

ENTROPY

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OCT 05 1992

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SOURCE EMISSIONS TESTING FINAL TEST REPORT

VOLUME I

POOLED SOURCE TESTING OF A RIG DIESEL-FIRED INTERNAL COMBUSTION ENGINE

Source Location:

Halliburton Equipment Yard

Bakersfield, California 93309

Test Date(s): July 29 Through 31, 1992

Issue Date: October 2, 1992

Conducted for:

Western States Petroleum Association
901 Tower Way, Suite 300
Bakersfield, California 93309

Conducted by:

Entropy Environmentalists, Inc.
EEI No.: 30037

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SAN JOAQUIN VALLEY AIR QUALITY DISTRICT
APCD—SOUTHERN REGION

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SPECIALISTS IN AIR EMISSIONS TESTING

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1.0 INTRODUCTION

1.1 Source Information

Name and Address: Halliburton Equipment Yard
34722 7th Standard Road
Bakersfield, CA 93380

Source(s) Tested: Diesel-Fired I.C. Engine for Rigs

Contact(s): Mr. Bill Brelih

Phone Number: (805) 393-8111

1.2 Testing Firm Information

Name and Address: Entropy Environmentalists, Inc.
5932 Bolsa Avenue, Suite 105
Huntington Beach, CA 92649

Contact: Mr. Tony Wong

Phone Number: (714) 373-0998

Subcontractors: Alta Analytical Laboratory Inc.
5070 Robert J. Matthew, Suite 2
El Dorado Hills, CA 95630

Performance Analytical Inc.
20954 Osborne Street
Canoga Park, CA 91340

West Coast Analytical Service, Inc.
9840 Alburdis Avenue
Santa Fe Spring, CA 90670

Core Laboratories
3700 Cherry Avenue
Long Beach, CA 90807

1.3 Test Information

Test Requested By: Western States Petroleum Association
901 Tower Way, Suite 300
Bakersfield, CA 93309

Contact(s) Mr. Micheal Emanuel

Purpose of Test: AB 2588 Toxic Emission Inventory

Test Date(s): July 29 Through 31, 1992

1.4 Test Personnel

Test Coordinator(s): Mr. Micheal Emanuel
Western States Petroleum Association

Entropy Test Personnel: Miguel Chavez
Shawn Graham
Wayne Johnson
Phillip Juneau
Gary Mata
Clyde Nack
Tony Wong

2.0 TEST RESULTS AND DATA PRESENTATION

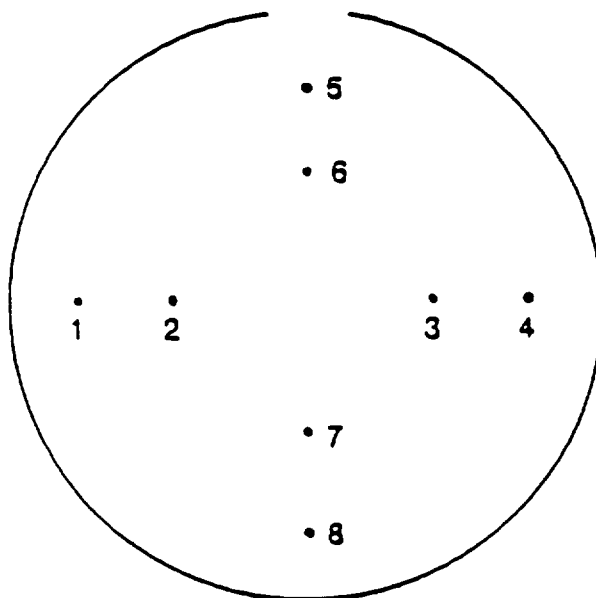
The results of the testing are summarized as listed below.

TEST RESULTS

Source Tested	Sampling Method	Sampling Objective	Table Number	Page Number(s)
Diesel-Fired I.C. Engine	Summary	Emission Factors	2-1	2-2
	CARB Method 5	Particulate	2-2	2-3
	CARB Method 100	CO, NOx, THC, CO ₂ , O ₂	2-3	2-4, 5
	CARB Method 410A	Benzene	2-4	2-6
	CARB Method 422.102	1,3 Butadiene	2-5	2-7
	CARB Method 422	Volatile Organic Compounds	2-6	2-8
	CARB Method 425	Hexavalent Chromium and Total Chromium	2-7	2-9
	CARB Method 429	Polycyclic Aromatic Hydrocarbons	2-8	2-10, 11, 12
	CARB Method 430	Acetaldehyde, Acrolein and Formaldehyde	2-9	2-13
	Blank Data	Background Values	2-10	2-14, 15
		Fuel Analysis	2-11	2-16

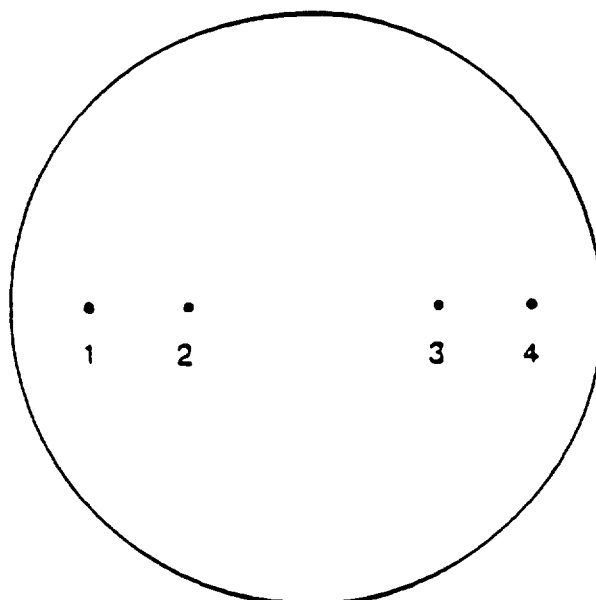
Detailed field data and results tabulations are presented in Appendix A. Example calculations are given in Appendix B. Field data are given in Appendix C. Analytical data are provided in Appendix D. Calibration data are presented in Appendix E. An engine process schematic is shown in Appendix F.

SAMPLING AND VELOCITY TRAVERSE POINT LOCATIONS



Velocity Traverse Points

<u>Point</u>	<u>Distance From Duct Wall</u>
1	0.5 in.
2	1.18 in.
3	3.56 in.
4	4.25 in.



Isokinetic Sampling Traverse Points

TABLE 2-1
SUMMARY OF DIESEL ENGINE EMISSION FACTORS
HALLIBURTON EQUIPMENT YARD

COMPOUND	LBS/MMBTU	LBS/MGAL
Condensable Particulate	1.400E-01	1.908E+01
Filterable Particulate	1.180E-01	1.609E+01
Total Particulate	2.570E-01	3.503E+01
Carbon Monoxide (CO)	1.000	136.3
Nitrogen Oxides (NOx)	1.910	260.4
Total Hydrocarbons as Methane	3.310	451.2
Benzene	1.820E-03	2.481E-01
1,3-Butadiene	3.170E-03	4.321E-01
Ethylbenzene	7.960E-05	1.085E-02
n-Hexane	1.970E-04	2.685E-02
Toluene	1.160E-03	1.581E-01
m- & p-Xylenes	2.460E-04	3.353E-02
o-Xylene	1.100E-04	1.499E-02
Total Xylenes	3.600E-04	4.907E-02
Hexavalent Chromium	4.290E-07	5.848E-05
Total Chromium	4.550E-06	6.202E-04
Acenaphthene	1.734E-05	2.364E-03
Acenaphthylene	1.716E-05	2.339E-03
Anthracene	1.660E-06	2.263E-04
Benz(a)anthracene *	6.933E-06	9.451E-04
Benzo(b)fluoranthene *	8.676E-07	1.183E-04
Benzo(k)fluoranthene *	4.088E-07	5.573E-05
Benzo(g,h,i)perylene	2.238E-07	3.051E-05
Benzo(a)pyrene *	7.279E-08	9.922E-06
Chrysene *	6.936E-06	9.455E-04
Dibenz(a,h)anthracene *	5.501E-08	7.499E-06
Fluoranthene	6.556E-06	8.937E-04
Fluorene	6.552E-05	8.931E-03
Indeno(1,2,3-c,d)pyrene *	2.026E-07	2.762E-05
Napthalene	1.869E-04	2.548E-02
Phenanthrene	2.949E-04	4.020E-02
Pyrene	1.368E-05	1.865E-03
Total Seven Listed Carcinogenic PAH *	1.548E-05	2.110E-03
Acetaldehyde	6.170E-03	8.411E-01
Acrolein	4.310E-04	5.875E-02
Formaldehyde	1.270E-02	1.731E+00
METALS BY MASS BALANCE		
Arsenic	1.318E-05	1.797E-03
Beryllium	1.318E-05	1.797E-03
Cadmium	5.272E-06	7.186E-04
Copper	5.272E-06	7.186E-04
Lead	2.636E-05	3.593E-03
Mercury	2.636E-05	3.593E-03
Nickel	5.272E-06	7.186E-04
Selenium	2.636E-05	3.593E-03
Zinc	2.812E-05	3.833E-03

* AB2588 Listed Carcinogen

** Basis = 136.314 MMBtu/Mgallon

TABLE 2-2
PARTICULATE - CARB METHOD 5
HALLIBURTON EQUIPMENT YARD

	<u>M5-1</u>	<u>M5-2</u>	<u>M5-3</u>	<u>Average</u>
Moisture Content, Percent by Volume	4.8	5.3	4.8	5.0
Carbon Dioxide, Percent by Volume	3.1	3.1	3.0	3.1
Oxygen, Percent by Volume	16.7	16.6	16.8	16.7
Temperature, Degrees F	314	313	302	310
Volumetric Flow Rate, SCFM	303	303	305	304
<u>Condensible Particulate</u>				
Concentration, Grains per DSCM	2.26E-02	2.31E-02	1.76E-02	2.11E-02
Emission Rate, Pounds per Hour	5.86E-02	6.00E-02	4.60E-02	5.49E-02
Emission Factor, Pounds per Million Btu	1.45E-01	1.50E-01	1.23E-01	1.40E-01
<u>Filterable Particulate</u>				
Concentration, Grains per DSCM	1.85E-02	1.73E-02	1.74E-02	1.77E-02
Emission Rate, Pounds per Hour	4.81E-02	4.50E-02	4.54E-02	4.62E-02
Emission Factor, Pounds per Million Btu	1.19E-01	1.13E-01	1.21E-01	1.18E-01
<u>Total Particulate</u>				
Concentration, Grains per DSCM	4.11E-02	4.04E-02	3.49E-02	3.88E-02
Emission Rate, Pounds per Hour	1.07E-01	1.05E-01	9.14E-02	1.01E-01
Emission Factor, Pounds per Million Btu	2.65E-01	2.63E-01	2.44E-01	2.57E-01

TABLE 2-3

CO, NO_x, THC, CO₂, O₂ - CARB METHOD 100

HALLIBURTON EQUIPMENT YARD

	<u>M100-1</u>	<u>M100-2</u>	<u>M100-3</u>	<u>AVERAGE</u>
IDLE:				
Volumetric Flow Rates	192	189	181	187
Oxygen Percent	18.9	18.9	19.0	18.9
Carbon Dioxide Percent	1.50	1.50	1.50	1.50
Carbon Monoxide (CO)				
Concentration, Parts per Million, ppm	176	177	168	174
Emission Rate, Pounds per Hour, lb/hr	0.148	0.146	0.133	0.142
Emission Factor, Pounds per Million Btu, lb/MMBtu	1.21	1.26	1.29	1.25
Nitrogen Oxides (NO_x)				
Concentration, Parts per Million, ppm	116	114	189	140
Emission Rate, Pounds per Hour, lb/hr	0.160	0.154	0.245	0.186
Emission Factor, Pounds per Million Btu, lb/MMBtu	1.31	1.34	2.38	1.68
Total Hydrocarbons as Methane				
Concentration, Parts per Million, ppm	271	249	265	262
Emission Rate, Pounds per Hour, lb/hr	0.518	0.469	0.477	0.488
Emission Factor, Pounds per Million Btu, lb/MMBtu	4.26	4.06	4.64	4.32
HIGH:				
Volumetric Flow Rates	636	646	675	652
Oxygen Percent	10.0	9.8	10.3	10.0
Carbon Dioxide Percent	7.80	7.90	7.50	7.73
Carbon Monoxide (CO)				
Concentration, Parts per Million, ppm	206	207	175	196
Emission Rate, Pounds per Hour, lb/hr	0.579	0.591	0.523	0.564
Emission Factor, Pounds per Million Btu, lb/MMBtu	0.260	0.266	0.241	0.256
Nitrogen Oxides (NO_x)				
Concentration, Parts per Million, ppm	1256	1253	1137	1215
Emission Rate, Pounds per Hour, lb/hr	5.80	5.87	5.57	5.75
Emission Factor, Pounds per Million Btu, lb/MMBtu	2.61	2.64	2.57	2.61
Total Hydrocarbons as Methane				
Concentration, Parts per Million, ppm	93.2	94.0	93.9	93.7
Emission Rate, Pounds per Hour, lb/hr	0.598	0.612	0.640	0.617
Emission Factor, Pounds per Million Btu, lb/MMBtu	0.269	0.276	0.295	0.280

TABLE 2-3 (Continued)
CO, NO_x, THC, CO₂, O₂ - CARB METHOD 100
HALLIBURTON EQUIPMENT YARD

	<u>M100-1</u>	<u>M100-2</u>	<u>M100-3</u>	<u>AVERAGE</u>
TIME WEIGHTED AVERAGE:				
Volumetric Flow Rates	303	303	305	304
Oxygen Percent	16.7	16.6	16.8	16.7
Carbon Monoxide Percent	3.1	3.1	3.0	3.1
Carbon Monoxide (CO)				
Concentration, Parts per Million, ppm	183	184	170	179
Emission Rate, Pounds per Hour, lb/hr	0.256	0.257	0.231	0.248
Emission Factor, Pounds per Million Btu, lb/MMBtu	0.973	1.01	1.03	1.00
Nitrogen Oxides (NO _x)				
Concentration, Parts per Million, ppm	401	399	426	409
Emission Rate, Pounds per Hour, lb/hr	1.569	1.583	1.576	1.576
Emission Factor, Pounds per Million Btu, lb/MMBtu	1.63	1.66	2.43	1.91
Total Hydrocarbons as Methane				
Concentration, Parts per Million, ppm	227	210	222	220
Emission Rate, Pounds per Hour, lb/hr	0.538	0.505	0.518	0.520
Emission Factor, Pounds per Million Btu, lb/MMBtu	3.26	3.11	3.55	3.31

TABLE 2-4

BENZENE - CARB METHOD 410A

HALLIBURTON EQUIPMENT YARD

	<u>M410A-1</u>	<u>M410A-2</u>	<u>M410A-3</u>	<u>Average</u>
Volumetric Flow Rate, SCFM	303	303	305	304
<u>Benzene</u>				
Concentration, Parts Per Billion by Volume	220	190	170	193
Concentration, Micrograms per DSCM	726	627	561	638
Emission Rate, Pounds per Hour	8.11E-04	7.00E-04	6.31E-04	7.14E-04
Emission Factor, Pounds per Million Btu	2.01E-03	1.76E-03	1.69E-03	1.82E-03

TABLE 2-5

1,3-BUTADIENE - CARB METHOD 422.102

HALLIBURTON EQUIPMENT YARD

		<u>M422.102-1</u>	<u>M422.102-2</u>	<u>M422.102-3</u>	<u>Average</u>
Volumetric Flow Rate, SCFM	75%	192	189	181	187
	25%	636	646	675	652
Time Average Volumetric Flow Rate		303	303	305	304
<u>1,3-Butadiene</u>					
Concentration, Parts Per Million by Volume		0.530	0.557	0.375	0.487
Concentration, Micrograms per DSCM		1211	1272	857	1113
Emission Rate, Pounds per Hour		1.35E-03	1.42E-03	9.63E-04	1.25E-03
Emission Factor, Pounds per Million Btu		3.35E-03	3.57E-03	2.58E-03	3.17E-03

TABLE 2-6

VOLATILE ORGANIC COMPOUNDS - CARB METHOD 422

HALLIBURTON EQUIPMENT YARD

	<u>M422-1</u>	<u>M422-2</u>	<u>M422-3</u>	<u>Average</u>
Volumetric Flow Rate, SCFM	303	303	305	304
<u>Ethylbenzene</u>				
Concentration, Parts Per Billion by Volume	9.20	5.50	4.10	6.27
Concentration, Micrograms per DSCM	41.3	24.7	18.4	28.1
Emission Rate, Pounds per Hour	4.61E-05	2.75E-05	2.07E-05	3.14E-05
Emission Factor, Pounds per Million Btu	1.14E-04	6.91E-05	5.53E-05	7.96E-05
<u>n-Hexane</u>				
Concentration, Parts Per Billion by Volume	4.0	11.0	40.0	18.3
Concentration, Micrograms per DSCM	14.6	40.0	145.6	66.7
Emission Rate, Pounds per Hour	1.63E-05	4.47E-05	1.64E-04	7.49E-05
Emission Factor, Pounds per Million Btu	4.03E-05	1.12E-04	4.38E-04	1.97E-04
<u>Toluene</u>				
Concentration, Parts Per Billion by Volume	100	120	94.0	105
Concentration, Micrograms per DSCM	389	467	366	407
Emission Rate, Pounds per Hour	4.35E-04	5.22E-04	4.11E-04	4.56E-04
Emission Factor, Pounds per Million Btu	1.08E-03	1.31E-03	1.10E-03	1.16E-03
<u>m-&p-Xylenes</u>				
Concentration, Parts Per Billion by Volume	27.0	17.0	14.0	19.3
Concentration, Micrograms per DSCM	121	76.2	62.8	86.7
Emission Rate, Pounds per Hour	1.35E-04	8.52E-05	7.06E-05	9.70E-05
Emission Factor, Pounds per Million Btu	3.35E-04	2.14E-04	1.89E-04	2.46E-04
<u>o-Xylenes</u>				
Concentration, Parts Per Billion by Volume	11.0	8.60	6.30	8.63
Concentration, Micrograms per DSCM	49.3	38.6	28.2	38.7
Emission Rate, Pounds per Hour	5.51E-05	4.31E-05	3.18E-05	4.33E-05
Emission Factor, Pounds per Million Btu	1.37E-04	1.08E-04	8.49E-05	1.10E-04

TABLE 2-7

HEXAVALENT CHROMIUM AND TOTAL CHROMIUM - CARB METHOD 425

HALLIBURTON EQUIPMENT YARD

	<u>425-1</u>	<u>425-2</u>	<u>425-3</u>	<u>Average</u>
Moisture Content, Percent by Volume	4.8	4.8	5.1	4.9
Carbon Dioxide, Percent by Volume	3.1	3.1	3.0	3.1
Oxygen, Percent by Volume	16.7	16.6	16.8	16.7
Temperature, Degrees F	314	313	302	310
Volumetric Flow Rate, SCFM	303	303	305	304
<u>Hexavalent Chromium</u>				
Concentration, Micrograms per DSCM	0.0958	0.1077	0.2324	0.1453
Emission Rate, Pounds per Hour	1.09E-07	1.22E-07	2.65E-07	1.65E-07
Emission Rate, Pounds per Million Btu	2.70E-07	3.07E-07	7.10E-07	4.29E-07
<u>Total Chromium</u>				
Concentration, Micrograms per DSCM	1.76	1.24	1.689	1.56
Emission Rate, Pounds per Hour	2.00E-06	1.41E-06	1.93E-06	1.78E-06
Emission Rate, Pounds per Million Btu	4.95E-06	3.54E-06	5.16E-06	4.55E-06
<u>Fraction Hex Chromium/Total Chromium</u>				
Concentration, Micrograms per DSCM	5.44 %	8.69 %	13.76 %	9.30 %

TABLE 2-8

POLYCYCLIC AROMATIC HYDROCARBONS - CARB METHOD 429

HALLIBURTON EQUIPMENT YARD

	<u>429-1</u>	<u>429-2</u>	<u>429-3</u>	<u>Average</u>
Moisture Content, Percent by Volume	5.1	5.3	4.0	4.8
Carbon Dioxide, Percent by Volume	3.1	3.1	3.0	3.1
Oxygen, Percent by Volume	16.7	16.6	16.8	16.7
Temperature, Degrees F	314	313	302	310
Volumetric Flow Rate, SCFM	303	303	305	304
<u>Acenaphthene</u>				
Concentration, Nanograms per DSCM	6187	5815	5917	5973
Emission Rate, Pounds per Hour	7.02E-06	6.60E-06	6.76E-06	6.79E-06
Emission Factor, Pounds per Million Btu	1.74E-05	1.66E-05	1.81E-05	1.73E-05
<u>Acenaphthylene</u>				
Concentration, Nanograms per DSCM	6187	5214	6299	5900
Emission Rate, Pounds per Hour	7.02E-06	5.92E-06	7.20E-06	6.71E-06
Emission Factor, Pounds per Million Btu	1.74E-05	1.49E-05	1.92E-05	1.72E-05
<u>Anthracene</u>				
Concentration, Nanograms per DSCM	5981	4011	7062	5684
Emission Rate, Pounds per Hour	6.79E-06	4.55E-06	8.07E-06	6.47E-06
Emission Factor, Pounds per Million Btu	1.68E-05	1.14E-05	2.16E-05	1.66E-05
<u>Benz(a)anthracene *</u>				
Concentration, Nanograms per DSCM	2269	2607	2290	2389
Emission Rate, Pounds per Hour	2.57E-06	2.96E-06	2.62E-06	2.72E-06
Emission Factor, Pounds per Million Btu	6.38E-06	7.43E-06	7.00E-06	6.94E-06
<u>Benzo(b)fluoranthene *</u>				
Concentration, Nanograms per DSCM	351	261	286	299
Emission Rate, Pounds per Hour	3.98E-07	2.96E-07	3.27E-07	3.40E-07
Emission Factor, Pounds per Million Btu	9.87E-07	7.43E-07	8.74E-07	8.68E-07
<u>Benzo(k)fluoranthene *</u>				
Concentration, Nanograms per DSCM	227	106	93.5	142
Emission Rate, Pounds per Hour	2.57E-07	1.21E-07	1.07E-07	1.62E-07
Emission Factor, Pounds per Million Btu	6.38E-07	3.03E-07	2.86E-07	4.09E-07
<u>Benzo(g,h,i)perylene</u>				
Concentration, Nanograms per DSCM	105	54.1	72.5	77.3
Emission Rate, Pounds per Hour	1.19E-07	6.14E-08	8.29E-08	8.79E-08
Emission Factor, Pounds per Million Btu	2.96E-07	1.54E-07	2.22E-07	2.24E-07

TABLE 2-8 (CONTINUED)

POLYCYCLIC AROMATIC HYDROCARBONS - CARB METHOD 429

HALLIBURTON EQUIPMENT YARD

	<u>429-1</u>	<u>429-2</u>	<u>429-3</u>	<u>Average</u>
<u>Benzo(a)pyrene *</u>				
Concentration, Nanograms per DSCM	43.3	13.4	19.1	25.3
Emission Rate, Pounds per Hour	4.92E-08	1.52E-08	2.18E-08	2.87E-08
Emission Factor, Pounds per Million Btu	1.22E-07	3.83E-08	5.83E-08	7.28E-08
<u>Benzo(e)pyrene</u>				
Concentration, Nanograms per DSCM	NA	NA	NA	NA
Emission Rate, Pounds per Hour	NA	NA	NA	NA
Emission Factor, Pounds per Million Btu	NA	NA	NA	NA
<u>Chrysene *</u>				
Concentration, Nanograms per DSCM	2475	2406	2290	2390
Emission Rate, Pounds per Hour	2.81E-06	2.73E-06	2.62E-06	2.72E-06
Emission Factor, Pounds per Million Btu	6.96E-06	6.85E-06	7.00E-06	6.94E-06
<u>Dibenz(a,h)anthracene *</u>				
Concentration, Nanograms per DSCM	22.7	13.0	21.0	18.9
Emission Rate, Pounds per Hour	2.57E-08	1.48E-08	2.40E-08	2.15E-08
Emission Factor, Pounds per Million Btu	6.38E-08	3.71E-08	6.41E-08	5.50E-08
<u>Fluoranthene</u>				
Concentration, Nanograms per DSCM	227	3409	3054	2230
Emission Rate, Pounds per Hour	2.57E-07	3.87E-06	3.49E-06	2.54E-06
Emission Factor, Pounds per Million Btu	6.38E-07	9.71E-06	9.33E-06	6.56E-06
<u>Fluorene</u>				
Concentration, Nanograms per DSCM	22685	22058	22904	22549
Emission Rate, Pounds per Hour	2.57E-05	2.50E-05	2.62E-05	2.56E-05
Emission Factor, Pounds per Million Btu	6.38E-05	6.28E-05	7.00E-05	6.55E-05
<u>Indeno(1,2,3-c,d)pyrene *</u>				
Concentration, Nanograms per DSCM	82.5	54.1	72.5	69.7
Emission Rate, Pounds per Hour	9.36E-08	6.14E-08	8.29E-08	7.93E-08
Emission Factor, Pounds per Million Btu	2.32E-07	1.54E-07	2.22E-07	2.03E-07
<u>Naphthalene</u>				
Concentration, Nanograms per DSCM	68055	64168	61078	64434
Emission Rate, Pounds per Hour	7.72E-05	7.28E-05	6.98E-05	7.33E-05
Emission Factor, Pounds per Million Btu	1.92E-04	1.83E-04	1.87E-04	1.87E-04

TABLE 2-8 (CONTINUED)

POLYCYCLIC AROMATIC HYDROCARBONS - CARB METHOD 429

HALLIBURTON EQUIPMENT YARD

	<u>429-1</u>	<u>429-2</u>	<u>429-3</u>	<u>Average</u>
<u>Phenanthrene</u>				
Concentration, Nanograms per DSCM	101052	96252	106887	101397
Emission Rate, Pounds per Hour	1.15E-04	1.09E-04	1.22E-04	1.15E-04
Emission Factor, Pounds per Million Btu	2.84E-04	2.74E-04	3.26E-04	2.95E-04
<u>Pyrene</u>				
Concentration, Nanograms per DSCM	4949	4813	4390	4717
Emission Rate, Pounds per Hour	5.62E-06	5.46E-06	5.02E-06	5.36E-06
Emission Factor, Pounds per Million Btu	1.39E-05	1.37E-05	1.34E-05	1.3682E-05

TABLE 2-9

ACETALDEHYDE, ACROLEIN AND FORMALDEHYDE - CARB METHOD 430

HALLIBURTON EQUIPMENT YARD

	<u>M430-1</u>	<u>M430-2</u>	<u>M430-3</u>	<u>Average</u>
Volumetric Flow Rate, SCFM	303	303	305	304
<u>Acetaldehyde</u>				
Concentration, Micrograms per DSCM	2365	2280	1756	2134
Emission Rate, Pounds per Hour	2.68E-03	2.59E-03	2.01E-03	2.43E-03
Emission Factor, Pounds per Million Btu	6.66E-03	6.49E-03	5.36E-03	6.17E-03
<u>Acrolein</u>				
Concentration, Micrograms per DSCM	155	189	105	149
Emission Rate, Pounds per Hour	1.76E-04	2.14E-04	1.20E-04	1.70E-04
Emission Factor, Pounds per Million Btu	4.36E-04	5.37E-04	3.20E-04	4.31E-04
<u>Formaldehyde</u>				
Concentration, Micrograms per DSCM	4706	5024	3442	4391
Emission Rate, Pounds per Hour	5.34E-03	5.70E-03	3.93E-03	4.99E-03
Emission Rate, Pounds per Million Btu	1.32E-02	1.43E-02	1.05E-02	1.27E-02

TABLE 2-10
BLANK ANALYTICAL RESULTS
HALLIBURTON EQUIPMENT YARD

<u>METHOD</u>	<u>COMPOUND</u>	<u>MATRIX BLANK</u>	<u>RESULTS</u>	<u>DETECTION LIMIT</u>	<u>UNITS</u>
CARB 5	Particulate	Field	19.1	0.1	mg
ARB 410A	Benzene	Method	ND	1.6	ppb
ARB 422	Benzene	Method	ND	1.6	ppb
	Toluene	Method	ND	1.3	ppb
	Ethylbenzene	Method	ND	1.2	ppb
	m-&p-Xylenes	Method	ND	1.2	ppb
	o-Xylene	Method	ND	1.2	ppb
	n-Hexane	Method	ND	1.2	ppb
ARB 425	Hexavalent Chromium	Field	0.72	0.01	ug/l
	Total Chromium	Field	12.4	1	ug/l
ARB 430	Acetaldehyde	Field	38.39	0.03	ug
	Acrolein	Field	29.4	0.03	ug
	Formaldehyde	Field	ND	0.05	ug

ND - Not Detected

TABLE 2-10 (CONTINUED)
BLANK ANALYTICAL RESULTS
HALLIBURTON EQUIPMENT YARD

<u>METHOD</u>	<u>COMPOUND</u>	<u>MATRIX BLANK</u>	<u>RESULTS</u>	<u>DETECTION LIMIT</u>	<u>UNITS</u>
ARB 429	Acenaphthene	Method	ND	10	ng
	Acenaphthylene	Method	ND	10	ng
	Anthracene	Method	ND	10	ng
	Benz(a)anthracene	Method	ND	10	ng
	Benzo(b)fluoranthene	Method	ND	10	ng
	Benzo(k)fluoranthene	Method	ND	10	ng
	Benzo(g,h,i)perylene	Method	ND	10	ng
	Benzo(a)pyrene	Method	ND	10	ng
	Benzo(e)pyrene	Method	NA	NA	ng
	Chrysene	Method	ND	10	ng
	Dibenz(a,h)anthracene	Method	ND	10	ng
	Fluoranthene	Method	ND	10	ng
	Fluorene	Method	13	10	ng
	Indeno(1,2,3-c,d)pyrene	Method	ND	10	ng
	Naphthalene	Method	410	25	ng
	Phenanthrene	Method	36	25	ng
	Pyrene	Method	ND	10	ng
	Acenaphthene	Field	ND	10	ng
	Acenaphthylene	Field	ND	10	ng
	Anthracene	Field	ND	10	ng
	Benz(a)anthracene	Field	ND	10	ng
	Benzo(b)fluoranthene	Field	ND	10	ng
	Benzo(k)fluoranthene	Field	ND	10	ng
	Benzo(g,h,i)perylene	Field	ND	10	ng
	Benzo(a)pyrene	Field	ND	10	ng
	Benzo(e)pyrene	Field	NA	NA	ng
	Chrysene	Field	ND	10	ng
	Dibenz(a,h)anthracene	Field	ND	10	ng
	Fluoranthene	Field	ND	10	ng
	Fluorene	Field	22	10	ng
	Indeno(1,2,3-c,d)pyrene	Field	ND	10	ng
	Naphthalene	Field	590	25	ng
	Phenanthrene	Field	50	25	ng
	Pyrene	Field	ND	10	ng

TABLE 2-11
FUEL ANALYSIS
HALLIBURTON EQUIPMENT YARD

	1	2	3	Averages
Fd, dscf/MMBtu	9058	9388	9598	9348
Fc, scf/MMBtu	1408	1482	1489	1460
BTU/lb	19622	18788	18497	18969
Cetane Index	44.5	44.3	43.8	44.2
Distillation, End Point Deg. F	672	674	680	675
Flash Point(PMCC), Deg. F	162	162	160	161
Heating Value, BTU/lb	19622	18788	18497	18969
Pour Point, Deg. F	-5	-5	-15	-8
Gravity API @ 60 Deg. F, Deg. API	32.4	32.6	33.0	32.7
Viscosity @ 100 Deg. F, cST	3.39	3.30	3.10	3.26
Benzene, ppm v/v	16	0	0	5
Ethylbenzene, ppm v/v	.160	144	171	158
Toluene, ppm v/v	171	129	102	134
Xylene, ppm v/v	704	613	627	648
Napthalenes, Vol. %	10.64	10.48	9.85	10.32
Carbon, % Wt.	86.05	86.72	85.78	86.18
Hydrogen, % Wt.	12.73	12.09	12.81	12.54
Nitrogen, ppm	747	696	620	688
Oxygen, % Wt.	1.11	1.19	1.22	1.17
Total Chlorides, ppm	< 1	2	< 1	< 1
Sulfur, % Wt.	0.4413	0.413	0.388	0.414
Arsenic, ppm/wt	< 0.500	< 0.500	< 0.500	< 0.500
Beryllium, ppm/wt	< 0.500	< 0.500	< 0.500	< 0.500
Cadmium, ppm/wt	< 0.2	< 0.2	< 0.2	< 0.2
Chromium, ppm/wt	< 0.500	< 0.500	< 0.500	< 0.500
Copper, ppm/wt	< 0.2	< 0.2	< 0.2	< 0.2
Lead, ppm/wt	< 1.0	< 1.0	< 1.0	< 1.0
Mercury, ppm/wt	< 1.0	< 1.0	< 1.0	< 1.0
Nickel, ppm/wt	< 0.2	< 0.2	< 0.2	< 0.2
Selenium, ppm/wt	< 1.0	< 1.0	< 1.0	< 1.0
Zinc, ppm/wt	< 1.2	0.8	0.2	0.533

3.0 GENERAL INTRODUCTION

Entropy Environmentalists, Inc. conducted source emissions testing for Western States Petroleum Association (WSPA) at Halliburton equipment yard in Bakersfield, CA. The testing was conducted on the Cummins NTA engine configuration D092331CX02, CPL 463 rated at 2100 RPM. The purpose of the test was to provide WSPA with some of the information needed to establish emission factors and emission rates for substances to be reported in Toxic Emissions Inventory Reports (TEIR). The test results presented will be used to estimate emissions for TIER's.

Below is a test log which shows the source tested, sampling methods, sampling objectives, test dates, and run numbers for the test program.

TEST LOG

Source Tested	Sampling Method	Sampling Objective	Test Date	Run Numbers		
DFIC Engine	CARB Method 5	Particulate	7/29	M5-1	M5-2	M5-3
			7/30			
			7/31			
	CARB Method 100	CO, NOx, THC, CO ₂ , O ₂	7/29	1 & 1A	2 & 2A	3 & 3A
			7/30			
			7/31			
	CARB Method 410A	Benzene	7/29	M410A-1	M410A-2	M410A-3
			7/30			
			7/31			
	CARB Method 422.102	1,3 Butadiene	7/29	1	2	3
			7/30			
			7/31			
	CARB Method 422	Volatile Organic ⁽¹⁾ Compounds	7/29	M422-1	M422-2	M422-3
			7/30			
			7/31			
	CARB Method 425	Hexavalent Chromium And Total Chromium	7/29	M425-1	M425-2	M425-3
			7/30			
			7/31			
	CARB Method 429	PAHs ⁽²⁾	7/29	M429-1	M429-2	M429-3
			7/30			
			7/31			
	CARB Method 430	Acetaldehyde, Acrolein and Formaldehyde	7/29	M430-1	M430-2	M430-3
			7/30			
			7/31			
	Grab Samples	Diesel Fuel ⁽³⁾	7/29	1	2	3
			7/30			
			7/31			

(1) Benzene, Toluene, Ethylbenzene, n-Hexane, Xylene

(2) Polycyclic Aromatic Hydrocarbons

(3) Section 5.11 contains a list of parameters and analytical methods

4.0 SOURCE PROCESS AND EQUIPMENT DESCRIPTION

4.1 Process Description

The engine tested was a Cummins NTA engine configuration D092331CX02, CPL 463 rated at 335 horsepower at 2100 RPM. It was fired with diesel fuel and was equipped with a turbocharger. Emissions of nitrogen oxides (NO_x) were uncontrolled. The engine was fitted with a stack extension to facilitate the testing. A fuel sample was taken from the storage tank during the test each day. The engine design specifications are presented in Appendix F, Table F-1.

4.2 Location Description

Refer to the engine process description shown in Appendix F.

4.3 Process Operation

The process data collected during testing is presented in Appendix F.

5.0 SAMPLING, ANALYTICAL AND QUALITY ASSURANCE PROCEDURES

Following are brief descriptions of the sampling and analytical procedures employed during this test program.

5.1 Sampling Point Determination - EPA Method 1A

EPA Method 1A was used to determine sampling point locations since the stack or duct is less than 12 inches in diameter or 113 square inches in cross-sectional area, but equal to or greater than 4 inches in diameter or 12.57 square inches in cross-sectional area. The flue gas velocity was measured using a standard Pitot downstream of the actual sampling site. A total of 8 sampling points (4 per axis) were used for velocity traverses.

Modified Sampling Method. Due to the small duct diameter and the stack configuration, isokinetic sampling was conducted using four traverse points along the horizontal axis only.

5.2 Flue Gas Velocity and Volumetric Flow Rate - EPA Method 2C

EPA Method 2C was used to determine the flue gas velocity and volumetric flow rate since the stack or duct is less than 12 inches in diameter or 113 square inches in cross-sectional area, but equal to or greater than 4 inches in diameter or 12.57 square inches in cross-sectional area. Velocity measurements were made using Standard instead of Type S Pitot tubes. Gas flow rates were calculated as outlined in EPA Method 2. The flue gas molecular weight was calculated using the O₂ and CO₂ results from CARB Method 100 and the moisture results from the CARB Method 5 sampling train.

5.3 Particulate - CARB Method 5

The sampling procedures outlined in CARB Method 5 were used to determine the particulate emissions.

Sampling Train Design and Operation. Due to the high temperatures (approximately 900°F), the sampling train consisted of a glass nozzle, a heated glass probe, a heated borosilicate glass filter holder with a glass frit filter support, four chilled impingers in series, a pump, a dry gas meter and a calibrated orifice. The impingers were placed in an ice bath to maintain the gas temperature exiting the

last impinger at 68°F or less. The first two impingers contained deionized water. The third impinger was empty, and the fourth impinger contained silica gel.

All glassware was precleaned by washing with soap, tap water and DI water.

Each of the 4 points was sampled for 80 minutes, resulting in a net run time of 320 minutes. The leak check procedures were performed according to the method. A minimum volume of 150 standard cubic feet of source gas was collected.

Sample Recovery. The filter was removed and placed into an amber jar. The contents of the first and second impingers were poured into a glass jar, weighed and the weight recorded. The silica gel was returned to the original tared jar, weighed and the weight recorded.

The volume of water vapor collected in the impingers and silica gel were summed and entered into the moisture content calculations.

The front half of the train including the nozzle, the probe and the connecting glassware was rinsed with acetone into a jar. The first three impingers and the fronthalf of the filter holder were rinsed with acetone into a jar.

Sample Analysis. Analysis was performed by Entropy Environmentalist, Inc.. The particulate mass, which includes any material that condenses at or above the filtration temperature, was determined gravimetrically after removal of unconfined water. The amount of water collected in the sample train was also determined gravimetrically. The particulate catch was itemized as follows: (1) condensable, (2) filterable, (3) and total.

5.4 CO, NO_x, THC, O₂, CO₂ - CARB Method 100

The sampling and analytical procedures outlined in CARB Method 100 were used to measure the concentrations of gaseous species in the flue gas stream using Entropy's CHEM Mobile Laboratory.

Instrumentation and Equipment Description. Sample gas was withdrawn from the source using a heated stainless steel probe with a quartz wool filter attached to the front end. Heated Teflon sample line was used to transport the sample gas to the sample conditioner where the moisture was separated from the gas. A peristaltic pump is used to continuously remove the liquid from the sample

conditioner. The sample gas is then passed through a post-pump condenser for further moisture removal before entering the sample manifold. Flow to each instrument is controlled by flow control valves and meters downstream of the sample manifold. All fittings and material which could contact the sample gas were constructed of either Teflon or stainless steel. Instrument outputs are permanently recorded by a PC-based data acquisition system (DAS) developed by Entropy. The DAS consists of a Toshiba Model 3200SX portable computer, Data Translation, Inc. interface hardware, and software written by Entropy. The DAS reads analyzer signals once each second and prints one-minute and other selectable averages. It also is used to record calibration results. The continuous monitor specifications for the sample system are shown in Table 5-1.

Quality Assurance. Leak check, calibration error, bias, residence time, interference and sampling procedures were performed according to the method. Sample flow rates were monitored to ensure that sample and calibration flow rates to the analyzers were equivalent. Calibrations were conducted at least once per hour by injecting zero and span calibration gases at the probe outlet. The analytical principle for each analyzer is listed in Table 5-1.

TABLE 5-1
DESCRIPTION OF CONTINUOUS EMISSION MONITORING INSTRUMENTATION

Parameter	Manufacturer Model Number	Detection Principle	Range	Minimum Detection % of FS	Noise Level % of FS (peak to peak)
Oxygen	Teledyne 320P-4	Fuel cell	0-10 % 0-25 %	5.0	± 1
Carbon Dioxide	ACS (Fuji) 3300	Non-Dispersive Infrared	0-10 % 0-20 %	0.50	± 0.5
Carbon Monoxide	Thermo Environmental 48	Gas Filter Correlation	0-10 ppm 0-20 0-50 0-100 0-200 0-500 0-1,000	0.2	± 0.02
Nitrogen Oxides	Thermo Environmental 10 with NO ₂ /NO converter	Chemilumin- escence	0-25 ppm 0-100 0-250 0-1,000 0-2,500 0-10,000	1.0	± 0.5
Hydrocarbons	Ratfish RS55	Flame Ionization	0-10 ppm 0-100 0-1,000 0-10,000	1.0	± 0.5

5.5 Benzene - CARB Method 410A

The sampling and analytical procedures outlined in CARB Method 410A were used to determine the benzene emissions.

Sampling Train Design and Operation. The sampling train consisted of a glass probe containing a glass wool filter, a Teflon sample line, two impingers in series, a rotometer, a Tedlar bag enclosed in a rigid container and a dry gas meter.

All glassware was precleaned using soap and tap water, and DI water.

The sampling was conducted for one hour with 75% of the sample time at the idle condition and 25% of the sample time at the high load condition. Due to the changes in stack flow rates for the two conditions, proportional sampling was conducted. Sampling was conducted at approximately 6.25 sccm/min (standard cubic centimeter per minute) and 25 sccm/min during the idle and high load conditions, respectively.

Sample Recovery. The tedlar bag was removed.

Sample Analysis. Analysis was performed by Performance Analytical Inc. The contents of the tedlar bag was analyzed for benzene using a gas chromatographer combined with mass spectrometry (GC/MS).

Quality Assurance. The contents of the tedlar bags were analyzed within 72 hours of sample collection. All components of the sampling train contacting the sample were constructed of glass and Teflon. A method blank was analyzed.

5.6 1,3-Butadiene - CARB Method 422.102

The sampling procedures outlined in CARB Method 422.102 were used to determine 1,3-Butadiene emissions.

Sampling Train Design and Operation. The sampling train consisted of:

Probe. Glass, heated.
Filter holder. Teflon, heated.
Filter. Teflon coated filter paper.
Sampling line. Heated Teflon tubing.
Sampling pump. Leak free pump, with capacity of at least 2 liters per minute.
Valves. Mininert Teflon valves.
Flow meters. Rotometer type, with a measurement range of 0.05 to 1.0 liters per minute.
Alkaline impinger. Teflon, or glass.
Water impinger. Teflon, or glass.
Teflon cross. To split sample after pump.
Teflon tee.

The Gas Chromatographer(GC) will consist of the following components:

GC. Helmet Backyard 5890 with FID(PID optional).
Injection. A 0.25ml to 1.0ml sample loop.
Carrier gas. Ultra-pure nitrogen
Valve. Air actuated 10 port.
Columns. Fused silica, 10-m x 0.53-mm ID 1.8- μ CP WAX 57 CB (backflushable pre-column),
and 50-m x 0.53-mm ID Al₂O₃/KCl PLOT.

Analytical Equipment: The analytical instrumentation to be used is similar to the system described in CARB Method 422.102 Appendix C, with references to NIOSH Method 1024.

Calibrated rotometers with adjustable valves.

Tedlar bags. To be used to for calibration dilution.

Expendable Materials:

Type I deionized water

Certified A.C.S. grade sodium hydroxide, 0.1 Normal

Ultra-Pure(99.999%) nitrogen

2 ppm Certified $\pm 2\%$ 1,3-butadiene, and 10 ppm $\pm 5\%$ 1,3-butadiene.

The sampling was conducted for five hours with 75% of the sample time at the idle condition and 25% of the sample time at the high load condition.

Sample Analysis. Analysis was performed by Entropy Environmentalist, Inc.. The 1,3-butadiene was analyzed using a Helmet Backyard 5890 Gas Chromatographer with a Flame Ionization Detector (FID).

Calibration of the instrument was done according to CARB Method 422.199, using linear regression techniques. After calibrating, a nitrogen blank was run before the samples were introduced. A calibration standard was run after every ten samples, with a nitrogen blank to be run at the completion of a day's sampling.

Quality Assurance. The leak check procedures were performed according to the method. All components of the sampling train contacting the sampling were constructed of glass, stainless steel, and Teflon.

Modified Sampling/Analytical Methods. A heated Teflon filter holder was used for particulate removal instead of a glass wool plug.

5.7 Volatile Organic Compounds - CARB Method 422

The sampling and analytical procedures outlined in CARB Method 422 were used to determine the volatile organic compounds (VOCs) emissions.

Sampling Train Design and Operation. The sampling train consisted of a glass probe containing a glass wool filter, a Teflon sample line, two chilled impingers in series, a rotometer, a tedlar bags, a dry gas meter and a pump. The first impinger contained 0.1 N NaOH and the second was charged with distilled, deionized (DI) water.

All glassware was precleaned using soap and water, DI water, 0.1 N nitric acid (HNO_3) and DI water.

The sampling was conducted for one hour with 75% of the sample time at the idle condition and 25% of the sample time at the high load condition. Due to the changes in stack flow rates for the two conditions, proportional sampling was conducted. Sampling was conducted at approximately 6.25 sccm/min and 25 sccm/min during the idle and high load conditions, respectively.

Sample Recovery. The filter was removed and discarded. The contents of the first impinger was poured into a 40 mL vial. The contents of the second impinger were poured into a separate 40 mL vial.

The first impinger was rinsed with DI water and the rinse was poured into the vial containing the first impinger's reagent leaving no headspace. The second impinger was rinsed with DI water into the vial containing the second impinger's reagent leaving no headspace.

Sample Analysis. Analysis was performed by Performance Analytical Laboratories. The vials containing the reagent/rinses were archived. The tedlar bag was analyzed for VOCs by gas chromatography combined with mass spectrometry (GC/MS). The analysis procedures in CARB Method 422 were strictly followed.

Quality Assurance. The leak check procedures were performed according to the method. The contents of the tedlar bags were analyzed within 72 hours of sample collection. All components of the sampling train contacting the sample were constructed of glass and Teflon.

A method blank was analyzed for VOCs.

5.8 Hexavalent Chromium and Total Chromium - CARB Method 425

The sampling procedures outlined in CARB Method 425 were used to determine the hexavalent chromium and total chromium emissions.

Sampling Train Design and Operation. The sampling train consisted of a glass nozzle, glass probe, three chilled impingers in series, a pump, a dry gas meter and a calibrated heated Teflon coated filter was placed between the second and third impingers. The filter was in a glass filter holder and supported on a Teflon frit. The first and second impingers contained 0.1 N (NaOH) and the third contained preweighed silica gel.

GC/MS
VOC

All glassware was precleaned by washing with soap, tap water, and DI water; soaking in 1:1 HNO₃; rinsing with distilled, deionized (DI) water; and rinsing with 0.1 N NaOH.

Each of the 4 points was sampled for 80 minutes, resulting in a net run time of 320 minutes. The leak check procedures were performed according to the method. A minimum volume of 150 standard cubic feet of source gas was collected.

Sample Recovery. The filter was removed and placed into a glass jar. The contents of the first, second and third impingers were poured into a glass jar, weighed and the weight recorded. The silica gel was returned to the original tared jar, weighed and the weight recorded.

The volume of water vapor collected in the impingers and silica gel were summed and entered into the moisture content calculations.

The front half of the train including the nozzle, the probe and the connecting glassware was rinsed with 0.1 N NaOH into a glass jar. The first three impingers and the front half of the filter holder were rinsed with 0.1 N NaOH into a glass jar.

Sample Analysis. Analysis was performed by West Coast Analytical Service, Inc. The front half rinse was analyzed separately. The impinger contents, the impinger rinses and the filter were analyzed together. Analysis for hexavalent chromium was conducted using ion chromatography coupled with a post column reactor (IC/PCR) and analysis for total chromium was conducted using graphite furnace atomic absorption.

Quality Assurance. All components of the sampling train contacting the sample were constructed of glass or Teflon.

Hexavalent Chromium. A blank train was prepared and analyzed. A matrix spike and matrix spike duplicate were conducted. A 0.1 N NaOH reagent blank was analyzed.

Total Chromium. A blank train was prepared and analyzed. Duplicate analyses were conducted for the combined impinger reagent, impinger rinse and filter from run M425-2. A 0.1 N NaOH reagent blank was analyzed. A matrix spike was conducted on the combined impinger reagent, impinger rinse and filter from run M425-2.

Due to the small duct diameter and the stack configuration, sampling was conducted using four traverse points along the horizontal axis only.

5.9 Polycyclic Aromatic Hydrocarbons and Phenol - CARB Method 429

The sampling and analytical procedures outlined in CARB Method 429 were used to determine the polycyclic aromatic hydrocarbons (PAHs) emissions.

Sampling Train Design and Operation. The sampling train consisted of a glass nozzle, a heated glass probe, a heated Teflon-coated glass fiber filter, a water-cooled condenser, a XAD sorbent trap, four chilled impingers in series, a pump, a dry gas meter and a calibrated orifice. The filter was housed in

glass filter holder and supported on a Teflon frit. The condenser was placed above the XAD sorbent trap allowing the condensate to drain vertically through the sorbent for removal of the organic constituents in the gas. The sorbent trap was charged with the precleaned resin. The first impinger was empty, the second contained distilled, deionized (DI) water, the third was empty and the fourth contained preweighed silica gel.

Care was taken to ensure that the XAD resin was stored on ice before and after sample collection to prevent resin decomposition.

All glassware (including the sorbent trap glassware) was precleaned prior to sampling according to the procedure listed below.

1. Soak in hot soapy water
2. Rinse three times with tap water
3. Rinse three times with DI water
4. Rinse three times with acetone rinse
5. Rinse three times with hexane
6. Rinse three times with methylene chloride
7. Cap glassware with clean glass plugs or methylene chloride-rinsed aluminum foil.

Each of the 4 points was sampled for 80 minutes, resulting in a net run time of 320 minutes. The leak check procedures were performed according to the method. The entire sample train was leak tested to ensure that leakage did not exceed the lesser of a) 4 percent of the average sampling rate or b) 0.02 cubic feet per minute. The temperature of the gas entering the sorbent trap was maintained at or below 60 °F.

Sample Recovery. The XAD trap was removed and capped. The filter was removed and placed in a petri dish and sealed with Teflon tape and stored on dry ice. The contents of the first three impingers were returned to the original jar, weighed, the weight recorded and the liquid level marked. The silica gel was returned to the original jar, weighed and the weight recorded.

The volume of water vapor collected in the impingers and silica gel were summed and entered into the moisture content calculations.

The front half of the train including the nozzle, probe and front half of the filter holder was rinsed three times each with methanol, toluene and methylene chloride into a glass jar. The back half of the filter holder and the condenser and connectors were rinsed three times each with methanol, hexane, and methylene chloride into a glass jar. The first impinger was rinsed three times each with methanol,

hexane and methylene chloride into a glass jar. The second and third impingers were rinsed three times with DI water and the rinse was added to the jar containing the impingers' reagent. The samples were maintained at 0-4 °C from the time of collection to extraction using ice and coldpacks.

Analytical Methods. Analysis was performed by Alta Analytical Laboratory, Inc. The XAD trap, filter and impinger contents and rinses were analyzed for PAHs according to CARB Method 429. The analytical method entails the addition of internal standards in known quantities, matrix-specific extraction of the sample, preliminary fractionating and cleanup of extracts (if necessary) and analysis of the processed extract for PAHs. The analyses were conducted using high resolution capillary column gas chromatography coupled with high resolution mass spectrometry (HRGC/HRMS).

Quality Assurance. Sealing greases were not used on the sample train. Recovery of the samples and assembly of the sample trains were conducted in an environment free from uncontrolled dust. A blank train was prepared and consisted of a complete sampling train (probe, filter, transfer line, condenser, XAD trap and impinger set) which was assembled and leak checked in the same manner as a test run. The train was placed at the sampling location for the duration of one test run. The train was then returned to the laboratory and disassembled for recovery using the same procedure used to recover the actual samples.

Polycyclic Aromatic Hydrocarbons. A method blank was analyzed. A blank train was analyzed.

Sampling/Analytical Modifications. To reduce the possibility of contamination, filters used for particulate removal will not be labeled.

Due to the small duct diameter and the stack configuration, sampling will be conducted using four traverse points along the horizontal axis only.

5.10 Acetaldehyde, Acrolein and Formaldehyde - CARB Method 430

The sampling and analytical procedures outlined in CARB Method 430 were used to determine the acetaldehyde and formaldehyde emissions.

Sampling Train Design and Operation. The sampling train consisted of a glass probe containing a glass wool plug, four chilled midjet impingers in series, a dry gas meter, a pump, and a rotometer. The first and second impingers contained dinitrophenylhydrazine (DNPH), the third was empty and the

fourth contained preweighed silica gel. The pump was capable of sampling between 100 and 1000 mL/minute.

Based on a target detection limit of $12 \mu\text{g}/\text{m}^3$, a minimum sample volume of 23.0 liters was calculated. The sample run was conducted for two hours with 90 minutes of sampling at the idle condition and 30 minutes at the high load condition. Based on previous test data, the sample flow rates were approximately 6.25 sccm/min at the idle condition and 25 sccm/min at the high load condition. The leak check procedures were performed according to the method.

Sample Recovery. The contents of the first impinger were poured into a 40 mL amber vial. The contents of the second impinger were poured into a second 40 mL amber vial. The first impinger was rinsed with distilled, deionized (DI) water into the vial containing the first impinger's reagent. The probe was rinsed with DNPH into this same vial leaving no headspace. The second impinger was rinsed with DI water into the vial containing the second impinger's reagent leaving no headspace. The samples were stored cold until extraction for analysis.

Analytical Method. Analysis was performed by West Coast Analytical Service, Inc. The combined impinger contents and rinses were analyzed for acetaldehyde, acrolein and formaldehyde using reverse phase high performance liquid chromatography (HPLC) with an ultraviolet absorption detector operated at 360 nm.

Quality Assurance. The samples were extracted within seven days after collection. All components of the sampling train contacting the sample were constructed of glass or Teflon. No sealing grease was used on any of the sampling train components.

Acetaldehyde, acrolein and formaldehyde matrix spikes were performed.

5.11 Fuel Sampling and Analysis

A diesel fuel sample was from the fuel storage tank during the test program. The following methods of analysis were conducted by Core Laboratories:

<u>Parameter</u>	<u>Reference Method</u>
Cetane Index	ASTM D976
Distillation	ASTM D86
Flash Point	ASTM D93
Heating Value	ASTM D240
Pour Point	ASTM D97
Specific Gravity	ASTM D287
Viscosity	ASTM D445
Benzene	Capillary Analysis
Ethylbenzenes	Capillary Analysis
Toluene	Capillary Analysis
Xylenes	Capillary Analysis
Propylene	Capillary Analysis
Naphthalenes	ASTM D1840
Carbon	Carlo Erba Instrument
Hydrogen	Carlo Erba Instrument
Nitrogen	ASTM 4629
Oxygen	Carlo Erba Instrument
Total Chlorides	Dohrman
Sulfur	ASTM D4294
Arsenic	EPA 6020
Beryllium	EPA 6020
Cadmium	A.A.
Chromium	EPA 6020
Copper	A.A.
Lead	A.A.
Mercury	EPA 6020
Nickel	A.A.
Selenium	EPA 6020
Zinc	A.A.

6.0 TEST CRITIQUE

6.1 Diesel Fuel Analysis

Octane, motor and Reid vapor pressure analysis is not considered applicable to diesel samples and was not performed. Also, cetane number could not be performed due to insufficient sample. F-factors were calculated from the fuel results and used for lb/MMBtu emission factor calculations. The lb/MMBtu can be calculated using two methods: (1) fuel flow rates and heat content or (2) F-factor. The F-factor method was chosen because the fuel flow rates were not measurable during the idling conditions. The F-factor method requires fuel analysis and stack flow rates and is independent of fuel flow rate.

6.2 Flow Rates - EPA Method 2C

An eight point traverse was performed at the beginning of both load conditions for each isokinetic test run. The data from the velocity traverses was used to calculate an actual stack gas volumetric flow rate for each condition and a time weighted average volumetric flow rate for each run.

6.3 Particulate - CARB Method 5

The average sampling rate for run M5-1 was under-isokinetic at 88.8%. Therefore the results have a potential positive bias of 1.2% depending on the particle size. The average sampling rate for runs M5-2 and M5-3 was within 10% of isokinetic. The M5-1 test results were similar to runs M5-2 and M5-3 indicating that the under-isokinetic sampling had little or no effect on the test results. No sampling train leaks were observed during testing.

The particulate emission rates (lb/hr & lb/MMBtu) for runs M5-1, M5-2, and M5-3 were calculated using the time weighted average volumetric flow rate from Method 2C.

6.4 CO, NO_x, THC, CO₂, O₂ - CARB Method 100

No sampling train leaks were observed during testing. The emission rates (lb/hr & lb/MMBtu) for runs 1&1A, 2&2A, and 3&3A were calculated using the volumetric flow rate from Method 2C.

6.5 Benzene - CARB Method 410A

No sampling train leaks were observed during the testing. The contents of the Tedlar bag were analyzed within 72 hours of sample collection. A method blank was analyzed for benzene with none detected.

The benzene emission rates (lb/hr & lb/MMBtu) for runs M410A-1, M410A-2, and M410A-3 were calculated using the time weighted average volumetric flow rate from Method 2C.

6.6 1,3-Butadiene - CARB Method 422.102

No sampling train leaks were observed during the testing. The 1,3-butadiene emission rates (lb/hr & lb/MMBtu) for runs 1, 2, and 3 were calculated using the time weighted average volumetric flow rate from Method 2C.

6.7 Volatile Organic Compounds - CARB Method 422

No sampling train leaks were observed during the testing. The contents of the Tedlar bag were analyzed within 72 hours of sample collection. A method blank was analyzed for VOCs with none detected.

The VOCs emissions rate (lb/hr & lb/MMBtu) for runs M422-1, M422-2, and M422-3 were calculated using the time weighted average volumetric flow rates from Method 2C.

6.8 Hexavalent Chromium and Total Chromium - CARB Method 425

The average sampling rate for run M25-1 was under isokinetic at 88%. Therefore the results have a potential positive bias of 2.0% depending on the particle size. The average sampling rate for runs M25-2 and M25-3 was within 10% of isokinetic. The M25-1 test results were similar to runs M25-2 and M25-3 indicating that the underisokinetic sampling had little or no effect on the test results. No sampling train leaks were observed during testing.

Hexavalent Chromium. A blank train was prepared and analyzed with 0.46 micrograms detected. Duplicate hexavalent chromium analyses were conducted on the combined impinger reagent, of the M425-1 train with a RPD of 0% calculated. Matrix spikes were conducted for each of the duplicate analyses with MSRs of 63% and 63% observed.

Total Chromium. A blank train was prepared and analyzed with 2.87 micrograms detected. Duplicate analyses were conducted on the impinger rinse from run M425-3 with a RPD of 22% calculated.

The hexavalent and total chromium emission rates (lb/hr & lb/MMBtu) for runs M425-1, M425-2, and M425-3 were calculated using the time weighted average volumetric flow rates from Method 2C.

6.9 Polycyclic Aromatic Hydrocarbons - CARB Method 429

The average sampling rate for run M29-1 was under isokinetic at 87.1%. Therefore the results have a potential positive bias of 2.9% depending on the particle size. The average sampling rate for runs M29-2 and M29-3 was within 10% of isokinetic. The M29-1 test results were similar to runs M29-2 and M29-3 indicating that the underisokinetic sampling had little or no effect on the test results. No sampling train leaks were observed during testing. The temperature of the gas entering the sorbent trap was maintained at or below 60 °F.

Polycyclic Aromatic Hydrocarbons. A method blank was analyzed with 410 nanograms(ng) of naphthalene, 13 ng of fluorene and 36 ng of phenanthrene detected. A blank train was analyzed with 590 ng of naphthalene, 22 ng of fluorene and 50 ng of phenanthrene detected.

The samples had significant matrix interferences and high level PAH compounds present for the early eluters. A 1:10 dilution was performed on these three samples. Several of the internal standards could not be quantified due to the dilution and the matrix interferences.

The recoveries of the pre-spike d12-benzo(e)pyrene and d14-terphenyl were within the acceptable range.

The polycyclic aromatic hydrocarbons emission rates (lb/hr & lb/MMBtu) for runs M429-1, M429-2, and M429-3 were calculated using the time weighted average volumetric flow rate from Method 2C.

6.10 Acetaldehyde and Formaldehyde - CARB Method 430

No sampling train leaks were observed during the testing.

Acetaldehyde, acrolein and formaldehyde matrix spikes were performed. There were no MSRs reported for acetaldehyde and formaldehyde because the sample amount exceeded the spike level. The MSR for acrolein is 23%.

The acetaldehyde, acrolein and formaldehyde emission rates (lb/hr & lb/MMBtu) for run M430-1, M430-2, and M430-3 were calculated using the time weighted average of the volumetric flow rates from Method 2C.

7.0 CALIBRATION AND QUALITY ASSURANCE

7.1 Equipment Inspection and Maintenance

Each item of field test equipment purchased by Entropy is assigned a unique, permanent identification number. An effective preventive maintenance program is necessary to ensure data quality. Each item of equipment returning from the field is inspected before it is returned to storage. During the course of these inspections, items are cleaned, repaired, reconditioned, and recalibrated as necessary.

Each item of equipment transported to the field is inspected before being packed to detect equipment problems which may originate during periods of storage. Occasional equipment failure in the field is unavoidable despite the most rigorous inspection and maintenance procedures. For this reason, Entropy routinely transports to the job site replacement equipment for all critical sampling train components.

7.2 Equipment Calibration

New items which require calibration are calibrated before initial field use. Equipment whose calibration status may change with use or time is inspected in the field before testing and again upon return from field use. When an item fails to meet the required calibration specifications, it is repaired and recalibrated or retired from service. All equipment is periodically recalibrated in full, regardless of the outcome of these regular inspections.

Calibrations are conducted in a manner, and at a frequency, which meet or exceed U. S. EPA and CARB specifications. Entropy follows the calibration procedures outlined in the applicable EPA Methods and those recommended in the Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III (EPA-600/4-77-027b, August, 1977). When these methods are inapplicable, Entropy uses methods prescribed by the American Society for Testing and Materials (ASTM). Emissions sampling equipment requiring calibration include Pitot tubes, pressure gauges, thermometers, dry gas meters, orifices and barometers.

Calibration data are recorded on standardized forms which are checked for completeness and accuracy. Data reduction and subsequent calculations are performed using Entropy's computer facilities.

7.3 Sample Custody Procedures

Sample custody procedures are based on procedures recommended by the EPA. All samples are given a unique alphanumeric identification code. Because the samples are transported to the analytical laboratory for analysis, the custody procedures emphasize careful documentation of the sampling and analytical data and use of the chain of custody records. All sampling data, including information regarding sampling times, locations, and any specific considerations associated with sample acquisition are recorded on preformatted data sheets. All samples are inspected upon arrival at the analytical laboratory to insure sample integrity is not compromised.

7.4 Sampling QA/QC Procedures

All sampling is performed in accordance with the specified test methods. Adherence to prescribed QC procedures ensures data of consistent and measurable quality. The following general QC procedures are incorporated into the sampling effort:

- All sampling equipment was thoroughly inspected to ensure clean and operable components.
- The number and location of the sampling and/or traverse points are checked before taking measurements.
- The temperature measurement system is visually checked for damage and operability by measuring the ambient temperature prior to use.
- All leak checks are conducted in accordance with the specified method.
- All sampling data and calculations are recorded on preformatted data sheets.
- Any unusual occurrences are noted during each run on the appropriate data form.
- The project supervisor reviews each sampling data sheet on a daily basis.

7.5 Analytical QA/QC Procedures

All analyses are performed using the laboratory procedures specified in the analytical protocols. Adherence to prescribed QC procedures ensures data of consistent and measurable quality. Analytical QC focuses on the use of control standards to provide a measure of analytical precision and accuracy. Also, specific acceptance criteria are defined for various analytical operations including

calibrations, control standard analyses, drift checks, blanks, etc. The following general QC procedures are incorporated into the analytical effort:

- The on-site project supervisor reviews all analytical data and QC data on a daily basis for completeness and acceptability.
- Analytical QC data are tabulated using the appropriate charts and forms on a daily basis.
- Copies of the QC data tabulation are submitted to the quality assurance manager following the completion of the test program.
- All hardcopy raw data (i.e., chromatograms, computer printouts, etc.) are maintained in organized files.

Appendix A
Results Tabulation

Appendix A.1

Flue Gas Velocity And Volumetric Flow Rate - EPA Method 2C

FIELD DATA AND RESULTS TABULATION

PLANT: HALLIBURTON EQUIPMENT YARD

SAMPLING LOCATION: Engine Exhaust Duct

		M2-1	M2-2	Time Average
	Test Date	7/29/92	7/29/92	
	Run Start Time	0730	1558	
	Run Finish Time	0735	1603	
	Net Traversing Points	4	4	
Cp	Pitot Tube Coefficient	0.99	0.99	
Pbar	Barometric Pressure, Inches Hg	29.5	29.5	29.5
%H2O	Moisture Content, Percent by Volume	4.9	4.9	4.9
Mfd	Molecular Fraction	0.951	0.951	0.951
%CO2	Carbon Dioxide, Percent By Volume, Dry	1.5	7.8	3.1
%O2	Oxygen, Percent By Volume, Dry	18.9	10.0	16.7
%CO+N2	CO + N2, Percent By Volume, Dry	79.6	82.2	80.3
Md	Gas Molecular Weight, Lb/Lb-Mole, Dry	29.00	29.65	29.16
Ms	Gas Molecular Weight, Lb/Lb-Mole, Wet	28.45	29.08	28.61
Pg	Flue Gas Static Pressure, Inches H2O	0.04	0.75	0.22
Ps	Absolute Flue Gas Pressure, Inches Hg	29.50	29.56	29.52
ts	Flue Gas Temperature, Degrees F	168	728	308
Delta-p	Average Velocity Head, Inches H2O	0.17	3.61	1.03
vs	Flue Gas Velocity, Feet/Second	30.17	189.04	69.89
A	Stack/Duct Area, Square Inches	19.63	19.63	19.63
Qsd	Volumetric Air Flow Rate, Dry SCFM*	192	636	303
Qaw	Volumetric Air Flow Rate, Wet ACFM	247	1,546	572

* 60° F (20° C) -- 29.92 Inches of Mercury (Hg)

FIELD DATA AND RESULTS TABULATION

PLANT: HALLIBURTON EQUIPMENT YARD

SAMPLING LOCATION: Engine Exhaust Duct

		M2-1	M2-2	Time Average
	Test Date	7/30/92	7/30/92	
	Run Start Time	1050	1630	
	Run Finish Time	1055	1635	
	Net Traversing Points	4	4	
Cp	Pitot Tube Coefficient	0.99	0.99	
Pbar	Barometric Pressure, Inches Hg	29.5	29.5	29.5
%H2O	Moisture Content, Percent by Volume	5.3	5.3	5.3
Mfd	Molecular Fraction	0.947	0.947	0.947
%CO2	Carbon Dioxide, Percent By Volume, Dry	1.5	7.9	3.1
%O2	Oxygen, Percent By Volume, Dry	18.9	9.8	16.6
%CO+N2	CO + N2, Percent By Volume, Dry	79.6	82.3	80.3
Md	Gas Molecular Weight, Lb/Lb-Mole, Dry	29.00	29.66	29.17
Ms	Gas Molecular Weight, Lb/Lb-Mole, Wet	28.42	29.04	28.58
Pg	Flue Gas Static Pressure, Inches H2O	0.04	0.75	0.22
Ps	Absolute Flue Gas Pressure, Inches Hg	29.50	29.56	29.52
ts	Flue Gas Temperature, Degrees F	179	732	317
Delta-p	Average Velocity Head, Inches H2O	0.17	3.76	1.07
vs	Flue Gas Velocity, Feet/Second	30.47	193.39	71.20
A	Stack/Duct Area, Square Inches	19.63	19.63	19.63
Qsd	Volumetric Air Flow Rate, Dry SCFM*	189	646	303
Qaw	Volumetric Air Flow Rate, Wet ACFM	249	1,582	582

* 60° F (16° C) -- 29.92 Inches of Mercury (Hg)

FIELD DATA AND RESULTS TABULATION

PLANT: HALLIBURTON EQUIPMENT YARD

SAMPLING LOCATION: Engine Exhaust Duct

		M2-1	M2-2	Time Average
	Test Date	7/31/92	7/31/92	
	Run Start Time	1300	1945	
	Run Finish Time	1304	2000	
	Net Traversing Points	4	4	
Cp	Pitot Tube Coefficient	0.99	0.99	
Pbar	Barometric Pressure, Inches Hg	29.7	29.7	29.7
%H2O	Moisture Content, Percent by Volume	4.8	4.8	4.8
Mfd	Molecular Fraction	0.952	0.952	0.952
%CO2	Carbon Dioxide, Percent By Volume, Dry	1.5	7.5	3.0
%O2	Oxygen, Percent By Volume, Dry	19.0	10.3	16.8
%CO+N2	CO + N2, Percent By Volume, Dry	79.5	82.2	80.2
Md	Gas Molecular Weight, Lb/Lb-Mole, Dry	29.00	29.61	29.2
Ms	Gas Molecular Weight, Lb/Lb-Mole, Wet	28.47	29.05	28.62
Pg	Flue Gas Static Pressure, Inches H2O	0.75	0.75	0.75
Ps	Absolute Flue Gas Pressure, Inches Hg	29.76	29.76	29.76
ts	Flue Gas Temperature, Degrees F	166	735	308
Delta-p	Average Velocity Head, Inches H2O	0.15	4.06	1.13
vs	Flue Gas Velocity, Feet/Second	28.18	200.50	71.26
A	Stack/Duct Area, Square Inches	19.63	19.63	19.63
Qsd	Volumetric Air Flow Rate, Dry SCFM*	181	675	305
Qaw	Volumetric Air Flow Rate, Wet ACFM	230	1,640	583

* 60° F (16° C) -- 29.92 Inches of Mercury (Hg)

Appendix A.2

Particulate Matter - CARB Method 5

FIELD DATA AND RESULTS TABULATION

Plant: Western States Petroleum Association

Test Location: Halliburton Equipment Yard

<u>Run Number</u>	<u>Run Date</u>	<u>Operator</u>
M5-1	7/29/92	Shawn Graham
M5-2	7/30/92	Shawn Graham
M5-3	7/31/92	Clyde Nack

		<u>M5-1</u>	<u>M5-2</u>	<u>M5-3</u>
	Run Start Time	745	1100	1310
	Run Stop Time	1841	1831	2120
	Net Sampling/Traversing Points	4	4	4
	Net Run Time, Minutes	320	320	320
Dia	Nozzle Diameter, Inches	0.217	0.217	0.217
Cp	Pitot Tube Coefficient	0.99	0.99	0.99
Y	Dry Gas Meter Calibration Coefficient	1.0200	1.0200	1.0200
Pbar	Barometric Pressure, Inches Hg	29.50	29.50	29.70
Delta-H	Orifice Average Pressure Differential, Inches H2O	1.707	1.687	1.974
Vm	Sampled Volume of Source Gas, Dry ACF	191.206	190.012	198.625
Vmm	Sampled Volume of Source Gas, Dry ACM	5.41	5.38	5.62
tm	Dry Gas Meter Temperature, Degrees F	109	106	111
Vmstd	Sampled Volume of Source Gas, Dry SCF	176.384	176.333	184.000
Vmstdm	Sampled Volume of Source Gas, Dry SCM	4.995	4.993	5.210
Vlc	Volume of Condensed Liquid, mL	193.8	213.0	201.8
Vwstd	Volume of Water Vapor, SCF	8.983	9.873	9.354
%H2O	Moisture Content, Percent by Volume	4.85	5.30	4.84
%H2Osat	Saturated Moisture Content, Percent by Volume	100.0	100.0	100.0
Mfd	Source Gas Dry Mole Fraction	0.952	0.947	0.952
%CO2	Source Gas CO2 Content, Percent by Dry Volume	3.1	3.1	3.0
%O2	Source Gas O2 Content, Percent by Dry Volume	16.7	16.6	16.8
Md	Source Gas Dry Molecular Weight, Lb/Lb-Mole	29.16	29.16	29.15
Ms	Source Gas Wet Molecular Weight, Lb/Lb-Mole	28.62	28.57	28.61
Pg	Source Gas Static Pressure, Inches H2O	0.22	0.22	0.22
Ps	Source Gas Absolute Pressure, Inches Hg	29.52	29.52	29.72
ts	Source Gas Temperature, Degrees F	314	313	302
Delta-p	Source Gas Average Velocity Head, Inches H2O	0.6217	0.5731	0.6294
vs	Source Gas Velocity, Feet/Second	63.87	61.34	63.58
A	Source Cross Sectional Area, Square Inches	19.63	19.63	19.63
Qsd	Source Gas Volumetric Flow Rate, Dry SCFM	330	315	335
Qmsd	Source Gas Volumetric Flow Rate, Dry SCMM	9	9	9
Qaw	Source Gas Volumetric Flow Rate, Wet ACFM	522	502	520
Qmaw	Source Gas Volumetric Flow Rate, Wet ACMM	15	14	15
%I	Average Isokinetic Sampling Rate, Percent	88.8	92.7	91.0
%EA	Excess Air, Percent	373	361	384
Fo	Fuel Factor	1.355	1.387	1.367
F	F-Factor, DSCF/Million Btu	9,058	9,388	9,598
MMBtu/Hr	Heat Input Rate, Million Btu/Hour	0.403	0.398	0.374
Qsd	Source Gas Volumetric Flow Rate, Dry SCFM *	303	303	305

Note:

All standard volumes and flow rates based on 60 Degrees F (16 Degrees C) -- 29.92 Inches of Mercury (Hg)

The lesser of %H2O and %H2Osat was used for calculation purposes

* Calculated from EPA Method 2 - Used for all Emission Rate calculations

FIELD DATA AND RESULTS TABULATION

		<u>M5-1</u>	<u>M5-2</u>	<u>M5-3</u>
	<u>Condensible Particulate</u>			
mg	Catch Weight, Milligrams	258.1	263.8	209.8
gr/DSCM	Concentration, Grains per DSCM	2.26E-02	2.31E-02	1.76E-02
lb/hr	Emission Rate, Pounds per Hour	5.86E-02	6.00E-02	4.60E-02
lb/MMBtu	Emission Factor, Pounds per Million Btu	1.45E-01	1.50E-01	1.23E-01
	<u>Filterable Particulate</u>			
mg	Catch Weight, Milligrams	211.8	197.9	206.9
gr/DSCM	Concentration, Grains per DSCM	1.85E-02	1.73E-02	1.74E-02
lb/hr	Emission Rate, Pounds per Hour	4.81E-02	4.50E-02	4.54E-02
lb/MMBtu	Emission Factor, Pounds per Million Btu	1.19E-01	1.13E-01	1.21E-01
	<u>Total Particulate</u>			
mg	Catch Weight, Milligrams	469.9	461.7	416.7
gr/DSCM	Concentration, Grains per DSCM	4.11E-02	4.04E-02	3.49E-02
lb/hr	Emission Rate, Pounds per Hour	1.07E-01	1.05E-01	9.14E-02
lb/MMBtu	Emission Factor, Pounds per Million Btu	2.65E-01	2.63E-01	2.44E-01

Appendix A.3

CO, NOx, THC, CO2, O2 - CARB Method 100

CALCULATION OF AVERAGE THC, NO_x AND CO EMISSIONS

RUN: 1
SOURCE: Halliburton

DATE: 7/29/92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm THC	-0.0	0.5	0.2
804.7 ppm THC	804.8	803.4	804.1
0.0 ppm NO _x	1.0	0.5	0.8
867.0 ppm NO _x	866.3	866.4	866.4
0.0 ppm CO	-0.4	-0.5	-0.5
807.0 ppm CO	806.8	806.7	806.8
0.00 % Oxygen	0.01	0.04	0.03
20.50 % Oxygen	20.48	20.42	20.45
0.00 % CO ₂	-0.01	-0.03	-0.02
17.74 % CO ₂	17.74	17.79	17.77

Uncorrected Data: 270.9 ppm THC 18.9 % Oxygen
116.5 ppm NO_x 1.46 % CO₂
178.5 ppm CO 192 DSCFM

===== CORRECTED RESULTS

271.0 ppm THC 1.50 % CO₂
116.0 ppm NO_x 18.9 % Oxygen
176.2 ppm CO 0.130 lb THC/hr
1.07 lb THC/MMBtu 0.160 lb NO_x/hr
1.31 lb NO_x/MMBtu 0.148 lb CO/hr
1.21 lb CO/MMBtu

$$\text{Corrected Conc.} = C_m(\bar{C} - C_o)/(C_m - C_o)$$

Where: $\bar{C}$ = mean reference measurement
C_o = mean zero calibration response
C_m = mean mid or upscale calibration gas response
C_{ma} = actual mid or upscale calibration gas concentration

NOTE: CO concentrations are corrected for the lost volume of CO₂
using a multiplication factor of [1 - (%CO₂/100)].

$$\text{lb/hr} = (\text{ppm pollutant})(\text{DSCFM flow})(\text{Conv. Factor})(60)$$

$$\text{lb/MMBtu} = (\text{ppm pollutant})(\text{F-Factor})(\text{Conv. Factor})(20.9/20.9 - \% \text{ O}_2)$$

Where: THC Conv. Factor = 4.156E-08 lb THC/DSCF - ppm THC
NO_x Conv. Factor = 1.194E-07 lb NO₂/DSCF - ppm NO₂
CO Conv. Factor = 7.273E-08 lb CO/DSCF - ppm CO
F-Factor = 9058 DSCF/MMBtu

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: Halliburton

TEST DATE: 7/29/92

RUN NUMB 1

SPAN VALU 1000 ppm THC
1000 ppm NOx
1000 ppm CO
20 % Oxygen
20 % CO2

	—INITIAL VALUES—			—FINAL VALUES—		
	ANALYZER CAL RESPONSE	SYSTEM CAL RESPONSE	SYSTEM CAL BIAS (% OF SPAN)	SYSTEM CAL RESPONSE	SYSTEM CAL BIAS (% OF SPAN)	DRIFT (% OF SPAN)
THC ZERO	-0.0	-0.0	0.00	0.5	0.05	0.05
THC UP-SCA	804.8	804.8	0.00	803.4	-0.14	-0.14
NOx ZERO G	1.0	1.0	0.00	0.5	-0.05	-0.05
NOx UP-SCA	866.3	866.3	0.00	866.4	0.01	0.01
CO ZERO G	-0.4	-0.4	0.00	-0.5	-0.01	-0.01
CO UP-SCAL	806.8	806.8	0.00	806.7	-0.01	-0.01
O2 ZERO GA	0.01	0.01	0.00	0.04	0.15	0.15
O2 UP-SCAL	20.48	20.48	0.00	20.42	-0.30	-0.30
CO2 ZERO G	-0.01	-0.01	0.00	-0.03	-0.10	-0.10
CO2 UP-SCA	17.74	17.74	0.00	17.79	0.25	0.25

SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE
SYSTEM CAL. BIAS = _____ X 100
SPAN

FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE
DRIFT = _____ X 100
SPAN

CALCULATION OF AVERAGE THC, NOx AND CO EMISSIONS

RUN: 1A
SOURCE: Halliburton

DATE: 7/29/92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm THC	0.5	-3.3	-1.4
804.7 ppm THC	811.3	798.6	805.0
0.0 ppm NOx	0.5	14.7	7.6
1843.0 ppm NOx	1842.1	1779.0	1810.6
0.0 ppm CO	-0.5	-0.5	-0.5
807.0 ppm CO	806.7	786.4	796.6
0.00 % Oxygen	0.04	0.01	0.03
20.50 % Oxygen	20.42	20.24	20.33
0.00 % CO2	-0.03	-0.05	-0.04
17.74 % CO2	17.79	17.90	17.85

Uncorrected Data: 92.0 ppm THC 9.9 % Oxygen
1237 ppm NOx 7.9 % CO2
220.1 ppm CO 636 DSCFM

===== CORRECTED RESULTS

93.2 ppm THC 7.8 % CO2
1256 ppm NOx 10.0 % Oxygen
205.9 ppm CO 0.148 lb THC/hr
0.067 lb THC/MMBtu 5.723 lb NOx/hr
2.605 lb NOx/MMBtu 0.571 lb CO/hr
0.260 lb CO/MMBtu

$$\text{Corrected Conc.} = C_{ma}(C - C_o)/(C_m - C_o)$$

Where: $\bar{C}$ = mean reference measurement
 C_o = mean zero calibration response
 C_m = mean mid or upscale calibration gas response
 C_{ma} = actual mid or upscale calibration gas concentration

NOTE: CO concentrations are corrected for the lost volume of CO2
using a multiplication factor of $[1 - (\%CO_2/100)]$.

lb/hr = (ppm pollutant)(DSCFM flow)(Conv. Factor)(60)
lb/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: THC Conv. Factor = 4.156E-08 lb THC/DSCF - ppm THC
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NO2
CO Conv. Factor = 7.273E-08 lb CO/DSCF - ppm CO
F-Factor = 9058 DSCF/MMBtu

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: Halliburton

TEST DATE: 7/29/92

RUN NUMB 1A

SPAN VALU 1000 ppm THC
 2500 ppm NOx
 1000 ppm CO
 25 % Oxygen
 20 % CO2

	—INITIAL VALUES—			—FINAL VALUES—		
	ANALYZER CAL RESPONSE	SYSTEM CAL RESPONSE	SYSTEM CAL BIAS (% OF SPAN)	SYSTEM CAL RESPONSE	SYSTEM CAL BIAS (% OF SPAN)	DRIFT (% OF SPAN)
THC ZERO	-0.0	0.5	0.05	-3.3	-0.33	-0.38
THC UP-SCA	804.8	811.3	0.65	798.6	-0.62	-1.27
NOx ZERO G	1.0	0.5	-0.02	14.7	0.55	0.57
NOx UP-SCA	1842.1	1842.1	0.00	1779.0	-2.52	-2.52
CO ZERO G	-0.5	-0.5	0.00	-0.5	0.00	0.00
CO UP-SCAL	806.7	806.7	0.00	786.4	-2.03	-2.03
O2 ZERO G	0.01	0.04	0.12	0.01	0.00	-0.12
O2 UP-SCAL	20.42	20.42	0.00	20.24	-0.72	-0.72
CO2 ZERO G	-0.01	-0.03	-0.10	-0.05	-0.20	-0.10
CO2 UP-SCA	17.74	17.79	0.25	17.90	0.80	0.55

SYSTEM CAL RESPONSE - ANALYZER CAL RESPONSE
 SYSTEM CAL BIAS = _____ X 100

SPAN

FINAL SYSTEM CAL RESPONSE - INITIAL CAL RESPONSE
 DRIFT = _____ X 100

SPAN

CALCULATION OF AVERAGE THC, NOx AND CO EMISSIONS

RUN: 2
 SOURCE: Halliburton DATE: 7/30/92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm THC	0.7	38.9	19.8
804.7 ppm THC	804.8	806.6	805.7
0.0 ppm NOx	0.3	1.5	0.9
867.0 ppm NOx	867.3	841.6	854.5
0.0 ppm CO	-0.2	-0.5	-0.4
807.0 ppm CO	804.8	803.4	804.1
0.00 % Oxygen	-0.04	-0.03	-0.04
20.50 % Oxygen	20.50	20.52	20.51
0.00 % CO2	0.01	-0.03	-0.01
17.74 % CO2	17.70	17.73	17.72

Uncorrected Data: 263.2 ppm THC 18.9 % Oxygen
 113.6 ppm NOx 1.46 % CO2
 178.3 ppm CO 189 DSCFM

===== CORRECTED RESULTS

249.2 ppm THC 1.50 % CO2
 114.0 ppm NOx 18.9 % Oxygen
 176.6 ppm CO 0.117 lb THC/hr
 1.016 lb THC/MMBtu 0.154 lb NOx/hr
 1.335 lb NOx/MMBtu 0.146 lb CO/hr
 1.260 lb CO/MMBtu

$$\text{Corrected Conc.} = C_{ma}(C - C_o)/(C_m - C_o)$$

Where: $\bar{C}$ = mean reference measurement
 C_o = mean zero calibration response
 C_m = mean mid or upscale calibration gas response
 C_{ma} = actual mid or upscale calibration gas concentration

NOTE: CO concentrations are corrected for the lost volume of CO2
 using a multiplication factor of $[1 - (\%CO_2/100)]$.

lb/hr = (ppm pollutant)(DSCFM flow)(Conv. Factor)(60)
 lb/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: THC Conv. Factor = 4.156E-08 lb THC/DSCF - ppm THC
 NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NO2
 CO Conv. Factor = 7.273E-08 lb CO/DSCF - ppm CO
 F-Factor = 9388 DSCF/MMBtu

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: Halliburton

TEST DATE: 7/30/92

RUN NUMB 2

SPAN VALU 1000 ppm THC
 1000 ppm NOx
 1000 ppm CO
 20 % Oxygen
 20 % CO2

	—INITIAL VALUES—			—FINAL VALUES—		
	ANALYZER CAL RESPONSE	SYSTEM CAL RESPONSE	SYSTEM CAL BIAS (% OF SPAN)	SYSTEM CAL RESPONSE	SYSTEM CAL BIAS (% OF SPAN)	DRIFT (% OF SPAN)
THC ZERO	-0.0	0.7	0.07	38.9	3.89	3.82
THC UP-SCA	804.8	804.8	0.00	806.6	0.18	0.18
NOx ZERO G	1.0	0.3	-0.07	1.5	0.05	0.12
NOx UP-SCA	866.3	867.3	0.10	841.6	-2.47	-2.57
CO ZERO G	-0.2	-0.2	0.00	-0.5	-0.03	-0.03
CO UP-SCAL	804.8	804.8	0.00	803.4	-0.14	-0.14
O2 ZERO G	0.01	-0.04	-0.25	-0.03	-0.20	0.05
O2 UP-SCAL	20.50	20.50	0.00	20.52	0.10	0.10
CO2 ZERO G	-0.01	0.01	0.10	-0.03	-0.10	-0.20
CO2 UP-SCA	17.74	17.70	-0.20	17.73	-0.05	0.15

SYSTEM CAL RESPONSE - ANALYZER CAL RESPONSE
 SYSTEM CAL BIAS = _____ X 100

SPAN

FINAL SYSTEM CAL RESPONSE - INITIAL CAL RESPONSE
 DRIFT = _____ X 100

SPAN

CALCULATION OF AVERAGE THC, NOx AND CO EMISSIONS

RUN: 2A
SOURCE: Halliburton

DATE: 7/30/92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm THC	38.9	14.1	26.5
804.7 ppm THC	806.6	774.5	790.6
0.0 ppm NOx	2.4	17.0	9.7
1843.0 ppm NOx	1842.3	1802.6	1822.5
0.0 ppm CO	-0.5	-0.5	-0.5
807.0 ppm CO	803.4	810.7	807.1
0.00 % Oxygen	-0.03	-0.02	-0.03
5.01 % Oxygen	5.03	5.08	5.06
0.00 % CO2	-0.03	0.02	-0.01
17.74 % CO2	17.73	17.67	17.70

Uncorrected Data: 115.8 ppm THC 10.0 % Oxygen
1243 ppm NOx 7.90 % CO2
224.5 ppm CO 646 DSCFM

CORRECTED RESULTS

94.0 ppm THC 7.90 % CO2
1253 ppm NOx 9.80 % Oxygen
207.0 ppm CO 0.605 lb THC/hr
0.276 lb THC/MMBtu 5.80 lb NOx/hr
2.64 lb NOx/MMBtu 0.584 lb CO/hr
0.266 lb CO/MMBtu

$$\text{Corrected Conc.} = \text{Cma}(\bar{C} - \text{Co}) / (\text{Cm} - \text{Co})$$

Where: $\bar{C}$ = mean reference measurement
Co = mean zero calibration response
Cm = mean mid or upscale calibration gas response
Cma = actual mid or upscale calibration gas concentration

NOTE: CO concentrations are corrected for the lost volume of CO2 using a multiplication factor of $[1 - (\% \text{CO}_2 / 100)]$.

lb/hr = (ppm pollutant)(DSCFM flow)(Conv. Factor)(60)
lb/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: SO2 Conv. Factor = 1.660E-07 lb SO2/DSCF - ppm SO2
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NO2
CO Conv. Factor = 7.273E-08 lb CO/DSCF - ppm CO
F-Factor = 9388 DSCF/MMBtu

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: Halliburton

TEST DATE: 7/30/92

RUN NUMB 2A

SPAN VALU 1000 ppm THC
 2500 ppm NOx
 1000 ppm CO
 25 % Oxygen
 20 % CO2

	—INITIAL VALUES—			—FINAL VALUES—		
	ANALYZER CAL RESPONSE	SYSTEM CAL RESPONSE	SYSTEM CAL BIAS (% OF SPAN)	SYSTEM CAL RESPONSE	SYSTEM CAL BIAS (% OF SPAN)	DRIFT (% OF SPAN)
THC ZERO	38.9	38.9	0.00	14.1	-2.48	-2.48
THC UP-SCA	806.6	806.6	0.00	774.5	-3.21	-3.21
NOx ZERO G	2.4	2.4	0.00	17.0	0.58	0.58
NOx UP-SCA	1842.3	1842.3	0.00	1802.6	-1.59	-1.59
CO ZERO G	-0.5	-0.5	0.00	-0.5	0.00	0.00
CO UP-SCAL	803.4	803.4	0.00	810.7	0.73	0.73
O2 ZERO G	-0.03	-0.03	0.00	-0.02	0.04	0.04
O2 UP-SCAL	5.03	5.03	0.00	5.08	0.20	0.20
CO2 ZERO G	-0.03	-0.03	0.00	0.02	0.25	0.25
CO2 UP-SCA	17.74	17.73	-0.05	17.67	-0.35	-0.30

SYSTEM CAL RESPONSE - ANALYZER CAL RESPONSE
 SYSTEM CAL BIAS = _____ X 100

SPAN

FINAL SYSTEM CAL RESPONSE - INITIAL CAL RESPONSE
 DRIFT = _____ X 100

SPAN

CALCULATION OF AVERAGE THC, NOx AND CO EMISSIONS

RUN: 3
SOURCE: Halliburton

DATE: 7/31/92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm THC	1.9	40.3	21.1
804.7 ppm THC	805.4	819.9	812.7
0.0 ppm NOx	0.1	2.1	1.1
867.0 ppm NOx	840.7	902.6	871.7
0.0 ppm CO	1.0	0.5	0.8
807.0 ppm CO	809.8	817.8	813.8
0.00 % Oxygen	-0.04	-0.03	-0.04
20.50 % Oxygen	20.54	20.52	20.53
0.00 % CO2	-0.01	-0.03	-0.02
17.74 % CO2	17.79	17.81	17.80

Uncorrected Data: 281.3 ppm THC 19.0 % Oxygen
 190.6 ppm NOx 1.50 % CO2
 172.6 ppm CO 181 DSCFM

CORRECTED RESULTS

264.5 ppm THC 1.50 % CO2
 189.0 ppm NOx 19.0 % Oxygen
 168.0 ppm CO 0.119 lb THC/hr
 1.16 lb THC/MMBtu 0.245 lb NOx/hr
 2.38 lb NOx/MMBtu 0.133 lb CO/hr
 1.29 lb CO/MMBtu

$$\text{Corrected Conc.} = C_{ma}(C - C_o)/(C_m - C_o)$$

Where: $\bar{C}$ = mean reference measurement
 C_o = mean zero calibration response
 C_m = mean mid or upscale calibration gas response
 C_{ma} = actual mid or upscale calibration gas concentration

NOTE: CO concentrations are corrected for the lost volume of CO2
 using a multiplication factor of $[1 - (\%CO_2/100)]$.

lb/hr = (ppm pollutant)(DSCFM flow)(Conv. Factor)(60)
 lb/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: THC Conv. Factor = 4.156E-08 lb THC/DSCF - ppm THC
 NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NO2
 CO Conv. Factor = 7.273E-08 lb CO/DSCF - ppm CO
 F-Factor = 9598 DSCF/MMBtu

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: Halliburton

TEST DATE: 7/31/92

RUN NUMB 3

SPAN VALU 1000 ppm THC
1000 ppm NOx
1000 ppm CO
20 % Oxygen
20 % CO2

	—INITIAL VALUES—			—FINAL VALUES—		
	ANALYZER CAL RESPONSE	SYSTEM CAL RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	SYSTEM CAL RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
THC ZERO	-0.0	1.9	0.19	40.3	4.03	3.84
THC UP-SCA	804.8	805.4	0.06	819.9	1.51	1.45
NOx ZERO G	1.0	0.1	-0.09	2.1	0.11	0.20
NOx UP-SCA	866.3	840.7	-2.56	902.6	3.63	6.19
CO ZERO G	1.0	1.0	0.00	0.5	-0.05	-0.05
CO UP-SCAL	809.8	809.8	0.00	817.8	0.80	0.80
O2 ZERO G	0.01	-0.04	-0.25	-0.03	-0.20	0.05
O2 UP-SCAL	5.06	20.54	77.40	20.52	77.30	-0.10
CO2 ZERO G	-0.01	-0.01	0.00	-0.03	-0.10	-0.10
CO2 UP-SCA	17.74	17.79	0.25	17.81	0.35	0.10

SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE
SYSTEM CAL. BIAS = _____ X 100

SPAN

FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE
DRIFT = _____ X 100

SPAN

CALCULATION OF AVERAGE THC, NOx AND CO EMISSIONS

RUN: 3A
SOURCE: Halliburton

DATE: 7/31/92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm THC	40.3	23.4	31.9
804.7 ppm THC	819.9	800.0	810.0
0.0 ppm NOx	2.1	15.7	8.9
1843.0 ppm noX	1878.6	1876.4	1877.5
0.0 ppm CO	0.5	0.7	0.6
807.0 ppm CO	817.8	819.6	818.7
0.00 % Oxygen	-0.03	-0.02	-0.03
5.01 % Oxygen	5.08	5.08	5.08
0.00 % CO2	-0.03	0.02	-0.01
17.74 % CO2	17.81	17.67	17.74

Uncorrected Data: 122.7 ppm THC 10.5 % Oxygen
1161 ppm NOx 7.47 % CO2
192.5 ppm CO 675 DSCFM

CORRECTED RESULTS

93.9 ppm THC 7.50 % CO2
1137 ppm NOx 10.3 % Oxygen
175.1 ppm CO 0.158 lb THC/hr
0.074 lb THC/MMBtu 5.50 lb NOx/hr
2.57 lb NOx/MMBtu 0.516 lb CO/hr
0.241 lb CO/MMBtu

$$\text{Corrected Conc.} = C_{ma}(\bar{C} - C_o)/(C_m - C_o)$$

Where: $\bar{C}$ = mean reference measurement

C_o = mean zero calibration response

C_m = mean mid or upscale calibration gas response

C_{ma} = actual mid or upscale calibration gas concentration

NOTE: CO concentrations are corrected for the lost volume of CO2
using a multiplication factor of $[1 - (\%CO_2/100)]$.

$$\text{lb/hr} = (\text{ppm pollutant})(\text{DSCFM flow})(\text{Conv. Factor})(60)$$

$$\text{lb/MMBtu} = (\text{ppm pollutant})(\text{F-Factor})(\text{Conv. Factor})(20.9/20.9 - \%O_2)$$

Where: THC Conv. Factor = 4.156E-08 lb THC/DSCF - ppm THC
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NO2
CO Conv. Factor = 7.273E-08 lb CO/DSCF - ppm CO
F-Factor = 9598 DSCF/MMBtu

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: Halliburton

TEST DATE: 7/31/92

RUN NUMB 3A

SPAN VALU 1000 ppm THC
 2500 ppm NOx
 1000 ppm CO
 25 % Oxygen
 20 % CO2

	—INITIAL VALUES—			—FINAL VALUES—		
	ANALYZER CAL RESPONSE	SYSTEM CAL RESPONSE	SYSTEM CAL BIAS (% OF SPAN)	SYSTEM CAL RESPONSE	SYSTEM CAL BIAS (% OF SPAN)	DRIFT (% OF SPAN)
THC ZERO	-0.0	40.3	4.03	23.4	2.34	-1.69
THC UP-SCA	804.8	819.9	1.51	800.0	-0.48	-1.99
NOx ZERO G	1.0	2.1	0.04	15.7	0.59	0.54
NOx UP-SCA	1878.6	1878.6	0.00	1876.4	-0.09	-0.09
CO ZERO G	0.5	0.5	0.00	0.7	0.02	0.02
CO UP-SCAL	817.8	817.8	0.00	819.6	0.18	0.18
O2 ZERO G	0.01	-0.03	-0.16	-0.02	-0.12	0.04
O2 UP-SCAL	5.06	5.08	0.08	5.08	0.08	0.00
CO2 ZERO G	-0.01	-0.03	-0.10	0.02	0.15	0.25
CO2 UP-SCA	17.74	17.81	0.35	17.67	-0.35	-0.70

SYSTEM CAL RESPONSE - ANALYZER CAL RESPONSE
 SYSTEM CAL BIAS = _____ X 100

SPAN

FINAL SYSTEM CAL RESPONSE - INITIAL CAL RESPONSE
 DRIFT = _____ X 100

SPAN

Appendix A.4
Benzene - CARB Method 410A

FIELD DATA AND RESULTS TABULATION

Plant: Western States Petroleum Association

Test Location: Halliburton Equipment Yard

<u>Run Number</u>	<u>Run Date</u>	<u>Operator</u>
M410A-1	7/29/92	Tony Wong
M410A-2	7/30/92	Wayne Johnson
M410A-3	7/31/92	Wayne Johnson

		<u>M410A-1</u>	<u>M410A-2</u>	<u>M410A-3</u>
	Run Start Time	1223	1341	1501
	Run Stop Time	1715	1709	2002
	Net Sampling/Traversing Points	1	1	1
	Net Run Time, Minutes	60	60	60
Y	Dry Gas Meter Calibration Coefficient	0.9930	0.9930	0.9930
Pbar	Barometric Pressure, Inches Hg	29.50	29.50	29.70
Delta-H	Orifice Average Pressure Differential, Inches H2O	1.000	1.000	1.000
Qsd	Source Gas Volumetric Flow Rate, Dry SCFM	303	303	305
F	F-Factor, DSCF/Million Btu	9,058	9,388	9,598
MMBtu/Hr	Heat Input Rate, Million Btu/Hour	0.403	0.398	0.374
	<u>Benzene</u>			
FWt	Formula Weight, Lb/Lb-Mole	78.12	78.12	78.12
ppbvd	Concentration, Parts Per Billion by Volume	220	190	170
ug/DSCM	Concentration, Micrograms per DSCM	725.9	626.89	560.90
ng/DSCM	Concentration, Nanograms per DSCM	725,877	626,894	560,905
lb/hr	Emission Rate, Pounds per Hour	8.11E-04	7.00E-04	6.31E-04
lb/MMBtu	Emission Factor, Pounds per Million Btu	2.01E-03	1.76E-03	1.69E-03

Note:

All standard volumes and flow rates based on 16 Degrees C (60 Degrees F) -- 29.92 Inches of Mercury (Hg)

Appendix A.5

1,3-Butadiene - CARB Method 422.102

OPY DIESEL ENGINE TEST

1992 - 1.3 BUTADIENE RESULTS

	AREA	CONC	ACTUAL		PERIOD	TOTAL		FUEL	TOTAL	ELAPSED	COMPOSITE		ENTROPY	RATIO
			CONCENTR	STACK FLOW		EMISSIONS	DURING				TIME AT	EMISSION		
TIME	COUNT	(ppm)	(ppm)	(scfm)	RATE	(lb/hr)	PERIOD	DURING	PERIOD	RUN	CONDITION	POUNDS/	EMISSION	COMPOSITE
												MMBTU	FACTOR	TO ENTROPY
01-92														
07:45	60	0.492	0.492	192	7.9567E-04	1.9346E-04		0.0304259314			IDLE			
08:00	57	0.465	0.465	192	7.5201E-04	1.8639E-04		0.0304259313			IDLE			
08:15	56	0.457	0.457	192	7.3907E-04	1.8934E-04		0.0324543268			IDLE			
08:31	52	0.422	0.422	192	6.8247E-04	1.7405E-04		0.0304259312			IDLE			
08:46	54	0.439	0.439	192	7.0996E-04	1.7223E-04		0.0304259314			IDLE			
08:01	51	0.413	0.413	192	6.6791E-04	1.5647E-04		0.0304259314			IDLE			
08:16	45	0.361	0.361	192	5.8382E-04	3.9636E-04		0.0770790261			IDLE			
08:54	51	0.413	0.413	192	6.6791E-04	1.8718E-04		0.0344827223			IDLE			
10:11	50	0.404	0.404	192	6.5336E-04	1.7811E-04		0.0324543268			IDLE			
10:27	52	0.422	0.422	192	6.8247E-04	1.8005E-04		0.0324543268		06:02:00	IDLE			
10:43	51	0.413	0.413	192	6.6791E-04	1.6898E-04		0.0304259313			IDLE			
10:58	51	0.413	0.413	192	6.6791E-04	1.9520E-04		0.0344827222			IDLE			
11:15	54	0.439	0.439	192	7.0996E-04	1.3760E-04		0.0324543268			IDLE			
11:31	53	0.431	0.431	192	6.9702E-04	3.8296E-04		0.0649086536			IDLE			
12:03	56	0.457	0.457	192	7.3907E-04	1.9515E-04		0.0324543268			IDLE			
12:19	55	0.448	0.448	192	7.2452E-04	2.2148E-04		0.0365111176			IDLE			
12:37	57	0.465	0.465	192	7.5201E-04	1.9130E-04		0.0344827222			IDLE			
12:54	46	0.370	0.370	192	5.9837E-04	2.0911E-04		0.0365111176			IDLE			
13:12	60	0.492	0.492	192	7.9567E-04	2.2544E-04		0.0344827222			IDLE			
13:29	60	0.492	0.492	192	7.9567E-04	2.2803E-04		0.0365111176			IDLE			
13:47	55	0.448	0.448	192	7.2452E-04						IDLE			
14:05	109	0.918	0.918	636	4.9172E-03	1.3123E-03		0.5859020179			LOAD			
14:11	109	0.918	0.920	636	4.9285E-03	1.3580E-03		0.6591397696			LOAD			
17:29	92	0.770	0.770	636	4.1249E-03	1.1973E-03		0.6591397702		01:27:00	LOAD			
17:47	86	0.719	0.720	636	3.5571E-03	1.2294E-03		0.6225208954			LOAD			
18:04	107	0.901	0.900	636	4.8214E-03	1.4785E-03		0.6591397702			LOAD			
18:22	112	0.945	0.940	636	5.6256E-03						LOAD			
TOTAL	1629	13.331	13.384	7212		1.0793E-02		3.9201213678		07:29:00		2.7503E-03	1.3500E-03	0.62433
LB/HOUR	30.025	0.17334	0.17388	93.697		1.4022E-04		0.0509298176						
BTU/HOUR	64.481	0.531	0.53051	290.66		1.2789E-03		4.3173E-04						

PPY DIESEL ENGINE TEST

1992 - 110 BUTADIENE RESULTS

TIME	AREA COUNT	CONC (ppm)	ACTUAL CONCENTR (ppm)	STACK FLOW RATE (scfm)	PERIOD EMISSION RATE (lb/hr)	TOTAL EMISSIONS DURING PERIOD (POUNDS)	TOTAL FUEL DURING PERIOD TOTAL MMBTU	RUN CONDITION	ELAPSED TIME AT RUN CONDITION (HRS:MIN:SEC)	COMPOSITE EMISSION FACTOR POUNDS/ MMBTU	ENTROPY EMISSION FACTOR	RATIO COMPOSITE TO ENTROPY
11-02												
11:00	53	0.457	0.457	189	7.2751E-04	1.2439E-04	0.0674280309	IDLE				
11:05	53	0.457	0.457	189	7.2751E-04	1.8849E-04	0.0308242427	IDLE				
11:11	50	0.431	0.431	189	6.8613E-04	1.8658E-04	0.0308242428	IDLE				
12:07	52	0.448	0.448	189	7.1320E-04	1.8276E-04	0.0308242427	IDLE				
12:23	48	0.413	0.413	189	6.5748E-04	1.7533E-04	0.0308242427	IDLE				
12:39	43	0.413	0.413	189	6.5748E-04	1.6278E-04	0.0288977275	IDLE				
12:54	47	0.405	0.405	189	6.4474E-04	3.5461E-04	0.0635750007	IDLE	04:05:00			
13:27	47	0.405	0.405	189	6.4474E-04	1.6641E-04	0.0308242427	IDLE				
13:43	44	0.379	0.379	189	6.0335E-04	1.6089E-04	0.0308242427	IDLE				
13:59	44	0.379	0.379	189	6.0335E-04	1.7363E-04	0.0308242427	IDLE				
14:15	51	0.439	0.439	189	6.9887E-04	1.8636E-04	0.0308242427	IDLE				
14:31	51	0.439	0.439	189	6.9887E-04	1.8828E-04	0.0308242427	IDLE				
14:47	52	0.448	0.448	189	7.1320E-04	2.1826E-04	0.0346772729	IDLE				
15:03	54	0.466	0.466	189	7.4185E-04	3.8080E-04	0.0616484853	IDLE				
15:37	52	0.431	0.431	189	6.8613E-04		0.1310030314	IDLE				
16:45	117	0.979	0.979	646	5.3270E-03	1.4394E-03	0.5847309912	LOAD				
17:01	116	1.005	1.005	646	5.4665E-03	1.4732E-03	0.5481853043	LOAD				
17:16	134	1.161	1.161	646	6.3173E-03	2.7748E-03	1.1329162978	LOAD	01:18:00			
17:47	94	0.813	0.813	646	4.4238E-03	1.1550E-03	0.5847309906	LOAD				
18:03	90	0.779	0.779	646	4.2388E-03			LOAD				
19:01		11.1	11.147	6065	3.5980E-02	9.5920E-03	3.5152113169		05:23:00	2.8425E-03	3.5700E-03	0.78621
19:00				62.299	3.8958E-04	1.8561E-03	0.6529804303					
19:00		1.083	1.083	597.33	5.4491E-03	5.5511E-04	0.1850111219					

COPY DIESEL ENGINE TEST

1992 - 1,3 BUTADIENE RESULTS

COPY DIESEL ENGINE TEST												
1992 - 1.3 BUTADIENE RESULTS												
TIME	AREA COUNT	CONC (ppm)	ACTUAL CONCENTR (ppm)	STACK FLOW (scfm)	PERIOD EMISSION RATE (lb/hr)	TOTAL EMISSIONS DURING PERIOD (POUNDS)	TOTAL FUEL DURING PERIOD TOTAL MMBTU	RUN CONDITION	ELAPSED TIME AT RUN CONDITION (HRS:MIN:SEC)	COMPOSITE EMISSION FACTOR POUNDS/ MMBTU	ENTROPY EMISSION FACTOR	RATIO COMPOSITE TO ENTROPY
01-92												
13:00	50	0.434	0.434	181	6.6166E-04	1.3474E-04	0.0257155848	IDLE				
13:15	44	0.378	0.378	181	5.7629E-04	2.4664E-04	0.0462880524	IDLE				
13:42	40	0.341	0.341	181	5.1988E-04	1.4046E-04	0.027429957	IDLE				
13:58	41	0.350	0.350	181	5.3360E-04	1.4981E-04	0.027429957	IDLE				
14:14	45	0.387	0.387	181	5.9001E-04	1.6134E-04	0.0291443294	IDLE				
14:31	42	0.360	0.360	181	5.4885E-04	1.4433E-04	0.027429957	IDLE				
14:47	41	0.350	0.350	181	5.3360E-04	3.0145E-04	0.0565742864	IDLE				
15:20	43	0.369	0.369	181	5.6257E-04	1.6134E-04	0.0291443294	IDLE				
15:37	44	0.378	0.378	181	5.7629E-04	1.5002E-04	0.027429957	IDLE				
15:53	42	0.360	0.360	181	5.4885E-04	1.4819E-04	0.027429957	IDLE	04:30:00			
16:09	43	0.369	0.369	181	5.6257E-04	1.5193E-04	0.027429957	IDLE				
16:25	44	0.378	0.378	181	5.7629E-04	1.5754E-04	0.027429957	IDLE				
16:41	46	0.397	0.397	181	6.0525E-04	1.5939E-04	0.0291443294	IDLE				
16:58	40	0.341	0.341	181	5.1988E-04	3.0004E-04	0.0548599139	IDLE				
17:30	46	0.397	0.397	181	6.0525E-04			IDLE				
01-98												
19:26	54	0.471	0.471	675	2.6779E-03	9.5369E-04	0.7490346357	LOAD	01:08:00			
19:47	45	0.387	0.387	675	2.2003E-03	5.5718E-04	0.5350247427	LOAD				
20:02	46	0.397	0.397	675	2.2572E-03	5.1701E-04	0.5706930565	LOAD				
20:18	34	0.285	0.285	675	1.6204E-03	4.9578E-04	0.5706930565	LOAD				
20:34	43	0.369	0.369	675	2.0980E-03			LOAD				
05-98												
05:38:00	873	7.498	7.498	6090	1.9375E-02	4.9508E-03	2.888326016		05:38:00	1.7141E-03	2.5800E-03	0.6647
05:51:27					1.8948E-04	4.8419E-05	0.5127205944					
06:16:01	43.65	0.3749	0.3749	304.5	9.6155E-04	2.7504E-04	0.1604625564			2.4366E-03	3.1667E-03	0.7681
06-98												
06:10:00					9.6873E-04							
THREE RUNS COMBINED												
TOTAL	3795	32.026	32.029	19367	5.5354E-02	2.5736E-02	10.3236587007		15:30:00			
AVERAGE	57.59	0.48761	0.48758	299.47	1.2280E-03	4.2063E-04	0.1674261777		06:10:00	2.4366E-03	3.1667E-03	0.7681

FIELD DATA AND RESULTS TABULATION

Job: WSPA
 Address: Bakersfield, CA
 Location: Engine Exhaust Duct

DILUTION FACTOR
 1.00

1,3-BUTADIENE

Mol. WT

54.09

INJECTION	TIME	AREA COUNT	CONCEN. As ANALZ (PPM)	RECOVERY FACTOR	ACTUAL CONCEN. (PPMVD)	FLOW RATE (SCFM)	EMISSIONS (lb/hr)
RUN 1							
1	745	60	0.492	1	0.492	192	7.95E-04
2	800	57	0.465	1	0.465	192	7.53E-04
3	815	56	0.457	1	0.457	192	7.39E-04
4	831	52	0.422	1	0.422	192	6.82E-04
5	846	54	0.439	1	0.439	192	7.10E-04
6	901	51	0.413	1	0.413	192	6.68E-04
7	916	45	0.361	1	0.361	192	5.84E-04
8	954	51	0.413	1	0.413	192	6.68E-04
9	1011	50	0.404	1	0.404	192	6.54E-04
10	1027	52	0.422	1	0.422	192	6.82E-04
11	1043	51	0.413	1	0.413	192	6.68E-04
12	1058	51	0.413	1	0.413	192	6.68E-04
13	1115	54	0.439	1	0.439	192	7.10E-04
14	1131	53	0.431	1	0.431	192	6.96E-04
15	1203	56	0.457	1	0.457	192	7.39E-04
16	1219	55	0.448	1	0.448	192	7.24E-04
17	1237	57	0.465	1	0.465	192	7.53E-04
18	1254	46	0.370	1	0.370	192	5.98E-04
19	1312	60	0.492	1	0.492	192	7.95E-04
20	1329	60	0.492	1	0.492	192	7.95E-04
21	1347	55	0.448	1	0.448	192	7.24E-04
22	1655	109	0.918	1	0.918	636	4.92E-03
23	1711	109	0.918	1	0.920	636	4.93E-03
24	1729	92	0.770	1	0.770	636	4.12E-03
25	1747	86	0.718	1	0.720	636	3.86E-03
26	1804	107	0.901	1	0.900	636	4.82E-03
27	1822	112	0.945	1	0.940	636	5.04E-03
Average			0.531		0.530		1.57E-03

FIELD DATA AND RESULTS TABULATION

1,3-BUTADIENE

0.099	13.000
0.540	69.000
1.080	126.000

1,3-BUTADIENE

Regression Output:

Constant	3.5842927
Std Err of Y Est	4.2143397
R Squared	0.9972182
No. of Observations	3
Degrees of Freedom	1

X Coefficient(s) 114.779
Std Err of Coef. 6.06214

FIELD DATA AND RESULTS TABULATION

Plant: WSPA
Location: Bakersfield, CA

1,3-BUTADIENE CALIBRATION
Date: 07/29/92

LEVEL 1

	1,3-BUT
Concentration, ppvd	0.0985
Area Count	13

LEVEL 2

	1,3-BUT
Concentration, ppvd	0.54
Area Count	69

LEVEL 3

	1,3-BUT
Concentration, ppvd	1.08
Area Count	126

FIELD DATA AND RESULTS TABULATION

Job: WSPA
Address: Bakersfield, CA
Location: Engine Exhaust Duct

DILUTION FACTOR
1.00

1,3-BUTADIENE

Mol. WT

54.09

INJECTION	TIME	AREA COUNT	CONCEN. AS ANALZ (PPM)	RECOVERY FACTOR	ACTUAL CONCEN. (PPMVD)	FLOW RATE (SCFH)	EMISSIONS (lb/hr)
RUN 2							
1	1100	53	0.457	1	0.457	189	7.27E-04
2	1135	53	0.457	1	0.457	189	7.27E-04
3	1151	50	0.431	1	0.431	189	6.86E-04
4	1207	52	0.448	1	0.448	189	7.13E-04
5	1223	48	0.413	1	0.413	189	6.58E-04
6	1239	48	0.413	1	0.413	189	6.58E-04
7	1254	47	0.405	1	0.405	189	6.44E-04
8	1327	47	0.405	1	0.405	189	6.44E-04
9	1343	44	0.379	1	0.379	189	6.03E-04
10	1359	44	0.379	1	0.379	189	6.03E-04
11	1415	51	0.439	1	0.439	189	7.00E-04
12	1431	51	0.439	1	0.439	189	7.00E-04
13	1447	52	0.448	1	0.448	189	7.13E-04
14	1505	54	0.466	1	0.466	189	7.41E-04
15	1537	50	0.431	1	0.431	189	6.86E-04
16	1645	113	0.979	1	0.979	646	5.33E-03
17	1701	116	1.005	1	1.005	646	5.47E-03
18	1716	134	1.161	1	1.161	646	6.32E-03
19	1747	94	0.813	1	0.813	646	4.43E-03
20	1803	90	0.779	1	0.779	646	4.24E-03
Average			0.557		0.557		1.80E-03

FIELD DATA AND RESULTS TABULATION

1,3-BUTADIENE

0.099	11.000
0.540	64.000
1.080	124.000

1,3-BUTADIENE

Regression Output:

Constant	0.4675423
Std Err of Y Est	1.7689513
R Squared	0.9995105
No. of Observations	3
Degrees of Freedom	1

X Coefficient(s) 114.982
Std Err of Coef. 2.54456

FIELD DATA AND RESULTS TABULATION

Plant: WSPA
Location: Bakersfield, CA

1,3-BUTADIENE CALIBRATION
Date: 07/30/92

LEVEL 1

	1,3-BUT
Concentration, ppmd	0.0985
Area Count	11

LEVEL 2

	1,3-BUT
Concentration, ppmd	0.54
Area Count	64

LEVEL 3

	1,3-BUT
Concentration, ppmd	1.08
Area Count	124

A 33

ENTROPY

FIELD DATA AND RESULTS TABULATION

Job: WSPA
Address: Bakersfield, CA
Location: Engine Exhaust Duct

DILUTION FACTOR
1.00

1,3-BUTADIENE

Mol. WT

54.09

INJECTION	TIME	AREA COUNT	CONCEN. As ANALZ (PPM)	RECOVERY FACTOR	ACTUAL CONCEN. (PPMVD)	FLOW RATE (SCFM)	EMISSIONS (lb/hr)
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RUN 1

1	1310	50	0.434	1	0.434	181	6.61E-04
2	1315	44	0.378	1	0.378	181	5.76E-04
3	1342	40	0.341	1	0.341	181	5.20E-04
4	1358	41	0.350	1	0.350	181	5.34E-04
5	1414	45	0.387	1	0.387	181	5.91E-04
6	1431	42	0.360	1	0.360	181	5.48E-04
7	1447	41	0.350	1	0.350	181	5.34E-04
8	1520	43	0.369	1	0.369	181	5.62E-04
9	1537	44	0.378	1	0.378	181	5.76E-04
10	1553	42	0.360	1	0.360	181	5.48E-04
11	1609	43	0.369	1	0.369	181	5.62E-04
12	1625	44	0.378	1	0.378	181	5.76E-04
13	1641	46	0.397	1	0.397	181	6.05E-04
14	1658	40	0.341	1	0.341	191	5.20E-04
15	1730	46	0.397	1	0.397	181	6.05E-04
16	1926	54	0.471	1	0.471	181	7.18E-04
17	1947	45	0.387	1	0.387	675	2.20E-03
18	2002	46	0.397	1	0.397	675	2.26E-03
19	2018	34	0.285	1	0.285	675	1.62E-03
20	2034	43	0.369	1	0.369	675	2.10E-03

Average

0.375

0.375

8.71E-04

34

ENTROPY

FIELD DATA AND RESULTS TABULATION

1,3-BUTADIENE

0.099	13.000
0.540	63.000
1.080	119.000

1,3-BUTADIENE

Regression Output:

Constant	3.2254114
Std Err of Y Est	1.8902034
R Squared	0.9993647
No. of Observations	3
Degrees of Freedom	1

X Coefficient(s) 107.840
Std Err of Coef. 2.71897

FIELD DATA AND RESULTS TABULATION

Plant: WSPA

1,3-BUTADIENE CALIBRATION

Location: Bakersfield, CA

Date: 07/31/92

LEVEL 1

	1,3-BUT
Concentration, ppvd	0.0985
Area Count	13

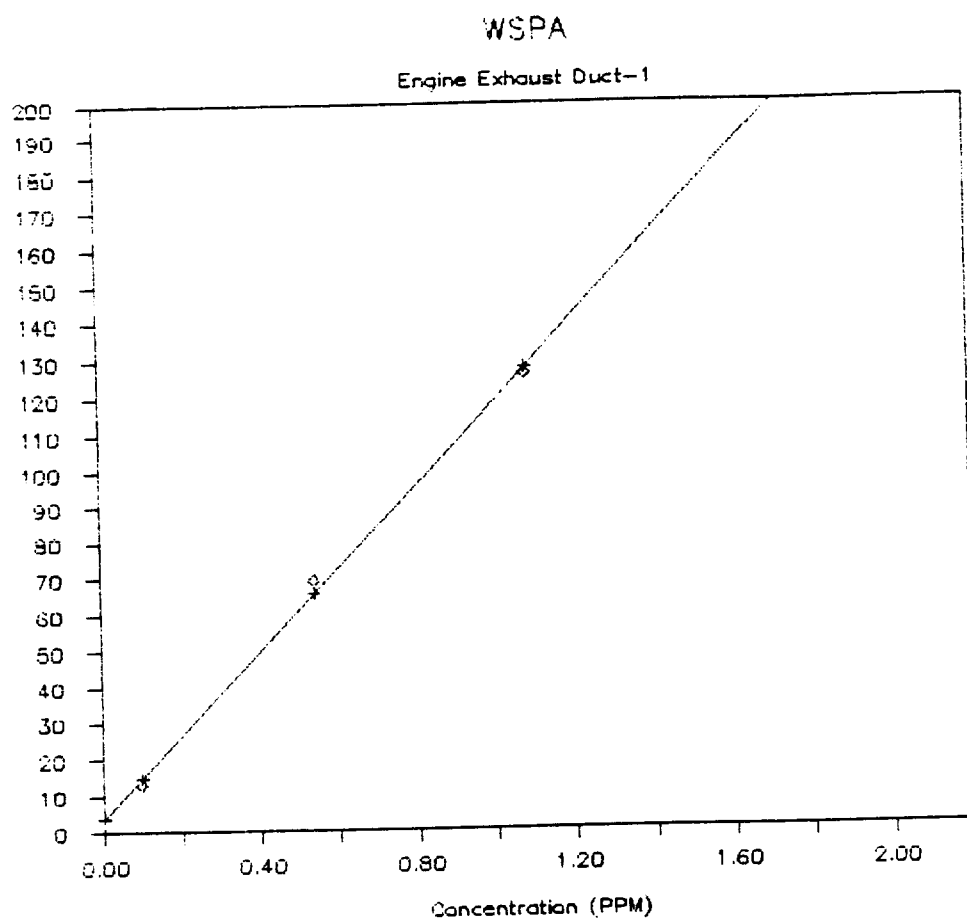
LEVEL 2

	1,3-BUT
Concentration, ppvd	0.54
Area Count	63

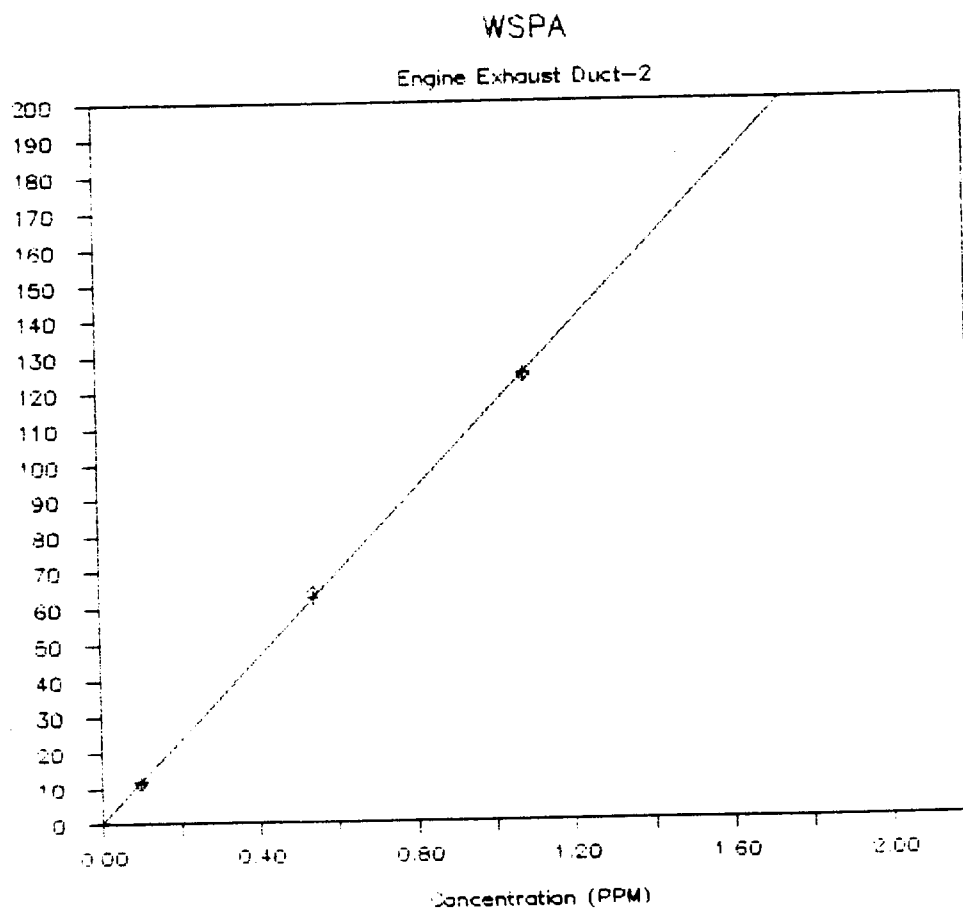
LEVEL 3

	1,3-BUT
Concentration, ppvd	1.08
Area Count	119

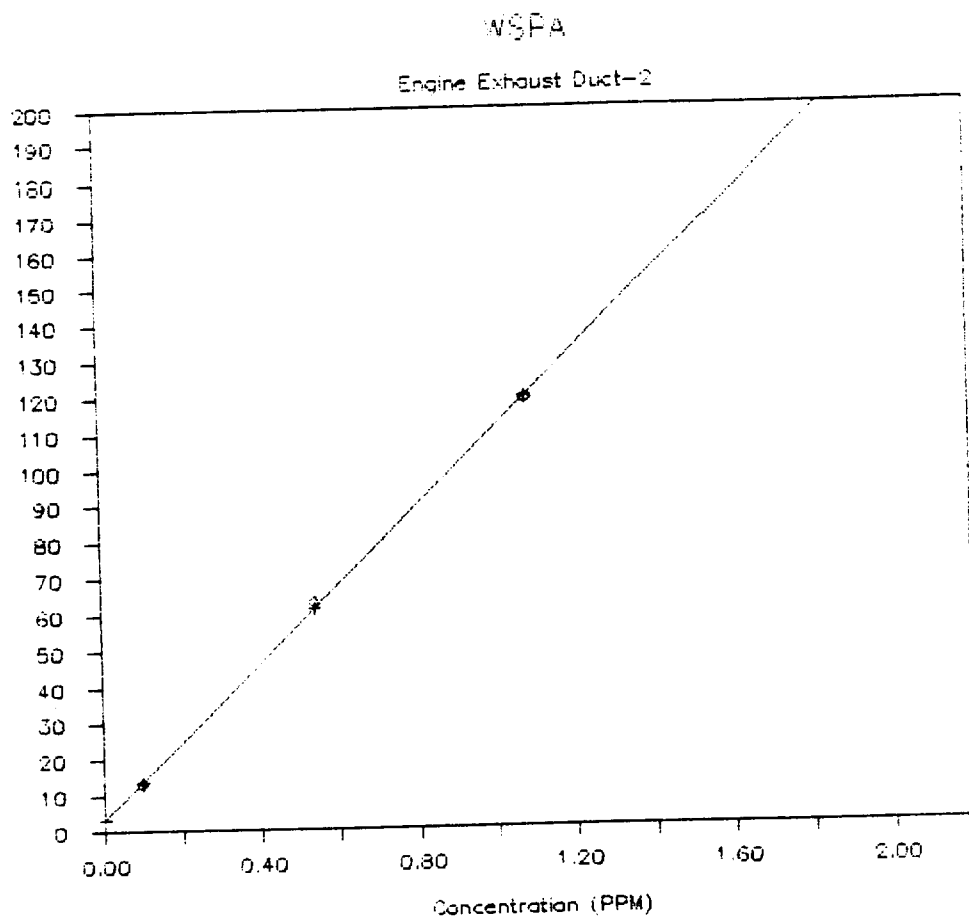
Area Count



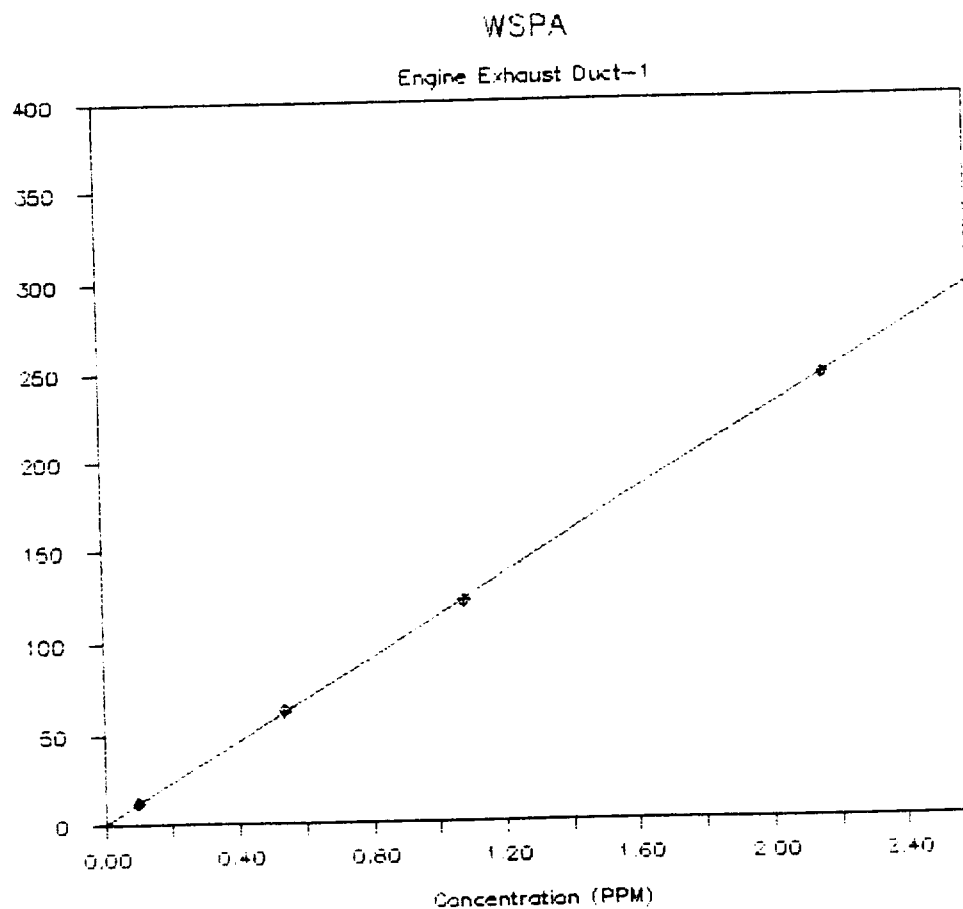
Area Count



Area Count



Area Count



FIELD DATA AND RESULTS TABULATION

Plant: Western States Petroleum Association
Test Location: Halliburton Equipment Yard

<u>Run Number</u>		<u>Run Date</u>	<u>Operator</u>	
M422.102-1		7/29/92	Gary Mata	
M422.102-2		7/30/92	Gary Mata	
M422.102-3		7/31/92	Gary Mata	
		<u>M422.102-1</u>	<u>M422.102-2</u>	<u>M422.102-3</u>
Run Start Time		745	1100	1310
Run Stop Time		1822	1803	2034
Net Sampling/Traversing Points		1	1	1
Net Run Time, Minutes		320	320	320
Qsd	Source Gas Volumetric Flow Rate, Dry SCFM	303	303	305
F	F-Factor, DSCF/Million Btu	9,058	9,388	9,598
MMBtu/Hr	Heat Input Rate, Million Btu/Hour	0.403	0.398	0.374
				.
<u>1,3-Butadiene</u>				
FWt	Formula Weight, Lb/Lb-Mole	54.09	54.09	54.09
ppmvd	Concentration, Parts Per Million by Volume	0.530	0.557	0.375
ug/DSCM	Concentration, Micrograms per DSCM	1211	1272	857
ng/DSCM	Concentration, Nanograms per DSCM	1,210,796	1,272,478	856,695
lb/hr	Emission Rate, Pounds per Hour	1.35E-03	1.42E-03	9.63E-04
lb/MMBtu	Emission Rate, Pounds per Million Btu	3.35E-03	3.57E-03	2.58E-03

Note:

All standard volumes and flow rates based on 16 Degrees C (60 Degrees F) -- 29.92 Inches of Mercury (Hg)

Appendix A.6

Volatile Organic Compounds - CARB Method 422

FIELD DATA AND RESULTS TABULATION

Plant: Western States Petroleum Association
Test Location: Halliburton Equipment Yard

<u>Run Number</u>	<u>Run Date</u>	<u>Operator</u>
M422-1	7/29/92	Tony Wong
M422-2	7/30/92	Wayne Johnson
M422-3	7/31/92	Wayne Johnson

		<u>M422-1</u>	<u>M422-2</u>	<u>M422-3</u>
	Run Start Time	1217	1334	1500
	Run Stop Time	1715	1708	1959
	Net Sampling/Traversing Points	1	1	1
	Net Run Time, Minutes	60	60	60
Y	Dry Gas Meter Calibration Coefficient	0.998	0.998	0.998
Pbar	Barometric Pressure, Inches Hg	29.5	29.5	29.7
Qsd	Source Gas Volumetric Flow Rate, Dry SCFM	303	303	305
F	F-Factor, DSCF/Million Btu	9,058	9,388	9,598
MMBtu/Hr	Heat Input Rate, Million Btu/Hour	0.403	0.398	0.374
	<u>Ethylbenzene</u>			
FWt	Formula Weight, Lb/Lb-Mole	106.16	106.16	106.16
ppbvd	Concentration, Parts Per Billion by Volume	9.2	5.5	4.1
ug/DSCM	Concentration, Micrograms per DSCM	41.3	24.7	18.4
ng/DSCM	Concentration, Nanograms per DSCM	43601	24660	18383
lb/hr	Emission Rate, Pounds per Hour	4.61E-05	2.75E-05	2.07E-05
lb/MMBtu	Emission Factor, Pounds per Million Btu	1.14E-04	6.91E-05	5.53E-05
	<u>n-Hexane</u>			
FWt	Formula Weight, Lb/Lb-Mole	86.18	86.18	86.18
ppbvd	Concentration, Parts Per Billion by Volume	4	11	40
ug/DSCM	Concentration, Micrograms per DSCM	14.6	40.0	146
ng/DSCM	Concentration, Nanograms per DSCM	14559	40038	145594
lb/hr	Emission Rate, Pounds per Hour	1.63E-05	4.47E-05	1.64E-04
lb/MMBtu	Emission Factor, Pounds per Million Btu	4.03E-05	1.12E-04	4.38E-04
	<u>Toluene</u>			
FWt	Formula Weight, Lb/Lb-Mole	92.13	92.13	92.13
ppbvd	Concentration, Parts Per Billion by Volume	100	120	94
ug/DSCM	Concentration, Micrograms per DSCM	389	467	366
ng/DSCM	Concentration, Nanograms per DSCM	389116	466939	365769
lb/hr	Emission Rate, Pounds per Hour	4.35E-04	5.22E-04	4.11E-04
lb/MMBtu	Emission Factor, Pounds per Million Btu	1.08E-03	1.31E-03	1.10E-03

Notes:
All standard volumes and flow rates based on 16 Degrees C (60 Degrees F) -- 29.92 Inches of Mercury (Hg)

FIELD DATA AND RESULTS TABULATION

		<u>M422-1</u>	<u>M422-2</u>	<u>M422-3</u>
	<u>m-&p-Xylenes</u>			
FWt	Formula Weight, Lb/Lb-Mole	106.16	106.16	106.16
ppbvd	Concentration, Parts Per Billion by Volume	27	17	14
ug/DSCM	Concentration, Micrograms per DSCM	121	76.2	62.8
ng/DSCM	Concentration, Nanograms per DSCM	121061	76223	62772
lb/hr	Emission Rate, Pounds per Hour	1.35E-04	8.52E-05	7.06E-05
lb/MMBtu	Emission Factor, Pounds per Million Btu	3.35E-04	2.14E-04	1.89E-04
	<u>o-Xylenes</u>			
FWt	Formula Weight, Lb/Lb-Mole	106.16	106.16	106.16
ppbvd	Concentration, Parts Per Billion by Volume	11	8.6	6.3
ug/DSCM	Concentration, Micrograms per DSCM	49.3	38.6	28.2
ng/DSCM	Concentration, Nanograms per DSCM	49321	38560	28247
lb/hr	Emission Rate, Pounds per Hour	5.51E-05	4.31E-05	3.18E-05
lb/MMBtu	Emission Factor, Pounds per Million Btu	1.37E-04	1.08E-04	8.49E-05

Appendix A.7

Hexavalent and Total Chromium - CARB Method 425

FIELD DATA AND RESULTS TABULATION

Plant: Western States Petroleum Association

Test Location: Halliburton Equipment Yard

<u>Run Number</u>	<u>Run Date</u>	<u>Operator</u>
425-1	7/29/92	Shawn C. Graham
425-2	7/30/92	Shawn C. Graham
425-3	7/31/92	Clyde E. Nack

		<u>425-1</u>	<u>425-2</u>	<u>425-3</u>
	Run Start Time	745	1100	1310
	Run Stop Time	1841	1831	2120
	Net Sampling/Traversing Points	4	4	4
	Net Run Time, Minutes	320	320	320
Dia	Nozzle Diameter, Inches	0.217	0.216	0.217
Cp	Pitot Tube Coefficient	0.99	0.99	0.99
Y	Dry Gas Meter Calibration Coefficient	0.9960	0.9960	0.9960
Pbar	Barometric Pressure, Inches Hg	29.50	29.50	29.70
Delta-H	Orifice Average Pressure Differential, Inches H2O	1.561	1.505	1.728
Vm	Sampled Volume of Source Gas, Dry ACF	196.195	192.993	201.299
Vmm	Sampled Volume of Source Gas, Dry ACM	5.56	5.46	5.70
tm	Dry Gas Meter Temperature, Degrees F	109	109	110
Vmstd	Sampled Volume of Source Gas, Dry SCF	176.877	173.856	182.354
Vmstdm	Sampled Volume of Source Gas, Dry SCM	5.009	4.923	5.164
Vlc	Volume of Condensed Liquid, mL	192.6	188.2	212.6
Vwstd	Volume of Water Vapor, SCF	8.927	8.723	9.854
%H2O	Moisture Content, Percent by Volume	4.80	4.78	5.13
%H2Osat	Saturated Moisture Content, Percent by Volume	100.0	100.0	100.0
Mfd	Source Gas Dry Mole Fraction	0.952	0.952	0.949
%CO2	Source Gas CO2 Content, Percent by Dry Volume	3.1	3.1	3.0
%O2	Source Gas O2 Content, Percent by Dry Volume	16.7	16.6	16.8
Md	Source Gas Dry Molecular Weight, Lb/Lb-Mole	29.16	29.16	29.15
Ms	Source Gas Wet Molecular Weight, Lb/Lb-Mole	28.63	28.63	28.58
Pg	Source Gas Static Pressure, Inches H2O	0.22	0.22	0.22
Ps	Source Gas Absolute Pressure, Inches Hg	29.52	29.52	29.72
ts	Source Gas Temperature, Degrees F	314	313	302
Delta-p	Source Gas Average Velocity Head, Inches H2O	0.6217	0.5731	0.6294
vs	Source Gas Velocity, Feet/Second	63.87	61.28	63.60
A	Source Cross Sectional Area, Square Inches	19.63	19.63	19.63
Qsd	Source Gas Volumetric Flow Rate, Dry SCFM	330	317	334
Qmsd	Source Gas Volumetric Flow Rate, Dry SCMM	9	9	9
Qaw	Source Gas Volumetric Flow Rate, Wet ACFM	522	501	520
Qmaw	Source Gas Volumetric Flow Rate, Wet ACMM	15	14	15
%I	Average Isokinetic Sampling Rate, Percent	89.0	91.9	90.4
%EA	Excess Air, Percent	373	361	384
Fo	Fuel Factor	1.355	1.387	1.367
F	F-Factor, DSCF/Million Btu	9,058	9,388	9,598
MMBtu/Hr	Heat Input Rate, Million Btu/Hour	0.403	0.398	0.374
Qsd	Source Gas Volumetric Flow Rate, Dry SCFM *	303	303	305

Note:

All standard volumes and flow rates based on 60 Degrees F (16 Degrees C) -- 29.92 Inches of Mercury (Hg)

The lesser of %H2O and %H2Osat was used for calculation purposes

* Calculated from EPA Method 2 - Used for emission rate calculations

FIELD DATA AND RESULTS TABULATION

		<u>425-1</u>	<u>425-2</u>	<u>425-3</u>
	<u>Hexavalent Chromium</u>			
FWt	Formula Weight, Lb/Lb-Mole	52.00	52.00	52.00
ug	Catch Weight, Micrograms	0.480	0.530	1.20
ug/DSCM	Concentration, Micrograms per DSCM	0.0958	0.108	0.232
ng/DSCM	Concentration, Nanograms per DSCM	95.8	108	232
lb/hr	Emission Rate, Pounds per Hour	1.09E-07	1.22E-07	2.65E-07
lb/MMBtu	Emission Rate, Pounds per Million Btu	2.70E-07	3.07E-07	7.10E-07
	<u>Total Chromium</u>			
FWt	Formula Weight, Lb/Lb-Mole	52.00	52.00	52.00
ug	Catch Weight, Micrograms	8.81	6.12	8.72
ug/DSCM	Concentration, Micrograms per DSCM	1.76	1.24	1.689
ng/DSCM	Concentration, Nanograms per DSCM	1,759	1,243	1,689
lb/hr	Emission Rate, Pounds per Hour	2.00E-06	1.41E-06	1.93E-06
lb/MMBtu	Emission Rate, Pounds per Million Btu	4.95E-06	3.54E-06	5.16E-06

Appendix A.8

Polycyclic Aromatic Hydrocarbons and Phenol - CARB Method 429

FIELD DATA AND RESULTS TABULATION

Plant: Western States Petroleum Association
Test Location: Halliburton Equipment Yard

<u>Run Number</u>	<u>Run Date</u>	<u>Operator</u>
429-1	7/29/92	Mike Chavez
429-2	7/30/92	Mike Chavez
429-3	7/31/92	Mike Chavez

		<u>429-1</u>	<u>429-2</u>	<u>429-3</u>
	Run Start Time	745	1100	1310
	Run Stop Time	1841	1831	2120
	Net Sampling/Traversing Points	4	4	4
	Net Run Time, Minutes	320	320	320
Dia	Nozzle Diameter, Inches	0.217	0.217	0.216
Cp	Pitot Tube Coefficient	0.99	0.99	0.99
Y	Dry Gas Meter Calibration Coefficient	1.0120	1.0120	1.0120
Pbar	Barometric Pressure, Inches Hg	29.00	29.50	29.70
Delta-H	Orifice Average Pressure Differential, Inches H2O	1.684	1.698	1.948
Vm	Sampled Volume of Source Gas, Dry ACF	189.208	185.045	196.553
Vmm	Sampled Volume of Source Gas, Dry ACM	5.36	5.24	5.57
tm	Dry Gas Meter Temperature, Degrees F	106	87	98
Vmstd	Sampled Volume of Source Gas, Dry SCF	171.240	176.110	185.020
Vmstdm	Sampled Volume of Source Gas, Dry SCM	4.849	4.987	5.239
Vlc	Volume of Condensed Liquid, mL	198.5	211.2	166.9
Vwstd	Volume of Water Vapor, SCF	9.201	9.789	7.736
%H2O	Moisture Content, Percent by Volume	5.10	5.27	4.01
%H2Osat	Saturated Moisture Content, Percent by Volume	100.0	100.0	100.0
Mfd	Source Gas Dry Mole Fraction	0.949	0.947	0.960
%CO2	Source Gas CO2 Content, Percent by Dry Volume	3.1	3.1	3.0
%O2	Source Gas O2 Content, Percent by Dry Volume	16.7	16.6	16.8
Md	Source Gas Dry Molecular Weight, Lb/Lb-Mole	29.16	29.16	29.15
Ms	Source Gas Wet Molecular Weight, Lb/Lb-Mole	28.59	28.57	28.70
Pg	Source Gas Static Pressure, Inches H2O	0.22	0.22	0.22
Ps	Source Gas Absolute Pressure, Inches Hg	29.02	29.52	29.72
ts	Source Gas Temperature, Degrees F	314	313	302
Delta-p	Source Gas Average Velocity Head, Inches H2O	0.6217	0.5731	0.6294
vs	Source Gas Velocity, Feet/Second	64.44	61.33	63.47
A	Source Cross Sectional Area, Square Inches	19.63	19.63	19.63
Qsd	Source Gas Volumetric Flow Rate, Dry SCFM	326	315	338
Qmsd	Source Gas Volumetric Flow Rate, Dry SCMM	9	9	10
Qaw	Source Gas Volumetric Flow Rate, Wet ACFM	527	502	519
Qmaw	Source Gas Volumetric Flow Rate, Wet ACMM	15	14	15
%I	Average Isokinetic Sampling Rate, Percent	87.1	92.6	91.7
%EA	Excess Air, Percent	373	361	384
Fo	Fuel Factor	1.355	1.387	1.367
F	F-Factor, DSCF/Million Btu	9,058	9,388	9,598
MMBtu/Hr	Heat Input Rate, Million Btu/Hour	0.403	0.398	0.374
Qsd	Source Gas Volumetric Flow Rate, Dry SCFM *	303	303	305

Note:

All standard volumes and flow rates based on 60 Degrees F (16 Degrees C) -- 29.92 Inches of Mercury (Hg)

The lesser of %H2O and %H2Osat was used for calculation purposes

* Calculated from EPA Method 2 - Used for emission rate calculations

FIELD DATA AND RESULTS TABULATION

		<u>429-1</u>	<u>429-2</u>	<u>429-3</u>
<u>Acenaphthene</u>				
FWt	Formula Weight, Lb/Lb-Mole	154.21	154.21	154.21
ng	Catch Weight, Nanograms	30000	29000	31000
ug/DSCM	Concentration, Micrograms per DSCM	6.19	5.82	5.92
ng/DSCM	Concentration, Nanograms per DSCM	6187	5815	5917
lb/hr	Emission Rate, Pounds per Hour	7.02E-06	6.60E-06	6.76E-06
lb/MMBtu	Emission Factor, Pounds per Million Btu	1.74E-05	1.66E-05	1.81E-05
<u>Acenaphthylene</u>				
FWt	Formula Weight, Lb/Lb-Mole	152.20	152.2	152.2
ng	Catch Weight, Nanograms	30000	26000	33000
ug/DSCM	Concentration, Micrograms per DSCM	6.19	5.21	6.30
ng/DSCM	Concentration, Nanograms per DSCM	6.19E+03	5.21E+03	6.30E+03
lb/hr	Emission Rate, Pounds per Hour	7.02E-06	5.92E-06	7.20E-06
lb/MMBtu	Emission Factor, Pounds per Million Btu	1.74E-05	1.49E-05	1.92E-05
<u>Anthracene</u>				
FWt	Formula Weight, Lb/Lb-Mole	178.23	178.23	178.23
ng	Catch Weight, Nanograms	29000	20000	37000
ug/DSCM	Concentration, Micrograms per DSCM	5.98	4.01	7.06
ng/DSCM	Concentration, Nanograms per DSCM	5.98E+03	4.01E+03	7.06E+03
lb/hr	Emission Rate, Pounds per Hour	6.79E-06	4.55E-06	8.07E-06
lb/MMBtu	Emission Factor, Pounds per Million Btu	1.68E-05	1.14E-05	2.16E-05
<u>Benz(a)anthracene *</u>				
FWt	Formula Weight, Lb/Lb-Mole	228.30	228.30	228.30
ng	Catch Weight, Nanograms	11000	13000	12000
ug/DSCM	Concentration, Micrograms per DSCM	2.27	2.61	2.29
ng/DSCM	Concentration, Nanograms per DSCM	2.27E+03	2.61E+03	2.29E+03
lb/hr	Emission Rate, Pounds per Hour	2.57E-06	2.96E-06	2.62E-06
lb/MMBtu	Emission Factor, Pounds per Million Btu	6.38E-06	7.43E-06	7.00E-06
<u>Benzo(b)fluoranthene *</u>				
FWt	Formula Weight, Lb/Lb-Mole	252.32	252.32	252.32
ng	Catch Weight, Nanograms	1700	1300	1500
ug/DSCM	Concentration, Micrograms per DSCM	0.351	0.261	0.286
ng/DSCM	Concentration, Nanograms per DSCM	351	261	286
lb/hr	Emission Rate, Pounds per Hour	3.98E-07	2.96E-07	3.27E-07
lb/MMBtu	Emission Factor, Pounds per Million Btu	9.87E-07	7.43E-07	8.74E-07
<u>Benzo(k)fluoranthene *</u>				
FWt	Formula Weight, Lb/Lb-Mole	252.32	252.32	252.32
ng	Catch Weight, Nanograms	1100	530	490
ug/DSCM	Concentration, Micrograms per DSCM	0.227	0.106	0.094
ng/DSCM	Concentration, Nanograms per DSCM	227	106	93.5
lb/hr	Emission Rate, Pounds per Hour	2.57E-07	1.21E-07	1.07E-07
lb/MMBtu	Emission Factor, Pounds per Million Btu	6.38E-07	3.03E-07	2.86E-07
<u>Benzo(g,h,i)perylene</u>				
FWt	Formula Weight, Lb/Lb-Mole	276.34	276.34	276.34
ng	Catch Weight, Nanograms	510	270	380
ug/DSCM	Concentration, Micrograms per DSCM	0.105	0.0541	0.0725
ng/DSCM	Concentration, Nanograms per DSCM	105	54.1	72.5
lb/hr	Emission Rate, Pounds per Hour	1.19E-07	6.14E-08	8.29E-08
lb/MMBtu	Emission Factor, Pounds per Million Btu	2.96E-07	1.54E-07	2.22E-07

* AB2588 Listed Carcinogen

FIELD DATA AND RESULTS TABULATION

		<u>429-1</u>	<u>429-2</u>	<u>429-3</u>
<u>Benzo(a)pyrene *</u>				
FWt	Formula Weight, Lb/Lb-Mole	252.32	252.32	252.32
ng	Catch Weight, Nanograms	210	67	100
ug/DSCM	Concentration, Micrograms per DSCM	0.0433	0.0134	0.0191
ng/DSCM	Concentration, Nanograms per DSCM	43.3	13.4	19.1
lb/hr	Emission Rate, Pounds per Hour	4.92E-08	1.52E-08	2.18E-08
lb/MMBtu	Emission Factor, Pounds per Million Btu	1.22E-07	3.83E-08	5.83E-08
<u>Benzo(e)pyrene</u>				
FWt	Formula Weight, Lb/Lb-Mole	252.32	252.32	252.32
ng	Catch Weight, Nanograms	NA	NA	NA
ug/DSCM	Concentration, Micrograms per DSCM	NA	NA	NA
ng/DSCM	Concentration, Nanograms per DSCM	NA	NA	NA
lb/hr	Emission Rate, Pounds per Hour	NA	NA	NA
lb/MMBtu	Emission Factor, Pounds per Million Btu	NA	NA	NA
<u>Chrysene *</u>				
FWt	Formula Weight, Lb/Lb-Mole	228.29	228.29	228.29
ng	Catch Weight, Nanograms	12000	12000	12000
ug/DSCM	Concentration, Micrograms per DSCM	2.47	2.41	2.29
ng/DSCM	Concentration, Nanograms per DSCM	2.47E+03	2.41E+03	2.29E+03
lb/hr	Emission Rate, Pounds per Hour	2.81E-06	2.73E-06	2.62E-06
lb/MMBtu	Emission Factor, Pounds per Million Btu	6.96E-06	6.85E-06	7.00E-06
<u>Dibenz(a,h)anthracene *</u>				
FWt	Formula Weight, Lb/Lb-Mole	278.35	278.35	278.35
ng	Catch Weight, Nanograms	110	65	110
ug/DSCM	Concentration, Micrograms per DSCM	0.0227	0.0130	0.0210
ng/DSCM	Concentration, Nanograms per DSCM	22.7	13.0	21.0
lb/hr	Emission Rate, Pounds per Hour	2.57E-08	1.48E-08	2.40E-08
lb/MMBtu	Emission Factor, Pounds per Million Btu	6.38E-08	3.71E-08	6.41E-08
<u>Fluoranthene</u>				
FWt	Formula Weight, Lb/Lb-Mole	202.26	202.26	202.26
ng	Catch Weight, Nanograms	1100	17000	16000
ug/DSCM	Concentration, Micrograms per DSCM	0.227	3.41	3.05
ng/DSCM	Concentration, Nanograms per DSCM	227	3.41E+03	3.05E+03
lb/hr	Emission Rate, Pounds per Hour	2.57E-07	3.87E-06	3.49E-06
lb/MMBtu	Emission Factor, Pounds per Million Btu	6.38E-07	9.71E-06	9.33E-06
<u>Fluorene</u>				
FWt	Formula Weight, Lb/Lb-Mole	166.22	166.22	166.22
ng	Catch Weight, Nanograms	110000	110000	120000
ug/DSCM	Concentration, Micrograms per DSCM	22.7	22.1	22.9
ng/DSCM	Concentration, Nanograms per DSCM	2.27E+04	2.21E+04	2.29E+04
lb/hr	Emission Rate, Pounds per Hour	2.57E-05	2.50E-05	2.62E-05
lb/MMBtu	Emission Factor, Pounds per Million Btu	6.38E-05	6.28E-05	7.00E-05
<u>Indeno(1,2,3-c,d)pyrene *</u>				
FWt	Formula Weight, Lb/Lb-Mole	288.35	288.35	288.35
ng	Catch Weight, Nanograms	400	270	380
ug/DSCM	Concentration, Micrograms per DSCM	0.0825	0.0541	0.0725
ng/DSCM	Concentration, Nanograms per DSCM	82.5	54.1	72.5
lb/hr	Emission Rate, Pounds per Hour	9.36E-08	6.14E-08	8.29E-08
lb/MMBtu	Emission Factor, Pounds per Million Btu	2.32E-07	1.54E-07	2.22E-07

FIELD DATA AND RESULTS TABULATION

		<u>429-1</u>	<u>429-2</u>	<u>429-3</u>
	<u>Naphthalene</u>			
FWt	Formula Weight, Lb/Lb-Mole	128.17	128.17	128.17
ng	Catch Weight, Nanograms	330,000	320,000	320,000
ug/DSCM	Concentration, Micrograms per DSCM	68.1	64.2	61.1
ng/DSCM	Concentration, Nanograms per DSCM	6.81E+04	6.42E+04	6.11E+04
lb/hr	Emission Rate, Pounds per Hour	7.72E-05	7.28E-05	6.98E-05
lb/MMBtu	Emission Factor, Pounds per Million Btu	1.92E-04	1.83E-04	1.87E-04
	<u>Phenanthrene</u>			
FWt	Formula Weight, Lb/Lb-Mole	178.23	178.23	178.23
ng	Catch Weight, Nanograms	490000	480000	560000
ug/DSCM	Concentration, Micrograms per DSCM	101	96.3	107
ng/DSCM	Concentration, Nanograms per DSCM	1.01E+05	9.63E+04	1.07E+05
lb/hr	Emission Rate, Pounds per Hour	1.15E-04	1.09E-04	1.22E-04
lb/MMBtu	Emission Factor, Pounds per Million Btu	2.84E-04	2.74E-04	3.26E-04
	<u>Pyrene</u>			
FWt	Formula Weight, Lb/Lb-Mole	202.26	202.26	202.26
ng	Catch Weight, Nanograms	24000	24000	23000
ug/DSCM	Concentration, Micrograms per DSCM	4.95	4.81	4.39
ng/DSCM	Concentration, Nanograms per DSCM	4.95E+03	4.81E+03	4.39E+03
lb/hr	Emission Rate, Pounds per Hour	5.62E-06	5.46E-06	5.02E-06
lb/MMBtu	Emission Factor, Pounds per Million Btu	1.39E-05	1.37E-05	1.34E-05

Appendix A.9

Acetaldehyde, Acrolein, Formaldehyde - CARB Method 430

FIELD DATA AND RESULTS TABULATION

Plant: Western States Petroleum Association
Test Location: Halliburton Equipment Yard

<u>Run Number</u>	<u>Run Date</u>	<u>Operator</u>
M430-1	7/29/92	Tony Wong
M430-2	7/30/92	Wayne Johnson
M430-3	7/31/92	Wayne Johnson

		<u>M430-1</u>	<u>M430-2</u>	<u>M430-3</u>
	Run Start Time	1145	1311	1427
	Run Stop Time	1707	1714	2011
	Net Sampling/Traversing Points	1	1	1
	Net Run Time, Minutes	120	120	120
Y	Dry Gas Meter Calibration Coefficient	1.0030	1.0030	1.0030
Pbar	Barometric Pressure, Inches Hg	29.50	29.50	29.70
Delta-H	Orifice Average Pressure Differential, Inches H2O	1.300	1.300	1.300
Vm	Sampled Volume of Source Gas, Dry AL	26.170	23.434	24.469
tm	Dry Gas Meter Temperature, Degrees C	39	45	39
Vmstd	Sampled Volume of Source Gas, Dry SCL	24.013	21.097	22.604
Vmstdm	Sampled Volume of Source Gas, Dry SCM	0.024	0.021	0.023
Qsd	Source Gas Volumetric Flow Rate, Dry SCFM	303	303	305
F	F-Factor, DSCF/Million Btu	9,058	9,388	9,598
MMBtu/Hr	Heat Input Rate, Million Btu/Hour	0.403	0.398	0.374

	<u>Acetaldehyde</u>			
FWt	Formula Weight, Lb/Lb-Mole	44.05	44.05	44.05
ug	Catch Weight, Micrograms	56.8	48.1	39.7
ug/DSCM	Concentration, Micrograms per DSCM	2365	2280	1756
ng/DSCM	Concentration, Nanograms per DSCM	2365394	2279975	1756338
lb/hr	Emission Rate, Pounds per Hour	2.68E-03	2.59E-03	2.01E-03
lb/MMBtu	Emission Factor, Pounds per Million Btu	6.66E-03	6.49E-03	5.36E-03

	<u>Acrolein</u>			
FWt	Formula Weight, Lb/Lb-Mole	56.06	56.06	56.06
ug	Catch Weight, Micrograms	3.72	3.98	2.37
ug/DSCM	Concentration, Micrograms per DSCM	155	189	105
ng/DSCM	Concentration, Nanograms per DSCM	154917	188655	104849
lb/hr	Emission Rate, Pounds per Hour	1.76E-04	2.14E-04	1.20E-04
lb/MMBtu	Emission Factor, Pounds per Million Btu	4.36E-04	5.37E-04	3.20E-04

	<u>Formaldehyde</u>			
FWt	Formula Weight, Lb/Lb-Mole	30.03	30.03	30.03
ug	Catch Weight, Micrograms	113	106	77.8
ug/DSCM	Concentration, Micrograms per DSCM	4706	5024	3442
ng/DSCM	Concentration, Nanograms per DSCM	4705801	5024476	3441892
lb/hr	Emission Rate, Pounds per Hour	5.34E-03	5.70E-03	3.93E-03
lb/MMBtu	Emission Factor, Pounds per Million Btu	1.32E-02	1.43E-02	1.05E-02

Note:

All standard volumes and flow rates based on 16 Degrees C (60 Degrees F) -- 29.92 Inches of Mercury (Hg)

Appendix B
Example Calculations

EXAMPLE TEST CALCULATIONS

Halliburton Equipment Yard

Run Number: M2-1

Date: 7/29/92

DRY MOLE FRACTION OF FLUE GAS

$$M_{fd} = 1 - (\%H_2O / 100)$$

$$M_{fd} = 1 - (4.9 / 100) = 0.951$$

DRY MOLECULAR WEIGHT OF FLUE GAS

$$M_d = (\%CO_2 * 0.44) + (\%O_2 * 0.32) + (\%CO + \%N_2 * 0.28)$$

$$M_d = (1.5 * 0.44) + (18.9 * 0.32) + (79.6 * 0.28) = 29.00 \text{ lb/lb-mole}$$

WET MOLECULAR WEIGHT OF FLUE GAS

$$M_s = (M_d * M_{fd}) + (0.18 * \%H_2O)$$

$$M_s = (29.00 * 0.951) + (0.18 * 4.9) = 28.45 \text{ lb/lb-mole}$$

ABSOLUTE FLUE GAS PRESSURE

$$P_s = P_{bar} + (P_g / 13.6)$$

$$P_s = 29.5 + (0.040 / 13.6) = 29.50 \text{ inches Hg}$$

AVERAGE FLUE GAS VELOCITY - Note: (Delta p) avg. is square of avg. sq root

$$v_s = 85.49 * C_p * \text{SQRT} \left[\frac{(\Delta p)_{avg} * (460 + t_s)}{P_s * M_s} \right]$$

$$v_s = 85.49 * 0.99 * \text{SQRT} \left[\frac{(0.1700 * (460 + 168))}{29.50 * 28.45} \right] = 30.17 \text{ ft/sec}$$

DRY VOLUMETRIC FLUE GAS FLOW RATE AT STANDARD CONDITIONS

$$Q_{sd} = \frac{60}{144} * M_{fd} * v_s * A * \frac{T_{std}}{t_s + 460} * \frac{P_s}{P_{std}}$$

$$Q_{sd} = \frac{60}{144} * 0.951 * 30.17 * 20 * \frac{528}{168 + 460} * \frac{29.50}{29.92} = 192 \text{ SCFM}$$

WET VOLUMETRIC FLUE GAS FLOW RATE AT STACK CONDITIONS

$$Q_{aw} = 60 / 144 * v_s * A$$

$$Q_{aw} = 60 / 144 * 30.17 * 20 = 247 \text{ ACFM}$$

EXAMPLE CALCULATIONS, RUN M5-1

SAMPLED VOLUME OF SOURCE GAS, DRY ACTUAL CUBIC FEET

$$\begin{aligned}V_{mm} &= V_m * 0.028317 \\&= 191.206 * 0.028317 \\&= 5.41\end{aligned}$$

SAMPLED VOLUME OF SOURCE GAS, DRY STANDARD CUBIC FEET

$$\begin{aligned}V_{mstd} &= [(T_{std} + 460)/P_{std}] * Y * V_m * (P_{bar} + \Delta H/13.6) / (460 + t_m) \\&= [(60 + 460)/29.92] * 1.0200 * 191.206 * (29.50 + 1.707/13.6) / (460 + 109) \\&= 176.384\end{aligned}$$

SAMPLED VOLUME OF SOURCE GAS, DRY STANDARD CUBIC METER

$$\begin{aligned}V_{mstdm} &= V_{mstd} * 0.028317 \\&= 176.384 * 0.028317 \\&= 4.995\end{aligned}$$

VOLUME OF WATER VAPOR, STANDARD CUBIC FEET

$$\begin{aligned}V_{wstd} &= 0.002667 * [(T_{std} + 460) / P_{std}] * V_{lc} \\&= 0.002667 * [(60 + 460) / 29.92] * 193.8 \\&= 8.983\end{aligned}$$

MOISTURE CONTENT, PERCENT BY VOLUME

$$\begin{aligned}\%H_2O &= V_{wstd} / (V_{wstd} + V_{mstd}) \\&= 8.983 / (8.983 + 176.384) \\&= 4.85\end{aligned}$$

DRY MOLE FRACTION, LB-MOLE/LB-MOLE

$$\begin{aligned}M_{fd} &= 1 - \%H_2O/100 \\&= 1 - 4.85/100 \\&= 0.952\end{aligned}$$

DRY MOLECULAR WEIGHT, LB/LB-MOLE

$$\begin{aligned}M_d &= 44 * (\%CO_2/100) + 32 * (\%O_2/100) + 28 * \{[100 - (\%CO_2 + \%O_2)]/100\} \\&= 44 * (3.1/100) + 32 * (16.7/100) + 28 * \{[100 - (3.1 + 16.7)]/100\} \\&= 29.16\end{aligned}$$

WET MOLECULAR WEIGHT, LB/LB-MOLE

$$\begin{aligned}M_s &= M_d * M_{fd} + 18.0 * \%H_2O/100 \\&= 29.16 * 0.952 + 18.0 * 4.85/100 \\&= 28.62\end{aligned}$$

ABSOLUTE PRESSURE, INCHES OF MERCURY

$$\begin{aligned}P_s &= P_{bar} + P_g/13.6 \\&= 29.50 + 0.22/13.6 \\&= 29.52\end{aligned}$$

VELOCITY, FEET PER SECOND

$$\begin{aligned}v_s &= 85.49 * C_p * \text{SQRT}[\Delta p * (460 + t_s) / P_s / M_s] \\&= 85.49 * 0.99 * \text{SQRT}[0.6217 * (460 + 314) / 29.52 / 28.62] \\&= 63.87\end{aligned}$$

VOLUMETRIC FLOW RATE, DRY STANDARD CUBIC FEET PER MINUTE

$$\begin{aligned} Q_{sd} &= (60/144) * M_{fd} * v_s * A * (T_{std} + 460)/(t_s + 460) * (P_s/P_{std}) \\ &= (60/144) * 0.952 * 63.87 * 20 * (60 + 460)/(314 + 460) * (29.52/29.92) \\ &= 330 \end{aligned}$$

VOLUMETRIC FLOW RATE, DRY STANDARD CUBIC METER PER MINUTE

$$\begin{aligned} Q_{msd} &= Q_{sd} * 0.028317 \\ &= 330 * 0.028317 \\ &= 9 \end{aligned}$$

VOLUMETRIC FLOW RATE, ACTUAL CUBIC FEET PER MINUTE

$$\begin{aligned} Q_{aw} &= (60/144) * v_s * A \\ &= (60/144) * 63.87 * 20 \\ &= 522 \end{aligned}$$

VOLUMETRIC FLOW RATE, ACTUAL CUBIC METER PER MINUTE

$$\begin{aligned} Q_{maw} &= Q_{aw} * 0.028317 \\ &= 522 * 0.028317 \\ &= 15 \end{aligned}$$

ISOKINETIC SAMPLING RATE, PERCENT

$$\begin{aligned} \%I &= P_{std}/(T_{std} + 460) * (100/60) * V_{mstd} * (t_s + 460)/[P_s * v_s * M_{fd} * \theta * (\pi * D_{ia} * D_{ia}/576)] \\ &= 29.92/(60 + 460) * (100/60) * 176.384 * (314 + 460)/[29.52 * 63.87 * 0.952 * 320.00 * (\pi * 0.217 * 0.217/576)] \\ &= 88.8 \end{aligned}$$

FUEL FACTOR

$$\begin{aligned} F_o &= (20.9 - \%O_2) / 20.9 \\ &= (20.9 - 16.7) / 20.9 \\ &= 1.355 \end{aligned}$$

HEAT INPUT RATE, MILLION BTU PER HOUR

$$\begin{aligned} \text{MMBtu/hr} &= 60 * Q_{SD} * (20.9 - \%O_2) / 20.9 / F \\ &= 60 * 303 * (20.9 - 16.7) / 20.9 / 9058 \\ &= 0.403 \end{aligned}$$

CONDENSIBLE PARTICULATE CONCENTRATION, MICROGRAMS PER DRY STANDARD CUBIC METER

$$\begin{aligned} \text{gr/DSCM} &= (7000 / 453.592) * (\text{Catch} / 1000 / V_{mstd}) \\ &= (7000 / 453.592) * (258.1 / 1000 / 176.384) \\ &= 0.02258 \end{aligned}$$

CONDENSIBLE PARTICULATE EMISSION RATE, POUNDS PER HOUR

$$\begin{aligned} \text{lb/hr} &= 60 * (\text{Catch/Conversion}) * Q_{sd} / 453.592 / V_{mstd} \\ &= 60 * 258.10/1000 * 303 / 453.592 / 176.384 \\ &= 0.0586 \end{aligned}$$

CONDENSIBLE PARTICULATE EMISSION RATE, POUNDS PER MILLION Btu

$$\begin{aligned} \text{lb/MMBtu} &= (\text{Catch/Conversion}) * F / 453.592 / V_{mstd} * (20.9 / (20.9 - \%O_2)) \\ &= * (258.10/1000) * 9058 / 453.592 / 176.384 * (20.9 / (20.9 - 16.7)) \\ &= 0.1454098 \end{aligned}$$

EXAMPLE CALCULATIONS, RUN M410A-1

HEAT INPUT RATE, MILLION BTU PER HOUR

$$\begin{aligned}\text{MMBtu/hr} &= 60 * \text{QSD} * (20.9 - \%O_2) / 20.9 / F \\ &= 60 * 303 * (20.9 - 16.7) / 20.9 / 9058 \\ &= 0.40333\end{aligned}$$

BENZENE CONCENTRATION, MICROGRAMS PER DRY STANDARD CUBIC METER

$$\begin{aligned}\text{ug/DSCM} &= (1000 * \text{ppbvd}/1000) * \text{Fwt} / [62.36 * (273 + \text{Tstd}) / \text{Pstd}] \\ &= (1000 * 220.0 / 1000) * 78.12 / [62.36 * (273 + 16) / 29.92] \\ &= 725.88\end{aligned}$$

BENZENE CONCENTRATION, NANOGRAMS PER DRY STANDARD CUBIC METER

$$\begin{aligned}\text{ng/DSCM} &= (1000000 * \text{ppbvd}/1000) * \text{Fwt} / [62.36 * (273 + \text{Tstd}) / \text{Pstd}] \\ &= (1000000 * 220.0 / 1000) * 78.12 / [62.36 * (273 + 16) / 29.92] \\ &= 725877\end{aligned}$$

BENZENE EMISSION RATE, POUNDS PER HOUR

$$\begin{aligned}\text{lb/hr} &= 60 * \text{ppbvd}/1000 * \text{FWt} * \text{Qsd} / 385.3 / 1000000 \\ &= 60 * 220.0 / 1000 * 78.12 * 303 / 385.3 / 1000000 \\ &= 0.0008109233\end{aligned}$$

BENZENE EMISSION RATE, POUNDS PER MILLION Btu

$$\begin{aligned}\text{lb/MMBtu} &= \text{lb/hr} / \text{MMBtu/hr} \\ &= 0.00081 / 0.403 \\ &= 0.00201055\end{aligned}$$

EXAMPLE CALCULATIONS
for Run 1 Injection 1
1,3-Butadiene

RECOVERY FACTOR

$$F(r) = 1.0$$

DILUTION FACTOR

$$F(d) = 1.0$$

STACK GAS FLOW RATE

$$\text{SCFM} = 192$$

STACK GAS CONCENTRATION AS ANALYZED

$$\begin{aligned} \text{PPM} &= (\text{area count} - \text{constant}) / X \text{ coefficient} \\ &= (60 - 3.5843) / 114.779 \\ &= 0.492 \text{ ppm} \end{aligned}$$

STACK GAS CONCENTRATION ACTUAL

$$\begin{aligned} \text{PPMVD} &= \text{ppm} * F(r) * F(d) \\ &= 0.492 * 1.0 * 1.0 \\ &= 0.492 \text{ ppmvd} \end{aligned}$$

1,3-BUTADIENE EMISSION RATE

$$\begin{aligned} \text{LBS/HR} &= (\text{ppmvd} * \text{mol. wt.} * \text{scfm} * 60) / 385.3\text{E}6 \\ &= (0.492 * 54.09 * 192 * 60) / 385.3\text{E}6 \\ &= 0.000795 \text{ lbs/hr} \end{aligned}$$

EXAMPLE CALCULATIONS, RUN M422.102-1

1,3-BUTADIENE HEAT INPUT RATE, MILLION BTU PER HOUR

$$\begin{aligned}\text{MMBtu/hr} &= 60 * \text{QSD} * (20.9 - \%O_2) / 20.9 / F \\ &= 60 * 303 * (20.9 - 16.7) / 20.9 / 9058 \\ &= 0.40333\end{aligned}$$

1,3-BUTADIENE CONCENTRATION, MICROGRAMS PER DRY STANDARD CUBIC METER

$$\begin{aligned}\text{ug/DSCM} &= (1000 * \text{ppmvd}/1) * \text{Fwt} / [62.36 * (273 + \text{Tstd}) / \text{Pstd}] \\ &= (1000 * 0.5/1) * 54.09 / [62.36 * (273 + 16) / 29.92] \\ &= 1211\end{aligned}$$

1,3-BUTADIENE CONCENTRATION, NANOGRAMS PER DRY STANDARD CUBIC METER

$$\begin{aligned}\text{ng/DSCM} &= (1000000 * \text{ppmvd}/1) * \text{Fwt} / [62.36 * (273 + \text{Tstd}) / \text{Pstd}] \\ &= (1000000 * 0.5/1) * 54.09 / [62.36 * (273 + 16) / 29.92] \\ &= 1210796\end{aligned}$$

1,3-BUTADIENE EMISSION RATE, POUNDS PER HOUR

$$\begin{aligned}\text{lb/hr} &= 60 * \text{ppmvd}/1 * \text{FWt} * \text{Qsd} / 385.3 / 1000000 \\ &= 60 * 0.5/1 * 303 * 54.09 / 385.3 / 1000000 \\ &= 0.0013527\end{aligned}$$

1,3-BUTADIENE EMISSION RATE, POUNDS PER MILLION Btu

$$\begin{aligned}\text{lb/MMBtu} &= \text{lb/hr} / \text{MMBtu/hr} \\ &= 0.001 / 0.40333 \\ &= 0.003354\end{aligned}$$

EXAMPLE CALCULATIONS, RUN M422-1

HEAT INPUT RATE, MILLION BTU PER HOUR

$$\begin{aligned}\text{MMBtu/hr} &= 60 * \text{QSD} * (20.9 - \%O_2) / 20.9 / F \\ &= 60 * 303 * (20.9 - 16.7) / 20.9 / 9058 \\ &= 0.403\end{aligned}$$

BENZENE CONCENTRATION, MICROGRAMS PER DRY STANDARD CUBIC METER

$$\begin{aligned}\text{ug/DSCM} &= (1000 * \text{ppbvd}/1000) * \text{Fwt} / [62.36 * (273 + \text{Tstd}) / \text{Pstd}] \\ &= (1000 * 210.0 / 1000) * 78.12 / [62.36 * (273 + 16) / 29.92] \\ &= 692.88\end{aligned}$$

BENZENE CONCENTRATION, NANOGRAMS PER DRY STANDARD CUBIC METER

$$\begin{aligned}\text{ng/DSCM} &= (1000000 * \text{ppbvd}/1000) * \text{Fwt} / [62.36 * (273 + \text{Tstd}) / \text{Pstd}] \\ &= (1000000 * 210.0 / 1000) * 78.12 / [62.36 * (273 + 16) / 29.92] \\ &= 692882\end{aligned}$$

BENZENE EMISSION RATE, POUNDS PER HOUR

$$\begin{aligned}\text{lb/hr} &= 60 * \text{ppbvd}/1000 * \text{FWt} * \text{Qsd} / 385.3 / 1000000 \\ &= 60 * 210.0 / 1000 * 303 * 78.12 / 385.3 / 1000000 \\ &= 0.000774\end{aligned}$$

BENZENE EMISSION RATE, POUNDS PER MILLION Btu

$$\begin{aligned}\text{lb/MMBtu} &= \text{lb/hr} / \text{MMBtu/hr} \\ &= 0.00077 / 0.403 \\ &= 0.00191916\end{aligned}$$

EXAMPLE CALCULATIONS, RUN 425-1

SAMPLED VOLUME OF SOURCE GAS, DRY ACTUAL CUBIC FEET

$$\begin{aligned}V_{mm} &= V_m * 0.028317 \\&= 196.195 * 0.028317 \\&= 5.5557\end{aligned}$$

SAMPLED VOLUME OF SOURCE GAS, DRY STANDARD CUBIC FEET

$$\begin{aligned}V_{mstd} &= [(T_{std} + 460)/P_{std}] * Y * V_m * (P_{bar} + \Delta H/13.6) / (460 + t_m) \\&= [(60 + 460)/29.92] * 0.9960 * 196.195 * (29.50 + 1.56/13.6) / (460 + 109) \\&= 176.877\end{aligned}$$

SAMPLED VOLUME OF SOURCE GAS, DRY STANDARD CUBIC METERS

$$\begin{aligned}V_{mstdm} &= V_{mstd} * 0.028317 \\&= 176.877 * 0.028317 \\&= 5.00863\end{aligned}$$

VOLUME OF WATER VAPOR, STANDARD CUBIC FEET

$$\begin{aligned}V_{wstd} &= 0.002667 * [(T_{std} + 460) / P_{std}] * V_{lc} \\&= 0.002667 * [(60 + 460) / 29.92] * 192.6 \\&= 8.927\end{aligned}$$

MOISTURE CONTENT, PERCENT BY VOLUME

$$\begin{aligned}\%H_2O &= V_{wstd} / (V_{wstd} + V_{mstd}) \\&= 8.927 / (8.927 + 176.877) \\&= 4.80\end{aligned}$$

DRY MOLE FRACTION, LB-MOLE/LB-MOLE

$$\begin{aligned}M_{fd} &= 1 - \%H_2O/100 \\&= 1 - 4.80/100 \\&= 0.952\end{aligned}$$

DRY MOLECULAR WEIGHT, LB/LB-MOLE

$$\begin{aligned}M_d &= 44 * (\%CO_2/100) + 32 * (\%O_2/100) + 28 * \{[100 - (\%CO_2 + \%O_2)]/100\} \\&= 44 * (3.1/100) + 32 * (16.7/100) + 28 * \{[100 - (3.1 + 16.7)]/100\} \\&= 29.16\end{aligned}$$

WET MOLECULAR WEIGHT, LB/LB-MOLE

$$\begin{aligned}M_s &= M_d * M_{fd} + 18.0 * \%H_2O/100 \\&= 29.16 * 0.952 + 18.0 * 4.80/100 \\&= 28.63\end{aligned}$$

ABSOLUTE PRESSURE, INCHES OF MERCURY

$$\begin{aligned}P_s &= P_{bar} + P_g/13.6 \\&= 29.50 + 0.22/13.6 \\&= 29.52\end{aligned}$$

VELOCITY, FEET PER SECOND

$$\begin{aligned}v_s &= 85.49 * C_p * \text{SQRT}[\Delta p * (460 + t_s)/P_s/M_s] \\&= 85.49 * 0.99 * \text{SQRT}[0.6217 * (460 + 314)/29.52/28.63] \\&= 63.87\end{aligned}$$

VOLUMETRIC FLOW RATE, DRY STANDARD CUBIC FEET PER MINUTE

$$\begin{aligned} Q_{sd} &= (60/144) * M_{fd} * v_s * A * (T_{std} + 460)/(t_s + 460) * (P_s/P_{std}) \\ &= (60/144) * 0.952 * 63.87 * 20 * (60 + 460)/(314 + 460) * (29.52/29.92) \\ &= 330 \end{aligned}$$

VOLUMETRIC FLOW RATE, DRY STANDARD CUBIC METER PER MINUTE

$$\begin{aligned} Q_{msd} &= Q_{sd} * 0.028317 \\ &= 330 * 0.028317 \\ &= 9.3330 \end{aligned}$$

VOLUMETRIC FLOW RATE, ACTUAL CUBIC FEET PER MINUTE

$$\begin{aligned} Q_{aw} &= (60/144) * v_s * A \\ &= (60/144) * 63.87 * 20 \\ &= 522.39 \end{aligned}$$

VOLUMETRIC FLOW RATE, ACTUAL CUBIC METER PER MINUTE

$$\begin{aligned} Q_{maw} &= Q_{aw} * 0.028317 \\ &= 522 * 0.028317 \\ &= 14.79 \end{aligned}$$

ISOKINETIC SAMPLING RATE, PERCENT

$$\begin{aligned} \%I &= P_{std}/(T_{std} + 460) * (100/60) * V_{mstd} * (t_s + 460)/[P_s * v_s * M_{fd} * \theta * (\pi * D_{ia} * D_{ia}/576)] \\ &= 29.92/(60 + 460) * (100/60) * 176.877 * (314 + 460)/[29.52 * 63.87 * 0.952 * 320.00 * (\pi * 0.217 * 0.217/576)] \\ &= 89.0 \end{aligned}$$

FUEL FACTOR

$$\begin{aligned} F_o &= (20.9 - \%O_2) / 20.9 \\ &= (20.9 - 16.7) / 20.9 \\ &= 1.355 \end{aligned}$$

HEAT INPUT RATE, MILLION BTU PER HOUR

$$\begin{aligned} MMBtu/hr &= 60 * Q_{SD} * (20.9 - \%O_2) / 20.9 / F \\ &= 60 * 303 * (20.9 - 16.7) / 20.9 / 9058 \\ &= 0.4033 \end{aligned}$$

HEXAVALENT CHROMIUM CONCENTRATION, MICROGRAMS PER DRY STANDARD CUBIC METER

$$\begin{aligned} ug/DSCM &= g * 1,000,000 / V_{mstdm} = (Catch/Conversion) * 1,000,000 / V_{mstdm} \\ &= (0.48/1000000) * 1,000,000 / 5.009 \\ &= 0.0958 \end{aligned}$$

HEXAVALENT CHROMIUM CONCENTRATION, NANOGRAMS PER DRY STANDARD CUBIC METER

$$\begin{aligned} ng/DSCM &= g * 1,000,000,000 / V_{mstdm} = (Catch/Conversion) * 1,000,000,000 / V_{mstdm} \\ &= (0.48/1000000) * 1,000,000,000 / 5.009 \\ &= 95.8 \end{aligned}$$

HEXAVALENT CHROMIUM EMISSION RATE, POUNDS PER HOUR

$$\begin{aligned} lb/hr &= 60 * Catch/Conversion * Q_{sd} / 453.592 / V_{mstd} \\ &= 60 * 0.48/1000000 * 303 / 453.592 / 176.877 \\ &= 0.000000109 \end{aligned}$$

HEXAVALENT CHROMIUM EMISSION RATE, POUNDS PER MILLION Btu

$$\begin{aligned} lb/MMBtu &= Catch/Conversion * F / 453.592 / V_{mstd} * (20.9 / (20.9 - \%O_2)) \\ &= 60 * 0.48/1000000 * 0.40 / 453.592 / 176.877 * (20.9 / (20.9 - 16.7)) \\ &= 0.000000270 \end{aligned}$$

EXAMPLE CALCULATIONS, RUN 429-1

SAMPLED VOLUME OF SOURCE GAS, DRY ACTUAL CUBIC FEET

$$\begin{aligned} V_{mm} &= V_m * 0.028317 \\ &= 189.208 * 0.028317 \\ &= 5.36 \end{aligned}$$

SAMPLED VOLUME OF SOURCE GAS, DRY STANDARD CUBIC FEET

$$\begin{aligned} V_{mstd} &= [(T_{std} + 460)/P_{std}] * Y * V_m * (P_{bar} + \Delta H/13.6) / (460 + t_m) \\ &= [(60 + 460)/29.92] * 1.0120 * 189.208 * (29.00 + 1.684/13.6) / (460 + 106) \\ &= 171.240 \end{aligned}$$

SAMPLED VOLUME OF SOURCE GAS, DRY STANDARD CUBIC METER

$$\begin{aligned} V_{mstdm} &= V_{mstd} * 0.028317 \\ &= 171.240 * 0.028317 \\ &= 4.849 \end{aligned}$$

VOLUME OF WATER VAPOR, STANDARD CUBIC FEET

$$\begin{aligned} V_{wstd} &= 0.002667 * [(T_{std} + 460) / P_{std}] * V_{lc} \\ &= 0.002667 * [(60 + 460) / 29.92] * 198.5 \\ &= 9.201 \end{aligned}$$

MOISTURE CONTENT, PERCENT BY VOLUME

$$\begin{aligned} \%H_2O &= V_{wstd} / (V_{wstd} + V_{mstd}) \\ &= 9.201 / (9.201 + 171.240) \\ &= 5.10 \end{aligned}$$

DRY MOLE FRACTION, LB-MOLE/LB-MOLE

$$\begin{aligned} M_{fd} &= 1 - \%H_2O/100 \\ &= 1 - 5.10/100 \\ &= 0.949 \end{aligned}$$

DRY MOLECULAR WEIGHT, LB/LB-MOLE

$$\begin{aligned} M_d &= 44 * (\%CO_2/100) + 32 * (\%O_2/100) + 28 * \{[100 - (\%CO_2 + \%O_2)]/100\} \\ &= 44 * (3.1/100) + 32 * (16.7/100) + 28 * \{[100 - (3.1 + 16.7)]/100\} \\ &= 29.16 \end{aligned}$$

WET MOLECULAR WEIGHT, LB/LB-MOLE

$$\begin{aligned} M_s &= M_d * M_{fd} + 18.0 * \%H_2O/100 \\ &= 29.16 * 0.949 + 18.0 * 5.10/100 \\ &= 28.59 \end{aligned}$$

ABSOLUTE PRESSURE, INCHES OF MERCURY

$$\begin{aligned} P_s &= P_{bar} + P_g/13.6 \\ &= 29.00 + 0.22/13.6 \\ &= 29.02 \end{aligned}$$

VELOCITY, FEET PER SECOND

$$\begin{aligned} v_s &= 85.49 * C_p * \sqrt{[\Delta p * (460 + t_s) / (P_s / M_s)]} \\ &= 85.49 * 0.99 * \sqrt{[0.6217 * (460 + 314) / (29.02 / 28.59)]} \\ &= 64.44 \end{aligned}$$

VOLUMETRIC FLOW RATE, DRY STANDARD CUBIC FEET PER MINUTE

$$\begin{aligned} Q_{sd} &= (60/144) * M_{fd} * v_s * A * (T_{std} + 460)/(t_s + 460) * (P_s/P_{std}) \\ &= (60/144) * 0.949 * 64.44 * 20 * (60 + 460)/(314 + 460) * (29.02/29.92) \\ &= 326 \end{aligned}$$

VOLUMETRIC FLOW RATE, DRY STANDARD CUBIC METER PER MINUTE

$$\begin{aligned} Q_{msd} &= Q_{sd} * 0.028317 \\ &= 326 * 0.028317 \\ &= 9.2326 \end{aligned}$$

VOLUMETRIC FLOW RATE, ACTUAL CUBIC FEET PER MINUTE

$$\begin{aligned} Q_{aw} &= (60/144) * v_s * A \\ &= (60/144) * 64.44 * 20 \\ &= 527 \end{aligned}$$

VOLUMETRIC FLOW RATE, ACTUAL CUBIC METER PER MINUTE

$$\begin{aligned} Q_{maw} &= Q_{aw} * 0.028317 \\ &= 527 * 0.028317 \\ &= 14.92 \end{aligned}$$

ISOKINETIC SAMPLING RATE, PERCENT

$$\begin{aligned} \%I &= P_{std}/(T_{std} + 460) * (100/60) * V_{mstd} * (t_s + 460)/[P_s * v_s * M_{fd} * \theta * (\pi * D_{ia} * D_{ia}/576)] \\ &= 29.92/(60 + 460) * (100/60) * 171.240 * (314 + 460)/[29.02 * 64.44 * 0.949 * 320.00 * (\pi * 0.217 * 0.217/576)] \\ &= 87.1 \end{aligned}$$

FUEL FACTOR

$$\begin{aligned} F_o &= (20.9 - \%O_2) / 20.9 \\ &= (20.9 - 16.7) / 20.9 \\ &= 1.355 \end{aligned}$$

HEAT INPUT RATE, MILLION BTU PER HOUR

$$\begin{aligned} \text{MMBtu/hr} &= 60 * Q_{SD} * (20.9 - \%O_2) / 20.9 / F \\ &= 60 * 303 * (20.9 - 16.7) / 20.9 / 9058 \\ &= 0.403 \end{aligned}$$

ACENAPHTHENE CONCENTRATION, MICROGRAMS PER DRY STANDARD CUBIC METER

$$\begin{aligned} \text{ug/DSCM} &= g * 1,000,000 / V_{mstdm} = (\text{Catch/Conversion}) * 1,000,000 / V_{mstdm} \\ &= (30000.00/1000000000) * 1,000,000 / 4.849 \\ &= 6.19 \end{aligned}$$

ACENAPHTHENE CONCENTRATION, NANOGRAMS PER DRY STANDARD CUBIC METER

$$\begin{aligned} \text{ng/DSCM} &= g * 1,000,000,000 / V_{mstdm} = (\text{Catch/Conversion}) * 1,000,000,000 / V_{mstdm} \\ &= (30000.00/1000000000) * 1,000,000,000 / 4.849 \\ &= 6187 \end{aligned}$$

ACENAPHTHENE EMISSION RATE, POUNDS PER HOUR

$$\begin{aligned} \text{lb/hr} &= 60 * (\text{Catch/Conversion}) * Q_{sd} / 453.592 / V_{mstd} \\ &= 60 * 30000.00/1000000000 * 303 / 453.592 / 171.240 \\ &= 0.0000070217 \end{aligned}$$

ACENAPHTHENE EMISSION RATE, POUNDS PER MILLION Btu

$$\begin{aligned} \text{lb/MMBtu} &= (\text{Catch/Conversion}) * F / 453.592 / V_{mstd} * (20.9 / (20.9 - \%O_2)) \\ &= (30000.00/1000000000) * 9058 / 453.592 / 171.240 * (20.9 / (20.9 - 16.7)) \\ &= 0.000017409 \end{aligned}$$

EXAMPLE CALCULATIONS, RUN M430-1

SAMPLED VOLUME OF SOURCE GAS, DRY STANDARD LITERS

$$\begin{aligned} V_{mstd} &= [(T_{std} + 273)/P_{std}] * Y * V_m * (P_{bar} + \Delta H/13.6) / (273 + t_m) \\ &= [(16 + 273)/29.92] * 1.0030 * 26.170 * (29.50 + 1.300/13.6) / (273 + 39) \\ &= 24.013 \end{aligned}$$

SAMPLED VOLUME OF SOURCE GAS, DRY STANDARD CUBIC METERS

$$\begin{aligned} V_{mstdm} &= V_{mstd} / 1000 \\ &= 24.013 / 1000 \\ &= 0.024 \end{aligned}$$

HEAT INPUT RATE, MILLION BTU PER HOUR

$$\begin{aligned} \text{MMBtu/hr} &= 60 * Q_{SD} * (20.9 - \%O_2) / 20.9 / F \\ &= 60 * 303 * (20.9 - 16.7) / 20.9 / 9058 \\ &= 0.403 \end{aligned}$$

ACETALDEHYDE CONCENTRATION, MICROGRAMS PER DRY STANDARD CUBIC METER

$$\begin{aligned} \mu\text{g/DSCM} &= g * 1,000,000 / V_{mstdm} = (\text{Catch/Conversion}) * 1,000,000 / V_{mstdm} \\ &= (56.80/1000000) * 1,000,000 / 0.024 \\ &= 2365.39 \end{aligned}$$

ACETALDEHYDE CONCENTRATION, NANOGRAMS PER DRY STANDARD CUBIC METER

$$\begin{aligned} \text{ng/DSCM} &= g * 1,000,000,000 / V_{mstdm} = (\text{Catch/Conversion}) * 1,000,000,000 / V_{mstdm} \\ &= (56.80/1000000) * 1,000,000,000 / 0.024 \\ &= 2365394 \end{aligned}$$

ACETALDEHYDE EMISSION RATE, POUNDS PER HOUR

$$\begin{aligned} \text{lb/hr} &= 60 * \text{Catch/Conversion} * (Q_{sd} * 28.317) / 453.592 / V_{mstd} \\ &= 60 * 56.80/1000000 * (303 * 28.317) / 453.592 / 24.013 \\ &= 0.00268 \end{aligned}$$

ACETALDEHYDE EMISSION RATE, POUNDS PER MILLION Btu

$$\begin{aligned} \text{lb/MMBtu} &= \text{lb/hr} / \text{MMBtu/hr} \\ &= 0.002685 / 0.403 \\ &= 0.00666 \end{aligned}$$

ENTROPY

ENVIRONMENTALISTS, INC.

5932 BOLSA AVENUE
SUITE 105
HUNTINGTON BEACH
CALIFORNIA 92649
FAX 714/895-1915 714/373-0998

SOURCE EMISSIONS TESTING FINAL TEST REPORT

VOLUME II

POOLED SOURCE TESTING OF A RIG DIESEL-FIRED INTERNAL COMBUSTION ENGINE

Source Location:

Halliburton Equipment Yard

Bakersfield, California 93309

Test Date(s): July 29 Through 31, 1992

Issue Date: October 2, 1992

Conducted for:

Western States Petroleum Association
901 Tower Way, Suite 300
Bakersfield, California 93309

Conducted by:

Entropy Environmentalists, Inc.
EEI No.: 30037

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Appendix C

Field Data

Appendix C.1

Flue Gas Velocity and Volumetric Flow Rate - CARB Method 2C

AIR FLOW RATE DETERMINATIONS

Plant Name Halliburton Equipment Yard Run No. 102-1
City/State Bakersfield, Ca Date 7/29/92
Test Location Engine Exhaust Duct Personnel SOS - Gm
Barometric Pres. (Pbar) 29.5 In. Hg Static Pres. (Pg) 0.45 ^{0.04} In. H₂O
Pitot/Orifice ID 160-18 Pitot Coef. (Cp) 0.99 Pres. Gauge Set ID 126
Thermocouple ID R126 Duct Length/Diameter _____ Width _____
--Specify inches (") or feet (')--

[illegible]

ORSAT DATA					
Sampling Time	Analysis Time	CO ₂ (A) Reading	O ₂ (B) Reading	%O ₂ (B-A)	%CO+N ₂ (100-B)
Average					
Bag No. _____		Pump _____			

FYRITE DATA, % CO ₂				
--------------------------------	--	--	--	--

MOISTURE DATA (WET BULB/DRY BULB)					
Port	Time	Dry Bulb °F	Wet Bulb °F	Diff.	% H ₂ O

MOISTURE DATA (STOICHIOMETRIC)	
Free Water in Fuel, %	
Water from Fuel Combustion, %	
Ambient Water, %	
Relative Humidity, %	
Ambient Temperature, °F	
Total %	

VOLUMETRIC AIR FLOW RATES	
Dry at Standard Conditions, Qsd =	SCFM
Wet at Stack Conditions, Qaw =	ACFM

ADDITIONAL DATA

* ΔP average is square of average square root. See page 2 for field flow rate calculations.

AIR FLOW RATE DETERMINATIONS

Plant Name Halliburton Equipment Yard Run No. M2-2
City/State Rockersfield, Ca Date 7/24/92
Test Location Engine Exhaust Duct Personnel SKL-mc
Barometric Pres. (Pbar) 29.5 In. Hg Static Pres. (Pg) 0.75 In. H₂O
Pitot/Orifice ID 1/2" - 18 Pitot Coef. (Cp) 0.99 Pres. Gauge Set ID M26
Thermocouple ID R126 Duct Length/Diameter _____ Width _____
--Specify inches (") or feet (')--

[illegible]

ORSAT DATA					
Sampling Time	Analysis Time	CO ₂ (A) Reading	O ₂ (B) Reading	%O ₂ (B-A)	%CO+N ₂ (100-B)
Average					
Bag No. _____		Pump _____			

FYRITE DATA, % CO ₂				
--------------------------------	--	--	--	--

MOISTURE DATA (WET BULB/DRY BULB)					
Port	Time	Dry Bulb °F	Wet Bulb °F	Diff.	% H ₂ O

MOISTURE DATA (STOICHIOMETRIC)		
Free Water in Fuel, %		
Water from Fuel Combustion, %		
Ambient Water, %		
Relative Humidity, %		
Ambient Temperature, °F		
Total %		

VOLUMETRIC AIR FLOW RATES	
Dry at Standard Conditions, Q _{sd} =	SCFM
Wet at Stack Conditions, Q _{aw} =	ACFM

ADDITIONAL DATA

* ΔP average is square of average square root. See page 2 for field flow rate calculations.

AIR FLOW RATE DETERMINATIONS

Plant Name Halliburton Equipment Yard Run No. M2-2
City/State Bakersfield, Ca Date 7/30/92
Test Location Engine Exhaust Duct Personnel SCG-mc
Barometric Pres. (Pbar) 29.5 In. Hg Static Pres. (Pg) 260.04 In. H₂O
Pitot/Orifice ID 160-1B Pitot Coef. (Cp) 0.99 Pres. Gauge Set ID N 26
Thermocouple ID R126 Duct Length/Diameter _____ Width _____
--Specify inches (") or feet (')--

[illegible]

ORSAT DATA					
Sampling Time	Analysis Time	CO ₂ (A) Reading	O ₂ (B) Reading	%O ₂ (B-A)	%CO+N ₂ (100-B)
Average					
Bag No. _____		Pump _____			

FYRITE DATA, % CO ₂				
--------------------------------	--	--	--	--

MOISTURE DATA (WET BULB/DRY BULB)					
Port	Time	Dry Bulb °F	Wet Bulb °F	Diff.	% H ₂ O

MOISTURE DATA (STOICHIOMETRIC)		
Free Water in Fuel, %		
Water from Fuel Combustion, %		
Ambient Water, %		
Relative Humidity, %		
Ambient Temperature, °F		
Total %		

VOLUMETRIC AIR FLOW RATES	
Dry at Standard Conditions, Qsd =	SCFM
Wet at Stack Conditions, Qaw =	ACFM

ADDITIONAL DATA

* ΔP average is square of average square root. See page 2 for field flow rate calculations.

AIR FLOW RATE DETERMINATIONS

Plant Name Halliburton Equipment Company Run No. M2-2
City/State Bakersfield, Ca Date 7/30/92
Test Location Engine Exhaust Duct Personnel SCG-ms
Barometric Pres. (Pbar) 29.5 In. Hg Static Pres. (Pg) 0.75 In. H₂O
Pitot/Orifice ID 160-18 Pitot Coef. (Cp) 0.99 Pres. Gauge Set ID N26
Thermocouple ID U/R Duct Length/Diameter _____ Width _____
--Specify inches (") or feet (')--

[illegible]

ORSAT DATA					
Sampling Time	Analysis Time	CO ₂ (A) Reading	O ₂ (B) Reading	%O ₂ (B-A)	%CO+N ₂ (100-B)
Average					
Bag No. _____		Pump _____			

FYRITE DATA, % CO ₂				
--------------------------------	--	--	--	--

MOISTURE DATA (WET BULB/DRY BULB)					
Port	Time	Dry Bulb °F	Wet Bulb °F	Diff.	% H ₂ O

MOISTURE DATA (STOICHIOMETRIC)		
Free Water in Fuel, %		
Water from Fuel Combustion, %		
Ambient Water, %		
Relative Humidity, %		
Ambient Temperature, °F		
Total %		

VOLUMETRIC AIR FLOW RATES	
Dry at Standard Conditions, Q _{sd} =	SCFM
Wet at Stack Conditions, Q _{aw} =	ACFM

ADDITIONAL DATA

* ΔP average is square of average square root. See page 2 for field flow rate calculations.

AIR FLOW RATE DETERMINATIONS

Plant Name HAUBERTON EQUIP YARD Run No. 8-M2-1
City/State BARBERSFIELD CALIF Date 7-31-92
Test Location Engin Exhaust Duct Personnel MLW, SCW
Barometric Pres. (Pbar) 29.7 In. Hg Static Pres. (Pg) 75 In. H₂O
Pitot/Orifice ID 1/4 Pitot Coef. (Cp) .99 Pres. Gauge Set ID 1/26
Thermocouple ID 07 Duct Length/Diameter _____ Width _____
--Specify inches (") or feet (')--

[illegible]

ORSAT DATA					
Sampling Time	Analysis Time	CO ₂ (A) Reading	O ₂ (B) Reading	%O ₂ (B-A)	%CO+N ₂ (100-B)
Average					
Bag No. _____		Pump _____			

FYRITE DATA, % CO ₂				
--------------------------------	--	--	--	--

MOISTURE DATA (WET BULB/DRY BULB)					
Port	Time	Dry Bulb °F	Wet Bulb °F	Diff.	% H ₂ O

MOISTURE DATA (STOICHIOMETRIC)		
Free Water in Fuel, %		
Water from Fuel Combustion, %		
Ambient Water, %		
Relative Humidity, %		
Ambient Temperature, °F		
Total %		

VOLUMETRIC AIR FLOW RATES	
Dry at Standard Conditions, Qsd =	SCFM
Wet at Stack Conditions, Qaw =	ACFM

ADDITIONAL DATA

* ΔP average is square of average square root. See page 2 for field flow rate calculations.

AIR FLOW RATE DETERMINATIONS

Plant Name HAUBONT Run No. M2-2
City/State BAKERSFIELD CALIF Date 7-31-92
Test Location Engine EXHAUST ~~PO~~ STACK Personnel CEC SCG
Barometric Pres. (Pbar) 29.7 In. Hg Static Pres. (Pg) - In. H₂O
Pitot/Orifice ID 16 Pitot Coef. (Cp) .99 Pres. Gauge Set ID N26
Thermocouple ID 17 Duct Length/Diameter _____ Width _____
--Specify inches (") or feet (')--

[illegible]

ORSAT DATA					
Sampling Time	Analysis Time	CO ₂ (A) Reading	O ₂ (B) Reading	%O ₂ (B-A)	%CO+N ₂ (100-B)
Average					
Bag No. _____		Pump _____			

FYRITE DATA, % CO ₂				
--------------------------------	--	--	--	--

MOISTURE DATA (WET BULB/DRY BULB)					
Port	Time	Dry Bulb °F	Wet Bulb °F	Diff.	% H ₂ O

MOISTURE DATA (STOICHIOMETRIC)		
Free Water in Fuel, %		
Water from Fuel Combustion, %		
Ambient Water, %		
Relative Humidity, %		
Ambient Temperature, °F		
Total %		

VOLUMETRIC AIR FLOW RATES	
Dry at Standard Conditions, Qsd =	SCFM
Wet at Stack Conditions, Qaw =	ACFM

ADDITIONAL DATA

* ΔP average is square of average square root. See page 2 for field flow rate calculations.

Appendix C.2
Particulate Matter - CARB Method 5

FIELD DATA - METHOD(S) ARBS

PLANT Hallyburton Equipment Yard RUN NO. MS-1

CITY/STATE Bakersfield, Ca JOB NO. 30037 DATE 7/28/97

SAMPLING LOC. Engine Exhaust Duct TIME START 0745

BAROMETRIC PRESSURE, IN. HG 29.4 STATIC PRESSURE, IN. H₂O 0.75 TIME FINISH 7841

LEAK CHECK, VACUUM IN. HG 15 5 5 15 OPERATOR SCG

LEAK RATE, CUBIC FEET/MIN. 0.004 0.000 0.000 0.012 ASST(S) _____

EQUIPMENT CHECKS*		EQUIPMENT I.D. NUMBERS				LEAK CHECKS			
N/A	PITOT, PRETEST	REAGENT BOX	C52	METER BOX	N22	Y	1.020	B	1042.3
N/A	PITOT, POSTTEST	PITOT	160-18	Cp	0.99	NOZ'L	GP200	DIA.	0.217
✓	NOZZLE, PRE/POST	TC READOUT	N26	TC PROBE	N/A	UMBILICAL	N/A	E	1042.200
✓	TC 91 °F PRE	SAMPL'G BOX	10	ORSAT PUMP	N/A	TEDLAR BAG	N/A	B	
✓	TC 104 °F POST					E		B	
N/A	ORSAT SYSTEM					E		B	
		NOMOGRAPH DATA				E		B	
		DELTA Hg	1.7392					B	
		METER TEMP	100					E	
		EST. XH2O	7					B	
		C FACTOR	0.942	0.961				E	
		STACK TEMP	295					FYRITES	
		REF DELTA P	1.80						
		K FACTOR	1.52						

* PITOT: VISUAL INSPECTION/LEAK CHECK; NOZZLE: VISUAL INSPECTION; TC: AMBIENT TEMPS.; ORSAT SYSTEM: LEAK CHECK

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READING CUBIC FEET	PITOT READING IN. H ₂ O	GAS METER TEMP. °F	STACK TEMP. °F	ORIFICE SETTING IN. H ₂ O		GAUGE VACUUM IN. HG	GAS TEMPERATURES °F			
							ACTUAL	IDEAL		FILTER BOX	IMPING EXIT	PROBE	COND. EXIT
		0	1448.124										
1	A1	5	950.11	0.17	81	166	0.47	0.47	1	255	60		N/A
2		10	952.60	0.17	81	166	0.47	0.47	1	255	58		
3		15	953.43	0.17	81	166	0.48	0.48	1	256	60		
4		20	955.26	0.18	81	166	0.51	0.51	1	260	50		
5		25	957.80	0.18	83	167	0.51	0.51	1	250	60		
6		30	959.70	0.18	96	167	0.51	0.51	1	235	60		
7		35	961.62	0.17	105	166	0.49	0.49	1	246	58		
8		40	963.51	0.17	102	167	0.49	0.49	1	246	58		
9		45	965.43	0.17	102	167	0.49	0.49	1	246	58		
10		50	967.33	0.18	105	169	0.52	0.52	1	258	58		
11		55	969.24	0.17	106	170	0.49	0.49	1	262	58		
12		60	971.12	0.17	107	170	0.49	0.49	1	250	58		
13	A2	5	973.00	0.17	107	172	0.49	0.49	1	265	58		
14		10	974.95	0.19	107	176	0.55	0.55	1	250	57		
15		15	976.98	0.19	110	176	0.55	0.55	1	250	68		
16		20	978.80	0.19	110	176	0.55	0.55	1	250	70		
17		25	980.29	0.18	98	175	0.51	0.51	1	250	70		
18		30	982.77	0.18	100	172	0.51	0.51	1	250	68		
19		35	984.74	0.17	101	172	0.48	0.48	1	250	60		
20		40	986.67	0.17	102	173	0.48	0.48	1	251	60		
21		45	988.67	0.18	103	173	0.51	0.51	1	252	60		
22		50	990.52	0.17	104	175	0.48	0.48	1	245	60		
23		55	992.54	0.18	105	176	0.51	0.51	1	245	64		
24		60	994.55	0.18	108	177	0.52	0.52	1	245	56		
25	A2	5	996.51	0.18	110	176	0.52	0.52	1	253	56		

320	191.206	0.6617	159.3	313.8	1.707
Min. (°)	Vm	($\sqrt{AP}$) ²	tm	ts	ΔH

FIELD DATA (continued)

PLANT Ho-Houston Equipment Yard RUN NO. 50037-105-1
 SAMPLING LOC. Engine Exhaust Stack JOB. NO. 20037

COMMENTS													
LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READING CUBIC FEET	PITOT READING IN. H ₂ O	GAS METER TEMP. °F	STACK TEMP. °F	ORIFICE SETTING IN. H ₂ O		GAUGE VACUUM IN. HG	GAS TEMPERATURES °F			
							ACTUAL	IDEAL		FILTER BOX	IMPING EXIT	PROBE	COND. EXIT
26		10	998.44	0.17	110	179	0.49	0.49	1	255	58		N/A
27		15	1000.31	0.17	111	182	0.49	0.49	1	252	58		1
28		20	1002.29	0.19	112	180	0.55	0.55	1	255	57		1
29		25	1004.33	0.20	114	180	0.58	0.58	1	255	59		
30		30	1006.25	0.20	114	182	0.58	0.57	1	250	56		
31		35	1008.48	0.21	113	178	0.61	0.61	1	250	55		
32		40	1005.55	0.19	114	179	0.55	0.55	1	251	58		
33		45	1012.58	0.19	115	179	0.55	0.55	1	245	50		
34		50	1014.57	0.18	116	178	0.52	0.52	1	245	52		
35		55	1016.56	0.18	116	179	0.52	0.52	1	244	54		
36		003	1018.54	0.18	116	178	0.52	0.52	1	244	58		
37	A4	5	1020.491	0.19	117	181	0.55	0.55	1	245	58		
38		10	1022.55	0.18	109	176	0.52	0.52	1	244	64		
39		15	1024.54	0.18	109	175	0.52	0.52	1	250	64		
40		20	1026.53	0.18	110	176	0.55	0.55	1	251	64		
41		25	1028.49	0.18	111	176	0.57	0.52	1	251	62		
42		30	1030.43	0.18	112	175	0.52	0.52	1	257	70		
43		35	1032.39	0.18	112	175	0.52	0.52	1	249	70		
44		40	1034.31	0.18	114	176	0.52	0.52	1	253	70		
45		45	1036.25	0.18	116	176	0.55	0.55	1	257	64		
46		50	1038.21	0.19	117	178	0.55	0.55	1	255	58		
47		55	1040.19	0.19	116	178	0.46	0.46	1	255	58		
48		004	1042.31	0.18	117	178	0.46	0.46	1	255	58		
49	A1	5	1044.70	3.2	112	725	4.5	4.5	9	N/A	52		
50		10	1054.11	3.2	114	730	4.5	4.5	9	N/A	55		
51		15	1066.08	3.4	120	748	5.2	5.2	11	N/A	60		
52	A	20	1068.25	3.4	125	748	5.2	5.2	14	N/A	60		
53	A2	25	1072.4	3.4	128	732	5.2	5.3	15	N/A	62		
54		30	1078.5	4.0	122	735	5.0	5.22	17	N/A	66		
55		35	1084.41	3.8	128	735	5.7	5.7	8	N/A	64		
56		40	1090.4	3.6	128	726	5.5	5.5	8	N/A	62		
57	A3	45	1097.12	3.8	110	727	5.8	5.8	8	N/A	60		
58		50	1105.43	3.4	110	737	5.8	5.8	11	N/A	62		
59		55	1109.578	3.8	110	733	5.0	5.8	11	N/A	62		
60		005	1107.115	3.7	116	730	5.7	5.7	13	N/A	64		
61	A3.4	5	1122.20	3.9	116	735	6.0	6.0	14	N/A	64		
62		10	1128.02	3.2	120	726	5.0	5.0	14		64		
63		15	1133.99	3.2	117	720	4.6	5.0	14		66		
64		20	1139.46	3.2	120	724	4.5	5.0	14		66		
65													

on 5

off 134 or 163

Min. (θ) Vm (√ΔP)² tm ts ΔH

ENTROPY

11

FIELD DATA - METHOD(S) ARB 5

PLANT Halliburton Equipment Yard RUN NO. MS-2
 CITY/STATE Bakersfield, Ca JOB NO. 30087 DATE 7/30/82
 SAMPLING LOC. Engine Exhaust Duct TIME START 1100
 BAROMETRIC PRESSURE, IN. HG 29.5 STATIC PRESSURE, IN. H₂O 0.04 TIME FINISH 1831
 LEAK CHECK, VACUUM IN. HG 15 15 15 15 OPERATOR SCG
 LEAK RATE, CUBIC FEET/MIN. 0.008 0.004 0.004 0.004 ASST(S) _____

EQUIPMENT CHECKS*		EQUIPMENT I.D. NUMBERS				LEAK CHECKS	
☒ PITOT, PRETEST	REAGENT BOX <u>CS2/MU3</u>	METER BOX <u>N22</u>	<u>Y 1.020</u>		B	<u>234.229</u>	B
☒ PITOT, POSTTEST	PITOT <u>160-18</u>	CP <u>0.99</u>	NOZ <u>LG1206</u>	DIA. <u>0.0217</u>	E	<u>234.456</u>	E
☒ NOZZLE, PRE/POST	TC READOUT <u>F61</u>	TC PROBE <u>N/A</u>	UMBILICAL <u>N/A</u>		B		B
☒ TC <u>BT</u> °F PRE	SAMPL'G BOX <u>25</u>	ORSAT PUMP <u>N/A</u>	TEDLAR BAG <u>N/A</u>		E		E
☒ TC _____ °F POST					B		B
<u>N/A</u> ORSAT SYSTEM					E		E
		NOMOGRAPH DATA					
		DELTA HG <u>1.7392</u>	<u>1.955</u>				
FILTER/XAD	TARE WT.	METER TEMP	<u>100</u>	<u>100</u>			
<u>1031</u>	<u>0.4446</u>	EST. XH ₂ O	<u>3</u>	<u>3</u>			
<u>1032</u>	<u>0.4948</u>	C FACTOR	<u>1.404</u>	<u>1.579</u>			
		STACK TEMP	<u>295</u>	<u>295</u>			
		REF DELTA P	<u>0.845</u>	<u>0.721</u>			
		K FACTOR	<u>2.230</u>	<u>2.553</u>			

* PITOT: VISUAL INSPECTION/LEAK CHECK; NOZZLE: VISUAL INSPECTION; TC: AMBIENT TEMPS.; ORSAT SYSTEM: LEAK CHECK

I N E	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READING CUBIC FEET	PITOT READING IN. H ₂ O	GAS METER TEMP. °F	STACK TEMP. °F	ORIFICE SETTING IN. H ₂ O		GAUGE VACUUM IN. HG	GAS TEMPERATURES °F			
							ACTUAL	IDEAL		FILTER BOX	IMPING EXIT	PROBE	COND. EXIT
		0	<u>140.106</u>										
1	A1	5	141.99	0.15	97	176	0.45	0.45	1	233	66		N/A
2		10	143.86	0.15	92	177	0.45	0.45	1	240	64		
3		15	145.73	0.16	96	178	0.48	0.48	1	248	60		
4		20	147.69	0.16	99	176	0.48	0.48	1	247	65		
5		25	149.44	0.16	100	175	0.48	0.44	1	248	64		
6		30	151.32	0.16	102	174	0.48	0.44	1	246	64		
7		35	153.19	0.16	104	174	0.48	0.44	1	244	60		
8		40	155.06	0.16	106	176	0.48	0.44	1	246	55		
9		45	158.94	0.16	108	177	0.48	0.44	1	240	55		
10		50	158.90	0.17	110	178	0.52	0.52	1	243	55		
11		55	160.80	0.16	111	178	0.49	0.49	1	246	55		
12		60/1	162.762	0.17	111	178	0.52	0.52	1	250	58		
13	A2	5	164.82	0.17	112	176	0.53	0.53	1	256	60		
14		10	166.91	0.15	114	175	0.47	0.47	1	256	58		
15		15	168.81	0.16	113	178	0.49	0.49	1	260	56		
16		20	170.80	0.17	114	180	0.52	0.53	1	258	56		
17		25	172.73	0.16	115	177	0.50	0.50	1	258	54		
18		30	174.64	0.16	116	177	0.50	0.50	1	257	58		
19		35	176.53	0.16	116	179	0.50	0.50	1	258	58		
20		40	178.47	0.16	117	176	0.50	0.50	1	258	58		
21		45	180.42	0.16	118	176	0.50	0.50	1	258	58		
22		50	182.33	0.16	119	176	0.50	0.50	1	262	60		
23		55	184.24	0.16	118	178	0.50	0.50	1	253	60		
24		60/2	186.23	0.18	112	181	0.52	0.52	1	253	60		
25	43	5	188.23	0.18	104	180	0.54	0.55	1	256	58		

230 190.012 0.5731 105.9 312.8 1.627
 Min. (θ) Vm (√ΔP)² tm ts ΔH

FIELD DATA - METHOD(S) 5

PLANT HALIBURTON EQUIPMENT YARD RUN NO. M5-3
 CITY/STATE BAKER FIELD CALIF JOB NO. 30037 DATE 7-3-92
 SAMPLING LOC. ENGINE EXHAUST DUCT TIME START 1310
 BAROMETRIC PRESSURE, IN. HG 29.7 STATIC PRESSURE, IN. H₂O .75 TIME FINISH 2120
 LEAK CHECK, VACUUM IN. HG 15 15 15 OPERATOR CEV
 LEAK RATE, CUBIC FEET/MIN. 004 001 001 ASST(S) _____

EQUIPMENT CHECKS*		EQUIPMENT I.D. NUMBERS		LEAK CHECKS	
☒ PITOT, PRETEST	REAGENT BOX <u>C52</u>	METER BOX <u>N22</u>	Y <u>1.020</u>	B <u>425-153</u>	B _____
☒ PITOT, POSTTEST	PITOT _____	Cp <u>.99</u>	NOZ'L _____	E <u>424-170</u>	E _____
☒ NOZZLE, PRE/POST	TC READOUT <u>N22</u>	TC PROBE <u>07</u>	UMBILICAL <u>UT2</u>	B _____	B _____
☒ TC <u>92</u> °F PRE	SAMPL'G BOX <u>10</u>	ORSAT PUMP <u>NA</u>	TEDLAR BAG <u>NA</u>	E _____	E _____
☒ TC <u>92</u> °F POST				B _____	B _____
<u>NA</u> ORSAT SYSTEM				E _____	E _____
		NOMOGRAPH DATA			
		DELTA Hg <u>1.955</u>			
FILTER/XAD	TARE WT.	METER TEMP <u>100</u>			
		EST. XH ₂ O <u>3</u>			
		C FACTOR <u>1.519</u>			
		STACK TEMP <u>295</u>			
		REF DELTA P <u>.721</u>			
		K FACTOR <u>2.553</u>			

* PITOT: VISUAL INSPECTION/LEAK CHECK; NOZZLE: VISUAL INSPECTION; TC: AMBIENT TEMPS.; ORSAT SYSTEM: LEAK CHECK

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READING CUBIC FEET	PITOT READING IN. H ₂ O	GAS METER TEMP. °F	STACK TEMP. °F	ORIFICE SETTING IN. H ₂ O		GAUGE VACUUM IN. HG	GAS TEMPERATURES °F	FILTER *	IMPING. EXIT	PROBE OR COND EXIT**	✓
							ACTUAL	IDEAL						
1	2	0	330.220										NA	
2	1	5	332.110	.16	94	169	.48	.48	1	250	80			
3		10	333.80	.12	100	117	.36	.36	1	253	70			
4		15	335.55	.13	100	166	.4	.40	1	255	70			
5		20	337.45	.15	102	171	.46	.46	1	250	70			
6		25	339.14	.15	104	170	.46	.46	1	250	70			
7		30	341.17	.15	106	173	.46	.40	1	250	70			
8		35	343.04	.15	106	171	.46	.46	1	250	71			
9		40	344.72	.15	108	174	.46	.46	1	250	75			
10		45	346.47	.16	110	171	.46	.46	1	250	70			
11		50	348.52	.15	110	171	.46	.46	1	250	70			
12		55	350.25	.16	110	170	.44	.44	1	250	70			
13		60/0	352.08	.15	112	169	.46	.46	1	250	70			
14		5	353.87	.17	114	175	.52	.52	1	250	70			
15		10	355.85	.17	116	175	.53	.53	1	250	70			
16		15	357.750	.19	118	175	.56	.56	1	245	65			
17		20	359.87	.17	110	177	.52	.52	1	245	65			
18		25	361.71	.17	110	177	.52	.52	1	250	65			
19		30	363.71	.17	110	177	.52	.52	1	250	60			
20		35	365.75	.17	112	176	.52	.52	1	250	60			
21		40	367.65	.17	112	175	.52	.52	1	253	60			
22		45	369.67	.19	112	177	.52	.52	1	253	60			
23		50	371.67	.19	112	177	.58	.58	1	250	60			
24		55	373.61	.17	112	176	.52	.52	1	250	60			
25		120/0	375.42	.17	112	173	.52	.52	1	250	60			

* FILTER EXIT for NJ Method 1. FILTER BOX for all others.

** PROBE EXIT & ✓ (probe & filter heat off) apply to NJ Method 1. COND EXIT applies if sampling train has a condenser.

320 146.105 0.6294 111.1 3022 1.774
 Min. (θ) Vm (ΔP)² tm ts ΔH

ENTROPY

FIELD DATA (continued)

PLANT HALIBURTON EQUIPMENT YARD
SAMPLING LOC. ENGINE EXHAUST DUCTRUN NO. M5 3
JOB. NO. 30037

COMMENTS												
LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READING CUBIC FEET	PITOT READING IN. H ₂ O	GAS METER TEMP. °F	STACK TEMP. °F	ORIFICE SETTING IN. H ₂ O		GAUGE VACUUM IN. HG	GAS TEMPERATURES °F		✓
							ACTUAL	IDEAL		FILTER *	IMPING. EXIT	
26		5	377.65	.19	114	176	.59	.59	1	250	60	NA
27		10	379.62	.19	114	175	.59	.59	1	250	70	
28		15	381.75	.18	113	177	.55	.55	1	250	70	
29		20	383.34	.19	114	176	.59	.59	1	250	70	
30		25	386.04	.21	114	176	.65	.65	1	255	70	
31		30	388.12	.19	114	177	.58	.58	1	255	65	
32		35	390.11	.20	114	178	.61	.61	1	250	65	
33		40	392.29	.19	114	175	.59	.59	1	250	65	
34		45	394.40	.19	114	175	.59	.59	1	250	60	
35		50	396.49	.19	114	174	.59	.59	1	250	60	
36		55	398.67	.20	114	174	.62	.62	1	250	60	
37		180/0	400.68	.19	112	174	.59	.59	1	250	60	
38		5	402.96	.20	112	175	.62	.62	1	255	60	
39		10	404.87	.19	110	170	.59	.59	1	260	65	
40		15	406.81	.16	110	170	.49	.49	1	260	65	
41		20	408.89	.18	110	172	.55	.55	1	250	60	
42		25	410.82	.18	110	173	.55	.55	1	250	60	
43		30	412.81	.18	110	176	.55	.55	1	250	60	
44		35	414.81	.18	110	173	.55	.55	1	250	60	
45		40	416.79	.17	110	172	.52	.52	1	245	65	
46		45	418.85	.18	112	173	.56	.56	1	240	60	
47		50	420.96	.18	112	172	.56	.56	1	240	60	
48		55	423.12	.18	112	172	.56	.56	1	240	60	
49		240/0	425.155	.17	112	171	.53	.53	7	NA	70	NA
50		5	432.21	3.49	106	724	6.58	6.58	5		70	
51		10	438.31	4.00	108	677	6.79	6.79	5		65	
52		15	444.72	4.00	108	683	6.69	6.69	5		65	
53		20	451.05	3.40	110	683	5.69	5.69	5		60	
54		25	457.37	3.40	110	692	5.71	5.71	5		60	
55		30	463.47	3.00	110	694	5.07	5.07	5		60	
56		35	469.37	3.20	100	690	5.39	5.39	11		60	
57		40	476.02	3.90	112	688	6.57	6.57	15		60	
58		45	482.62	4.00	114	685	6.73	6.73	5		65	
59		50	489.07	3.80	116	692	6.43	6.43	9		65	
60		55	499.40	4.00	116	697	6.04	6.04	9		60	
61		60/0	502.61	4.10	116	692	6.94	6.94	9		60	
62		5	510.02	3.60	116	696	6.10	6.10	9		60	
63		10	515.72	3.40	116	696	5.74	5.74	9		60	
64		15	522.41	3.80	116	689	6.58	6.58	9		60	
65		20	528.845	4.00	116	680	6.85	6.85	10		60	

* FILTER EXIT for NJ Method 1. FILTER BOX for all others.

** PROBE EXIT & ✓ (probe & filter heat off) apply to NJ Method 1. COND EXIT applies if sampling train has a condenser.

Min. (θ) Vm $(\sqrt{dp})^2$ tm ts ΔH

ENTROPY

: 15

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Appendix C.3

CO, NO_x, THC, CO₂, O₂ - CARB Method 100

CALIBRATION SUMMARY

SOURCE: WSPA I.C. Engine Pooled Source Test

REASON: Initial Calibration (through system)

DATE : 07-29-1992 TIME: 06:21 - 06:45

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
10	TECO8	ppmNOx	0.0	1.0
10	TECO8	ppmNOx	867.0	866.3
9	TECO2	ppm CO	0.0	-0.4
9	TECO2	ppm CO	807.0	806.8
2	as CH4	ppmTHC	0.0	-0.0
2	as CH4	ppmTHC	804.7	804.8
12	FUJ13	%CO2	0.00	-0.01
12	FUJ13	%CO2	17.74	17.74
8	SERVMX	%Oxygn	0.00	0.01
8	SERVMX	%Oxygn	5.01	5.06
8	SERVMX	%Oxygn	20.50	20.48

WSPA I.C. Engine Pooled Source Test

07-29-1992

	CHAN10 TECO8 ppmNOx	CHAN 9 TECO2 ppm CO	CHAN 2 as CH4 ppmTHC	CHAN12 FUJI3 %CO2	CHAN 8 SERVMX %Oxygen
07:39	117.4	222.3	289.2	1.54	18.83
07:40	117.6	222.3	289.6	1.54	18.84

AVERAGE VALUES FOR THE LAST HOUR: 2 MINUTES OF VALID DATA

07:40	117.5	222.3	289.4	1.54	18.83
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07:41	117.1	221.2	286.0	1.53	18.84
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07:42	116.6	218.8	282.8	1.53	18.85
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WSPA I.C. Engine Pooled Source Test

07-29-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJ13	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
07:46	115.7	212.1	271.8	1.53	18.38
07:47	115.3	211.8	270.9	1.52	18.88
07:48	115.6	209.7	268.6	1.52	18.39
07:49	115.6	208.1	266.0	1.52	18.89
07:50	115.9	207.4	263.4	1.51	18.90
07:51	115.4	206.5	260.8	1.51	18.90
07:52	115.5	205.6	262.8	1.51	18.89
07:53	115.2	205.6	264.7	1.51	18.89
07:54	115.8	205.6	262.9	1.51	18.90
07:55	116.4	205.3	261.7	1.50	18.88

AVERAGE VALUES FOR THE LAST 10 MINUTES

07:55	115.6	207.8	265.4	1.52	18.89
07:56	116.5	203.8	260.8	1.52	18.78
07:57	115.5	205.2	259.9	1.54	18.77
07:58	118.3	202.3	255.6	1.55	18.30
07:59	125.8	201.7	252.8	1.61	18.68
08:00	125.0	200.8	253.8	1.58	18.76
08:01	115.7	201.0	254.5	1.50	18.91
08:02	116.0	201.7	255.2	1.50	18.90
08:03	116.4	202.0	253.8	1.50	18.90
08:04	116.2	203.4	254.4	1.50	18.90
08:05	116.4	203.4	253.5	1.50	18.89

AVERAGE VALUES FOR THE LAST 10 MINUTES

08:05	118.2	202.5	255.4	1.53	18.83
08:06	116.5	203.7	252.8	1.50	18.89
08:07	116.2	202.3	250.5	1.50	18.89
08:08	115.4	200.9	248.2	1.50	18.90
08:09	115.1	199.9	248.3	1.50	18.90
08:10	115.5	200.7	246.3	1.49	18.87
08:11	114.6	199.6	247.4	1.50	18.88
08:12	114.7	198.9	244.7	1.50	18.94
08:13	115.8	198.2	245.1	1.56	18.79
08:14	116.4	199.3	245.6	1.52	18.82
08:15	115.8	199.9	250.9	1.52	18.83

AVERAGE VALUES FOR THE LAST 10 MINUTES

08:15	115.6	200.7	248.0	1.51	18.87
08:16	115.5	201.0	248.2	1.51	18.83
08:17	116.1	199.2	247.2	1.51	18.81
08:18	115.3	200.1	248.9	1.52	18.81
08:19	115.3	200.0	248.7	1.50	18.90
08:20	115.1	200.0	241.3	1.49	18.92
08:21	115.3	196.6	234.1	1.49	18.92
08:22	115.5	193.2	232.3	1.50	18.84
08:23	115.0	194.1	232.4	1.50	18.89
08:24	115.8	193.8	228.6	1.49	18.92
08:25	116.9	194.5	228.8	1.49	18.91

WSPA I.C. Engine Pooled Source Test

07-29-1992

TIME	CHAN10 TECO8 ppmNOx	CHAN 9 TECO2 ppm CO	CHAN 2 as CH4 ppmTHC	CHAN12 FUJI3 %CO2	CHAN 8 SERVMX %Oxygen
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AVERAGE VALUES FOR THE LAST 10 MINUTES

08:25	115.6	197.3	239.1	1.50	18.88
08:26	116.7	194.1	226.6	1.49	18.91
08:27	116.6	194.4	224.6	1.49	18.90
08:28	117.3	194.0	223.1	1.49	18.89
08:29	116.8	194.1	228.1	1.48	18.89
08:30	121.3	192.6	238.0	1.53	18.83
08:31	127.1	191.7	235.6	1.58	18.71
08:32	124.7	189.5	234.5	1.55	18.74
08:33	106.9	190.9	219.8	1.47	18.80
08:34	45.4	79.7	126.4	1.46	18.73
08:35	27.5	30.2	155.6	0.34	19.56

STOP TO
change
FILTER

AVERAGE VALUES FOR THE LAST 10 MINUTES

08:35	102.0	165.1	211.2	1.39	18.90
08:36	2.4	0.6	110.3	0.06	20.56
08:37	59.2	39.8	200.6	0.91	19.81
08:38	115.5	189.4	229.8	1.49	18.88
08:39	116.5	190.7	238.5	1.49	18.89
08:40	116.9	189.9	246.0	1.49	18.89
08:41	117.0	189.9	250.1	1.49	18.90
08:42	117.5	189.0	249.0	1.54	18.88
08:43	118.1	188.0	260.7	1.49	18.90
08:44	119.6	189.4	271.6	1.49	18.85
08:45	120.5	185.4	270.3	1.48	18.86

Back on
line

AVERAGE VALUES FOR THE LAST 10 MINUTES

08:45	100.7	155.2	232.7	1.29	19.14
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

08:45	111.2	188.0	242.0	1.46	18.92
08:46	118.9	185.7	263.9	1.47	18.89
08:47	118.3	184.7	268.1	1.49	18.90
08:48	118.4	184.7	265.4	1.49	18.85
08:49	118.3	185.5	267.6	1.50	18.85
08:50	119.8	188.1	274.0	1.50	18.81
08:51	120.5	186.9	270.4	1.50	18.88
08:52	121.0	187.1	269.6	1.50	18.88
08:53	119.6	184.9	267.9	1.49	18.90
08:54	119.1	183.4	272.6	1.49	18.90
08:55	118.3	186.1	270.2	1.49	18.90

AVERAGE VALUES FOR THE LAST 10 MINUTES

08:55	119.2	185.7	269.0	1.49	18.88
08:56	119.0	185.0	266.0	1.50	18.88
08:57	119.0	185.4	265.3	1.49	18.90
08:58	117.9	184.8	266.0	1.49	18.91
08:59	118.6	184.0	267.4	1.49	18.90
09:00	120.0	183.9	280.8	1.50	18.90

ENTROPY

WSPA I.C. Engine Pooled Source Test

07-29-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJ13	SERV MX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
09:01	119.3	185.0	274.0	1.50	18.90
09:02	119.6	181.4	266.2	1.49	18.91
09:03	120.1	181.8	274.5	1.49	18.89
09:04	125.2	181.3	266.3	1.55	18.82
09:05	128.5	180.1	263.5	1.58	18.75

AVERAGE VALUES FOR THE LAST 10 MINUTES

09:05	120.7	183.3	269.0	1.51	18.88
09:06	125.4	179.1	275.2	1.54	18.71
09:07	118.3	180.9	273.7	1.50	18.88
09:08	118.8	181.9	269.6	1.54	18.69
09:09	119.1	180.7	267.8	1.51	18.86
09:10	118.9	181.1	265.3	1.53	18.76
09:11	118.4	182.0	265.6	1.55	18.79
09:12	118.0	180.7	270.5	1.58	18.67
09:13	117.9	181.8	265.7	1.56	18.68
09:14	118.2	180.4	265.1	1.56	18.65
09:15	118.8	179.8	264.3	1.55	18.72

AVERAGE VALUES FOR THE LAST 10 MINUTES

09:15	119.2	180.8	268.3	1.54	18.74
09:16	118.3	179.8	263.5	1.49	18.89
09:17	119.2	179.4	267.4	1.49	18.89
09:18	121.4	181.8	281.2	1.50	18.89

COMMENTS: Interrupted sampling due to filter plugging.

CALIBRATION SUMMARY

SOURCE: WSPA I.C. Engine Pooled Source Test

REASON: calibration check

DATE : 07-29-1992 TIME: 09:20 - 09:39

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
10	TECO8	ppmNOx	0.0	1.2
10	TECO8	ppmNOx	867.0	864.0
9	TECO2	ppm CO	0.0	-0.4
9	TECO2	ppm CO	807.0	807.8
12	FUJ13	%CO2	0.00	0.00
12	FUJ13	%CO2	17.74	17.68
8	SERVMX	%Oxygn	0.00	0.03
8	SERVMX	%Oxygn	5.01	5.01

WSPA I.C. Engine Pooled Source Test

07-29-1992

TIME	CHAN10 TECO8 ppmNOx	CHAN 9 TECO2 ppm CO	CHAN 2 as CH4 ppmTHC	CHAN12 FUJ13 %CO2	CHAN 5 SERVMX %Oxygen
09:46	123.9	180.5	236.5	1.50	18.84
09:47	122.4	178.1	238.7	1.50	18.85
09:48	124.5	176.1	241.1	1.50	18.86
09:49	124.9	174.3	245.9	1.51	18.84
09:50	125.7	174.8	253.8	1.51	18.85
09:51	125.4	174.8	254.2	1.51	18.86
09:52	124.0	173.2	257.8	1.51	18.86
09:53	123.6	173.1	253.6	1.51	18.86
09:54	123.0	173.3	256.4	1.51	18.84
09:55	122.7	174.0	256.8	1.51	18.87

AVERAGE VALUES FOR THE LAST 10 MINUTES

09:55	124.0	175.2	249.5	1.51	18.85
09:56	123.2	175.9	257.6	1.51	18.87
09:57	123.1	174.6	257.8	1.51	18.87
09:58	120.7	175.1	262.3	1.52	18.86
09:59	119.0	177.9	268.1	1.52	18.86
10:00	119.2	178.7	265.8	1.51	18.87
10:01	119.7	177.1	266.7	1.51	18.87
10:02	119.8	180.6	276.5	1.51	18.87

COMMENTS: manual test methods not ready

WSPA I.C. Engine Pooled Source Test

07-29-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJI3	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
10:29	123.5	175.0	228.3	1.51	18.86
10:30	124.2	172.6	234.1	1.51	18.85
10:31	124.8	171.9	241.4	1.50	18.87
10:32	124.2	171.9	243.6	1.50	18.87
10:33	124.6	171.6	246.6	1.51	18.85
10:34	124.0	170.8	248.6	1.51	18.86
10:35	123.5	171.2	249.8	1.50	18.86
10:36	123.8	172.2	257.1	1.50	18.88
10:37	125.3	173.4	256.4	1.51	18.86
10:38	125.3	172.9	256.5	1.50	18.87

AVERAGE VALUES FOR THE LAST 10 MINUTES

10:38	124.3	172.3	246.2	1.51	18.86
10:39	124.3	173.1	254.6	1.50	18.88
10:40	124.8	173.3	262.4	1.50	18.87
10:41	125.0	173.6	274.0	1.50	18.87
10:42	124.7	175.2	273.5	1.50	18.88
10:43	122.6	172.1	262.9	1.50	18.89
10:44	122.7	170.9	263.4	1.50	18.89
10:45	123.7	171.7	269.2	1.50	18.88
10:46	123.4	174.0	265.5	1.50	18.88
10:47	123.6	172.6	268.9	1.50	18.88
10:48	124.0	174.8	276.8	1.50	18.88

AVERAGE VALUES FOR THE LAST 10 MINUTES

10:48	123.9	173.1	267.1	1.50	18.88
10:49	123.0	173.8	269.3	1.50	18.89
10:50	123.4	173.7	274.5	1.50	18.87
10:51	123.5	177.2	279.9	1.50	18.86
10:52	123.5	176.5	276.3	1.50	18.86
10:53	123.8	176.0	276.3	1.51	18.87
10:54	132.7	173.7	272.0	1.59	18.74
10:55	132.9	170.2	267.4	1.59	18.71
10:56	124.3	171.6	265.1	1.50	18.84
10:57	124.1	173.8	272.0	1.50	18.86
10:58	124.0	174.5	267.5	1.50	18.86

AVERAGE VALUES FOR THE LAST 10 MINUTES

10:58	125.5	174.1	272.0	1.52	18.84
10:59	122.5	174.9	266.6	1.49	18.88
11:00	122.2	173.2	268.4	1.49	18.87
11:01	122.1	172.8	267.1	1.49	18.86
11:02	121.5	172.4	265.6	1.49	18.87
11:03	121.0	172.2	264.9	1.49	18.88
11:04	120.9	172.6	268.8	1.50	18.88
11:05	120.5	173.8	269.9	1.51	18.88
11:06	121.3	173.0	274.2	1.49	18.87
11:07	121.9	173.9	270.8	1.50	18.87
11:08	122.4	174.5	267.9	1.50	18.86

WSPA I.C. Engine Pooled Source Test

07-29-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJ13	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen

AVERAGE VALUES FOR THE LAST 10 MINUTES

11:08	121.6	173.3	268.4	1.50	18.87
11:09	121.5	174.5	270.4	1.49	18.87
11:10	121.7	176.6	271.1	1.50	18.87
11:11	121.9	174.8	268.9	1.49	18.87
11:12	121.1	174.3	267.7	1.49	18.88
11:13	120.4	175.4	268.2	1.49	18.88
11:14	119.7	175.2	269.4	1.49	18.88
11:15	119.4	174.6	271.3	1.49	18.88
11:16	120.4	174.8	272.6	1.53	18.88
11:17	120.1	174.4	270.2	1.49	18.88
11:18	119.7	175.0	273.4	1.49	18.88

AVERAGE VALUES FOR THE LAST 10 MINUTES

11:18	120.6	174.9	270.3	1.49	18.88
11:19	119.7	177.5	282.9	1.49	18.88
11:20	120.4	177.1	277.0	1.49	18.87
11:21	120.2	176.0	276.4	1.49	18.87
11:22	120.8	177.1	277.8	1.50	18.37
11:23	120.9	178.5	273.0	1.49	18.87
11:24	120.2	176.5	273.7	1.49	18.88
11:25	119.7	175.4	267.3	1.48	18.88
11:26	119.4	173.2	264.3	1.49	18.87
11:27	118.8	174.0	266.8	1.49	18.88
11:28	119.6	174.5	271.6	1.49	18.94

AVERAGE VALUES FOR THE LAST 10 MINUTES

11:28	120.0	176.0	273.1	1.49	18.88
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

11:28	122.6	174.0	266.2	1.50	18.87
11:29	119.7	175.6	275.0	1.49	18.93
11:30	119.7	175.4	274.9	1.49	18.93
11:31	119.0	177.3	274.5	1.49	18.92
11:32	119.5	175.8	272.6	1.49	18.91
11:33	127.6	176.4	271.8	1.57	18.80
11:34	131.3	175.9	264.0	1.59	18.75
11:35	125.0	172.1	265.3	1.52	18.84
11:36	120.4	173.7	268.9	1.48	18.91
11:37	120.5	175.2	273.9	1.49	18.91
11:38	121.1	175.1	270.4	1.49	18.90

AVERAGE VALUES FOR THE LAST 10 MINUTES

11:38	122.4	175.3	271.1	1.51	18.88
11:39	121.4	174.5	266.6	1.48	18.91
11:40	121.1	173.8	265.7	1.48	18.91
11:41	121.0	174.2	263.4	1.48	18.90
11:42	120.8	173.7	262.4	1.49	18.90
11:43	120.2	174.5	263.9	1.49	18.88

ENTROPY

WSPA I.C. Engine Pooled Source Test

07-29-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJ13	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
11:44	118.9	172.4	257.8	1.47	18.91
11:45	118.0	170.8	256.6	1.46	18.92
11:46	117.4	172.1	257.0	1.46	18.92
11:47	118.5	172.7	255.9	1.46	18.91
11:48	118.6	174.0	258.4	1.47	18.91
AVERAGE VALUES FOR THE LAST 10 MINUTES				1.48	18.91
11:49	117.5	173.3	260.8		
11:49	119.0	174.4	259.4	1.47	18.90
11:50	118.2	173.4	255.3	1.46	18.91
11:51					
	118.0	174.0	258.7	1.47	18.90
11:52	118.9	175.0	271.2	1.47	18.89
11:53	118.6	177.3	272.2	1.47	18.90
11:54	117.2	174.3	267.5	1.46	18.90
11:55	117.3	172.3	266.5	1.46	18.90
11:56	117.7	174.4	268.5	1.46	18.89
11:57	117.1	173.6	263.5	1.46	18.90
11:58	117.2	175.8	265.5	1.46	18.89
AVERAGE VALUES FOR THE LAST 10 MINUTES					
11:58	118.0	174.5	264.8	1.46	18.90
11:59	116.8	175.3	263.6	1.46	18.89
12:00	116.5	174.2	260.6	1.46	18.89
12:01	116.7	172.7	259.7	1.46	18.89
12:02	116.4	174.4	260.2	1.46	18.89
12:03	115.8	174.5	259.7	1.46	18.89
12:04	116.7	176.9	261.2	1.47	18.88
12:05	117.0	176.7	260.0	1.46	18.89
12:06	117.1	176.9	258.1	1.46	18.89
12:07	117.4	177.0	259.0	1.46	18.87
12:08	116.7	176.8	259.0	1.45	18.88
AVERAGE VALUES FOR THE LAST 10 MINUTES					
12:08	116.7	175.5	260.1	1.46	18.88
12:09	116.7	176.0	257.9	1.45	18.90
12:10	116.5	174.8	260.2	1.45	18.90
12:11	116.5	176.6	260.6	1.45	18.89
12:12	37.6	105.9	108.0	0.31	20.44
12:13	35.2	8.5	154.4	0.56	20.40
12:14	125.4	154.5	265.4	1.58	18.82
12:15	123.1	173.8	286.1	1.53	18.80
12:16	116.4	174.4	294.7	1.46	18.93
12:17	115.9	174.4	302.8	1.46	18.93
12:18	116.6	175.4	310.1	1.46	18.92
AVERAGE VALUES FOR THE LAST 10 MINUTES					
12:18	102.0	149.4	250.0	1.27	19.19
12:19	116.0	176.5	304.0	1.46	18.92
12:20	116.7	176.6	302.5	1.46	18.91
12:21	117.1	176.8	303.0	1.46	18.91
12:22	117.0	175.8	302.5	1.46	18.90

STOP TO
change filter

on-line

ENTROPY

WSPA I.C. Engine Pooled Source Test

07-29-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECC2	as CH4	FUJ13	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
12:23	117.0	176.4	306.1	1.46	18.90
12:24	116.8	176.3	306.0	1.52	18.87
12:25	115.8	178.8	315.1	1.49	18.81
12:26	115.1	177.3	312.1	1.46	18.92
12:27	115.8	176.3	311.9	1.46	18.92
12:28	116.4	175.8	310.5	1.45	18.92

AVERAGE VALUES FOR THE LAST 10 MINUTES

12:28	116.4	176.7	307.4	1.47	18.90
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

12:28	115.8	170.8	269.0	1.44	18.94
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12:29	116.1	175.8	311.4	1.45	18.93
12:30	116.6	177.6	311.6	1.46	18.92
12:31	116.1	175.5	306.6	1.45	18.93
12:32	116.3	174.8	304.1	1.45	18.93
12:33	116.3	175.6	307.5	1.45	18.93
12:34	117.1	176.7	309.5	1.46	18.91
12:35	117.4	176.5	311.3	1.46	18.91
12:36	117.2	177.2	292.9	1.45	18.92
12:37	117.1	178.4	292.3	1.45	18.92
12:38	116.9	178.1	291.7	1.45	18.93

AVERAGE VALUES FOR THE LAST 10 MINUTES

12:38	116.7	176.6	303.9	1.45	18.92
12:39	117.6	178.7	293.2	1.45	18.92
12:40	116.9	178.6	293.2	1.45	18.91
12:41	116.7	178.2	296.7	1.45	18.92
12:42	116.8	178.8	297.1	1.46	18.91
12:43	115.8	178.0	296.7	1.45	18.93
12:44	116.2	177.5	300.6	1.48	18.84
12:45	115.5	180.5	305.7	1.46	18.91
12:46	114.4	180.7	296.7	1.45	18.92
12:47	115.4	177.9	297.8	1.45	18.92
12:48	115.7	177.8	299.2	1.46	18.91

AVERAGE VALUES FOR THE LAST 10 MINUTES

12:48	116.1	178.7	297.7	1.46	18.91
12:49	115.7	178.0	298.1	1.48	18.90
12:50	115.4	178.6	300.3	1.45	18.93
12:51	115.1	177.0	301.4	1.45	18.93
12:52	115.2	177.7	305.3	1.45	18.93
12:53	115.0	179.7	314.6	1.46	18.92
12:54	120.7	181.3	303.1	1.52	18.83
12:55	125.2	176.1	302.2	1.55	18.76
12:56	121.1	176.7	311.4	1.50	18.83
12:57	115.2	180.8	313.4	1.46	18.92
12:58	114.5	179.2	313.4	1.45	18.92

WSPA I.C. Engine Pooled Source Test

07-29-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJI3	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen

AVERAGE VALUES FOR THE LAST 10 MINUTES

12:58	117.3	178.5	306.3	1.48	18.89
12:59	113.8	177.9	313.5	1.45	18.93
13:00	114.6	178.4	314.8	1.46	18.90
13:01	115.4	178.9	323.5	1.46	18.89
13:02	115.4	181.1	317.6	1.46	18.90
13:03	114.9	180.7	314.9	1.45	18.91
13:04	114.7	182.9	322.9	1.46	18.90
13:05	114.1	183.5	316.0	1.45	18.91
13:06	114.3	181.6	314.0	1.45	18.91
13:07	113.9	180.5	315.7	1.46	18.91
13:08	112.9	180.9	317.3	1.45	18.92

AVERAGE VALUES FOR THE LAST 10 MINUTES

13:08	114.4	180.6	317.0	1.46	18.91
13:09	112.9	180.6	320.3	1.45	18.91
13:10	113.7	183.2	332.1	1.46	18.90
13:11	113.2	181.9	327.6	1.45	18.91
13:12	113.7	182.0	324.4	1.45	18.91
13:13	113.7	183.0	327.8	1.45	18.90
13:14	113.3	183.6	331.9	1.45	18.90
13:15	113.0	183.5	330.3	1.46	18.91
13:16	112.6	184.2	336.0	1.46	18.91
13:17	111.6	185.5	328.5	1.45	18.92
13:18	111.6	183.3	325.6	1.45	18.92

AVERAGE VALUES FOR THE LAST 10 MINUTES

13:18	112.9	183.1	328.4	1.45	18.91
13:19	112.0	183.3	326.7	1.45	18.91
13:20	111.7	183.6	324.2	1.45	18.90
13:21	109.1	179.7	321.8	1.42	18.95
13:22	108.3	176.9	322.5	1.41	18.97
13:23	107.8	178.4	319.5	1.41	18.99
13:24	107.3	176.8	321.1	1.41	18.99
13:25	108.5	176.8	322.2	1.42	18.98
13:26	108.8	177.6	324.4	1.42	18.98
13:27	108.7	179.4	320.3	1.42	18.98
13:28	109.0	178.4	326.5	1.42	18.97

AVERAGE VALUES FOR THE LAST 10 MINUTES

13:28	109.1	179.1	322.9	1.42	18.96
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

13:28	114.4	179.4	312.7	1.45	18.92
13:29	108.2	183.8	327.7	1.42	18.97
13:30	108.4	181.1	325.3	1.41	18.98
13:31	108.9	180.4	324.1	1.42	18.98
13:32	108.6	180.7	324.1	1.42	18.98
13:33	107.6	180.7	326.0	1.42	18.99

WSPA I.C. Engine Pooled Source Test

07-29-1992

TIME	CHAN10 TECO8 ppmNOx	CHAN 9 TECO2 ppm CO	CHAN 2 as CH4 ppmTHC	CHAN12 FUJI3 %CO2	CHAN 8 SERVMX %Oxygen
13:34	107.7	178.3	322.9	1.41	18.98
13:35	107.3	177.1	322.0	1.42	18.98
13:36	115.9	177.5	322.9	1.51	18.84
13:37	117.4	177.7	322.8	1.51	18.82
13:38	109.4	176.5	321.7	1.42	18.96

AVERAGE VALUES FOR THE LAST 10 MINUTES

13:38	109.9	179.4	323.9	1.44	18.95
13:39	107.4	177.1	325.5	1.41	18.99
13:40	108.0	179.4	324.6	1.42	18.97
13:41	108.0	179.1	323.3	1.42	18.98
13:42	107.7	179.7	321.9	1.41	18.98
13:43	107.6	179.2	323.6	1.42	18.98
13:44	108.7	180.4	326.9	1.42	18.97
13:45	108.1	180.3	327.6	1.41	18.98
13:46	107.5	182.0	328.3	1.41	18.98
13:47	107.6	182.4	329.2	1.42	18.98
13:48	108.0	181.5	329.3	1.42	18.97

AVERAGE VALUES FOR THE LAST 10 MINUTES

13:48	107.9	180.1	326.0	1.42	18.98
13:49	107.2	181.0	328.7	1.42	18.98
13:50	106.9	180.7	328.8	1.42	18.97
13:51	107.0	180.0	331.7	1.42	18.97
13:52	107.7	181.8	339.2	1.43	18.95
13:53	109.8	186.7	342.9	1.45	18.91
13:54	109.0	186.6	344.5	1.45	18.91
13:55	109.4	185.6	347.4	1.46	18.90
13:56	109.4	185.0	347.7	1.45	18.90
13:57	108.5	184.8	347.7	1.45	18.90
13:58	109.2	184.9	349.0	1.46	18.89

AVERAGE VALUES FOR THE LAST 10 MINUTES

13:58	108.4	183.7	340.8	1.44	18.93
13:59	109.5	188.7	352.0	1.46	18.90
14:00	109.8	189.1	350.7	1.45	18.91

COMMENTS: Stop Sampling to Calibrate and Change Loads.

CALIBRATION SUMMARY

SOURCE: WSPA I.C. Engine Pooled Source Test

REASON: calibration check

DATE : 07-29-1992 TIME: 14:00 - 15:16

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
10	TECO8	ppmNOx	0.0	1.4
10	TECO8	ppmNOx	0.0	0.5
10	TECO8	ppmNOx	867.0	866.4
10	TECO8	ppmNOx	867.0	843.1
9	TECO2	ppm CO	0.0	-0.5
9	TECO2	ppm CO	807.0	806.7
2	as CH4	ppmTHC	0.0	0.5
2	as CH4	ppmTHC	0.0	24.8
2	as CH4	ppmTHC	804.7	803.4
2	as CH4	ppmTHC	804.7	811.3
12	FUJI3	%CO2	0.00	-0.03
12	FUJI3	%CO2	17.74	17.79
8	SERVMX	%Oxygn	0.00	0.04
8	SERVMX	%Oxygn	5.01	5.05
8	SERVMX	%Oxygn	20.50	20.42
8	SERVMX	%Oxygn	20.90	20.93

CALIBRATION SUMMARY

SOURCE: WSPA I.C. Engine Pooled Source Test
 REASON: calibration of NOx on high range

DATE : 07-29-1992 TIME: 15:52 - 16:01

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
10	TECO8	ppmNOx	0.0	1.2
10	TECO8	ppmNOx	1843.0	1842.1

WSPA I.C. Engine Pooled Source Test

07-29-1992

	CHAN10 TECO8	CHAN 9 TECO2	CHAN 2 as CH4	CHAN12 FUJ13 %CO2	CHAN 8 SERVMX %Oxyan
TIME	ppmNOx	ppm CO	ppmTHC		
16:12	1214.7	213.4	203.1	7.72	10.10
16:13	1213.7	213.1	225.2	7.74	10.10
16:14	1218.1	215.3	237.2	7.76	10.09
16:15	1211.1	217.3	232.0	7.78	10.07
16:16	1215.8	214.2	214.5	7.82	10.03
16:17	1230.6	214.3	199.1	7.83	10.02
16:18	1227.9	215.9	189.8	7.84	10.00
16:19	1227.8	217.0	180.9	7.83	10.01
16:20	1232.4	216.0	175.6	7.82	10.02
16:21	1234.7	223.7	173.6	7.85	9.99

AVERAGE VALUES FOR THE LAST 10 MINUTES

16:21	1222.7	216.0	203.1	7.80	10.04
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16:22	1237.0	222.8	169.2	7.86	9.98
16:23	1242.1	223.5	163.2	7.86	9.97
16:24	1248.0	227.9	160.3	7.88	9.94
16:25	1248.9	231.9	157.1	7.88	9.92
16:26	1252.3	232.0	153.7	7.88	9.94
16:27	1247.4	231.8	151.2	7.88	9.94
16:28	1245.0	233.2	146.0	7.86	9.95
16:29	1244.9	223.8	143.8	7.89	9.92
16:30	1249.3	229.2	142.1	7.89	9.92
16:31	1252.4	230.2	141.8	7.90	9.90

AVERAGE VALUES FOR THE LAST 10 MINUTES

16:31	1246.7	228.6	152.8	7.88	9.94
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16:32	1258.8	240.2	143.4	7.93	9.88
16:33	1264.0	241.3	141.6	7.94	9.85
16:34	1266.1	238.2	135.9	7.95	9.85
16:35	1265.7	233.2	127.8	7.94	9.86
16:36	1270.4	225.1	124.1	7.94	9.86
16:37	1265.8	224.0	121.5	7.93	9.87
16:38	1263.2	224.6	121.4	7.93	9.87
16:39	1262.2	225.9	120.2	7.94	9.85
16:40	1264.0	228.4	118.4	7.94	9.86
16:41	1268.7	229.9	120.9	7.95	9.85

AVERAGE VALUES FOR THE LAST 10 MINUTES

16:41	1264.9	231.1	127.5	7.94	9.86
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16:42	1270.1	234.2	121.8	7.94	9.85
16:43	1267.2	227.8	118.3	7.92	9.87
16:44	1259.2	224.8	115.6	7.90	9.89
16:45	1257.9	221.4	109.2	7.93	9.87
16:46	1261.2	217.0	110.8	7.92	9.92
16:47	1257.1	222.3	115.6	7.91	9.93
16:48	1254.7	228.0	114.1	7.92	9.92
16:49	1253.7	228.6	116.2	7.94	9.89
16:50	1255.2	233.6	116.6	7.93	9.90
16:51	1258.5	228.7	112.1	7.93	9.90

WSPA I.C. Engine Pooled Source Test

07-29-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJ13	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen

AVERAGE VALUES FOR THE LAST 10 MINUTES

16:51	1259.5	226.6	115.0	7.92	9.89
16:52	1260.3	229.0	113.8	7.94	9.86
16:53	1266.6	233.3	113.0	7.95	9.85
16:54	1253.1	231.6	112.0	7.93	9.87
16:55	1254.8	231.9	111.6	7.94	9.86
16:56	1250.6	224.3	106.5	7.91	9.90
16:57	1255.2	220.8	108.2	7.89	9.92
16:58	1254.6	222.4	107.0	7.90	9.92
16:59	1247.8	223.3	105.4	7.90	9.91
17:00	1245.7	226.6	106.2	7.92	9.89
17:01	1250.2	227.1	105.5	7.93	9.88

AVERAGE VALUES FOR THE LAST 10 MINUTES

17:01	1253.9	227.0	108.9	7.92	9.89
17:02	1253.9	228.1	102.7	7.92	9.88
17:03	1253.6	222.6	101.3	7.91	9.90
17:04	1252.6	221.8	100.5	7.89	9.92
17:05	1245.0	220.0	101.6	7.88	9.92
17:06	1239.7	220.7	101.8	7.87	9.94
17:07	1244.9	220.6	99.2	7.87	9.94
17:08	1251.1	221.9	100.2	7.89	9.91
17:09	1253.2	220.7	103.7	7.89	9.95
17:10	1255.7	216.9	105.4	7.90	9.97
17:11	1243.5	219.3	102.6	7.91	9.95

AVERAGE VALUES FOR THE LAST 10 MINUTES

17:11	1249.3	221.3	101.9	7.89	9.93
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

17:11	1249.5	225.1	134.9	7.89	9.92
17:12	1244.0	217.9	101.0	7.91	9.94
17:13	1246.3	219.8	101.3	7.91	9.94
17:14	1238.8	217.8	102.8	7.90	9.95
17:15	1243.1	216.9	101.9	7.88	9.97
17:16	1246.7	215.7	98.9	7.90	9.95
17:17	1243.1	218.5	97.9	7.91	9.93
17:18	1248.4	223.4	102.5	7.90	9.93
17:19	1251.1	225.2	102.5	7.89	9.94
17:20	1248.6	217.4	100.3	7.87	9.95
17:21	1245.7	215.8	99.6	7.87	9.95

AVERAGE VALUES FOR THE LAST 10 MINUTES

17:21	1245.6	218.8	100.9	7.89	9.95
17:22	1239.9	221.3	98.8	7.87	9.94
17:23	1238.1	222.2	99.1	7.85	9.95
17:24	1233.5	219.2	97.4	7.83	9.97
17:25	1226.7	214.8	95.3	7.83	9.97
17:26	1225.8	215.3	92.3	7.84	9.95

ENTROPY

WSPA I.C. Engine Pooled Source Test

07-29-1992

TIME	CHAN10 TECO8 ppmNOx	CHAN 9 TECO2 ppm CO	CHAN 2 as CH4 ppmTHC	CHAN12 FUJI3 %CO2	CHAN 8 SERVMX %Oxygen
17:27	883.9	194.2	48.3	4.98	13.20
17:28	49.5	29.5	10.0	0.01	20.87
17:29	826.1	72.8	78.6	5.87	13.58
17:30	1217.8	205.0	93.6	7.83	10.00
17:31	1217.5	211.2	94.6	7.81	9.97

AVERAGE VALUES FOR THE LAST 10 MINUTES

17:31	1035.9	180.6	80.8	6.57	11.74
17:32	1214.3	208.3	97.4	7.79	9.98
17:33	1208.8	212.4	101.8	7.79	9.99
17:34	1209.3	214.4	98.7	7.81	9.97
17:35	1209.9	212.0	97.0	7.80	9.99
17:36	1211.2	205.7	101.8	7.79	9.99
17:37	1208.9	213.6	104.7	7.80	9.97
17:38	1206.5	215.4	105.7	7.83	9.96
17:39	1212.3	222.6	103.5	7.85	9.92
17:40	1215.3	218.4	102.5	7.84	9.93
17:41	1207.6	217.4	101.7	7.80	9.96

AVERAGE VALUES FOR THE LAST 10 MINUTES

17:41	1210.4	214.0	101.5	7.81	9.97
17:42	1197.9	215.2	101.1	7.78	10.00
17:43	1201.2	218.1	101.0	7.77	10.00
17:44	1190.2	209.5	99.8	7.74	10.04
17:45	1189.4	209.4	99.4	7.77	10.02
17:46	1195.5	214.6	100.3	7.80	9.97
17:47	1194.0	212.4	94.9	7.74	10.03
17:48	1190.0	199.9	93.2	7.73	10.04
17:49	1185.9	202.7	94.7	7.74	10.04
17:50	1208.0	211.1	99.8	7.81	9.97
17:51	1218.4	216.1	97.1	7.80	9.97

AVERAGE VALUES FOR THE LAST 10 MINUTES

17:51	1197.1	210.9	98.1	7.77	10.01
17:52	1211.8	211.5	93.9	7.78	9.98
17:53	1208.7	211.6	92.3	7.81	9.99
17:54	1214.2	208.1	98.3	7.84	10.01
17:55	1210.3	215.2	99.3	7.84	10.00
17:56	1222.2	214.4	98.4	7.87	9.98
17:57	1225.2	217.0	95.6	7.88	9.96
17:58	1217.8	211.9	96.4	7.88	9.96
17:59	1217.3	210.7	95.4	7.88	9.96
18:00	1219.5	211.9	93.9	7.87	9.97
18:01	1214.4	212.1	92.9	7.87	9.97

AVERAGE VALUES FOR THE LAST 10 MINUTES

18:01	1216.1	212.4	95.6	7.85	9.98
18:02	1222.6	208.4	90.9	7.87	9.96
18:03	1215.2	211.7	96.4	7.86	9.97
18:04	1211.2	212.1	97.0	7.86	9.98
18:05	1214.5	217.7	95.3	7.85	9.98

ENTROPY

WSPA I.C. Engine Pooled Source Test

07-29-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJI3	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
18:06	1212.9	210.3	88.9	7.85	9.99
18:07	1211.7	206.5	92.2	7.85	9.99
18:08	1210.9	210.7	88.8	7.84	9.99
18:09	1218.2	209.5	87.3	7.85	9.97
18:10	1219.0	212.2	88.8	7.86	9.97
18:11	1216.3	208.7	87.1	7.84	9.99

AVERAGE VALUES FOR THE LAST 10 MINUTES

18:11	1215.2	210.8	91.3	7.85	9.98
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

18:11	1186.7	207.9	94.7	7.62	10.27
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18:12	1207.9	205.5	89.1	7.82	10:80
18:13	1207.9	205.5	89.1	7.82	10:80

COMMENTS: 29:00 plugged to 200 change plugged filter 82

WSPA I.C. Engine Pooled Source Test 07-29-1992

WSPA I.C. Engine Pooled Source Test

07-29-1992

TIME	CHAN10 TECO8 ppmNOx	CHAN 9 TECO2 ppm CO	CHAN 2 as CH4 ppmTHC	CHAN12 FUJ13 %CO2	CHAN 8 SERVMX %Oxygen
18:19	1216.7	217.1	86.8	7.91	9.89
18:20	1235.1	218.8	88.9	7.89	9.90
18:21	1240.6	221.8	89.9	7.93	9.86
18:22	1237.6	223.3	91.3	7.91	9.88
18:23	1240.4	215.6	88.7	7.92	9.86
18:24	1246.3	220.7	87.7	7.93	9.85
18:25	1246.5	225.5	89.0	7.92	9.85
18:26	1245.9	226.2	92.9	7.91	9.86
18:27	1247.7	227.8	91.3	7.93	9.83
18:28	1251.6	223.8	85.9	7.93	9.83

AVERAGE VALUES FOR THE LAST 10 MINUTES

18:28	1240.8	222.1	89.2	7.92	9.86
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18:29	1251.8	220.4	84.2	7.93	9.83
18:30	1245.5	222.3	85.9	7.90	9.85
18:31	1241.6	221.4	88.5	7.91	9.85
18:32	1245.8	230.5	90.9	7.92	9.84
18:33	1243.5	228.5	88.6	7.92	9.83
18:34	1238.6	224.7	86.3	7.91	9.84
18:35	1239.8	226.5	86.2	7.92	9.83
18:36	1238.5	228.3	84.8	7.91	9.84
18:37	1234.6	224.8	85.1	7.90	9.85
18:38	1232.9	229.2	82.8	7.90	9.85

AVERAGE VALUES FOR THE LAST 10 MINUTES

18:38	1241.3	225.6	86.3	7.91	9.84
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18:39	1241.5	228.8	81.4	7.91	9.82
18:40	1243.4	226.5	84.5	7.90	9.84
18:41	1239.8	229.5	82.2	7.89	9.85
18:42	1241.8	227.0	83.0	7.89	9.85
18:43	1244.5	224.2	84.1	7.89	9.84
18:44	1239.7	226.2	83.8	7.89	9.82
18:45	1238.2	225.5	83.3	7.87	9.84
18:46	1243.1	226.0	80.1	7.89	9.82
18:47	1241.8	225.5	78.4	7.88	9.83

COMMENTS: End Test Run 1

CALIBRATION SUMMARY

SOURCE: WSPA I.C. Engine Pooled Source Test

REASON: calibration check

DATE : 07-29-1992 TIME: 18:47 - 19:01

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
10	TECO8	ppmNOx	0.0	14.7
10	TECO8	ppmNOx	1843.0	1779.0
9	TECO2	ppm CO	0.0	-0.5
9	TECO2	ppm CO	807.0	786.4
2	as CH4	ppmTHC	0.0	-3.3
2	as CH4	ppmTHC	804.7	798.6
12	FUJI3	%CO2	0.00	-0.05
12	FUJI3	%CO2	17.74	17.90
8	SERVMX	%Oxygn	0.00	0.01
8	SERVMX	%Oxygn	20.50	20.24

CALIBRATION SUMMARY

SOURCE: WSPA I.C. Engine Pooled Source Test

REASON: Initial Calibration (at probe)

DATE : 07-30-1992 TIME: 09:41 - 10:06

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
10	TECO8	ppmNOx	0.0	0.3
10	TECO8	ppmNOx	867.0	867.3
9	TECO2	ppm CO	0.0	-0.2
9	TECO2	ppm CO	807.0	807.8
2	as CH4	ppmTHC	0.0	0.7
2	as CH4	ppmTHC	804.7	804.8
12	FUJI3	%CO2	0.00	0.01
12	FUJI3	%CO2	17.74	17.70
8	SERVMX	%Oxygn	0.00	-0.04
8	SERVMX	%Oxygn	5.01	5.05
8	SERVMX	%Oxygn	20.50	20.50

WSPA I.C. Engine Pooled Source Test

07-30-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJ13	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygn
11:37	114.0	171.2	205.2	1.51	18.92
11:38	113.3	172.1	210.5	1.51	18.92
11:39	113.4	173.4	213.3	1.51	18.89
11:40	113.7	173.4	223.1	1.51	18.91

AVERAGE VALUES FOR THE LAST 10 MINUTES

11:40	115.2	171.3	208.2	1.52	18.90
11:41	113.2	174.9	220.5	1.50	18.92
11:42	114.2	174.1	224.7	1.50	18.93
11:43	114.3	173.0	221.1	1.50	18.94
11:44	114.7	173.4	219.1	1.50	18.94
11:45	114.8	172.5	217.2	1.50	18.92
11:46	115.1	173.0	221.6	1.50	18.92
11:47	115.2	172.7	229.4	1.50	18.93
11:48	114.3	174.0	218.3	1.50	18.93
11:49	115.3	171.4	225.6	1.50	18.93
11:50	115.1	174.1	223.0	1.50	18.93

AVERAGE VALUES FOR THE LAST 10 MINUTES

11:50	114.6	173.3	222.0	1.50	18.93
11:51	115.4	172.4	225.8	1.50	18.92
11:52	115.2	172.1	223.9	1.51	18.91
11:53	114.6	169.8	221.8	1.50	18.92
11:54	114.5	172.9	226.3	1.51	18.91
11:55	114.5	173.1	223.8	1.50	18.92
11:56	115.2	169.8	219.3	1.50	18.92
11:57	115.7	168.7	222.2	1.51	18.91
11:58	115.9	169.6	219.4	1.51	18.91
11:59	116.4	172.4	227.6	1.51	18.91
12:00	115.7	172.2	222.6	1.51	18.91

AVERAGE VALUES FOR THE LAST 10 MINUTES

12:00	115.3	171.3	223.3	1.51	18.91
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

12:00	118.1	175.7	215.7	1.53	18.87
12:01	115.7	170.6	222.6	1.51	18.92
12:02	115.9	169.4	226.8	1.51	18.97
12:03	115.6	174.5	229.7	1.52	18.95
12:04	116.0	172.4	227.4	1.51	18.96
12:05	116.2	173.3	232.3	1.51	18.97
12:06	115.8	169.1	237.1	1.50	18.98
12:07	116.7	171.0	239.4	1.53	18.95
12:08	124.8	168.2	234.2	1.60	18.82
12:09	124.9	164.1	239.9	1.60	18.81
12:10	116.0	170.6	244.6	1.51	18.95

AVERAGE VALUES FOR THE LAST 10 MINUTES

12:10	117.8	170.3	233.4	1.53	18.93
12:11	115.3	171.1	234.4	1.51	18.96

ENTROPY

WSPA I.C. Engine Pooled Source Test

07-30-1992

	CHAN10 TECO8	CHAN 9 TECO2	CHAN 2 as CH4	CHAN12 FUJ13	CHAN 8 SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
12:12	115.9	165.7	230.1	1.50	18.98
12:13	116.3	166.8	229.0	1.51	18.96
12:14	116.9	168.9	236.9	1.51	18.96
12:15	117.8	167.6	228.5	1.51	18.96
12:16	117.6	165.5	223.9	1.50	18.96
12:17	117.5	165.1	224.8	1.50	18.97
12:18	116.9	164.8	224.4	1.51	18.96
12:19	116.4	163.7	224.4	1.51	18.97
12:20	117.3	164.7	226.3	1.51	18.97

AVERAGE VALUES FOR THE LAST 10 MINUTES

12:20	116.8	166.4	228.3	1.51	18.96
12:21	117.1	165.2	224.3	1.51	18.97
12:22	116.7	165.5	224.2	1.50	18.97
12:23	116.8	166.1	224.9	1.50	18.97
12:24	117.6	167.2	225.1	1.51	18.97
12:25	117.7	167.9	225.8	1.50	18.97
12:26	117.6	168.6	226.0	1.50	18.97
12:27	117.2	168.3	228.0	1.50	18.97
12:28	116.8	169.0	229.2	1.51	18.96
12:29	117.3	167.6	226.6	1.50	18.97
12:30	117.3	168.2	226.8	1.50	18.97

AVERAGE VALUES FOR THE LAST 10 MINUTES

12:30	117.2	167.4	226.1	1.50	18.97
12:31	116.8	168.0	228.1	1.50	18.96
12:32	117.1	167.7	228.0	1.50	18.93
12:33	117.0	168.1	230.7	1.51	18.95
12:34	117.3	170.7	230.9	1.51	18.96
12:35	87.0	146.7	166.1	1.02	19.62
12:36	6.2	28.7	72.1	0.04	21.08
12:37	80.6	70.2	200.0	1.25	19.88
12:38	115.2	169.3	231.1	1.52	18.94
12:39	114.8	172.2	236.1	1.51	18.91
12:40	115.1	171.1	234.0	1.51	18.89

AVERAGE VALUES FOR THE LAST 10 MINUTES

12:40	98.7	143.3	205.7	1.29	19.29
12:41	115.7	170.8	236.3	1.51	18.88
12:42	115.8	170.8	237.7	1.51	18.89
12:43	115.8	169.6	240.4	1.51	18.90
12:44	116.4	170.6	243.2	1.51	18.89
12:45	116.0	170.7	244.4	1.51	18.90
12:46	116.1	169.9	244.0	1.53	18.89
12:47	124.3	167.2	238.9	1.60	18.76
12:48	124.7	164.8	238.3	1.60	18.76
12:49	116.1	165.2	241.4	1.51	18.90
12:50	115.2	168.4	243.7	1.51	18.91

AVERAGE VALUES FOR THE LAST 10 MINUTES

12:50	117.6	168.8	240.8	1.53	18.87
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STOP TO Change Filter

WSPA I.C. Engine Pooled Source Test

07-30-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJ13	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
12:51	115.3	166.8	243.2	1.51	18.91
12:52	115.1	166.6	242.2	1.50	18.91
12:53	114.9	168.1	244.3	1.50	18.91
12:54	115.6	168.7	243.6	1.51	18.90
12:55	116.1	168.5	246.1	1.51	18.91
12:56	115.9	169.1	246.7	1.50	18.91
12:57	115.7	169.0	246.8	1.50	18.91
12:58	115.1	168.5	248.0	1.50	18.91
12:59	115.7	169.2	250.8	1.51	18.91
13:00	114.9	169.6	250.7	1.50	18.91

AVERAGE VALUES FOR THE LAST 10 MINUTES

13:00	115.4	168.4	246.2	1.50	18.91
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

13:00	113.9	164.1	230.1	1.48	18.99
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13:01	114.3	169.7	251.4	1.50	18.92
13:02	115.1	170.0	253.4	1.50	18.91
13:03	115.5	169.3	250.7	1.51	18.90
13:04	115.6	169.1	251.2	1.50	18.91
13:05	115.2	170.5	251.8	1.50	18.91
13:06	114.5	171.3	251.8	1.50	18.88
13:07	114.5	170.0	251.1	1.50	18.90
13:08	114.5	170.3	251.4	1.50	18.91
13:09	114.8	169.9	249.5	1.50	18.91
13:10	115.4	169.9	248.3	1.50	18.91

AVERAGE VALUES FOR THE LAST 10 MINUTES

13:10	114.9	170.0	251.1	1.50	18.91
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13:11	115.5	168.4	248.5	1.50	18.90
13:12	115.8	169.0	248.5	1.50	18.90
13:13	114.7	168.1	249.7	1.50	18.90
13:14	114.9	170.9	250.9	1.51	18.89
13:15	115.1	170.6	252.0	1.51	18.90
13:16	115.3	169.9	251.0	1.51	18.89
13:17	115.0	168.8	249.7	1.51	18.89
13:18	115.0	168.7	249.1	1.51	18.88
13:19	115.8	169.5	249.6	1.51	18.89
13:20	115.0	169.5	248.6	1.51	18.90

AVERAGE VALUES FOR THE LAST 10 MINUTES

13:20	115.2	169.3	249.8	1.50	18.90
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13:21	115.5	169.2	249.3	1.50	18.90
13:22	115.4	169.0	251.9	1.51	18.91
13:23	115.0	169.6	252.8	1.51	18.90
13:24	115.8	170.0	252.6	1.51	18.90
13:25	114.9	169.3	251.8	1.51	18.91
13:26	118.2	167.7	250.1	1.55	18.86
13:27	124.5	165.6	248.6	1.60	18.76
13:28	123.7	165.7	249.1	1.60	18.75
13:29	122.8	165.1	248.7	1.58	18.77

ENTROPY

WSPA I.C. Engine Pooled Source Test 07-30-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJ13	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
13:30	113.1	164.9	250.8	1.50	18.92

AVERAGE VALUES FOR THE LAST 10 MINUTES

13:30	117.9	167.6	250.6	1.54	18.86
13:31	112.7	165.9	250.4	1.49	18.93
13:32	112.3	165.3	250.9	1.49	18.94
13:33	112.4	165.1	250.5	1.49	18.92
13:34	112.4	164.9	250.5	1.49	18.92
13:35	112.4	165.8	250.7	1.49	18.93
13:36	111.7	165.0	250.4	1.48	18.94
13:37	111.5	164.6	249.9	1.49	18.93
13:38	111.8	165.9	250.3	1.49	18.93
13:39	111.8	165.6	250.3	1.49	18.91
13:40	112.3	166.0	250.2	1.49	18.94

AVERAGE VALUES FOR THE LAST 10 MINUTES

13:40	112.1	165.4	250.4	1.49	18.93
13:41	111.7	164.9	248.0	1.49	18.96
13:42	111.8	163.5	249.1	1.49	18.96
13:43	111.6	164.3	250.3	1.49	18.97
13:44	111.9	164.1	249.9	1.49	18.97
13:45	112.5	165.1	249.2	1.49	18.97
13:46	112.8	164.7	249.6	1.49	18.97
13:47	112.7	165.1	249.9	1.49	18.97
13:48	112.5	165.4	250.2	1.49	18.97
13:49	112.1	165.1	250.8	1.49	18.97
13:50	111.8	164.8	250.5	1.49	18.97

AVERAGE VALUES FOR THE LAST 10 MINUTES

13:50	112.2	164.7	249.7	1.49	18.97
13:51	112.3	165.7	251.7	1.49	18.97
13:52	113.0	166.5	252.2	1.49	18.96
13:53	112.4	165.7	249.8	1.49	18.96
13:54	112.6	163.9	249.4	1.49	18.97
13:55	112.8	164.9	250.6	1.49	18.96
13:56	111.7	165.3	252.6	1.49	18.97
13:57	111.6	165.1	252.6	1.49	18.97
13:58	110.9	164.8	252.5	1.49	18.97
13:59	111.3	165.9	253.2	1.49	18.97
14:00	112.0	166.0	253.7	1.49	18.97

AVERAGE VALUES FOR THE LAST 10 MINUTES

14:00	112.1	165.4	251.8	1.49	18.97
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

14:00	114.1	167.1	250.6	1.50	18.92
14:01	111.5	166.4	253.9	1.48	18.96
14:02	111.6	166.6	252.8	1.49	18.98
14:03	114.1	167.1	250.7	1.52	18.94
14:04	121.6	164.9	247.1	1.58	18.83

ENTROPY

WSPA I.C. Engine Pooled Source Test

07-30-1992

	CHAN10 TECO8	CHAN 9 TECO2	CHAN 2 as CH4	CHAN12 FUJI3	CHAN 8 SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
14:05	121.4	164.1	246.5	1.56	18.84
14:06	112.1	165.2	251.8	1.49	18.98
14:07	111.8	166.9	254.3	1.49	18.98
14:08	111.7	166.9	255.6	1.49	18.97
14:09	111.4	168.2	256.9	1.49	18.98
14:10	111.5	169.7	257.0	1.48	18.98

AVERAGE VALUES FOR THE LAST 10 MINUTES

14:10	113.9	166.6	252.6	1.51	18.94
14:11	111.0	168.9	256.0	1.48	18.98
14:12	110.6	169.7	256.4	1.48	18.98
14:13	110.5	169.6	256.4	1.49	18.97
14:14	110.6	170.4	258.2	1.48	18.97
14:15	110.6	170.1	259.3	1.48	18.97
14:16	110.4	170.4	258.8	1.48	18.99
14:17	109.9	170.2	259.1	1.48	18.98
14:18	109.7	171.0	261.1	1.48	18.97
14:19	110.2	172.2	262.7	1.49	18.97
14:20	110.5	172.0	260.5	1.48	18.97

AVERAGE VALUES FOR THE LAST 10 MINUTES

14:20	110.4	170.4	258.9	1.48	18.97
14:21	111.0	172.1	259.6	1.48	18.98
14:22	111.1	172.4	260.2	1.48	18.98
14:23	110.4	172.1	261.9	1.48	18.97
14:24	110.1	172.0	263.3	1.48	18.97
14:25	110.4	171.9	263.9	1.48	18.97
14:26	109.9	171.4	264.6	1.48	18.95
14:27	109.8	170.4	263.6	1.48	18.96
14:28	110.5	170.4	265.2	1.48	18.95
14:29	110.3	171.0	263.6	1.49	18.94
14:30	110.4	170.4	265.2	1.49	18.94

AVERAGE VALUES FOR THE LAST 10 MINUTES

14:30	110.4	171.4	263.1	1.48	18.96
14:31	110.2	173.1	266.5	1.49	18.94
14:32	110.5	173.0	264.1	1.48	18.95
14:33	110.6	171.9	262.3	1.48	18.95
14:34	110.0	171.5	260.6	1.48	18.95
14:35	109.7	172.6	260.9	1.49	18.94
14:36	110.8	172.1	260.8	1.48	18.95
14:37	109.8	172.5	263.5	1.48	18.96
14:38	109.5	172.2	264.1	1.48	18.96
14:39	113.5	171.6	261.6	1.53	18.89
14:40	118.1	170.8	259.5	1.57	18.79

AVERAGE VALUES FOR THE LAST 10 MINUTES

14:40	111.3	172.1	262.4	1.50	18.93
14:41	116.7	170.3	259.7	1.54	18.84
14:42	109.8	172.1	263.4	1.48	18.95
14:43	109.3	172.8	263.2	1.48	18.94

ENTROPY

WSPA I.C. Engine Pooled Source Test

07-30-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJ13	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
14:44	109.5	171.3	262.8	1.48	18.95
14:45	109.1	172.8	264.4	1.49	18.95
14:46	109.5	173.5	266.1	1.48	18.94
14:47	109.8	174.0	266.9	1.48	18.93
14:48	109.5	173.9	266.0	1.48	18.93
14:49	109.8	173.5	265.6	1.48	18.93
14:50	109.3	172.4	265.5	1.48	18.94

AVERAGE VALUES FOR THE LAST 10 MINUTES

14:50	110.2	172.7	264.4	1.49	18.93
14:51	111.6	174.5	267.5	1.50	18.90
14:52	111.6	175.4	267.8	1.50	18.89
14:53	110.9	175.6	268.1	1.50	18.89
14:54	111.1	176.1	268.4	1.50	18.90
14:55	110.6	177.3	267.6	1.51	18.90
14:56	111.1	177.0	267.6	1.50	18.89
14:57	110.8	177.3	268.6	1.50	18.90
14:58	110.4	176.7	267.2	1.50	18.90
14:59	110.0	176.2	269.3	1.50	18.90
15:00	109.8	175.9	269.0	1.50	18.89

AVERAGE VALUES FOR THE LAST 10 MINUTES

15:00	110.8	176.2	268.1	1.50	18.90
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

15:00	111.2	171.6	261.6	1.49	18.94
15:01	111.0	177.6	268.4	1.50	18.89
15:02	111.4	177.5	269.6	1.50	18.89
15:03	111.2	177.1	270.8	1.50	18.91
15:04	111.0	177.3	272.2	1.50	18.89
15:05	110.7	177.6	272.6	1.50	18.90
15:06	111.1	176.8	272.9	1.50	18.91

15:07	111.2	177.0	272.3	1.50	18.91
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WSPA I.C. Engine Pooled Source Test

07-30-1992

	CHAN10 TECO8	CHAN 9 TECO2	CHAN 2 as CH4	CHAN12 FUJI3	CHAN 8 SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
15:08	110.9	177.2	273.8	1.50	18.91
15:09	111.0	177.6	272.7	1.50	18.89
15:10	111.0	177.1	272.6	1.50	18.88

AVERAGE VALUES FOR THE LAST 10 MINUTES

15:10	111.0	177.3	271.8	1.50	18.90
15:11	111.1	178.4	273.4	1.50	18.89
15:12	111.3	178.1	272.7	1.50	18.88
15:13	111.1	177.6	273.0	1.50	18.89
15:14	111.5	177.6	273.1	1.50	18.88
15:15	112.3	176.4	273.0	1.51	18.87
15:16	121.0	175.7	269.4	1.59	18.73
15:17	120.9	174.6	264.5	1.59	18.73
15:18	113.0	173.5	266.6	1.50	18.86
15:19	111.3	174.4	266.7	1.50	18.89
15:20	111.3	173.5	266.0	1.50	18.88

AVERAGE VALUES FOR THE LAST 10 MINUTES

15:20	113.5	176.0	269.8	1.52	18.85
15:21	111.5	174.1	266.3	1.50	18.87
15:22	111.8	175.6	266.1	1.50	18.87
15:23	111.4	175.6	266.4	1.50	18.87
15:24	111.7	175.0	268.0	1.50	18.87
15:25	111.9	175.9	268.5	1.51	18.92
15:26	113.1	176.6	268.1	1.51	18.92
15:27	112.6	176.9	268.5	1.51	18.93
15:28	112.7	178.0	268.6	1.50	18.94
15:29	112.5	177.1	267.5	1.50	18.95
15:30	112.3	175.8	267.4	1.51	18.94

AVERAGE VALUES FOR THE LAST 10 MINUTES

15:30	112.2	176.1	267.5	1.50	18.91
15:31	113.3	175.0	268.4	1.51	18.95
15:32	113.0	175.8	268.6	1.51	18.96
15:33	112.1	176.5	279.9	1.51	18.95
15:34	111.9	177.5	283.1	1.51	18.94
15:35	111.3	177.8	283.7	1.51	18.94
15:36	112.1	178.2	283.5	1.51	18.95
15:37	112.8	177.9	282.5	1.51	18.95
15:38	112.4	177.9	283.1	1.51	18.95
15:39	112.7	178.9	284.3	1.51	18.94
15:40	113.0	178.2	284.8	1.51	18.93

AVERAGE VALUES FOR THE LAST 10 MINUTES

15:40	112.5	177.4	280.2	1.51	18.95
15:41	111.9	177.1	285.2	1.50	18.94
15:42	111.6	177.7	285.3	1.50	18.95
15:43	85.4	174.9	219.0	1.02	19.38
15:44	5.6	32.5	114.9	0.03	20.94
15:45	3.2	0.5	93.5	0.03	20.95
15:46	2.3	0.5	82.1	0.02	20.95

ENTROPY

WSPA I.C. Engine Pooled Source Test

07-30-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJ13	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
10:59	200.9	156.1	177.2	1.53	18.95
11:00	201.0	155.8	185.3	1.53	18.96

AVERAGE VALUES FOR THE LAST HOUR: 2 MINUTES OF VALID DATA

11:00	200.9	156.0	181.3	1.53	18.95
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11:01	200.0	156.1	191.4	1.53	18.96
11:02	198.5	156.0	193.6	1.53	18.96
11:03	152.4	155.0	195.9	1.53	18.96
11:04	107.8	153.2	201.7	1.52	18.87
11:05	111.0	175.9	210.4	1.52	18.87
11:06	110.3	177.5	212.2	1.52	18.87
11:07	110.5	175.0	220.6	1.52	18.86
11:08	111.8	178.2	230.0	1.52	18.87
11:09	111.8	177.3	228.1	1.52	18.86
11:10	112.1	178.5	225.9	1.52	18.86

No flow
to analyzer

manual methods
stop

AVERAGE VALUES FOR THE LAST 10 MINUTES

11:10	132.6	168.3	211.0	1.52	18.89
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11:11	112.4	175.6	230.8	1.52	18.86
11:12	127.1	221.2	227.3	1.90	18.31
11:13	112.7	170.0	228.2	1.51	18.87
11:14	134.8	384.5	225.3	2.10	18.01
11:15	112.9	167.1	216.4	1.51	18.87
11:16	112.9	169.4	220.1	1.52	18.86
11:17	112.2	175.7	218.7	1.52	18.85
11:18	111.7	173.7	213.9	1.51	18.86
11:19	112.0	171.7	207.7	1.51	18.86
11:20	111.8	170.6	205.7	1.50	18.86

engine revved

AVERAGE VALUES FOR THE LAST 10 MINUTES

11:20	116.1	198.0	219.4	1.61	18.72
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11:21	112.4	170.1	205.8	1.51	18.86
11:22	113.1	170.8	207.9	1.52	18.84
11:23	112.6	171.5	211.9	1.52	18.83
11:24	112.7	173.7	214.9	1.52	18.83
11:25	113.0	174.6	213.8	1.52	18.83
11:26	113.1	173.4	213.0	1.52	18.87
11:27	114.4	173.5	211.5	1.52	18.92
11:28	114.8	172.7	211.1	1.52	18.92
11:29	116.5	172.5	208.5	1.53	18.91
11:30	124.4	170.5	203.4	1.60	18.79

AVERAGE VALUES FOR THE LAST 10 MINUTES

11:30	114.7	172.3	210.2	1.53	18.86
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11:31	124.4	167.2	200.9	1.60	18.79
11:32	116.7	169.3	206.7	1.52	18.89
11:33	114.5	172.4	207.3	1.52	18.91
11:34	114.3	171.4	205.1	1.51	18.91
11:35	114.2	171.4	205.6	1.51	18.91
11:36	113.5	170.9	204.7	1.51	18.92

manual
methods
restarted

ENTROPY

CALIBRATION SUMMARY

SOURCE: WSPA I.C. Engine Pooled Source Test

REASON: calibration check

DATE : 07-30-1992 TIME: 16:00 - 16:13

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
10	TECO8	ppmNOx	0.0	1.5
10	TECO8	ppmNOx	867.0	841.6
9	TECO2	ppm CO	0.0	-0.5
9	TECO2	ppm CO	807.0	803.4
2	as CH4	ppmTHC	0.0	38.9
2	as CH4	ppmTHC	804.7	806.6
12	FUJI3	%CO2	0.00	-0.03
12	FUJI3	%CO2	17.74	17.73
8	SERVMX	%Oxygen	0.00	-0.03
8	SERVMX	%Oxygen	5.01	5.03

CALIBRATION SUMMARY

SOURCE: WSPA I.C. Engine Pooled Source Test

REASON: calibration of NOx analyzer after changing to 2500 ppm range

DATE : 07-30-1992 TIME: 16:13 - 16:20

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
10	TEC08	ppmNOx	0.0	2.4
10	TEC08	ppmNOx	1843.0	1842.3

WSPA I.C. Engine Pooled Source Test				07-30-1992	
	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJI3	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
16:31	1284.3	243.9	153.0	8.00	9.86
16:32	1282.9	241.4	151.5	8.02	9.84
16:33	1277.5	239.1	148.9	7.98	9.87
16:34	1276.3	237.4	146.2	7.99	9.87
16:35	1282.1	240.1	145.0	8.00	9.85
16:36	1275.6	234.5	143.0	7.98	9.85
16:37	1273.3	235.5	142.1	7.98	9.88
16:38	1270.8	238.2	142.9	7.97	9.89
16:39	1265.2	235.8	137.1	7.97	9.88
16:40	1262.6	236.0	136.1	7.97	9.88

AVERAGE VALUES FOR THE LAST 10 MINUTES

16:40	1275.1	238.2	144.6	7.99	9.87
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16:41	1260.8	231.0	134.5	7.96	9.91
16:42	1266.4	234.2	132.5	7.94	9.92
16:43	1257.0	228.7	131.6	7.92	9.96
16:44	1257.0	224.4	129.7	7.90	9.97
16:45	1260.2	224.2	128.4	7.89	9.99
16:46	1248.8	228.3	134.5	7.93	9.94
16:47	1250.4	235.2	132.8	7.92	9.94
16:48	1240.7	233.6	128.9	7.91	9.97
16:49	1247.0	226.5	131.6	7.92	9.95
16:50	1270.8	229.2	129.0	7.94	9.95

AVERAGE VALUES FOR THE LAST 10 MINUTES

16:50	1255.9	229.5	131.4	7.92	9.95
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16:51	1272.2	233.0	131.2	7.94	9.92
16:52	1269.6	234.2	130.6	7.92	9.94
16:53	1262.7	237.4	132.2	7.96	9.90
16:54	1267.7	242.2	135.0	7.97	9.89
16:55	1265.4	242.2	132.2	7.97	9.87
16:56	1272.1	243.5	131.8	7.99	9.85
16:57	1287.1	239.5	132.0	7.98	9.85
16:58	1285.9	241.9	131.5	7.97	9.88
16:59	1281.2	239.7	130.0	7.97	9.85
17:00	1281.5	237.2	126.4	7.94	9.89

AVERAGE VALUES FOR THE LAST 10 MINUTES

17:00	1274.5	239.1	131.3	7.96	9.88
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17:01	1275.3	231.9	126.2	7.95	9.90
17:02	1285.7	232.5	124.5	7.94	9.90
17:03	1291.1	232.0	124.3	7.94	9.89
17:04	1274.4	231.0	124.6	7.94	9.88
17:05	1286.6	237.3	123.4	7.97	9.85
17:06	1301.7	238.4	123.6	7.98	9.82
17:07	1301.2	235.4	124.1	8.01	9.81
17:08	1301.4	240.2	125.8	8.02	9.80
17:09	1301.1	245.3	125.5	8.03	9.77
17:10	1300.4	247.3	124.2	8.03	9.79

WSPA I.C. Engine Pooled Source Test

07-30-1992

TIME	CHAN10 TECO8 ppmNOx	CHAN 9 TECO2 ppm CO	CHAN 2 as CH4 ppmTHC	CHAN12 FUJ13 %CO2	CHAN 8 SERVMX %Oxygen
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AVERAGE VALUES FOR THE LAST 10 MINUTES

17:10	1291.9	237.1	124.6	7.98	9.84
17:11	1303.5	247.7	124.3	8.04	9.77
17:12	1302.0	249.1	123.6	8.03	9.78
17:13	1291.8	242.7	121.9	7.99	9.83
17:14	1293.5	241.9	124.1	8.01	9.85
17:15	1290.6	246.5	125.5	8.00	9.87
17:16	1293.3	244.7	124.9	7.99	9.89
17:17	1292.9	244.0	126.7	8.01	9.86
17:18	1295.0	244.8	125.2	8.01	9.86
17:19	1298.6	242.5	124.5	8.01	9.87
17:20	1306.1	246.3	124.1	8.03	9.83

AVERAGE VALUES FOR THE LAST 10 MINUTES

17:20	1296.7	245.0	124.5	8.01	9.84
17:21	1316.4	241.3	123.6	8.00	9.86
17:22	1319.1	239.7	124.1	8.01	9.85
17:23	1291.0	239.6	113.7	7.92	9.94
17:24	1265.9	226.8	106.7	7.91	9.98
17:25	1257.7	215.4	105.2	7.87	10.03
17:26	1248.2	213.7	105.2	7.87	10.03
17:27	557.0	156.9	41.0	2.59	16.61
17:28	50.9	3.7	24.0	0.17	20.87
17:29	42.1	2.4	21.7	0.15	20.88
17:30	34.2	1.5	20.4	0.11	20.90

STOP TO
CHANGE
FILTER

AVERAGE VALUES FOR THE LAST 10 MINUTES

17:30	838.3	154.1	78.6	5.06	13.90
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

17:30	1205.4	223.8	122.5	7.49	10.55
17:31	34.1	1.5	19.9	0.16	20.87
17:32	34.8	2.3	19.3	0.16	20.86
17:33	206.3	3.6	50.3	2.00	19.14
17:34	1196.2	177.3	97.6	7.87	10.15
17:35	1211.3	213.3	100.5	7.86	10.07
17:36	1213.8	212.4	105.1	7.85	10.06
17:37	1218.9	217.2	110.8	7.84	10.08
17:38	1224.3	213.4	108.8	7.84	10.08
17:39	1229.5	211.1	105.3	7.86	10.04
17:40	1215.9	210.9	106.6	7.83	10.08

Sample

AVERAGE VALUES FOR THE LAST 10 MINUTES

17:40	878.5	146.3	82.4	5.73	13.14
17:41	1210.3	214.2	112.9	7.82	10.09
17:42	1201.3	215.9	107.3	7.83	10.09
17:43	1203.7	210.1	106.6	7.84	10.07
17:44	1201.5	212.4	104.2	7.82	10.07
17:45	1199.7	208.4	111.1	7.83	10.11

ENTROPY

WSPA I.C. Engine Pooled Source Test				07-30-1992	
	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJI3	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
17:46	1216.5	212.4	111.2	7.85	10.07
17:47	1221.1	214.9	108.4	7.85	10.07
17:48	1220.8	210.3	109.4	7.86	10.06
17:49	1222.2	213.9	107.7	7.88	10.03
17:50	1222.0	211.1	105.8	7.86	10.06

AVERAGE VALUES FOR THE LAST 10 MINUTES

17:50	1211.9	212.4	108.5	7.84	10.07
17:51	1217.7	212.3	109.4	7.87	10.04
17:52	1226.1	219.8	110.5	7.89	10.02
17:53	1235.0	218.0	109.4	7.89	10.02
17:54	1223.6	215.7	106.3	7.86	10.04
17:55	1221.1	212.1	104.6	7.86	10.05
17:56	1227.5	208.9	105.5	7.87	10.04
17:57	1224.6	213.2	104.8	7.87	10.03
17:58	1219.0	215.4	105.8	7.86	10.05
17:59	1220.5	215.9	104.7	7.86	10.04
18:00	1209.0	210.1	103.6	7.84	10.07

AVERAGE VALUES FOR THE LAST 10 MINUTES

18:00	1222.4	214.1	106.5	7.87	10.04
18:01	1210.3	211.3	104.4	7.86	10.04
18:02	1204.5	214.2	105.7	7.85	10.06
18:03	1209.3	214.9	104.1	7.83	10.06
18:04	1196.6	208.2	103.3	7.82	10.07
18:05	1198.1	210.2	101.1	7.82	10.07
18:06	1189.3	209.0	105.2	7.82	10.06
18:07	1198.6	216.5	107.6	7.83	10.06
18:08	1212.5	217.2	106.8	7.87	10.01
18:09	1220.4	216.7	105.0	7.88	10.02
18:10	1224.8	215.9	104.3	7.86	10.04

AVERAGE VALUES FOR THE LAST 10 MINUTES

18:10	1206.4	213.4	104.8	7.85	10.05
18:11	1219.0	211.2	104.9	7.86	10.04
18:12	1213.8	214.7	103.0	7.89	10.01
18:13	1215.2	215.5	105.6	7.88	10.01
18:14	1215.9	217.0	108.2	7.86	10.03
18:15	1223.4	222.6	106.4	7.88	10.01
18:16	1222.7	219.1	103.5	7.88	10.01
18:17	1217.2	215.5	102.0	7.89	10.00
18:18	1217.2	215.7	103.4	7.87	10.01
18:19	1213.6	218.2	102.1	7.87	10.01
18:20	1214.2	211.8	98.2	7.85	10.03

AVERAGE VALUES FOR THE LAST 10 MINUTES

18:20	1217.2	216.1	103.7	7.87	10.02
18:21	1216.7	212.1	99.9	7.85	10.03
18:22	1210.8	214.6	101.2	7.85	10.03
18:23	1210.3	212.3	97.4	7.85	10.02
18:24	1208.4	212.1	95.7	7.84	10.03

ENTROPY

WSPA I.C. Engine Pooled Source Test . 07-30-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJ13	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
18:25	1208.1	209.6	99.2	7.82	10.05
18:26	1208.2	213.3	99.5	7.82	10.04
18:27	1213.6	213.1	98.9	7.84	10.01
18:28	1206.1	213.4	101.5	7.79	10.06
18:29	1206.5	215.5	100.2	7.81	10.05
18:30	1207.9	217.7	97.7	7.81	10.04

AVERAGE VALUES FOR THE LAST 10 MINUTES

18:30	1209.7	213.4	99.1	7.63	10.03
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

18:30	1157.7	202.6	100.8	7.50	10.56
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18:31	1210.8	216.8	97.1	7.81	10.03
18:32	1204.8	218.6	99.6	7.80	10.05
18:33	1205.2	215.5	94.9	7.79	10.05
18:34	1205.6	209.7	94.3	7.77	10.08
18:35	1208.8	209.9	93.8	7.80	10.04
18:36	1064.1	211.5	88.5	6.37	11.16

COMMENTS: End Test
Run 2

CALIBRATION SUMMARY

SOURCE: WSPA I.C. Engine Pooled Source Test

REASON: final calibration check (through probe)

DATE : 07-30-1992 TIME: 18:43 - 18:56

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
10	TECO8	ppmNOx	0.0	17.0
10	TECO8	ppmNOx	1843.0	1802.6
9	TECO2	ppm CO	0.0	-0.5
9	TECO2	ppm CO	807.0	810.7
2	as CH4	ppmTHC	0.0	14.1
2	as CH4	ppmTHC	804.7	774.5
12	FUJ13	%CO2	0.00	0.02
12	FUJ13	%CO2	17.74	17.67
8	SERVMX	%Oxygn	0.00	-0.02
8	SERVMX	%Oxygn	5.01	5.08
8	SERVMX	%Oxygn	20.50	20.41
8	SERVMX	%Oxygn	20.90	20.98

CALIBRATION SUMMARY

SOURCE: WSPA I.C. Engine Pooled Source Test

REASON: Pretest Calibration Through System

DATE : 07-31-1992 TIME: 11:32 - 11:57

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
10	TECO8	ppmNOx	0.0	0.1
10	TECO8	ppmNOx	867.0	840.7
9	TECO2	ppm CO	0.0	1.0
9	TECO2	ppm CO	807.0	809.8
1	as CH4	ppmTHE	0.0	1.9
2	as CH4	ppmTHE	804.7	803.4
12	FUJ13	%CO2	0.00	-0.01
12	FUJ13	%CO2	17.74	17.79

WSPA I.C. Engine Pooled Source Test

07-31-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJ13	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
13:11	128.0	179.0	272.0	1.52	18.97
13:12	128.0	175.4	267.5	1.52	18.97
13:13	128.7	173.6	265.7	1.52	18.98
13:14	128.6	174.9	273.3	1.51	18.97
13:15	129.5	176.0	270.9	1.52	18.96
13:16	129.7	173.4	270.6	1.52	18.97
13:17	130.1	174.4	274.1	1.52	18.93
13:18	129.1	174.4	270.9	1.52	18.91
13:19	128.5	174.1	271.2	1.52	18.92
13:20	128.3	175.1	277.2	1.51	18.98

AVERAGE VALUES FOR THE LAST 10 MINUTES

13:20	128.9	175.0	271.3	1.52	18.96
13:21	136.3	173.7	273.1	1.59	18.87
13:22	139.1	173.0	267.8	1.61	18.83
13:23	133.5	170.0	267.8	1.54	18.91
13:24	128.8	171.0	273.8	1.51	18.98
13:25	129.2	174.2	274.1	1.51	18.98
13:26	128.8	174.9	279.8	1.51	18.98
13:27	129.0	174.2	272.5	1.51	18.98
13:28	128.3	172.6	271.3	1.51	18.97
13:29	128.7	172.9	270.9	1.52	18.98
13:30	129.0	173.3	274.4	1.52	18.97

AVERAGE VALUES FOR THE LAST 10 MINUTES

13:30	131.1	173.0	272.5	1.53	18.94
13:31	128.9	175.5	284.1	1.52	18.97
13:32	128.7	173.6	275.2	1.51	18.98
13:33	129.9	172.5	277.9	1.52	18.98
13:34	130.5	173.9	274.5	1.51	18.97
13:35	130.0	171.3	272.3	1.50	18.99
13:36	129.1	171.2	272.9	1.51	18.99
13:37	129.5	172.0	274.1	1.51	18.99
13:38	128.6	172.7	280.3	1.51	18.99
13:39	128.0	172.7	275.7	1.51	18.99
13:40	128.3	171.9	274.3	1.51	18.99

AVERAGE VALUES FOR THE LAST 10 MINUTES

13:40	129.2	172.7	276.1	1.51	18.98
13:41	128.6	172.7	281.4	1.51	18.99
13:42	130.7	173.8	280.8	1.51	18.98
13:43	130.0	172.4	280.8	1.51	18.99
13:44	129.2	172.8	279.5	1.51	18.98
13:45	129.6	173.4	287.7	1.51	18.98
13:46	129.2	173.5	283.7	1.50	18.99
13:47	129.3	173.5	284.9	1.51	18.98
13:48	130.0	173.6	286.8	1.51	18.98

ENTROPY

WSPA I.C. Engine Pooled Source Test

07-31-1992

TIME	CHAN10 TECO8 ppmNOx	CHAN 9 TECO2 ppm CO	CHAN 2 as CH4 ppmTHC	CHAN12 FUJ13 %CO2	CHAN 8 SERVMX %Oxygen
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AVERAGE VALUES FOR THE LAST 10 MINUTES

13:50	129.5	172.6	284.1	1.51	18.99
13:51	128.1	169.0	286.8	1.50	18.99
13:52	128.4	171.5	290.4	1.51	18.96
13:53	129.7	176.3	294.4	1.51	18.98
13:54	129.7	172.2	283.7	1.50	18.98
13:55	129.4	171.2	284.4	1.50	18.97
13:56	134.2	171.7	287.2	1.56	18.89
13:57	139.8	170.2	277.5	1.60	18.81
13:58	137.3	168.6	262.9	1.56	18.85
13:59	128.7	169.9	265.2	1.50	18.97
14:00	129.6	172.3	269.5	1.51	18.98

AVERAGE VALUES FOR THE LAST 10 MINUTES

14:00	131.5	171.3	280.2	1.52	18.94
14:01	129.6	170.9	266.5	1.51	18.97
14:02	130.4	170.3	264.9	1.51	18.97
14:03	130.3	171.1	265.6	1.51	18.98
14:04	129.9	169.8	265.0	1.50	18.99
14:05	129.7	169.8	269.5	1.50	18.98
14:06	130.2	170.2	269.8	1.50	18.94
14:07	128.8	170.5	271.3	1.50	18.95
14:08	130.0	172.6	283.8	1.50	18.95
14:09	129.0	173.6	276.4	1.51	18.94
14:10	129.4	172.4	271.8	1.51	18.94

AVERAGE VALUES FOR THE LAST 10 MINUTES

14:10	129.7	171.1	270.4	1.50	18.96
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

14:10	130.0	172.6	275.8	1.52	18.96
14:11	129.1	171.3	270.8	1.50	18.96
14:12	129.5	170.1	270.9	1.50	18.96
14:13	129.0	169.7	270.1	1.50	18.96
14:14	129.0	169.9	272.8	1.50	18.96
14:15	130.6	172.5	275.2	1.51	18.97
14:16	129.7	172.5	281.1	1.50	18.96
14:17	129.2	170.5	274.8	1.50	18.93
14:18	129.1	170.1	273.1	1.50	18.96
14:19	128.9	170.6	277.6	1.50	18.95
14:20	128.6	171.7	276.1	1.50	18.93

AVERAGE VALUES FOR THE LAST 10 MINUTES

14:20	129.3	170.1	270.9	1.50	18.95
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14:22	129.2	171.5	278.0	1.51	18.95
14:23	130.2	170.6	276.7	1.51	18.91
14:24	129.0	170.5	279.0	1.51	18.99
14:25	129.4	171.1	284.6	1.50	19.01

WSPA I.C. Engine Pooled Source Test 07-31-1992

	CHAN10 TECO8	CHAN 9 TECO2	CHAN 2 as CH4	CHAN12 FUJI3	CHAN 8 SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
14:26	129.2	174.6	285.8	1.51	18.89
14:27	129.0	173.9	280.9	1.51	18.97
14:28	127.6	171.0	276.3	1.50	19.01
14:29	128.6	169.3	274.7	1.51	19.01
14:30	129.6	168.1	276.8	1.50	19.01

AVERAGE VALUES FOR THE LAST 10 MINUTES

14:30	129.0	171.2	279.4	1.51	18.98
14:31	130.6	170.4	275.7	1.51	19.00
14:32	137.2	169.2	275.5	1.56	18.92
14:33	141.4	167.0	272.3	1.59	18.87
14:34	135.6	165.8	274.2	1.55	18.93
14:35	127.7	167.0	273.0	1.50	19.03
14:36	128.4	166.7	273.5	1.50	19.02
14:37	128.9	167.4	271.7	1.50	19.02
14:38	129.4	167.5	274.0	1.51	19.02
14:39	130.0	168.6	272.8	1.51	19.01
14:40	129.6	168.6	272.7	1.50	19.01

AVERAGE VALUES FOR THE LAST 10 MINUTES

14:40	131.9	167.8	273.5	1.52	18.98
14:41	129.2	169.0	272.5	1.50	19.02
14:42	128.5	169.3	271.9	1.50	19.03
14:43	129.4	168.1	272.1	1.50	19.03
14:44	129.6	169.0	272.9	1.49	19.03
14:45	129.4	166.6	272.8	1.49	19.04
14:46	129.4	166.6	273.9	1.49	19.04
14:47	129.1	166.8	274.1	1.49	19.03
14:48	130.0	166.6	272.8	1.49	19.04
14:49	130.2	165.6	273.7	1.50	19.04
14:50	129.0	165.9	273.7	1.49	19.02

AVERAGE VALUES FOR THE LAST 10 MINUTES

14:50	129.4	167.4	273.0	1.49	19.03
14:51	128.5	167.4	272.1	1.49	19.03
14:52	128.9	167.4	274.5	1.50	19.02
14:53	128.6	167.6	274.8	1.49	19.03
14:54	128.5	166.9	273.6	1.49	19.03
14:55	128.5	166.8	273.6	1.49	19.03
14:56	127.9	166.3	276.9	1.49	19.03
14:57	127.7	168.1	274.2	1.49	19.04
14:58	127.4	167.0	275.3	1.48	19.04
14:59	127.7	166.7	276.3	1.49	19.03
15:00	127.7	168.2	277.2	1.49	19.03

AVERAGE VALUES FOR THE

15:00	128.1	167.2	274.9	1.49	19.03
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ENTROPY

15:01	128.2	168.8	276.3	1.50	19.02
15:02	128.5	169.0	276.9	1.49	19.02
15:03	127.8	168.4	276.1	1.49	19.03
15:04	127.1	167.7	276.2	1.49	19.02

WSPA I.C. Engine Pooled Source Test 07-31-1992

	CHAN10 TECO8	CHAN 9 TECO2	CHAN 2 as CH4	CHAN12 FUJI3	CHAN 8 SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
15:05	126.8	168.0	278.9	1.49	19.01
15:06	127.1	169.1	282.1	1.49	19.03
15:07	126.5	168.8	277.5	1.49	19.03
15:08	132.6	167.6	275.3	1.54	18.95
15:09	138.3	165.7	272.8	1.58	18.87
15:10	134.0	165.8	275.1	1.54	18.92

AVERAGE VALUES FOR THE LAST 10 MINUTES

15:10	129.7	167.9	276.7	1.51	18.99
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

15:10	129.6	168.7	275.3	1.50	18.99
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15:11	127.5	168.1	277.2	1.49	19.02
15:12	127.5	168.3	277.0	1.49	19.02
15:13	127.5	168.0	277.4	1.49	19.02
15:14	127.6	168.8	277.9	1.49	19.02
15:15	127.1	169.2	278.9	1.48	19.03
15:16	126.5	168.5	278.3	1.48	19.03
15:17	126.4	168.4	278.7	1.48	19.03
15:18	126.2	168.0	280.0	1.48	19.02
15:19	126.6	169.1	279.0	1.48	19.03
15:20	127.1	168.5	279.3	1.48	19.03

AVERAGE VALUES FOR THE LAST 10 MINUTES

15:20	127.0	168.5	278.4	1.48	19.03
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15:21	126.9	167.7	277.6	1.48	19.03
15:22	126.8	168.6	276.9	1.48	19.03
15:23	127.0	168.8	276.8	1.48	19.02
15:24	126.0	168.9	281.1	1.48	19.03
15:25	124.8	169.0	276.7	1.48	19.03
15:26	125.1	168.3	275.0	1.48	19.01
15:27	126.1	168.8	275.0	1.49	19.00
15:28	126.3	169.0	274.3	1.48	18.99
15:29	125.8	169.8	275.8	1.48	19.00
15:30	125.8	171.4	276.4	1.49	18.99

AVERAGE VALUES FOR THE LAST 10 MINUTES

15:30	126.1	169.0	276.6	1.48	19.01
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15:31	126.6	170.3	274.9	1.48	18.99
15:32	125.9	169.4	274.2	1.48	19.00
15:33	125.5	169.1	273.6	1.48	18.99
15:34	125.1	169.0	274.4	1.48	18.98
15:35	125.7	169.3	273.9	1.48	18.98
15:36	125.8	170.1	273.2	1.48	18.99
15:37	125.4	169.1	274.1	1.48	19.00
15:38	125.6	170.0	275.0	1.48	18.97

ENTROPY

WSPA I.C. Engine Pooled Source Test 07-31-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJI3	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen

AVERAGE VALUES FOR THE LAST 10 MINUTES

15:40	125.7	169.9	274.5	1.48	18.98
15:41	124.3	169.0	276.9	1.48	18.98
15:42	125.1	170.1	277.9	1.48	18.98
15:43	124.9	170.1	272.1	1.48	18.98
15:44	127.9	168.9	268.3	1.52	18.93
15:45	135.9	166.5	267.0	1.57	18.84
15:46	133.9	166.7	267.0	1.55	18.85
15:47	124.7	167.9	269.9	1.48	18.98
15:48	123.6	169.0	272.7	1.48	18.98
15:49	123.7	169.4	268.5	1.47	18.98
15:50	124.4	168.3	267.7	1.48	18.98

AVERAGE VALUES FOR THE LAST 10 MINUTES

15:50	126.8	168.6	270.8	1.50	18.95
15:51	125.5	169.8	268.9	1.48	18.97
15:52	125.6	171.5	270.0	1.49	18.96
15:53	125.7	171.3	270.1	1.49	18.97
15:54	125.3	171.8	270.0	1.49	18.96
15:55	124.8	170.7	271.2	1.49	18.94
15:56	126.1	171.1	272.4	1.49	18.96
15:57	126.1	172.3	274.3	1.50	18.96
15:58	125.5	171.4	272.1	1.50	18.97
15:59	125.8	171.5	272.0	1.54	18.98
16:00	125.2	172.1	273.1	1.51	18.98

AVERAGE VALUES FOR THE LAST 10 MINUTES

16:00	125.6	171.3	271.4	1.50	18.96
16:01	124.3	171.6	272.3	1.50	19.00
16:02	123.3	170.2	272.5	1.49	18.98
16:03	124.2	171.3	273.7	1.49	18.96
16:04	125.9	171.0	273.4	1.49	18.99
16:05	125.6	172.0	275.1	1.49	18.98
16:06	125.3	173.7	274.0	1.49	18.95
16:07	126.1	173.6	274.8	1.50	18.94
16:08	125.2	173.5	274.3	1.49	18.96
16:09	124.1	174.9	274.9	1.49	18.96
16:10	125.0	174.2	276.6	1.50	18.92

AVERAGE VALUES FOR THE LAST 10 MINUTES

16:10	124.9	172.6	274.1	1.49	18.96
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

16:10	126.0	170.0	272.0	1.49	18.98
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ENTROPY

16:12	127.4	175.8	277.1	1.50	19.00
16:13	126.3	174.8	278.8	1.50	19.00
16:14	127.0	174.7	278.0	1.50	19.01
16:15	127.6	173.9	281.0	1.50	19.01

WSPA I.C. Engine Pooled Source Test 07-31-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJ13	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
16:16	126.9	176.8	286.1	1.51	19.01

16:17	126.4	175.0	285.9	1.50	19.02
16:18	125.7	175.0	285.9	1.51	19.00

	CHAN 10 TECO8 ppmNOx	CHAN 11 TECO2 ppm CO	CHAN 12 as CH4 ppmTHC	CHAN 13 FUJI3 %CO2	CHAN 14 SERVMX %Oxygen
16:55	126.0	178.5	294.4	1.50	19.00
16:56	126.3	177.9	295.0	1.50	19.00
16:57	129.2	178.1	293.8	1.53	18.96
16:58	136.4	176.3	293.0	1.59	18.86
16:59	135.6	174.3	293.2	1.57	18.87
17:00	125.1	175.2	300.0	1.50	19.00

AVERAGE VALUES FOR THE LAST 10 MINUTES

17:00	128.2	177.6	295.6	1.52	18.96
17:01	125.2	178.8	298.7	1.50	19.00
17:02	125.3	177.9	297.4	1.50	19.00
17:03	125.8	177.4	297.1	1.50	18.99
17:04	125.4	177.4	296.7	1.50	18.98
17:05	125.7	177.2	297.7	1.50	18.97
17:06	125.9	178.1	297.3	1.50	18.99
17:07	125.5	177.3	297.3	1.50	18.99
17:08	125.0	177.4	297.8	1.50	18.99
17:09	126.4	177.8	295.0	1.50	18.99
17:10	126.1	178.7	295.2	1.50	18.99

AVERAGE VALUES FOR THE LAST 10 MINUTES

17:10	125.6	177.8	297.0	1.50	18.99
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

17:10	127.0	176.5	291.5	1.51	18.98
17:11	125.6	178.8	297.0	1.50	18.99
17:12	125.4	178.6	296.6	1.50	18.99
17:13	125.5	177.3	297.2	1.50	18.99
17:14	125.3	178.2	299.1	1.50	18.99
17:15	124.7	178.3	297.3	1.50	18.99
17:16	124.8	176.1	295.8	1.50	18.95
17:17	125.3	176.6	296.9	1.50	18.97
17:18	125.5	177.8	296.2	1.50	18.99
17:19	125.8	177.5	298.5	1.49	19.00
17:20	125.9	179.1	298.9	1.50	18.99

AVERAGE VALUES FOR THE LAST 10 MINUTES

17:20	125.4	177.8	297.3	1.50	18.99
17:21	125.4	178.5	298.0	1.50	18.99
17:22	125.1	178.8	298.7	1.50	18.98
17:23	126.4	178.7	301.1	1.50	18.97
17:24	127.1	179.2	301.7	1.50	18.98
17:25	126.9	179.2	301.5	1.50	18.97
17:26	127.0	179.3	299.8	1.50	18.94
17:27	127.1	179.7	299.4	1.50	18.94
17:28	127.7	179.5	299.0	1.50	18.94
17:29	127.4	178.6	298.5	1.49	18.95
17:30	126.9	178.6	298.7	1.49	18.97

	CHAN 1 TECO8	CHAN 2 TECO2	CHAN 3 as CH4	CHAN 4 FUJ13	CHAN 5 SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen

AVERAGE VALUES FOR THE LAST 10 MINUTES

17:30	126.7	179.0	299.6	1.50	18.96
17:31	126.1	176.7	298.6	1.50	18.96
17:32	127.0	177.7	298.1	1.49	18.95
17:33	126.8	177.5	297.0	1.49	18.95
17:34	127.2	178.0	297.7	1.51	18.95
17:35	136.7	177.3	294.8	1.59	18.80
17:36	137.9	175.3	294.2	1.59	18.79
17:37	130.0	176.3	295.8	1.50	18.92
17:38	126.3	177.2	295.5	1.49	18.96
17:39	126.8	178.4	296.2	1.49	18.95

COMMENTS: calibration check

CALIBRATION SUMMARY

SOURCE: WSPA I.C. Engine Pooled Source Test

REASON: calibration check

DATE : 07-31-1992 TIME: 17:47 - 18:22

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
10	TECO8	ppmNOx	0.0	2.1
10	TECO8	ppmNOx	1843.0	1878.6
9	TECO2	ppm CO	0.0	0.5
9	TECO2	ppm CO	807.0	817.8
2	as CH4	ppmTHC	0.0	40.3
2	as CH4	ppmTHC	804.7	819.9
12	FUJI3	%CO2	0.00	-0.03
12	FUJI3	%CO2	17.74	17.81
8	SERVMX	%Oxygen	0.00	-0.03
8	SERVMX	%Oxygen	5.01	5.08

WSPA I.C. Engine Pooled Source Test

07-31-1992

	CHAN10 TECO8	CHAN 9 TECO2	CHAN 2 as CH4	CHAN12 FUJ13	CHAN 8 SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
19:28	1254.3	212.5	153.8	7.73	10.17
19:29	1251.9	213.4	152.5	7.74	10.18
19:30	1262.2	213.6	150.3	7.77	10.13
19:31	1316.1	229.0	175.3	7.96	9.94
19:32	1402.0	265.2	178.4	8.08	9.77
19:33	1419.3	258.2	172.9	8.09	9.76
19:34	1428.2	266.4	177.4	8.09	9.76
19:35	1431.9	274.8	165.9	8.10	9.75
19:36	1432.1	263.5	166.3	8.11	9.74
19:37	1139.4	249.4	139.8	7.03	11.08

AVERAGE VALUES FOR THE LAST 10 MINUTES

19:37	1333.7	244.6	163.3	7.87	10.03
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19:38	1420.2	242.6	156.6	8.27	9.65
19:39	1206.6	268.5	132.8	7.17	10.75
19:40	511.9	141.8	94.0	4.35	14.61
19:41	608.1	102.9	106.2	5.53	13.35
19:42	637.5	118.0	107.7	5.62	13.05
19:43	823.2	133.0	123.5	6.58	12.04
19:44	1180.3	212.0	126.5	7.70	10.22
19:45	1193.0	200.0	129.1	7.67	10.27
19:46	1195.5	203.4	133.0	7.66	10.28
19:47	1207.7	203.5	129.6	7.67	10.27

AVERAGE VALUES FOR THE LAST 10 MINUTES

19:47	998.4	182.6	123.9	6.82	11.45
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19:48	1209.2	203.1	131.8	7.67	10.26
19:49	1209.0	202.9	137.1	7.65	10.29
19:50	1206.6	207.6	133.9	7.64	10.29
19:51	1207.9	202.3	131.1	7.66	10.29
19:52	1208.4	197.5	131.4	7.66	10.32
19:53	1209.8	195.8	132.2	7.66	10.31
19:54	1208.6	200.2	133.6	7.67	10.30
19:55	1202.4	201.2	137.0	7.67	10.31
19:56	1201.8	198.3	133.6	7.66	10.32
19:57	1203.9	198.0	131.9	7.65	10.32

AVERAGE VALUES FOR THE LAST 10 MINUTES

19:57	1206.8	200.7	133.4	7.66	10.30
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19:58	1204.7	196.7	129.4	7.65	10.33
19:59	1200.5	194.6	132.4	7.66	10.33
20:00	1193.2	197.4	133.2	7.63	10.35
20:01	1200.7	196.4	132.7	7.66	10.33
20:02	1193.8	195.0	129.6	7.63	10.36
20:03	1188.3	193.2	128.0	7.60	10.39
20:04	1182.8	193.1	130.6	7.59	10.41
20:05	1181.3	193.9	128.0	7.58	10.40
20:06	1178.7	192.0	130.0	7.59	10.39
20:07	1184.5	200.7	127.7	7.60	10.36

WSPA I.C. Engine Pooled Source Test

07-31-1992

	CHAN10	CHAN 9	CHAN 2	CHAN12	CHAN 8
	TECO8	TECO2	as CH4	FUJ13	SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxvgn

AVERAGE VALUES FOR THE LAST 10 MINUTES

20:07	1190.8	195.3	130.2	7.62	10.37
20:08	1184.9	194.7	130.9	7.61	10.35
20:09	1186.5	198.8	129.3	7.62	10.35
20:10	1185.3	197.4	128.7	7.63	10.34
20:11	1187.5	198.1	130.9	7.62	10.34
20:12	1163.4	195.2	127.5	7.56	10.41
20:13	1164.3	189.3	125.6	7.55	10.43
20:14	1152.4	184.6	123.5	7.51	10.47
20:15	1158.3	188.8	128.9	7.54	10.44
20:16	1160.6	194.3	129.8	7.55	10.43
20:17	1164.6	194.4	130.1	7.55	10.41

AVERAGE VALUES FOR THE LAST 10 MINUTES

20:17	1170.8	193.6	128.5	7.57	10.40
20:18	1165.9	196.4	130.4	7.56	10.41
20:19	1164.3	197.5	130.1	7.56	10.41
20:20	1164.7	198.8	129.1	7.56	10.41
20:21	1163.0	196.6	128.1	7.56	10.41
20:22	1161.2	194.1	127.9	7.54	10.43
20:23	1162.8	196.0	128.0	7.55	10.42
20:24	1160.7	199.0	127.9	7.53	10.43
20:25	1157.1	197.3	126.8	7.53	10.43
20:26	1159.1	198.9	126.2	7.54	10.42
20:27	1155.3	193.5	126.6	7.52	10.44

AVERAGE VALUES FOR THE LAST 10 MINUTES

20:27	1161.4	196.8	128.1	7.55	10.42
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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA

20:27	1177.0	202.3	134.5	7.51	10.49
20:28	1149.3	192.9	124.0	7.53	10.49
20:29	1155.4	190.9	124.7	7.54	10.47
20:30	1154.8	193.9	122.8	7.53	10.49
20:31	1145.9	192.5	123.1	7.52	10.50
20:32	1144.4	192.1	122.1	7.50	10.52
20:33	1139.6	186.5	119.7	7.49	10.53
20:34	1140.4	186.0	117.4	7.49	10.53
20:35	1129.6	178.5	116.6	7.46	10.56
20:36	1126.1	182.2	114.8	7.44	10.58
20:37	1118.1	179.3	110.4	7.40	10.53

AVERAGE VALUES FOR THE LAST 10 MINUTES

20:37	1140.4	187.5	119.6	7.49	10.53
20:38	1105.2	174.3	106.3	7.36	10.67
20:39	1092.1	171.8	103.5	7.33	10.71
20:40	1077.0	171.1	101.2	7.30	10.74
20:41	1067.2	167.3	97.9	7.26	10.78
20:42	1055.7	160.7	95.5	7.24	10.81

ENTROPY

WSPA I.C. Engine Pooled Source Test

07-31-1992

	CHAN10 TECO8	CHAN 9 TECO2	CHAN 2 as CH4	CHAN12 FUJI3	CHAN 8 SERVMX
TIME	ppmNOx	ppm CO	ppmTHC	%CO2	%Oxygen
20:43	1044.9	159.6	94.4	7.22	10.82
20:44	1037.3	160.4	92.9	7.19	10.85
20:45	1029.6	155.8	89.3	7.17	10.88
20:46	1022.3	152.4	88.9	7.15	10.89
20:47	1018.3	154.3	89.2	7.14	10.91

AVERAGE VALUES FOR THE LAST 10 MINUTES

20:47	1055.0	162.8	95.9	7.24	10.81
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20:48	1011.6	153.0	89.4	7.13	10.91
20:49	1009.0	156.1	88.9	7.11	10.92
20:50	1073.5	164.8	111.9	7.40	10.64
20:51	1171.1	199.6	123.4	7.58	10.38
20:52	1193.2	198.3	124.6	7.57	10.39
20:53	1196.7	200.6	127.0	7.57	10.40
20:54	1206.3	203.0	126.8	7.58	10.38
20:55	1214.5	202.9	129.1	7.57	10.38
20:56	1217.9	201.1	128.6	7.56	10.38
20:57	1217.2	200.9	127.9	7.56	10.38

AVERAGE VALUES FOR THE LAST 10 MINUTES

20:57	1151.1	188.0	117.8	7.46	10.52
-------	--------	-------	-------	------	-------

20:58	1216.3	199.9	125.7	7.55	10.39
20:59	1214.6	200.1	129.1	7.54	10.40
21:00	1248.7	210.0	130.3	7.61	10.33
21:01	1197.4	196.5	112.0	7.43	10.55
21:02	1191.1	181.8	111.6	7.44	10.55
21:03	1186.0	188.8	112.1	7.44	10.55
21:04	1184.5	185.2	108.4	7.42	10.56
21:05	1175.8	180.2	106.6	7.42	10.56
21:06	1169.8	183.3	107.8	7.41	10.56
21:07	1169.1	185.1	104.5	7.41	10.57

AVERAGE VALUES FOR THE LAST 10 MINUTES

21:07	1195.3	191.1	114.8	7.47	10.50
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21:08	1161.6	176.9	102.8	7.38	10.60
21:09	1158.1	180.9	103.6	7.38	10.60
21:10	1160.0	179.3	100.8	7.38	10.59
21:11	1163.9	178.4	105.3	7.38	10.59
21:12	1159.7	183.1	102.9	7.37	10.60
21:13	1186.6	181.8	108.6	7.46	10.50
21:14	1208.3	188.8	111.4	7.49	10.45
21:15	1215.6	189.1	112.3	7.49	10.44
21:16	1212.7	192.4	112.3	7.49	10.44
21:17	1228.7	191.9	113.1	7.53	10.40

AVERAGE VALUES FOR THE LAST 10 MINUTES

21:17	1185.5	184.3	107.3	7.43	10.52
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21:18	1220.9	194.0	113.3	7.49	10.43
21:19	1220.4	189.3	109.7	7.48	10.44
21:20	1218.8	185.7	110.4	7.46	10.46
21:21	1213.9	188.9	111.9	7.46	10.47

COMMENTS: END OF RUN NO. 7

CONTINUED ON ENTROPY

CALIBRATION SUMMARY

SOURCE: WSPA I.C. Engine Pooled Source Test

REASON: POST TEST CALIBRATION ERROR CHECK

DATE : 07-31-1992 TIME: 21:22 - 21:38

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
10	TEC08	ppmNOx	0.0	15.7
10	TEC08	ppmNOx	1843.0	1876.4
9	TEC02	ppm CO	0.0	0.7
9	TEC02	ppm CO	807.0	819.6
2	as CH4	ppmTHC	0.0	23.4

Appendix C.4
Benzene - CARB Method 410A

GASEOUS POLLUTANT FIELD DATA, METHOD 410A

Plant Name Halliburton (NSPA) Run No. M410A-1
 City/State Burbank, CA Job No. 30037 Date 7/29/92
 Sampling Loc. Engine Exhaust Duct Time Start 1223
 Barometric Press. 29.5 In. Hg Ambient Temp. 96 °F Time Finish 1715
 Sample Box No. NA Operator JW Assistant(s) —
 Meterbox I.D. 9P Gamma 0.993 DGM Used (v) Singer — Rockwell —
 Leak Check OK? (v) Pretest ✓ Posttest ✓ Purge Duration NA Min.
 Leak Check Readings B — B — B — B —
 (where applicable) E — E — E — E —
 Vacuum, In. Mercury — — — —

EPA METHOD 6 CRITERIA: SAMPLING TRAIN LEAK RATE MUST BE $\leq 2.0\%$ OF AVERAGE SAMPLING RATE.

EPA METHOD 26 CRITERIA: LEAK CHECK VACUUM MUST REMAIN STABLE FOR 30 SECONDS.

FOR PUMP LEAK CHECK, VACUUM MUST REMAIN STABLE FOR 30 SECONDS.

* LITERS FOR SINGER DRY GAS METER; CUBIC FEET FOR ROCKWELL DRY GAS METER.

Time Clock	Net	DGM Reading* (l)(cf)	Rotameter Reading	DGM Pressure In. H ₂ O	Train Vacuum In. Hg	Temperature °F	
						DGM	Imp Exit
1223	0	<u>NA</u>	25	NA	NA	NA	NA
1228	5		25				
1233	10		25				
1238	15		25				
1243	20		25				
1248	25		25				
1253	30		25				
1258	35		25				
1655 1655	40		55				
1700 1700	45		55				
1705	50		55				
1710	55		55				
1715	60	✓	55	✓	✓	✓	✓

Vol. Metered
(l)(cf)*

69 Average
DGM WC

Average
DGM °F

VOLATILE ORGANIC SAMPLING TRAIN (VOST) FIELD DATA

Plant Name WSPA Run No. 410A-2W
 City/State Bakersfield Job No. 30037 Date 7/30/92
 Sampling Loc. Engine Exhaust Duct Time Start 1341
 Barometric Press. 29.5 In. Hg Ambient Temp. 90 °F Time Finish 1709
 Sample Box No. _____ Operator WAT Assistant(s) _____
 Meterbox I.D. 9P WSP Gamma 0.9980.998 *DGM Used (✓) Singer _____ Rockwell _____
 Leak Check OK? (✓) Pretest _____ Posttest _____ Condensate Final Vol. _____ mL
 LEAK RATE MUST BE < 2.5 MM (< 0.1 IN.) HG AFTER ONE MINUTE OF LEAK TEST.
 Sorbent Traps I.D. Tenax Tube A _____ Tube B _____
 Tenax/Charcoal Tube A _____ Tube B _____
 Other (specify) _____

* LITERS FOR SINGER DRY GAS METER; CUBIC FEET FOR ROCKWELL DRY GAS METER.

Time Clock	Net	DGM Reading* (l)(cf)	Rotameter Setting	DGM Pressure In. H ₂ O	Train Vacuum In. Hg	DGM Temp. °F	Temp. (°F) (°C) (indicate)	
							Cond.	Probe
<u>1341</u> 1340	0	NA	25	NA	0	106	NA	NA
1346	5		25	NA	0	106		
1351	10		25	N	0	106		
1356	15		25		0	106		
1401	20		25		1	106		
1406	25		25		1	107		
1411	30		25		1	108		
1416	35		25		1	108		
1421	40		25		1	108		
1426	45		25		1	108		
1459	60		55		2	108		
1704	65		55		2	108		
1709	60		55		2	108		

Vol. Metered
(l)(cf)*3 70 Average
Pressure107
Average
Temp.

VOLATILE ORGANIC SAMPLING TRAIN (VOST) FIELD DATA

Plant Name WSPA, Halliburton Ser. Run No. 410A-3
 City/State Bakersfield, CA Job No. 30037 Date 7/31/92
 Sampling Loc. Engine Exhaust Duct Time Start 1501
 Barometric Press. 29.7 In. Hg Ambient Temp. 100 °F Time Finish 2002
 Sample Box No. NA Operator WAS Assistant(s) NA
 Meterbox I.D. 9P Gamma 0.993 *DGM Used (✓) Singer Rockwell
 Leak Check OK? (✓) Pretest ✓ Posttest ✓ Condensate Final Vol. mL

LEAK RATE MUST BE < 2.5 MM (< 0.1 IN.) HG AFTER ONE MINUTE OF LEAK TEST.

Sorbent Traps I.D. Tenax Tube A NA Tube B NA
 Tenax/Charcoal Tube A NA Tube B NA
 Other (specify)

* LITERS FOR SINGER DRY GAS METER; CUBIC FEET FOR ROCKWELL DRY GAS METER.

Time		DGM Reading* (l)(cf)	Rotameter Setting	DGM Pressure In. H ₂ O	Train Vacuum In. Hg	DGM Temp. °F	Temp. (°F) (°C) (indicate)	
Clock	Net						Cond.	Probe
1501	0	NA	25	NA	1	104	NA	NA
1506	5	NA	25		1	104		
1511	10		25		1	104		
1516	15		25		1	104		
1521	20		25		1	104		
1526	25		25		1	105		
1531	30		25		1	105		
1536	35		25		1	106		
1541	40		25		1	106		
1546	45		25		1	106		
19520K 19549	50		40		2	96		
1957	55		55		2	96		
2002 2002	60		55		2	96		

Process Change

Vol. Metered
(l)(cf)*

Average
Pressure

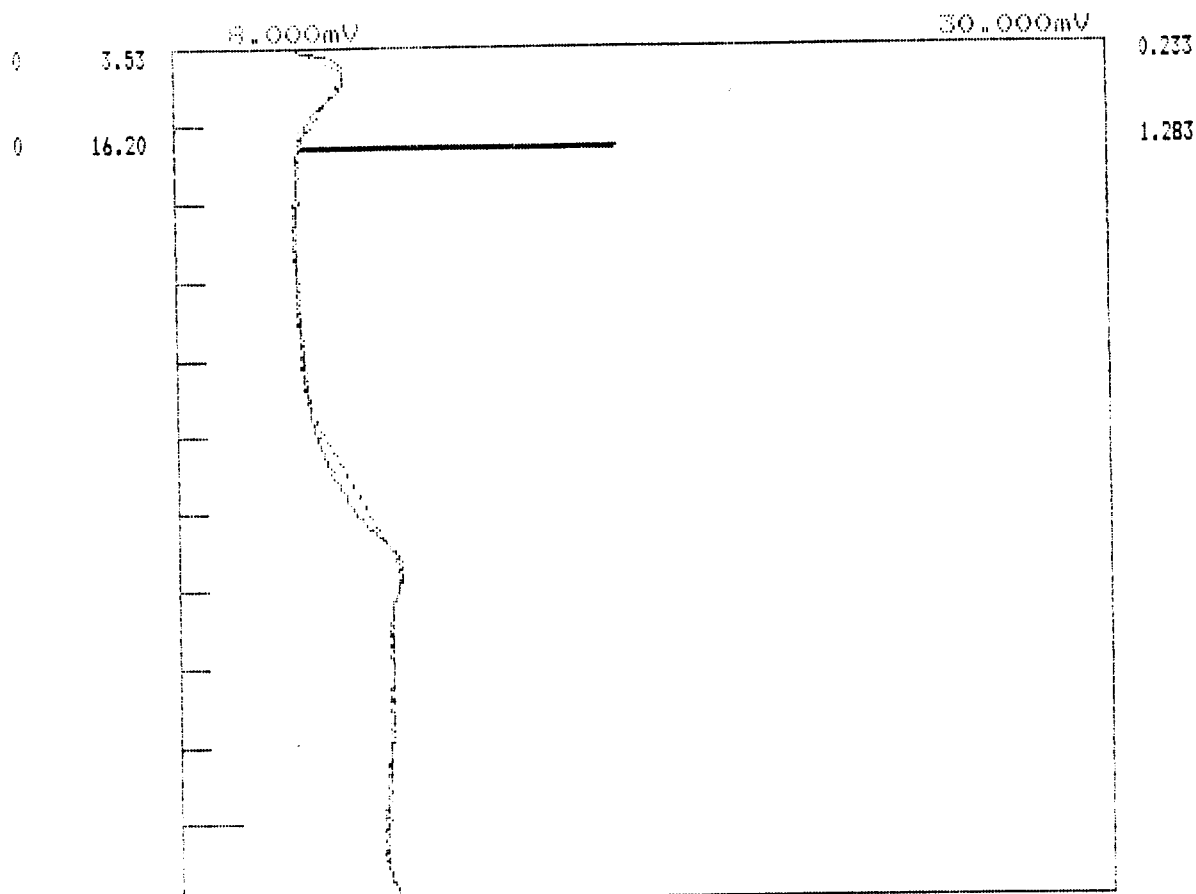
10.3
Average
Temp.

Appendix C.5

1,3-Butadiene - CARB Method 422.102

A-H₂
A112 BLANK
DIRECT FLOW 152^{cm}

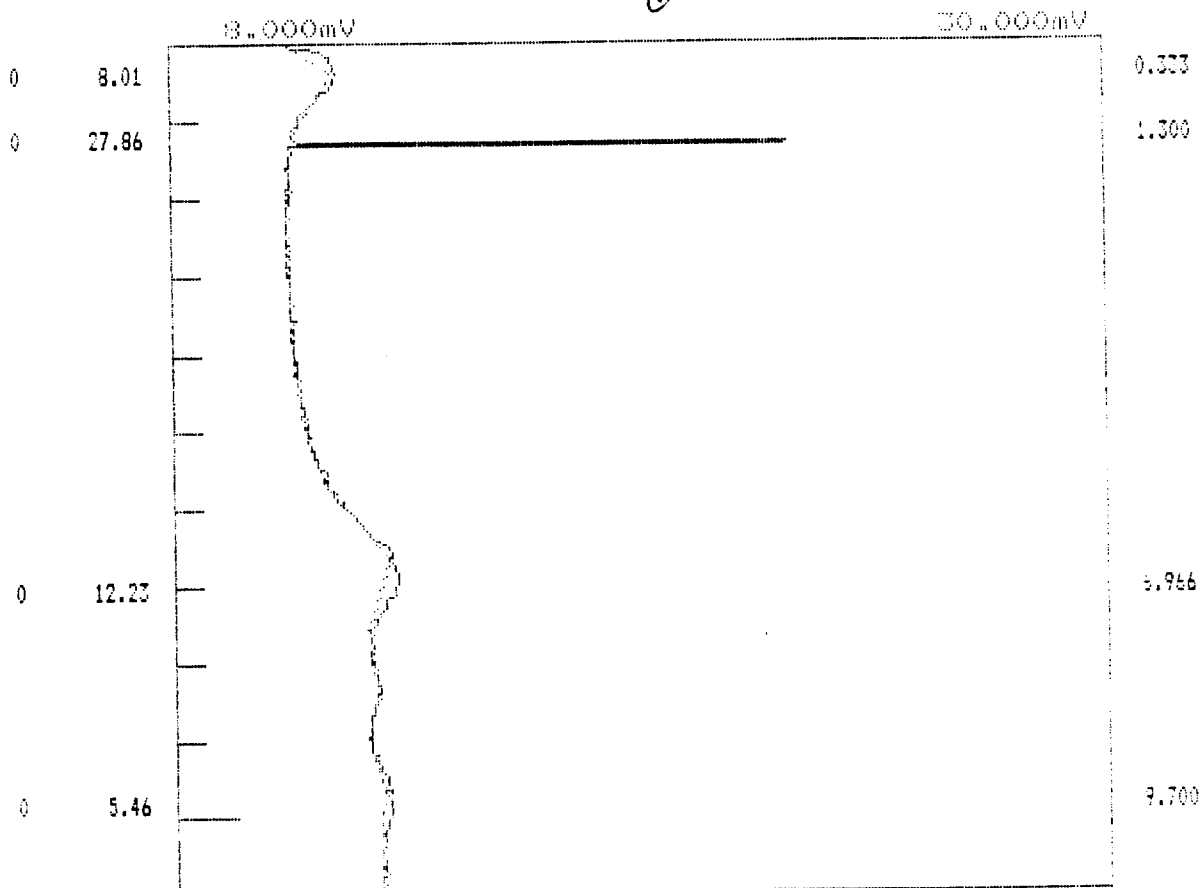
Operator :
File : Cal42201
Temperature :
Components :
Date : 07/28/1992
Time : 10:16:07



Component	Number	Retention	Area	Units
	0	0.233	3.53	
	0	1.283	16.20	
2			19.73	

Operator : Gary Mata
 File : Ca-23334
 Temperature :
 Components :
 Date : 07/28/1992
 Time : 10:35:37

VAD 20701070
 WAS STILL IN LINE
 @ HOE BOX



Component	Number	Retention	Area	Units
	0	0.333	8.01	
	0	1.300	27.86	
	0	6.966	12.23	
	0	9.700	5.46	

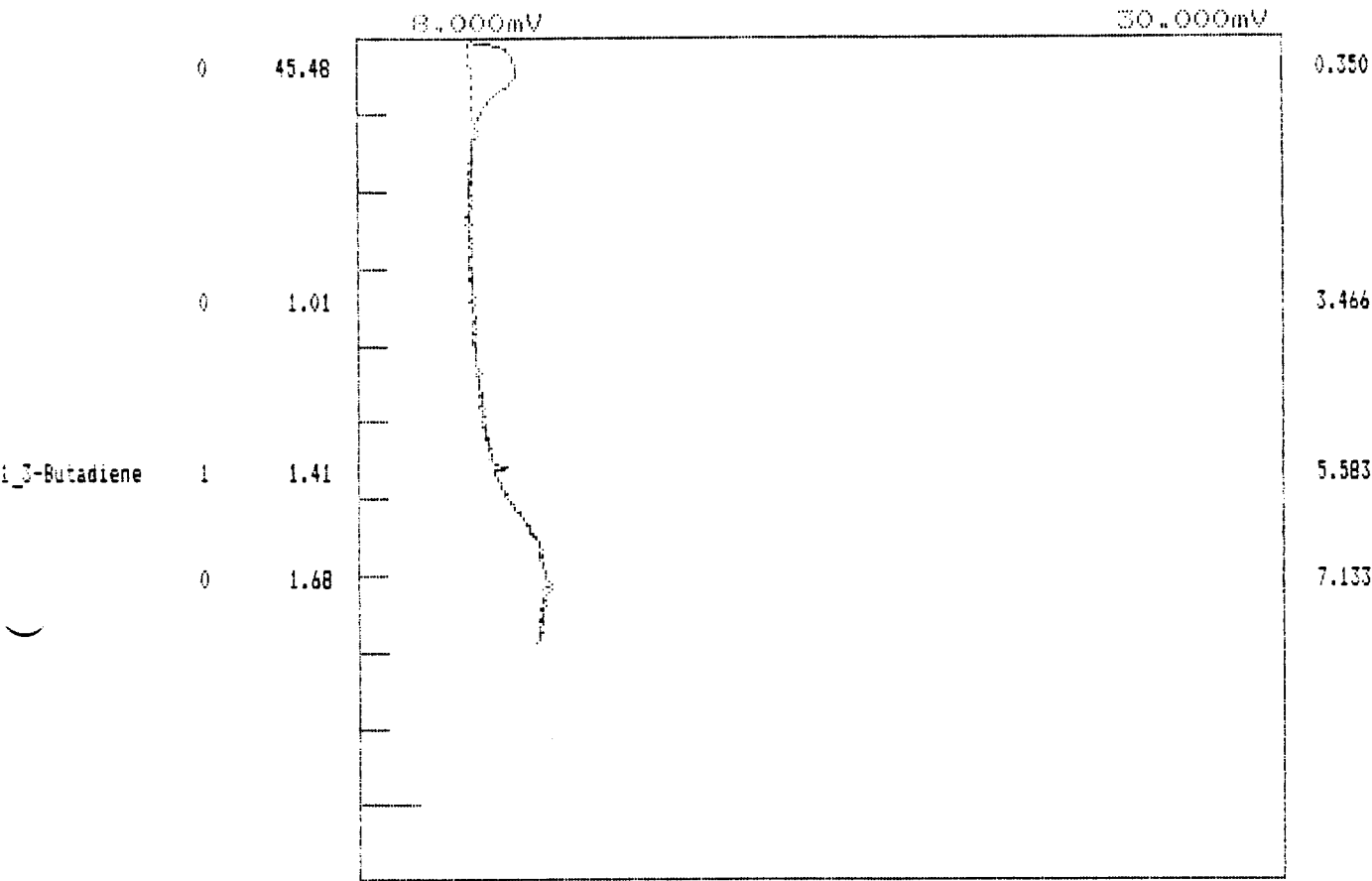
4

53.56

LOW 10 (0.0155)

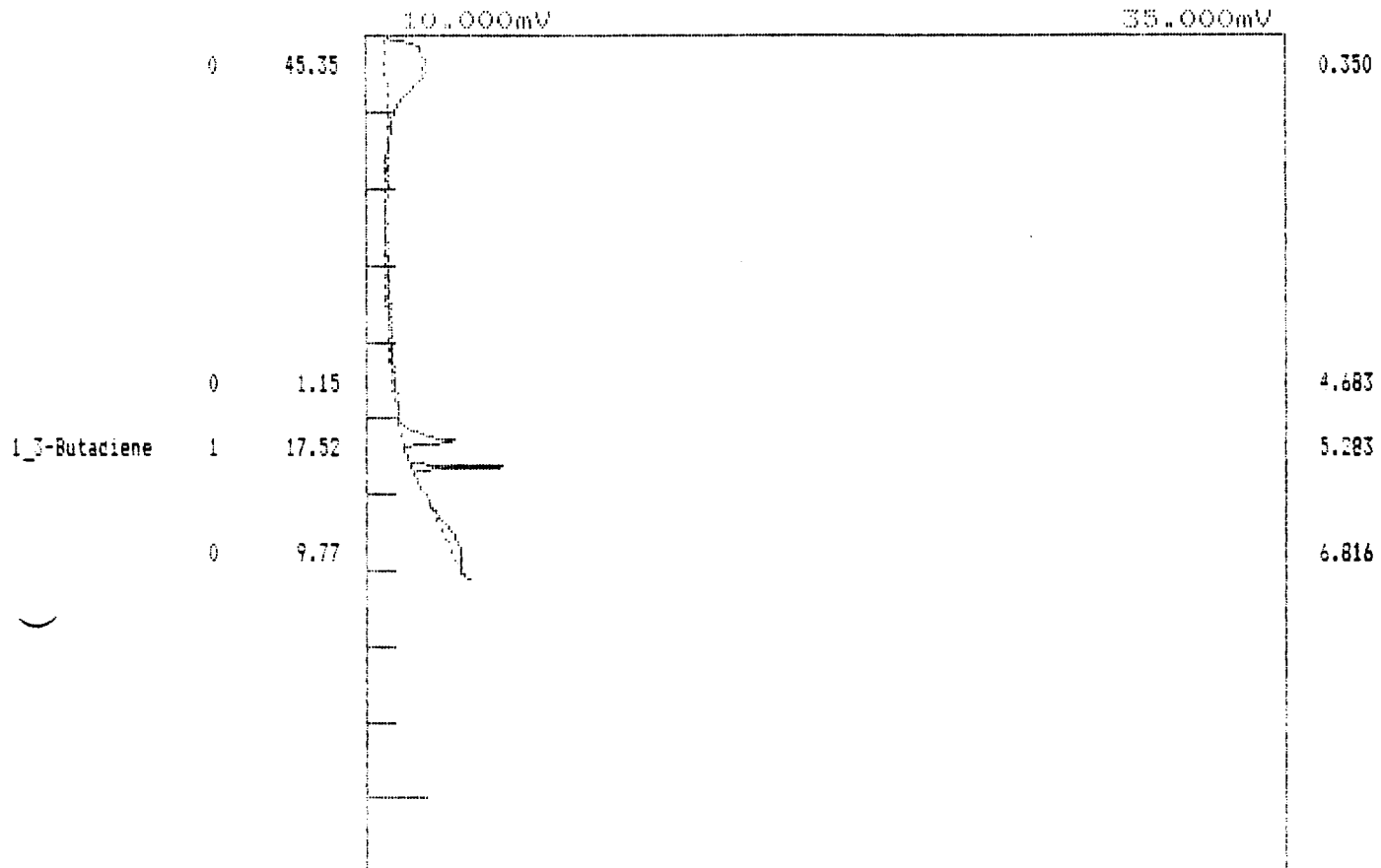
DIRECT FLOW = 152.6
u

Operator : Gary Mata
File : CAL1
Temperature :
Components :
Date : 07/28/1992
Time : 10:52:28



Component	Number	Retention	Area	Units
1,3-Butadiene	0	0.350	45.48	
	0	3.466	1.01	
	1	5.583	1.41	
	0	7.133	1.68	
4			49.58	

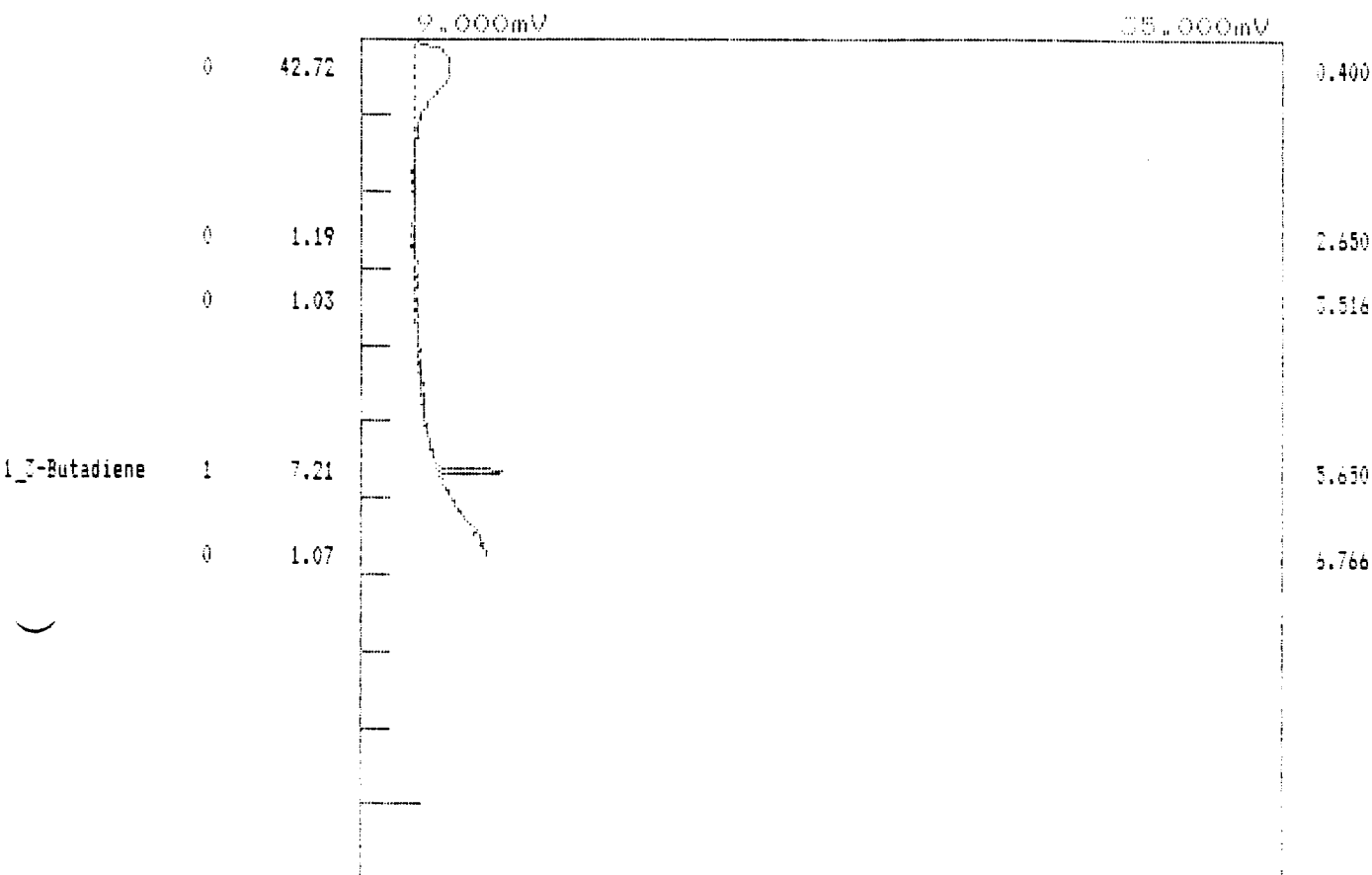
Operator : Gary Mata
File : CAL3
Temperature :
Components :
Date : 07/28/1992
Time : 11:20:42



Component	Number	Retention	Area	Units
	0	0.350	45.35	
	0	1.15	1.15	
1,3-Butadiene	1	17.52	17.52	
	0	9.77	9.77	
	4		73.79	

MIDCAL (0.500ppm)
Direct down 152M/L

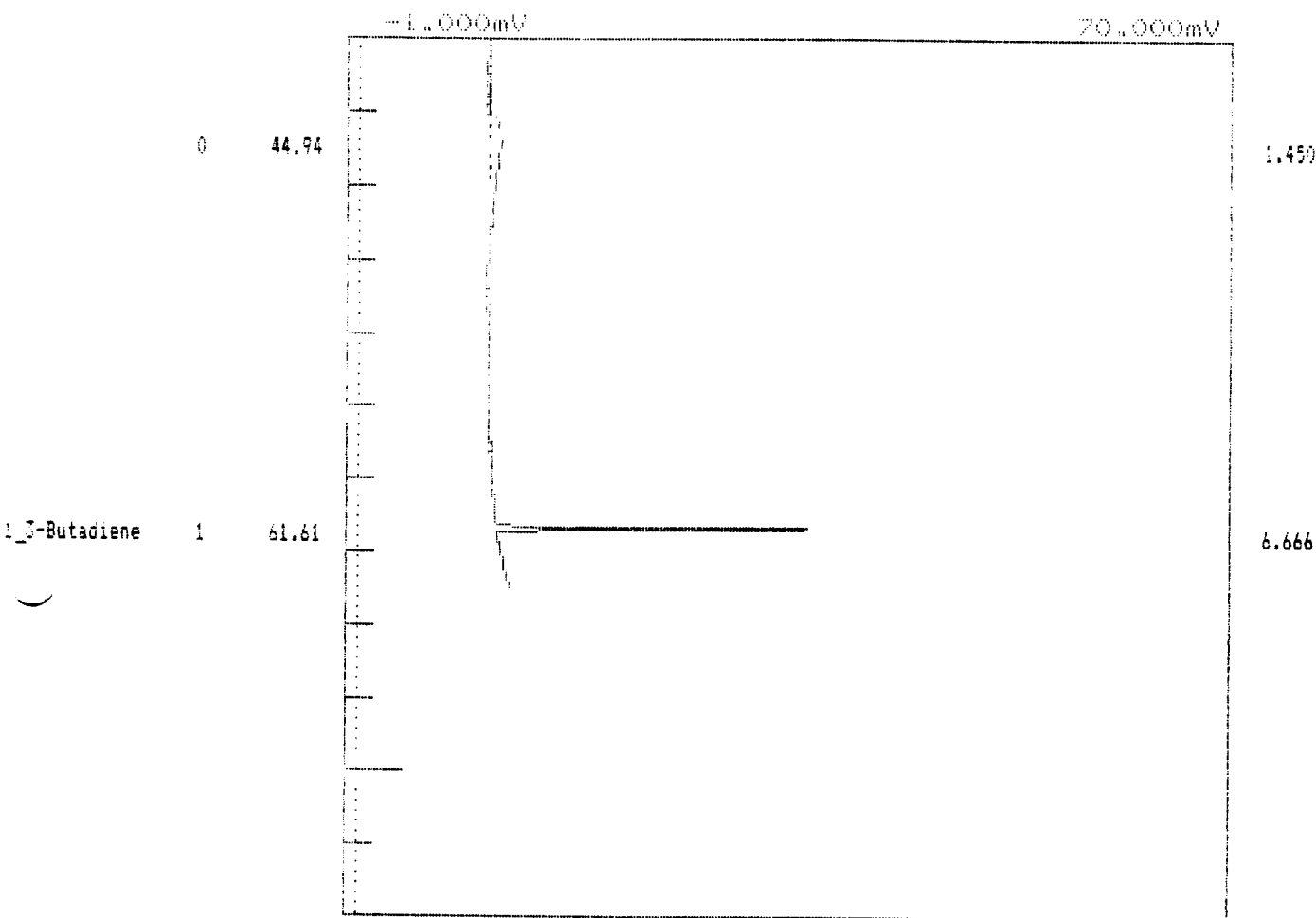
Operator : Gary Mata
File : CAL4
Temperature :
Components :
Date : 07/28/1992
Time : 11:32:35



Component	Number	Retention	Area	Units
	0	0.400	42.72	
	0	2.650	1.19	
	0	3.516	1.03	
1,3-Butadiene	1	5.650	7.21	
	0	6.766	1.07	
	5		53.23	

MID CAL (0.54ppm)
DIRECT 152me/min

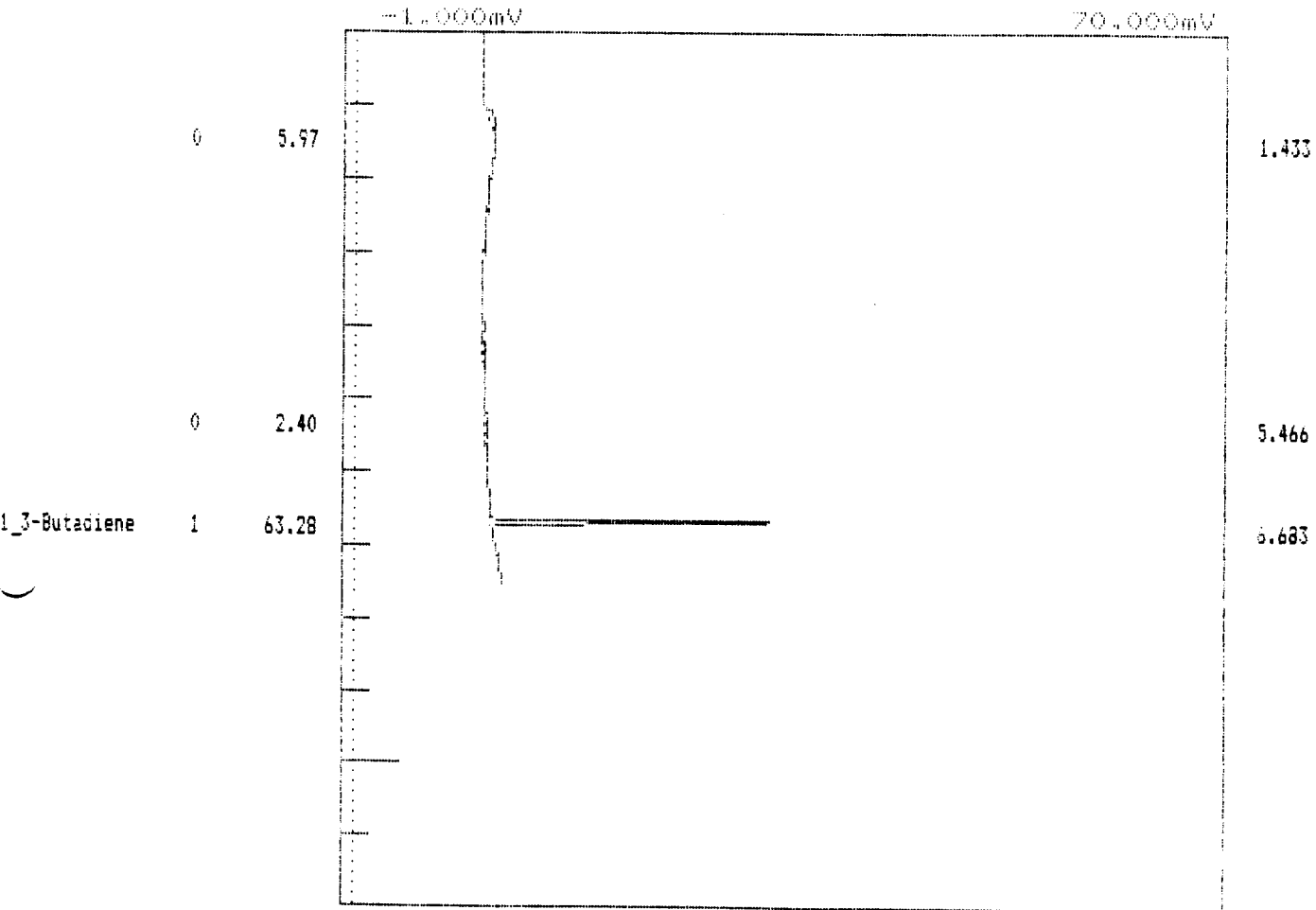
Operator : Gary Mata
File : CAL5
Temperature :
Components :
Date : 07/28/1992
Time : 11:44:19



Component	Number	Retention	Area	Units
1_3-Butadiene	0	1.450	44.94	
	1	6.666	61.61	
2			106.55	

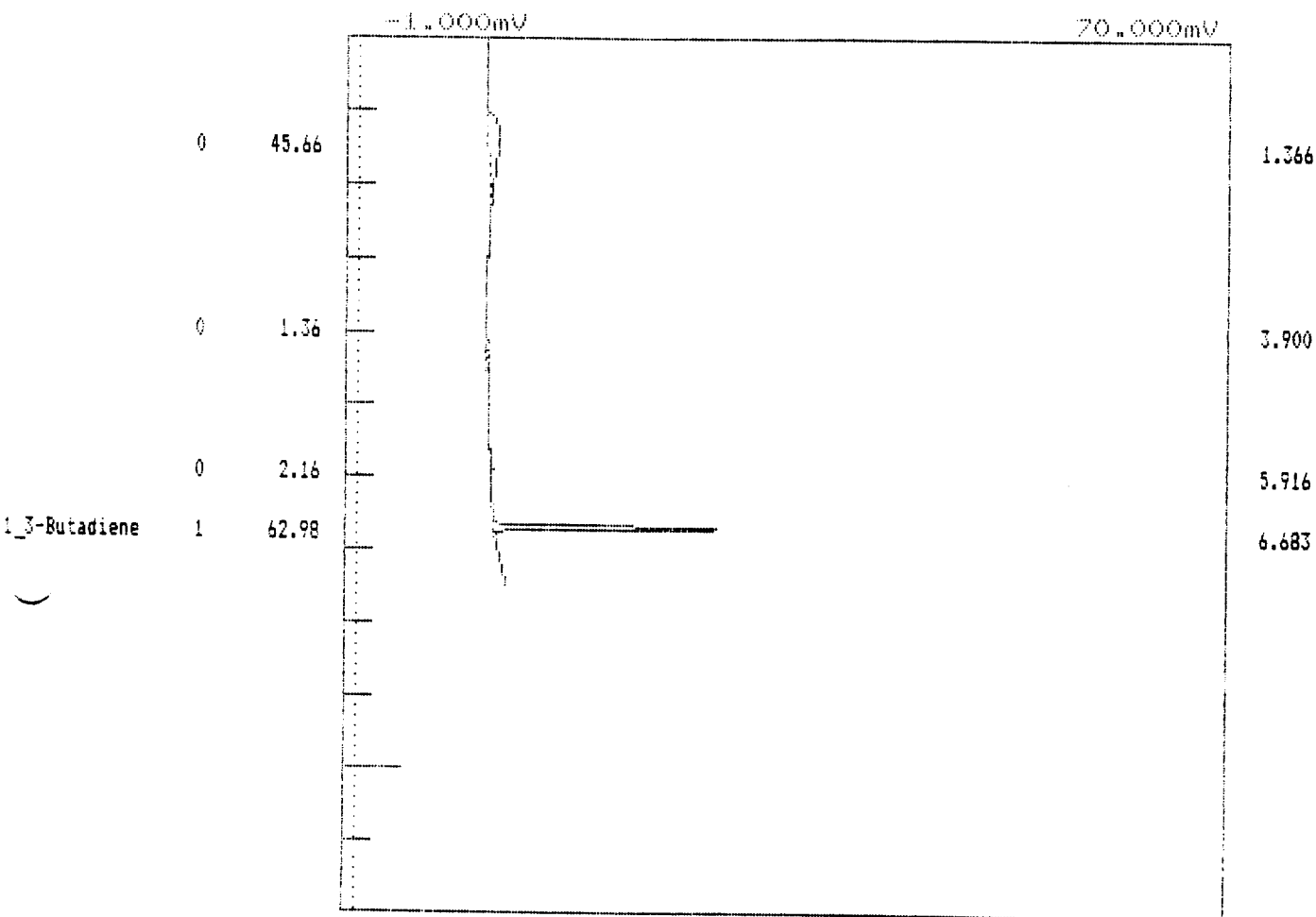
MID CAL (0.540, 1.433)
DIRECT ISOTHERM

Operator : Gary Mata
File : CAL6
Temperature :
Components :
Date : 07/28/1992
Time : 11:56:51



Component	Number	Retention	Area	Units
	0	1.433	5.97	
	0	5.466	2.40	
1_3-Butadiene	1	6.683	63.28	
	3		71.65	

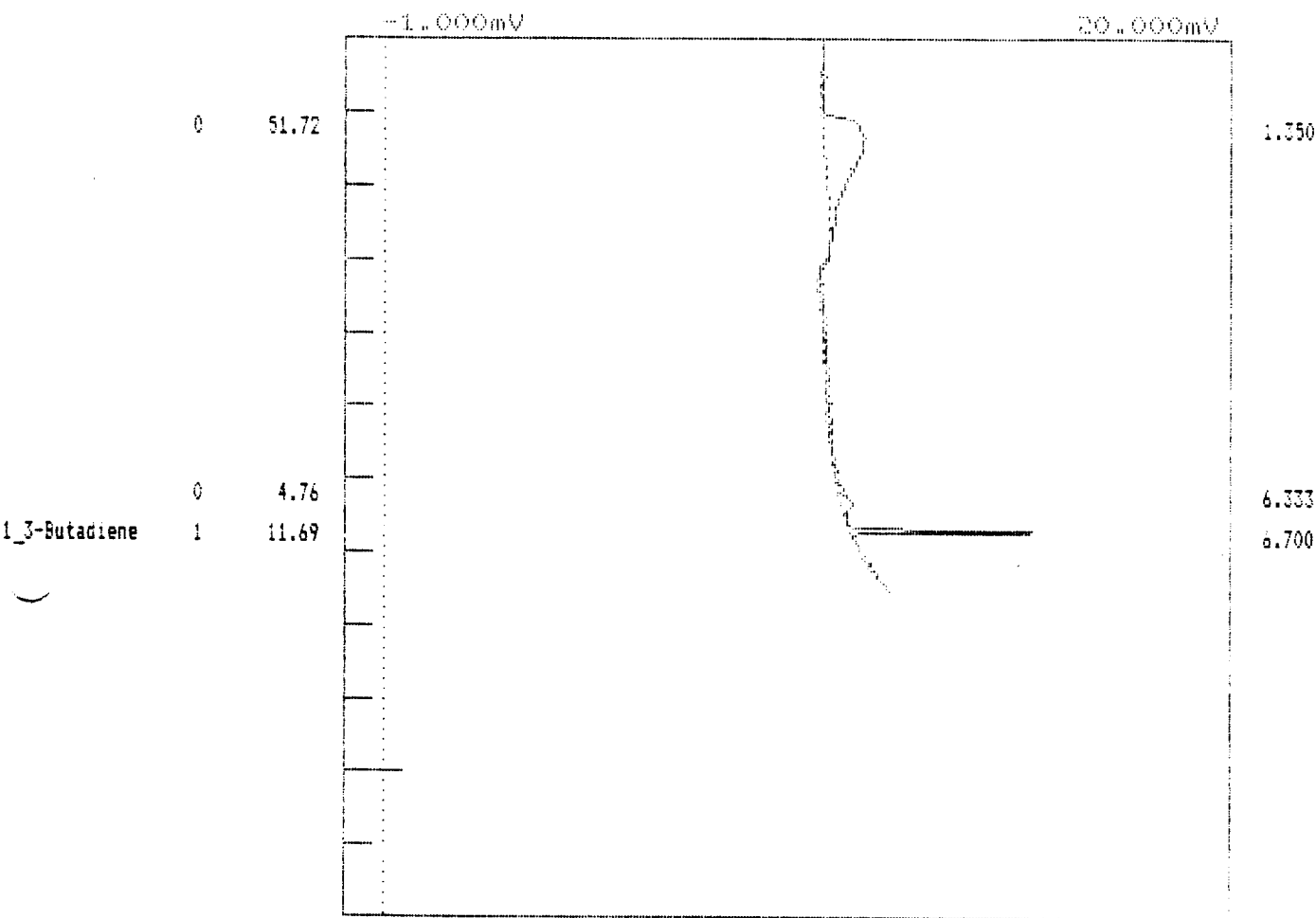
Operator : Gary Mata
File : CAL7
Temperature :
Components :
Date : 07/28/1992
Time : 12:08:14



Component	Number	Retention	Area	Units
	0	1.366	45.66	
	0	3.900	1.36	
	0	5.916	2.16	
1_3-Butadiene	1	6.683	62.98	
4			112.16	

LOW STD - 0.975ppm
DIRECT INJECTION

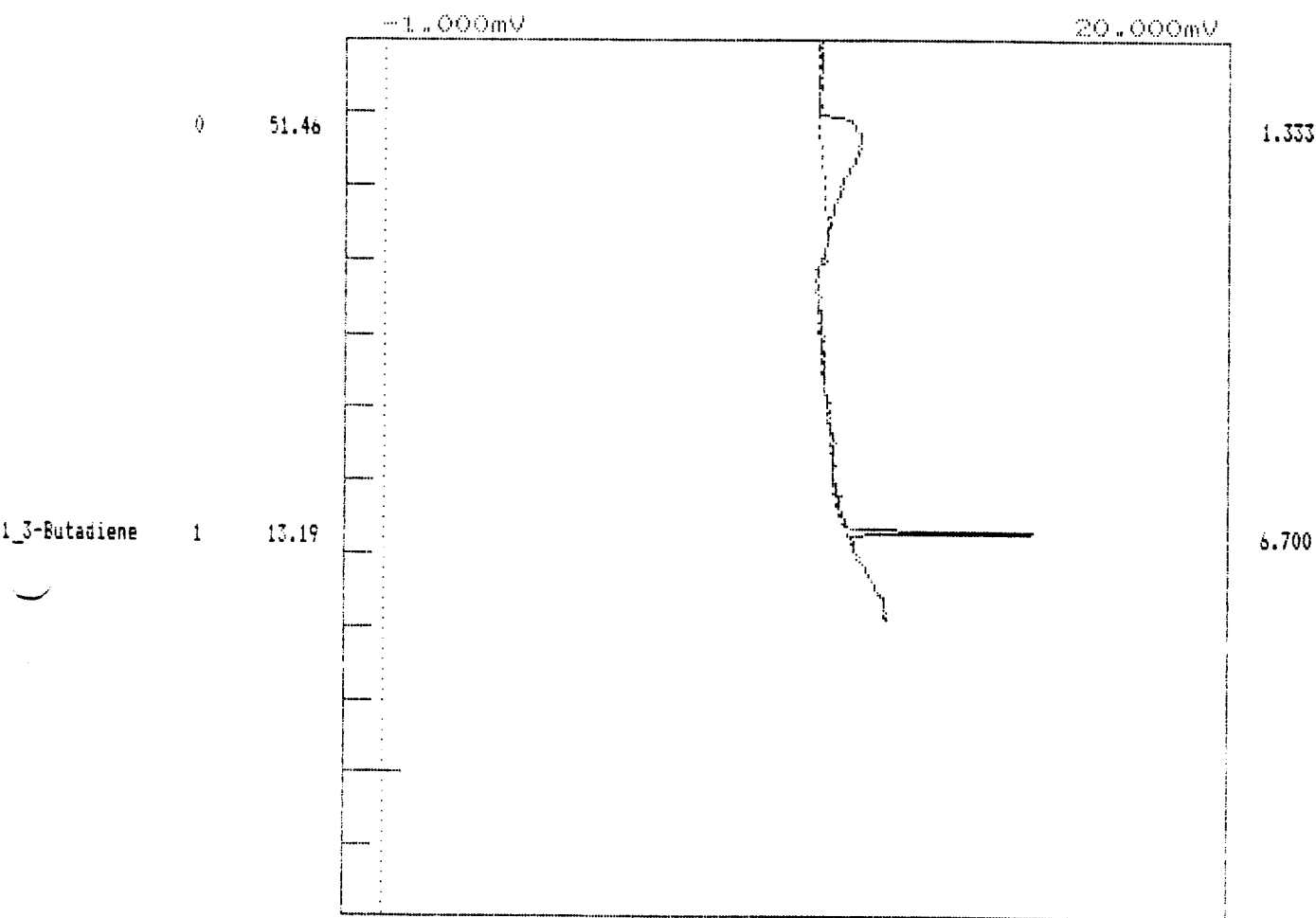
Operator : Gary Mata
File : CALB
Temperature :
Components :
Date : 07/28/1992
Time : 12:19:39



1_3-Butadiene

Component	Number	Retention	Area	Units
	0	1.350	51.72	
	0	6.333	4.76	
1_3-Butadiene	1	6.700	11.69	
3			68.17	

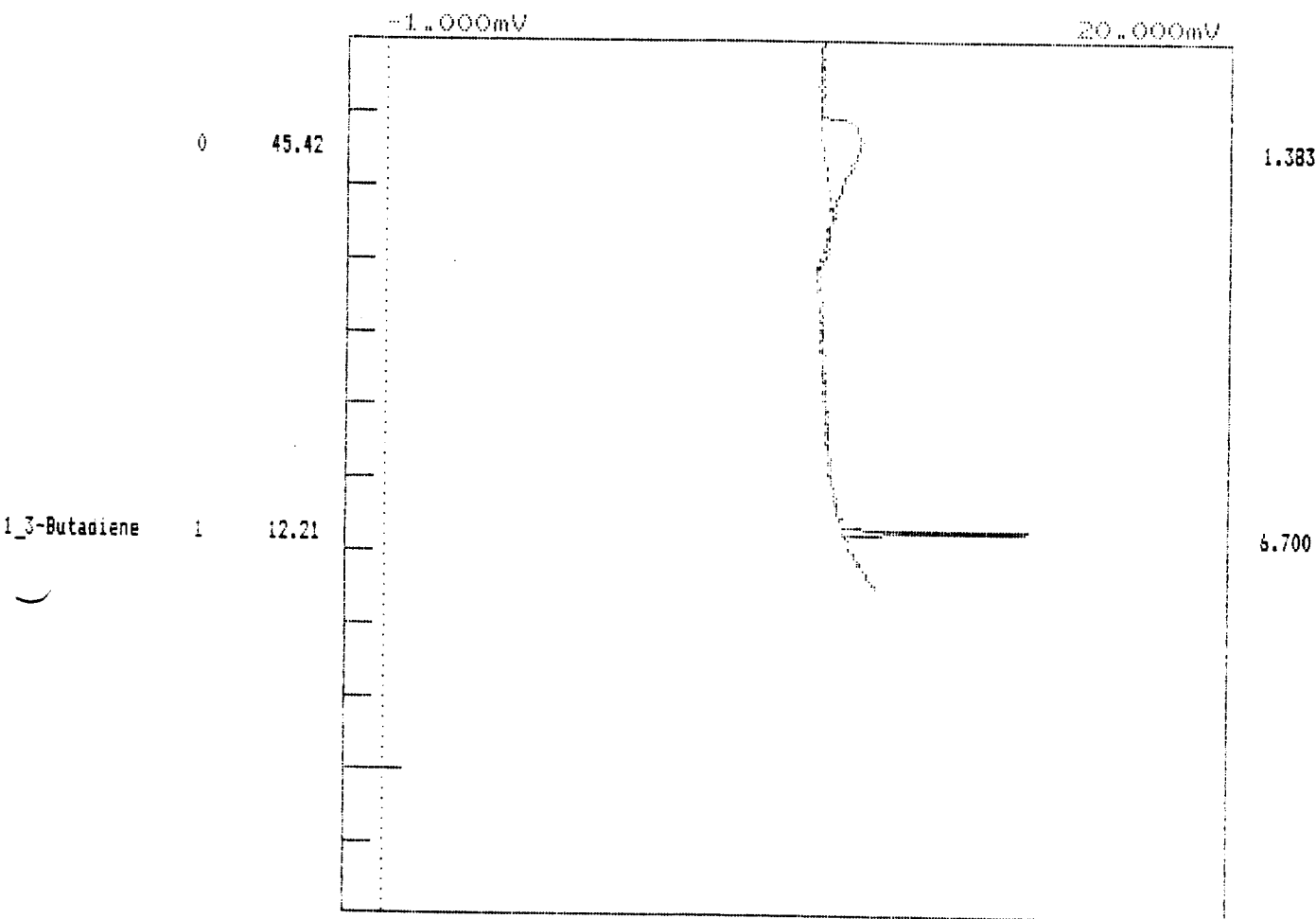
Operator : Gary Mata
 File : CAL9
 Temperature :
 Components :
 Date : 07/28/1992
 Time : 12:31:33



Component	Number	Retention	Area	Units
1,3-Butadiene	0	1.333	51.46	
	1	6.700	13.19	
	2		64.64	

20.000mV
DIRECT 152.000mV

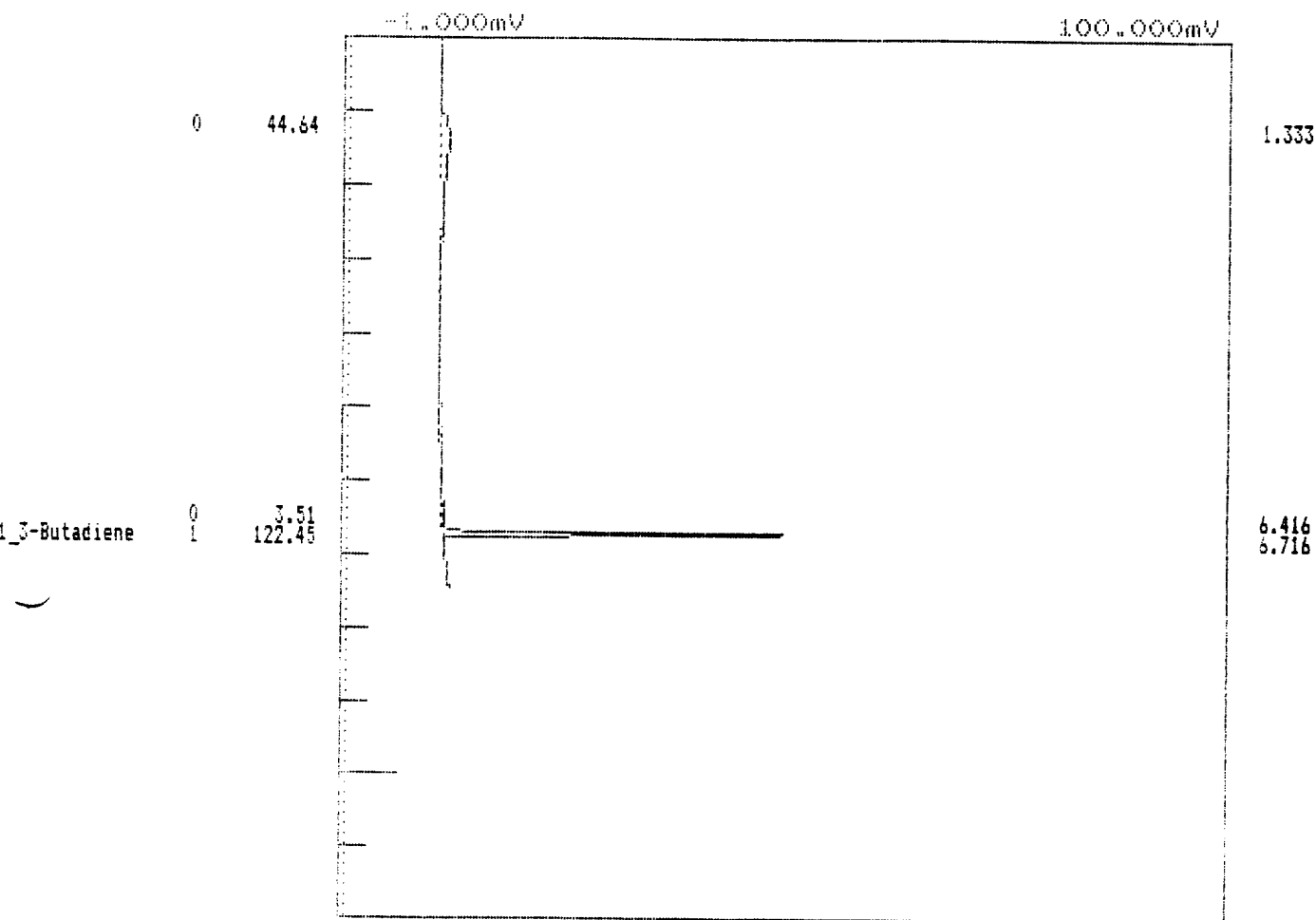
Operator : Gary Mata
File : CAL10
Temperature :
Components :
Date : 07/28/1992
Time : 12:43:40



Component	Number	Retention	Area	Units
1_3-Butadiene	0	1.383	45.42	
	1	6.700	12.21	
	2		57.63	

High SEC (1.08 ppm)
Direct 152 ml/min

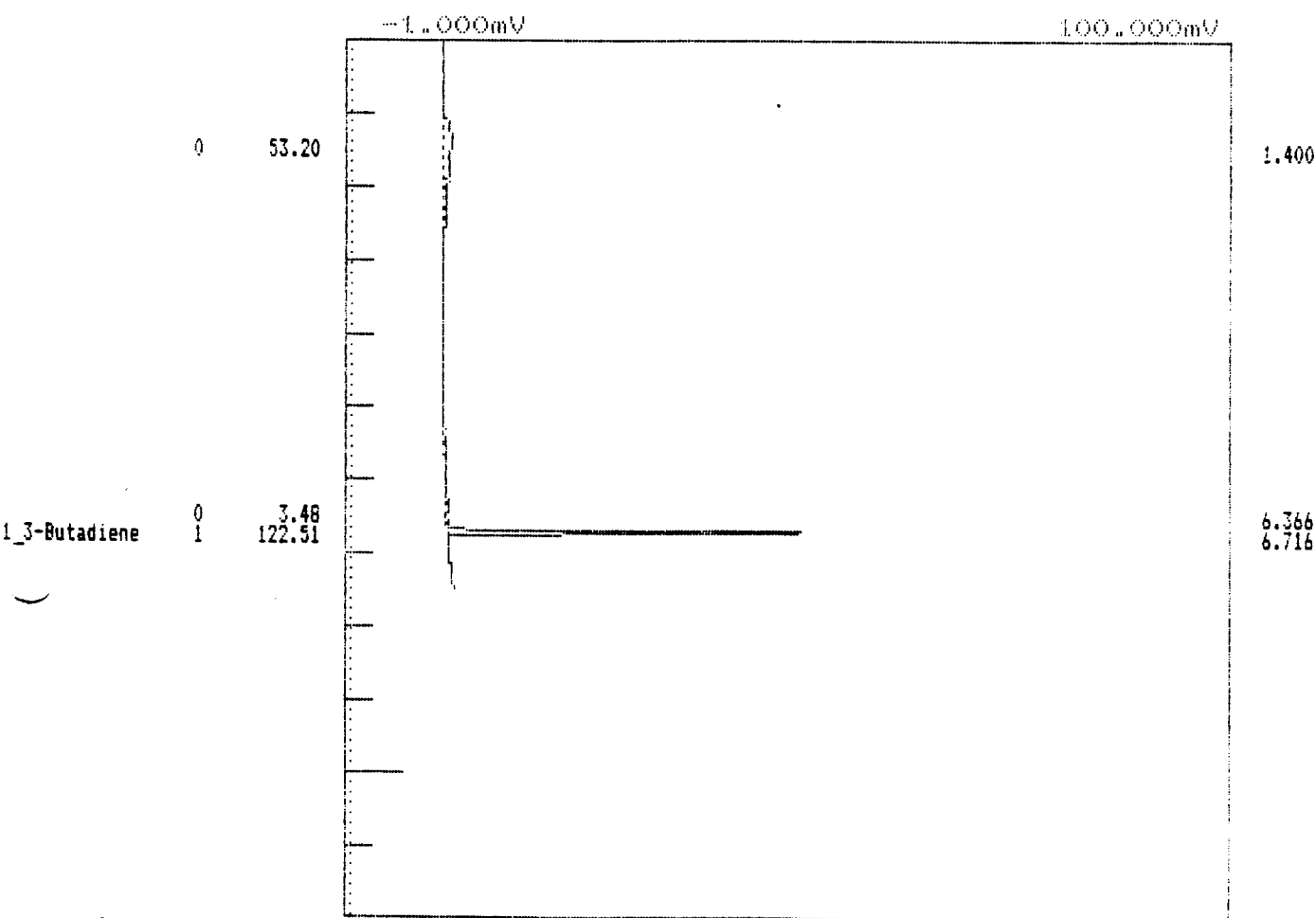
Operator : Gary Mata
File : CAL11
Temperature :
Components :
Date : 07/28/1992
Time : 12:54:48



Component	Number	Retention	Area	Units
1,3-Butadiene	0	1.333	44.64	
	0	6.416	3.51	
	1	6.716	122.45	
3			170.60	

HIGH STD (1.05pp)
DIRECT ISL ~/m...

Operator : Gary Mata
File : CAL12
Temperature :
Components :
Date : 07/28/1992
Time : 13:05:48

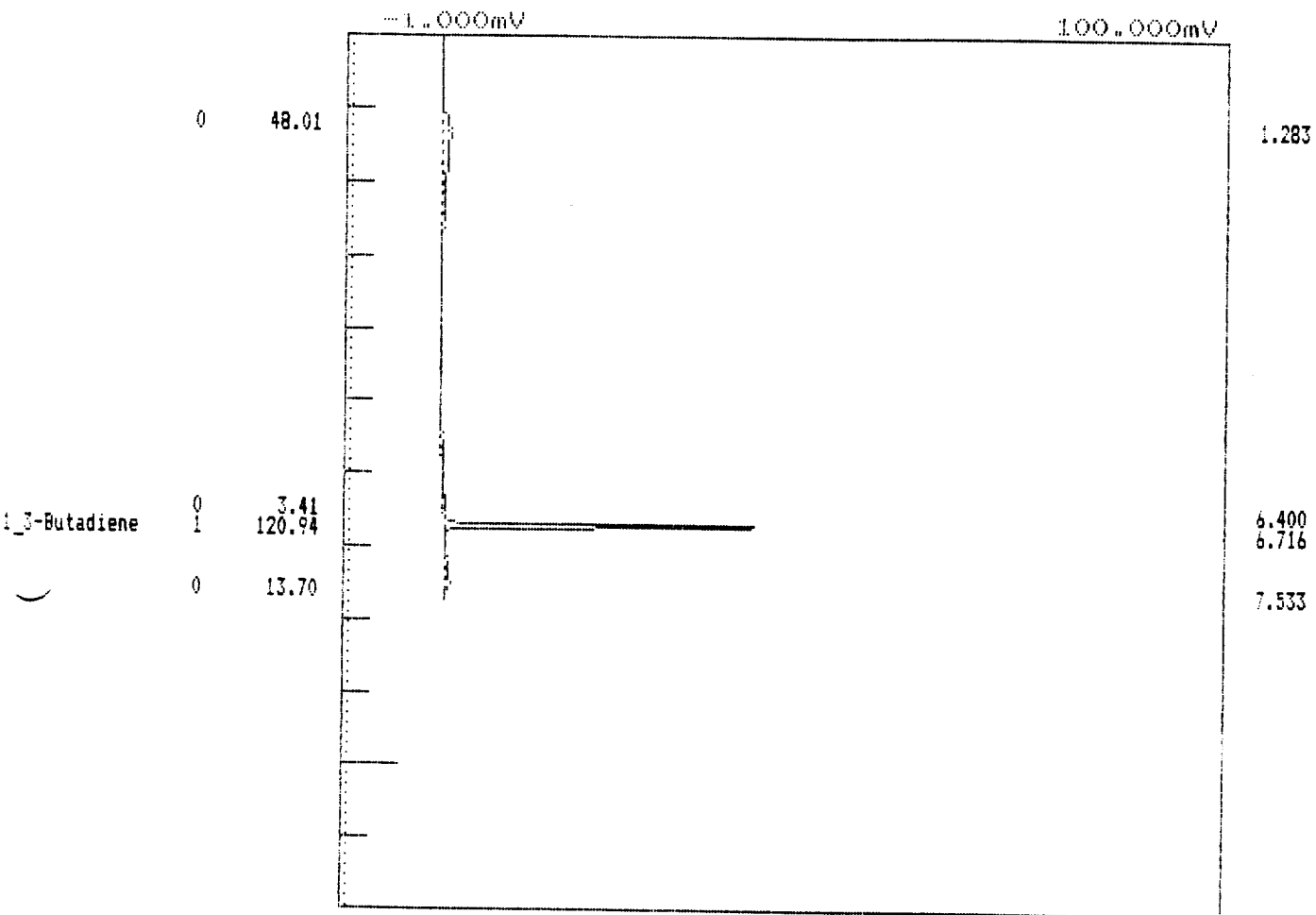


1_3-Butadiene 0 3.48
1 122.51

Component	Number	Retention	Area	Units
	0	1.400	53.20	
	0	6.366	3.48	
1_3-Butadiene	1	6.716	122.51	
3			179.19	

High ID (0.03ppm)
DIRECT 152Hz/min

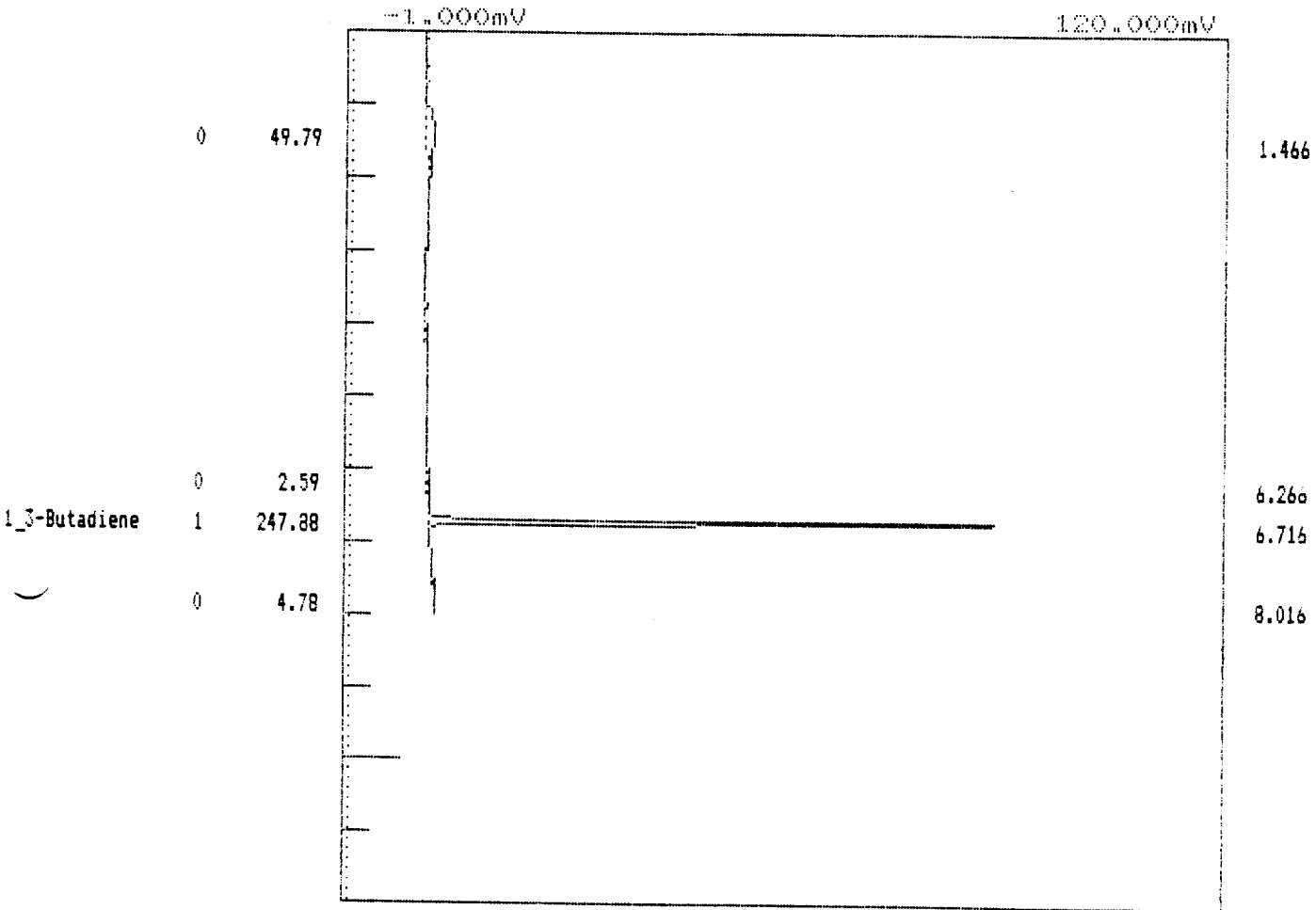
Operator : Gary Mata
File : CAL13
Temperature :
Components :
Date : 07/28/1992
Time : 13:17:17



Component	Number	Retention	Area	Units
	0	1.283	48.01	
	0	3.41	3.41	
1,3-Butadiene	1	6.716	120.94	
	0	7.533	13.70	
4			186.06	

4" STD (2.14ppm)
Direct 152m/min

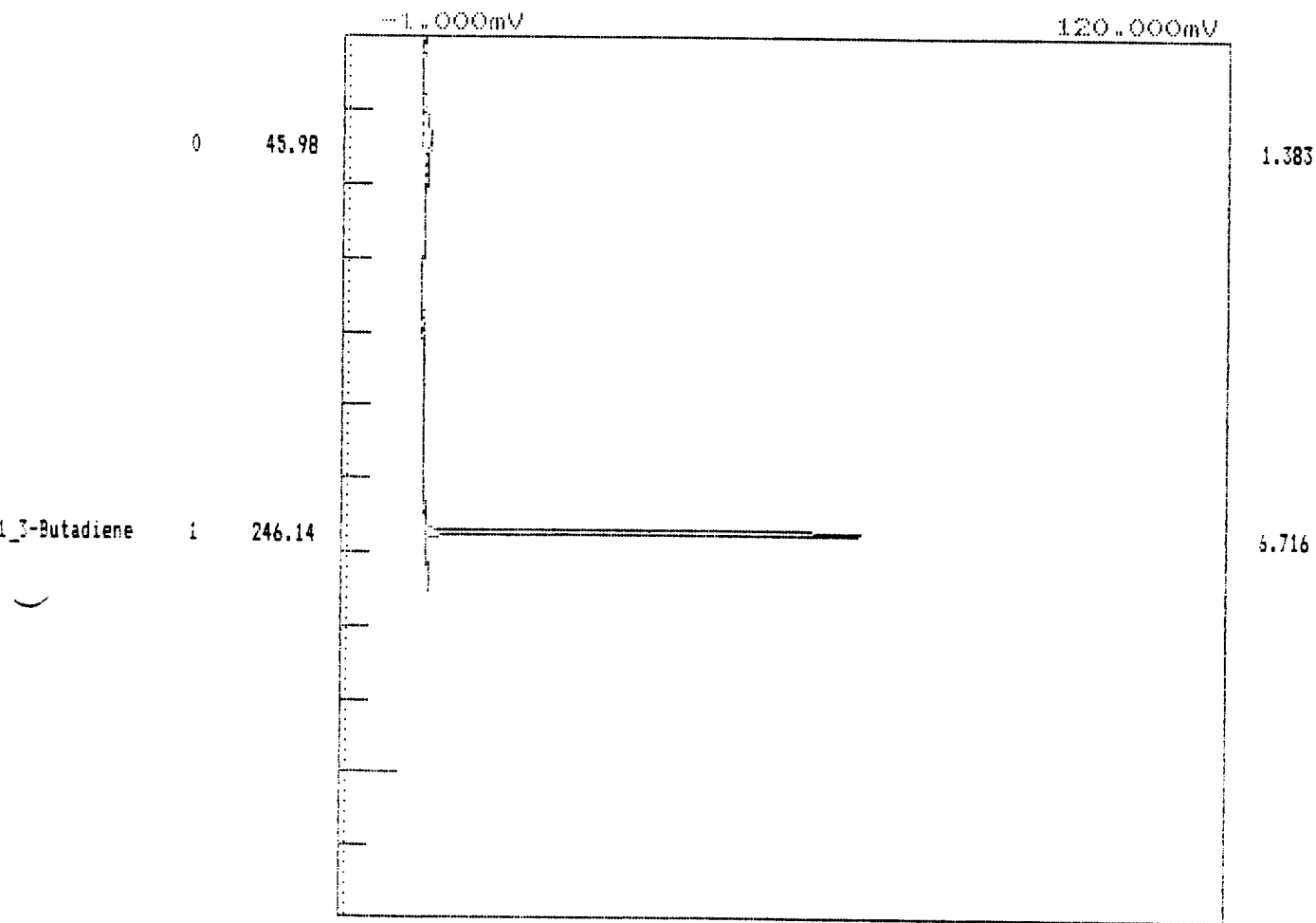
Operator : Gary Mata
File : CAL14
Temperature :
Components :
Date : 07/28/1992
Time : 13:28:45



Component	Number	Retention	Area	Units
1_3-Butadiene	0	1.466	49.79	
	0	6.266	2.59	
	1	6.716	247.88	
	0	8.016	4.78	
	4		305.04	

4th STD (2.16ppm)
DIRECT 152 ml/min

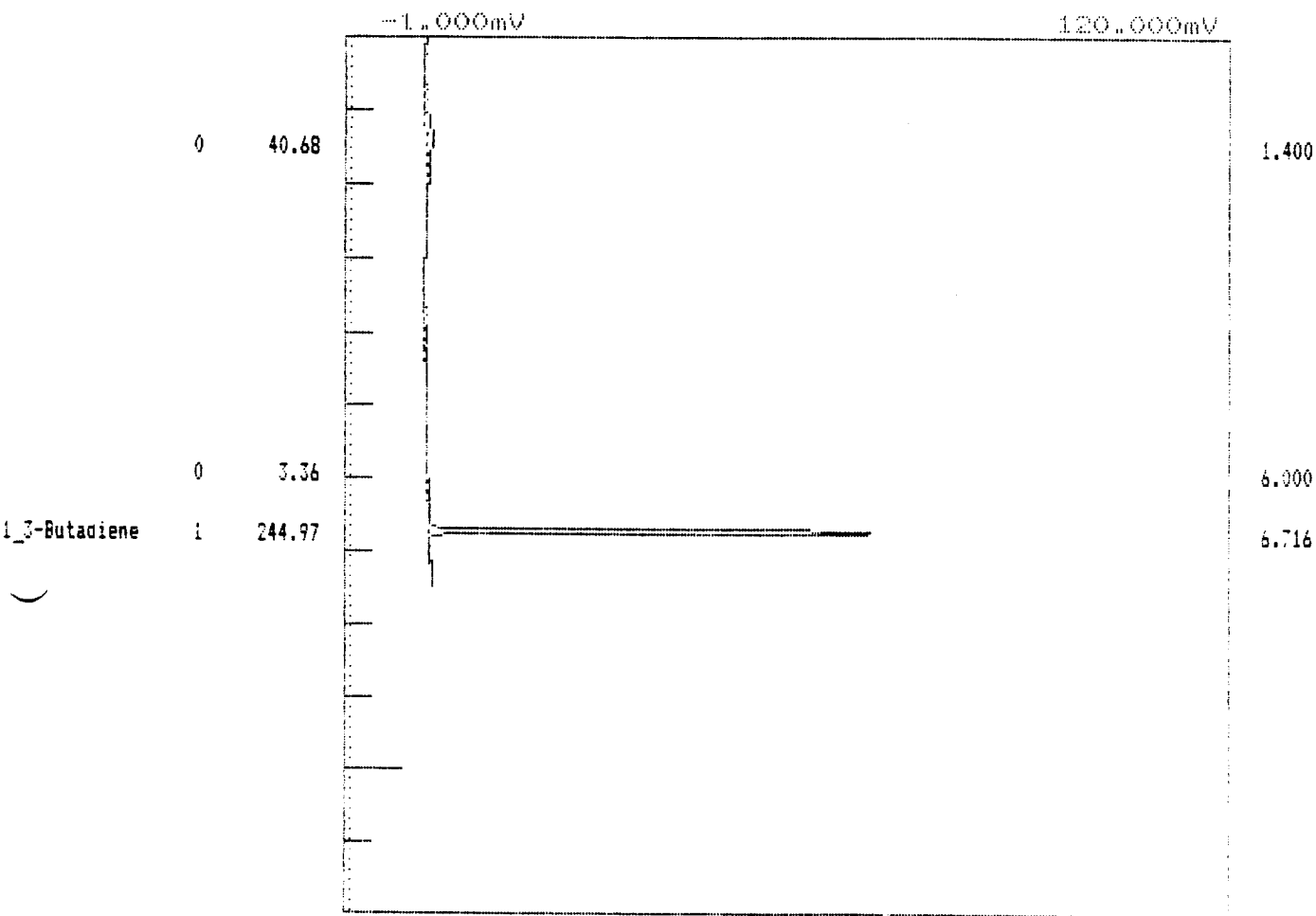
Operator : Gary Mata
File : CAL15
Temperature :
Components :
Date : 07/28/1992
Time : 13:40:13



Component	Number	Retention	Area	Units
1,3-Butadiene	0	1.383	45.98	
	1	6.716	246.14	
	2		292.12	

471 STD (2.16 min)
DIRECT 152.4/min

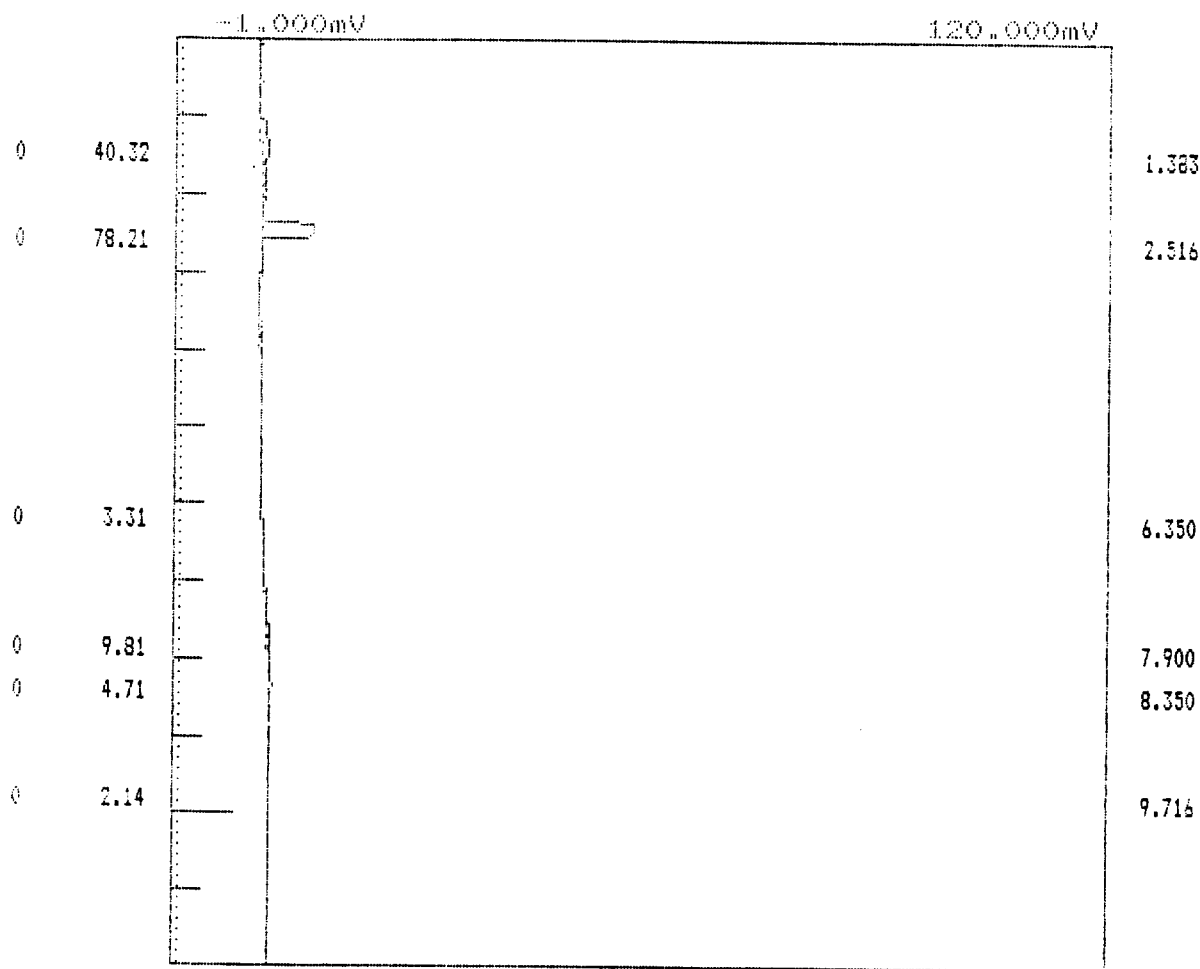
Operator : Gary Mata
File : CAL16
Temperature :
Components :
Date : 07/28/1992
Time : 13:45:30



Component	Number	Retention	Area	Units
	0	1.400	40.68	
	0	6.000	3.36	
1_3-Butadiene	1	6.716	244.97	
3			289.01	

AIR BLANK
DIRECT FLOW 155 ^{ml}/min

Operator : Gary Mata
File : CAL17
Temperature :
Components :
Date : 07/28/1992
Time : 13:56:54



Component	Number	Retention	Area	Units
	0	1.383	40.32	
	0	2.516	78.21	
	0	6.350	3.31	
	0	7.900	9.81	
	0	8.350	4.71	
	0	9.716	2.14	

6

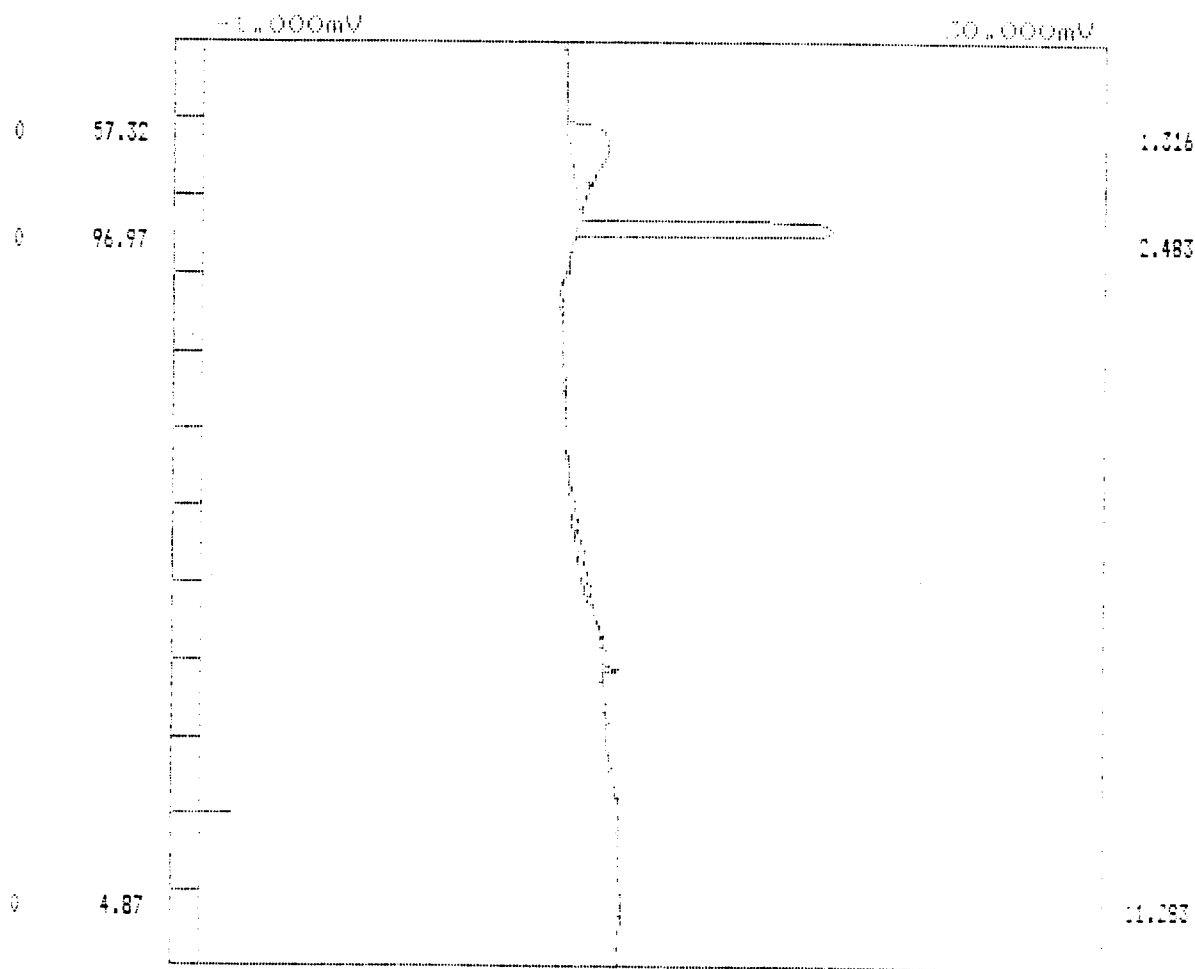
138.50

3 91

ENTROPY

ALL BURNER
DIRECT FLOW 155 ml/min

Operator : Gary Mata
File : Cal18
Temperature :
Components : default
Date : 07/29/1992
Time : 05:14:49



Component	Number	Retention	Area	Units
	0	1.316	57.32	
	0	2.483	96.97	
	0	11.283	4.87	

3

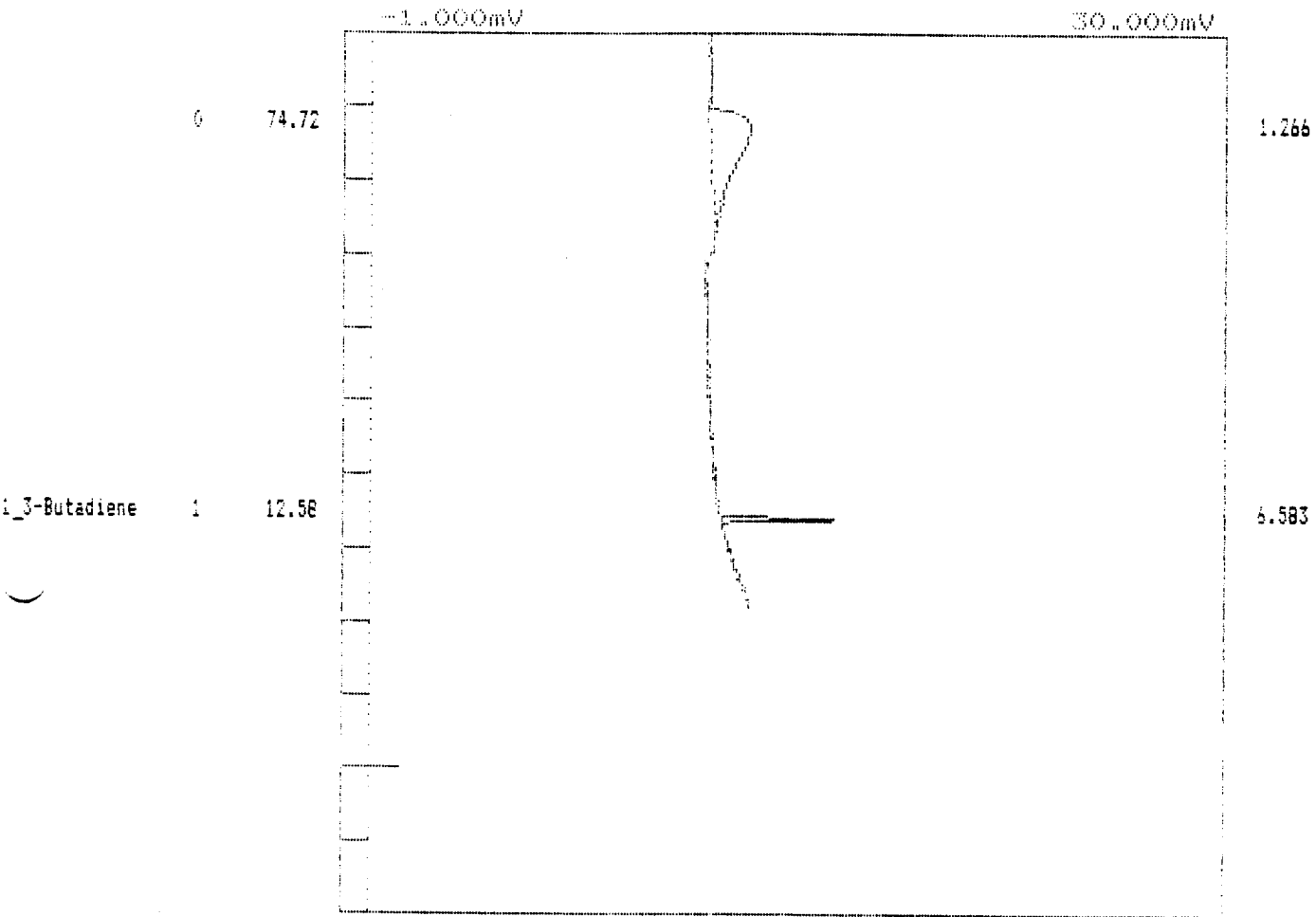
159.16

92

ENTROPY

MTD
LOW STD (0.0985ppm)
DIRECT 155 ml/min

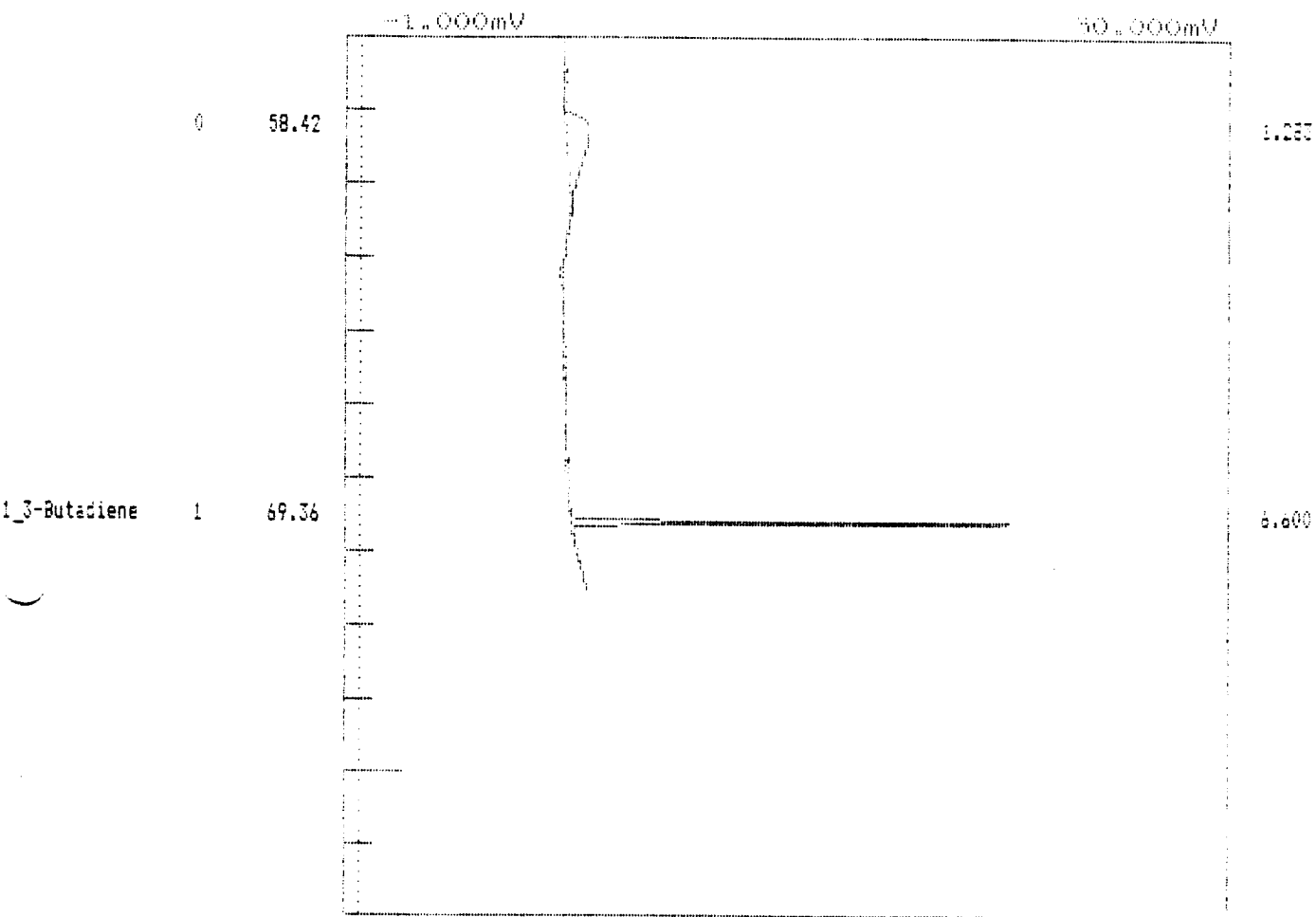
Operator : Gary Mata
File : Cal19
Temperature :
Components : default
Date : 07/29/1992
Time : 05:30:27



Component	Number	Retention	Area	Units
1_3-Butadiene	0	1.266	74.72	
	1	6.583	12.58	
	2		87.30	

M10 STD (0.540 ppm)
SUBST Flow 1.576/min

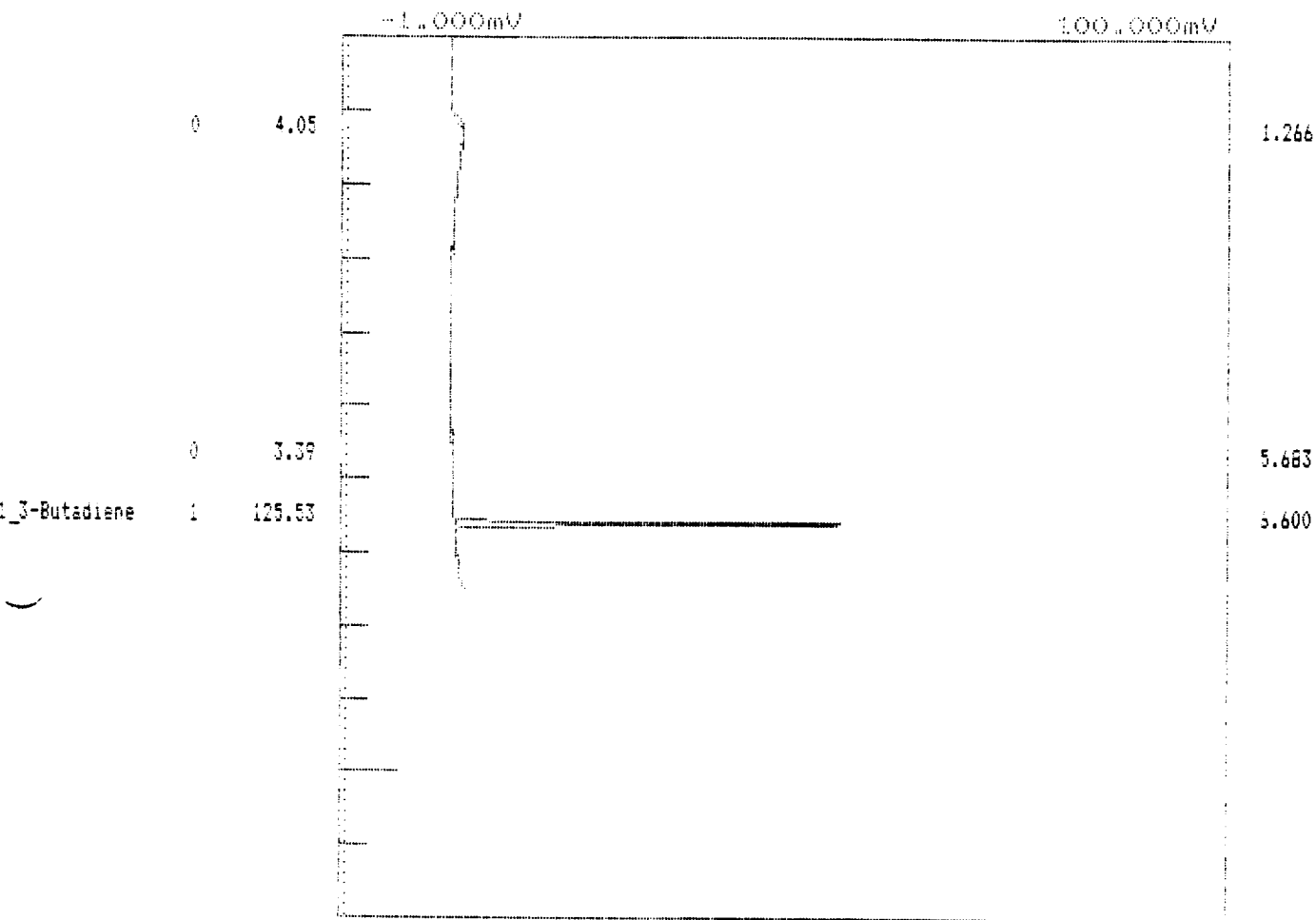
Operator : Gary Mata
File : Cal20
Temperature :
Components : default
Date : 07/29/1992
Time : 05:41:39



Component	Number	Retention	Area	Units
1_3-Butadiene	0	1.283	58.42	
	1	6.600	69.36	
	2		127.78	

HIGH STD(2.05ppm)
Direct Flow = 155ml/min

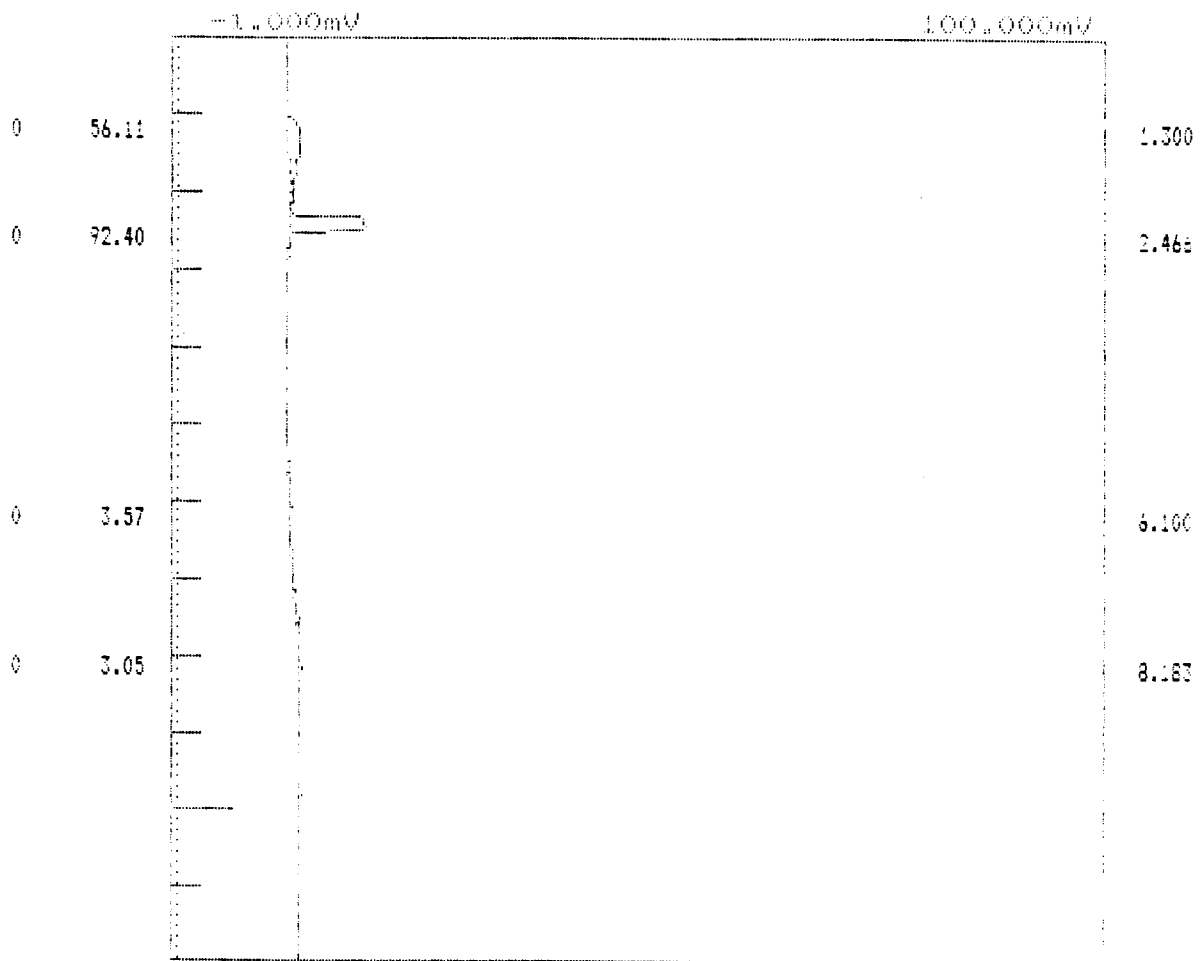
Operator : Gary Mata
File : Cal21
Temperature :
Components : default
Date : 07/29/1992
Time : 05:52:16



Component	Number	Retention	Area	Units
1_3-Butadiene	0	1.266	4.05	
	0	5.683	3.39	
	1	5.600	125.53	
	3		132.97	

ALL BLANK
DIRECT FLOW 55 ml/min

Operator : Gary Mata
File : Cal22
Temperature :
Components : default
Date : 07/29/1992
Time : 06:02:43



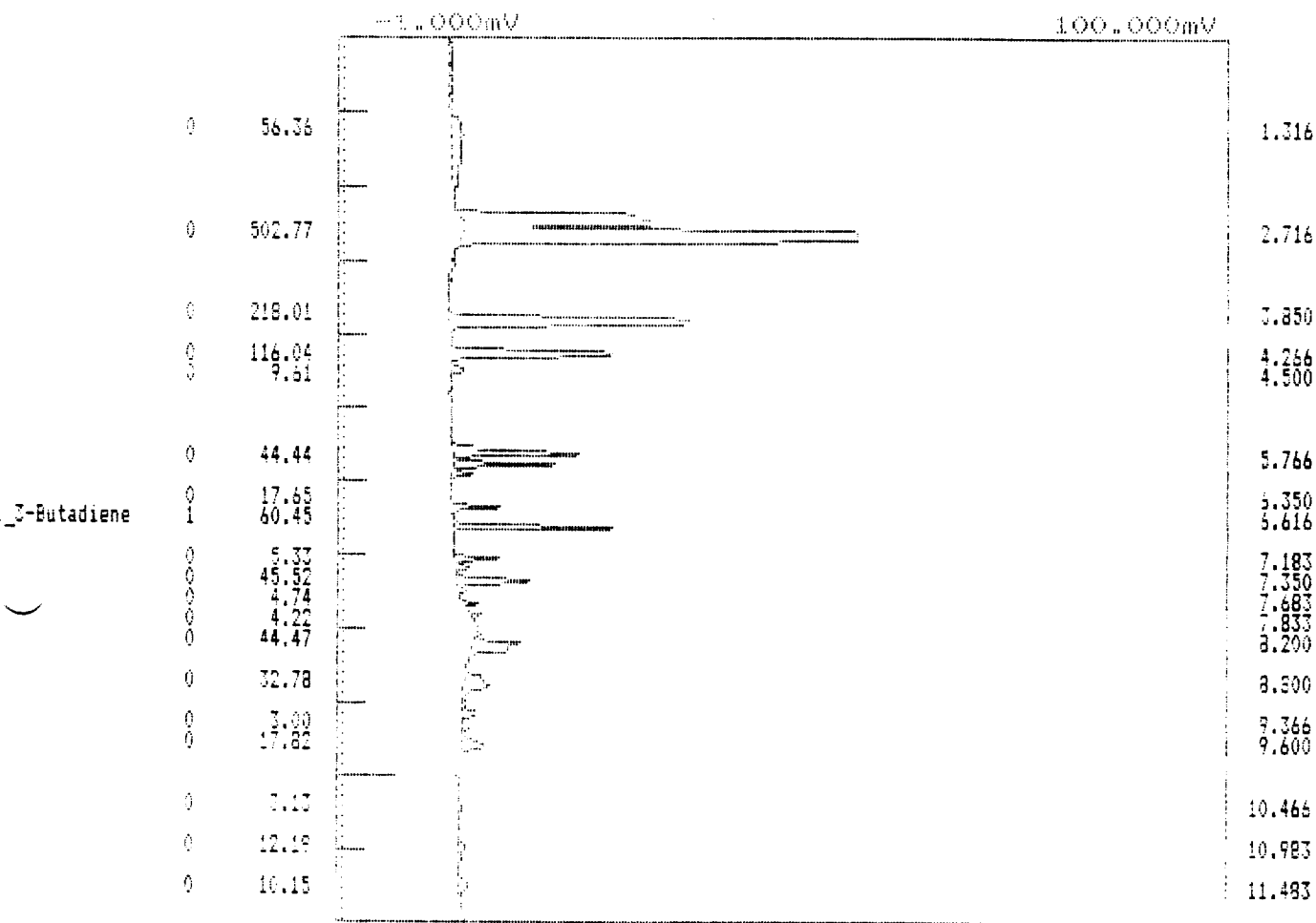
Component	Number	Retention	Area	Units
	0	1.300	56.11	
	0	2.466	92.40	
	0	6.100	3.57	
	0	8.183	3.05	
4			155.13	

12 INJECTION

1ST RUN

DIRECT FLOW = 152 $\frac{\text{ml}}{\text{min}}$

Operator : Gary Mata
File : 422-1-1
Temperature :
Components : default
Date : 07/29/1992
Time : 07:45:13



3-Butadiene

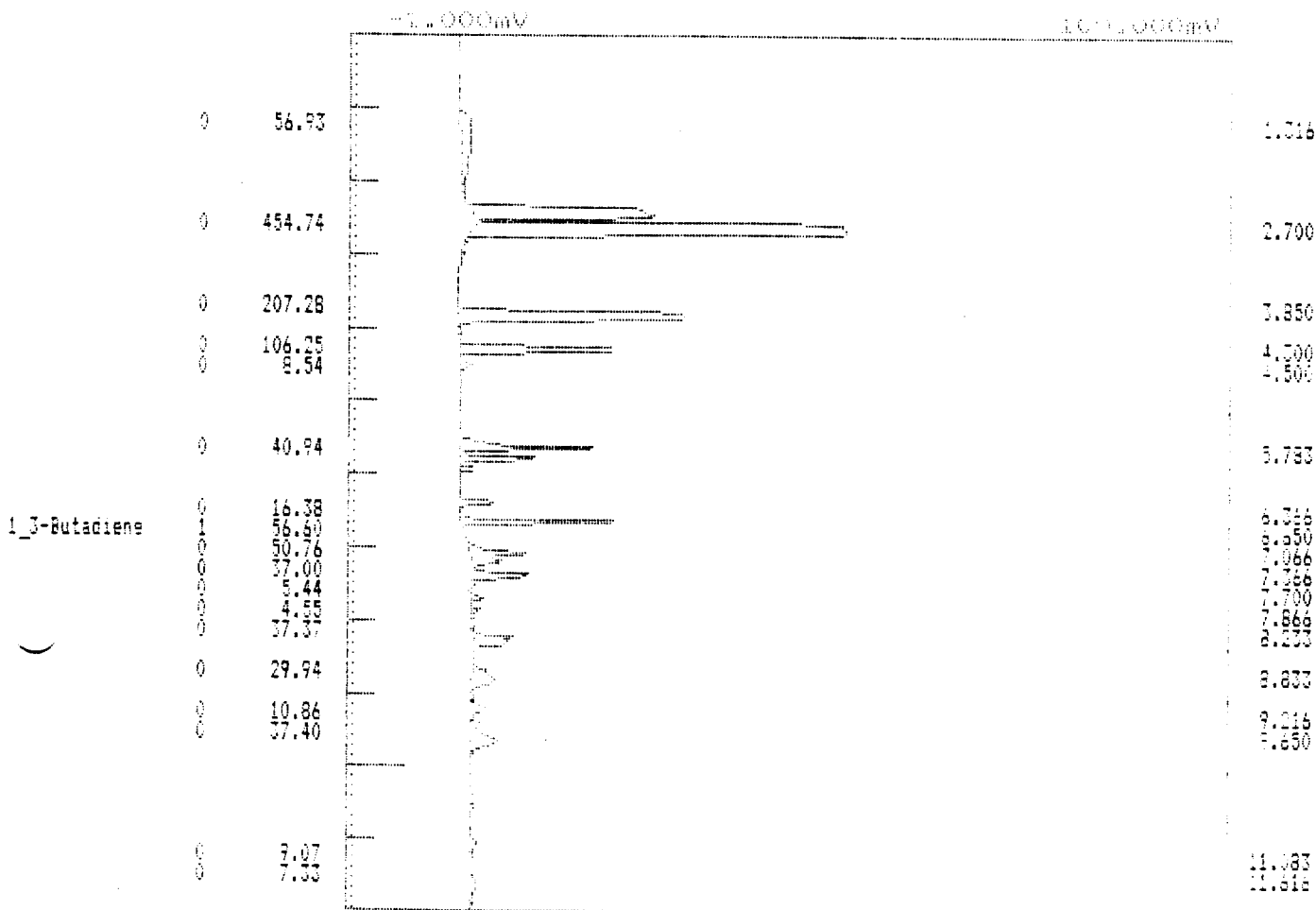
3-Butadiene

Component	Number	Retention	Area	Units
-----------	--------	-----------	------	-------

0	1.316	56.36
0	2.500	226.74
0	2.716	502.77
0	3.850	218.01
0	4.266	116.04
0	4.500	9.61
0	5.616	67.42
0	5.766	44.44
0	6.350	17.65
1	6.616	60.45
0	7.050	16.74
0	7.183	5.33
0	7.350	45.52
0	7.683	4.74
0	7.833	4.22
0	8.200	44.47
0	8.500	32.78
0	9.166	3.00
0	9.366	17.82
0	9.600	17.82
0	10.466	10.15
0	10.983	10.15
0	11.483	10.15

ENTROPY

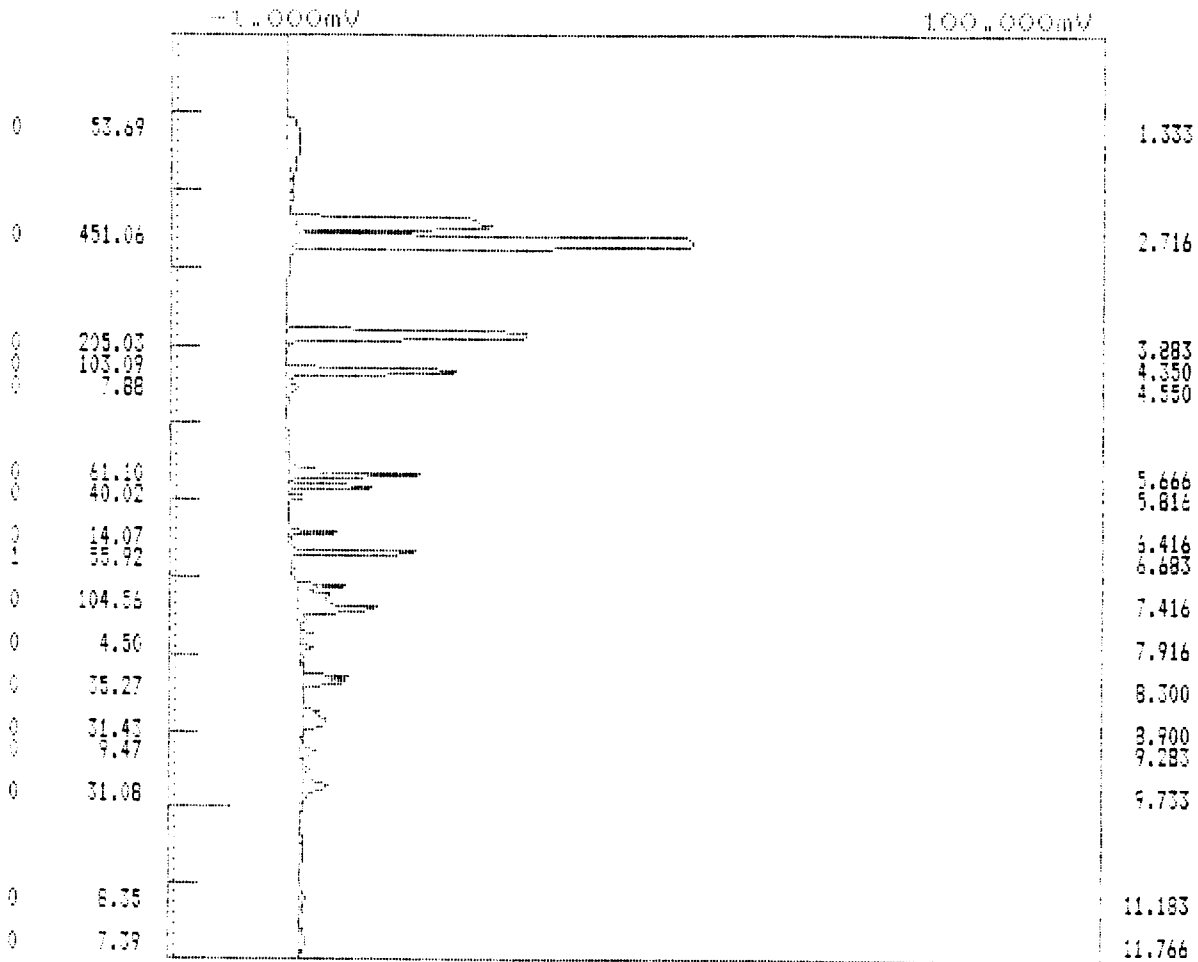
Operator : Gary Mata
 File : 42221-2
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 08:00:29



Component	Number	Retention	Area	Units
	0	1.316	56.93	
	0	2.483	211.62	
	0	2.700	454.74	
	0	3.850	207.28	
	0	4.300	106.25	
	0	4.500	8.54	
	0	5.433	60.42	
	0	5.733	40.94	
	0	6.366	16.38	
1_3-Butadiene	1	6.650	56.60	
	0	7.066	50.76	
	0	7.366	37.00	
	0	7.700	5.44	
	0	7.866	4.55	
	0	8.233	37.37	
	0	8.833	29.94	
	0	9.216	10.86	
	0	9.650	37.40	
	0	11.083	7.07	
	0	11.616	7.33	

5-20-92
1ST RUN
DIRECT FLOW 152 ml/min

Operator : Gary Mata
File : 422-1-3
Temperature :
Components : default
Date : 07/29/1992
Time : 08:15:48



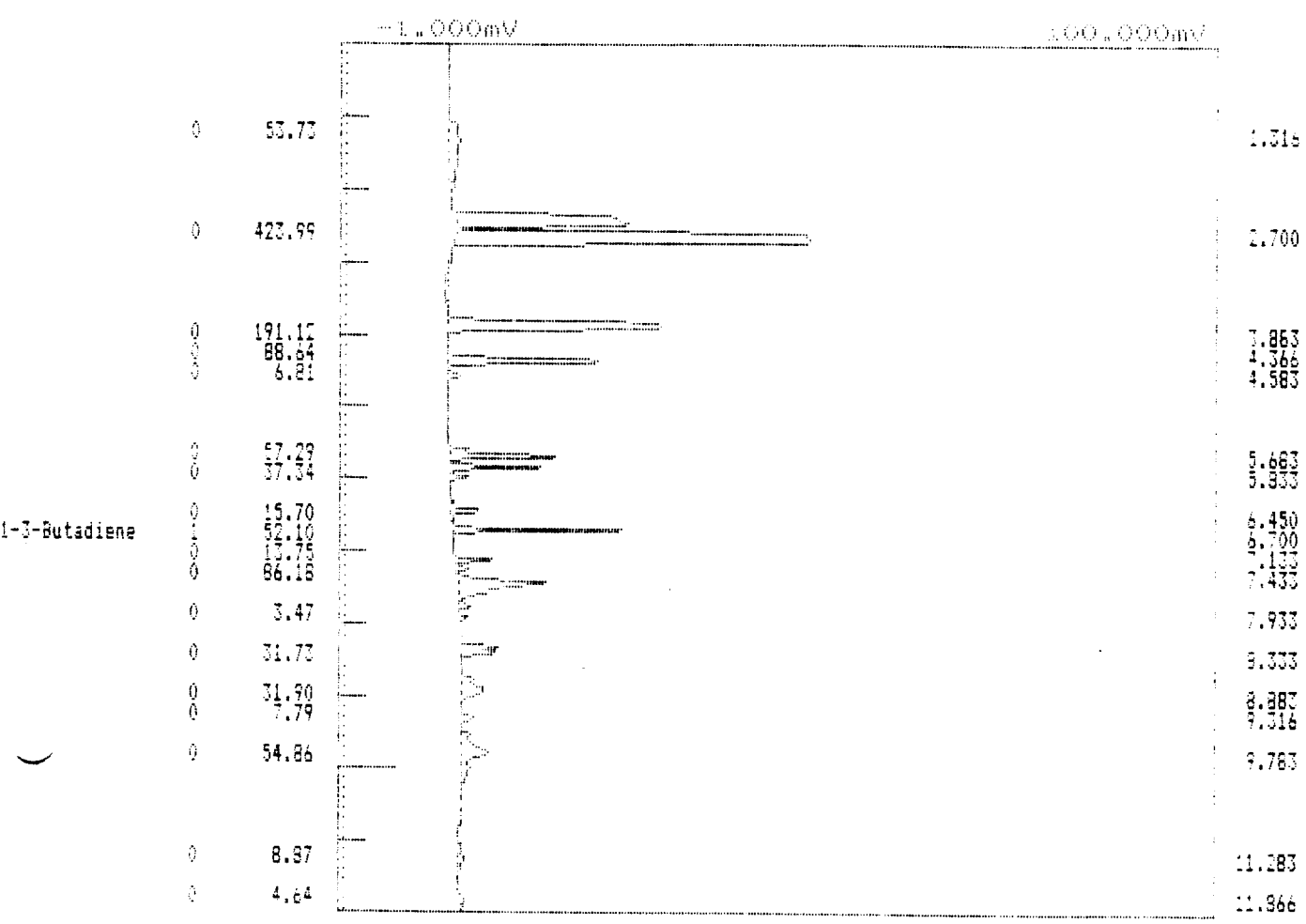
Component	Number	Retention	Area	Units
1-3-Butadiene	0	1.333	53.69	
	0	2.466	205.61	
	0	2.716	451.06	
	0	3.883	205.03	
	0	4.350	103.09	
	0	4.550	7.88	
	0	5.666	61.10	
	0	5.816	40.02	
	0	6.416	14.07	
	1	6.683	35.92	
	0	7.416	104.56	
	0	7.950	4.83	
	0	7.916	4.50	
	0	8.300	35.27	
	0	8.900	31.43	
	0	9.283	9.47	
	0	9.733	31.08	
	0	11.183	8.35	
	0	11.766	7.39	

4-2-12-10

1-3-Butadiene

Direct Flow 1521

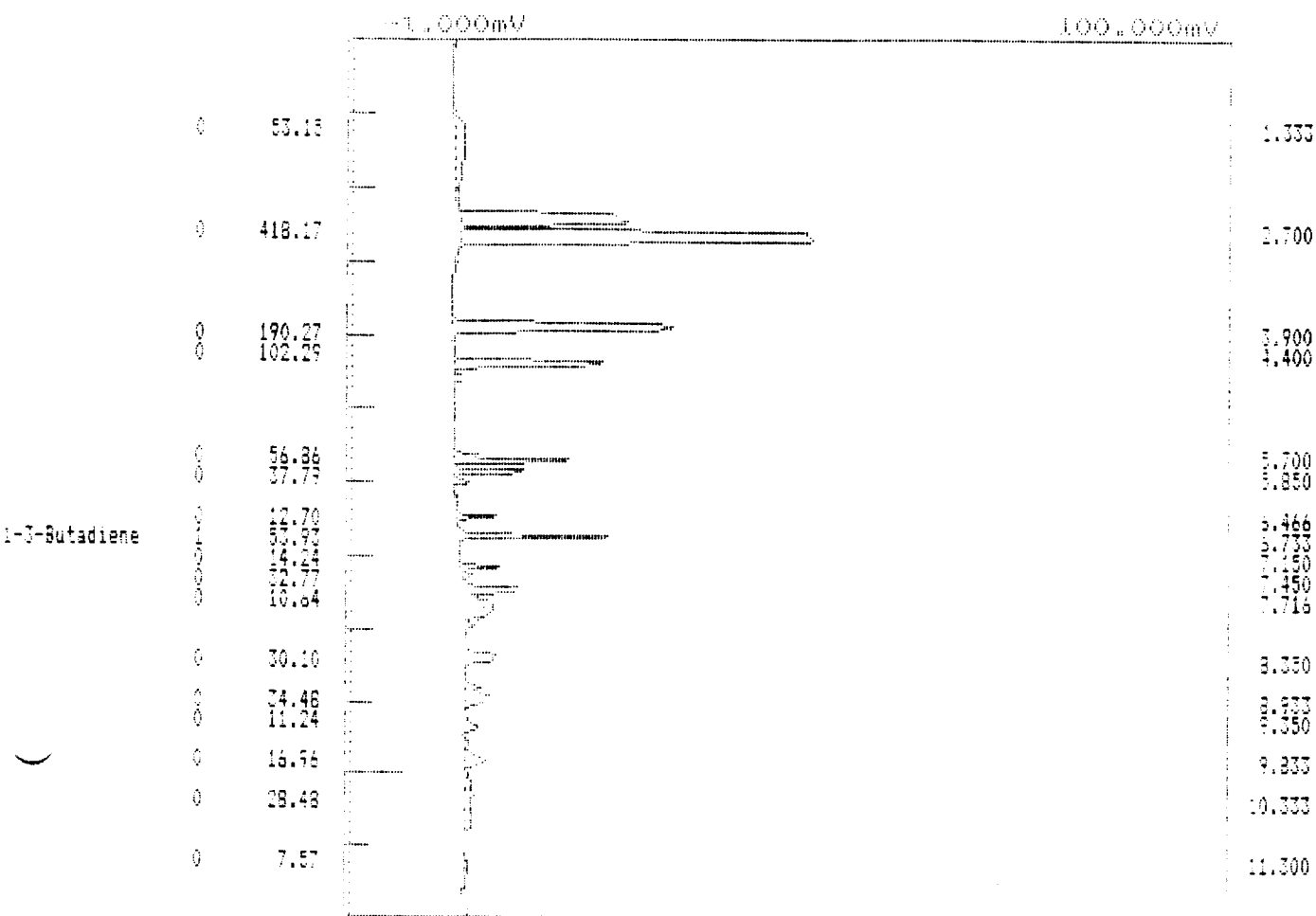
Operator : Gary Mata
File : 422-1-4
Temperature :
Components : default
Date : 07/29/1992
Time : 08:31:02



Component	Number	Retention	Area	Units
1-3-Butadiene	0	1.316	53.73	
	0	2.466	199.64	
	0	2.700	423.79	
	0	3.883	191.12	
	0	4.366	88.64	
	0	4.583	6.81	
	0	5.683	57.29	
	0	5.533	37.34	
	0	6.450	15.70	
	1	6.700	52.10	
	0	7.133	13.75	
	0	7.433	86.18	
	0	7.766	3.71	
	0	7.933	3.47	
	0	8.333	31.73	
	0	8.883	31.90	
	0	9.316	7.79	
	0	9.783	54.86	
	0	11.283	8.37	
	0	11.866	4.64	

5% INJECTION
 15% RUN
 DIRECT FLOW 152 ml/min

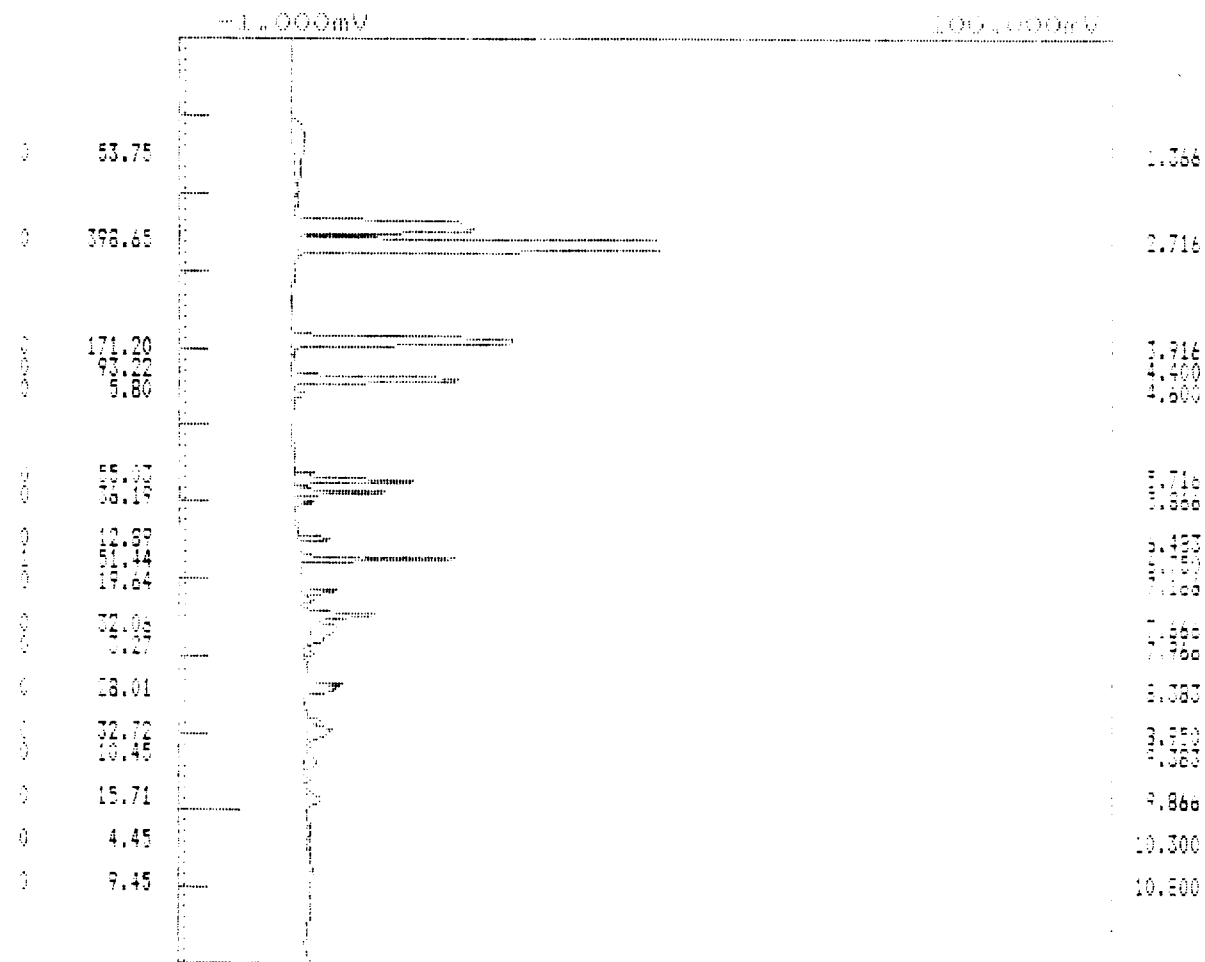
Operator : Gary Mata
 File : 422-1-5
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 08:46:07



Component	Number	Retention	Area	Units
	0	1.333	53.15	
	0	2.466	191.82	
	0	2.700	418.17	
	0	3.900	190.27	
	0	4.400	102.29	
	0	5.700	56.86	
	0	5.850	37.79	
	0	6.466	12.70	
	0	6.733	33.93	
	0	7.150	14.24	
	0	7.264	4.37	
	0	7.450	32.77	
	0	7.716	10.64	
	0	8.350	30.10	
	0	8.833	34.48	
	0	9.350	11.24	
	0	9.833	16.76	
	0	10.333	26.48	
	0	11.300	7.57	

INJECTION
15 MIN
DIRECT FLOW 14.24%

Operator : Gary Mata
File : 422-1-6
Temperature :
Components : default
Date : 07/29/1992
Time : 09:01:25



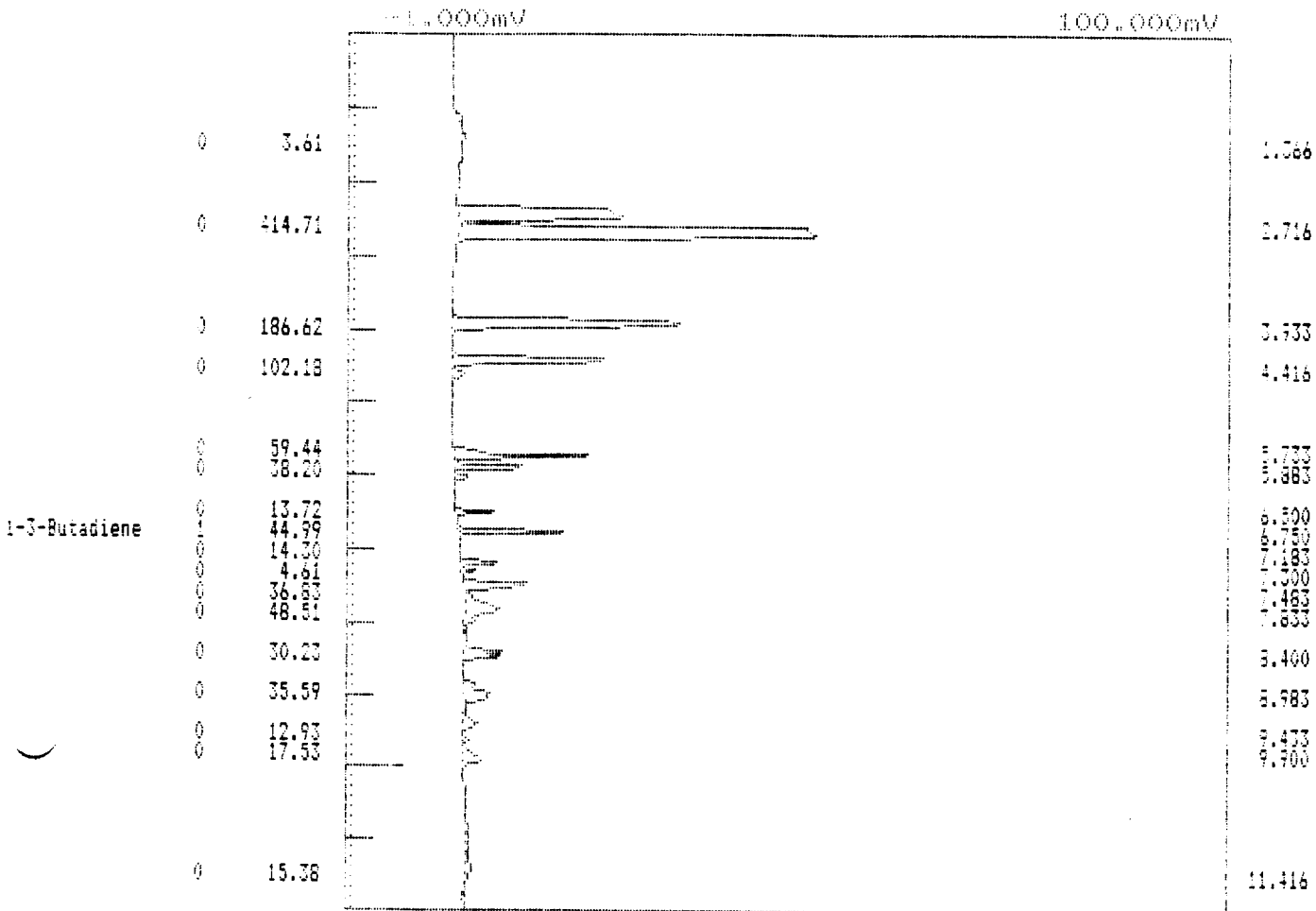
Component	Number	Retention	Area	Units
	0	1.366	43.75	
	0	2.466	187.66	
	0	2.716	398.65	
	0	3.916	171.20	
	0	4.400	93.22	
	0	4.600	5.80	
	0	5.716	55.03	
	0	5.866	38.19	
1-3-Butadiene	0	6.750	12.89	
	0	6.750	51.44	
	0	7.166	19.64	
	0	7.466	27.96	
	0	7.666	32.06	
	0	7.966	3.27	
	0	8.366	28.01	
	0	8.750	32.72	
	0	9.366	10.45	
	0	9.866	15.71	
	0	10.300	4.45	
	0	10.800	9.45	

7/29/92

12th RUN

DIRECT FLOW 152th M

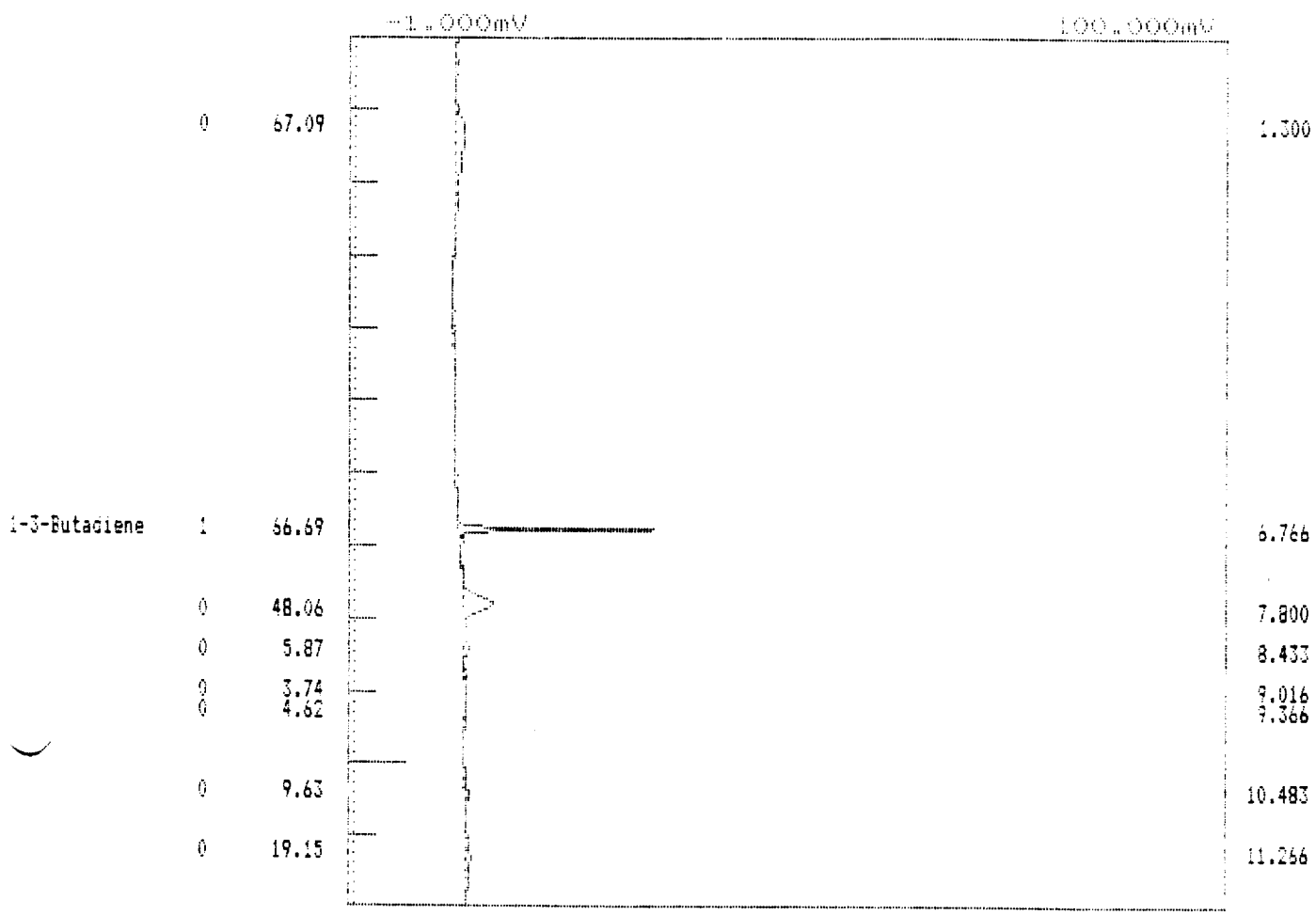
Operator : Gary Mata
File : 422-1-7
Temperature :
Components : default
Date : 07/29/1992
Time : 09:16:41



Component	Number	Retention	Area	Units
1-3-Butadiene	0	1.366	3.61	
	0	2.466	186.39	
	0	2.716	414.71	
	0	3.933	186.62	
	0	4.416	102.18	
	0	5.733	59.44	
	0	5.883	38.20	
	0	6.500	13.72	
	0	6.750	44.99	
	0	7.183	14.30	
	0	7.300	4.61	
	0	7.483	36.83	
	0	7.833	48.51	
	0	8.400	30.23	
	0	8.983	35.59	
	0	9.433	12.93	
	0	9.900	17.53	
	0	11.416	15.38	

MID 5.000mV
DIRECT FLOW = 152 ml/min

Operator : Gary Mata
File : 422-1-8
Temperature :
Components : default
Date : 07/29/1992
Time : 09:33:07



Component	Number	Retention	Area	Units
1-3-Butadiene	0	1.300	67.09	
	1	6.766	66.69	
	0	7.800	48.06	
	0	8.433	5.87	
	0	9.016	3.74	
	0	9.366	4.62	
	0	10.483	9.63	
	0	11.266	19.15	

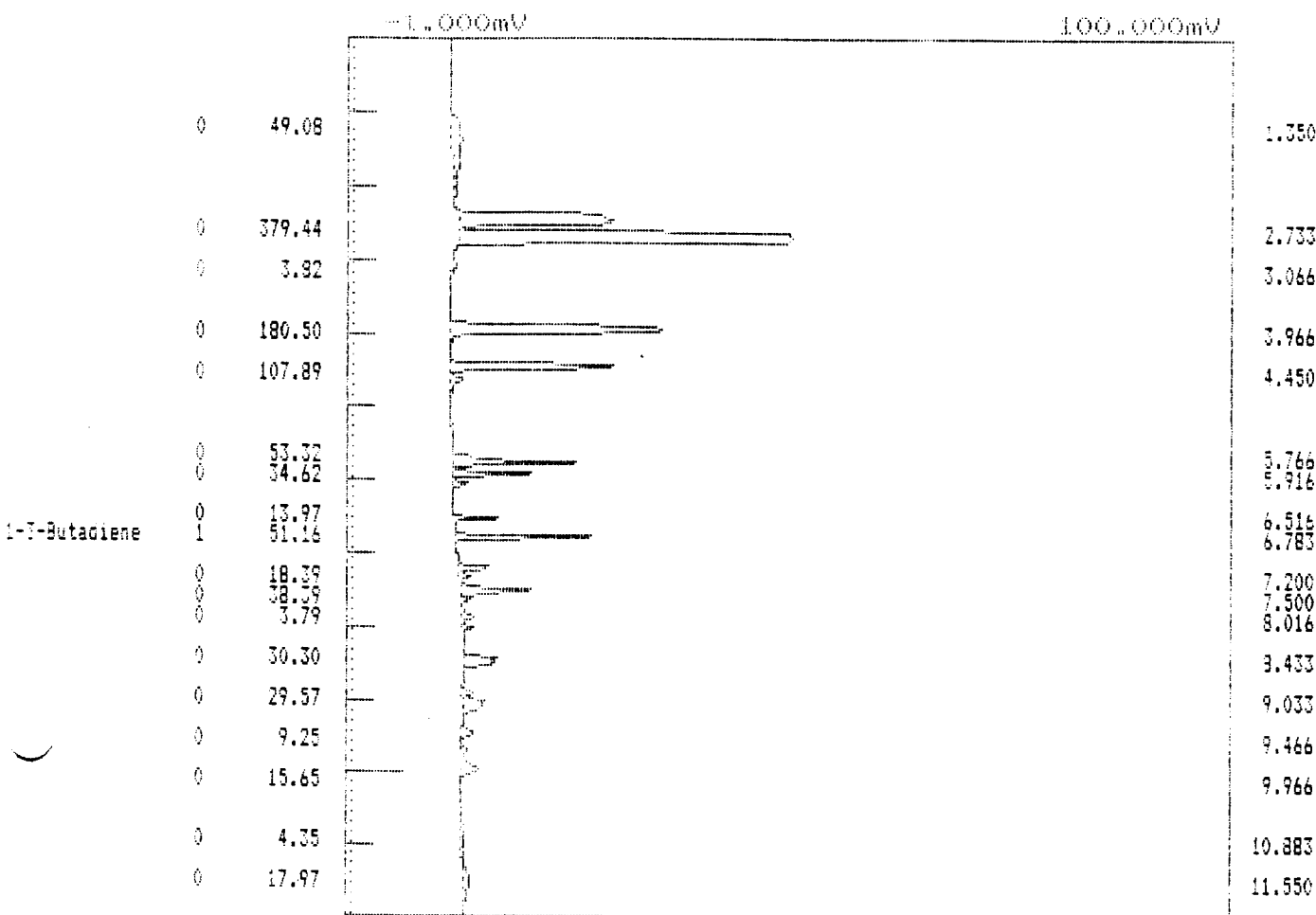
8 224.86

3104

ENTROPY

3rd INJECTION
 1ST RUN
 DIRECT FLOW 152.4 μm

Operator : Gary Mata
 File : 422-1-9
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 09:54:52



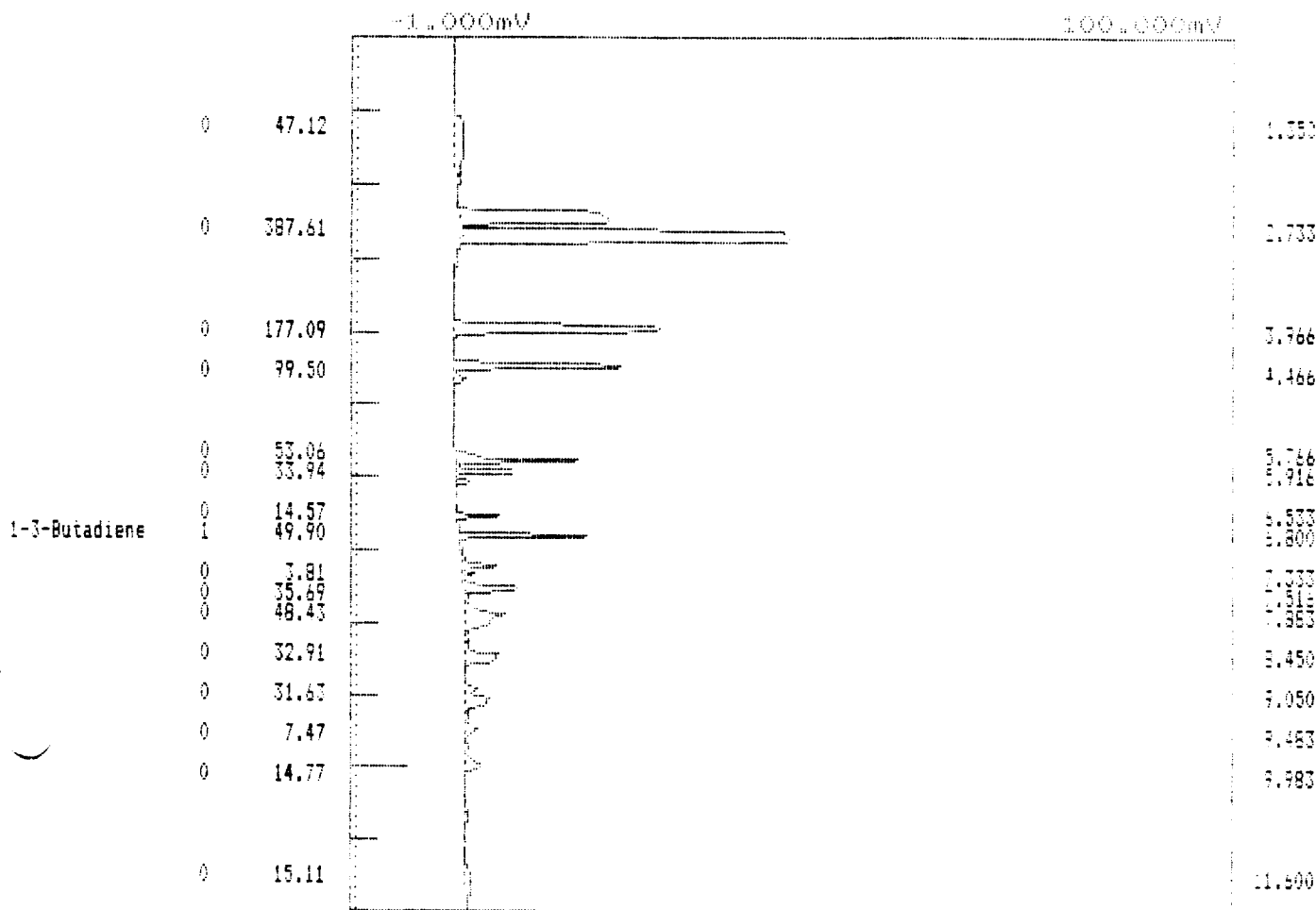
1-3-Butadiene

1-3-Butadiene

Component	Number	Retention	Area	Units
	0	1.350	49.08	
	0	2.733	379.44	
	0	3.066	3.82	
	0	3.966	180.50	
	0	4.450	107.89	
	0	5.766	53.32	
	0	5.916	34.62	
	0	6.516	13.97	
	1	6.783	51.16	
	0	7.200	18.39	
	0	7.500	38.39	
	0	7.866	5.32	
	0	8.016	3.79	
	0	8.433	30.30	
	0	9.033	29.57	
	0	9.466	9.25	
	0	9.966	15.65	
	0	10.883	4.35	
	0	11.550	17.97	

Operator : Gary Mata
 File : 422-1-10
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 10:11:35

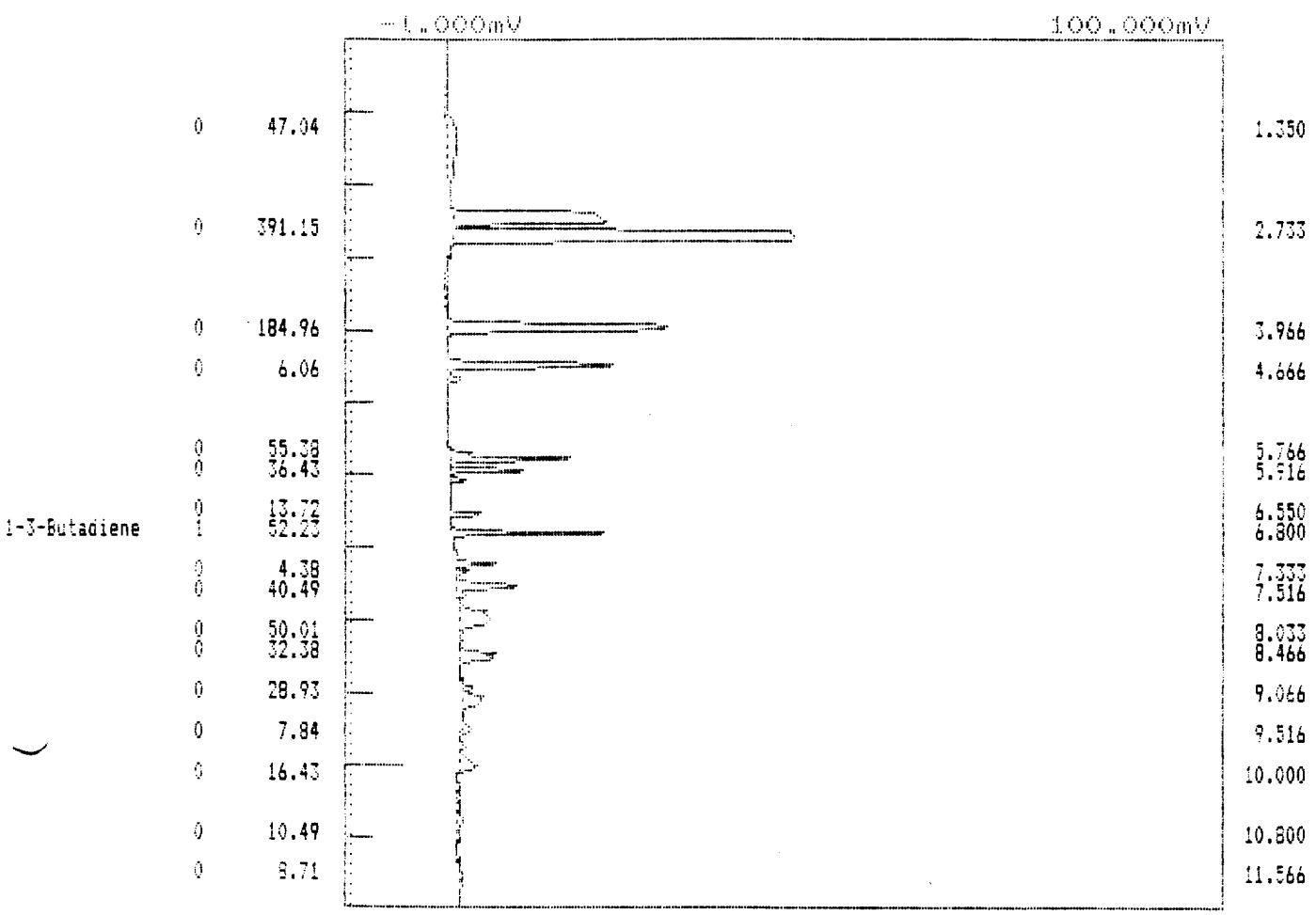
17.000
Direct to disk 152 mV/min



Component	Number	Retention	Area	Units
1-3-Butadiene	0	1.350	47.12	
	0	2.483	177.09	
	0	2.733	387.61	
	0	3.766	177.09	
	0	4.466	99.50	
	0	5.766	53.06	
	0	5.916	33.94	
	0	6.533	14.57	
	1	6.800	49.90	
	0	7.216	16.04	
	0	7.333	3.81	
	0	7.516	35.69	
	0	7.883	48.43	
	0	8.450	32.91	
	0	9.050	31.63	

10th INJECTION
 1st RUN
 DIRECT FLOW 152.6 $\frac{\mu}{min}$

Operator : Gary Mata
 File : 422-1-11
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 10:27:51



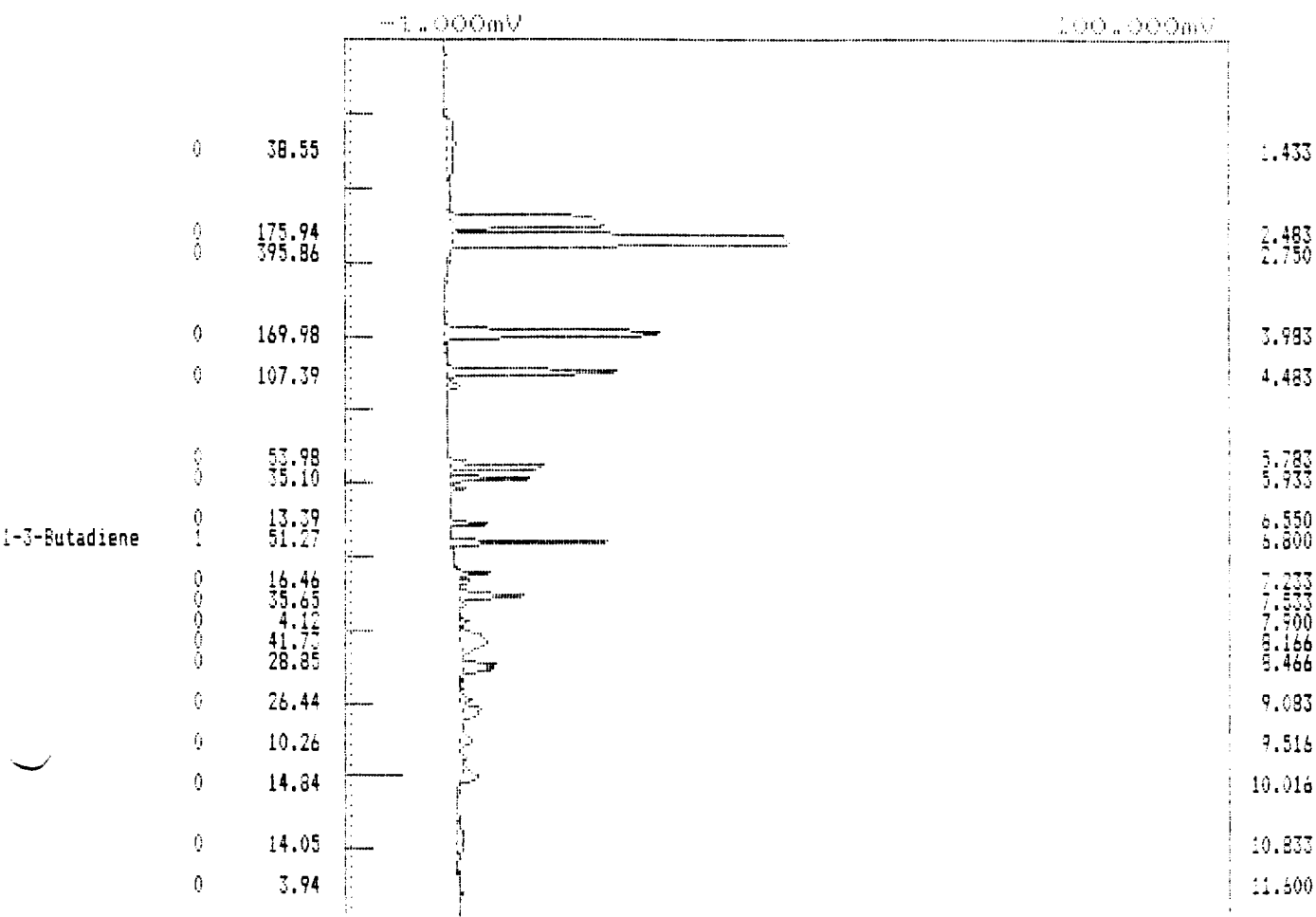
1-3-Butadiene

1-3-Butadiene

Component	Number	Retention	Area	Units
	0	1.350	47.04	
	0	2.483	171.33	
	0	2.733	391.15	
	0	3.966	184.96	
	0	4.483	97.40	
	0	4.666	6.06	
	0	5.766	55.38	
	0	5.916	36.43	
	0	6.550	13.72	
1-3-Butadiene	1	6.800	52.23	
	0	7.216	16.25	
	0	7.333	4.38	
	0	7.516	40.49	
	0	8.033	50.01	
	0	8.466	32.38	
	0	9.066	28.93	
	0	9.516	7.84	
	0	10.000	16.43	
	0	10.800	10.49	
	0	11.566	8.71	

Operator : Gary Mata
 File : 422-1-12
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 10:43:38

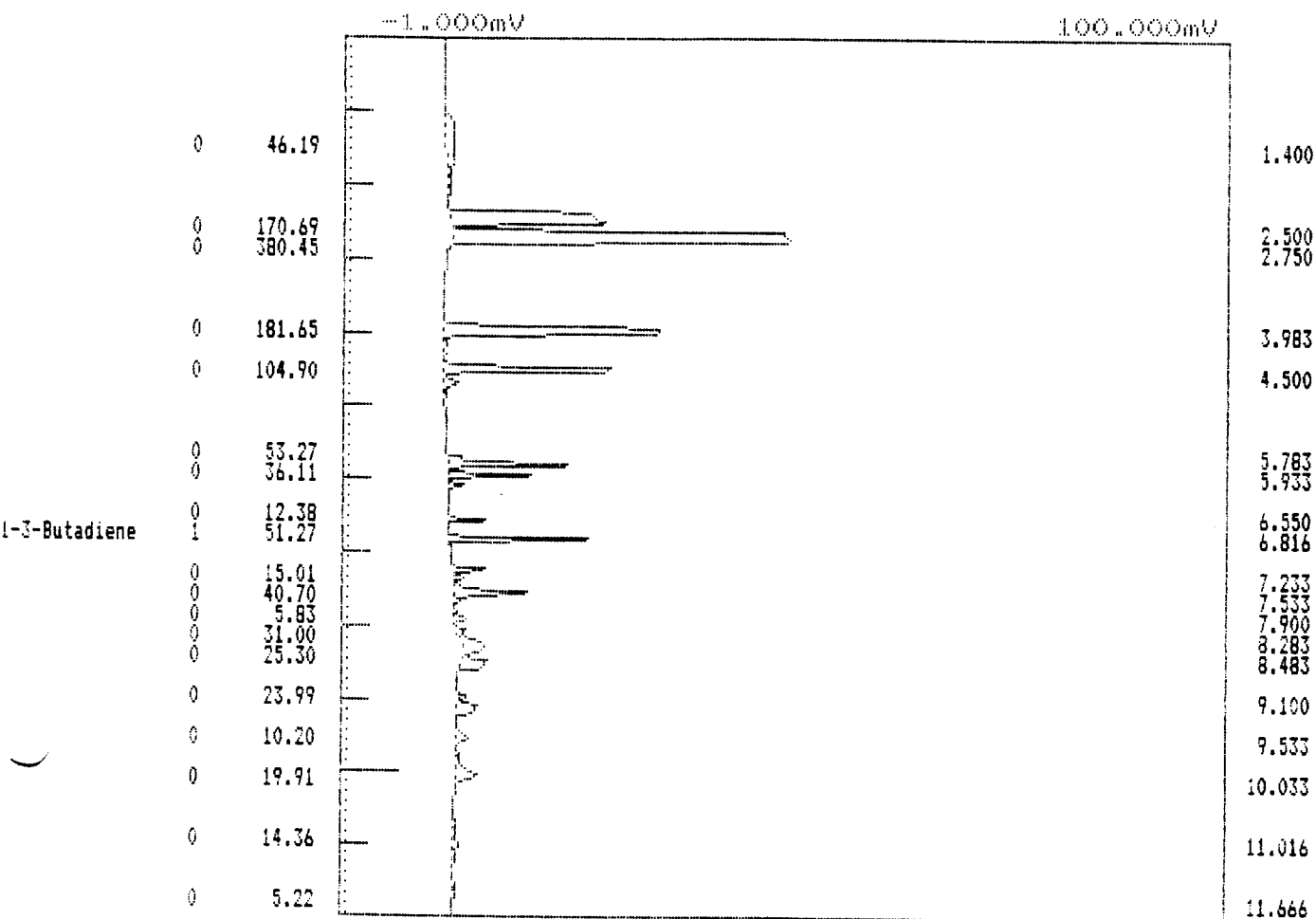
152 mL/min
 DIRECT FLOW = 152 mL/min



Component	Number	Retention	Area	Units
	0	1.433	38.55	
	0	2.483	175.94	
	0	2.750	395.86	
	0	3.983	169.98	
	0	4.483	107.39	
	0	5.783	53.98	
	0	5.933	35.10	
	0	6.550	13.39	
1-3-Butadiene	1	6.800	51.27	
	0	7.233	16.46	
	0	7.533	35.65	
	0	7.900	4.12	
	0	8.166	41.73	
	0	8.466	28.85	
	0	9.083	26.44	
	0	9.516	10.26	
	0	10.016	14.84	
	0	10.833	14.05	
	0	11.500	3.94	

12TH INJECTION1ST RUNDIRECT FLOW = 152 $\frac{mL}{hr}$

Operator : Gary Mata
 File : 422-1-13
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 10:58:59



Component	Number	Retention	Area	Units
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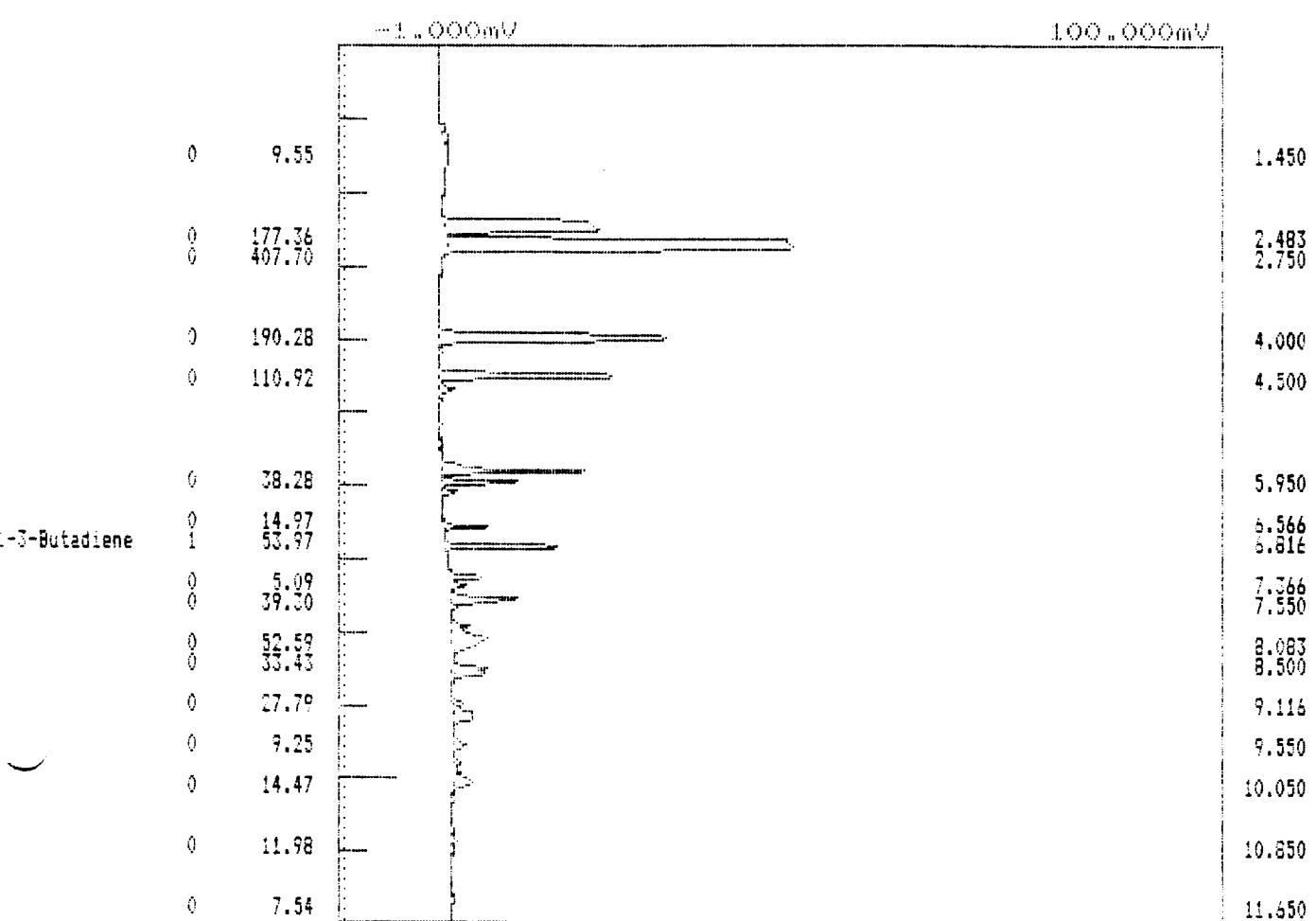
	0	1.400	46.19	
	0	2.500	170.69	
	0	2.750	380.45	
	0	3.983	181.65	
	0	4.500	104.90	
	0	5.783	53.27	
	0	5.933	36.11	
	0	6.550	12.38	
1-3-Butadiene	1	6.816	51.27	
	0	7.233	15.01	
	0	7.533	40.70	
	0	7.900	5.83	
	0	8.283	31.00	
	0	8.483	25.30	
	0	9.100	23.99	
	0	9.533	10.20	
	0	10.033	19.91	
	0	11.016	14.36	
	0	11.666	5.22	

15-105-01112

1ST RUN

DIRECT FLOW 152nd Min

Operator : Gary Mata
File : 422-1-14
Temperature :
Components : default
Date : 07/29/1992
Time : 11:15:34



1-3-Butadiene

1-3-Butadiene

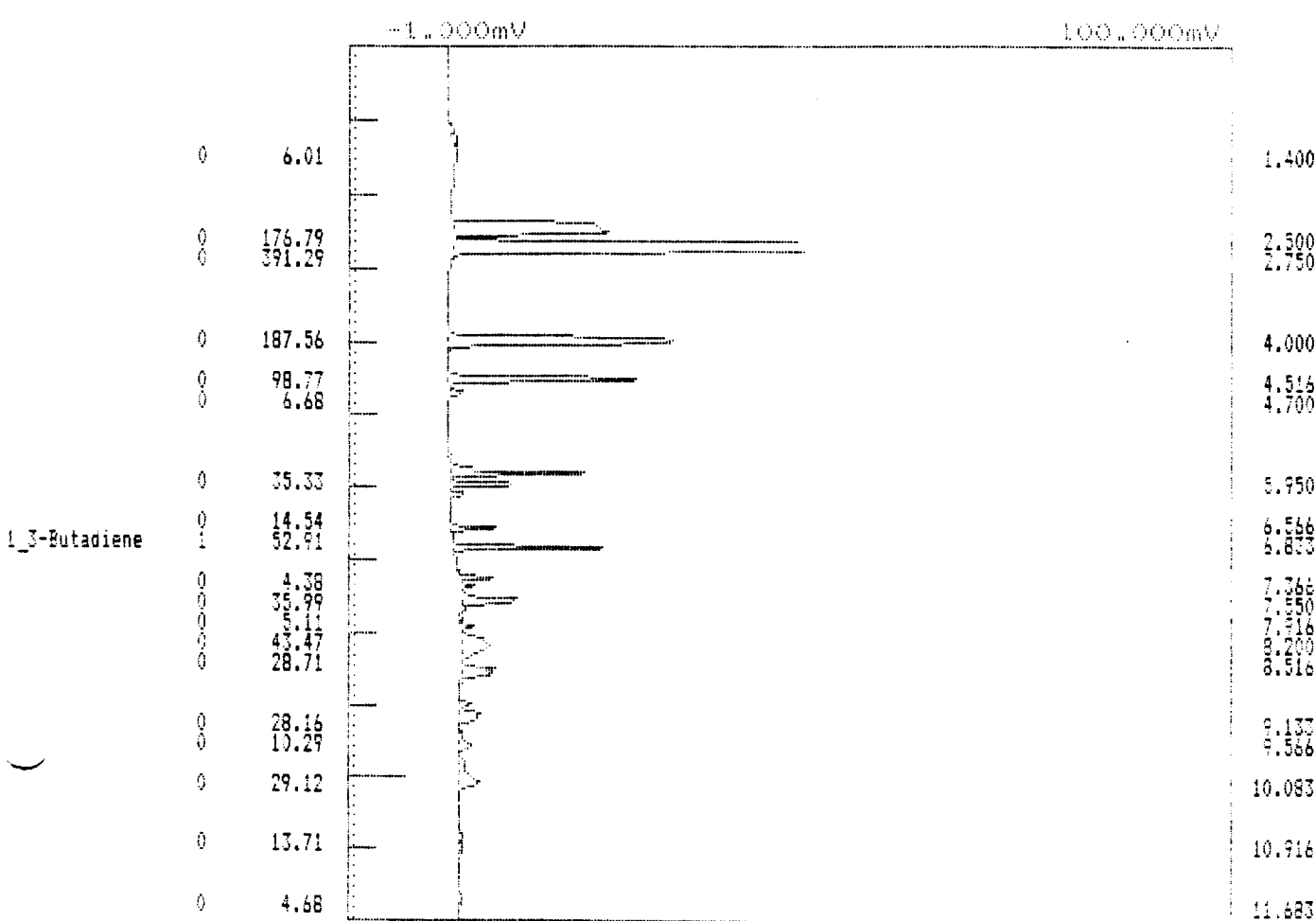
Component	Number	Retention	Area	Units
	0	1.450	9.55	
	0	2.483	177.36	
	0	2.750	407.70	
	0	4.000	190.28	
	0	4.500	110.92	
	0	5.950	38.28	
	0	6.566	14.97	
	0	6.816	53.97	
1-3-Butadiene	1	7.250	10.99	
	0	7.366	5.09	
	0	7.550	39.30	
	0	8.083	52.59	
	0	8.500	33.43	
	0	9.116	27.79	
	0	9.550	9.25	
	0	10.050	14.47	
	0	10.850	11.98	
	0	11.650	7.54	

143 INJECTION

12 RUN

DIRECT FLOW 152.4/min

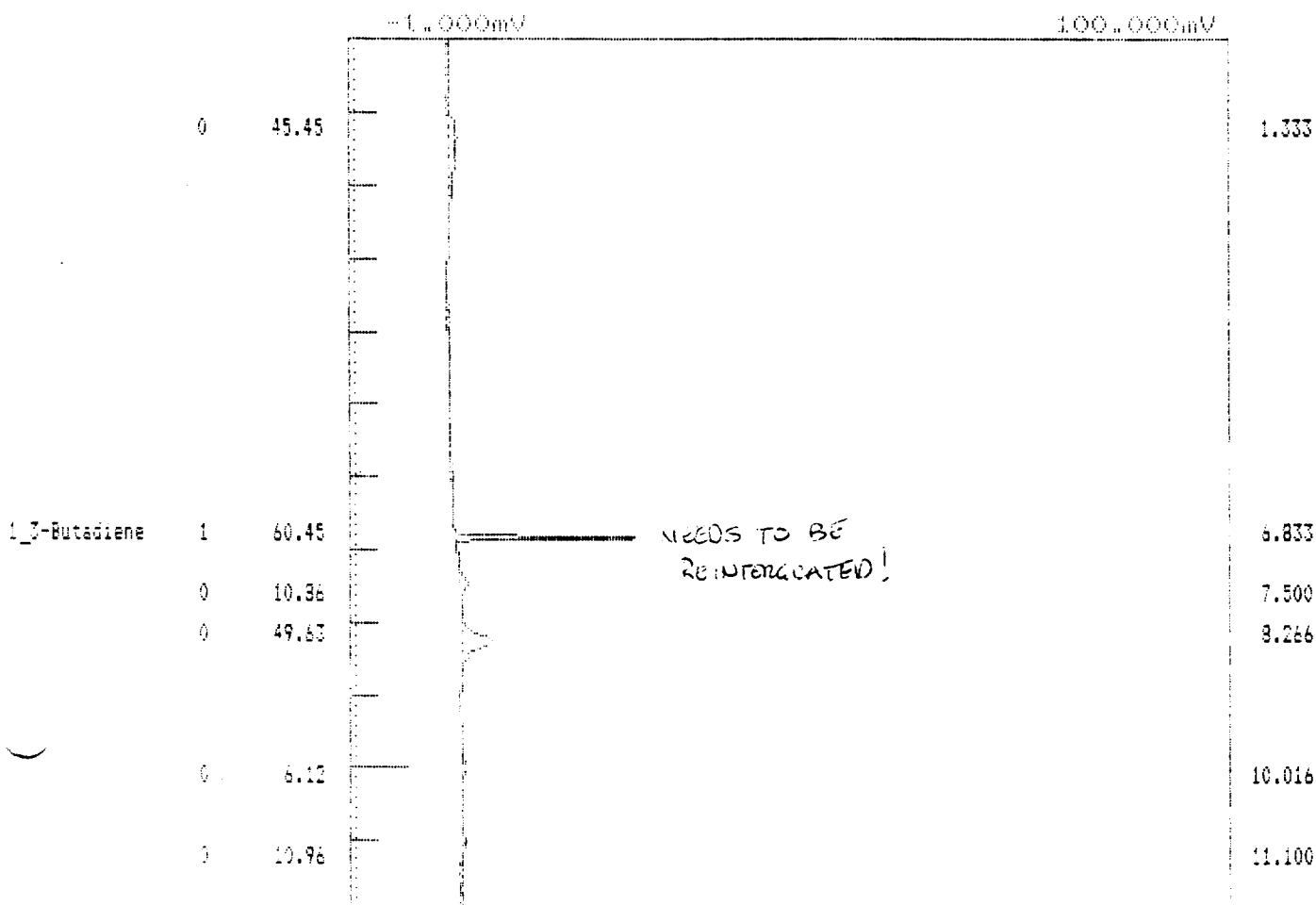
Operator : Gary Mata
 File : 422-1-15
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 11:31:30



Component	Number	Retention	Area	Units
1,3-Butadiene	0	1.400	6.01	
	0	2.500	176.79	
	0	2.750	391.29	
	0	4.000	187.56	
	0	4.516	98.77	
	0	4.700	6.68	
	0	5.800	35.33	
	0	5.950	14.54	
	0	6.566	52.91	
	1	6.833	9.89	
	0	7.250	4.38	
	0	7.366	35.99	
	0	7.550	5.11	
	0	7.916	43.47	
	0	8.200	28.71	
	0	8.516	28.16	
	0	9.133	10.29	
	0	9.566	29.12	
	0	10.083	13.71	
	0	10.916	4.68	
	0	11.683		

Operator : Gary Mata
 File : 422-1-16
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 11:48:01

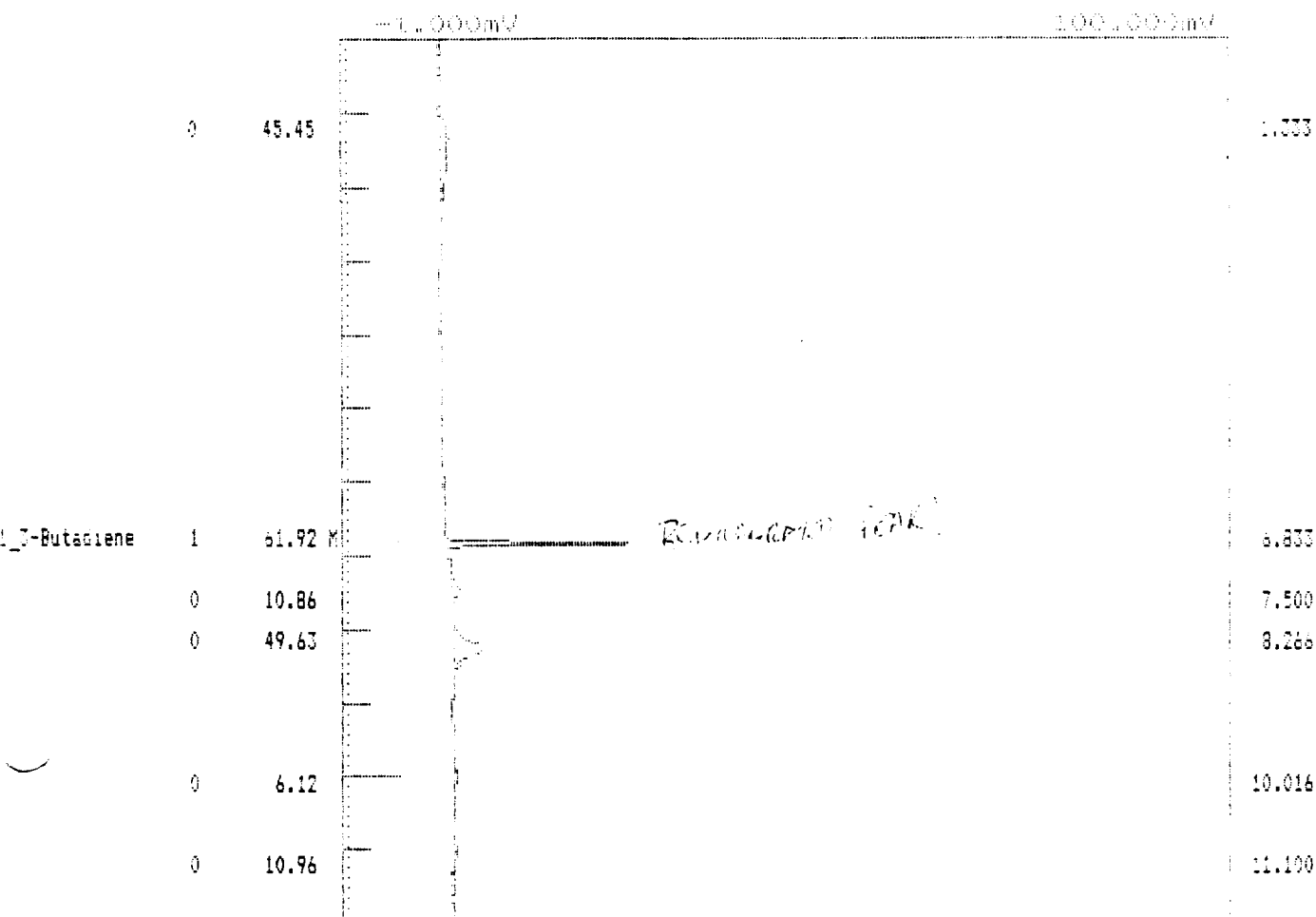
MID STD (0.540ppm)
 DIRECT FLOW 182.47
 125 ROL



Component	Number	Retention	Area	Units
1,3-Butadiene	0	1.333	45.45	
	1	6.833	60.45	
	0	7.500	10.36	
	0	8.266	49.63	
	0	10.016	6.12	
	0	11.100	10.96	
	6		183.47	

1.333
 5.833
 7.500 8.266

Operator : Gary Mata
 File : 422-1-16
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 11:48:01



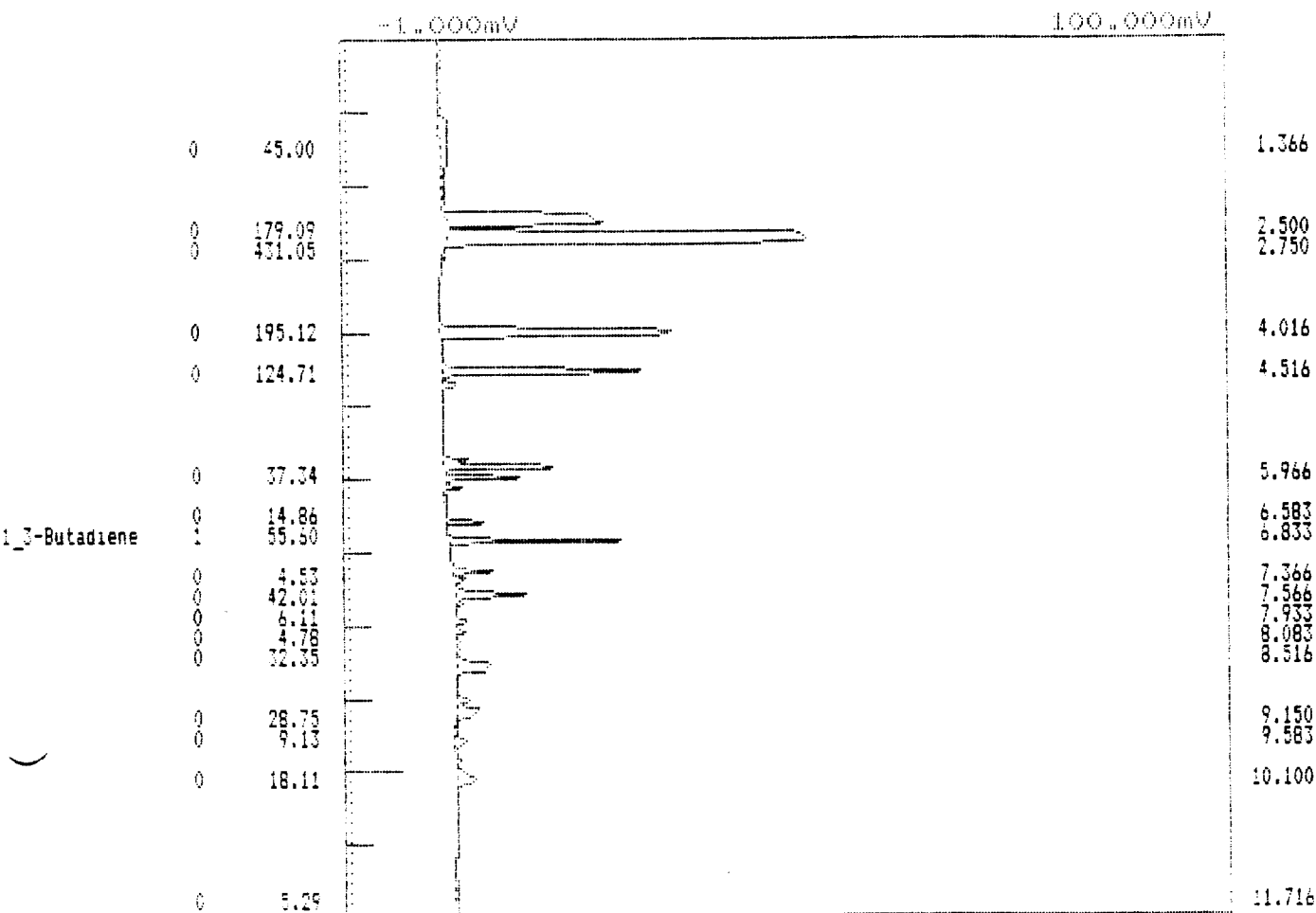
Component	Number	Retention	Area	Units
1,3-Butadiene	0	1.333	45.45	
	1	6.833	61.92 M	
	0	7.500	10.86	
	0	8.266	49.63	
	0	10.016	6.12	
	0	11.100	10.96	
	6		184.94	

0113

ENTROPY

Operator : Gary Mata
 File : 422-1-17
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 12:04:11

125 INJECTION
 125 INJ
 7.000 5.000 150 $\frac{\mu\text{m}}{\text{min}}$



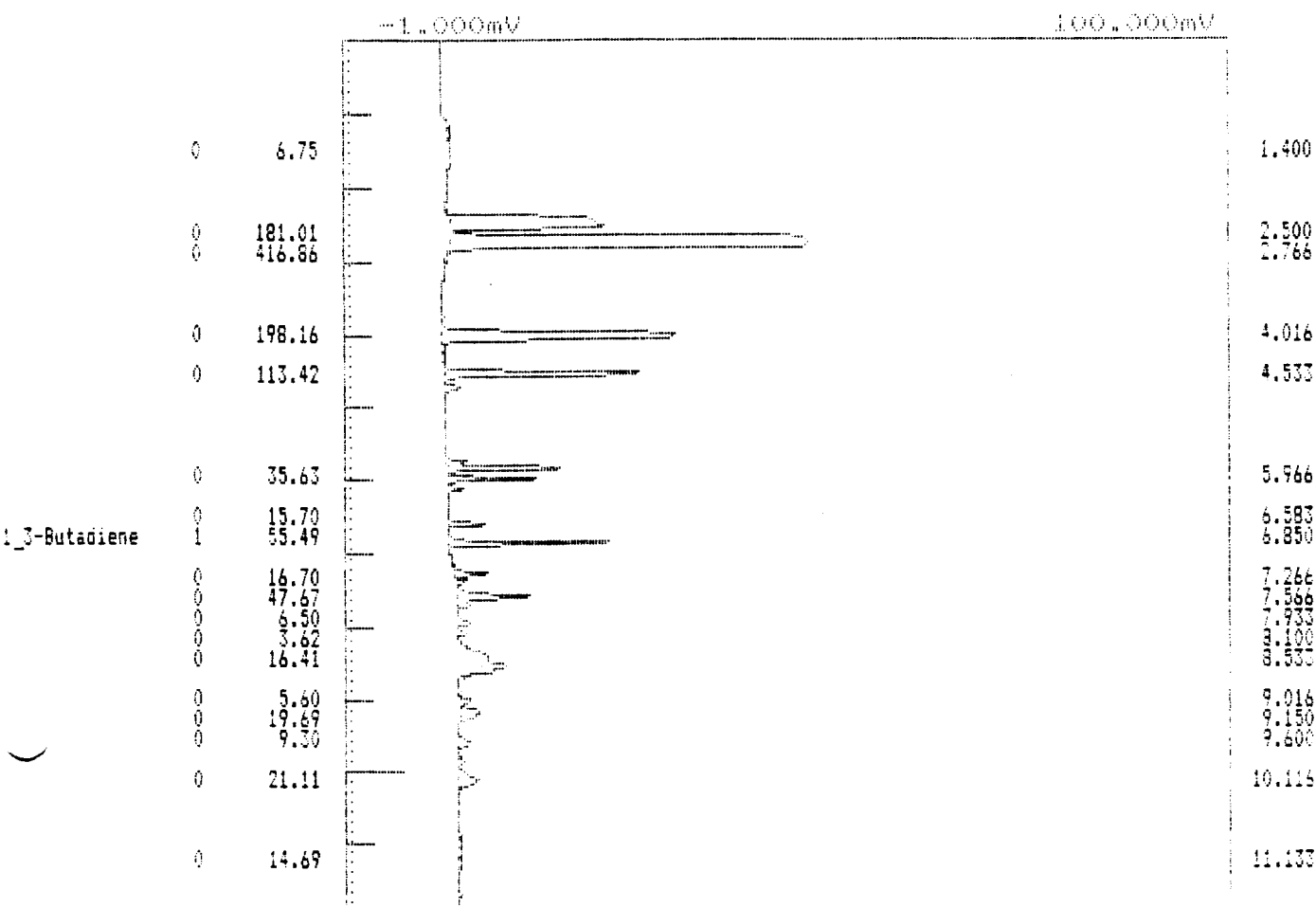
1_3-Butadiene

1_3-Butadiene

Component	Number	Retention	Area	Units
	0	1.366	45.00	
	0	2.500	179.09	
	0	2.750	431.05	
	0	4.016	195.12	
	0	4.516	124.71	
	0	5.816	56.22	
	0	5.966	37.34	
	0	6.583	14.86	
	1	6.833	55.60	
	0	7.250	12.83	
	0	7.366	4.53	
	0	7.566	42.01	
	0	7.933	6.11	
	0	8.083	4.78	
	0	8.516	32.35	
	0	9.150	28.75	
	0	9.583	9.13	
	0	10.100	18.11	
	0	11.716	5.29	

Operator : Gary Mata
 File : 422-1-18
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 12:20:04

ENTROPY
 DIRECT Scan 152.46
 min



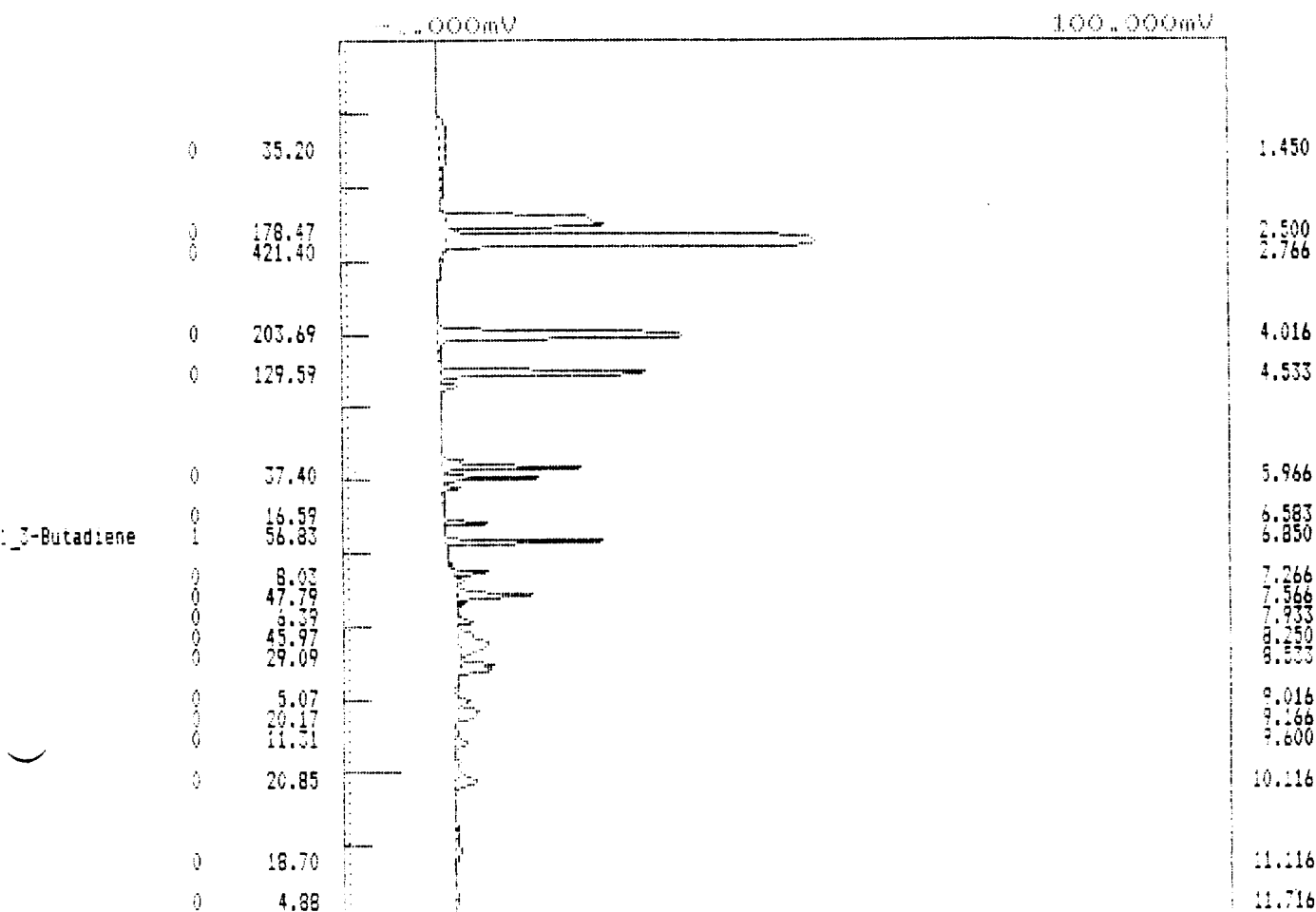
1_3-Butadiene

1_3-Butadiene

Component	Number	Retention	Area	Units
	0	1.400	6.75	
	0	2.500	181.01	
	0	2.766	416.86	
	0	4.016	198.16	
	0	4.533	113.42	
	0	5.966	35.63	
	0	6.583	15.70	
	1	6.850	55.49	
	0	7.266	16.70	
	0	7.586	47.67	
	0	7.933	6.50	
	0	8.100	3.62	
	0	8.533	16.41	
	0	9.016	5.60	
	0	9.150	19.69	
	0	9.600	9.30	
	0	10.116	21.11	
	0	11.133	14.69	

Injection
1250N
Direct Flow = 150 ml/min

Operator : Gary Mata
File : 422-1-19
Temperature :
Components : default
Date : 07/29/1992
Time : 12:37:18



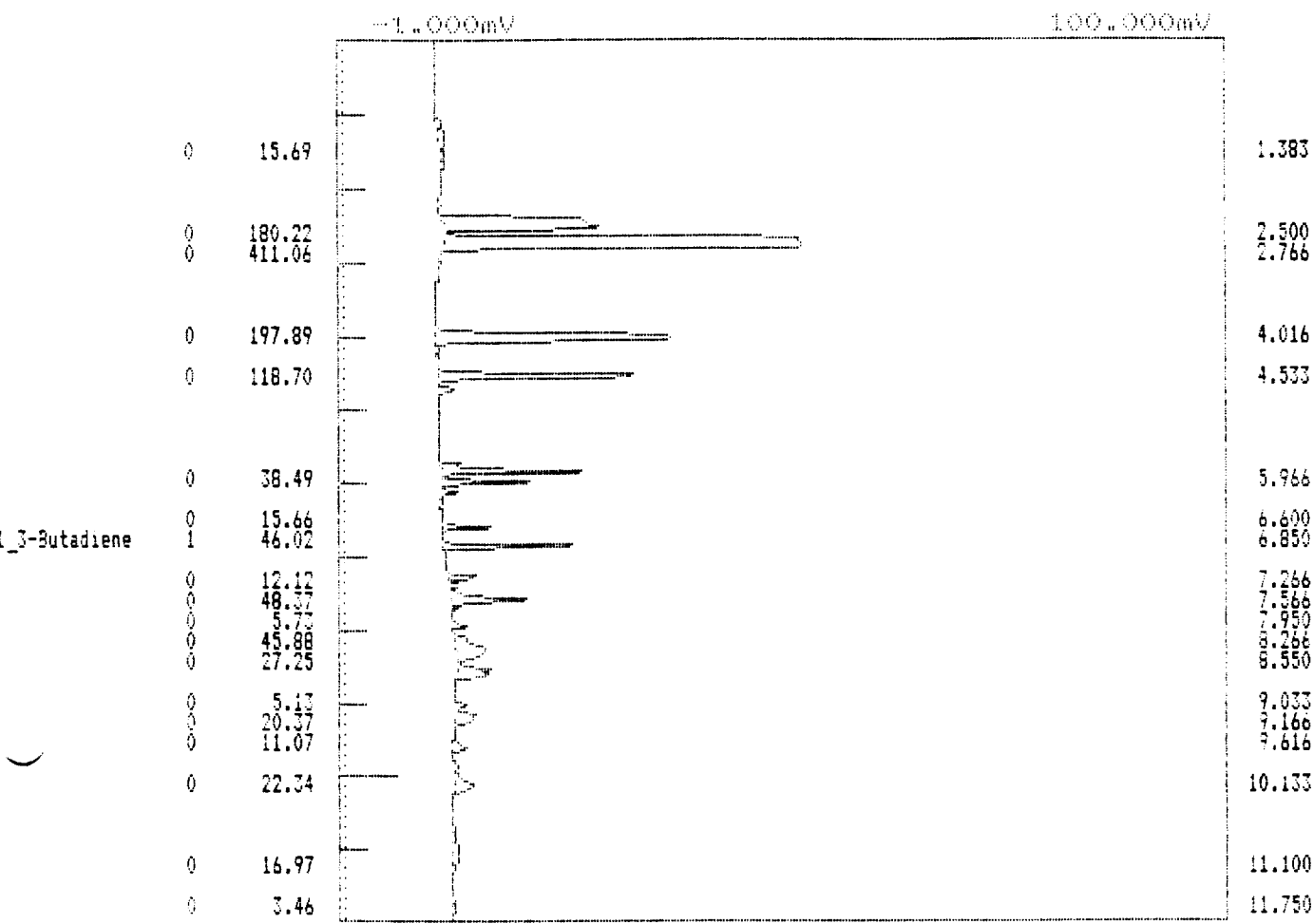
1,3-Butadiene

1,3-Butadiene

Component	Number	Retention	Area	Units
	0	1.450	35.20	
	0	2.500	178.47	
	0	2.766	421.40	
	0	4.016	203.69	
	0	4.533	129.59	
	0	5.816	61.54	
	0	5.966	37.40	
	0	6.583	16.59	
	1	6.850	56.83	
	0	7.266	8.03	
	0	7.566	47.79	
	0	7.933	6.39	
	0	8.250	45.97	
	0	8.533	29.09	
	0	9.016	5.07	
	0	9.166	20.17	
	0	9.600	11.31	
	0	10.116	20.85	
	0	11.116	18.70	
	0	11.716	4.88	

157-000000
 2-1000
 DIRECT FLOW 157-000000

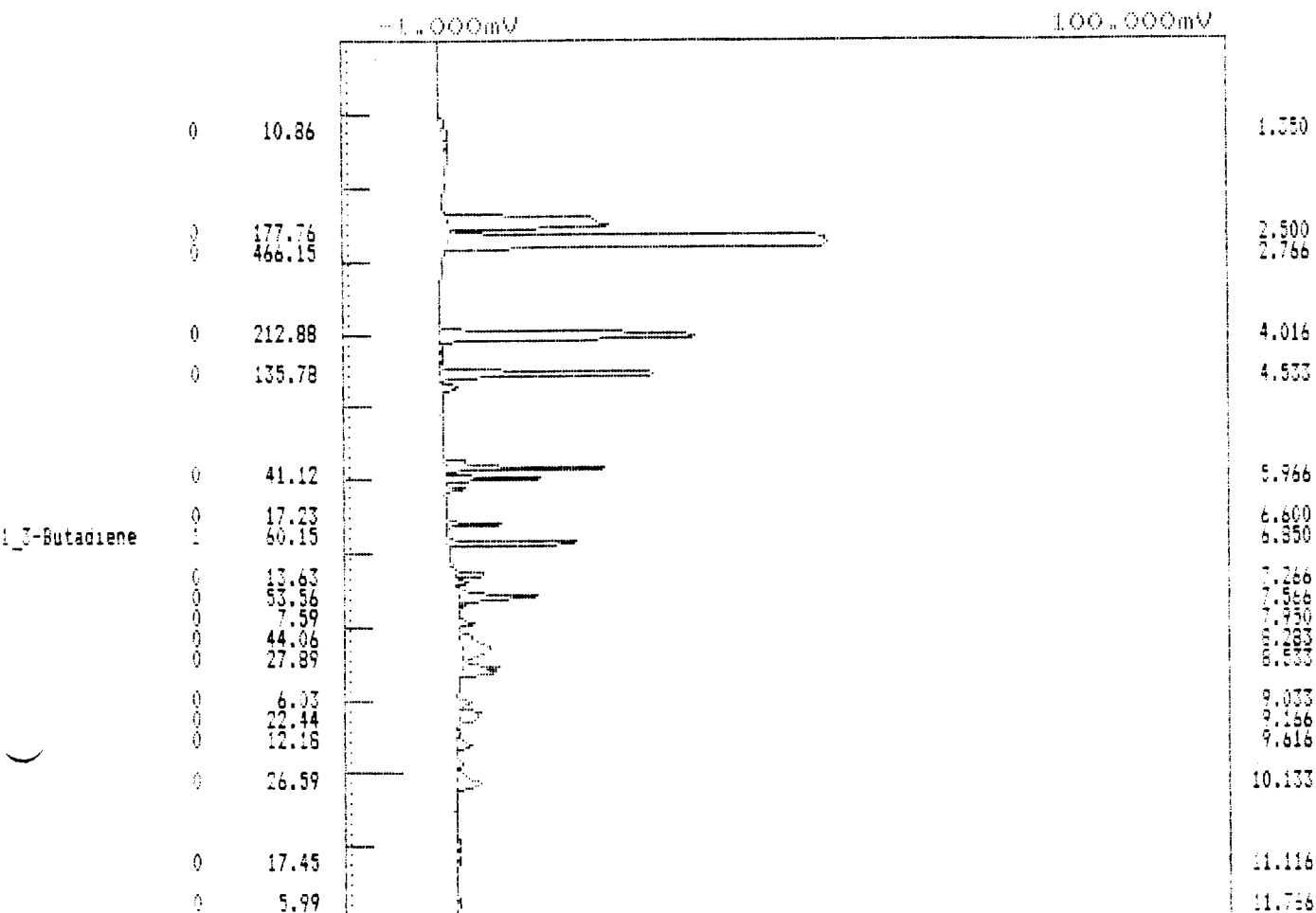
Operator : Gary Mata
 File : 422-1-20
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 12:54:43



Component	Number	Retention	Area	Units
1,3-Butadiene	0	1.383	15.69	
	0	2.500	180.22	
	0	2.766	411.06	
	0	4.016	197.89	
	0	4.533	118.70	
	0	5.933	58.66	
	0	5.966	38.49	
	0	6.600	15.66	
	1	6.850	46.02	
	0	7.266	12.12	
	0	7.566	48.37	
	0	7.950	5.73	
	0	8.266	45.88	
	0	8.550	27.25	
	0	9.033	5.13	
	0	9.166	20.37	
	0	9.616	11.07	
	0	10.133	22.34	
	0	11.100	16.97	
	0	11.750	3.46	

9th INJECTION
1ST RUN
7-29-1992

Operator : Gary Mata
File : 422-1-21
Temperature :
Components : default
Date : 07/29/1992
Time : 13:12:11



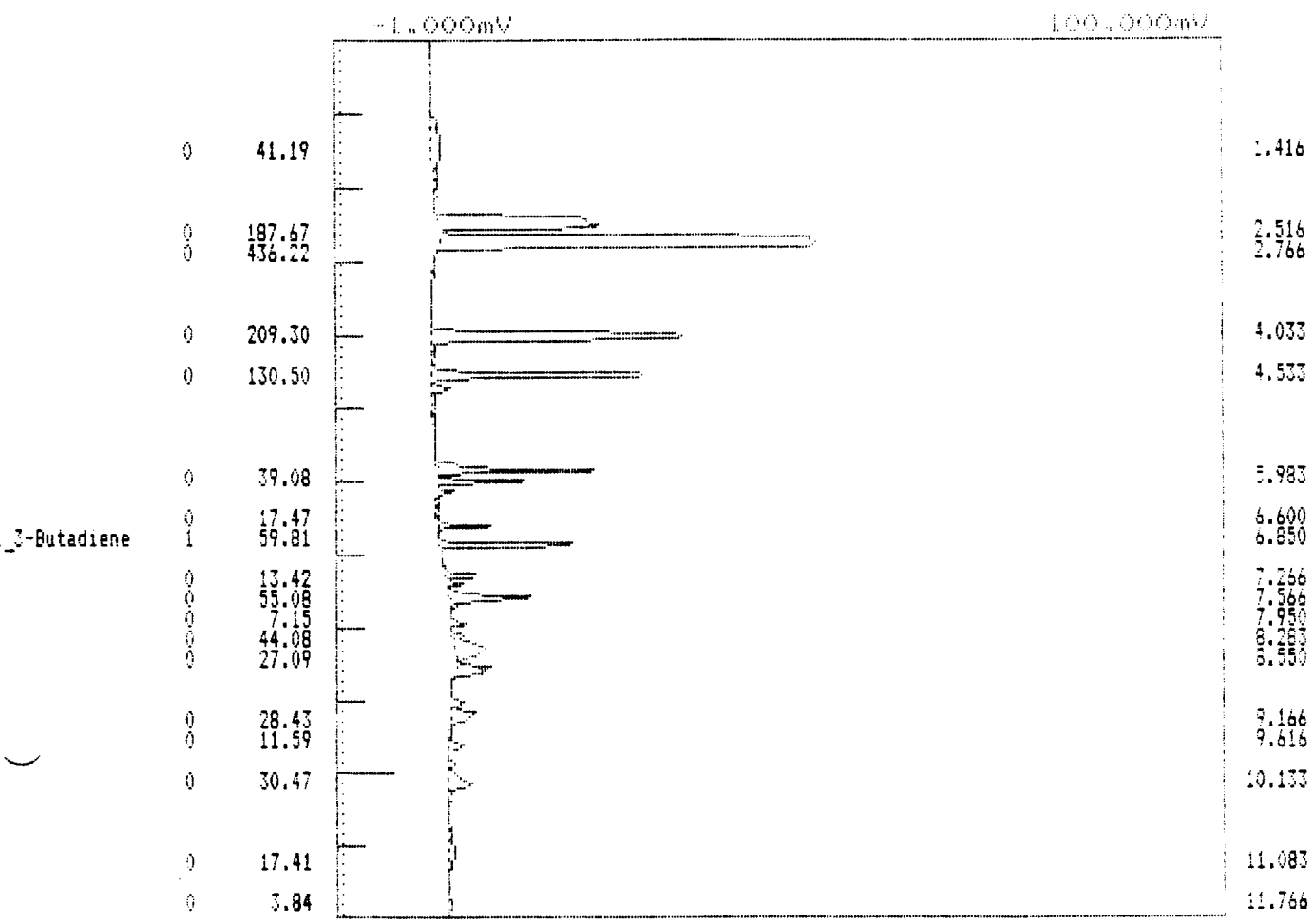
1,3-Butadiene

1,3-Butadiene

Component	Number	Retention	Area	Units
	0	1.350	10.86	
	0	2.500	177.76	
	0	2.766	466.15	
	0	4.016	212.88	
	0	4.533	135.78	
	0	5.833	62.77	
	0	5.966	41.12	
	0	6.600	17.23	
	1	6.850	60.15	
	0	7.266	13.63	
	0	7.566	53.56	
	0	7.950	7.59	
	0	8.283	44.06	
	0	8.533	27.89	
	0	9.033	6.03	
	0	9.166	22.44	
	0	9.616	12.18	
	0	10.133	26.59	
	0	11.116	17.45	
	0	11.766	5.99	

Injection
12th run
DIRECT FLOW 152^{min}

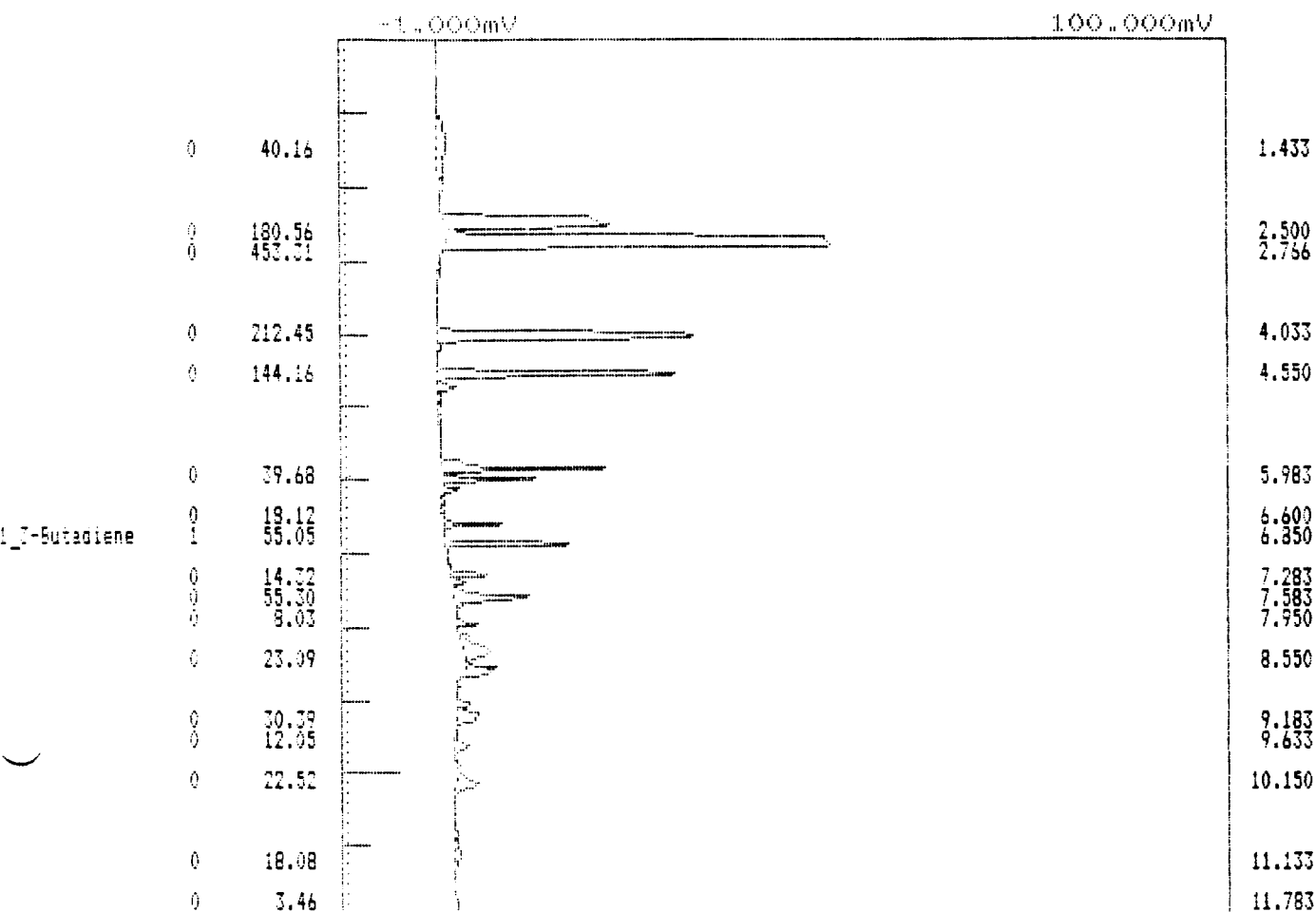
Operator : Gary Mata
File : 422-1-22
Temperature :
Components : default
Date : 07/29/1992
Time : 13:30:01



Component	Number	Retention	Area	Units
	0	1.416	41.19	
	0	2.516	187.67	
	0	2.766	436.22	
	0	4.033	209.30	
	0	4.533	130.50	
	0	5.833	63.10	
	0	5.983	39.08	
	0	6.600	17.47	
1,3-Butadiene	1	6.850	59.81	
	0	7.266	13.42	
	0	7.566	55.08	
	0	7.950	7.15	
	0	8.283	44.08	
	0	8.550	27.09	
	0	9.166	28.43	
	0	9.616	11.59	
	0	10.133	30.47	
	0	11.083	17.41	
	0	11.766	3.84	

212 INJECTION
 13720N
 DIRECT FLOW 150^{mm}

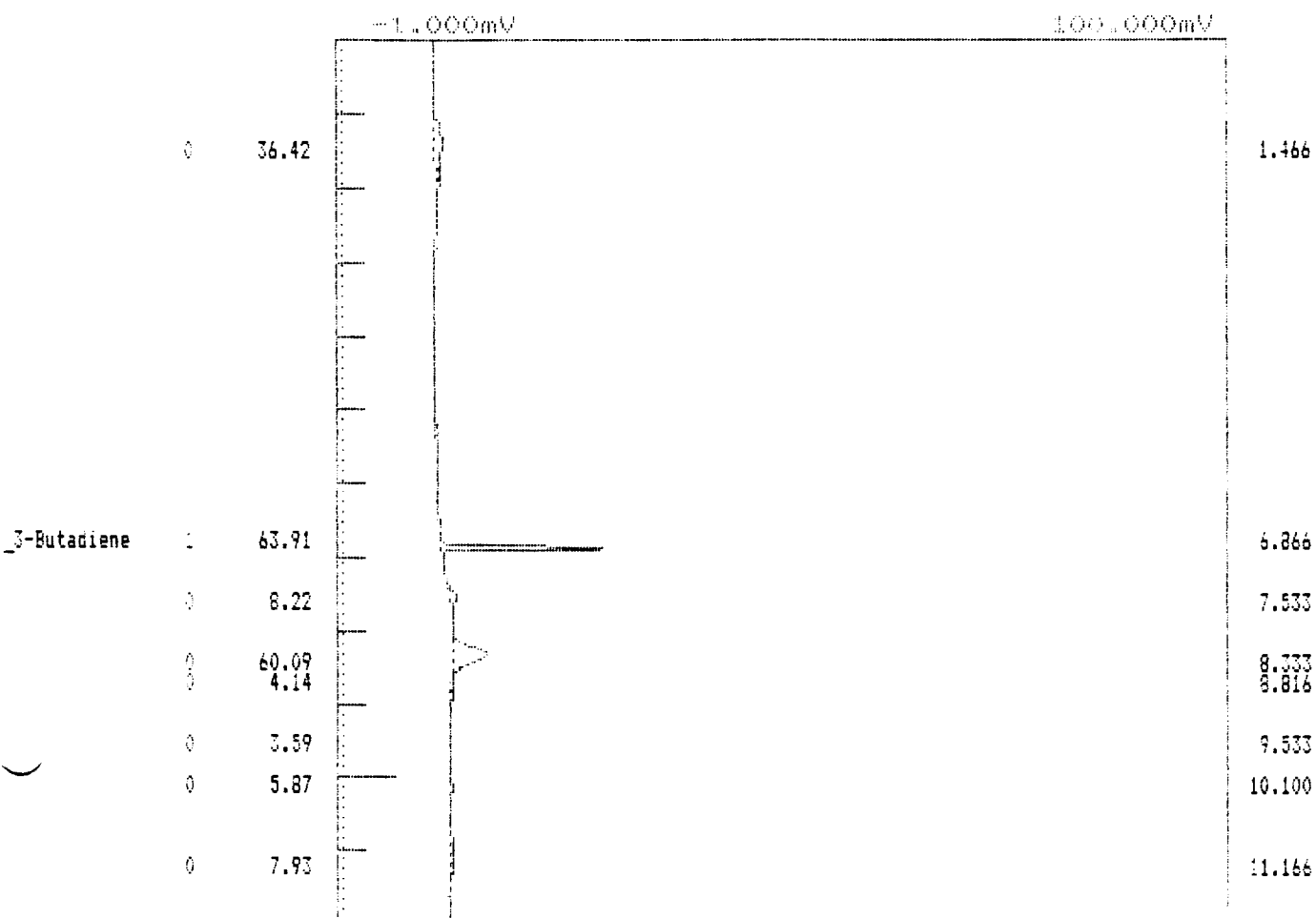
Operator : Gary Mata
 File : 422-1-23
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 13:47:40



Component	Number	Retention	Area	Units
	0	1.433	40.16	
	0	2.500	180.56	
	0	2.766	453.31	
	0	4.033	212.45	
	0	4.550	144.16	
	0	5.983	39.68	
	0	6.600	18.12	
	0	6.850	55.05	
1_7-Butadiene	1	6.850	55.05	
	0	7.283	14.32	
	0	7.583	55.30	
	0	7.950	8.03	
	0	8.516	38.51	
	0	8.550	23.09	
	0	9.183	30.39	
	0	9.633	12.05	
	0	10.150	22.52	
	0	11.133	18.08	
	0	11.783	3.46	

MIDICAL 500
 12120N
 DIRECT FLOW 500 $\frac{m}{m}$

Operator : Gary Mata
 File : 422-1-24
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 14:06:28



Component	Number	Retention	Area	Units
1,3-Butadiene	0	1.466	36.42	
	1	6.866	63.91	
	0	7.533	9.22	
	0	8.333	60.09	
	0	8.816	4.14	
	0	9.533	3.59	
	0	10.100	5.87	
	0	11.166	7.93	
	0			

8

190.16

0121

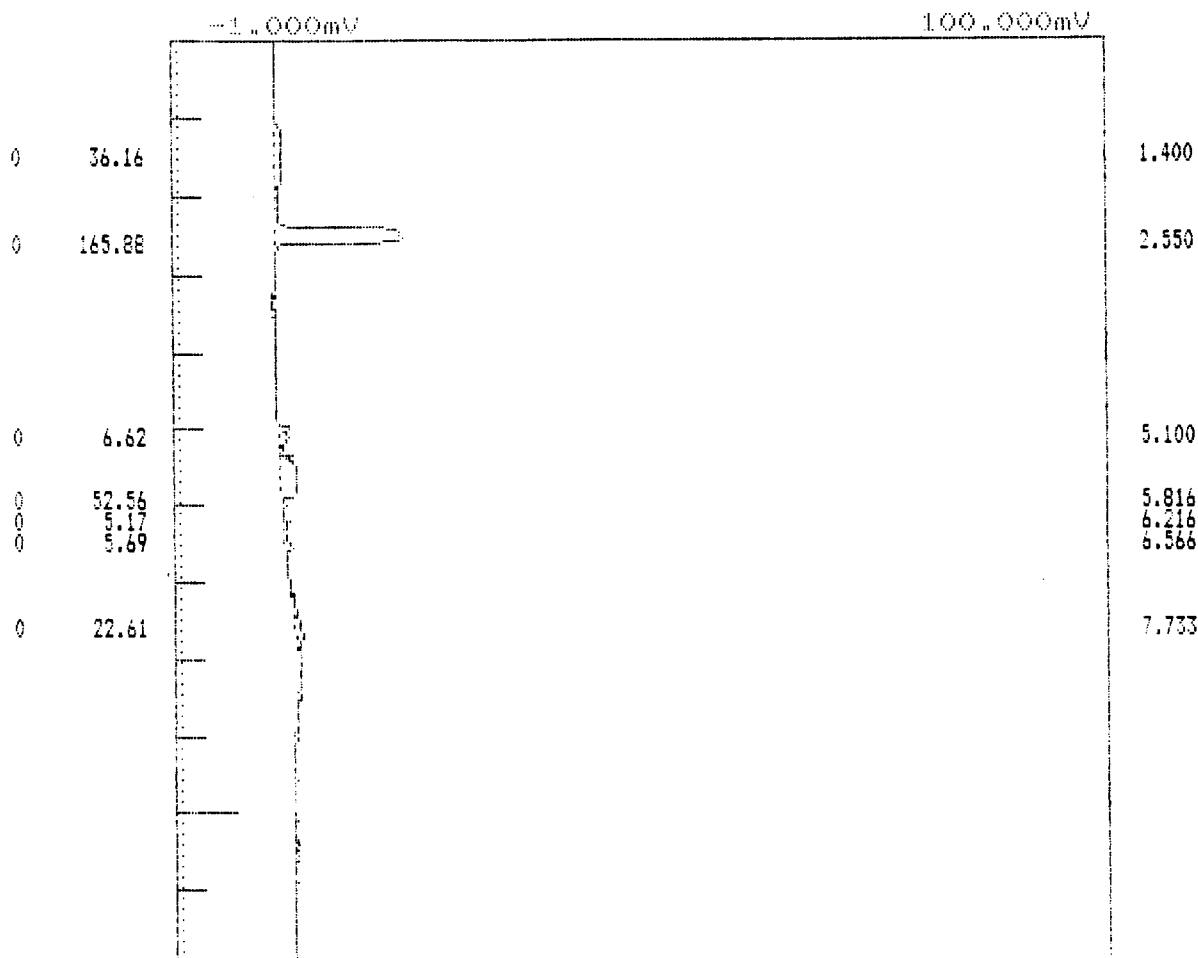
ENTROPY

Operator : Gary Mata
 File : 422-1-25
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 16:35:44

12" INJECTION
 12 RUN
 DIRECT FLOW 152 $\frac{ml}{min}$

NO GOOD

VOID - PUMP NOT ON!



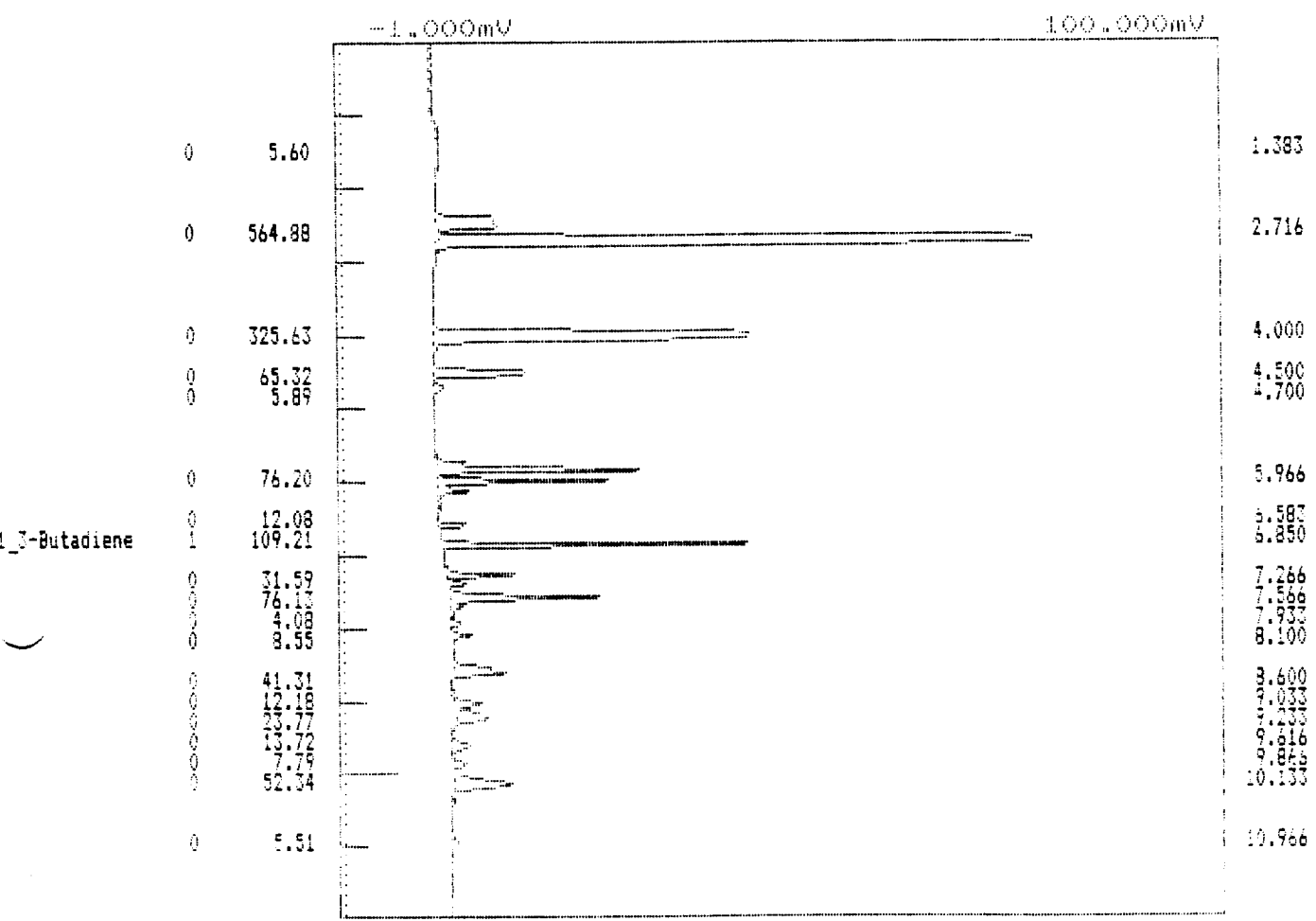
Component	Number	Retention	Area	Units
	0	1.400	36.16	
	0	2.550	165.88	
	0	3.100	6.62	
	0	5.816	52.56	
	0	6.216	5.17	
	0	6.566	5.69	
	0	7.733	22.61	
	7		294.69	

0122

ENTROPY

2/11/1992
 151 RUN
 DIRECT FLOW 152 ml/min

Operator : Gary Mata
 File : 42221-28
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 16:55:33



1,3-Butadiene

1,3-Butadiene

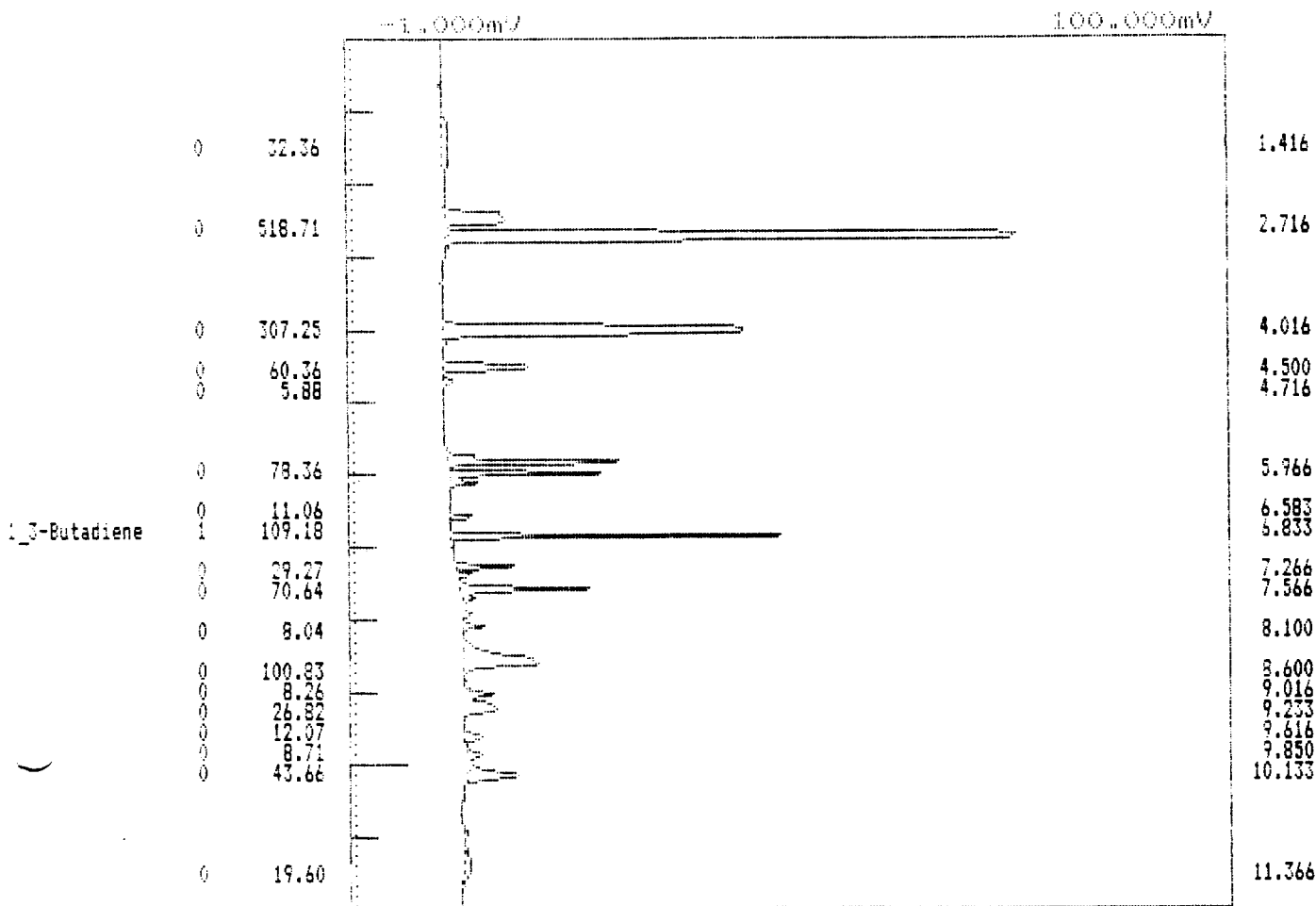
Component	Number	Retention	Area	Units
	0	1.383	5.60	
	0	2.516	72.97	
	0	2.716	564.88	
	0	4.000	325.63	
	0	4.500	65.32	
	0	4.700	5.89	
	0	5.916	21.77	
	0	5.966	76.20	
	0	6.583	12.08	
	1	6.850	109.21	
	0	7.266	31.59	
	0	7.566	76.13	
	0	7.933	4.08	
	0	8.100	8.55	
	0	8.600	41.31	
	0	9.033	12.18	
	0	9.333	23.77	
	0	9.816	13.72	
	0	9.866	7.79	
	0	10.133	52.34	
	0	10.966	5.51	

22ND INJECTION

13TH RUN

DIRECT FLOW 152 mL/MIN

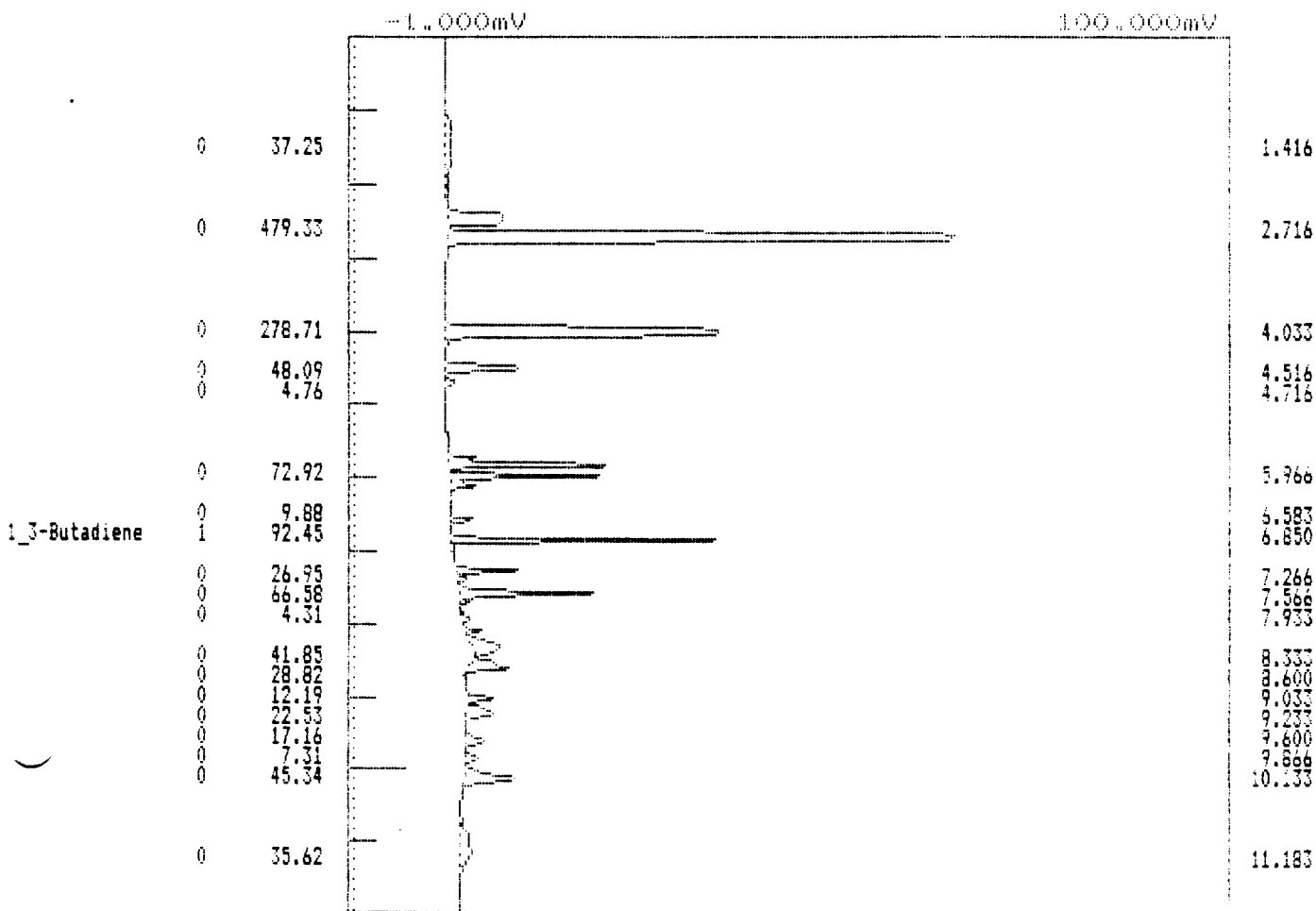
Operator : Gary Mata
File : 422-1-27
Temperature :
Components : default
Date : 07/29/1992
Time : 17:11:47



Component	Number	Retention	Area	Units
	0	1.416	32.36	
	0	2.516	71.32	
	0	2.716	518.71	
	0	4.016	307.25	
	0	4.500	60.36	
	0	4.716	5.88	
	0	5.816	83.17	
	0	5.966	78.36	
	0	6.583	11.06	
1,3-Butadiene	1	6.833	109.18	
	0	7.266	29.27	
	0	7.566	70.64	
	0	8.100	8.04	
	0	8.600	100.83	
	0	9.016	8.26	
	0	9.233	26.82	
	0	9.616	12.07	
	0	9.850	8.71	
	0	10.133	43.66	
	0	11.366	19.60	

Operator : Gary Mata
 File : 422-1-28
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 17:29:31

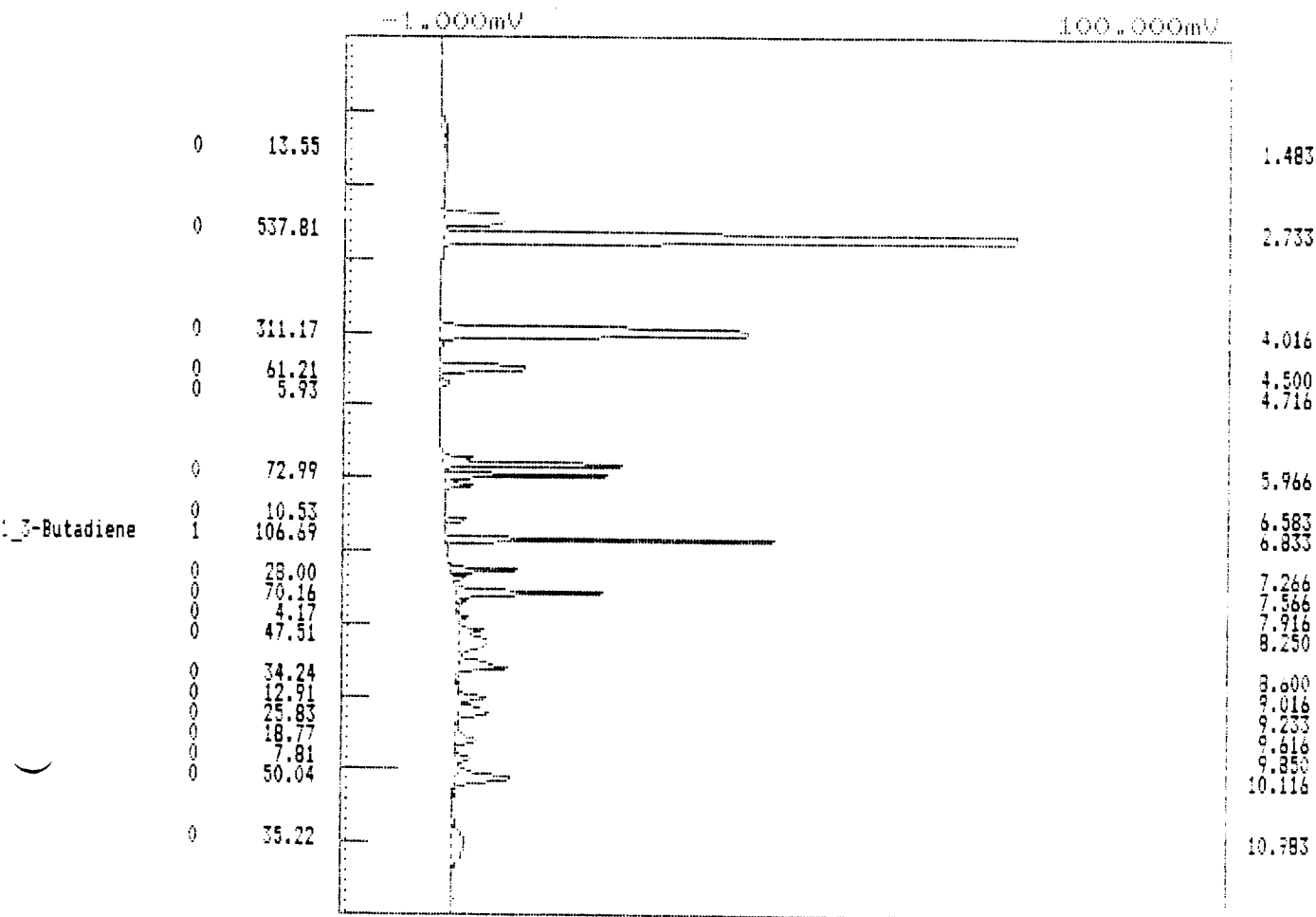
29.2 injection
 15.12m
 DMSO-ET Flow 152ml/min



Component	Number	Retention	Area	Units
	0	1.416	37.25	
	0	2.516	45.77	
	0	2.716	479.33	
	0	4.033	278.71	
	0	4.516	48.09	
	0	4.716	4.76	
	0	5.816	79.27	
	0	5.966	72.92	
	0	6.583	9.88	
1,3-Butadiene	1	6.850	92.45	
	0	7.266	26.95	
	0	7.566	66.58	
	0	7.933	4.31	
	0	8.333	41.85	
	0	8.600	28.82	
	0	9.033	12.19	
	0	9.233	22.53	
	0	9.600	17.16	
	0	9.866	7.31	
	0	10.133	45.34	
	0	11.183	35.62	

Operator : Gary Mata
 File : 422-1-30
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 18:04:36

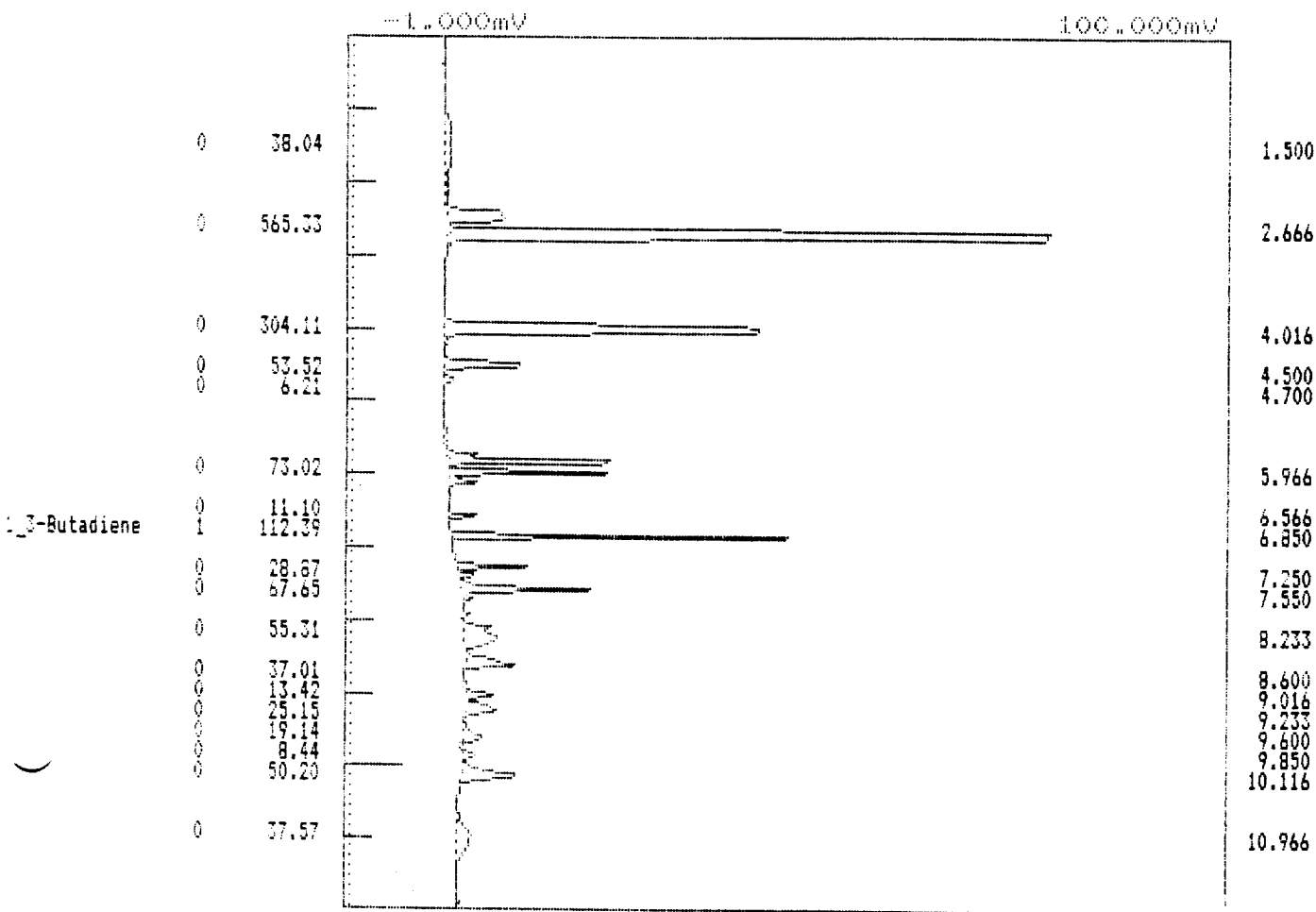
2nd INJECTION
 1st RUN
 DIRECT FLOW 15 $\frac{min}{min}$



Component	Number	Retention	Area	Units
	0	1.483	13.55	
	0	2.516	71.45	
	0	2.733	537.81	
	0	4.016	311.17	
	0	4.500	61.21	
	0	4.716	5.93	
	0	5.816	89.69	
	0	5.966	72.99	
	0	6.583	10.53	
1,3-Butadiene	1	6.833	106.69	
	0	7.266	28.00	
	0	7.566	70.16	
	0	7.916	4.17	
	0	8.250	47.51	
	0	8.600	34.24	
	0	9.016	12.91	
	0	9.233	25.83	
	0	9.616	18.77	
	0	9.850	7.81	
	0	10.116	50.04	
	0	10.983	35.22	

Operator : Gary Mata
 File : 422-1-31
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 18:22:31

28th INJECTION
 1st RUN
 DIRECT FLOW 150 μ m



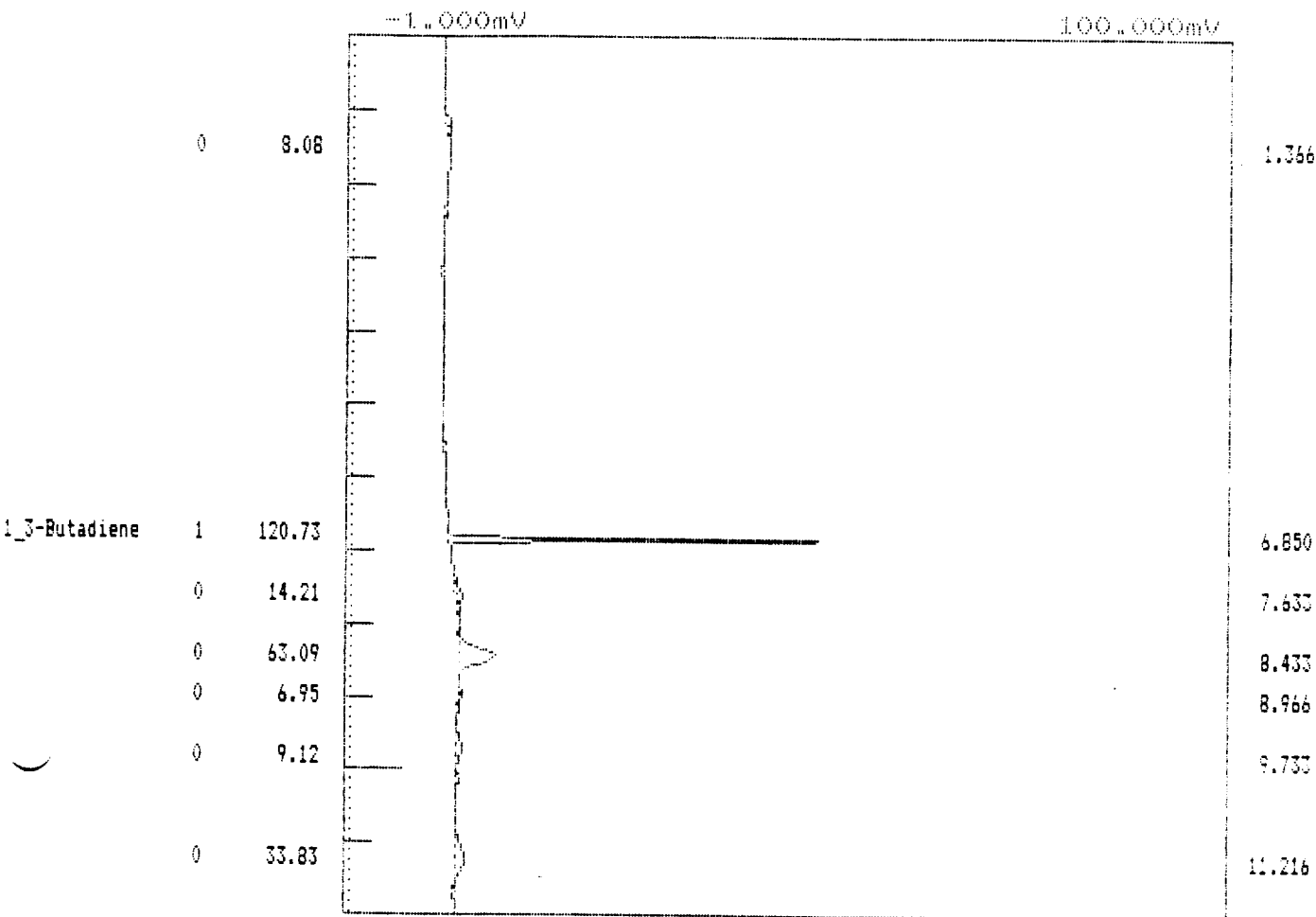
1,3-Butadiene

1,3-Butadiene

Component	Number	Retention	Area	Units
	0	1.500	38.04	
	0	2.500	65.61	
	0	2.666	565.33	
	0	4.016	304.11	
	0	4.500	53.52	
	0	4.700	6.21	
	0	5.816	91.55	
	0	5.966	73.02	
	0	6.566	11.10	
	1	6.850	112.39	
	0	7.250	28.87	
	0	7.550	67.65	
	0	8.233	55.31	
	0	8.600	37.01	
	0	9.016	13.42	
	0	9.233	25.15	
	0	9.600	19.14	
	0	9.850	8.44	
	0	10.116	50.20	
	0	10.966	37.57	

Operator : Gary Mata
 File : 422-1-32
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 18:38:52

8-24-1992 (11:35 PM)
 1-1-1-1-1-1
 DIRECT FLUX 152.14



Component	Number	Retention	Area	Units
1_3-Butadiene	0	1.366	8.08	
	1	6.850	120.73	
	0	7.633	14.21	
	0	8.433	63.09	
	0	8.966	6.95	
	0	9.733	9.12	
	0	11.216	33.83	
	0			

7

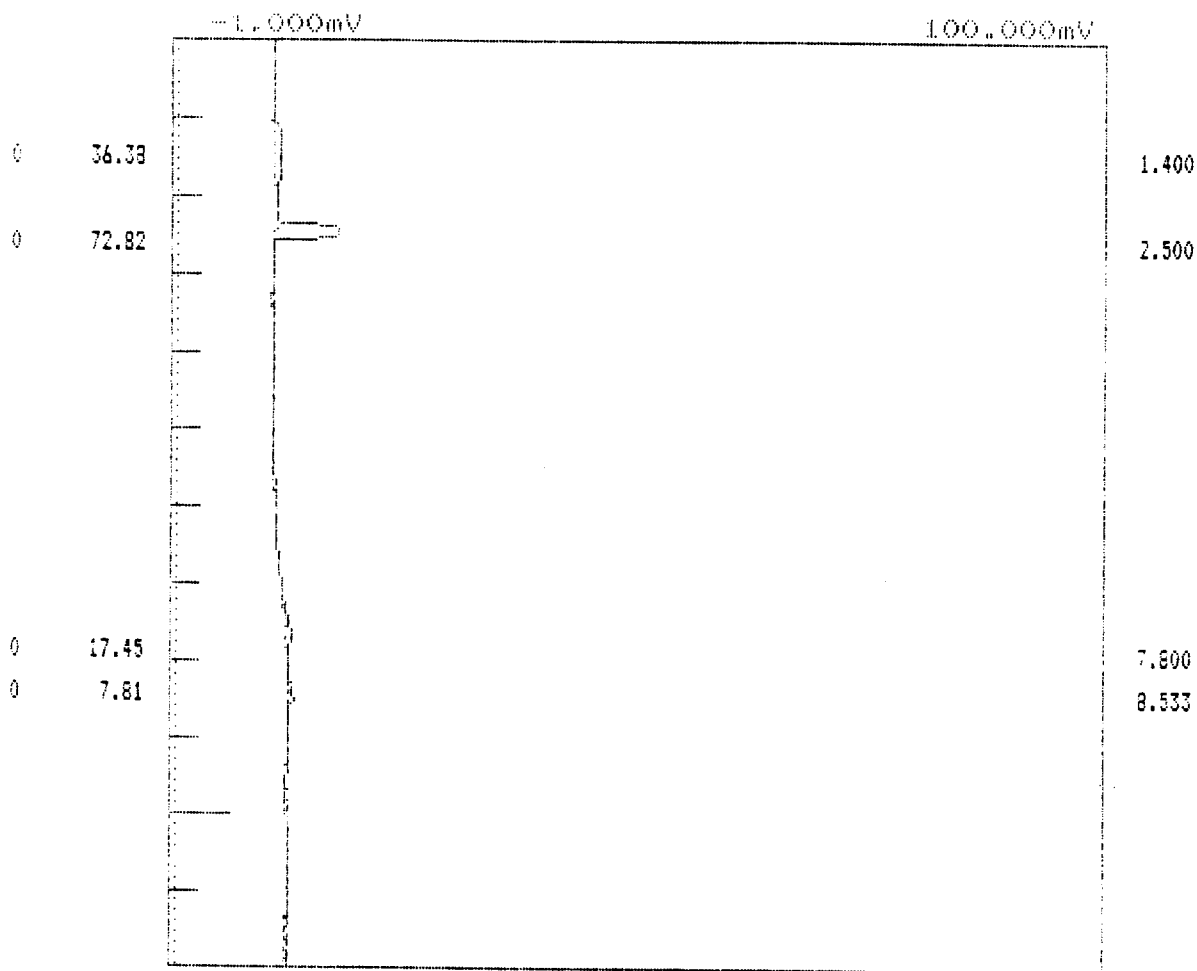
256.01

0129

ENTROPY

AIR 0.000
 121 RUN
 DIRECT FLOW 152 $\frac{ml}{min}$

Operator : Gary Mata
 File : 422-1-33
 Temperature :
 Components : default
 Date : 07/29/1992
 Time : 18:56:53



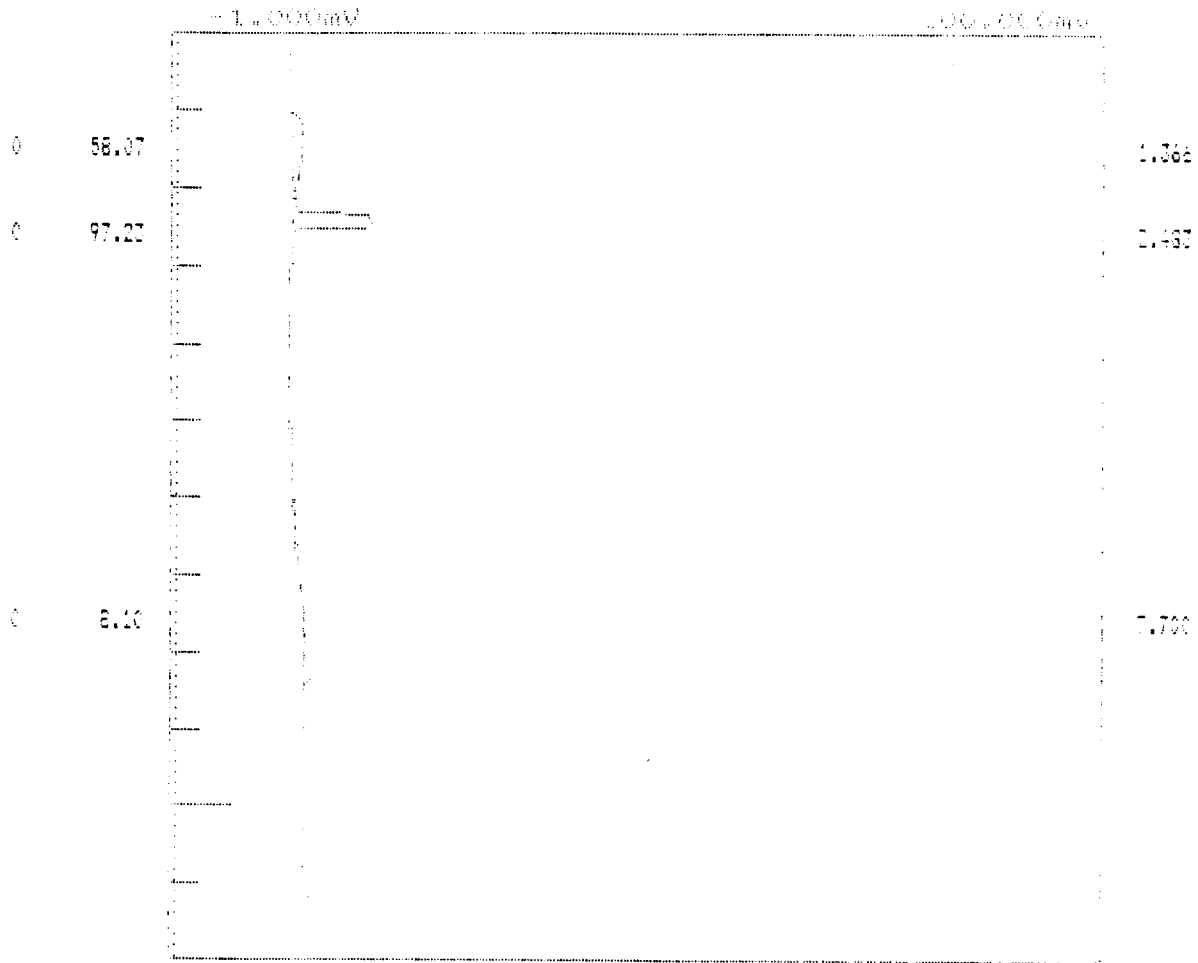
Component	Number	Retention	Area	Units
	0	1.400	36.38	
	0	2.500	72.82	
	0	7.800	17.45	
	0	8.533	7.81	
4			134.45	

0130

ENTROPY

HIL STATION
 2nd RUN
 DIRECT FLOW 15 ml/min

Operator : Gary Mata
 File : CAL23
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 06:47:08



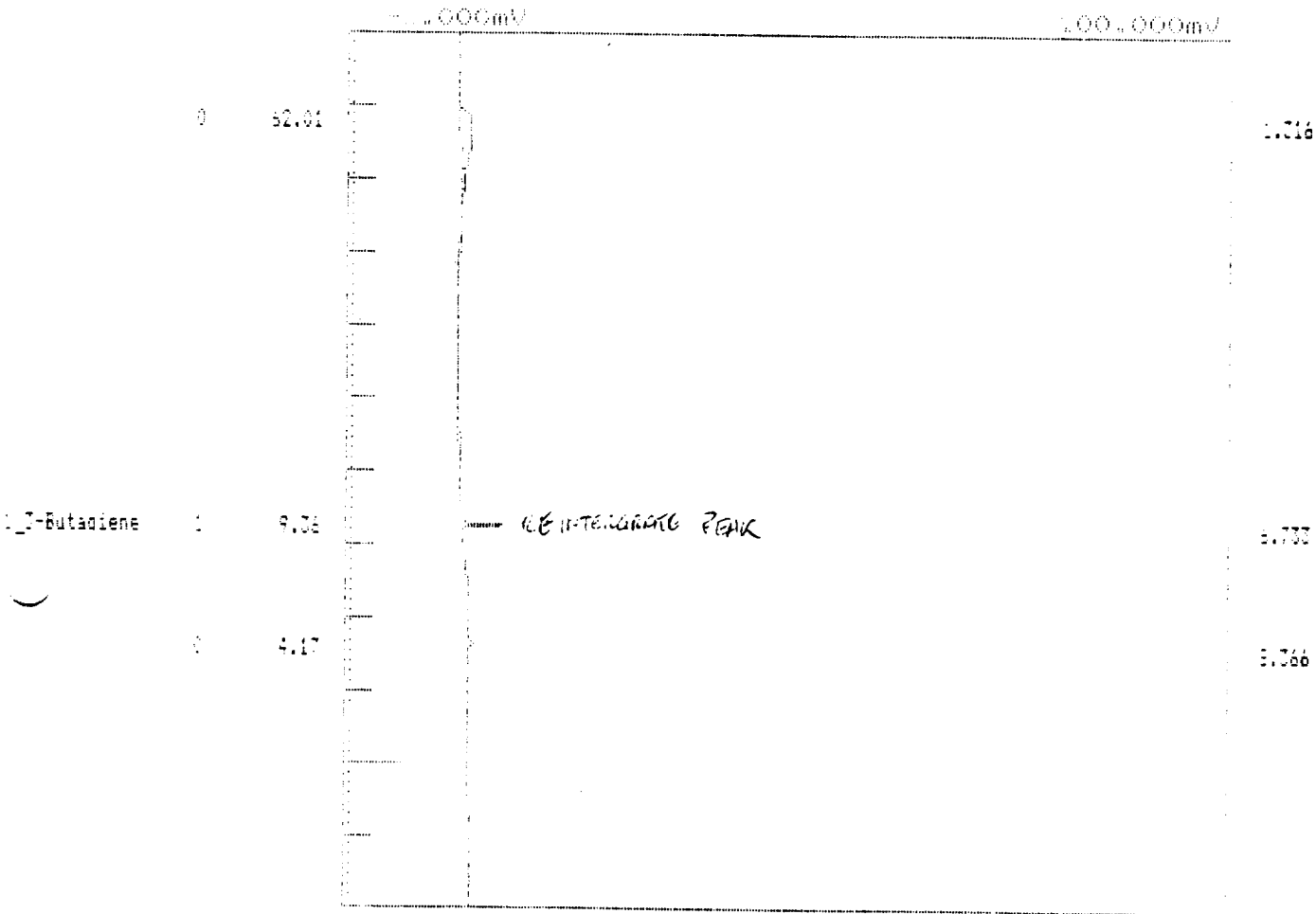
Component	Number	Retention	Area	Units
	0	1.000	58.07	
	0	1.485	97.23	
	0	7.700	177.00	
3			163.40	

0131

ENTROPY

LOW 70 (0.0985 rpm)
 2nd Run
 DIRECT FLOW 52 ml/min

Operator : Gary Mata
 File : CAL24
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 07:02:30



1,3-Butadiene

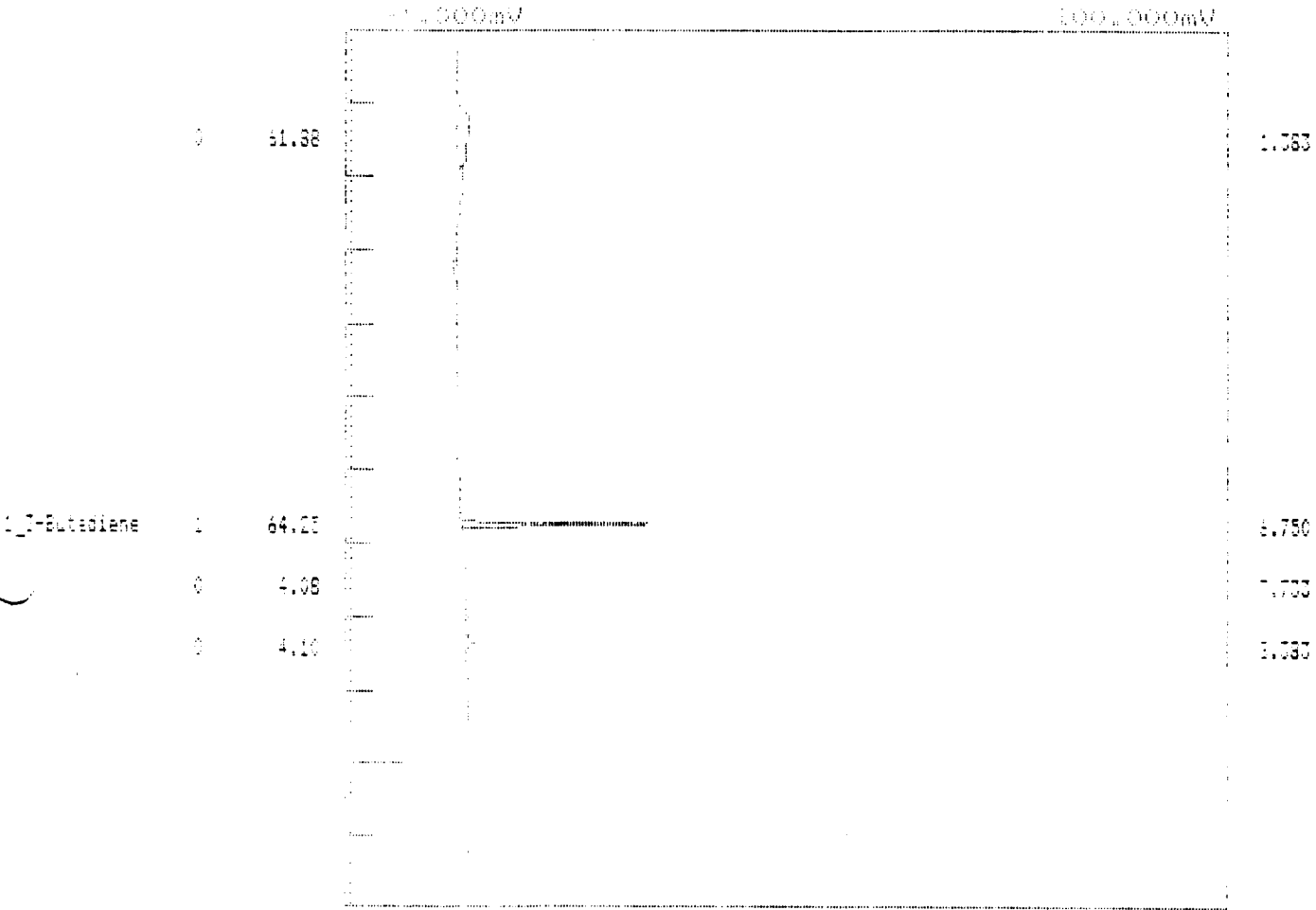
Component	Number	Retention	Area	Units
1,3-Butadiene	0	1.716	62.01	
	1	9.733	9.36	
	2	9.766	4.17	
3			75.54	

0132

ENTROPY

MID STD (0.1% LPPM)
 2ND RUN
 DIRECT FLOW 152 ml/min

Operator : Gary Mata
 File : CAL25
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 07:19:52



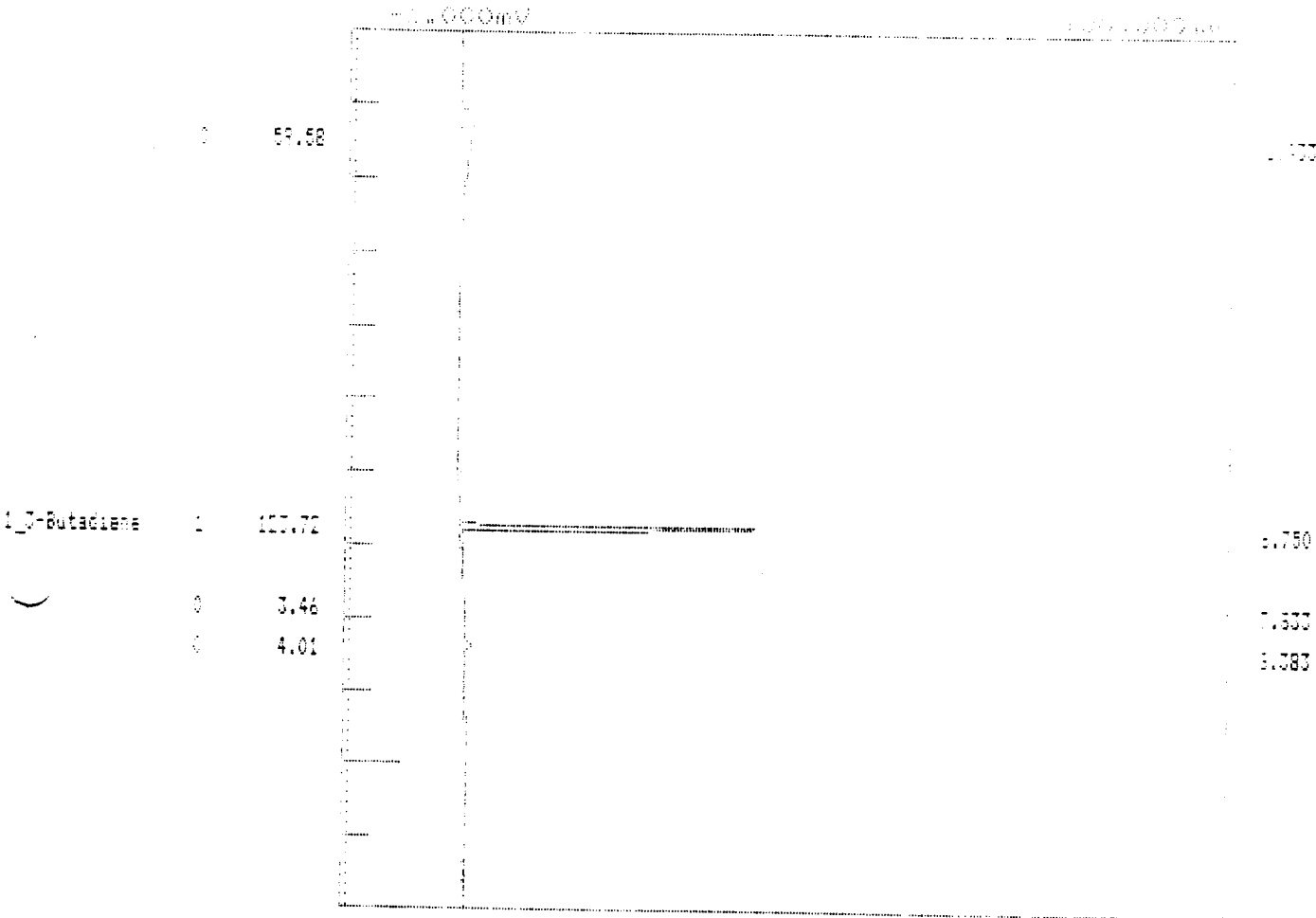
Component	Number	Retention	Area	Units
1,1-Dichloroethane	1	61.68	61.68	
	0	4.08	64.25	
	0	4.08	4.08	
	0	4.10	4.10	
	4		134.31	

0134

ENTROPY

HIGH SPEED SYSTEM
 2ND RUN
 DIRECT FLOW 150 ml/min

Operator : Gary Mata
 File : CAL26
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 07:34:48



1,3-Butadiene 1 100.72 1.750
 0 3.46 1.333
 0 4.01 1.383

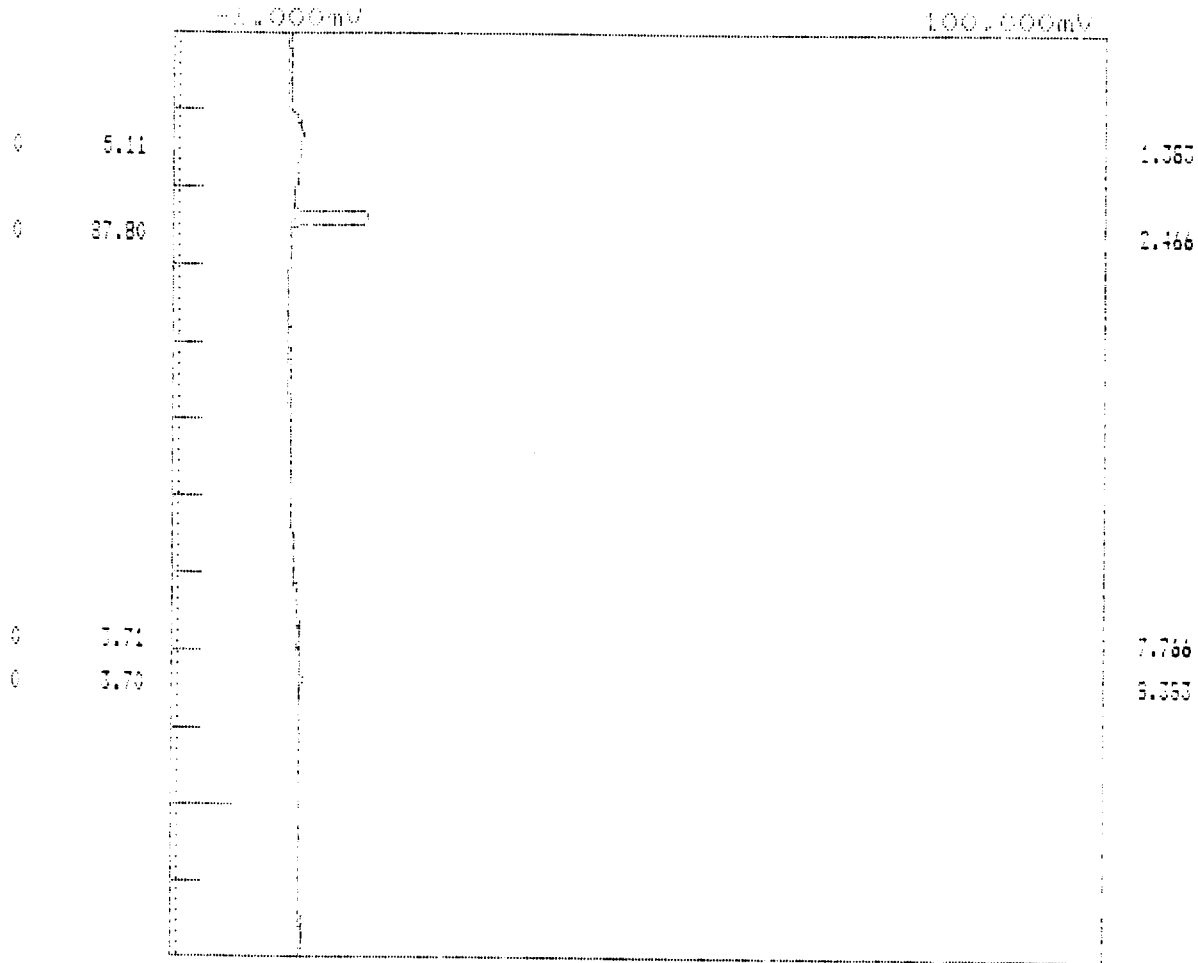
Component	Number	Retention	Area	Units
1,3-Butadiene	0	1.333	57.38	
	1	4.75	143.77	
	0	1.333	1.30	
	0	1.383	4.01	
4			190.76	

0135

ENTROPY

ALL DONE
2nd RUN
DIRECT FLOW 150 ml/min

Operator : Gary Mata
File : CAL27
Temperature :
Components : default
Date : 07/30/1992
Time : 07:51:11



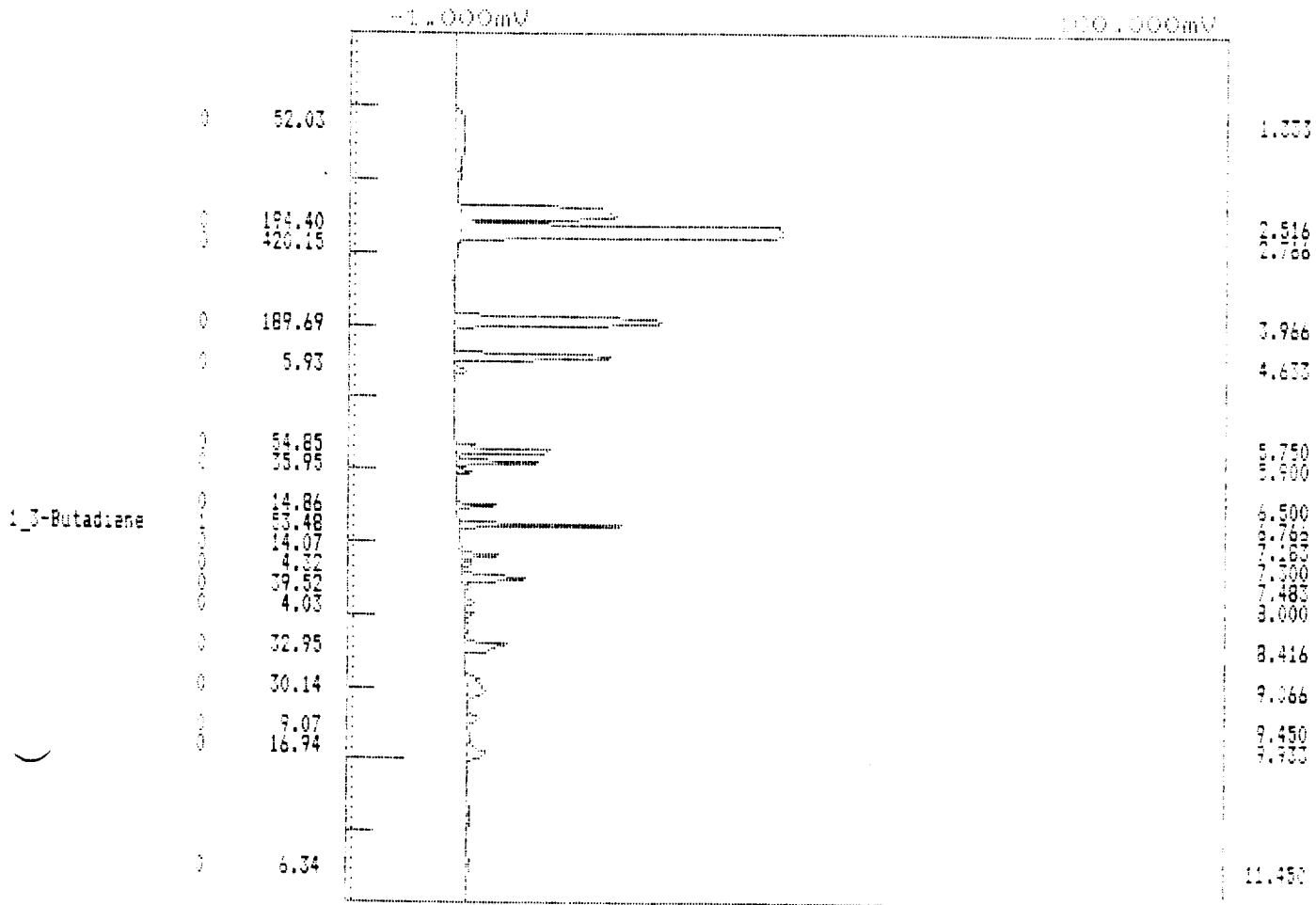
Component	Number	Retention	Area	Units
	1	5.11	1.365	
	2	37.80	2.466	
	3	7.71	7.766	
	4	3.70	8.383	
4			100.32	

0136

ENTROPY

Operator : Gary Mata
 File : 422-2-1
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 11:00:23

INJECTION
 2nd RUN
 DIRECT FROM 52nd



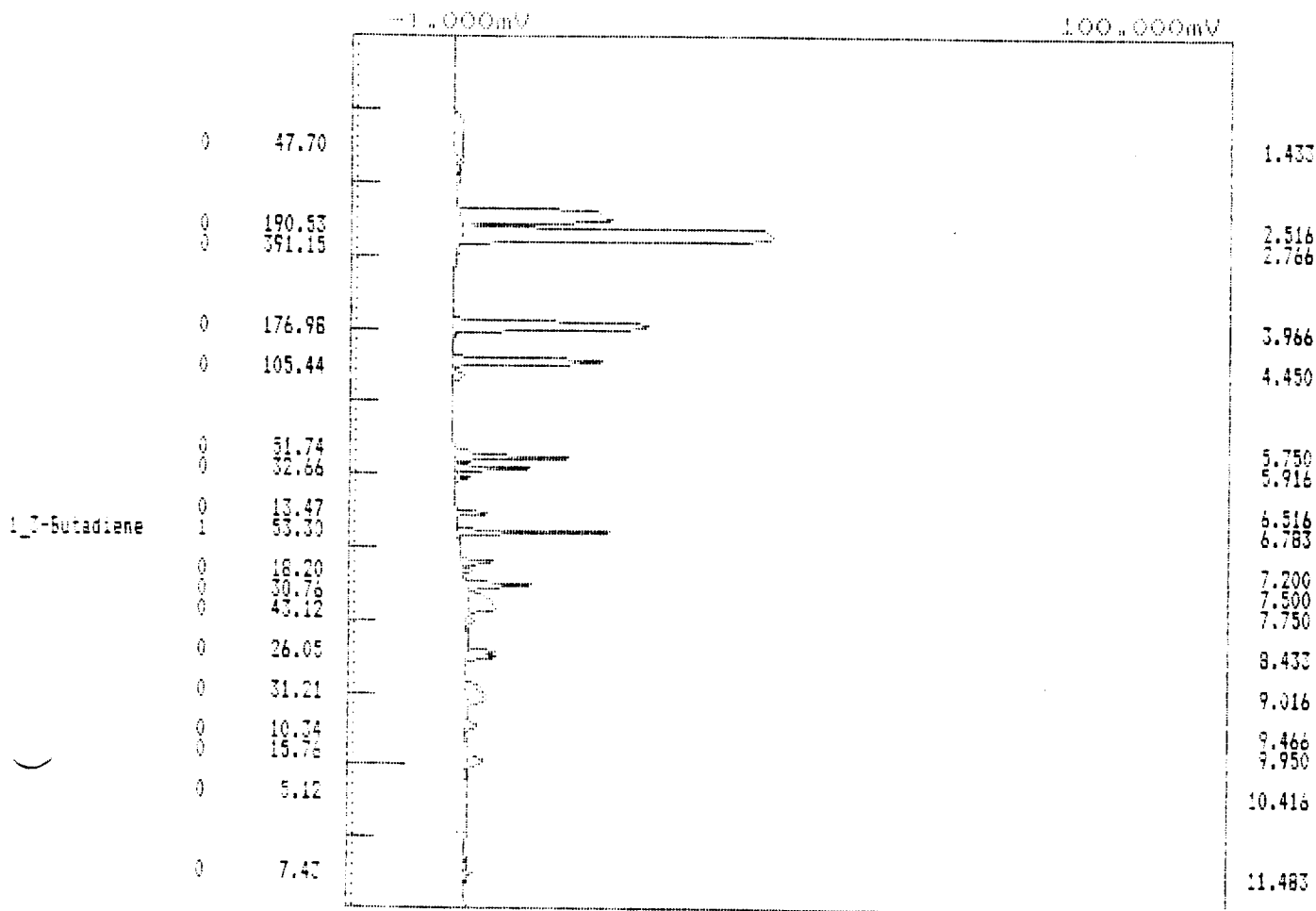
1,3-Butadiene

1,3-Butadiene

Component	Number	Retention	Area	Units
	0	1.333	52.03	
	0	2.516	194.40	
	0	2.766	420.15	
	0	3.966	189.69	
	0	4.450	95.03	
	0	4.633	5.93	
	0	5.750	54.85	
	0	5.900	35.95	
	0	6.500	14.86	
1,3-Butadiene	1	6.766	53.45	
	0	7.163	14.07	
	0	7.300	4.32	
	0	7.483	39.52	
	0	7.833	4.72	
	0	8.000	4.03	
	0	8.416	32.95	
	0	9.066	30.14	
	0	9.450	9.07	
	0	9.733	16.94	
	0	11.450	6.34	

Operator : Gary Mata
 File : 422-2-2
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 11:36:12

2nd Injection
 2nd Run
 DIRECT FLOW 152.00
 min



Component	Number	Retention	Area	Units
	0	1.433	47.70	
	0	2.516	190.53	
	0	2.766	391.15	
	0	3.966	176.98	
	0	4.450	105.44	
	0	5.750	51.74	
	0	5.916	32.66	
	0	6.516	13.47	
1,3-Butadiene	1	6.783	53.30	
	0	7.200	18.20	
	0	7.500	30.76	
	0	7.750	43.12	
	0	8.433	26.05	
	0	9.016	31.21	
	0	9.466	10.34	
	0	9.950	15.76	
	0	10.416	5.12	
	0	11.483	7.43	

18

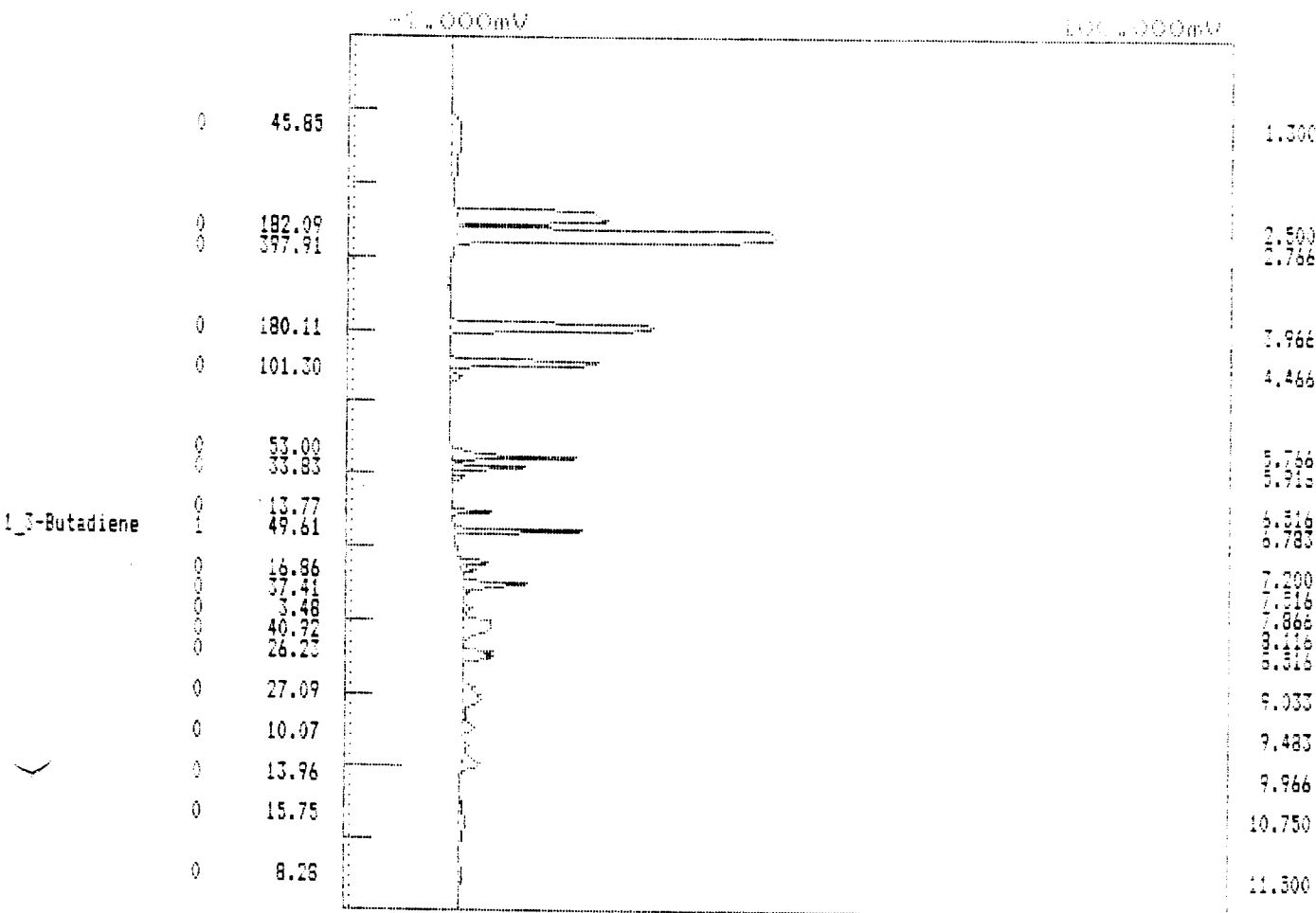
1250.95

1138

ENTROPY

Operator : Gary Mata
 File : 422-2-3
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 11:51:30

25" INJECTOR
 2.5" BUN
 DETECT FROM 192" / 4" / 1"



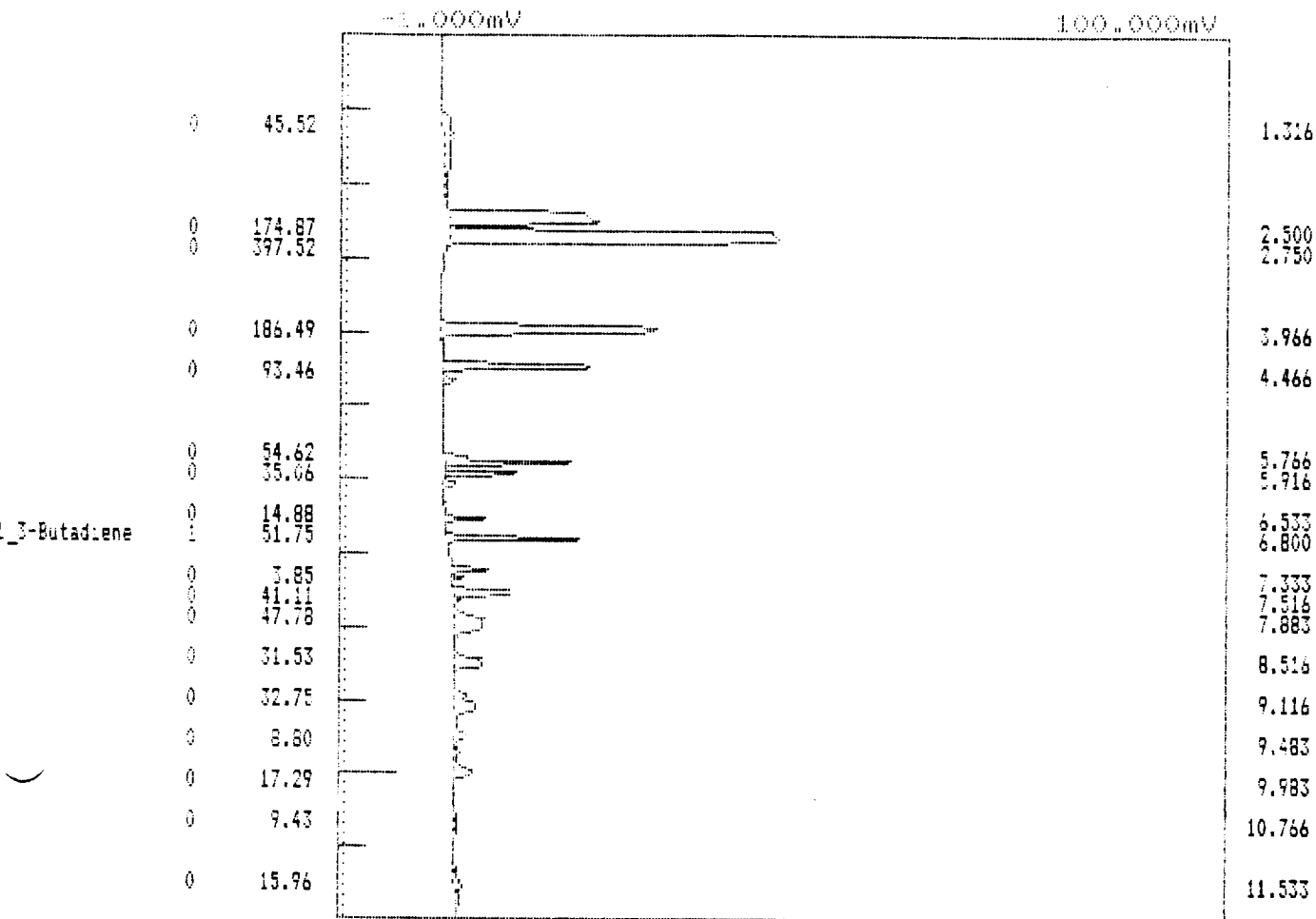
1,3-Butadiene

1,3-Butadiene

Component	Number	Retention	Area	Units
	0	1.500	45.85	
	0	2.500	182.09	
	0	2.766	397.91	
	0	3.966	180.11	
	0	4.466	101.30	
	0	5.766	53.00	
	0	5.916	33.83	
	0	6.516	13.77	
	1	6.783	49.61	
	0	7.200	16.86	
	0	7.516	37.41	
	0	7.866	3.48	
	0	8.116	40.92	
	0	8.516	26.23	
	0	9.053	27.09	
	0	9.483	10.07	
	0	9.966	13.76	
	0	10.750	15.75	
	0	11.500	8.28	

Operator : Gary Mata
 File : 422-2-4
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 12:08:01

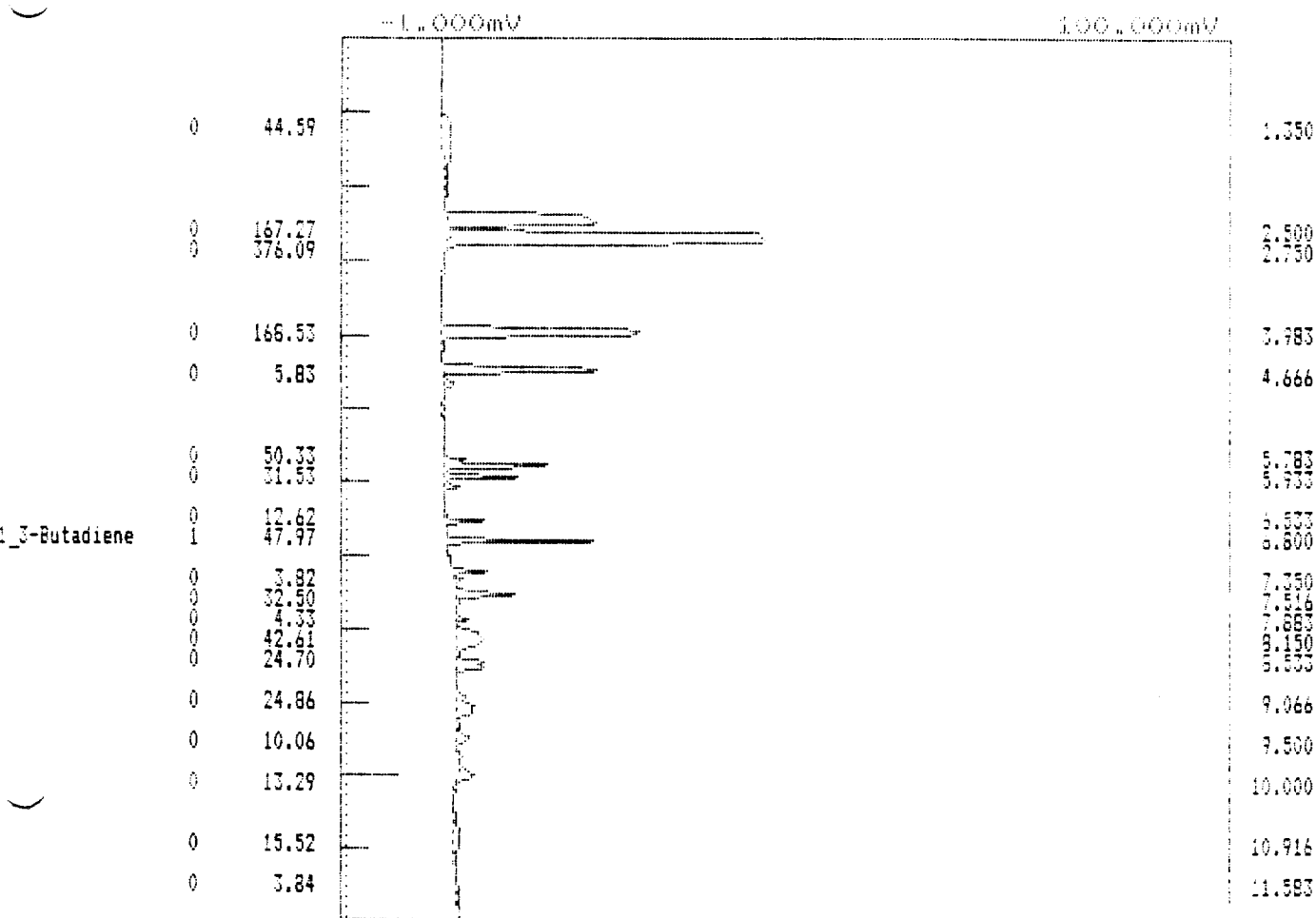
7th INJECTION
 2nd RUN
 DIRECT FLOW 152nd/min



Component	Number	Retention	Area	Units
3-Butadiene	0	1.316	45.52	
	0	2.500	174.87	
	0	2.750	397.52	
	0	3.966	186.49	
	0	4.466	93.46	
	0	5.766	54.62	
	0	5.916	35.06	
	0	6.533	14.88	
	1	6.800	51.75	
	0	7.216	15.29	
	0	7.333	3.85	
	0	7.516	41.11	
	0	7.883	47.78	
	0	8.516	31.53	
	0	9.116	32.75	
	0	9.483	8.80	
	0	9.983	17.29	
	0	10.766	9.43	
	0	11.533	15.96	

Operator : Gary Mata
 File : 422-2-5
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 12:23:36

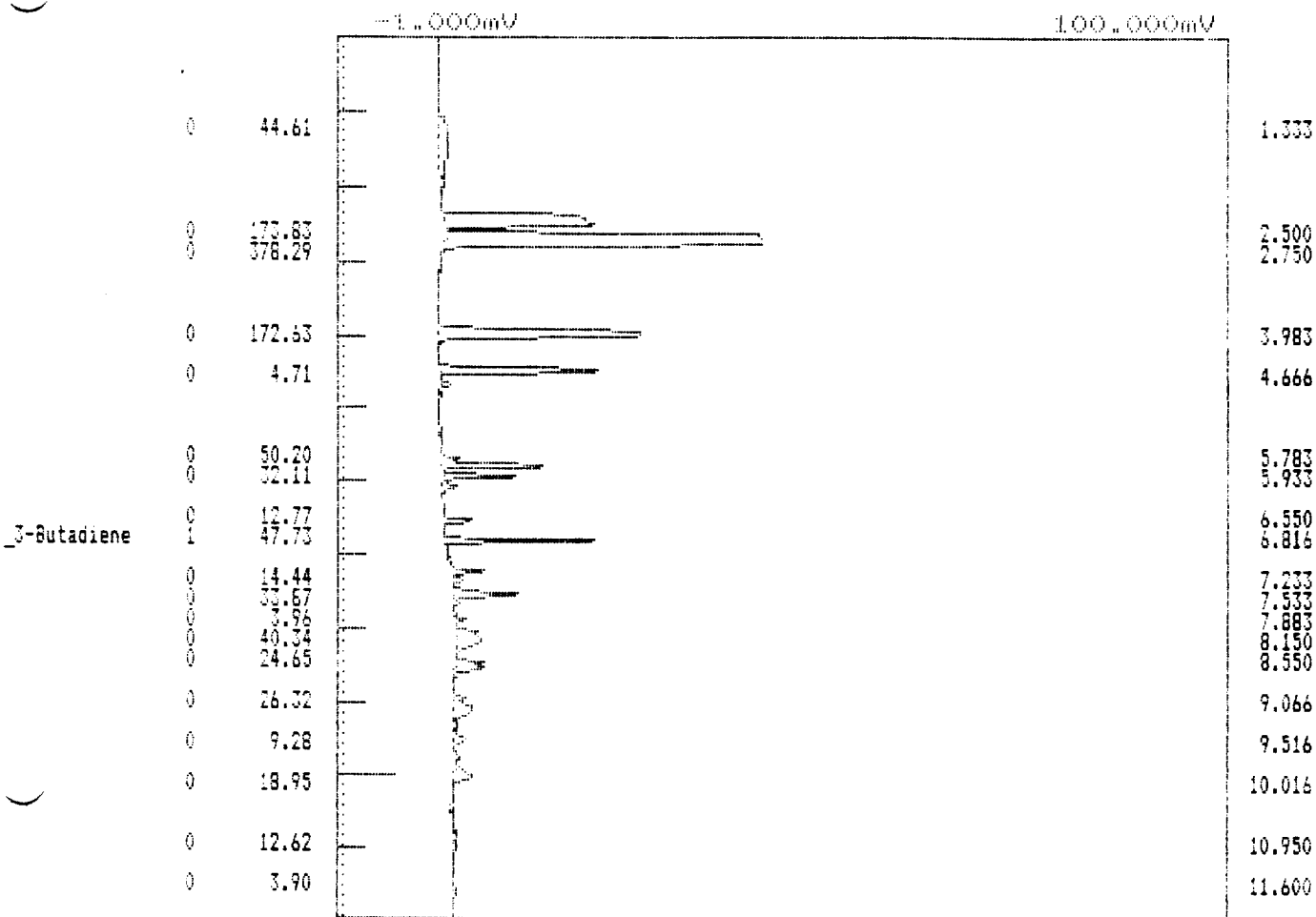
5th Injection
 2nd RUN
 DIRECT FLOW 152 $\frac{mL}{min}$



Component	Number	Retention	Area	Units
	0	1.350	44.59	
	0	2.500	167.27	
	0	2.750	376.09	
	0	3.983	166.53	
	0	4.666	91.20	
	0	4.666	5.83	
	0	5.783	50.33	
	0	5.933	31.53	
	0	6.533	12.62	
1,3-Butadiene	1	6.800	47.97	
	0	7.216	9.94	
	0	7.350	3.82	
	0	7.516	32.50	
	0	7.883	4.33	
	0	8.150	42.61	
	0	8.533	24.70	
	0	9.066	24.86	
	0	9.500	10.06	
	0	10.000	13.29	
	0	10.916	15.52	
	0	11.583	3.84	

Operator : Gary Mata
 File : 422-2-6
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 12:39:18

65 INJECTION
 2ND RUN
 DIRECT FLOW 152 $\frac{mg}{4in}$



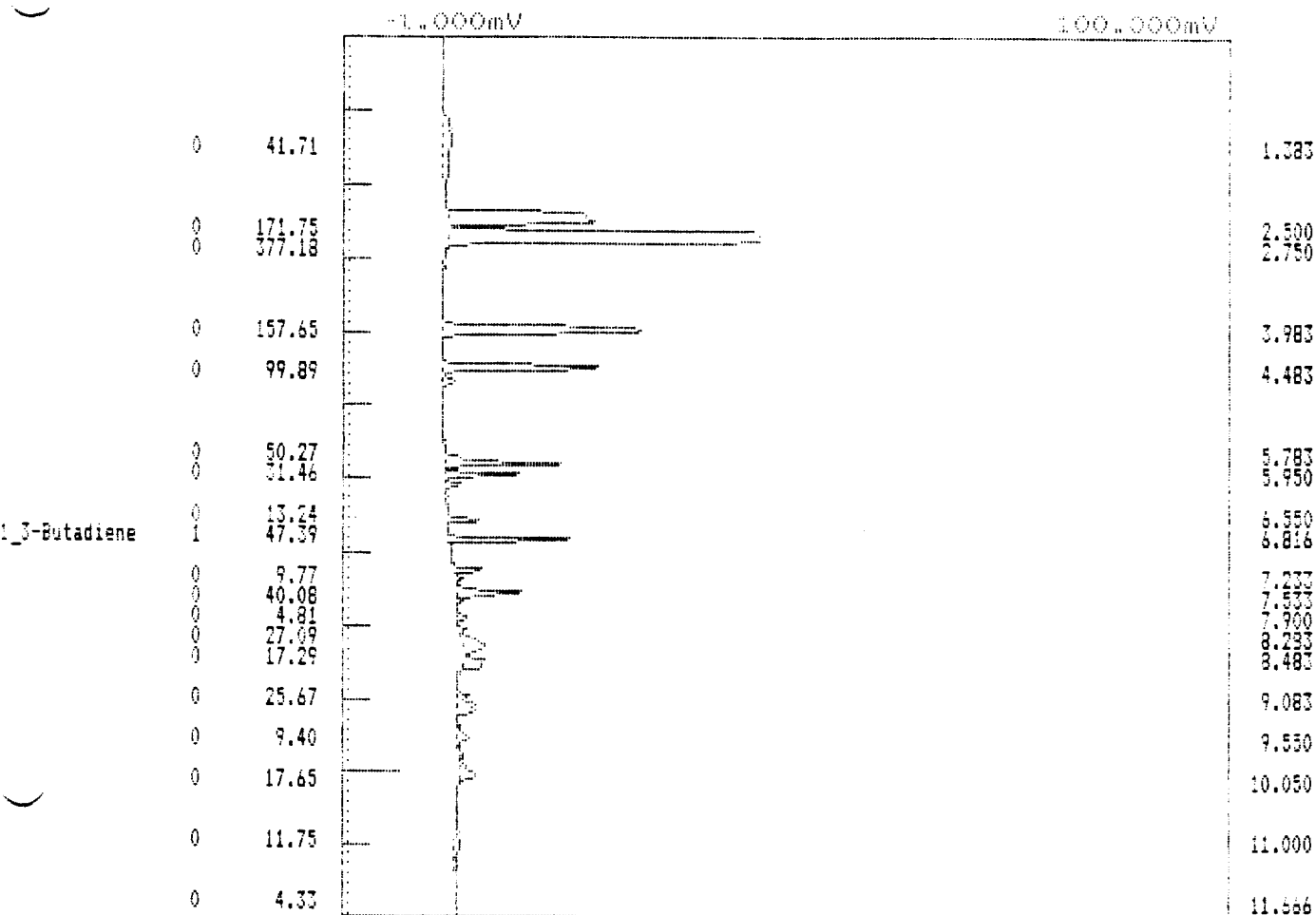
Component	Number	Retention	Area	Units
	0	1.333	44.61	
	0	2.500	173.83	
	0	2.750	378.29	
	0	3.983	172.63	
	0	4.483	91.24	
	0	4.666	4.71	
	0	5.783	50.20	
	0	5.933	32.11	
	0	6.550	12.77	
3-Butadiene	1	6.816	47.73	
	0	7.233	14.44	
	0	7.533	33.87	
	0	7.683	3.96	
	0	8.150	40.34	
	0	8.550	24.65	
	0	9.066	26.32	
	0	9.516	9.28	
	0	10.016	18.95	
	0	10.950	12.62	
	0	11.600	3.90	

Operator : Gary Mata
 File : 422-2-7
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 12:54:23

7th INJECTION

2nd RUN

DIRECT FLUX 152.4 MIN



Component	Number	Retention	Area	Units
	0	1.383	41.71	
	0	2.500	171.75	
	0	2.750	377.18	
	0	3.983	157.65	
	0	4.483	99.89	
	0	5.783	50.27	
	0	5.950	31.46	
	0	6.550	13.24	
1,3-Butadiene	1	6.816	47.39	
	0	7.233	9.77	
	0	7.533	40.08	
	0	7.900	4.81	
	0	8.283	27.09	
	0	8.483	17.29	
	0	9.083	25.67	
	0	9.550	9.40	
	0	10.050	17.65	
	0	11.000	11.75	
	0	11.666	4.33	

19

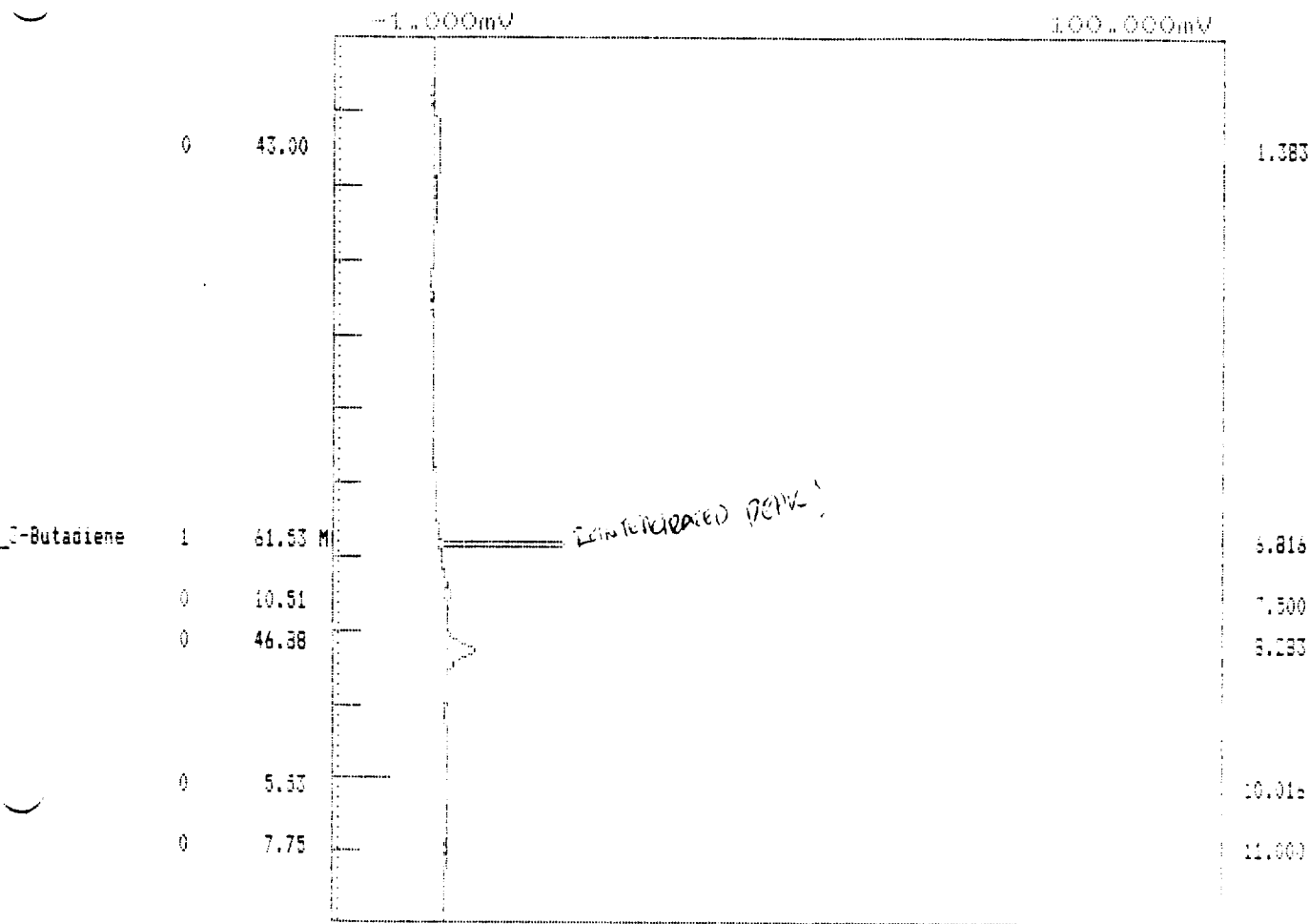
1158.38

3143

ENTROPY

Operator : Gary Mata
 File : 422-2-8
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 13:09:59

Handwritten notes:
 2nd peak
 Direct run 1.52 w/ air



Component	Number	Retention	Area	Units
1,3-Butadiene	0	1.383	43.00	
	1	6.816	61.53	%
	2	7.500	10.51	
	3	8.283	46.88	
	4	10.016	5.53	
	5	11.000	7.75	

6

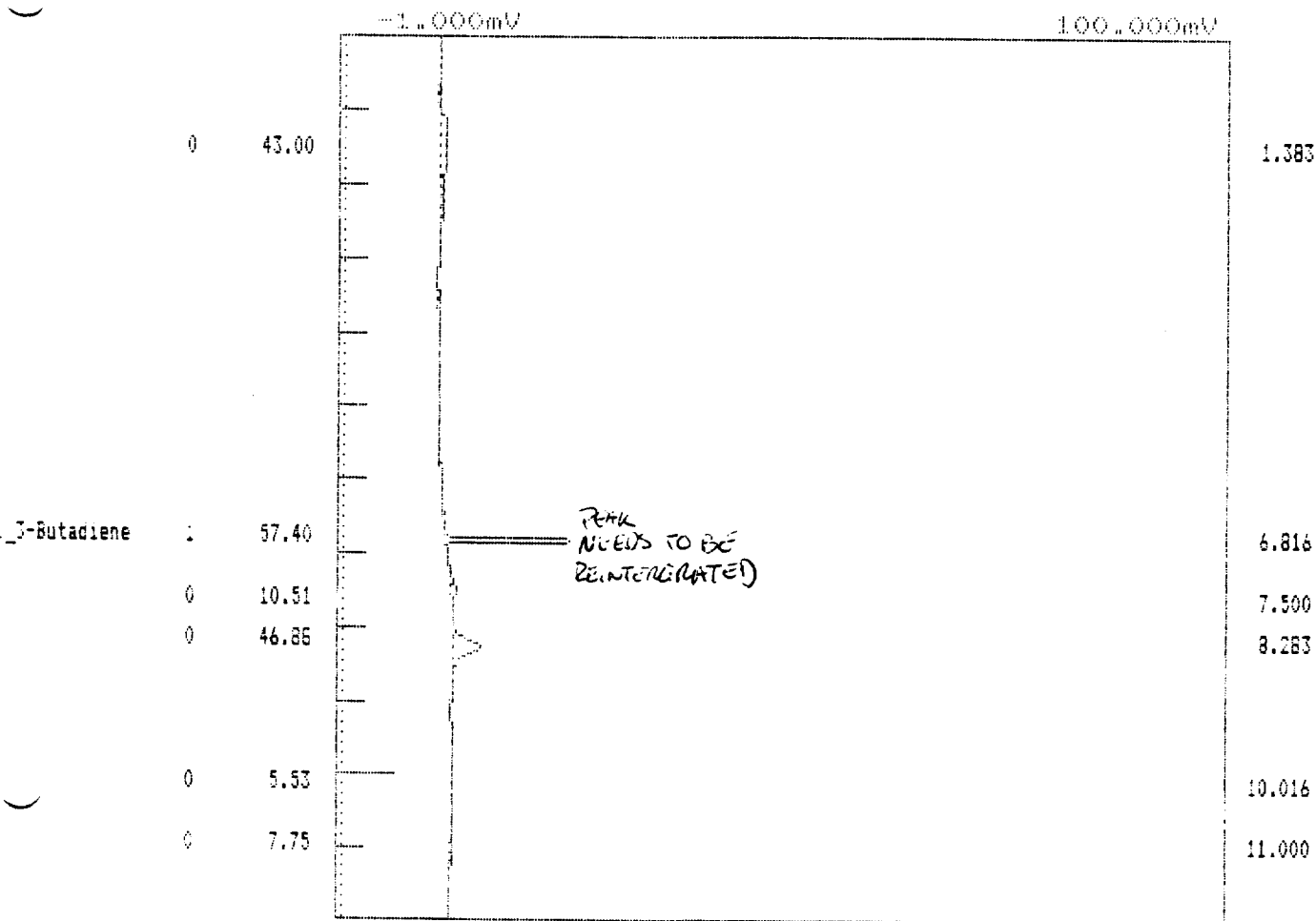
175.19

0145

ENTROPY

Operator : Gary Mata
 File : 422-2-8
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 13:09:59

MIDCLO 210
 2ND RUN
 DIRECT FLOW 152 ml/min



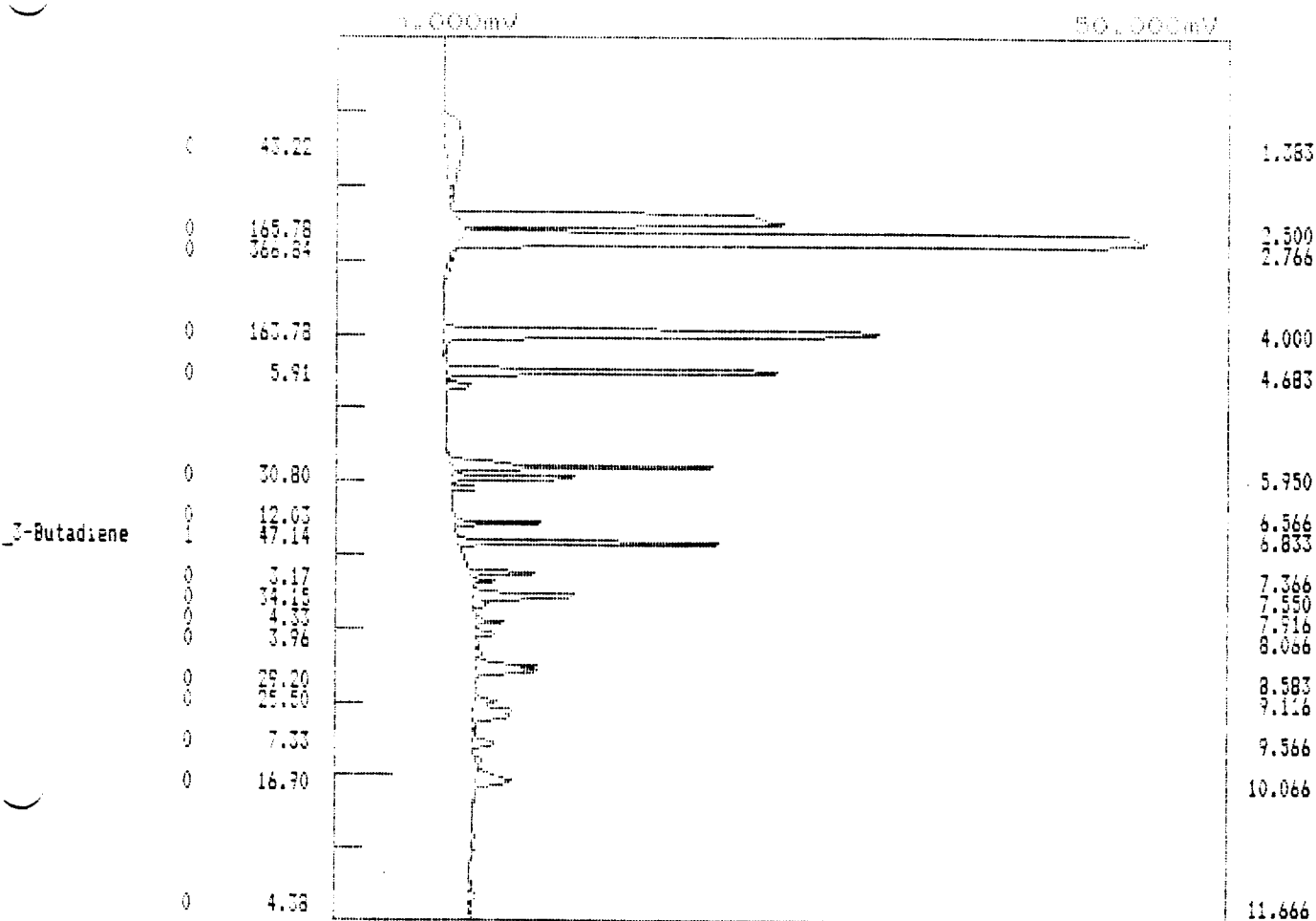
Component	Number	Retention	Area	Units
3-Butadiene	0	1.383	43.00	
	1	6.816	57.40	
	0	7.500	10.51	
	0	8.283	46.86	
	0	10.016	5.53	
	0	11.000	7.75	
6			171.06	

0144

ENTROPY

Operator : Gary Mata
 File : 422-2-9
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 13:27:25

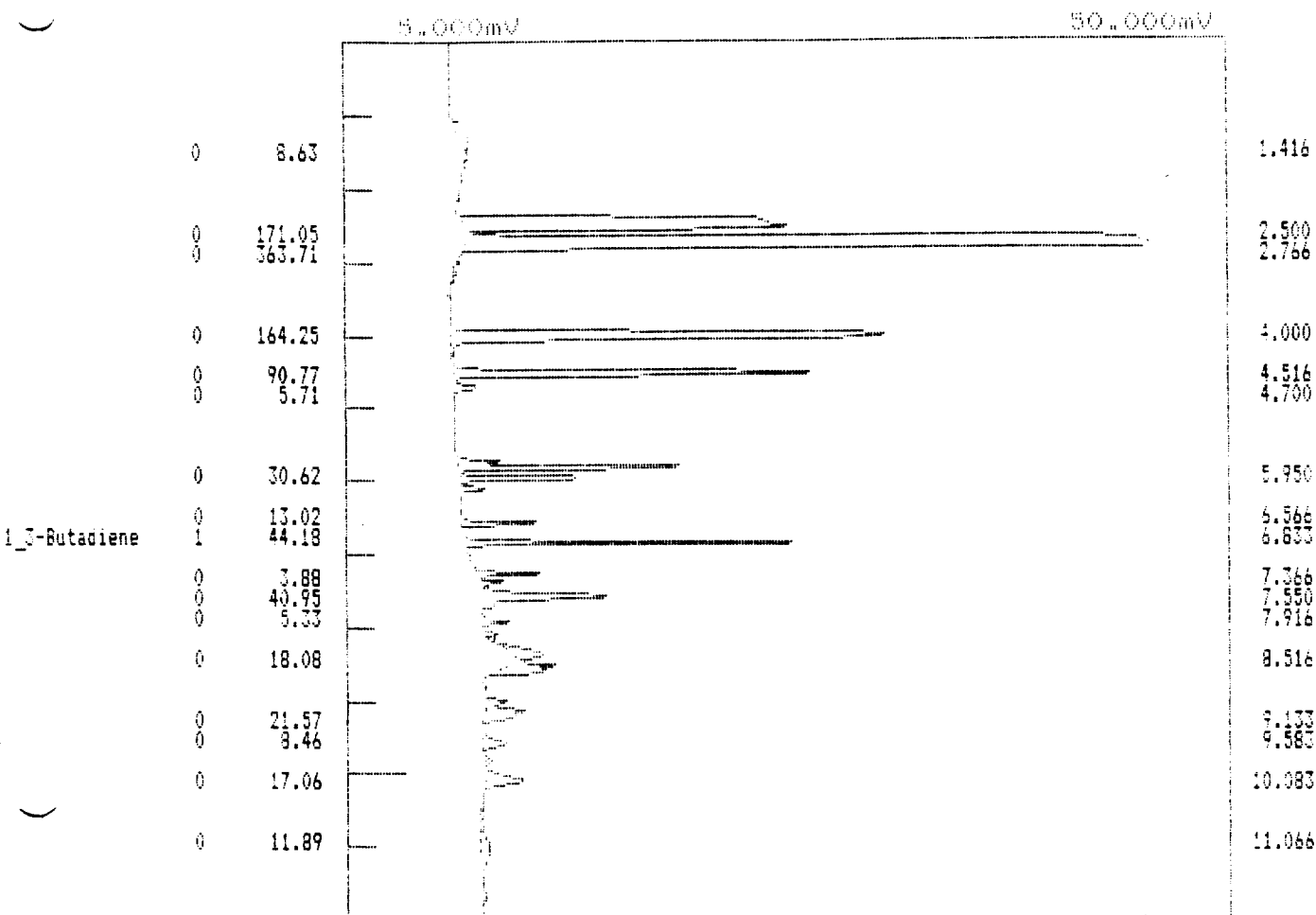
SP. INJECTION
 3RD RUN
 DIRECT FLOW 152 mL/MIN



Component	Number	Retention	Area	Units
3-Butadiene	0	1.383	43.22	
	0	2.500	165.78	
	0	2.766	366.84	
	0	4.000	163.78	
	0	4.500	84.21	
	0	4.683	5.91	
	0	5.800	44.07	
	0	5.950	30.80	
	0	6.566	12.03	
	1	6.833	47.14	
	0	7.250	11.27	
	0	7.366	3.17	
	0	7.550	34.15	
	0	7.916	4.33	
	0	8.066	3.96	
	0	8.583	29.20	
	0	9.116	25.50	
	0	9.566	7.33	
	0	10.066	16.90	
	0	11.666	4.38	

Operator : Gary Mata
 File : 422-2-10
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 13:43:21

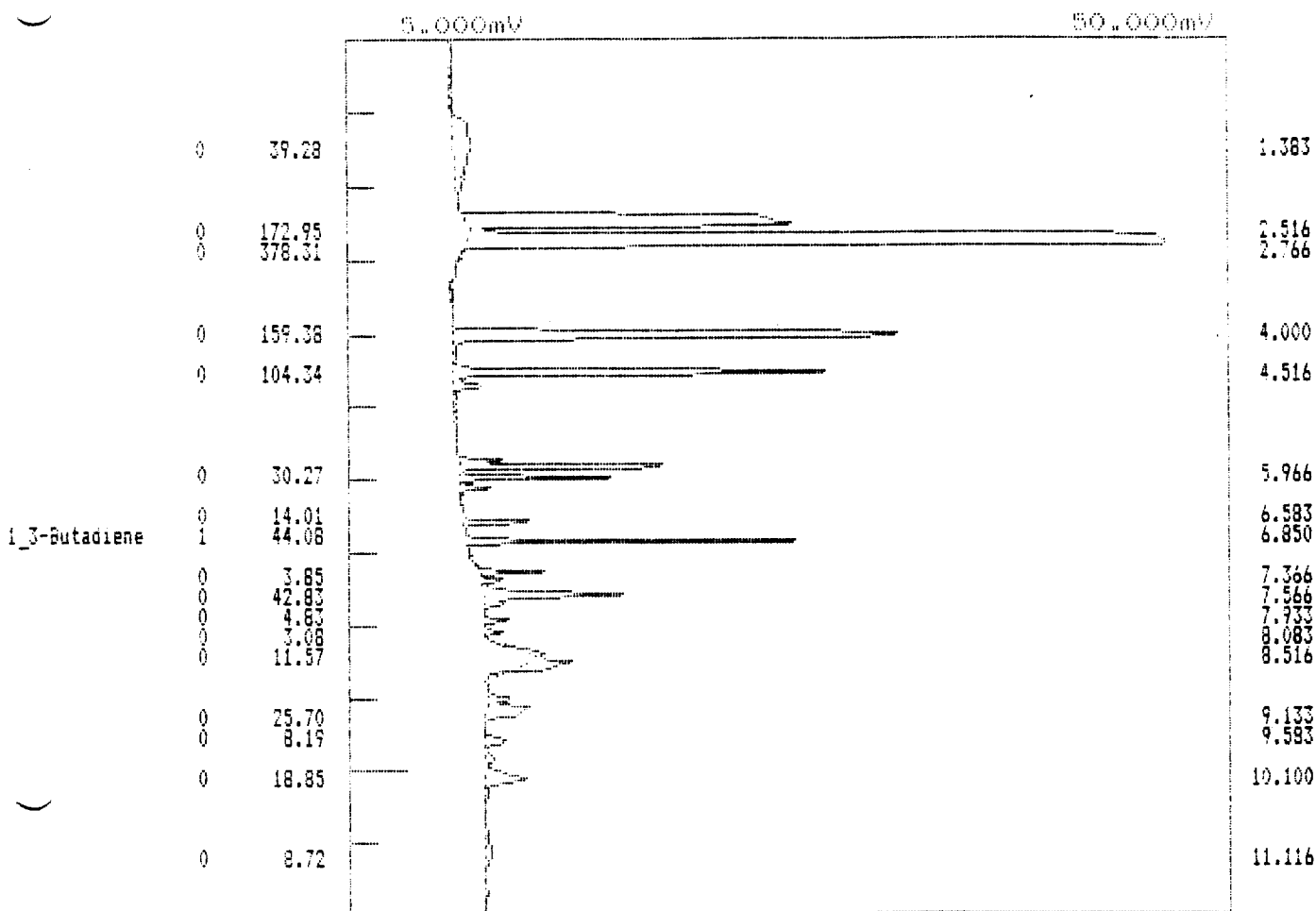
100%
 2nd Run
 Direct Flow 152.4/min



Component	Number	Retention	Area	Units
	0	1.416	8.63	
	0	2.500	171.05	
	0	2.766	363.71	
	0	4.000	164.25	
	0	4.516	90.77	
	0	4.700	5.71	
	0	5.816	47.76	
	0	5.950	30.62	
	0	6.566	13.02	
1,3-Butadiene	1	6.833	44.18	
	0	7.250	8.96	
	0	7.366	3.88	
	0	7.550	40.95	
	0	7.916	5.33	
	0	8.350	13.23	
	0	8.516	18.08	
	0	9.133	21.57	
	0	9.583	8.46	
	0	10.083	17.06	
	0	11.066	11.89	

Operator : Gary Mata
 File : 422-2-11
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 13:59:20

10% Injection
 25000
 Direct = 19200/min



Component	Number	Retention	Area	Units
	0	1.383	39.28	
	0	2.516	172.95	
	0	2.766	378.31	
	0	4.000	159.38	
	0	4.516	104.34	
	0	5.966	30.27	
	0	6.583	14.01	
1,3-Butadiene	1	6.850	44.08	
	0	7.366	3.85	
	0	7.566	42.83	
	0	7.933	4.83	
	0	8.083	3.08	
	0	8.516	11.57	
	0	9.133	25.70	
	0	9.583	8.19	
	0	10.100	18.85	
	0	11.116	8.72	

19

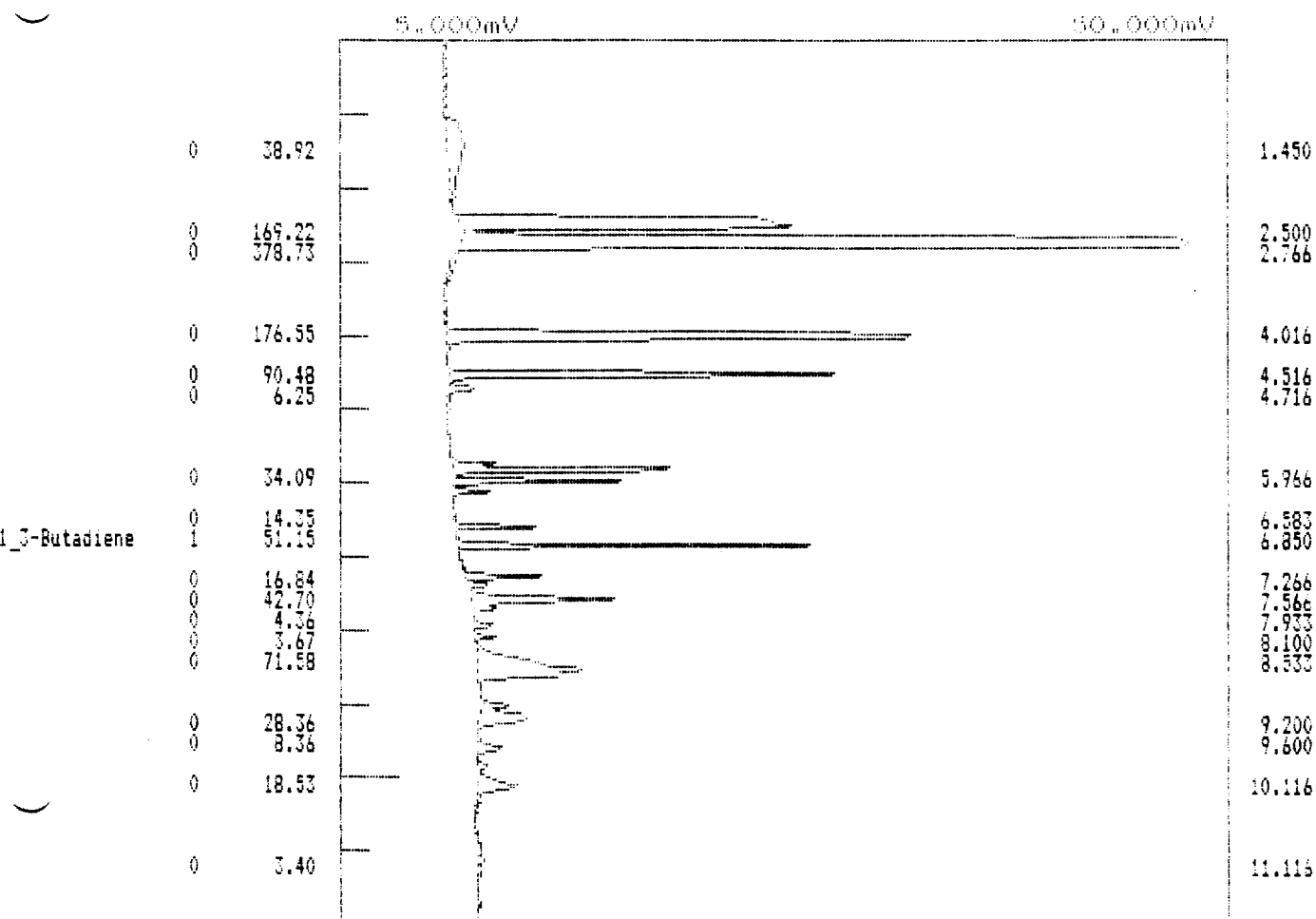
1128.47

3148

ENTROPY

Operator : Gary Mata
 File : 422-2-12
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 14:15:22

INJECTION
 2:00 120V
 DIRECT FLOW 152 ml/min



Component	Number	Retention	Area	Units
	0	1.450	38.92	
	0	2.500	169.22	
	0	2.766	378.73	
	0	4.016	176.55	
	0	4.516	90.48	
	0	4.716	6.25	
	0	5.966	49.89	
	0	5.966	34.09	
	0	6.583	14.35	
1_3-Butadiene	1	6.850	51.15	
	0	7.266	16.84	
	0	7.566	42.70	
	0	7.933	4.36	
	0	8.100	3.67	
	0	8.533	71.58	
	0	9.200	28.36	
	0	9.600	8.36	
	0	10.116	18.53	
	0	11.116	3.40	

19

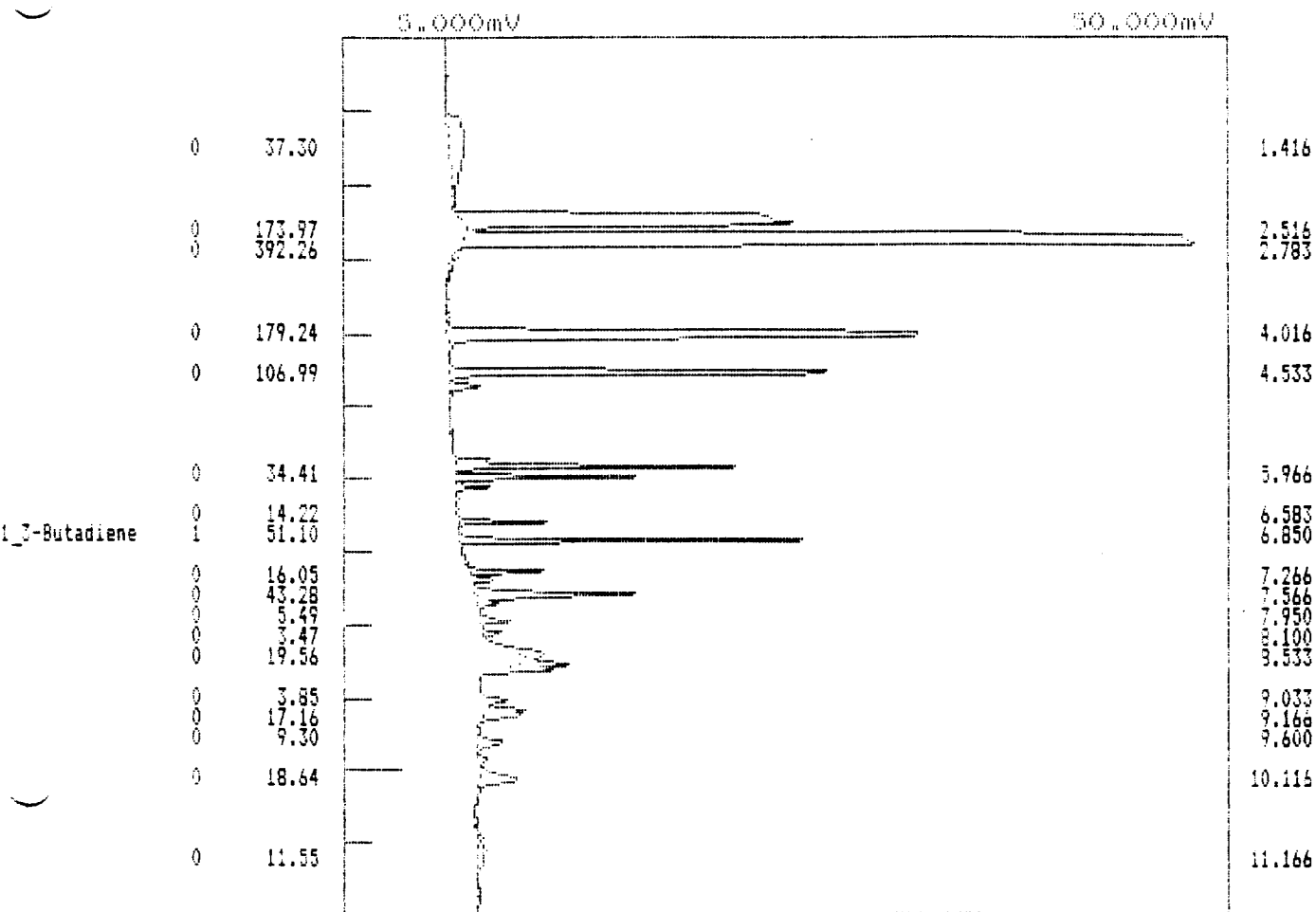
1207.43

0149

ENTROPY

Operator : Gary Mata
 File : 422-2-13
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 14:31:35

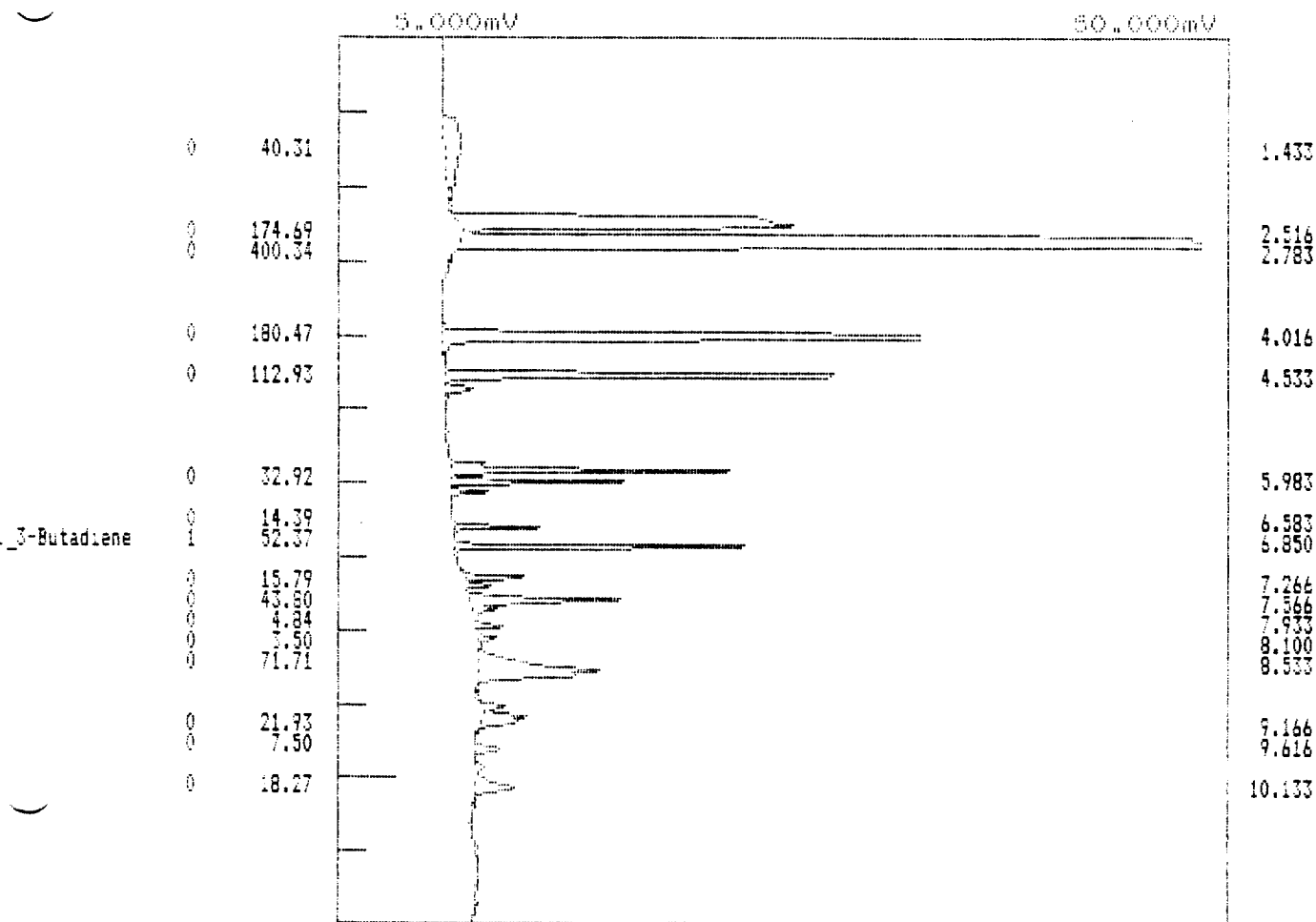
22 INJECTION
 200 KHz
 DIRECT FLOW 152 ml/min



Component	Number	Retention	Area	Units
	0	1.416	37.30	
	0	2.516	173.97	
	0	2.783	392.26	
	0	4.016	179.24	
	0	4.533	106.99	
	0	5.833	52.22	
	0	5.966	34.41	
	0	6.583	14.22	
1,3-Butadiene	1	6.850	51.10	
	0	7.266	16.05	
	0	7.566	43.28	
	0	7.950	5.49	
	0	8.100	3.47	
	0	8.400	8.97	
	0	8.533	19.56	
	0	9.033	3.85	
	0	9.166	17.16	
	0	9.600	9.30	
	0	10.116	18.64	
	0	11.166	11.55	

Operator : Gary Mata
 File : 422-2-14
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 14:47:47

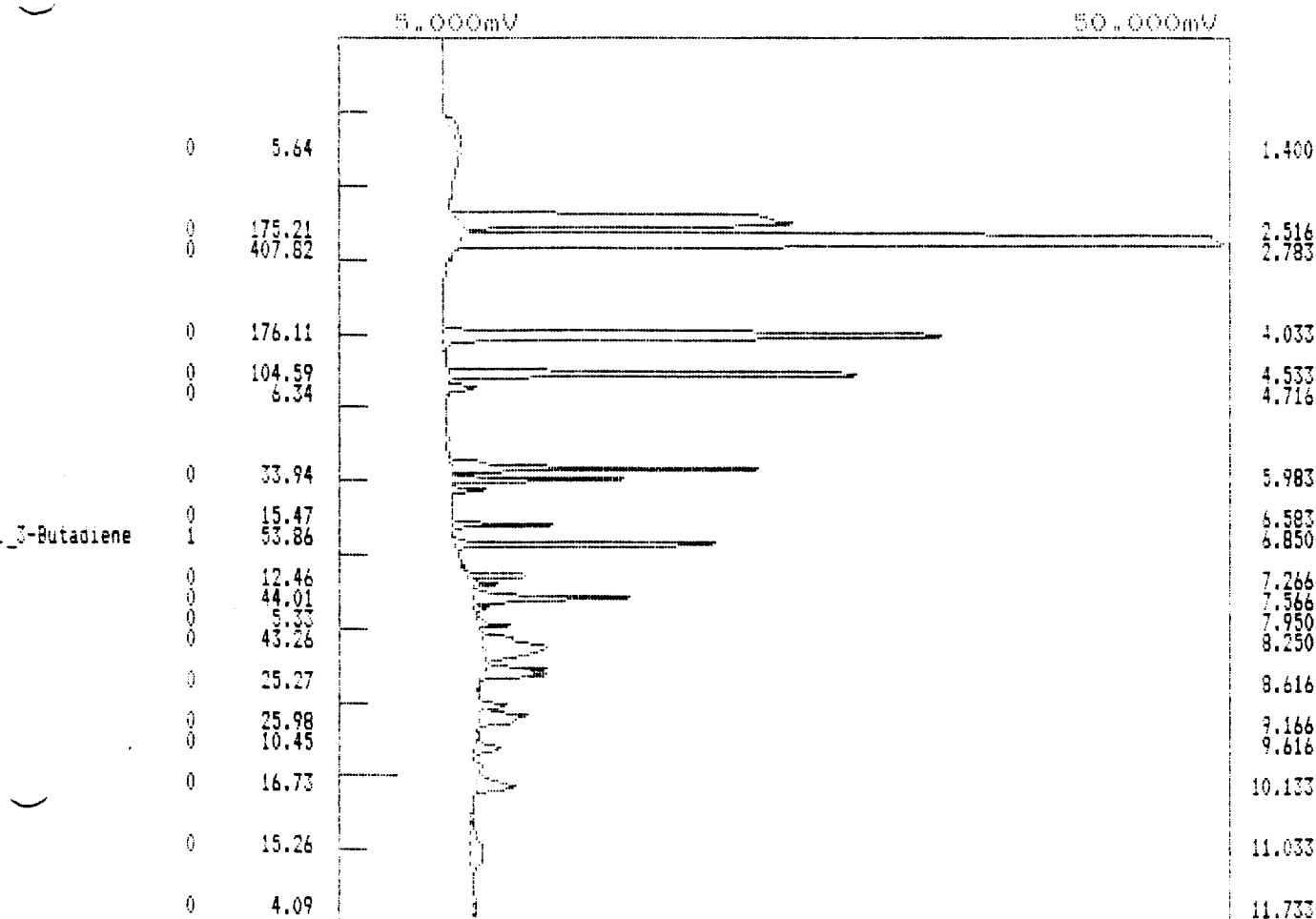
152 INJECTION
 2ND RUN
 DIRECT FLOW 152 ml/min



Component	Number	Retention	Area	Units
3-Butadiene	0	1.433	40.31	
	0	2.516	174.69	
	0	2.783	400.34	
	0	4.016	180.47	
	0	4.533	112.93	
	0	5.983	32.92	
	0	6.583	14.39	
	1	6.850	52.37	
	0	7.266	15.79	
	0	7.566	43.80	
	0	7.933	4.84	
	0	8.100	3.50	
	0	8.533	71.71	
	0	9.166	21.93	
	0	9.616	7.50	
	0	10.133	18.27	

Operator : Gary Mata
 File : 422-2-15
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 15:05:02

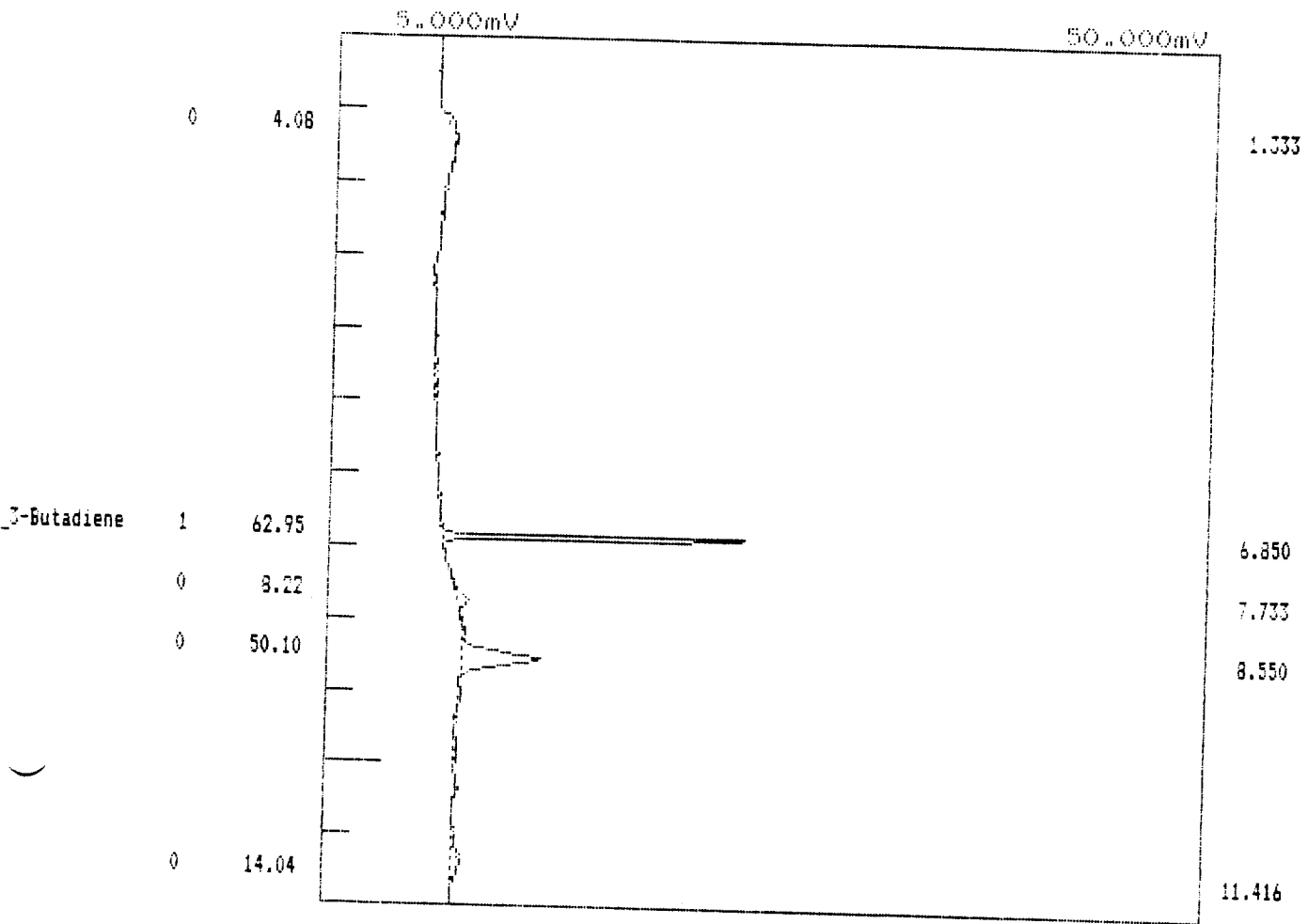
INJECTION
 2ND RUN
 DIRECT FLOW = 152 μ l/min



Component	Number	Retention	Area	Units
	0	1.400	5.64	
	0	2.516	175.21	
	0	2.783	407.82	
	0	4.033	176.11	
	0	4.533	104.59	
	0	4.716	6.34	
	0	5.983	54.27	
	0	5.983	33.94	
	0	6.583	15.47	
3-Butadiene	1	6.850	53.86	
	0	7.266	12.46	
	0	7.566	44.01	
	0	7.950	5.33	
	0	8.250	43.26	
	0	8.616	25.27	
	0	9.166	25.98	
	0	9.616	10.45	
	0	10.133	16.73	
	0	11.033	15.26	
	0	11.733	4.09	

Operator : Gary Mata
 File : 422-2-16
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 15:21:23

41D STD (0.540ppm)
 2ND RUN
 DIRECT FLOW 152 ml/min



Component	Number	Retention	Area	Units
3-Butadiene	0	1.333	4.08	
	1	6.850	62.95	
	0	7.733	8.22	
	0	8.550	50.10	
	0	11.416	14.04	

5

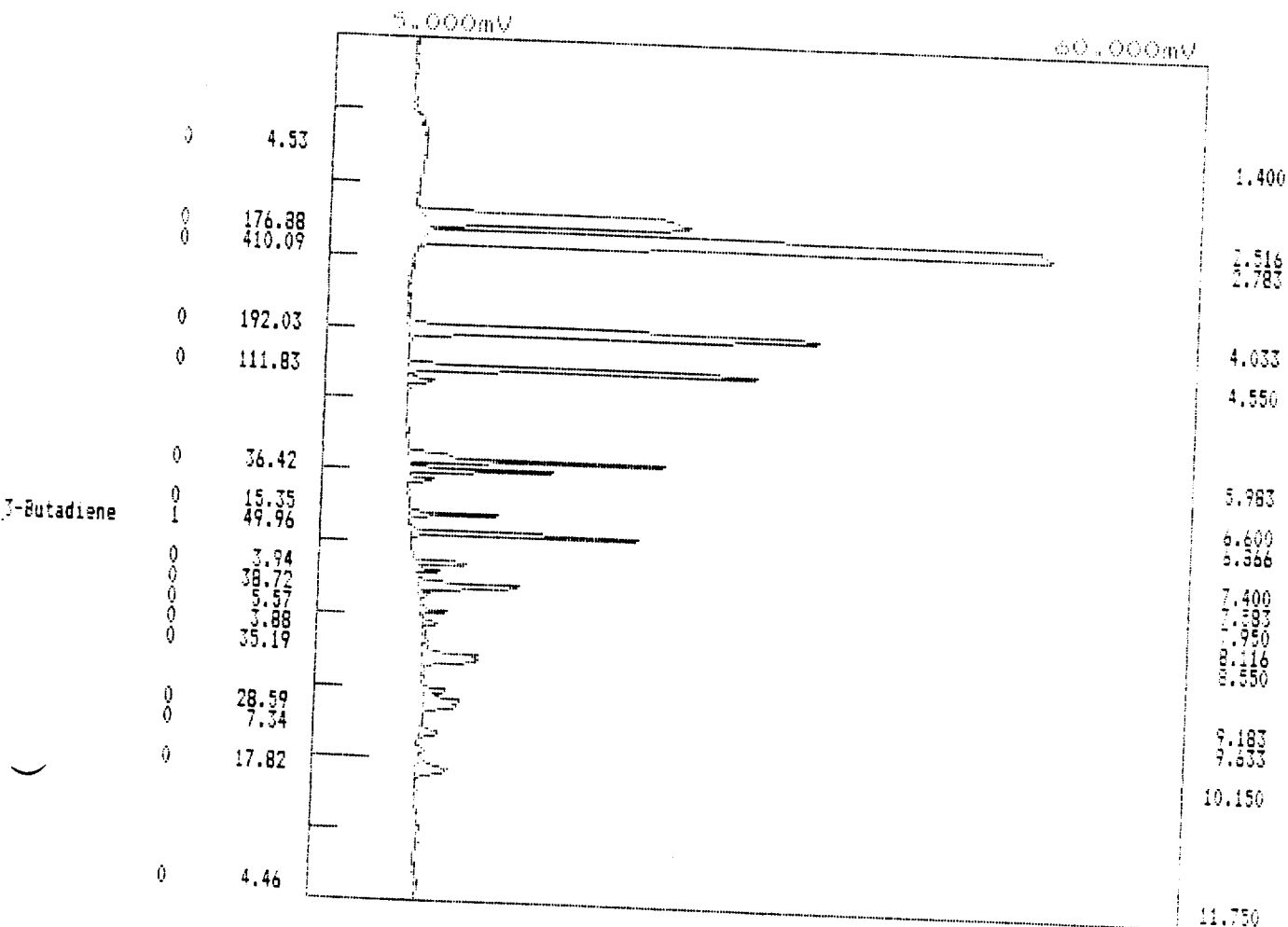
139.39

0153

ENTROPY

Operator : Gary Mata
 File : 422-2-17
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 15:37:35

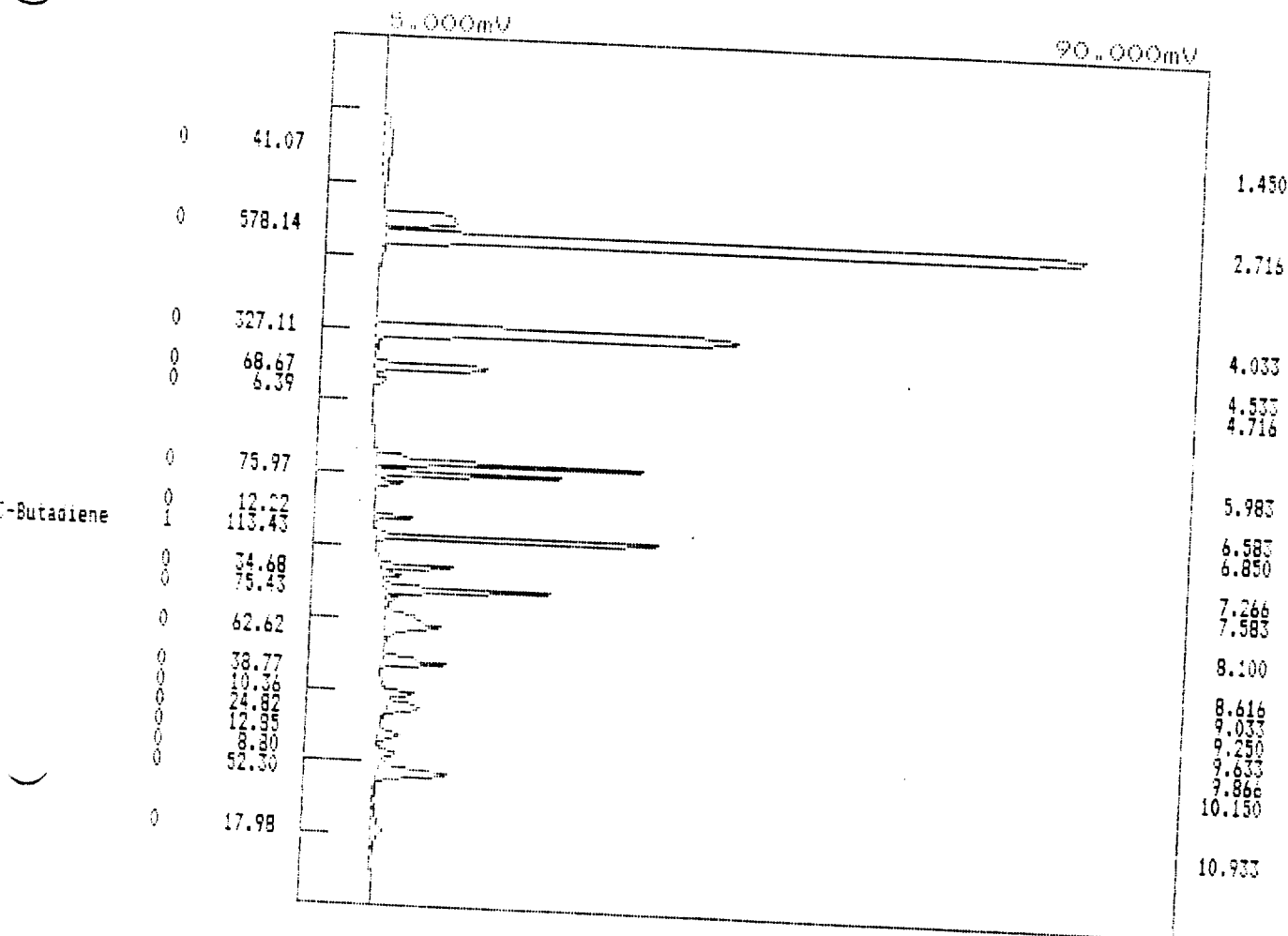
15th INJECTION
 2nd RUN
 DIRECT FLOW 152ml/min



Component	Number	Retention	Area	Units
	0	1.400	4.53	
	0	2.516	176.88	
	0	2.783	410.09	
	0	4.033	192.03	
	0	4.550	111.83	
	0	5.833	36.42	
	0	5.983	15.35	
3-Butadiene	1	6.600	49.96	
	0	6.866	3.94	
	0	7.283	38.72	
	0	7.400	5.57	
	0	7.583	3.88	
	0	7.950	35.19	
	0	8.116	28.59	
	0	8.550	7.34	
	0	9.183	17.82	
	0	9.633	4.46	
	0	10.150		
	0	11.750		

Operator : Gary Mata
 File : 422-2-18
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 16:45:28

16th INJECTION
 2ND RUN
 DIRECT FLOW = 152 $\frac{ml}{min}$



Component	Number	Retention	Area	Units
	0	1.450	41.07	
	0	2.533	77.84	
	0	2.716	578.14	
	0	4.033	327.11	
	0	4.533	68.67	
	0	4.716	6.39	
	0	5.833	91.46	
	0	5.983	75.97	
	0	6.583	12.22	
	1	6.850	113.43	
	0	7.266	34.68	
	0	7.583	75.43	
	0	8.100	62.62	
	0	8.616	38.77	
	0	9.033	10.36	
	0	9.250	24.82	
	0	9.633	12.85	
	0	9.866	8.80	
	0	10.150	52.30	
	0	10.933	17.98	

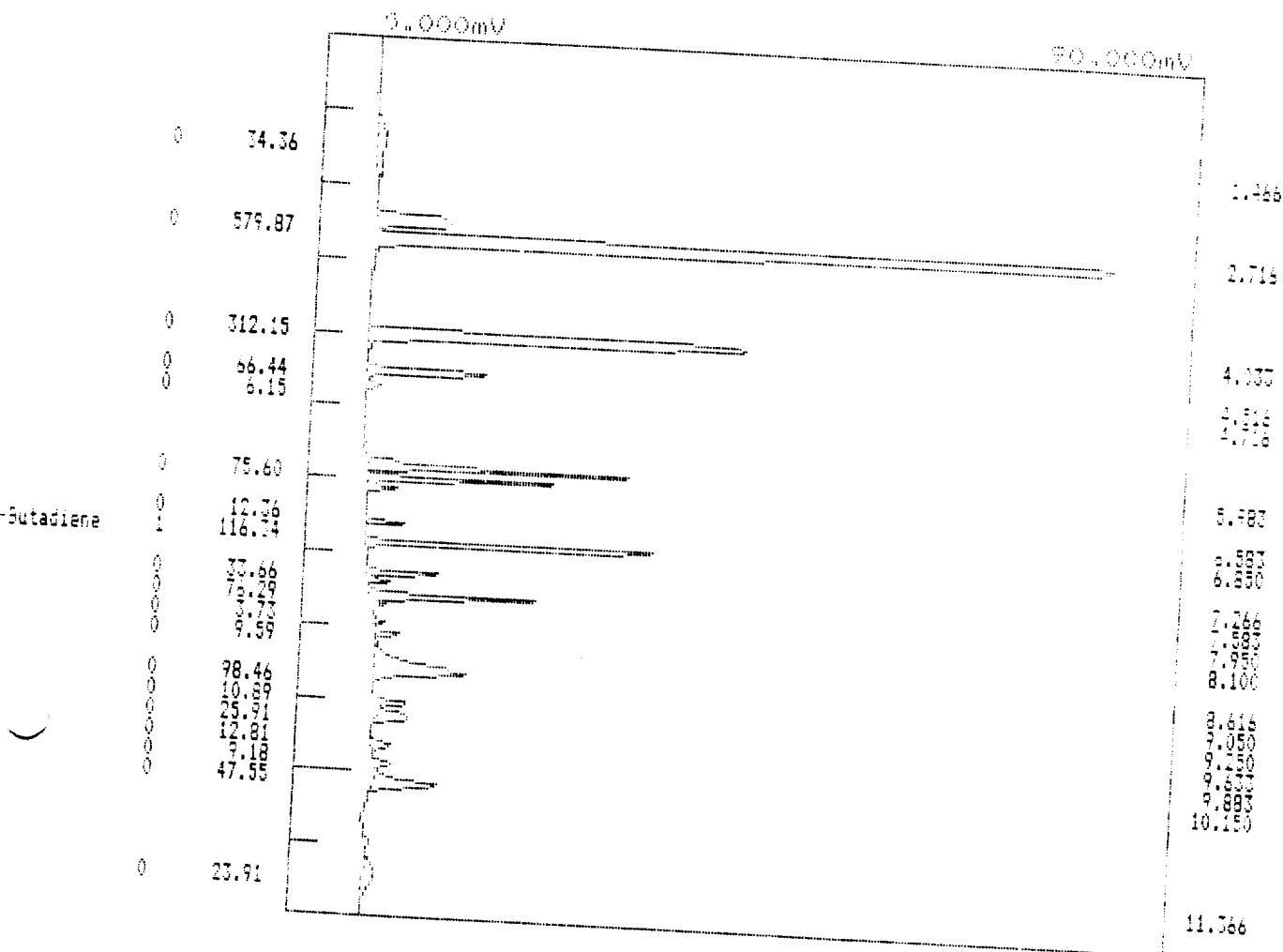
1730.92

3155

ENTROPY

Operator : Gary Mata
 File : 422-2-19
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 17:01:32

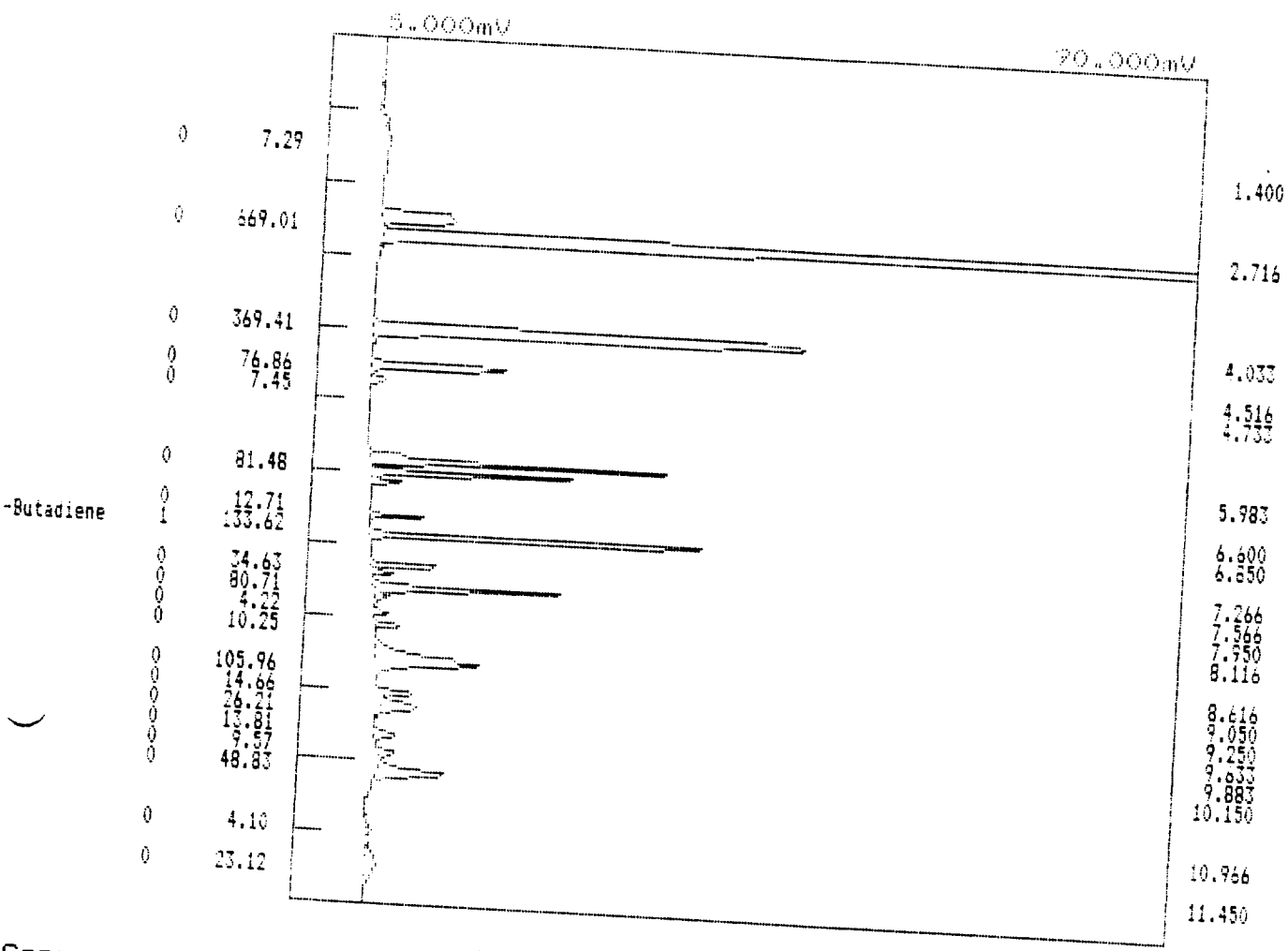
12th INJECTION
 ZINCON
 DIRECT SLOW 150



Component	Number	Retention	Area	Units
	0	1.466	54.36	
	0	2.516	74.48	
	0	2.716	579.87	
	0	4.033	312.15	
	0	4.516	66.44	
	0	4.716	6.15	
	0	5.833	92.22	
	0	5.953	75.60	
	0	6.583	12.36	
	1	6.850	116.34	
	0	7.266	33.66	
	0	7.583	76.29	
	0	7.950	3.73	
	0	8.100	9.59	
	0	8.616	98.46	
	0	9.050	10.89	
	0	9.250	25.91	
	0	9.633	12.81	
	0	9.883	9.18	
	0	10.150	47.55	
	0	11.366	23.91	

18th INJECTION
 2nd RUN
 DIRECT FLOW 150°C
 1.1

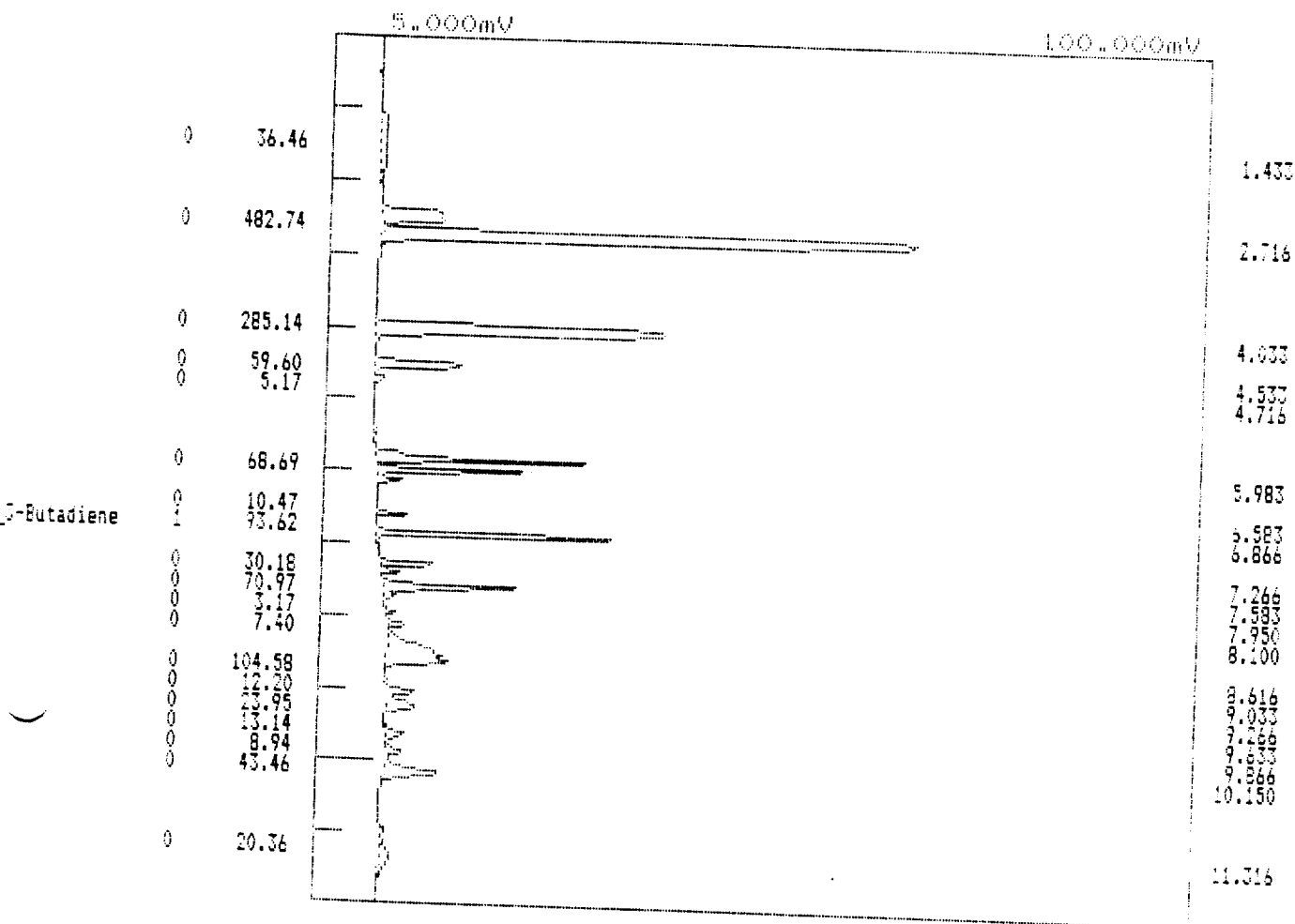
Operator : Gary Mata
 File : 422-2-20
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 17:16:59



Component	Number	Retention	Area	Units
	0	1.400	7.29	
	0	2.516	75.34	
	0	2.716	669.01	
	0	4.033	369.41	
	0	4.516	76.86	
	0	4.733	7.45	
	0	5.833	102.33	
	0	5.983	81.48	
	0	6.600	12.71	
	1	6.850	133.62	
	0	7.266	34.63	
	0	7.566	80.71	
	0	7.950	4.22	
	0	8.116	10.25	
	0	8.616	105.96	
	0	9.050	14.66	
	0	9.250	26.21	
	0	9.633	13.81	
	0	9.883	9.57	
	0	10.150	48.83	
	0	10.966	4.10	
	0	11.450	23.12	

Operator : Gary Mata
 File : 422-2-21
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 17:47:30

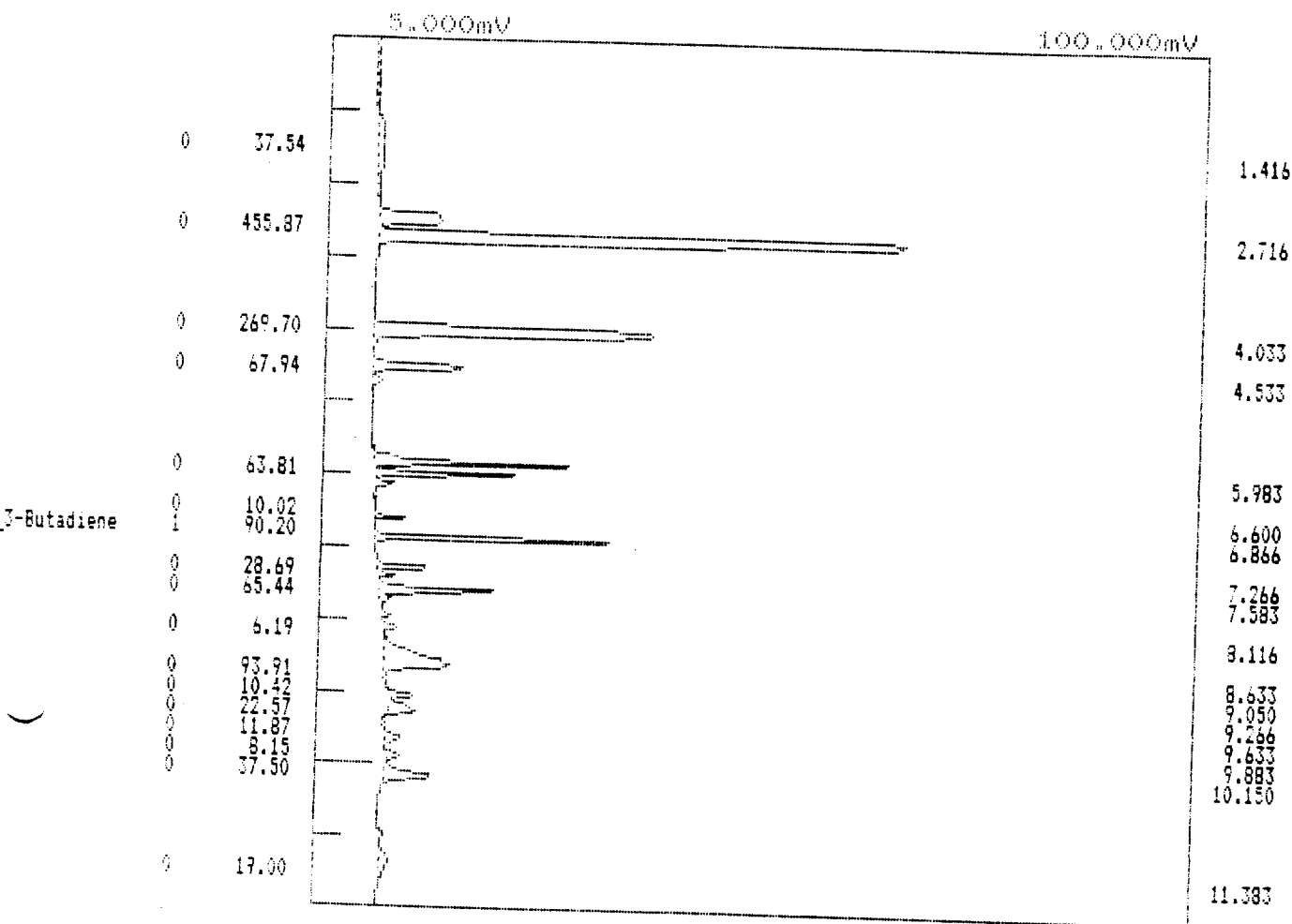
19th INJECTION
 2nd RUN
 DIRECT FLOW (52ml/min)



Component	Number	Retention	Area	Units
	0	1.433	36.46	
	0	2.516	71.41	
	0	2.716	482.74	
	0	4.033	285.14	
	0	4.533	59.60	
	0	4.716	5.17	
	0	5.833	82.50	
	0	5.983	68.69	
	0	6.583	10.47	
	1	6.866	93.62	
	0	7.266	30.18	
	0	7.583	70.97	
	0	7.950	3.17	
	0	8.100	7.40	
	0	8.616	104.58	
	0	9.033	12.20	
	0	9.266	23.95	
	0	9.633	13.14	
	0	9.866	8.94	
	0	10.150	43.46	
	0	11.316	20.36	

Operator : Gary Mata
 File : 422-2-22
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 18:04:03

20th INJECTION
 2nd RUN
 DIRECT FLOW = 152 $\frac{ml}{min}$

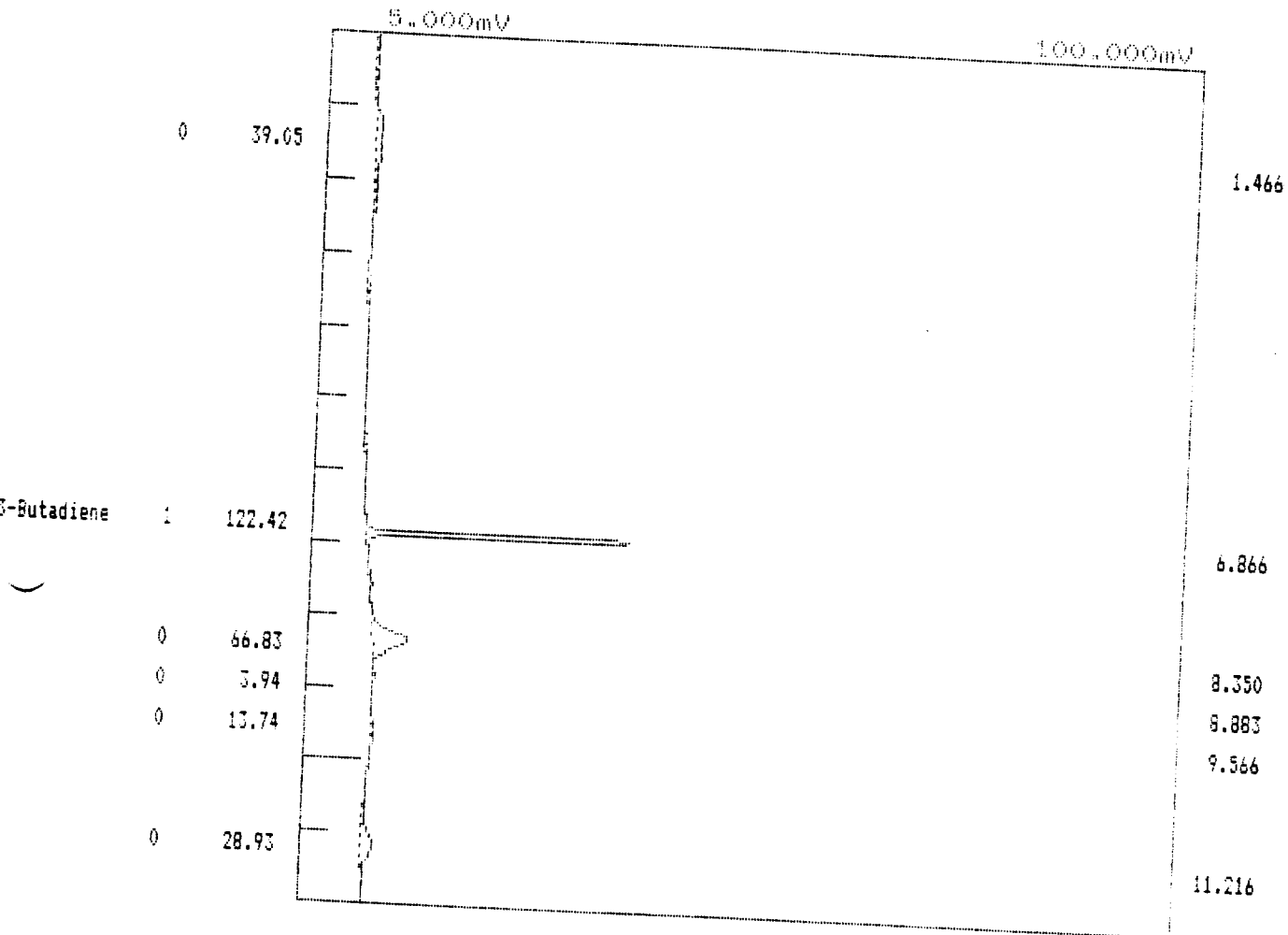


Component	Number	Retention	Area	Units
	0	1.416	37.54	
	0	2.516	71.83	
	0	2.716	455.87	
	0	4.033	269.70	
	0	4.533	67.94	
	0	5.833	75.81	
	0	5.983	63.81	
	0	6.600	10.02	
3-Butadiene	1	6.866	90.20	
	0	7.266	28.69	
	0	7.583	65.44	
	0	8.116	6.19	
	0	8.633	93.91	
	0	9.050	10.42	
	0	9.266	22.57	
	0	9.633	11.87	
	0	9.883	8.15	
	0	10.150	37.50	
	0	11.383	17.00	

1446.47

HIGH STD (1.08 ppm)
 2nd RUN
 DIRECT FLOW (50 μ g/mL)

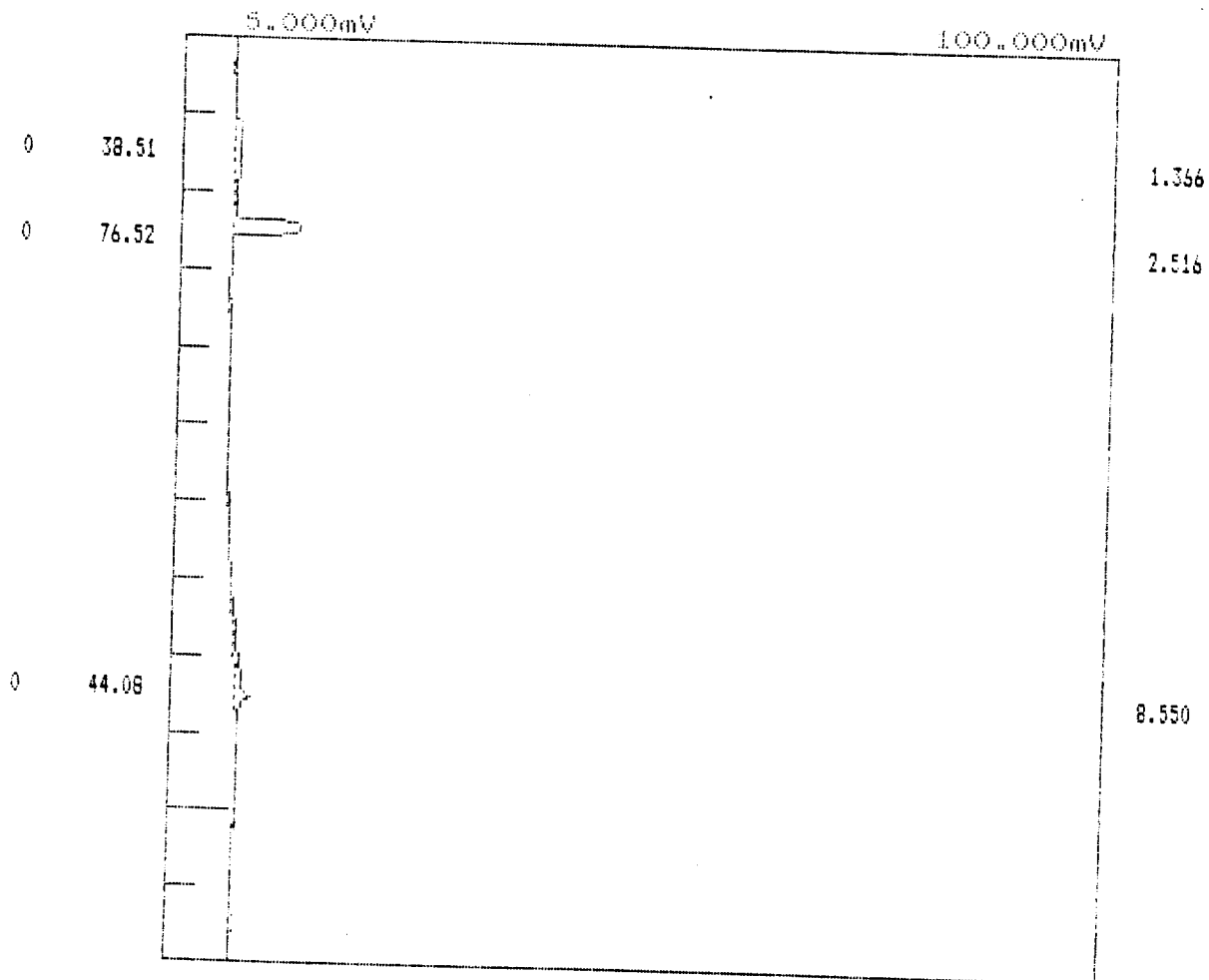
Operator : Gary Mata
 File : 422-2-23
 Temperature :
 Components : default
 Date : 07/30/1992
 Time : 18:21:48



Component	Number	Retention	Area	Units
3-Butadiene	0	1.466	39.05	
	1	6.866	122.42	
	0	8.350	66.83	
	0	8.883	3.94	
	0	9.566	13.74	
	0	11.216	28.93	
			274.92	

AIR BLANK
2ND RUN
DIRECT FLOW 152 ml/min

Operator : Gary Mata
File : 422-2-24
Temperature :
Components : default
Date : 07/30/1992
Time : 18:37:53



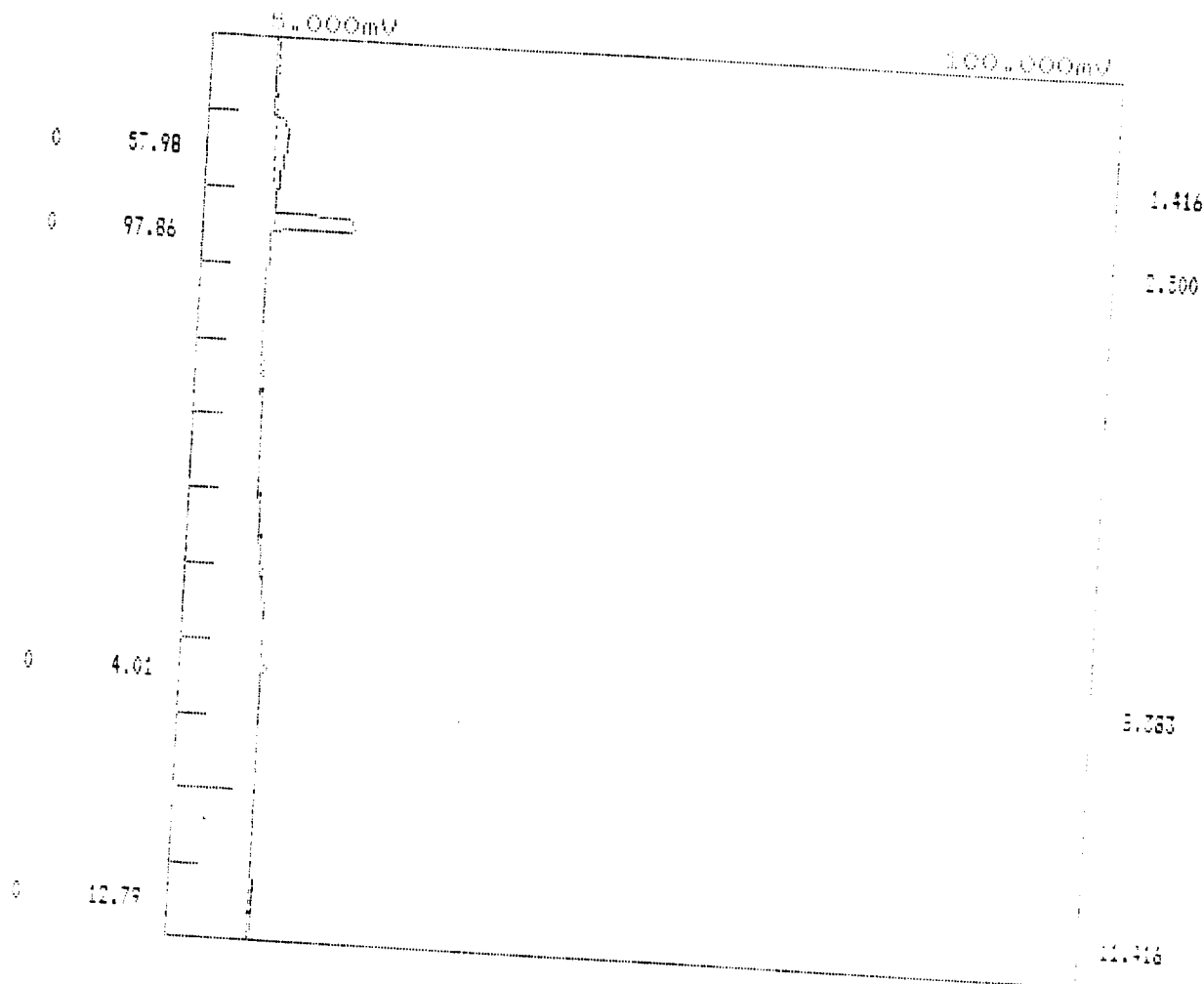
Component	Number	Retention	Area	Units
	0	1.356	38.51	
	0	2.516	76.52	
	0	8.550	44.08	
3			159.11	

0161

ENTROPY

AIR BLANK
 3RD RUN
 DIRECT FLOW 152 ml/min

Operator : Gary Mata
 File : Cal28
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 09:53:23



Component	Number	Retention	Area	Units
0	1	1.416	57.98	
0	2	2.500	97.86	
0	3	8.383	4.01	
0	4	11.416	12.73	

4

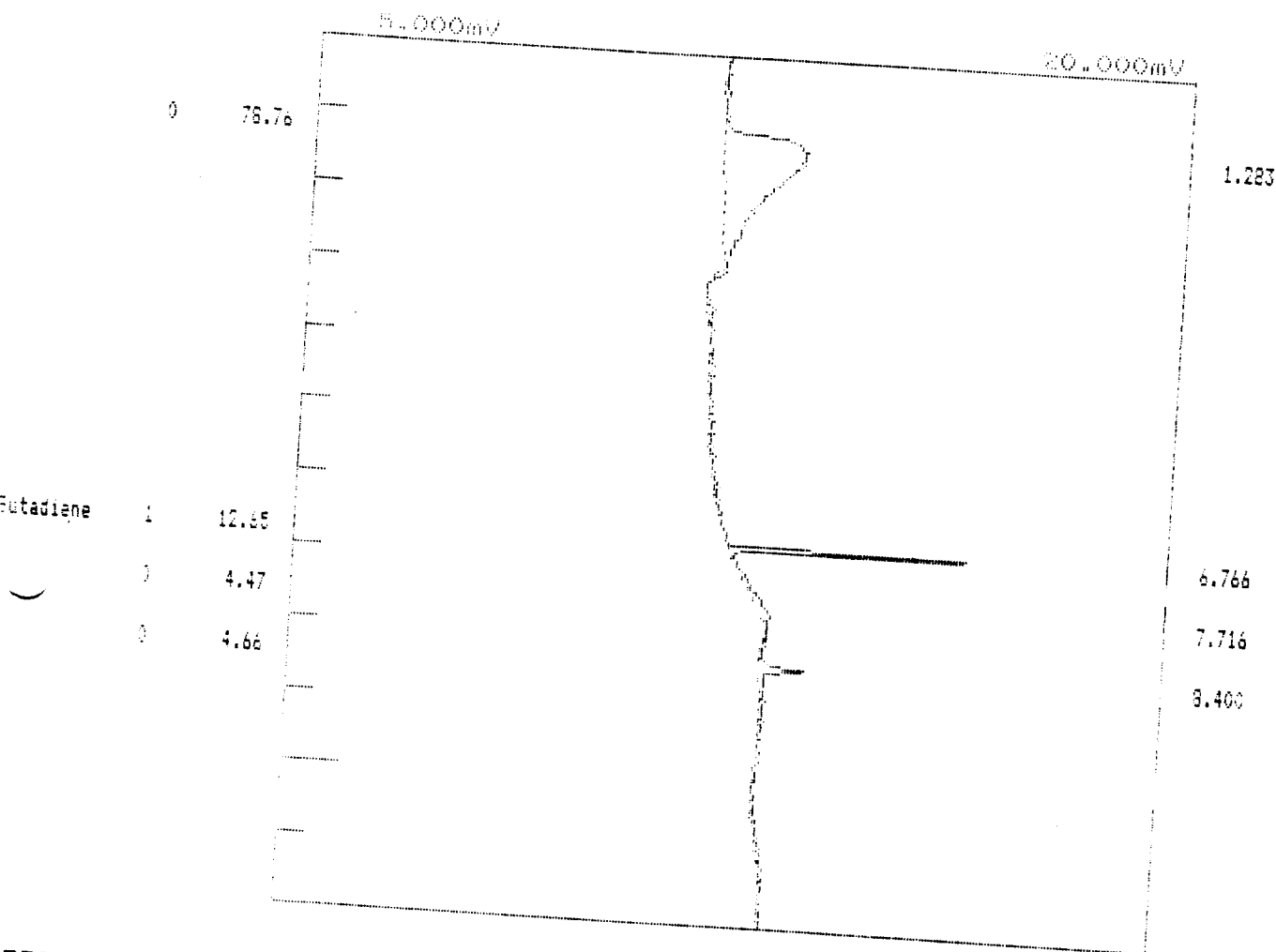
172.64

0162

ENTROPY

LOW STD (0.0935 ppm)
DIRECT FLOW 152.12/min
31226N

Operator : Gary Mata
File : Cal29
Temperature :
Components : default
Date : 07/31/1992
Time : 10:08:43



Butadiene

1 12.65
3 4.47
3 4.66

Component	Number	Retention	Area	Units
Butadiene	0	1.283	76.76	
	1	6.766	12.65	
	2	7.716	4.47	
	3	8.400	4.66	

4

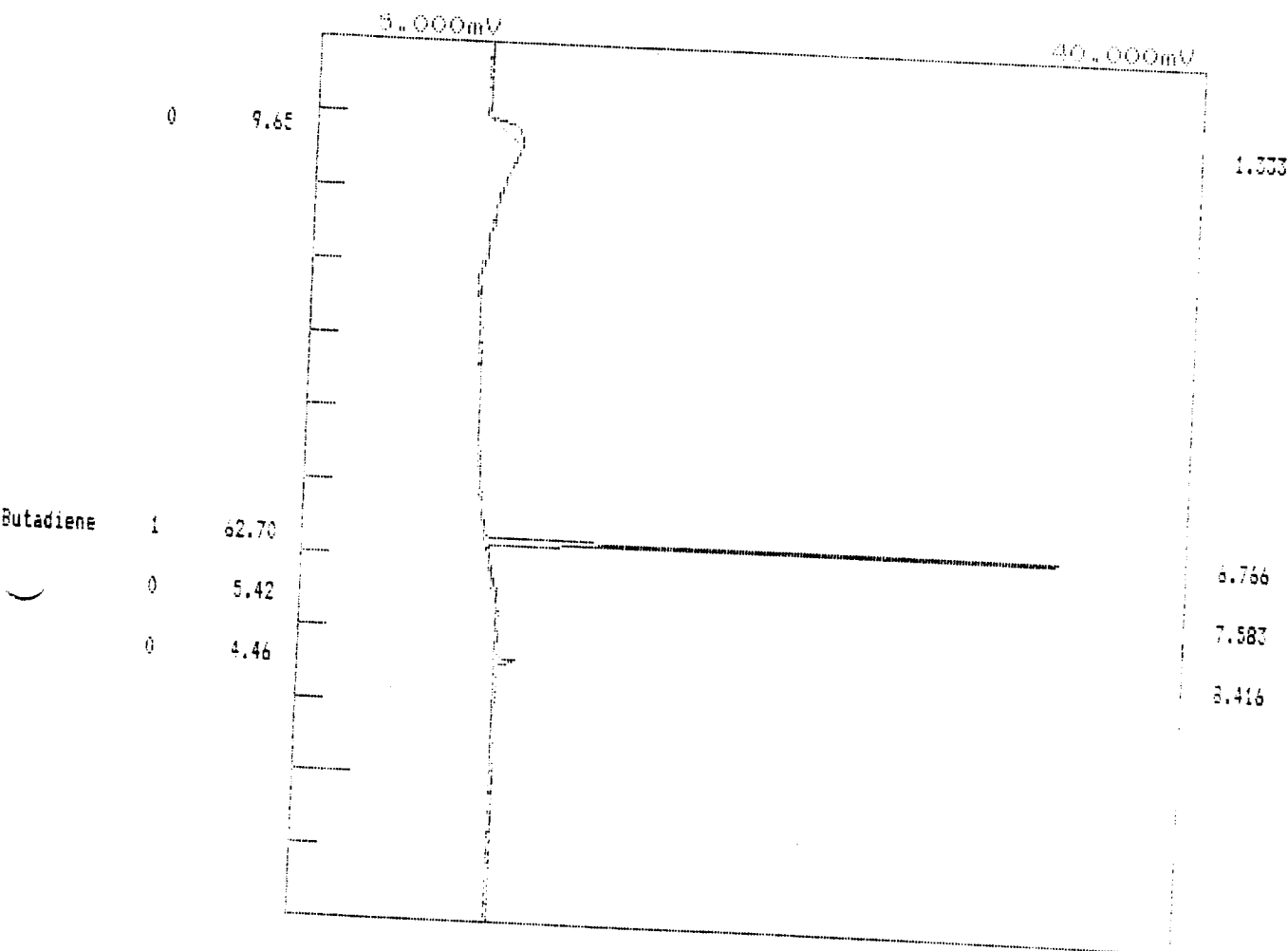
100.54

0163

ENTROPY

MID STD (0.5400pm)
 3rd RUN
 DIRECT FLOW 152nd / M.A.

Operator : Gary Mata
 File : Cal30
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 10:24:10



Component	Number	Retention	Area	Units
Butadiene	0	1.333	9.65	
	1	6.766	62.70	
	0	7.583	5.42	
	0	8.416	4.46	

4

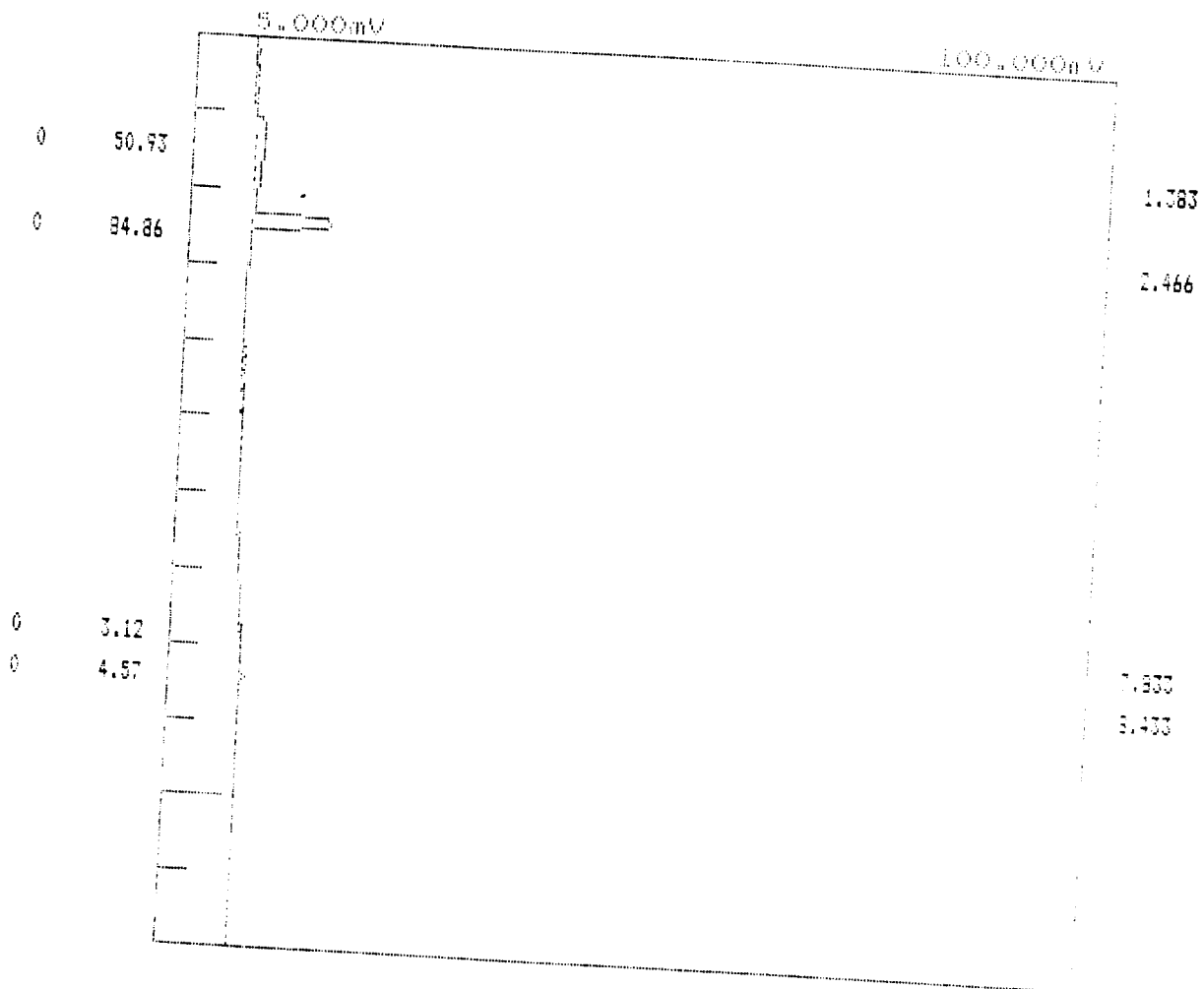
82.22

3164

ENTROPY

AIR BLANK
 3.12 RUN
 DIRECT FLOW 152 ml/min

Operator : Gary Mata
 File : Cal32
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 10:57:05



Component	Number	Retention	Area	Units
	0	1.383	50.93	
	0	2.466	84.86	
	0	7.833	3.12	
	0	8.433	4.57	

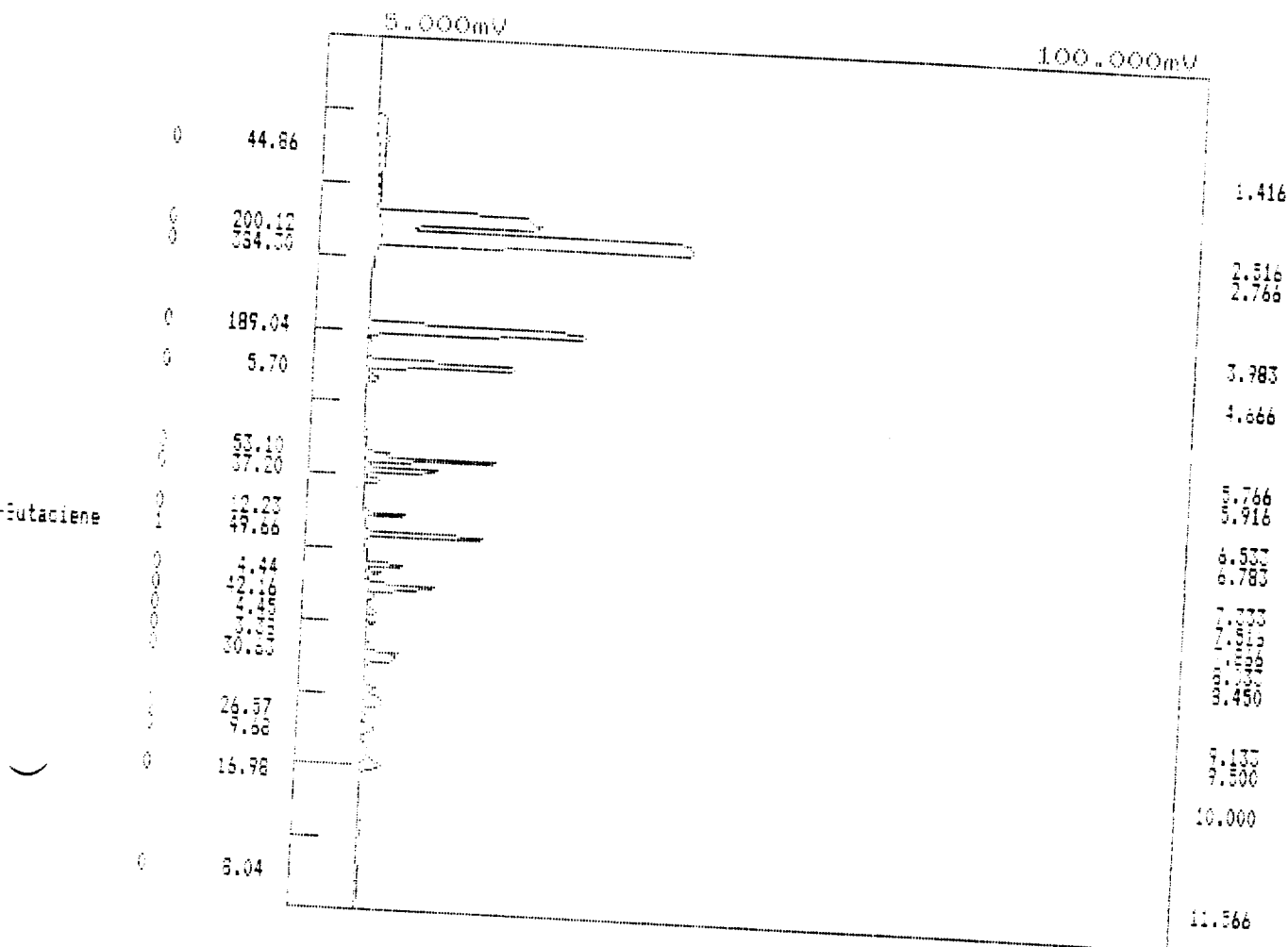
143.47

3166

ENTROPY

Operator : Gary Mata
 File : 42223-1
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 13:10:19

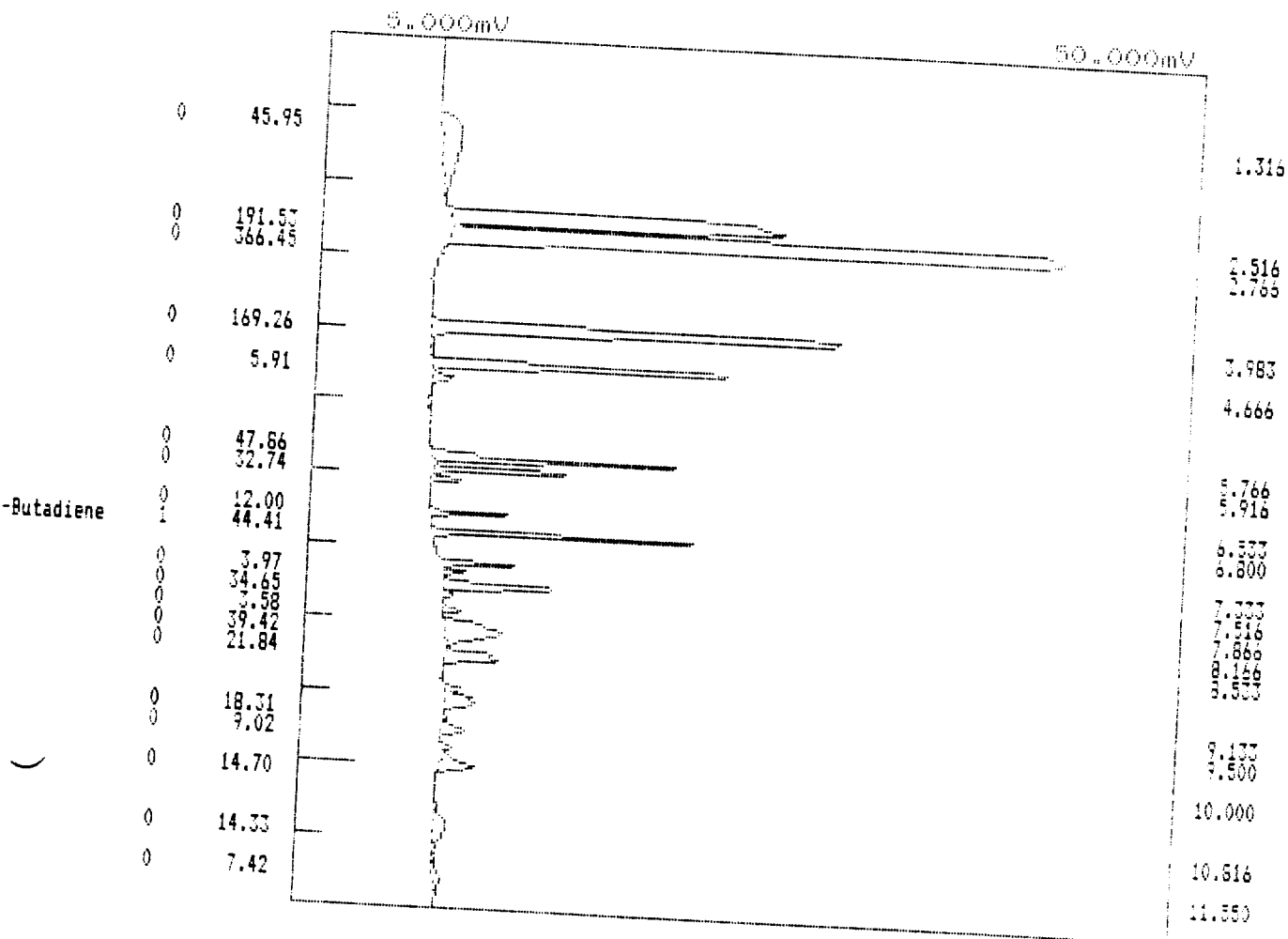
12⁵ INJECTION
 3rd RUN
 DIRECT FLOW 152 ml/min



Component	Number	Retention	Area	Units
	0	1.416	44.86	
	0	2.516	200.12	
	0	2.766	384.30	
	0	3.783	189.04	
	0	4.466	90.14	
	0	4.666	5.70	
	0	5.766	53.10	
	0	5.916	37.20	
Butadiene	0	6.533	12.23	
	0	6.783	49.66	
	0	7.216	12.94	
	0	7.333	4.44	
	0	7.516	42.16	
	0	7.866	4.45	
	0	8.033	3.38	
	0	8.450	30.63	
	0	9.133	26.57	
	0	9.500	9.68	
	0	10.000	16.98	
	0	11.566	8.04	

Operator : Gary Mata
 File : 422-3-2
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 13:26:04

2nd INJECTION
 3rd RUN
 DIRECT FLOW 152^{ms}
 M



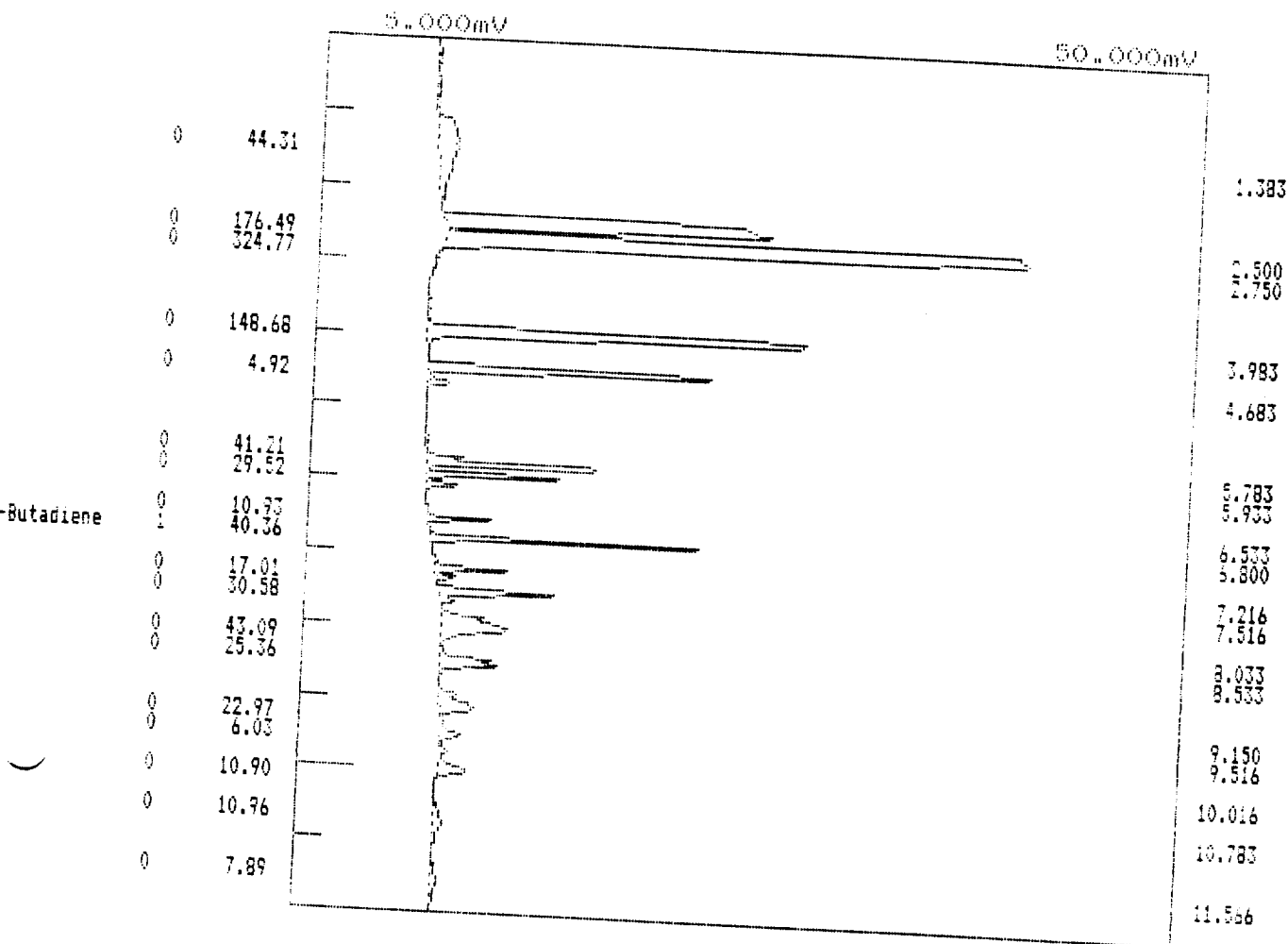
Component	Number	Retention	Area	Units
	0	1.316	45.95	
	0	2.516	191.53	
	0	2.766	366.45	
	0	3.983	169.26	
	0	4.466	84.84	
	0	4.666	5.91	
	0	5.766	47.66	
	0	5.916	32.74	
-Butadiene	0	6.533	12.00	
	1	6.800	44.41	
	0	7.216	10.57	
	0	7.333	3.97	
	0	7.516	34.65	
	0	7.866	3.58	
	0	8.166	39.42	
	0	8.533	21.84	
	0	9.133	18.31	
	0	9.500	9.02	
	0	10.000	14.70	
	0	10.816	14.33	
	0	11.550	7.42	

1178.76
 3168

ENTROPY

Operator : Gary Mata
 File : 422-3-3
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 13:43:08

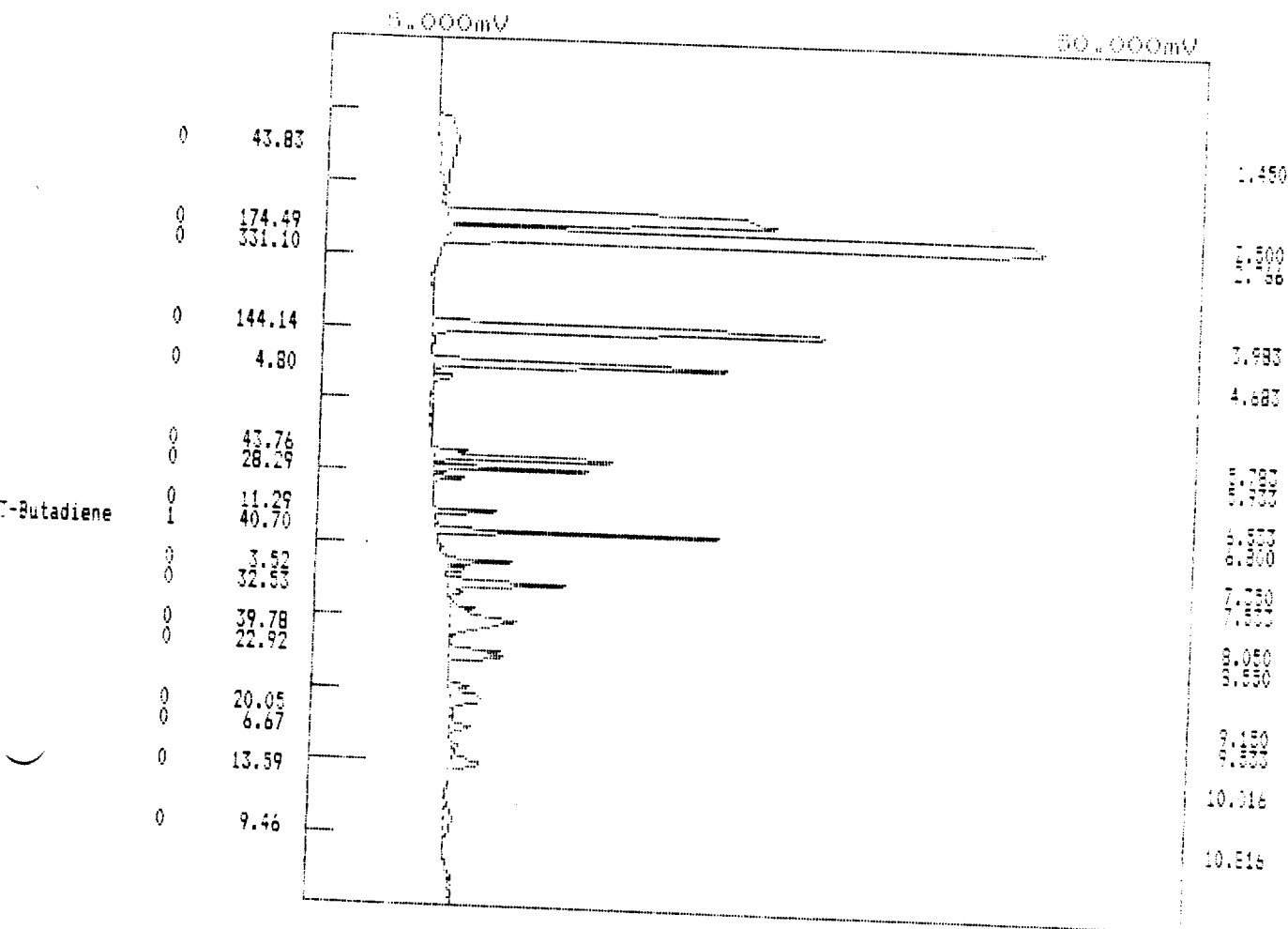
3RD INJECTION
 3RD RUN
 DIRECT 152 ^{MC}/_{ML}



Component	Number	Retention	Area	Units
	0	1.383	44.31	
	0	2.500	176.49	
	0	2.750	324.77	
	0	3.983	148.68	
	0	4.483	75.59	
	0	4.683	4.92	
	0	5.783	41.21	
	0	5.933	29.52	
Butadiene	0	6.533	10.93	
	1	6.800	40.36	
	0	7.216	17.01	
	0	7.516	30.58	
	0	8.033	43.09	
	0	8.533	25.36	
	0	9.150	22.97	
	0	9.516	6.03	
	0	10.016	10.90	
	0	10.783	10.96	
	0	11.566	7.89	

Operator : Gary Mata
 File : 422-3-4
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 13:59:12

4th INJECTION
 3RD RUN
 DIRECT Flow 152 mL/min



Component	Number	Retention	Area	Units
	0	1.450	43.83	
	0	2.500	174.49	
	0	2.766	331.10	
	0	3.983	144.14	
	0	4.483	4.80	
	0	4.683	43.76	
	0	5.783	28.29	
	0	6.733	11.29	
	1	6.800	40.70	
	0	7.233	3.52	
	0	7.350	32.53	
	0	7.533	39.78	
	0	8.550	22.92	
	0	9.150	20.05	
	0	9.333	6.67	
	0	10.016	13.59	
	0	10.816	9.46	

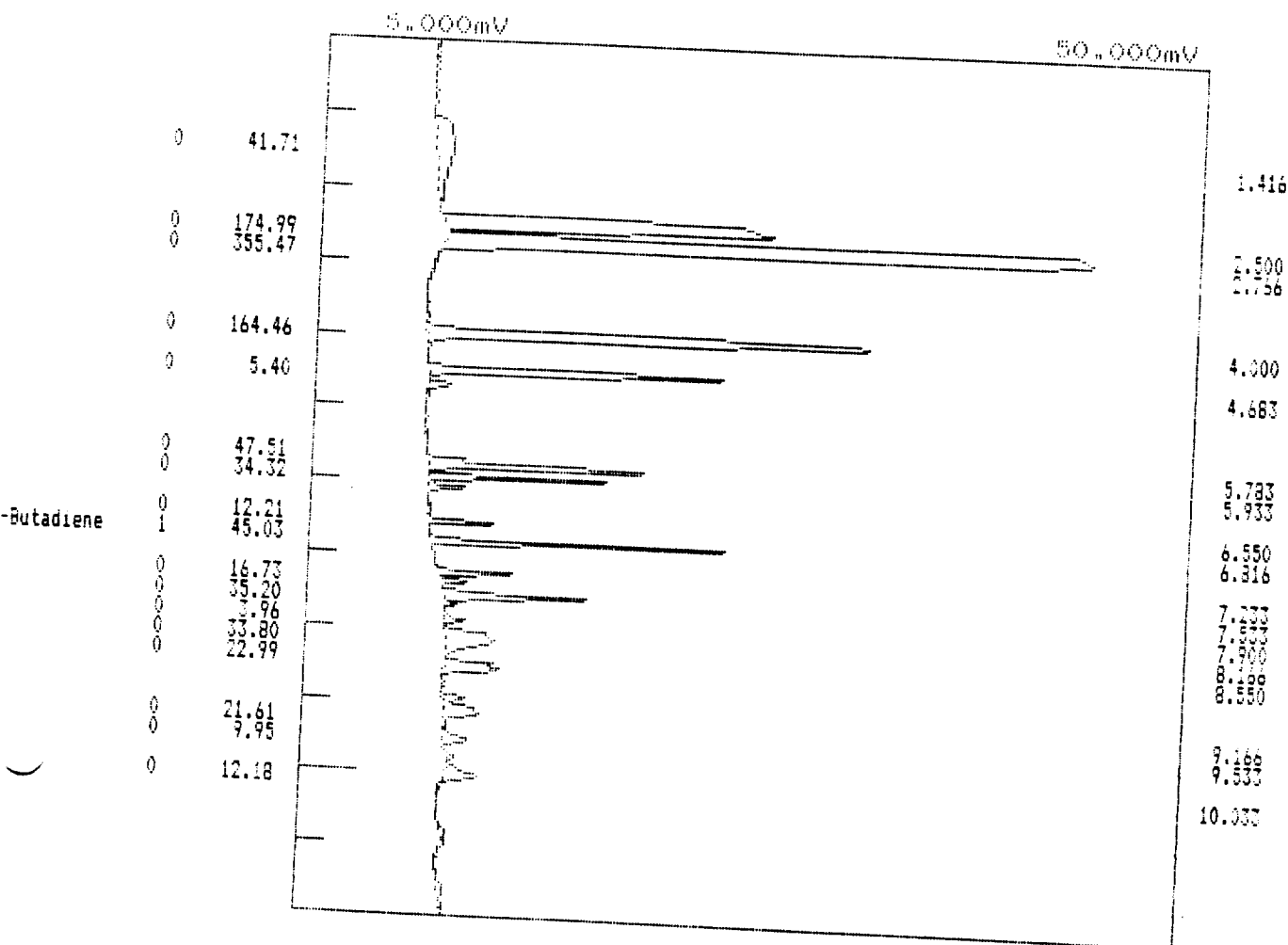
1055.94

3170

ENTROPY

Operator : Gary Mata
 File : 422-3-5
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 14:14:58

5th INJECTION
 310 RUM
 DIRECT FLOW 152ml/min



Component	Number	Retention	Area	Units
	0	1.416	41.71	
	0	2.500	174.99	
	0	2.766	355.47	
	0	4.000	164.46	
	0	4.483	76.67	
	0	4.683	5.40	
	0	5.783	47.51	
	0	5.933	34.32	
-Butadiene	0	6.550	12.21	
	1	6.816	45.03	
	0	7.233	16.73	
	0	7.533	35.20	
	0	7.900	3.96	
	0	8.166	33.80	
	0	8.550	22.99	
	0	9.166	21.61	
	0	9.533	9.95	
	0	10.033	12.18	

18

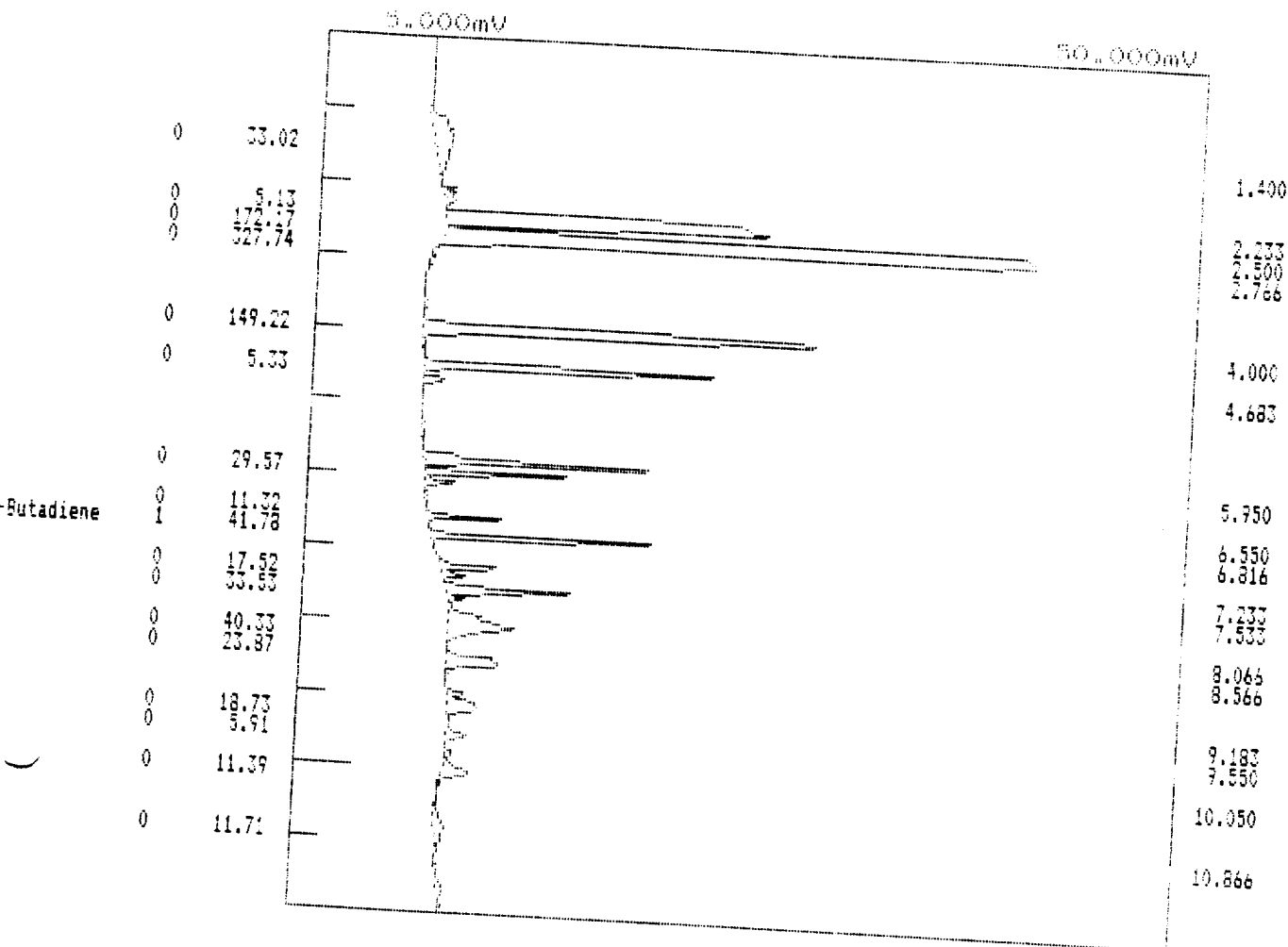
1114.18

3171

ENTROPY

Operator : Gary Mata
 File : 422-3-6
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 14:32:09

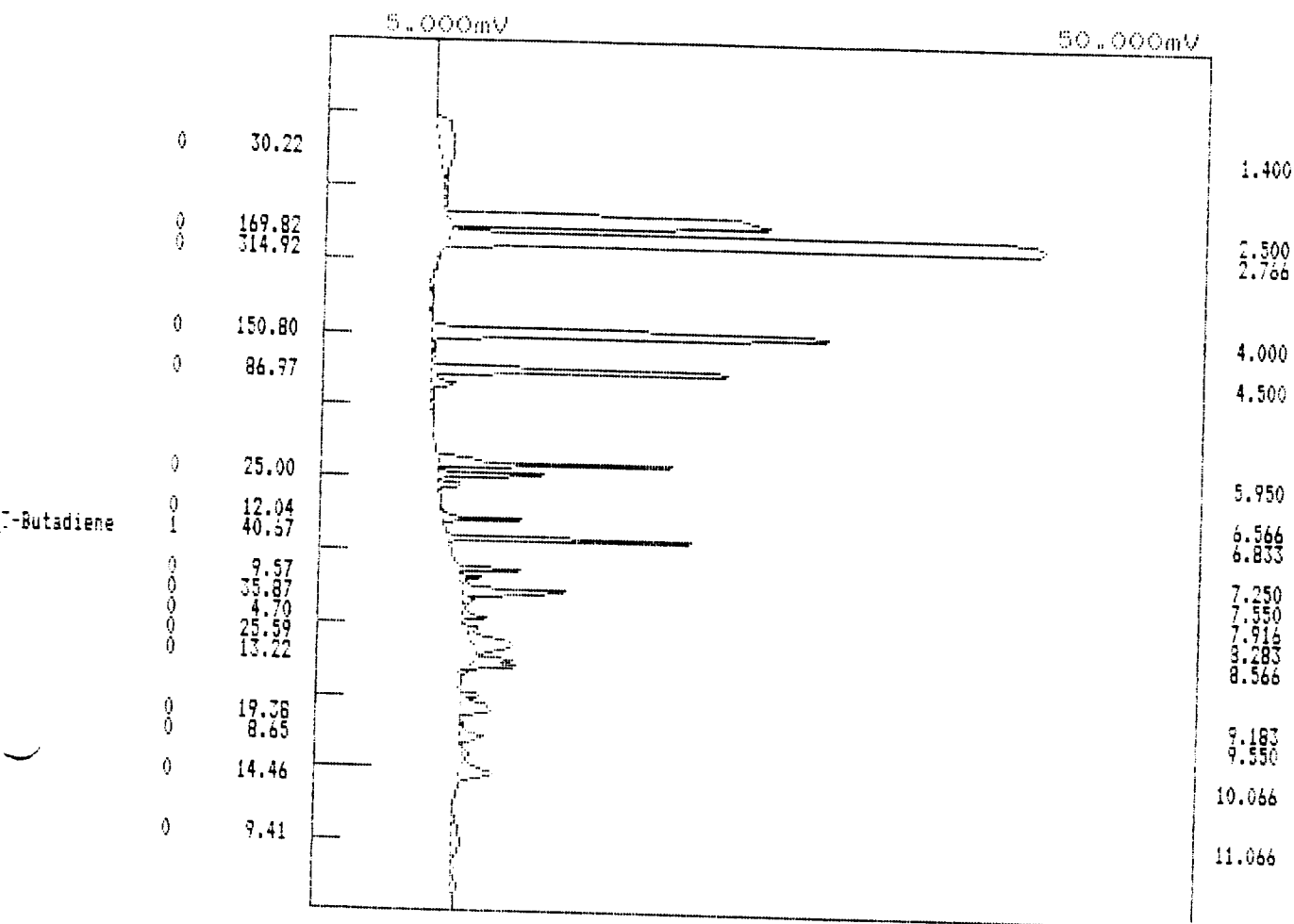
6th INJECTION
 3rd RUN
 DIRECT FLOW 152 ml/min



Component	Number	Retention	Area	Units
	0	1.400	33.02	
	0	2.233	5.13	
	0	2.500	172.17	
	0	2.766	327.74	
	0	4.000	149.22	
	0	4.483	70.39	
	0	4.683	5.33	
	0	5.800	44.73	
	0	5.950	29.57	
Butadiene	1	6.550	11.32	
	0	6.816	41.78	
	0	7.233	17.52	
	0	7.533	33.53	
	0	8.066	40.33	
	0	8.566	23.87	
	0	9.183	18.73	
	0	9.550	5.91	
	0	10.050	11.39	
	0	10.866	11.71	

Operator : Gary Mata
 File : 422-3-7
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 14:47:59

7th INJECTION
 3rd RUN
 DIRECT FLOW 152 ml/min



Component	Number	Retention	Area	Units
	0	1.400	30.22	
	0	2.500	169.82	
	0	2.766	314.92	
	0	4.000	150.80	
	0	4.500	86.97	
	0	5.800	42.35	
	0	5.950	25.00	
	0	6.566	12.04	
	1	6.833	40.67	
	0	7.250	9.57	
	0	7.550	35.87	
	0	7.916	4.70	
	0	8.283	25.59	
	0	8.566	13.22	
	0	9.183	19.38	
	0	9.550	8.65	
	0	10.066	14.46	
	0	11.066	9.41	

18

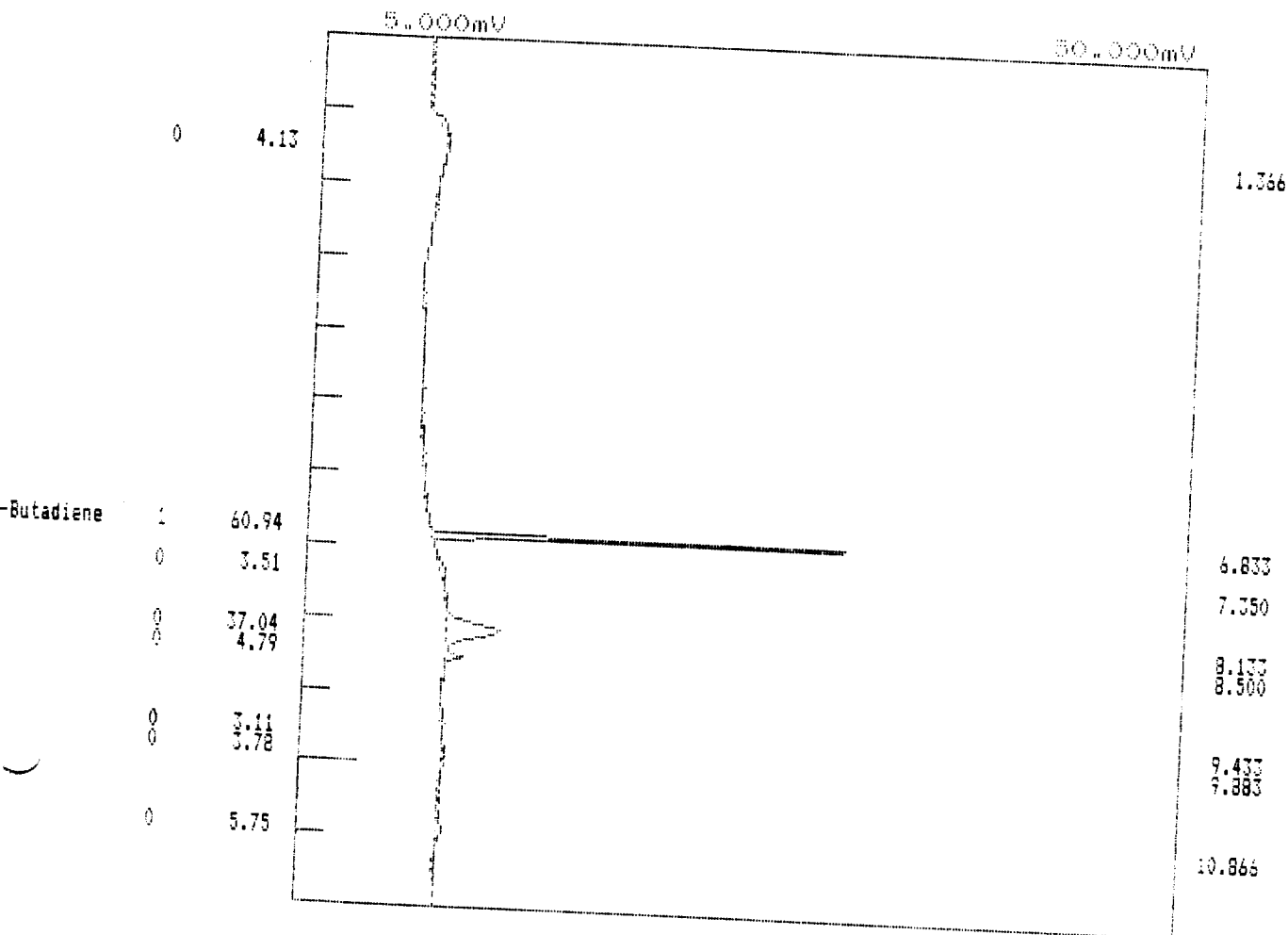
1013.65

3173

ENTROPY

Operator : Gary Mata
 File : 422-3-8
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 15:05:11

M10 STD (c. 540 ppm)
 3.00 RUN
 DIRECT FLOW 152 μ l/min



Component	Number	Retention	Area	Units
Butadiene	0	1.366	4.13	
	1	6.833	60.94	
	0	7.350	3.51	
	0	8.133	37.04	
	0	8.500	4.79	
	0	9.433	3.11	
	0	9.883	3.78	
	0	10.866	5.75	

8

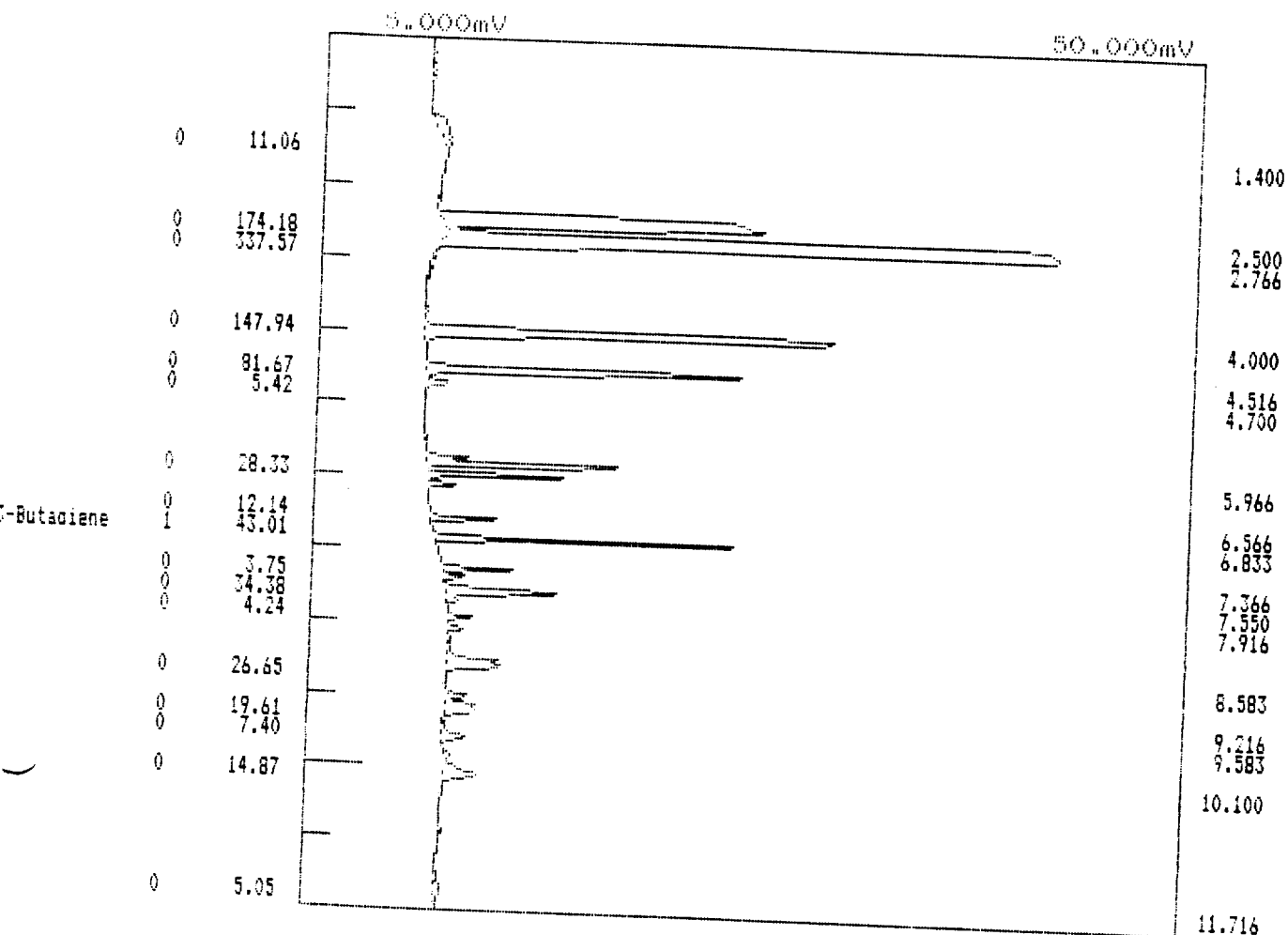
123.06

0174

ENTROPY

Operator : Gary Mata
 File : 422-3-9
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 15:20:55

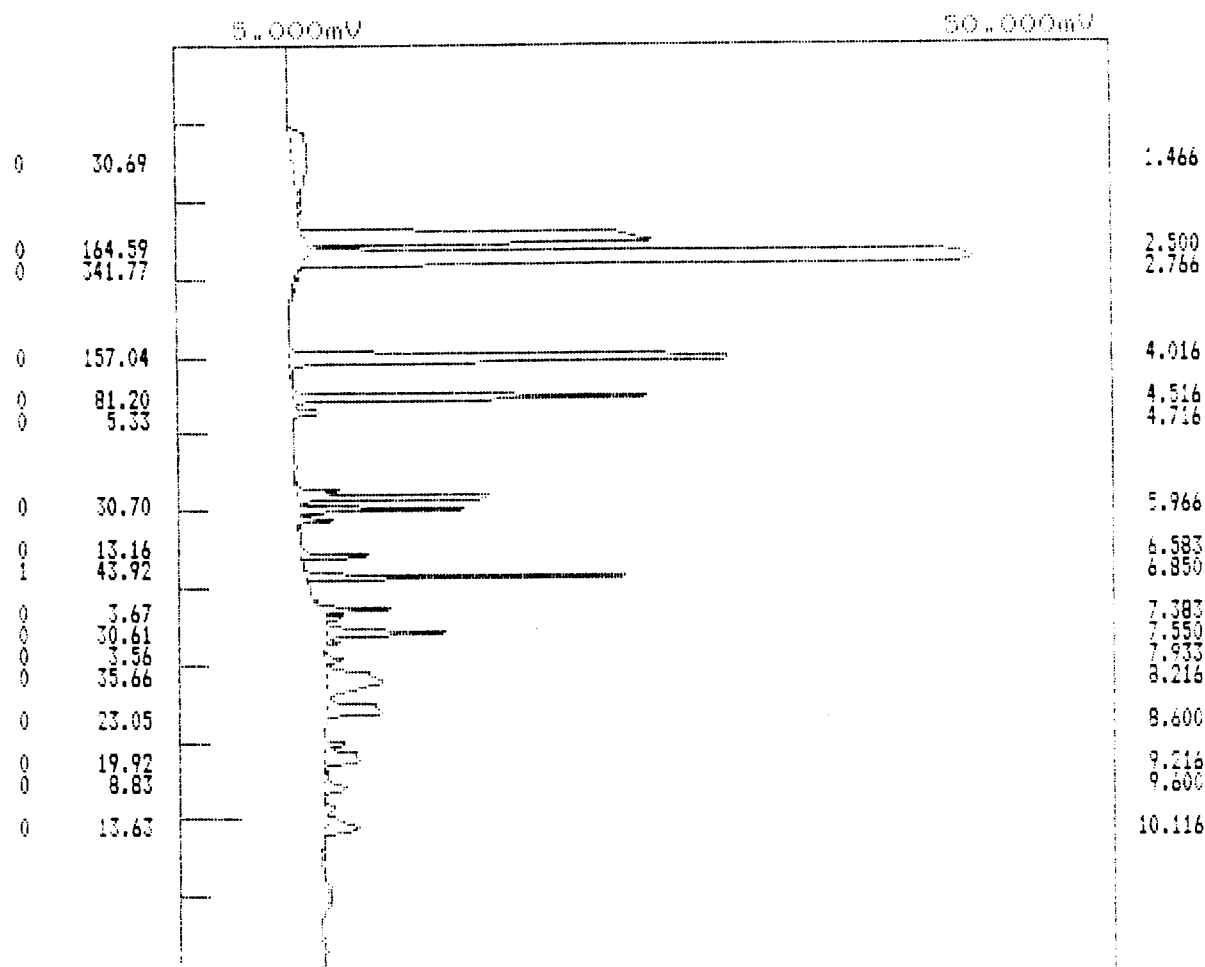
8th INJECTION
 3RD RUN
 DIRECT FLOW 1524/min



Component	Number	Retention	Area	Units
	0	1.400	11.06	
	0	2.500	174.18	
	0	2.766	337.57	
	0	4.000	147.94	
	0	4.516	81.67	
	0	4.700	5.42	
	0	5.816	46.08	
	0	5.966	28.33	
	0	6.566	12.14	
	1	6.833	43.01	
	0	7.266	11.10	
	0	7.366	3.75	
	0	7.550	34.38	
	0	7.916	4.24	
	0	8.583	26.65	
	0	9.216	19.61	
	0	9.583	7.40	
	0	10.100	14.87	
	0	11.716	5.05	

Operator : Gary Mata
 File : 422-3-10
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 15:37:43

9th section
 3rd run
 Direct read 152
 410



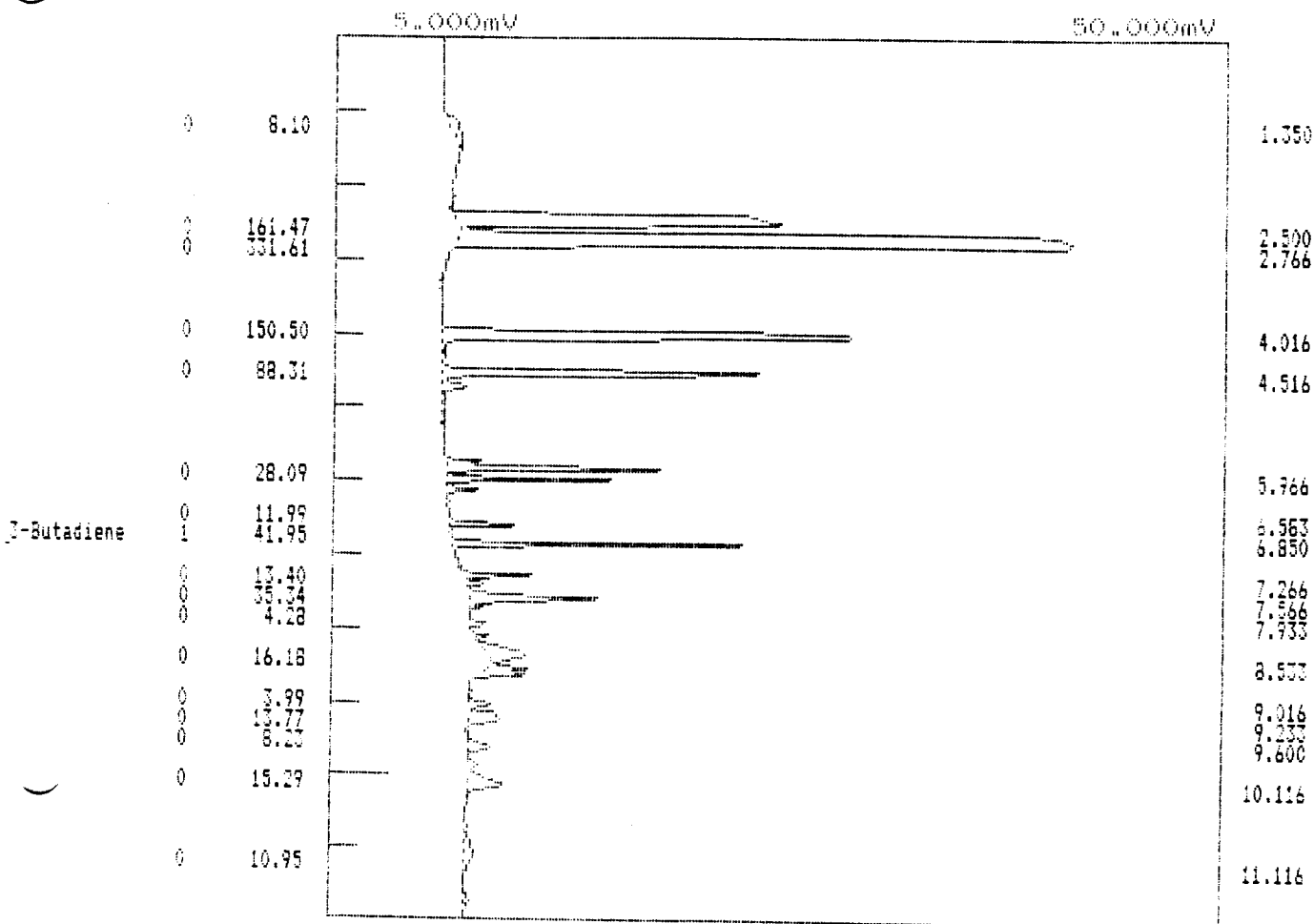
Component	Number	Retention	Area	Units
-----------	--------	-----------	------	-------

0	1.466	30.69
0	2.500	164.59
0	2.766	341.77
0	4.016	157.04
0	4.516	81.20
0	4.716	5.33
0	5.966	46.23
0	5.966	30.70
0	6.583	13.16
1	6.850	43.92
0	7.266	9.63
0	7.383	3.67
0	7.550	30.61
0	7.933	3.56
0	8.216	35.66
0	8.600	23.05
0	9.216	19.92
0	9.600	8.83
0	10.116	13.63

_3-Butadiene

Operator : Gary Mata
 File : 422-3-11
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 15:53:49

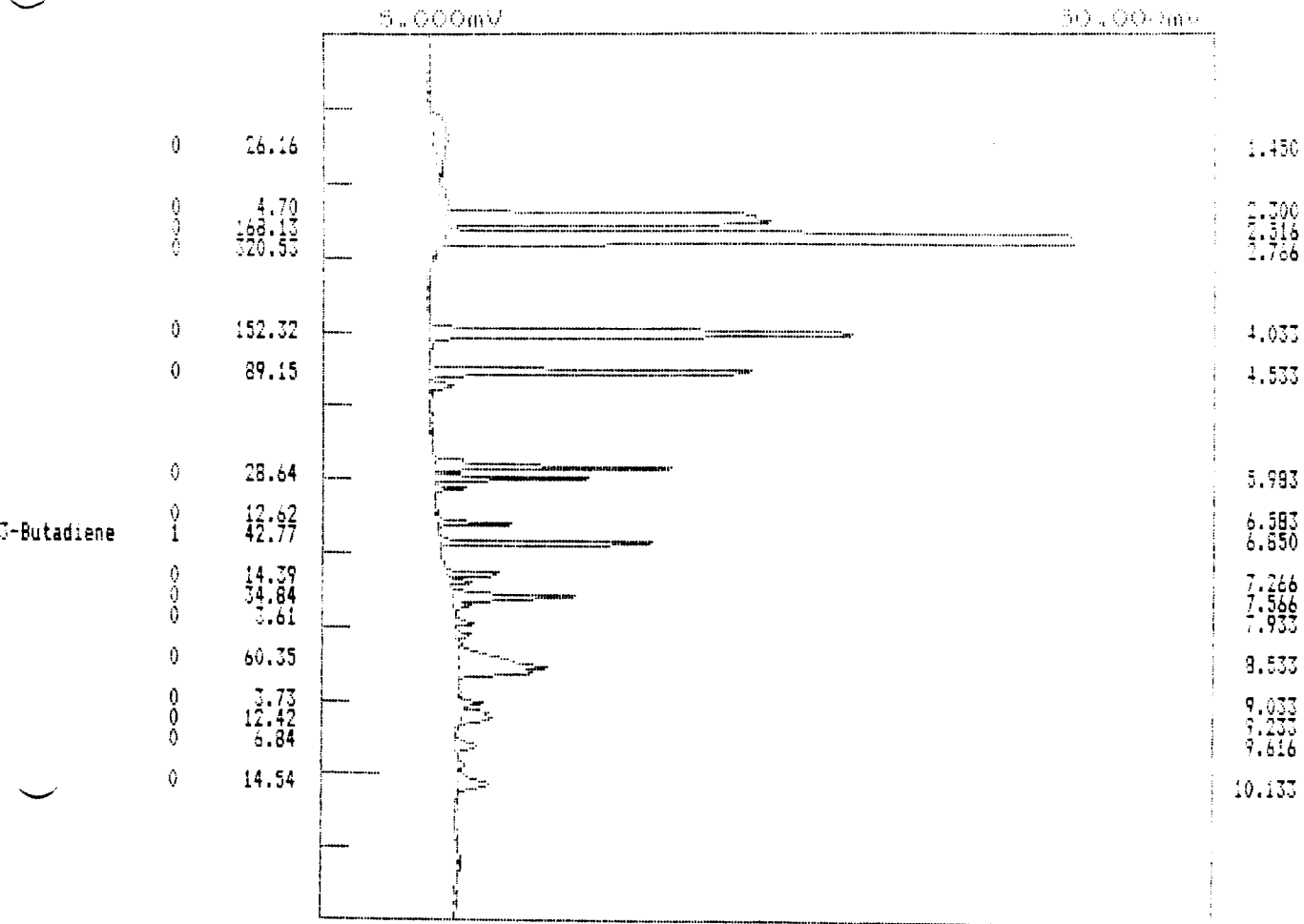
10th Injection
 3rd run
 Direct Flow 190 ml/min



Component	Number	Retention	Area	Units
3-Butadiene	0	1.350	8.10	
	0	2.500	161.47	
	0	2.766	331.61	
	0	4.016	150.50	
	0	4.516	88.31	
	0	5.766	45.35	
	0	6.563	28.09	
	0	6.850	11.95	
	1	6.350	41.95	
	0	7.266	13.40	
	0	7.566	35.34	
	0	7.933	4.28	
	0	8.533	20.88	
	0	8.833	16.18	
	0	9.016	3.99	
	0	9.233	13.77	
	0	9.600	8.23	
	0	10.116	15.29	
	0	11.116	10.95	

11th INJECTION
3rd RUN
DIRECT FLOW 152nd/min

Operator : Gary Mata
File : 422-3-12
Temperature :
Components : default
Date : 07/31/1992
Time : 16:09:59



Component	Number	Retention	Area	Units
	0	1.450	26.16	
	0	2.300	4.70	
	0	2.316	168.13	
	0	2.766	320.53	
	0	4.033	152.32	
	0	4.533	89.15	
	0	5.833	44.11	
	0	5.983	28.64	
3-Butadiene	1	6.583	12.62	
	1	6.850	42.77	
	0	7.266	14.39	
	0	7.566	34.84	
	0	7.933	3.61	
	0	8.533	60.35	
	0	9.033	3.73	
	0	9.233	12.42	
	0	9.616	6.84	
	0	10.133	14.54	

18

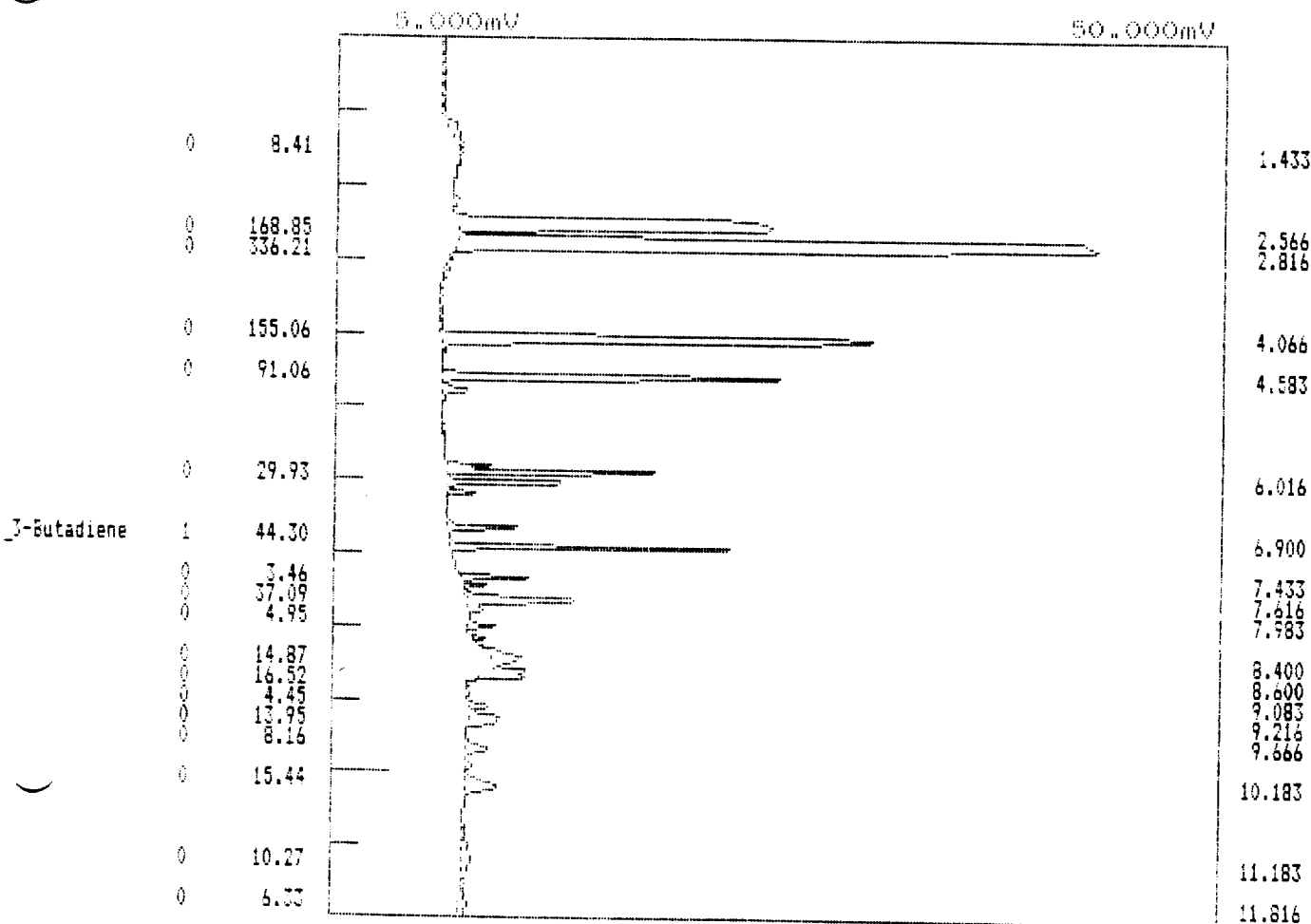
1039.85

0178

ENTROPY

Operator : Gary Mata
 File : 422-3-13
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 16:25:32

12th INTERACT,
 3:00 AM
 DIRECT FROM SEC
 M

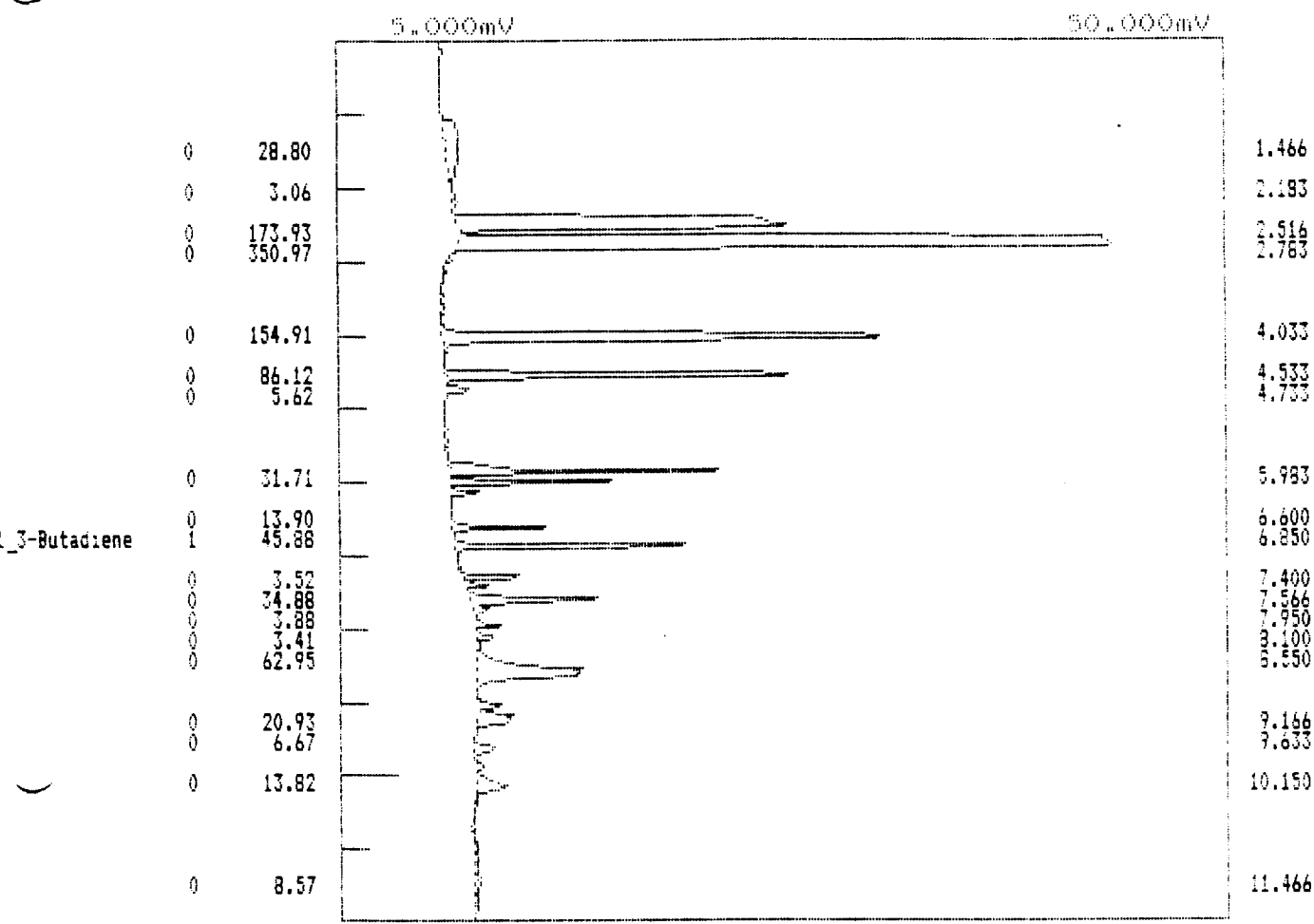


Component Number Retention Area Units

0	1.433	8.41
0	2.566	168.85
0	2.816	336.21
0	4.066	155.06
0	4.583	91.06
0	5.883	45.13
0	6.016	29.93
0	6.650	13.13
0	6.900	44.30
0	7.316	11.25
0	7.433	3.46
0	7.616	37.09
0	7.983	4.95
0	8.400	14.87
0	8.600	16.52
0	9.083	4.45
0	9.216	13.95
0	9.666	8.16
0	10.183	15.44
0	11.183	10.27
0	11.816	6.33

17th INJECTION
 3.00 RUN
 DIRECT FLOW = 152nd

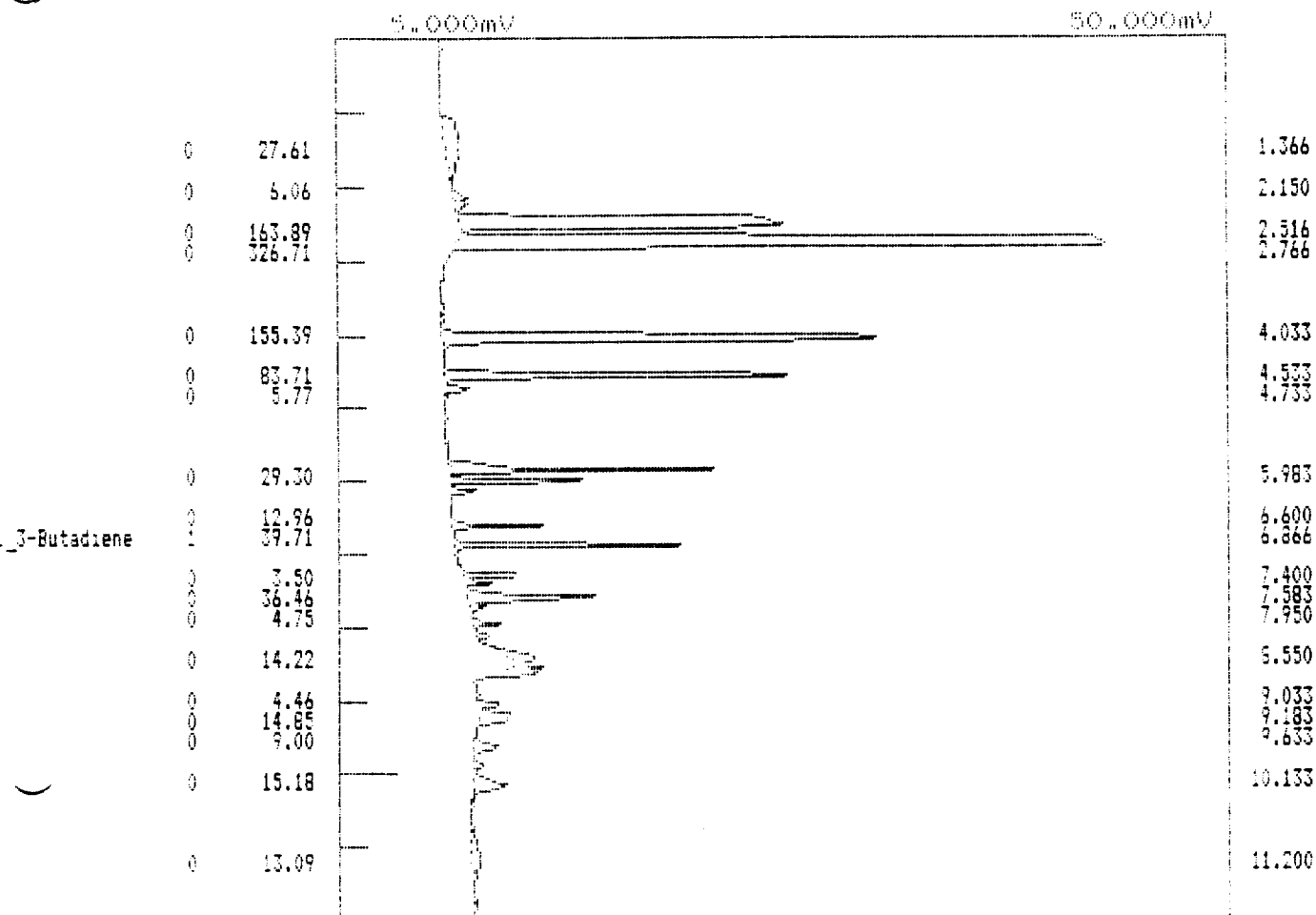
Operator : Gary Mata
 File : 422-3-14
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 16:41:39



Component	Number	Retention	Area	Units
	0	1.466	28.80	
	0	2.183	3.06	
	0	2.516	173.93	
	0	2.783	350.97	
	0	4.033	154.91	
	0	4.533	86.12	
	0	4.733	5.62	
	0	5.983	47.12	
	0	5.983	31.71	
	0	6.600	13.90	
1,3-Butadiene	1	6.850	45.88	
	0	7.266	10.17	
	0	7.400	3.52	
	0	7.566	34.88	
	0	7.950	3.88	
	0	8.100	3.41	
	0	8.550	62.95	
	0	9.166	20.93	
	0	9.633	6.67	
	0	10.150	13.82	
	0	11.466	8.57	

Operator : Gary Mata
 File : 422-3-15
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 16:58:22

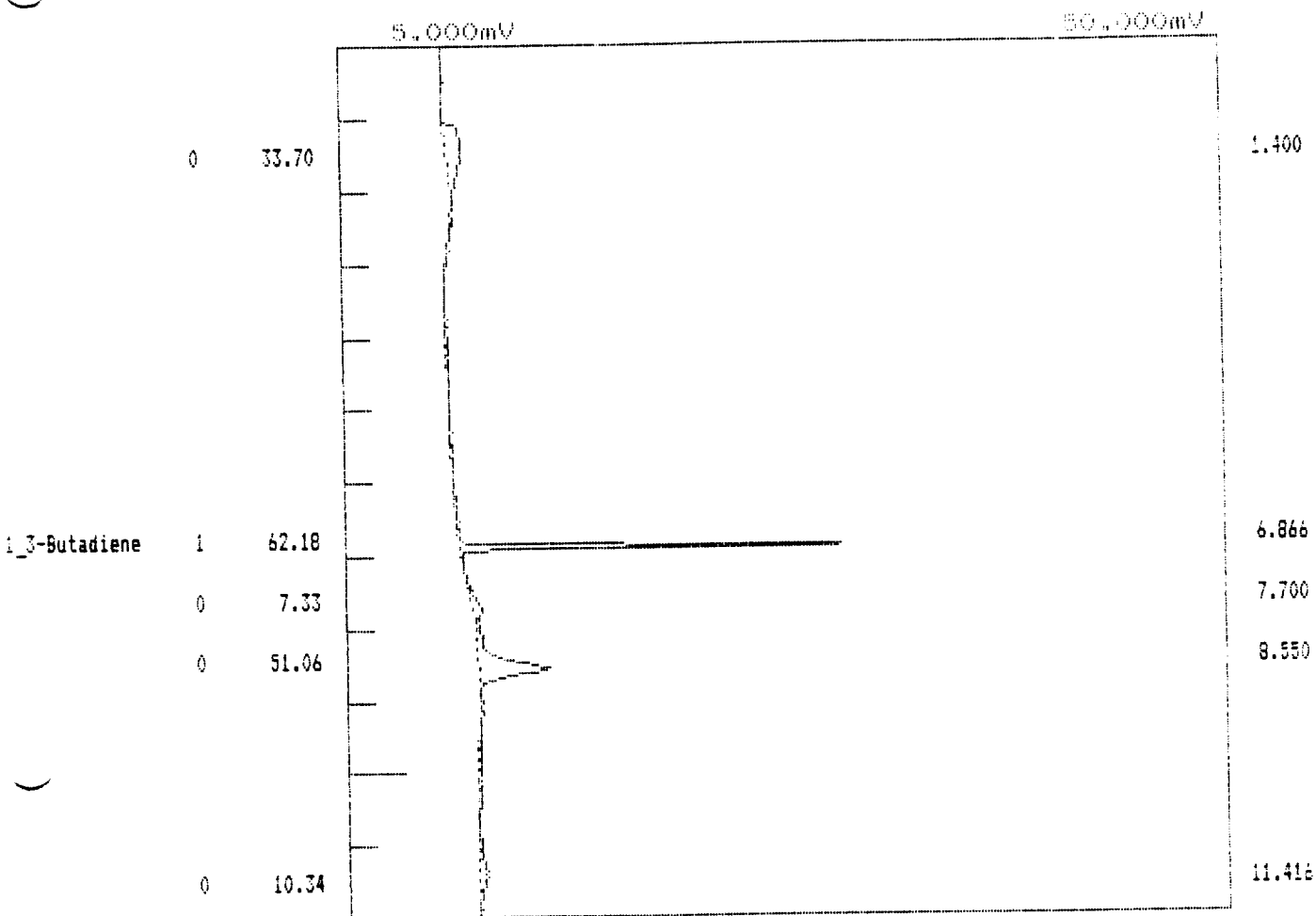
14 INJECTION
 DIRECT FLOW 152ml/min
 Run #3



Component	Number	Retention	Area	Units
	0	1.366	27.61	
	0	2.150	6.06	
	0	2.516	163.89	
	0	2.766	326.71	
	0	4.033	155.39	
	0	4.533	83.71	
	0	4.733	5.77	
	0	5.983	29.30	
	0	6.600	12.96	
3-Butadiene	1	6.866	39.71	
	0	7.266	10.68	
	0	7.400	3.50	
	0	7.583	36.46	
	0	7.950	4.75	
	0	8.400	11.29	
	0	8.550	14.22	
	0	9.033	4.46	
	0	9.183	14.85	
	0	9.633	9.00	
	0	10.133	15.18	
	0	11.200	13.09	

Operator : Gary Mata
 File : 422-3-16
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 17:14:13

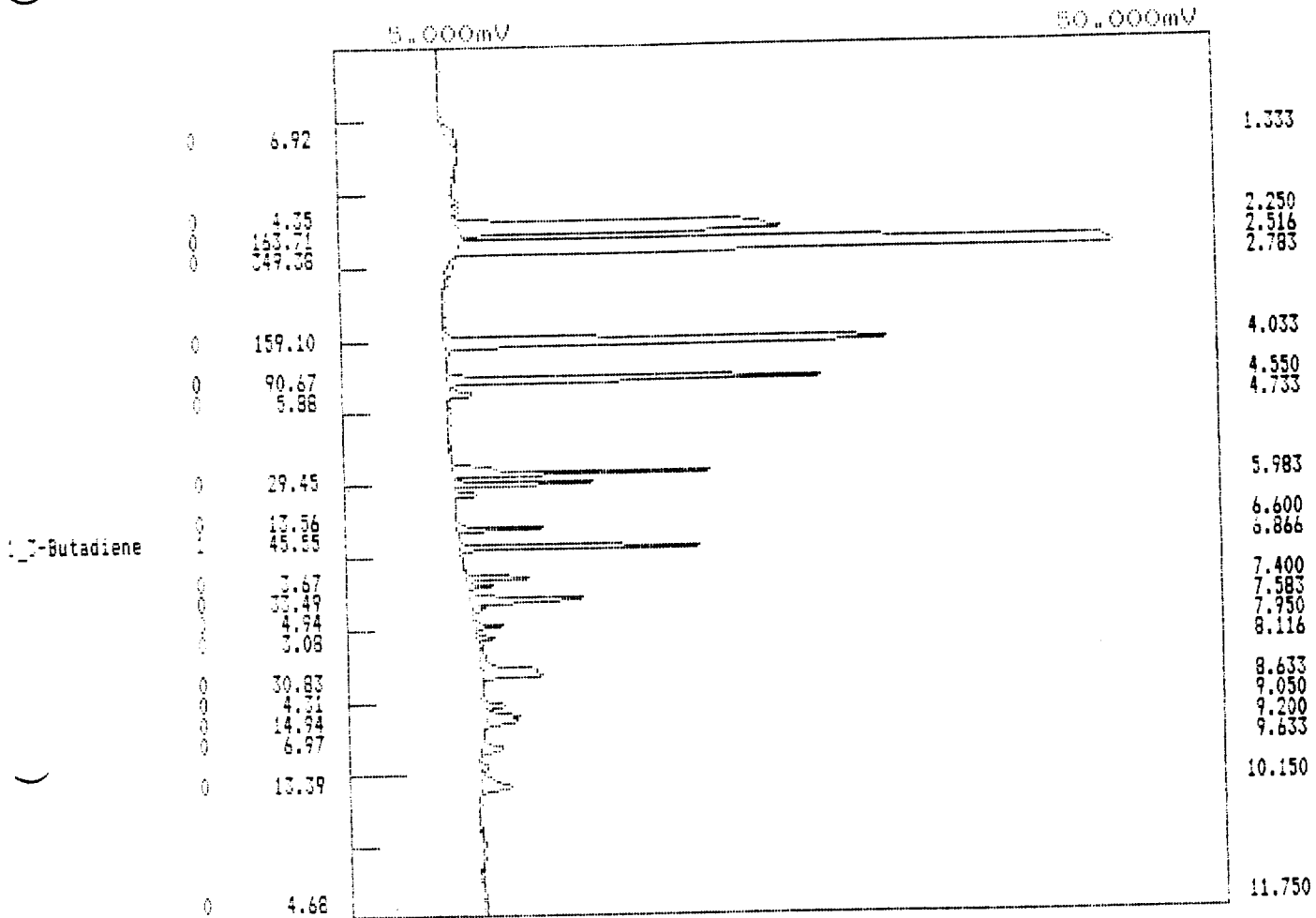
Mid 50 (0.540 ppm)
 3rd RUN
 Direct Flow 152 ml/min



Component	Number	Retention	Area	Units
	0	1.400	33.70	
1,3-Butadiene	1	6.866	62.18	
	0	7.700	7.33	
	0	8.550	51.06	
	0	11.416	10.34	
5			164.62	

1ST INJECTION
3RD RUN
DIRECT FLOW 152 ml/min

Operator : Gary Mata
File : 422-3-17
Temperature :
Components : default
Date : 07/31/1992
Time : 17:30:09



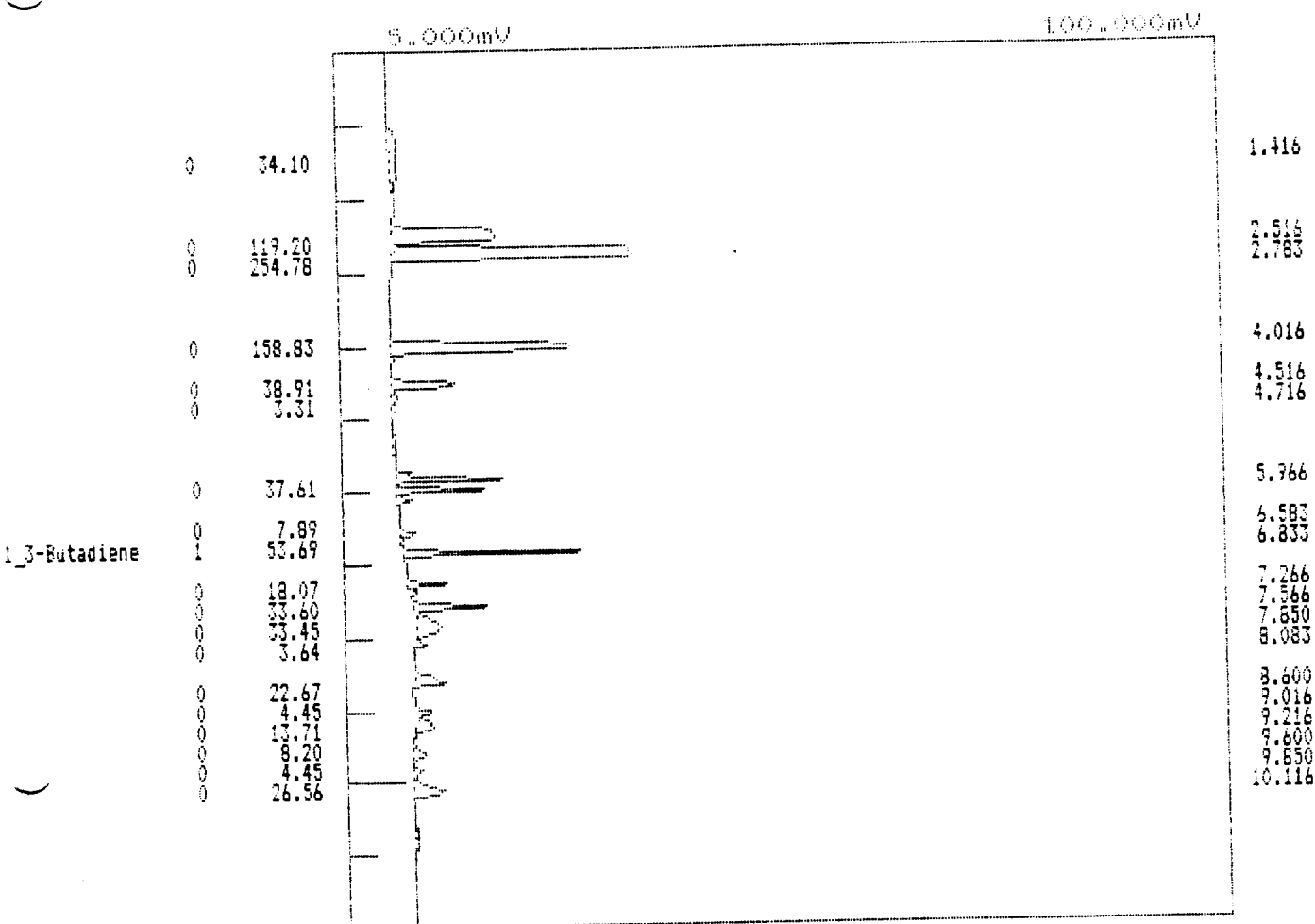
1,3-Butadiene

1,3-Butadiene

Component	Number	Retention	Area	Units
	0	1.333	6.92	
	0	2.250	4.35	
	0	2.516	163.71	
	0	2.783	349.38	
	0	4.033	159.10	
	0	4.550	90.67	
	0	4.733	5.88	
	0	5.983	47.42	
	0	6.600	29.45	
	0	6.866	13.56	
	1	6.866	45.55	
	0	7.283	11.41	
	0	7.400	3.67	
	0	7.583	33.49	
	0	7.950	4.94	
	0	8.116	3.08	
	0	8.633	30.83	
	0	9.050	4.31	
	0	9.200	14.94	
	0	9.633	6.97	
	0	10.150	13.39	
	0	11.750	4.68	

Operator : Gary Mata
 File : 422-3-18
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 19:26:47

16" INJECTION
 3.00 RUN
 DIRECT FLOW 152nd
 min



Component	Number	Retention	Area	Units
	0	1.416	34.10	
	0	2.516	119.20	
	0	2.783	254.78	
	0	4.016	158.83	
	0	4.516	38.91	
	0	4.716	3.31	
	0	5.966	46.72	
	0	6.583	37.61	
	0	6.833	7.89	
1,3-Butadiene	1	6.833	53.69	
	0	7.266	18.07	
	0	7.566	33.60	
	0	7.850	33.45	
	0	8.083	3.64	
	0	8.600	22.67	
	0	9.016	4.45	
	0	9.216	13.71	
	0	9.600	8.20	
	0	9.850	4.45	
	0	10.116	26.56	

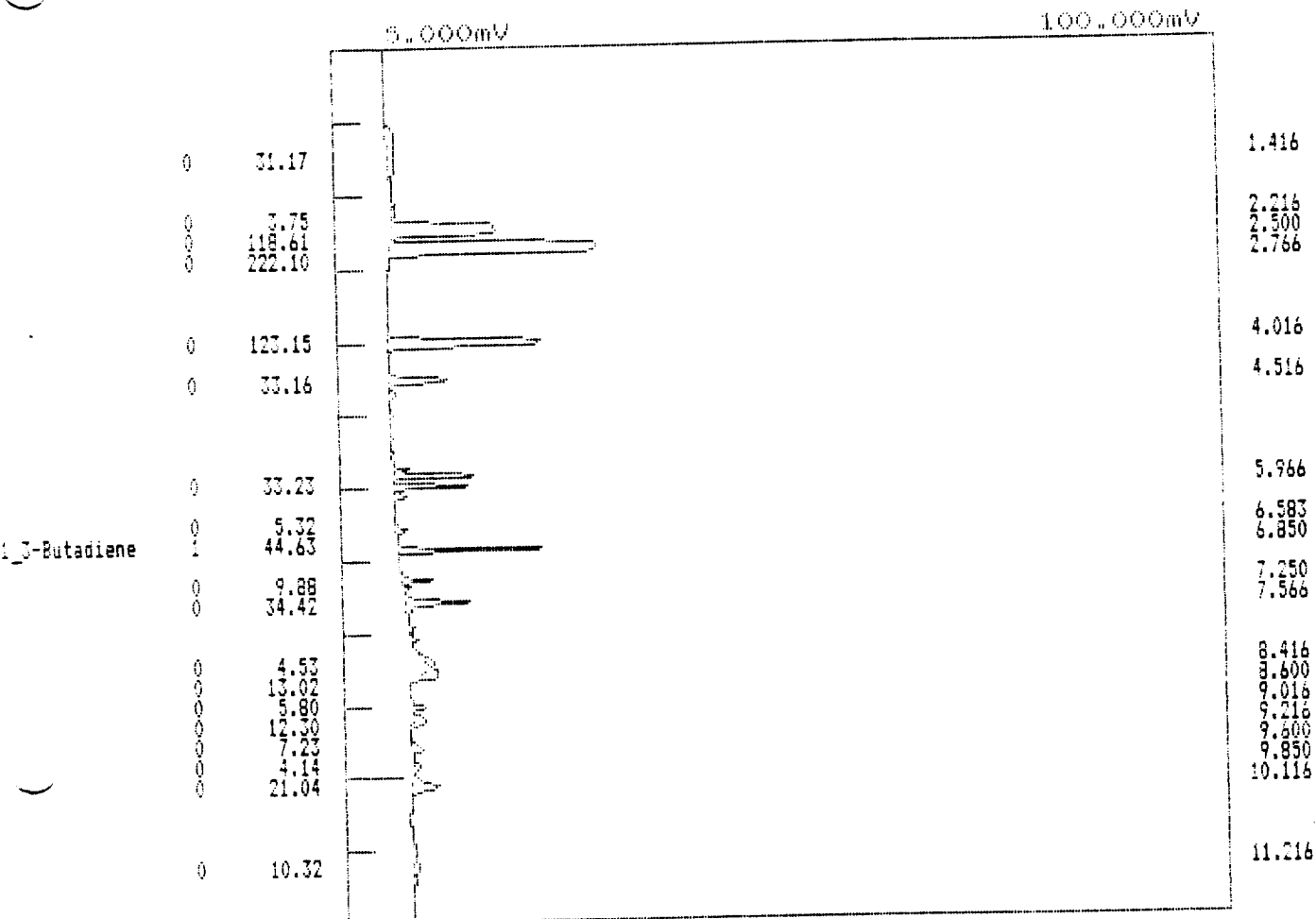
923.85

0184

ENTROPY

Operator : Gary Mata
 File : 422-3-19
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 19:47:40

17TH INJECTION
 3RD RUN
 DIRECT FLOW = 152 $\frac{\mu\text{L}}{\text{min}}$

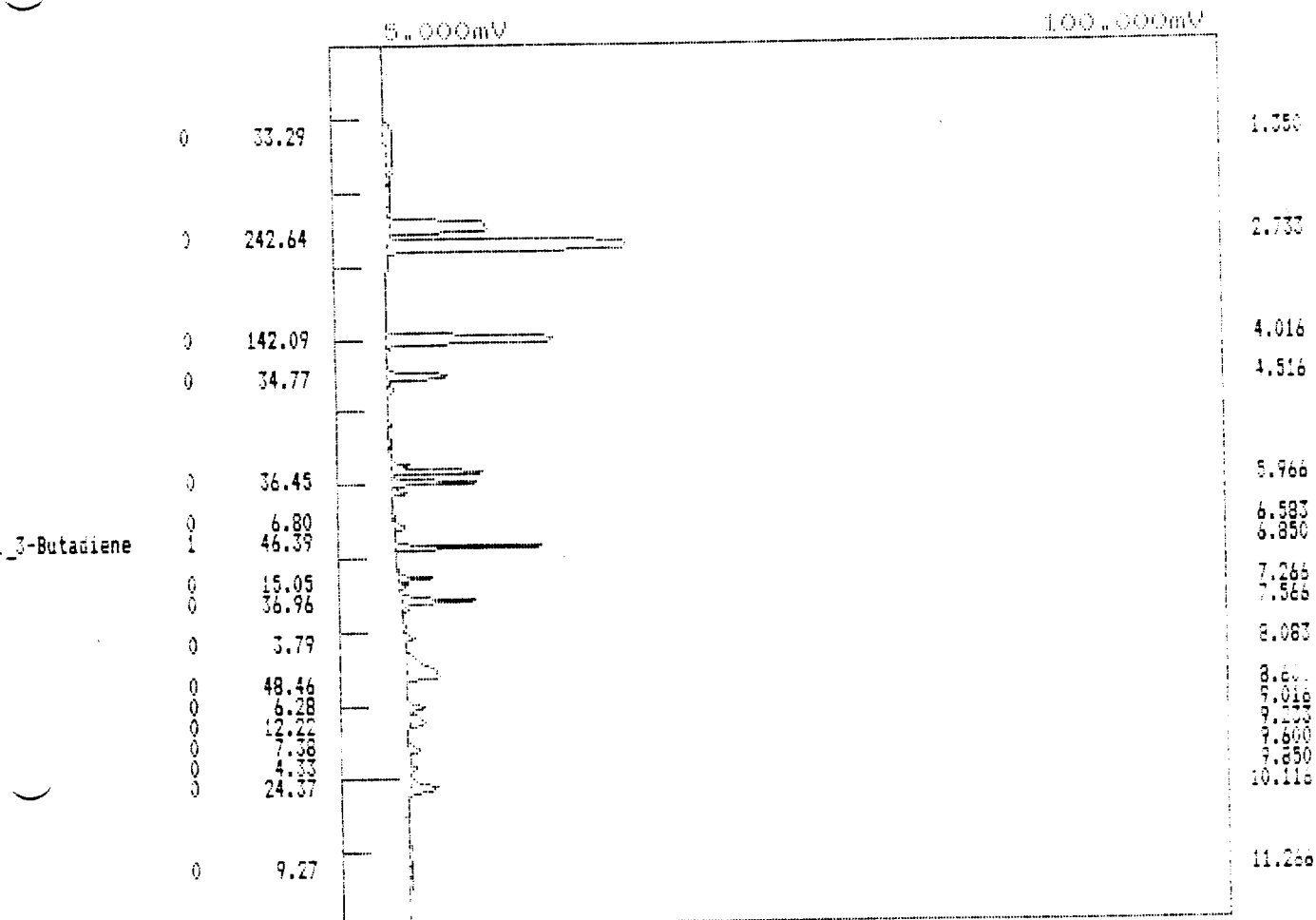


Component	Number	Retention	Area	Units
	0	1.416	31.17	
	0	2.216	3.75	
	0	2.500	118.61	
	0	2.766	222.10	
	0	4.016	123.15	
	0	4.516	33.16	
	0	5.816	38.05	
	0	5.966	33.23	
	0	6.583	5.32	
1_3-Butadiene	1	6.850	44.63	
	0	7.250	9.88	
	0	7.566	34.42	
	0	8.416	4.53	
	0	8.600	13.02	
	0	9.016	5.80	
	0	9.216	12.30	
	0	9.600	7.23	
	0	9.850	4.14	
	0	10.116	21.04	
	0	11.216	10.32	

775.86

Operator : Gary Mata
 File : 422-3-20
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 20:03:17

15% INJECTION
 3.00 RUN
 DIRECT FLOW 152 ml/min



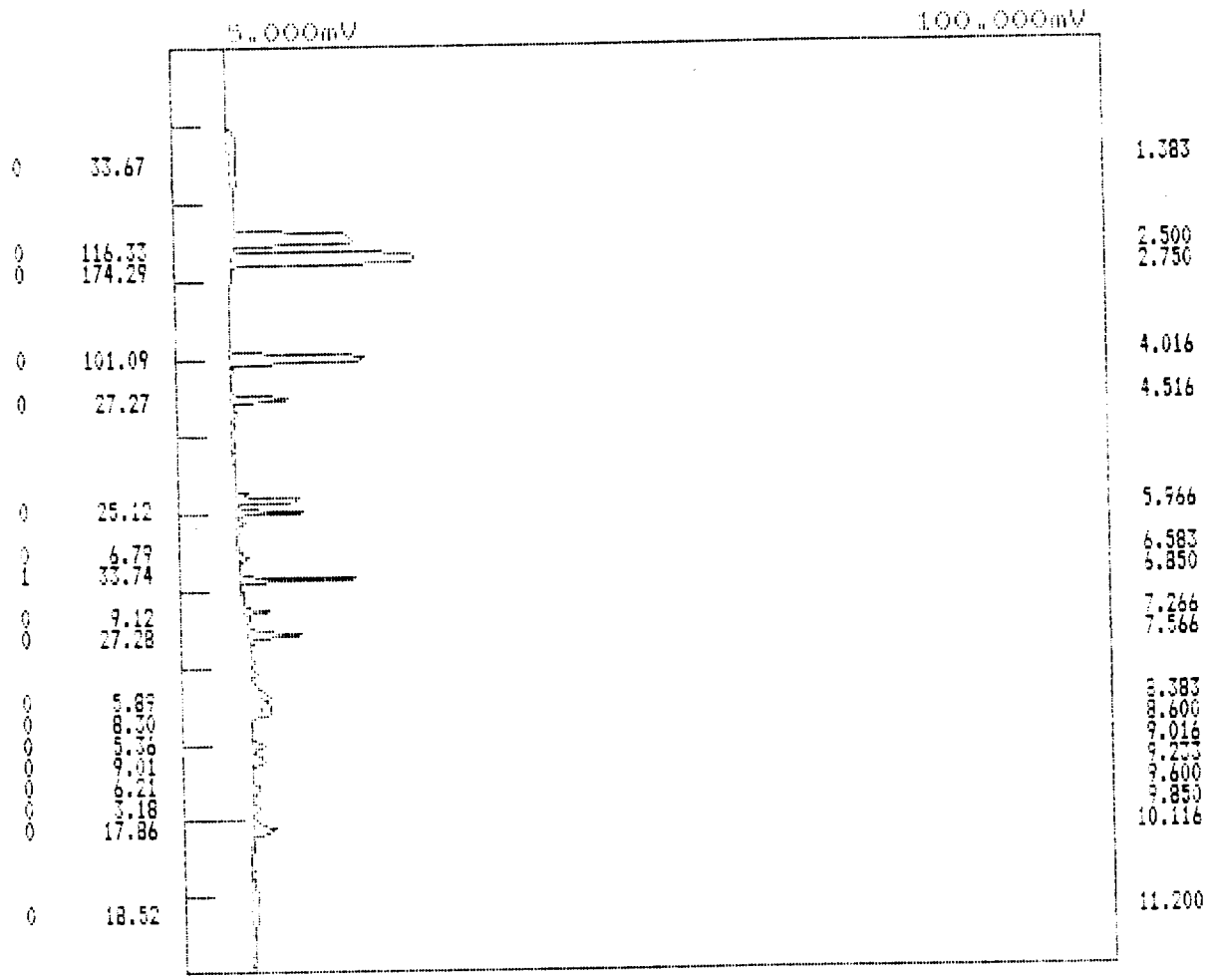
3-Butadiene

1,3-Butadiene

Component	Number	Retention	Area	Units
	0	1.350	33.29	
	0	2.500	107.73	
	0	2.733	242.64	
	0	4.016	142.09	
	0	4.516	34.77	
	0	5.816	41.50	
	0	5.966	36.45	
	0	6.583	6.80	
	1	6.850	46.39	
	0	7.266	15.05	
	0	7.566	36.96	
	0	8.063	3.79	
	0	8.600	48.46	
	0	9.016	6.28	
	0	9.233	12.22	
	0	9.600	7.38	
	0	9.850	4.33	
	0	10.116	24.37	
	0	11.266	9.27	

192 INJECTION
 3RD RUN
 DIRECT FLOW 152nd MIN

Operator : Gary Mata
 File : 422-3-21
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 20:19:04



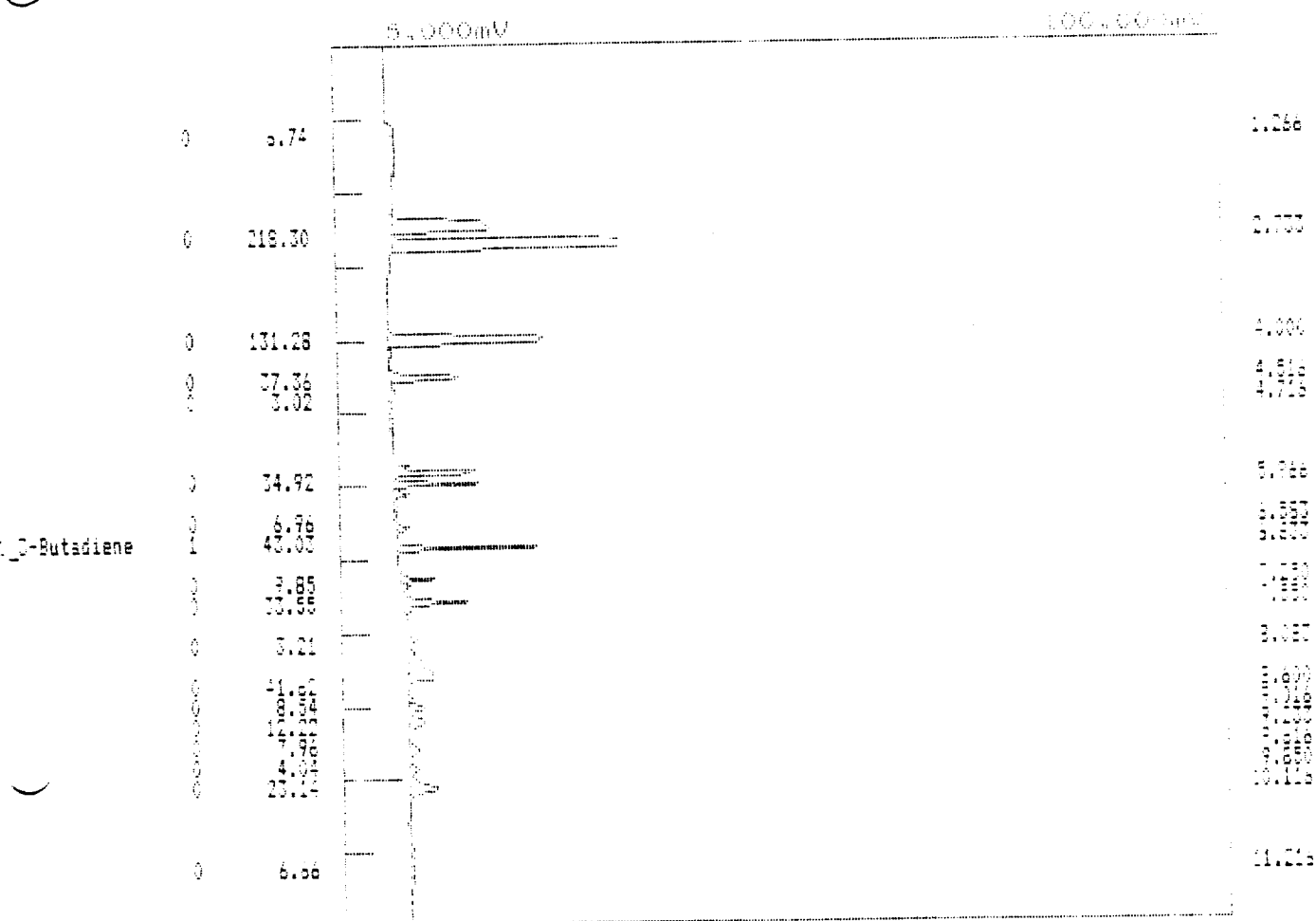
1,3-Butadiene

1,3-Butadiene

Component	Number	Retention	Area	Units
	0	1.383	33.67	
	0	2.500	116.33	
	0	2.750	174.29	
	0	4.016	101.09	
	0	4.516	27.27	
	0	5.966	25.12	
	0	6.583	6.77	
	0	6.850	33.74	
	0	7.246	9.12	
	0	7.566	27.28	
	0	8.383	5.87	
	0	8.600	8.30	
	0	9.016	5.36	
	0	9.233	9.01	
	0	9.600	6.21	
	0	9.850	3.18	
	0	10.116	17.86	
	0	11.200	18.52	

Operator : Gary Mata
 File : 422-3-22
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 20:34:46

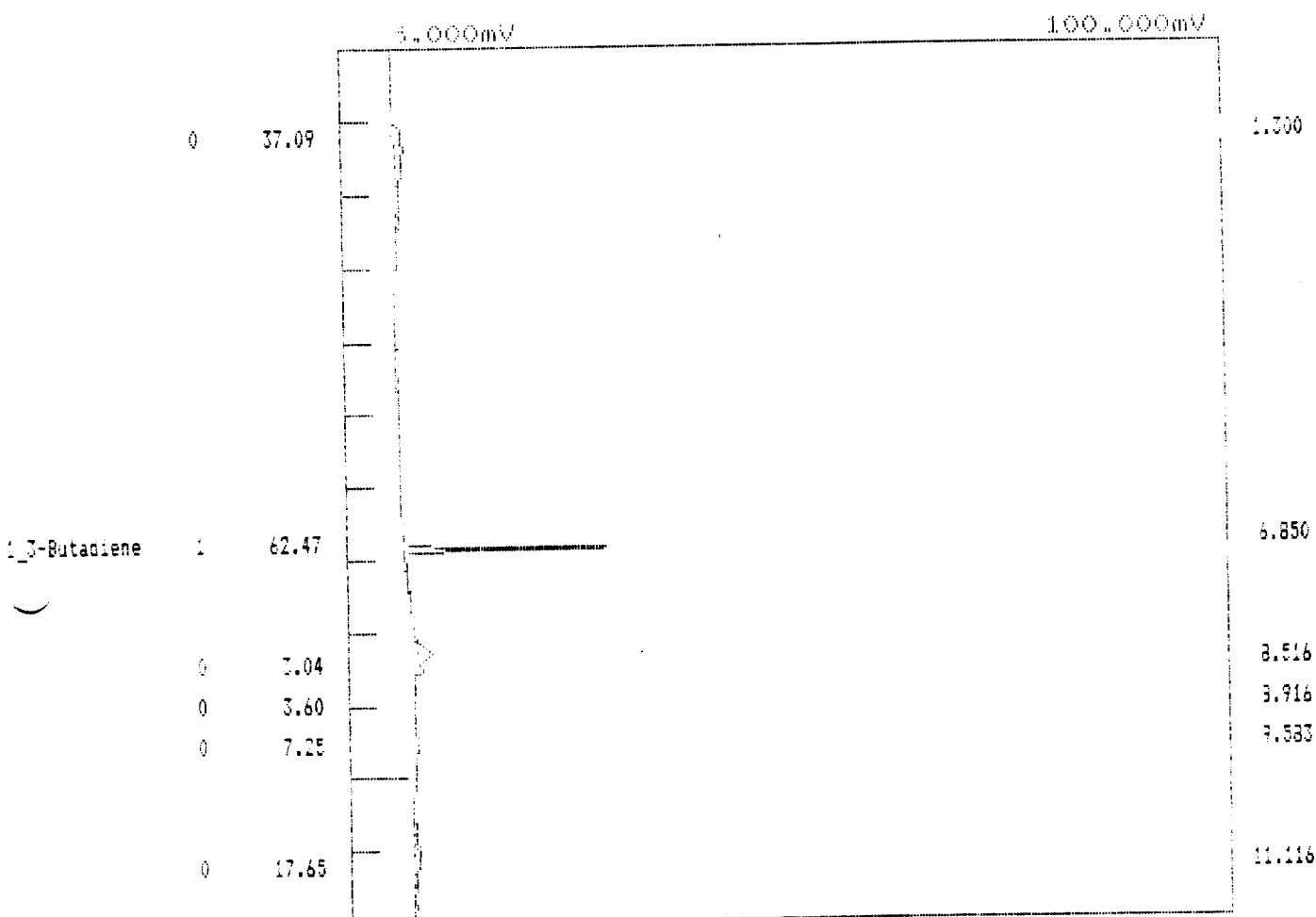
20th INJECTION
 3RD RUN
 DIRECT FLOW 152^{ml}/min



Component	Number	Retention	Area	Units
	0	1.266	6.74	
	0	2.500	103.01	
	0	2.733	218.30	
	0	4.000	131.28	
	0	4.516	37.36	
	0	4.716	3.02	
	0	5.816	41.03	
	0	5.966	34.92	
	0	6.583	6.76	
	1	6.833	43.03	
	0	7.250	3.85	
	0	7.550	37.55	
	0	8.083	3.21	
	0	8.300	41.62	
	0	9.016	8.54	
	0	9.203	12.22	
	0	9.616	7.98	
	0	9.850	4.04	
	0	10.116	23.14	
	0	11.216	6.66	

410 STD 0.540 ppm!
 342 RUN
 DIRECT FLOW 152 ml/min

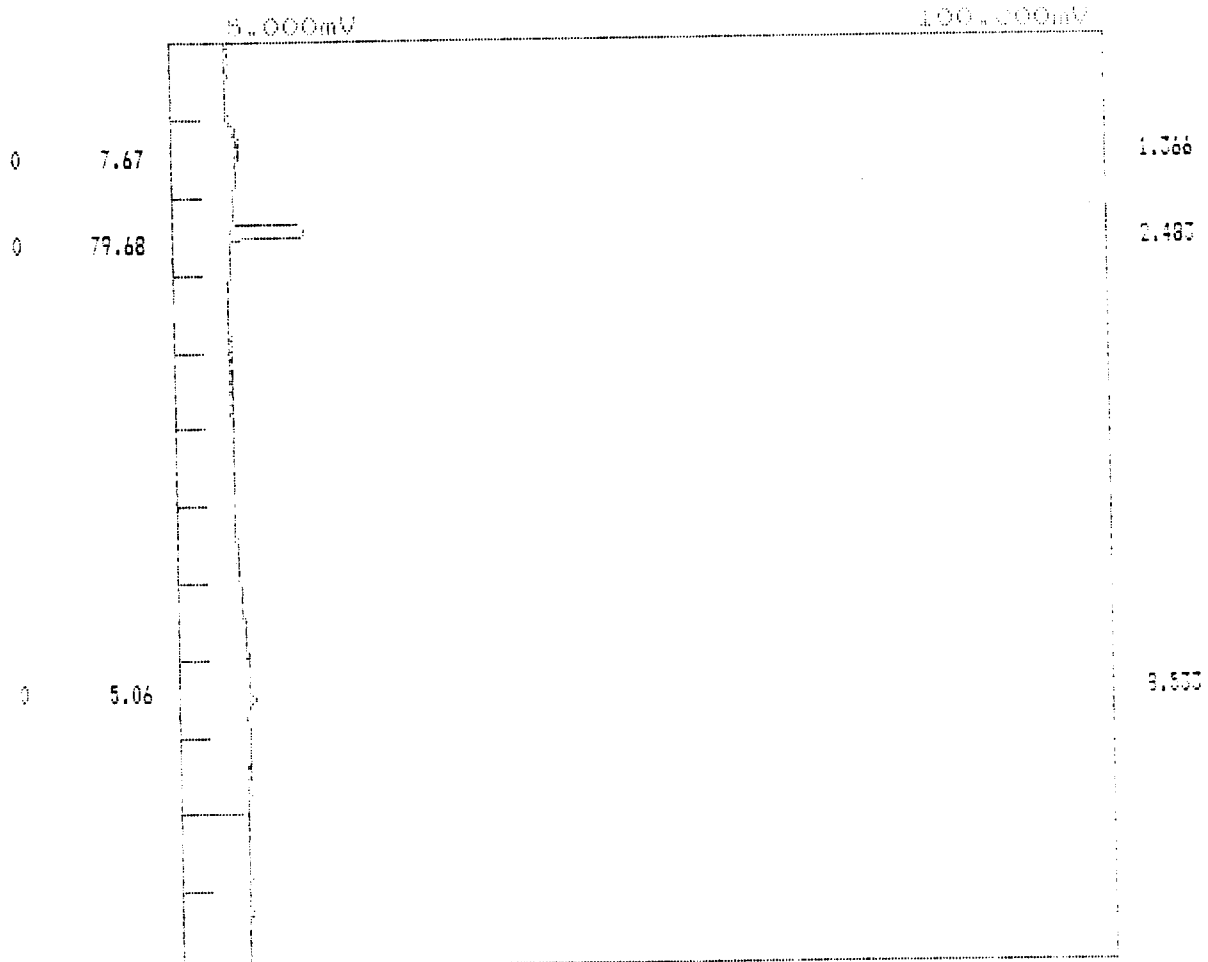
Operator : Gary Mata
 File : 422-3-23
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 20:51:31



Component	Number	Retention	Area	Units
1,3-Butadiene	0	1.300	37.09	
	1	6.850	62.47	
	0	8.300	19.50	
	0	8.516	3.04	
	0	8.916	3.60	
	0	9.583	7.25	
	0	11.116	17.65	
	7		150.59	

AIR BLANK
 3RD RUN
 DIRECT FLOW 152 ml/min

Operator : Gary Mata
 File : 422-3-24
 Temperature :
 Components : default
 Date : 07/31/1992
 Time : 21:06:52



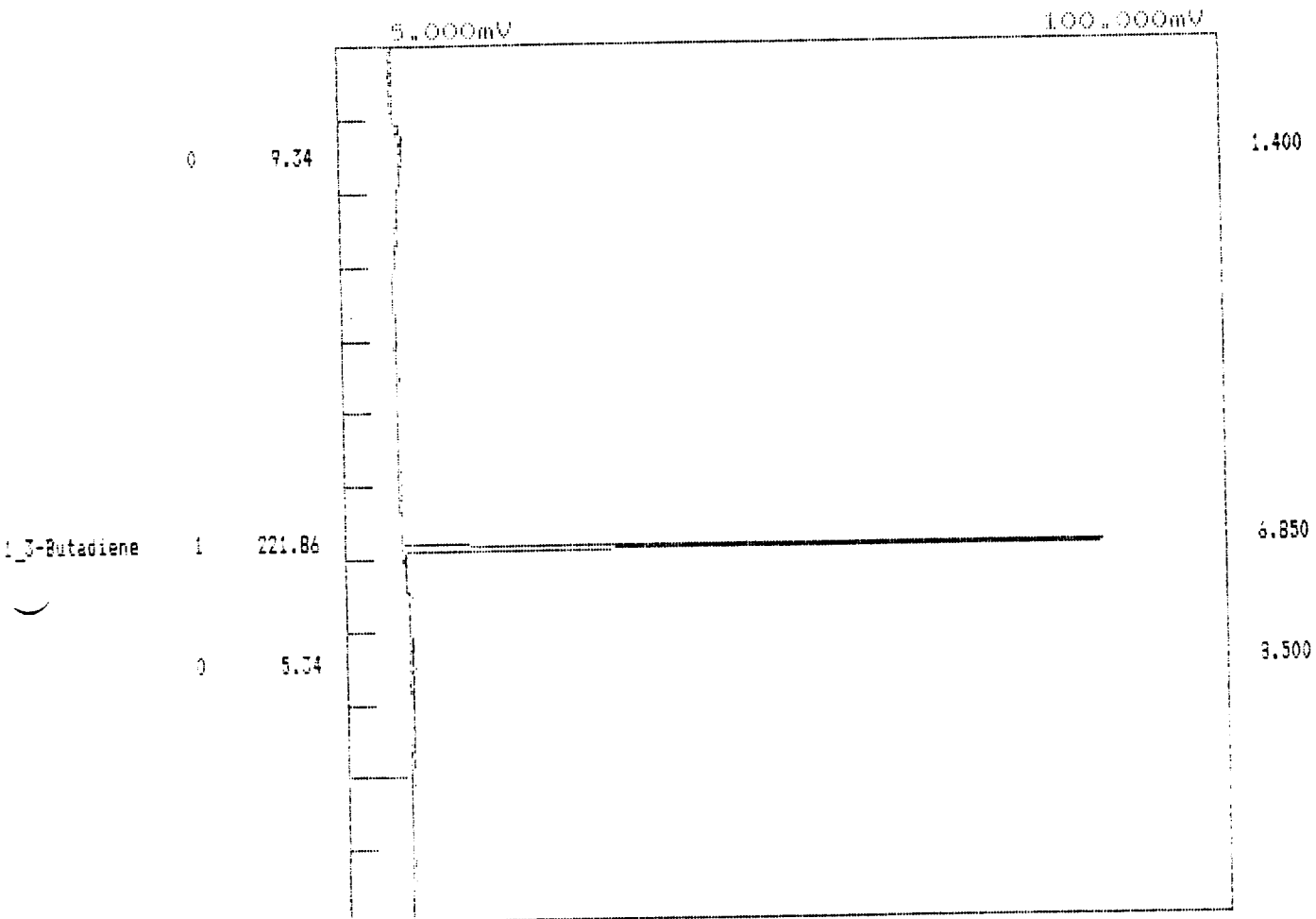
Component	Number	Retention	Area	Units
	0	1.366	7.67	
	0	2.483	79.68	
	0	8.533	5.06	
3			92.42	

0190

ENTROPY

SYSTEM CHECK
3rd Run
DIRECT FLOW 252nd/min

Operator : Gary Mata
File : 422-3-25
Temperature :
Components : default
Date : 07/31/1992
Time : 21:22:26



Component	Number	Retention	Area	Units
1,3-Butadiene	0	1.400	9.34	
	1	6.850	221.86	
	0	8.500	5.34	
3			236.54	

Appendix C.6

Volatile Organic Compounds - CARB Method 422

GASEOUS POLLUTANT FIELD DATA, METHOD #422

Plant Name Hartford (USPA) Run No. 1422-1
 City/State Burlington, CT Job No. 3037 Date 7/29/92
 Sampling Loc. Engine Exhaust Duct Time Start 1217
 Barometric Press. 29.5 In. Hg Ambient Temp. 96 °F Time Finish 1715
 Sample Box No. NA Operator MI Assistant(s) —
 Meterbox I.D. 103T#5 Gamma 0.908 DGM Used (v) Singer — Rockwell —
 Leak Check OK? (v) Pretest ✓ Posttest ✓ Purge Duration — Min.
 Leak Check Readings B — B — B — B —
 (where applicable) E — E — E — E —
 Vacuum, In. Mercury — — — —

EPA METHOD 6 CRITERIA: SAMPLING TRAIN LEAK RATE MUST BE $\leq 2.0\%$ OF AVERAGE SAMPLING RATE.

EPA METHOD 26 CRITERIA: LEAK CHECK VACUUM MUST REMAIN STABLE FOR 30 SECONDS.

FOR PUMP LEAK CHECK, VACUUM MUST REMAIN STABLE FOR 30 SECONDS.

* LITERS FOR SINGER DRY GAS METER; CUBIC FEET FOR ROCKWELL DRY GAS METER.

Time Clock	Net	DGM Reading* (l)(cf)	Rotameter Reading	DGM Pressure In. H ₂ O	Train Vacuum In. Hg	Temperature °F	
						DGM	Imp Exit
1217	0	NA	25	NA	NA	NA	NA
1222	5		25				
1227	10		25				
1232	15		25				
1237	20		25				
1242	25		25				
1247	30		25				
1252	35		25				
1257	40		25				
1258 1300	45		25				
1300 1305	50		25				
1305 1310	55		25				
1310 1315	60	✓	25	✓	✓	✓	✓

Vol. Metered
(l)(cf)*

2193 Average
DGM WC

Average
DGM °F

VOLATILE ORGANIC SAMPLING TRAIN (VOST) FIELD DATA

Plant Name WSPA Run No. 422-2
 City/State Bakersfield, Ca Job No. 30037 Date 7/30/92
 Sampling Loc. Engine Exhaust Duct Time Start 1334
 Barometric Press. 29.5 In. Hg Ambient Temp. 106 °F Time Finish 1708
 Sample Box No. _____ Operator WAT Assistant(s) _____
 Meterbox I.D. 92108T Gamma 0.998 *DGM Used (✓) Singer _____ Rockwell _____
 Leak Check OK? (✓) Pretest ✓ Posttest _____ Condensate Final Vol. _____ mL
 LEAK RATE MUST BE < 2.5 MM (< 0.1 IN.) HG AFTER ONE MINUTE OF LEAK TEST.
 Sorbent Traps I.D. Tenax Tube A _____ Tube B _____
 Tenax/Charcoal Tube A _____ Tube B _____
 Other (specify) _____

* LITERS FOR SINGER DRY GAS METER; CUBIC FEET FOR ROCKWELL DRY GAS METER.

Time		DGM Reading* (l)(cf)	Rotameter Setting	DGM Pressure In. H ₂ O	Train Vacuum In. Hg	DGM Temp. °F	Temp. (°F) (°C) (indicate)	
Clock	Net						Cond.	Probe
1334	0	NA	25	0.6	0	43	NA	NA
1339	5		25	0.6	0	43		
1344	10		25	0.6	0	44		
1349	15		25	0.6	0	43		
1354	20		25	0.7	0	44		
1359	25		25	0.7	0	44		
1404	30		25	0.7	0	44		
1409	35		25	0.7	0	45		
1414	40		25	0.7	0	44		
1419	45		25	0.7	0	45		
1424	50		25	0.7	0	45		
1656	55		55	0.8	3	45		
1701	60		55	0.8	3	45		
1706	65		55	0.8	3	45		
1708	66		55	0.8	3	45		

Vol. Metered
(l)(cf)*

Average
Pressure

Average
Temp.

VOLATILE ORGANIC SAMPLING TRAIN (VOST) FIELD DATA

Plant Name WSPA. Malliburton Service Run No. 422-3

City/State Bakersfield, Ca Job No. 30037 Date 7/31/92

Sampling Loc. Engine Exhaust Duct Time Start 1500

Barometric Press. 29.7 In. Hg Ambient Temp. 100 °F Time Finish 1957

Sample Box No. NA Operator WAF Assistant(s) NA

Meterbox I.D. VOST 5 Gamma 0.998 *DGM Used (v) Singer Rockwell

Leak Check OK? (✓) Pretest ✓ Posttest ✓ Condensate Final Vol. _____ mL

LEAK RATE MUST BE < 2.5 MM (< 0.1 IN.) HG AFTER ONE MINUTE OF LEAK TEST.

Sorbent Traps I.D. Tenax Tube A NA Tube B NA

Tenax/Charcoal Tube A NA Tube B NA

Other (specify) _____

* LITERS FOR SINGER DRY GAS METER; CUBIC FEET FOR ROCKWELL DRY GAS METER.

[illegible]

Vol. Metered
(1)(cf)*

1.2
Average
Pressure

42.5
Average
Temp.

Appendix C.7

Hexavalent and Total Chromium - CARB Method 425

FIELD DATA - METHOD(S) ARB 425

PLANT Halliburton Equipment Yard RUN NO. 425-1
 CITY/STATE Bakersfield Ca JOB NO. 30037 DATE 7/28/92
 SAMPLING LOC. Engine Exhaust Duct TIME START 0745
 BAROMETRIC PRESSURE, IN. HG 29.39 STATIC PRESSURE, IN. H₂O 0.75 TIME FINISH 1841
 LEAK CHECK, VACUUM IN. HG 15 15 15 15 OPERATOR SCG
 LEAK RATE, CUBIC FEET/MIN. 0.002 0.004 0.002 0.0 ASST(S) _____

EQUIPMENT CHECKS*		EQUIPMENT I.D. NUMBERS		LEAK CHECKS	
N/A	PITOT, PRETEST	REAGENT BOX <u>0210</u>	METER BOX <u>N26</u>	B	<u>935.997</u>
N/A	PITOT, POSTTEST	PITOT <u>160-18</u>	TC <u>0.97</u> NOZ'L <u>6P207/6P01A</u>	E	<u>935.997</u>
✓	NOZZLE, PRE/POST	TC READOUT <u>N26</u>	TC PROBE <u>N26</u> UNBILICAL <u>U73</u>	B	<u>936.60</u>
✓	TC <u>94</u> °F PRE	SAMPL'G BOX <u>20</u>	ORSAT PUMP <u>N/A</u> TEDLAR BAG <u>N/A</u>	E	<u>936.60</u>
✓	TC <u>101</u> °F POST			B	<u>970.640</u>
N/A	ORSAT SYSTEM			E	<u>980.00</u>
FILTER/XAD		TARE WT.		FYRITES	
N/A		N/A			
		MONOGRAPH DATA			
		DELTA H ₂	<u>2.7392</u>		
		METER TEMP	<u>100</u>		
		EST. XH ₂ O	<u>7</u>		
		C FACTOR	<u>0.942</u>		
		STACK TEMP	<u>295</u>		
		REF DELTA P	<u>1.21</u>		
		K FACTOR	<u>1.56</u>		

* PITOT: VISUAL INSPECTION/LEAK CHECK; NOZZLE: VISUAL INSPECTION; TC: AMBIENT TEMPS.; ORSAT SYSTEM: LEAK CHECK

LINE	SAMPLING POINT	CLOCK TIME MINUTES	DRY GAS METER READING CUBIC FEET	PITOT READING IN. H ₂ O	GAS METER TEMP. °F	STACK TEMP. °F	ORIFICE SETTING IN. H ₂ O		GAUGE VACUUM IN. HG	GAS TEMPERATURES °F			
							ACTUAL	IDEAL		FILTER BOX	IMPING EXIT	PROBE	COND. EXIT
		0	906.45										
1	A1	5	908.44	0.17	81	168	0.42	0.47	1	250	60		N/A
2		10	910.17	0.17	81	166	0.42	0.42	1	250	55		
3		15	912.35	0.17	86	166	0.42	0.42	1	250	55		
4		20	914.36	0.18	88	168	0.45	0.45	1	245	55		
5		25	915.54	0.18	91	167	0.45	0.45	1	245	55		
6		30	917.46	0.18	92	167	0.45	0.45	1	245	55		
7		35	919.45	0.17	94	168	0.43	0.43	1	240	55		
8		40	921.46	0.17	96	167	0.43	0.43	1	240	55		
9		45	923.34	0.17	98	167	0.43	0.43	1	240	55		
10		50	925.28	0.18	98	169	0.43	0.46	1	240	55		
11		55	927.20	0.17	100	170	0.43	0.43	1	240	58		
12		60/4	929.12	0.17	101	170	0.43	0.43	1	245	55		
13	A2	5	931.00	0.17	102	172	0.43	0.43	1	245	59		
14		10	932.88	0.17	103	176	0.48	0.48	1	250	59		
15		15	937.30	0.19	104	176	0.48	0.48	3	250	65		
16		20	939.32	0.19	104	176	0.48	0.48	12	250	70		
17		25	941.33	0.18	98	175	0.45	0.45	1	250	70		
18		30	941.33	0.18	100	172	0.45	0.46	1	250	60		
19		35	943.32	0.17	101	172	0.43	0.43	1	250	52		
20		40	945.31	0.17	102	173	0.43	0.43	1	245	52		
21		45	947.30	0.18	103	173	0.46	0.46	1	245	52		
22		50	949.35	0.17	104	175	0.43	0.43	1	245	52		
23		55	951.36	0.18	105	176	0.46	0.46	1	245	50		
24		60/2	953.39	0.18	106	177	0.46	0.46	1	245	48		
25	A3	5	955.08	0.18	108	176	0.46	0.46	1	245	48		

350 196.195 6.622 108.625 313.8 1.561
 Min. (θ) Vm (ΔP)² cm ts ΔH

0197

C-0001 (Page 1) 9-91

ENTROPY

FIELD DATA - METHOD(S) ARR425

PLANT Halliburton Equipment Yard RUN NO. M425-2
 CITY/STATE Bakerfield, Ca JOB NO. 30037 DATE 7/30/92
 SAMPLING LOC. Engine Exhaust Duct TIME START 1100
 BAROMETRIC PRESSURE, IN. HG 29.5 STAT. PRESSURE, IN. H₂O 0.04 TIME FINISH 1231
 LEAK CHECK, VACUUM IN. HG 15 15 15 OPERATOR SCC
 LEAK RATE, CUBIC FEET/MIN. 0.004 0.004 0.004 ASST(S) _____

EQUIPMENT CHECKS*		EQUIPMENT I.D. NUMBERS		LEAK CHECKS	
✓ PITOT, PRETEST	REAGENT BOX <u>0210</u>	METER BOX <u>N26</u>	Y <u>0.996</u>	B <u>198.54</u>	B _____
✓ PITOT, POSTTEST	PITOT <u>160-1P</u>	0.99 NOZ'L <u>61203</u>	DIA. <u>0.216</u>	E <u>199.056</u>	E _____
✓ NOZZLE, PRE/POST	TC READOUT <u>5.21</u>	ORIFICE <u>N/A</u>	UMBILICAL <u>U73</u>	B _____	B _____
✓ TC <u>84</u> °F PRE	SAMPL'G BOX <u>73</u>	CALIB PUMP <u>N/A</u>	TEDLAR BAG <u>N/A</u>	E _____	E _____
TC _____ °F POST					B _____
<u>N/A</u> ORSAT SYSTEM					E _____
		NOMOGRAPH DATA			
FILTER/XAD <u>N/A</u>	TARE WT. _____	DELTA H ₂ <u>1.7392</u>			
		METER TEMP <u>100</u>			
		EST. XH ₂ O <u>3</u>			
		C FACTOR <u>1.409</u>			
		STACK TEMP <u>295</u>			
		REF DELTA P <u>0.825</u>			
		K FACTOR <u>2.23</u>			

* PITOT: VISUAL INSPECTION/LEAK CHECK; NOZZLE: VISUAL INSPECTION; TC: AMBIENT TEMPS.; ORSAT SYSTEM: LEAK CHECK

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READING CUBIC FEET	PITOT READING IN. H ₂ O	GAS METER TEMP. °F	STACK TEMP. °F	ORIFICE SETTING IN. H ₂ O		GAUGE VACUUM IN. HG	GAS TEMPERATURES °F			COND. EXIT
							ACTUAL	IDEAL		FILTER BOX	IMPING EXIT	PROBE	
		0	106.06	0.15	98	176	0.40	0.40	1	235	66		N/A
1	A1	5	106.06	0.15	98	176	0.40	0.40	1	235	66		
2		10	106.06	0.15	93	177	0.40	0.39	1	236	66		
3		15	107.12	0.16	96	178	0.42	0.42	1	250	66		
4		20	111.76	0.16	98	176	0.42	0.42	1	248	68		
5		25	113.64	0.16	100	175	0.42	0.42	1	242	60		
6		30	115.51	0.16	101	174	0.42	0.43	1	238	60		
7		35	117.42	0.16	102	174	0.42	0.43	1	239	60		
8		40	119.32	0.16	104	176	0.42	0.43	1	238	64		
9		45	121.19	0.16	106	177	0.42	0.43	1	239	64		
10		50	123.11	0.17	108	178	0.45	0.46	1	240	64		
11		55	124.93	0.16	109	178	0.43	0.43	1	240	64		
12		60	126.795	0.17	109	178	0.45	0.46	1/11	240	66		
13	A2	5	128.88	0.17	109	176	0.46	0.46	1	248	66		
14		10	130.96	0.15	110	175	0.41	0.41	1	244	64		
15		15	132.94	0.16	111	178	0.43	0.43	1	246	64		
16		20	134.95	0.17	112	180	0.45	0.46	1	247	62		
17		25	136.95	0.16	114	177	0.43	0.43	1	245	60		
18		30	138.89	0.16	114	177	0.43	0.43	1	244	70		
19		35	140.81	0.16	114	171	0.43	0.43	1	250	70		
20		40	142.82	0.16	115	176	0.43	0.44	1	249	70		
21		45	144.77	0.16	115	177	0.43	0.43	1	250	70		
22		50	146.75	0.16	116	176	0.43	0.44	1	245	68		
23		55	148.69	0.16	115	178	0.43	0.43	1	249	62		
24		60/2	150.72	0.17	112	181	0.45	0.46	1	248	60		
25	A3	5	152.72	0.18	105	180	0.48	0.48	1	246	64		

36.1 198.992 0.5731 108.78 313 1.504
 Min. (θ) Vm (ΔP)² cm ts ΔH

FIELD DATA (continued)

PLANT

U.S. Environmental Equipment Yard

RUN NO.

M425-1

SAMPLING LOC.

Exhaust Fan Exhaust Stack

JOB NO. 30057

COMMENTS

L I N E	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READING CUBIC FEET	PITOT READING IN. H ₂ O	GAS METER TEMP. °F	STACK TEMP. °F	ORIFICE SETTING IN. H ₂ O		GAUGE VACUUM IN. HG	GAS TEMPERATURES °F			
							ACTUAL	IDEAL		FILTER BOX	IMPING EXIT	PROBE	COND. EXIT
26		10	957.35	0.17	109	179	0.43	0.43	1	250	58		N/A
27		15	959.30	0.17	110	182	0.43	0.43	1	250	58		
28		20	961.31	0.19	110	180	0.48	0.48	1	250	58		
29		25	963.45	0.20	111	180	0.51	0.51	1	250	58		
30		30	965.60	0.20	111	182	0.51	0.51	1	250	58		
31		35	967.89	0.21	112	178	0.54	0.54	2	250	60		
32		40	970.00	0.19	112	179	0.49	0.49	1	250	60		
33		45	972.00	0.19	113	179	0.49	0.49	2	250	60		
34		50	974.00	0.18	114	178	0.46	0.46	2	250	60		
35		55	975.79	0.18	114	179	0.46	0.46	7	250	56		
36		60/3	977.24	0.18	114	178	0.46	0.46	2	250	55		
37A		5	979.69	0.19	114	181	0.49	0.49	4	250	55		
38		10	982.00	0.18	108	176	0.46	0.46	1	250	60		
39		15	984.01	0.18	110	175	0.49	0.49	1	250	64		
40		20	986.03	0.18	110	176	0.46	0.46	1	250	66		
41		25	988.05	0.18	110	176	0.46	0.46	1	250	68		
42		30	990.07	0.18	111	175	0.46	0.46	1	250	68		
43		35	992.08	0.18	111	175	0.46	0.46	1	250	68		
44		40	994.10	0.18	112	176	0.46	0.46	1	250	68		
45		45	996.10	0.18	113	177	0.46	0.46	1	250	68		
46		50	998.13	0.19	113	176	0.49	0.49	1	250	66		
47		55	1000.19	0.19	115	178	0.49	0.49	1	250	66		
48		60A	1002.255	0.18	116	178	0.46	0.46	1	250	65		
49	A1	5	1005.25	3.2	117	177	4.4	4.4	8	N/A	50		
50		10	1014.74	3.2	116	176	4.4	4.4	8	N/A	50		
51		15	1020.41	3.4	120	178	4.6	4.6	8	N/A	50		
52		20	1026.65	3.4	128	178	4.7	4.7	8	N/A	64		
53	A2	25	1037.94	3.4	130	173	4.8	4.8	9	N/A	64		
54		30	1038.8	4.0	120	175	5.5	5.5	10	N/A	66		
55		35	1046.32	3.8	110	177	5.0	5.0	9	N/A	60		
56		40	1053.62	3.8	115	176	5.0	5.0	9	N/A	60		
57	A3	45	1059.5	3.8	116	177	5.0	5.0	10	N/A	60		
58		50	1065.80	3.4	115	175	5.2	5.2	11	N/A	67		
59		55	1072.152	3.8	124	174	5.2	5.2	11	N/A	64		
60		60/5	1078.1A	3.7	128	173	5.2	5.2	10	N/A	66		
61	AA	10	1085.25	3.9	118	175	5.3	5.3	10	N/A	60		
62		15	1091.40	3.2	120	176	4.4	4.4	10	N/A	67		
63		20	1097.43	3.2	124	170	4.5	4.5	10	N/A	64		
64		25	1103.558	3.2	125	174	4.5	4.5	10	N/A	61		
65													

Min. (θ)

Vm

(√Δθ)²

tm

ts

ΔH

ENTROPY

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FIELD DATA (continued)

 PLANT: Halliburton Equipment Yard
 SAMPLING LOC.: Engine Exhaust Duct

 RUN NO. M425-2
 JOB. NO. 20037

COMMENTS													
L I N E	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READING ORIC FLEET	PITOT READING IN. H ₂ O	GAS METER TEMP. °F	STACK TEMP. °F	ORIFICE SETTING IN. H ₂ O		GAUGE VACUUM IN. HG	GAS TEMPERATURES °F			
							ACTUAL	IDEAL		FILTER BOX	IMPING EXIT	PROBE	COND. EXIT
26		10	154.71	0.18	102	179	0.48	0.48	1	245	64		N/A
27		15	156.64	0.18	101	180	0.47	0.47	1	248	64		
28		20	158.62	0.18	100	180	0.47	0.47	1	247	64		
29		25	160.51	0.18	100	181	0.47	0.47	1	246	64		
30		30	162.395	0.18	105	181	0.47	0.48	1/11	247	64		
31		35	164.47	0.18	110	181	0.48	0.48	1	249	65		
32		40	166.45	0.18	111	179	0.48	0.48	1	250	64		
33		45	168.45	0.18	110	178	0.48	0.49	1	252	64		
34		50	170.44	0.18	109	177	0.48	0.48	1	249	63		
35		55	172.50	0.18	109	179	0.48	0.48	1	248	62		
36		60/3	174.54	0.18	110	179	0.48	0.48	1	249	62		
37	A4	5	176.58	0.18	112	177	0.49	0.49	1	249	62		
38		10	178.63	0.17	116	178	0.46	0.46	1	247	64		
39		15	180.68	0.17	116	177	0.46	0.46	1	250	64		
40		20	182.70	0.17	117	177	0.46	0.46	1	250	64		
41		25	184.73	0.17	114	177	0.46	0.46	1	250	58		
42		30	186.75	0.17	116	177	0.46	0.46	1	251	58		
43		35	188.72	0.17	109	177	0.46	0.46	1	251	58		
44		40	190.76	0.18	108	178	0.46	0.48	1	251	58		
45		45	192.75	0.17	108	180	0.46	0.46	1	252	58		
46		50	194.77	0.18	110	179	0.48	0.48	1	253	59		
47		55	196.72	0.18	112	177	0.48	0.48	1	252	60		
48		60/4	198.514	0.17	116	177	0.46	0.46	3	250	60		
49	A1	5	204.89	2.7	104	706	3.9	3.9	4	N/A	68		
50		10	210.40	2.6	106	694	3.8	3.8	5		64		
51		15	215.09	2.70	108	707	3.7	3.9	5		64		
52		20	221.9	2.80	112	703	4.1	4.1	6		64		
53	A2	25	227.85	3.0	116	728	4.3	4.3	6		66		
54		30	233.40	3.1	118	735	4.5	4.46	7		68		
55		35	240.05	3.1	120	724	4.5	4.5	7		70		
56		40	246.155	3.1	119	732	4.5	4.5	7		70		
57	A3	45	252.64	3.6	107	717	5.2	5.2	8		79		
58		50	259.16	3.6	114	715	5.2	5.2	8		70		
59		55	265.62	3.6	120	721	5.3	5.3	9		70		
60		60/5	272.07	3.6	124	719	5.3	5.3	9		70		
61	A4	5	278.61	3.6	128	722	5.1	5.14	9		68		
62		10	284.82	3.6	102	721	5.1	5.1	10		68		
63		15	291.25	3.6	101	725	5.1	5.06	10		68		
64		20	297.631	3.5	101	721	4.9	4.9	10		68		
65													

 211
 @ 140
 or
 @ 140

 off
 15
 or
 @ 164

 211
 170
 150

Min. (°)

V_m $(\sqrt{\Delta P})^2$

cm

ts

ΔH

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ENTROPY

2200

4BB-429

PLANT Halliburton Equipment YARD

RUN NO. 429-3

CITY/STATE Bakersfield

JOB NO. 30037

DATE 7/31/92

SAMPLING LOC. ENGINE EXHAUST STACK

TIME START 1310

TIME FINISH 2120

BAROMETRIC PRESSURE, IN. HG 29.7

STATIC PRESSURE, IN. H₂O 048.75

OPERATOR Mike C

LEAK CHECK, VACUUM IN. HG

ASST(S) C.E.V

LEAK RATE: CUBIC FEET/MIN.

EQUIPMENT CHECKS*		EQUIPMENT I.D. NUMBERS		LEAK CHECKS	
N/A	PITOT, PRETEST	REAGENT BOX	C004	METER BOX	N-30 Y 1.0120
N/A	PITOT, POSTTEST	PITOT	N/A	CP	89 NOZ'L G200 DIA. .216
/	NOZZLE, PRE/POST	TC READOUT	N-30	TC PROBE	N/A
N/A	TC °F PRE	SAMPL'G BOX	50	ORSAT PUMP	N/A
N/A	TC °F POST			UMBILICAL	US3
N/A	ORSAT SYSTEM			TEDLAR BAG	N/A
		NOMOGRAPH DATA			
		DELTA H ₂	2.0169		
		METER TEMP	100		
		EST. XH ₂ O	3		
		C FACTOR	1.626		
		STACK TEMP	295		
		REF DELTA P	.713		
		K FACTOR	2.581		
FILTER/XAD		TARE WT.		FYRITES	
				N/A	

* PITOT: VISUAL INSPECTION/LEAK CHECK; NOZZLE: VISUAL INSPECTION; TC: AMBIENT TEMPS.; ORSAT SYSTEM: LEAK CHECK

[illegible]
$$\frac{320}{\text{Min. } (\theta)} \quad \frac{196.553}{V_m} \quad \frac{0.1798}{(\Delta P)^2} \quad \frac{97.16}{t_m} \quad \frac{202.2}{t_s} \quad \frac{1.94E}{\Delta H}$$

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ENTROPY

0208

FIELD DATA (continued)

PLANT Halliburton Equipment Yard
SAMPLING LOC. ENGINE EXHAUST STACK

RUN NO. 429-3
JOB. NO. 50037

COMMENTS											
L I N E	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READING CUBIC FEET	PITOT READI. IN. H ₂ O	GAS METER TEMP. °F	STACK TEMP. °F	SURFACE SETTING IN. H ₂ O		GAUGE VACUUM IN. HG	FILTER B.	
							ACTUAL	IDEAL			
26		10	124.74	.19	88	175	.57	.570	2	250	65
27		15	126.75	.18	89	177	.54	.540	2	250	65
28		20	128.79	.19	90	176	.57	.571	2	253	65
29		25	130.91	.21	90	176	.63	.632	2	250	65
30		30	132.87	.19	90	177	.57	.570	2	250	65
31		35	134.92	.20	92	178	.60	.602	2	250	65
32		40	136.93	.19	93	175	.57	.575	2	250	65
33		45	139.00	.19	95	175	.58	.578	2	250	66
34		50	141.02	.19	97	174	.58	.581	2	250	66
35		55	143.09	.20	98	174	.61	.612	2	250	66
36		60/3	145.12	.19	100	174	.58	.584	2	250	66
37	4	5	147.17	.20	96	175	.60	.609	2	250	66
38		10	149.14	.19	84	170	.57	.571	2	265	66
39		15	150.95	.16	85	172	.43	.420	2	250	66
40		20	152.90	.18	86	172	.54	.541	2	246	66
41		25	154.84	.18	88	173	.54	.542	2	244	66
42		30	156.76	.18	88	176	.54	.539	2	244	66
43		35	158.72	.18	86	173	.54	.540	2	244	66
44		40	160.59	.17	85	172	.51	.510	2	252	66
45		45	162.46	.17	84	173	.51	.508	2	252	66
46		50	164.38	.18	85	172	.54	.540	2	250	66
47		55	166.33	.18	86	173	.54	.540	2	254	66
48		60/4	168.190	.17	88	171	.51	.514	2	254	66
49	1	5	174.85	4.0	102	724	6.6	6.604	12		50
50		10	181.48	4.0	105	677	6.8	6.811	12		50
51		15	188.23	4.0	106	693	6.7	6.725	12		50
52		20	194.16	3.4	112	693	5.8	5.778	9		50
53	2	25	200.66	3.4	114	692	5.9	5.837	9		50
54		30	206.77	3.0	118	684	5.2	5.204	10		50
55		35	212.98	3.2	114	690	5.5	5.492	11		50
56		40	219.54	3.9	102	693	6.5	6.532	15		50
57	3	45	226.35	4.0	100	695	6.6	6.647	14		50
58		50	232.91	3.8	98	692	6.3	6.307	17		50
59		55	239.54	4.0	81	653	6.7	6.667	15		50
60		60/5	246.18	4.1	90	692	6.7	6.707	16		50
61	4	5	252.59	3.6	93	691	5.9	5.926	15		50
62		10	258.83	3.4	92	696	5.6	5.633	13		50
63		15	265.40	3.8	98	669	6.4	6.451	15		50
64		20	272.045	4.0	100	680	6.7	6.736	16		50
65											

Min. (θ)

Vm

(√ΔP)²

cm

tr

ΔH

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ENTROPY

0209

Appendix C.9

Acetaldehyde, Acrolein, Formaldehyde - CARB Method 430

GASEOUS POLLUTANT FIELD DATA, METHOD 430

Plant Name Halliburton (WSPA) Run No. 11430-1 (14-2)

City/State Birmingham, AL Job No. 30037 Date 7/29/92

Sampling Loc. Engine Exhaust Duct Time Start 1145

Barometric Press. 29.5 In. Hg Ambient Temp. 93 °F Time Finish 1707

Sample Box No. _____ Operator JW Assistant(s) _____

Meterbox I.D. 1.354 Gamma 1.003 DGM Used (V) Singer ☒ Rockwell _____

Leak Check OK? (V) Pretest ☒ Posttest _____ Purge Duration _____ Min.

Leak Check Readings (where applicable) B 1579.38 B 1579.65 B _____ B _____

E 1579.65 E 1579.700 E _____ E _____

Vacuum, In. Mercury 2

EPA METHOD 6 CRITERIA: SAMPLING TRAIN LEAK RATE MUST BE $\leq 2.0\%$ OF AVERAGE SAMPLING RATE.

EPA METHOD 26 CRITERIA: LEAK CHECK VACUUM MUST REMAIN STABLE FOR 30 SECONDS.

FOR PUMP LEAK CHECK, VACUUM MUST REMAIN STABLE FOR 30 SECONDS.

* LITERS FOR SINGER DRY GAS METER; CUBIC FEET FOR ROCKWELL DRY GAS METER.

Time		DGM Reading* (l) (cf)	Rotameter Reading	DGM Pressure In. H ₂ O	Train Vacuum In. Hg	Temperature °F	
Clock	Net					DGM	Imp Exit
1145	0	1567.35	0.125 ^a	1.2	0	36	NA
1150	5	1568.06	0.125	1.2	0	36	—
1155	10	1568.80	0.125	1.2	0	36	—
1200	15	1569.28	0.125	1.2	0	37	—
1205	20	1570.03	0.125	1.2	0	37	—
1210	25	1570.60	0.125	1.2	0	38	—
1215	30	1571.25	0.125	1.2	0	37	—
1220	35	1571.94	0.125	1.2	0	38	—
1225	40	1572.51	0.125	1.2	0	38	—
1230	45	1573.18	0.125	1.2	0	37	—
1235	50	1573.86	0.125	1.2	0	37	—
1240	55	1574.44	0.125	1.2	0	38	—
1245	60	1575.22	0.125	1.2	0	38	—
1250	65	1575.86	0.125	1.2	0	38	—
1255	70	1576.59	0.125	1.2	0	38	✓

326.17
Vol. Metered
(l) (cf)*

0211 1.3
Average
DGM WC

39
Average
DGM °F

GASEOUS POLLUTANT FIELD DATA, METHOD 430

Plant Name Halliburton (WSPA) Run No. M430-1 (207-2)
 City/State Bakersfield, CA Job No. 30037 Date 7/29/92
 Sampling Loc. Engine Exhaust Duct Time Start 11:45
 Barometric Press. 29.5 In. Hg Ambient Temp. 96 °F Time Finish 1767
 Sample Box No. 29.5 Operator SW Assistant(s) _____
 Meterbox I.D. VAST #4 Gamma 1.003 DGM Used (✓) Singer ✓ Rockwell _____
 Leak Check OK? (✓) Pretest ✓ Posttest ✓ Purge Duration NA Min.
 Leak Check Readings B _____ B _____ B _____ B _____
 (where applicable) E _____ E _____ E _____ E _____
 Vacuum, In. Mercury _____

EPA METHOD 6 CRITERIA: SAMPLING TRAIN LEAK RATE MUST BE ≤ 2.0% OF AVERAGE SAMPLING RATE.

EPA METHOD 26 CRITERIA: LEAK CHECK VACUUM MUST REMAIN STABLE FOR 30 SECONDS.

FOR PUMP LEAK CHECK, VACUUM MUST REMAIN STABLE FOR 30 SECONDS.

* LITERS FOR SINGER DRY GAS METER; CUBIC FEET FOR ROCKWELL DRY GAS METER.

Time Clock	Net	DGM Reading* (l) (cf)	Rotameter Reading	DGM Pressure In. H ₂ O	Train Vacuum In. Hg	Temperature °F	
						DGM	Imp Exit
1300	79	1577.33	0.125	1.2	0	39	NA
1305	80	1578.98	0.125	1.2	0	39	
1310	85	1578.76	0.125	1.2	0	39	
1315	90	1579.38	0.125	1.2	0	39	
1648 1642	95	1582.010	0.500	1.8 1.5	1	43	
1647 1647	100	1584.460	0.500	1.41	2	43	
1653 1652	105	1586.83	0.500	1.5	2	43	
1657 1657	110	1588.700	0.500	1.5	3	44	
1702	115	1591.100	0.500	1.5	3	44	
1707	120	1593.520	0.500	1.5	3	44	
							N

26.17
Vol. Metered
(l) (cf) *

2212
Average
DGM WC

29
Average
DGM °F

VOLATILE ORGANIC SAMPLING TRAIN (VOST) FIELD DATA

Plant Name WSPA Run No. 4130-2 1 of 2
 City/State Bakersfield CA Job No. 30037 Date 7/30/92
 Sampling Loc. Engine Exhaust duct Time Start 1311
 Barometric Press. 29.5 In. Hg Ambient Temp. 95 °F Time Finish 1714
 Sample Box No. _____ Operator WAT Assistant(s) _____
 Meterbox I.D. 1.0 Gamma 1.003 *DGM Used (✓) Singer _____ Rockwell _____
 Leak Check OK? (✓) Pretest ☒ Posttest _____ Condensate Final Vol. _____ mL
 LEAK RATE MUST BE < 2.5 MM (< 0.1 IN.) HG AFTER ONE MINUTE OF LEAK TEST.
 Sorbent Traps I.D. Tenax Tube A _____ Tube B _____
 Tenax/Charcoal Tube A _____ Tube B _____
 Other (specify) _____

* LITERS FOR SINGER DRY GAS METER; CUBIC FEET FOR ROCKWELL DRY GAS METER.

Time Clock	Net	DGM Reading* (l) (cf)	Rotameter Setting	DGM Pressure In. H ₂ O	Train Vacuum In. Hg	DGM Temp. °F	Temp. (°F) (°C) (indicate)	
							Cond.	Probe
1311	0	1598.588	0.125	1.2	0	42	NA	NA
1316	5	1599.118	0.125	1.2	0	43		
1321	10	1599.607	0.125	1.3	0	43		
1326	15	1600.155	0.125	1.2	0	43		
1331	20	1600.632	0.125	1.2	0	44		
1336	25	1601.060	0.125	1.2	0	44		
1341	30	1601.605	0.125	1.2	0	44		
1346	35	1602.121	0.125	1.2	0	44		
1351	40	1602.566	0.125	1.2	0	45		
1356	45	1603.040	0.125	1.2	0	46		
1401	50	1603.660	0.125	1.2	0	45		
1406	55	1604.175	0.125	1.2	0	46		
1411	60	1604.640	0.125	1.2	0	46		
1416	65	1605.185	0.125	1.3	0	46		
1421	70	1605.735	0.125	1.2	0	47		

23.434
 Vol. Metered
 (l) (cf)*

1.3
 Average
 Pressure

45
 Average
 Temp.

VOLATILE ORGANIC SAMPLING TRAIN (VOST) FIELD DATA

Plant Name WSPA Run No. 430-2 2of2
 City/State Bakersfield, Ca Job No. 30037 Date 7/30/92
 Sampling Loc. Engine Exhaust Duct Time Start 1311
 Barometric Press. 29.5 In. Hg Ambient Temp. 900 °F Time Finish 1714
 Sample Box No. NA Operator WAT Assistant(s) NA
 Meterbox I.D. 1.003 Gamma 1.003 *DGM Used (✓) Singer NA Rockwell NA
 Leak Check OK? (✓) Pretest ✓ Posttest ✓ Condensate Final Vol. mL
 LEAK RATE MUST BE < 2.5 MM (< 0.1 IN.) HG AFTER ONE MINUTE OF LEAK TEST.
 Sorbent Traps I.D. Tenax Tube A NA Tube B NA
 Tenax/Charcoal Tube A NA Tube B NA
 Other (specify) Leak Check 3 1607.799
E 1607.920

* LITERS FOR SINGER DRY GAS METER; CUBIC FEET FOR ROCKWELL DRY GAS METER.

Time Clock	Net	DGM Reading* (l)(cf)	Rotameter Setting	DGM Pressure In. H ₂ O	Train Vacuum In. Hg	DGM Temp. °F	Temp. (°F) (°C) (indicate)	
							Cond.	Probe
1426	75	1606.180	0.125	1.2	0	47	NA	NA
1431	80	1606.740	0.125	1.2	0	47		
1436	85	1607.306	0.125	1.2	0	47		
1441	90	1607.799	0.125	1.2	0	47		
1649	95	1610.150	0.5	1.6	0	45		
1654	100	1612.600	0.5	1.7	0	45		
1659	105	1614.840	0.5	1.5	0	45		
1704	110	1617.200	0.5	1.6	0	45		
1709	115	1619.645	0.5	1.5	0	46		
1714	120	1622.022	0.5	1.5	0	46		

Vol. Metered
(l)(cf)*

Average
Pressure

Average
Temp.

0214

VOLATILE ORGANIC SAMPLING TRAIN (VOST) FIELD DATA

Plant Name WSPA, Halliburton Services Run No. 430-3 1 of 2
Rockwell
 City/State Bakersfield, CA Job No. 30037 Date 7/31/92
 Sampling Loc. Engine Exhaust Time Start 1427
 Barometric Press. 29.7 In. Hg Ambient Temp. 100 °F Time Finish 2:11
 Sample Box No. NA Operator WAT Assistant(s) _____
 Meterbox I.D. VOST 4 Gamma 1.003 *DGM Used (✓) Singer _____ Rockwell _____
 Leak Check OK? (✓) Pretest ☒ Posttest _____ Condensate Final Vol. _____ mL

LEAK RATE MUST BE < 2.5 MM (< 0.1 IN.) HG AFTER ONE MINUTE OF LEAK TEST.

Sorbent Traps I.D. Tenax Tube A NA Tube B NA
 Tenax/Charcoal Tube A NA Tube B NA
 Other (specify) Leak Check E

* LITERS FOR SINGER DRY GAS METER; CUBIC FEET FOR ROCKWELL DRY GAS METER.

Time		DGM	Rotameter	DGM	Train	DGM	Temp. (°F) (°C)	
Clock	Net	Reading* (l)(cf)	Setting	Pressure In. H ₂ O	Vacuum In. Hg	Temp. °F	(Indicate)	
1427	0	1623.981	0.125	1.2	0	41	NA	NA
1432	5	1624.660	0.125	1.3	0	42		
1437	10	1625.202	0.125	1.2	0	42		
1442	15	1625.667	0.125	1.2	0	42		
1447	20	1626.210	0.125	1.3	0	44		
1452	25	1626.870	0.125	1.3	0	44		
1457	30	1627.375	0.125	1.2	0	45		
1502	35	1628.890	0.125	1.2	0	45		
1507	40	1628.530	0.125	1.2	0	45		
1512	45	1629.070	0.125	1.2	0	45		
1517	50	1629.567	0.125	1.2	0	45		
1522	55	1630.650	0.125	1.2	0	45		
1527	60	1630.734	0.125	1.2	0	45		
1532	65	1631.210	0.125	1.2	0	45		
1537	70	1631.782	0.125	1.2	0	46		

24.469
Vol. Metered
(1) (cf) *

1.3
Average
Pressure

39
Average
Temp.

VOLATILE ORGANIC SAMPLING TRAIN (VOST) FIELD DATA

Plant Name WSPA, Halliburton Services Run No. 430-3 2 of 2
 City/State Bakersfield, CA Job No. 30037 Date 7/31/92
 Sampling Loc. Engine Exhaust Duct Time Start 1427
 Barometric Press. 29.7 In. Hg Ambient Temp. 100 °F Time Finish 2011
 Sample Box No. NA Operator WAT Assistant(s) NONE
 Meterbox I.D. VOST 4 Gamma 1.003 *DGM Used (✓) Singer Rockwell
 Leak Check OK? (✓) Pretest ✓ Posttest ✓ Condensate Final Vol. NA mL
 LEAK RATE MUST BE < 2.5 MM (< 0.1 IN.) HG AFTER ONE MINUTE OF LEAK TEST.
 Sorbent Traps I.D. Tenax Tube A NA Tube B NA

Tenax/Charcoal Tube A NA Tube B NA

Other (specify) Leak test E 1634.435
B 1634.022

* LITERS FOR SINGER DRY GAS METER; CUBIC FEET FOR ROCKWELL DRY GAS METER.

Time		DGM Reading* (l) (cf)	Rotameter Setting	DGM Pressure In. H ₂ O	Train Vacuum In. Hg	DGM Temp. °C	Temp. (°F) (°C) (indicate)	
Clock	Net						Cond.	Probe
1542	75	1632.370 NA	0.125 25	1.2 0.7	0	46	NA	NA
1547	80	1632.850	0.125	1.2	0	45		
1552	85	1633.401	0.125	1.3	0	45		
1557	90	1634.022	0.125	1.2	0	45		
1932	95	1636.670	0.50	1.5	0	36		
1937	100	1638.880	0.5	1.5	2	36		
1956	105	1641.300	0.5	1.5	2	35		
1942	105	1641	0.5	1.5	2	35		
2001	110	1643.590	0.5	1.5	2	36		
2008	115	1645.950	0.49	1.5	3	35		
2011	120	1648.450	0.5	1.5	3	34		

Vol. Metered
(l) (cf) *

Average
Pressure

Average
Temp.

Appendix C.10
Engine Operating Parameters

WSPA I.C. ENGINE POOLED SOURCE TEST ENGINE OPERATING DATA

Company: Halliburton Services
 Location: Bakersfield, CA
 Date: 7/29/92
 Personnel: RTJ
 Test Run: 1 Page: 1 of 2

2 psig
Rail Press.

Time	Temperatures (Deg. F)			Fuel Flow		Engine Speed		Turbo Boost		Water Brake	
	Coolant	Lube Oil	Fuel	(lb/hr)		(RPM)		Temp (F)	(In. Hg)	Flow (BPM)	Press. (psig)
7:45	164	164	71	-	-	765		87	-0.05	0	0
8:00	167	166	73	-	-	767		89	-0.05	0	0
8:15	169	165	76	-	-	750		91	-0.05	0	0
8:30	164	165	78	-	-	755		92	-0.05	0	0
8:45	166	165	81	-	-	755		94	-0.05	0	0
9:00	167	167	85	-	-	780		96	-0.05	-	-
9:15	168	168	87	-	-	750		99	-0.05	-	-
Sampling interrupted											
10:30	165	170	88	-	-	760		100	-0.05	-	-
10:45	169	170	89	-	-	749		101	-	-	-
11:00	165	169	88	-	-	752		99	-	-	-
11:15	169	171	89	-	-	751		106	-	-	-
11:30	169	170	89	-	-	750		106	-	-	-
11:50	169	171	95	-	-	750		109	-	-	-
12:00	166	169	95	-	-	755		109	-	-	-
12:15	164	169	95	-	-	745		109	-	-	-
12:30	168	170	96			750		110	-	-	-
12:45	166	169	91			755		109	-	-	-
13:00	164	169	96			758		109	-	-	-
13:15	163	168	98			756		109	-	-	-
13:30	164	167	98			760		113	-	-	-
14:00	165	169	98			750		111	-	-	-
Stop to change load											
	181	222	105	137	0.212	2093		310	30.7	5.27	1850
16:35	175	205	110	98	0.108	2135		255	21.7	5.81	1120
16:45	175	206	110	104	0.132	2065		254	21.8	5.83	1110
17:00	176	207	114	102	0.126	2072		258	21.7	5.78	1110
17:15	175	205	112	101	0.114	2057		252	21.8	5.78	1120
17:30	175	205	112	102		2084		249	21.7	5.77	1105

12:15

Full Throttle
+ 2100 RPM
163 psig
Rail Press.

239 H.

66.7%

66.3%

65.8%

WSPA I.C. ENGINE POOLED SOURCE TEST ENGINE OPERATING DATA

Company: Halliburton Services
Location: Bakersfield, CA
Date: 7/27/92
Personnel: PJJ
Test Run: I Page: 2 of 2

[illegible]

WSPA I.C. ENGINE POOLED SOURCE TEST ENGINE OPERATING DATA

Company: Halliburton Services
 Location: Bakersfield, CA
 Date: 6/30/93
 Personnel: RJS
 Test Run: 2 Page: 1 of 1

239

Time	Temperatures (Deg. F)			Fuel Flow (b/hr)	Engine Speed (RPM)	Turbo Boost		Water Brake	
	Coolant	Lube Oil	Fuel			Temp (F)	(In. Hg)	Flow (BPM)	Press. (psia)
11:00	165	167	85	-	756	108	0.0	0	0
11:35	166	172	87	-	751	101	0.0	0	0
11:45	165	170	88	-	756	104	0.0	0	0
12:00	164	169	90	-	759	104	0.0	0	0
12:15	164	168	95	-	750	108	0.0	0	0
12:30	163	170	95	-	764	105	0.0	0	0
12:45	164	169	97	-	764	109	0.0	0	0
13:00	164	168	97	-	756	106	0.0	0	0
13:15	164	168	96	-	761	110	0.0	0	0
13:30	163	168	97	-	767	111	0.0	0	0
13:45	165	168	97	-	767	114	0.0	0	0
14:00	163	167	98	-	796	112	0.0	0	0
14:15	164	166	98	-	763	110	0.0	0	0
14:30	165	167	102	-	760	112	0.0	0	0
14:45	165	169	104	-	755	111	0.0	0	0
15:00	165	169	106	-	769	111	0.0	0	0
15:15	166	168	106	-	760	112	0.0	0	0
15:35	167	168	105	-	761	112	0.0	0	0
Change to 25% Load									
16:30	173	203	106	104/0.108	2080	250	21.6	1100	5.84
16:45	173	203	108	104/0.108	2086	247	20.7	1090	5.82
17:00	174	204	109	104/0.112	2080	250	21.4	1100	5.83
17:15	175	205	109	106/0.122	2092	253	21.8	1110	5.89
17:40	173	204	109	98/0.091	2041	242	19.6	1080	5.74
18:00	173	205	108	98/0.108	2048	242	19.6	1080	5.76
18:15	174	204	107	100/0.096	2061	244	20.2	1100	5.78
18:32	174	203	107	99/0.066	2059	240	19.6	1080	5.78

65.8
65.1
66.8
67.0
63.2
63.2
65.1

WSPA I.C. ENGINE POOLED SOURCE TEST ENGINE OPERATING DATA

Company: Halliburton / Entropy Environmental Inc.
 Location: Halliburton Service Yard
 Date: 7/21/92
 Personnel: WAT, SCG
 Test Run: 3 Page: 1 of 1

Time	Temperatures (Deg. F)			Fuel Flow (lb/hr)	Engine Speed (RPM)	Turbo Boost		Water Brake	
	Coolant	Lube Oil	Fuel			Temp (F)	(in. Hg)	Flow (BPM)	Press (psia)
1300	167	171	86	—	755	95.4	0	0	0
1315	169	170	87	—	760	105	0	0	0
1330	165	171	88	—	756	106	0	0	0
1345	165	168	90	—	752	107	0	0	0
1400	165	168	95	—	748	107	0	0	0
1415	165	168	99	—	750	108	0	0	0
1430	164	169	100	—	757	111	0	0	0
1445	166	169	101	—	760	112	0	0	0
1500	164	169	106	—	755	111	0	0	0
1515	164	169	108	—	758	111	0	0	0
1530	164	169	100	—	755	112	0	0	0
1545	165	169	100	—	767	112	0	0	0
1600	167	167	100	—	763	113	0	0	0
1615	164	168	100	—	758	109	0	0	0
1630	168	168	100	—	755	110	0	0	0
1645	167	168	101	—	765	111	0	0	0
1700	166	168	101	—	762	110	0	0	0
1715	167	168	102	—	755	111	0	0	0
Process Change									
1915	177	242	100	107	2130	200	25.6	1115	5.77
1930	172	245	100	95	2078	243	25.6	1240	6.11
1945	170	245	100	95	2080	236	20.8	1090	5.78
2000	170	200	100	90/0.1	2062	234	20.6	1115	5.77
2015	171	196	95	105/0.12	2067	231	20.6	1118	5.77
2045	165	193	100	100/0.11	1950	206	16.2	1181	5.84
2100	168	198	84	100/0.12	2070	230	21.0	1160	5.77
2115	169	197	84	110/0.12	2100	233	22.2	1184	5.83
2125	168	197	84	110/0.12	2093	232	21.8	1156	5.84

Adjusted
operating
parameters

mixed
results

Appendix D
Analytical Data

Appendix D.1
Particulate Matter - CARB Method 5

MOISTURE ANALYTICAL RESULTS

Plant Name G. C. SWEETLAND WSPA / Halliburton Job No. 30016
 City/State Bakersfield, CA Sampling Loc. Engine Exhaust Duct

Run Number

MS-1

MS-2

MS-3

Sampling Date

7/29/92

7/30/92

Analysis Date

7/29/92

7/30/92

Analyst

JW

CC

Reagent 1 (<u>200ml DI</u>)			
Final Weight, g	743.7	724.2	741.5
Tared Weight, g	590.7 585.4	590.7 552.6	590.7
Water Catch, g	158.3	171.6	150.8
Reagent 2 ()			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
Reagent 3 ()			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
CONDENSED WATER, g			
Silica Gel			
Final Weight, g	236.4	446.4	451.7
Tared Weight, g	200.9 9	200.5 222.4 905.0	200.3 200.4 400.7
ADSORBED WATER, g	35.5	41.4	51.0
TOTAL WATER COLLECTED, g	193.8	213.0	201.8

Balance No. (ZIM #3) Type ☒ Triple Beam ☒ Electronic

Reagent Box No. C52

Balance located in stable, draft-free area ☒ Yes ☐ No (If "No", explain below.)

Comments

FIELD SAMPLE RECOVERY QUALITY CONTROL

Box No. 152 Assembly Date 07/22/92 Assembled By AM
 Plant Name/address D.C. Sanitation WSPA/Halliburton Job No. 30016
 Sampling Loc. Engine Exhaust Duct Method ACB METHOD 5
 Individual Tare Of Reagent 200 (Ml) (gm) Of DI
 Individual Tare Of Reagent _____ (Ml) (gm) Of _____
 Individual Tare Of Reagent _____ (Ml) (gm) Of _____
 Individual Tare Of Sil. Gel 200 Gm _____ other (specify) _____

Run Number	Run Date	Filter or XAD Number	Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
M5-1	7/30	E2028	0.5017	✓	JW	7/29/92	80	Yes	SCG

E2029 0.4988

E1030 0.4962

Filter Appearance*

Heavy coating of oily black particles

Reagents Appearance*

1st imp yellow; 2nd cloudy

M5-2	7/31	E2024	0.4988	✓	JW	7/30/92	60	Yes	SCG
------	------	------------------	--------	---	----	---------	----	-----	-----

E1031 0.4946

E1032 0.4948

E1033

Filter Appearance*

Black (2)

Reagents Appearance*

1st Yellow; 2nd opaque

M5-3	8/1/92	E2032	0.5021	✓	SCG	7/30/92	70	Yes	COG
------	--------	-------	--------	---	-----	---------	----	-----	-----

E2033 0.5035

E1033 0.4920

Filter Appearance*

Black (3 total)

Reagents Appearance*

1st Yellow - 2nd Opaque to milky

Filter Appearance*

Reagents Appearance*

* Use "REMARKS" section if needed.

@ All liquid levels at mark? (check) YES _____ NO _____ (estimate loss if not at mark; use "REMARKS" section).

REMARKS _____

Custodian _____

0-1002 Rev. 10-91

Date _____

Time _____

ENTROPY

RECORD OF CUSTODY, CONTAINER NO. C52

Container Type (check) ☒ Reagent Box ☐ Cooler ☐ Other (specify) _____

Plant Name/Address C. L. SANITATION WSPA/Halliburton

Job No. 30016 Sampling Method ARB METHOD 5 (EPA, NIOSH, etc.)

Seal ID	Date	Time	*	Full Signature	Reason for Breaking Seal**
0000547	07/02/92	1615	S	(Kang) M. L. H.	
	7/17/92	1115	B	Long Wong	to change train
0000349	7/21/92	1632	S	Long Wong	
	7/29/92	0810	B	Shan Ch.	replace filter
0000739	7/27/92	2045	S	Shan Ch.	
	7/30	0610	B	Long Wong	Change Train
0000852	7/30	1125	S	Long Wong	Recover MS-2 Train
	7/30	1935	B	Wang John	
0000037	7/30	2015	S	Shan Ch.	
			B		
			S		
			B		
			S		
			B		
			S		
			B		

* S = Sealed By; B = Broken By ** Use "REMARKS" Section if more space needed.

Relinqu'd By _____ Date _____ Time _____ Rec'd By _____
 Relinqu'd By _____ Date _____ Time _____ Rec'd By _____
 Relinqu'd By _____ Date _____ Time _____ Rec'd By _____

As Applicable:
 All liquid levels at mark (check)? ☐ YES ☒ NO (Estimate loss if not at mark; describe in "REMARKS")

As Applicable:
 TUBE SAMPLES put in freezer by _____ Date _____ Time _____

CONDENSATE SAMPLES put in refrige. by _____ Date _____ Time _____

REMARKS RUN MS-3 BACK 1/2 & FRONT 1/2 RINGS FLUID LEVELS
WERE NOT MARKED!

SUMMARY OF IMPINGERS' WATER ANALYSIS (Version 02.12.92)

Plant Name: Halliburton Equipment Yard (WSPA) EEI Ref# 30037

Run Number	M5-1				M5-2				M5-3			
Sample ID/Container #	1 / #056				1 / #061				1 / #066			
	init.	date		date		date		date		date		date
	GM	8/18/9	@	3.7347	8/18/9	@	3.6840	8/18/9	@	3.6035		
	GM	8/17/9		3.7348	8/17/9		3.6845	8/17/9		3.6040		
Tare Wt., g.	(	200 ml)		3.7114	(	200 ml)		3.6503	(	200 ml)		3.5876
SAMPLE WT., g.				0.0233				0.0337				0.0159
Sample ID/Container #	2 / #055				2 / #060				2 / #065			
	init.	date		date		date		date		date		date
	GM	8/18/9	@	3.8819	8/18/9	@	4.0461	8/18/9	@	3.7597		
	GM	8/17/9		3.8821	8/17/9		4.0474	8/17/9		3.7609		
Tare Wt., g.	(	200 ml)		3.6702	(	200 ml)		3.8372	(	200 ml)		3.5938
SAMPLE WT., g.				0.2117				0.2089				0.1659
Sample ID/Container #	3 / #054				3 / #059				3 / #064			
	init.	date		date		date		date		date		date
	GM							8/20/9	@	3.6353		
	GM				8/19/9		3.7710	8/19/9		3.6358		
	GM	8/18/9		3.7613	8/18/9	@	3.7707	8/18/9		3.6374		
	GM	8/17/9	@	3.7610	8/17/9		3.7713	8/17/9		3.6445		
Tare Wt., g.	(	200 ml)		3.7354	(	200 ml)		3.7470	(	200 ml)		3.6048
SAMPLE WT., g.				0.0256				0.0237				0.0305
1 Condensible Organic Catch, mg.				23.3				33.7				15.9
Solvent Blank Residue, mg.				0.5				0.5				0.5
ORGANIC CONDENSIBLES,mg				22.8				33.2				15.4
2 Inorganic Fraction Catch, mg.				211.7				208.9				165.9
Water Blank Residue, mg.				1.5				1.5				1.5
INORGANIC CONDENSIBLES, mg.				210.2				207.4				164.4
3 Methylene Chloride Soluble Catch, mg.				25.6				23.7				30.5
Methylene Chloride Blank Residue, mg.				0.5				0.5				0.5
METHYLENE CHLORIDE SOLUBLE CONDEN				25.1				23.2				30.0
TOTAL CONDENSIBLES PARTICULATE, mg				258.1				263.8				209.8
TOTAL FILTERABLE PARTICULATE, mg.				211.8				197.9				206.9
TOTAL PARTICULATE, mg.				469.9				461.7				416.7

Procedure Explanation

- 1 - Extractable with Methylene Chloride
- 2 - Water catch after extraction and heating to 210 F
- 3 - Acetone rinsings of impingers and connecting glassware
- 4 - Water catch after heating to _____ F

Printing Date

08/20/92

Printing Time

05:25 PM

PARTICULATE SAMPLING LABORATORY RESULTS (Version 02.14.92)

Plant Name: Halliburton Equipment Yard (WSPA) EEI Ref# 30037
 Sampling Location: Engine Exhaust Duct
 Date Received: August 3, 1992

Run Number	M5-1				M5-2				M5-3			
Sample ID/Container #	F / #052				F / #057				F / #062			
	init.	date		date		date		date				
	GM	8/18/92	@	4.9385	8/18/92	@	4.8671	8/18/92	@	5.4061		
	GM	8/17/92		4.9386	8/17/92		4.8676	8/17/92		5.4068		
Baggie Tare Wt., g.				3.7920			3.7278			3.7489		
Filter Tare Wt., g.				0.9950			0.9894			1.4976		
FILTER SAMPLE WT., g.				0.1515			0.1499			0.1596		

Sample ID/Container #	R / #053				R / #058				R / #063			
	init.	date		date		date		date				
	GM	8/20/92	@	3.8305								
	GM	8/19/92		3.8308				8/19/92	@	3.7749		
	GM	8/18/92		3.8325	8/18/92		3.7236	8/18/92		3.7751		
	GM	8/17/92		3.8348	8/17/92	@	3.7235	8/17/92		3.7765		
Tare Wt., g.		(200 ml)		3.7686	(200 ml)		3.6739	(200 ml)		3.7260		
RINSE SAMPLE WT., g.				0.0619			0.0496			0.0489		

Filter Catch, mg.	151.5	149.9	159.6
Rinse Catch, mg.	61.9	49.6	48.9
Rinse Blank Residue, mg.	1.6	1.6	1.6
Net Rinse Catch, mg.	60.3	48.0	47.3
FILTERABLE PARTICULATE, mg.	211.8	197.9	206.9

Blank Beaker #	B / #067	—Legend—		Sample Description		
Final wt., mg.	3.6814	@ = Final Weight				
Tare wt., mg.	3.6643	F = Filter	R = Rinse	Run #	Color	Loading
Residue, mg.	17.1					
Volume, ml.	200	1 = Light		-	1 2 3	1 2 3
Density, mg/ml	785.0	2 = Medium		-	1 2 3	1 2 3
Conc., mg/mg	1.089E-04	3 = Heavy or Dark		-	1 2 3	1 2 3
Upper Limit, mg/mg	1.000E-05	<--				

Notes and comments:

Predominate color of samples is: Opaque in impingers and rinse, and black in the front half rinse.
 Date of full balance span August 17, 1992

Printing Date

20-Aug-92

Printing Time

05:01 PM

REAGENT BLANK(S) LABORATORY RESULTS (Version 02.14.92)

Plant Name: Halliburton Equipment Yard (WSPA)

EEI Ref #

30037

Sampling Location: N/A

Date Received: August 3, 1992

Run Number

Acetone

Sample ID/Container #

init.

date

B / #067

GM	8/19/92	3.6815
GM	8/18/92 @	3.6814
GM	8/17/92	3.6856

Tare Wt., g.	(200 ml)	3.6643
SAMPLE WT., g.		0.0171

Notes and comments:

Predominate color of samples is: N/A

Date of full balance span August 17, 1992

Printing Date

20-Aug-92

Printing Time

05:01 PM

REAGENT BLANK(S) LABORATORY RESULTS

Plant Name: Halliburton Equipment Yard (WSPA) **EEL Ref#** 30037
Sampling Location: NA
Date Received: August 3, 1992

Run Number	Acetone	Solvent	DI H2O
------------	---------	---------	--------

Sample ID/Container #	init.	date	<u>B / #067</u>	date	<u>B / #069</u>	date	<u>B / #068</u>		
	GM	8/19/9	3.6815						
	GM	8/18/9 @	3.6814	8/18/9 @	3.7363	8/18/9 @	3.7483		
	GM	8/17/9	3.6856	8/17/9	3.7366	8/17/9	3.7487		
Tare Wt., g.	(	200 ml)	3.6643	(	200 ml)	3.7358	(	200 ml)	3.7468
SAMPLE WT., g.			0.0171		0.0005		0.0015		

Blank Beaker #	B / #067	B / #069	B / #068
Final wt., mg.	3.6814	3.7363	3.7483
Tare wt., mg.	3.6643	3.7358	3.7468
Residue, mg.	17.1	0.5	1.5
Volume, ml.	200	200	200
Density, mg/ml	785.0	1315.0	1000.0
Conc., mg/mg	1.1E-04	1.9E-06 @	7.5E-06 @
Upper Limit, mg/mg	1.0E-05 @	1.0E-05	1.0E-05

Notes and comments:

Predominate color of samples is: N/A
Date of full balance span

Appendix D.2
Benzene - CARB Method 410A



Performance Analytical Inc.
Environmental Testing and Consulting

7/31/92

LABORATORY REPORT

Client: ENTROPY ENVIRONMENTALISTS INC.

Date of Report: 08/07/92

Address: 5932 Bolsa Avenue, Suite 105

Date Received: 07/31/92

Huntington Beach, CA 92649

PAI Project No: 4445A

Contact: Mr. Tony Wong

Purchase Order: 30037-1

Client Project ID: WSPA #30037

Two (2) Tedlar Bag Samples labeled:

"M410A-1" and "M410A-2"

Two (2) Liquid Samples labeled:

"M410A-1" and "M410A-2"

The samples were received at the laboratory under chain of custody on July 31, 1992. The samples were received intact. The liquid sample vials were received with only moisture in them, therefore analyses could not be performed on the liquid samples. The samples were analyzed on July 31, 1992.

Benzene Analysis

The samples were analyzed by combined gas chromatography/mass spectrometry (GC/MS) for Benzene. The analyses were performed according to the methodology outlined in EPA Method TO-14 from the Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, EPA 600/4-84-041, U.S. Environmental Protection Agency, Research Triangle Park, NC, April, 1984 and May, 1988. The Method was modified for using Tedlar Bags. The analyses were performed by gas chromatography/mass spectrometry, utilizing a direct cryogenic trapping technique. The analytical system used was comprised of a Finnigan Model 4500 GC/MS/DS interfaced to a Tekmar 5010 Automatic Desorber. A thick film (5 micron) crossbonded 100% Dimethyl polysiloxane megabore column (RT_x-1, Restek Corporation, Bellefonte, PA) was used to achieve chromatographic separation.

The results of analyses are given on the attached data summary sheet.

Data Release Authorization:

Reviewed and Approved:

Chris Parnell
Senior Chemist

Michael Tuday
Laboratory Director



Performance Analytical Inc.
Environmental Testing and Consulting

LABORATORY REPORT

Client: ENTROPY ENVIRONMENTALISTS INC. Date of Report: 08/07/92
Address: 5932 Bolsa Avenue, Suite 105 Date Received: 08/03/92
Huntington Beach, CA 92649 PAI Project No: 4449A
Contact: Mr. Tony Wong Purchase Order: 30037-3
Client Project ID: WSPA #30037

One (1) Tedlar Bag Sample labeled: "M410A-3"

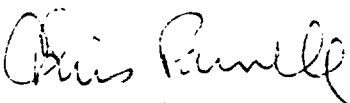
The sample was received at the laboratory under chain of custody on August 3, 1992.
The sample was received intact. The sample was analyzed on August 4, 1992.

Benzene Analysis

The sample was analyzed by combined gas chromatography/mass spectrometry (GC/MS) for Benzene. The analyses were performed according to the methodology outlined in EPA Method TO-14 from the Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, EPA 600/4-84-041, U.S. Environmental Protection Agency, Research Triangle Park, NC, April, 1984 and May, 1988. The Method was modified for using Tedlar Bags. The analyses were performed by gas chromatography/mass spectrometry, utilizing a direct cryogenic trapping technique. The analytical system used was comprised of a Finnigan Model 4500 GC/MS/DS interfaced to a Tekmar 5010 Automatic Desorber. A thick film (5 micron) crossbonded 100% Dimethyl polysiloxane megabore column (RT_x-1, Restek Corporation, Bellefonte, PA) was used to achieve chromatographic separation.

The results of analyses are given on the attached data summary sheet.

Data Release Authorization:



Chris Parnell
Senior Chemist

Reviewed and Approved:



Michael Tuday
Laboratory Director



RESULTS OF BENZENE ANALYSIS

Test Code	: GC/MS Mod. EPA TO-14/CARB 410	Matrix	: Tedlar Bags
Analyst	: Chris Parnell	Date Received	: 07/31/92
Instrument ID	: Finnigan 4500C/Tekmar 5010	Date Analyzed	: 07/31/92
Verified by	: Michael Tудay	Volume Analyzed:	1.00 Liter & 0.50 Liter

CLIENT SAMPLE ID	PAI SAMPLE ID	RESULT (UG/M ³)	DETECTION LIMIT (UG/M ³)	RESULT (PPB)	DETECTION LIMIT (PPB)
M410A-1 (07/29/92)	9203812	700	5.0	220	1.6
M410A-2 (07/30/92)	9203814	600	10	190	3.1
N/A (07/31/92)	Method Blank	ND	5.0	ND	1.6

ND = Not Detected TR = Trace Level - Below Indicated Detection Limit



Performance Analytical Inc.
Environmental Testing and Consulting

PERFORMANCE ANALYTICAL INC.

RESULTS OF BENZENE ANALYSIS

Client : Entropy Environmentalists, Inc.
Client Project No : 30037
PAI Project ID : 4449A

Test Code : GC/MS Mod. EPA TO-14/CARB 410 Matrix : Tedlar Bags
Analyst : Chris Parnell Date Received : 08/03/92
Instrument ID : Finnigan 4500C/Tekmar 5010 Date Analyzed : 08/04/92
Verified by : Michael Taday Volume Analyzed: 1.00 Liter

CLIENT SAMPLE ID	PAI SAMPLE ID	RESULT (UG/M ³)	DETECTION LIMIT (UG/M ³)	RESULT (PPB)	DETECTION LIMIT (PPB)
M410A-3 (07/31/92)	9203845	550	5.0	170	1.6
N/A (08/04/92)	Method Blank	ND	5.0	ND	1.6

ND = Not Detected TR = Trace Level - Below Indicated Detection Limit

ENTROPY

ENVIRONMENTALISTS, INC.

5832 BOLSA AVENUE
SUITE 105
HUNTINGTON BEACH
CALIFORNIA 92648
FAX 714/895-1915 714/373-0898

REQUEST FOR ANALYSIS

PURCHASE

ORDER # 30037-1

JOB NAME: WSPA

LABORATORY: Performance Analytical

DATE SAMPLES

WERE TRANSMITTED: 8/31/92

EXPECTED DATE

OF RESULTS: 8/11/92

SAMPLE MATRIX: ARB Method 410A - Jeddah bags and 40ml
mak w/d.T. water

TYPE OF ANALYSIS REQUESTED: Analyse for benzene using ARB
Method 410A within 72 hours of collection

Sample ID	Component/ Matrix		Collection Date	Collection Time	
M410A-1	Jeddah Bag		7/29/92		Analyse for Benzene
M410A-1	40ml Mak				Analyse for Benzene
M410A-1					
M410A-2	Jeddah Bag		7/30/92		Analyse for Benzene
M410A-2	40ml Mak				Analyse for Benzene
M410A-2					

SUBMITTED BY: Joey Wong

ENVIRONMENTALISTS, INC.

FAX 714/895-1915 714/373-0998

4449

JOB NAME: WSPA

LABORATORY: PERFORMANCE ANALYTICAL

DATE SAMPLES WERE TRANSMITTED: 08/03/92 EXPECTED DATE OF RESULTS: 08/13/92

SAMPLE MATRIX: ARB METHOD 410A - TOLLAR BAGS AND
40ml VIALS WIDE WATER

TYPE OF ANALYSIS REQUESTED: ANALYZE FOR BENZENE USING
ARB METHOD 410A WITHIN 72 HOURS OF COLLECTION

[illegible]

SUBMITTED BY:

CHAIN OF CUSTODY FOR SAMPLES

Plant Name: Hallwaxton (WSPA)

Job No.: 30037

Sample Recovery Date: 7/29/2017 7/30/2017

Entropy P.O. No.: 30037-1

[illegible][illegible]

Comments: Analyze for benzene using AFB Method 940 A within
72 hours of collection

Samples Relinquished by: Long alone

Date/Time: 8/8/92 11:07a.

Transported by: Samuel Uland

Date/Time: 7/7

Transported to: Performance Analytics

20954 Osborni 4.

Received by Handwritten Signature

Date/Time: 7/31/92 15:00

Laboratory: Please return this form with analysis results.

CHAIN OF CUSTODY FOR SAMPLES

Plant Name: WSPA (HALLIBURTON)

Job No.: 30037

Sample Recovery Date: 07/31/92

Entropy P.O. No.: 30037-3

[illegible][illegible]

Comments: ANALYZE FOR BENZENE USING ARLB METHOD 410A
WITHIN 72 HOURS OF COLLECTION

Samples Relinquished by: Valley Math

Date/Time: 08/03/92 0936

Transported by: Paula Linder

Date/Time: 8-3-92 9:36

Transported to: PERFORMANCE ANALYTICAL

20954 OSBOENE ST.

CANOGA PARK, CA 91304

Received by Robert M. Ziv

Date/Time: 8/3/92 11:20

Laboratory: Please return this form with analysis results.

Appendix D.3

1,3-Butadiene - CARB Method 422.102

1,3-Butadiene

CARB Method 422.102

----- Concentration, ppmvd -----		
<u>Run 1</u>	<u>Run 2</u>	<u>Run 3</u>
0.530	0.557	0.375

Appendix D.4

Volatile Organic Compounds - CARB Method 422



Performance Analytical Inc.
Environmental Testing and Consulting

LABORATORY REPORT

Client: ENTROPY ENVIRONMENTALISTS INC. Date of Report: 08/07/92
Address: 5932 Bolsa Avenue, Suite 105 Date Received: 07/31/92
Huntington Beach, CA 92649 PAI Project No: 4445B
Contact: Mr. Tony Wong Purchase Order: 30037-2
Client Project ID: WSPA #30037

Two (2) Tedlar Bag Samples labeled: "M422-1" and "M422-2"

Four (4) Liquid Samples (two of each) labeled: "M422-1" and "M422-2"

The samples were received at the laboratory under chain of custody on July 31, 1992. The samples were received intact. The client requested that the liquid samples be archived, therefore no analysis was performed. The Tedlar bag samples were analyzed on July 31, 1992.

Volatile Organic Compounds Analysis

The samples were analyzed by combined gas chromatography/mass spectrometry (GC/MS) for Benzene, Toluene, Ethylbenzene, Total Xylenes and n-Hexane. The analyses were performed according to the methodology outlined in EPA Method TO-14 from the Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, EPA 600/4-84-041, U.S. Environmental Protection Agency, Research Triangle Park, NC, April, 1984 and May, 1988. The Method was modified for using Tedlar Bags. The analyses were performed by gas chromatography/mass spectrometry, utilizing a direct cryogenic trapping technique. The analytical system used was comprised of a Finnigan Model 4500 GC/MS/DS interfaced to a Tekmar 5010 Automatic Desorber. A thick film (5 micron) crossbonded 100% Dimethyl polysiloxane megabore column (RT_x-1, Restek Corporation, Bellefonte, PA) was used to achieve chromatographic separation.

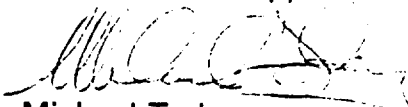
The results of analyses are given on the attached data summary sheets.

Data Release Authorization:



Chris Parnell
Senior Chemist

Reviewed and Approved:



Michael Tuday
Laboratory Director

LABORATORY REPORT

Client: ENTROPY ENVIRONMENTALISTS INC. Date of Report: 08/07/92
Address: 5932 Bolsa Avenue, Suite 105 Date Received: 08/03/92
Huntington Beach, CA 92649 PAI Project No: 4449B
Contact: Mr. Tony Wong Purchase Order: 30037-4
Client Project ID: WSPA #30037

One (1) Tedlar Bag Sample labeled: "M422-3"

Two (2) Liquid Samples labeled: "M422-3"

The samples were received at the laboratory under chain of custody on August 3, 1992. The samples were received intact. The client requested that the liquid samples be archived, therefore no analysis was performed. The Tedlar bag sample was analyzed on August 4, 1992.

Volatile Organic Compounds Analysis

The sample was analyzed by combined gas chromatography/mass spectrometry (GC/MS) for Benzene, Toluene, Ethylbenzene, Total Xylenes and n-Hexane. The analyses were performed according to the methodology outlined in EPA Method TO-14 from the Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, EPA 600/4-84-041, U.S. Environmental Protection Agency, Research Triangle Park, NC, April, 1984 and May, 1988. The Method was modified for using Tedlar Bags. The analyses were performed by gas chromatography/mass spectrometry, utilizing a direct cryogenic trapping technique. The analytical system used was comprised of a Finnigan Model 4500 GC/MS/DS interfaced to a Tekmar 5010 Automatic Desorber. A thick film (5 micron) crossbonded 100% Dimethyl polysiloxane megabore column (RT_x-1, Restek Corporation, Bellefonte, PA) was used to achieve chromatographic separation.

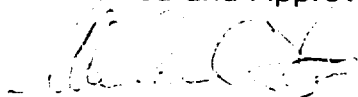
The results of analyses are given on the attached data summary sheets.

Data Release Authorization:



Chris Parnell
Senior Chemist

Reviewed and Approved:



Michael Tuday
Laboratory Director



Performance Analytical Inc.
Environmental Testing and Consulting

51742

PERFORMANCE ANALYTICAL INC.

RESULTS OF ANALYSIS

Client: Entropy Environmentalists, Inc.

Client Sample ID: N/A

PAI Sample ID: PAI Method Blank

Test Code: GC/MS Mod. EPA TO-14/CARB 422
Analyst: Chris Parnell
Instrument ID: Finnigan 4500C/Tekmar 5010
Verified by: Michael Today

Matrix: Tedlar Bag
Date Received: N/A
Date Analyzed: 07/31/92
Volume Analyzed: 1.00 Liter

CAS #	COMPOUND	RESULT (UG/M ³)	DETECTION LIMIT (UG/M ³)	RESULT (PPB)	DETECTION LIMIT (PPB)
71-43-2	BENZENE	ND	5.0	ND	1.6
108-88-3	TOLUENE	ND	5.0	ND	1.3
100-41-4	ETHYLBENZENE	ND	5.0	ND	1.2
1330-20-7	m- & p-XYLENES	ND	5.0	ND	1.2
95-47-6	o-XYLENES	ND	5.0	ND	1.2
110-54-3	n-HEXANE	ND	5.0	ND	1.4

ND = Not Detected TR = Trace Level - Below Indicated Detection Limit

PERFORMANCE ANALYTICAL INC.

RESULTS OF ANALYSIS

Client: Entropy Environmentalists, Inc.

Client Sample ID: N/A

PAI Sample ID: PAI Method Blank

Test Code: GC/MS Mod. EPA TO-14/CARB 422
Analyst: Chris Parnell
Instrument ID: Finnigan 4500C/Tekmar 5010
Verified by: Michael Tудay

Matrix: Tedlar Bag
Date Received: N/A
Date Analyzed: 08/04/92
Volume Analyzed: 1.00 Liter

CAS #	COMPOUND	RESULT (UG/M ³)	DETECTION LIMIT (UG/M ³)	RESULT (PPB)	DETECTION LIMIT (PPB)
71-43-2	BENZENE	ND	5.0	ND	1.6
108-88-3	TOLUENE	ND	5.0	ND	1.3
100-41-4	ETHYLBENZENE	ND	5.0	ND	1.2
1330-20-7	m- & p-XYLENES	ND	5.0	ND	1.2
95-47-6	o-XYLENES	ND	5.0	ND	1.2
110-54-3	n-HEXANE	ND	5.0	ND	1.4

ND = Not Detected TR = Trace Level - Below Indicated Detection Limit



Performance Analytical Inc.
Environmental Testing and Consulting

PERFORMANCE ANALYTICAL INC.

RESULTS OF ANALYSIS

Client: Entropy Environmentalists, Inc.

Client Sample ID: M422-1 (07/29/92)

PAI Sample ID: 9203816

Test Code: GC/MS Mod. EPA TO-14/CARB 422
Analyst: Chris Parnell
Instrument ID: Finnigan 4500C/Tekmar 5010
Verified by: Michael Taday

Matrix: Tedlar Bag
Date Received: 07/31/92
Date Analyzed: 07/31/92
Volume Analyzed: 0.60 Liter

CAS #	COMPOUND	RESULT (UG/M ³)	DETECTION LIMIT (UG/M ³)	RESULT (PPB)	DETECTION LIMIT (PPB)
71-43-2	BENZENE	680	5.0	210	1.6
108-88-3	TOLUENE	380	5.0	100	1.3
100-41-4	ETHYLBENZENE	40	5.0	9.2	1.2
1330-20-7	m- & p-XYLENES	120	5.0	27	1.2
95-47-6	o-XYLENES	49	5.0	11	1.2
110-54-3	n-HEXANE	14	5.0	4.0	1.4

ND = Not Detected TR = Trace Level - Below Indicated Detection Limit

PERFORMANCE ANALYTICAL INC.

RESULTS OF ANALYSIS

Client: Entropy Environmentalists, Inc.

Client Sample ID: M422-2 (07/30/92)

PAI Sample ID: 9203819

Test Code: GC/MS Mod. EPA TO-14/CARB 422
Analyst: Chris Parnell
Instrument ID: Finnigan 4500C/Tekmar 5010
Verified by: Michael Tудay

Matrix: Tedlar Bag
Date Received: 07/31/92
Date Analyzed: 07/31/92
Volume Analyzed: 0.60 Liter

CAS #	COMPOUND	RESULT (UG/M ³)	DETECTION LIMIT (UG/M ³)	RESULT (PPB)	DETECTION LIMIT (PPB)
71-43-2	BENZENE	550	5.0	170	1.6
108-88-3	TOLUENE	440	5.0	120	1.3
100-41-4	ETHYLBENZENE	24	5.0	5.5	1.2
1330-20-7	m- & p-XYLENES	72	5.0	17	1.2
95-47-6	o-XYLENES	37	5.0	8.6	1.2
110-54-3	n-HEXANE	38	5.0	11	1.4

ND = Not Detected TR = Trace Level - Below Indicated Detection Limit



Performance Analytical Inc.
Environmental Testing and Consulting

PERFORMANCE ANALYTICAL INC.

RESULTS OF ANALYSIS

Client: Entropy Environmentalists, Inc.

Client Sample ID: M422-3 (07/31/92) (18:00)

PAI Sample ID: 9203846

Test Code: GC/MS Mod. EPA TO-14/CARB 422
Analyst: Chris Parnell
Instrument ID: Finnigan 4500C/Tekmar 5010
Verified by: Michael Taday

Matrix: Tedlar Bag
Date Received: 08/03/92
Date Analyzed: 08/04/92
Volume Analyzed: 0.50 Liter

CAS #	COMPOUND	RESULT (UG/M ³)	DETECTION LIMIT (UG/M ³)	RESULT (PPB)	DETECTION LIMIT (PPB)
71-43-2	BENZENE	310	10	98	3.1
108-88-3	TOLUENE	350	10	94	2.7
100-41-4	ETHYLBENZENE	18	10	4.1	2.3
1330-20-7	m- & p-XYLENES	62	10	14	2.3
95-47-6	o-XYLENES	27	10	6.3	2.3
110-54-3	n-HEXANE	140	10	40	2.8

ND = Not Detected TR = Trace Level - Below Indicated Detection Limit

ENVIRONMENTALISTS, INC.

**5932 BOLSA AVENUE
SUITE 105
HUNTINGTON BEACH
CALIFORNIA 92649
FAX 714/895-1915 714/373-0998**

REQUEST FOR ANALYSIS

PURCHASE

ORDER # 30037-2

JOB NAME: WBPB

LABORATORY: Performance Analytical

DATE SAMPLES

WERE TRANSMITTED: 8/11/92

EXPECTED DATE

OF RESULTS: 8/11/92

SAMPLE MATRIX: ARR Method 422 - Jellen Bags and 40ml
water w/ 0.1 N NaOH and DI water

TYPE OF ANALYSIS REQUESTED: Analysis for volatile using AFB
Method 4021 within 72 hours of collection. Volatiles include
BTEX, and hexane. Analysis for benzene, toluene, xylene and
ethylbenzene using SW-846 8020 and hexane using SW-846 8240
Component/

Sample ID	Matrix	Collection Date	Collection Time
M422-1	Sediment Bag	7/29/92	Analyze for Volatiles
M422-1	D.I.N. MOH Vial		Archive
M422-1	DI Water Vial		Archive
M422-2	Sediment Bag	7/30/92	Analyze for Volatiles
M422-2	D.I.N. MOH Vial		Archive
M422-2	DI Water Vial		Archive

SUBMITTED BY:

Jong Wong

ENVIRONMENTALISTS, INC.

FAX 714/895-1915 714/373-0898

REQUEST FOR ANALYSIS

4449

PURCHASE

ORDER # 30037-4

JOB NAME: WSPA

LABORATORY: PERFORMANCE ANALYTICAL

DATE SAMPLES

EXPECTED DATE

WERE TRANSMITTED: 08/03/92 OF RESULTS: 08/13/92

SAMPLE MATRIX: ARB METHOD 422 - TEDLAR BAGS AND 40ml
VIALS w/ 0.1N NaOH AND DI H₂O

TYPE OF ANALYSIS REQUESTED: ANALYZE FOR VOLATILES WITHIN 72 HOURS OF COLLECTION. VOLATILES INCLUDE BTEX AND HEXANE. ANALYZE FOR BENZENE, TOLUENE, XYLENE AND ETHYLBENZENE USING SW-846 8020 AND HEXANE USING SW-846 8240.

[illegible]

SUBMITTED BY:

CHAIN OF CUSTODY FOR SAMPLES

Plant Name: Halliburton (WSPA)

Job No.: 30737

Sample Recovery Date: 7/29 + 7/30

Entropy P.O. No.: 30037-2

[illegible]

} Archive.
Do Not
Analyze.

Archive
Do Not
Analyze.

[illegible]

Comments: Analyze within 72 hrs. Use SW-846 Method 8020 for
Benzene, toluene, ethylbenzene, and xylene. Use SW-846 Method
8240 for hexane.

Samples Relinquished by: John Wilson

Date/Time: 7/31/92 11:07am

Transported by: Sam Allen

Date/Time: _____

Transported to: Performance Analytical
20954 Osborne St.

Received by Canoga Park, CA 91304
[Signature]

Date/Time: 7/31/92 15:00

Laboratory: Please return this form with analysis results.

CHAIN OF CUSTODY FOR SAMPLES

Plant Name: *USPA (HALLIBURTON)*

Job No.: 30037

Sample Recovery Date: 07/31/92

Entropy P.O. No.: 30037-4

[illegible][illegible]

Comments: ANALYZE W/IN 72 HOURS OF SAMPLE COLLECTION. USE SW-846.
METHOD 8020 FOR BENZENE, TOLUENE, ETHYLBENZENE, AND XYLENE. USE
SW-846 METHOD 8240 FOR HEXANE.

Samples Relinquished by: New Math

Date/Time: 08/31/92 0936

Transported by: Kocher, Richard L R

Date/Time: 8-3-92 9:36

Transported to: PERFORMANCE ANALYTICAL

20954 OSBORNE ST.

CINOGA PARK, CA 91304

Received by Richard D. Fox

Date/Time: 8/3/92 11:20

Laboratory: Please return this form with analysis results.

Appendix D.5

Hexavalent and Total Chromium - CARB Method 425

MOISTURE ANALYTICAL RESULTS

Plant Name UCSPA

Job No. 30037

City/State B. Knifield, CA

Sampling Loc. Engine Exhaust Duct

Run Number

M425-BT

M425-1

M425-2

Sampling Date

7/27/92

7/29/92

7/30/92

Analysis Date

7/27/92

7/29/92

7/30/92

Analyst

JW

JW

SCC

Reagent 1 (<u>DIN N. 014</u>)			
Final Weight, g	<u>—</u>	<u>736.0</u>	<u>739.5</u>
Tared Weight, g	<u>585.5</u>	<u>581.1</u>	<u>581.3</u>
Water Catch, g	<u>—</u>	<u>154.9</u>	<u>153.2</u>
Reagent 2 (<u>—</u>)	<u>/</u>	<u>/</u>	<u>/</u>
Final Weight, g	<u>/</u>	<u>/</u>	<u>/</u>
Tared Weight, g	<u>/</u>	<u>/</u>	<u>/</u>
Water Catch, g	<u>/</u>	<u>/</u>	<u>/</u>
Reagent 3 (<u>—</u>)	<u>/</u>	<u>/</u>	<u>/</u>
Final Weight, g	<u>/</u>	<u>/</u>	<u>/</u>
Tared Weight, g	<u>/</u>	<u>/</u>	<u>/</u>
Water Catch, g	<u>/</u>	<u>/</u>	<u>/</u>
CONDENSED WATER, g	<u>—</u>	<u>—</u>	<u>—</u>
Silica Gel			
Final Weight, g	<u>—</u>	<u>239.2</u>	<u>233.0</u>
Tared Weight, g	<u>201.7</u>	<u>201.5</u>	<u>198.0</u>
ADSORBED WATER, g	<u>—</u>	<u>37.7</u>	<u>35.0</u>
TOTAL WATER COLLECTED, g	<u>—</u>	<u>192.6 (ST)</u>	<u>188.2</u>

Balance No. CEM #3 Type ☒ Triple Beam ☒ Electronic

Reagent Box No. 0210

Balance located in stable, draft-free area ☒ Yes ☒ No (If "No", explain below.)

Comments —

MOISTURE ANALYTICAL RESULTS

Plant Name USPA Job No. 30037
 City/State Bakersfield, CA Sampling Loc. Engine Exhaust Duct

Run Number

M425-3

Sampling Date

Analysis Date

Analyst

<u>Reagent 1 (0.1 N NaOH)</u>			
Final Weight, g	<u>752.3</u>		
Tared Weight, g	<u>585.3</u>		
Water Catch, g	<u>167.0</u>		
<u>Reagent 2 ()</u>			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
<u>Reagent 3 ()</u>			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
CONDENSED WATER, g			
<u>Silica Gel</u>			
Final Weight, g	<u>226.6</u>		
Tared Weight, g	<u>222.8</u>		
	<u>201.4</u>		
ADSORBED WATER, g	<u>25.2</u> <u>20.4</u> = <u>45.6</u>		
TOTAL WATER COLLECTED, g	<u>212.6</u>		

Balance No. _____ Type ☒ Triple Beam ☐ Electronic _____ Reagent Box No. 020
 Balance located in stable, draft-free area ☒ Yes ☐ No (If "No", explain below.)
 Comments _____

FIELD SAMPLE RECOVERY QUALITY CONTROL

Box No. 0210 Assembly Date 07/23/92 Assembled By GM
 Plant Name/address WSPA Job No. 30037
 Sampling Loc. Engine Exhaust Duct Method ACB 425
 Individual Tare Of Reagent 200 (Ml) (gm) Of 0.1 N NaOH
 Individual Tare Of Reagent _____ (Ml) (gm) Of _____
 Individual Tare Of Reagent _____ (Ml) (gm) Of _____
 Individual Tare Of Sil. Gel 200 Gm _____ other (specify) _____

Run Number	Run Date	Filter or XAD Number	Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
M425-BT	7/27	-	-	✓	JW	7/28/92	NA	YES	GM

Filter Appearance*

white

Reagents Appearance*

clear

M425-1	7/29	-	-	✓	JW	7/29/92	95	Yes	JW
--------	------	---	---	---	----	---------	----	-----	----

Filter Appearance*

Black (4 total)

Reagents Appearance*

cloudy (Black)

M425-2	7/30	-	-	✓	SC	7/30/92	95	Yes	SC
--------	------	---	---	---	----	---------	----	-----	----

Filter Appearance*

Black (4 total)

Reagents Appearance*

Black

--	--	--	--	--	--	--	--	--	--

Filter Appearance*

Reagents Appearance*

* Use "REMARKS" section if needed.

@ At: (liquid levels at mark? (check) YES ☐ NO ☒ (estimate loss if not at mark; use "REMARKS" section).

REMARKS 36

Custodian Henry White Date 08/03/92 Time 1623
 3-1002 rev. '0-91

ENTROPY

FIELD SAMPLE RECOVERY QUALITY CONTROL

Box No. 020 Assembly Date 02/23/92 Assembled By GAI
 Plant Name/address WSPA Job No. 30037
 Sampling Loc. Engine Exhaust Duct Method ARB 425
 Individual Tare Of Reagent 200 (Ml) (gm) Of 0.1 N NaOH
 Individual Tare Of Reagent _____ (Ml) (gm) Of _____
 Individual Tare Of Reagent _____ (Ml) (gm) Of _____
 Individual Tare Of Sil. Gel 400 Gm _____ other (specify) _____

Run Number	Run Date	Filter or XAD Number	Liquid Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
M425-3	7/31/92	—	—	✓	20	7/31/92	80	Yes	WAT

Filter Appearance*

Black, Solid (4 TOTAL)

Reagents Appearance*

Turbid w/ Blackness

Filter Appearance*

Reagents Appearance*

Filter Appearance*

Reagents Appearance*

Filter Appearance*

Reagents Appearance*

* Use "REMARKS" section if needed.

@ All liquid levels at mark? (check) YES _____ NO ☒ (estimate loss if not at mark; use "REMARKS" section).

REMARKS _____

37

Custodian

Date

Time

2-1002 Rev. 10-91

ENTEROBY

RECORD OF CUSTODY, CONTAINER NO. 0210

Container Type (check) ☒ Reagent Box ☐ Cooler ☐ Other (specify) _____

Plant Name/Address UCSPA

Job No. 30037 Sampling Method AIRB 425 (EPA, NIOSH, etc.)

Seal ID	Date	Time	*	Full Signature	Reason for Breaking Seal**
0003300	6-12/92	1015	S	Hang Moto	
	7/27/92	1512	B	Long Wong	Change Labels
0000908	7/27/92	1630	S	Long Wong	
	7/28/92	1530	B	Hang Moto	TO RECOVER BLANK TRAIN
0000677	7/28/92	1700	S	Shel Ch	
	7/29/92	1245	B	Long Wong	To Recover Train
0000979	7/29/92	2107	S	Long Wong	Put 1st filter from
	7/30/92	1245	B	Wade Johnson	Run 2 into Jar
0000698	7/30/92	1247	S	Wade Johnson	
	7/30/92	1427	B	Long Wong	Recover Filter
0000816	7/30/92	1945	S	Shel Ch	
	08/03/92	1619	B	Hang Moto	TO SEND TO CONT. LAB
			S		
			B		
			S		
			B		

* S = Sealed By; B = Broken By ** Use "REMARKS" Section if more space needed.

Relinqu'd By _____ Date _____ Time _____ Rec'd By _____

Relinqu'd By _____ Date _____ Time _____ Rec'd By _____

Relinqu'd By _____ Date _____ Time _____ Rec'd By _____

As Applicable:
All liquid levels at mark (check)? ☐ YES ☒ NO (Estimate loss if not at mark; describe in "REMARKS")

As Applicable:
TUBE SAMPLES put in freezer by _____ Date _____ Time _____

CONDENSATE SAMPLES put in refrige. by _____ Date _____ Time _____

REMARKS _____

RECORD OF CUSTODY, CONTAINER NO. 020

Container Type (check) ☒ Reagent Box ☐ Cooler ☐ Other (specify) _____

Plant Name/Address WSPA

Job No. 30037

Sampling Method ARB 425 (EPA, NIOSH, etc.)

Seal ID	Date	Time	*	Full Signature	Reason for Breaking Seal**
0000892	07/26/92	10:15	S	<i>Steve Wata</i>	
	7/30/92	06:15	B	<i>Long Wong</i>	Change Inain
0000730	7/30/92	11:23	S	<i>Long Wong</i>	
	8/1/92	18:30	B	<i>Steve Wata</i>	To retrieve filter jar
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		

* S = Sealed By; B = Broken By ** Use "REMARKS" Section if more space needed.

Relinqu'd By _____ Date _____ Time _____ Rec'd By _____

Relinqu'd By _____ Date _____ Time _____ Rec'd By _____

Relinqu'd By _____ Date _____ Time _____ Rec'd By _____

As Applicable:
All liquid levels at mark (check)? ☐ YES ☒ NO (Estimate loss if not at mark; describe in "REMARKS")

As Applicable:
TUBE SAMPLES put in freezer by _____ Date _____ Time _____

CONDENSATE SAMPLES put in refrige. by _____ Date _____ Time _____

REMARKS _____

WCAS**WEST COAST
ANALYTICAL
SERVICE, INC.**

ANALYTICAL CHEMISTS

August 31, 1992

ENTROPY ENVIRONMENTALISTS, INC.
5932 Bolsa Ave.
Suite 105
Huntington Beach, CA 92649

Attn: Gary Mata

JOB NO. 22011

D

LABORATORY REPORT

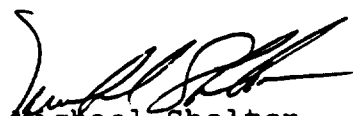
Samples Received: Twelve (12) Liquids & Five (5) Filters
Date Received: 8-3-92
Purchase Order No: 30037-6

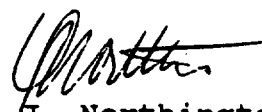
The samples were analyzed as follows:

<u>Samples Analyzed</u>	<u>Analysis</u>	<u>Results</u>
Eight (8) liquids	Hexavalent Chromium by CARB 425/IC	Data Sheet
Eight (8) liquids	Total Chromium by CARB 425/GFAA	Data Sheet

40

Page 1 of 3


Michael Shelton
Technical Director


D. J. Northington, Ph.D.
President

This report is to be reproduced in its entirety.

Client: Entropy Environmentalists, Inc.
Job no.: 22011

Hexavalent Chromium by CARB 425/IC

Sample ID	Parts Per Billion (ug/L)	Impinger Volume (L)	Total Microgram (ug)
M425-BT-Rinse	0.33	0.08	0.03
M425-BT-Composite	0.39	0.33	0.13
M425-1-Rinse	1.5	0.3	0.45
M425-1-Composite	0.05	0.54	0.03
M425-2-Rinse	2.5	0.13	0.33
M425-2-Composite	0.40	0.51	0.20
M425-3-Rinse	3.5	0.28	0.98
M425-3-Composite	0.49	0.46	0.22

Detection Limit: 0.01

Date(s) Analyzed: 8-05-92

Matrix Spike/Matrix Spike Duplicate Recovery Summary

Client:	Entropy Environmentalists	Sample:M425-1-COMPOSITE
Job No.:	22011	Matrix:Impinger
Date(s)		Units :ppb (ug/L)
Analyzed:	8-05-92	Method:CARB 425

Analyte	Sample Amount	MS	% Rec	MSD	% Rec	RPD
	Result	Spiked	Result	MS	Result	MSD
Hexavalent Chromium	0.05	1	0.678	63 ***	0.677	63 ***

*** - Result is outside control limits; suspect matrix interference.

QC limits may not be valid for this matrix.

QC Limits

Analyte	Warning	RPD	Control	Warning	% Recovery	Control
Hexavalent Chromium	9		13	86	108	74 117

Client: Entropy Environmentalists, Inc.
Job no.: 22011

Total Chromium by CARB 425/GFAA

Sample ID	Parts Per Billion (ug/L)	Impinger Volume (L)	Total Microgram (ug)
M425-BT Rinse	4.9	0.08	0.39
M425-BT Composite	7.5	0.33	2.48
M425-1 Rinse	5.1	0.3	1.55
M425-1 Composite	13.4	0.54	7.26
M425-2 Rinse	11.5	0.13	1.50
M425-2 Composite	9.0	0.51	4.62
M425-3 Rinse	15.7	0.28	4.41
M425-3 Composite	9.3	0.46	4.31

Detection Limit: 1

Date(s) Analyzed: 8-24-92

QC Summary

Total Chromium (ug/L)

Sample	Original	Amount Spiked	Amount Recovered	% Recovery
M425-1 Composite	9.0	200	175	84.5

Sample	Original	Duplicate	RPD
M425-3 Rinse	15.7	12.6	22

Abbreviations Summary

General Reporting Abbreviations:

- B Blank - Indicates that the compound was found in both the sample and the blank. The sample value is reported without blank subtraction. If the sample value is less than 10X the blank value times the sample dilution factor, the compound may be present as a laboratory contaminant.
- D Indicates that the sample was diluted, and consequently the surrogates were too dilute to accurately measure.
- DL Detection Limit - Is the minimum value which we believe can be detected in the sample with a high degree of confidence, taking into account dilution factors and interferences. The reported detection limits are equal to or greater than Method Detection Limits (MDL) to allow for day to day and instrument to instrument variations in sensitivity.
- J Indicates that the value is an estimate.
- ND Not Detected - Indicates that the compound was not found in the sample at or above the detection limit.
- ppm parts per million (billion) in liquids is usually equivalent to mg/l (ug/l), or in solids to mg/kg (ug/kg). In the gas phase it is equivalent to ul/l (ul/m³).
- ppb
- TR Trace - Indicates that the compound was observed at a value less than our normal reported Detection Limit (DL), but we feel its presence may be important to you. These values are subject to large errors and low degrees of confidence.

kg kilogram	mg milligram	l liter	m meter
g gram	ug microgram	ul microliter	

QC Abbreviations:

- Control Control Limits are determined from historical data for a QC parameter. The test value must be within this acceptable range for the test to be considered in control. Usually this range corresponds to the 99% confidence interval for the historical data.
- % Error Percent Error - This is a measure of accuracy based on the analysis of a Laboratory Control Standard (LCS). An LCS is a reference sample of known value such as an NIST Standard Reference Material (SRM). The % Error is expressed in percent as the difference between the known value and the experimental value, divided by the known value. The LCS may simply be a solution based standard which confirms calibration (ICV or CCV - initial or continuing calibration verification), or it may be a reference sample taken through preparation and analysis.

CHAIN OF CUSTODY FOR SAMPLES

Plant Name: USPA (HALLIRITON)

Job No.: 30037

Sample Recovery Date: 07/28, 29, 30, 31/92

Entropy P.O. No.: 30037-6

SAMPLE ID	SAMPLE MATRIX
M425-1	IMPINGER REAGENT
	IMPINGER RINSE
	FRONT HALF RINSE
	FILTER (4 TOTAL)
M425-2	IMPINGER REAGENT
	IMPINGER RINSE
	FRONT HALF RINSE
	FILTER (4 TOTAL)
M425-3	IMPINGER REAGENT
	IMPINGER RINSE
	FRONT HALF RINSE
	FILTER (4 TOTAL)
M425-BT	IMPINGER REAGENT
	IMPINGER RINSE
	FRONT HALF RINSE
	FILTER (1 FILTER)

[illegible]

Comments: ANALYZE FOR ARB METHOD 425 (TOTAL & HEXAVALENT CHROME)

Samples Relinquished by:

Date/Time: 08/03/92 17:00

Transported by:

Date/Time:

Transported to: WEST EAST ANALYTICAL

9840 ALBERTA AVE.

SANTA FE, SPRINGS CA 90670

Received by

Gene Stettin W.C.A.S.

Date/Time: 8-3-92 5:50

Laboratory: Please return this form with analysis results.

#22011

Appendix D.6

Polycyclic Aromatic Hydrocarbons and Phenol - CARB Method 429

MOISTURE ANALYTICAL RESULTS

Job No. 30037

Plant Name WSPA

City/State Birmingham, CA

Sampling Loc. Engine Exhaust Stack

Run Number

APPROX

M429-BT

M429-1

Sampling Date

7/27/92

7/29/92

Analysis Date

7/28/92

7/29/92

Analyst

JW

Mike C

Reagent 1 (<u>DI water</u>)			
Final Weight, g	<u>—</u>	<u>638.0</u>	
Tared Weight, g	<u>186.7</u>	<u>489.5</u>	
Water Catch, g	<u>—</u>	<u>148.5</u>	
Reagent 2 (<u>XAN</u>)			
Final Weight, g	<u>—</u>	<u>391.1</u>	
Tared Weight, g	<u>398.0</u>	<u>388.0</u>	
Water Catch, g	<u>—</u>	<u>32.1</u> (F)	
Reagent 3 (<u>—</u>)			
Final Weight, g	<u>—</u>	<u>—</u>	
Tared Weight, g	<u>—</u>	<u>—</u>	
Water Catch, g	<u>—</u>	<u>—</u>	
CONDENSED WATER, g	<u>—</u>	<u>—</u>	
Silica Gel			
Final Weight, g	<u>—</u>	<u>201.6</u> <u>217.5</u>	
Tared Weight, g	<u>201.8</u>	<u>202.0</u> <u>233.0</u>	
ADSORBED WATER, g	<u>—</u>	<u>46.9</u>	
TOTAL WATER COLLECTED, g	<u>—</u>	<u>197.5</u>	

Balance No. CEM #3

Type (J) Triple Beam ☒

Electronic ☐

Reagent Box No. 0001

Balance located in stable, draft-free area (J)? Yes ☒ No ☐ (If "No", explain below.)

Comments —

MOISTURE ANALYTICAL RESULTS

Job No. 30037

Plant Name WSPA

City/State Bakersfield, CA

Sampling Loc. Engine Exhaust Duct

Run Number

1459-2

1459-BT

Sampling Date

7/30/92

7/30/92

Analysis Date

7/30/92

7/30/92

Analyst

Whe C

WAT

Reagent 1 (<u>MF H₂O</u>)			
Final Weight, g	<u>643.0</u>	<u>485.5</u>	
Tared Weight, g	<u>485.9</u>	<u>487.4</u>	
Water Catch, g	<u>157.1</u>	<u>-1.9</u>	
Reagent 2 (<u>XAD</u>)			
Final Weight, g	<u>406.5</u>	<u>398.2</u>	
Tared Weight, g	<u>395.9</u>	<u>391.0</u>	
Water Catch, g	<u>10.6</u>	<u>7.2</u>	
Reagent 3 (_____)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
CONDENSED WATER, g			
Silica Gel			
Final Weight, g	<u>211.0</u>	<u>204.7</u>	
Tared Weight, g	<u>233.5</u>	<u>201.2</u>	
ADSORBED WATER, g	<u>43.5</u>	<u>3.5</u>	
TOTAL WATER COLLECTED, g	<u>211.2</u>	<u>8.8</u>	

Balance No. 7011 #3 Type (☒) Triple Beam ☒ Electronic

Reagent Box No. 1459

Balance located in stable, draft-free area (☒)? Yes ☒ No (If "No", explain below.)

Comments _____

MOISTURE ANALYTICAL RESULTS

Job No. 30037

Plant Name WSPA

City/State Exeter, NH

Sampling Loc. Engine Exhaust Duct

Run Number

M429-3

Sampling Date

7/31/92

Analysis Date

7/31/92

Analyst

WLC

Reagent 1 (<u>Dilute</u>)			
Final Weight, g	<u>608.59</u>		
Tared Weight, g	<u>487.6</u>		
Water Catch, g	<u>120.99</u>		
Reagent 2 (<u>YAD</u>)			
Final Weight, g	<u>401.5</u>		
Tared Weight, g	<u>399.9</u>		
Water Catch, g	<u>1.6 g</u>		
Reagent 3 (_____)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
CONDENSED WATER, g			
Silica Gel			
Final Weight, g	<u>201.4 232.5</u>		
Tared Weight, g	<u>201.7 215.0</u>		
ADSORBED WATER, g	<u>44.4</u>		
TOTAL WATER COLLECTED, g	<u>166.9</u>		

Balance No. 12M#2 Type (☒) Triple Beam ☒ Electronic

Reagent Box No. C002

Balance located in stable, draft-free area (☒)? Yes ☒ No (If "No", explain below.)

Comments _____

FIELD SAMPLE RECOVERY QUALITY CONTROL

Box No. 0001 Assembly Date 07/25/92 Assembled By GM
 Plant Name/address WISPA Job No. 30087
 Sampling Loc. Engine Exhaust Stack Method 4.18-29
 Individual Tare Of Reagent 100 (Ml) (gm) Of DI Water
 Individual Tare Of Reagent _____ (Ml) (gm) Of _____
 Individual Tare Of Reagent _____ (Ml) (gm) Of _____
 Individual Tare Of Sil. Gel 4.75 Gm _____ other (specify) _____

Run Number	Run Date	Filter or XAD Number	Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
11429-BT	7/27	—	388.0	✓	SW	7/28	0	✓	SW

ALERTED

Filter Appearance* 300 gms

NA

Reagents Appearance*

NA

11429-1	7/1		388.0	—	SW	7/29	90	—	ink C
---------	-----	--	-------	---	----	------	----	---	-------

Filter Appearance*

Very Dark

Reagents Appearance*

Clear.

--	--	--	--	--	--	--	--	--	--

Filter Appearance*

Reagents Appearance*

--	--	--	--	--	--	--	--	--	--

Filter Appearance*

Reagents Appearance*

* Use "REMARKS" section if needed.

@ All liquid levels at mark? (check) YES ✓ NO — (estimate loss if not at mark; use "REMARKS" section).

REMARKS

3 49

Custodian

Kevin White

Date 07/23/92

Time 0944

ENTROPY

FIELD SAMPLE RECOVERY QUALITY CONTROL

Box No. 0004 Assembly Date 07/23/92 Assembled By GM
 Plant Name/address WSPA Job No. 30037
 Sampling Loc. Engine Exhaust Duct Method ARB 429
 Individual Tare Of Reagent 100 (Ml) (gm) of DE H₂O
 Individual Tare Of Reagent _____ (Ml) (gm) Of _____
 Individual Tare Of Reagent _____ (Ml) (gm) Of _____
 Individual Tare Of Sil. Gel 407 Gm _____ other (specify) _____

Run Number	Run Date	Filter or XAD Number	Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
M429-2	7/30	XAD	395.9	✓	JW	7/30/92	70	✓	init
				Filter Appearance*					
				<u>DARK</u>					
				Reagents Appearance*					
				<u>Average</u>					
M429-BJ	7/30	XAD	391.0	✓	JW				
				Filter Appearance*					
				Reagents Appearance*					
				Filter Appearance*					
				Reagents Appearance*					
				Filter Appearance*					
				Reagents Appearance*					

* Use "REMARKS" section if needed.
 @ All liquid levels at mark? (check) YES _____ NO ✓ (estimate loss if not at mark; use "REMARKS" section).

REMARKS

J 50

FIELD SAMPLE RECOVERY QUALITY CONTROL

Box No. 1002 Assembly Date 07/23/92 Assembled By GM
 Plant Name/address USPA Job No. 30037
 Sampling Loc. Engine Exhaust Duct Method MB 429
 Individual Tare Of Reagent 100 (Ml) (gm) Of DE
 Individual Tare Of Reagent _____ (Ml) (gm) Of _____
 Individual Tare Of Reagent _____ (Ml) (gm) Of _____
 Individual Tare Of Sil. Gel 400 Gm _____ other (specify) _____

Run Number	Run Date	Filter or XAD Number	Tare, grams	Liquid Tare at Mark? @	Init.	Sample Recov. Date	%Sil. Gel Spent	Liquid Level Marked?	Init.
11429-3	7/31/92		999.9	✓	SW	7/31/92	60	✓	WLC

Filter Appearance*

DARK

Reagents Appearance*

Average

Filter Appearance*

Reagents Appearance*

Filter Appearance*

Reagents Appearance*

Filter Appearance*

Reagents Appearance*

* Use "REMARKS" section if needed.

@ All liquid levels at mark? (check) YES ☐ NO ☒ (estimate loss if not at mark; use "REMARKS" section).

REMARKS _____

Custodian Thuy N. Ho

0-1002 rev. 10-91

Date 08/03/92

Time 1000

ENTROPY

RECORD OF CUSTODY, CONTAINER NO. CCC-I

Container Type (check) ☒ Reagent Box ☒ Cooler ☐ Other (specify) _____

Plant Name/Address WSPA

Job No. 30037 Sampling Method ARB 429 (EPA, NIOSH, etc.)

Seal ID	Date	Time	*	Full Signature	Reason for Breaking Seal**
0000675	6/23/92	1615	S	Chang White	
	7/27/92	1634	B	Long Wong	Change train
0000727	7/27/92	1736	S	Long Wong	
	7/28/92	1620	B	Long Wong	Recover Blank Run
0000784	7/28/92	1700	S	Long Wong	
	7/29/92	2000	B	Mike C	Recover Run 429-1
0000763	7/29/92	2100	S	Mike C	
	7/30/92	1125	B	Long Wong	Abort Blank Run
0000894	7/30/92	1435	S	Long Wong	
	7/31/92	944	B	Chang White	TO SEND TO CCVT. LABS
			S		
			B		
			S		
			B		
			S		
			B		

* S = Sealed By; B = Broken By ** Use "REMARKS" Section if more space needed.

Relinqu'd By _____ Date _____ Time _____ Rec'd By _____

Relinqu'd By _____ Date _____ Time _____ Rec'd By _____

Relinqu'd By EW Date _____ Time _____ Rec'd By _____

As Applicable:
All liquid levels at mark (check)? ☒ YES ☐ NO (Estimate loss if not at mark; describe in "REMARKS")

As Applicable:
TUBE SAMPLES put in freezer by _____ Date _____ Time _____

CONDENSATE SAMPLES put in refrige. by _____ Date _____ Time _____

REMARKS _____

J 52

RECORD OF CUSTODY, CONTAINER NO. 0002

Container Type (check) Reagent Box ☒ Cooler ☐ other (specify) _____

Plant Name/Address WSPA

Job No. 30037 Sampling Method ACB 429 (EPA, NIOSH, etc.)

Seal ID	Date	Time	*	Full Signature	Reason for Breaking Seal**
000501	6/23/92	1615	S	Shirley Mote	
	7/31/92	1440	B	John W. W.	Change Level
000544	7/31/92	2311	S	John W. W.	
	8/10/92	950	B	Shirley Mote	TO SEND TO MONT. LAB
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		

* S = Sealed By; B = Broken By ** Use "REMARKS" Section if more space needed.

Relinqu'd By _____ Date _____ Time _____ Rec'd By _____

Relinqu'd By _____ Date _____ Time _____ Rec'd By _____

Relinqu'd By _____ Date _____ Time _____ Rec'd By _____

As Applicable:
All liquid levels at mark (check)? ☐ YES ☒ NO (Estimate loss if not at mark; describe in "REMARKS")

As Applicable:
TUBE SAMPLES put in freezer by _____ Date _____ Time _____

CONDENSATE SAMPLES put in refrige. by _____ Date _____ Time _____

REMARKS _____

RECORD OF CUSTODY, CONTAINER NO. 600

Container Type (check) Reagent Box Cooler Other (specify)

Plant Name/Address USPA

Job No. 30037 Sampling Method ALB-229 (EPA, NIOSH, etc.)

Seal ID	Date	Time	*	Full Signature	Reason for Breaking Seal**
0000953	02/13/92	1615	S	Shirley M. Tate	
	07/28/92	1645	B	Long Wong	Change Train
0000157	01/04/92	1700	S	Long Wong	
	01/30/92	1620	B	Long Wong	Change Train
0000955	7/30/92	2030	S	Walter Channing	Put Rinse Jar from
	7/30/92	2034	B	Walter Channing	BT TRAIN whichd been left out
0000968	7/30/92	2036	S	Walter Channing	
	08/13/92	450	B	Shirley M. Tate	TO SEND TO CENT. LAB
			S		
			B		
			S		
			B		
			S		
			B		
			S		
			B		

* S = Sealed By; B = Broken By ** Use "REMARKS" Section if more space needed.

Relinqu'd By _____ Date _____ Time _____ Rec'd By _____

Relinqu'd By _____ Date _____ Time _____ Rec'd By _____

Relinqu'd By _____ Date _____ Time _____ Rec'd By _____

As Applicable:
All liquid levels at mark (check)? YES NO (Estimate loss if not at mark; describe in "REMARKS")

As Applicable:
TUBE SAMPLES put in freezer by _____ Date _____ Time _____

CONDENSATE SAMPLES put in refrige. by _____ Date _____ Time _____

REMARKS _____



August 4, 1992

Mr. Tony Wong
Entropy Environmentalists Inc.
5932 BOLSA Ave. Suite 105
Huntington Beach, CA 92649

Dear Mr. Wong,

The samples listed in Table 1 were received by Alta Analytical Laboratory on 4-Aug-92. Attached is a copy of the chain-of-custody (C-O-C) or other documentation for your records.

Analytical results are scheduled to be reported to you on or about 25-Aug-92. All sample containers and their contents will be returned to you at the above address approximately 30 calendar days following issuance of a final written report.

Please contact me if you have any questions regarding the status of the work associated with these samples at (916) 933-1640.

For rapid telephone assistance, please refer to the laboratory Identification Number: 11500 when requesting information.

Sincerely,

Robert S. Mitzel
Alta Analytical Laboratory

J 55

Alta Analytical Laboratory Inc.

5070 Robert J. Mathews Pkwy., Suite 2
El Dorado Hills, CA. 95630

FAX (916) 933-0940
(916) 933-1640

Section I. Sample Inventory

Date Received: 4-Aug-92

Alta Lab ID.

Client ID.

11500-1-A	M429-BT FILTER
11500-1-B	M429-BT XAD
11500-1-C	M429-BT FHR
11500-1-D	M429-BT BHR
11500-1-E	M429-BT IMP REAGENT
11500-2-A	M429-1 FILTER
11500-2-B	M429-1 XAD
11500-2-C	M429-1 FHR
11500-2-D	M429-1 BHR
11500-2-E	M429-1 IMP REAGENT
11500-2-F	M429-1 IMP RINSE
11500-3-A	M429-2 FILTER
11500-3-B	M429-2 XAD
11500-3-C	M429-2 FHR
11500-3-D	M429-2 BHR
11500-3-E	M429-2 IMP REAGENT
11500-3-F	M429-2 IMP RINSE
11500-4-A	M429-3 FILTER
11500-4-B	M429-3 XAD
11500-4-C	M429-3 FHR
11500-4-D	M429-3 BHR
11500-4-E	M429-3 IMP REAGENT
11500-4-F	M429-3 IMP RINSE

CHAIN OF CUSTODY FOR SAMPLES

Plant Name: WSPA (HALLIBURTON)

Job No.: 30037

Sample Recovery Date: 07/29, 30, 31/92

Entropy P.O. No.: 30037-5

SAMPLE ID	SAMPLE MATRIX
M429-1	IMPINGER REAGENT
	FRONT HALF RINSE
	BACK HALF RINSE
	1 ST IMPINGER RINSE
	FILTER (3 FILTERS)
	XAD TRAP
M429-2	IMPINGER REAGENT
	FRONT HALF RINSE
	BACK HALF RINSE
	1 ST IMPINGER RINSE
	FILTER (2 FILTERS)
	XAD TRAP
M429-3	IMPINGER REAGENT
	FRONT HALF RINSE
	BACK HALF RINSE
	IMPINGER RINSE
	FILTER (2 FILTERS)
	XAD TRAP

[illegible]

Comments: ANALYZE FOR ARB METHOD 429 FOR PAH'S. EXTRACTION
OF SAMPLES MUST BE PERFORMED W/IN 7 DAYS OF COLLECTION

Samples Relinquished by:

Date/Time: 08/03/92 1612

Transported by:

Date/Time: (115) 08/03/92 1607

Transported to:

SC37 ROBERT J. MATTHEWS PKWY. SUITE 2

EL DORADO HILLS CA 95630

Received by

Date/Time: 0930 / 18-4-92

Laboratory: Please return this form with analysis results.



August 19, 1992

Alta Batch I.D.: 11500

Mr. Tony Wong
Entropy Environmentalists, Inc.
5932 Bolsa Ave. Suite 105
Huntington Beach, CA 92649

Dear Mr. Wong,

Enclosed are the results for the four MM5 trains received at Alta Analytical Laboratory on August 4, 1992. This work was authorized under your Purchase Order Number 30037-5. These samples were analyzed using CARB Method Method 429 polycyclic aromatic hydrocarbons (PAH) using High Resolution Mass Spectrometry (HRMS). A standard turnaround time was requested for this work.

The following difficulties were associated with these samples. Sample ID.'s M429-1, M429-2, and M429-3 had significant matrix interferences and high level PAH compounds present for the early eluters. A 1:10 dilution was performed on these three samples. Several of the internal standards could not be quantitated due to the dilution and the matrix interferences. This is designated in the data qualifier section as an asterisk "*". The recovery standards were used to quantitate the native compounds whose internal standard were affected by the matrix interferences.

The following report consists of a Sample Inventory (Section I), Analytical Results (Section II) and the Appendix. The Appendix contains a copy of the chain-of-custody, a list of data qualifiers and abbreviations and copies of the raw data (if requested).

If you have any questions regarding this report please feel free to contact me.

Sincerely,

Robert S. Mitzel
Director of Operations

J 58

Alta Analytical Laboratory Inc.

5070 Robert J. Mathews Pkwy., Suite 2
El Dorado Hills, CA. 95630

FAX (916) 933-0940
(916) 933-1640

Section I. Sample Inventory

Date Received: 4-Aug-92

Alta Lab ID.

Client ID.

11500-1-A	M429-BT FILTER
11500-1-B	M429-BT XAD
11500-1-C	M429-BT FHR
11500-1-D	M429-BT BHR
11500-1-E	M429-BT IMP REAGENT
11500-2-A	M429-1 FILTER
11500-2-B	M429-1 XAD
11500-2-C	M429-1 FHR
11500-2-D	M429-1 BHR
11500-2-E	M429-1 IMP REAGENT
11500-2-F	M429-1 IMP RINSE
11500-3-A	M429-2 FILTER
11500-3-B	M429-2 XAD
11500-3-C	M429-2 FHR
11500-3-D	M429-2 BHR
11500-3-E	M429-2 IMP REAGENT
11500-3-F	M429-2 IMP RINSE
11500-4-A	M429-3 FILTER
11500-4-B	M429-3 XAD
11500-4-C	M429-3 FHR
11500-4-D	M429-3 BHR
11500-4-E	M429-3 IMP REAGENT
11500-4-F	M429-3 IMP RINSE

SECTION II.

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

METHOD BLANK

Lab ID: 11500-MB-PAH

Matrix: MM5

Date Received: NA

Date Extracted: 8/04/92

Sample Amount: Sample

ICAL ID: IPAH

QC Lot: LC0804M

Units: ng/sample

<u>Compound</u>	<u>Conc.</u>	<u>R.L.</u>	<u>Qualifier</u>
Naphthalene	410	25	
Acenaphthylene	ND	10	
Acenaphthene	ND	10	
Fluorene	13	10	
Phenanthrene	36	25	
Anthracene	ND	10	
Fluoranthene	ND	10	
Pyrene	ND	10	
Benz(a)anthracene	ND	10	
Chrysene	ND	10	
Benzo(b)fluoranthene	ND	10	
Benzo(k)fluoranthene	ND	10	
Benzo(a)pyrene	ND	10	
Benzo(e)pyrene	NA	NA	
Indeno(1,2,3-c,d)pyrene	ND	10	
Dibenz(a,h)anthracene	ND	10	
Benzo(g,h,i)perylene	ND	10	

Analyst: 6/14

Page 1 of 2

Reviewer: 9/14

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

Sample ID: M429-BT
Lab ID: 11500-001-PAH
Matrix: MM5

Date Received: 8/04/92
Date Extracted: 8/04/92
Sample Amount: Sample

ICAL ID: IPAH
QC Lot: LC0804M
Units: ng/sample

<u>Compound</u>	<u>Conc.</u>	<u>R.L.</u>	<u>Qualifier</u>
Naphthalene	590	25	B
Acenaphthylene	ND	10	
Acenaphthene	ND	10	
Fluorene	22	10	B
Phenanthrene	50	25	B
Anthracene	ND	10	
Fluoranthene	ND	10	
Pyrene	ND	10	
Benz(a)anthracene	ND	10	
Chrysene	ND	10	
Benzo(b)fluoranthene	ND	10	
Benzo(k)fluoranthene	ND	10	
Benzo(a)pyrene	ND	10	
Benzo(e)pyrene	NA	NA	
Indeno(1,2,3-c,d)pyrene	ND	10	
Dibenz(a,h)anthracene	ND	10	
Benzo(g,h,i)perylene	ND	10	

Analyst: KM

Page 1 of 2

Reviewer: SMP

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

Sample ID: M429-1
Lab ID: 11500-002-PAH
Matrix: MM5

Date Received: 8/04/92
Date Extracted: 8/04/92
Sample Amount: Sample

ICAL ID: IPAH
QC Lot: LC0804M
Units: ng/sample

<u>Compound</u>	<u>Conc.</u>	<u>R.L.</u>	<u>Qualifier</u>
Naphthalene	330000	250	B
Acenaphthylene	30000	100	
Acenaphthene	30000	100	
Fluorene	110000	100	B
Phenanthrene	490000	250	B
Anthracene	29000	100	
Fluoranthene	17000	10	
Pyrene	24000	10	
Benz(a)anthracene	11000	10	
Chrysene	12000	10	
Benzo(b)fluoranthene	1700	10	
Benzo(k)fluoranthene	1100	10	
Benzo(a)pyrene	210	10	
Benzo(e)pyrene	NA	NA	
Indeno(1,2,3-c,d)pyrene	400	10	
Dibenz(a,h)anthracene	110	10	
Benzo(g,h,i)perylene	510	10	

Analyst: SM

Page 1 of 2

Reviewer: JL

**POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429**

Sample ID: M429-2
Lab ID: 11500-003-PAH
Matrix: MM5

Date Received: 8/04/92
Date Extracted: 8/04/92
Sample Amount: Sample

ICAL ID: IPAH
QC Lot: LC0804M
Units: ng/sample

<u>Compound</u>	<u>Conc.</u>	<u>R.L.</u>	<u>Qualifier</u>
Naphthalene	320000	250	B
Acenaphthylene	26000	100	
Acenaphthene	29000	100	
Fluorene	110000	100	B
Phenanthrene	480000	250	B
Anthracene	20000	100	
Fluoranthene	17000	10	
Pyrene	24000	10	
Benz(a)anthracene	13000	10	
Chrysene	12000	10	
Benzo(b)fluoranthene	1300	10	
Benzo(k)fluoranthene	530	10	
Benzo(a)pyrene	67	10	
Benzo(e)pyrene	NA	NA	
Indeno(1,2,3-c,d)pyrene	270	10	
Dibenz(a,h)anthracene	65	10	
Benzo(g,h,i)perylene	270	10	

Analyst: MM

Reviewer: MM

**POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429**

Sample ID: M429-3
Lab ID: 11500-004-PAH
Matrix: MM5

Date Received: 8/04/92
Date Extracted: 8/04/92
Sample Amount: Sample

ICAL ID: IPAH
QC Lot: LC0804M
Units: ng/sample

<u>Compound</u>	<u>Conc.</u>	<u>R.L.</u>	<u>Qualifier</u>
Naphthalene	320000	250	B
Acenaphthylene	33000	100	
Acenaphthene	31000	100	
Fluorene	120000	100	B
Phenanthrene	560000	250	B
Anthracene	37000	100	
Fluoranthene	16000	10	
Pyrene	23000	10	
Benz(a)anthracene	12000	10	
Chrysene	12000	10	
Benzo(b)fluoranthene	1500	10	
Benzo(k)fluoranthene	490	10	
Benzo(a)pyrene	100	10	
Benzo(e)pyrene	NA	NA	
Indeno(1,2,3-c,d)pyrene	380	10	
Dibenz(a,h)anthracene	110	10	
Benzo(g,h,i)perylene	380	10	

Analyst: Slag

Page 1 of 2

Reviewer: SLA

**POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429**

METHOD BLANK

Lab ID: 11500-MB-PAH

Isotopic Recovery Results

<u>Internal Standard:</u>	<u>% R</u>	<u>Qualifier</u>
d ₈ -Naphthalene	86	
d ₈ -Acenaphthylene	72	
d ₁₀ -Acenaphthene	76	
d ₁₀ -Fluorene	76	
d ₁₀ -Phenanthrene	77	
d ₁₀ -Anthracene	64	
d ₁₀ -Fluoranthene	86	
d ₁₂ -Benz(a)anthracene	65	
d ₁₂ -Chrysene	72	
d ₁₂ -Benzo(b)fluoranthene	106	
d ₁₂ -Benzo(k)fluoranthene	103	
d ₁₂ -Benzo(a)pyrene	70	
d ₁₂ -Indeno(1,2,3-c,d)pyrene	88	
d ₁₂ -Benzo(g,h,i)perylene	93	
d ₁₄ -Dibenz(a,h)anthracene	78	

$$\overline{\%R} = 80.8$$

$$S = 12.6$$

Pre-spike Recovery Standard:

d ₁₂ -Benzo(e)pyrene	NA
d ₁₄ -Terphenyl	NA

Date Analyzed: 8/18/92

Analyst: SKM

Reviewer: SKM

**POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429**

Sample ID: M429-BT
Lab ID: 11500-001-PAH

Isotopic Recovery Results

<u>Internal Standard:</u>	<u>% R</u>	<u>Qualifier</u>
d ₆ -Naphthalene	85	
d ₆ -Acenaphthylene	86	
d ₁₀ -Acenaphthene	93	
d ₁₀ -Fluorene	109	
d ₁₀ -Phenanthrene	127	
d ₁₀ -Anthracene	136	
d ₁₀ -Fluoranthene	88	
d ₁₂ -Benz(a)anthracene	128	
d ₁₂ -Chrysene	121	
d ₁₂ -Benzo(b)fluoranthene	96	
d ₁₂ -Benzo(k)fluoranthene	95	
d ₁₂ -Benzo(a)pyrene	86	
d ₁₂ -Indeno(1,2,3-c,d)pyrene	128	
d ₁₂ -Benzo(g,h,i)perylene	132	
d ₁₄ -Dibenz(a,h)anthracene	125	

$\bar{\%R} = 102.3$

$s = 25.8$

Pre-spike Recovery Standard:

d ₁₂ -Benzo(e)pyrene	100
d ₁₄ -Terphenyl	102

Date Analyzed: 8/18/92

Analyst: Sly

Page 2 of 2

Reviewer: Sly

**POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429**

Sample ID: M429-1
Lab ID: 11500-002-PAH

Isotopic Recovery Results

<u>Internal Standard:</u>	<u>% R</u>	<u>Qualifier</u>
d ₈ -Naphthalene	NA	*
d ₈ -Acenaphthylene	NA	*
d ₁₀ -Acenaphthene	NA	*
d ₁₀ -Fluorene	NA	*
d ₁₀ -Phenanthrene	NA	*
d ₁₀ -Anthracene	NA	*
d ₁₀ -Fluoranthene	NA	*
d ₁₂ -Benz(a)anthracene	NA	*
d ₁₂ -Chrysene	NA	*
d ₁₂ -Benzo(b)fluoranthene	95	
d ₁₂ -Benzo(k)fluoranthene	83	
d ₁₂ -Benzo(a)pyrene	70	
d ₁₂ -Indeno(1,2,3-c,d)pyrene	83	
d ₁₂ -Benzo(g,h,i)perylene	65	
d ₁₄ -Dibenz(a,h)anthracene	84	

$\bar{y}, R = 80.0$
 $s = 10.8$

Pre-spike Recovery Standard:

d ₁₂ -Benzo(e)pyrene	102
d ₁₄ -Terphenyl	109

Date Analyzed: 8/19/92

Analyst: LM

Page 2 of 2

Reviewer: [Signature]

**POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429**

Sample ID: M429-2
Lab ID: 11500-003-PAH

Isotopic Recovery Results

<u>Internal Standard:</u>	<u>% R</u>	<u>Qualifier</u>
d ₅ -Naphthalene	NA	*
d ₅ -Acenaphthylene	NA	*
d ₁₀ -Acenaphthene	NA	*
d ₁₀ -Fluorene	NA	*
d ₁₀ -Phenanthrene	NA	*
d ₁₀ -Anthracene	NA	*
d ₁₀ -Fluoranthene	NA	*
d ₁₂ -Benz(a)anthracene	NA	*
d ₁₂ -Chrysene	NA	*
d ₁₂ -Benzo(b)fluoranthene	97	
d ₁₂ -Benzo(k)fluoranthene	85	
d ₁₂ -Benzo(a)pyrene	67	
d ₁₂ -Indeno(1,2,3-c,d)pyrene	72	
d ₁₂ -Benzo(g,h,i)perylene	58	
d ₁₄ -Dibenz(a,h)anthracene	74	

Handwritten:
 $\bar{R} = 76.5$
 $S = 13.7$

Pre-spike Recovery Standard:

d ₁₂ -Benzo(e)pyrene	108
d ₁₄ -Terphenyl	113

Date Analyzed: 8/19/92

Analyst: BSM

Page 2 of 2

Reviewer: [Signature]

**POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429**

Sample ID: M429-3
Lab ID: 11500-004-PAH

Isotopic Recovery Results

<u>Internal Standard:</u>	<u>% R</u>	<u>Qualifier</u>
d ₆ -Naphthalene	NA	*
d ₆ -Acenaphthylene	NA	*
d ₁₀ -Acenaphthene	NA	*
d ₁₀ -Fluorene	NA	*
d ₁₀ -Phenanthrene	NA	*
d ₁₀ -Anthracene	NA	*
d ₁₀ -Fluoranthene	NA	*
d ₁₂ -Benz(a)anthracene	NA	*
d ₁₂ -Chrysene	NA	*
d ₁₂ -Benzo(b)fluoranthene	97	
d ₁₂ -Benzo(k)fluoranthene	82	
d ₁₂ -Benzo(a)pyrene	78	
d ₁₂ -Indeno(1,2,3-c,d)pyrene	83	
d ₁₂ -Benzo(g,h,i)perylene	66	
d ₁₄ -Dibenz(a,h)anthracene	82	

$\overline{\%R} = 81.3$
s = 10

Pre-spike Recovery Standard:

d ₁₂ -Benzo(e)pyrene	102
d ₁₄ -Terphenyl	106

Date Analyzed: 8/19/92

Analyst: Sim

Page 2 of 2

Reviewer: Jim

**POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429**

LCS RESULTS

Lab ID: 11500-LCS1/LCS2
Matrix: MM5

Date Received: NA
Date Extracted: 8/04/92
Sample Amount: Sample

ICAL ID: IPAH
QC Lot: LC0804M
Units: NA

<u>COMPOUND</u>	<u>LCS1 % R</u>	<u>LCS2 % R</u>	<u>RPD %</u>
Naphthalene	106	96	9.9
Acenaphthylene	110	107	2.8
Acenaphthene	112	118	5.2
Fluorene	115	126	9.1
Phenanthrene	116	121	4.2
Anthracene	101	95	6.1
Fluoranthene	110	109	0.91
Pyrene	101	93	8.2
Benz(a)anthracene	116	116	0.0
Chrysene	114	115	0.87
Benzo(b)fluoranthene	110	108	1.8
Benzo(k)fluoranthene	108	111	2.7
Benzo(a)pyrene	112	114	1.8
Benzo(e)pyrene	NA	NA	NA
Indeno(1,2,3-c,d)pyrene	110	111	0.90
Dibenz(a,h)anthracene	110	112	1.8
Benzo(g,h,i)perylene	112	109	2.7

Analyst: SM

Page 1 of 2

Reviewer: Jme

**POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429**

LCS RESULTS

Lab ID: 11500-LCS1/LCS2

Isotopic Recovery Results

<u>Internal Standard:</u>	<u>LCS1 % R</u>	<u>LCS2 % R</u>
d ₈ -Naphthalene	85	95
d ₈ -Acenaphthylene	71	75
d ₁₀ -Acenaphthene	75	75
d ₁₀ -Fluorene	79	72
d ₁₀ -Phenanthrene	90	79
d ₁₀ -Anthracene	78	62
d ₁₀ -Fluoranthene	85	95
d ₁₂ -Benz(a)anthracene	86	66
d ₁₂ -Chrysene	85	73
d ₁₂ -Benzo(b)fluoranthene	98	72
d ₁₂ -Benzo(k)fluoranthene	92	65
d ₁₂ -Benzo(a)pyrene	89	36
d ₁₂ -Indeno(1,2,3-c,d)pyrene	112	68
d ₁₂ -Benzo(g,h,i)perylene	108	68
d ₁₄ -Dibenz(a,h)anthracene	104	56

Date Analyzed: 8/18/92

Analyst: SLK

Page 2 of 2

Reviewer: SP/2

APPENDIX

DATA QUALIFIERS & ABBREVIATIONS

A	The amount detected is below the Method Quantitation Limit.
B	This compound was also detected in the blank.
C	The amount detected is less than five times the Method Quantitation Limit.
D	The amount reported is the maximum possible concentration.
E	The detection limit was raised above the Method Quantitation Limit due to chemical interferences.
F	This result has been reported off the DB-225 column.
G	This result has been reported off the SP-2331 column.
H	The signal-to-noise ratio is greater than 10:1.
I	Chemical Interference

Conc.	Concentration
D.L.	Detection Limit
NA	Not applicable
S/N	Signal-to-noise
MPC	Maximum Possible Concentration
*	See Cover Letter
R.L.	Reporting Limit

CHAIN OF CUSTODY FOR SAMPLES

Plant Name: WSPA (HALLIBURTON)

Job No.: 3037

Sample Recovery Date: 07/29, 30, 31/92

Entropy P.O. No.: 30037-5

SAMPLE ID	SAMPLE MATRIX
M429-1	IMPINGER REAGENT
	FRONT HALF RINSE
	BACK HALF RINSE
	1ST IMPINGER RINSE
	FILTER (3 FILTERS)
	XAD TRAP
M429-2	IMPINGER REAGENT
	FRONT HALF RINSE
	BACK HALF RINSE
	1ST IMPINGER RINSE
	FILTER (2 FILTERS)
	XAD TRAP
M429-3	IMPINGER REAGENT
	FRONT HALF RINSE
	BACK HALF RINSE
	IMPINGER RINSE
	FILTER (2 FILTERS)
	XAD TRAP

[illegible]

Comments: ANALYZE FOL ARB METHOD 429 FOR PAH'S EXTRACTION
OF SAMPLES MUST BE PERFORMED W/IN 7 DAYS OF COLLECTION

Samples Relinquished by: Paul Mata

Date/Time: 08/03/92 1612

Transported by: Norm Loban

Date/Time: (15) - 8/03/92 1607

Transported to: Auth/ANALYTICAL

SC 70 ROBERT J. MATTHEW'S PKWY SUITE 2

EL DORADO HILLS CA 95630

Received by L. J. H. #

Date/Time: 0930 / 8-4-92

Laboratory: Please return this form with analysis results. *Kenneth J. Platt Alt. Analyzed*

ENTROPY

ENVIRONMENTALISTS, INC.

5932 BOLSA AVENUE
SUITE 105
HUNTINGTON BEACH
CALIFORNIA 92648

FAX 714/895-1915 714/373-0998

REQUEST FOR ANALYSIS

PURCHASE

ORDER # 30037-5

JOB NAME WSPA

LABORATORY: ALTA ANALYTICAL

DATE SAMPLES

WERE TRANSMITTED: 08/03/92 EXPECTED DATE OF RESULTS: 08/17/92

SAMPLE MATRIX: ARB METHOD 429

TYPE OF ANALYSIS REQUESTED: ARB METHOD 429 FOR PAH'S.
EXTRACTION OF SAMPLES MUST BE PERFORMED WITHIN
7 DAYS OF SAMPLE COLLECTION. ANALYZE SINGLE COMPOSITE
SAMPLE FROM THE SAMPLING TRAIN.

SAMPLE/REQ#	COMPONENTS	MATRIX
M429-1	IMPIINGER REAGENT	WATER
	FRONT HALF RINSE	NPH. HEXANE, NPH
	BACK HALF RINSE	" "
	IMPIINGER RINSE	" "
	FILTER	FILTER (3 FILTERS)
	VAD TUB	XAD RESIN
M429-2	IMPIINGER REAGENT	WATER
	FRONT HALF RINSE	NPH. HEXANE, NPH
	BACK HALF RINSE	" "
	IMPIINGER RINSE	" "
	FILTER	FILTER (3 FILTERS)
	VAD TUB	XAD RESIN

SUBMITTED BY: My P. Malt

ENTROPY

ENVIRONMENTALISTS, INC.

5932 SOLSA AVENUE
SUITE 105
HUNTINGTON BEACH
CALIFORNIA 92640
FAX 714/895-1915 714/373-0898

REQUEST FOR ANALYSIS

PURCHASE

ORDER # 30037-5

JOB NAME WSPA

LABORATORY: ALTA ANALYTICAL

DATE SAMPLES

WERE TRANSMITTED: 08/03/92 EXPECTED DATE OF RESULTS: 08/17/92

SAMPLE MATRIX: ARB METHOD 429

TYPE OF ANALYSIS REQUESTED: ARB METHOD 429 FOR PAH'S.
EXTRACTION OF SAMPLES MUST BE PERFORMED WITHIN
7 DAYS OF SAMPLE COLLECTION. ANALYZE SINGLE COMPOSITE
SAMPLE FROM THE SAMPLING TRAIN.

SAMPLE RUN#	COMPONENTS	MATRIX
M429-3	IMPINGED REAGENT	WATER
	FRONT HALF RINSE	MeOH, Hexane, MeCl
	BACK HALF RINSE	" " "
	IMPINGED RINSE	" " "
	FILTER	FILTER (7 FILTERS)
	XAD TRAP	XAD RESIN
M429-BT	IMPINGED REAGENT	WATER
	FRONT HALF RINSE	MeOH, Hexane, MeCl
	BACK HALF RINSE	" " "
	FILTER	FILTER (1 FILTER)
	XAD TRAP	XAD RESIN

SUBMITTED BY: [Signature]

ALTA Analytical Laboratory

Batch ID: 11500

Sample Log-In Checklist		Yes	No
1. Samples Arrived by: <u>Courier</u>			
2. Airbill Present? Number _____		☒	
3. Shipping Container is Intact?	☒		
4. Custody Seals Present? Number _____			☒
If yes, are they intact? <u>N/A</u>			
5. Sample Containers Intact?	☒		
6. Shipping Preservation: <u>Ice/Blue Ice/None</u>			
7. Temperature: <u>8°C</u>			
8. Chain of Custody Present?	☒		
9. Discrepancies in Chain of Custody?			☒
10. Packing Retained?	☒		

Name: [Signature] Date Rcv'd: 8-4-92

Comments:

ALTA Analytical Laboratory

Batch ID: 11500

Sample Log-In Checklist		Yes	No
1. Samples Arrived by: <u>Courier</u>			
2. Airbill Present? Number _____		☒	
3. Shipping Container is Intact?	☒		
4. Custody Seals Present? Number _____		☒	
If yes, are they intact? <u>N/A</u>			
5. Sample Containers Intact?	☒		
6. Shipping Preservation: Ice/Blue Ice/ <u>None</u>			
7. Temperature: <u>20°C</u>			
8. Chain of Custody Present?	☒		
9. Discrepancies in Chain of Custody?			☒
10. Packing Retained?	☒		

Name: [Signature] Date Rcv'd: 8-4-92

Comments:

ALTA Analytical Laboratory

Batch ID: 11500

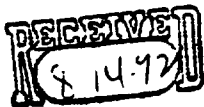
Sample Log-In Checklist		Yes	No
1. Samples Arrived by: <u>Courier</u>			
2. Airbill Present? Number _____			X
3. Shipping Container is Intact?	X		
4. Custody Seals Present? Number _____			X
If yes, are they intact? <u>N/A</u>			
5. Sample Containers Intact?	X		
6. Shipping Preservation: Ice/Blue Ice/ <u>None</u>			
7. Temperature: <u>20°C</u>			
8. Chain of Custody Present?	X		
9. Discrepancies in Chain of Custody?			X
10. Packing Retained?	X		

Name: 1 R/H/E Date Rcv'd: 8-4-92

Comments:

Appendix D.7

Acetaldehyde, Acrolein and Formaldehyde - CARB Method 430



**WEST COAST
ANALYTICAL
SERVICE, INC.**

ANALYTICAL CHEMISTS

August 13, 1992

ENTROPY ENVIRONMENTALISTS, INC.
5932 Bolsa Avenue
Suite 105
Huntington Beach, CA 92649

Attn: Gary Mata

JOB NO. 22012

D

LABORATORY REPORT

Samples Received: Eight (8) Liquid Samples
Date Received: 8-3-92
Purchase Order No: 30037-7/WSPA

The sample was analyzed as follows:

<u>Samples Analyzed</u>	<u>Analysis</u>	<u>Results</u>
Eight (8) liquids	Aldehydes by CARB 430	Table 1

All of the "1st impinger" samples contained orange crystals upon arrival. This indicates that the DNPH impinger solution may have become overloaded, increasing the likelihood of breakthrough.

J 82

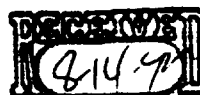
Page 1 of 3


B. Michael Hovanec
Senior Staff Chemist


Michael Shelton
Technical Director

This report is to be reproduced in its entirety.

Client: Entropy Environmentalists, Inc.
Job No: 22012



Formaldehyde by CARB 430

<u>Sample ID</u>	<u>Total Micrograms</u>	<u>Impinger Volume (mL)</u>	<u>Parts per Million (mg/L)</u>
M430-1 1st Impinger	110	44	2.50
M430-1 2nd Impinger	3.04	44	0.069
M430-2 1st Impinger	104	44	2.36
M430-2 2nd Impinger	2.10	41	0.051
M430-3 1st Impinger	72.6	44	1.65
M430-3 2nd Impinger	5.21	38	0.137
M430-RB-1	6.99	315	0.022
M430-RB-2	31.4	265	0.119
Detection Limit	0.03	----	----

Acetaldehyde by CARB 430

<u>Sample ID</u>	<u>Total Micrograms</u>	<u>Impinger Volume (mL)</u>	<u>Parts per Million (mg/L)</u>
M430-1 1st Impinger	45.1	44	1.03
M430-1 2nd Impinger	11.7	44	0.266
M430-2 1st Impinger	37.6	44	0.855
M430-2 2nd Impinger	10.5	41	0.256
M430-3 1st Impinger	26.2	44	0.595
M430-3 2nd Impinger	13.5	38	0.355
M430-RB-1	16.5	315	0.052
M430-RB-2	12.9	265	0.049
Detection Limit	0.03	----	----

Acrolein by CARB 430

<u>Sample ID</u>	<u>Total Micrograms</u>	<u>Impinger Volume (mL)</u>	<u>Parts per Million (mg/L)</u>
M430-1 1st Impinger	2.85	44	0.065
M430-1 2nd Impinger	0.87	44	0.019
M430-2 1st Impinger	3.30	44	0.075
M430-2 2nd Impinger	0.68	41	0.017
M430-3 1st Impinger	1.55	44	0.035
M430-3 2nd Impinger	0.82	38	0.022
M430-RB-1	ND<0.3	315	ND<0.001
M430-RB-2	ND<0.3	265	ND<0.001
Detection Limit	0.05	----	----

Date Extracted: 8-5-92
Date Analyzed: 8-11-92

Aldehydes

RECEIVED
8-14-92

Matrix Spike Recovery Summary

Client: Entropy
Job no.: 22012
Date
Analyzed: 8-11-92

QC Batch #: 81192I

Matrix: Impinger
Units: total ug

Analyte	Sample Result	Amount Spiked	MS Result	% Rec MS
Formaldehyde	110	5.14	101	N/A
Acetaldehyde	45.1	5.16	41.4	N/A
Acrolein	2.85	4.92	4.00	23 **

*** - Result is outside control limits; suspect saturation of the impinger solution.

N/A - Not applicable; sample amount exceeds spike level.

QC Limits

Analyte	% Recovery	
	Warning	Control
Formaldehyde	61	107
Acetaldehyde		49
Acrolein		25
		50
		119
		134
		150

Abbreviations Summary

General Reporting Abbreviations:

- B Blank - Indicates that the compound was found in both the sample and the blank. The sample value is reported without blank subtraction. If the sample value is less than 10X the blank value times the sample dilution factor, the compound may be present as a laboratory contaminant.
- D Indicates that the sample was diluted, and consequently the surrogates were too dilute to accurately measure.
- DL Detection Limit - Is the minimum value which we believe can be detected in the sample with a high degree of confidence, taking into account dilution factors and interferences. The reported detection limits are equal to or greater than Method Detection Limits (MDL) to allow for day to day and instrument to instrument variations in sensitivity.
- J Indicates that the value is an estimate.
- ND Not Detected - Indicates that the compound was not found in the sample at or above the detection limit.
- ppm parts per million (billion) in liquids is usually equivalent to mg/l (ug/l), or in solids to mg/kg₃ (ug/kg). In the gas phase it is equivalent to ul/l (ul/m³).
- TR Trace - Indicates that the compound was observed at a value less than our normal reported Detection Limit (DL), but we feel its presence may be important to you. These values are subject to large errors and low degrees of confidence.
- | | | | |
|-------------|--------------|---------------|---------|
| kg kilogram | mg milligram | l liter | m meter |
| g gram | ug microgram | ul microliter | |

QC Abbreviations:

- Control Control Limits are determined from historical data for a QC parameter. The test value must be within this acceptable range for the test to be considered in control. Usually this range corresponds to the 99% confidence interval for the historical data.
- % Error Percent Error - This is a measure of accuracy based on the analysis of a Laboratory Control Standard (LCS). An LCS is a reference sample of known value such as an NIST Standard Reference Material (SRM). The % Error is expressed in percent as the difference between the known value and the experimental value, divided by the known value. The LCS may simply be a solution based standard which confirms calibration (ICV or CCV - initial or continuing calibration verification), or it may be a reference sample taken through preparation and analysis.

CHAIN OF CUSTODY FOR SAMPLES

Plant Name: WSPA (HALLIBURTON)

Job No.: 30057

Sample Recovery Date:

Entropy P.O. No.: 30037-7

[illegible][illegible]

Comments: ANALYZE ACCORDING TO AARB METHOD 430
FOR FORMALDEHYDE, ACETALDEHYDE, & ACROLEIN

Samples Relinquished by:

Date/Time: 08/03/92 1700

Transported by:

Date/Time:

Transported to:

WEST COAST ANALYTICAL

9840 ALBURTIS AVE

~~CANOGA PARK, CA SANTA FE SPRINGS, CA 90670~~

Received by

Rebecca Williams

Date/Time: 8-3-92 5:45 p.m.

Laboratory: Please return this form with analysis results.

#22012

Appendix D.8

Diesel Fuel - F- Factor and Fuel Analysis

DRY FUEL FACTOR CALCULATIONS

SOURCE: Engine Exhaust Duct
 LOCATION: Halliburton Equipment Yard
 SAMPLE ID.: Diesel Fuel 1-1

Element	Weight %
H	12.73
C	86.05
O	1.11
N	0.00
S	0.44
Total	100.33

Fd, dscf/MMBtu 9,058
 Fc, scf/MMBtu 1408
 Btu/lb 19,622

DRY FUEL FACTOR CALCULATIONS

SOURCE: Engine Exhaust Duct
 LOCATION: Halliburton Equipment Yard
 SAMPLE ID.: Diesel Fuel 1-2

Element	Weight %
H	12.09
C	86.72
O	1.19
N	0.00
S	0.41
Total	100.41

Fd, dscf/MMBtu 9,388
 Fc, scf/MMBtu 1482
 Btu/lb 18,788

DRY FUEL FACTOR CALCULATIONS

SOURCE: Engine Exhaust Duct
 LOCATION: Halliburton Equipment Yard
 SAMPLE ID.: Diesel Fuel 1-3

Element	Weight %
H	12.81
C	85.78
O	1.22
N	0.00
S	0.39
Total	100.20

Fd, dscf/MMBtu 9,598
 Fc, scf/MMBtu 1489
 Btu/lb 18,497

CORE LABORATORIES
ANALYTICAL REPORT

Job Number: 921801

Prepared For:

Entropy Environmentalists, Inc.
Attention: Son Bui
5932 Bolsa Avenue, Suite #105
Huntington Beach, CA 92649

Date: 08/31/92

Jim Adial
Signature

8/31/92
Date:

Name: Jim Adial

Core Laboratories - Long Beach
3700 Cherry Avenue
Long Beach, CA 90807

Title: Lab Supervisor



9/8/92

CORE LABORATORIES

LABORATORY TESTS RESULTS 08/31/92

JOB NUMBER: 921801

CUSTOMER: Entropy Environmentalists, Inc.

ATTN: Attention: Son Bui

CLIENT I.D.: WSPA Job #30037 1-1 Diesel

DATE SAMPLED: 07/29/92

TIME SAMPLED: :

WORK DESCRIPTION: 1-1 Diesel Fuel

LABORATORY I.D.: 921801-0001

DATE RECEIVED: 08/06/92

TIME RECEIVED: 15:30

REMARKS: 500 ml Plastic Bottle

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
BETX in Naphtha		*1		Capillary Analysis	08/24/92	CSS
Benzene	16	1	ppm v/v	Capillary Analysis		
Toluene	171	1	ppm v/v	Capillary Analysis		
Xylene	704	1	ppm v/v	Capillary Analysis		
Ethyl Benzene	160	1	ppm v/v	Capillary Analysis		
C, H, N, O		*1		Carlo Erba	08/31/92	HM
Carbon Content	86.05	0.05	% Wt.	Carlo Erba		
Hydrogen Content	12.73	0.05	% Wt.	Carlo Erba		
Oxygen Content	1.11	0.05	% Wt.	Carlo Erba		
Nitrogen	747	1.0	ppm	ASTM 4629		
ASTM D-86 Distillation		*1		ASTM D-86	06/23/92	PCW
Initial Boiling Point	372	1	Deg. F	ASTM D-86		
05% Evaporated Temperature	421	1	Deg. F	ASTM D-86		
10% Evaporated Temperature	431	1	Deg. F	ASTM D-86		
15% Evaporated Temperature	441	1	Deg. F	ASTM D-86		
20% Evaporated Temperature	460	1	Deg. F	ASTM D-86		
30% Evaporated Temperature	483	1	Deg. F	ASTM D-86		
40% Evaporated Temperature	507	1	Deg. F	ASTM D-86		
50% Evaporated Temperature	525	1	Deg. F	ASTM D-86		
60% Evaporated Temperature	544	1	Deg. F	ASTM D-86		
70% Evaporated Temperature	566	1	Deg. F	ASTM D-86		
80% Evaporated Temperature	598	1	Deg. F	ASTM D-86		
90% Evaporated Temperature	626	1	Deg. F	ASTM D-86		
95% Evaporated Temperature	662	1	Deg. F	ASTM D-86		
End Point	672	1	Deg. F	ASTM D-86		
% Recovery	97.2	0.1	Vol.%	ASTM D-86		
% Residue	2.1	0.1	Vol.%	ASTM D-86		
% Loss	0.7	0	Vol.%	ASTM D-86		
Beryllium (Be)	<0.500	0.500	ppm/wt	EPA 6020	08/31/92	AN
Selenium (Se)	<1.0	1.0	ppm/wt	EPA 6020	08/31/92	AN
Total Chlorides	<1	1	ppm	Dohrmann	08/31/92	AN
Cetane Index	44.5	0.1		ASTM D-976	08/31/92	JA
Heating Value, (Gross)	19622	1	BTU/lb	ASTM D-240	08/31/92	
Sulfur by X-ray Spectrophotometry	0.441	0.005	Wt.%	ASTM D-4294	08/25/92	DD

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Long Beach, CA 90807
(310) 595-8401

J 92

PAGE:1

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CORE LABORATORIES

LABORATORY TESTS RESULTS 08/31/92

JOB NUMBER: 921801

CUSTOMER: Entropy Environmentalists, Inc.

ATTN: Attention: Son Bui

CLIENT I.D.: WSPA Job #30037 1-1 Diesel

DATE SAMPLED: 07/29/92

TIME SAMPLED:

WORK DESCRIPTION: 1-1 Diesel Fuel

LABORATORY I.D.: 921801-0001

DATE RECEIVED: 08/06/92

TIME RECEIVED: 15:30

REMARKS: 500 ml Plastic Bottle

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Pour Point	-5	-60	Deg F	ASTM D-97	08/27/92	
Gravity, API @ 60 Deg F	32.4	-20	Deg. API	ASTM D-287	08/25/92	DD
Flash Point, PMCC	162	70	Deg. F	ASTM D-93	08/25/92	DD
Arsenic, total	<0.500	0.500	ppm/wt	EPA 6020	08/31/92	AN
Mercury, total	<1.0	1.0	ppm/wt	EPA 6020	08/31/92	AN
Chromium, total	<0.500	0.500	ppm/wt	EPA 6020	08/31/92	AN
Cadmium, total	<0.2	0.1	ppm/wt	A.A.	08/25/92	DD
Lead, Total	<1.0	1.0	ppm/wt	A.A.	08/25/92	DD
Naphthalenes	10.64	0.05	Vol. %	ASTM D-1840	08/27/92	DD
Nickel, total	<0.2	0.1	ppm/wt	A.A.	08/25/92	DD
Copper, total	<0.2	0.1	ppm/wt	A.A.	08/25/92	DD
Zinc, Total	1.2	0.1	ppm/wt	A.A.	08/25/92	DD
Viscosity @ 100 Deg F	3.39	0.01	cSt	ASTM D-445	08/28/92	DD

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CORE LABORATORIES

LABORATORY TESTS RESULTS 08/31/92

JOB NUMBER: 921801

CUSTOMER: Entropy Environmentalists, Inc.

ATTN: Attention: Son Bui

CLIENT I.D.: WSPA Job #30037 2-1 Diesel

DATE SAMPLED: 07/30/92

TIME SAMPLED: :

WORK DESCRIPTION: 2-1 Diesel Fuel

LABORATORY I.D.: 921801-0002

DATE RECEIVED: 08/06/92

TIME RECEIVED: 15:30

REMARKS: 500 ml Plastic Bottle

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
BETX in Naphtha		*1		Capillary Analysis	08/24/92	CSS
Benzene		1	ppm v/v	Capillary Analysis		
Toluene	129	1	ppm v/v	Capillary Analysis		
Xylene	613	1	ppm v/v	Capillary Analysis		
Ethyl Benzene	144	1	ppm v/v	Capillary Analysis		
C, H, N, O		*1		Carlo Erba	08/31/92	HN
Carbon Content	86.72	0.05	% Wt.	Carlo Erba		
Hydrogen Content	12.09	0.05	% Wt.	Carlo Erba		
Oxygen Content	1.19	0.05	% Wt.	Carlo Erba		
Nitrogen	696	1.0	ppm	ASTM 4629		
ASTM D-86 Distillation		*1		ASTM D-86	06/23/92	PCW
Initial Boiling Point	373	1	Deg. F	ASTM D-86		
05% Evaporated Temperature	415	1	Deg. F	ASTM D-86		
10% Evaporated Temperature	434	1	Deg. F	ASTM D-86		
15% Evaporated Temperature	443	1	Deg. F	ASTM D-86		
20% Evaporated Temperature	453	1	Deg. F	ASTM D-86		
30% Evaporated Temperature	471	1	Deg. F	ASTM D-86		
40% Evaporated Temperature	500	1	Deg. F	ASTM D-86		
50% Evaporated Temperature	520	1	Deg. F	ASTM D-86		
60% Evaporated Temperature	540	1	Deg. F	ASTM D-86		
70% Evaporated Temperature	564	1	Deg. F	ASTM D-86		
80% Evaporated Temperature	588	1	Deg. F	ASTM D-86		
90% Evaporated Temperature	627	1	Deg. F	ASTM D-86		
95% Evaporated Temperature	660	1	Deg. F	ASTM D-86		
End Point	674	1	Deg. F	ASTM D-86		
% Recovery	97.2	0.1	Vol.%	ASTM D-86		
% Residue	2.1	0.1	Vol.%	ASTM D-86		
% Loss	0.7	0	Vol.%	ASTM D-86		
Beryllium (Be)	<0.500	0.500	ppm/wt	EPA 6020	08/31/92	AM
Selenium (Se)	<1.0	1.0	ppm/wt	EPA 6020	08/31/92	AM
Total Chlorides	2	1	ppm	Dohrmann	08/31/92	AM
Cetane Index	44.3	0.1		ASTM D-976	08/31/92	JA
Heating Value, (Gross)	18788	1	BTU/lb	ASTM D-240	08/31/92	
Sulfur by X-ray Spectrophotometry	0.413	0.005	Wt.%	ASTM D-4294	08/25/92	DD

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(310) 595-8401



CORE LABORATORIES

LABORATORY TESTS RESULTS

08/31/92

JOB NUMBER: 921801

CUSTOMER: Entropy Environmentalists, Inc.

ATTN: Attention: Son Bui

CLIENT I.D.: WSPA Job #30037 2-1 Diesel

DATE SAMPLED: 07/30/92

TIME SAMPLED: :

WORK DESCRIPTION: 2-1 Diesel Fuel

LABORATORY I.D.: 921801-0002

DATE RECEIVED: 08/06/92

TIME RECEIVED: 15:30

REMARKS: 500 ml Plastic Bottle

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Pour Point	-5	-60	Deg F	ASTM D-97	08/27/92	
Gravity, API @ 60 Deg F	32.6	-20	Deg. API	ASTM D-287	08/25/92	DD
Flash Point, PMCC	162	70	Deg. F	ASTM D-93	08/25/92	DD
Arsenic, total	<0.500	0.500	ppm/wt	EPA 6020	08/31/92	AN
Mercury, total	<1.0	1.0	ppm/wt	EPA 6020	08/31/92	AN
Chromium, total	<0.500	0.500	ppm/wt	EPA 6020	08/31/92	AN
Cadmium, total	<0.2	0.1	ppm/wt	A.A.	08/25/92	DD
Pb, Total	<1.0	1.0	ppm/wt	A.A.	08/25/92	DD
Naphthalenes	10.48	0.05	Vol. %	ASTM D-1840	08/27/92	DD
Nickel, total	<0.2	0.1	ppm/wt	A.A.	08/25/92	DD
Copper, total	<0.2	0.1	ppm/wt	A.A.	08/25/92	DD
Zinc, Total	0.8	0.1	ppm/wt	A.A.	08/25/92	DD
Viscosity @ 100 Deg F	3.30	0.01	cSt	ASTM D-445	08/28/92	DD

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CORE LABORATORIES

LABORATORY TESTS RESULTS 08/31/92

JOB NUMBER: 921801

CUSTOMER: Entropy Environmentalists, Inc.

ATTN: Attention: Son Bui

CLIENT I.D.: WSPA Job #30037 3-1 Diesel

DATE SAMPLED: 07/31/92

TIME SAMPLED: :

WORK DESCRIPTION: 3-1 Diesel Fuel

LABORATORY I.D.: 921801-0003

DATE RECEIVED: 08/06/92

TIME RECEIVED: 15:30

REMARKS: 500 ml Plastic Bottle

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
BETX in Naphtha		*1		Capillary Analysis	08/24/92	CSS
Benzene		1	ppm v/v	Capillary Analysis		
Toluene	102	1	ppm v/v	Capillary Analysis		
Xylene	627	1	ppm v/v	Capillary Analysis		
Ethyl Benzene	171	1	ppm v/v	Capillary Analysis		
C, H, N, O		*1		Carlo Erba	08/31/92	HN
Carbon Content	85.78	0.05	% Wt.	Carlo Erba		
Hydrogen Content	12.81	0.05	% Wt.	Carlo Erba		
Oxygen Content	1.22	0.05	% Wt.	Carlo Erba		
Nitrogen	620	1.0	ppm	ASTM 4629		
D-86 Distillation		*1		ASTM D-86	06/23/92	PCW
Initial Boiling Point	372	1	Deg. F	ASTM D-86		
05% Evaporated Temperature	410	1	Deg. F	ASTM D-86		
10% Evaporated Temperature	424	1	Deg. F	ASTM D-86		
15% Evaporated Temperature	432	1	Deg. F	ASTM D-86		
20% Evaporated Temperature	445	1	Deg. F	ASTM D-86		
30% Evaporated Temperature	468	1	Deg. F	ASTM D-86		
40% Evaporated Temperature	487	1	Deg. F	ASTM D-86		
50% Evaporated Temperature	510	1	Deg. F	ASTM D-86		
60% Evaporated Temperature	532	1	Deg. F	ASTM D-86		
70% Evaporated Temperature	557	1	Deg. F	ASTM D-86		
80% Evaporated Temperature	587	1	Deg. F	ASTM D-86		
90% Evaporated Temperature	621	1	Deg. F	ASTM D-86		
95% Evaporated Temperature	668	1	Deg. F	ASTM D-86		
End Point	680	1	Deg. F	ASTM D-86		
% Recovery	97.7	0.1	Vol.%	ASTM D-86		
% Residue	0.1	0.1	Vol.%	ASTM D-86		
% Loss	2.2	0	Vol.%	ASTM D-86		
Beryllium (Be)	<0.500	0.500	ppm/wt	EPA 6020	08/31/92	AN
Selenium (Se)	<1.0	1.0	ppm/wt	EPA 6020	08/31/92	AN
Total Chlorides	<1	1	ppm	Dohrmann	08/31/92	AN
Cetane Index	43.8	0.1		ASTM D-976	08/31/92	JA
Heating Value, (Gross)	18497	1	BTU/lb	ASTM D-240	08/31/92	
Sulfur by X-ray Spectrophotometry	0.388	0.005	Wt.%	ASTM D-4294	08/25/92	DD

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Long Beach, CA 90807
(310) 595-8401



CORE LABORATORIES

LABORATORY TESTS RESULTS

08/31/92

JOB NUMBER: 921801

CUSTOMER: Entropy Environmentalists, Inc.

ATTN: Attention: Son Bui

CLIENT I.D.: WSPA Job #30037 3-1 Diesel

DATE SAMPLED: 07/31/92

TIME SAMPLED: :

WORK DESCRIPTION: 3-1 Diesel Fuel

LABORATORY I.D.: 921801-0003

DATE RECEIVED: 08/06/92

TIME RECEIVED: 15:30

REMARKS: 500 ml Plastic Bottle

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Pour Point	-15	-60	Deg F	ASTM D-97	08/27/92	
Gravity, API @ 60 Deg F	33.0	-20	Deg. API	ASTM D-287	08/25/92	DD
Flash Point, PMCC	160	70	Deg. F	ASTM D-93	08/25/92	DD
Arsenic, total	<0.500	0.500	ppm/wt	EPA 6020	08/31/92	AN
Mercury, total	<1.0	1.0	ppm/wt	EPA 6020	08/31/92	AN
Chromium, total	<0.500	0.500	ppm/wt	EPA 6020	08/31/92	AN
Cadmium, total	<0.2	0.1	ppm/wt	A.A.	08/25/92	DD
Lead, Total	<1.0	1.0	ppm/wt	A.A.	08/25/92	DD
Naphthalenes	9.85	0.05	Vol. %	ASTM D-1840	08/27/92	DD
Nickel, total	<0.2	0.1	ppm/wt	A.A.	08/25/92	DD
Copper, total	<0.2	0.1	ppm/wt	A.A.	08/25/92	DD
Zinc, Total	0.2	0.1	ppm/wt	A.A.	08/25/92	DD
Viscosity @ 100 Deg F	3.10	0.01	cSt	ASTM D-445	08/28/92	DD

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CORE LABORATORIES

QUALITY ASSURANCE REPORT 08/31/92

JOB NUMBER: 921801 CUSTOMER: Entropy Environmentalists, Inc. ATTN: Attention: Son Bui

ANALYSIS				DUPLICATES		REFERENCE STANDARDS		MATRIX SPIKES		
ANALYSIS TYPE	ANALYSIS SUB-TYPE	ANALYSIS I.D.	ANALYZED VALUE (A)	DUPLICATE VALUE (B)	RPD or (A-B)	TRUE VALUE	PERCENT RECOVERY	ORIGINAL VALUE	SPIKE ADDED	PERCENT RECOVERY

PARAMETER: Lead, Total DATE/TIME ANALYZED: 08/25/92 13:37 QC BATCH NUMBER: 935455
REPORTING LIMIT/DF: 1.0 UNITS: ppm/wt METHOD REFERENCE : A.A. TECHNICIAN: DD

BLANK STANDARD	Reagent Prepared	Xylene Conostan	<1.0			1.2	100			
STANDARD	"	"	1.2			3.2	100			
DUPLICATE	Analytical	921801-1	<1.0	<1.0	NC					

PARAMETER: Copper, total DATE/TIME ANALYZED: 08/25/92 13:39 QC BATCH NUMBER: 935456
REPORTING LIMIT/DF: 0.2 UNITS: ppm/wt METHOD REFERENCE : A.A. TECHNICIAN: DD

BLANK STANDARD	Reagent Prepared	Xylene Conostan	<0.2			1.18	103			
STANDARD	"	"	1.22			3.17	103			
DUPLICATE	Analytical	921801-3	<0.2	<0.2	NC					

PARAMETER: Nickel, total DATE/TIME ANALYZED: 08/25/92 13:42 QC BATCH NUMBER: 935457
REPORTING LIMIT/DF: 0.2 UNITS: ppm/wt METHOD REFERENCE : A.A. TECHNICIAN: DD

BLANK STANDARD	Reagent Prepared	Xylene Conostan	<0.2			1.2	108			
STANDARD	"	"	1.3			3.2	106			
DUPLICATE	Analytical	921801-3	<0.2	<0.2	NC					

PARAMETER: Flash Point, PMCC DATE/TIME ANALYZED: 08/25/92 13:49 QC BATCH NUMBER: 935461
REPORTING LIMIT/DF: 70 UNITS: Deg. F METHOD REFERENCE : ASTM D-93 TECHNICIAN: DD

DUPLICATE	Analytical	921801-1	162	160	2					
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PARAMETER: Sulfur by X-ray Spectrophotometry DATE/TIME ANALYZED: 08/25/92 13:52 QC BATCH NUMBER: 935462
REPORTING LIMIT/DF: 0.005 UNITS: Wt.% METHOD REFERENCE : ASTM D-4294 TECHNICIAN: DD

BLANK STANDARD	Reference Reference	MinriOil Alpha	<0.005			0.331	93			
STANDARD	"	"	0.308			0.511	104			
DUPLICATE	Analytical	921801-3	0.388	0.390	1					

PARAMETER: Gravity, API @ 60 Deg F DATE/TIME ANALYZED: 08/25/92 13:54 QC BATCH NUMBER: 935463
REPORTING LIMIT/DF: -20 UNITS: Deg. API METHOD REFERENCE : ASTM D-287 TECHNICIAN: DD

DUPLICATE	Analytical	921801-2	32.6	32.6	0					
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PARAMETER: Cadmium, total DATE/TIME ANALYZED: 08/25/92 13:56 QC BATCH NUMBER: 935464
REPORTING LIMIT/DF: 0.2 UNITS: ppm/wt METHOD REFERENCE : A.A. TECHNICIAN: DD

BLANK STANDARD	Reagent Prepared	Xylene Conostan	<0.2			1.18	97			
STANDARD	"	"	1.15			3.17	99			
DUPLICATE	Analytical	921801-1	<0.2	<0.2	NC					

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QUALITY ASSURANCE REPORT 08/31/92

JOE NUMBER: 921801

CUSTOMER: Entropy Environmentalists, Inc.

ATTN: Attention: Son Bul

ANALYSIS				DUPLICATES		REFERENCE STANDARDS		MATRIX SPIKES		
ANALYSIS TYPE	ANALYSIS SUB-TYPE	ANALYSIS I.D.	ANALYZED VALUE (A)	DUPLICATE VALUE (B)	RPD or (A-B)	TRUE VALUE	PERCENT RECOVERY	ORIGINAL VALUE	SPIKE ADDED	PERCENT RECOVERY
PARAMETER: Cadmium, total				DATE/TIME ANALYZED: 08/25/92 13:56				QC BATCH NUMBER: 935464		
REPORTING LIMIT/DF: 0.2 UNITS: ppm/wt				METHOD REFERENCE : A.A.				TECHNICIAN: DD		
PARAMETER: Zinc, Total				DATE/TIME ANALYZED: 08/25/92 14:03				QC BATCH NUMBER: 935465		
REPORTING LIMIT/DF: 0.1 UNITS: ppm/wt				METHOD REFERENCE : A.A.				TECHNICIAN: DD		
BLANK	Reagent	Xylene	<0.1							
STANDARD	Prepared	Conostan	1.2			1.2	100			
STANDARD	"	"	3.2			3.2	100			
DUPLICATE	Analytical	921801-3	0.2	0.2	0.0					
PARAMETER: Naphthalenes				DATE/TIME ANALYZED: 08/27/92 11:52				QC BATCH NUMBER: 935516		
REPORTING LIMIT/DF: 0.05 UNITS: Vol. %				METHOD REFERENCE : ASTM D-1840				TECHNICIAN: DD		
DUPLICATE	Analytical	921801-2	10.48	9.83	6					
PARAMETER: Pour Point				DATE/TIME ANALYZED: 08/27/92 15:08				QC BATCH NUMBER: 935524		
REPORTING LIMIT/DF: -60 UNITS: Deg F				METHOD REFERENCE : ASTM D-97				TECHNICIAN:		
DUPLICATE	Analytical	921801-3	-15	-15	0					
PARAMETER: Viscosity @ 100 Deg F				DATE/TIME ANALYZED: 08/28/92 10:08				QC BATCH NUMBER: 935536		
REPORTING LIMIT/DF: 0.01 UNITS: cSt				METHOD REFERENCE : ASTM D-445				TECHNICIAN: DD		
DUPLICATE	Analytical	921888-1	6.28	6.28	0					
DUPLICATE	"	921801-1	3.39	3.40	0					
PARAMETER: Total Chlorides				DATE/TIME ANALYZED: 08/31/92 10:50				QC BATCH NUMBER: 935568		
REPORTING LIMIT/DF: 1 UNITS: ppm				METHOD REFERENCE : Dohrmann				TECHNICIAN: AN		
BLANK	Reference	Toluene	<1							
STANDARD	Reference	Std.	50.52			52.54	96			
DUPLICATE	Analytical	921130-2	2	2	0					
PARAMETER: Heating Value, (Gross)				DATE/TIME ANALYZED: 08/31/92 11:39				QC BATCH NUMBER: 935570		
REPORTING LIMIT/DF: 1 UNITS: BTU/lb				METHOD REFERENCE : ASTM D-240				TECHNICIAN:		
DUPLICATE	Analytical	921871-2	5819	5746	1					

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QUALITY ASSURANCE REPORT 08/31/92

JOB NUMBER: 921801 CUSTOMER: Entropy Environmentalists, Inc. ATTN: Attention: Son Bui

ASTM D-86 Distillation DATE ANALYZED: 06/23/92 TIME ANALYZED: 10:30 METHOD: ASTM D-86 QC NUMBER: 934122

REFERENCE STANDARDS

TEST DESCRIPTION	ANALYSIS SUB-TYPE	ANALYSIS I. D.	DILUTION FACTOR	ANALYZED VALUE	TRUE VALUE	PERCENT RECOVERY	DETECTION LIMITS	UNITS OF MEASURE
Initial Boiling Point	Reference	Toluene	1	230.5	231.1	100	1	Deg. F
05% Evaporated Temperature	Reference	Toluene	1	232.0	231.1	100	1	Deg. F
10% Evaporated Temperature	Reference	Toluene	1	232.0	231.1	100	1	Deg. F
50% Evaporated Temperature	Reference	Toluene	1	232.0	231.1	100	1	Deg. F
80% Evaporated Temperature	Reference	Toluene	1	232.0	231.1	100	1	Deg. F

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QUALITY ASSURANCE REPORT 08/31/92

JOB NUMBER: 921801 CUSTOMER: Entropy Environmentalists, Inc. ATTN: Attention: Son Bui

ASTM D-86 Distillation DATE ANALYZED: 06/23/92 TIME ANALYZED: 10:30 METHOD: ASTM D-86 QC NUMBER: 934122

DUPLICATES

TEST DESCRIPTION	ANALYSIS SUB-TYPE	ANALYSIS I. D.	DILUTION FACTOR	ANALYZED VALUE (A)	DUPLICATE VALUE (B)	RPD or (A-B)	DETECTION LIMITS	UNITS OF MEASURE
Initial Boiling Point	Analytical	921294-1	1	103	98	5	1	Deg. F
05% Evaporated Temperature	Analytical	921294-1	1	127	123	3	1	Deg. F
10% Evaporated Temperature	Analytical	921294-1	1	138	134	3	1	Deg. F
50% Evaporated Temperature	Analytical	921294-1	1	205	205	0	1	Deg. F
80% Evaporated Temperature	Analytical	921294-1	1	278	278	0	1	Deg. F

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JOB NUMBER: 921801 CUSTOMER: Entropy Environmentalists, Inc. ATTN: Attention: Son Bui

BETX Fuel Gas DATE ANALYZED: 08/24/92 TIME ANALYZED: 10:48 METHOD: Capillary Analysis QC NUMBER: 935485

TEST DESCRIPTION	ANALYSIS SUB-TYPE	ANALYSIS I. D.	DILUTION FACTOR	ANALYZED VALUE	TRUE VALUE	PERCENT RECOVERY	DETECTION LIMITS	UNITS OF MEASURE
Toluene	Prepared	Toluene	1	4923	5000	98	1	ppm v/v
Benzene	Prepared	Benzene	1	4972	5000	99	1	ppm v/v
Xylene	Prepared	Xylene	1	4973	5000	99	1	ppm v/v
Ethyl Benzene	Prepared	Ethyl Benz	1	4982	5000	100	1	ppm v/v

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QUALITY ASSURANCE FOOTER
08/31/92

Testing in accordance with ASTM Methods Vol 5.01, 5.02, 5.03, 5.04, 5.05

Repeatability Criteria : If the values of A&B are greater than or equal to 5 times the detection limit (DL) then the relative percent difference (RPD) is calculated from $[(|A-B|)/((A+B)/2)]*100$ where A=Analyzed & B=Duplicate values.

If the values of A & B are less than 5 times the DL then $(|A-B|)$ is compared to DL to determine the acceptability of the duplicate value. $(|A-B|)$ must be less than DL for acceptance of the duplicate value.

NC= Not calculable due to values lower than the detection limit.

Repeatability and reproducibility acceptance criteria are in accordance with the appropriate ASTM precision statements.

The "Time Analyzed" in the QA Report refers to the start time of the analytical batch which may not reflect the actual time of each analysis. The "Date Analyzed" is the actual date of analysis.

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Appendix E
Calibration Data

SAMPLING EQUIPMENT AUDIT

Plant Name Walbridge (WSPA) Job No. 30237
 City/State Bakersfield, CA Auditor(s) JW
 Test Loc. Engine Exhaust Duct Date 7/27/92

BAROMETER
 Entropy In-House Ref. Barometer _____ "Hg vs Field Barometer _____ "Hg
 Date Compared _____ Dev. _____ "Hg (Max. Allowable Dev.: ± 0.1 "Hg)
 Field Barometric Pressure Corrected for Test Location Elevation? (✓) _____
 (Note: deduct 0.1" Hg from local NWS STATION pressure for each 100' of test location elevation; example: $29.6 - (300'/100 * 0.1) = 29.3$ "Hg.)

Ref. Therm. Initial Ambient Temp., °F	Allowable Deviation From Ambient	Ambient Temperature, °F	Audit OK (✓)
THERMOMETERS *			
Dry Gas Meter	± 5.4 °F	_____ (Meterbox No. _____)	_____
Impinger Exit	± 2.0 °F	_____	_____
Filter Box	± 5.4 °F	_____	_____

* Adjust thermometer until acceptable. If it cannot be adjusted, use as backup. If no backup, record ambient temperature indicated by unadjusted thermometer and label with correction factor (indicate):

THERMOCOUPLES Allowable Deviation from Ambient: $\pm 8.0^\circ\text{F}^*$ ($\pm 2.0^\circ\text{F}^{**}$)

TC No. / °F	✓ OK	TC No. / °F	✓ OK	TC No. / °F	✓ OK	TC No. / °F	✓ OK	TC No. / °F	✓ OK
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

* ± 8.0 °F = $\pm 1.5\%$ of ambient absolute temperature.
 ** (± 2.0 °F if used in saturated or water droplet-laden gas stream.)

ISOKINETIC METERBOX I.D. 3106 Gamma (Y) 0.998 AHE 1.9759
 As Applicable (check): Zero Magnehelics? _____ Zero/Level Manometer? ☒
 Barometric Pressure (Pbar) 29.55 Auditor JW Date 7/27/92

Dry Gas Meter Reading (Cubic Ft.)	Meter Temperature (°F)	Lower and Upper Limits for Audit Gamma
Final <u>839.224</u>	Final <u>109</u>	$0.96 * Y = \underline{0.958}$
Initial <u>831.647</u>	Initial <u>107.5</u>	$1.04 * Y = \underline{1.038}$

Dry Gas Volume Metered (Cubic Ft.)	Average Meter Temp. (°F)	Run Time (Base = 10)	
		(Minutes)	(Seconds)
Vm = <u>7.577</u>	Tm = <u>108</u>	<u>10</u>	<u>0</u>

$$Y_c = \frac{[\text{Min.} + (\text{Sec.} / 60)]}{V_m} * \left[\frac{0.0319 (T_m + 460)}{P_{\text{bar}}} \right]^{1/2}$$

$$Y_c = \frac{[10 + (0 / 60)]}{7.577} * \left[\frac{0.0319 (108 + 460)}{29.55} \right]^{1/2} = \underline{1.033}$$

Audit Gamma

Audit Gamma Acceptable (between lower & upper limits)? (✓) ☒ Yes ☐ No

SAMPLING EQUIPMENT AUDIT

Plant Name (WSPA) Halliburton Equipment Yard Job No. 30037
 City/State Bakersfield, Ca Auditor(s) SCG
 Test Loc. Engine Exhaust Duct Date 7/27/92

BAROMETER
 Entropy In-House Ref. Barometer _____ "Hg vs Field Barometer _____ "Hg
 Date Compared _____ Dev. _____ "Hg (Max. Allowable Dev.: ± 0.1 "Hg)
 Field Barometric Pressure Corrected for Test Location Elevation? (V) _____
 (Note: deduct 0.1" Hg from local NWS STATION pressure for each 100' of test location elevation; example: $29.6 - (300'/100 * 0.1) = 29.3$ "Hg.)

Ref. Therm. Initial Ambient Temp., °F	Allowable Deviation From Ambient	Ambient Temperature, °F	Audit OK (V)
THERMOMETERS *			
Dry Gas Meter	± 5.4 °F	(Meterbox No. _____)	_____
Impinger Exit	± 2.0 °F	_____	_____
Filter Box	± 5.4 °F	_____	_____

* Adjust thermometer until acceptable. If it cannot be adjusted, use as backup. If no backup, record ambient temperature indicated by unadjusted thermometer and label with correction factor (indicate):

THERMOCOUPLES Allowable Deviation from Ambient: ± 8.0 °F* (± 2.0 °F)**

TC No. / °F	OK	TC No. / °F	OK	TC No. / °F	OK	TC No. / °F	OK	TC No. / °F	OK
_____	✓	_____	✓	_____	✓	_____	✓	_____	✓

* ± 8.0 °F = $\pm 1.5\%$ of ambient absolute temperature.
 ** (± 2.0 °F if used in saturated or water droplet-laden gas stream.)

ISOKINETIC METERBOX I.D. N22 Gamma (Y) 1.020 ΔH_e 1.95
 As Applicable (check): Zero Magnehelics? ☒ Zero/Level Manometer? _____
 Barometric Pressure (P_{bar}) 29.5 Auditor SCG Date 7/27/92

Dry Gas Meter Reading (Cubic Ft.)	Meter Temperature (°F)	Lower and Upper Limits for Audit Gamma
Final <u>946.951</u>	Final <u>108</u>	$0.96 * Y = \underline{0.9792}$
Initial <u>939.258</u>	Initial <u>102</u>	$1.04 * Y = \underline{1.0608}$

Dry Gas Volume Metered (Cubic Ft.)	Average Meter Temp. (°F)	Run Time (Base = 10)	
		(Minutes)	(Seconds)
V _m = <u>7.693</u>	T _m = <u>105</u>	<u>10</u>	<u>00</u>

$$Y_c = \frac{(\text{Min.} + (\text{Sec.} / 60))}{V_m} * \left[\frac{0.0319 (T_m + 460)}{P_{bar}} \right]^{1/2}$$

$$Y_c = \frac{(\underline{10} + (\underline{0} / 60))}{\underline{7.693}} * \left[\frac{0.0319 (\underline{105} + 460)}{\underline{29.5}} \right]^{1/2} = \underline{1.016}$$

Audit Gamma

Audit Gamma Acceptable (between lower & upper limits)? (V) ☒ Yes ☐ No

DRY GAS METER CALIBRATION RECORD

Test Location: BRI Huntington Lab

Date: 4/22/92

Personnel: PB

SECONDARY STANDARD DGM ID: <u>3586003</u> G: <u>0.9908</u> Date: <u>08/14/91</u>	GAS METER BEING TESTED DGM ID: <u>VOST4</u>
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TIME	Flow (lpm)	Vs1 (cu. ft.)	Ts (F)	Dps ("H2O)	Vs1f (cu. ft.)	Vm1 (liters)	Tm (F)	Pbar (" Hg)	Vmf (liters)	G1	(G1max- G1min) < 0.010	G1avg	$\frac{G1avg}{1 + 0.02}$
10	0.5	421.131	73	0.00	421.306	60.520	75	29.88	65.370	1.016			
10	0.5	421.306	74	0.00	421.483	65.370	77	29.88	70.275	1.018	0.007	1.015	1.012
10	0.5	421.991	75	0.00	422.164	84.835	79	29.88	89.670	1.011			
10	1.0	422.552	75	-0.01	422.903	100.700	79	29.88	110.630	0.999			
10	1.0	422.903	76	-0.01	423.245	110.630	81	29.88	120.415	0.99	0.009	0.993	0.990
10	1.0	423.597	76	-0.01	423.937	130.290	81	29.88	140.004	0.991			
10	1.5	424.312	77	-0.01	424.847	150.550	79	29.88	165.500	1.008			
10	1.5	424.847	77	-0.01	425.369	165.500	81	29.88	180.265	0.999	0.009	1.004	1.000
10	1.5	425.369	77	-0.01	425.895	180.265	81	29.88	195.080	1.004			
10	2.0	426.585	77	-0.02	427.280	214.560	82	29.88	234.130	1.006			
10	2.0	427.280	77	-0.02	427.972	234.130	82	29.88	253.740	0.999	0.007	1.001	0.998
10	2.0	427.972	77	-0.02	428.663	253.740	82	29.88	273.330	0.999			

Vs1, Vs1f - Initial and final volume readings on secondary standard (cu. ft.)

OVERALL GAMMA, Gavg: 1.003

G - Gamma factor for secondary standard.

Ts - Temperature of secondary standard meter (Deg. F).

PREVIOUS GAMMA: 0.994

Dps - Pressure of secondary standard meter (in. H2O).

DATE: 12/15/91

Vm1, Vmf - Initial and final volume readings on tested meter (liters).

Tm - Temperature of tested gas meter (Deg. F).

DEVIATION FROM PREVIOUS GAMMA: 0.938

Pbar - Barometric Pressure (in. Hg).

$$Vs1d = (Vs1f - Vs1)(G)(17.64)[Pbar + (Dps/13.6)]/(Ts + 460)$$

☐ PRETEST CALIBRATION

$$G1 = 28.32 (Vs1d)/[(Vm1f - Vm1)(17.64)(Pbar)/(Tm + 460)]$$

☐ POSTTEST CALIBRATION

☒ FULLTEST CALIBRATION

SAMPLING EQUIPMENT AUDIT

Plant Name Halliburton Equipment Yard Job No. 30087
 City/State Bakersfield, Ca Auditor(s) SCG
 Test Loc. Engine Exhaust Duct Date 7/27/92

BAROMETER
 Entropy In-House Ref. Barometer _____ "Hg vs Field Barometer _____ "Hg
 Date Compared _____ Dev. _____ "Hg (Max. Allowable Dev.: ± 0.1 "Hg)
 Field Barometric Pressure Corrected for Test Location Elevation? (✓) _____
 (Note: deduct 0.1" Hg from local NWS STATION pressure for each 100' of test location elevation; example: $29.6 - (300/100 * 0.1) = 29.3$ "Hg.)

Ref. Therm. Initial Ambient Temp., °F	Allowable Deviation From Ambient	Ambient Temperature, °F	Audit OK (✓)
THERMOMETERS *			
Dry Gas Meter	± 5.4 °F	_____ (Meterbox No. _____)	_____
Impinger Exit	± 2.0 °F	_____	_____
Filter Box	± 5.4 °F	_____	_____

* Adjust thermometer until acceptable. If it cannot be adjusted, use as backup. If no backup, record ambient temperature indicated by unadjusted thermometer and label with correction factor (indicate):

THERMOCOUPLES Allowable Deviation from Ambient: ± 8.0 °F* (± 2.0 °F)**

TC No. / °F	✓ OK	TC No. / °F	✓ OK	TC No. / °F	✓ OK	TC No. / °F	✓ OK	TC No. / °F	✓ OK
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

* ± 8.0 °F = $\pm 1.5\%$ of ambient absolute temperature.
 ** (± 2.0 °F if used in saturated or water droplet-laden gas stream.)

ISOKINETIC METERBOX I.D. N26 Gamma (Y) 0.996 ΔH 1.7392
 As Applicable (check): Zero Magnehelics? ☒ Zero/Level Manometer? _____
 Barometric Pressure (Pbar) 29.5 Auditor SCG Date 7/27/92

Dry Gas Meter Reading (Cubic Ft.)	Meter Temperature (°F)	Lower and Upper Limits for Audit Gamma
Final <u>904.288</u>	Final <u>109</u>	$0.96 * Y = 0.9562$
Initial <u>896.444</u>	Initial <u>103</u>	$1.04 * Y = 1.036$

Dry Gas Volume Metered (Cubic Ft.)	Average Meter Temp. (°F)	Run Time (Base = 10)	
		(Minutes)	(Seconds)
Vm = <u>7.844</u>	Tm = <u>106</u>	<u>10</u>	<u>0</u>

$$Y_c = \frac{[Min. + (Sec. / 60)]}{Vm} * \left[\frac{0.0319 (Tm + 460)}{Pbar} \right]^{1/2}$$

$$Y_c = \frac{[10 + (0 / 60)]}{7.844} * \left[\frac{0.0319 (106 + 460)}{29.5} \right]^{1/2} = 0.9974$$

Audit Gamma

Audit Gamma Acceptable (between lower & upper limits)? (✓) ☒ Yes ☐ No

DRY GAS METER CALIBRATION RECORD

Test Location: EEI Huntington Lab

Date: 3/12/92

Calibrated By: PB

SECONDARY STANDARD

DGM ID: 3586003

G: 0.9908

Date: 8/14/91

GAS METER BEING TESTED

DGM ID: N26

TIME	Flow (cfm)	Vs1 (cu. ft)	Ts (F)	Dps ("H2O)	Vsf (cu. ft)	Vml (cu. ft)	Tm (F)	Pbar ("Hg)	Vmf (cu. ft)	Gl	(Gmax- Gmin)	Gavg	$\frac{Gavg}{1 + 0.02}$
5	0.4	135.337	70	0.00	137.416	555.718	78	29.98	557.836	0.987			
5	0.4	137.416	70	0.00	139.485	557.836	79	29.98	559.949	0.987	0.003	0.986	0.990
5	0.4	139.485	70	0.00	141.549	559.949	80	29.98	562.067	0.984			
5	0.6	141.760	70	0.00	144.657	562.282	80	29.98	565.235	0.99			
5	0.6	144.657	70	0.00	147.540	565.235	82	29.98	568.180	0.992	0.005	0.992	0.996
5	0.6	147.540	70	0.00	150.425	568.180	84	29.98	571.130	0.995			
5	0.8	153.310	70	0.00	157.308	574.073	85	29.98	578.154	0.998			
5	0.8	157.308	70	0.00	161.310	578.154	87	29.98	582.252	0.999	0.003	0.999	1.003
5	1.0	166.013	70	0.00	171.202	587.058	83	29.98	592.302	1.004			
5	1.0	171.202	70	0.00	176.398	592.302	86	29.98	597.556	1.009	0.006	1.008	1.011
5	1.0	176.398	70	0.00	181.719	597.556	87	29.98	602.943	1.01			

OVERALL GAMMA, Gavg: 0.996

PREVIOUS GAMMA: 0.989

DATE: 10/11/91

DEVIATION FROM PREVIOUS GAMMA: 0.71%

PRETEST CALIBRATION ☐

POSTTEST CALIBRATION ☐

FULL TEST CALIBRATION ☒

G - Gamma factor for secondary standard.
 Vs1, Vsf - Initial and final volume readings on secondary standard (cu. ft).
 Ts - Temperature of secondary standard meter (Deg. F).
 Dps - Pressure of secondary standard meter (in. H2O).
 Vml, Vmf - Initial and final volume readings on tested meter (cu. ft).
 Tm - Temperature of tested gas meter (Deg. F).
 Pbar - Barometric Pressure (in. Hg).
 $Vstd = (Vsf - Vs1)(G)(17.64)(Pbar + (Dps/13.6))/(Ts + 460)$
 $Gl = Vstd/[(Vmf - Vml)(17.64)(Pbar)/(Tm + 460)]$

Orifice Setting "H2O	dH _g (68 F)	dH _g (60 F)
0.5	1.6374	1.6616
0.5	1.6483	1.6725
0.5	1.6536	1.6779
1	1.6807	1.7055
1	1.6893	1.7142
1	1.6796	1.7044
2	1.748	1.7737
2	1.7364	1.7619
2	1.7411	1.7667
3.5	1.8238	1.8507
3.5	1.8088	1.8355
3.5	1.7204	1.7457
	1.7140	1.7392

DRY GAS METER CALIBRATION RECORD

Test Location: EEI Huntington Lab

Date: 4/22/92

Personnel: PB

SECONDARY STANDARD	GAS METER BEING TESTED
DGM ID: <u>3586003</u> G: <u>0.9908</u> Date: <u>08/14/91</u>	DGM ID: <u>VOST4</u>

TIME	Flow (lpm)	Vs1 (cu. ft.)	Ts (F)	Dps ("H2O)	Vsf (cu. ft.)	Vm1 (liters)	Tm (F)	Pbar (" Hg)	Vmf (liters)	G1	(G1max- G1min) < 0.010	G1avg	G1avg 1 + 0.02
10	0.5	421.131	73	0.00	421.306	60.520	75	29.88	65.370	1.016			
10	0.5	421.306	74	0.00	421.483	65.370	77	29.88	70.275	1.018	0.007	1.015	1.012
10	0.5	421.991	75	0.00	422.164	84.835	79	29.88	89.670	1.011			
10	1.0	422.552	75	-0.01	422.903	100.700	79	29.88	110.630	0.999			
10	1.0	422.903	76	-0.01	423.245	110.630	81	29.88	120.415	0.99	0.009	0.993	0.990
10	1.0	423.597	76	-0.01	423.937	130.290	81	29.88	140.004	0.991			
10	1.5	424.312	77	-0.01	424.847	150.550	79	29.88	165.500	1.008			
10	1.5	424.847	77	-0.01	425.369	165.500	81	29.88	180.265	0.999	0.009	1.004	1.000
10	1.5	425.369	77	-0.01	425.895	180.265	81	29.88	195.080	1.004			
10	2.0	426.585	77	-0.02	427.280	214.560	82	29.88	234.130	1.006			
10	2.0	427.280	77	-0.02	427.972	234.130	82	29.88	253.740	0.999	0.007	1.001	0.998
10	2.0	427.972	77	-0.02	428.663	253.740	82	29.88	273.330	0.999			

Vs1, Vsf - Initial and final volume readings on secondary standard (cu. ft.)

OVERALL GAMMA, Gavg:

1.003

G - Gamma factor for secondary standard.

Ts - Temperature of secondary standard meter (Deg. F).

PREVIOUS GAMMA:

0.994

Dps - Pressure of secondary standard meter (In. H2O).

Vm1, Vmf - Initial and final volume readings on tested meter (liters).

DATE: 12/15/91

Tm - Temperature of tested gas meter (Deg. F).

Pbar - Barometric Pressure (In. Hg).

DEVIATION FROM PREVIOUS GAMMA:

0.938

Vstd = (Vsf - Vs1)(G)(17.64)(Pbar + (Dps/13.6))/(Ts + 460)

☐ PRETEST CALIBRATION

G1 = 28.32 (Vstd)/((Vmf - Vm1)(17.64)(Pbar)/(Tm + 460))

☐ POSTTEST CALIBRATION

☒ FULLTEST CALIBRATION

DRY GAS METER CALIBRATION RECORD

Test Location: ERI Huntington Lab

Date: 1/2/92

Personnel: PB

SECONDARY STANDARD

DGM ID: M90049 G: 1.0126
Date: 2/12/91

GAS METER BEING TESTED

DGM ID: YOST5

TIME	Flow (lpm)	Vsi (liters)	Ts (F)	Dps ("H2O)	Vsf (liters)	Vmi (liters)	Tm (F)	pbar (" Hg)	Vmf (liters)	Gl	(Gimax- Gimin) < 0.010	Glavg	$\frac{Glavg}{1 + 0.02}$
10	0.5	5816.180	68	0.00	5820.200	187.720	78	29.95	191.940	0.983			
10	0.5	5820.200	68	0.00	5824.280	191.940	81	29.95	196.290	0.973	0.010	0.976	0.978
10	0.5	5828.165	68	0.00	5832.020	200.530	82	29.95	204.650	0.973			
10	1.0	5861.003	65	-0.01	5870.390	234.435	75	29.95	244.135	0.999			
10	1.0	5842.350	64	-0.01	5851.640	215.160	71	29.95	224.800	0.989	0.010	0.996	0.998
10	1.0	5851.640	64	-0.01	5861.003	224.800	72	29.95	234.435	0.999			
10	1.5	5899.500	57	-0.01	5914.090	274.020	63	29.95	288.900	1.004			
10	1.5	5914.090	57	-0.01	5928.695	288.900	64	29.95	303.785	1.007	0.010	1.003	1.005
10	1.5	5929.280	58	-0.01	5943.830	304.300	68	29.95	319.360	0.997			
10	2.0	5950.480	59	-0.02	5971.060	326.200	72	29.95	347.250	1.015			
10	2.0	5971.060	61	-0.02	5992.000	347.250	68	29.95	368.345	1.019	0.004	1.017	1.019
10	2.0	5992.000	61	-0.02	6013.000	368.345	70	29.95	389.600	1.018			

Vsl, Vsf - Initial and final volume readings on secondary standard (li (liters)).

G - Gamma factor for secondary standard.

Ts - Temperature of secondary standard meter (Deg. F).

Dps - Pressure of secondary standard meter (in. H2O).

Vmi, Vmf - Initial and final volume readings on tested meter (c (liters)).

Tm - Temperature of tested gas meter (Deg. F).

pbar - Barometric Pressure (in. Hg).

$$Vstd = (Vsf - Vsl)(G)(17.64)(pbar + (Dps/13.6))/(Ts + 460)$$

$$Gl = Vstd / [(Vmf - Vmi)(17.64)(pbar)/(Tm + 460)]$$

☐ PRETEST CALIBRATION

☐ POSTTEST CALIBRATION

☒ FULLTEST CALIBRATION

PREVIOUS GAMMA: 0.998

DATE: 1/2/92

DEVIATION FROM PREVIOUS GAMMA: 0.008

0.998

NOZZLE NUMBER 6P200

Note: 1. All diameters measured in inches.
2. Maximum 0.004 inches from lowest to highest diameter.

FIGURE 2 NOZZLE CALIBRATION FORM R-0033

NOZZLE CALIBRATION

NOZZLE NUMBER 6P203

[illegible]

Note: 1. All diameters measured in inches.
2. Maximum 0.004 inches from lowest to highest diameter.

A-0033 rev. 1-90

FIGURE 2 NOZZLE CALIBRATION FORM R-0033

NOZZLE NUMBER GP205

Note: 1. All diameters measured in inches.
2. Maximum 0.004 inches from lowest to highest diameter.

R-0033 rev. 1-90

FIGURE 2 NOZZLE CALIBRATION FORM R-0033

NOZZLE NUMBER GP206

Note: 1. All diameters measured in inches.
2. Maximum 0.004 inches from lowest to highest diameter.

A-0033 rev. 1-90

FIGURE 2 NOZZLE CALIBRATION FORM R-0033

NOZZLE CALIBRATION

NOZZLE NUMBER 6P202

[illegible]

Note: 1. All diameters measured in inches.
2. Maximum 0.004 inches from lowest to highest diameter.

A-0033 rev. 1-90

FIGURE 2 NOZZLE CALIBRATION FORM R-0033

DRY GAS METER CALIBRATION RECORD

Test Location: EEI Huntington Lab

Date: 1/2/92

Personnel: PB

SECONDARY STANDARD						GAS METER BEING TESTED							
DGM ID: <u>M900498</u> G: <u>1.0126</u> Date: <u>2/12/91</u>						DGM ID: <u>9P</u>							
TIME	Flow (lpm)	Vsi (liters)	Ts (F)	DPs ("H2O)	Vsf (liters)	Vmi (cu. ft)	Tm (F)	Pbar (" Hg)	Vmf (cu. ft)	Gi	(Gimax- Gimin) < 0.010	Giavg	$\frac{Giavg}{Gavg}$ 1 + 0.02
10	0.5	5621.500	64	-0.01	5626.300	269.072	65	30.00	269.248	0.977	0.006	0.980	0.987
10	0.5	5626.300	64	-0.01	5631.550	269.248	66	30.00	269.440	0.981			
10	0.5	5631.550	65	-0.01	5636.460	269.440	69	30.00	269.620	0.983			
10	1.0	5638.100	65	-0.01	5646.350	269.682	72	30.00	269.985	0.987	0.008	0.987	0.994
10	1.0	5646.350	65	-0.01	5654.500	269.985	73	30.00	270.286	0.983			
10	1.0	5654.500	66	-0.01	5662.840	270.286	73	30.00	270.591	0.991			
10	2.0	5663.470	67	-0.02	5681.890	270.617	75	30.00	271.283	1.004	0.008	1.003	1.009
10	2.0	5681.890	67	-0.02	5700.230	271.283	75	30.00	271.945	1.006			
10	2.0	5700.230	67	-0.02	5718.570	271.945	75	30.00	272.612	0.998			
10	3.0	5719.350	67	-0.03	5748.006	272.640	75	30.00	273.678	1.002	0.003	1.003	1.010
10	3.0	5748.006	67	-0.03	5776.650	273.678	75	30.00	274.712	1.005			
10	3.0	5776.650	67	-0.03	5805.185	274.712	75	30.00	275.745	1.003			

Vsi, Vsf - Initial and final volume readings on secondary standard (liters).

G - Gamma factor for secondary standard.

Ts - Temperature of secondary standard meter (Deg. F).

DPs - Pressure of secondary standard meter (in. H2O).

Vmi, Vmf - Initial and final volume readings on tested meter (cu. ft).

Tm - Temperature of tested gas meter (Deg. F).

Pbar - Barometric Pressure (in. Hg).

OVERALL GAMMA, Gavg: 0.993

PREVIOUS GAMMA: 0.989

DATE: 6/6/91

DEVIATION FROM PREVIOUS GAMMA: 0.448

$$Vstd = (Vsf - Vsi)(G)(17.64)[Pbar + (DPs/13.6)]/(Ts + 460)$$

☐ PRETEST CALIBRATION

$$Gi = Vstd/[(Vmf - Vmi)(17.64)(28.32)(Pbar)/(Tm + 460)]$$

☐ POSTTEST CALIBRATION

THERMOCOUPLE CALIBRATION

Thermocouple No.: T007

Date: 3/16/92

Calibrated By: MC

Barometric Pressure, Inches Hg: 29.92

Ambient Temperature, °F: 70.4

Mercury-In-Glass Thermometer I.D. No.: 5001F

Calibration System Used	Potentiometer I.D. Number	Reference Thermometer Temperature		Mean Temperature of Hg Column T_m °F	Thermocouple Thermometer Temperature T_t °F	Temperature Diff., % (Allowable: ≤ 1.5 %)
		T_o °F	T_c °F			
Ice Bath	F59	32.0	31.96	67.0	33.0	-.21
		32.0	31.96	67.0	33.0	-.21
		32.0	31.96	67.0	33.0	-.21
Boiling Water	F59	215.0	216.84	110.0	217.0	-.02
		215.0	216.84	110.0	216.0	.12
		215.0	216.84	110.0	216.0	.12
Boiling Oil	F59	410.0	420.18	120.0	409.0	1.27
		410.0	420.18	120.0	409.0	1.27
		410.0	420.18	120.0	409.0	1.27

$$\text{Corrected Temperature} = T_c = T_o + [(.00009) * (T_o - 20) * (T_o - T_m)]$$

$$\text{Temperature Difference} = \frac{[(T_c + 460) - (T_t + 460)]}{(T_c + 460)} * 100$$

ROTOMETER CALIBRATION

ENTROPY

88.23 0.50 STD.CU.CM./MIN. AIR

07-24-1992

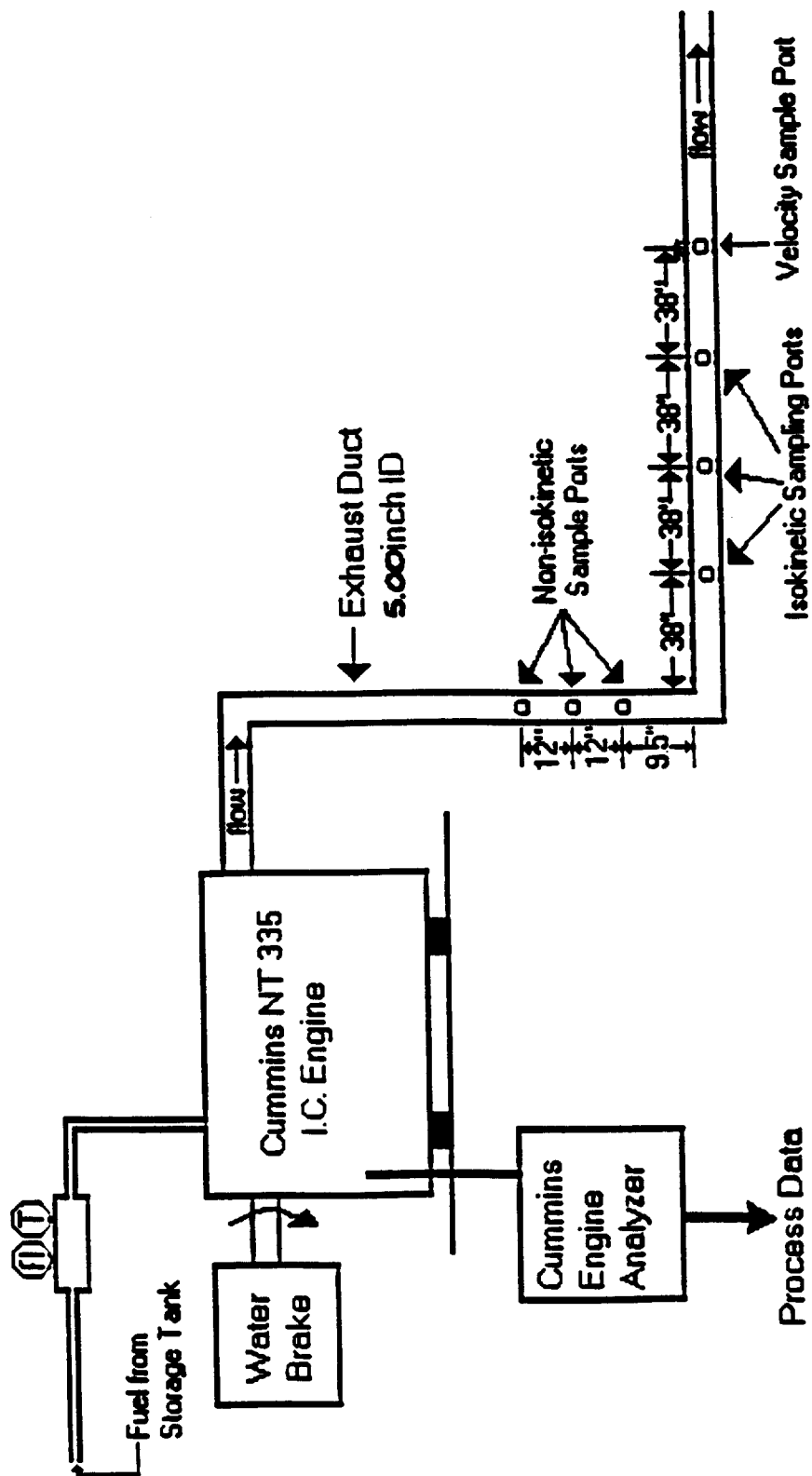
R-215-AA
Spherical
GLASS
1 ATMOS. & 70°F
2.

14.7 PSI
70.0 DEG.F
0.0 PSIG
0.00120 GMS/CC
2.54000 GMS/CC
0.00120 GMS/CC
0.01812 cP

LINEAR

100----	88.2	60----	29.8	20----	4.4
98----	84.3	58----	27.8	18----	3.7
96----	80.4	56----	25.9	16----	3.1
94----	76.6	54----	24.1	14----	2.5
92----	72.8	52----	22.3	12----	1.9
90----	69.3	50----	20.6	10----	1.5
88----	66.0	48----	19.2	8----	1.2
86----	62.8	46----	17.9	6----	0.9
84----	59.8	44----	16.6	4----	0.6
82----	56.8	42----	15.3	2----	0.3
80----	53.9	40----	14.0		
78----	51.3	38----	12.7		
76----	48.8	36----	11.4		
74----	46.3	34----	10.2		
72----	43.8	32----	9.1		
70----	41.3	30----	8.1		
68----	39.0	28----	7.3		
66----	36.6	26----	6.6		
64----	34.3	24----	5.9		
62----	32.0	22----	5.2		

Appendix F
Process Schematic



I. C. Engine Process Schematic

TABLE F-1
I. C. ENGINE DESIGN PARAMETERS

Engine Design Parameters	Units	Value
Manufacturer		Cummins
Model		NT 335
Service		Workover Rig
Brake Power	HP	335
Heat Input (Total All Cylinders)	MMBtu/hr	Not Available
Ignition		Compression
Injection		Direct
Number Strokes Per Cycle		4 Stroke
Date Commissioned		Not Available
Injector Type		Pressure/Timer
Geometry:		
Bore to Stroke Ratio		5.5
Stroke Length	Inches	6
Bowl to Cylinder Diameter Ratio		?
Number of Cylinders		6
Compression Ratio	Volume Ratio	14
Stratified Charge		No
Turbocharging		Yes
NO _x Control:		
EGR		No
Water Injection		No
Charge Cooling		No
Injection Retard		No
Timing (Evaluated Before Source Testing)		
Fuel Injection	Angle BTDC	?
Intake Valve Open	Angle BTDC	?
Intake Valve Closed	Angle ABDC	?
Exhaust Valve Closed	Angle BBDC	?
Exhaust Valve Open	Angle ATDC	?

TABLE F-2

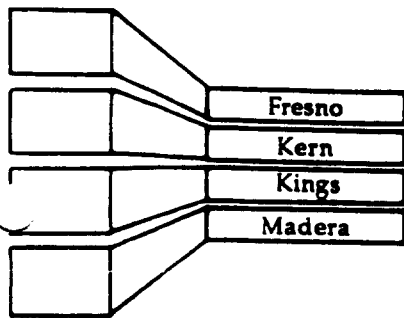
I.C. ENGINE POOLED SOURCE TEST

OPERATING DATA SUMMARY

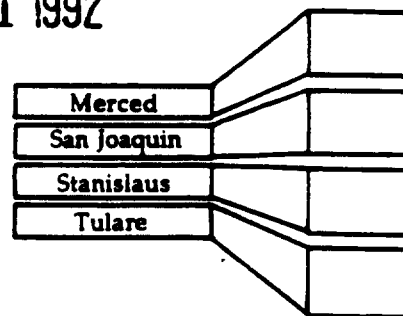
DATE	TEMPERATURE (DEG F)			FUEL FLOW		ENGINE SPEED (RPM)	TURBO BOOST		WATER BRAKE	
	COOLANT	LUBE OIL	FUEL	(LB/HR)	(BPD)		TEMP (F)	(in. Hg)	FLOW (BPM)	PRESS. (psig)
LOW LOAD: 7/29/92	166	168	87	NA	NA	755	102	0	0	0
7/30/92	165	168	97	NA	NA	762	109	0	0	0
7/31/92	166	169	99	NA	NA	757	109	0	0	0
HIGH LOAD: 7/29/92	175	207	110	105	0.138	2076	259	22.1	1192	5.74
7/30/92	174	204	108	102	0.101	2068	246	20.6	1092	5.80
7/31/92	170	212	92.7	100	0.115	2070	223	21.1	1151	5.83

Appendix G
Post Protocol Correspondence

JUL 31 1992



San Joaquin Valley
Unified Air Pollution Control District



July 28, 1992

District Board Members

RICK JENSEN, Chair
Supervisor, Madera County
PAULINE LARWOOD, Vice Chair
Supervisor, Kern County
BILL SOUSA
Supervisor, San Joaquin County
NICK BLOM
Supervisor, Stanislaus County
BLAIR BRADLEY
Councilmember, City of Ceres
MIKE BOGNA
Supervisor, Merced County
DOUG VAGIM
Supervisor, Fresno County
TOM STEARNS
Councilmember, City of Clovis
JOE HAMMOND
Supervisor, Kings County
CLYDE GOULD
Supervisor, Tulare County
MEL McLAUGHLIN
Councilmember, City of Wasco

Ms. Catherine Reheis
Western States Petroleum Association (WSPA):
901 Tower Way, Suite 300
Bakersfield, CA 93309-1585

Subject: Air Toxics "Hot Spots" Information and
Assessment Act (AB-2588)

Regarding: WSPA I.C. Engine Source Test Protocol
Conditional Approval

Dear Ms. Reheis:

On July 24, 1992, the District received WSPA's response to the District's July 19, 1992 letter concerning the California Air Resources Board's comments on WSPA's diesel-fired internal combustion engine pooled source test protocol. WSPA's response included a letter from ENTROPY Environmentalists, Inc. addressing all source testing concerns:

Based upon a preliminary review of WSPA's response, the District conditionally approves of the pooled source test protocol; subject to the following conditions:

1. Comparing Turbo Charged to Naturally Aspirated Diesel Engines:

Based on a preliminary review of the information WSPA submitted, the District has determined that criteria emission rates for a turbocharged versus a normally aspirated I.C. engine appear to be similar. However, please note that the District may require additional testing in the future should new or more applicable information demonstrate that criteria/toxic emission rates are not similar.

2. Method 410A Condensate Trap:

In order to determine if a condensate trap is necessary in the CARB Method 410A, the District requires WSPA to perform the first 410A run as proposed (with a knockout and rotameter). If no significant moisture is encountered, the remaining runs must be performed without the above modifications. Also, to avoid any possible contamination, the rotameter must be thoroughly cleaned prior to sampling. This cleaning must be performed with three consecutive washes with methylene chloride then followed by an acetone rinse.

3. Method 430:

Several problems were noted in the calculations for CARB Method 430. Item two of attachment two lists West Coast Analytical (WCA) average reagent blank values for formaldehyde, acetaldehyde, and acrolein. The values for formaldehyde and acetaldehyde are close to values encountered in the past. However, the blank value for acrolein, 8.3 ng/ml, is much lower than values encountered in the past. The District requires that all reagent blanks be performed as stated on page four of CARB Method 430, the section titled The Pre-Test Protocol.

The calculations performed in attachment two of the response used a Target Aldehyde Concentration (TAC) of 1 ppm. Using this value, and the reagent blank values provided by WCA, a sample volume of approximately 11 liters is calculated. To ensure that a lower detection limit can be attained in case the source concentration is lower than expected, WCA proposed to sample 26.3 liters of sample. In order to determine the TAC for a 26.3 liter sample, the District performed the required calculations and found the TAC to equal 0.5 ppm.

Please note, to attain detection limits lower than 0.5 ppm, a larger volume of gas must be sampled. (All of these calculations are based on WCA average blank values. The calculations must be performed using the reagent blank values of the DNPH solution that will be used for this testing program.)

WSPA
July 28, 1992
Page 3

Should you have any questions, please call Mr. Frank Ripepi or myself at (805) 861-3682.

Sincerely



William Weese
District Manager, Toxic Assessment

FR/ww

cc: Mike Emanuel - WSPA
Elvin Bounds - SWEPI
Mark Boese - SJVUAPCD
Steve Arita - SJVUAPCD
Ted Strauss - SJVUAPCD
John Lathrop - SJVUAPCD
Phil Juneau - Entropy
George Lew - CARB

July 24, 1992

Mr. William Weese
Manager, Toxics Assessment Division
San Joaquin Valley Unified APCD
2314 Mariposa Street, #100
Fresno, California 93715

RE: CARB Comments on WSPA Proposed Diesel-Fired IC Engine Air Toxics Pooled Source Test Protocol

Dear Mr. Weese:

Western States Petroleum Association (WSPA) is responding to the San Joaquin Valley Unified Air Pollution Control District (District) letter dated July 19, 1992 concerning WSPA's proposed protocol to conduct air toxics pooled source testing on a diesel-fired internal combustion engine. The District's letter included a copy of the California Air Resources Board's (CARB) comments on the protocol, which WSPA will respond to in this correspondence.

WSPA submitted the diesel test protocol to the District April 20, 1992. As you are aware, the District issued a letter to WSPA dated May 6, 1992 outlining deficiency items and concerns the District had with the proposed protocol. Following numerous discussions and meetings with the District, WSPA addressed the District's deficiency letter by providing the District with an addendum to the original test protocol on June 17, 1992. At that time, WSPA also requested that the District forward the protocol to CARB for its review and approval, which the District did in a letter dated June 24, 1992.

Testing a Turbocharged Diesel Engine

As outlined in our June 17 letter, WSPA attempted to access data that was available comparing toxics emissions from turbocharged versus naturally aspirated diesel engines. WSPA noted that in the absence of such data, the emissions of total hydrocarbons and/or carbon monoxide may serve as an indicator of the relative toxics from the two types. WSPA had provided engine specification data on four similar Detroit diesel engines--two with and two without turbochargers. WSPA has obtained specification information on two additional turbocharged engines, one of which is the proposed test model, and provided source test information on four naturally aspirated diesel engines (attached).

A summary sheet has been provided comparing all the diesel engines. As was the case before, the specifications and the source test information do not indicate a significant difference between emissions from naturally aspirated diesel engines and turbocharged diesel engines.

It should be noted again that one of main reasons WSPA selected the particular engine for the pooled source test is that it provided the opportunity to mimic actual field operating conditions of variably operated diesel engines and still test isokinetically.

Other Technical Issues

WSPA's consultant, Entropy Environmentalists, has addressed the other technical deficiency issues related to sampling and analysis, which is included with this correspondence.

WSPA has scheduled Entropy Environmentalists to commence testing July 27, 1992. A test schedule will be sent to the District prior to testing. As is always the case, as new information becomes available, WSPA is willing to review and discuss technical matters, such as air toxics testing. WSPA appreciates all efforts the District has put forth in expediting the protocol review process in order to meet the test plan schedule.

If you have any questions, please do not hesitate to call me or Mike Emanuel at this office, or Mr. Elvin Bounds of SWEPI at (805) 326-5988.

Sincerely,



Michael Emanuel
Environmental Representative
Upstream & San Joaquin Valley Issues

Enclosures

ME/sa

cc: Mark Boese - SJVUAPCD
Steve Arita - SJVUAPCD
Tony Wong - Entropy Environmentalists
Phil Juneau - Entropy Environmentalists
Elvin Bounds - SWEPI
Mike Wang - WSPA
Cathy Reheis - WSPA
Melinda Luthin - WSPA

ENTROPY

ENVIRONMENTALISTS, INC.

3832 BOLSA AVENUE
SUITE 105
HUNTINGTON BEACH
CALIFORNIA 92649
FAX 714/895-1915 714/373-0998

July 23, 1992

Michael Emanuel
Environmental Representative
Western States Petroleum Association
901 Tower Way, Suite 300
Bakersfield, California 93309

Post-It™ brand fax transmittal memo 7671

of pages = 4

To <i>Mike Emanuel</i>	From <i>Phil J.</i>
Co.	Co.
Dept.	Phone #
Fax #	Fax #

SUBJECT: ARB test protocol comments

EEL Reference #: 30037 IC Engine Pooled Source Test

Dear Mike:

This letter is written in response to the comments received from the California Air Resources Board on the test protocol for the IC Engine Pooled Source Testing. We have conducted pretest calibrations of the dry gas meters for the isokinetic sampling trains. Due to the difference in stack velocity between the idle and 65% load conditions, it was believed that different meterbox calibration factors would be required for the two sampling rates. This was not found to be the case. The dry gas meter calibration factors for the two flow rates were within the tolerances of Method 5.

The following are Entropy's responses to ARB's comments on the source test protocol:

1. Fuel Analysis:

ARB indicated that the fuel samples should be analyzed for both metals and chloride in addition to the other tests listed.

Response:

Attachment 1 is a revised list of the fuel sample analysis methods. In order to achieve lower detection limits, Entropy is proposing that the metals analysis be conducted using the EPA SW-846 methods listed.

4. Method 410A Moisture Removal:

ARB approved of the use of an empty Impinger to remove condensed moisture before the tedlar bag for Method 410A. They stipulated that any moisture collected in the Impinger should be analyzed for the target compounds.

Response:

The condensate will be rinsed from the knockout Impingers with deionized water and transported to Performance Analytical in 40 ml glass sample vials with zero headspace. The vial contents will be analyzed for benzene, toluene, xylene, and ethylbenzene using EPA Method SW846-8020 and for hexane by SW846-8240. A calibrated glass rotameter will be used between the Impinger and the tedlar bag. The sample volume will be determined by using the sampling time and flow rates.

SPECIALISTS IN AIR EMISSIONS TESTING

Sample Calculation:

If the 40 ml sample from the impinger is analyzed and found to contain benzene in a concentration of 0.5 $\mu\text{g/l}$ the total amount of benzene in the condensate is $0.5 \times 0.040 \text{ liters} = 0.020 \mu\text{g}$. If the bag is sampled for 45 minutes at 0.038 lpm and for 15 minutes at 0.150 lpm then the total sample volume is 3.96 liters. The portion of benzene caught in the impinger is $0.02(1000)/(3.96) = 5.05 \mu\text{g}/\text{m}^3$. If the tedar bag concentration is analyzed to be 15 $\mu\text{g}/\text{m}^3$, then the total concentration is $15.0 + 5.05 = 20 \mu\text{g}/\text{m}^3$.

5. Addition of Empty Impinger to ARB Method 425 Sample Train:

ARB will not approve of the use of an empty impinger at the front of the ARB Method 425 sample train without adequate justification. The addition of the extra impinger was suggested by Kern County.

Response:

The empty impinger will not be added to the ARB Method 425 train.

6. ARB Method 430 Sampling Rates:

ARB stipulated that the sample flow rates should be between 0.1 and 0.5 lpm. Also, the sample flow rates originally proposed were for testing at the 80% load condition.

Response:

Attachment 2 contains the pretest calculations required by ARB Method 430.

Please call me if you have any questions or comments.

Sincerely,



Phillip Juneau
Senior Project Manager

ATTACHMENT 1. Fuel Sampling and Analysis

A diesel fuel sample will be collected from the fuel storage tank during the test program. The following methods of analysis will be conducted by Core Laboratories:

<u>Parameter</u>	<u>Reference Method</u>
Cetane Index	ASTM D976
Cetane Number	ASTM D613
Distillation	ASTM D86
Flash Point	ASTM D93
Heating Value	ASTM D240
Octane, Motor	ASTM D2700
Pour Point	ASTM D97
Raid Vapor Pressure	ASTM D323
Specific Gravity	ASTM D287
Viscosity	ASTM D445
Benzene	ASTM D1017
Ethylbenzenes	ASTM D1017
Toluene	ASTM D1017
Xylenes	ASTM D1017
Propylene	ASTM D2505
Naphthalene	ASTM D2159
Carbon	Carlo Erba Instrument
Hydrogen	Carlo Erba Instrument
Nitrogen	ASTM D34269
Oxygen	Carlo Erba Instrument
Sulfur	ASTM D129-84
Chloride	ASTM D808-87
Arsenic	EPA SW-846-7061
Beryllium	EPA SW-846-7091
Cadmium	EPA SW-846-7131
Chromium	EPA SW-846-7191
Copper	EPA SW-846-7210
Lead	EPA SW-846-7421
Mercury	EPA SW-846-7471
Nickel	EPA SW-846-7521
Selenium	EPA SW-846-7741
Zinc	EPA SW-846-7950

Attachment 2. ARB Method 430 Sample Volume Calculations

1) Target Aldehyde Concentration (TAC)

According to Method 430, if there is no regulatory limit, the TAC's are:

1.25 mg HCHO/dscm
1.83 mg CH₃CHO/dscm, and
2.33 mg CH₂CHCHO/dscm.

2) Average Reagent Blank Concentration (C_{RB})

The average reagent blank values from West Coast Analytical are:

34 ng/ml formaldehyde
33 ng/ml acetaldehyde, and
8.3 ng/ml acrolein.

3) Estimated Sampling Train Field Blank (ESTFB)

ESTFB = $1.5 \times C_{RB} \times 24$
= 1224 ng formaldehyde
= 1188 ng acetaldehyde
= 299 ng acrolein

4) Planned Sample Volume (PSV)

PSV (formaldehyde) = $10 \times 1224 / 1000 \times 100 / 90 \times 1 / 1.25 = 10.9$ liters

PSV (acetaldehyde) = $10 \times 1188 / 1000 \times 100 / 90 \times 1 / 1.83 = 7.2$ liters

PSV (acrolein) = $10 \times 299 / 1000 \times 100 / 90 \times 1 / 2.33 = 1.4$ liters

5) Planned Sampling Time (PST):

The sampling will be conducted at the idle condition for 75% of the sampling period and at 65% load for 25% of the sampling period. Preliminary velocity traverses indicate that the exhaust flow rates at the two conditions are 157 scfm at idle and 630 scfm at 65% load. In order to conduct proportional sampling, the ratio of the flow rates between the 65% load and idle conditions must be 4:1. According to Method 430, the sample flow rates must be between 0.1 and 0.5 lpm. The following sampling rates are proposed:

0.125 lpm for 90 minutes at the idle condition and
0.500 lpm for 30 minutes at the 65% load condition.

This will result in a total sample volume of 28.3 liters. The volume is greater than the PSV in order to achieve a lower detection limit in case the test results are lower than expected.

Summary of Emission Rates of Turbocharged and Naturally Aspirated IC Diesel Engine

Turbo?	Spec Yes 208	Spec Yes 280	Spec Yes 287	Spec Yes 335	Spec No 180	Spec No 240	Chev No 350	Unocal No 350	SWEPI No 550	SWEPI No 850
HC lb/hr	0.17	0.24	0.07	0.16	0.16	0.21	0.20	0.08	0.21	0.03
CO lb/hr	0.13	0.19	0.95	0.43	2.43	2.62	n/a	3.45	n/a	0.55
NOx lb/hr	9.35	8.44	7.28	9.38	5.67	8.60	n/a	n/a	n/a	n/a

ENGINE SPECIFICATION DATA

General Data

Model	7063-7301
Number of Cylinders	6
Bore and Stroke (mm)	4.25x5.30(108x127)
Displacement (in ³ (L))	426(19.9)
Compression Ratio	17:1
Piston Speed (ft/min (m/min))	1750(533)
Valves Per Cylinder	4
Exhaust	NOT APPLICABLE
Combustion System	DIRECT INJECTION
Engine Type	63.5° VEE - 2 CYCLE
Aspiration	TURBOCHARGED

Configuration

Turbocharger	TV7522(1.08 A/R)
Charge Air Cooling System	NONE
Blower Type	BYPASS
Blower Drive Ratio	1.95:1
Low Idle Speed (rpm)	550
High Idle Speed (rpm)	2000
Thrust Bearing Load Limit	Continuous-1000 (2570)
Intermittent-1000 (2570)	1800(4000)
Engine Crankcase Vent System	OPEN
Maximum Pressure in H ₂ O (kPa)	2.0(0.30)

Physical Data

Size	
Length (mm)	39.9(15.7)
Width (mm)	40.2(15.8)
Height (mm)	33.0(13.0)
Weight, dry (kg)	2080(458)
Center of Gravity Distance	
From S.E.C. (x axis) (mm)	NOT AVAILABLE
Above Crankshaft (y axis) (mm)	NOT AVAILABLE
Right of Crankshaft (z axis) (mm)	NOT AVAILABLE
Installation Drawing	5101003
Maximum Allowable Static Bending Moment	
at Rear Face of Flywheel (ft-lb (N-m))	0

Fuel System

Fuel Injector/Timing	7N65/1.484
Fuel Injection Pump/Timing	NOT APPLICABLE
Fuel Consumption - g/kWh (hp)	78.2(33.5)
Fuel Consumption - g/kWh (hp)	11.2(47.3)
Fuel Spray Pattern (deg)	503.3(226.3)
Fuel Spray Pattern (deg)	72.0(272.5)
Total Fuel Flow (g/min (lb/min))	181.5(263.8)
Total Fuel Flow (g/min (lb/min))	33.2(13.4)
Maximum Allowable Fuel Pump Output	
at 1800 rpm (g/min (lb/min))	5100
at 2000 rpm (g/min (lb/min))	12141
Fuel Filter micron size	
Primary - micron	30
Secondary - micron	10

Application System

Oil Pressure	
Rated Speed (ft/min (m/min))	60(414)
Low Idle (ft/min (m/min))	5(34)
at 1800 rpm Temperature (°F (°C))	200-250(93-121)
Oil Flow (g/min (lb/min))	34(129)
Oil Pan Capacity	
High (qt (L))	20.0(18.9)
Low (qt (L))	16.0(15.1)
Total Engine Oil Capacity with	
Filters (qt (L))	32.0(20.8)
Bypass Oil Filter Gratic (in (mm))	0.101(2.57)
Engine Angularity Limits	
Front down - degrees	23
Front down - degrees	24
Side tilt - degrees	NOT AVAILABLE

Exhaust Data

Exhaust	
Exhaust	50
Exhaust	75
Exhaust	4240
Exhaust	360
Rated Speed - Bosch Number	NOT AVAILABLE
Peak Torque Speed - Bosch Number	NOT AVAILABLE
Voices - dB(A) @ 1m	NOT AVAILABLE
Communication Approval	NOT APPLICABLE

Cooling System

Engine Heat Rejection (Btu/min (kW))	6700(117.8)
Engine Radiator Heat (Btu/min (kW))	1030(18.1)
Coolant Flow (gal/min (L/min))	94(356)
Thermostat	
Start to Open (°F (°C))	173(78)
Fully Open (°F (°C))	186(86)
Maximum Water Pump Inlet	
Restriction (in H ₂ O (kPa))	3.0(10.2)
Engine Coolant Capacity (qt (L))	28(26.3)
Minimum Pressure Cap (lb/in ² (kPa))	9.0(62.1)
Maximum Coolant Pressure (Exclusive of Pressure Cap) (lb/in ² (kPa))	NOT AVAILABLE
Maximum Top Tank Temperature (°F (°C))	210(99)
Minimum Top Tank Temperature (°F (°C))	160(71)
Minimum Coolant Fill Rate	
gal/min (L/min)	3.0(11.4)
Cooling Index	
Minimum Air to Boil (°F (°C))	NOT APPLICABLE
Maximum Air to Water Out (°F (°C))	100(55.6)
Ram Air Flow - Mile/HP (km/hp)	NOT APPLICABLE
Coolant Type (°F (min) (°C))	6.6(0.017)
Grassman - Minimum Requirement for 105	
of Cooling System Capacity (whichever is Larger) (°F (°C))	4.0(13.8)

Air System

Maximum Allowed Temperature Rise	
(Ambient Air to Engine Inlet) (°F (°C))	30(16.7)
Air Intake Restriction Maximum Limit	
at 1800 rpm (in H ₂ O (kPa))	20(3.0)
Clean Air Cleaning H ₂ O (kg/m ³)	12(3.0)
Engine Air Flow - ft ³ /min (m ³ /min)	760(21.5)
Engine Air Box/Manifold Pressure	
in Hg (kPa)	33.7(113.8)
Recommended Intake Pipe Dia. (in (mm))	6.0(152)

Exhaust System

Exhaust Flow (ft ³ /min (m ³ /min))	1530(43)
Exhaust Temperature (°F (°C))	620(327)
Maximum Allowable Back	
Pressure (in Hg (kPa))	1.7(5.7)
Recommended Exhaust Pipe Dia.	
Single (in (mm))	5.0(127)
Double (in (mm))	NOT APPLICABLE
Exhaust Brake Max. Allowable Back	
Pressure (in Hg (kPa))	NOT APPLICABLE

Electrical System

Recommended Battery Capacity (CCA) @ 0°F	
12 Volt System	
Above 32°F (0°C) - A	950
Below 32°F (0°C) - A	1250
24 Volt System	
Above 32°F (0°C) - A	475
Below 32°F (0°C) - A	625
Maximum Allowable Resistance at	
Starting Circuit	
12 volt system - ohm	0.0012
24 volt system - ohm	0.002

Performance Data

Power Output (hp (kW))	208(155)
Full Load Speed (rpm)	1800
Peak Torque (ft-lb (N-m))	629(929)
Peak Torque Speed (rpm)	1000
BMEP (lb/in ² (kPa))	107.7(743)
Friction Power	
Rated Speed (hp (kW))	52(39)
Peak Torque Speed (hp (kW))	21(16)
Artificial Capability (ft-lb (N-m))	10000(3050)
Torque Available at 600 /min	
12 ft (N-m)	615(834)

Engine

Speed rpm	Power BHP (kW)	Torque ft-lb (N-m)	Eff %
1000	100(73)	100(134)	33(228)
1500	150(109)	150(186)	37(227)
1800	180(131)	180(189)	37(227)
2000	200(146)	200(192)	38(233)
2200	220(161)	220(199)	39(241)

All values at rated speed and power and with standard engine hardware unless otherwise noted.

ENGINE SPECIFICATION DATA

GENERAL DATA

Model.....	7083-7301
Number of Cylinders.....	8
Bore and Stroke-in(mm).....	4.25x5.00(1.67x1.97)
Displacement-in ³ (L).....	568(9.3)
Compression Ratio.....	17:1
Piston Speed-ft/min(m/min).....	1750(533)
Valves Per Cylinder	
Intake.....	NOT APPLICABLE
Exhaust.....	NOT APPLICABLE
Combustion System.....	4
Engine Type.....	DIRECT INJECTION
Aspiration.....	63.5° VEE - 2 CYCLE
Configuration	TURBOCHARGED
Turbocharger.....	TVR301(1.23 A/R)
Charge Air Cooling System.....	NOT APPLICABLE
Blower Type.....	BY-PASS
Blower Drive Ratio.....	1.93:1
Low Idle Speed-r/min.....	530
High Idle Speed-r/min.....	2500
Thrust Bearing Load Limit	
Continuous-lbf(N).....	630(257C)
Intermittent-lbf(N).....	1800(8000)
Engine Crankcase Vent System.....	OPEN
Maximum Pressure-in H ₂ O(kPa).....	1.9(C.47)

Physical Data

Size	
Length-in(mm).....	50.3(1279)
Width-in(mm).....	39.6(1006)
Height-in(mm).....	33.2(1352)
Weight-dry-lb(kg).....	2495(1132)
Center of Gravity Distance	
From R.F.O.B. (z axis)-in(mm).....	12.1(307.8)
Above Crankshaft (y axis)-in(mm).....	7.46(189.3)
Right of Crankshaft (z axis)-in(mm).....	1.31(33.3)
Installation Drawing.....	NOT AVAILABLE
Maximum Allowable Static Bending Moment of Rear Face of FN Hsg-lbf ft(N m).....	3

Fuel System

Fuel Injector/Timing.....	N60/1.460
Fuel Injection Pump/Timing.....	NOT APPLICABLE
Fuel Consumption-lb/hr(kg/hr).....	105.6(47.9)
Fuel Consumption-gal/hr(L/hr).....	15.1(57.2)
Fuel Spill Rate-lb/hr(kg/hr).....	503.3(229.3)
Fuel Spill Rate-gal/hr(L/hr).....	72.0(272.5)
Total Fuel Flow-lb/hr(kg/hr).....	608.9(276.2)
Total Fuel Flow-gal/hr(L/hr).....	87.1(329.7)
Maximum Allowable Fuel Pump Suction	
Clean System-in Hg(kPa).....	5(20)
Dirty System-in Hg(kPa).....	12(4.1)
Fuel Filter Micron Size	
Primary - Micron.....	30
Secondary - Micron.....	10

Lubrication System

Oil Pressure	
Rated Speed-lbf/in ² (kPa).....	60(414)
Low Idle-lbf/in ² (kPa).....	5(34)
In Pan Oil Temperature-°F(°C).....	200-250(93-121)
Oil Flow-gal/min(L/min).....	37(140)
Oil Pan Capacity	
High-qt(L).....	24.5(92.7)
Low-qt(L).....	18.5(70.0)
Total Engine Oil Capacity with Filters-qt(L).....	26.9(100.3)
Bypass Oil Filter Orifice-in(mm).....	0.101(2.57)
Engine Angularity Limits	
Front up - degrees.....	19
Front down - degrees.....	19
Side tilt - degrees.....	NOT AVAILABLE

Emission Data

CO-gm/hr.....	110
HC-gm/hr.....	85
NO _x -gm/hr.....	3050
SO ₂ -gm/hr.....	480
Smoke	
Rated Speed - Bosch Number.....	NOT AVAILABLE
Peak Torque Speed - Bosch Number.....	NOT AVAILABLE
Noise - dBA @ 1 m.....	NOT AVAILABLE
Certification Approval.....	NOT APPLICABLE

Cooling System

Engine Heat Rejection-Btu/min(kW).....	9000(158.3)
Engine Radiated Heat-Btu/min(kW).....	1370(24.4)
Coolant Flow-gal/min(L/min).....	130(492)
Thermostat	
Start to Open-°F(°C).....	173(78)
Fully Open-°F(°C).....	186(86)
Maximum Water Pump Inlet Restriction-in Hg(kPa).....	3.0(10.2)
Engine Coolant Capacity-qt(L).....	31(29.3)
Minimum Pressure Cap-lbf/in ² (kPa).....	9.0(62.1)
Maximum Coolant Pressure (Exclusive of Pressure Cap)-lbf/in ² (kPa).....	NOT AVAILABLE
Maximum Top Tank Temperature-°F(°C).....	210(99)
Minimum Top Tank Temperature-°F(°C).....	180(71)
Minimum Coolant Fill Rate-gal/min(L/min).....	3.0(11.4)
Cooling Index	
Minimum Air to Cool-°F(°C).....	NOT APPLICABLE
Maximum Air to Water Diff.-°F(°C).....	100(35.6)
Ram Air Flow - mile/hr(km/hr).....	NOT APPLICABLE
Operation-Air Injection	
Capacity-ft ³ /min(m ³ /min).....	0.8(0.023)
Drawdown - Minimum Requirement (or 10% of Cooling System Capacity-whichever is Larger)-qt(L).....	4.0(3.8)

Air System

Maximum Allowable Temperature Rise (Ambient Air to Engine Inlet)-°F(°C).....	30(16.7)
Air Intake Restriction Maximum Limit	
Dirty Air Cleaner-in H ₂ O(kPa).....	20(5.0)
Clean Air Cleaner-in H ₂ O(kPa).....	12(3.0)
Engine Air Flow - ft ³ /min(m ³ /min).....	1030(29.2)
Engine Air Box/Manifold Pressure-in Hg(kPa).....	41.0(138.3)
Recommended Intake Pipe Dia.-in(mm).....	6.0(152)

Exhaust System

Exhaust Flow-ft ³ /min(m ³ /min).....	2110(59.8)
Exhaust Temperature-°F(°C).....	640(338)
Maximum Allowable Back Pressure-in Hg(kPa).....	7.5(8.4)
Recommended Exhaust Pipe Dia.	
Single-in(mm).....	6.3(152)
Dual-in(mm).....	NOT APPLICABLE
Exhaust Brake Max. Allowable Back Pressure-in Hg(kPa).....	NOT APPLICABLE

Electrical System

Recommended Battery Capacity(CCA @ 0°F)	
12 Volt System	
Above 32°F(0°C)-A.....	1900
Below 32°F(0°C)-A.....	2500
24 Volt System	
Above 32°F(0°C)-A.....	950
Below 32°F(0°C)-A.....	1250
Maximum Allowable Resistance of Starting Circuit	
12 volt system - ohm.....	0.0012
24 volt system - ohm.....	0.002

Performance Data

Power Output-shp(kW).....	280(209)
Full Load Speed-r/min.....	2100
Peak Torque-lb ft(N m).....	861(1167)
Peak Torque Speed-r/min.....	1000
BMEP-lbf/in ² (kPa).....	93.0(641)
Friction Power	
Rated Speed-bhp(kW).....	83(63)
Peak Torque Speed-bhp(kW).....	23(19)
Altitude Capability-ft(m).....	18000(4882)
Torque Available at 600 r/min-lb ft (N m).....	700(949)

Engine

Speed r/min	Power bhp(kW)	Torque lb ft(N m)	BSPC lb/bhp hr (g/kW hr)
2100	280(209)	700 (949)	.377(229)
2000	274(204)	720 (976)	.372(225)
1800	264(197)	770(1044)	.359(218)
1600	245(183)	804(1090)	.356(217)
1400	222(166)	831(1127)	.357(217)
1200	195(145)	853(1156)	.361(220)
1000	164(122)	861(1167)	.370(225)

All values at rated speed and power and with standard engine hardware unless otherwise noted.

Curve No. 24-7083-32-33
Date: 6-17-84
Rev./Date:
SHV. 2 of 2

Cummins Engine Company, Inc.
Box 9008
Columbus, Indiana
47202-9008



FACSIMILE TRANSMISSION FORM

To: GARY NOEL
HALLIBURTON WELL DRILLING SERVICES
FAX No. 405-251-2398 Office No. _____
cc: MR. BILL SHAVERS - CUMMINS SO. PLAINS (405) 255-7967
FROM: P. E. JOHNSON Office No. 812-377-7476
MAIL CODE: 50179 FAX No. 812-377-7226
TOTAL PAGES TRANSFERRED 3 (INCLUDING THIS ONE)
Message: _____ Date: MAY 1, 1991

CPL 463 Emissions

This letter is in response to your request for steady-state exhaust emissions data for Cummins' NTA engine configuration D092331CX02, CPL 463 rated at 335 hp at 2100 rpm. Cummins is trying to provide a systematic method and format for the presentation of emissions data to regulating agencies around the country. In an effort to make the process most effective, we would request that this information not be passed along to a third party other than the regulatory agency requesting the information.

It is necessary to provide some explanation along with the data for clarification. As you may be aware, the EPA has not specified a certified test procedure for the documentation of the exhaust emissions from industrial engines. It is possible to have the exhaust emissions from the same engine appear differently depending on the way the data is being reported. For example, the composite averages from the 13 mode test procedure will yield one value because the test procedure calculates the weighted averages of the engine emissions over a specific duty cycle. A reporting of mode 8, which is rated speed and load, from the 13 mode cycle will typically show a difference in emissions from the composite averages. If a typical duty cycle can be defined for an application the exhaust emissions can be estimated more accurately and the quality of the information being reported can be improved.

The data shown below are derived from results or reasonable engineering approximations of engine performance based on tests conducted according to the test procedure defined by the Environmental Protection Agency as found in 40 CFR, Chapter 1, Part

May 1, 1991

86, Subpart D. This test method is the "13 Mode Test Procedure" used by the EPA for on-highway engine certification between 1974 and 1985. However, testing of non-automotive engines performed by Cummins was for the purpose of performance documentation and not for EPA certification. As a result, not all of the EPA test and data recording requirements were followed. These slight procedural differences should not effect the accuracy of the emissions data.

The emissions data reported below are not for the particular engine in question but are from a single engine built to the specification of the model indicated. Both production and measurement variability can result in variations between engines built to the same specifications.

The following data is from mode 8, rated speed and load, and mode 6, torque peak speed and load, of the 13 mode emission test.

Units for NOX, HC, CO: gm/bhp-hr
Other units as noted

Engine Model	HP/SPD (rpm)	Exhaust Flow (lbs/hr)	Exhaust Stack Temp (deg F)	ROD (HC)	NOX	CO	BSFC (lb/hp-hr)
NTA	335/2100	4090	900	.22	12.70	.58	.380
	287/1500	2450	1040	.11	11.50	1.90	.353

The sulfur dioxide emission from the engine is dependent on the sulfur content of the fuel being used. Since the molecular weight of sulfur dioxide is twice the molecular weight of sulfur, the product must be doubled in the equation. The sulfur emission can be estimated, assuming 90 percent of the sulfur in the fuel is converted to sulfur dioxide, by the following formula.

$$BSSO_2 = 2 * S * BSFC * 453.59 * .90$$

BSSO₂ = brake specific sulfur dioxide emission in units of gr/hp-hr

S = percentage sulfur content of the fuel

BSFC = brake specific fuel consumption in units of lb/hp-hr

453.59 = the units conversion of pounds to grams

.90 = the conversion rate of the sulfur

Example: What is the SO₂ emission from a 435 hp engine that is consuming 21 gallons of fuel per hour using a fuel with a .5% sulfur content?

Mr. Greg Noel

-3-

May 1, 1991

$$\begin{aligned} \text{BSFC} &= (20.4 \text{ gal/hr}) * (7.1 \text{ lb/gal}) / 435 \text{ hp} = .333 \text{ lb/hp-hr} \\ \text{BSSO}_2 &= 2 * (.005 \text{ lbs sulfur/lb fuel}) * .333 \text{ lb/hp-hr} * 433.89 \\ &\quad \text{gr/lb} * .9 = \\ \text{BSSO}_2 &= 1.36 \text{ gr/hp-hr} \end{aligned}$$

The total weight of sulfur dioxides emitted would be equal to the brake specific sulfur dioxide emissions times the engine horsepower output.

$$\text{SO}_2 \text{ (gr/hr)} = 1.36 \text{ gr/hp-hr} * 435 \text{ hp} = 591.3 \text{ gr/hr}$$

Cummins does not have any data on the particulate emissions from industrial engines. However, an estimated value of .5 gr/hp-hr is a reasonable engineering estimate.

I hope this information helps answer some of your questions, but if you need any further assistance please feel free to contact me.

Sincerely,

Paul E. Johnson

Manager - N14 Industrial
Product Development

cc: H. E. Schisler - 50179
T. P. Mayer - 50179
D. P. Quigley - 50179
D. W. Brown - 60602
M. S. Brand - 60702

WP12J91-4

General Data

Model.....	7003-7000
Number of Cylinders.....	8
Bore and Stroke (in)(mm).....	4.23x5.00(108x127)
Displacement-in ³ (L).....	588(9.3)
Compression Ratio.....	18.7:1
Piston Speed-ft/min(m/min).....	1500(457)
Valves Per Cylinder.....	4
Intake.....	NOT APPLICABLE
Exhaust.....	4
Combustion System.....	DIRECT INJECTION
Engine Type.....	55.3° VEE - 2 CYCLE
Aspiration.....	NATURAL

Construction

Turbocharger.....	NOT APPLICABLE
Charge Air Cooling System.....	NONE
Blower Type.....	STANDARD
Blower Drive Ratio.....	2.05:1
Low Idle Speed-r/min.....	550
High Idle Speed-r/min.....	1950
Thrust Bearing Load Limit	
Continuous-lbf(N).....	600(2670)
Intermittent-lbf(N).....	1800(8000)
Engine Crankcase Vent System.....	OPEN
Maximum Pressure-in H ₂ O(kPa).....	1.9(0.47)

Physical Data

Size	
Length-in(mm).....	47.9(1207)
Width-in(mm).....	39.0(991)
Height-in(mm).....	47.8(1213)
Weight, dry-lb(kg).....	2310(1046)
Center of Gravity Distance	
From R.F.O.B. (x axis)-in(mm).....	12.4(315)
Above Crankshaft (y axis)-in(mm).....	6.4(163)
Right of Crankshaft (z axis)-in(mm).....	1.47(37.3)
Installation Drawing.....	3122160
Maximum Allowable Static Bending Moment	
at Rear Face of Fly Wheel-lbf ft(N m).....	0

Fuel System

Fuel Injector/Timing.....	M59/1.460
Fuel Injection Pump/Timing.....	NOT APPLICABLE
Fuel Consumption-lb/hr(kg/hr).....	30.3(41.3)
Fuel Consumption-gal/hr(L/hr).....	12.9(48.9)
Fuel Spill Rate-lb/hr(kg/hr).....	303.3(228.3)
Fuel Spill Rate-gal/hr(L/hr).....	72(272.5)
Total Fuel Flow-lb/hr(kg/hr).....	393.6(269.3)
Total Fuel Flow-gal/hr(L/hr).....	84.9(321.3)
Maximum Allowable Fuel Pump Suction	
Clean System-in Hg(kPa).....	6(20)
Dirty System-in Hg(kPa).....	12(41)
Fuel Filter Micron Size	
Primary - Micron.....	30
Secondary - Micron.....	10

Lubrication System

Oil Pressure	
Rated Speed-lbf/in ² (kPa).....	50(4.4)
Low Idle-lbf/in ² (kPa).....	5(34)
in Pan Oil Temperature-°F(°C).....	200-235(93-113)
Oil Flow-gal/min(L/min).....	34(129)
Oil Pan Capacity	
High-qt(L).....	23(21.8)
Low-qt(L).....	17.0(16.1)
Total Engine Oil Capacity with	
Filters-qt(L).....	25(23.7)
Bypass Oil Filter Orifice-in(mm).....	0.10(12.57)
Engine Angularity Limits	
Front up - degrees.....	15
Front down - degrees.....	18
Side tilt - degrees.....	NOT AVAILABLE

Emission Data

CO-gm/hr.....	1190
HC-gm/hr.....	96
NO _x -gm/hr.....	3900
SO _x -gm/hr.....	410
Smoke	
Rated Speed - Bosch Number.....	0.5
Peak Torque Speed - Bosch Number.....	1.0
Noise - dBA @ 1 m.....	58.4
Certification Approval.....	NOT APPLICABLE

Cooling System

Engine Heat Rejection-Btu/min(kW).....	6840(120.3)
Engine Radiator Heat-Btu/min(kW).....	1440(25.3)
Coolant Flow-gal/min(L/min).....	112(426)
Thermostat	
Start to Open-°F(°C).....	170(77)
Fully Open-°F(°C).....	187(66)
Maximum Water Pump Inlet	
Restriction-in Hg(kPa).....	2.0(4.7)
Engine Coolant Capacity-qt(L).....	31(29.3)
Minimum Pressure Cap-lbf/in ² (kPa).....	9.0(62.1)
Maximum Coolant Pressure, (Exclusive	
of Pressure Cap)-lbf/in ² (kPa).....	20(138)
Maximum Top Tank Temperature-°F(°C).....	210(99)
Minimum Top Tank Temperature-°F(°C).....	160(71)
Minimum Coolant Fill Rate-	
gal/min(L/min).....	3.0(11.4)
Cooling Index	
Minimum Air to Belt-°F(°C).....	117(47.2)
Minimum Air to Water Diff.-°F(°C).....	93(32.8)
Ram Air Flow - Mile/hr(km/hr).....	NOT APPLICABLE
Deaeration-Air Injection	
Capacity-ft ³ /min(m ³ /min).....	0.8(0.023)
Overhead - Minimum Requirement (or 10%	
of Cooling System Capacity-which ever	
is Larger-qt(L).....	4.0(3.8)

Air System

Maximum Allowable Temperature Rise	
(Ambient Air to Engine Inlet)-°F(°C).....	30(16.7)
Air Intake Restriction Maximum Limit	
Dirty Air Cleaner-in H ₂ O(kPa).....	25.0(6.2)
Clean Air Cleaner-in H ₂ O(kPa).....	13.4(3.3)
Engine Air Flow - ft ³ /min(m ³ /min).....	780(21.3)
Engine Air Box/Manifold Pressure-	
in Hg(kPa).....	6.6(20.3)
Recommended Intake Pipe Dia.-in(mm).....	3.0(127)

Exhaust System

Exhaust Flow-ft ³ /min(m ³ /min).....	1730(49.0)
Exhaust Temperature-°F(°C).....	770(410)
Maximum Allowable Back	
Pressure-in Hg(kPa).....	3.3(11.2)
Recommended Exhaust Pipe Dia.	
Single-in(mm).....	5.0(127)
Dual-in(mm).....	3.3(89)
Exhaust Brakes Max. Allowable Back	
Pressure-in Hg(kPa).....	NOT APPLICABLE

Electrical System

Recommended Battery Capacity(CCA @ 0°F)	
12 Volt System	
Above 32°F(0°C)-A.....	1900
Below 32°F(0°C)-A.....	2500
24 Volt System	
Above 32°F(0°C)-A.....	950
Below 32°F(0°C)-A.....	1250
Maximum Allowable Resistance @:	
Starting Circuit	
12 volt system - ohm.....	0.0012
24 volt system - ohm.....	0.002

Performance Data

Power Output-shp(kW).....	240(179)
Full Load Speed-r/min.....	1800
Peak Torque-lb ft(N m).....	740(1003)
Peak Torque Speed-r/min.....	1200
BMEP-lbf/in ² (kPa).....	93.3(643)
Friction Power	
Rated Speed-shp(kW).....	60(43)
Peak Torque Speed-shp(kW).....	31(23)
Altitude Capability-ft(m).....	18000(4880)
Torque Available at 800 r/min-	
lb ft (N m).....	720(974)

Engine

Engine Speed r/min	Power shp(kW)	Torque lb ft(N m)	BSPC lb/dhp hr (g/kW hr)
1800	240(179)	702 (952)	.375(220)
1600	220(164)	722 (979)	.376(229)
1400	196(147)	737 (999)	.380(231)
1200	169(126)	740(1003)	.389(237)
1000	140(103)	737 (999)	.401(244)

All values at rated speed and power and with standard engine hardware unless otherwise noted.

Curve No. E4-7C83-52-33
Date: 4-11-83
Rev./Date:
Shp. 2 of 2

TABLE 4-18
TOTAL HYDROCARBON EMISSION TEST RESULTS

Site No: 3

Source Owner: Chevron U.S.A., Inc.

Unit Type: 350 HP Water Injection Engine

Fuel Type: Diesel

Heat Input, MMBtu/hr: 1.72

Fuel F factor, dscf/MMBtu @ 0% O₂: 8,915

Test No.	15A-HC	15B-HC	15C-HC	Average
Date	4/12/90	4/12/90	4/12/90	
Exhaust gas flow, dscfm	743	743	743	743
Exhaust gas temp., °F	580	580	580	580
O ₂ , %	14.0	13.4	13.7	13.7
CO ₂ , %	5.0	5.3	5.0	5.1
Hydrocarbons, as CH ₄				
ppm	116	103	102	107
lb/hr	0.22	0.19	0.19	0.20
lb/MMBtu	0.132	0.108	0.111	0.117

Emissions of Air Toxic Species:

Test Conducted Under AB2588

for the Western States Petroleum Association

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CR 72600-2061

CARNOT, May 1990

CARNOT
Hydrocarbon Emissions

Site No:	3
Source Owner:	Chevron
Reference Temp (F)	60
HHV, Btu/lb	19500
Fuel F Factor, dscf/MMbtu	8915
Crude Oil Flowrate (gal/min)	0.21
Heat Input, MMbtu/hr	1.72
Exhaust Gas Flowrate (dscfm)	7.43E+02
	measured

Test No.	15A-HC
O2 %	14
ppm CH4	116
lb/hr	0.22
lb/MMbtu	1.32E-01

Test No.	15B-HC
O2 %	13.4
ppm CH4	103
lb/hr	0.19
lb/MMbtu	1.08E-01

Test No.	15C-HC
O2 %	13.7
ppm CH4	102
lb/hr	0.19
lb/MMbtu	1.11E-01

Average	
ppm	107.00
lb/hr	0.201
lb/MMbtu	1.17E-01

Emissions of Air Toxic Species:
Test Conducted Under AB2588
for the Western States Petroleum Association

CARNOT, May 1990

TABLE 1-3a

**Organic Compound Emission Rates
Diesel Workover Rig: 350-hp IC Engine**

Compound	Emission Data	Weight Fraction of THC
Total Hydrocarbons ^a (ppmv) (lb/MMBtu)	67.8 1.15E-01	1.0000
Benzene (ppmv) (lb/MMBtu)	0.147 1.33E-03	0.0115
Toluene (ppmv) (lb/MMBtu)	0.050 5.56E-04	0.0048
Xylenes (ppmv) (lb/MMBtu)	0.021 2.58E-04	0.0022
Propylene (ppmv) (lb/MMBtu)	0.793 3.86E-03	0.0335
PAH ^b (ppmv) (lb/MMBtu)	0.0108 1.61E-04	0.0014
Formaldehyde (ppmv) (lb/MMBtu)	0.284 9.87E-04	0.0086
Acetaldehyde (ppmv) (lb/MMBtu)	0.091 4.64E-04	0.0040
Acrolein (ppmv) (lb/MMBtu)	0.020 1.32E-04	0.0011
^a Reported as methane. ^b Reported as naphthalene.		

Western States Petroleum Association
Pooled Source Emission Test Report:
Oil and Gas Production Sources,
Fresno and Ventura Counties, California

ENSR, December 1990

TABLE 1-3b
**Fuel Analysis Results
Diesel Workover Rig**

HHV, Btu/gal	141,800
API Gravity at 60° F	31.7
Specific Gravity at 60° F	0.867
F-factor, dscf/MMBtu	9,194
Carbon (wt. %)	86.71
Hydrogen (wt. %)	13.12
Oxygen (wt. %)	<0.1
Nitrogen (wt. %)	0.17
Sulfur (wt. %)	0.004
Ash (wt. %)	<0.01
<u>Inorganics Results</u>	
Arsenic (mg/kg)	<0.3
Beryllium (mg/kg)	<0.5
Bromide (mg/kg)	<2.0
Cadmium (mg/kg)	<0.3
Chloride (mg/kg)	<2.0
Chromium, total (mg/kg)	<0.5
Copper (mg/kg)	0.1
Lead (mg/kg)	<3.0
Manganese (mg/kg)	<1.0
Mercury (mg/kg)	<0.02
Nickel (mg/kg)	<3.0
Selenium (mg/kg)	<0.3
Phosphorus (mg/kg)	<30
Zinc (mg/kg)	1.9

Western States Petroleum Association
Pooled Source Emission Test Report:
Oil and Gas Production Sources,
Fresno and Ventura Counties, California

ENSR, December 1990

SPA - VOC RESULTS
CARB METHOD 410A
DIESEL WORKOVER RIG

DATE	SEPT.14	SEPT.14	SEPT.14				
	1990	1990	1990				
TEST	RUN A	RUN B	RUN C	AVERAGE	AVERAGE	AVERAGE	WT FRACTI

SPECIES	MW	(ppbv)	(ppbv)	(ppbv)	(lb/Mgal)	(lb/MMBtu)	
HC	44			22600	16.3453902	1.15E-01	1
BENZENE	78	130	160	147	0.18804431	1.33E-03	0.011504
TOLUENE	96	50	49	50	0.07889971	5.56E-04	0.004827
XYLENES	106	26	11	21	0.03658974	2.58E-04	0.002238
PROPYLENE	42	680	840	793	0.54769549	3.86E-03	0.033507

VE GAL/HR= 5

CARB METHOD 410A
DIESEL DRILLING RIG

DATE	SEPT.18	SEPT.18	SEPT.18				
	1990	1990	1990				
TEST	RUN A	RUN B	RUN C	AVERAGE	AVERAGE	AVERAGE	

SPECIES	MW	(ppbv)	(ppbv)	(ppbv)	(lb/Mgal)	(lb/MMBtu)	
HC	44			11500	3.24686354	2.35E-02	1
BENZENE	78	220	210	214	0.10727483	7.76E-04	0.033039
TOLUENE	96	62	63	63	0.03880836	2.81E-04	0.011952
XYLENES	106	40	38	39	0.02675347	1.93E-04	0.008239
PROPYLENE	42	1300	1500	1433	0.38628692	2.79E-03	0.118972

VE GAL/HR=

CARB METHOD 410A
CRUDE FIRED STEAM GENERATOR

DATE	SEPT.20	SEPT.20	SEPT.20				
	1990	1990	1990				
TEST	RUN A	RUN B	RUN C	AVERAGE	AVERAGE	AVERAGE based on F-factor	WT FRAC

SPECIES	MW	(ppbv)	(ppbv)	(ppbv)	(lb/Mgal)	(lb/MMBtu)	
HC	16			1200	0.08904	5.67E-04	1
BENZENE	78	3	3	3	0.00096	6.14E-06	0.010833
TOLUENE	96	5	5	5	0.00223	5.56E-05	0.025
XYLENES	106	10 *	10 *	10 *	0.00492	*1.23E-04	*0.055208
PROPYLENE	42	10 *	10 *	10 *	0.00195	*4.87E-05	*0.021875

E GAL/HR= 1048

COMPOUND NOT DETECTED. VALUES ARE BASED
ON THE DETECTION LIMITS OF THE ANALYTICAL METHOD

Western States Petroleum Association
 Pooled Source Emission Test Report:
 Oil and Gas Production Sources,
 Fresno and Ventura Counties, California
 ENSR, December 1990
 Appendix D

TABLE 4-25
TOTAL HYDROCARBON EMISSION TEST RESULTS

Site No: 10

Source Owner: SWEPI

Unit Type: 550 HP Drilling Rig Engine

Fuel Type: Diesel

Heat Input, MMBtu/hr: 0.19

Fuel F factor, dscf/MMBtu @ 0% O₂: 8,902

Test No.	23A-HC	23B-HC	23C-HC	Average
Date	4/25/90	4/25/90	4/25/90	
Exhaust gas flow, dscfm	154	163	163	160
O ₂ , %	17.0	17.2	17.2	17.1
CO ₂ , %	2.1	1.8	1.8	1.9
Hydrocarbons, as CH ₄				
ppm	444	510	579	511
lb/hr	0.17	0.21	0.24	0.207
lb/MMBtu	0.893	1.08	1.23	1.07

Emissions of Air Toxic Species:
Test Conducted Under AB2588
for the Western States Petroleum Association

CARNOT, May 1990

**CARNOT
Hydrocarbon Emissions**

Site No:	10
Source Owner:	SWEPI
Reference Temp (F)	60
HHV, Btu/lb	19500
Fuel F Factor, dscf/MMbtu	8902
Diesel Flowrate (gal/min)	0.023
Heat Input, MMbtu/hr	0.19
Exhaust Gas Flowrate (dscfm)	2.88E+01 at 0% O ₂

Test No.	23A-HC
O ₂ %	17
ppm CH ₄	444
lb/hr	0.17
lb/MMbtu	8.93E-01

Test No.	23B-HC
O ₂ %	17.2
ppm CH ₄	510
lb/hr	0.21
lb/MMbtu	1.08E+00

Test No.	23C-HC
O ₂ %	17.2
ppm CH ₄	579
lb/hr	0.24
lb/MMbtu	1.23E+00

Average	
ppm	511.00
lb/hr	0.207
lb/MMbtu	1.07E+00

Emissions of Air Toxic Species:
Test Conducted Under AB2588
for the Western States Petroleum Association

CARNOT, May 1990

Appendix C.9.10

TABLE 1-4a

**Organic Compound Emission Rates
Diesel Drilling Rig: 850-hp IC Engine**

Compound		Emission Data	Weight Fraction of THC
Total Hydrocarbons ^a	(ppmv) (lb/MMBtu)	34.5 2.35E-02	1.0000
Benzene	(ppmv) (lb/MMBtu)	0.214 7.76E-04	0.0330
Toluene	(ppmv) (lb/MMBtu)	0.063 2.81E-04	0.0120
Xylenes	(ppmv) (lb/MMBtu)	0.039 1.93E-04	0.0082
Propylene	(ppmv) (lb/MMBtu)	1.433 2.79E-03	0.1190
PAH ^b	(ppmv) (lb/MMBtu)	0.0356 2.12E-04	0.0090
Formaldehyde	(ppmv) (lb/MMBtu)	0.057 7.89E-05	0.0034
Acetaldehyde	(ppmv) (lb/MMBtu)	0.012 2.52E-05	0.0011
Acrolein	(ppmv) (lb/MMBtu)	0.003 7.88E-06	0.0003
^a Reported as methane. ^b Reported as naphthalene.			

Western States Petroleum Association
Pooled Source Emission Test Report:
Oil and Gas Production Sources,
Fresno and Ventura Counties, California

ENSR, December 1990

TABLE 1-4b
**Fuel Analysis Results
Diesel Drilling Rig**

HHV, Btu/gal	138,300
API Gravity at 60°F	34.9
Specific Gravity at 60°F	0.850
F-factor, dscf/MMBtu	9,157
Carbon (wt. %)	87.06
Hydrogen (wt. %)	12.52
Oxygen (wt. %)	0.03
Nitrogen (wt. %)	0.35
Sulfur (wt. %)	0.03
Ash (wt. %)	0.01
<u>Inorganics Results</u>	
Arsenic (mg/kg)	<0.3
Beryllium (mg/kg)	<0.5
Bromide (mg/kg)	<2.0
Cadmium (mg/kg)	<0.3
Chloride (mg/kg)	<2.0
Chromium, total (mg/kg)	0.7
Copper (mg/kg)	<0.1
Lead (mg/kg)	<3.0
Manganese (mg/kg)	<1.0
Mercury (mg/kg)	<0.02
Nickel (mg/kg)	<3.0
Phosphorus (mg/kg)	<30
Selenium (mg/kg)	<0.3
Zinc (mg/kg)	4.8

Western States Petroleum Association
Pooled Source Emission Test Report:
Oil and Gas Production Sources,
Fresno and Ventura Counties, California

ENSR, December 1990

To: Mike Short, ENSR

From: Susie King, Conoco

Date: May 14, 1990

Subject: Conoco Grubb Lease - 1989 Use
of Diesel Powered Engines

Drilling:	BHP	No. of DA
1. Cleveland 5 Rig (3 engines)	800 HP each	90 days
2. Grace 170 (4 engines)	1,350 HP ea.	226 days
WORK OVER / COMPLETION:		
1. 2.5 rigs	350 HP each	18 hours/day 365 days/y

Made By _____

Checked By _____

Date _____

Page _____

of _____

3 28

Conoco Inc.
Calculation Sheet

Title _____

Job No. _____

Field _____

State _____

TABLE 4-7

Combustion Equipment Parameters

ID	Name	Rated Capacity	Fuel	Annual Use	Maximum Hourly	Units
5	HEATER TRT FAC 15	9 MMBTU/hr	NTG	36.50000	0.1000000	MMcf
7	#1 COMPR FAC 25	680 hp	Gas	55,896.10000	6.38476000	MMBtu
8	TURBINE FAC 24	4,686 hp	Gas	347.00000	0.03968000	MMcf
10	#5 COMPR FAC 25	330 hp	Gas	13,974.02500	3.19002400	MMBtu
24	#6 COMPR FAC 25	330 hp	Gas	13,974.02500	3.19002400	MMBtu
25	#2 COMPR	660 hp	Gas	55,896.10000	6.38476000	MMBtu
26	#3 COMPR FAC 25	680 hp	Gas	55,896.10000	6.38476000	MMBtu
27	#8 COMPR FAC 25	660 hp	Gas	55,896.10000	6.38476000	MMBtu
28	#9 COMPR FAC 25	660 hp	Gas	55,896.10000	6.38476000	MMBtu
36	PORT.PUMP ENGINE	90 hp	Gas	359.10000	0.71250000	Mcf
80001	CLEVELAND 5 RIG	2,400 hp	Diesel	72.00000	0.44400000	Mgal
80002	GRADE 170 RIG	5,200 hp	Diesel	339.00000	0.83300000	Mgal
80003	WORKOVER RIGS	875 hp	Diesel	91.25000	0.01390000	Mgal

TABLE 2-18
Total Hydrocarbons and Combustion Gases

Date	Site	O ₂ (%)	CO ₂ (%)	THC ^a (ppm)	CO (ppm)
09/14	Unocal - Workover Rig	16.6	3.5	67.8	1,500
09/18	SWEPI - Drilling Rig	10.2	9.4	34.5	308
09/21	Santa Fe - Crude Oil-Fired Steam Generator	3.6	13.7		
09/22		3.6	13.2		2.0
09/23		3.5	13.2		
09/26		3.5	13.6	1.2	4.6
09/27	SWEPI - Gas-Fired Steam Generator	2.6	10.5	0.9	0.1
^a Reported as methane.					

Western States Petroleum Association
Pooled Source Emission Test Report:
Oil and Gas Production Sources,
Fresno and Ventura Counties, California

ENSR, December 1990

SUEPI DRILLING RIG CO EMISSION RATE

CO conc. : 308 ppmv
 MW : 28
 O₂ IN STAKE GAS : 10.2 %
 f - FACTOR : 9,157 dscf/MMBtu
 GAL/MMBtu : 7.231
 MMBtu/GAL : .1383
 GAL/HR : 10

CONST. : $\frac{385.5 \text{ dscf}}{16-M} @ 68^{\circ}\text{F}$

$$\frac{\text{lb CO}}{\text{dscf}} = \left(\frac{308 \cdot 10^{-6} \text{ ppmv}}{385.5 \frac{\text{dscf}}{16-M}} \right) \left(\frac{28 \frac{\text{LB}}{\text{LB-M}}}{16-M} \right) = 2.24 \cdot 10^{-5} \frac{\text{LB}}{\text{dscf}}$$

$$\frac{\text{lb CO}}{\text{MMBtu}} = \left(2.24 \cdot 10^{-5} \frac{\text{lb}}{\text{dscf}} \right) \left(9,157 \frac{\text{dscf}}{\text{MMBtu}} \right) \left(\frac{20.9}{20.9 - 10.2} \right) = 0.40 \frac{\text{lb}}{\text{MMBtu}}$$

$$\frac{\text{lb CO}}{\text{HR}} = \left(0.40 \frac{\text{lb}}{\text{MMBtu}} \right) \left(.1383 \frac{\text{MMBtu}}{\text{GAL}} \right) \left(10 \frac{\text{GAL}}{\text{HR}} \right) = 0.55 \frac{\text{lb}}{\text{HR}}$$

UNOCAL WORKOVER RIG CO EMISSION RATE

-BP

CO CONC.	1500 ppmv	CONSTANT :	$\frac{385.5 \text{ dscf}}{\text{lb-M}} @ 68^\circ\text{F}$
MW	28		
O ₂ IN STACK GAS	16.6%		
f - FACTOR	9,194 dscf/MMBtu		
GAL/MMBtu	7.052	OR	1418 MMBtu/GAL
GAL/HR	5		

$$\frac{\text{lb CO}}{\text{dscf}} = \frac{\left(\frac{1500 \cdot 10^{-6} \text{ ppmv}}{385.5 \frac{\text{dscf}}{\text{lb-M}}} \right) \left(\frac{28 \text{ lb}}{\text{lb-M}} \right)}{1} = 1.09 \cdot 10^{-4} \frac{\text{lb}}{\text{dscf}}$$

$$\frac{\text{lb CO}}{\text{MMBtu}} = \left(1.09 \cdot 10^{-4} \frac{\text{lb}}{\text{dscf}} \right) \left(\frac{9,194 \text{ dscf}}{\text{MMBtu}} \right) \left(\frac{20.9}{20.9 - 16.6} \right) = 4.87 \frac{\text{lb}}{\text{MMBtu}}$$

$$\frac{\text{lb CO}}{\text{HR}} = \left(4.87 \frac{\text{lb}}{\text{MMBtu}} \right) \left(\frac{1418 \text{ MMBtu}}{\text{GAL}} \right) \left(\frac{5 \text{ GAL}}{\text{HR}} \right) = \boxed{3.45 \frac{\text{lb}}{\text{HR}}}$$

OTHER CALCULATIONS

1. Converting grams/hour to pounds/hr:

Conversion Factor: 453.59 gm/lb

2. Converting grams/brakehorsepower-hour to pounds/hr:

$\text{gm/bhp-hr} * \text{bhp} * \text{lb/453.59 gm}$

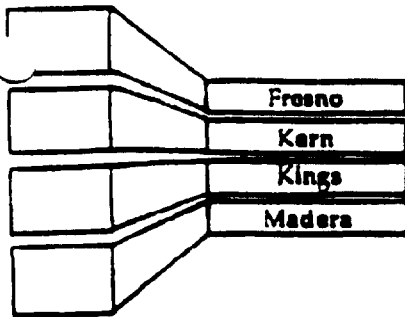
3. Converting lb/MMBTU to lb/hr for VOC's:

$\text{lb/MMBTU} * \text{MMBTU/hr}$
(CARNOT Test Data)

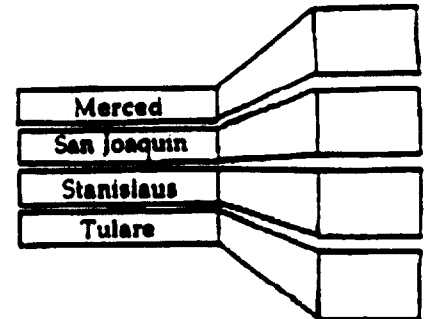
$\text{lb/MMBTU} * 0.1418 \text{ MMBTU/gallon diesel} * \text{gal/hr}$
(ENSR Test Data)

4. Converting ppm carbon monoxide to lb/hr:

(Separate calculation sheet provided)



**San Joaquin Valley
Unified Air Pollution Control District**



July 19, 1992

District Board Members

RICK JENSEN, Chair

Supervisor, Madera County

PAULINE LARWOOD, Vice Chair

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Supervisor, Tulare County

MEL McLAUGHLIN

Councilmember, City of Wasco

Ms. Catherine Reheis

Western States Petroleum Association

901 Tower Suite 300

Bakersfield, CA 93309

**Subject: WSPA Proposed AB 2588 I.C. Engine Pooled
Source Test Protocol:**

Regarding: CARB Letter Dated July 13, 1992

Dear Ms. Reheis:

Attached is a copy of the CARB's comments regarding WSPA's proposed AB 2588 I.C. engine pooled source test protocol. The proposal was reviewed in accordance with Sections 93337 and 93336 of the AB 2588 Criteria Guideline Regulations.

The CARB identified major deficiencies which are described in the letter. Specifically, the CARB expressed concern of applying the turbocharged engine test results to naturally aspirated I.C. engines. This concern was based on insufficient information that satisfactorily demonstrated that the two engines have similar emission and operating parameters.

Previously, the District expressed similar concerns in regards to pooling the turbocharged engine test results with that of naturally aspirated I.C. engines. In light of the CARB's comments, the District requests that WSPA provide written documentation and information demonstrating that turbocharged verses naturally aspirated engines do not vary significantly in regards to criteria and/or toxic emissions and operating parameters

In addition, please explain in detail how the impinger contents in Method 410A will be analyzed and applied to the total test results. Include sample calculations.

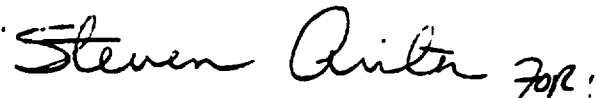
WSPA - I.C. Engine P&T
July 19, 1992
Page -2-

Please address all other items listed in the CARB comment letter. The District realizes that WSPA has tentatively scheduled to start testing on monday, July 27, 1992; therefore, please respond to both the CARB's and the District's concerns as soon as possible.

Based on our records, the District had not received a copy of the CARB's comment letter as of July 17, 1992. On friday, July 17, 1992, the District contacted the CARB, regarding the status of WSPA's I.C. engine pooled source test protocol. Mr. George Law of CARB, stated that they had mailed out their response on July 13, 1992. Upon District request, the CARB faxed a copy of their comment letter at 4:39 pm on friday, July 17, 1992.

Should you have any questions, please contact Mr. Steven Arita at (805) 861-3682 or Mr. William H. Weese at (209) 488-3330.

Sincerely,

Handwritten signature of Steven Arita in cursive script.

William H. Weese
District Manager, Toxic Assessment

SJA/whw

cc: William H. Weese - District Mgr. Toxic Assessment:
Ted Strauss - Interim Mgr. Toxic Assessment (Central Region)
Michael Emmanuel - WSPA
Elvin Bounds - SWEPI

JUL 20 1992

STATE OF CALIFORNIA

AIR RESOURCES BOARD

2020 L STREET
P.O. BOX 2815
SACRAMENTO, CA 95812

PETE WILSON, Governor



July 13, 1992

Mr. Steve Arita
San Joaquin Valley Unified APCD
Southern Region
2700 "M" Street, Suite 275
Bakersfield, CA 93301

Dear Mr. Arita:

We are responding to your letter dated June 24, 1992 regarding the proposal from Western States Petroleum Association to use pooled source testing to quantify emissions pursuant to the Emission Inventory Criteria and Guideline Regulations for the Air Toxics "Hot Spots" Information and Assessment Act of 1987.

The proposal was reviewed in accordance with the Criteria and Guideline Regulations, Section 93337 (Pooled Source Testing) and 93336 (Source Testing and Measurement). We have identified major deficiencies which are summarized in the attachment to this letter. These major deficiencies must be corrected before this proposal may be approved. The district may approve the proposal as corrected without further review by the ARB staff.

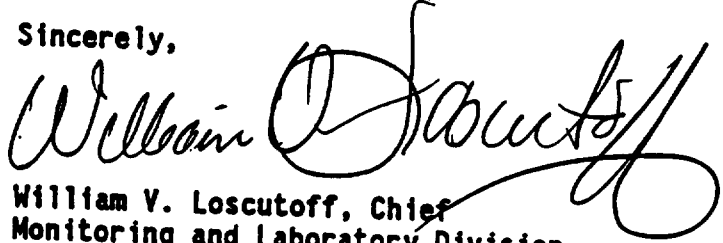
In addition, WSPA proposes several minor modifications to existing ARB source test methods. Section 93336(c) of the Regulation allows the operator to propose the use of equivalent sampling methods provided the proposal includes sufficient information to enable the Executive Officer of the ARB to determine in writing that the alternative method is substantially equivalent to the ARB adopted method for that facility.

Based upon the information submitted, the proposal to use EPA Method 1A and EPA Method 2C instead of ARB Method 1 and ARB Method 2 as specified in ARB Method 5 is acceptable due to the small stack diameter (4.75 inches ID) and due to the proposed sampling and velocity point locations. The proposal to modify ARB Method 410A to include a empty impinger knockout in order to prevent moisture condensation is acceptable under the condition that any material collected within the impinger must be included in the analysis for the target analytes. However, the proposal for Method 425 to utilize an extra empty impinger before the filter cannot be approved without evidence supporting the need for this modification to the ARB method.

Approval to use these modifications is granted for application to this specific source test only. WSPA will need to submit a letter formally requesting approval to use similar modifications for any additional tests. Approval will be granted on a case-by-case basis. In addition, WSPA should be advised that they may need approval from the local district for each modification.

If you or your staff have questions or would like clarification of our attached comments, please contact George Lew, Chief, Engineering Evaluation Branch, Monitoring and Laboratory Division, at (916) 445-0657. For other questions regarding the pooled source test procedure or the alternatives to required source testing procedure, please contact Linda Murchison, Chief, Emission Inventory Branch, Technical Support Division, at (916) 322-6021.

Sincerely,



William V. Loscutt, Chief
Monitoring and Laboratory Division

Attachment

cc: Catherine H. Reheis, WSPA
George Lew, MLD
Linda Murchison, TSD

DEFICIENCY IDENTIFICATION SHEET

APCD: San Joaquin Valley Unified APCD ARB ID NO. 388

Facility Operator: Western States Petroleum Association (WSPA)

Proposal deficiencies identified by ARB staff are checked below.

CODE: 1 = no comment
2 = minor deficiencies
3 = major deficiencies

1. The minimum information required by the Criteria and Guideline Regulations, Sections 93337 (Pooled Source Testing) or 93338 (Alternatives to Required Source Testing) was not present. Therefore the ARB staff could not comment on the acceptability of the plan.
2. Information in proposal received by ARB:
 - a. Information describing the untested facility(s) to which source test results are to be applied.
 - b. Information describing the facility(s) to be tested.
 - c. 3 Information describing the source tests to be conducted.
 - d. 2 Information describing how the source test results are to be applied.
3. Application of same emission factor to pooled facilities.
4. Number of facilities to be tested.
5. Number of tests to be performed.
6. 2 Source test procedures.

Additional comments:

See Attached

ARB RECOMMENDATION:

- X Serious (code 3) deficiencies must be corrected
- Approve, noting minor deficiencies
-

COMMENTS

APCD: San Joaquin Valley Unified APCD

ARB ID NO. 388

Facility Operator: WSPA - Halliburton Well Drilling Services

Western States Petroleum Association is proposing to conduct pooled source testing on a variable operating 335 horsepower diesel fired internal combustion engine which is equipped with a turbocharger. The test results will be used to estimate emissions from other similar turbocharged units. The engine will be located at Halliburton Well Drilling Services in Bakersfield. It is proposed to operate at idle during 75% of sampling time and to operate at a load of 65% of rated capacity during the remaining 25% of sampling time. The initial proposal written by Entropy was submitted to the SJVUAPCD in April and upon District review and comment an addendum to the proposal was submitted in June. This revised proposal was submitted to the ARB and we have the following comments:

1. Appendix D of the Emission Inventory Criteria and Guidelines Regulation for Air Toxics Hot Spots specifies that diesel-fired combustion sources conduct laboratory analysis of the fuel for both metals and chloride. The proposal and the June 17, 1992 addendum do not include metals or chloride in the list of analytes to be measured during fuel sampling and analysis. Also note that Section 93336 of the regulation specifies the test methods to be used for the analysis of the fuel sample.
2. The proposal discusses testing on only one engine which may restrict the application of the results to other potential pooled engines. Sufficient information has been included to enable districts to compare this tested turbocharged engine to similar turbocharged engines when applying the pooled results. We do not believe that sufficient information has been presented to allow comparison of the results of this testing to naturally aspirated diesel engines. ARB staff is aware that WSPA has previously conducted pooled testing which may be applicable to naturally aspirated diesel engines. The proposal should include additional discussion on how the results will be applied to other facilities.
3. WSPA proposes to use EPA Method 1A and EPA Method 2C instead of ARB Method 1 and ARB Method 2 as specified in ARB Method 5. Section 93336(c) of the Regulation allows the operator to propose the use of equivalent sampling methods provided the proposal includes sufficient information to enable the Executive Officer of the ARB to determine in writing that the alternative method is substantially equivalent to the ARB adopted method for that facility. ARB staff believes that the use of EPA Method 1A and 2C is equivalent to the use of the specified ARB methods due to the small stack diameter (4.75 inches ID) and due to the proposed sampling and velocity point locations. Approval to use these changes will be granted for this specific source test only.
4. The proposal indicates that ARB Method 410A will be used to test for benzene, toluene, xylene, ethylbenzene, and hexane. ARB staff acknowledges that Appendix D of the Regulation does not require the operator within this source category to source test for these compounds and that a source test is likely to be produce the best estimate of emissions of these compounds. It also is noted that ARB Method 410A

was specifically adopted for benzene and that the methodology has previously been utilized for measuring the other compounds.

The addendum indicates that WSPA and the District have agreed to modify ARB Method 410A to include a empty impinger knockout in order to prevent moisture condensation in the tedlar bag. ARB staff believes that any material collected within the impinger must be included in the analysis for the target analytes. ARB staff believes that this modification to ARB Method 410A is appropriate to address the anticipated moisture problem in the sample matrix.

5. The proposal for Method 425 indicates that an extra empty impinger will be used before the filter. The proposal does not provide any evidence supporting the need for this modification to the ARB method and therefore the addition of the extra impinger will not be approved without adequate justification.
6. The calculations submitted as required under ARB Method 430 indicated that a sampling rate of 0.6 liters per minute (Lpm) would be used during the "loaded" mode. ARB Method 430 Section 3.4 indicates that the sampling rate should range from 0.1 to 0.5 Lpm to avoid exceeding the absorbing capacity of the impinger solution. The proposed sampling rate should be within the required range while remaining proportional to the stack flow.

In addition, the calculations submitted by Entropy in the letter dated May 22, 1992 may need to be revised based upon the changes in the operating parameters for the test. In Method 430, the calculations were done for testing at 80% of sampling time during idle mode and 20% of sampling time during load. The addendum indicates testing will be done at 75% idle and 25% load conditions for the sampling program. If the calculations are redone with a maximum of 0.5 Lpm as the sampling rate and with the current sampling times, then the sample volume would be .024 cubic meters.

JUN 26 1992

San Joaquin Valley
Unified Air Pollution Control District

June 24, 1992

Fresno

Kern

Kings

Madera

Merced

San Joaquin

Stanislaus

Tulare

District Board Members

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Supervisor, Madera County

PAULINE LARWOOD, Vice Chair

Supervisor, Kern County

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Supervisor, San Joaquin County

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Councilmember, City of Clovis

JOE HAMMOND

Supervisor, Kings County

CLYDE GOULD

Supervisor, Tulare County

MEL McLAUGHLIN

Councilmember, City of Wasco

Mr. George Lew
California Air Resources Board
Monitoring and Laboratory Division
P.O. Box 2818
Sacramento, CA 95812

Regarding: WSPA Pooled Source Test Review: Oil Field Diesel-
Fired Internal Combustion Engine

Dear Mr. Lew:

In accordance with Section 93337 (b) of the Air Toxic Emission Inventory Criteria and Guidelines Regulation, the San Joaquin Valley Unified Air Pollution Control District is submitting the following "Pooled Source Testing Proposal" from :

Mr. Michael Emanuel
Western States Petroleum Association (WSPA)
901 Tower Way, Suite 300
Bakersfield, CA 93309

PROPOSED "POOLED SOURCE TEST PLAN" SUBMITTED FOR:

Oil Field Diesel-fired Internal Combustion Engine

Due to a tight time frame and scheduling constraints, the District would appreciate a response from the CARB no later than July 15, 1992.

G 41

David L. Crow • Executive Director / APCO

P.O. Box 1312 • Fresno, California 93715 • 2314 Mariposa Street #100 • (209) 488-3330 • FAX (209) 488-3134

Printed on recycled paper.

WSPA Pooled Source Test
June 24, 1992
Page -2-

Please send all correspondence regarding AB 2588 to:

Mr. Steven Arita
San Joaquin Valley Unified APCD
Southern Region
2700 "M" Street, Suite 275
Bakersfield, CA 93301

Should you have any questions please contact Mr. Steven Arita at (805) 861-3682 or Mr. William Weese at (209) 488-3330.

Sincerely,

Steve Arita For:

William H. Weese
District Manager, Toxic Assessment

SZF/sa

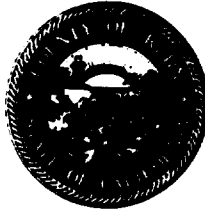
cc: Catherine Reheis - Western States Petroleum Association
Michael Emanuel - Western States Petroleum Association
Elvin Bounds - Shell Western Exploration and Production Inc.

RESOURCE MANAGEMENT AGENCY

MAY 06 1992

RANDALL L. ABBOTT
DIRECTOR

DAVID PRICE III
ASSISTANT DIRECTOR



Air Pollution Control District
WILLIAM J. RODDY, APCO

Environmental Health Services Department
STEVE McCALLEY, REHS, DIRECTOR

Planning & Development Services Department
TED JAMES, AICP, DIRECTOR

AIR POLLUTION CONTROL DISTRICT

May 6, 1992

Ms. Catherine Reheis
Western States Petroleum Association
901 Tower Way, Suite 300
Bakersfield, CA 93309

SUBJECT: Pooled Source Testing of an Oil Field Diesel Fired Internal Combustion Engine:

Dear Ms. Reheis:

The Kern and Fresno Zones of the SJVUAPCD has reviewed your source test protocol dated April 16, 1992. We are unable to approve the protocol as it is presented.

Please address the following deficiencies and concerns:

1. **Testing Conditions - Varying Load:**

WSPA propose to simulate the varying load rates the I.C. Engine operates at during the test. Specifically, the test will be conducted with the engine operating at idle 80% of the time, and at full throttle the remaining 20% of the time.

The District requires WSPA to submit documentation to verify the described 80% and 20% operating parameters.

6 43

2. **Sampling Small Ducts:**

WSPA propose using EPA Method 1A to sample exhaust ducts less than 12 inches in diameter, but greater than 4 inches in diameter. It is not clear how the sampling will be conducted. Please provide an explanation of the sampling traverse procedures and include an expanded diagram of the stack and sampling port/traverse configuration.

3. **CARB Method 5 - Particulate Matter:**

WSPA stated the following:

"In order to ensure accurate calibration of the dry gas meters over the range of flow rates, it may be necessary to use different calibration factors for the two flow conditions. These calibration factors will be determined before and after the test program."

Please provide the calibration factors, also include complete calculations.

4. **CARB Method 15 - Hydrogen Sulfide:**

The District requires WSPA to use either EPA Method 11 or the BAAQMD ST-28 Method to quantify hydrogen sulfide emissions. Please refer to the attached copies of the methods.

5. **CARB Method 430 - Formaldehyde, Acetaldehyde and Acrolein:**

WSPA propose to modify the extraction procedure for CARB Method 430. Specifically, the proposed modification includes injecting the run reagents directly rather than extracting the samples using the required hexane/methylene chloride procedure.

According to Section 93338, parts (a) and (b) of the CARB Regulation, the District requires all facilities that propose an alternative method or modification to an existing CARB approved method, to obtain CARB review and approval. Since WSPA has proposed modifying the extraction procedure for CARB Method 430, the District will formally request CARB to conduct a technical review and comment on the proposed modification.

6. **Pre-Test Procedures and Calculations:**

The District requires that WSPA perform all pretest procedures and calculations described in the approved methods. This is to include, at a minimum, sample rate, sample time, sample volume, and minimum detection limit calculations. Each calculation must be performed as outlined in the method. When no equation is provided in the method an appropriate calculation may be substituted.

All sample train/equipment and analytical apparatus/equipment must be prepared as outlined in the pre-test procedures of the approved methods.

7. **Turbocharger:**

The District is concerned that a turbocharged engine is not representative of the population of engines currently operated by WSPA member companies. Please provide information to demonstrate that the proposed engine is representative of the WSPA engine population.

8. **Particulate Testing:**

Particulate testing is not required for AB 2588 reporting purposes. Please explain why particulate sampling is proposed.

9. **CARB Method 422.102:**

The District will not allow the sample pump to be located upstream of the GC. The pump must be located downstream from the sample T.

10. **CARB Method 410A:**

WSPA proposes using an impinger knockout for CARB methods 410A and 422. The District will allow the use of a NaOH and water knockout for CARB 422 if the gas stream pH is less than 4. The District will not allow the use of an NaOH impinger for CARB 410A.

11. **Method 425:**

WSPA proposes using inductively coupled plasma-mass spectrometry (ICP/MS) instead of graphite furnace atomic absorption (GFAA). This is not an CARB approved modification. The District requires that WSPA use GFAA for total chromium.

12. **PAH:**

The District requires that all standard labeling as outlined in CARB Method 429, including the filter, be performed.

13. **CARB Method 430:**

The District requires WSPA to use the new CARB Method 430 for the determination of formaldehyde, acetaldehyde, and acrolein. Please note that all pretest calculations outlined in the sampling method must be performed for each of the target compounds.

The District will not approve the proposed modification of directly analyzing the sample. All aldehyde samples must be extracted as outlined in the new CARB Method 430.

WSPA - IC Engine Protocol
May 6, 1992
Page -5-

Should you have any questions please contact Mr. Frank Ripepi or myself at (805) 861-3682.

Sincerely,

WILLIAM J. RODDY
Assistant APCO (SJVUAPCD)



William H. Weese
Supervisor Technical Services
Compliance Division

WW/sa

cc: Mike Emmanuel - WSPA
Mark Boese - Deputy APCO (SJVUAPCD)



Western States Petroleum Association

June 17, 1992

Mr. William Weese
Manager, Toxics Assessment Division
San Joaquin Valley Unified APCD
2314 Mariposa Street, #100
Fresno, California 93715

RE: Air Toxics Pooled Source Testing, Diesel-Fired IC Engine

Dear Mr. Weese:

Western States Petroleum Association (WSPA) is responding to the Kern and Fresno Zone letter dated May 6, 1992 addressing deficiencies with WSPA's proposed protocol to conduct air toxics pooled source testing on a diesel-fired internal combustion engine. Please consider this correspondence and attached information as an addendum to the original diesel test protocol submitted to the District April 20, 1992.

Application of Pooled Source Test to Oil and Gas Operations

In oil and gas producing operations, diesel engines are most commonly used for well drilling and servicing operations. Because of the continual need to secure piping and adjust equipment, the operating mode these engines varies from idle to a loaded condition. WSPA indicated in its April 16 test protocol, that on a typical day's work, an engine will operate in the idle condition approximately 80% of the time.

To support this assertion, WSPA has provided information from a variably operated diesel engine. Using engine digital readout data, and historical data on the engine's total fuel use, total operating hours, and fuel consumption rates, calculations show that when varying between idle and 75% load, the engine operates over 95% of the time in an idle condition (attached). If operated between idle and 50% load, the engine would still operate more than 90% of the time in an idle condition. Additionally, WSPA has provided a tachograph reading from another variably operating diesel engine which shows approximately 75-85% of operating time at idle.

Testing Diesel Engine at Varying Load

Taking this information into account, as discussed during our meeting with Unified District staff at the Bakersfield office on June 11, 1992, WSPA will conduct three test runs during each of which the diesel engine will operate 75% of the sampling time at idle and 25% of the sampling time at load. An emission factor will then be calculated by dividing pounds of each toxic substance emitted during each test run by the quantity of fuel burned during each run

to arrive at "pounds toxic per gallon of diesel fuel consumed." The resultant emission factor will be practical as most WSPA members only have record of total diesel engine operating hours and estimates of total fuel use.

Percent of Rated Capacity When Operating At Load

WSPA had initially estimated, based on WSPA member experience and discussions with drilling contractors, that variably operating engines operate at 80% of rated capacity when operating under loaded conditions. However, there appears to be little official documentation or data to support this assertion. Under previous WSPA pooled source testing efforts, a constant load diesel engine was tested for numerous toxic substances. Information shows that the specific engine operated at approximately 60% of rated capacity (attached). Therefore, as discussed June 12, 1992, the diesel engine proposed for testing this biennial update will operate at 65% of rated capacity during load conditions.

Testing a Turbocharger Equipped Diesel Engine

It is our understanding that there is little data available comparing emissions from turbocharged versus naturally aspirated diesel engines. In the absence of such data, the emissions of total hydrocarbons and/or carbon monoxide may serve as an indicator of the relative toxics from the two types. WSPA has provided engine specification data on four similar Detroit diesel engines--two with and two without turbochargers (attached). The specifications do not indicate a clear relationship between hydrocarbon and NO_x emissions from diesel engines naturally aspirated compared to turbocharger equipped engines.

It is expected that as air toxics data is gradually collected and compiled, this information can be compared and analyzed for trends and relationships among parameters, such as turbochargers, emission controls, firing rates, and toxic emissions.

Other Technical Issues

As we indicated during our meeting with District staff on June 11, 1992, WSPA's consultant, Entropy Environmentalists, has addressed most of the technical deficiency issues related to sampling, which is included with this correspondence and which WSPA also sent to the Kern Zone office on June 1, 1992. The District had two subsequent outstanding issues related the use of an impinger knockout and the addition of dilution air to the bag for Method 410A and related to pretest calculations required by Method 430.

Following a conference call between Entropy, WSPA staff, and Unified District staff on June 16, 1992, there is now understanding on these outstanding issues. For Method 410A, the District will allow the use of an empty impinger knockout but will not allow an NaOH knockout nor the addition of dilution air to the bag prior to sampling. For Method 430, Entropy indicated that it has obtained the latest version of Method 430 from the Air Resources

Board and will supply the proper pretest calculations to the District prior to testing.

Additionally, please note that although the original protocol and the Entropy response contained in this addendum would indicate that testing for hydrogen sulfide will occur, WSPA does not plan to test for hydrogen sulfide. Reference to hydrogen sulfide testing and use of Method 15 was an apparent error as testing a diesel engine for hydrogen sulfide was not intended.

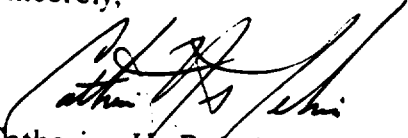
Protocol Approval

The last remaining issue is related to protocol approval. In order to avoid any future deficiency issues, WSPA is concerned about receiving full proper approval prior to commencing testing. Now that it appears WSPA and the Unified District have reached agreement on the planned diesel engine source test, WSPA requests that the Unified District officially request the California Air Resources Board (CARB) to review and approve the protocol. WSPA feels that it is essential to receive CARB approval prior to testing.

Unfortunately, WSPA had to cancel its previously planned diesel test scheduled for the first week of June as there was not full agreement on the test plan and therefore the Unified District had not requested CARB review and approval. WSPA has now scheduled Entropy Environmentalists to commence testing July 13, 1992, which is the earliest date available. Therefore, WSPA appreciates all efforts the District can put forth in getting an expedited protocol review in order to respond to any of CARB's concerns and meet the test plan schedule.

If you have any questions, please do not hesitate to call me or Mike Emanuel at this office, or Mr. Elvin Bounds of SWEPI at (805) 326-5988.

Sincerely,



Catherine H. Reheis

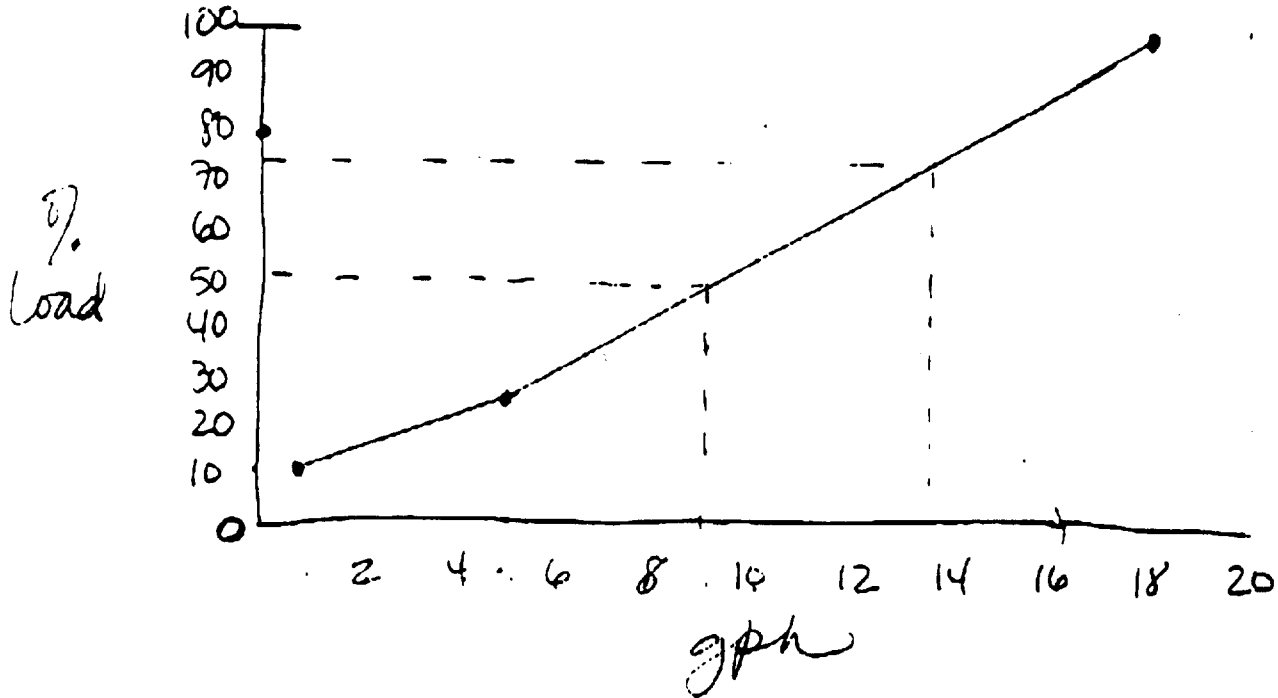
Enclosures

ME/sa

cc: Mark Boese - SJVUAPCD
Steve Arita - SJVUAPCD
Tony Wong - Entropy Environmentalists
Phil Juneau - Entropy Environmentalists
Mike Wang - WSPA
Melinda Luthin - WSPA
Scott Folwarkow - WSPA Bay Area

General Purpose Worksheet

WORKOVER RIG



Condition	RPM	Load %	Fuel Use (gph)
Idle	711	11	0.9
Full RPM/No Load	2193	25	5.0
Full RPM/Loaded 100%	1986	100	18.0

Historical data: Total engine hours: 1873.5
 " fuel used: 2485.4 gal

$\therefore$ 1.327 gph historical average

- 1) @ idle + 100% Load
 $(0.9 \text{ gph})(x) + 18 \text{ gph}(1-x) = 1.327 \text{ gph}$
 $x = 98\%$
- 2) @ idle + 50% load
 94.7%
- 3) @ idle + 75% load
 = 96.6%
- $\therefore$ 98% of time engine is idle

PROBLEM AREA IDENTIFICATION SHEET

COMPANY OR CONTRACTOR: CPS HOIST #: 123 DATE 3-10-92

GROUP 4 HEAD OPERATOR 1 1
days p.m. morning

Instructions: Turn in one tachograph and one detail sheet for all three shifts to the morning tour foreman.
 Work performed must be written on tach.

Assume 70% rpm

ENTER ALL TIMES IN MINUTES: *

	P.M.	MORN
WAIT ON TOOLS		
HAULING PIPE		
WAIT ON MANPOWER		
LOCATION PROBLEMS		
TRAINING		
MEETINGS		
SCCELLANEOUS		

US

FOREMAN INITIALS
days p.m. morning

THIS INFORMATION WILL BE USED TO TRACK AND IDENTIFY PROBLEM AREAS TO IMPROVE THE WELLWORK PROCESS

15-25% full throttle

**COMPANY OR
CONTRACTOR**

CPS

HOIST #

128

DATE

3-10-92.

GACUF

4

HEAD OPERATOR

1

1

daya

ப.ந.

morning

**Instructions: Turn in one tachograph and one detail sheet
for all three shifts to the morning tour foreman.
Work performed must be written on tach.**

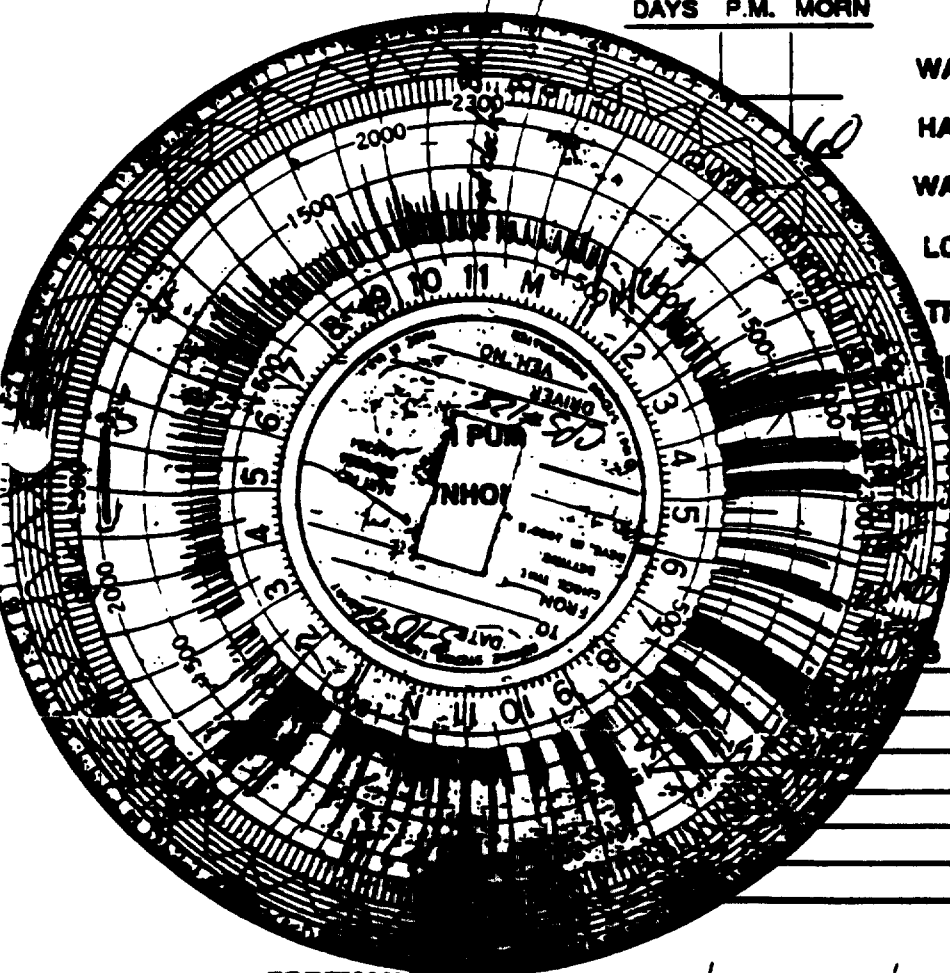
✱

ENTER ALL TIMES IN MINUTES

*

DAYS P.M. MORN

DAYS P.M. MORN



WAIT ON TOOLS

HAULING PIPE

WAIT ON MANPOWER

LOCATION PROBLEMS

TRAINING

MEETINGS

SCCELLANEEOUS

FOREMAN INTRODUCTION

days

p.m.

morning

THIS INFORMATION WILL BE USED TO TRACK AND IDENTIFY PROBLEM AREAS TO IMPROVE THE WELLWORK PROCESS

6/5/92

1-BP

CARNOT TEST OF CHEVRON KERN RIVER IC ENGINE: APR 11, 1990LOAD FACTOR CALCULATIONDATA FROM TEST REPORT:

$$dscfm_{AVE} = 742$$

(appendix)

$$O_2_{AVE} = 13.8 \%$$

(appendix)

$$f - \text{FACTOR} = 8,915 \frac{dscf}{MMBtu}$$

(pg. 4-3)

$$\text{DIESEL HHV} = 19,500 \frac{Btu}{lb}$$

(pg. 4-3)

I. HEAT INPUT RATE:DIESEL
CONSUMP.

$$= \left(742 \frac{dscf}{min} \right) \left(\frac{60 \text{ min}}{hr} \right) \left(\frac{20.9 - 13.8}{20.9} \right)$$

$$= \left(8,915 \frac{dscf}{MMBtu} \right)$$

HEAT INPUT =

$$1.70 \frac{MMBtu}{hr}$$

II. HORSEPOWER (hp) OUTPUT:

CONSTANTS

$$2547 \frac{Btu}{hr}$$

$$= 1 \text{ hp-hr}$$

$$\eta_{THERMAL} = 0.30 = \text{THERMAL EFFICIENCY OF DIESEL IC ENGINE}$$

$$W = Q_{in} \cdot \eta_{THERMAL} = 1,700,000 (0.30) = 510,000 \frac{Btu}{hr}$$

$$hp = \frac{510,000 \frac{Btu}{hr}}{2,547 \frac{Btu}{hp-hr}} = 200 \text{ hp}$$

6/5/92

BP

III ENGINE LOAD DURING TEST AS % OF MAX. OUTPUT:

ASSUME: 350 hp MAX.

200 hp DURING TEST

$$\% \text{ OF MAX.} = \frac{200}{350} \cdot 100\% = 57\%$$

MAY 29 1992

ENTROPY

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May 22, 1992

Michael Emanuel
Environmental Representative
Western States Petroleum Association
901 Tower Way, Suite 300
Bakersfield, California 93309.

SUBJECT: Kern County test protocol comments

EEL Reference #: 30037

Dear Mike:

Following are responses to Kern County's test protocol comments dated May 6, 1992.

2. Sampling Small Ducts:

WSPA propose using EPA Method 1A to sample exhaust ducts less than 12 inches in diameter, but greater than 4 inches in diameter. It is not clear how the sampling will be conducted. Please provide an explanation of the sampling traverse procedures and include an expanded diagram of the stack and sampling port/traverse configuration.

Response:

In these small ducts, the conventional Method 5 stack assembly (consisting of a Type S Pitot tube attached to a sampling probe, equipped with a nozzle and thermocouple) blocks a significant portion of the cross section of the duct and causes inaccurate measurements. Therefore, for isokinetic sampling in small ducts, the gas velocity is measured using a standard Pitot tube downstream of the actual emission sampling site. The straight run of duct between the isokinetic sampling and velocity measurement sites allows the flow profile, temporarily disturbed by the presence of the sampling probe, to redevelop and stabilize.

As shown in the horizontal section of the exhaust duct, the first three ports will be used for isokinetic sampling and the fourth port to be used for velocity measurements. The ports are 38 inches apart representing 8 diameters. The flow measurements from the fourth port will be used to set isokinetic sampling rates. The 8 diameters between ports allows the flow to redevelop and stabilize. Also due to the small duct size, traversing will be conducted only across one axis.

3. CARB Method 5 - Particulate Matter:

WSPA stated the following:

In order to ensure accurate calibration of the dry gas meters over the range of flow rates, it may be necessary to use different calibration factors for the two flow conditions. These calibration factors will be determined before and after the test program."

Please provide the calibration factors, also include complete calculations.

Response:

Calibration factors and calculations will be available approximately May 29.

4. CARB Method 15 - Hydrogen Sulfide:

The District requires WSPA to use either EPA Method 11 or the BAAQMD ST-28 Method to quantify hydrogen sulfide emissions. Please refer to the attached copies of the methods.

Response:

EPA Method 11 and BAAQMD ST-28 Method is for the "Determination of hydrogen sulfide content of fuel gas streams in petroleum refineries." CARB Method 15 is for the "Determination of hydrogen sulfide, carbonyl sulfide, and carbon disulfide emissions from stationary sources." Because testing is to be performed on an emission source, CARB Method 15 appears to be more appropriate for the measurement of hydrogen sulfide.

5. CARB Method 430 - Formaldehyde, Acetaldehyde, and Acrolein:

WSPA propose to modify the extraction procedure for CARB Method 430. Specifically, the proposed modification includes injecting the run reagents directly rather than extracting the samples using the required hexane/methylene chloride procedure.

According to Section 93338, parts (a) and (b) of the CARB Regulation, the District requires all facilities that propose an alternative method or modification to an existing CARB approved method, to obtain CARB review and approval. Since WSPA has proposed modifying the extraction procedure for CARB Method 430, the District will formally request CARB to conduct a technical review and comment on the proposed modification.

Response:

Entropy will perform the extraction procedure as described in the method.

6. Pre-Test Procedures and Calculations:

The district requires that WSPA perform all pretest procedures and calculations described in the approved methods. This is to include, at a minimum, sample rate, sample time, sample volume, and minimum detection limit calculations. Each calculation must be performed as outlined in the method. When no equation is provided in the method an appropriate calculation may be substituted.

All sample train/equipment and analytical apparatus/equipment must be prepared as outlined in the pre-test procedures of the approved methods.

Response:

Calculations have been provided as attachments for CARB Methods 425, 429 and 430. CARB Methods 15, 100, 410A, 422, and 422.102 detection limits are independent of sample rate, time and volume. Calculations are not provided for these methods.

9. CARB Method 422.102:

The District will not allow the sample pump to be located upstream of the GC. The pump must be located downstream from the sample T.

Response:

The sample pump will be located downstream of the sample T.

10. CARB Method 410A:

WSPA proposes using an impinger knockout for CARB methods 410A and 422. The District will allow the use of a NaOH and water knockout for CARB 422 if the gas stream pH is less than 4. The District will not allow the use of an impinger for CARB 410A.

Response:

An impinger knockout will not be used for CARB Method 410A. As described in the method, dilution air will be added to the bag prior to sampling to prevent moisture condensation.

11. CARB Method 425:

WSPA proposes using inductively coupled plasma-mass spectrometry (ICP/MS) instead of graphite furnace atomic absorption (GFAA). This is not an CARB approved modification. The District requires that WSPA use GFAA for total chromium.

Response:

GFAA will be used for the analysis of total chromium.

12. PAH:

The district requires that all standard labeling as outlined in CARB Method 429, including the filter, be performed.

Response:

Standard labeling as outlined in CARB Method 429, including the filter, will be performed.

13. CARB Method 430:

The District requires WSPA to use the new CARB Method 430 for the determination of formaldehyde, acetaldehyde, and acrolein. Please note that all pretest calculations outlined in the sampling method must be performed for each of the target compounds.

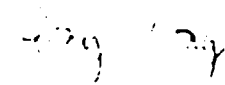
The District will not approve the proposed modification of directly analyzing the sample. All aldehyde samples must be extracted as outlined in the new CARB Method 430.

Response:

The new CARB Method 430 will be used for the determination of formaldehyde, acetaldehyde, and acrolein. Pretest calculations are attached. Samples will be extracted as outlined in the new CARB Method 430.

Please call me if you have any questions or comments.

Sincerely,



Tony Wong
Vice President

ARB Method 425

Sample Volume Calculations

- 1) Targeted Minimum Detectable Concentration (a) = 100 ng per cubic meter
- 2) Expected Minimum Detection Limit Achievable at the laboratory using ion chromatography = 100 ng per liter solution

Assume 1000 ml final sample volume

Total train minimum detection limit (b)
= 100 ng per liter x 1 liter = 100 ng

- 3) Sampling Time Limitations - 5 hours

$$\text{Minimum Sample Volume} = \frac{b}{a} = 100 \text{ ng} \times \frac{1 \text{ cubic meter}}{100 \text{ ng}} = 1 \text{ cubic meter}$$

The sample run time will be five (5) hours with a typical sampling rate of 1 cubic meter per hour. Therefore the expected total sample volume will be 5 cubic meters which is 5 times greater than the calculated minimum sample volume of 1 cubic meter.