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REPORT ON COMPLIANCE TESTING

Performed for:
TERRA ENGINEERING AND CONSTRUCTION COMPANY
HIDEAWAY LANDFILL
MIDDLETON, WISCONSIN

Client Reference No: 468-2697
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To the best of our knowledge, the data presented in this report are accurate and complete.

Submitted by,

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CONTENTS

1 PROJECT OVERVIEW 1-1

2 RESULTS 2-1
Table 2-1: Landfill Flare - Nonmethane Organic Carbon Destruction Efficiency 2-1

3 DESCRIPTION OF INSTALLATION 3-1

4 METHODOLOGY 4-1
Table 4-1: Summary of Sampling Procedures 4-1
SAMPLING POINT DETERMINATION 4-2
Table 4-2: Sampling Points 4-2
Figure 4-1: Flare Inlet Sampling Point Determination (EPA Method 1) 4-3
Figure 4-2: Flare Outlet Sampling Point Determination 4-4
VELOCITY AND VOLUMETRIC FLOW RATE - EPA METHOD 2B 4-5
Figure 4-3: Velocity Sampling Apparatus (EPA Method 2B) 4-5
MOISTURE CONTENT - EPA METHOD 4 4-6
Figure 4-4: Moisture Sampling Apparatus (EPA Method 4) 4-7
OXYGEN, NITROGEN, CARBON MONOXIDE, CARBON DIOXIDE, METHANE, NONMETHANE ORGANIC CARBON, VINYL CHLORIDE AND BENZENE - EPA METHOD 25C AND TO-14 4-8
Figure 4-5: EPA Method 3C, 25C and TO-14 Sampling Apparatus 4-9

5 APPENDIX 5-1
SAMPLE CALCULATIONS ..... A
PARAMETERS ..... B
CALIBRATION DATA C
FIELD DATA ..... D
FIELD DATA PRINTOUTS ..... E
LABORATORY DATA ..... F
CHAIN OF CUSTODY ..... G

PROJECT OVERVIEW

Terra Engineering and Construction Company contracted Clean Air Engineering to perform emissions testing at the Hideaway Landfill Flare located in Middleton, Wisconsin for compliance purposes. The flare is used to control gaseous emissions from the landfill. The flare is required to comply with the Wisconsin Administrative Code Department of Natural Resources (WAC-DNR) Chapter NR445 LAER Design and Operating Requirements.

The test parameters included the following pollutants:

- Carbon monoxide (CO);
- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nonmethane organic carbon (NMOC);
- Vinyl Chloride (C_2H_3Cl);
- Benzene (C_6H_6).

In addition, oxygen and nitrogen were also determined as well as a TO-14 full scan for organics. Vinyl chloride and benzene were not detected in any samples. A complete list of detected organics can be found in Appendix F.

EPA Methods 3C, 25C and TO-14 were used for the determination of concentrations of all parameters at the inlet and outlet of the flare. Sample analysis was performed by Triangle Environmental Services, Inc. located in Durham, North Carolina. The TO-14 analysis was performed by Air Quality Laboratory, Inc. located in Research Triangle Park, North Carolina.

Volumetric flow determinations at the inlet were performed using EPA Methods 1, 2, 3C and 4. Volumetric flow rates at the outlet of the flare were calculated using EPA Method 2C. Destruction efficiency of NMOC was calculated by comparing inlet mass flow rates to outlet mass emissions rates.

The testing took place at the Inlet and Outlet of the flare on November 19 and 20, 1996. Coordinating the field testing were:

J. Falbo - Terra Engineering and Construction Company
G. Smith - Clean Air Engineering

A summary of test results are presented in Table 2-1 on page 2-1.

RESULTS

Table 2-1:
Landfill Flare - Nonmethane Organic Carbon Destruction Efficiency

Run No.		1	2	3	Average
Date (1996)		November 19	November 20	November 20	
Start Time (approx.)		15:05	09:29	10:39	
Stop Time (approx.)		16:05	10:29	11:39	
INLET					
Gas Conditions					
O_2	Oxygen (dry volume %)	1.3	1.5	1.3	1.4
CO_2	Carbon dioxide (dry volume %)	33.6	32.6	33.3	33.2
CO	Carbon monoxide (ppmdv)	28	31	30	30
T_s	Temperature (°F)	71	72	74	72
B_{wo}	Moisture (volume %)	1.95	1.17	1.26	1.5
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	385	345	371	367
Q_{std}	Standard conditions (dscfm)	381	345	369	365
Methane					
C	Concentration (ppmdv)	388,756	366,883	373,281	376,300
M	Mass flow rate (lb/hr)	370	349	355	358
Nonmethane Organic Carbon (as methane)					
C	Concentration (ppmdv)	2,070	2,181	2,686	2,312
M	Mass flow rate (lb/hr)	2.0	2.1	2.6	2.2
OUTLET					
Gas Conditions					
O_2	Oxygen (dry volume %)	5.3	11.8	11.4	9.5
CO_2	Carbon dioxide (dry volume %)	8.3	7.6	8.8	8.2
CO	Carbon monoxide (ppmdv)	2,252	138	22	804
Volumetric Flow Rate					
Q_{std}	Standard conditions (dscfm)	3,264	3,177	2,972	3,138
Methane					
C	Concentration (ppmdv)	39.0	<9.0	<9.0	19.0
M	Mass flow rate (lb/hr)	0.3	0.1	0.1	0.2
ε	Removal Efficiency (%)	99.91	99.98	99.98	99.96
Nonmethane Organic Carbon (as methane)					
C	Concentration (ppmdv)	142	86	147	125
M	Mass flow rate (lb/hr)	1.2	0.7	1.1	1.0
ε	Removal Efficiency (%)	41.29	67.15	57.36	55.27

Note: Vinyl Chloride and Benzene were not detected in any samples. A complete list of detected organics from TO-14 analysis can be found in Appendix F.

DESCRIPTION OF INSTALLATION

The Terra Engineering and Construction Company operates the Hideaway Landfill located in Middleton, Wisconsin. A flare is used to control emissions from the landfill. The testing reported in this document was performed at the inlet and outlet of the flare.

METHODOLOGY

The sampling followed procedures as detailed in U.S. Environmental Protection Agency (EPA) Methods 1A, 2B, 2C, 3C, 4 and 25C. The following table summarizes the methods and their respective sources.

Table 4-1:
Summary of Sampling Procedures

Title 40 CFR Part 60 Appendix A	
Method 1A	"Sample and Velocity Traverses for Stationary Sources with Small Stacks or Ducts"
Method 2B	"Determination of Exhaust Gas Volume Flow Rate from Gasoline Vapor Incinerators"
Method 2C	"Determination of Stack Gas Velocity and Volumetric Flow Rate from Small Stacks or Ducts (Standard Pitot Tube)"
Method 3C	"Determination of Oxygen, Carbon Dioxide, Nitrogen and Methane from Stationary Sources"
Method 4	"Determination of Moisture Content in Stack Gases"
Proposition 25C	"Determination of Nonmethane Organic Compounds (NMOC) in Landfill Gases"

These methods appear in detail in Title 40 of the Code of Federal Regulations (CFR).

Major aspects of the sampling, recovery and analytical procedures are summarized on pages 4-2 through 4-11.

All equipment was calibrated prior to and at the conclusion of the test program.

METHODOLOGY

SAMPLING POINT DETERMINATION

Sampling point locations were determined according to EPA Method 1A.

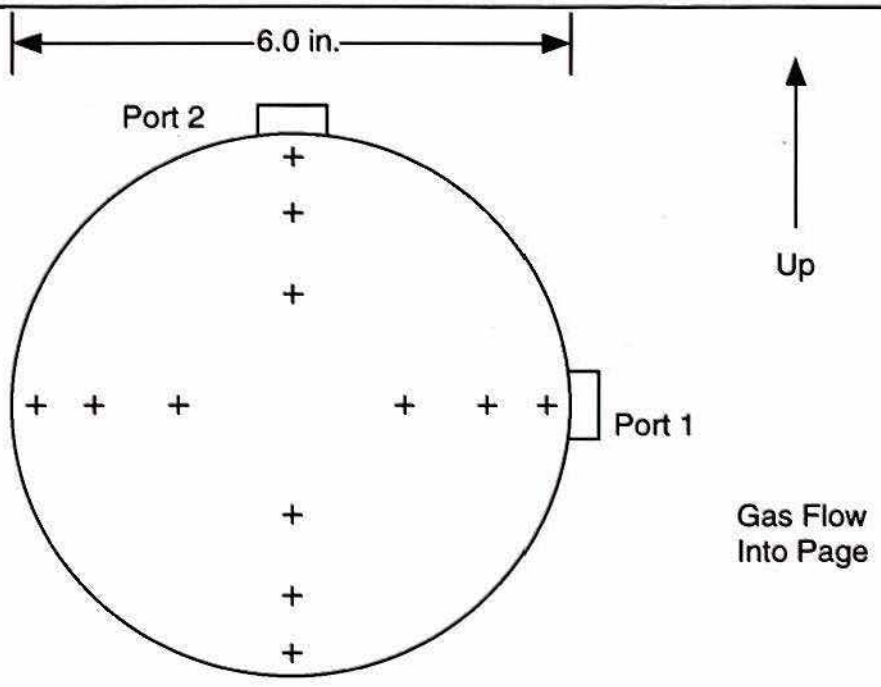
Table 4-2 outlines the sampling point configurations. Figure 4-1 through 4-2 illustrate the sampling points and orientation of sampling ports for each of the sources tested in the program.

Table 4-2:
Sampling Points

Location	Constituent	Method	Run No.	Ports	Points per Port	Minutes per Point	Total Minutes	Figure
Flare Inlet	Velocity	2A	1-3	2	6	na	na	4-1
	Moisture	4	1-3	1	1	60	60	
	O_2	3C	1-3	1	1	60	60	
	N_2	3C	1-3	1	1	60	60	
	CO	25C	1-3	1	1	60	60	
	CO_2	3C	1-3	1	1	60	60	
	CH_4	25C	1-3	1	1	60	60	
	NMOC	25C	1-3	1	1	60	60	
	Vinyl Chloride	TO-14	1-3	1	1	60	60	
	Benzene	TO-14	1-3	1	1	60	60	
Flare Outlet	Volumetric flow	2C	1-3	2	6	na	na	4-2
	O_2	3C	1-3	1	1	60	60	
	N_2	3C	1-3	1	1	60	60	
	CO	25C	1-3	1	1	60	60	
	CO_2	3C	1-3	1	1	60	60	
	CH_4	25C	1-3	1	1	60	60	
	NMOC	25C	1-3	1	1	60	60	
	Vinyl Chloride	TO-14	1-3	1	1	60	60	
	Benzene	TO-14	1-3	1	1	60	60	

METHODOLOGY

SAMPLING POINT DETERMINATION (CONTINUED)



Traverse Point	Port to Point Distance (in.)
1	0.50
2	0.88
3	1.78
4	4.22
5	5.12
6	5.50

Diameters to upstream disturbance: 3 Limit: 2.0
Diameters to downstream disturbance: 8 Limit: 0.5

Figure 4-1: Flare Inlet Sampling Point Determination (EPA Method 1)

SAMPLING POINT DETERMINATION (CONTINUED)

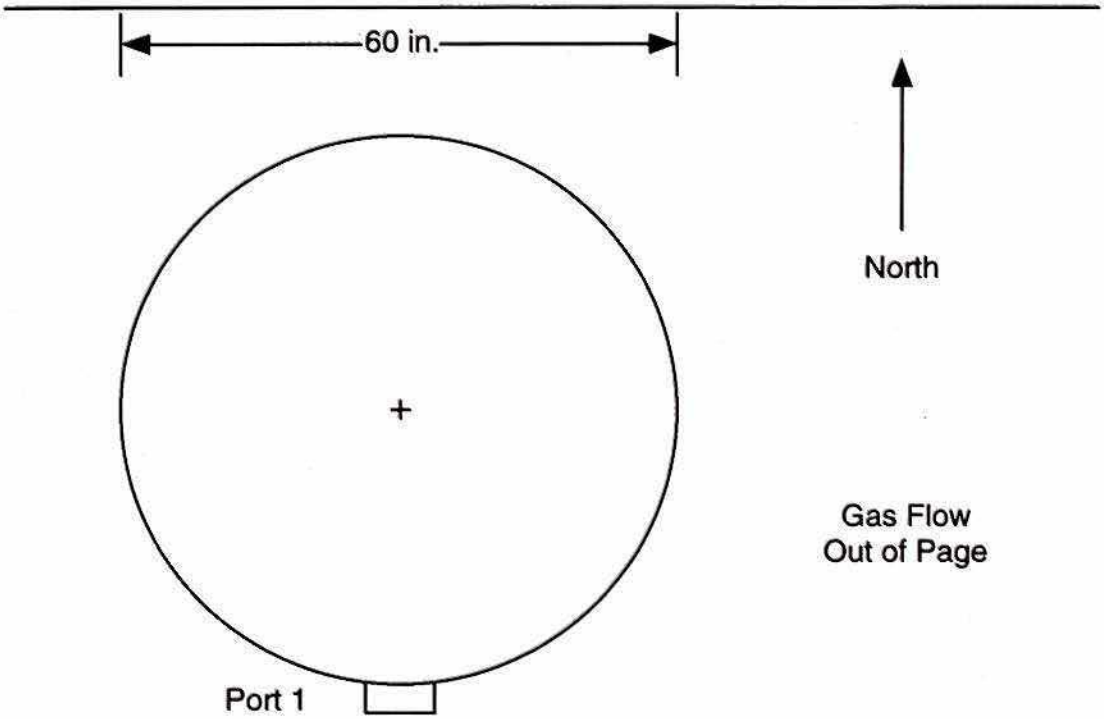


Figure 4-2: Flare Outlet Sampling Point Determination

VELOCITY AND VOLUMETRIC FLOW RATE - EPA METHOD 2B

EPA Method 2B was used to determine the gas velocity and flow rate at the inlet to the flare.

Figure 4-3 shows the major components of the Method 2B sampling apparatus.

Each set of velocity determinations included the measurement of gas velocity pressure and gas temperature at each of the EPA Method 1 traverse points. The velocity pressures were measured with a Standard pitot tube. Gas temperature measurements were made using a Type K thermocouple and digital pyrometer.

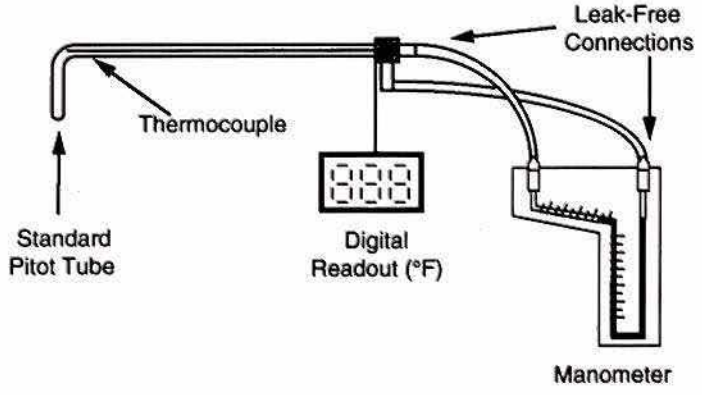


Figure 4-3: Velocity Sampling Apparatus (EPA Method 2B)

MOISTURE CONTENT - EPA METHOD 4

The flue gas moisture content at the inlet to the flare was determined in accordance with EPA Method 4. Figure 4-4 shows the major components of the EPA Method 4 sampling apparatus. The gas moisture was determined by quantitatively condensing the water in a chilled knock-out jar train. The amount of moisture condensed was determined volumetrically. A dry gas meter was used to measure the volume of gas sampled. The amount of water condensed and the volume of gas sampled were used to calculate the gas moisture content in accordance with EPA Method 4 calculations.

After passing through the probe, the sample gas entered an knock-out jar condenser system for drying of the gas. The condenser system consisted of four leak-free glass knock-out jars and rubber leak-free connectors. The first two knockout jars each contained 100 milliliters of water. The third knock-out jar was empty, and the fourth contained 300 grams of silica gel. All four of the knock-out jars were placed in an ice bath for the duration of the test.

The metering system included a vacuum gauge, a leak-free pump, thermometers accurate to within ±5.0°F and a dry gas meter accurate to within 2%.

Before and after each test, the sample apparatus was leak checked. A leakage rate of less than the 0.02 cfm was considered acceptable.

MOISTURE CONTENT (CONTINUED)

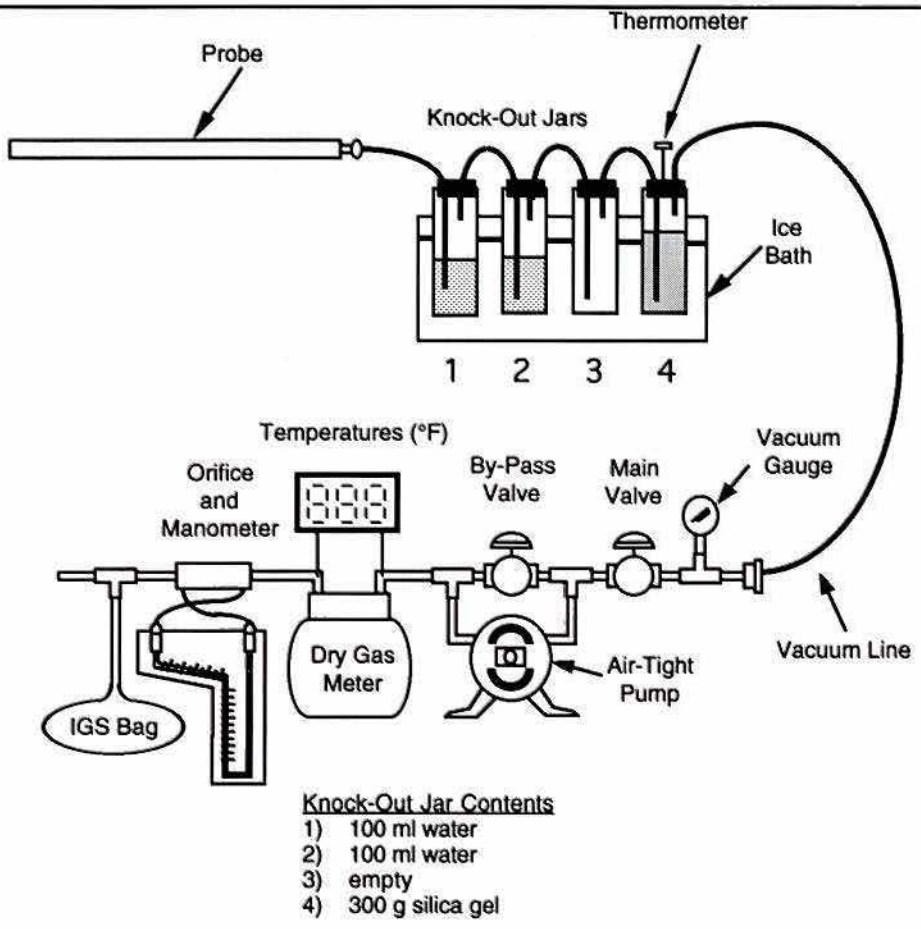


Figure 4-4: Moisture Sampling Apparatus (EPA Method 4)

OXYGEN, NITROGEN, CARBON MONOXIDE, CARBON DIOXIDE, METHANE, NONMETHANE ORGANIC CARBON, VINYL CHLORIDE AND BENZENE - EPA METHOD 25C AND TO-14

Samples for EPA Method 25C and TO-14 were obtained by using a common sampling apparatus. Figure 4-5 shows the major components of the combined EPA Method 25C and TO-14 sampling apparatus.

PRINCIPLE FOR THE DETERMINATION OF TOTAL CARBON CONCENTRATIONS (METHOD 25C)

The Nonmethane Organic Carbon (NMOC) concentration of the gas as methane, as well as the methane, carbon monoxide and carbon dioxide concentrations were determined by injecting a portion of the gas into a gas chromatographic column to separate the NMOC from carbon monoxide, carbon dioxide and methane.

PRETEST PREPARATION

The collection vessel was an evacuated stainless steel tank. The tank was verified as clean prior to shipment and testing. The sampling apparatus for organics was leak checked by evacuating the entire sample train to greater than 25 in. Hg. The sample train was sealed and the vacuum gauge monitored. If the vacuum dropped by more than the calculated allowable leak rate the sample train was considered unacceptable.

OXYGEN, NITROGEN, CARBON MONOXIDE, CARBON DIOXIDE, METHANE, NONMETHANE ORGANIC CARBON, VINYL CHLORIDE AND BENZENE (CONTINUED)

SAMPLING APPARATUS

- **Evacuated Sample Tank** - Sample tank with 0.25 in OD female quick connect, 4 to 8 liter capacity
- **Sample Probe** - 0.25 in OD Inconnel (low carbon steel) with cap (for sampling apparatus leak checks) Inconnel was used for the outlet sampling probe to prevent a positive bias from the probe because normal stainless steel can release carbon at high temperatures.
- **Sample Line** - 0.125 in OD Teflon
- **Flow Meter** - All glass flow meter capable of maintaining a constant flow of 0.05 to 0.12 l/min
- **Control Valve** - Stainless steel needle valve
- **Quick Connect** - Stainless steel 0.25 in OD male quick connect to attach evacuated sample tank
- **Mercury manometer** - Manometer used to check vacuum of sample tank

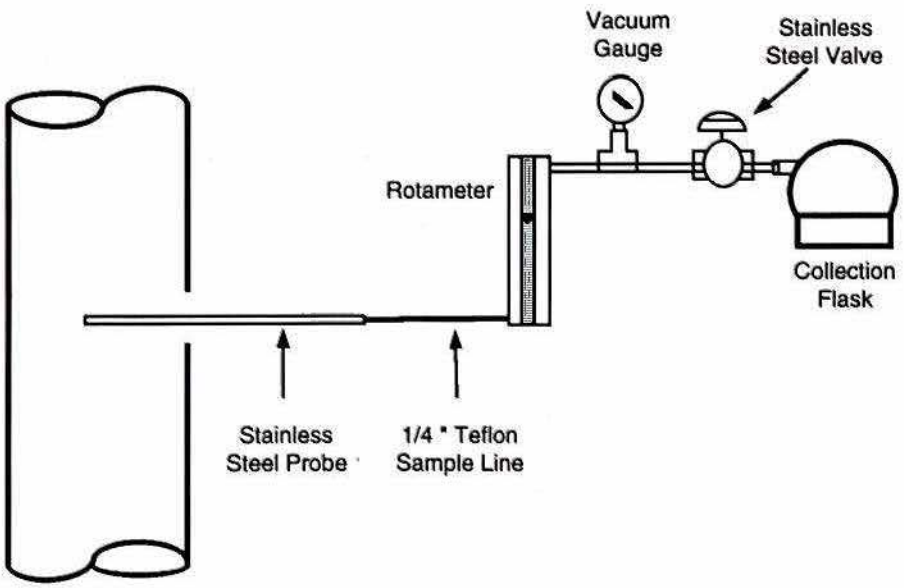


Figure 4-5: EPA Method 3C, 25C and TO-14 Sampling Apparatus

METHODOLOGY

OXYGEN, NITROGEN, CARBON MONOXIDE, CARBON DIOXIDE, METHANE, NONMETHANE ORGANIC CARBON, VINYL CHLORIDE AND BENZENE (CONTINUED)

SAMPLING

Prior to testing, the vacuum of the evacuated sample tank was measured and compared to the recorded value from the laboratory to verify that the tank had not leaked during shipment. The sample train itself was leak checked by capping the probe tip and evacuating the train with a spare sample tank. The vacuum drawn was monitored for five minutes. If the loss of vacuum was less than the allowable leak rate, then the leak check was considered acceptable. The cap was removed from the probe tip and the probe was placed into the gas stream for sampling. The control valve was in the "off" position and the evacuated sample tank was connected to the sample apparatus.

At the start of the test period, the valve was opened. The flow through the sample train was kept at a constant rate throughout the test so that the evacuated tank reached an absolute pressure that is between 2 and 5 in. Hg less than ambient after one hour. The valve was then switched to the "off" position. After the test the sample probe was capped and a leak check performed. The vacuum of the sample tank was measured with a mercury manometer and recorded.

SAMPLE HANDLING

After completion of sampling, they were packaged and sent immediately to the lab for analyses. The analysis was performed within the recommended period after testing. A chain of custody was used to track the location and status of the samples.

OXYGEN, NITROGEN, CARBON MONOXIDE, CARBON DIOXIDE, METHANE, NONMETHANE ORGANIC CARBON, VINYL CHLORIDE AND BENZENE (CONTINUED)

ANALYSIS FOR CARBON MONOXIDE, CARBON DIOXIDE, METHANE AND NONMETHANE ORGANIC CARBON (METHOD 25C)

The analyzer used during Method 25C analysis was a dedicated gas chromatograph specifically designed to determine non-methane Organic Carbons. The chromatographic column in the analyzer separates the sample into four components; carbon monoxide, methane, carbon dioxide and non-methane Organic Carbons. The separated sample was passed through an oxidation catalyst and a reduction catalyst, converting all of the carbon-containing compounds to methane. This methane was then measured by a flame ionization detector (FID). The conversion of the carbon in the sample to methane eliminates the variable response associated with the FID and the different types of Organic Carbons.

ANALYSIS FOR OXYGEN, NITROGEN AND CARBON DIOXIDE (METHOD 3C)

Samples were analyzed using a Gas Chromatograph coupled with a Thermal Conductivity Detector for the analysis of oxygen, nitrogen and carbon dioxide.

ANALYSIS FOR SPECIATED ORGANICS (TO-14)

To analyze the contents of the canisters for speciated organics according to TO-14, the water vapor in the gas sample was reduced by a Nafion dryer, and the VOCs were concentrated by collection into a cryogenically-cooled trap. The cryogen was removed and the temperature of the sample raised to volatilize the sample into a high resolution gas chromatograph. The GC temperature was increased through a temperature program and the compounds were eluted from the column on the basis of boiling points in a detector.

APPENDIX

SAMPLE CALCULATIONS....A
PARAMETERS....B
CALIBRATION DATA....C
FIELD DATA....D
FIELD DATA PRINTOUTS....E
LABORATORY DATA....F
CHAIN OF CUSTODY....G

SAMPLE CALCULATIONS

A

SAMPLE CALCULATIONS
FLARE INLET AND OUTLET - RUN NO. 1

The tables presenting the results are generated electronically from raw data. It may not be possible to exactly duplicate these results using a calculator. The reference method data, results and all calculations are carried to sixteen decimal places throughout. The final table is formatted to an appropriate number of significant figures.

1. Volume of water collected (wscf)

$$V_{wstd} = (0.04707)(V_{lc})$$
$$= (0.04707)(18.8)$$
$$= 0.88 \text{ wscf}$$

Where:

V_{lc}	total volume of liquid collected in impingers and silica gel (ml)
V_{wstd}	volume of water collected at standard conditions (ft^3)
0.04707	conversion factor (ft^3/ml)

2. Volume of gas metered, standard conditions (dscf)

$$V_{mstd} = \frac{(17.64)(V_m)\left(P_{bar} + \frac{\Delta H}{13.6}\right)(Y_d)}{(460 + T_m)}$$
$$= \frac{(17.64)(40.59)\left(30.07 + \frac{1.8}{13.6}\right)(1.016)}{(460 + 34)}$$
$$= 44.51 \text{ dscf}$$

Where:

P_{bar}	barometric pressure (in. Hg)
T_m	average dry gas meter temperature (°F)
V_m	volume of gas sample through the dry gas meter at meter conditions (ft^3)
V_{mstd}	volume of gas sample through the dry gas meter at standard conditions (ft^3)
Y_d	gas meter correction factor (dimensionless)
ΔH	average pressure drop across meter box orifice (in. H_2O)
17.64	conversion factor (°R/in. Hg)
13.6	conversion factor (in. H_2O/in. Hg)
460	°F to °R conversion constant

SAMPLE CALCULATIONS (CONTINUED)

3. Sample gas pressure (in. Hg)

$$P_s = P_{bar} + \left(\frac{P_g}{13.6}\right)$$

$$= 30.07 + \left(\frac{5.2}{13.6}\right)$$

$$= 30.45 \text{ in. Hg}$$

Where:

P_{bar}	barometric pressure (in. Hg)
P_g	sample gas static pressure (in. H_2O)
P_s	absolute sample gas pressure (in. Hg)
13.6	conversion factor (in. H_2O/in. Hg)

4. Actual vapor pressure (in. Hg)

$$P_v = \frac{e^{\left(18.3036 - \frac{3816.44}{\frac{5}{9}(T_s - 32) + 273.15 - 46.13}\right)}}{25.4}$$

$$= \frac{e^{\left(18.3036 - \frac{3816.44}{\frac{5}{9}(71 - 32) + 273.15 - 46.13}\right)}}{25.4}$$

$$= 0.76 \text{ in. Hg}$$

Where:

P_v	vapor pressure, actual (in. Hg)
T_s	average sample gas temperature (°F)

5. Moisture content (%)

$$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$$

$$= \frac{0.88}{44.51 + 0.88}$$

$$= .0195$$

$$\times 100\% = 1.95\ \%$$

Where:

B_{wo}	proportion of water vapor in the gas stream by volume (%)
V_{mstd}	volume of gas sample through the dry gas meter at standard conditions (ft^3)
V_{wstd}	volume of water collected at standard conditions (ft^3)

SAMPLE CALCULATIONS (CONTINUED)

6. Saturated moisture content (%)

$$B_{ws} = \frac{(P_v)}{(P_s)}$$

$$= \frac{(0.76)}{(30.45)}$$

$$= .0251$$

$$\times 100\% = 2.51\%$$

Where:

B_{ws}	proportion of water vapor in the gas stream by volume at saturated conditions (%)
P_s	absolute sample gas pressure (in. Hg)
P_v	vapor pressure, actual (in. Hg)

Whichever moisture value is smaller is used for B_{wo} in the following calculations.

7. Molecular weight of dry gas stream (lb/lb·mole)

$$M_d = M_{CO_2}\frac{(CO_2)}{(100)} + M_{O_2}\frac{(O_2)}{(100)} + M_{CO+N_2}\frac{(CO+N_2)}{(100)}$$

$$= 44.0\frac{(33.6)}{(100)} + 32.0\frac{(1.3)}{(100)} + 28.0\frac{(65.1)}{(100)}$$

$$= 33.42\frac{lb}{lb\cdot mole}$$

Where:

M_d	dry molecular weight of sample gas (lb/lb·mole)
M_{CO_2}	molecular weight of carbon dioxide (lb/lb·mole)
M_{O_2}	molecular weight of oxygen (lb/lb·mole)
M_{CO+N_2}	molecular weight of carbon monoxide and nitrogen (lb/lb·mole)
CO_2	proportion of carbon dioxide in the gas stream by volume (%)
O_2	proportion of oxygen in the gas stream by volume (%)
$CO+N_2$	proportion of carbon monoxide and nitrogen in the gas stream by volume (%)
100	conversion factor (%)

SAMPLE CALCULATIONS (CONTINUED)

8. Molecular weight of sample gas (lb/lb·mole)

$$M_s = (M_d)(1 - B_{wo}) + (M_{H_2O})(B_{wo})$$
$$= (33.421)(1 - .0195) + (18.0)(.0195)$$
$$= 33.12 \frac{lb}{lb \cdot mole}$$

Where:

B_{wo}	proportion of water vapor in the gas stream by volume
M_d	dry molecular weight of sample gas (lb/lb·mole)
M_{H_2O}	molecular weight of water (lb/lb·mole)
M_s	molecular weight of sample gas, wet basis (lb/lb·mole)

9. Velocity of sample gas (ft/sec)

$$V_s = (K_p)(C_p)(\overline{\sqrt{\Delta P}})\left(\sqrt{\frac{(\overline{T_s} + 460)}{(M_s)(P_s)}}\right)$$
$$= (85.49)(0.99)(0.532)\left(\sqrt{\frac{(71 + 460)}{(33.12)(30.45)}}\right)$$
$$= 32.7 \frac{ft}{sec}$$

Where:

K_p	velocity pressure constant $\left(\frac{ft}{sec}\left[\frac{(lb/lb \cdot mole)(in.\ Hg)}{(°R)(in.\ H_2O)}\right]\right)$
C_p	pitot tube coefficient
M_s	molecular weight of sample gas, wet basis (lb/lb·mole)
P_s	absolute sample gas pressure (in. Hg)
T_s	average sample gas temperature (°F)
V_s	sample gas velocity (ft/sec)
$\overline{\sqrt{\Delta P}}$	average square roots of velocity heads of sample gas (in. H_2O)
460	°F to °R conversion constant

10. Total flow of sample gas (acfm)

$$Q_a = (60)(A_s)(V_s)$$
$$= (60)(0.20)(32.7)$$
$$= 385 \text{ acfm}$$

Where:

A_s	cross sectional area of sampling location (ft^2)
Q_a	volumetric flow rate at actual conditions (acfm)
V_s	sample gas velocity (ft/sec)
60	conversion factor (sec/min)

SAMPLE CALCULATIONS (CONTINUED)

11. Total flow of sample gas (dscfm)

$$Q_{std} = \frac{(Q_a)(P_s)(17.64)(1-B_{wo})}{(\overline{T_s}+460)}$$

$$= \frac{(385)(30.45)(17.64)(1-0.0195)}{(71+460)}$$

$$= 381 \text{ dscfm}$$

Where:

B_{wo}	proportion of water vapor in the gas stream by volume
P_s	absolute sample gas pressure (in. Hg)
Q_a	volumetric flow rate at actual conditions (acfm)
Q_{std}	volumetric flow rate at standard conditions, dry basis (dscfm)
T_s	average sample gas temperature (°F)
17.64	conversion factor (°R/in. Hg)
460	°F to °R conversion constant

12. Total flow of sample gas - Flare Outlet (dscfm)

$$Q_{outlet} = \frac{(Q_{inlet})(TC_{inlet})}{(TC_{outlet}+300)}$$

$$= \frac{(381)(726,532)}{(85,196+300)}$$

$$= 3,241 \text{ dscfm}$$

Where:

Q_{inlet}	volumetric flow rate at standard conditions, dry basis at the inlet (dscfm)
Q_{outlet}	volumetric flow rate at standard conditions, dry basis at the outlet (dscfm)
TC_{inlet}	total carbon concentration at the inlet (ppm)
TC_{outlet}	total carbon concentration at the outlet (ppm)
300	assumed concentration of ambient carbon dioxide from dilution air (ppm)

13. Nonmethane Organic Carbon Mass Flow Rate at the Inlet, as methane (lb/hr)

$$DE = \frac{(Q_{std})(MW_{methane})(C_{nmoc})(60)}{(3.853\times10^6)}$$

$$= \frac{(381)(16.01)(2,070)(60)}{(3.853\times10^6)}$$

$$= 2.0 \text{ lb/hr}$$

Where:

E_{inlet}	mass flow rate of nomethane organic carbon as methane at the inlet (lb/hr)
E_{outlet}	mass flow rate of nomethane organic carbon as methane at the outlet (lb/hr)
100	conversion factor (%)

SAMPLE CALCULATIONS (CONTINUED)

14. Nonmethane Organic Carbon Destruction Efficiency (%)

$$DE = 100 \times \frac{(E_{inlet} - E_{outlet})}{(E_{inlet})}$$

$$= 100 \times \frac{(2.0 - 1.2)}{(2.0)}$$

$$= 41.29\ \%$$

Where:

E_{inlet}	mass flow rate at standard conditions, dry basis at the inlet (lb/hr)
E_{outlet}	mass flow rate at standard conditions, dry basis at the outlet (lb/hr)
100	conversion factor (%)

PARAMETERS

B

TERRA ENGINEERING AND CONSTRUCTION CORPORATION
CAE Project No: 7834
Inlet

VELOCITY AND MOISTURE PARAMETERS

Run No.		1	2	3
Date (1996)		November 19	November 20	November 20
Start Time (approx.)		15:05	09:29	10:39
Stop Time (approx.)		16:05	10:29	11:39
Sampling Conditions				
Y_d	Dry gas meter correction factor	1.0160	1.0160	1.0160
C_p	Pitot tube coefficient	0.99	0.99	0.99
Pg	Static pressure (in. H_2O)	5.2	5.7	5.7
A_s	Sample location area (ft^2)	0.20	0.20	0.20
P_{bar}	Barometric pressure (in. Hg)	30.07	30.07	30.07
O_2	Oxygen (dry volume %)	1.3	1.5	1.3
CO_2	Carbon dioxide (dry volume %)	33.6	32.6	33.3
V_{lc}	Liquid collected (ml)	18.8	11.0	12.1
V_m	Volume metered, meter conditions (ft^3)	40.59	40.76	41.73
T_m	Dry gas meter temperature (°F)	34	43	47
T_s	Sample temperature (°F)	71	72	74
ΔH	Meter box orifice pressure drop (in. H_2O)	1.80	1.80	1.80
Flow Results				
V_{wstd}	Volume of water collected (ft^3)	0.88	0.52	0.57
V_{mstd}	Volume metered, standard (ft^3)	44.51	43.90	44.52
P_s	Sample gas pressure, absolute (in. Hg)	30.45	30.49	30.49
P_v	Vapor pressure, actual (in. Hg)	0.76	0.79	0.83
B_{wo}	Moisture in sample (% by volume)	1.95	1.17	1.26
B_{ws}	Saturated moisture (% by volume)	2.51	2.59	2.74
$\sqrt{\Delta P}$	Velocity head ($\sqrt{}$in. H_2O)	0.532	0.477	0.512
M_d	MW of sample gas, dry (lb/lb-mole)	33.42	33.28	33.38
M_s	MW of sample gas, wet (lb/lb-mole)	33.12	33.10	33.18
V_s	Velocity of sample (ft/sec)	32.7	29.3	31.5
Q_a	Volumetric flow rate, actual (acfm)	385	345	371
Q_{std}	Volumetric flow rate, standard (dscfm)	381	345	369
		10.8	9.8	10.4

TERRA ENGINEERING AND CONSTRUCTION CORPORATION
CAE Project No: 7834
Outlet

OUTLET VOLUMETRIC FLOW PARAMETERS

Run No. 1
November 19, 1996

	Result
Inlet	
Non-methane Hydrocarbons (ppm, as carbon)	2,070
Methane (ppm, as carbon	388,756.0
Carbon Monoxide (ppm, as carbon)	28.0
Carbon Dioxide (ppm, as carbon)	335,678.0
Total Carbon Concentration, waste gas (ppm)	**726,532**
Flare Outlet	
Non-methane Hydrocarbons (ppm, as carbon)	142.0
Methane (ppm, as carbon	39.0
Carbon Monoxide (ppm, as carbon)	2,252.0
Carbon Dioxide (ppm, as carbon)	82,763
Total Carbon Concentration, outlet (ppm)	**85,196**

Run No. 2
November 20, 1996

	Result
Inlet	
Non-methane Hydrocarbons (ppm, as carbon)	2,181
Methane (ppm, as carbon	366,883.0
Carbon Monoxide (ppm, as carbon)	31.0
Carbon Dioxide (ppm, as carbon)	326,338.0
Total Carbon Concentration, waste gas (ppm)	**695,433.0**
Flare Outlet	
Non-methane Hydrocarbons (ppm, as carbon)	86.0
Methane (ppm, as carbon	9.0
Carbon Monoxide (ppm, as carbon)	138.0
Carbon Dioxide (ppm, as carbon)	75,563
Total Carbon Concentration, outlet (ppm)	**75,796**

TERRA ENGINEERING AND CONSTRUCTION CORPORATION
CAE Project No: 7834
Outlet

OUTLET VOLUMETRIC FLOW PARAMETERS

Run No. 3
November 20, 1996

	Result
Inlet	
Non-methane Hydrocarbons (ppm, as carbon)	2,686
Methane (ppm, as carbon	373,281.0
Carbon Monoxide (ppm, as carbon)	31.0
Carbon Dioxide (ppm, as carbon)	332,642.0
Total Carbon Concentration, waste gas (ppm)	**708,640**
Flare Outlet	
Non-methane Hydrocarbons (ppm, as carbon)	147.0
Methane (ppm, as carbon	9.0
Carbon Monoxide (ppm, as carbon)	22.0
Carbon Dioxide (ppm, as carbon)	88,065
Total Carbon Concentration, outlet (ppm)	**88,243**

TERRA ENGINEERING AND CONSTRUCTION CORPORATION
CAE Project No: 7834
Outlet

OUTLET VOLUMETRIC FLOW PARAMETERS

Run No.		1	2	3	Aversge
Date (1995)		November 19	November 20	November 20	
Start Time (approx.)		15:05	09:29	10:39	
Stop Time (approx.)		16:05	10:29	11:39	
Test Data Results					
C_n	Concentration total carbon, inlet (ppm)	726,532	695,433	708,640	**710,202**
Q_{std}	Volumetric flow rate, inlet (dscfm)	381	345	369	**365**
C_o	Concentration total carbon, outlet (ppm)	85,196	75,796	88,243	**83,078**
Calculated Data Results					
Q_{std}	Volumetric flow rate, outlet (dscfm)	3,241	3,152	2,952	**3,115**

CALIBRATION DATA

C

Meter Box Full Test Calibration

DATE: 11/13/96 Operator: M. Redel

Meter Box No: 84-M2	Meter Box ΔH@: 1.8559	Meter Box Y_d: 1.0160	Barometric Pressure: 29.90

				Standard Meter Gas Volume			Meter Box Gas Volume (ft^3)			Std. Meter Temperature (°F)			Meter Box Temperature (°F)					
Q	ΔH	ΔP	Y_{ds}	Initial	Final	V_{ds}	Initial	Final	V_d	Inlet	Outlet	T_{ds}	Inlet	T_o	T_d	Time	Y_d	H@
0.952	3.00	-3.80	1.0000	0.0	10.000	10.000	538.713	548.623	9.910	67.0	67.0	67.0	83.0	76.0	79.5	10.51	1.0159	1.8319
0.953	3.00	-3.80	1.0000	0.0	10.000	10.000	548.623	558.526	9.903	67.0	67.0	67.0	81.0	75.0	78.0	10.50	1.0138	1.8318
0.376	0.50	-2.00	1.0000	0.0	5.000	5.000	563.801	568.762	4.96	67.0	67.0	67.0	76.0	74.0	75.0	13.30	1.0169	1.9631
0.376	0.50	-2.00	1.0000	0.0	5.000	5.000	568.762	573.725	4.963	67.0	67.0	67.0	75.0	74.0	74.5	13.30	1.0155	1.9631
0.686	1.50	-2.70	1.0000	0.0	10.000	10.000	585.307	595.203	9.896	67.0	67.0	67.0	79.0	73.0	76.0	14.58	1.0172	1.7726
0.686	1.50	-2.70	1.0000	0.0	10.000	10.000	595.203	605.114	9.911	67.0	67.0	67.0	80.0	73.0	76.5	14.58	1.0166	1.7726
																AVERAGE	1.0160	1.8559

Nomenclature

P_b	Barometric Pressure (in. Hg)
Q	Flow Rate (cfm)
ΔH	Orifice Pressure Differential (in. H_20)
ΔP	Inlet Pressure Differential (in. H_20)
V_d	Gas Meter Volume - Dry (ft^3)
V_{ds}	Standard Meter Volume - Dry (ft^3)
T_d	Average Meter Box Temperature (°F)
T_o	Outlet Meter Box Temperature (°F)
T_{ds}	Average Standard Meter Temperature (°F)
Y_d	Meter Correction Factor (unitless)
Y_{ds}	Standard Meter Correction Factor (unitless)
ΔH@	Orifice Pressure Differential giving 0.75 cfm of air at 68°F and 29.92 in. Hg (in. H_20)

Vacuum Gauge

Standard (in. Hg)	Vacuum Gauge
4.4	5.0
9.7	10.0
14.9	15.0
20.0	20.0
25.3	25.0

Thermometers

Standard (°F)	Inlet	Outlet

Equations

$$Y_d = (Y_{ds})\left[\frac{V_{ds}}{V_d}\right]\left[\frac{T_d + 460}{T_{ds} + 460}\right]\left[\frac{P_b + \Delta P / 13.6}{P_b + \Delta H / 13.6}\right]$$

$$\Delta H@ = \frac{0.0319(\Delta H)}{P_b(T_o + 460)}\left[\frac{(T_{ds} + 460)\,\Theta}{(V_{ds})(Y_{ds})}\right]^2$$

$$Q = \frac{17.64\ (V_{ds})\ (P_b)}{(T_{ds} + 460)\ (\Theta)}$$

Pyrometer Calibration Sheet

Pyrometer No.: 84-M2
Calibrated By: M. Redel
Date: 11-13-96

Office: Palatine
Client:
Job or Reference No.:

Temperature Scale Used ■ Fahrenheit ☐ Celsius

■ Full Test ☐ Post Test

Calibration Reference Settings for Fahrenheit Scale	Pyrometer Reading	Calibration Reference Settings for Celsius Scale
50° F	50° F	25° C
100° F	101° F	50° C
150° F	150° F	75° C
200° F	200° F	100° C
250° F	251° F	125° C
300° F	301° F	150° C
350° F	350° F	175° C
400° F	399° F	200° C
450° F	449° F	225° C
500° F	500° F	250° C
550° F	550° F	275° C
600° F	600° F	300° C

Calibration Reference Information

Reference Used: Omega CL-23A Serial No: T-123216

Calibrated By: J. H.Metrology Co. Date Calibrated: 4-08-96

Calibration Report No.: 9648-R26517

CAE
Clean Air Engineering

FIELD DATA

D

MOISTURE DETERMINATION FIELD DATA SHEET

TEST LOCATION: Inlet

UNIT: Hidden Valley Fl **RUN:** 3

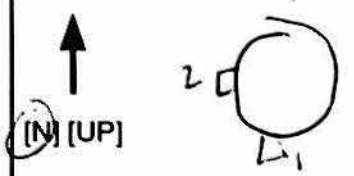
PAGE 1 **OF** 1

Client Tetra Engineering	Project No. 7034
Plant Hidden Valley	Date 10-20-96
Meter Operator K Stajkowski	
Probe Operator —	

Meter Box No. S-1-M2	
Meter Yd 1.0160	

Leak Rate Before	0.02 (cfm) @	12	(in.Hg)
Leak Rate After	0.02 (cfm) @	6	(in.Hg)

Cross-Section of Test Location



Duct Dimensions (in.) 6"

Static Press. (in. H_2O)	Port Len. (in.)	Gas Flow [In] [Out] of page	Point No. 1 all the way [In] [Out]
-5.7	2"		

Amb. Temp. (°F) 35	Bar. Press. 30.07 [in. Hg] [mbar]
Liner Material 304	

H_2O	6 [ml] [gm]	Silica Gel (gm)	6.1
Total V_{lc}	12.1		

Start Time:	10:34	Stop Time:	11:39

Traverse Point Number	Min/pt 5 Elapsed Time	Orifice Setting ΔH (in. H_2O)	Gas Sample Volume - V_m Init. Vol. (ft^3) 747.935	Stack Temp. t_s (°F)	Condensor Outlet t_c (°F)	DGM Inlet t_{min} (°F)	DGM Outlet t_{mout} (°F)	Pump Vacuum (in. Hg)	Notes
1-1	5:00	1.8	751.40	52	42	N/A	45	0.5	
	10:00	1.8	754.83	121	44		46	0.5	
	15:00	1.8	758.27	TRW	45		46	0.5	
	20:00	1.8	761.72		45		46	1.0	
	25:00	1.8	765.17		45		45	1.0	
	30:00	1.8	768.53		44		47	1.0	
	35:00	1.8	772.03		45		48	0.5	
	40:00	1.8	775.58		46		49	0.5	
	45:00	1.8	779.05		48		49	0.5	
	50:00	1.8	782.60		50		49	0.5	
	55:00	1.8	786.05		50		49	0.5	
	60:00	1.8	789.68		50		50	0.5	
	Total		41.73				769		
	Average	1.8					47		

DS 004 Moisture

Circle correct bracketed units on data sheet.

Method 25 Volatile Organic Carbon
Field Data Sheet

Location: INLET Run: 1 Page 1 of 1

Client TERRA ENG	Project Number 7834		
Plant MIDDLETON	Unit HIDEAWAY FLARE		
Date 11-19-96	~~Inlet/Outlet/Stack~~		
Operator G. SMITH			
Sampling Train ID No. 95-2			
Trap No. Left NA	Right NA		
Tank No. Left 94	Right NA		
Start Time: 16:25	Stop Time: 17:25		

	Left Side	Right Side	Bar. Press.	Tank Temp
	~~[in. Hg]~~ [mm. Hg]	NA	[in. Hg] [mbar]	(°F)
Pre Tank Pressure	28	NA	30.07	34
Post Tank Pressure	28	NA	30.07	35
Leak Rate Before	Ø (in. Hg)	NA (in. Hg)		
	Ø (black ball ●)	NA (black ball ●)		
Post Test With Existing Vac.	Ø (in. Hg)	NA (in. Hg)		
	Ø (black ball ●)	NA (black ball ●)		

Elapsed Time	Left Side Gauge Vacuum Init. Vac. [in. Hg] [mm. Hg]	Left Side Flowmeter Setting (silver ball)	Right Side Gauge Vacuum Init. Vac. [in. Hg] [mm. Hg]	Right Side Flowmeter Setting (silver ball)	Probe Temp T_p (°F)	Filter Temp T_f (°F)	Notes
	28				Set Points		
					NA	NA	
5	25	60	NA	NA			
10	22	50					
15	19	50					
20	15	65					
25	13	60					
30	11	65					
35	9	65					
40	7	60					
45	5	60					
50	3	60					
55	2	50					
60	1	50					

$\Delta P = 0.01 \frac{F\,Pb\,\theta}{Vt}$

ΔP=Pressure Change (in Hg)
F=Sampling Flow Rate (cc/min)
Pb=Barometric Pressure (in Hg)
θ=Leak Check Time Period (min)
Vt=Sample Train Volume (cc): approx 100 cc

Circle correct bracketed units on data sheet.

Clean Air Engineering

Method 25 Volatile Organic Carbon Field Data Sheet

Location: OUTLET Run: 3 Page 3 of 3

Client TERRA	Project Number 7934
Plant MIDDLETON	Unit KIEWIT #1 RRF
Date 11-20-96	~~Inlet/Outlet/Stack~~
Operator: C. JIMINEZ	
Sampling Train ID No.	339
Trap No. Left NA	Right NA
Tank No. Left NA	Right NA
Start Time: 10:39	Stop Time: 11:39

	Left Side (in. Hg) [mm. Hg]	Right Side	Bar. Press. [in. Hg] [mbar]	Tank Temp (°F)
Pre Tank Pressure	28	NA	30.07	34
Post Tank Pressure	3	NA	30.07	38
Leak Rate Before	0 (in. Hg)	NA (in. Hg)		
	0 (black ball ●)	NA (black ball ●)		
Post Test With Existing Vac.	0 (in. Hg)	NA (in. Hg)		
	0 (black ball ●)	NA (black ball ●)		

Elapsed Time	Left Side: Gauge Vacuum Init. Vac. [in. Hg] [mm. Hg]	Left Side: Flowmeter Setting (silver ball)	Right Side: Gauge Vacuum Init. Vac. [in. Hg] [mm. Hg]	Right Side: Flowmeter Setting (silver ball)	Probe Temp T_p (°F)	Filter Temp T_f (°F)	Notes
	28	75			Set Points		
5	25						
10	23						
15	21						
20	18						
25	16						
30	14						
35	11						
40	9						
45	7						
50	6						
55	4						
60	2						

$\Delta P = 0.01 \frac{F\,Pb\,\theta}{Vt}$

- ΔP=Pressure Change (in Hg)
- F=Sampling Flow Rate (cc/min)
- Pb=Barometric Pressure (in Hg)
- θ=Leak Check Time Period (min)
- Vt=Sample Train Volume (cc): approx 100 cc

Circle correct bracketed units on data sheet.

DS 025 Volatile Organic Carbon
CNVS/WRH.R3-1/8/96

Clean Air Engineering

CLEAN AIR ENGINEERING
Purchase Order No. 15824-66-7834

PRE TEST

Tank No.	Barometric Pressure (in. Hg)	Ambient Temperature (^{0}F)	Tank Vacuum (in. Hg)
N200	30.07	34	28.5
6182P	30.07	34	28.5
N339	30.07	34	28.7
N44	30.07	34	28.8
N94	30.07	34	28.8
N368	30.07	34	28.8

POST TEST

Tank No.	Barometric Pressure (in. Hg)	Ambient Temperature (^{0}F)	Tank Vacuum (in. Hg)
N200	30.07	35	4.2
6182P	30.07	35	10.0
N339	30.07	35	2.8
N44	30.07	35	0.5
N94	30.07	35	4.6
N368	30.07	35	2.6

FIELD DATA PRINTOUTS

E

Field Data Printout

Location: Inlet
Test Run: 2
Client: Terra Engineering and Construction Corporation
Project No: 7834
Test Date: 11/20/96
Meter ΔH@: 1.8559
Meter Y_d: 1.0160
Pitot C_p: 0.99
Static P: 5.7
Leak Rate Before: 0.004 cfm @ 15"Hg
Leak Rate After: 0.002 cfm @ 8"Hg

Method: 1-4
Testing Type: Vel/Moist
Area (ft^2): 0.20
Filter No: na
Thimble No: na
Beaker No: na

Bar. Press. (in. Hg): 30.07
Actual Moisture (%): 1.2
O_2 (dry volume %): 1.6
CO_2 (dry volume %): 35.4
Start Time (approx.): 09:29
Stop Time (approx.): 10:29
H_2O (condensate, ml): 5.0
H_2O (silica, g): 6.0

Traverse Point	Run Time	Pitot ΔP_s	Sample ΔH	Metered	Stack	Dry Gas Meter		$\sqrt{\Delta P_s}$	Volume
					T_s	$T_{m\ in}$	$T_{m\ out}$	(calculated)	(calculated)
	0.0	(in. H_2O)	(in. H_2O)	(ft^3) 706.96	(°F)	(°F)	(°F)	($\sqrt{in.\ H_2O}$)	(ft^3)
1-01	5.0	0.22	1.80	710.34	68	38	38	0.47	3.38
1-02	10.0	0.21	1.80	713.68	70	39	39	0.46	3.34
1-03	15.0	0.21	1.80	717.03	72	40	40	0.46	3.35
1-04	20.0	0.20	1.80	720.39	72	41	41	0.45	3.36
1-05	25.0	0.21	1.80	723.78	73	42	42	0.46	3.39
1-06	30.0	0.20	1.80	727.28	72	43	43	0.45	3.50
2-01	35.0	0.28	1.80	730.59	71	44	44	0.53	3.31
2-02	40.0	0.29	1.80	733.99	72	44	44	0.54	3.40
2-03	45.0	0.24	1.80	737.41	73	45	45	0.49	3.42
2-04	50.0	0.23	1.80	740.84	74	45	45	0.48	3.43
2-05	55.0	0.23	1.80	744.27	75	44	44	0.48	3.43
2-06	60.0	0.22	1.80	747.71	74	45	45	0.47	3.44
Final	60.0	0.48	1.80	40.76	72	43			

Field Data Printout

Location: Inlet
Test Run: 3
Client: Terra Engineering and Construction Corporation
Project No: 7834
Test Date: 11/20/96
Meter ΔH@: 1.8559
Meter Y_d: 1.0160
Pitot C_p: 0.99
Static P: 5.7
Leak Rate Before: 0.002 cfm @ 12"Hg
Leak Rate After: 0.002 cfm @ 8"Hg

Method: 1-4
Testing Type: Vel/Moist
Area (ft^2): 0.20
Filter No: na
Thimble No: na
Beaker No: na

Bar. Press. (in. Hg): 30.07
Actual Moisture (%): 1.3
O_2 (dry volume %): 1.4
CO_2 (dry volume %): 34.9
Start Time (approx.): 10:39
Stop Time (approx.): 11:39
H_2O (condensate, ml): 6.0
H_2O (silica, g): 6.1

Traverse Point	Run Time	Pitot ΔP_s	Sample ΔH	Metered	Stack	Dry Gas Meter		$\sqrt{\Delta P_s}$	Volume
					T_s	$T_{m\ in}$	$T_{m\ out}$	(calculated)	(calculated)
	0.0	(in. H_2O)	(in. H_2O)	(ft^3) 747.94	(°F)	(°F)	(°F)	($\sqrt{in.}$ H_2O)	(ft^3)
1-01	5.0	0.27	1.80	751.40	71	45	45	0.52	3.47
1-02	10.0	0.23	1.80	754.83	73	46	46	0.48	3.43
1-03	15.0	0.28	1.80	758.27	74	46	46	0.53	3.44
1-04	20.0	0.28	1.80	761.72	75	46	46	0.53	3.45
1-05	25.0	0.26	1.80	765.17	74	45	45	0.51	3.45
1-06	30.0	0.27	1.80	768.53	75	47	47	0.52	3.36
2-01	35.0	0.26	1.80	772.03	72	48	48	0.51	3.50
2-02	40.0	0.29	1.80	775.58	73	49	49	0.54	3.55
2-03	45.0	0.29	1.80	779.05	74	49	49	0.54	3.47
2-04	50.0	0.25	1.80	782.60	74	49	49	0.50	3.55
2-05	55.0	0.24	1.80	786.05	75	49	49	0.49	3.45
2-06	60.0	0.23	1.80	789.67	76	50	50	0.48	3.62
Final	60.0	0.51	1.80	41.73	74	47			

Revision 0

LABORATORY DATA

F

Method 25
Analytical Results

prepared for

CLEAN AIR ENGINEERING

500 W. Wood Street
Palatine, IL 60067

by

Triangle Environmental Services, Inc.

Reviewed by:

Larry W. Taylor
Laboratory Analyst

Approved by:

John Venezia
Laboratory Supervisor

Approved by:

John Y. Morimoto, Ph.D.
QA Officer

Report

96280M

December 19, 1996

P.O. Box 13294 Research Triangle Park, NC 27709 (800) 367-4862

Triangle Environmental Services, Inc.
COMMENTS ON THE ANALYSES

Report #96280M for Clean Air Engineering

Tanks Received: 11/21/96

Samples Analyzed: 12/4-11/96
Client Chain-of-Custody forms: 1 p

Samples #1-6:

- Non-methane organic concentrations are reported relative to carbon and not to CH4 as in Report #96280-25C.

- The measured CH_4 concentrations for Samples #4-6 and the measured CO_2 concentrations for Samples #1-6 in the Method 25 analyses exceeded the calibration range of the instrument. The tank contents were diluted so as to bring the measured concentrations within the calibration range. The reported final tank pressure is the original final tank pressure multiplied by the dilution factor.

Samples #1-3,5:

The lab receipt pressure/temperature ratios of the tanks for these samples differed from your post-test pressure/temperature ratios as indicated in the table below:

Run	Tank ID	Ratio	%	Run	Tank ID	Ratio	%
1	N200	0.941	-5.9%	3	N339	0.946	-5.4%
2	6182P	0.933	-6.7%	5	N94	0.939	-6.1%

$$\text{Ratio} = \frac{\text{Lab } P/T}{\text{Client } P/T} \qquad \% = (\text{Ratio} - 1) \times 100$$

This may have an effect on all of the concentration calculations. The normal range for variations without comment is 5%. A revised table of results using TES laboratory receipt pressure and temperature data in place of your post-test data is included (Report #96280MR).

Triangle Environmental Services, Inc.

METHOD 25 TABLE OF RESULTS

Client: Clean Air Engineering ID#96280M Analyzed: 12/4-11/96

Project ID: 7834

	Sample Description	Concentrations (ppmC) CO	CH4	CO2	Non-CH4 Organics	Mass Conc. (mgC/cu.m)
1	Run 1 Outlet	2252	39	82763	142	71
2	Run 2 Outlet	138	< 9	75563	86	43
3	Run 3 Outlet	22	< 9	88065	147	73
4	Run 1 Inlet	< 28	388756	335678	2070	1034
5	Run 2 Inlet	< 31	366883	326338	2181	1089
6	Run 3 Inlet	< 30	373281	332642	2686	1341
7	Blank	<474	1147	3379	<1185	<592

< # = Concentration Below Practical Quantitation Limit

Triangle Environmental Services, Inc.

METHOD 25 TABLE OF RESULTS

Client: Clean Air Engineering ID#96280MR Analyzed: 12/4-11/96

Project ID: 7834 (Post-test PT data replaced by laboratory receipt data)

	Sample Description	Concentrations (ppmC) CO	CH4	CO2	Non-CH4 Organics	Mass Conc. (mgC/cu.m)
1	Run 1 Outlet	2403	42	88322	152	76
2	Run 2 Outlet	149	< 10	81442	93	46
3	Run 3 Outlet	23	< 9	93413	156	78
4	Run 1 Inlet	< 29	408921	353090	2177	1087
5	Run 2 Inlet	< 34	392221	348876	2332	1164
6	Run 3 Inlet	< 31	386359	344296	2781	1388
7	Blank	<472	1141	3364	<1179	<589

< # = Concentration Below Practical Quantitation Limit

Triangle Environmental Services, Inc.
METHOD 25 PROCEDURES

CALIBRATION

Initial calibrations and operational checks of the analytical systems are conducted at a frequency of no greater than one year between sets. The calibrations satisfy the requirements for Methods 25, 25-C, and 10-B.

Triplicate injections of a calibration gas mixture consisting of 199.7 ppm carbon monoxide, 49.85 ppm methane, 10000 ppm carbon dioxide, and 24.88 ppm propane are made immediately before and after each batch of samples. Daily response factors are calculated from the pre-batch integrated responses (average area count / concentration in ppmC) and must agree within 10% of the response factors of the initial calibrations. Further, the post-batch response factors must agree within 2% of the pre-batch response factors. Both criteria must be met before the analyses are considered valid.

ANALYSIS

All samples, which include the daily calibration gas mixture and sample tanks, are analyzed in triplicate using a computer-interfaced gas chromatograph equipped with an automated gas sampling system and a flame ionization detector (FID). CO, CH_4, and CO_2 are eluted from the column and pass through the analytical reduction catalyst to the FID. The column is then backflushed to elute the nonmethane organic (NMO) fraction, which passes through the analytical oxidation and reduction catalysts to the FID.

CALCULATIONS

Calculations are done in accord with USEPA Method 25 procedures. A sample calculation for one of the samples is provided in the report. CO blanks are used to compensate for a background concentration of "CO" due to the interference of O_2 resulting from the coelution of O_2 and CO. A concentration of noncondensibles or condensibles of less than the PQL is considered to be zero in computing the TGNMO.

EQUIPMENT

Tanks are twice evacuated and filled with ambient air filtered through charcoal and are then evacuated to below 10 mm Hg and monitored for at least an hour to check that the tanks do not leak more than 1 mm Hg/hour. They are then pressurized to greater than ambient pressure with helium, analyzed to ensure < 2 ppmC NMO, and stored for later use.

Sampling units are reconditioned by checking that all sections operate properly. The unit is flushed with zero air for at least thirty minutes before an aliquot of this flow is injected into the analyzer. If the total carbon concentration is below 10 ppm, the unit is made ready for use and stored for shipment.

Triangle Environmental Services, Inc.

METHOD 25 SAMPLE CALCULATION

Client: Clean Air Engineering ID#96280M Analyzed: 12/4-11/96

Project ID: 7834

Sample # 4 Run 1 Inlet

D A T A

Note: All pressure values have been converted when necessary to mm Hg and all temperature values to Kelvin.

Pressure, Temperature, Volume Data:

	Pressure (mm Hg)	Temp. (K)
Presampling	32.3	274.26
Postsampling	751.1	274.82
Lab Receipt	779.0	299.15
Tank Final	26925.0	299.15

Tank N44:
Tank Volume = 0.004555 cu.m

Response Factors (RF), Practical Quantitation Limits (PQL), and Area Counts:

	RF (area/ppmC)	PQL (ppmC)	Area 1	Area 2	Area 3
CO	191.7	28	0	0	0
CH4	204.3	28	2,306,897	2,307,611	2,309,188
CO2	202.5	28	1,973,985	1,976,040	1,975,684
Non-CH4 Organics	220.4	69	13,222	13,438	13,114

CO Blank = 0 area counts

C A L C U L A T I O N S

Measured Concentrations, corrected for blank (ppmC):

Cm(CO) = [Area(CO) - CO Blank] / RF(CO)
= [0 - 0] / 191.7 = 0.0
= [0 - 0] / 191.7 = 0.0
= [0 - 0] / 191.7 = 0.0

Cm(CH4) = Area(CH4)/RF(CH4)
= 2306897 / 204.3 = 11291.7
= 2307611 / 204.3 = 11295.2
= 2309188 / 204.3 = 11302.9

Cm(CO2) = Area(CO2)/RF(CO2)
= 1973985 / 202.5 = 9748.1
= 1976040 / 202.5 = 9758.2
= 1975684 / 202.5 = 9756.5

Cm(Non-CH4 Organics) = Area(Non-CH4 Organics)/RF(Non-CH4 Organics)
= 13222 / 220.4 = 60.0
= 13438 / 220.4 = 61.0
= 13114 / 220.4 = 59.5

Pressure-Temperature Ratio, Q(i) = P(i)/T(i) (mm Hg/K):

Tank Presampling: Q(2) = 32.3 / 274.26 = 0.118
Tank Postsampling: Q(1) = 751.1 / 274.82 = 2.733
Tank Lab Receipt: Q(5) = 779.0 / 299.15 = 2.604
Tank Final: Q(3) =26925.0 / 299.15 =90.005

Volume Sampled (dscm) = 0.3857 x Tank Volume x [Q(1)-Q(2)]
= 0.3857 x 0.004555 x [2.733 - 0.118]
= 0.004595

Averages and % Relative Standard Deviations (%RSD) of Cm's are calculated.
(%RSD of C=%RSD of Cm)

Calculated Concentrations (ppmC):

C(CO) = Q(3)/[Q(1)-Q(2)] x Cm(CO)
= 90.005/(2.733 - 0.118) x 0.0 = 0.0 (<PQL of 28)

C(CH4) = Q(3)/[Q(1)-Q(2)] x Cm(CH4)
= 90.005/(2.733 - 0.118) x 11296.6 = 388756.3

C(CO2) = Q(3)/[Q(1)-Q(2)] x Cm(CO2)
= 90.005/(2.733 - 0.118) x 9754.3 = 335678.2

C(Non-CH4 Organics) = Q(3)/[Q(1)-Q(2)] x Cm(Non-CH4 Organics)
= 90.005/(2.733 - 0.118) x 60.2 = 2070.1

Mass Concentration (mgC/cu.m)
= 0.4993 x TGNMO
= 0.4993 x 2070.1 = 1033.6

<PQL of ### = Concentration Below Practical Quantitation Limit

Triangle Environmental Services, Inc.
METHOD 25 SAMPLE QA/QC DATA

DAILY ANALYZER CHECKS

5.3* **Daily Calibration**

Response Factor Checks
Requirement: Daily RF = Initial RF ± 10%

	Initial RF
CO	229.66
CH_4	220.11
CO_2	223.76
NMO	221.17

Triplicate injections of a mixture of CO, CH_4, CO_2, and C_3H_8 are made before and after each batch of samples.

INITIAL NMO ANALYZER PERFORMANCE CHECKS

5.2.1* **Oxidation Catalyst Efficiency Check** 3/4/96

FID response with reduction catalyst in bypass mode = 0
Requirement: ≤1%

5.2.2* **Reduction Catalyst Efficiency Check** 3/4/96

Response of CH_4 with oxidation and reduction catalysts in series mode compared to response with both catalysts in bypass mode.
105.8% Requirement: > 95%

5.2.3* **Analyzer Linearity Check + NMO Calibration** 3/4/96

		Requirement:
RF Value CO:	± 1.89%	± 2.5%
RF Value CH_4:	± 1.03%	± 2.5%
RF Value CO_2:	± 1.35%	± 2.5%
RF Value NMO:	± 1.31%	± 2.5%
% RSD Values:	0.50%	≤2%
$\frac{RF\ (NMO)}{RF\ (CO_2)}$ =	1.01	1.0 ± 0.1

* USEPA Method 25 Protocol Reference Number

5.2.4* **System Performance Check** 3/4/96

	Measured Value	Expected Value	Requirement
Propane in Mix	24.9	25.0	± 5%
Hexane	49.96	49.06	± 5%
Toluene	20.5	19.97	± 5%
Methanol	100.0	99.54	± 5%

EQUIPMENT CHECKS

4.1.1* **Clean Sampling Equipment Check**

Sample Unit <10 ppmC total C @ 100%
Tank < 2 ppmC NMO @ 100%

4.1.2* **Sample Tank Evacuation and Leak Check**

Tank evacuated to ≤ 10 mm Hg absolute pressure, monitored for ≥ 1 hour, and passed for use if no pressure change (< 1 mm Hg/hr) is noted.

5.4* **Sample Tank Volumes**

Tank weighed empty, filled with deionized distilled water (temperature recorded), and weighed to the nearest 2 g. Volume calculated based on density of water at that temperature and results recorded in permanent file.

* USEPA Method 25 Protocol Reference Number

Triangle Environmental Services, Inc.

METHOD 25 DATA REPORT

Client: Clean Air Engineering ID#96280M Analyzed: 12/4-11/96

Project ID: 7834

Sample # 1 Run 1 Outlet

Pressure, Temperature, Volume Data:

	Pressure (mm Hg)	Temp. (K)	P/T
Presampling	39.9	274.26	0.145
Postsampling	657.1	274.82	2.391
Lab Receipt	673.0	299.15	2.250
Tank Final	6215.0	299.15	20.776

Tank N200:
Tank Volume = 0.004473 cu.m
Volume Sampled = 0.003874 dscm

$\frac{\text{Lab Receipt P/T}}{\text{Postsampling P/T}} = 0.941$

Response Factors (RF), Practical Quantitation Limits (PQL), and Area Counts:

	RF (area/ppmC)	PQL (ppmC)	Area 1	Area 2	Area 3
CO	192.1	8	46,700	46,824	46,745
CH4	206.4	8	858	862	892
CO2	202.6	8	1,809,530	1,814,288	1,813,505
Non-CH4 Organics	211.8	19	3,206	3,167	3,392

CO Blank = 0 area counts

Concentrations:

*=corrected for Blank	ppmC Amount	±	SD	%RSD
CO*	2252	±	3	0.1
CH4	39	±	1	2.1
CO2	82763	±	116	0.1
Non-CH4 Organics	142	±	5	3.7

Mass Concentration 71 mgC/cu.m

Triangle Environmental Services, Inc.

METHOD 25 DATA REPORT

Client: Clean Air Engineering ID#96280M Analyzed: 12/4-11/96

Project ID: 7834

Sample # 2 Run 2 Outlet

Pressure, Temperature, Volume Data:

	Pressure (mm Hg)	Temp. (K)	P/T
Presampling	39.9	274.26	0.145
Postsampling	509.8	274.82	1.855
Lab Receipt	518.0	299.15	1.732
Tank Final	5533.0	299.15	18.496

Tank 6182P:
Tank Volume = 0.005721 cu.m
Volume Sampled = 0.003772 dscm

$\frac{\text{Lab Receipt P/T}}{\text{Postsampling P/T}} = 0.933$

Response Factors (RF), Practical Quantitation Limits (PQL), and Area Counts:

	RF (area/ppmC)	PQL (ppmC)	Area 1	Area 2	Area 3
CO	191.7	9	2,417	2,431	2,484
CH4	204.3	9	100	137	121
CO2	202.5	9	1,414,076	1,414,445	1,414,466
Non-CH4 Organics	220.4	22	1,789	1,849	1,640

CO Blank = 0 area counts

Concentrations:

*=corrected for Blank	ppmC Amount	±	SD	%RSD
CO*	138	±	2	1.4
CH4	< 9			
CO2	75563	±	12	0.0
Non-CH4 Organics	86	±	5	6.1

Mass Concentration 43 mgC/cu.m

< # = Concentration Below Practical Quantitation Limit

Triangle Environmental Services, Inc.

METHOD 25 DATA REPORT

Client: Clean Air Engineering ID#96280M Analyzed: 12/4-11/96

Project ID: 7834

Sample # 3 Run 3 Outlet

Pressure, Temperature, Volume Data:

	Pressure (mm Hg)	Temp. (K)	P/T
Presampling	34.8	274.26	0.127
Postsampling	692.7	274.82	2.520
Lab Receipt	713.0	299.15	2.383
Tank Final	7276.0	299.15	24.322

Tank N339:
Tank Volume = 0.004532 cu.m
Volume Sampled = 0.004184 dscm

$\frac{\text{Lab Receipt P/T}}{\text{Postsampling P/T}} = 0.946$

Response Factors (RF), Practical Quantitation Limits (PQL), and Area Counts:

	RF (area/ppmC)	PQL (ppmC)	Area 1	Area 2	Area 3
CO	191.7	9	432	388	410
CH4	204.3	9	0	0	0
CO2	202.5	9	1,754,526	1,754,427	1,755,958
Non-CH4 Organics	220.4	21	3,124	3,290	3,156

CO Blank = 0 area counts

Concentrations:

*=corrected for Blank	ppmC Amount	±	SD	%RSD
CO*	22	±	1	5.4
CH4	< 9			
CO2	88065	±	43	0.0
Non-CH4 Organics	147	±	4	2.8

Mass Concentration 73 mgC/cu.m

< # = Concentration Below Practical Quantitation Limit

Triangle Environmental Services, Inc.

METHOD 25 DATA REPORT

Client: Clean Air Engineering ID#96280M Analyzed: 12/4-11/96

Project ID: 7834

Sample # 4 Run 1 Inlet

Pressure, Temperature, Volume Data:

	Pressure (mm Hg)	Temp. (K)	P/T
Presampling	32.3	274.26	0.118
Postsampling	751.1	274.82	2.733
Lab Receipt	779.0	299.15	2.604
Tank Final	26925.0	299.15	90.005

Tank N44:
Tank Volume = 0.004555 cu.m
Volume Sampled = 0.004595 dscm

$\frac{\text{Lab Receipt P/T}}{\text{Postsampling P/T}} = 0.953$

Response Factors (RF), Practical Quantitation Limits (PQL), and Area Counts:

	RF (area/ppmC)	PQL (ppmC)	Area 1	Area 2	Area 3
CO	191.7	28	0	0	0
CH4	204.3	28	2,306,897	2,307,611	2,309,188
CO2	202.5	28	1,973,985	1,976,040	1,975,684
Non-CH4 Organics	220.4	69	13,222	13,438	13,114

CO Blank = 0 area counts

Concentrations:

*=corrected for Blank	ppmC Amount ± SD	%RSD
CO*	< 28	
CH4	388756 ± 197	0.1
CO2	335678 ± 187	0.1
Non-CH4 Organics	2070 ± 26	1.2

Mass Concentration 1034 mgC/cu.m

< # = Concentration Below Practical Quantitation Limit

Triangle Environmental Services, Inc.

METHOD 25 DATA REPORT

Client: Clean Air Engineering ID#96280M Analyzed: 12/4-11/96

Project ID: 7834

Sample # 5 Run 2 Inlet

Pressure, Temperature, Volume Data:

	Pressure (mm Hg)	Temp. (K)	P/T
Presampling	32.3	274.26	0.118
Postsampling	646.9	274.82	2.354
Lab Receipt	661.0	299.15	2.210
Tank Final	25916.0	299.15	86.632

Tank N94:
Tank Volume = 0.004544 cu.m
Volume Sampled = 0.003920 dscm

$\frac{\text{Lab Receipt P/T}}{\text{Postsampling P/T}} = 0.939$

Response Factors (RF), Practical Quantitation Limits (PQL), and Area Counts:

	RF (area/ppmC)	PQL (ppmC)	Area 1	Area 2	Area 3
CO	192.0	31	0	0	0
CH4	203.3	31	1,925,976	1,926,285	1,924,266
CO2	202.7	31	1,708,118	1,708,271	1,706,600
Non-CH4 Organics	215.0	78	11,855	12,176	12,285

CO Blank = 0 area counts

Concentrations:

*=corrected for Blank	ppmC Amount ± SD	%RSD
CO*	< 31	
CH4	366883 ± 207	0.1
CO2	326338 ± 177	0.1
Non-CH4 Organics	2181 ± 40	1.8

Mass Concentration 1089 mgC/cu.m

< # = Concentration Below Practical Quantitation Limit

Triangle Environmental Services, Inc.

METHOD 25 DATA REPORT

Client: Clean Air Engineering ID#96280M Analyzed: 12/4-11/96

Project ID: 7834

Sample # 6 Run 3 Inlet

Pressure, Temperature, Volume Data:

	Pressure (mm Hg)	Temp. (K)	P/T
Presampling	32.3	274.26	0.118
Postsampling	697.7	274.82	2.539
Lab Receipt	735.0	299.15	2.457
Tank Final	26789.0	299.15	89.550

Tank N368:
Tank Volume = 0.004473 cu.m
Volume Sampled = 0.004177 dscm

$\frac{\text{Lab Receipt P/T}}{\text{Postsampling P/T}} = 0.968$

Response Factors (RF), Practical Quantitation Limits (PQL), and Area Counts:

	RF (area/ppmC)	PQL (ppmC)	Area 1	Area 2	Area 3
CO	192.0	30	0	0	0
CH4	203.3	30	2,050,089	2,054,000	2,051,589
CO2	202.7	30	1,820,650	1,824,838	1,823,837
Non-CH4 Organics	215.0	74	15,610	15,672	15,570

CO Blank = 0 area counts

Concentrations:

*=corrected for Blank	ppmC Amount ± SD	%RSD
CO*	< 30	
CH4	373281 ± 359	0.1
CO2	332642 ± 399	0.1
Non-CH4 Organics	2686 ± 9	0.3
Mass Concentration	1341 mgC/cu.m	

< # = Concentration Below Practical Quantitation Limit

Triangle Environmental Services, Inc.

METHOD 25 DATA REPORT

Client: Clean Air Engineering ID#96280M Analyzed: 12/4-11/96

Project ID: 7834

Sample # 7 Blank

Pressure, Temperature, Volume Data:

	Pressure (mm Hg)	Temp. (K)	P/T
Presampling	1.0	296.15	0.003
Postsampling	4.0	299.15	0.013
Lab Receipt	4.0	298.15	0.013
Tank Final	1755.0	298.15	5.886

Tank 6169P:
Tank Volume = 0.005786 cu.m
Volume Sampled = 0.000022 dscm

$\frac{\text{Lab Receipt P/T}}{\text{Postsampling P/T}} = 1.003$

Response Factors (RF), Practical Quantitation Limits (PQL), and Area Counts:

	RF (area/ppmC)	PQL (ppmC)	Area 1	Area 2	Area 3
CO	190.7	474	0	0	0
CH4	202.1	474	296	354	524
CO2	201.1	474	1,168	1,141	1,134
Non-CH4 Organics	225.7	1185	0	0	0

CO Blank = 0 area counts

Concentrations:

*=corrected for Blank	ppmC Amount ± SD	%RSD
CO*	< 474	
CH4	1147 ± 347	30.3
CO2	3379 ± 53	1.6
Non-CH4 Organics	<1185	
Mass Concentration	<592 mgC/cu.m	

< # = Concentration Below Practical Quantitation Limit

Run File : C:\STAR\RECALCD\TES_5046.RUN
Method File : C:\STAR\AUTOSAM.MTH
Sample ID : 16 tank N200 Sample #1

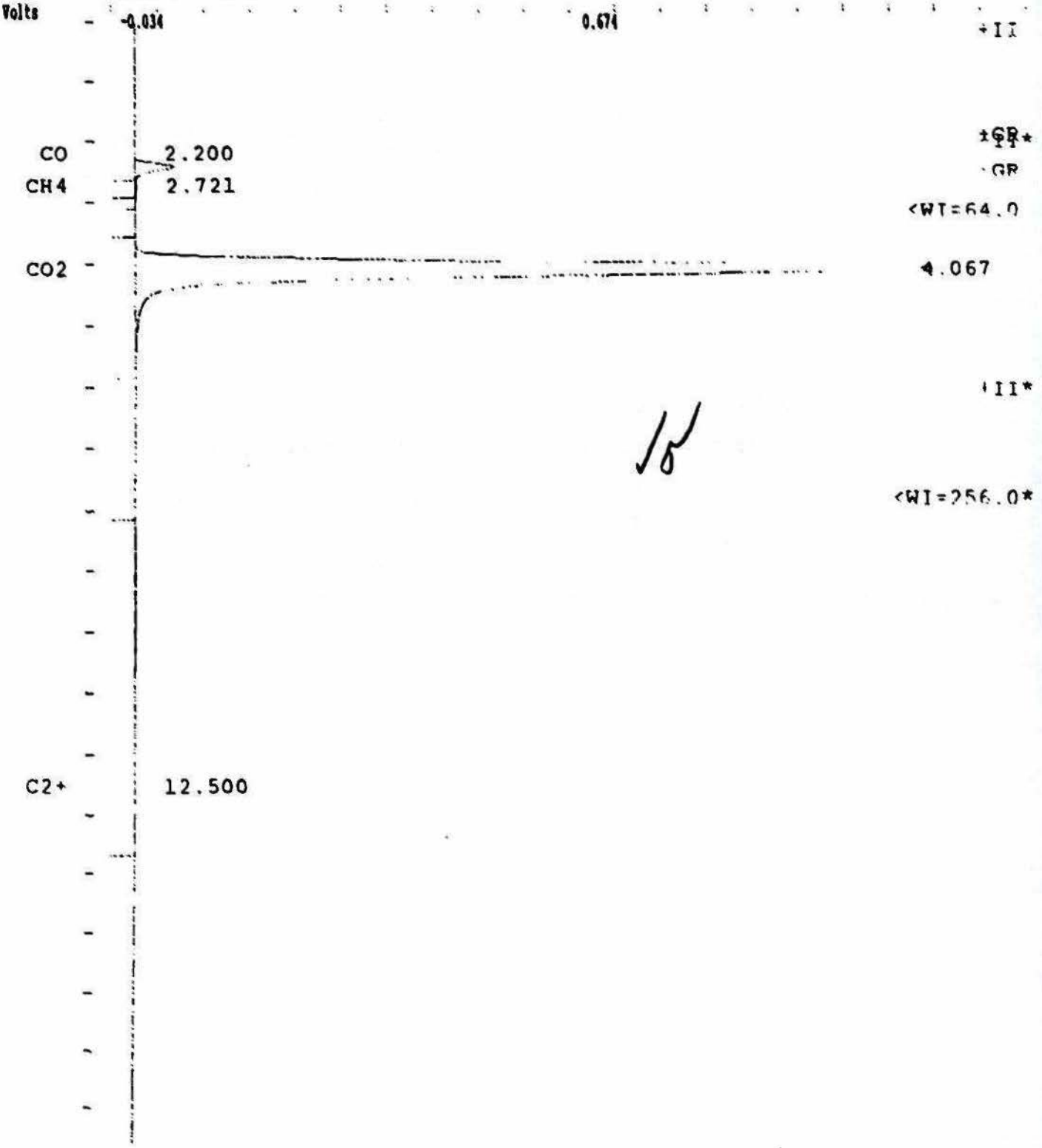
Injection Date: 9-DEC-96 9:42 AM Calculation Date: 9-JAN-97 11:39 AM

Operator : John Venezia
Workstation: MS-DOS 6
Instrument : TEK NMO ANALYZER
Channel : A - MS5

Detector Type: ADCR (10 Volts)
Bus Address : 16
Sample Rate : 10.00 Hz
Run Time : 19.002 min

********** Star Chromatography Software ********** Version 4.0 **********

Chart Speed : 1.10 cm/min Attenuation = 512 Zero Offset = 0
Start Time : 0.000 min End Time = 19.002 min Min / Pick = 0.000



Title : Total gaseous non-methane organic analysis
Run File : C:\STAR\RECALCB\TES_B046.RUN
Method File : C:\STAR\AUTOSAM.MTH
Sample ID : 16- tank N200 Sample #1

Injection Date: 9-DEC-96 2:42 AM Calculation Date: 6-JAN-97 11:27 AM

Operator : John Venezia
Workstation: MS-DOS_6
Instrument : TES NMO ANALYZER
Channel : A = M25

Detector Type: ADCB (10 Volts)
Bus Address : 16
Sample Rate : 10.00 Hz
Run Time : 19.002 min

********** Star Chromatography Software ********** Version 4.0 **********

Run Mode : Analysis - Subtract Blank Baseline
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	CO	2.5104	2.200	0.000	46700	GR	0.0	
2	CH4	0.0461	2.721	0.011	858	TS	0.0	
3	CO2	97.2712	4.067	0.037	1809530	BB	14.4	
4	C2+	0.1723	12.500	0.000	3206	GR	0.0	
	Totals:	100.0000		0.048	1860294			

Total Unidentified Counts : 0 counts

Detected Peaks: 4 Rejected Peaks: 0 Identified Peaks: 4

Amount Standard: N/A Multiplier: 1.000000 Divisor: 1.000000

Baseline Offset: 4 microVolts

Noise (used): 10 microVolts - fixed value
Noise (monitored before this run): 60 microVolts

Stream: 16 Injection Number: 1 Sampling Time: 0.00 min

Error Log:

3400 GC:

ADC Board:

Original Notes:

Appended Notes:

****

Title : Total gaseous non methane organic analysis
Run File : C:\STAR\RECALCS\TED_B088.RUN
Method File : C:\STAR\AUTOSAM.MTH
Sample ID : 14" tank #182P

Sample # 2

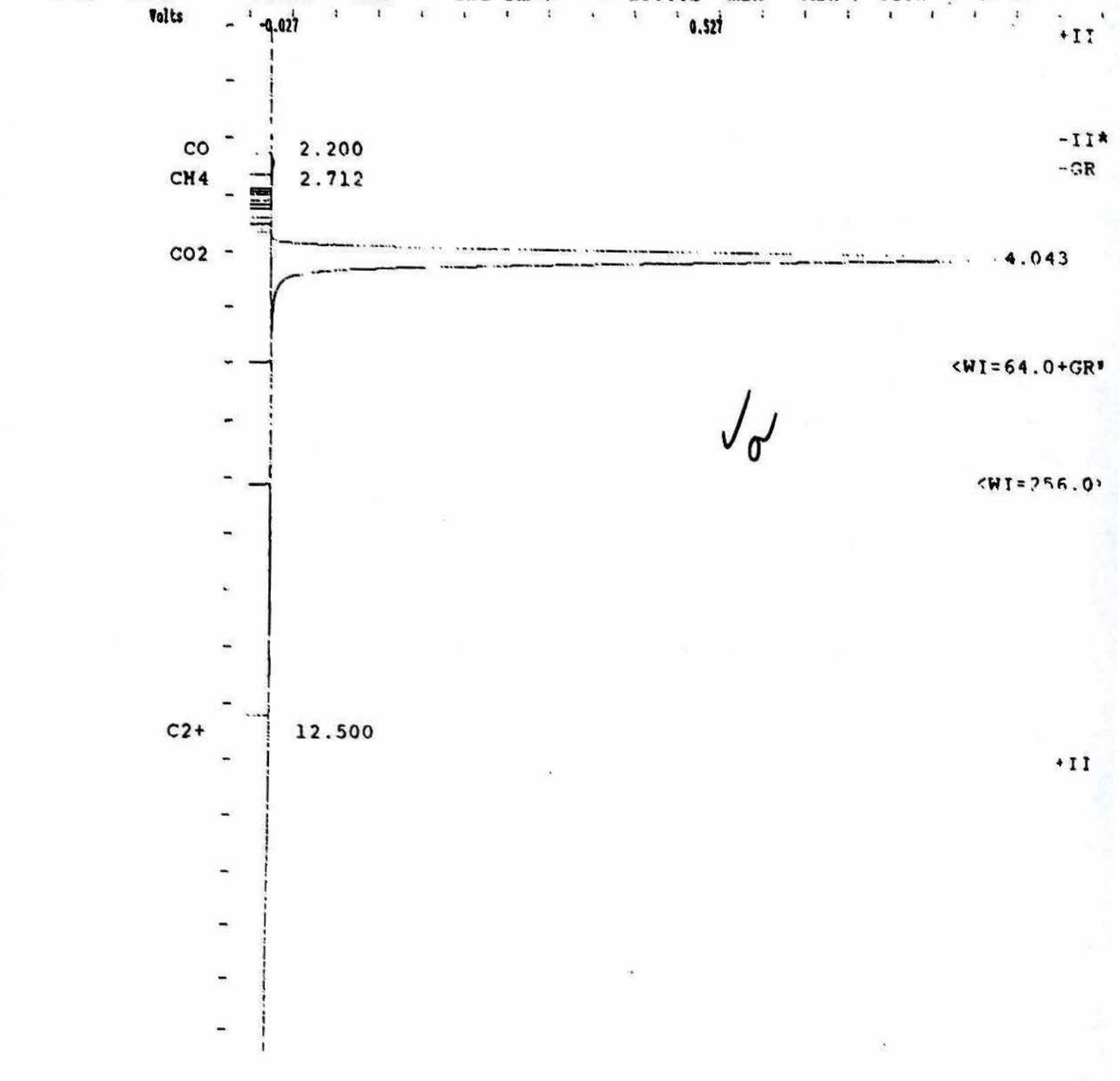
Injection Date: 10-DEC-96 4:42 AM Calculation Date: 9 JAN-97 11:20 AM

Operator : John Venezia
Workstation: WS 000 C
Instrument : TEB NMO ANALYZER
Channel : A = MZ5

Detector Type: ADCB (10 Volts)
Bus Address : 16
Sample Rate : 10.00 Hz
Run Time : 19.002 min

********** Star Chromatography Software ********** Version 4.0 **********

Chart Speed = 1.10 cm/min Attenuation = 431 Zero Offset = 31
Start Time = 0.000 min End Time = 19.002 min Min / Tick = 1.000



Title : Total gaseous non-methane organic analysis
Run File : C:\STAR\RECALCB\TES_B058.RUN
Method File : C:\STAR\AUTOSAM.MTH
Sample ID : 14- tank 6182P Sample #2

Injection Date: 10-DEC-96 4:42 AM Calculation Date: 6-JAN-97 11:30 AM

Operator : John Venezia
Workstation: MS-DOS_6
Instrument : TES NMO ANALYZER
Channel : A = M25

Detector Type: ADCB (10 Volts)
Bus Address : 16
Sample Rate : 10.00 Hz
Run Time : 19.002 min

********** Star Chromatography Software ********** Version 4.0 **********

Run Mode : Analysis - Subtract Blank Baseline
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	CO	0.1704	2.200	0.000	2417	GR	0.0	
2	CH4	0.0070	2.712	0.002	100	TS	0.0	
3	CO2	99.6964	4.043	0.013	1414076	PB	13.9	
4	C2+	0.1261	12.500	0.000	1789	GR	0.0	
	Totals:	99.9999		0.015	1418382			

Total Unidentified Counts : 0 counts

Detected Peaks: 12 Rejected Peaks: 8 Identified Peaks: 4

Amount Standard: N/A Multiplier: 1.000000 Divisor: 1.000000

Baseline Offset: 2 microVolts

Noise (used): 10 microVolts - fixed value
Noise (monitored before this run): 40 microVolts

Stream: 14 Injection Number: 1 Sampling Time: 0.00 min

Error Log:

3400 GC:

ADC Board:

Original Notes:

Appended Notes:

****

Run File : C:\STAR\RECALENTES [illegible].RUN
Method File : C:\STAR\AUTOSAM.MTH
Sample ID : 15 tank [illegible]

Sample #3

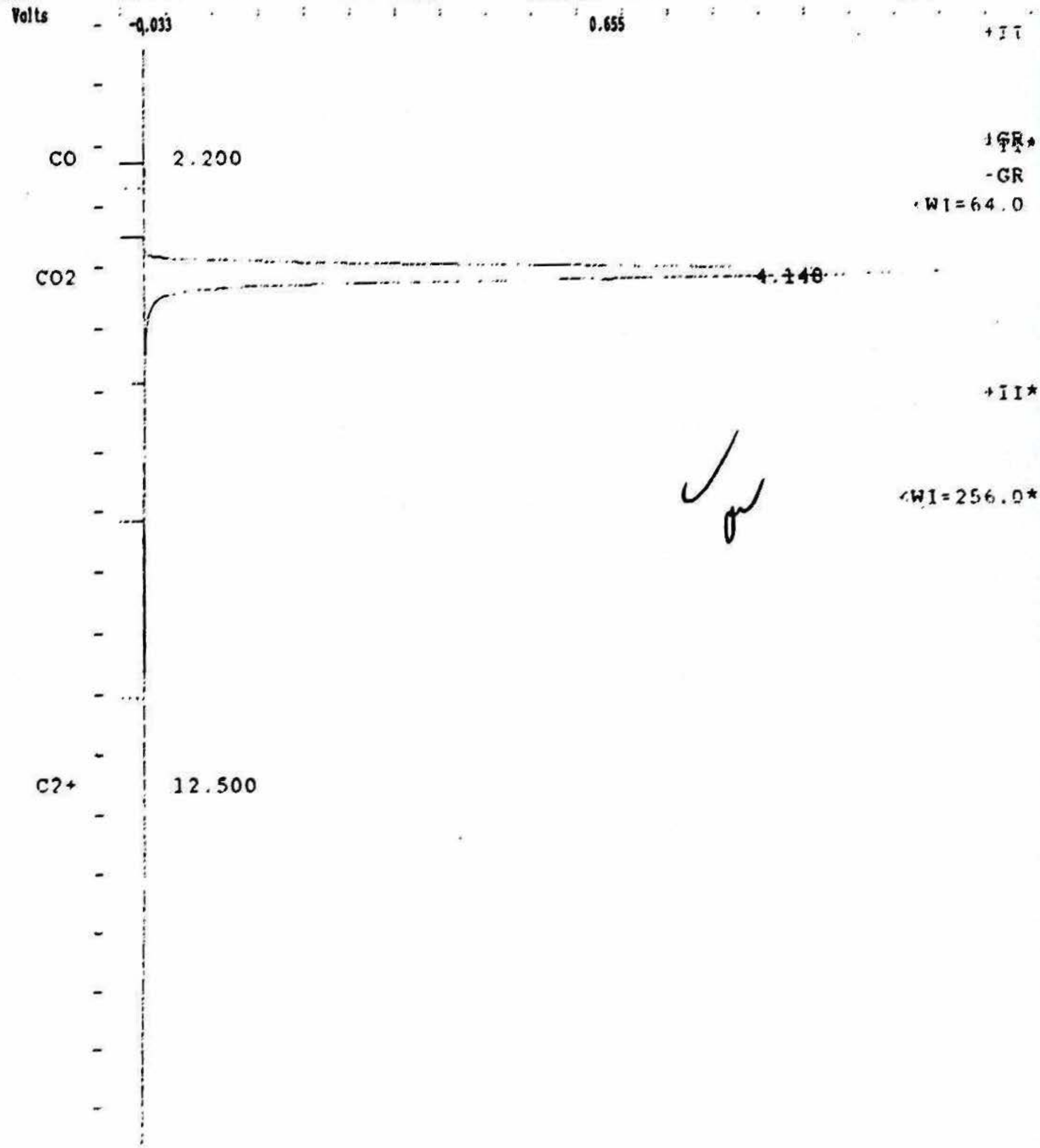
Injection Date: 16 DEC-96 [illegible] Calculation Date: [illegible]

Operator : John Venezia
Workstation: MS-DOS 6
Instrument : TEC NMO ANALYZER
Channel : A = M25

Detector Type: ADCB (10 Volts)
Bus Address : 16
Sample Rate : 10.00 Hz
Run Time : 19.002 min

*********** Star Chromatography Software *********** Version [illegible] ***************

Chart Speed = 1.10 cm/min Attenuation = 536 Zero Offset = [illegible]
Start Time = 0.000 min End Time = 19.002 min Min / Tick = 1.00



Title : Total gaseous non-methane organic analysis
Run File : C:\STAR\RECALCB\TES_B061.RUN
Method File : C:\STAR\AUTOSAM.MTH
Sample ID : 15- tank N339 Sample #3

Injection Date: 10-DEC-96 5:47 AM Calculation Date: 6-JAN-97 11:17 AM

Operator : John Venezia
Workstation: MS-DOS_6
Instrument : TES NMO ANALYZER
Channel : A = M25

Detector Type: ADCB (10 Volts)
Bus Address : 16
Sample Rate : 10.00 Hz
Run Time : 19.002 min

********** Star Chromatography Software ********** Version 4.0 **********

Run Mode : Analysis - Subtract Blank Baseline
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	CO	0.0246	2.200	0.000	432	GR	0.0	
2	CO2	99.7978	4.148	0.117	1754526	BB	14.3	
3	C2+	0.1777	12.500	0.000	3124	GR	0.0	
	Totals:	100.0001		0.117	1758082			

Total Unidentified Counts : 0 counts

Detected Peaks: 3 Rejected Peaks: 0 Identified Peaks: 3

Amount Standard: N/A Multiplier: 1.000000 Divisor: 1.000000

Baseline Offset: 1 microVolts

Noise (used): 10 microVolts - fixed value
Noise (monitored before this run): 50 microVolts

Stream: 15 Injection Number: 1 Sampling Time: 0.00 min

Error Log:

3400 GC:

ADC Board:

Original Notes:

Appended Notes:

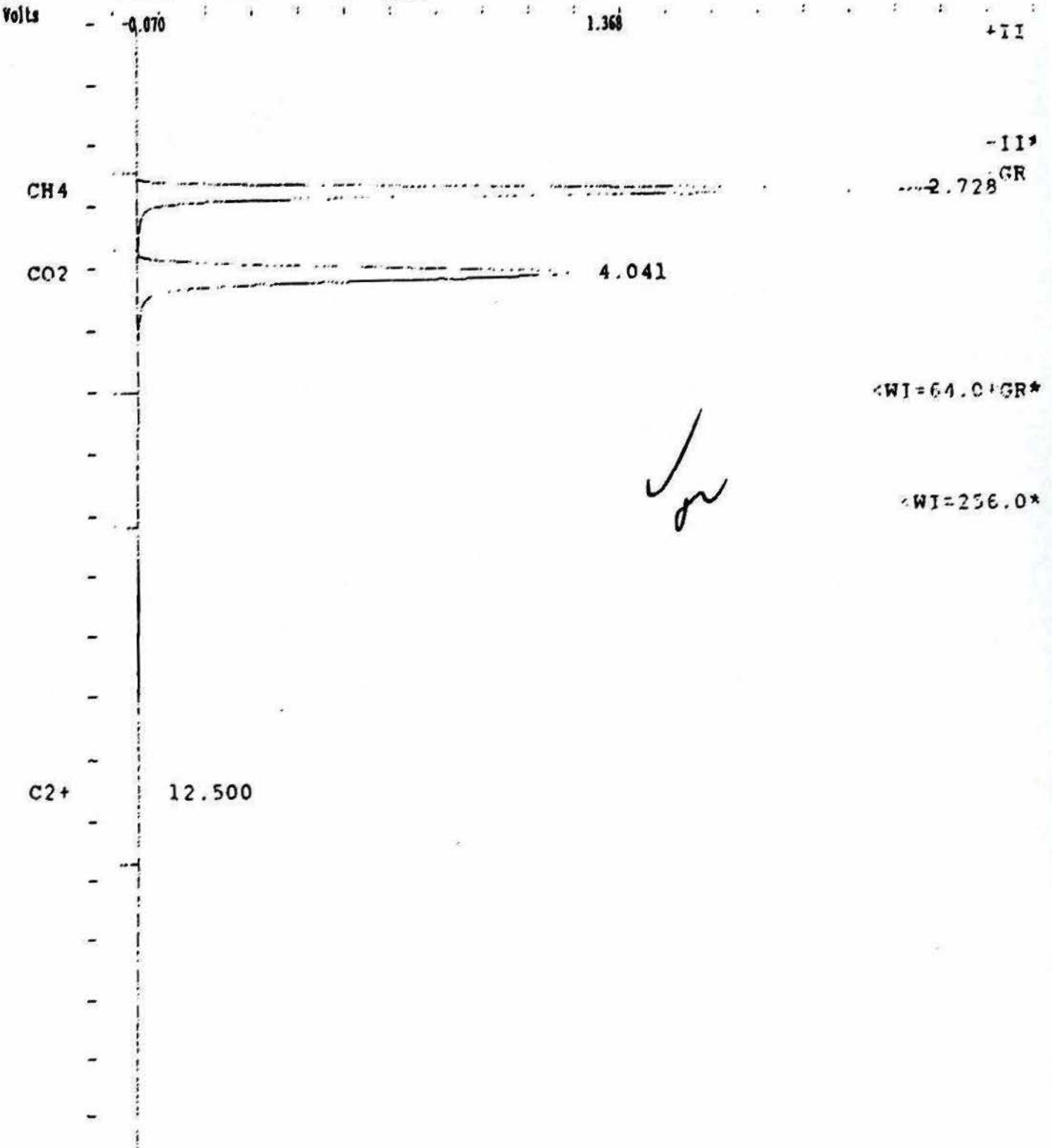
****

Sample #4

Operator : John Venezia
Instrument : TCD MMO ANALYZER
Channel : A - M25
Detector Type: Analog (10 Volts)
Bus Address : 16
Sample Rate : 10.00 Hz
Run Time : 19.002 min

********** Star Chromatography Software ********** Version 4.0 **********

Chart Speed : 1.0 cm/min Attenuation = 1120 Zero Offset = 0.
Start Time = 0.000 min End Time = 19.002 min Min / Div = 1.00



Title : Total gaseous non-methane organic analysis
Run File : C:\STAR\RECALCB\TES_B064.RUN
Method File : C:\STAR\AUTOSAM.MTH
Sample ID : 16- tank N44 Sample #4

Injection Date: 10-DEC-96 6:53 AM Calculation Date: 6-JAN-97 11:20 AM

Operator : John Venezia
Workstation: MS-DOS 6
Instrument : TES NMO ANALYZER
Channel : A = M25
Detector Type: ADCB (10 Volts)
Bus Address : 16
Sample Rate : 10.00 Hz
Run Time : 19.002 min

********** Star Chromatography Software ********** Version 4.0 **********

Run Mode : Analysis - Subtract Blank Baseline
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	CH4	53.7224	2.728	0.018	2306897	BV	8.8	
2	CO2	45.9697	4.041	0.011	1973985	VB	14.0	
3	C2+	0.3079	12.500	0.000	13222	GR	0.0	
	Totals:	100.0000		0.029	4294104			

Total Unidentified Counts : 0 counts

Detected Peaks: 3 Rejected Peaks: 0 Identified Peaks: 3

Amount Standard: N/A Multiplier: 1.000000 Divisor: 1.000000

Baseline Offset: -3 microVolts

Noise (used): 10 microVolts - fixed value
Noise (monitored before this run): 50 microVolts

Stream: 16 Injection Number: 1 Sampling Time: 0.00 min

Error Log:

3400 GC:

ADC Board:

Original Notes:

Appended Notes:

****

Run File : [illegible]\STAR\[illegible]_[illegible].RUN
Method File : [illegible]\STAR\AUTOSAM.MTH
Sample ID : 15 tank N#4 Sample #5

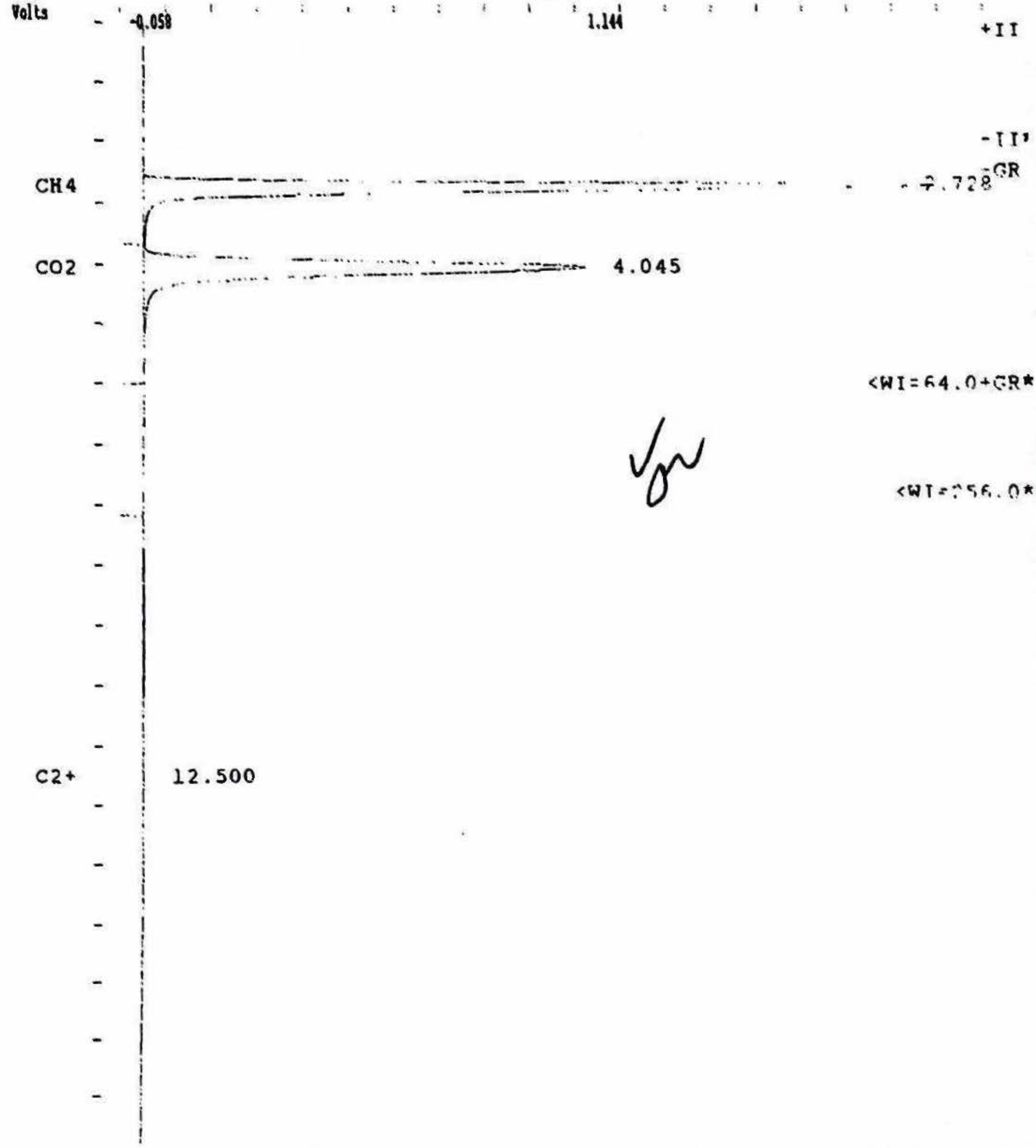
[illegible] Date: [illegible] 96 5:[illegible] AM Calculation Date: 6 [illegible]

Operator : [illegible] Venezia
Workstation: MS DOS 6
Instrument : [illegible] ANALYZER
Channel : A = M25

Detector Type: ADCB ([illegible] Volts)
Bus Address : [illegible]
Sample Rate : [illegible] Hz
Run Time : 1[illegible].002 min

*********** Star Chromatography Software *********** Version 4.[illegible] ***************

Chart Speed = [illegible] cm/min Attenuation = [illegible]36 Zero Offset [illegible]
Start Time [illegible] min End Time = 1[illegible] min Min / Tick [illegible]



Title : Total gaseous non-methane organic analysis
Run File : C:\STAR\RECALCB\TES_B125.RUN
Method File : C:\STAR\AUTOSAM.MTH
Sample ID : 15- tank N94 Sample #5

Injection Date: 11-DEC-96 5:33 AM Calculation Date: 6-JAN-97 11:09 AM

Operator : John Venezia
Workstation: MS-DOS_6
Instrument : TES NMO ANALYZER
Channel : A = M25

Detector Type: ADCB (10 Volts)
Bus Address : 16
Sample Rate : 10.00 Hz
Run Time : 19.002 min

********** Star Chromatography Software ********** Version 4.0 **********

Run Mode : Analysis - Subtract Blank Baseline
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	CH4	52.8251	2.728	0.018	1925976	BV	8.8	
2	CO2	46.8498	4.045	0.015	1708118	VB	13.9	
3	C2+	0.3252	12.500	0.000	11855	GR	0.0	
	Totals:	100.0001		0.033	3645949			

Total Unidentified Counts : 0 counts

Detected Peaks: 3 Rejected Peaks: 0 Identified Peaks: 3

Amount Standard: N/A Multiplier: 1.000000 Divisor: 1.000000

Baseline Offset: -3 microVolts

Noise (used): 10 microVolts - fixed value
Noise (monitored before this run): 60 microVolts

Stream: 15 Injection Number: 1 Sampling Time: 0.00 min

Error Log:

3400 GC:

ADC Board:

Original Notes:

Appended Notes:

****

Data File : C:\STAR\RESULTS\TEST_0120.RUN
Method File : C:\STAR\METHSAM.MTH
Sample ID : [illegible]

Sample #6

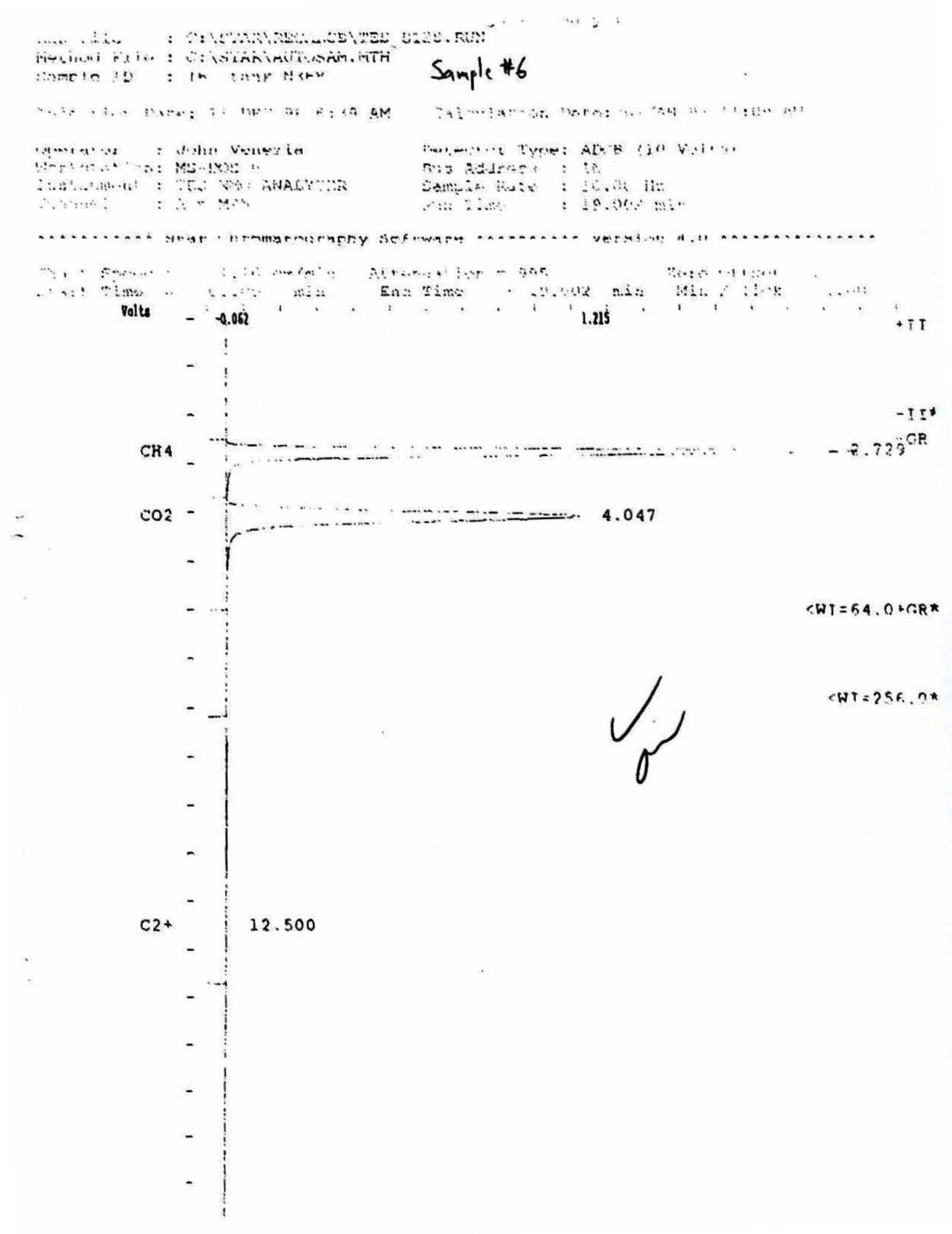
Run Date: [illegible] 6:49 AM Calibration Date: [illegible]

Operator : John Venezia
Workstation: WS-1000 #
Instrument : TEST 999: ANALYTICAL
Channel : A = MAIN

Detector Type: ADTB (10 Volts)
Bus Address : 18
Sample Rate : 10.00 Hz
Run Time : 10.000 min

********** Star Chromatography Software ********** Version 4.0 **********

Start Temp: [illegible] Attenuation = 995 Data Stored
Start Time = [illegible] min End Time = 10.002 min Min. / Inch [illegible]



Title : Total gaseous non-methane organic analysis
Run File : C:\STAR\RECALCB\TES_B128.RUN
Method File : C:\STAR\AUTOSAM.MTH
Sample ID : 16- tank N368 Sample #6

Injection Date: 11-DEC-96 6:39 AM Calculation Date: 6-JAN-97 11:09 AM

Operator : John Venezia
Workstation: MS-DOS_6
Instrument : TES NMO ANALYZER
Channel : A = M25

Detector Type: ADCB (10 Volts)
Bus Address : 16
Sample Rate : 10.00 Hz
Run Time : 19.002 min

********** Star Chromatography Software ********** Version 4.0 **********

Run Mode : Analysis - Subtract Blank Baseline
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	CH4	52.7510	2.729	0.019	2050089	BV	8.8	
2	CO2	46.8473	4.047	0.017	1820650	VB	14.0	
3	C2+	0.4017	12.500	0.000	15610	GR	0.0	
	Totals:	100.0000		0.036	3886349			

Total Unidentified Counts : 0 counts

Detected Peaks: 3 Rejected Peaks: 0 Identified Peaks: 3

Amount Standard: N/A Multiplier: 1.000000 Divisor: 1.000000

Baseline Offset: -3 microVolts

Noise (used): 10 microVolts - fixed value
Noise (monitored before this run): 30 microVolts

Stream: 16 Injection Number: 1 Sampling Time: 0.00 min

Error Log:

3400 GC:

ADC Board:

Original Notes:

Appended Notes:

****

Title : Total gaseous non-methane organic analysis
Run File : C:\STAR\RECALCB\TES_B186.RUN
Method File : C:\STAR\AUTOSAM.MTH
Sample ID : 14- tank 6169P Sample # 7

Injection Date: 12-DEC-96 4:19 AM Calculation Date: 6-JAN-97 11:33 AM

Operator : John Venezia
Workstation: MS-DOS_6
Instrument : TES NMO ANALYZER
Channel : A = M25

Detector Type: ADCB (10 Volts)
Bus Address : 16
Sample Rate : 10.00 Hz
Run Time : 19.002 min

********** Star Chromatography Software ********** Version 4.0 **********

Run Mode : Analysis - Subtract Blank Baseline
Peak Measurement: Peak Area
Calculation Type: Percent

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	CH4	18.5726	2.737	0.027	296	VV	8.4	
2	CO2	73.2965	4.065	0.035	1168	VV	15.6	
	Totals:	91.8691		0.062	1464			

Total Unidentified Counts : 130 counts

Detected Peaks: 29 Rejected Peaks: 23 Identified Peaks: 2

Amount Standard: N/A Multiplier: 1.000000 Divisor: 1.000000

Baseline Offset: -1 microVolts

Noise (used): 10 microVolts - fixed value
Noise (monitored before this run): 50 microVolts

Stream: 14 Injection Number: 1 Sampling Time: 0.00 min

Error Log:

3400 GC:

ADC Board:

Original Notes:

Appended Notes:

****

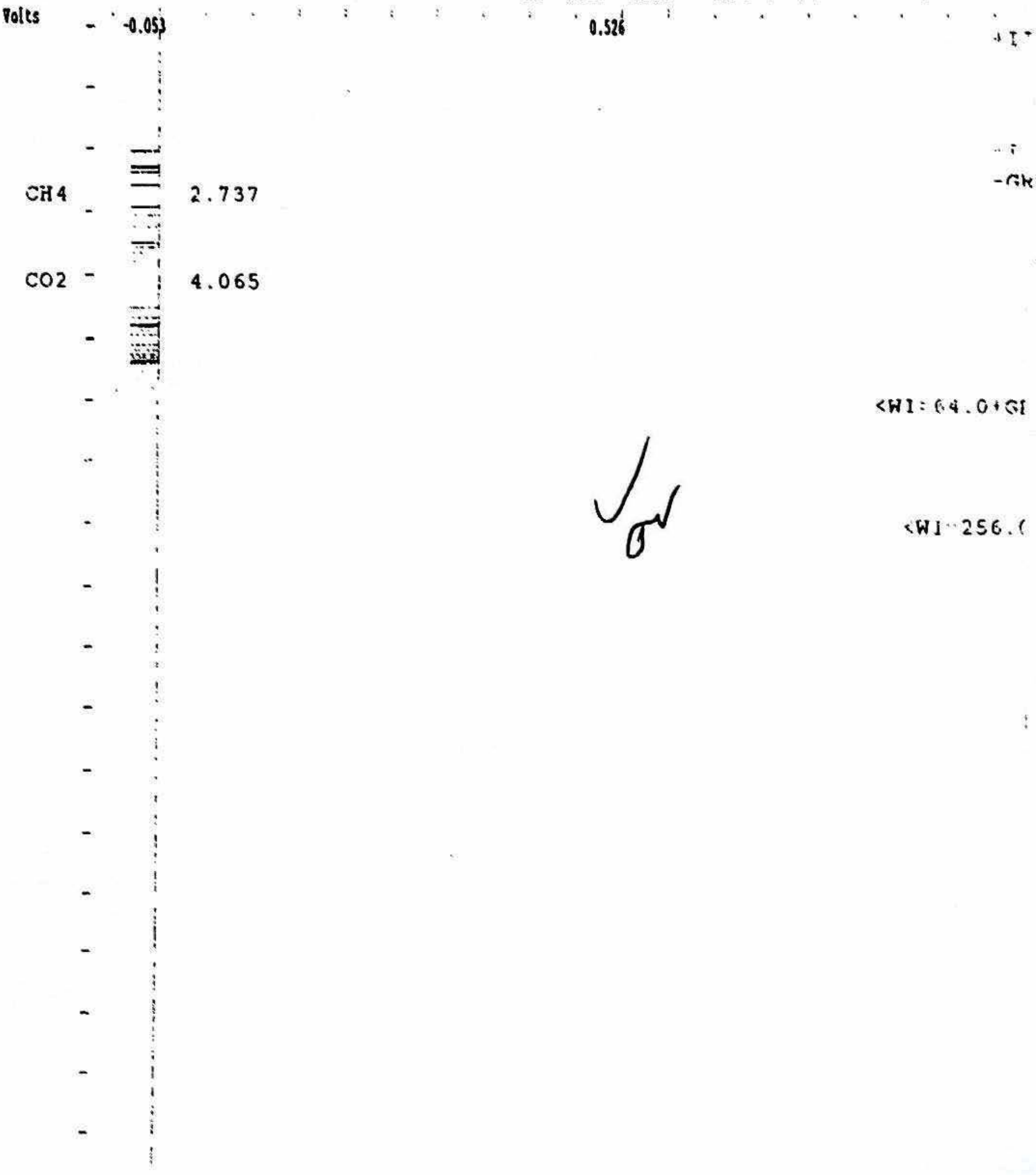
Run File : [illegible]_D186.RUN
Method File : [illegible]\AUTO[illegible].MTH
Sample ID : 14 Tank 6169P JV Sample #7

[illegible]

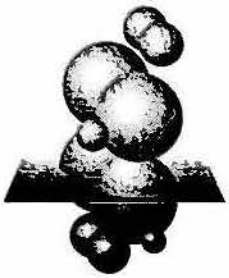
[illegible] Detector Type: [illegible]
Workstation: MS DOS [illegible] Bus Address : 16
[illegible] Sample Rate : 10.00 [illegible]
[illegible] : A [illegible] M25 Run Time : 19.002 min

********** Star Chromatography Software ********** Version 4.6 **************

[illegible] 1.10 cm/min Attenuation [illegible]
[illegible] End Time: 19.002 min [illegible]



Air Quality Laboratory, Inc.



CLIENT: Triangle Environmental Services, Inc.
PROJECT: 960280
PROJECT ID: Clean Air Engineering
AQL #: 96085
DATE OF REPORT: December 26, 1996
DATE RECEIVED: December 19, 1996

ANALYSIS OF CANISTERS FOR CHARACTERIZATION OF COMPONENTS BY GC-MS

The sample set consisted of six Method 25 sampling canister delivered to Air Quality Laboratory, Inc. via Triangle Environmental Services, Inc.

The samples were analyzed using USEPA Method TO-14 and TO-15 as a guidance documents.

Summary points of the results are:

1. The sample was diluted by Triangle Environmental Services personnel and by Air Quality Laboratory.

2. The samples were analyzed by GC-MS, utilizing a 0.32mm X 60 m DB-1 capillary column.

3. All samples arrived in good condition.

4. The tentatively identified compounds have an associated quantitation error of -50 - +100% as defined in the USEPA Contract Laboratory Program, "Volatile Organics Analysis of Ambient Air in Canisters", December, 1991, Revision VCAA01.0.4.

Thomas A. Buedel
Laboratory Manager
Air Quality Laboratory

12-26-96
Date

P.O.Box 12104 Research Triangle Park, NC 27709 Fax (919) 544-5600 Phone (919) 361-0338

Air Quality Laboratory, Inc.

Tentatively Identified Compounds

AQL Project 96085-1

FILE 960482, TES96280-1 CAE, Canister N200

Dilution Factor = 9.2515

Scan #	Tentative ID	Amount PPMV	Peak Area
555	Acetic Acid	0.4	10076
933	Xylene	12	275521
721	d8-Toluene (Internal Standard)	0.04	207627

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Air Quality Laboratory, Inc.

Tentatively Identified Compounds

AQL Project 96085-2

FILE 960483, TES96280-2 CAE, Canister 6182P

Dilution Factor = 21.6378

Scan #	Tentative ID	Amount PPMV	Peak Area
931	Xylene	10	77198
720	d8-Toluene (Internal Standard)	0.04	161434

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Air Quality Laboratory, Inc.

Tentatively Identified Compounds

AQL Project 96085-3

FILE 960484, TES96280-3 CAE, Canister N339

Dilution Factor = 20.323

Scan #	Tentative ID	Amount PPMV	Peak Area
932	Xylene	2	20455
722	d8-Toluene (Internal Standard)	0.04	176040

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Air Quality Laboratory, Inc.

Tentatively Identified Compounds

AQL Project 96085-4

FILE 960485, TES96280-4 CAE, Canister N44

Dilution Factor = 68.827

Scan #	Tentative ID	Amount PPMV	Peak Area
544	Cyclohexane	25	61453
731	Toluene	118	285507
811	Trimethylhexane	50	121733
919	Ethylbenzene	159	386936
935	Xylene	195	472196
980	Xylene	64	154710
1008	Trimethylheptane	146	353984
1071	Methylethylcyclohexane	114	277064
1124	Tetramethylpentane	342	829935
1145	Methylhexane	78	189359
1157	Trimethylbenzene	54	130866
1174	Decane	319	773747
1200	Methyl(methylethyl)benzene	94	229268
1207	Ethylmethylheptane	120	290325
1213	Tetramethylpentane	84	202745
1224	Tetramethylpentane	59	142704
1233	Ethylmethyloctane	108	262456
1256	Trimethyldecane	139	338240
723	d8-Toluene (Internal Standard)	0.04	167046

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Air Quality Laboratory, Inc.

Tentatively Identified Compounds

AQL Project 96085-5

FILE 960486, TES96280-5 CAE, Canister N94

Dilution Factor = 77.4728

Scan #	Tentative ID	Amount PPMV	Peak Area
450	Dichloroethene	47	107822
549	Cyclohexane	31	71283
732	Toluene	126	290489
812	Trimethylhexane	51	118077
918	Ethylbenzene	179	412508
935	Xylene	233	535870
1008	Tetramethylhexane	176	404529
1074	Hexyloxymethylhexane	140	322392
1089	Dimethyloctane	89	204870
1123	Dimethylcyclobutanone	128	294307
1133	Trimethyloctane	47	107664
1144	Tetramethylpentane	91	210288
1155	Methyl(methylethyl)cyclohexene	78	180312
1173	Decane	329	757434
1199	Methyl(methylethyl)benzene	94	215892
1205	Ethylmethylheptane	136	311952
1211	Tetramethylpentane	97	222400
1221	Dimethylcyclohexanedione	66	152544
1229	Dimethylundecane	105	241977
1252	Trimethyldecane	104	238378
1257	Trimethyldecane	65	148594
1292	Methylnonane	114	262640
725	d8-Toluene (Internal Standard)	0.04	178108

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Air Quality Laboratory, Inc.

Tentatively Identified Compounds

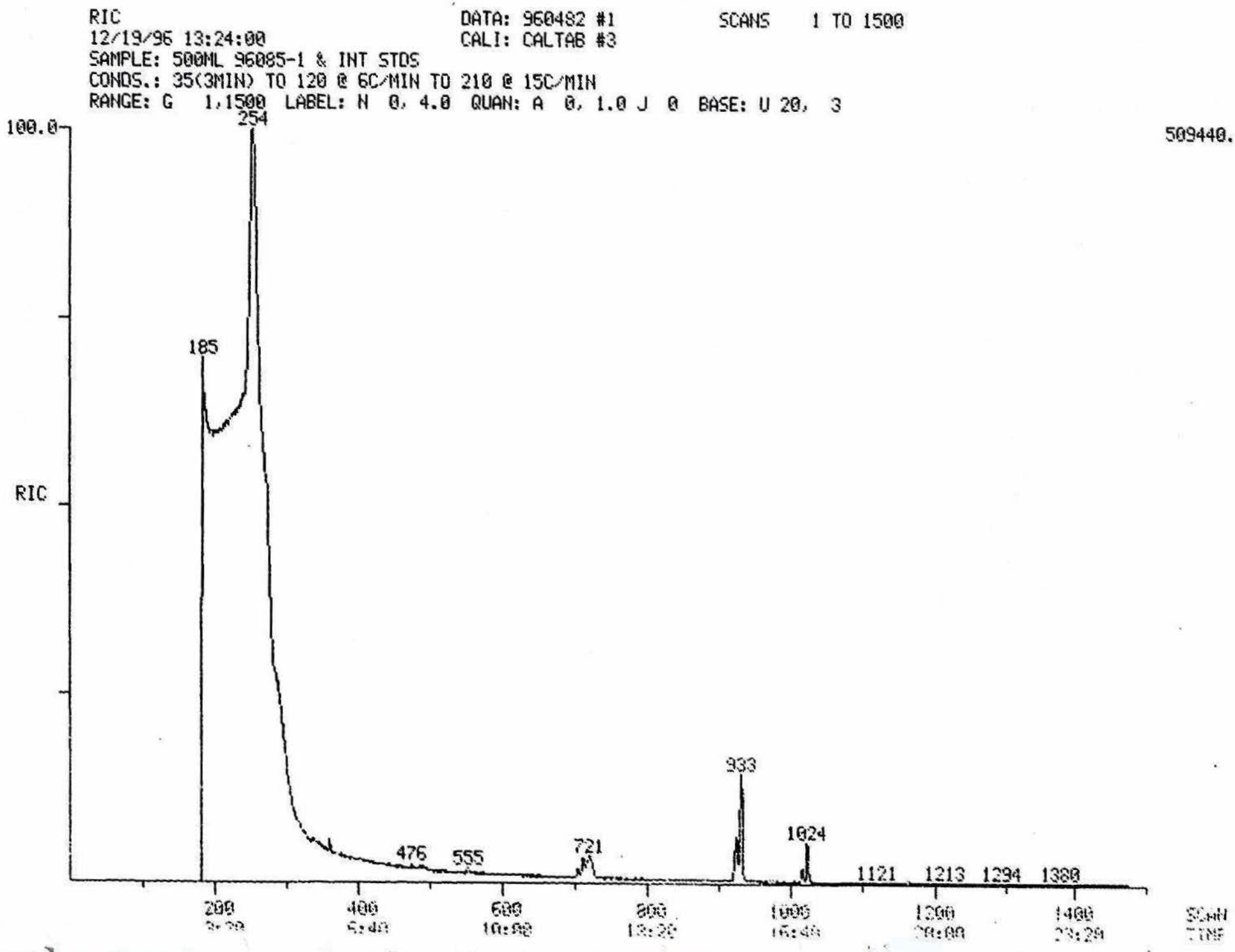
AQL Project 96085-6

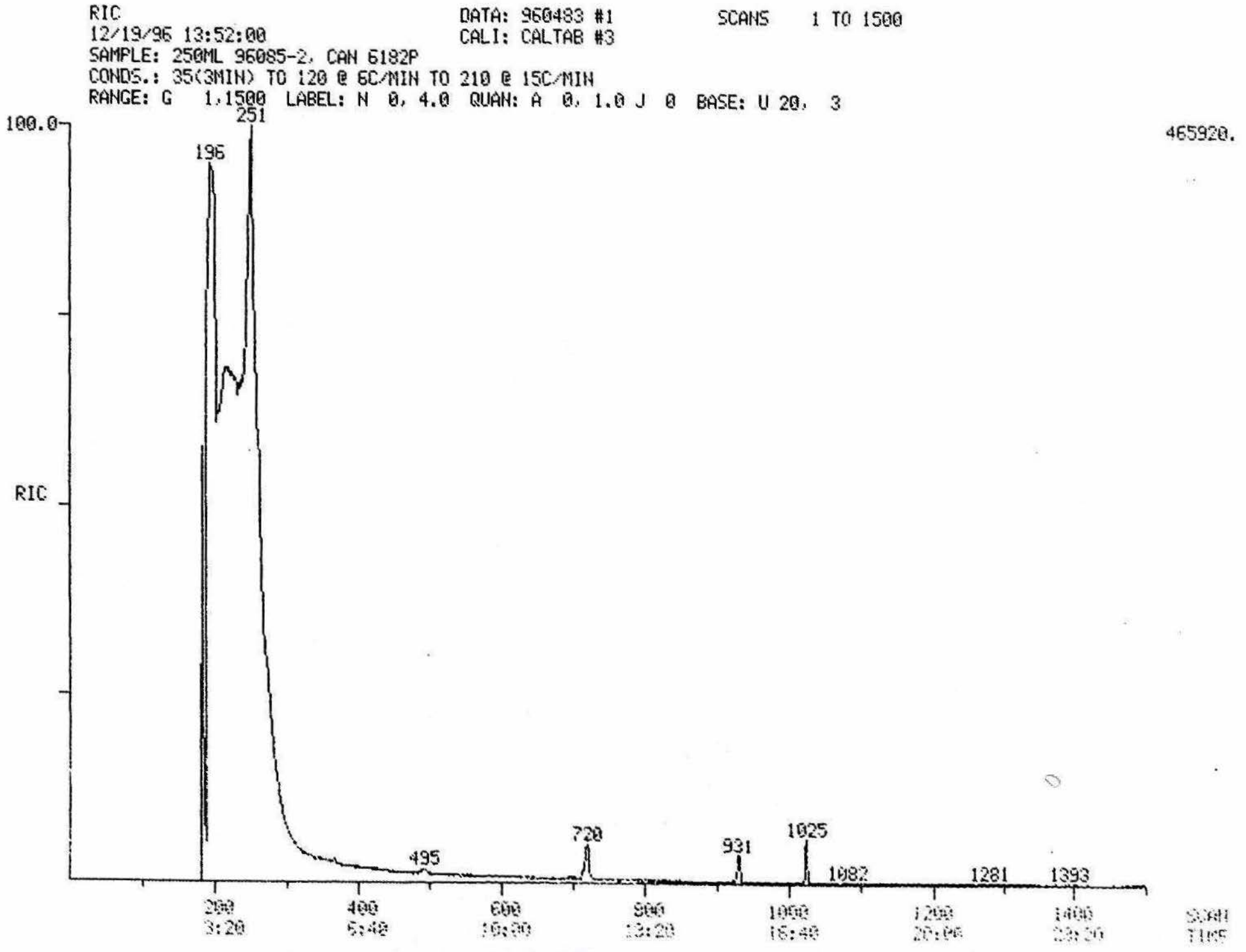
FILE 960487, TES96280-6 CAE, Canister N368

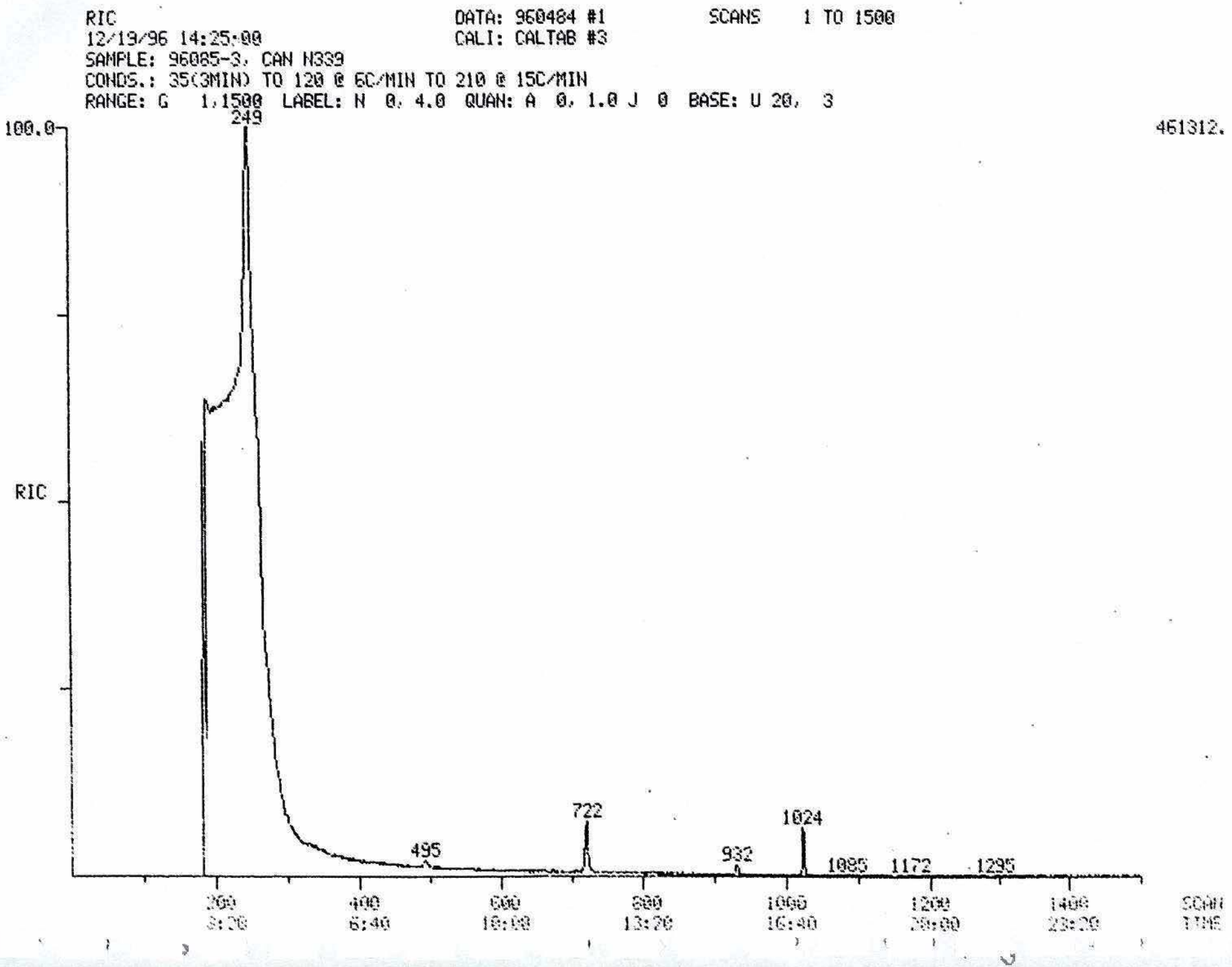
Dilution Factor = 73.9688

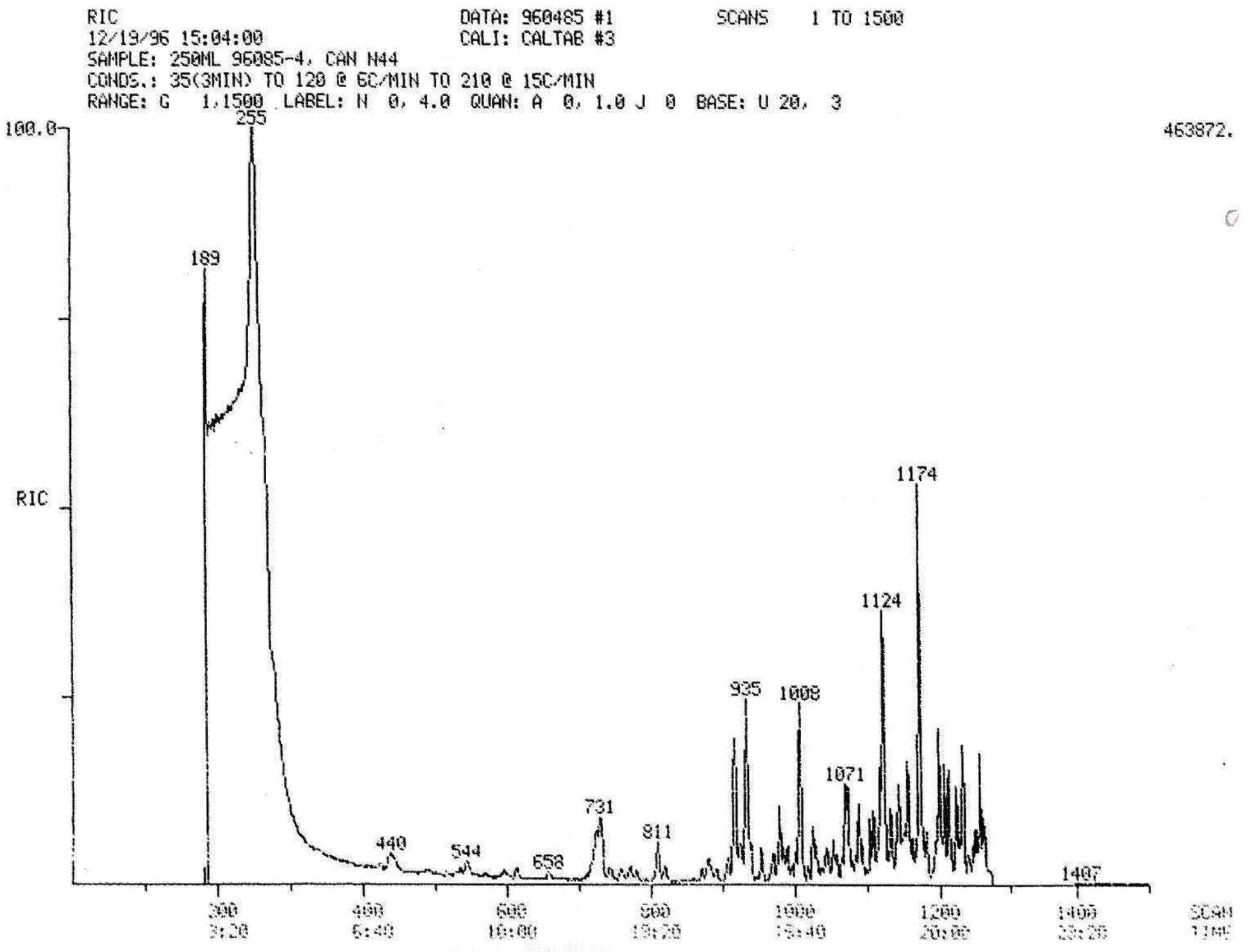
Scan #	Tentative ID	Amount PPMV	Peak Area
439	Dichloroethene	43	102330
541	Cyclohexane	25	59656
612	Heptane	12	29413
727	Toluene	97	232259
808	Octane	52	124533
879	Ethylhexane	31	75036
916	Ethylbenzene	135	322000
932	Xylene	167	398257
953	Methyloctane	33	78506
978	Xylene	57	137109
1006	Trimethylheptane	169	402692
1069	Methylethylcyclohexane	123	294007
1087	Trimethylhexene	82	195331
1123	Tetramethylpentane	358	854568
1132	Trimethyloctane	46	109312
1143	Tetramethylpentane	89	213264
1154	Methyl(methylethyl)cyclohexene	76	180260
1173	Dimethylheptane	328	782176
1199	Methyl(methylethyl)benzene	97	232052
1206	Ethylmethylheptane	141	337024
1212	Tetramethylpentane	99	236552
1223	Unknown	19	44968
1231	Dimethylundecane	123	292840
1255	Trimethyldecane	162	385648
1295	Methylnonane	118	282384
1326	Heptylhexylether	24	56675
1392	Trimethylhexene	10	23766
720	d8-Toluene (Internal Standard)	0.04	176414

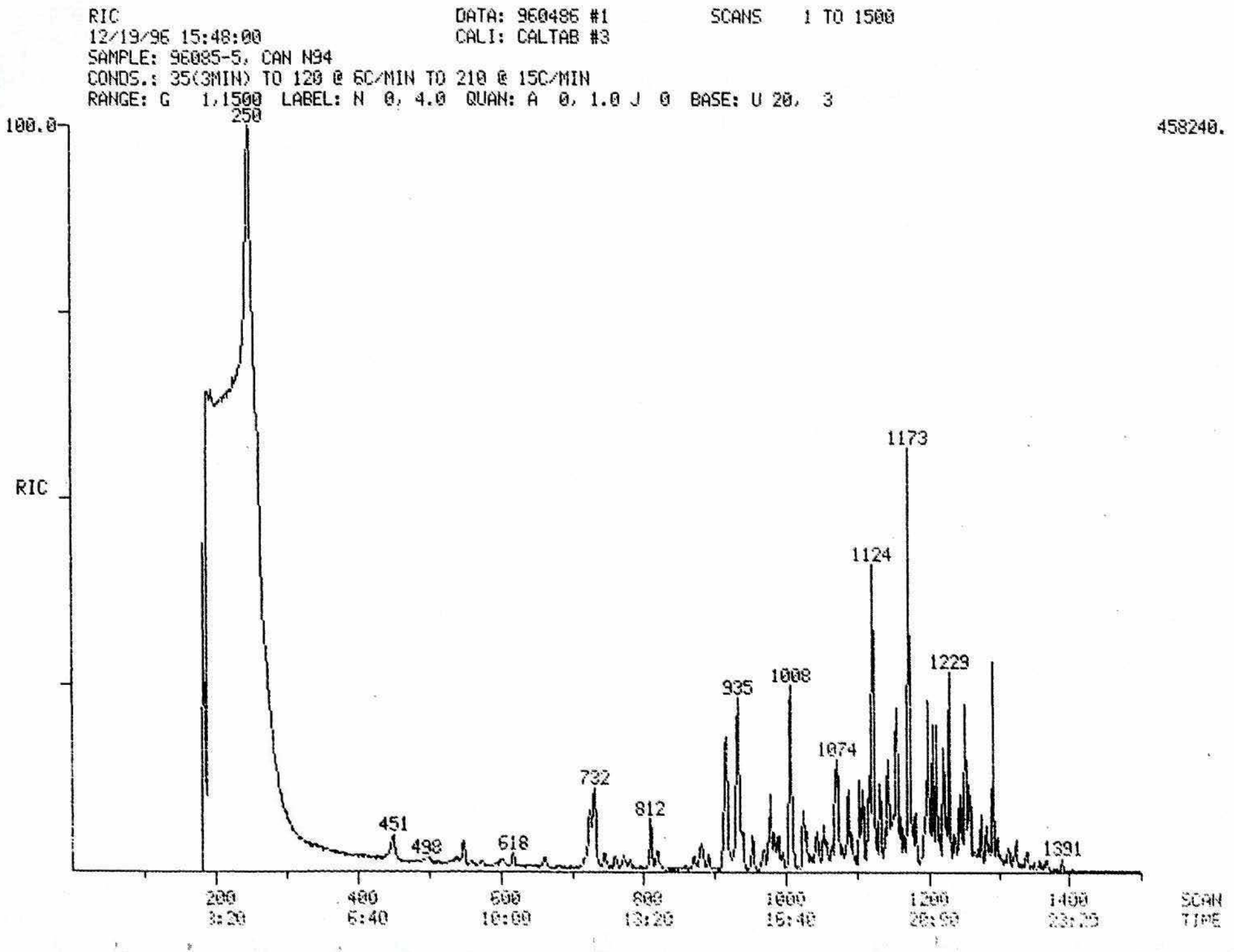
P.O.Box 12104 Research Triangle Park, NC 27709 Fax (919) 544-5600 Phone (919) 361-0338

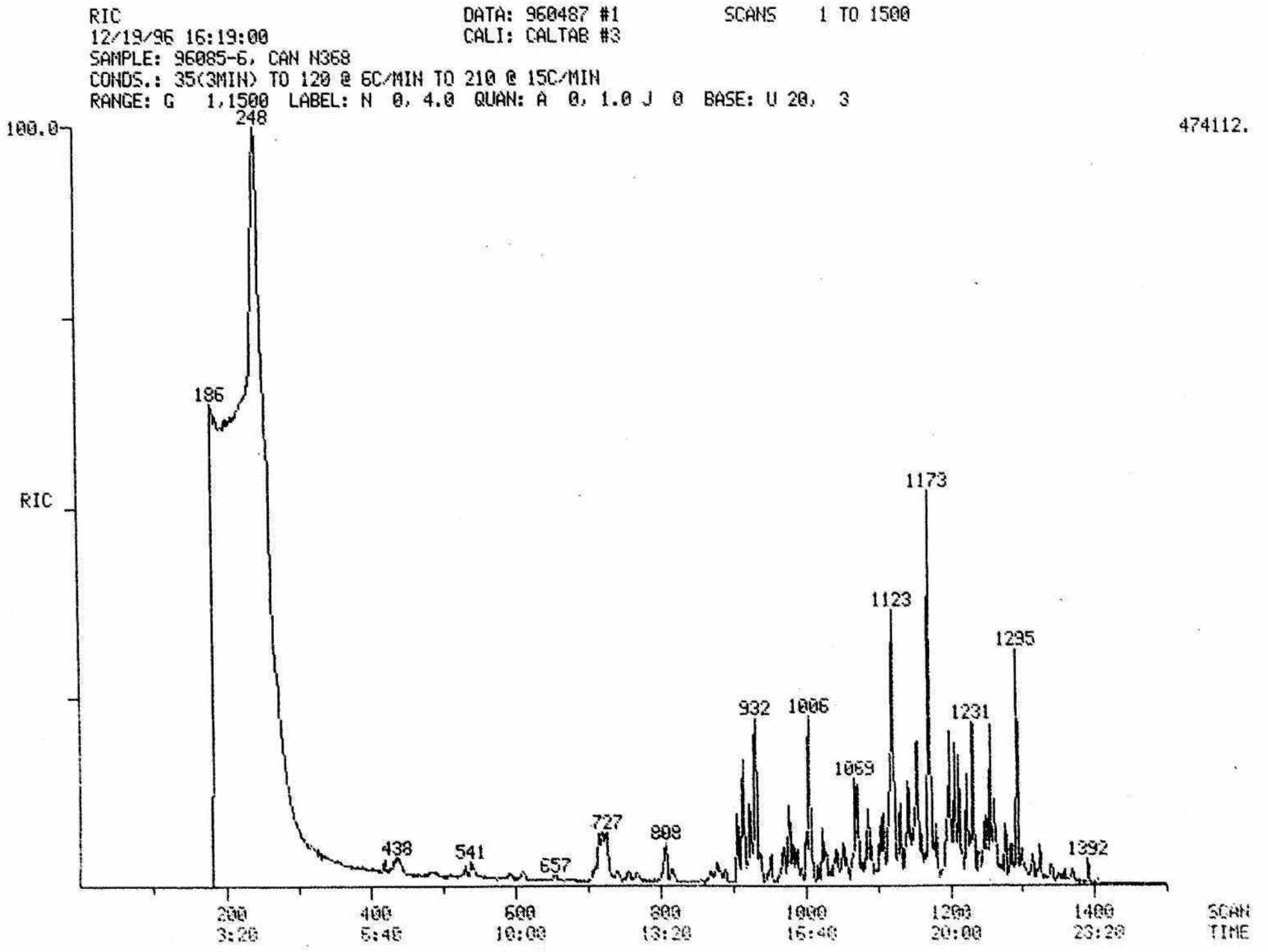

RIC
12/19/96 13:24:00
DATA: 960482 #1
CALI: CALTAB #3
SCANS 1 TO 1500
SAMPLE: 500ML 96085-1 & INT STDS
CONDS.: 35(3MIN) TO 120 @ 6C/MIN TO 210 @ 15C/MIN
RANGE: G 1,1500 LABEL: N 0, 4.0 QUAN: A 0, 1.0 J 0 BASE: U 20, 3
100.0
509440.
RIC
254
185
476
555
721
933
1024
1121
1213
1294
1380
200
400
600
800
1000
1200
1400
SCAN
TIME


RIC
12/19/96 13:52:00
DATA: 960483 #1
CALI: CALTAB #3
SCANS 1 TO 1500
SAMPLE: 250ML 96085-2, CAN 6182P
CONDS.: 35(3MIN) TO 120 @ 6C/MIN TO 210 @ 15C/MIN
RANGE: G 1,1500 LABEL: N 0, 4.0 QUAN: A 0, 1.0 J 0 BASE: U 20, 3
100.0
465920.
RIC
196
251
495
720
931
1025
1082
1281
1393
200
3:20
400
5:40
600
10:00
800
13:20
1000
16:40
1200
20:00
1400
23:20
SCAN
TIME


RIC
12/19/96 14:25:00
DATA: 960484 #1
CALI: CALTAB #3
SCANS 1 TO 1500
SAMPLE: 96085-3, CAN N339
CONDS.: 35(3MIN) TO 120 @ 6C/MIN TO 210 @ 15C/MIN
RANGE: G 1,1500 LABEL: N 0, 4.0 QUAN: A 0, 1.0 J 0 BASE: U 20, 3
100.0
461312.
RIC
249
722
495
932
1024
1085
1172
1295
200
400
600
800
1000
1200
1400
SCAN


RIC
DATA: 960485 #1
SCANS 1 TO 1500
12/19/96 15:04:00
CALI: CALTAB #3
SAMPLE: 250ML 96085-4, CAN N44
CONDS.: 35(3MIN) TO 120 @ 6C/MIN TO 210 @ 15C/MIN
RANGE: G 1,1500 LABEL: N 0, 4.0 QUAN: A 0, 1.0 J 0 BASE: U 20, 3
100.0
463872.
RIC
255
189
440
544
658
731
811
935
1008
1071
1124
1174
1407
400
3:20
600
10:00
800
13:20
1000
16:40
1200
20:00
1400
23:20
SCAN
TIME


RIC
DATA: 960486 #1
SCANS 1 TO 1500
12/19/96 15:48:00
CALI: CALTAB #3
SAMPLE: 96085-5, CAN N94
CONDS.: 35(3MIN) TO 120 @ 6C/MIN TO 210 @ 15C/MIN
RANGE: G 1,1500 LABEL: N 0, 4.0 QUAN: A 0, 1.0 J 0 BASE: U 20, 3
100.0
458240.
RIC
250
451
490
618
732
812
935
1008
1074
1124
1173
1229
1391
200
3:20
400
6:40
600
10:00
800
13:20
1000
15:40
1200
20:00
1400
23:20
SCAN
TIME


RIC
DATA: 960487 #1
SCANS 1 TO 1500
12/19/96 16:19:00
CALI: CALTAB #3
SAMPLE: 96085-6, CAN N368
CONDS.: 35(3MIN) TO 120 @ 6C/MIN TO 210 @ 15C/MIN
RANGE: G 1,1500 LABEL: N 0, 4.0 QUAN: A 0, 1.0 J 0 BASE: U 20, 3
100.0
474112.
RIC
248
186
438
541
657
727
808
932
1006
1059
1123
1173
1231
1295
1392
200
3:20
400
5:40
600
10:00
800
13:20
1000
16:40
1200
20:00
1400
23:20
SCAN
TIME

96085

Clean Air Engineering 7834
TES ID = 96280-25C

#	Sample ID	Tank ID	Dil'n Factor	(TES DF)	AQL DF.
1	Run 1 Outlet	N200	9.2515	(9.8729)	1
2	Run 2 Outlet	6182P	10.8189	(11.6606)	2
3	Run 3 Outlet	N339	10.1615	(10.7786)	2
4	Run 1 Inlet	N44	34.4135	(36.1985)	2
5	Run 2 Inlet	N94	38.7364	(41.4116)	2
6	Run 3 Inlet	N368	36.9844	(38.2801)	2
7	Blank	6169P	592.1467	(589.4872)	

DATE 12-19-96

PROJECT I.D. 96085 (TES 96280 (CAL))

SAMPLE CUSTODIAN Thomas Bucchi

.	CUSTODY SEAL	PRESENT	ABSENT	INTACT / NOT INTACT
2.	CHAIN-OF-CUSTODY	PRESENT	ABSENT	
3.	SAMPLE TAGS	PRESENT	ABSENT	
.	SAMPLE TAG #'S	LISTED	NOT LISTED	

	DATE RECEIVED	TIME RECEIVED	IDs MATCH?	CUSTOMER ID #	AQL ID #	COMM ENTS
1.	12-19-96	10:35 AM	Y	96280-1	96085-1	CAN N200
2.	12-19-96	13:31 P	Y	96280-2	96085-2	CAN 6182P
3.	12-19-96	13:53 P	Y	96280-3	96085-3	CAN N339
4.	12-19-96	14:21 P	Y	96280-4	96085-4	CAN N44
5.	12-19-96	15:03	Y	96280-5	96085-5	CAN N94
6.	12-19-96	16:07	Y	96280-6	96085-6	CAN N368
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						
16.						

CHAIN OF CUSTODY

G

Triangle Environmental Services, Inc.
LABORATORY SAMPLE INFORMATION AND CHAIN-OF-CUSTODY FORM

✓ all applicable boxes

Company Name: CLEAN AIR ENGINEERING	Project ID: 7834	Date: 11-20-96
Contact Person: GREG SMITH	Phone #: (847) 991-6200 x2046	Process Type:
Latest Date Samples Expected at Lab: (Normal Turnaround: 15 working days after last receipt of samples)	Results Due Date: 15 DAY	
	Report Package Due Date: 15 DAY	

Send Report to: (Street address required for UPS shipment of report)	Send Invoice to: (if different from report address)
Name GREG SMITH	Name CLEAN AIR ENGINEERING
Address 500 W WOOD ST	Address 500 W WOOD ST
PALATINE IL 60067	PALATINE, IL 60067
Phone # (847) 991-6200 x2046	FAX # (847) 991-3385

Analysis

US EPA: ☐ Method 25 ☒ Method 25C (as CH_4) ☐ Method 10 B

SCAQMD: ☐ Method 25.1 ☐ Method 25.2

# of Tank/Trap Pairs:	# of Tank-Only Samples:	# of Trap-Only Samples:	# of Bag Samples:
☐ Audit with Delay (extra charge)	☐ Rush Turnaround (extra charge)	☐ High Concentrations Possible ☐ Call if Concentrations High	☐ Dilute High Concentrations (extra charge)

Special Instructions: ALSO: TO-14 FULL SCAN + BENZENE + VINYL CHLORIDE + O_2 + N_2

Tanks (Bags) (List IDs): 200 / 6182 / 339 / N44 / 94 / 368 AND 6169

Traps (List IDs):

☒ TES Equipment ☐ Client Equipment ☐ Client Equipment to be Reconditioned

Tanks, Unused for Reconditioning (List IDs): 6154

Traps, Unused for Reconditioning (List IDs):

Relinquished by:	Date: 11-20-96	Time: 3:15pm	To: (Carrier) FED EX

Tanks received at TES by:	Condition: good	Date: 11/21/96	Time: 8:40	Traps received at TES by:	Condition:	Date:	Time: