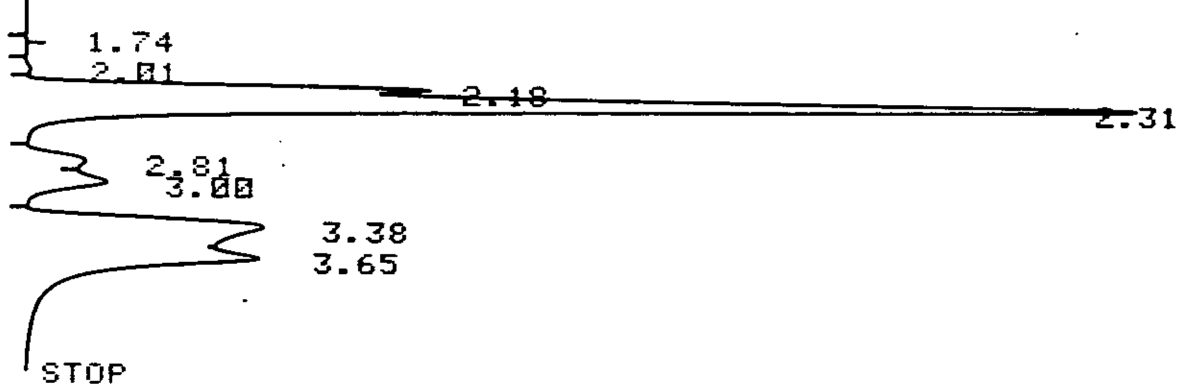


hp 5830A
AREA %

RT	AREA	AREA %
2.01	2699	0.156
2.19	197200	11.379
2.31	1041000	60.067
2.82	75860	4.377
2.94	91820	5.298
3.39	159900	9.226
3.61	164600	9.498

XF: 1.0000 E+ 0

1.85 μl Run # 2B ~~Outlet~~ MOS AK 258
dil. 1/51
INLET

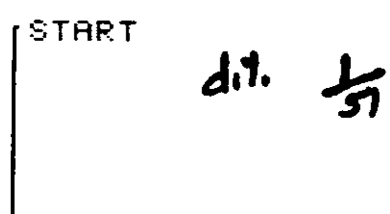


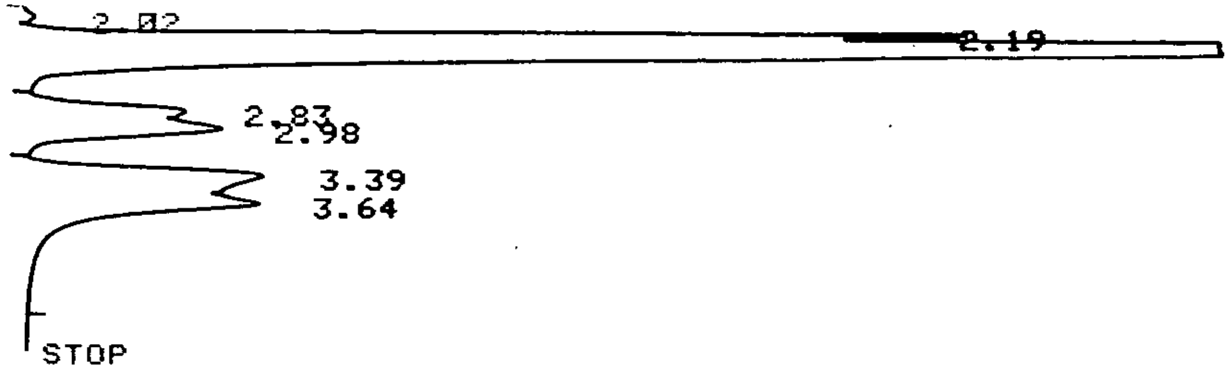
hp 5830A
AREA %

RT	AREA	AREA %
2.01	1553	0.157
→ 2.18	91280	9.228
→ 2.31	468700	47.383
→ 2.81	29230	2.955
3.00	45410	4.591
3.38	184700	18.672
3.65	168300	17.014

XF: 1.0000 E+ 0

1.7 μl 1A MOS INLET AK 253
dil. 1/51





hp 5830A
AREA %

RT	AREA	AREA %
2.02	2917	0.161
2.19	208300	11.493
2.32	1085000	59.864
2.83	69440	3.831
2.98	107400	5.926
3.39	172500	9.517
3.64	166900	9.208

use peaks of RT = 2.19, 2.32, 2.82

69.89 µg/ul

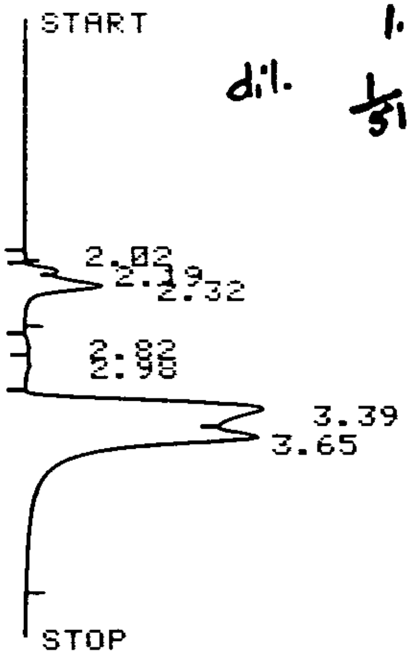
XF: 1.0000 E+ 0

Outlet 246

1.6µl ~~FA~~ MOS ~~INLET~~ AK ~~253~~

dil. 1/51 Run #3

~~Redone~~



2015 µg/ul

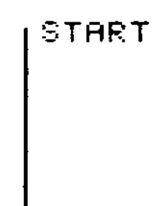
hp 5830A
AREA %

RT	AREA	AREA %
2.19	7772	1.982
2.32	32240	8.222
2.82	1880	0.479
2.98	3648	0.930
3.39	174500	44.499
3.65	172100	43.887

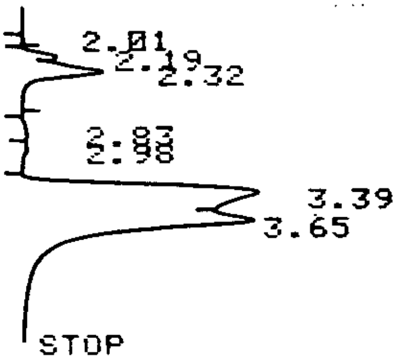
XF: 1.0000 E+ 0

1.9µl Run # 3 MOS OUTLET AK246

dil. 1/51



17878.9



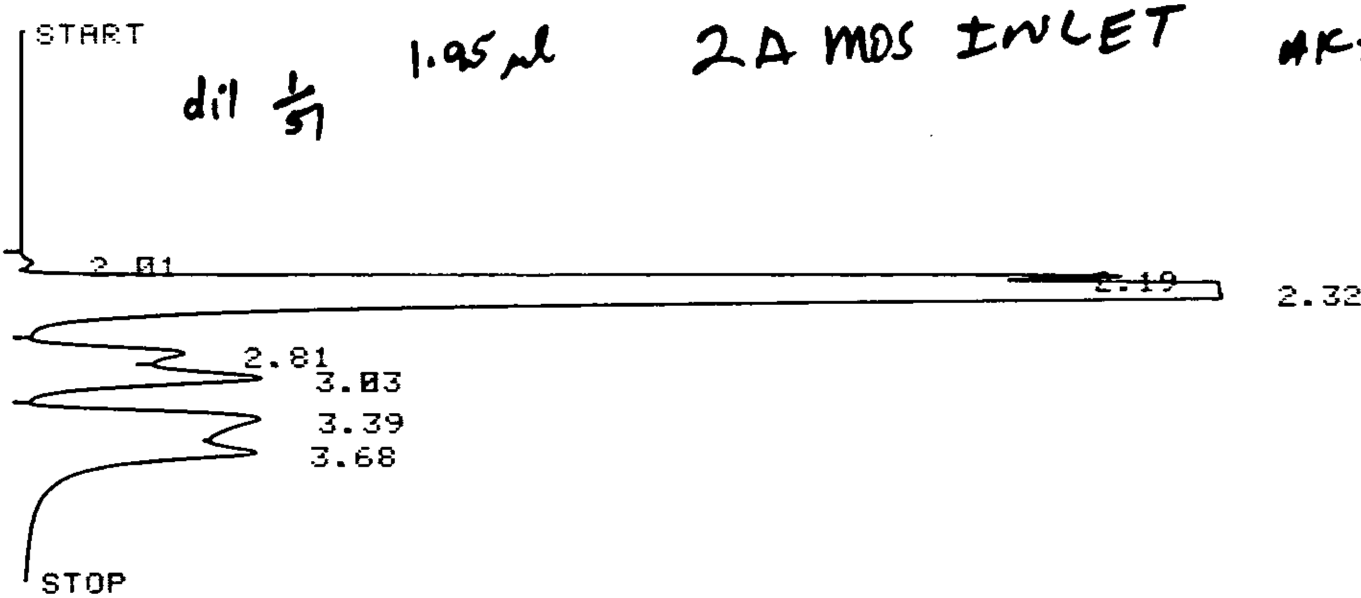
hp 5830A
AREA %

RT	AREA	AREA %
2.19	8410	2.162
2.32	33970	8.731
2.83	2087	0.536
2.98	3098	0.796
3.39	174100	44.748
3.65	167400	43.026

XF: 1.0000 E+ 0

1.95 µl 2A MDS INLET AK257

dil 1/51



hp 5830A
AREA %

74.58 mg/ml

use peaks @RT 2.19, 2.32, 2.81

RT	AREA	AREA %
2.01	3411	0.156
2.19	243700	11.152
2.32	1340000	61.321
2.81	84500	3.867
3.03	135000	6.178
3.39	194100	8.882
3.68	184500	8.443

XF: 1.0000 E+ 0

START

1.55 µl 2A MDS INLET AK 257

ATTN 2↑ 1 1 2 dil 1/51 Rerun

DATA ANALYSIS REPORT FORM

Client:

Analysis For:

Project Number: 3333N

Requisition Number:

Analyses Completion Date:

Analyst: MAK

Projected Hours:

Actual Hours:

Method Used: GC

Analytical Conditions

GC used: HP 5830 A

Column: SP 1000 (20 ft)

Detector: FID

Initial Col. Temp: 70 Hold Time: ISOTHERMAL

Final Col. Temp: 70 Hold Time:

Program Rate: —

Carrier Gas: N_2 Flow Rate: 29 ml/min

Injector Temp: 150

Detector Temp: 250

Chart Speed: 1.5 cm/min

Attenuation:

Range:

STANDARDS CALCULATIONS

Compound density: 0.65937 g/ml

Volume or weight of cpd. used: 1.3 µl

Final volume: 4001.3 µl

Standard Solvent: CS_2

Standard Concentration: 0.21416 µg/µl

$$\frac{1.3 \text{ µℓ. std.}}{4001.3 \text{ µℓ. solvent}} \times \frac{0.65937 \text{ gm.}}{1 \text{ ml}} \times 10^3 = 0.21416 \text{ µg/µℓ.}$$

Standard #	µℓ. inj.	Area Units	Area Units/µℓ.	Area Units/µg	or µg/Area Unit
Hexane 0.21416 µg/µl	2.45	318300	129918.4	6.0664×10^5	1.648×10^{-6}
	2.30	298900	129956	5.650×10^5	1.769×10^{-6}
	2.30	298500	129782.6	5.6427×10^5	1.772×10^{-6}
	2.8	364200	13007.4	6.07356×10^5	1.646×10^{-6}

Standard Equations

$$\frac{\text{Area}}{\text{µℓ}} \div \frac{\text{µg}}{\text{µℓ}} = \text{Area Units/microgram} \quad 5.858 \times 10^5 \text{ Area U/µg}$$

$$\frac{\text{µg}}{\text{µℓ}} \div \frac{\text{Area}}{\text{µℓ}} = \text{micrograms/Area Unit} \quad 1.7095 \times 10^{-6} \text{ µg/A.U}$$

2365241
2430228
2397734

SAMPLE CALCULATIONS

Final Sample Volume:

Response Factor:

Sample Solvent: CS_2

μg/area unit:

μg to μℓ. conversion factor:

Sample #	PEDCo #	μℓ. inj.	Area Units	μg/μℓ	μg Front	μg Back	Total ppm
ooler Run #1 ith Bubbler	AK 259	2.85	627	3.76×10^{-4}			✓
Cooler 2A AK 261	AK 261	2.80	59620 1251	0.03717			
ooler 3A AK 263	AK 263	2.75	61280 1242	0.0388			
Cooler 3B	AK 264	2.75	12 310	0.00765			
ooler #1	AK 260	3.2	301 700 12 540	0.1679			
ooler Run #2B	AK 262	2.9	20440 211	0.01218			
Run #3 with bubbler MDS outlet	AK 245	2.8	1556	9.502×10^{-4}			
un #2A MDS outlet	AK 243	2.9	105 8000 5042000 254000 605200	4.04*			
Run #3 MDS outlet	AK 246	1.8	430500 1743000 110700 174000	2.33			
un #2A MDS outlet	AK 243	1.75	754600 3032000 182000 284200	4.155*			

Sample Eq. $\frac{\text{Peak Area}}{\mu\ell.\ \text{inj.}} \times \frac{\text{Response Factor}}{1} \times \frac{\text{Sample Vol}(\mu\ell)}{1} = \text{Total micrograms}$

* the average of the two runs $= \frac{(4.04 + 4.155)}{2} = 4.097$ μg/μℓ

Additonal Sample Calculations:

Quality Control Calculations

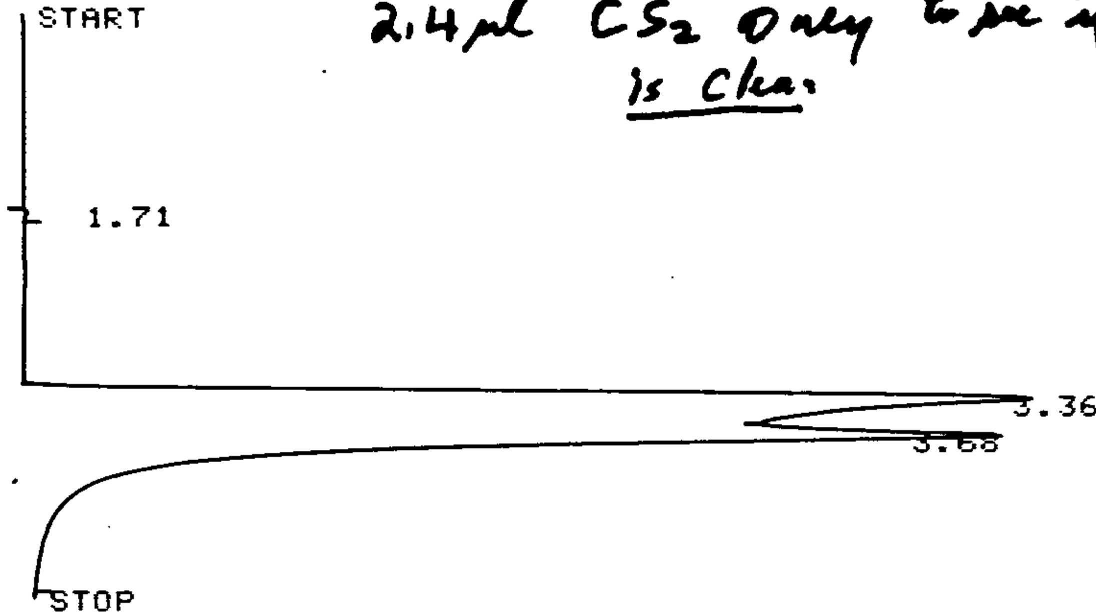
PRECISION

Parameter	Sample No.	Values Obtained

ACCURACY

Date	Theor. Val.	Exp. Val.	% of Theor.

2.4 µl CS_2 only to see if the syringe is clean



hp 5830A
AREA %

RT	AREA	AREA %
1.71	161	0.039
3.36	216800	53.051
3.68	191700	46.909

XF: 1.0000 E+ 0

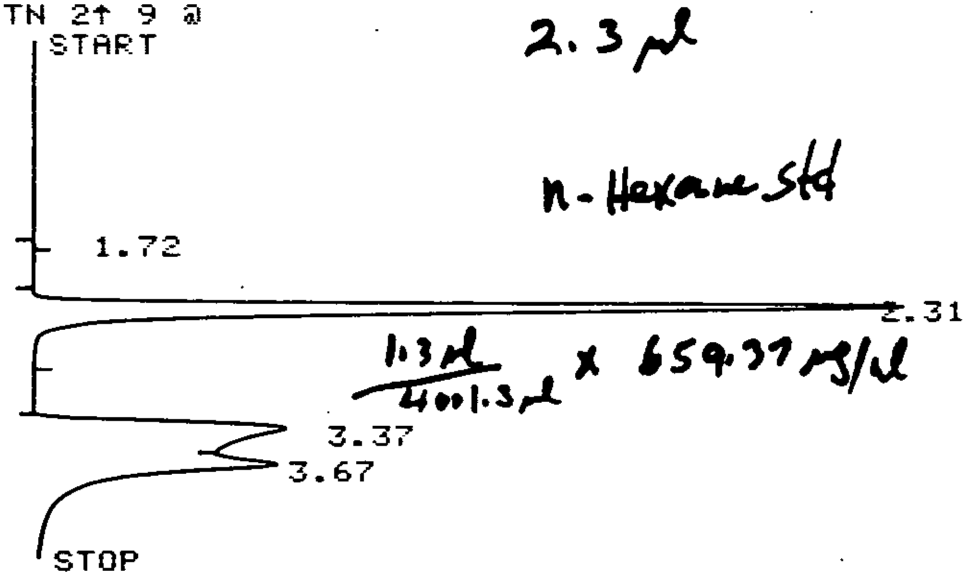
ATTN 2↑ 9 @

2.3 µl

n-Hexane std

129 782.6 AC/cc

$\frac{1.3\ \mu l}{4001.3\ \mu l} \times 659.37\ \mu g/\mu l$

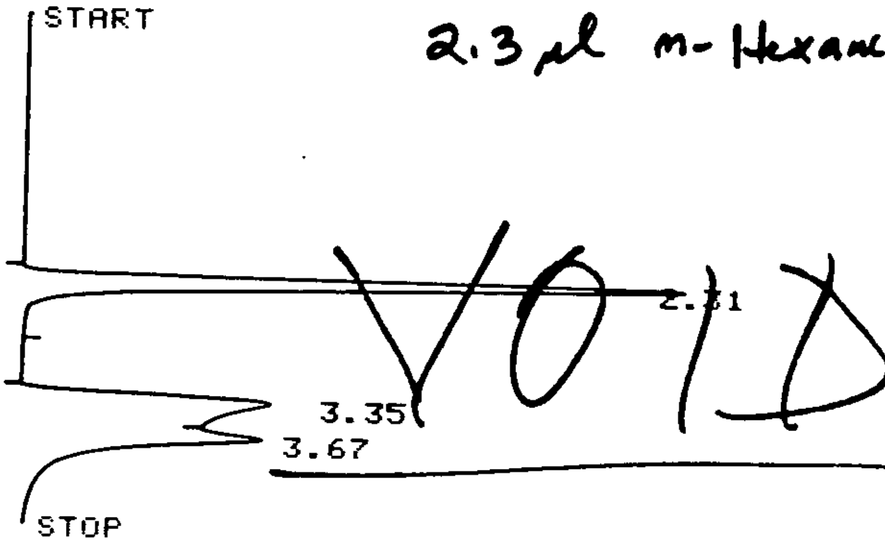


hp 5830A
AREA %

RT	AREA	AREA %
2.31	298500	44.001
3.37	206200	30.395
3.67	173700	25.604

XF: 1.0000 E+ 0

2.3 µl n-Hexane std



VOID

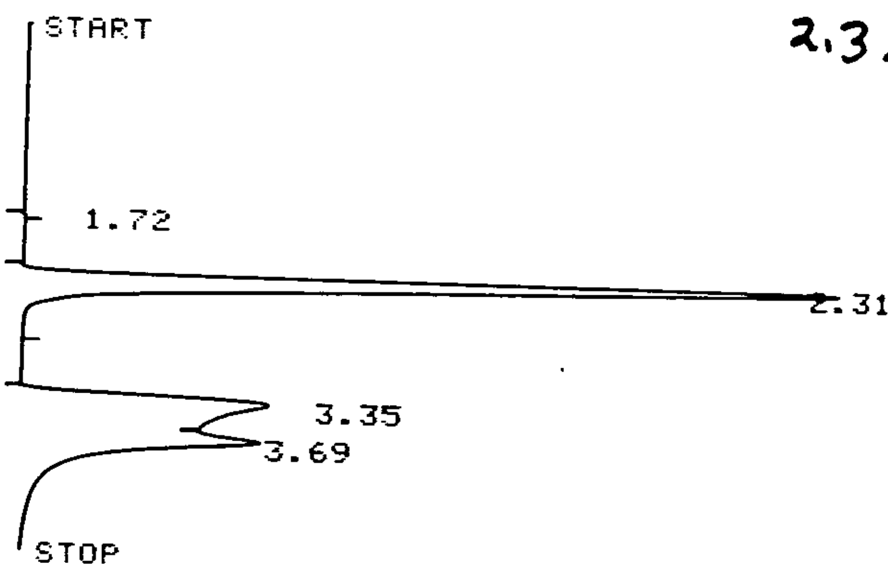
100434.8 A.U/µL

hp 5830A
AREA %

RT	AREA	AREA %
2.31	231000	37.665
3.35	211900	34.551
3.67	170400	27.784

XF: 1.0000 E+ 0

2.3 µl n-hexane



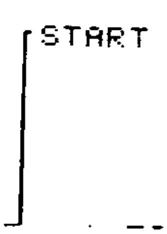
129956

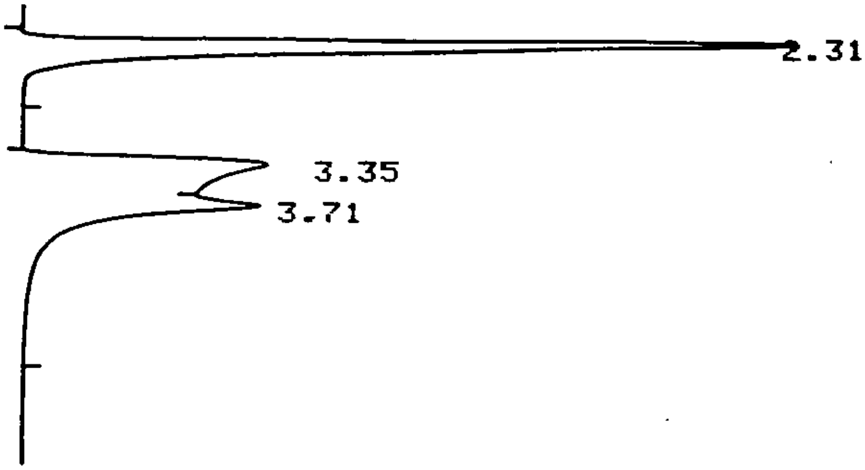
hp 5830A
AREA %

RT	AREA	AREA %
2.31	298900	43.212
3.35	215300	31.126
3.69	177500	25.661

XF: 1.0000 E+ 0

2.45µl n-Hexane std





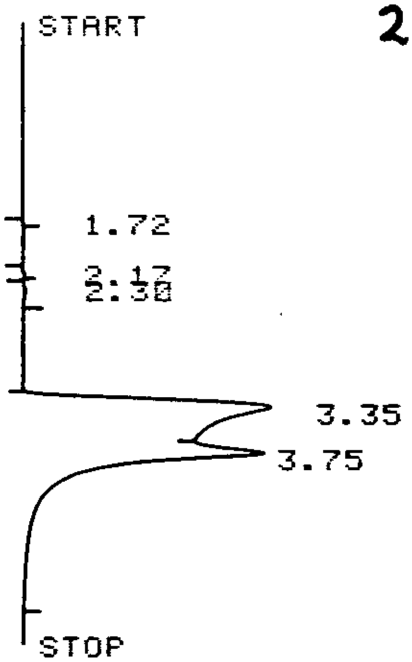
2.45 ml
Hexane 510

hp 5830A
AREA %

RT	AREA	AREA %
1.72	120	0.016
2.31	318300	42.995
3.35	234600	31.689
3.71	187300	25.300

XF: 1.0000 E+ 0

2,85 μl Cooler Run #1 AK 259
4 th Bubbler



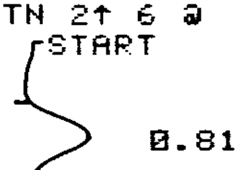
hp 5830A
AREA %

RT	AREA	AREA %
2.17	187	0.042
2.30	627	0.140
3.35	256300	57.234
3.75	190700	42.585

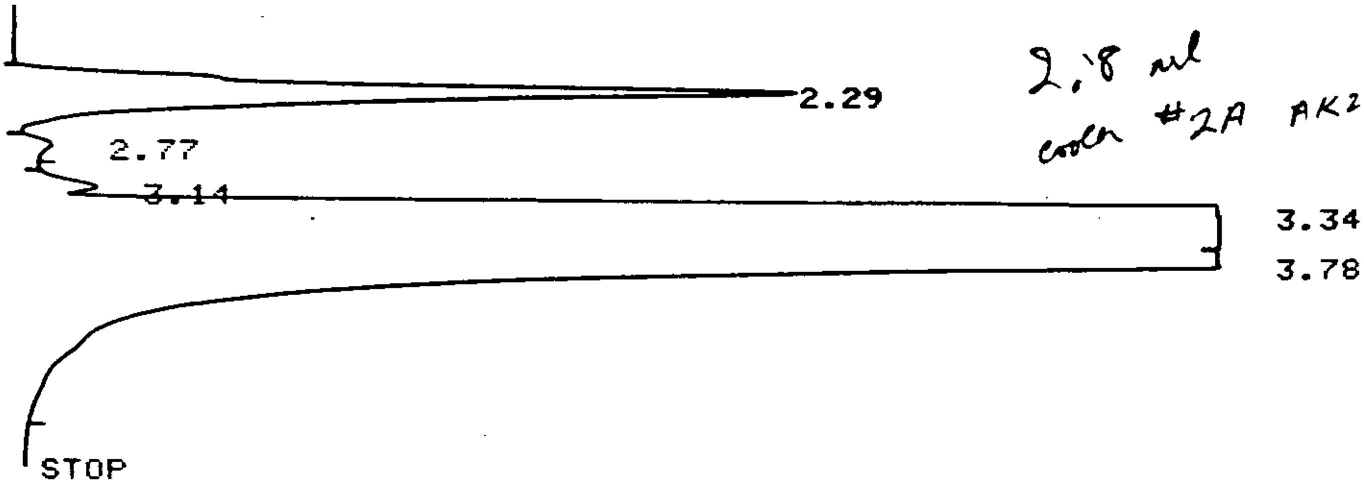
XF: 1.0000 E+ 0

ATTN 2↑ 6 @

2.8 μl Cooler Run #2 A AK 261



2.8 ml cooler #2A AK261



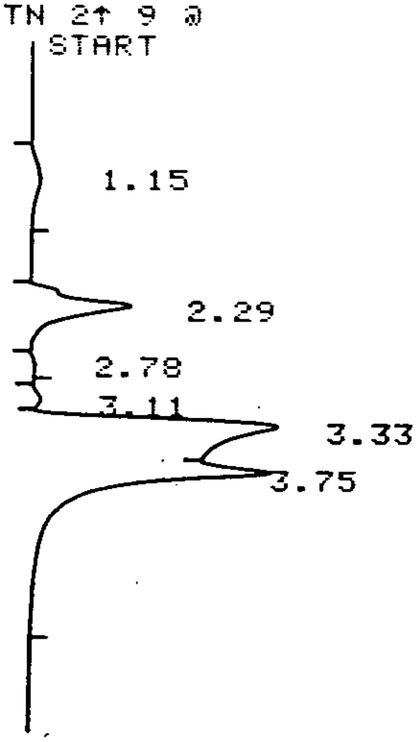
hp 5830A
AREA %

RT	AREA	AREA %
0.81	9142	1.701
2.29	59620	11.092
2.77	1251	0.233
3.14	3095	0.576
3.34	266600	49.599
3.78	197800	36.800

XF: 1.0000 E+ 0

ATTN 2↑ 9 @

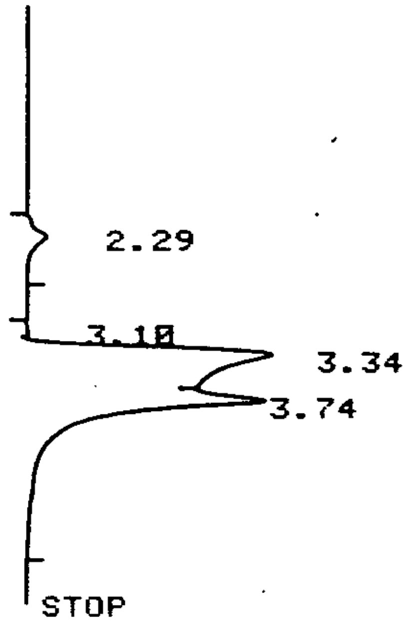
2.75 ml Cooler #3A AK 263



hp 5830A
AREA %

RT	AREA	AREA %
1.15	9836	1.919
2.29	61280	11.953
2.78	1242	0.242
3.11	3326	0.649
3.33	247800	48.334
3.75	189200	36.904

XF: 1.0000 E+ 0 A-90

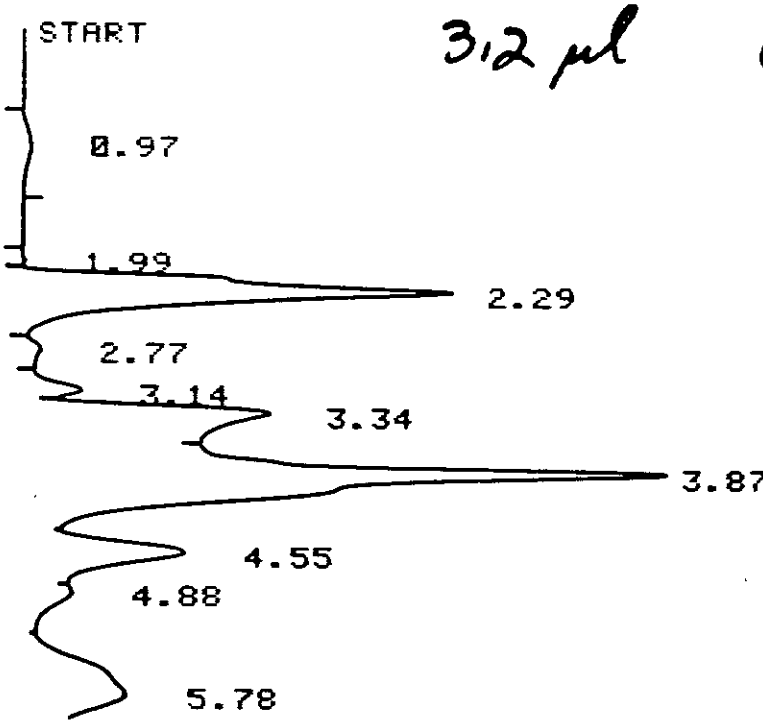


hp 5830A
AREA %

RT	AREA	AREA %
2.29	12310	2.695
3.10	436	0.095
3.34	252900	55.370
3.74	191100	41.839

XF: 1.0000 E+ 0

3.2 µl Cooler #1 AK 260



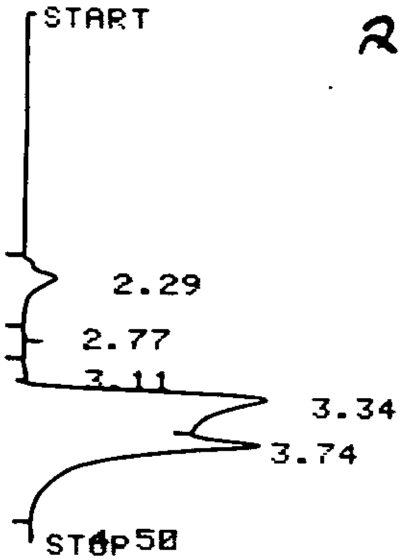
hp 5830A
AREA %

RT	AREA	AREA %
0.97	9598	0.602
1.99	642	0.040
2.29	301700	18.931
2.77	12540	0.787
3.14	33780	2.120
3.34	234400	14.708
3.87	627700	39.386
4.55	147700	9.268

5.78	177600	11.144

XF: 1.0000 E+ 0

2.9 µl Sodes Run #2
AK 262

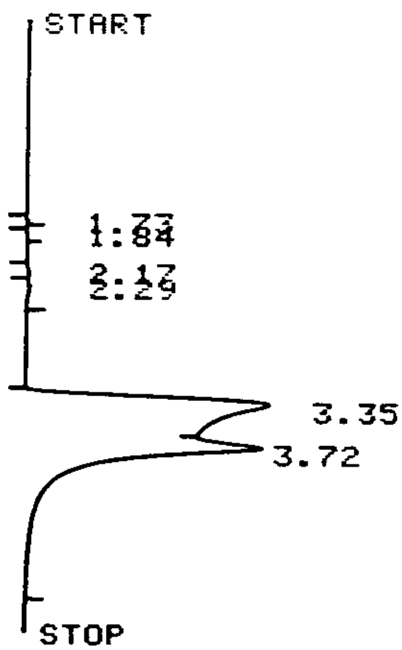


hp 5830A
AREA %

RT	AREA	AREA %
2.29	20440	4.537
2.77	211	0.047
3.11	922	0.205
3.34	249700	55.430
3.74	177900	39.491
4.50	1307	0.290

XF: 1.0000 E+ 0

2.8 µl Run #3 MOS outlet
4th bubbler
AK 245

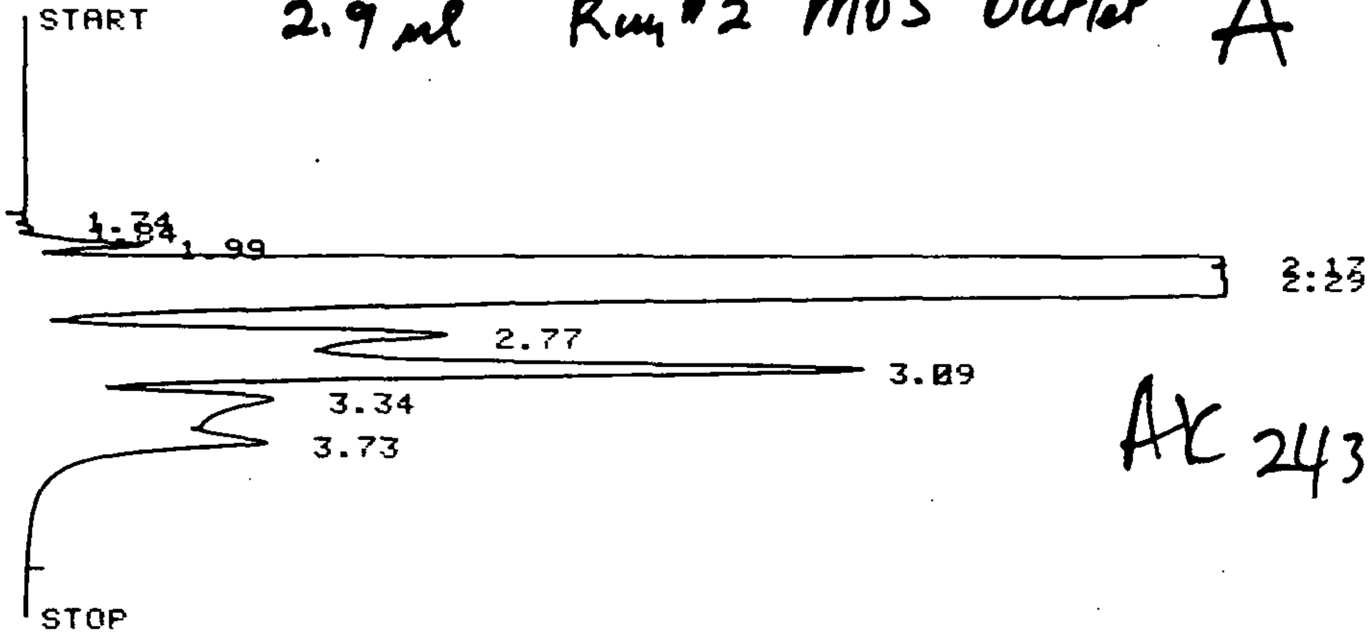


hp 5830A
AREA %

RT	AREA	AREA %
1.73	115	0.027
1.84	106	0.025
2.17	770	0.181
2.29	1556	0.366
3.35	241100	56.670
3.72	181800	42.732

XF: 1.0000 E+ 0

2.9 µl Run #2 MOS Outlet A



AK 243

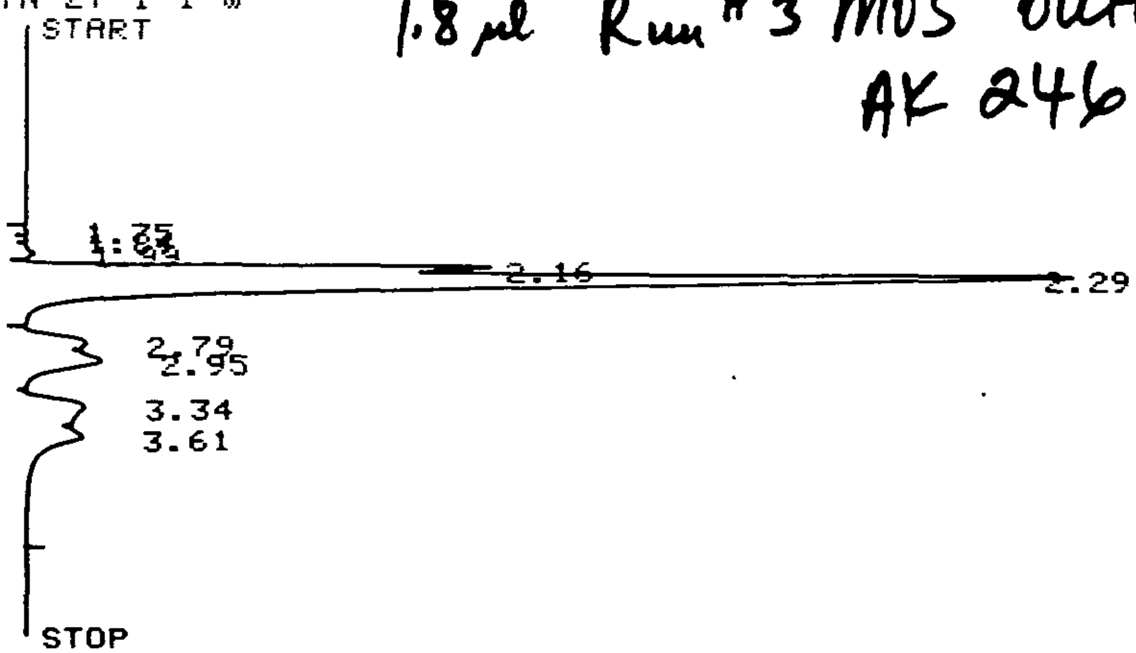
hp 5830A
AREA %

RT	AREA	AREA %
1.74	329	0.004
1.84	1633	0.022
1.99	34090	0.465
2.17	1058000	14.434
2.29	5042000	68.787
2.77	254000	3.465
3.09	505200	6.892
3.34	240600	3.282
3.73	194000	2.647

XF: 1.0000 E+ 0

ATTN 2↑ 1 1 0

1.8 µl Run #3 MOS Outlet
AK 246



hp 5830A
AREA %

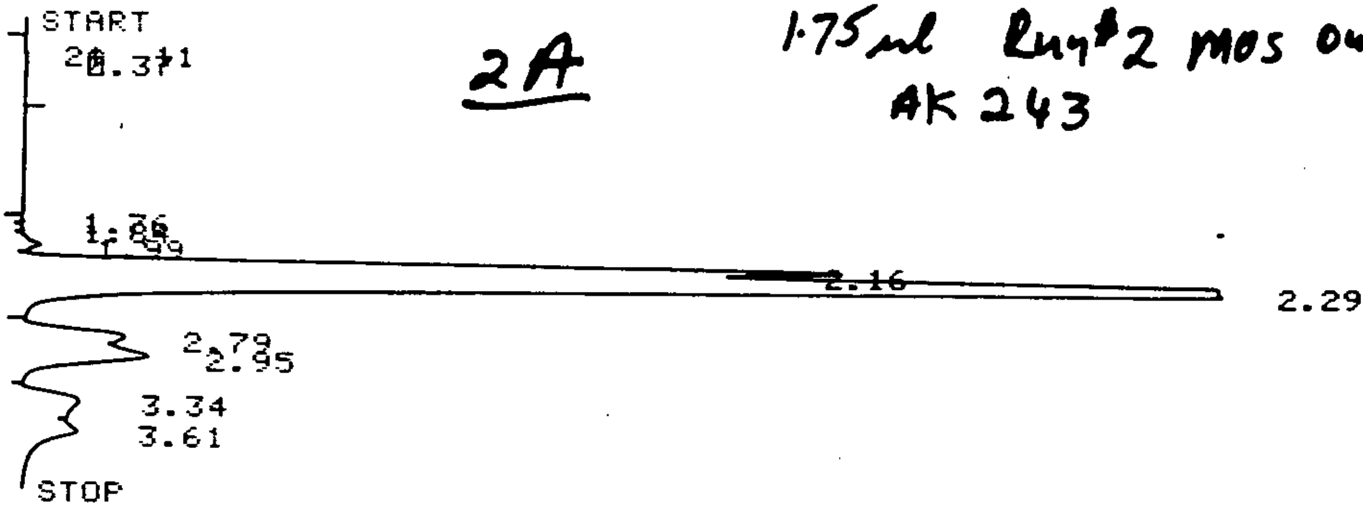
RT	AREA	AREA %
1.75	197	0.007
1.84	751	0.027

2.29	1743000	61.813
2.79	110700	3.926
2.95	174000	6.171
3.34	176800	6.270
3.61	171600	6.086

XF: 1.0000 E+ 0

2A

1.75 µl Run#2 MOS outlet
AK 243

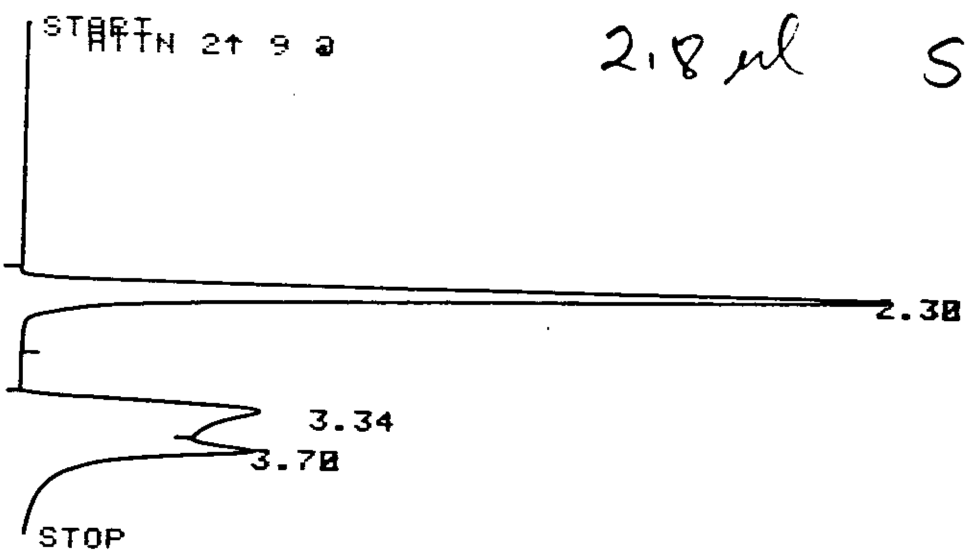


hp 5830A
AREA %

RT	AREA	AREA %
0.37	4965	0.108
1.76	166	0.004
1.84	982	0.021
1.99	21180	0.460
2.16	754600	16.375
2.29	3032000	65.793
2.79	182000	3.949
2.95	284300	6.169
3.34	171500	3.721
3.61	156700	3.400

XF: 1.0000 E+ 0

2.8 µl Std n-Hexane

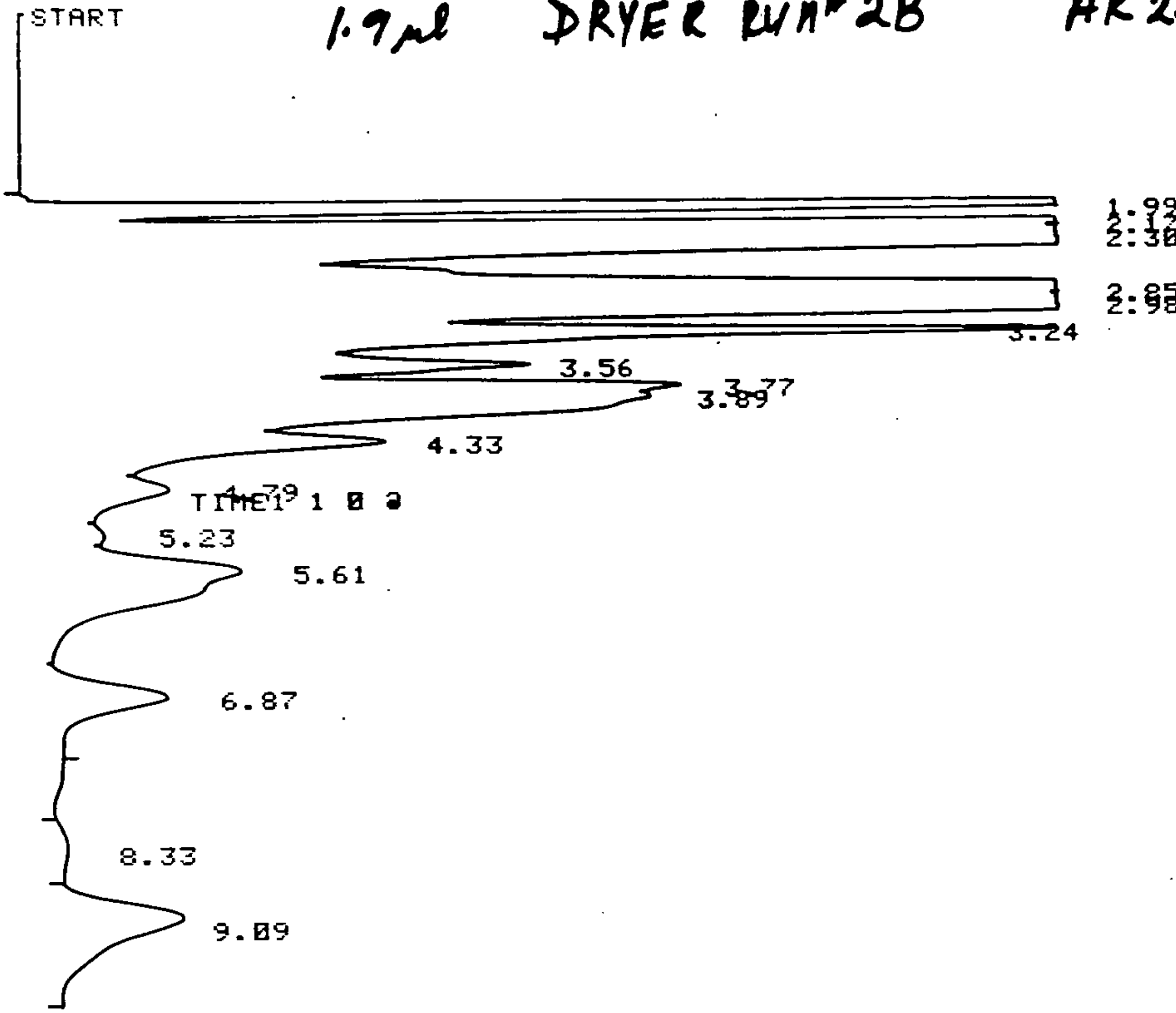


hp 5830A
AREA %

RT	AREA	AREA %
2.30	364200	47.883
3.34	223700	29.411
3.70	172700	22.706

XF: 1.0000 E+ 0

1.9 µl DRYER RUN# 2B AK 251



hp 5830A
AREA %

RT	AREA	AREA %
1.99	559500	4.858
2.17	730400	6.342
2.30	3701000	32.134
2.85	1187000	10.306
2.98	1514000	13.145
3.24	707800	6.145
3.56	378200	3.284
3.77	352300	3.059
3.89	701200	6.088
4.33	389000	3.378
4.79	198200	1.721
5.23	75240	0.653
5.61	511000	4.437
6.87	271200	2.355
8.33	21570	0.187
9.09	219800	1.908

XF: 1.0000 E+ 0

LABORATORY DATA

Client ______ Analysis ______

PN ______ Date ______ Method Number ______

Analyst ______ Checker ______

CS_2 Impinger samples
A E Stacy Des. Moines. 3/27/79.

Sample ID.	ml injected	R.T.	Area Unit A.U.	mg/A.U.		
STD - 0.2306 mg/ml Hexane in CS_2	1.4	2.19	252600	1.28×10^{-6}		
"	1.3	2.21	224400	1.34×10^{-6}		
"	1.2	2.19	223300	1.24×10^{-6}		
"	2.1	2.21	332600	1.46×10^{-6}		
"	2.15	2.20	360400	1.38×10^{-6}		
AVERAGE ~~AVGE~~				1.34×10^{-6}		
C-3A - color AK263	1.9	2.19	46810		mg in samp	mg/ml
		2.65	902			
		2.91	2919			
			50631	$\times 1.34\times10^{-6}$ =	6.78×10^{-2}	0.0357
"	2.4	2.20	58980			
		2.65	860			
		2.94	2292			
			62132	$\times 1.34\times10^{-6}$ =	8.33×10^{-2}	0.0347
C-3A AVERAGE						0.0352
C-3 B color AK264	2.2	2.20	11450			
		2.90	731			
			12181	$\times 1.34\times10^{-6}$ =	1.63×10^{-2}	0.0074

LABORATORY DATA

Client ~~A.E~~ USEPA
PN ______ Date ______
Analyst ______
A.E STALEY Des Moines
CS2 Impinger Samples

Analysis ______
Method Number ______
Checker ______

3/28/79

Sample ID	ml injected	RT.	Area units	Response factor mg/A.U.	mg	mg/ml
D-3A DRYER AK248	1.5 ~~2.5~~	2.11	4926	1.62×10^{-6}		
		2.24	46210			
Dilution 1:57		2.71	2870			
		2.92	5357			
			59363		.0962	0.064
"	1.9	1.93	–			
		2.22	64180			
		2.69	1297			
		2.98	4528			
			70005		0.113	0.060
D-3B DRYER AK249	2.05	1.94	315			
		2.23	20360			
Dilution 1:57		2.70	293			
		2.98	1482			
			22450		0.036	0.018
"	2.00	1.93	240			
		2.23	19540			
		2.70	307			
		2.98	1633			
			21720		0.035	0.0176
STD. 0.4283 mg/ml	ml inj	RT.	Area units	mg/AU.		
	2.2	2.24	589608 ~~[illegible]~~	1.60×10^{-6}		
	2.0	2.24	531000	1.61×10^{-6}		
	1.9	2.23	531100	1.53×10^{-6}		
	2.15	2.25	556500	1.65×10^{-6}		
	1.30	2.24	327700	1.70×10^{-6}		
AVG –				1.62×10^{-6}		

7.65 222100 99.221

XF: 1.0000 E+ 0

TEMP1 ESCAPE
TEMP1 70 70
TEMP1 1 5 0 @

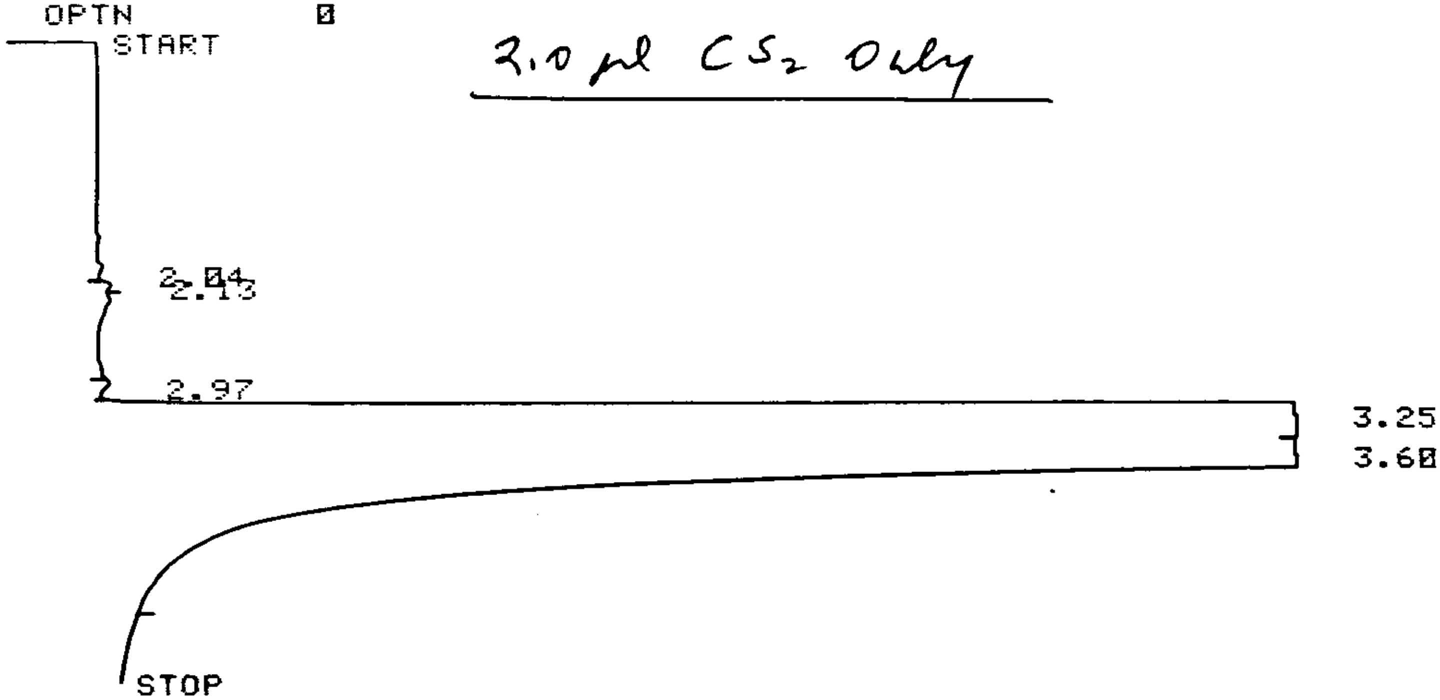
TIME1	10.0	
TEMP1	150	92
TEMP1	150	102
TEMP1	150	109
TEMP1	150	125
TEMP1	150	140
TEMP1	150	147
TEMP1	150	149
TEMP1	150	149
TEMP1	150	149
TEMP1	150	149
TEMP1	150	150

1/29/79

TEMP1 7 0 @

TEMP1	70	70
TIME1	10.0	
INJ TEMP	150	150
FID TEMP	250	250
TCD TEMP	50	50
AUX TEMP	45	45
OVEN MAX	270	

CHT SPD	1.50
ATTN 2↑	5
FID SGNL	A
SLP SENS	0.30
AREA REJ	100
FLOW A	29
FLOW B	2
OPTN	0



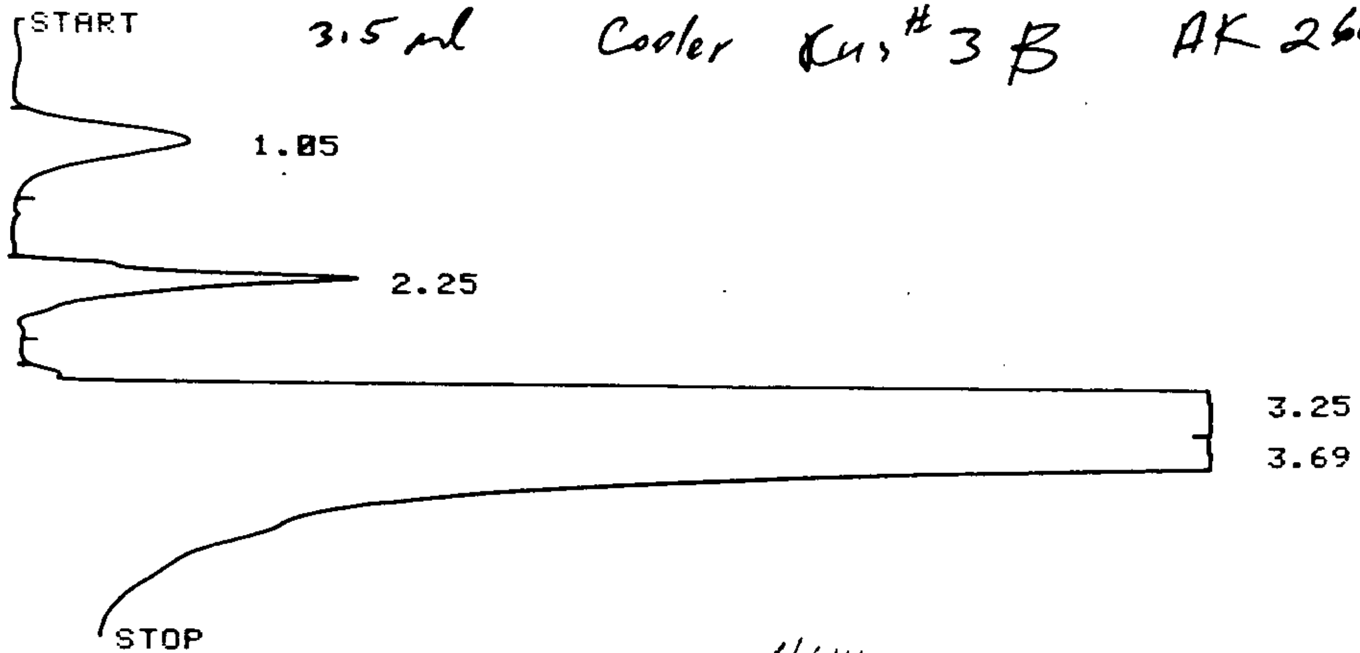
2.0 µl CS_2 Only

hp 5830A
AREA %

RT	AREA	AREA %
2.13	118	0.029
2.97	136	0.034
3.25	203800	50.943 A-98
3.60	196000	48.993

XF: 1.0000 E+ 0

3.5 ml Coder Run # 3 B AK 264



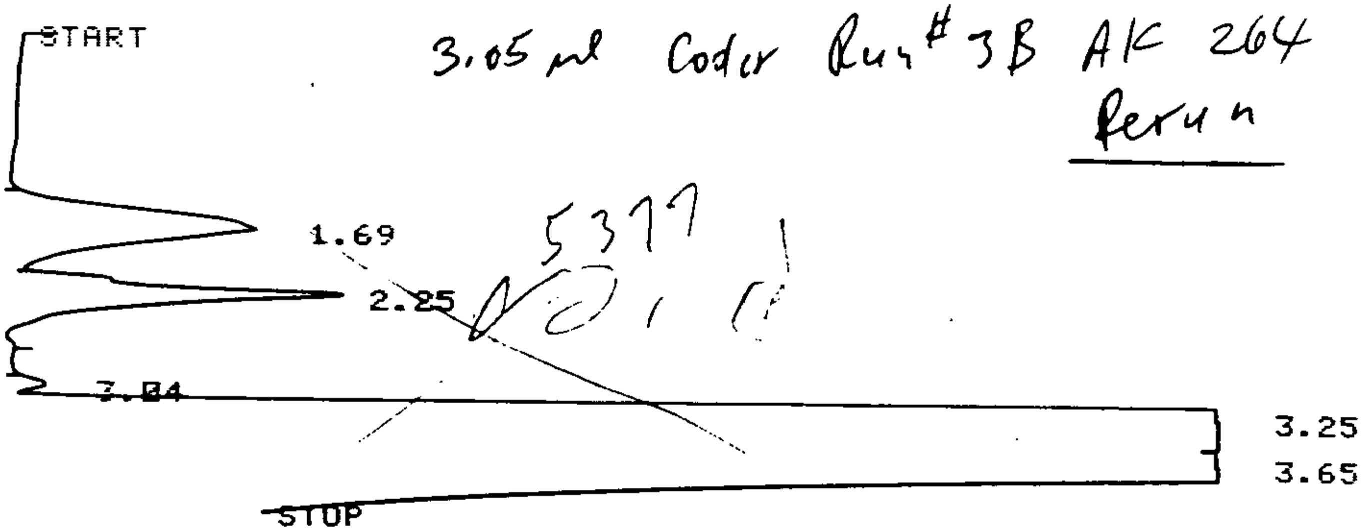
4/14.?

hp 5830A
AREA %

RT	AREA	AREA %
1.05	11910	2.334
2.25	14400	2.822
3.25	251400	49.274
3.69	232500	45.570

XF: 1.0000 E+ 0

3.05 ml Coder Run # 3B AK 264
Rerun

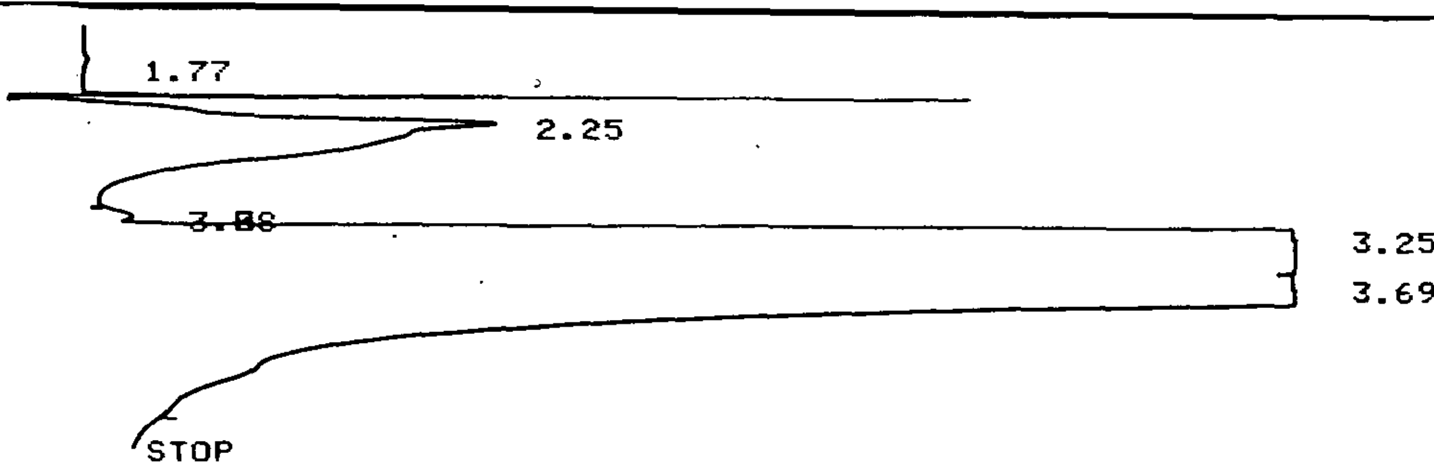


hp 5830A
AREA %

RT	AREA	AREA %
1.69	16400	3.853
2.25	13030	3.061
3.04	496	0.117
3.25	224900	52.840
3.65	170800	40.129

XF: 1.0000 E+ 0

3.55 ml Coder Run # 3B AK 264
Rerun

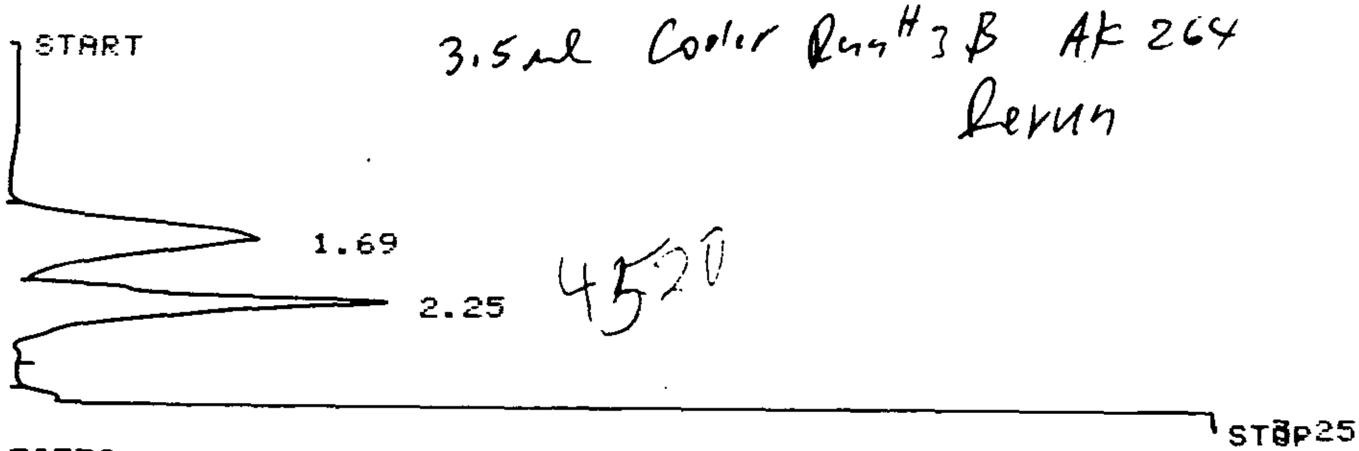


hp 5830A
AREA %

RT	AREA	AREA %
2.25	57990	10.915
3.08	4909	0.924
3.25	255400	48.071
3.69	213000	40.090

XF: 1.0000 E+ 0

3.5 ml Cooler Run # 3B AK 264
Rerun



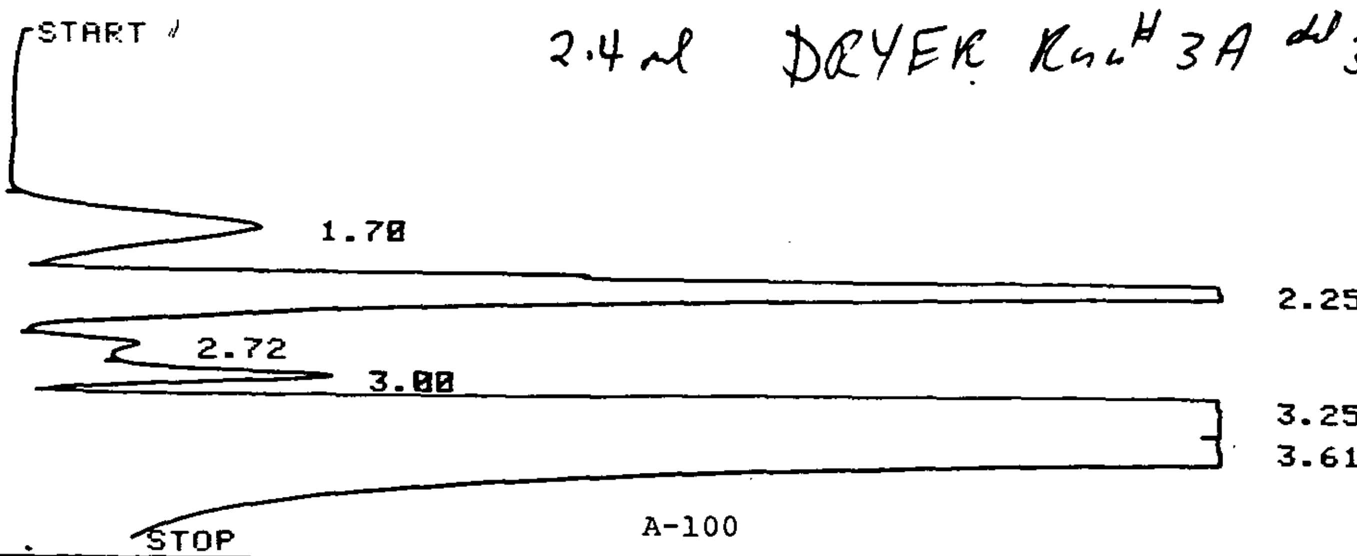
4520

hp 5830A
AREA %

RT	AREA	AREA %
1.69	15990	10.731
2.25	15820	10.617
3.25	117200	78.652

XF: 1.0000 E+ 0

2.4 ml DRYER Run # 3A dil 1/51

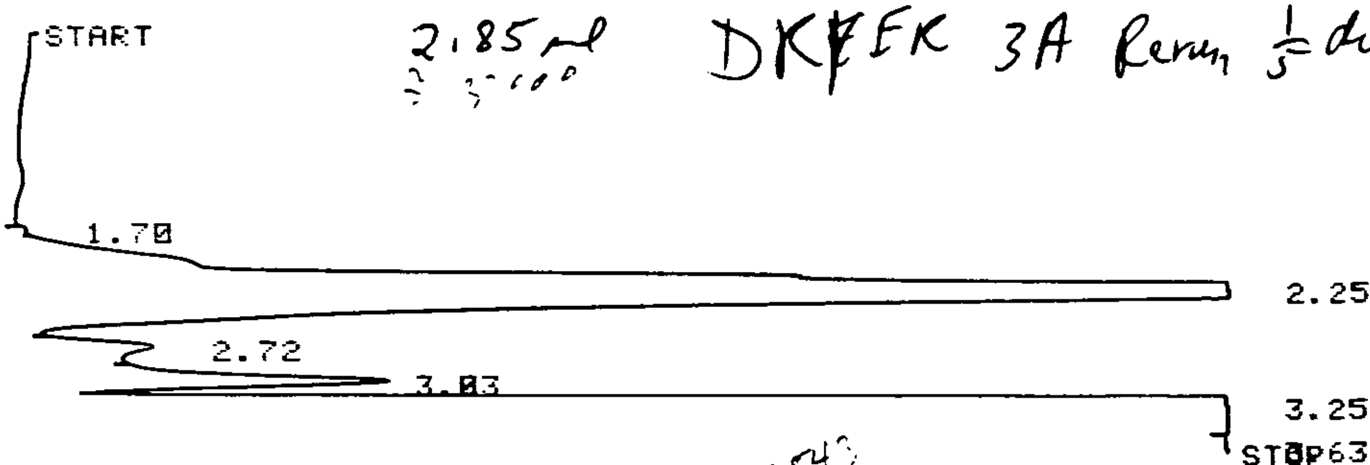


AREA %

RT	AREA	AREA %
1.70	15920	3.206
2.25	79280	15.968
2.72	2997	0.604
3.00	8700	1.752
3.25	206700	41.632
3.61	182900	36.838

XF: 1.0000 E+ 0

2.85 µl DK~~F~~EK 3A Rerun 1/5 dil.



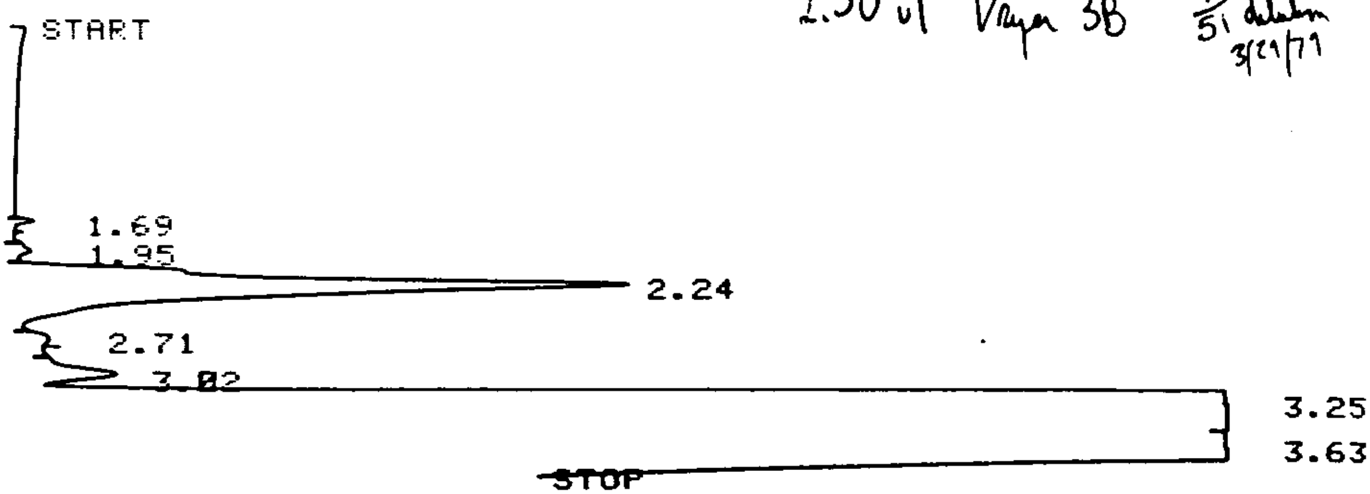
37543

hp 5830A
AREA %

RT	AREA	AREA %
1.70	102	0.022
2.25	107000	23.286
2.72	4471	0.973
3.03	12830	2.792
3.25	221800	48.270
3.63	113300	24.657

XF: 1.0000 E+ 0

2.30 ul Dryer 3B 1/5 dilution 3/21/71

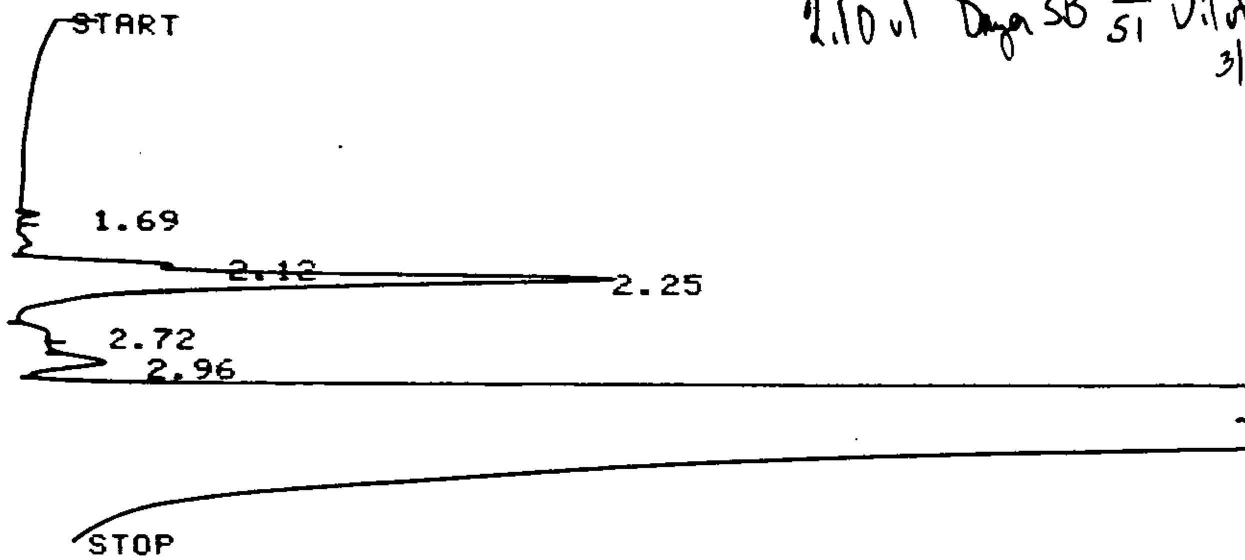


hp 5830A
AREA %

RT	AREA	AREA %
1.69	181	0.048
1.95	252	0.067
2.24	22390	5.978
2.71	292	0.078
3.02	1599	0.427
3.25	211800	56.553

XF: 1.0000 E+ 0

2.10 ul Dayn 3B $\frac{1}{51}$ Dilution 3/29/79

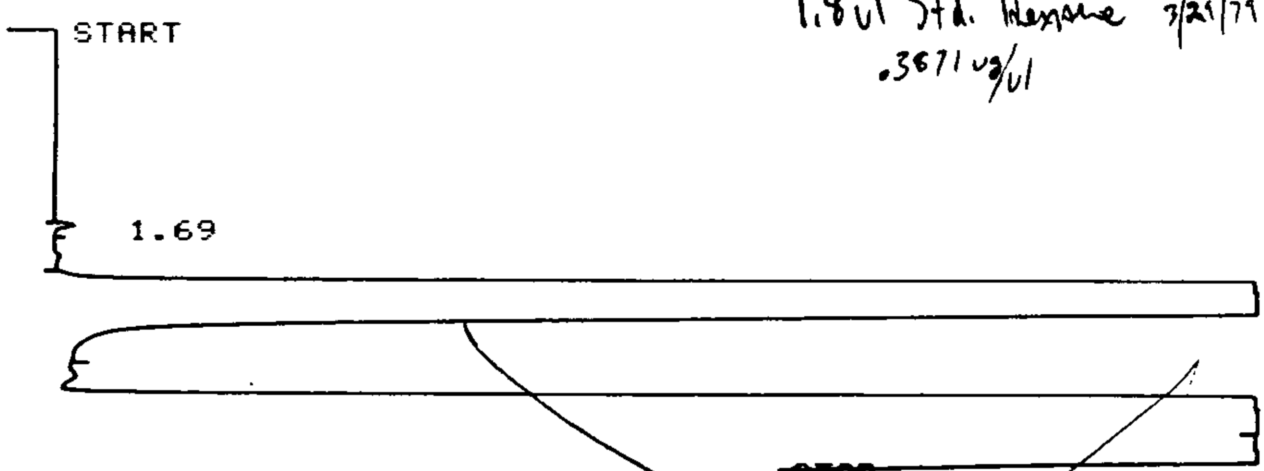


hp 5830A
AREA %

RT	AREA	AREA %
1.69	162	0.039
2.12	2069	0.502
2.25	17330	4.207
2.72	212	0.051
2.96	1652	0.401
3.25	196500	47.703
3.57	194000	47.096

XF: 1.0000 E+ 0

1.8 ul Std. Hexane 3/29/79
.3871 ug/ul



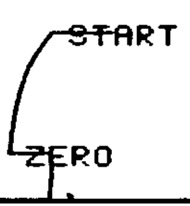
hp 5830A
AREA %

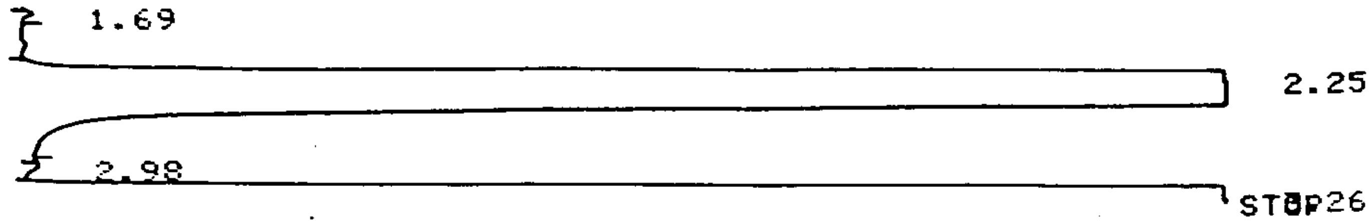
RT	AREA	AREA %
1.69	202	0.026
2.25	404600	51.945 - 2.24778
3.25	213400	27.398
3.61	160700	20.632

9.6x10^-7

XF: 1.0000 E+ 0

2.15 ul Std. Hexane 3/29/79
.3871 ug/ul





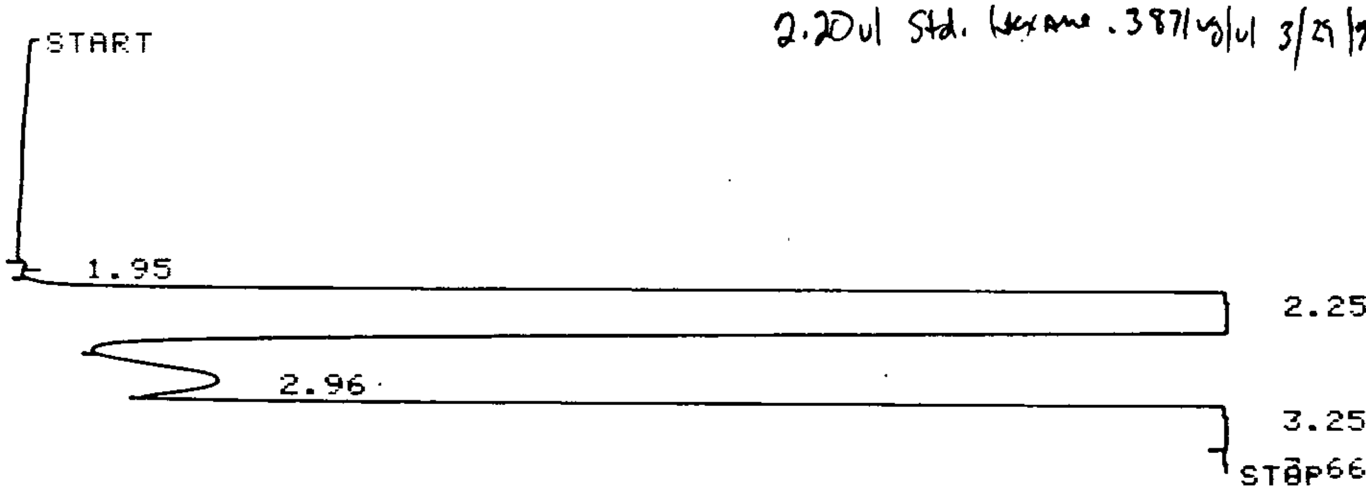
hp 5830A
AREA %

7.8×10^{-7}

RT	AREA	AREA %
1.69	104	0.017
2.25	494900	82.381
2.98	143	0.024
3.26	105600	17.578

XF: 1.0000 E+ 0

2.20ul Std. Hexane .3871ug/ul 3/29/79



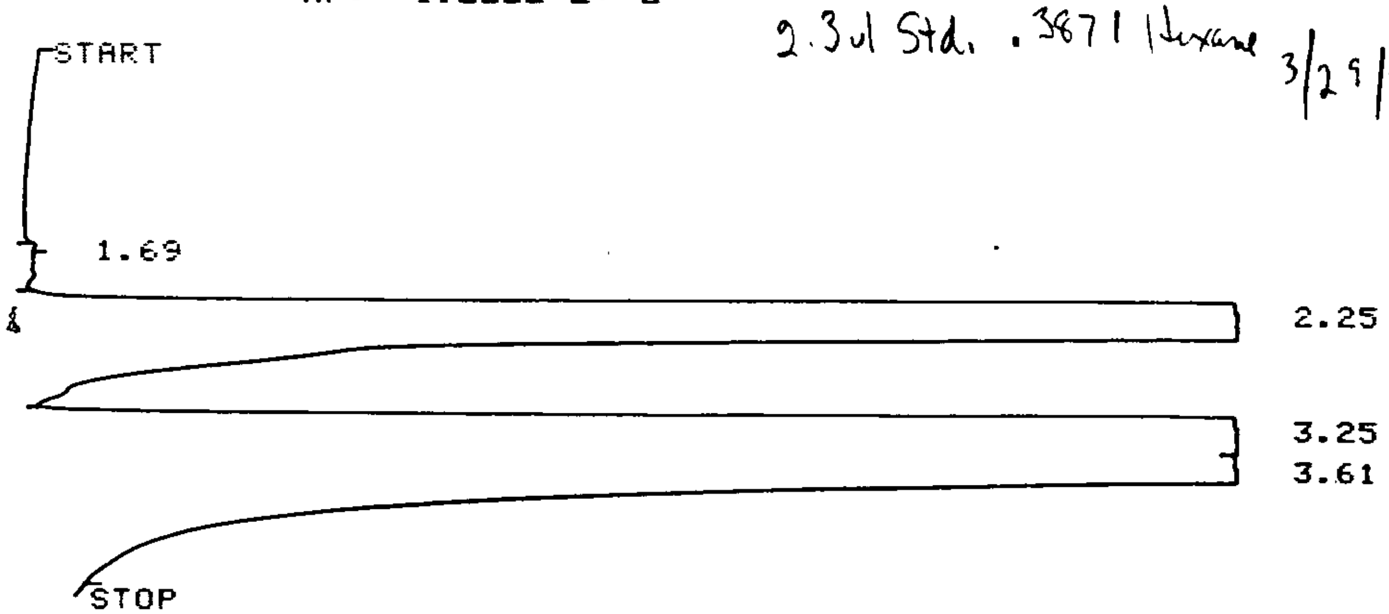
hp 5830A
AREA %

RT	AREA	AREA %
2.25	513900	57.276
2.96	12830	1.430
3.25	239000	26.638
3.66	131500	14.656

7.5×10^{-7}

XF: 1.0000 E+ 0

2.3ul Std. .3871 Hexane 3/29/79

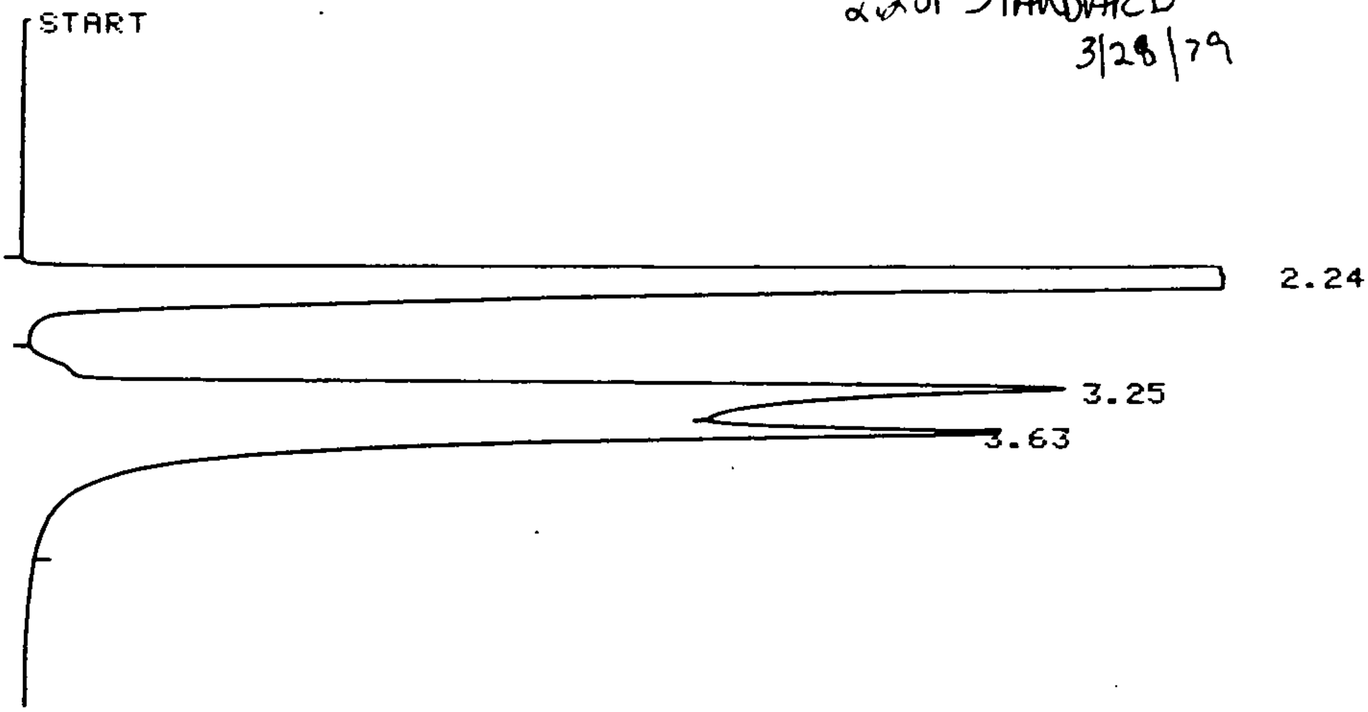


hp 5830A
AREA %

RT	AREA	AREA %

XF: 1.0000 E+ 0

2.2ul STANDARD
3/28/79

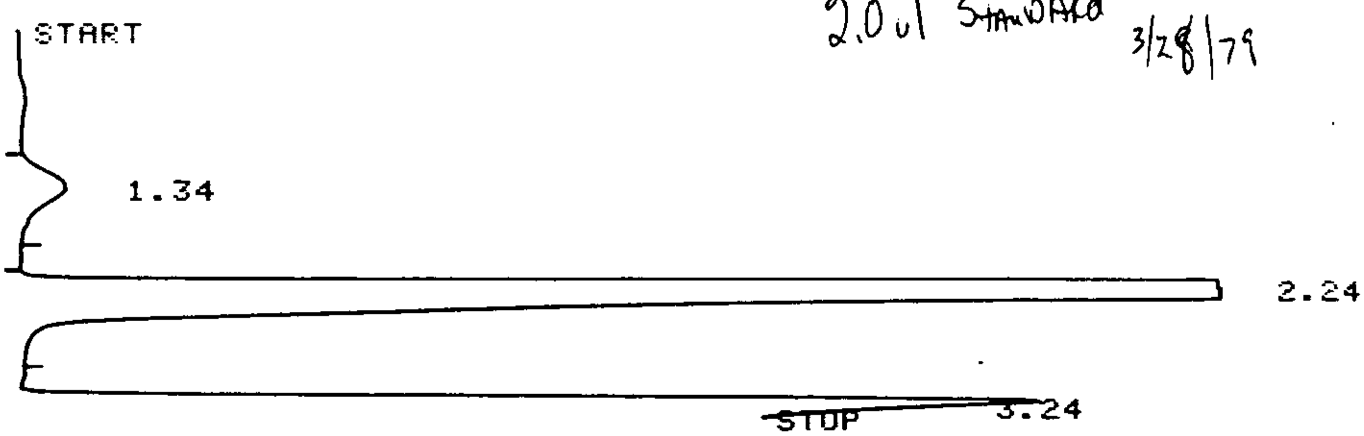


hp 5830A
AREA %

RT	AREA	AREA %
2.24	589600	57.561
3.25	239800	23.411
3.63	194900	19.028

XF: 1.0000 E+ 0

2.0ul STANDARD 3/28/79



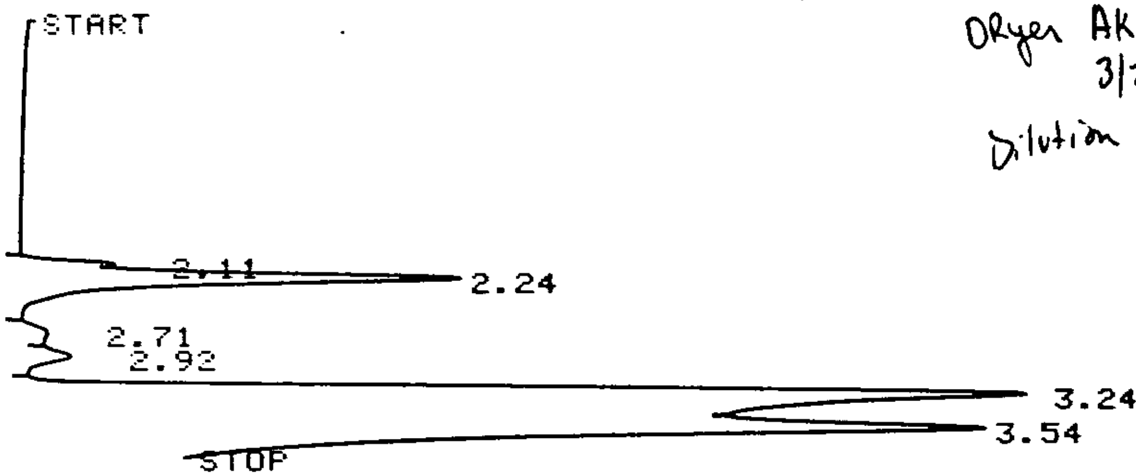
hp 5830A
AREA %

RT	AREA	AREA %
1.34	12440	1.788
2.24	531000	76.322
3.24	152300	21.890

XF: 1.0000 E+ 0

XF: 1.0000 E+ 0

1.5ul D-3 A
DRyer AK 248
3/28/79
Dilution 1-51

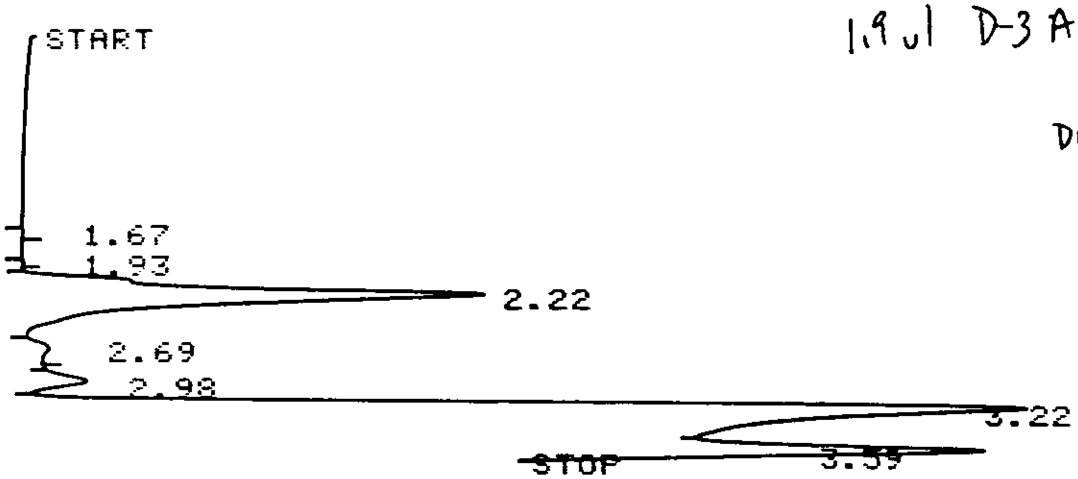


hp 5830A
AREA %

RT	AREA	AREA %
2.11	4926	1.374
2.24	46210	12.888
2.71	2870	0.800
2.92	5357	1.494
3.24	166600	46.463
3.54	132600	36.981

XF: 1.0000 E+ 0

1.9ul D-3 A Dryer AK 248
3/28/79
Dilution 1-51



hp 5830A
AREA %

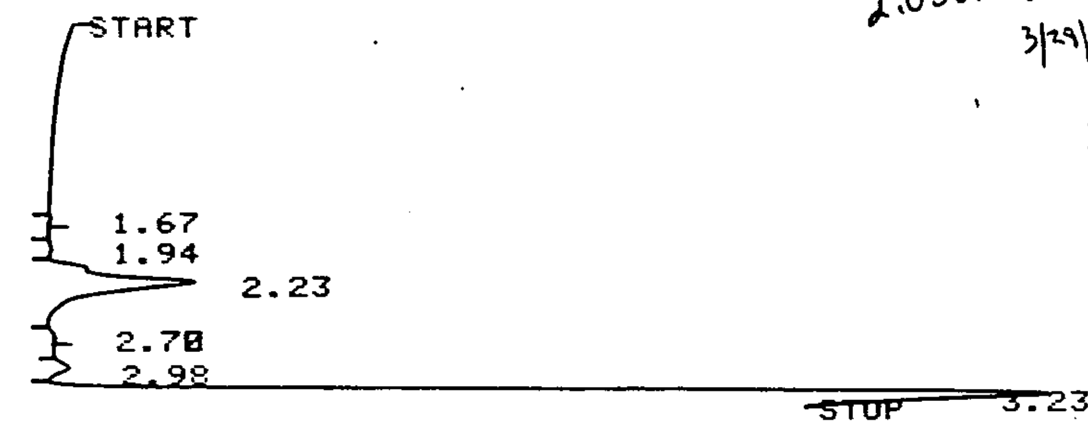
RT	AREA	AREA %
2.22	64180	15.529
2.69	1297	0.314
2.98	4528	1.096
3.22	210900	51.028
3.59	132400	32.035

XF: 1.000

..uuuu E+ 0

2.05ul O-3 B Dryer AK245
3/29/79

Dilution 1-51



hp 5830A
AREA %

RT	AREA	AREA %
1.67	130	0.085
1.94	315	0.206
2.23	20360	13.344
2.70	293	0.192
2.98	1482	0.971
3.23	130000	85.201

XF: 1.0000 E+ 0

2.00ul D-3 B Dryer AK245
3/28/79

Dilution 1-51

hp 5830A
AREA %

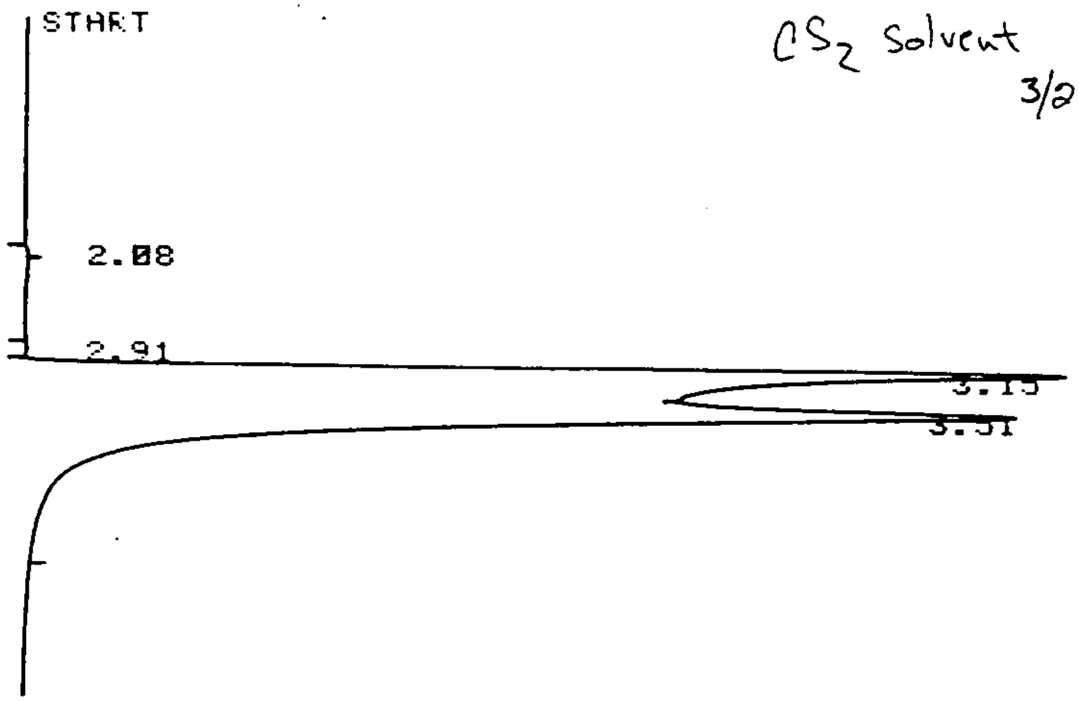
RT	AREA	AREA %
1.93	240	0.103
2.23	19540	8.368
2.70	307	0.131
2.98	1633	0.699
3.23	211800	90.699

XF: 1.0000 E+ 0

[illegible]	[illegible]	[illegible]
2.88	124	0.032
3.15	178400	45.796
3.49	2[illegible]0700	54.088

XF: 1.0000 E+ 0

CS_2 Solvent
3/27/79

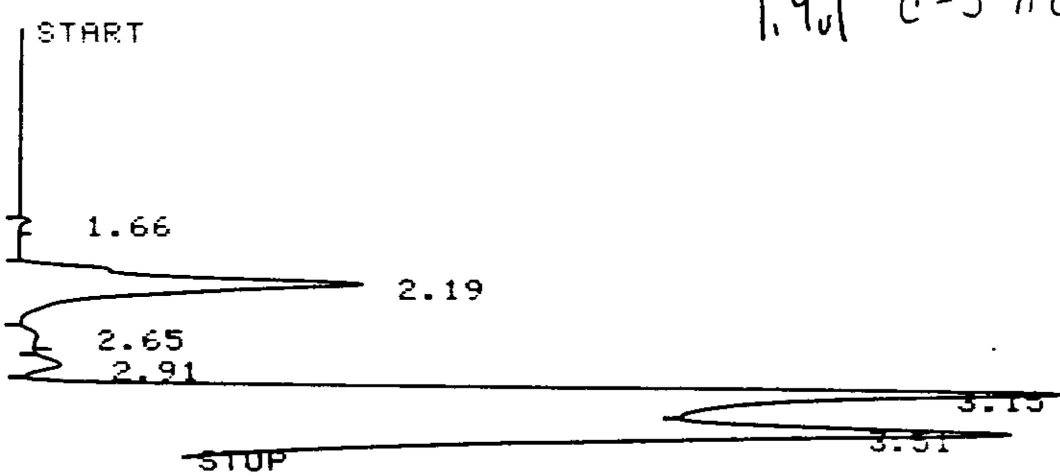


hp 5830A
AREA %

RT	AREA	AREA %
2.08	131	0.033
2.91	140	0.035
3.15	192200	47.850
3.51	209200	52.082

XF: 1.0000 E+ 0

1.9ul C-3 A Cooler AK 263
3/27/79



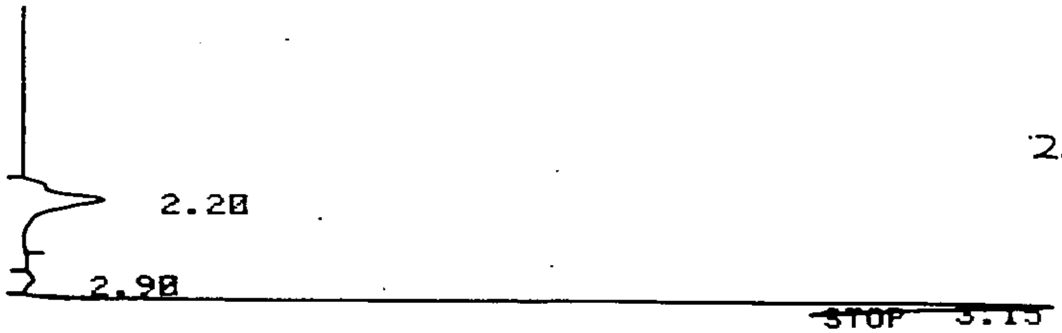
hp 5830A
AREA %

RT	AREA	AREA %
1.66	417	0.113
2.19	46810	12.725
2.65	902	0.245
2.91	2919	0.794
3.15	172600	46.922
3.51	144200	39.201

A-107

3/27/79

2.2 ml
C-3 B
cooler

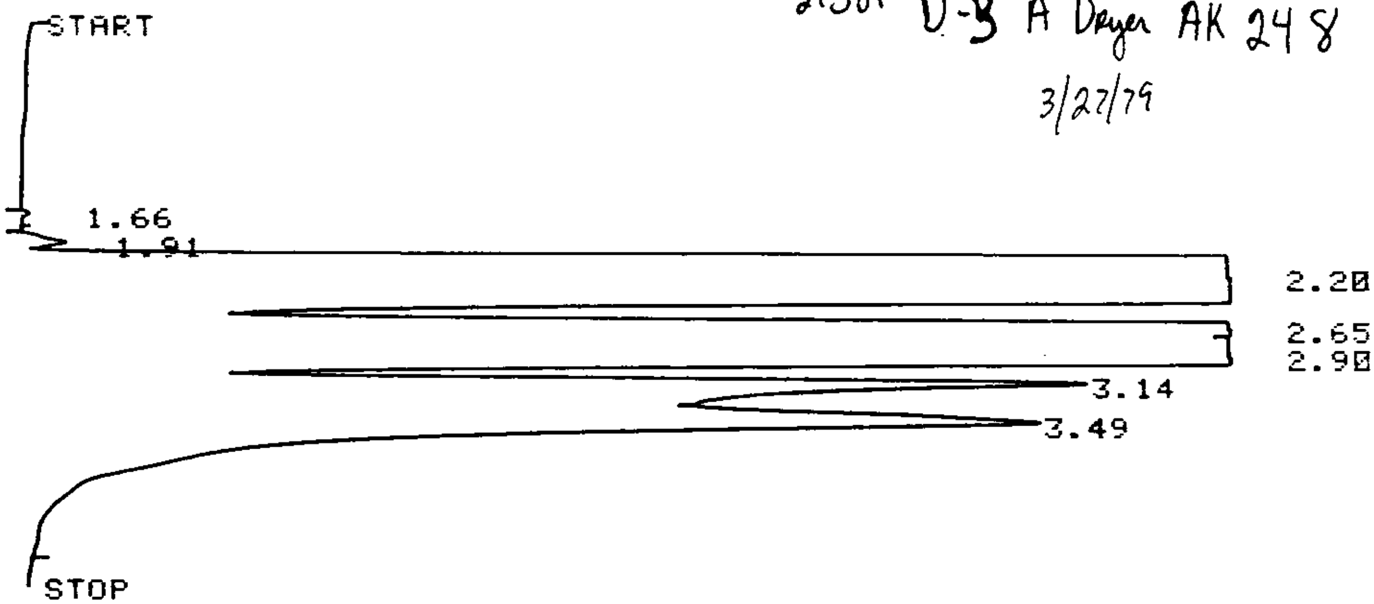


hp 5830A
AREA %

RT	AREA	AREA %
2.20	11450	10.570
2.90	731	0.675
3.15	96140	88.755

XF: 1.0000 E+ 0

2.5 ul D-3 A Dryer AK 248
3/27/79

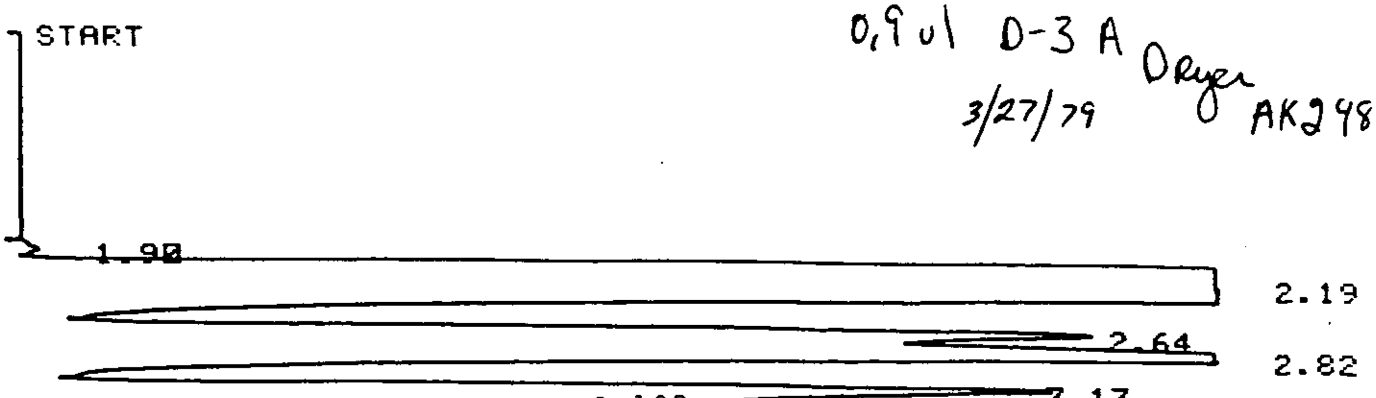


hp 5830A
AREA %

RT	AREA	AREA %
1.66	333	0.006
1.91	3226	0.059
2.20	4215000	77.305
2.65	210000	3.851
2.90	600700	11.017
3.14	174400	3.199
3.49	248800	4.563

XF: 1.0000 E+ 0

0.9 ul D-3 A Dryer AK248
3/27/79



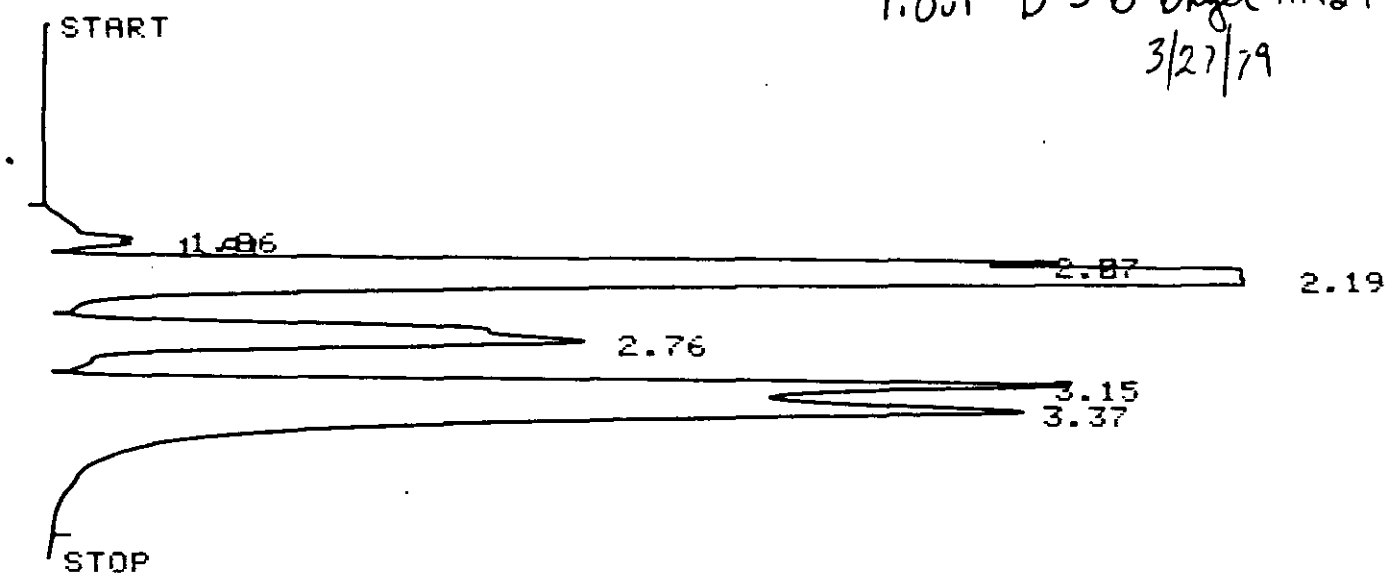
STOP

hp 5830A
AREA %

RT	AREA	AREA %
1.90	795	0.035
2.19	1649000	73.620
2.64	108800	4.857
2.82	191100	8.532
3.13	128300	5.728
3.41	161900	7.228

XF: 1.0000 E+ 0

1.0ul D-3 B Dryer AK249
3/27/79

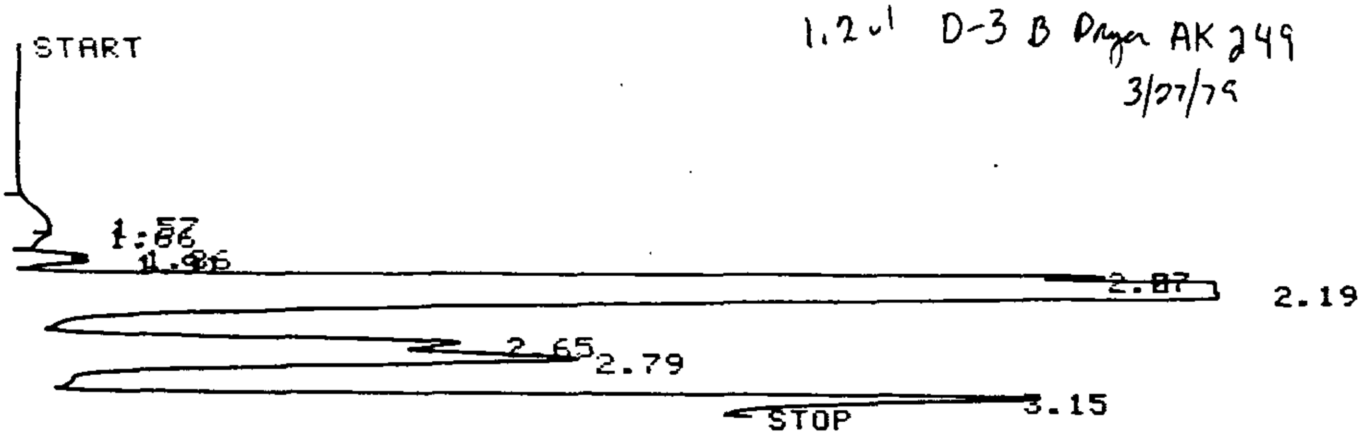


hp 5830A
AREA %

RT	AREA	AREA %
1.86	8662	0.942
1.91	4428	0.481
2.07	51830	5.635
2.19	436000	47.401
2.76	101000	10.980
3.15	121600	13.220
3.37	196300	21.341

XF: 1.0000 E+ 0

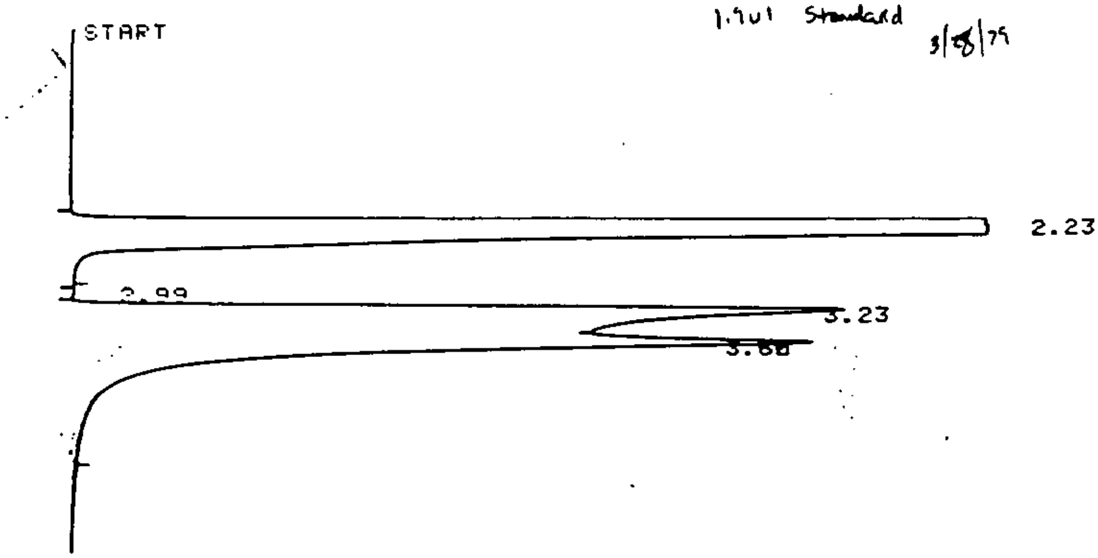
1.2ul D-3 B Dryer AK 249
3/27/79



hp 5830A
AREA %

RT	AREA	AREA %
1.57	4591	0.583
1.66	2671	0.339

1.9ul Standard 3/28/79

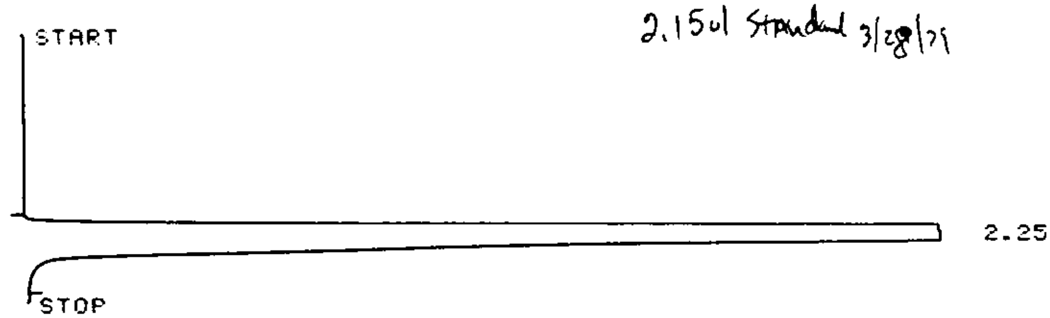


hp 5830A
AREA %

RT	AREA	AREA %
2.23	531100	56.173
2.99	172	0.018
3.23	217900	23.047
3.60	196300	20.762

XF: 1.0000 E+ 0

2.15ul Standard 3/28/79

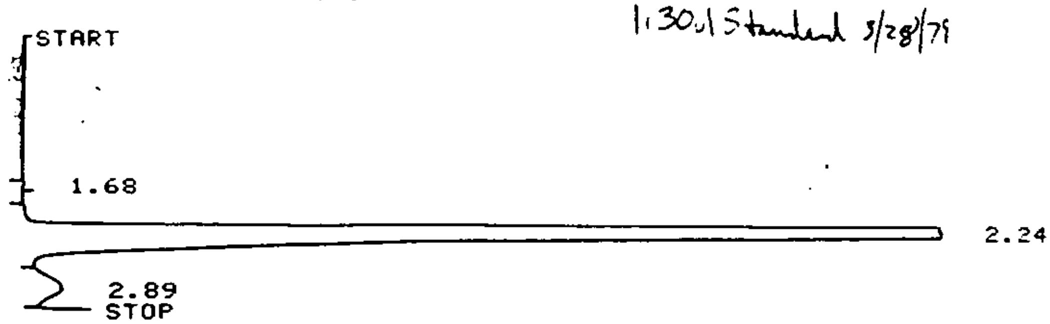


hp 5830A
AREA %

RT	AREA	AREA %
2.25	556500	100.000

XF: 1.0000 E+ 0

1.30ul Standard 3/28/79



hp 5830A
AREA %

RT	AREA	AREA %
1.68	147	0.044
2.24	327700	97.639
[illegible]	7770	2.317

APPENDIX B

FIELD DATA SHEETS

1. CS_2 IMPINGER TRAIN TESTS

CS_2 IMPINGER TRAIN DATA

Plant and City: STALEY - Des Moines

Date: [illegible] Ambient Temp.: ______ Ambient Press.: 28.93

Sampling Location: MOS Inlet A+B Run Number: MCS-I1

Sample Train Description: ______

Pump Type/No.: 44 (B) + 46 (A) Calibration Factor: 212 ml/min, 200 ml/min

Test Data

Clock Time Start: 11:24 Finish: 12:09 Pump Count Initial: ______ Final: ______

Sampling Time: 45 min Net: ______

Volume of Gas Sampled: ______

Stack Temp °F	Static Pressure in H_2O	Impinger Train Temperature °F
		A B*
		74°F
		74°F
		74°F
		74°F

* Thermo 'B' was not working

Moisture Determination

Silica Tube Number: ______

Pump Type/No.: 1/217 SKC. Calibration Factor: 529 ml/count

Clock Time Start: ______ Finish: ______ Pump Count Initial: 407595 Final: 420762

Net: 30 min Net: ______

Volume of Gas Sampled: ______

Grams H_2O Collected: 0.63

15.70
15.07 .63 gr.

CS_2 IMPINGER TRAIN DATA

Plant and City: Stacy Des Moines

Date: 3/13/77 Ambient Temp.: ______ Ambient Press.: 28.97

Sampling Location: MCS INLET Run Number: MCS-I2

Sample Train Description: ______

Pump Type/No.: #11, #13 Calibration Factor: [illegible]

** 3:41 PM Tubing to pump found disconnected, reconnected at that time

Test Data

Clock Time Start: 15:17 Finish: 16:22

Pump Count Initial: ______ Final: ______

Sampling Time: ______ Net: ______

Volume of Gas Sampled: ______

Stack Temp °F	Static Pressure in H_2O	Impinger Train Temperature °F
		2 1
230° [illegible]		85°F *
		85°F
		86°
		54°

* [illegible]

Moisture Determination

Silica Tube Number: ______

Pump Type/No.: ______ Calibration Factor: ______

Clock Time Start: ______ Finish: ______

Pump Count Initial: ______ Final: ______

Net: ______ Net: ______

Volume of Gas Sampled: ______

Grams H_2O Collected: ______

CS$_2$ IMPINGER TRAIN DATA

Plant and City: Staley Des Moines

Date: 11/13/79 Ambient Temp.: ______ Ambient Press.: ~~29~~

Sampling Location: INLET MCS Run Number: MCS-IN-3

Sample Train Description: ~~IN~~ CS2 IMPINGER TRAIN with extra impinger

Pump Type/No.: 44 Calibration Factor: ?*

* Check with Extra bubbler in train

Test Data

Clock Time Start: 17:00 Pump Count Initial: ______
Finish: 17:45 Final: ______

Sampling Time: ______ Net: ______

Volume of Gas Sampled: ______

Stack Temp ~~°F~~	Static Pressure in H_2O	Impinger Train Temperature °F
32°C		62
		68
		70
		72

Moisture Determination

Silica Tube Number: NA.

Pump Type/No.: ______ Calibration Factor: ______

Clock Time Start: ______ Pump Count Initial: ______
Finish: ______ Final: ______

Net: ______ Net: ______

Volume of Gas Sampled: ______

Grams H_2O Collected: ______

CS_2 IMPINGER TRAIN DATA

Plant and City: STALEY - Des Moine

Date: 11/13/79 Ambient Temp.: ______ Ambient Press.: 28.93

Sampling Location: MOS OUTLET A+B Run Number: M.S - Ø1

Sample Train Description: ______

Pump Type/No.: 54 & 43 (A) (B) Calibration Factor: 54 200 ml/min 43: 203 ml/m

Test Data

Clock Time Start: 11:34 (5 [illegible]) Pump Count Initial: ______

Finish: 12:09 Final: ______

Sampling Time: 45 min Net: ______

Volume of Gas Sampled: ______

Stack Temp °F	Static Pressure in H_2O	Impinger Train Temperature °F	
		[illegible]	[illegible]
35°C		75°F	75°F
		75°	90°
		90°	92°
		95°	93°

Moisture Determination

Silica Tube Number: ______

Pump Type/No.: ______ Calibration Factor: ______

Clock Time Start: ______ Pump Count Initial: ______

Finish: ______ Final: ______

Net: ______ Net: ______

Volume of Gas Sampled: ______

Grams H_2O Collected: ______

3:17 PM

CS$_2$ IMPINGER TRAIN DATA

Plant and City: Sonet, Des Moines

Date: 3/13/79 Ambient Temp.: ____ Ambient Press.: 28.97

Sampling Location: HCS OUTLET Run Number: HCS-02

Sample Train Description: ____

Pump Type/No.: ____ Calibration Factor: ____

Test Data

Clock Time Start: 15:17 Pump Count Initial: ____

Finish: 16:22 Final: ____

Sampling Time: ____ Net: ____

Volume of Gas Sampled: ____

Stack Temp ~~°F~~	Static Pressure in H_2O	Impinger Train Temperature °F	
		A	B
32°C ~ 90°F		74	84°F
		72	82
		72°F	82°F
		70	84°

Moisture Determination

Silica Tube Number: #1223 16.18 grams

Pump Type/No.: Bendix #1 Calibration Factor: 0.594 ml/count

Clock Time Start: 1531 HRS Pump Count Initial: 420529

Finish: 1607 HRS Final: 433189

Net: ____ Net: ____

Volume of Gas Sampled: ~~0.3~~ 7520.64 ml

Grams H_2O Collected: 0.34

16.52 grams - final net

16.18

CS_2 IMPINGER TRAIN DATA

Plant and City: N E Stale, Des Moines

Date: 1/13/79 Ambient Temp.: 32 Ambient Press.:

Sampling Location: OUTLET MOS Run Number: MOS-OUT-3-

Sample Train Description: extra impinger on CS_2 impinger train

Pump Type/No.: 54, 43 Calibration Factor: (?)*

*check with extra bubbler in train

Test Data

pump 54 down 5 sec

Clock Time Start: 17:00 Pump Count Initial:

Finish: 17:18 Final:

Sampling Time: ~~17:18~~ TEST END 17:45,15 sec) Pump 43 Net:

Volume of Gas Sampled:

Stack Temp ~~°F~~ °C	Static Pressure in H_2O	Impinger Train Temperature °F
32°C		55
		60
		60
		70

Moisture Determination

Silica Tube Number:

Pump Type/No.: Calibration Factor:

Clock Time Start: Pump Count Initial:

Finish: Final:

Net: Net:

Volume of Gas Sampled:

Grams H_2O Collected:

CS_2 IMPINGER TRAIN DATA

Plant and City: STALEY DES MOINES

Date: 3/15/79 Ambient Temp.: 25° Ambient Press.: 29.83

Sampling Location: Cooler Run Number: C-1

Sample Train Description: 1 impinger with extra Bubbler

Pump Type/No.: MSA / 43 Calibration Factor:

Test Data

Clock Time Start: 0841 Pump Count Initial:
Finish: 0950 Final:

Sampling Time: 71 min Net:

Volume of Gas Sampled:

Stack Temp °F	Static Pressure in H_2O	Impinger Train Temperature °F
		20 °F
120° F		22°
		20
		22
120 °F		

Moisture Determination

Silica Tube Number: 1342

Pump Type/No.: 216 Calibration Factor: 1

Clock Time Start: Pump Count Initial: 128010
Finish: Final: 135201

Net: Net:

Volume of Gas Sampled:

Grams H_2O Collected:

CS_2 IMPINGER TRAIN DATA

Plant and City: A.E. STALEY DES MOINES, IOWA

Date: 3/15/79 Ambient Temp.: 25°F Ambient Press.: 29.83

Sampling Location: COOLER Run Number: C-2 F-[illegible]

Sample Train Description: Dual Train for Hexane

Pump Type/No.: MSA 46 / 43 Calibration Factor:
A / B

Test Data

Clock Time Start: 14:10 Pump Count Initial:
Finish: 15:40 Final:

Sampling Time: 90 MINUTES Net:

Volume of Gas Sampled:

Stack Temp °F	Static Pressure in H_2O	Impinger Train Temperature °F A	B
115°F		42°F	30°F
		42	30
		42	30
118°		42	30
120°		42	30
130°		42	30

Moisture Determination

Silica Tube Number:

Pump Type/No.: Calibration Factor:

Clock Time Start: Pump Count Initial:
Finish: Final:

Net: Net:

Volume of Gas Sampled:

Grams H_2O Collected:

CS_2 IMPINGER TRAIN DATA

Plant and City: A.E. STALEY DES MOINES IOWA

Date: 3/15/79 Ambient Temp.: 25-30° Ambient Press.: 29.73

Sampling Location: COOLER Run Number: C-3

Sample Train Description: Double train for Hexane

Pump Type/No.: MSA 46 / 43 Calibration Factor: [illegible]
A / B

Test Data

Clock Time Start: 1645 Pump Count Initial:
Finish: 1815 Final:

Sampling Time: [illegible] Net:

Volume of Gas Sampled: A - 18.157 [illegible] B - 14.[illegible]

Stack Temp °F	Static Pressure in H_2O	Impinger Train Temperature °F A	B
[illegible]0°		46°F	32°F
117°		46	32
115°		46	32
115°		46	32
115°		46	32

Moisture Determination

Silica Tube Number:

Pump Type/No.: Calibration Factor:

Clock Time Start: Pump Count Initial:
Finish: Final:

Net: Net:

Volume of Gas Sampled:

Grams H_2O Collected:

CS_2 IMPINGER TRAIN DATA

Plant and City: STALEY, DES MOINES

Date: 3/15/79 Ambient Temp.: 30°F Ambient Press.: 29.80

Sampling Location: DRYER Run Number: D-1

Sample Train Description: Dry Imp, 4 Bubblers (15 ml CS_2) Dry Impinger

Pump Type/No.: 46 Calibration Factor:

Test Data

Clock Time Start: 8:36 AM ≈ 200 ml/min ~~Pump~~ Count Initial:
Finish: 9:36 Final:

Sampling Time: Net:

Volume of Gas Sampled: 12000 ml at 9°F 29.80 in Hg (13,455.4 STD)

Stack Temp ~~°F~~	Static Pressure in H_2O	Impinger Train Temperature °F
85°C		10°F
		9°F
		8°F
		8°F
		8°F
		9°F

Moisture Determination

Silica Tube Number: 13F-1

Pump Type/No.: SKC # 1 Calibration Factor: 0.524 ml/stroke

Clock Time 8:41 AM Start: 435235 Pump Count Initial:
Finish: 446185 Final: 0114

Net: Net:

Volume of Gas Sampled: TRAIN ICED up - no sample

Grams H_2O Collected:

CS_2 IMPINGER TRAIN DATA

Plant and City: Staley Des Moines Iowa (EPA Hexane)

Date: 3/15/79 Ambient Temp.: 10°C Ambient Press.:

Sampling Location: Dryer Run Number: #2A

Sample Train Description: 1st Impinger Dry, 3 bubblers 15mls CS_2, Dry Impinger

Pump Type/No.: 44 MSA Calibration Factor: ≃ ~~200~~ 158.3 ml/min ↑check

Test Data

Clock Time Start: 14:06 Pump Count Initial:
Finish: 15:21 Final:

Sampling Time: Net:

Volume of Gas Sampled:

Stack Temp ~~°F~~	Static Pressure in H_2O	Impinger Train Temperature °F
84°C		50°F
85°C		51°F
86°C		52°F
86°C		52°F
86°C		52°F
86°C		

Moisture Determination

Silica Tube Number:

Pump Type/No.: Calibration Factor:

Clock Time Start: Pump Count Initial:
Finish: Final:

Net: Net:

Volume of Gas Sampled:

Grams H_2O Collected:

CS_2 IMPINGER TRAIN DATA

Plant and City: Staley, Des Moines Iowa, (EPA Hexane)

Date: 3/15/79 Ambient Temp.: 10°C Ambient Press.: ______

Sampling Location: Dryer Run Number: #2B

Sample Train Description: Dry Impinger, 3 Bubblers 15 ml's CS_2, Dry Impinger

Pump Type/No.: MSA, ~~#54~~ Calibration Factor: ? ≃ 200 ml/min

Test Data

Clock Time Start: 14:06 ~~2:06~~ ~~Pump Count~~ ≃ 200 ml/min check Initial: ______
Finish: 15:21 Final: ______

Sampling Time: ______ Net: ______

Volume of Gas Sampled: ______

Stack Temp ~~°F~~	Static Pressure in H_2O	Impinger Train Temperature °F
84°C		50°F
85°C		50°F
86°C		50°F
86°C		50°F
86°C		50°F
86°C		

Moisture Determination

Silica Tube Number: ______

Pump Type/No.: ______ Calibration Factor: ______

Clock Time Start: ______ Pump Count Initial: ______
Finish: ______ Final: ______

Net: ______ Net: ______

Volume of Gas Sampled: ______

Grams H_2O Collected: 10 ml collected from impinger #

* @ 14:15 adjusted pump to visibly bubble as train #2A

CS_2 IMPINGER TRAIN DATA

Plant and City: Staley - Des Moines Iowa, (EPA Hexane)

Date: 3/15/79 Ambient Temp.: _____ Ambient Press.: _____

Sampling Location: Dryer Run Number: #3A

Sample Train Description: Dry Impinger, 3 midget bubblers 15ml's CS_2 each, Dry Impinger

Pump Type/No.: MSA, #49 Calibration Factor: ≃ 200ml/min ?

? Check calibration on bubble Calibrator in Cinn. lab. (Jun 4)

Test Data

Clock Time Start: 16:48 ~~Pump Count~~ Initial: _____
Finish: 17:48 Final: _____

Sampling Time: 60 min. Net: _____

Volume of Gas Sampled: ≃ 200ml's/min X 60 min = Vm

* Stack Temp ~~°F~~	Static Pressure in H_2O	Impinger Train Temperature °F
86°C		50°F
85°C		46°F
84°C		46°F
84°C		↓
83°C		↓
83°C		46°F

Moisture Determination

Silica Tube Number: gases Saturated at Ts of *___ °C

Pump Type/No.: _____ Calibration Factor: _____

Clock Time Start: _____ Pump Count Initial: _____
Finish: _____ Final: _____

Net: _____ Net: _____

Volume of Gas Sampled: _____

Grams H_2O Collected: _____

CS_2 IMPINGER TRAIN DATA

Plant and City: Staley, Des Moines, Iowa (EPA Hexane)

Date: 3/15/79 Ambient Temp.: ______ Ambient Press.: ______

Sampling Location: Dryer Run Number: #38

Sample Train Description: Dry Midgett Impinger, 3 midgett bubblers 15 ml's CS_2 each, Dry Impinger

Pump Type/No.: MSA, #54 Calibration Factor: ≃ 200 ml/min?

? Check Calibration in Cinn, hab to Verify. (JWL)

Test Data

Clock Time Start: 16:48 ~~Pump Count~~ N/A Initial: ______

Finish: ______ Final: ______

Sampling Time: 60 min Net: ______

Volume of Gas Sampled: ______

Stack Temp ~~°F~~	Static Pressure in H_2O	Impinger Train Temperature °F
86°C		51°F
85°C		47°F
84°C		46°F
84°C		46°F
83°C		46°F
83°C		46°F

Moisture Determination

Silica Tube Number: ______

Pump Type/No.: ______ Calibration Factor: ______

Clock Time Start: ______ Pump Count Initial: ______

Finish: ______ Final: ______

Net: ______ Net: ______

Volume of Gas Sampled: ______

Grams H_2O Collected: ______

2. VELOCITY DATA: COOLER AND DRYER SITES

PN 3333 N
Dale - 4902
4/10/79

GAS VELOCITY AND VOLUME DATA

PLANT AND CITY	RUN DATE
A.E. STALEY Des Moines	3/14/79

SAMPLING LOCATION	CLOCK TIME
cooler vent	14:30

RUN NUMBER	OPERATOR	AMB. TEMP. (°F)	BAR. PRESS (in. Hg)	STATIC PRESS (in. H_2O)
CV-1	Lewis, Hershey	~ 40	28.93	-2.58

MOLECULAR WT.	STACK INSIDE DIMENSION (in.) DIAM OR SIDE 1	SIDE 2	PITOT TUBE Cp
29.0	60.0		.84

FIELD DATA

TRAVERSE POINT NUMBER	SOUTH PORT ~~POSITION~~ ~~(in.)~~ ΔP_s	NORTH PORT VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMP, °F
1	.90	.30	120
2	.80	.48	
3	.63	.38	
4	.58	.44	
5	.60	.60	
6	.70	.56	
7	.82	.54	
8	.90	.64	
9	.94	.40	
10	.86	.62	
11	.86	.54	
12	.90	.56	
13	.86	.54	
14	.86	.54	
15	.90	.56	
16	.46	.58	
17	.48	.56	
18	.50	.44	
19	.46	.38	
20	.44	.50	
21	.40	.40	
22	.40	.38	
23	.44	.48	
24	.40	.20	
25			

c/8

PEDCo

GAS VELOCITY AND VOLUME DATA

	PLANT AND CITY	RUN DATE
1.	A.E. STALEY	03/15/79

SAMPLING LOCATION	CLOCK TIME
COOLER	16:00

	RUN NUMBER	OPERATOR	AMB. TEMP. (°F)	BAR. PRESS (in. Hg)	STATIC PRESS (in. H_2O)
2.	C-2	WALLAR/HERSHEY	≈28°	29.73	-2.54

MOLECULAR WT.	STACK INSIDE DIMENSION (in.) DIAM OR SIDE 1	SIDE 2	PITOT TUBE Cp
29.0	60.0		.84

left FIELD DATA right

TRAVERSE POINT NUMBER	A port POSITION (in.)	B port VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMP, °F
7, 8, 9, 10	11, 12, 13, 14	25, 26, 27, 28, 29	38, 39, 40, 41
1	0.20	.28	120
2	.20	.24	
3	.46	.40	
4	.56	.44	
5	.58	.60	
6	.62	.68	
7	.60	.58	
8	.62	.64	
9	.62	.62	
10	.62	.60	
11	.56	.59	
12	.54	.62	
13	.54	.52	
14	.56	.54	
15	.58	.54	
16	.57	.52	
17	.54	.56	
18	.56	.60	
19	.58	.54	
20	.58	.54	
21	.54	.60	
22	.52	.50	
23	.50	.58	
24	.48	.52	

GAS VELOCITY AND VOLUME DATA

PLANT AND CITY	RUN DATE
1. A.E. STALEY Des Moines	3/15/79

SAMPLING LOCATION	CLOCK TIME
DRYER VENT	11:10

RUN NUMBER	OPERATOR	AMB. TEMP. (°F)	BAR. PRESS (in. Hg)	STATIC PRESS (in. H_2O)
2. DV-1	Lewis, Hippie	30	29.73	-0.03

MOLECULAR WT.	STACK INSIDE DIMENSION (in.) DIAM OR SIDE 1	SIDE 2	PITOT TUBE Cp
24.49	47.0		.84

% mois 33

41%

FIELD DATA

TRAVERSE POINT NUMBER	POSITION (in.)	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMP, °F
E 1		0.03	170
2		0.03	
3		0.03	
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16		0.03	
N- 1		0.03	
2		0.02	
3		0.02	
4		0.02	
5		0.02	
6		0.05	
7		0.04	
8		0.04	
9		0.03	
10		0.03	
11		0.04	
12		0.04	
13		0.05	
14		0.03	
15		0.04	
16		0.05	

GAS VELOCITY AND VOLUME DATA

PLANT AND CITY	RUN DATE
1. A.E. STALEY Des Moines	3 / 15 / 79

SAMPLING LOCATION	CLOCK TIME
DRYER OUTLET	15:22

RUN NUMBER	OPERATOR	AMB. TEMP. (°F)	BAR. PRESS (in. Hg)	STATIC PRESS (in. H_2O)
2. DV-2	Lewis, Hippie	28	29.73	-0.03

MOLECULAR WT.	STACK INSIDE DIMENSION (in.) DIAM OR SIDE 1	SIDE 2	PITOT TUBE Cp
22.41	47.0		.84

% moisture 5.9, 9

FIELD DATA

TRAVERSE POINT NUMBER	POSITION (in.)	VELOCITY HEAD (Δp_s), in.H_2O	STACK TEMP, °F
E 1		0.03	187
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16		0.03	
N- 1		0.02	
2		0.03	
3		0.03	
4		0.04	
5		0.05	
6		0.05	
7		0.03	
8		0.03	
9		0.03	
10		0.04	
11		0.03	
12		0.02	
13		0.03	
14		0.02	
15		0.02	
16		0.02	

```
!JOB STKVEL,P3333N.PEI,PUB
PRIORITY = DS; INPRI = 10; TIME = UNLIMITED SECONDS
JOB NUMBER = #J460
WED, APR 11, 1979, 10:29 AM
HP3000 / MPE III B.00.02
:RUN STKVELPG.PUB.PEI
```

STACK VELOCITY DATA

PLANT	A. E. STALEY DESMOINES
DATE	03/14/79
SAMPLING LOCATION	COOLER VENT
RUN NUMBER	CU-1
CLOCK TIME	1430
OPERATOR	LEWIS, HERSHEY
AMBIENT TEMP. (DEG.F)	40.
BAR.PRESS.(IN HG)	28.93
STATIC PRESS.(IN H2O)	-2.58
MOLECULAR WEIGHT	29.00
STACK INSIDE DIM(IN)	60.000
PILOT TUBE COEFF.	.84
MOISTURE CONTENT(%)	.00

TRANSVERSE POINT NO.	POSITION INCHES	VELOCITY HEAD (IN H2O)	STACK TEMP (DEG.F)
01	.0	.300	120.
02	.0	.480	120.
03	.0	.380	120.
04	.0	.440	120.
05	.0	.600	120.
06	.0	.560	120.
07	.0	.540	120.
08	.0	.640	120.
09	.9	.400	120.
10	.0	.620	120.
11	.0	.540	120.
12	.0	.560	120.
13	.0	.540	120.
14	.0	.540	120.
15	.0	.560	120.
16	.0	.580	120.
17	.0	.560	120.
18	.0	.440	120.
19	.0	.380	120.
20	.0	.500	120.
21	.0	.400	120.
22	.0	.380	120.
23	.0	.480	120.
24	.0	.200	120.
25	.0	.900	120.
26	.0	.800	120.
27	.0	.630	120.
28	.0	.580	120.
29	.0	.600	120.
30	.0	.700	120.
31	.0	.820	120.
32	.0	.900	120.
33	.0	.940	120.
34	.0	.860	120.
35	.0	.860	120.
36	.0	.900	120.
37	.0	.860	120.

38	.0	.860	120.
39	.0	.900	120.
40	.0	.460	120.
41	.0	.480	120.
42	.0	.500	120.
43	.0	.460	120.
44	.0	.440	120.
45	.0	.400	120.
46	.0	.400	120.
47	.0	.440	120.
48	.0	.400	120.
AVERAGE		.577	120.

PLANT	A. E. STALEY DESMOINES
DATE	03/14/79
SAMPLING LOCATION	COOLER VENT
RUN NUMBER	CU-1

STACK AREA, SQ. FT.	19.635
STACK ABS. PRES., IN HG.	28.74
STACK GAS TEMPERATURE, DEG.F	120.
SQRT(VEL HD X STACK TEMP ABS)	18.1
STACK GAS VELOCITY, ACT. FPS	44.9
STACK GAS VOLUME (WET), ACT. CFM.	52938.6
STACK GAS VOLUME (DRY), ACT. CFM.	52938.6
STACK GAS VOLUME @ 29.92 IN. HG AND 68 DG. F :	
(DRY)	46292.3
(WET)	46292.3

SAMPLE CALCULATIONS

SYMBOLS:

AREA	CROSS-SECTIONAL STACK AREA, SQ FT	PTC	PILOT TUBE COEFFICENT
BPRES	BAROMETRIC PRESSURE, IN HG	SPRES	STATIC PRESSURE, IN H2O
DELP	DELTA P	STEMP	STACK TEMPERATURE, DEG F
DIA	DIAMETER OF CIRCULAR STACK, IN	STPRES	STACK PRESSURE, IN HG
DIM1	LENGTH OF RECTANGULAR STACK, IN	STVEL	STACK VELOCITY, AFPM
DIM2	WIDTH OF RECTANGULAR STACK, IN	TEMP	TEMPERATURE, DEG F
MOIST	MOISTURE CONTENT	VH	VELOCITY HEAD, IN H2O
MW	MOLECULAR WEIGHT	VOLFLD	VOLUMETRIC FLOW (DRY), ACFM
NP	NUMBER OF TRANSVERSE POINTS	VOLFLW	VOLUMETRIC FLOW (WET), ACFM

FORMULAS AND SAMPLE CALCULATIONS:

```
              SUM(SQRT(VH * TEMP))        867.1
       DELP = --------------------  =  ----------  =   18.1
                      NP                   48

       STPRES = BPRES + (SPRES/13.6)  =  28.93 + (-2.58/13.6)  =   28.7 IN HG

              SUM(STEMP)        5760.
       STEMP = ----------  =  ---------  =  120. DEG F
                  NP             48

                                 3.1416 * (DIA/2)**2        3.1416 * ( 60.000/2)**2
       AREA(CIRCULAR STACK)  =  --------------------  =  ------------------------  =   19.635 SQ FT
                                        144                         144

              85.49 * PTC * DELP        85.49 *  .84 *  18.1
       STVEL = -----------------  =  ----------------------  =   44.9 AFPM
              SQRT(MW * STPRES)        SQRT( 29.00 *  28.7 )

       VOLFLW  =  60. * STVEL * AREA  =  60. *  44.9 *  19.635  =   52938.6 ACFM

       VOLFLD  =  (1. - (MOIST/100.)) * VOLFLW  =  (1. - (   .00/100.)) *  52938.6  =   52938.6 ACFM
```

STACK VELOCITY DATA

PLANT	A. E. STALEY
DATE	03/15/79
SAMPLING LOCATION	COOLER
RUN NUMBER	C-2
CLOCK TIME	1600
OPERATOR	WALLAR/HERSHEY
AMBIENT TEMP. (DEG.F)	28.
BAR.PRESS.(IN HG)	29.73
STATIC PRESS.(IN H20)	-2.54
MOLECULAR WEIGHT	29.00
STACK INSIDE DIM(IN)	60.000
PILOT TUBE COEFF.	.84
MOISTURE CONTENT(%)	.00

TRANSVERSE POINT NO.	POSITION INCHES	VELOCITY HEAD (IN H2O)	STACK TEMP (DEG.F)
01	.0	.280	120.
02	.0	.240	120.
03	.0	.400	120.
04	.0	.440	120.
05	.0	.600	120.
06	.0	.680	120.
07	.0	.580	120.
08	.0	.640	120.
09	.0	.620	120.
10	.0	.600	120.
11	.0	.590	120.
12	.0	.620	120.
13	.0	.520	120.
14	.0	.540	120.
15	.0	.540	120.
16	.0	.520	120.
17	.0	.560	120.
18	.0	.600	120.
19	.0	.540	120.
20	.0	.540	120.
21	.0	.600	120.
22	.0	.500	120.
23	.0	.580	120.
24	.0	.520	120.
25	.0	.200	120.
26	.0	.200	120.
27	.0	.460	120.
28	.0	.560	120.
29	.0	.580	120.
30	.0	.620	120.
31	.0	.600	120.
32	.0	.620	120.
33	.0	.620	120.
34	.0	.620	120.
35	.0	.560	120.
36	.0	.540	120.
37	.0	.540	120.

38	.0	.560	120.
39	.0	.580	120.
40	.0	.570	120.
41	.0	.540	120.
42	.0	.560	120.
43	.0	.580	120.
44	.0	.580	120.
45	.0	.540	120.
46	.0	.520	120.
47	.0	.500	120.
48	.0	.480	120.
AVERAGE		.533	120.

PLANT	A. E. STALEY
DATE	03/15/79
SAMPLING LOCATION	COOLER
RUN NUMBER	C-2

STACK AREA, SQ. FT.	19.635
STACK ABS. PRES., IN HG.	29.54
STACK GAS TEMPERATURE, DEG.F	120.
SQRT(VEL HD X STACK TEMP ABS)	17.5
STACK GAS VELOCITY, ACT. FPS	42.9
STACK GAS VOLUME (WET), ACT. CFM.	50486.4
STACK GAS VOLUME (DRY), ACT. CFM.	50486.4
STACK GAS VOLUME @ 29.92 IN. HG AND 68 DG. F :	
(DRY)	45381.3
(WET)	45381.3

SAMPLE CALCULATIONS

SYMBOLS:

AREA	CROSS-SECTIONAL STACK AREA, SQ FT	PTC	PILOT TUBE COEFFICENT
BPRES	BAROMETRIC PRESSURE, IN HG	SPRES	STATIC PRESSURE, IN H2O
DELP	DELTA P	STEMP	STACK TEMPERATURE, DEG F
DIA	DIAMETER OF CIRCULAR STACK, IN	STPRES	STACK PRESSURE, IN HG
DIM1	LENGTH OF RECTANGULAR STACK, IN	STVEL	STACK VELOCITY, AFPM
DIM2	WIDTH OF RECTANGULAR STACK, IN	TEMP	TEMPERATURE, DEG F
MOIST	MOISTURE CONTENT	VH	VELOCITY HEAD, IN H2O
MW	MOLECULAR WEIGHT	VOLFLD	VOLUMETRIC FLOW (DRY), ACFM
NP	NUMBER OF TRANSVERSE POINTS	VOLFLW	VOLUMETRIC FLOW (WET), ACFM

FORMULAS AND SAMPLE CALCULATIONS:

```
          SUM(SQRT(VH * TEMP))         838.4
DELP  =  ----------------------  =  ----------  =   17.5
                  NP                    48

STPRES  =  BPRES + (SPRES/13.6)  =  29.73 + (-2.54/13.6)  =   29.5 IN HG

           SUM(STEMP)          5760.
STEMP  =  ------------  =  ----------  =  120. DEG F
               NP               48

                         3.1416 * (DIA/2)**2        3.1416 * ( 60.000/2)**2
AREA(CIRCULAR STACK)  =  --------------------  =  -------------------------  =   19.635 SQ FT
                                 144                          144

          85.49 * PTC * DELP          85.49 *  .84 *   17.5
STVEL  =  --------------------  =  -----------------------  =   42.9 AFPM
           SQRT(MW * STPRES)         SQRT( 29.00 *  29.5 )

VOLFLW  =  60. * STVEL * AREA  =  60. *  42.9 *  19.635  =   50486.4 ACFM

VOLFLD  =  (1. - (MOIST/100.)) * VOLFLW  =  (1. - (   .00/100.)) *  50486.4  =   50486.4 ACFM
```

STACK VELOCITY DATA

PLANT A. E. STALEY DESMOINES
DATE 03/15/79
SAMPLING LOCATION DRYER VENT
RUN NUMBER DU-1

CLOCK TIME 1110
OPERATOR LEWIS, HIPPLE
AMBIENT TEMP. (DEG.F) 30.
BAR.PRESS.(IN HG) 29.73
STATIC PRESS.(IN H2O) -.03
MOLECULAR WEIGHT 24.49
STACK INSIDE DIM(IN) 47.000
PILOT TUBE COEFF. .84
MOISTURE CONTENT(%) 41.00

TRANSVERSE POINT NO.	POSITION INCHES	VELOCITY HEAD (IN H2O)	STACK TEMP (DEG.F)
E-01	.0	.030	170.
E-02	.0	.030	170.
E-03	.0	.030	170.
E-04	.0	.030	170.
E-05	.0	.030	170.
E-06	.0	.030	170.
E-07	.0	.030	170.
E-08	.0	.030	170.
E-09	.0	.030	170.
E-10	.0	.030	170.
E-11	.0	.030	170.
E-12	.0	.030	170.
E-13	.0	.030	170.
E-14	.0	.030	170.
E-15	.0	.030	170.
E-16	.0	.030	170.
N-01	.0	.030	170.
N-02	.0	.020	170.
N-03	.0	.020	170.
N-04	.0	.020	170.
N-05	.0	.020	170.
N-06	.0	.050	170.
N-07	.0	.040	170.
N-08	.0	.040	170.
N-09	.0	.030	170.
N-10	.0	.030	170.
N-11	.0	.040	170.
N-12	.0	.040	170.
N-13	.0	.050	170.
N-14	.0	.030	170.
N-15	.0	.040	170.
N-16	.0	.050	170.
AVERAGE		.032	170.

PLANT	A. E. STALEY DESMOINES
DATE	03/15/79
SAMPLING LOCATION	DRYER VENT
RUN NUMBER	DU-1
STACK AREA, SQ. FT.	12.048
STACK ABS. PRES., IN HG.	29.73
STACK GAS TEMPERATURE, DEG.F	170.
SQRT(VEL HD X STACK TEMP ABS)	4.5
STACK GAS VELOCITY, ACT. FPS	11.9
STACK GAS VOLUME (WET), ACT. CFM.	8602.7
STACK GAS VOLUME (DRY), ACT. CFM.	5079.6
STACK GAS VOLUME @ 29.92 IN. HG AND 68 DG. F :	
(DRY)	4226.5
(WET)	7163.6

SAMPLE CALCULATIONS

SYMBOLS:

AREA	CROSS-SECTIONAL STACK AREA, SQ FT	PTC	PILOT TUBE COEFFICENT
BPRES	BAROMETRIC PRESSURE, IN HG	SPRES	STATIC PRESSURE, IN H2O
DELP	DELTA P	STEMP	STACK TEMPERATURE, DEG F
DIA	DIAMETER OF CIRCULAR STACK, IN	STPRES	STACK PRESSURE, IN HG
DIM1	LENGTH OF RECTANGULAR STACK, IN	STVEL	STACK VELOCITY, AFPM
DIM2	WIDTH OF RECTANGULAR STACK, IN	TEMP	TEMPERATURE, DEG F
MOIST	MOISTURE CONTENT	VH	VELOCITY HEAD, IN H2O
MW	MOLECULAR WEIGHT	VOLFLD	VOLUMETRIC FLOW (DRY), ACFM
NP	NUMBER OF TRANSVERSE POINTS	VOLFLW	VOLUMETRIC FLOW (WET), ACFM

FORMULAS AND SAMPLE CALCULATIONS:

```
               SUM(SQRT(VH * TEMP))          143.1
DELP    =    ----------------------  =  ----------  =      4.5
                      NP                     32

STPRES  =  BPRES + (SPRES/13.6)  =  29.73 + ( -.03/13.6)  =    29.7 IN HG

               SUM(STEMP)              5440.
STEMP   =    -------------  =  ----------  =  170. DEG F
                   NP                  32

                            3.1416 * (DIA/2)**2          3.1416 * ( 47.000/2)**2
AREA(CIRCULAR STACK)  =  ---------------------  =  --------------------------  =   12.048 SQ FT
                                  144                          144

          85.49 * PTC * DELP          85.49 * .84 *    4.5
STVEL  =  --------------------  =  -----------------------  =   11.9 AFPM
          SQRT(MW * STPRES)         SQRT( 24.49 *  29.7 )

VOLFLW  =  60. * STVEL * AREA  =  60. * 11.9 * 12.048  =    8602.7 ACFM

VOLFLD  =  (1. - (MOIST/100.)) * VOLFLW  =  (1. - ( 41.00/100.)) *   8602.7  =    5075.6 ACFM
```

STACK VELOCITY DATA

PLANT	A. E. STALEY DESMOINES
DATE	03/15/79
SAMPLING LOCATION	DRYER OUTLET
RUN NUMBER	DU-2
CLOCK TIME	1522
OPERATOR	LEWIS, HIPPLE
AMBIENT TEMP. (DEG.F)	28.
BAR.PRESS.(IN HG)	29.73
STATIC PRESS.(IN H2O)	-.03
MOLECULAR WEIGHT	22.41
STACK INSIDE DIM(IN)	47.000
PILOT TUBE COEFF.	.84
MOISTURE CONTENT(%)	39.90

TRANSVERSE POINT NO.	POSITION INCHES	VELOCITY HEAD (IN H2O)	STACK TEMP (DEG.F)
E-01	.0	.030	187.
E-02	.0	.030	187.
E-03	.0	.030	187.
E-04	.0	.030	187.
E-05	.0	.030	187.
E-06	.0	.030	187.
E-07	.0	.030	187.
E-08	.0	.030	187.
E-09	.0	.030	187.
E-10	.0	.030	187.
E-11	.0	.030	187.
E-12	.0	.030	187.
E-13	.0	.030	187.
E-14	.0	.030	187.
E-15	.0	.030	187.
E-16	.0	.030	187.
N-01	.0	.020	187.
N-02	.0	.030	187.
N-03	.0	.030	187.
N-04	.0	.040	187.
N-05	.0	.050	187.
N-06	.0	.050	187.
N-07	.0	.030	187.
N-08	.0	.030	187.
N-09	.0	.030	187.
N-10	.0	.040	187.
N-11	.0	.030	187.
N-12	.0	.020	187.
N-13	.0	.030	187.
N-14	.0	.020	187.
N-15	.0	.020	187.
N-16	.0	.020	187.
AVERAGE		.030	187.

PLANT	A. E. STALEY DESMOINES
DATE	03/15/79
SAMPLING LOCATION	DRYER OUTLET
RUN NUMBER	DU-2

STACK AREA, SQ. FT.	12.048
STACK ABS. PRES., IN HG.	29.73
STACK GAS TEMPERATURE, DEG.F	187.
SQRT(VEL HD X STACK TEMP ABS)	4.4
STACK GAS VELOCITY, ACT. FPS	12.2
STACK GAS VOLUME (WET), ACT. CFM.	8853.7
STACK GAS VOLUME (DRY), ACT. CFM.	3550.3
STACK GAS VOLUME @ 29.92 IN. HG AND 68 DG. F :	
(DRY)	2878.7
(WET)	7178.9

SYMBOLS:

AREA	CROSS-SECTIONAL STACK AREA, SQ FT	PTC	PILOT TUBE COEFFICENT
BPRES	BAROMETRIC PRESSURE, IN HG	SPRES	STATIC PRESSURE, IN H2O
DELP	DELTA P	STEMP	STACK TEMPERATURE, DEG F
DIA	DIAMETER OF CIRCULAR STACK, IN	STPRES	STACK PRESSURE, IN HG
DIM1	LENGTH OF RECTANGULAR STACK, IN	STVEL	STACK VELOCITY, AFPM
DIM2	WIDTH OF RECTANGULAR STACK, IN	TEMP	TEMPERATURE, DEG F
MOIST	MOISTURE CONTENT	VH	VELOCITY HEAD, IN H2O
MW	MOLECULAR WEIGHT	VOLFLD	VOLUMETRIC FLOW (DRY), ACFM
NP	NUMBER OF TRANSVERSE POINTS	VOLFLW	VOLUMETRIC FLOW (WET), ACFM

FORMULAS AND SAMPLE CALCULATIONS:

```
               SUM(SQRT(VH * TEMP))           140.9
       DELP  =  ---------------------  =  ----------  =     4.4
                        NP                     32

       STPRES  =  BPRES + (SPRES/13.6)  =  29.73 + ( -.03/13.6)  =   29.7 IN HG

                 SUM(STEMP)          5984.
       STEMP  =  ------------  =  ----------  =  187. DEG F
                     NP               32

                                  3.1416 * (DIA/2)**2       3.1416 * ( 47.000/2)**2
       AREA(CIRCULAR STACK)  =  ---------------------  =  -------------------------  =   12.048 SQ FT
                                         144                         144

              85.49 * PTC * DELP        85.49 *  .84 *    4.4
       STVEL  =  ---------------------  =  -----------------------  =   12.2 AFPM
              SQRT(MW * STPRES)         SQRT( 22.41 *  29.7 )

       VOLFLW  =  60. * STVEL * AREA  =  60. *  12.2 *  12.048  =    8853.7 ACFM

       VOLFLD  =  (1. - (MOIST/100.)) * VOLFLW  =  (1. - ( 59.90/100.)) *   8853.7  =    3550.3 ACFM
```

STACK VELOCITY DATA

PLANT	A. E. STALEY DESMOINES
DATE	03/15/79
SAMPLING LOCATION	DRYER VENT
RUN NUMBER	DU-3
CLOCK TIME	1551
OPERATOR	LEWIS, HIPPLE
AMBIENT TEMP. (DEG.F)	28.
BAR.PRESS.(IN HG)	29.73
STATIC PRESS.(IN H2O)	-.02
MOLECULAR WEIGHT	23.21
STACK INSIDE DIM(IN)	47.000
PILOT TUBE COEFF.	.84
MOISTURE CONTENT(%)	52.60

TRANSVERSE POINT NO.	POSITION INCHES	VELOCITY HEAD (IN H2O)	STACK TEMP (DEG.F)
E-01	.0	.030	181.
E-02	.0	.030	181.
E-03	.0	.030	181.
E-04	.0	.030	181.
E-05	.0	.030	181.
E-06	.0	.030	181.
E-07	.0	.030	181.
E-08	.0	.030	181.
E-09	.0	.030	181.
E-10	.0	.030	181.
E-11	.0	.030	181.
E-12	.0	.030	181.
E-13	.0	.030	181.
E-14	.0	.030	181.
E-15	.0	.030	181.
E-16	.0	.030	181.
N-01	.0	.020	181.
N-02	.0	.020	181.
N-03	.0	.030	181.
N-04	.0	.040	181.
N-05	.0	.030	181.
N-06	.0	.050	181.
N-07	.0	.050	181.
N-08	.0	.040	181.
N-09	.0	.030	181.
N-10	.0	.040	181.
N-11	.0	.030	181.
N-12	.0	.030	181.
N-13	.0	.030	181.
N-14	.0	.020	181.
N-15	.0	.020	181.
N-16	.0	.010	181.
AVERAGE		.030	181.

```
        PLANT                        A. E. STALEY DESMOINES
        DATE                         05/15/79
        SAMPLING LOCATION            DRYER VENT
        RUN NUMBER                     DH-5

  STACK AREA, SQ. FT.                      12.048
  STACK ABS. PRES., IN. HG.                29.75
  STACK GAS TEMPERATURE, DEG.F            181.
  SQRT(VEL HD X STACK TEMP ABS)             4.4

  STACK GAS VELOCITY, ACT. FPS             11.9
  STACK GAS VOLUME (WET), ACT. CFM.      8656.0
  STACK GAS VOLUME (DRY), ACT. CFM.      4095.6
  STACK GAS VOLUME @ 29.92 IN. HG AND 68 DG. F :
              (DRY)                      3550.4
              (WET)                      7068.0
```

SAMPLE CALCULATIONS

SYMBOLS:

AREA	CROSS-SECTIONAL STACK AREA, SQ FT	PTC	PITOT TUBE COEFFICIENT
BPRES	BAROMETRIC PRESSURE, IN HG	SPRES	STATIC PRESSURE, IN H2O
DELP	DELTA P	STEMP	STACK TEMPERATURE, DEG F
DIA	DIAMETER OF CIRCULAR STACK, IN	STPRES	STACK PRESSURE, IN HG
DIM1	LENGTH OF RECTANGULAR STACK, IN	STVEL	STACK VELOCITY, AFPM
DIM2	WIDTH OF RECTANGULAR STACK, IN	TEMP	TEMPERATURE, DEG F
MOIST	MOISTURE CONTENT	VH	VELOCITY HEAD, IN H2O
MW	MOLECULAR WEIGHT	VOLFLD	VOLUMETRIC FLOW (DRY), ACFM
NP	NUMBER OF TRANSVERSE POINTS	VOLFLW	VOLUMETRIC FLOW (WET), ACFM

FORMULAS AND SAMPLE CALCULATIONS:

$$DELP = \frac{SUM(SQRT(VH * TEMP))}{NP} = \frac{139.8}{32} = 4.4$$

$$STPRES = BPRES + (SPRES/13.6) = 29.73 + (-.02/13.6) = 29.7 \text{ IN HG}$$

$$STEMP = \frac{SUM(STEMP)}{NP} = \frac{5792.}{32} = 181. \text{ DEG F}$$

$$AREA(CIRCULAR\ STACK) = \frac{3.1416 * (DIA/2)**2}{144} = \frac{3.1416 * (47.000/2)**2}{144} = 12.048 \text{ SQ FT}$$

$$STVEL = \frac{85.49 * PTC * DELP}{SQRT(MW * STPRES)} = \frac{85.49 * .84 * 4.4}{SQRT(23.21 * 29.7)} = 11.9 \text{ AFPM}$$

$$VOLFLW = 60. * STVEL * AREA = 60. * 11.9 * 12.048 = 8636.4 \text{ ACFM}$$

$$VOLFLD = (1. - (MOIST/100.)) * VOLFLW = (1. - (52.60/100.)) * 8636.4 = 4093.6 \text{ ACFM}$$

PITOT TUBE CALIBRATION

The pitot tubes used in sampling were constructed by PEDCo Environmental and met all requirements of Method 2, section 4.1 of the Federal Register*. Therefore, a baseline coefficient of 0.84 was assigned to each pitot tube. See Figures E-4 and E-5 for alignment requirements of Method 2.

* Federal Register, Vol. 42, No. 160, August 18, 1977.

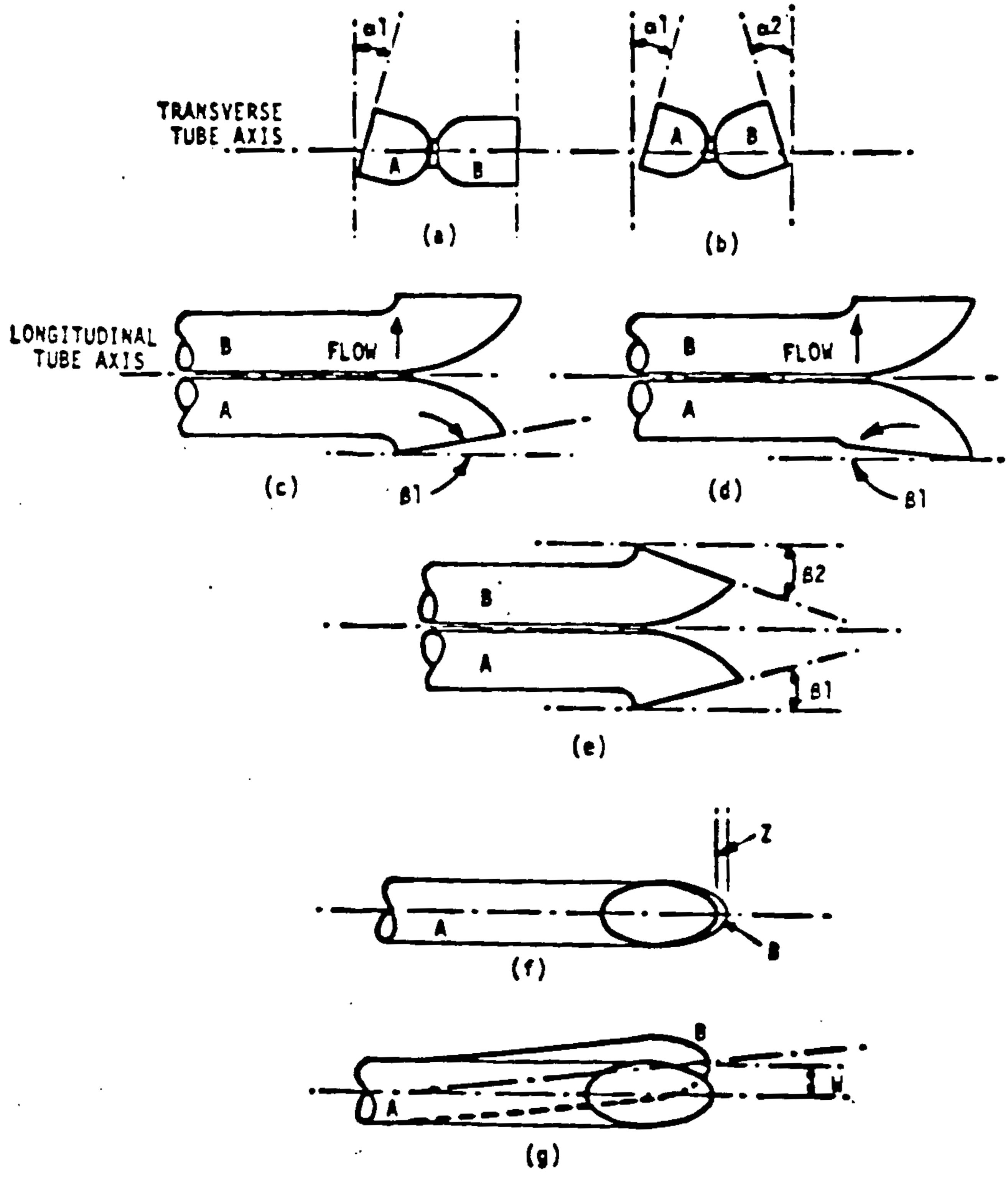


Figure E-5 Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect Cp so long as a_1 and a_2 <10°, β_1 and β_2 <5°, z <0.32 cm (1/8 in.) and w<0.08 cm (1/32 in.).

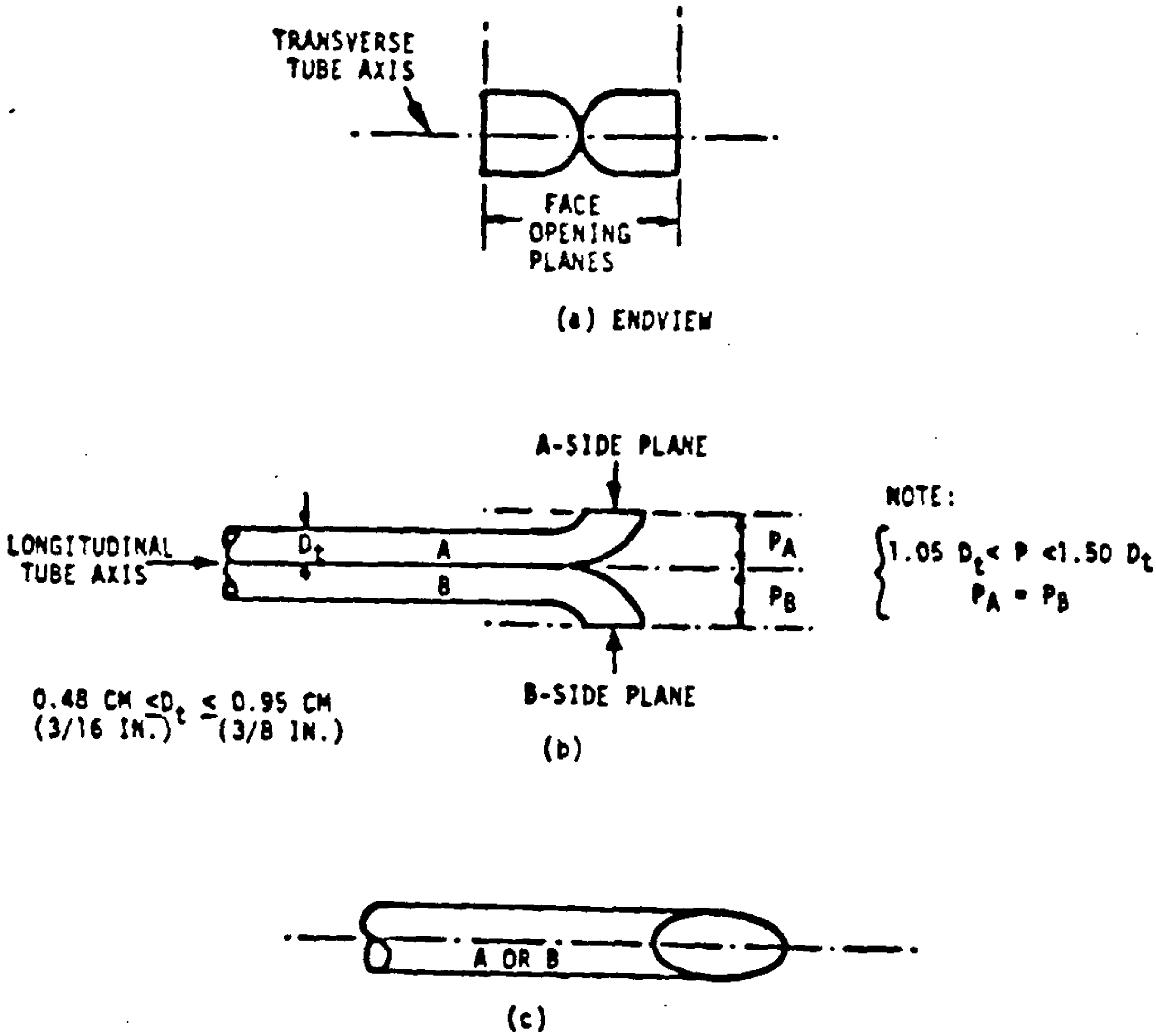


Figure E-4 Properly constructed Type S pitot tube, shown in: (a) end view; face opening planes perpendicular to transverse axis; (b) top view; face opening planes parallel to longitudinal axis; (c) side view; both legs of equal length and centerlines coincident, when viewed from both sides. Baseline coefficient values of 0.84 may be assigned to pitot tubes constructed this way.

APPENDIX C

PROJECT PARTICIPANTS

PROJECT PARTICIPANTS

Name	Affiliation	Title/Function
Nancy McLaughlin	EMB/USEPA	Project Technical Manager
Dale Hershey	PEI	Test Team Leader
Ali Khalifa	PEI	Project Chemist
Jerry Lewis	PEI	Source Test Technician
Jana Wallar	PEI	Source Test Technician
Gary Hipple	PCS	Subcontractor - Testing

EMB - Emission Measurement Branch - U.S. EPA
PEI - PEDCo Environmental, Inc.
PCS - Pollution Control Science, Inc.

APPENDIX D

SAMPLING LOG

SAMPLING LOG

Date	Time	Activity
3/12/79	9:00 - 12:00	Test teams from PEI and PCS arrive, begin set up of laboratory and equipment.
	13:00 - 16:00	Personnel from EMB and RTI arrive. Initial inspection of test sites.
3/13/79	8:00 - 11:00	Test team sets up for first test.
	11:24 - 12:09	Test 1 on mineral oil scrubber.
	12:10 - 15:17	Lunch break, clean up trains, begin analysis, prepare for Test 2.
	15:17 - 16:02	Test 2 MOS.
	16:02 - 17:00	Clean up 2nd test and set up for 3rd.
	17:00 - 17:45	Test 3 at MOS.
	18:30	Test team leaves for the day.
3/14/79	8:00 - 10:30	Initial set up on cooler and dryer sites.
	11:00 - 12:00	PCS conducts initial filter check test on meal dryer site.
	12:00 - 13:00	Lunch break.
	13:00 - 16:00	High winds cause cancellation of testing. Test team leaves for the day.
3/15/79	8:00 - 8:41	Set up for first test.
	8:41 - 9:50	Test 1 on cooler and dryer sites.