DESTRUCTION AND REMOVAL EFFICIENCY AND COMPLIANCE EMISSIONS TESTING

BROWNING-FERRIS INDUSTRIES
Imperial Landfill
IT McGill PCS Vapor Flare

Imperial, Pennsylvania

September 1992

EEI-20438

Prepared by:

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Prepared for:

Browning-Ferris Industries
Imperial, Pennsylvania

REPORT CERTIFICATION

The sampling and analysis performed for this report were carried out under my direction and supervision, and I hereby certify that the test report is authentic and accurate.

Date 9/17/92 Signature John Maxwell

John Maxwell
CEM Division

I have reviewed the testing details and results in this report, and hereby certify that the test report is authentic and accurate to the best of my knowledge.

Date 9-17-92 Signature W. Kent Spears

W. Kent Spears
Group Manager
CEM Division

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1. INTRODUCTION

The CEM Division of Entropy Environmentalists, Inc. was contracted by Browning-Ferris Industries (BFI) to conduct compliance emissions testing and destruction and removal efficiency (DRE) determinations on an IT McGill PCS enclosed ground flare at the Imperial Landfill in Imperial, Pennsylvania. The tests conducted on September 2, 1992 were performed according to the procedures outlined in EPA Methods 1, 2, 2B, 3A, 6C, 7E, 10, 18, and 26 and Alternate Method 4.

This report presents the results of the testing conducted by an Entropy test team comprised of John Maxwell, Chris Williams, Rob Pierce, Jack Wood, Chris Winterrowd, and Craig Haden. Gregory W. Holesh, P.E. and Kevin Honohan of BFI and Manuel T. Rei, P.E. of Rei Environmental coordinated the test program. Edwin J. Taylor and Phil Lawrence of the Allegheny County Health Department, Bureau of Air Pollution Control observed the test.

Section 2 of this report presents a summary of the test data. Section 3 contains a description of the test equipment and sampling procedures used by Entropy. The appendices to this report contain the tabulation of results, computer-recorded test data, field data sheets, analytical results, meterbox calibrations, the calibration gas certificates of analysis, a copy of the permit, and copies of the test methods.

2. SUMMARY OF RESULTS

The results of the carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NO_x), chlorine (Cl_2), hydrochloric acid (HCl), and total gaseous non-methane hydrocarbons (TGNMHC) emissions testing performed on the enclosed vapor flare at the BFI Landfill in Imperial, Pennsylvania are presented in Table 1. Each measured parameter result met the requirements of the operating permit (see Appendix E). Table 1 also summarizes the overall unit reduction efficiency for TGNMHC as well as total hydrocarbons (THC). Figure 1 is a schematic of the vapor flare system and the inlet and outlet sampling locations. Figure 2 presents the inlet sampling location dimensions.

The temperature measurements taken at the stack during testing are also presented in Table 1. The difference between the two readings can be attributed to the fact that the process temperature was taken approximately one foot from the stack wall and the test thermocouple was in the centroid of the stack. The test location temperature readings were consistently higher than the process readings.

TABLE 1.

EMISSION TEST SUMMARY
BFI IMPERIAL LANDFILL
ENCLOSED VAPOR FLARE
IMPERIAL, PENNSYLVANIA
SEPTEMBER 2, 1992

Measured Parameter	Run 1	Run 2	Run 3	Average	Permit Limit (lb/hr)
SO_2 ppm_{vd}	0	1.3	2.9	1.4	
SO_2 lbs/hr	0	0.16	0.34	0.17	6.6
NO_x ppm_{vd}	13.3	11.5	10.8	11.9	
NO_x lb/hr	1.06	1.01	0.91	0.99	9.6
CO ppm_{vd}	1.2	1.9	0	1.0	
CO lb/hr	0.06	0.10	0	0.05	36.0
HCl ppm_{vd}	0.67	1.06	0.40	0.71	
HCl lb/hr	0.042	0.074	0.264	0.048	14.4
Cl_2 ppm_{vd}	<0.23	<0.23	<0.23	<0.23	
Cl_2 lb/hr	<0.028	<0.032	<0.030	<0.030	0.3
Stack Temperature (as measured by Entropy)	1731°F	1727°F	1712°F	1723°F	1600°F
Stack Temperature (as measured by process instrumentation)	1600°F	1600°F	1600°F	1600°F	
Inlet					
TGNMHC $\%_{vd}$	0.145	0.150	0.140	0.145	
TGNMHC lb/hr	9.02	9.37	8.76	9.03	
Total Organics as C lb/hr	2,069	2,248	2,273	2,196.7	
Outlet					
TGNMHC ppm_{vd}	<6.50	<6.74	<6.70	<6.65	
TGNMHC lb/hr	<0.135	<0.155	<0.147	<0.146	6.5
TGNHMC Vapor Flare Destruction Efficiency	>98.5	>98.3	>98.3	>98.37	98%
THC Vapor Flare Destruction Efficiency	>99.99	>99.99	>99.99	>99.99	

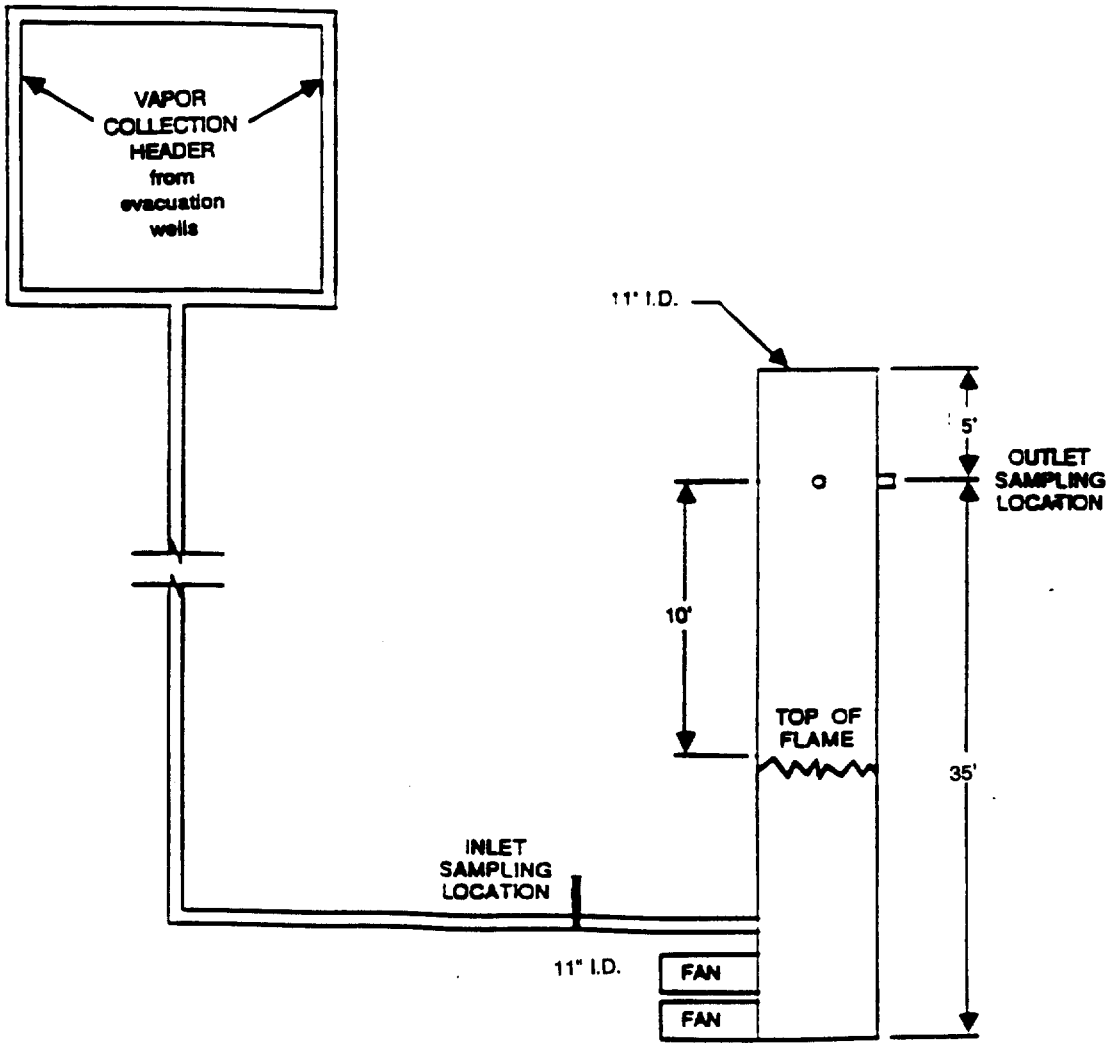
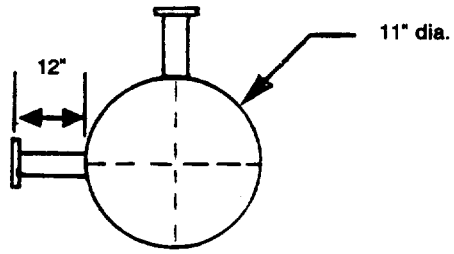


Figure 1. Inlet and outlet sampling locations, BFI.



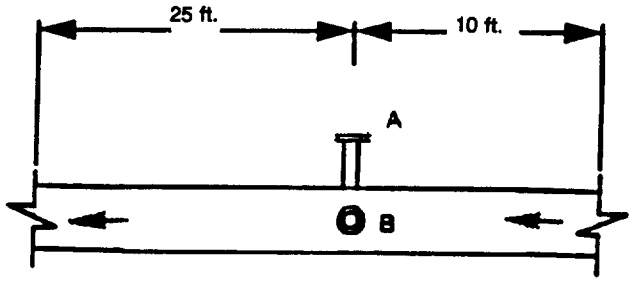


Figure 2. Inlet sampling location.

3. TEST EQUIPMENT AND SAMPLING PROCEDURES

The instrumentation and all sampling and analytical procedures utilized by Entropy for the test program conform with the requirements of EPA Methods 1, 2, 2B, 3A, 6C, 7E, 10, 18, and 26 (40 CFR 60, Appendix A) and Alternate Method 4.

3.1 INLET FLUE GAS VELOCITY AND VOLUMETRIC FLOW RATE - EPA METHODS 1 AND 2

Due to the large pipe diameter and high flow rate at the inlet location, the flue gas velocity and volumetric flow rate were determined according to the procedures outlined in EPA Methods 1 and 2. The number and location of the velocity traverse points were determined by Method 1 procedures. Velocity measurements were made using Type S pitot tubes conforming to the geometric specifications outlined in EPA Method 2. Accordingly, each has been assigned a coefficient of 0.84. Differential pressures were measured with Magnehelic gauges of appropriate range. Effluent gas temperatures were measured with a calibrated dial thermometer.

To determine an average molecular weight of the effluent gas stream at the inlet sampling location, an integrated sample was collected continuously during each one-hour test run into a Tedlar bag. The bag sample was analyzed for carbon dioxide (CO_2) and oxygen (O_2) concentrations with a Fuji 3300 nondispersive infrared (NDIR) CO_2 analyzer and a Teledyne 320A O_2 analyzer. The sample was then transferred to an evacuated tank and returned to the Entropy laboratory for methane content analysis.

3.2 OUTLET FLUE GAS VELOCITY AND VOLUMETRIC FLOW RATE - EPA METHOD 2B

EPA Method 2B was used to determine the exhaust gas volumetric flow rate. The method involves quantifying a carbon balance between the inlet and outlet

of the vapor flare. The organic carbon content (from the Method 18 total hydrocarbon and methane analysis) and the carbon dioxide content were measured and summed at the inlet sampling location. The organic carbon, carbon dioxide, and carbon monoxide content in the effluent at the outlet location were also measured and summed. The total carbon concentration ratio of the inlet to the outlet was then multiplied by the inlet volumetric flow rate determinations (from EPA Methods 1 and 2) to quantify the outlet volumetric flow rate.

3.3 FLUE GAS COMPOSITION AND MOLECULAR WEIGHT - EPA METHOD 3A

EPA Method 3A was used to determine the O_2 and CO_2 concentrations in the flue gas stream. Concentration measurements were made using instrumentation and test procedures that conform with the requirements of EPA Method 3A. An extractive sampling system provided a continuous, conditioned sample (i.e., free of water vapor and particulate matter) to the analyzers. Figure 3 is a diagram of the sampling system. The following analyzers were used for the measurements of O_2 and CO_2.

A Teledyne Model 320A analyzer was used to determine the concentration of O_2 in the flue gas stream. This instrument utilizes Teledyne's patented micro-fuel cell, which consumes O_2 from the atmosphere surrounding the measuring probe. The consumption of O_2 generates a proportional electrical current. This current is then amplified and provides a signal output which corresponds to full scale measurement ranges of either 0-10% or 0-25% O_2.

An ACS (Fuji) Model 3300 NDIR analyzer continuously monitored the CO_2 concentration in the flue gas stream. The theory of operation for this analyzer is based on the principle that CO_2 gas has a unique absorption line spectrum in the infrared region. The instrument consists of an infrared light

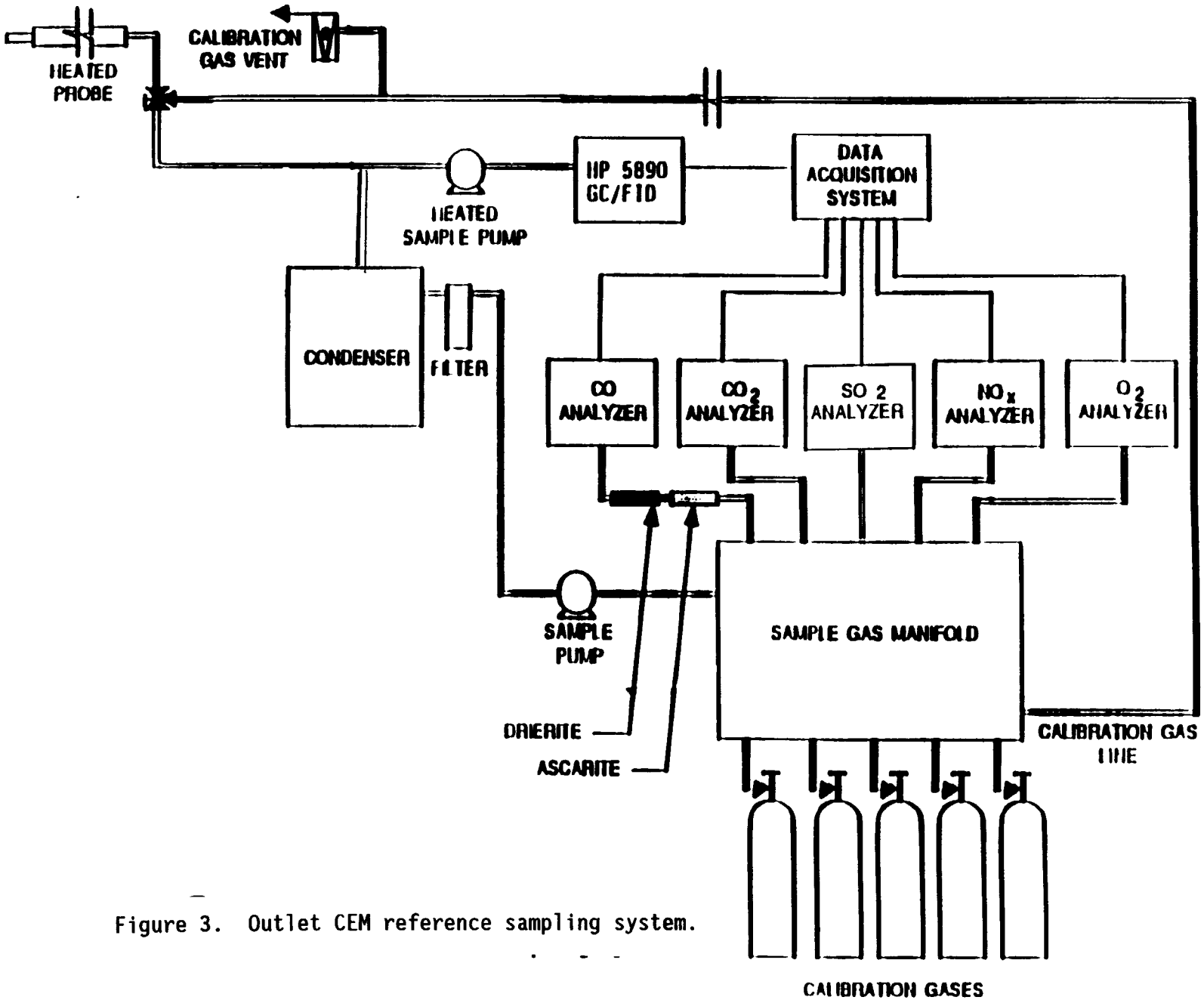


Figure 3. Outlet CEM reference sampling system.

source, a chopper, a measuring cell, and a detector. The infrared light beam emitted by the source passes through the measuring cell filled with a continuously flowing gas sample. The light beam is partially absorbed or attenuated by the gas species of interest in this cell before reaching the front chamber of the detector. Both the front and rear chambers of the sealed detector are filled with a reference gas. The difference in the amount of light absorbed between the front and rear chambers is dependent on the concentration of the gas species of interest within the sample measuring cell and creates a pressure differential between the two chambers. This pressure difference is then observed as gas flow by the micro-flow sensor located in a channel connecting the two chambers. The resulting AC signal from the micro-flow sensor is rectified, amplified, and linearized into a DC voltage signal for output. The analyzer full scale measurement is 0 to 50% for CO_2.

3.4 FLUE GAS MOISTURE CONTENT - ALTERNATE METHOD 4

The flue gas moisture content was determined in conjunction with the EPA Method 26 hydrochloric acid (HCl) test runs at the outlet sampling location. The moisture determinations were used to correct the TGNMHC concentrations (measured simultaneously) to a dry-basis volume. The sampling and analytical procedures outlined in Alternate Method 4 were used for the moisture measurements. Alternate Method 4 employs the mini-impinger technique described in EPA Method 4 as the approximation method, with the exception of the addition of a silica gel trap in the last impinger. Figure 4 diagrams the Alternate Method 4/Method 26 combined sampling train.

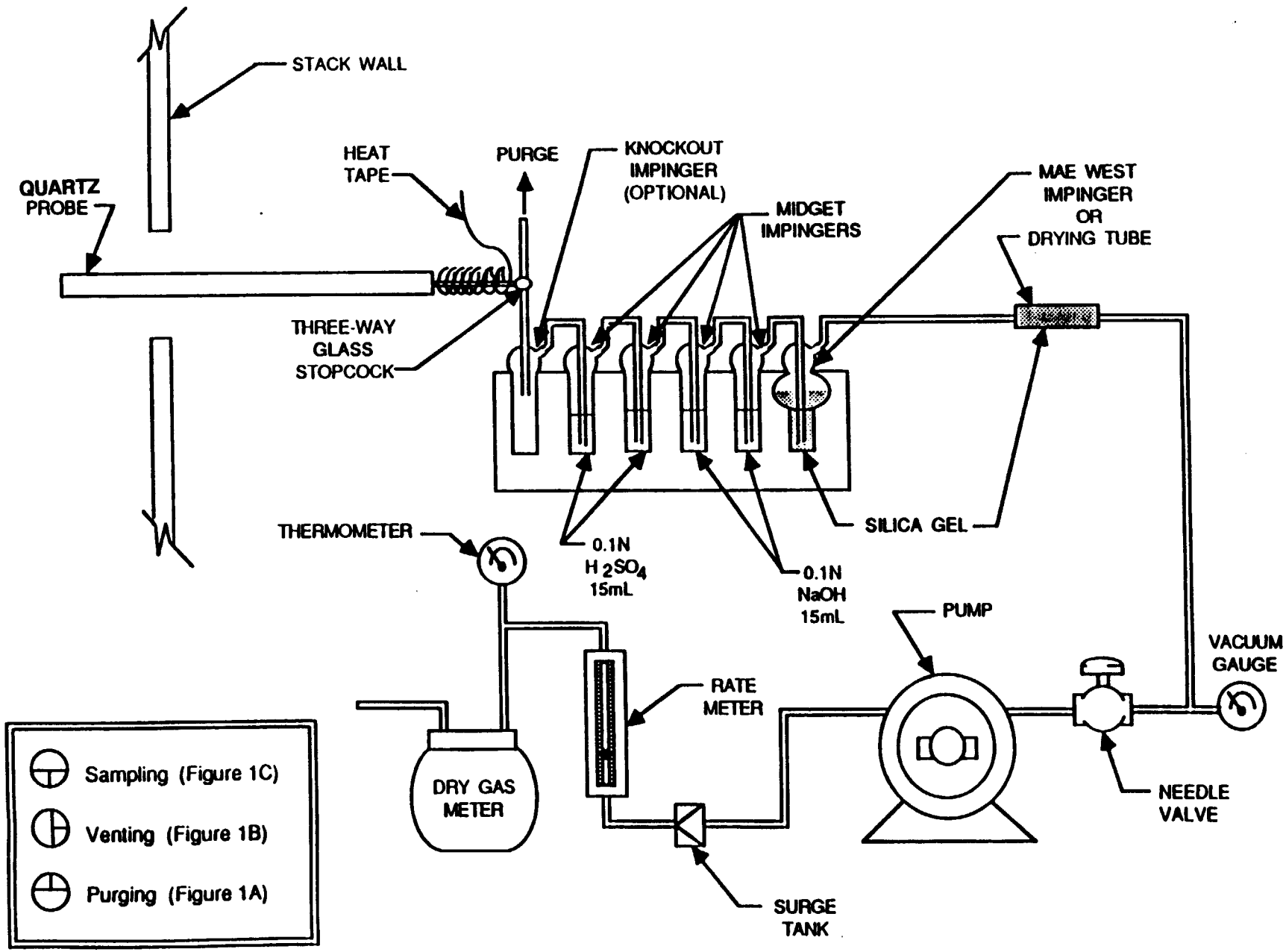


Figure 4. Alternate Method 4/EPA Method 26 sampling train.

3.5 SULFUR DIOXIDE (EPA METHOD 6C), NITROGEN OXIDES (EPA METHOD 7E), AND CARBON MONOXIDE (EPA METHOD 10) COMPLIANCE EMISSIONS TESTING

Concentration measurements of SO_2, NO_x, and CO were made according to EPA Methods 6C, 7E, and 10, respectively. These methods require the tester to: (1) select appropriate apparatus meeting the applicable equipment specifications of the methods, (2) conduct an interference response test prior to the testing program, and (3) conduct various measurements during the testing program to demonstrate conformance with the measurement system performance specifications. All pre-test and field checks of the CEMS, as well as all measurements made throughout the test program, were conducted according to the procedures specified in the EPA methods.

Three one-hour compliance test runs were performed simultaneously at the inlet and outlet sampling locations of the vapor flare. The flue gas sample was extracted from the stack using single point probes placed in the centroid of each sample duct.

A three-point (i.e., zero, mid-, and high-range) analyzer calibration error check was conducted on each reference analyzer (four-point for the CO analyzer) before initiating the compliance testing. This check is conducted (after final calibration adjustments are made) by injecting the calibration gases directly into each gas analyzer and recording the responses.

Zero and upscale calibration checks are conducted both before and after each test run in order to quantify measurement system calibration drift and sampling system bias. Upscale is either the mid- or high-range gas, whichever most closely approximates the flue gas level. During these checks, the calibration gases are introduced into the sampling system at the probe outlet so that the calibration gases are analyzed in the same manner as the flue gas samples. Drift is defined as the difference between the pre- and post-test run

calibration check responses. Sampling system bias is the difference between the test run calibration check responses (system calibration) and the initial calibration error responses (direct analyzer calibration) to the zero and upscale calibration gases. If an acceptable post-test bias check result is obtained but the zero or upscale drift result exceeds the drift limit, the test run result is valid; however, the analyzer calibration error and bias check procedures must be repeated before conducting the next test run. A run is considered invalid and must be repeated if the post-test zero or upscale calibration check result exceeds the bias specification. The calibration error and bias checks must be repeated and acceptable results obtained before testing can resume.

Although not required by Method 10, the same calibration and data reduction procedures required by Methods 3A, 6C, and 7E were used for the Method 10 CO determinations to improve the quality of the reference data.

The reference analyzer measurements were recorded as 1-, 15-, and 60-minute averages on Entropy's DAS. All test run concentration results were determined from the average gas concentrations measured during the run and adjusted based on the zero and upscale sampling system bias check results (Equation 6C-1 presented in Method 6C, Section 8). The reference SO_2, NO_x, and CO emission rate values in units of lb/hr were computed from each test run average of SO_2, NO_x, and CO (each adjusted for zero and upscale sampling system bias) using the following formula:

$$E = (ppm_d)(Q_{scfm}) \left[\frac{10^{-6}}{ppm}\right] \left[\frac{60\ min}{hr}\right] \left[\frac{lb\text{-}mole}{385.3\ ft^3}\right] \left[\frac{Mol.\ wt}{lb\text{-}mole}\right]$$

where: E = Emissions in lb pollutant/hour

Q_{scfm} = Volumetric flow rate in dscf/min

Mol. wt. = Molecular weight = 64.06 lb SO_2/lb-mole for SO_2
46.00 lb NO_2/lb-mole for NO_2
28.00 lb CO/lb-mole for CO

The instrumental test method compliance sampling at the exhaust stack was conducted using the reference analyzers listed in Table 2. Figure 3 is a simplified schematic of the extractive measurement system used by Entropy.

The extractive monitors require that the effluent gas sample be conditioned to eliminate any possible interference (i.e., water vapor and particulate matter), before being transported and injected into each analyzer. All components of the sampling system that contact the gas sample are either stainless steel, glass, or Teflon. A heated sample probe with an in-stack borosilicate glass wool particulate filter, heated sample line, a secondary out-of-stack particulate filter, moisture removal traps, sample pumps, and a distribution manifold board were used to deliver representative samples of flue gas to the analyzers.

The sampling probe is constructed of Type 316 stainless steel and is heated electrically to maintain the sample temperature above the dew point. An 8-foot length of heated Teflon tubing connects the probe to an ice bath condenser.

The condenser consists of a 30-foot coil of Teflon tubing followed by two condensate traps, all immersed in an ice bath to remove any moisture from the sample. The condensate is continuously removed from both traps via a condensate discharge pump. The systems were designed to minimize contact between the sample and the condensate. The sample exiting each condenser passes through a heated Balston particulate filter and is then transported through unheated 3/8-inch O.D. Teflon tubing by way of a Teflon-lined sample pump to the flow distribution manifold board, where the flow to the analyzers is monitored and controlled.

TABLE 2.

ANALYZERS USED FOR EPA METHODS 3A, 6C, 7E, AND 10
COMPLIANCE EMISSIONS TESTING

Parameter	Analyzer	Analytical Technique	Measurement Range
SO_2	Western Research Model 721AT2	UV Absorption	0-100 ppm
NO_x	Thermo Environmental Model 10AR	Chemiluminescence	0-100 ppm
CO	Thermo Environmental Model 48	Gas Filter Correlation	0-500 ppm
O_2	Teledyne 320P-4	Fuel Cell	0-25%
CO_2	Fuji 3300	NDIR	0-50%

The sample acquisition/sample conditioning system also includes two calibration gas injection ports: (1) immediately upstream of the analyzers for analyzer linearity checks, and (2) at the outlet of the probe for the sampling system bias and calibration drift checks. This arrangement provides both ease in checking the analyzer performance and a means of evaluating the entire monitoring system.

A Western Research Model 721AT2 SO_2 analyzer was used to provide a continuous analysis of SO_2 in the gas stream. The basic analytical principle involves quantitative measurement of the absorption of UV radiation by SO_2 molecules. The analyzer uses a single light source which emits an appropriate wavelength, illuminating the sample cell through which the sample is continuously passed. Narrow band optical filters are rotated through the beam, and the radiation passed is detected by a single photodetector. The signal pulses from the photodetector are separated by a demultiplexor into a measuring channel and a reference channel. A log ratio amplifier computes the logarithm

of the ratio of the input signals, producing a signal that is proportional to the concentration of SO_2.

A Thermo Environmental Model 10AR NO/NO_x analyzer was used to automatically and continuously determine the nitrogen oxides (NO_x) concentration in the exhaust gas. The analytical technique is chemiluminescence. In the determination of NO, the sample is quantitatively converted to NO_2 by gas phase oxidation with molecular ozone produced within the analyzer. In this reaction, the NO_2 molecules are elevated to an electronically excited state, and then immediately reverted to a non-excited ground state. This reversion is accompanied by emission of photons, which impinge on a photomultiplier detector, and generate a low level DC current. The current is then amplified and used to drive a front panel meter and a data recorder.

For the determination of NO_x, the analyzer utilizes the same principle as it does for determination of NO, except that before the sample enters the reaction chamber, it is routed through a converter, where the NO_2 within the sample is dissociated to form NO. The NO_x concentration seen by the instrument includes the contributions of both the NO in the sample and the NO resulting from the dissociation of the NO_2 in the sample.

The Thermo Environmental Model 48 CO analyzer used in this test program employs gas filter correlation (GFC) to measure CO by infrared (IR) absorption. GFC employs a correlation wheel consisting of two hemispherical cells, one filled with CO and the other filled with nitrogen (N_2). Radiation from the IR source is chopped and passed through the correlation wheel, alternating between the CO cell and the N_2 cell. Passing an infrared beam through the CO gas cell in the correlation filter provides a reference signal that cannot be attenuated further by the CO in the gas sample. The N_2 cell is transparent to the IR

radiation and therefore produces a measurement beam which can be absorbed by CO in the sample cell. Radiation then passes through a narrow bandpass interference filter and enters a multiple optical pass sample cell, where absorption by the sample gas occurs. Other gases in the sample do not cause modulation of the detector signal, since they absorb the reference and measurement beams equally.

Infrared absorption is a non-linear measurement technique. To correct for this characteristic, instrument electronics convert the analyzer signal into a linear output. The exact calibration curve is stored in the instrument's microcomputer memory and is used to linearize the instrument output over all ranges. The microcomputer is also used to process signals from a pressure transducer and a temperature transducer to correct instrument output for changes in the temperature or pressure of the sample gas.

The CO concentration averages were corrected for the volume of CO_2 removed from the sample gas by an ascarite/drierite CO_2 trap. The CO_2 concentrations were determined from the Method 3A analysis.

Entropy's data acquisition system (DAS) uses an IBM-compatible computer with hard disk storage and an internal 12-bit analog-to-digital converter with a 16-channel multiplexer. In addition to providing an instantaneous display of analyzer responses, the DAS compiles the analyzer data collected once each second and averages them, calculates emission rates, and documents analyzer calibrations. The test data and calibrations are stored on hard disk and also printed.

3.6 TOTAL HYDROCARBONS/METHANE - EPA METHOD 18 DIRECT INTERFACE SAMPLING

Wet-basis concentrations of total hydrocarbons and methane were quantified at the inlet and outlet using EPA Method 18. The nonmethane hydrocarbon (NMHC)

concentration was calculated by subtracting the methane concentration (ppm_w) from the concentration of total hydrocarbons (ppm_w). The values were then used to calculate the lb/hr emission rate results and the destruction and removal efficiency (DRE) of the vapor flare using the following equation:

$$DRE = \frac{\text{inlet lb/hr - stack lb/hr}}{\text{inlet lb/hr}} \times 100$$

The hydrocarbon testing was performed by drawing a gas sample from the stack at a constant rate and pumping the sample to an on-site gas chromatograph (GC) for analysis. All transfer lines, connections, and pumps were heated to either 220°F or to stack temperature, whichever was cooler. This prevented condensation of the volatile organics or water in the sample line. Figure 5 diagrams the EPA Method 18 sampling system used at the inlet location. The Method 18 sampling system used at the outlet location is included in Figure 3. Direct interface sampling with GC analysis is a semi-continuous method and provided one reading for approximately every 15 minutes of sample time.

The gas chromatograph was calibrated before testing with an external standard gas. The calibration gas was introduced at the probe outlet under the same conditions as the sample to ensure the integrity of the sampling system. This procedure was performed before and after each run.

3.7 HYDROGEN CHLORIDE AND CHLORINE - EPA METHOD 26

EPA Method 26 was used to sample and analyze for hydrogen chloride and chlorine concentrations in the effluent. Samples were withdrawn from the source using an EPA Method 26 sampling train consisting of a quartz probe, a heated 3-way valve, chilled midget impingers, and a metering console. The first impinger

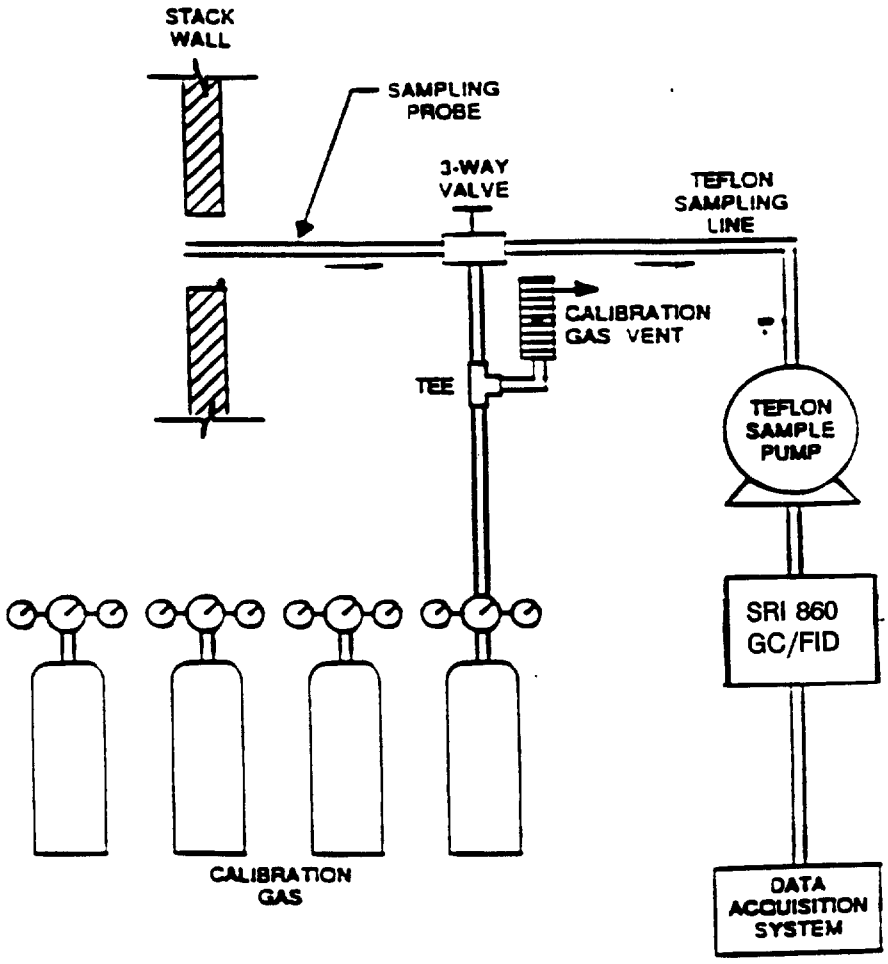


Figure 5. Inlet NMHC sampling system.

remained empty, the second two impingers each contained 15 mL of 0.1N sulfuric acid (H_2SO_4), the fourth and fifth impingers contained 15 mL of 0.1N sodium hydroxide (NaOH), and the sixth impinger contained preweighed silica gel. Teflon wool plugs were placed between the third and fourth impingers. The sampling probe was purged for five minutes prior to collecting each sample. A continuous sample was extracted at a rate of two liters per minute over the one- hour test period. Figure 4 illustrates the Method 26 HCl sampling train.

For sample recovery, the H_2SO_4 and NaOH reagents were returned to the original containers, weighed, the weights recorded on the labels, and the liquid levels marked. The volume of water vapor condensed in the impingers and the volume of water vapor collected in the silica gel were summed and entered into moisture content calculations following the Alternate Method 4 procedures.

The probe and the 3-way valve were rinsed with DI water into a Nalgene bottle. The first three impingers and the Teflon wool from between the third and fourth impingers were rinsed with DI water into the H_2SO_4 reagent jar. The fourth and fifth impingers were rinsed with DI water into the NaOH reagent jar.

For sample analysis, the H_2SO_4 reagent and DI water rinses from the first three impingers were analyzed in the Entropy laboratory for HCl and Cl_2 using ion chromatography. Duplicate analyses were performed on the samples and a reagent blank.

Appendix A. Test Results and Example Calculations

- Emission Rate Calculations (lb/hr)
- Calculation of Average SO_2, NO_x, CO, O_2 and CO_2 Concentrations
- Outlet Flow Rate Calculations
- Example Calculations

M2B FLARE OUTLET VOLUMETRIC AIR FLOW RATE, DRY SCFM

$$Qsd\text{-}out = \frac{Qsd\text{-}in * [(\%CH4d + \%NMOd)inlet / 100 * 10\text{^}6]}{(ppmCH4d + ppmNMOd)out + (\%CO2out/100*10\text{^}6) + ppmCOout - 300}$$

$$Qsd\text{-}out = \frac{3319 * [(33.2 + 0.145) / 100 * 10\text{^}6]}{(0 + 6.50) + (10.0 / 100 * 10\text{^}6) + 1.3 - 300}$$

Qsd-out = 11095 SCFM, Dry

NON-METHANE ORGANICS EMISSION RATE, LB/HR

lb/hrNMO = (Qsd-out * 60) * [(ppmNMO)out / 10^6] / 385.3 * Fwt

lb/hrNMO = 11095 * 60) * [(6.50 / 10^6] / 385.3 * 12.01

lb/hrNMO = 0.135 NMO lb/hr

EXAMPLE TEST CALCULATIONS

Vapor Flare Inlet

RUN NUMBER: Run 1

DRY MOLE FRACTION OF FLUE GAS

Mfd = 1 - (%H2O / 100)

Mfd = 1 - (1.47 / 100) = 0.985

DRY MOLECULAR WEIGHT OF FLUE GAS

Md = (%CO2 * 0.44) + (%O2 * 0.32) + (%CO + %N2 * 0.28) + (%CH4 * .1604) + (%NMO * .60)

Md = (31.3 * 0.44) + (3.4 * 0.32) + (32.0 * 0.28) + (33.2 * .1604) + (.145 * .60) = 29.22 lb/lb-mole

WET MOLECULAR WEIGHT OF FLUE GAS

Ms = (Md * Mfd) + (0.18 * %H2O)

Ms = (29.22 * 0.985) + (0.18 * 1.47) = 29.06 lb/lb-mole

ABSOLUTE FLUE GAS PRESSURE

Ps = Pbar + (Pg / 13.6)

Ps = 29.0 + (9.700 / 13.6) = 29.7 inches Hg

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

$$vs = 85.49 * Cp * SQRT\left[\frac{(Delta\ p)avg * (460 + ts)}{Ps * Ms}\right]$$

$$vs = 85.49 * 0.84 * SQRT\left[\frac{(2.6000 * (460 + 130))}{29.71 * 29.05}\right] = 95.72\ ft/sec$$

DRY VOLUMETRIC FLUE GAS FLOW RATE AT STANDARD CONDITIONS

$$Qsd = \frac{60}{144} * Mfd * vs * A * \frac{Tstd}{ts + 460} * \frac{Ps}{Pstd}$$

$$Qsd = \frac{60}{144} * 0.985 * 95.72 * 95 * \frac{528}{130 + 460} * \frac{29.71}{29.92} = 3319\ SCFM$$

NOTE

The example values shown in these calculations have been rounded for presentation purposes. Any hand calculations conducted using these example values may produce slightly different results than those presented.

CONSTANTS, DEFINITIONS, NOMENCLATURE, AND UNITS

460 0 degrees Fahrenheit in degrees Rankin. The sum of 460 and the standard temperature 60, 68, 77, etc. (°F) gives Tstd in deg. Rankin.

273 0 degrees Celcius in degrees Kelvin. The sum of 273 and the standard temperature 18, 20, 25, etc. (°C) gives Tstd in deg. Kelvin.

29.92 Standard absolute pressure (Pstd), inches of mercury. English unit.

760 Standard absolute pressure (Pstd), millimeters of mercury. Metric unit.

*24.056** Liters per gram-mole at standard conditions.

*385.3** Molar volume cubic feet/pound-mole at standard conditions.

*0.04707** Standard cubic feet per gram or mL of H_2O at standard conditions.

7000 Grains per pound.

453.592 Grams per pound.

0.02832 Cubic meters per cubic foot.

28.32 Liters per cubic foot.

0.03531 Cubic feet per liter.

35.31 Cubic feet per cubic meter.

1000 Conversion from milligrams to grams, milliliters to liters, and liters to cubic meters.

10^6 Conversion factor for decimal fraction to parts per million.

144 Square inches per square foot.

60 Minutes per hour and seconds per minute.

13.6 Specific gravity of mercury (1 inch of mercury = 13.6 inches of H_2O).

20.9 Percent O_2 by volume (dry basis) in ambient air.

85.49 Pitot tube constant (Kp)

$$\frac{\text{feet}}{\text{second}} \left[\frac{(\text{lb/lb-mole})\ (\text{inches Mercury})}{(^\circ\text{Rankin})\ (\text{inches } H_2O)} \right]^{1/2}$$

A Stack cross-sectional area, square inches.

* Where applicable, these constants must be corrected (if the standard temperature is not 68°F) by multiplying them by the ratio of the standard temperatures. For example to convert to 77° F: (460+77)÷(460+68)

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

COMPANY: BFI PITTSBURG Pa.
SOURCE: VAPOR FLARE
RUN: O-CEM-1(16:20-17:20) DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	0.2	0.0	0.1
50.5 ppm SO2	50.3	50.0	50.2
0.0 ppm NOx	0.3	4.5	2.4
49.8 ppm NOx	50.0	49.7	49.9
0.0 ppm CO	0.2	0.0	0.1
302.0 ppm CO	304.0	302.8	303.4
0.00 % Oxygen	0.06	0.07	0.07
12.03 % Oxygen	12.01	12.13	12.07
0.00 % CO2	0.40	0.50	0.45
10.90 % CO2	10.80	10.50	10.65

Uncorrected Data:

-1.4 ppm SO2	9.66 % Oxygen
15.1 ppm NOx	9.80 % CO2
1.4 ppm CO	1.110E+04 DSCFM

CORRECTED RESULTS

-1.5 ppm SO2	9.99 % CO2
13.3 ppm NOx	9.61 % Oxygen
1.2 ppm CO	-0.17 lb SO2/hr
	1.06 lb NOx/hr
	0.06 lb CO/hr

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

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 - (%CO2/100)].

lb/hr = (ppm pollutant)(DSCFM flow)(Conv. Factor)(60)
lb/MBtu = (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 = 7.263E-08 lb CO/DSCF - ppm CO

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

COMPANY: BFI PITTSBURG Pa.
SOURCE: VAPOR FLARE
RUN: O-CEM-2(19:25-20:27) DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	0.4	0.5	0.5
50.5 ppm SO2	50.2	50.0	50.1
0.0 ppm NOx	0.3	0.5	0.4
49.8 ppm NOx	49.5	49.4	49.5
0.0 ppm CO	0.5	0.0	0.3
302.0 ppm CO	301.8	301.8	301.8
0.00 % Oxygen	0.13	0.08	0.11
12.03 % Oxygen	12.12	12.11	12.12
0.00 % CO2	0.40	0.50	0.45
10.90 % CO2	10.90	10.90	10.90

Uncorrected Data:
1.8 ppm SO2
11.7 ppm NOx
2.4 ppm CO
9.30 % Oxygen
10.60 % CO2
1.230E+04 DSCFM

==========

CORRECTED RESULTS

1.3 ppm SO2
11.5 ppm NOx
1.9 ppm CO
10.59 % CO2
9.21 % Oxygen
0.16 lb SO2/hr
1.01 lb NOx/hr
0.10 lb CO/hr

==========

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

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 - (%CO2/100)].

lb/hr = (ppm pollutant)(DSCFM flow)(Conv. Factor)(60)
lb/MBtu = (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 = 7.263E-08 lb CO/DSCF - ppm CO

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

COMPANY: BFI PITTSBURG Pa.
SOURCE: VAPOR FLARE
RUN: O-CEM-3(21:35-22:35) DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	0.5	0.1	0.3
50.5 ppm SO2	50.0	50.8	50.4
0.0 ppm NOx	0.5	-0.6	-0.1
49.8 ppm NOx	49.4	48.6	49.0
0.0 ppm CO	0.0	0.1	0.1
302.0 ppm CO	301.8	301.8	301.8
0.00 % Oxygen	0.08	0.10	0.09
12.03 % Oxygen	12.11	12.07	12.09
0.00 % CO2	0.50	0.50	0.50
10.90 % CO2	10.90	10.90	10.90

Uncorrected Data:

3.2 ppm SO2	9.68 % Oxygen
10.5 ppm NOx	10.40 % CO2
0.0 ppm CO	1.172E+04 DSCFM

CORRECTED RESULTS

2.9 ppm SO2	10.38 % CO2
10.8 ppm NOx	9.61 % Oxygen
-0.1 ppm CO	0.34 lb SO2/hr
	0.91 lb NOx/hr
	-0.01 lb CO/hr

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

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 - (%CO2/100)].

lb/hr = (ppm pollutant)(DSCFM flow)(Conv. Factor)(60)
lb/MBtu = (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 = 7.263E-08 lb CO/DSCF - ppm CO

= = = = = CONVERSIONS TO ABSOLUTE = = = = =

BAROMETRIC PRESSURE, MM HG

PbA_1 = Pbar(field pretest) * 25.401

PbA_1 = 29.0 * 25.401 = 737

PbA_2 = Pbar(field post test) * 25.401

PbA_2 = 29.0 * 25.401 = 737

PbA_3 = Pbar(first pzatn) * 25.401

PbA_3 = 29.7 * 25.401 = 755

PbA_L = Pbar(Lab pzatn) * 25.401

PbA_L = 29.7 * 25.401 = 755

TANK ABSOLUTE TEMPERATURE, DEGREES KELVIN

$$ttA_1 = \frac{tt(\text{field pretest}) - 32}{1.8} + 273$$

$$ttA_1 = \frac{82 - 32}{1.8} + 273 = 301 \text{ degrees K}$$

$$ttA_2 = \frac{tt(\text{field post test}) - 32}{1.8} + 273$$

$$ttA_2 = \frac{76 - 32}{1.8} + 273 = 297 \text{ degrees K}$$

$$ttA_3 = \frac{tt(\text{first pzatn}) - 32}{1.8} + 273$$

$$ttA_3 = \frac{70 - 32}{1.8} + 273 = 294 \text{ degrees K}$$

$$ttA_L = \frac{tt(\text{Lab pzatn}) - 32}{1.8} + 273$$

$$ttA_L = \frac{70 - 32}{1.8} + 273 = 294 \text{ degrees K}$$

TANK ABSOLUTE PRESSURE, MM HG

PtA_{Pre} = Pt(field pretest) + PbA_1

PtA_{Pre} = -688.00 + 737 = 49 mm Hg

PtA_{Pst} = Pt(field post test) + PbA_2

PtA_{Pst} = 0 + 737 = 737 mm Hg

PtA_{1AP} = Pt(first pzatn) + PbA_3

PtA_{1AP} = 806.0 + 755 = 1561 mm Hg

P/T RATIO FACTOR

$$\text{P/T Ratio} = \frac{PtA_2}{ttA_2} - \frac{PtA_1}{ttA_1}$$

$$\text{P/T Ratio} = \frac{737}{297} - \frac{49}{301} = 2.3187$$

VOLUME OF GAS SAMPLED, DSL

Vmstd = Vmtk * 0.386 * P/T Ratio

Vmstd = 4.300 * 0.386 * 2.3187 = 3.849 DSL

ACTUAL CONCENTRATION, COMPOUND, PPMVD

$$\text{ppmvd} = \text{ppm as analyzed} * (PtA_3 / ttA_3 / \text{P/T Ratio}) * \frac{(Pta_{2AP})/(tta_L)}{(Pta_{1AP})/(tta_L)}$$

$$\text{ppmvd} = 10527.00 * (1561/294/2.3187) * \frac{1559 / 294}{115 / 294} = 327003 \text{ ppmvd}$$

EXAMPLE TEST CALCULATIONS

VAPOR FLARE STACK

RUN NUMBER: O-M26-1

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

$$Vmstd = Y * Vm * \frac{(Pbar + Delta\ H/13.6)}{(460 + tm)} * \frac{(460 + Tstd)}{29.92}$$

$$Vmstd = 0.9986 * 123.410 * \frac{(29.0 + 1.71/13.6)}{(460 + 83)} * \frac{(460 + 68)}{29.92} = 116.652\ DSL$$

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

$$Vwstd = 0.04707 * Vlc * ((460 + Tstd)/528)$$

$$Vwstd = 0.04707 * 9.0 * ((460 + 68)/528) = 0.424\ SCF$$

PERCENT MOISTURE, BY VOLUME, AS MEASURED IN FLUE GAS

$$\%H2O = 100 * Vwstd / (Vwstd + (Vmstd * 1.00/28.32)$$

$$\%H2O = 100 * 0.424 / (0.424 + (116.652 * 1.00/28.32) = 9.3\ \%$$

CONCENTRATION, CHLORINE, PPMVD

$$ppmvd = \frac{24.056 * ((460 + Tstd)/528) * \mu g/10\text{^}6}{Vmstd * 1.00 * fwt} * 10^6$$

$$ppmvd = \frac{24.056 * ((460 + 68)/528) * 79.1/10\text{^}6}{116.652 * 1.00 * 70.90} * 10^6 = 0.230\ ppmvd$$

EMISSION RATE, CHLORINE, LB/HR

$$lb/hr = \frac{60 * \mu g/10\text{^}6 * Qsd}{453.592 * (Vmstd * 1.00 * 0.03531)}$$

$$lb/hr = \frac{60 * 79.1/10\text{^}6 * 11095}{453.592 * (116.652 * 1.00 * 0.03531)} = 0.0282\ lb/hr$$

Appendix B. Computer-Recorded Test Data

- Uncorrected Computer-Recorded SO_2, NO_x, CO, O_2, CO_2, THC and CH_4 Reference Measurements
- Calibration Summaries
- System Bias and Drift Calculations

CALIBRATION SUMMARY

SOURCE: BFI PITTSBURG PA.

REASON: cal error check before run 1

DATE : 09-02-1992 TIME: 06:16 - 06:54

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
2	STACK	ppmCO	0.0	0.1
2	STACK	ppmCO	302.0	302.3
2	STACK	ppmCO	402.0	401.0
3	STACK	ppmSO2	0.0	0.2
3	STACK	ppmSO2	50.5	50.3
3	STACK	ppmSO2	88.1	88.0
4	STACK	ppmNOX	0.0	0.2
4	STACK	ppmNOX	49.8	49.9
4	STACK	ppmNOX	86.4	87.3
1	STACK	%O2	0.00	0.03
1	STACK	%O2	12.03	12.09
1	STACK	%O2	20.50	20.55
6	STACK	%CO2	0.0	0.5
6	STACK	%CO2	10.9	10.9
6	STACK	%CO2	17.5	17.4

CALIBRATION SUMMARY

SOURCE: BFI PITTSBURG PA.

REASON: cal error check

DATE : 09-02-1992 TIME: 11:02 - 11:12

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
2	STACK	ppmCO	0.0	0.2
2	STACK	ppmCO	302.0	302.3
3	STACK	ppmSO2	0.0	0.1
3	STACK	ppmSO2	50.5	50.5
4	STACK	ppmNOX	0.0	0.1
4	STACK	ppmNOX	49.8	50.0
1	STACK	%O2	0.00	0.06
1	STACK	%O2	12.03	12.05
6	STACK	%CO2	0.0	0.4
6	STACK	%CO2	10.9	10.8

CALIBRATION SUMMARY

SOURCE: BFI PITTSBURG PA.

REASON: system bias check

DATE : 09-02-1992 TIME: 11:12 - 11:35

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
2	STACK	ppmCO	0.0	0.7
2	STACK	ppmCO	302.0	301.8
3	STACK	ppmSO2	0.0	0.4
3	STACK	ppmSO2	50.5	50.0
4	STACK	ppmNOX	0.0	0.2
4	STACK	ppmNOX	49.8	49.5
1	STACK	%O2	0.00	0.06
1	STACK	%O2	12.03	12.04
6	STACK	%CO2	0.0	0.5
6	STACK	%CO2	10.9	10.8

CALIBRATION SUMMARY

SOURCE: BFI PITTSBURG PA.

REASON: system bias check after power outage

DATE : 09-02-1992 TIME: 15:13 - 15:36

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
2	STACK	ppmCO	0.0	0.2
2	STACK	ppmCO	302.0	304.0
3	STACK	ppmSO2	0.0	0.2
3	STACK	ppmSO2	50.5	50.3
4	STACK	ppmNOX	0.0	0.3
4	STACK	ppmNOX	49.8	50.0
1	STACK	%O2	0.00	0.06
1	STACK	%O2	12.03	12.01
6	STACK	%CO2	0.0	0.4
6	STACK	%CO2	10.9	10.8

BFI PITTSBURG PA. 09-02-1992

TIME	CHAN 2 STACK ppmCO	CHAN 3 STACK ppmSO2	CHAN 4 STACK ppmNOX	CHAN 1 STACK %O2	CHAN 6 STACK %CO2
16:21	1.5	0.1	15.5	9.47	10.2
16:22	1.5	0.1	15.0	9.44	10.0
16:23	2.0	0.0	15.8	9.52	10.3
16:24	2.0	-0.1	15.6	9.22	10.1
16:25	1.1	-1.1	7.1	13.30	3.6
16:26	1.4	-0.8	15.2	16.55	10.1
16:27	2.2	-0.5	15.6	9.71	10.2
16:28	2.0	-0.6	15.8	9.34	10.2
16:29	2.1	-0.5	15.7	9.27	10.2
16:30	2.0	-0.5	15.7	9.30	10.2
16:31	2.0	-0.5	15.8	9.14	10.3
16:32	2.0	-0.6	15.6	9.24	10.2
16:33	2.0	-0.7	14.6	9.27	9.8
16:34	2.0	-0.7	14.7	9.78	9.9
16:35	1.9	-0.7	14.6	9.60	9.7
AVERAGE VALUES FOR THE LAST 15 MINUTES					
16:35	1.8	-0.5	14.8	10.14	9.7
16:36	1.5	-0.7	14.6	9.75	9.8
16:37	1.5	-0.8	14.9	9.63	9.8
16:38	1.5	-0.9	15.0	9.59	9.9
16:39	1.5	-0.9	14.6	9.51	9.7
16:40	1.5	-0.9	14.9	9.68	9.9
16:41	1.5	-1.0	15.1	9.57	10.0
16:42	1.5	-1.0	15.2	9.44	9.9
16:43	1.5	-1.0	15.2	9.46	9.9
16:44	1.5	-0.9	15.5	9.38	10.0
16:45	1.5	-1.1	15.4	9.31	10.0
16:46	1.5	-1.2	15.4	9.35	10.0
16:47	1.5	-1.2	15.3	9.38	10.0
16:48	1.7	-1.4	15.4	9.41	10.0
16:49	2.0	-1.4	16.3	9.27	10.3
16:50	1.9	-1.5	15.6	9.03	10.1
AVERAGE VALUES FOR THE LAST 15 MINUTES					
16:50	1.6	-1.1	15.2	9.45	10.0
16:51	2.0	-1.5	15.9	9.18	10.1
16:52	2.0	-1.5	15.1	9.25	9.9
16:53	1.8	-1.7	15.1	9.50	9.8
16:54	1.7	-1.7	15.0	9.57	9.9
16:55	1.5	-1.6	15.1	9.55	9.9
16:56	1.5	-1.5	15.0	9.46	9.8
16:57	1.4	-1.6	14.8	9.60	9.8
16:58	1.3	-1.7	15.1	9.62	9.9
16:59	1.4	-1.7	15.1	9.50	9.9
17:00	1.1	-1.7	15.1	9.49	9.9
17:01	1.1	-1.8	15.2	9.50	9.9
17:02	1.1	-1.8	15.0	9.47	9.8
17:03	1.1	-1.9	14.9	9.58	9.7
17:04	1.0	-1.9	14.9	9.65	9.7
17:05	0.9	-1.9	15.2	9.60	9.8

BFI PITTSBURG PA. 09-02-1992

TIME	CHAN 2 STACK ppmCO	CHAN 3 STACK ppmSO2	CHAN 4 STACK ppmNOX	CHAN 1 STACK %O2	CHAN 6 STACK %CO2
AVERAGE VALUES FOR THE LAST 15 MINUTES					
17:05	1.4	-1.7	15.1	9.50	9.9
17:06	1.0	-2.0	15.1	9.50	9.8
17:07	1.0	-2.1	15.1	9.49	9.8
17:08	0.9	-2.2	15.4	9.60	9.9
17:09	1.0	-2.1	15.4	9.42	9.9
17:10	0.7	-2.2	15.0	9.51	9.7
17:11	1.0	-2.3	15.3	9.61	9.8
17:12	1.0	-2.2	15.7	9.44	10.0
17:13	1.0	-2.2	15.5	9.36	9.9
17:14	0.9	-2.2	15.3	9.46	9.8
17:15	0.8	-2.3	15.2	9.55	9.8
17:16	0.7	-2.3	15.3	9.59	9.7
17:17	0.6	-2.3	15.2	9.63	9.7
17:18	0.5	-2.2	15.0	9.62	9.7
17:19	0.5	-2.3	15.0	9.69	9.7
17:20	0.5	-2.3	15.4	9.73	9.8
AVERAGE VALUES FOR THE LAST 15 MINUTES					
17:20	0.8	-2.2	15.3	9.55	9.8
AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA					
17:20	1.4	-1.4	15.1	9.66	9.8

COMMENTS: end run O-CEM-1

CALIBRATION SUMMARY

SOURCE: BFI PITTSBURG PA.

REASON: SYSTEM BIAS CHECK AFTER RUN O-CEM-1

DATE : 09-02-1992 TIME: 17:21 - 17:43

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
2	STACK	ppmCO	0.0	0.0
2	STACK	ppmCO	302.0	302.8
3	STACK	ppmSO2	0.0	0.0
3	STACK	ppmSO2	50.5	50.0
4	STACK	ppmNOX	0.0	4.5
4	STACK	ppmNOX	49.8	49.7
1	STACK	%O2	0.00	0.07
1	STACK	%O2	12.03	12.13
6	STACK	%CO2	0.0	0.5
6	STACK	%CO2	10.9	10.5

CALIBRATION SUMMARY

SOURCE: BFI PITTSBURG PA.

REASON: cal error check after power outage

DATE : 09-02-1992 TIME: 14:59 - 15:13

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
2	STACK	ppmCO	0.0	0.2
2	STACK	ppmCO	302.0	302.6
3	STACK	ppmSO2	0.0	0.4
3	STACK	ppmSO2	50.5	50.8
4	STACK	ppmNOX	0.0	0.0
4	STACK	ppmNOX	49.8	50.2
1	STACK	%O2	0.00	0.05
1	STACK	%O2	12.03	12.11
6	STACK	%CO2	0.0	0.4
6	STACK	%CO2	10.9	10.9

CALIBRATION SUMMARY

SOURCE: BFI PITTSBURG PA.

REASON: CAL ERROR CHECK AFTER O-CEM-1 AND BEFORE O-CEM-2

DATE : 09-02-1992 TIME: 17:47 - 17:58

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
2	STACK	ppmCO	0.0	0.0
2	STACK	ppmCO	302.0	303.3
3	STACK	ppmSO2	0.0	0.0
3	STACK	ppmSO2	50.5	51.2
4	STACK	ppmNOX	0.0	0.2
4	STACK	ppmNOX	49.8	50.0
1	STACK	%O2	0.00	0.03
1	STACK	%O2	12.03	12.05
6	STACK	%CO2	0.0	0.3
6	STACK	%CO2	10.9	11.0

CALIBRATION SUMMARY

SOURCE: BFI PITTSBURG PA.

REASON: SYSTEM BIAS CHECK AFTER REDIRECT CAL AFTER O-CEM-1 PRE O-CEM-2

DATE : 09-02-1992 TIME: 18:00 - 18:28

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
2	STACK	ppmCO	0.0	0.5
2	STACK	ppmCO	302.0	301.8
3	STACK	ppmSO2	0.0	0.4
3	STACK	ppmSO2	50.5	50.2
4	STACK	ppmNOX	0.0	0.3
4	STACK	ppmNOX	49.8	49.5
1	STACK	%O2	0.00	0.13
1	STACK	%O2	12.03	12.12
6	STACK	%CO2	0.0	0.4
6	STACK	%CO2	10.9	10.9

BFI PITTSBURG PA. 09-02-1992

TIME	CHAN 2 STACK ppmCO	CHAN 3 STACK ppmSO2	CHAN 4 STACK ppmNOX	CHAN 1 STACK %O2	CHAN 6 STACK %CO2
19:26	33.1	1.6	11.7	8.53	10.4
19:27	5.6	1.7	11.9	10.04	10.6
19:28	5.3	1.7	11.9	9.48	10.6
19:29	4.9	1.7	11.8	9.23	10.5
19:30	4.1	1.7	11.9	9.21	10.6
19:31	3.6	1.8	11.6	9.24	10.4
19:32	3.2	2.0	11.7	9.40	10.5
COMMENTS: AVG. 8.59		1.74	11.79	9.30	10.5

BFI PITTSBURG PA. 09-02-1992

TIME	CHAN 2 STACK ppmCO	CHAN 3 STACK ppmSO2	CHAN 4 STACK ppmNOX	CHAN 1 STACK %O2	CHAN 6 STACK %CO2
19:34	2.4	1.7	11.9	9.31	10.6
19:35	2.4	1.6	12.0	9.29	10.7
19:36	2.0	1.7	11.9	9.28	10.6
19:37	2.0	1.7	11.7	9.29	10.5
19:38	1.6	1.7	11.7	9.33	10.6
19:39	1.5	1.7	11.9	9.32	10.6
19:40	1.5	1.7	11.9	9.35	10.7
19:41	1.5	1.7	11.8	9.31	10.7
19:42	1.5	1.7	11.7	9.28	10.5
19:43	1.3	1.7	11.9	9.36	10.7
19:44	1.1	1.6	11.8	9.25	10.6
19:45	1.1	1.7	12.0	9.32	10.8
19:46	1.0	1.6	11.7	9.19	10.6
19:47	1.0	1.6	11.8	9.35	10.6
19:48	1.0	1.6	11.7	9.31	10.6
AVERAGE VALUES FOR THE LAST 15 MINUTES					
19:48	1.5	1.7	11.8	9.30	10.6
19:49	1.0	1.6	11.7	9.34	10.5
19:50	1.0	1.7	11.9	9.36	10.7
19:51	1.0	1.7	11.8	9.23	10.6
19:52	1.0	1.7	11.8	9.34	10.6
19:53	1.0	1.7	11.8	9.32	10.6
19:54	1.0	1.6	11.5	9.37	10.5
19:55	1.0	1.6	12.0	9.42	10.7
19:56	0.9	1.7	11.7	9.20	10.6
19:57	0.9	1.7	11.8	9.31	10.6
19:58	0.7	1.6	11.8	9.35	10.7
19:59	0.6	1.7	11.7	9.28	10.6
20:00	0.5	1.6	11.5	9.33	10.4
20:01	0.5	1.6	11.5	9.50	10.5
20:02	0.5	1.7	11.8	9.48	10.7
20:03	0.5	1.6	11.2	9.31	10.4
AVERAGE VALUES FOR THE LAST 15 MINUTES					
20:03	0.8	1.6	11.7	9.34	10.6
20:04	0.5	1.7	11.8	9.61	10.8
20:05	0.5	1.7	11.6	9.25	10.6
20:06	0.5	1.7	11.9	9.35	10.8
20:07	0.5	1.7	11.8	9.18	10.7
20:08	0.5	1.7	12.0	9.25	10.7
20:09	0.5	1.8	11.4	9.26	10.5
20:10	0.6	1.8	11.7	9.46	10.7
20:11	0.6	1.8	11.7	9.34	10.6
20:12	0.6	1.7	11.6	9.35	10.6
20:13	0.5	1.8	11.9	9.40	10.7
20:14	0.5	1.8	11.4	9.22	10.5
20:15	0.5	1.9	11.8	9.46	10.8
20:16	0.5	1.9	11.5	9.26	10.5
20:17	0.5	1.8	11.3	9.39	10.4
20:18	0.5	1.8	11.5	9.50	10.7

BFI PITTSBURG PA. 09-02-1992

TIME	CHAN 2 STACK ppmCO	CHAN 3 STACK ppmSO2	CHAN 4 STACK ppmNOX	CHAN 1 STACK %O2	CHAN 6 STACK %CO2
AVERAGE VALUES FOR THE LAST 15 MINUTES					
20:18	0.5	1.8	11.7	9.35	10.6
20:19	0.5	1.8	11.2	9.31	10.4
20:20	0.5	1.8	11.9	9.57	10.8
20:21	0.5	1.9	11.6	9.19	10.7
20:22	0.5	1.9	11.3	9.25	10.5
20:23	0.5	1.8	11.6	9.47	10.7
20:24	0.5	1.9	11.6	9.33	10.8
20:25	0.5	2.0	11.6	9.27	10.7
20:26	0.5	2.0	11.5	9.23	10.6
20:27	0.5	2.0	11.5	9.31	10.7
AVG	0.5	1.9	11.53	9.33	10.60

ONE HOUR AVG.

CO	SO_2	NOx	$\%O_2$	$\%CO_2$
2.37	1.75	11.72	9.3	10.6

CALIBRATION SUMMARY

SOURCE: BFI PITTSBURG PA.

REASON: SYSTEM BIAS CHECK AFTER RUN 0-CEM-2 BEFORE 0-CEM-3

DATE : 09-02-1992 TIME: 20:27 - 20:38

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
2	STACK	ppmCO	0.0	0.0
2	STACK	ppmCO	302.0	301.8
3	STACK	ppmSO2	0.0	0.5
3	STACK	ppmSO2	50.5	50.0
4	STACK	ppmNOX	0.0	0.5
4	STACK	ppmNOX	49.8	49.4
1	STACK	%O2	0.00	0.08
1	STACK	%O2	12.03	12.11
6	STACK	%CO2	0.0	0.5
6	STACK	%CO2	10.9	10.9

BFI PITTSBURG PA. 09-02-1992

TIME	CHAN 2 STACK ppmCO	CHAN 3 STACK ppmSO2	CHAN 4 STACK ppmNOX	CHAN 1 STACK %O2	CHAN 6 STACK %CO2
21:36	0.2	2.5	10.6	10.03	10.1
21:37	-0.1	2.5	10.6	9.89	10.3
21:38	-0.1	2.6	11.2	9.74	10.6
21:39	-0.1	2.5	10.7	9.36	10.3
21:40	0.0	2.6	11.0	9.66	10.5
21:41	0.0	2.6	11.0	9.54	10.4
21:42	-0.1	2.7	11.2	9.54	10.5
21:43	0.0	2.7	10.9	9.55	10.4
21:44	0.0	2.8	10.9	9.61	10.4
21:45	0.0	2.7	10.9	9.56	10.3
21:46	-0.1	2.7	10.8	9.76	10.4
21:47	-0.1	2.8	11.0	9.58	10.5
21:48	0.0	2.7	10.7	9.52	10.4
21:49	0.0	2.8	10.7	9.62	10.4
21:50	0.0	2.8	10.4	9.62	10.3
AVERAGE VALUES FOR THE LAST 15 MINUTES					
21:50	-0.0	2.7	10.8	9.64	10.4
21:51	0.0	2.9	10.5	9.77	10.3
21:52	0.0	2.9	10.6	9.71	10.4
21:53	0.0	2.9	10.8	9.66	10.5
21:54	0.0	3.0	10.6	9.54	10.5
21:55	-0.1	3.0	10.5	9.55	10.4
21:56	0.0	2.9	10.3	9.67	10.3
21:57	0.0	3.0	10.8	9.79	10.5
21:58	0.0	3.1	10.5	9.54	10.4
21:59	-0.2	3.1	10.6	9.70	10.4
22:00	0.0	3.1	10.5	9.59	10.4
22:01	0.0	3.2	10.4	9.72	10.4
22:02	0.0	3.2	10.6	9.69	10.5
22:03	0.0	3.3	10.5	9.56	10.4
22:04	0.0	3.3	10.3	9.71	10.3
22:05	0.0	3.3	10.3	9.70	10.5
AVERAGE VALUES FOR THE LAST 15 MINUTES					
22:05	-0.0	3.1	10.5	9.66	10.4
22:06	0.0	3.3	10.6	9.63	10.5
22:07	0.0	3.4	10.6	9.63	10.5
22:08	0.0	3.4	10.1	9.69	10.4
22:09	0.0	3.4	10.2	9.74	10.4
22:10	0.0	3.1	10.5	9.73	10.5
22:11	0.0	3.2	10.5	9.57	10.5
22:12	-0.1	3.2	10.1	9.68	10.3
22:13	0.0	3.2	10.3	9.78	10.3
22:14	0.0	3.3	10.6	9.73	10.5
22:15	0.0	3.4	10.0	9.64	10.1
22:16	0.0	3.3	10.6	9.87	10.5
22:17	0.0	3.3	10.5	9.75	10.5
22:18	0.0	3.4	10.3	9.64	10.3
22:19	-0.1	3.5	10.4	9.69	10.5
22:20	0.0	3.5	10.4	9.66	10.5

BFI PITTSBURG PA. 09-02-1992

TIME	CHAN 2 STACK ppmCO	CHAN 3 STACK ppmSO2	CHAN 4 STACK ppmNOX	CHAN 1 STACK %O2	CHAN 6 STACK %CO2
AVERAGE VALUES FOR THE LAST 15 MINUTES					
22:20	-0.0	3.3	10.4	9.70	10.4
22:21	0.0	3.5	10.1	9.59	10.3
22:22	0.0	3.6	10.5	9.75	10.5
22:23	0.2	3.6	10.0	9.67	10.3
22:24	0.1	3.6	10.1	9.82	10.3
22:25	0.0	3.6	10.1	9.78	10.3
22:26	0.0	3.6	10.5	9.83	10.5
22:27	0.0	3.7	10.1	9.63	10.3
22:28	0.0	3.7	10.0	9.78	10.3
22:29	0.0	3.7	10.2	9.79	10.4
22:30	0.0	3.8	10.2	9.76	10.3
22:31	0.0	3.9	10.0	9.82	10.4
22:32	0.0	3.9	10.0	9.83	10.4
22:33	0.0	3.9	10.5	9.71	10.6
22:34	0.0	4.0	10.1	9.55	10.3
22:35	0.0	4.0	9.7	9.80	10.2
AVERAGE VALUES FOR THE LAST 15 MINUTES					
22:35	0.0	3.7	10.1	9.74	10.4
AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA					
22:35	-0.0	3.2	10.5	9.68	10.4

COMMENTS: END RUN O-CEM-3

CALIBRATION SUMMARY

SOURCE: BFI PITTSBURG PA.

REASON: SYSTEM BIAS CHECK AFTER RUN O-CEM-3

DATE : 09-02-1992 TIME: 22:35 - 22:51

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
2	STACK	ppmCO	0.0	0.1
2	STACK	ppmCO	302.0	301.8
3	STACK	ppmSO2	0.0	0.1
3	STACK	ppmSO2	50.5	50.8
4	STACK	ppmNOX	0.0	-0.6
4	STACK	ppmNOX	49.8	48.6
1	STACK	%O2	0.00	0.10
1	STACK	%O2	12.03	12.07
6	STACK	%CO2	0.0	0.5
6	STACK	%CO2	10.9	10.9

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

COMPANY: BFI PITTSBURG Pa.
SOURCE: VAPOR FLARE

TEST DATE: 09-02-92

RUN NUMBER: O-CEM-1(16:20-17:20)

SPAN VALUES:
100.0 ppm SO2
100.0 ppm NOx
500.0 ppm CO
25.00 % Oxygen
50.00 % 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)
SO2 ZERO GAS	0.4	0.2	-0.20	0.0	-0.40	-0.20
SO2 UP-SCALE	50.8	50.3	-0.50	50.0	-0.80	-0.30
NOx ZERO GAS	0.0	0.3	0.30	4.5	2.40	2.40
NOx UP-SCALE	50.2	50.0	-0.20	49.7	-0.50	-0.3
CO ZERO GAS	0.2	0.2	0.00	0.0	-0.04	-0.04
CO UP-SCALE	302.6	304.0	0.28	302.8	0.04	-0.24
O2 ZERO GAS	0.05	0.06	0.04	0.07	0.08	0.04
O2 UP-SCALE	12.11	12.01	-0.40	12.13	0.08	0.48
CO2 ZERO GAS	0.40	0.40	0.00	0.50	0.20	0.20
CO2 UP-SCALE	10.90	10.80	-0.20	10.50	-0.80	-0.60

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

COMPANY: BFI PITTSBURG Pa.
SOURCE: VAPOR FLARE

TEST DATE: 09-02-92

RUN NUMBER: O-CEM-2(19:25-20:27)

SPAN VALUES:
100.0 ppm SO2
100.0 ppm NOx
500.0 ppm CO
25.00 % Oxygen
50.00 % 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)
SO2 ZERO GAS	0.0	0.4	0.40	0.5	0.50	0.10
SO2 UP-SCALE	51.2	50.2	-1.00	50.0	-1.20	-0.20
NOx ZERO GAS	0.2	0.3	0.10	0.5	0.30	0.20
NOx UP-SCALE	50.0	49.5	-0.50	49.4	-0.60	-0.10
CO ZERO GAS	0.0	0.5	0.10	0.0	0.00	-0.10
CO UP-SCALE	303.3	301.8	-0.30	301.8	-0.30	0.00
O2 ZERO GAS	0.03	0.13	0.40	0.08	0.20	-0.20
O2 UP-SCALE	12.05	12.12	0.28	12.11	0.24	-0.04
CO2 ZERO GAS	0.30	0.40	0.20	0.50	0.40	0.20
CO2 UP-SCALE	11.00	10.90	-0.20	10.90	-0.20	0.00

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

COMPANY: BFI PITTSBURG Pa.
SOURCE: VAPOR FLARE

TEST DATE: 09-02-92

RUN NUMBER: O-CEM-3(21:35-22:35)

SPAN VALUES:
100.0 ppm SO2
100.0 ppm NOx
500.0 ppm CO
25.00 % Oxygen
50.00 % 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)
SO2 ZERO GAS	0.0	0.5	0.50	0.1	0.10	-0.40
SO2 UP-SCALE	51.2	50.0	-1.20	50.8	-0.40	0.80
NOx ZERO GAS	0.2	0.5	0.30	-0.6	-0.80	-1.10
NOx UP-SCALE	50.0	49.4	-0.60	48.6	-1.40	-0.80
CO ZERO GAS	0.0	0.0	0.00	0.1	0.02	0.02
CO UP-SCALE	303.3	301.8	-0.30	301.8	-0.30	0.00
O2 ZERO GAS	0.03	0.08	0.20	0.10	0.28	0.08
O2 UP-SCALE	12.05	12.11	0.24	12.07	0.08	-0.16
CO2 ZERO GAS	0.30	0.50	0.40	0.50	0.40	0.00
CO2 UP-SCALE	11.00	10.90	-0.20	10.90	-0.20	0.00

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

EEI Ref#: 11117 Date: September 2 1992

Non-Methane Organics Analysis: Vapor Flare Inlet

Standard Concentration PPM	Area Count 1	Dev From Mean %	Area Count 2	Dev From Mean %	Area Count Average	Predicted Concent PPM	Deviation From Tag (%)
0						-119	NA
3020	805	-1.71	832	1.59	819	2966	-1.79
6020	1659	0.24	1650	-0.30	1655	6115	1.57
10020	2708	1.01	2654	-1.01	2681	9979	-0.41

SAMPLE ID	INJECTION TIME	AREA COUNT		CONCENTRATION PPM
6020 ppm pretest syst cal	1543	1643		6070
6020 ppm pretest syst cal	1543	1593		5881
I-M18-1a	1619	533		1889
I-M18-1b	1628	406		1410
I-M18-1c	1638	343		1173
I-M18-1d	1653	351		1203
I-M18-1e	1656	367		1263
I-M18-1f	1707	432		1508
I-M18-1g	1721	451		1580
			Run Average	1432
6020 ppm posttest syst cal	1735	1710		6322
6020 ppm posttest syst cal	1735	1734		6412
I-M18-2a	1924	376		1297
I-M18-2b	1934	384		1327
I-M18-2c	1945	453		1587
I-M18-2d	1955	434		1516
I-M18-2e	2008	405		1406
I-M18-2f	2015	442		1546
I-M18-2g	2026	483		1700
			Run Average	1483
6020 ppm posttest syst cal	2040	1772		6555
6020 ppm posttest syst cal	2040	1710		6322
I-M18-3a	2136	497		1753
I-M18-3b	2144	400		1388
I-M18-3c	2154	425		1482
I-M18-3d	2206	403		1399
I-M18-3e	2215	412		1433
I-M18-3f	2225	293		985
I-M18-3g	2236	360		1237
			Run Average	1382
6020 ppm posttest syst cal	2246	1796		6646
6020 ppm posttest syst cal	2246	1739		6431

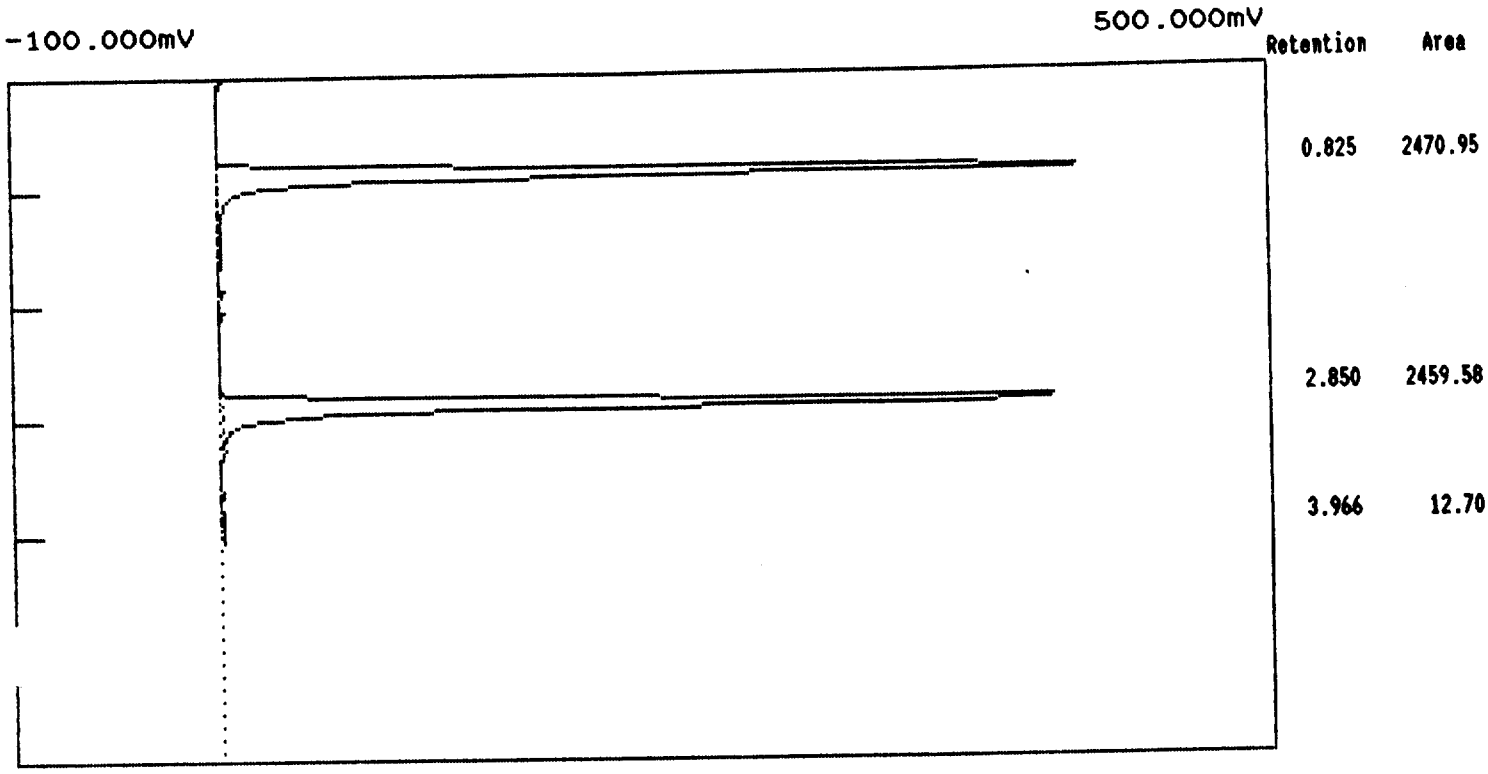
EEI Ref#: 11117 Date: Sept 9 1992

INLET METHANE ANALYSIS

Standard Concentration PPM	Area Count 1	Dev From Mean %	Area Count 2	Dev From Mean %	Area Count Average	Predicted Concent PPM	Deviation From Tag (%)
0						63	NA
3020	737	0.41	731	-0.41	734	3030	0.35
6020	1462	-0.48	1475	0.41	1469	6002	-0.3
10020	2470	0.20	2459	-0.24	2465	10028	0.08

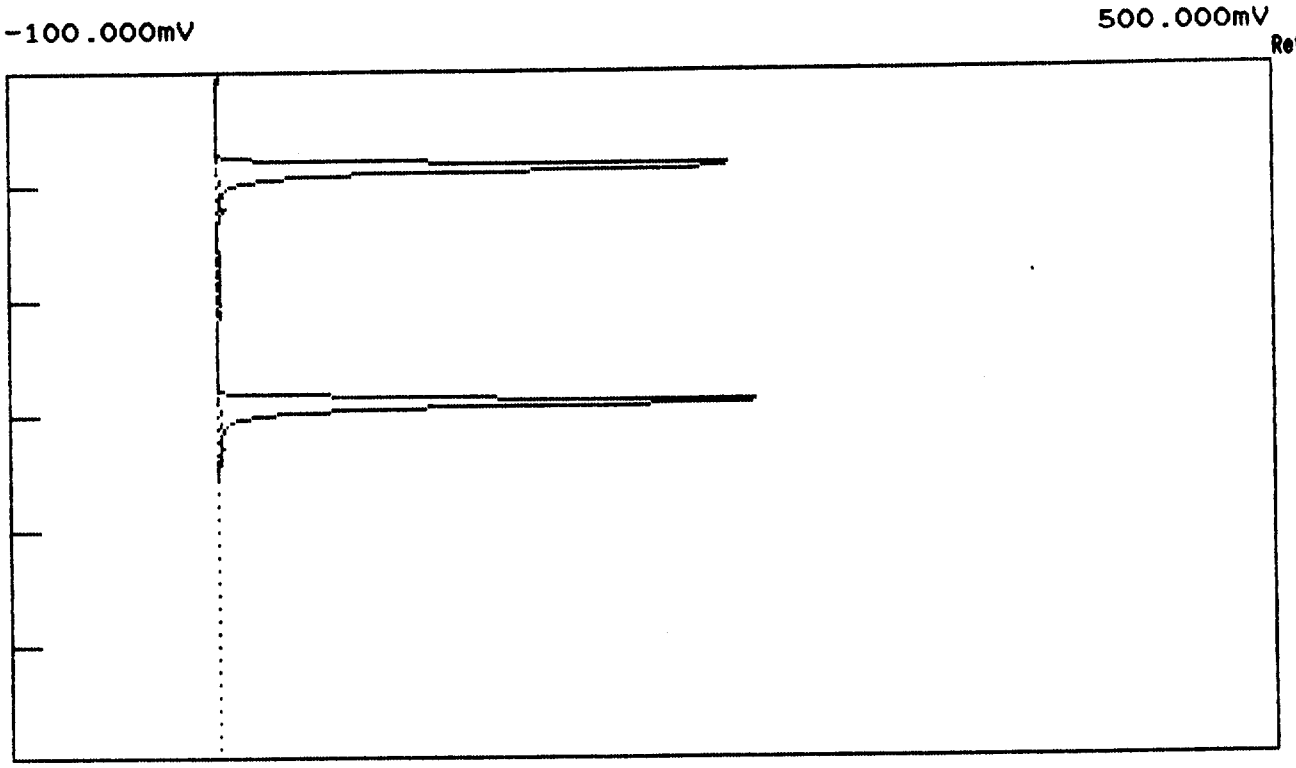
SAMPLE ID	AREA COUNT		CONCENTRATION PPM
I-M3-1	2579		10488.70
I-M3-1	2598		10565.50
		Average	10527.10
I-M3-2	2718		11050.59
I-M3-2	2738		11131.44
		Average	11091.01
I-M3-3	2773		11272.92
I-M3-3	2675		10876.77
		Average	11074.85

Operator : REP
Description : BFI inlet
Conditions : 10020 ppm CH4 standard for diluted inlet CH4
: analysis of tank samples
File : BFI-105.CHR
Date : 09/09/1992
Time : 09:31:17



Retention	Area
0.825	2470.95
2.850	2459.58
3.966	12.70
	4943.23

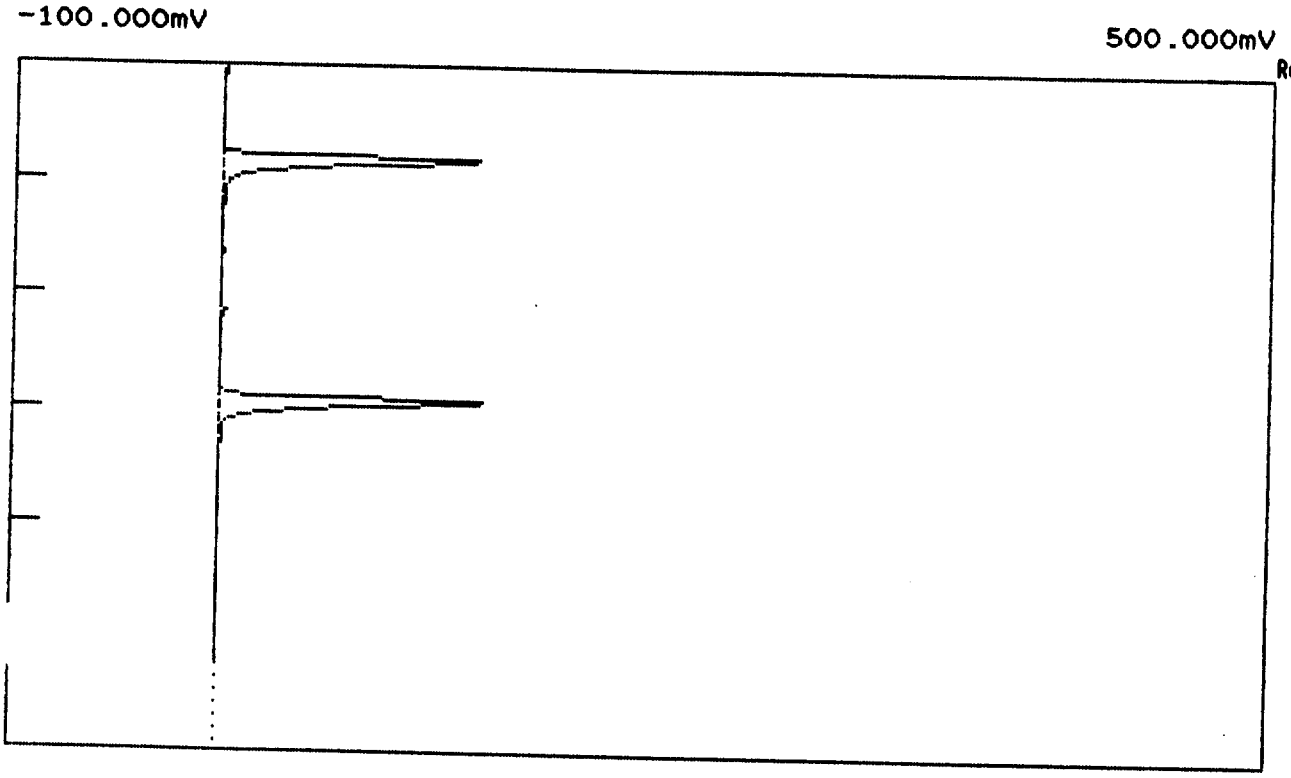
Operator : REP
Description : BFI inlet
Conditions : 6020 ppm CH4 standard for diluted inlet CH4
: analysis of tank samples
File : BFI-106.CHR
Date : 09/09/1992
Time : 09:36:10



Retention	Area
0.816	1475.99
1.875	14.45
2.858	1462.08

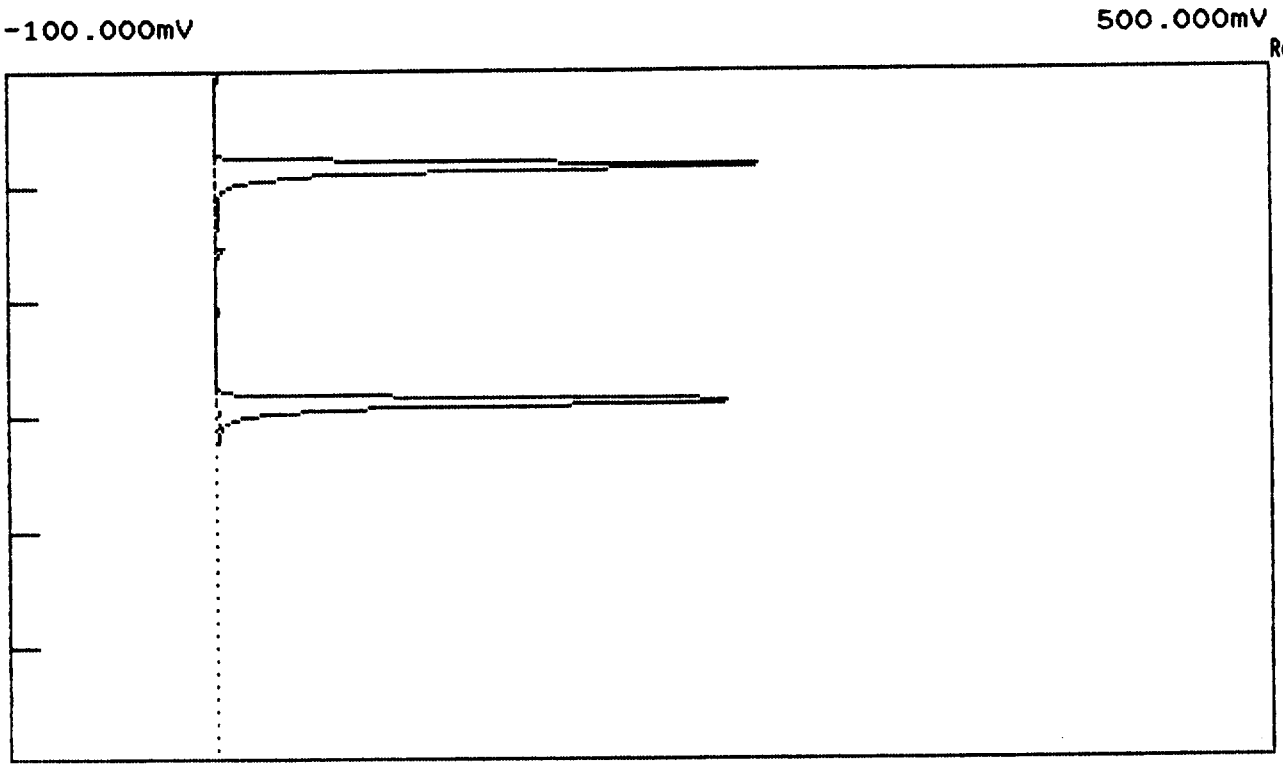
Retention	Area
0.816	1475.99
1.875	14.45
2.858	1462.08
	2952.52

Operator : REP
Description : BFI inlet
Conditions : 3020 ppm CH4 standard for diluted inlet CH4
: analysis of tank samples
File : BFI-107.CHR
Date : 09/09/1992
Time : 09:42:55



Retention	Area
0.816	737.76
2.925	731.51
	1469.28

Operator : REP
Description : BFI inlet
Conditions : 6020 ppm CH4 standard, postanalysis.
File : BFI-112.CHR
Date : 09/09/1992
Time : 13:42:32



Retention	Area
0.800	1468.87
1.533	14.93
2.850	1493.04
	2976.83

EEI Ref#: 11117 Date: September 2 1992

Non-Methane Organics Analysis: Vapor Flare Inlet

Standard Concentration PPM	Area Count 1	Dev From Mean %	Area Count 2	Dev From Mean %	Area Count Average	Predicted Concent PPM	Deviation From Tag (%)
0						-119	NA
3020	805	-1.71	832	1.59	819	2966	-1.79
6020	1659	0.24	1650	-0.30	1655	6115	1.57
10020	2708	1.01	2654	-1.01	2681	9979	-0.41

SAMPLE ID	INJECTION TIME	AREA COUNT		CONCENTRATION PPM
6020 ppm pretest syst cal	1543	1643		6070
6020 ppm pretest syst cal	1543	1593		5881
I-M18-1a	1619	533		1889
I-M18-1b	1628	406		1410
I-M18-1c	1638	343		1173
I-M18-1d	1653	351		1203
I-M18-1e	1656	367		1263
I-M18-1f	1707	432		1508
I-M18-1g	1721	451		1580
			Run Average	1432
6020 ppm posttest syst cal	1735	1710		6322
6020 ppm posttest syst cal	1735	1734		6412
I-M18-2a	1924	376		1297
I-M18-2b	1934	384		1327
I-M18-2c	1945	453		1587
I-M18-2d	1955	434		1516
I-M18-2e	2008	405		1406
I-M18-2f	2015	442		1546
I-M18-2g	2026	483		1700
			Run Average	1483
6020 ppm posttest syst cal	2040	1772		6555
6020 ppm posttest syst cal	2040	1710		6322
I-M18-3a	2136	497		1753
I-M18-3b	2144	400		1388
I-M18-3c	2154	425		1482
I-M18-3d	2206	403		1399
I-M18-3e	2215	412		1433
I-M18-3f	2225	293		985
I-M18-3g	2236	360		1237
			Run Average	1382
6020 ppm posttest syst cal	2246	1796		6646
6020 ppm posttest syst cal	2246	1739		6431

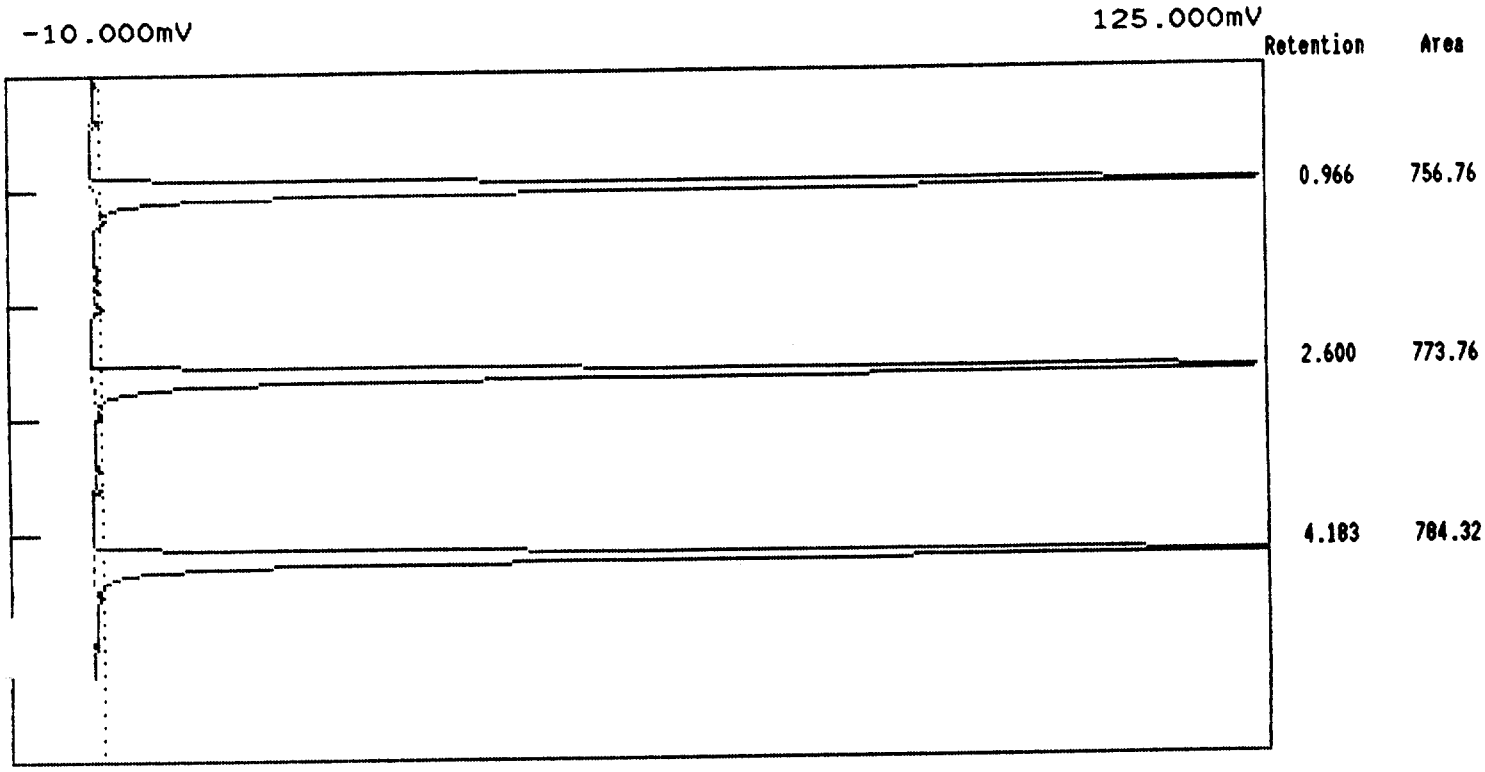
EEI Ref#: 11117 Date: September 2 1992

Non-Methane Organics Analysis: Vapor Flare Outlet

Standard Concentration PPM	Area Count 1	Dev From Mean %	Area Count 2	Dev From Mean %	Area Count Average	Predicted Concent PPM	Deviation From Tag (%)
0						2.0	NA
43.2	106	0.00	106	0.00	106	42.7	-1.16
80.1	205	0.00	205	0.00	205	80.7	0.73
301.0	774	-0.64	784	0.64	779	300.9	-0.03

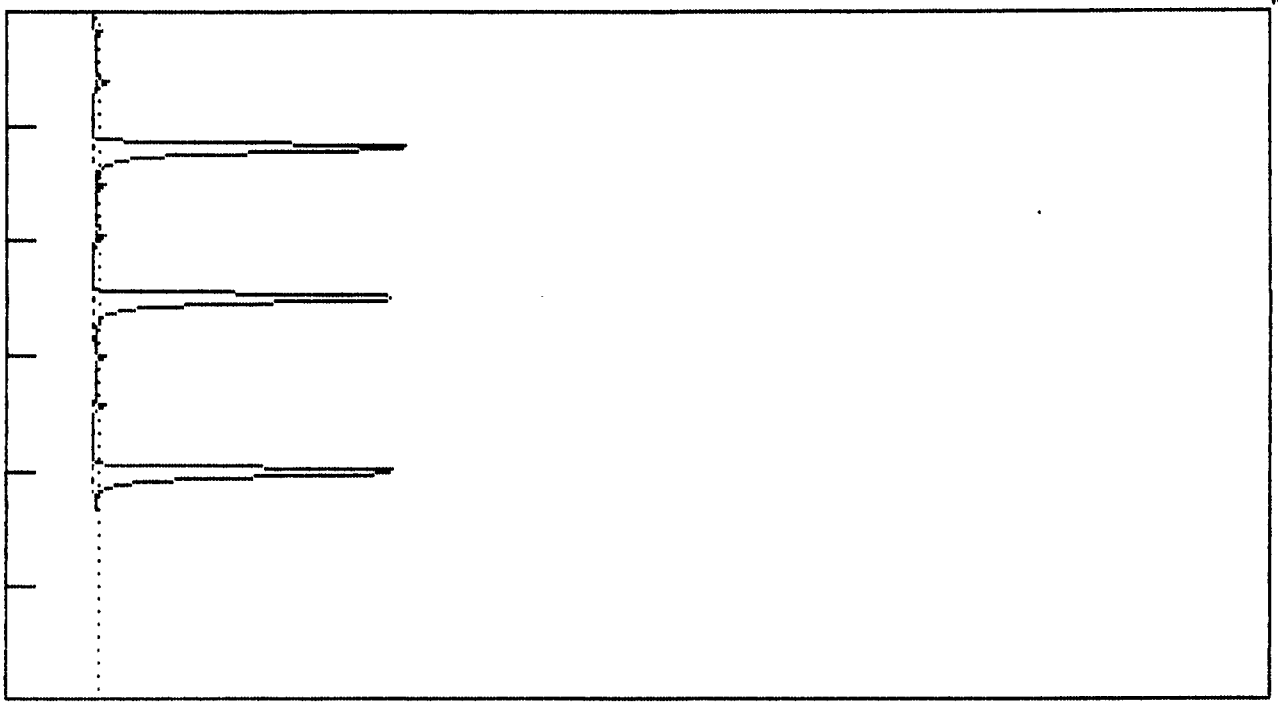
SAMPLE ID	INJECTION TIME		AREA COUNT		CONCENTRATION PPM
80.1 ppm pretest syst cal	1555		199.0		78.4
80.1 ppm pretest syst cal	1555		200.0		78.8
O-M18-1a	1619	<	10.0	<	5.9
O-M18-1b	1628	<	10.0	<	5.9
O-M18-1c	1638	<	10.0	<	5.9
O-M18-1d	1653	<	10.0	<	5.9
O-M18-1e	1656	<	10.0	<	5.9
O-M18-1f	1707		24.0		11.2
O-M18-1g	1721	<	10.0	<	5.9
				Run Average	<5.9
80.1 ppm posttest syst cal	1753		203.0		79.9
80.1 ppm posttest syst cal	1753		197.0		77.6
O-M18-2a	1619	<	10.0	<	5.9
O-M18-2b	1628	<	10.0	<	5.9
O-M18-2c	1638	<	10.0	<	5.9
O-M18-2d	1653	<	10.0	<	5.9
O-M18-2e	1656	<	10.0	<	5.9
O-M18-2f	1707	<	21.8		10.4
O-M18-2g	1721	<	48.5		20.6
				Run Average	<5.9
80.1 ppm posttest syst cal	2047		201.0		79.1
80.1 ppm posttest syst cal	2047		199.0		78.4
O-M18-3a	2136		40.7		17.6
O-M18-3b	2144	<	10.0	<	5.9
O-M18-3c	2154	<	10.0	<	5.9
O-M18-3d	2206	<	10.0	<	5.9
O-M18-3e	2215		18.0		8.9
O-M18-3f	2225	<	10	<	5.9
O-M18-3g	2236	<	10	<	5.9
				Run Average	<5.9
80.1 ppm posttest syst cal	2303		204.0		80.3
80.1 ppm posttest syst cal	2303		205.5		80.9

Operator : REP
Description : BFI outlet
Conditions : 301 ppm CH4 direct cal
File : BFIo-13.CHR
Date : 09/02/1992
Time : 15:24:35



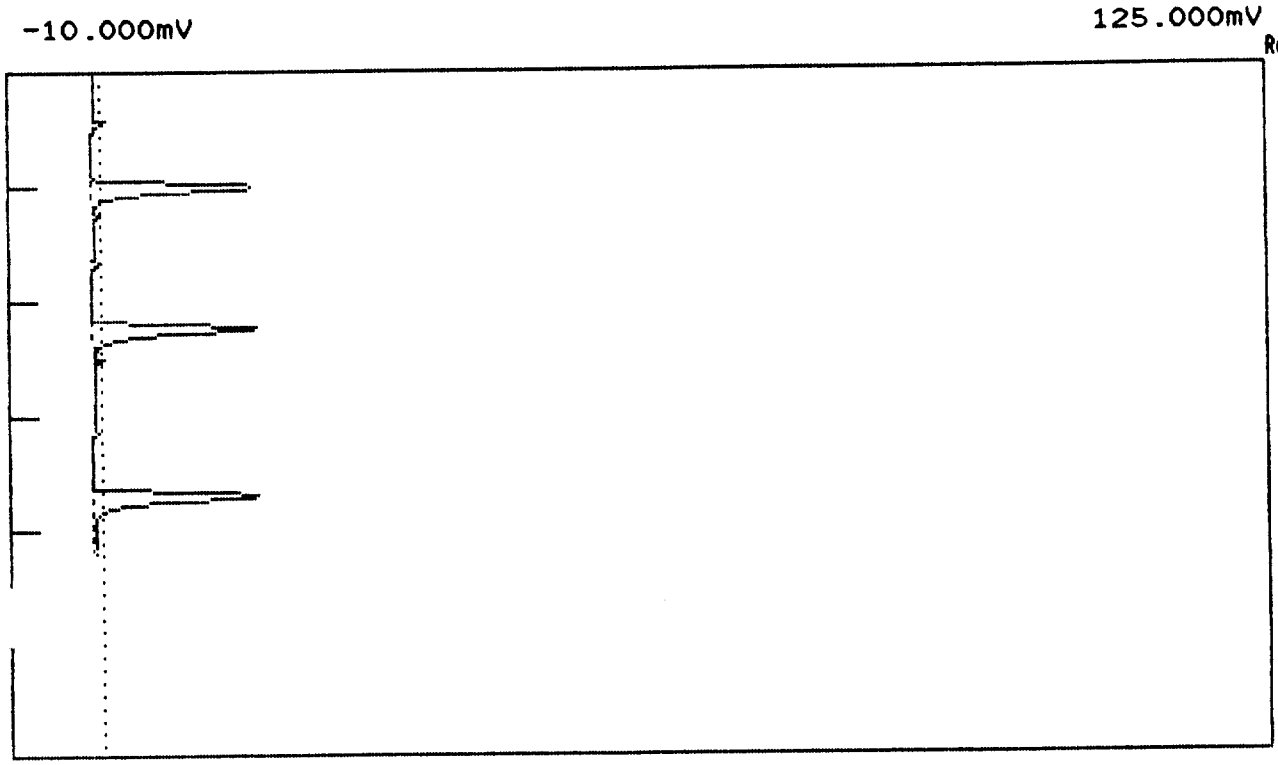
Retention	Area
0.966	756.76
2.600	773.76
4.183	784.32
	2314.85

Operator : REP
Description : BFI outlet
Conditions : 80.1 ppm CH4 direct cal
File : BFIo-11.CHR
Date : 09/02/1992
Time : 15:03:51



Retention	Area
1.175	205.08
2.491	204.65
3.983	201.84
	611.57

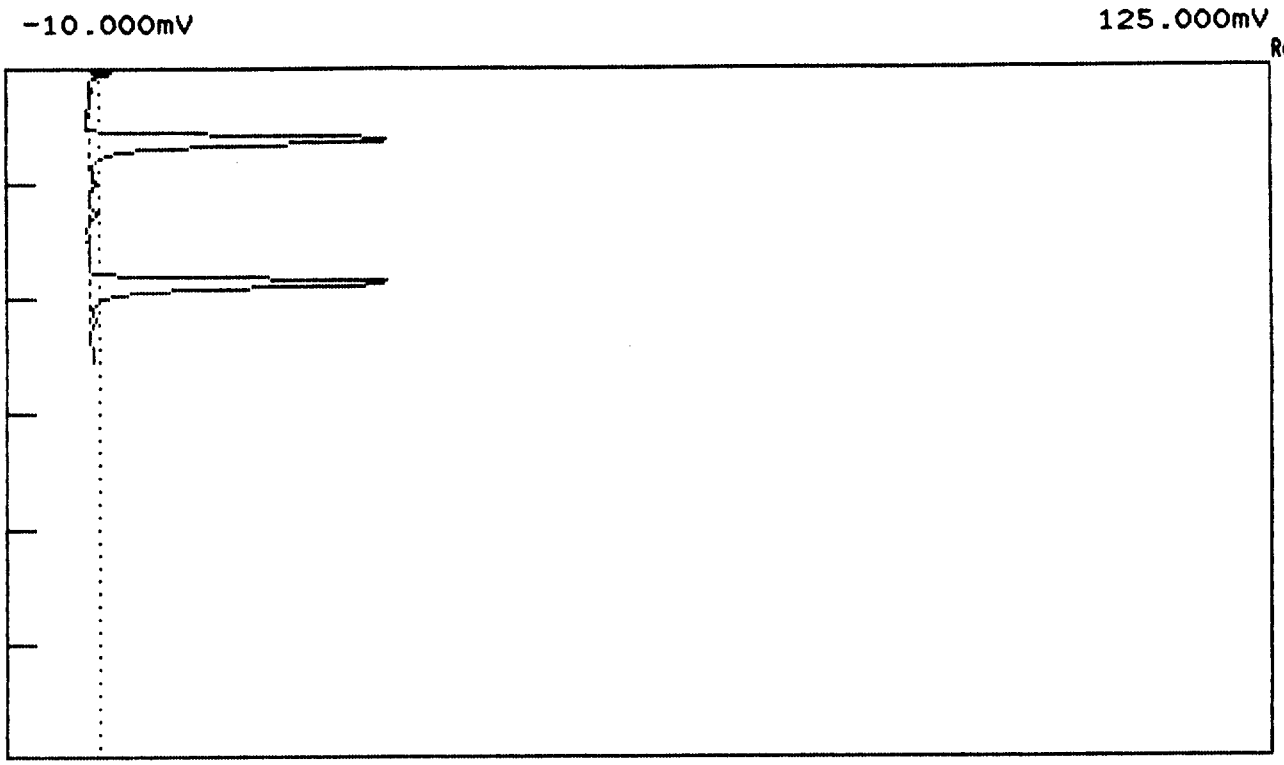
Operator : REP
Description : BFI outlet
Conditions : 43.2 ppm CH4 direct cal
File : BFIo-12.CHR
Components :
Date : 09/02/1992
Time : 15:16:05



Retention	Area
0.991	106.34
2.225	106.28
3.691	111.78

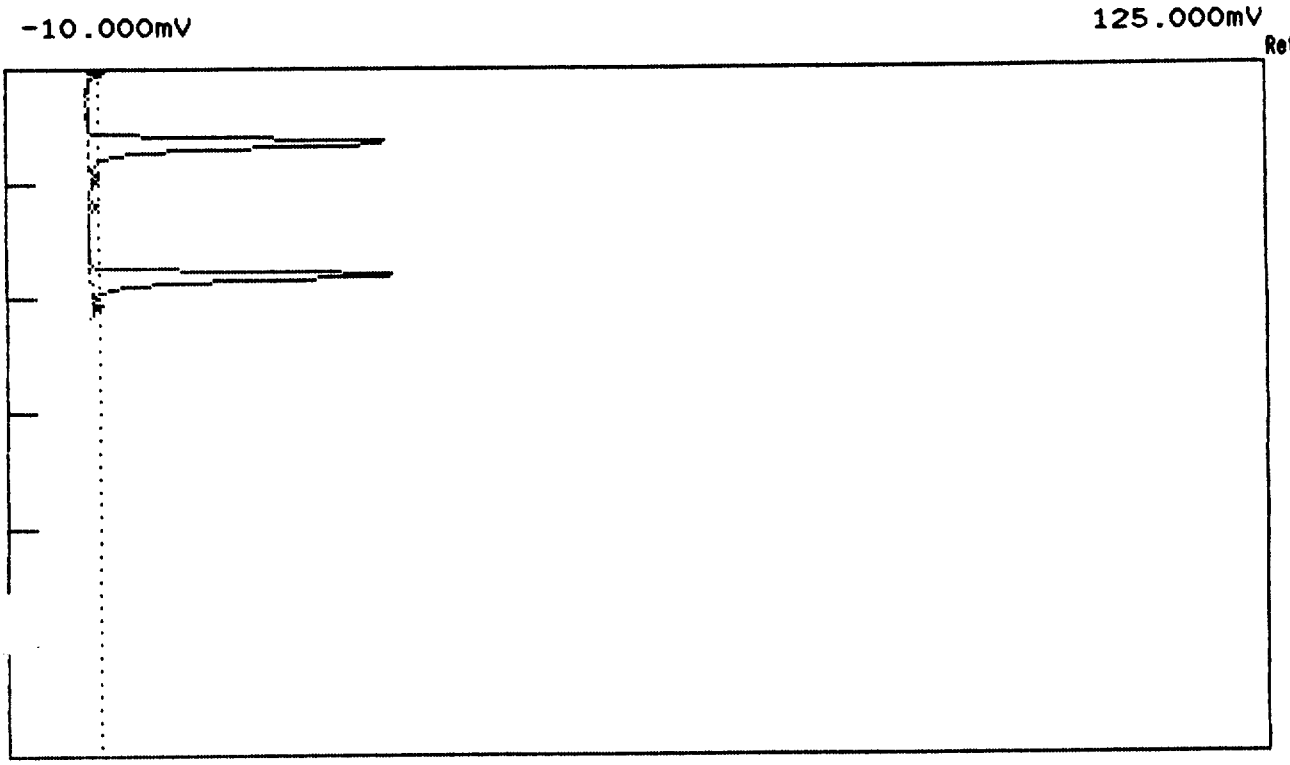
Retention	Area
0.991	106.34
2.225	106.28
3.691	111.78
	324.40

Operator : REP
Description : BFI outlet
Conditions : 80.1 ppm CH4 outlet system calibration
Components :
Date : 09/02/1992
Time : 15:54:32



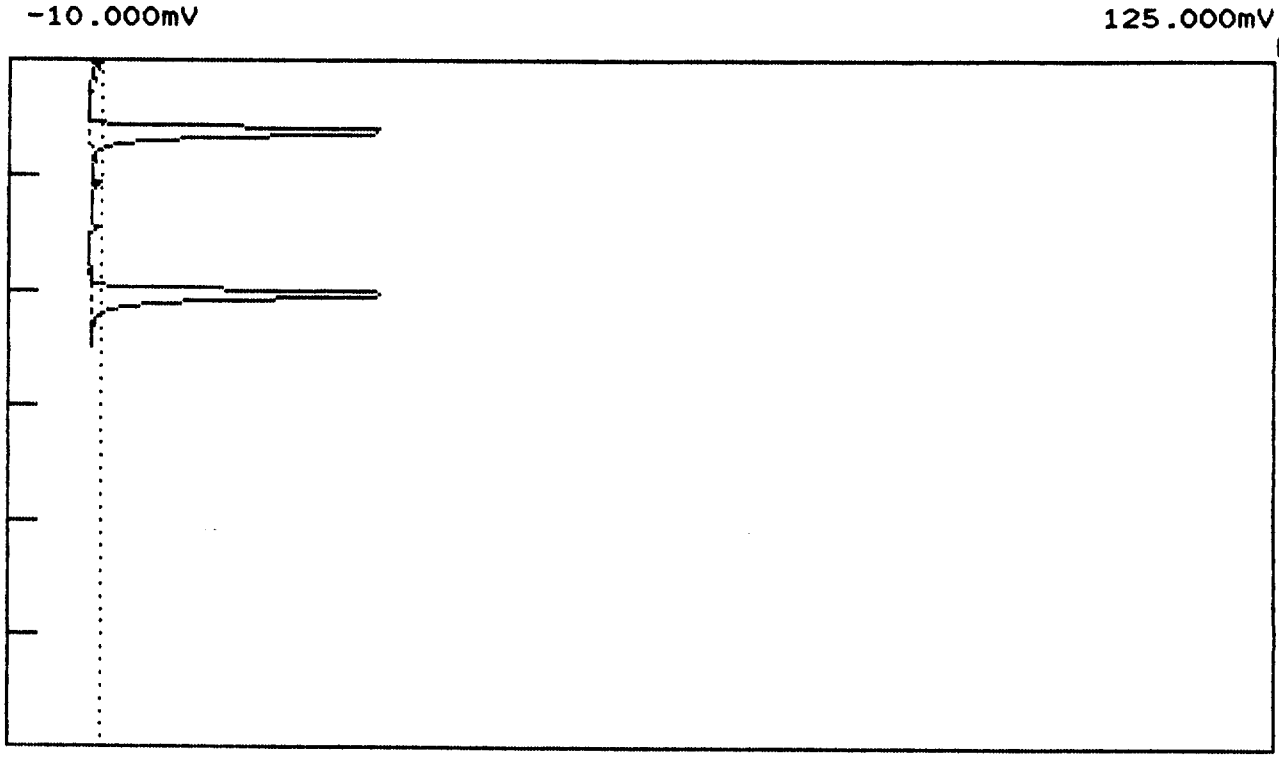
Retention	Area
0.600	198.80
1.841	200.28
	399.08

Operator : REP
Description : BFI outlet
Conditions : 80.1 ppm CH4 outlet posttest system calibration
Components :
Date : 09/02/1992
Time : 17:53:04



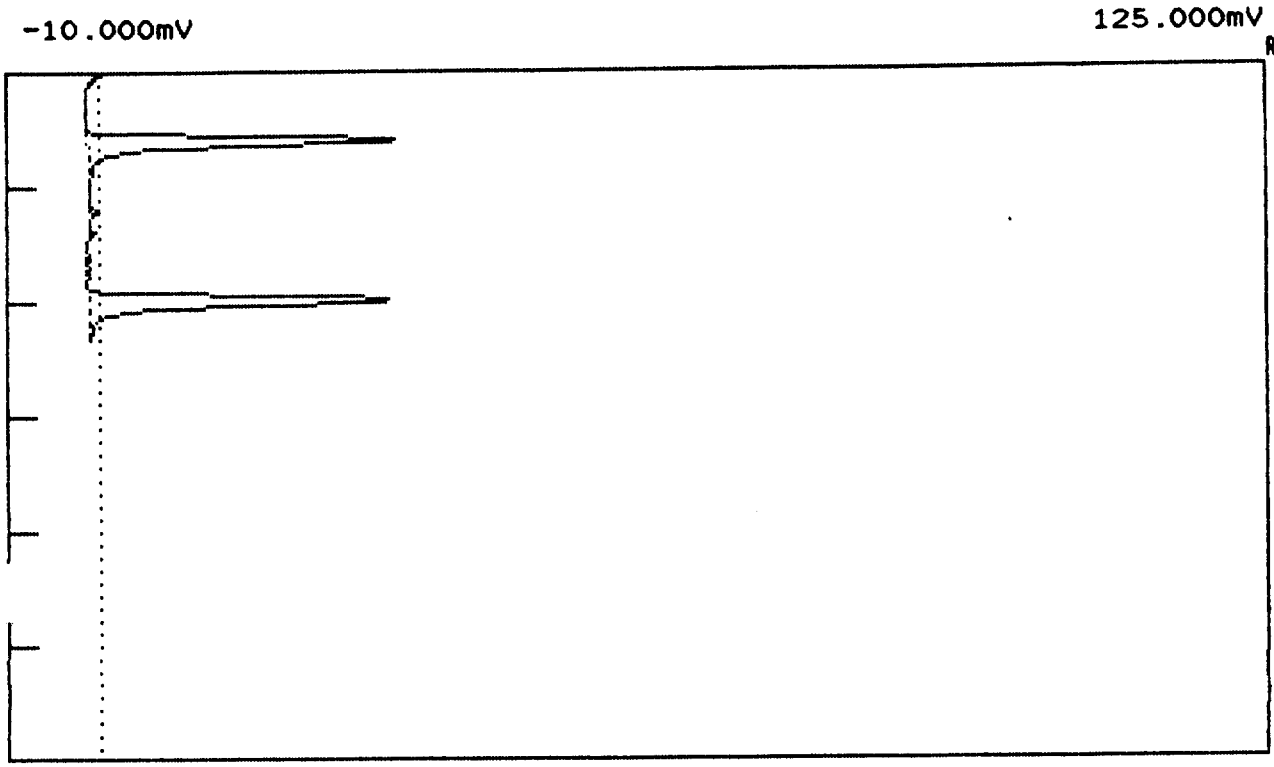
Retention	Area
0.616	202.93
1.775	197.25
	400.18

Operator : REP
Description : BFI outlet
Conditions : 80.1 ppm CH4 outlet system calibration
File : BFIo-33.CHR
Date : 09/02/1992
Time : 20:47:16



Retention	Area
0.600	201.50
2.016	199.27
	400.76

Operator : REP
Description : BFI outlet
Conditions : 80.1 ppm CH4 posttest outlet system calibration
File : BFIo-43.CHR
Components :
Date : 09/02/1992
Time : 23:03:07

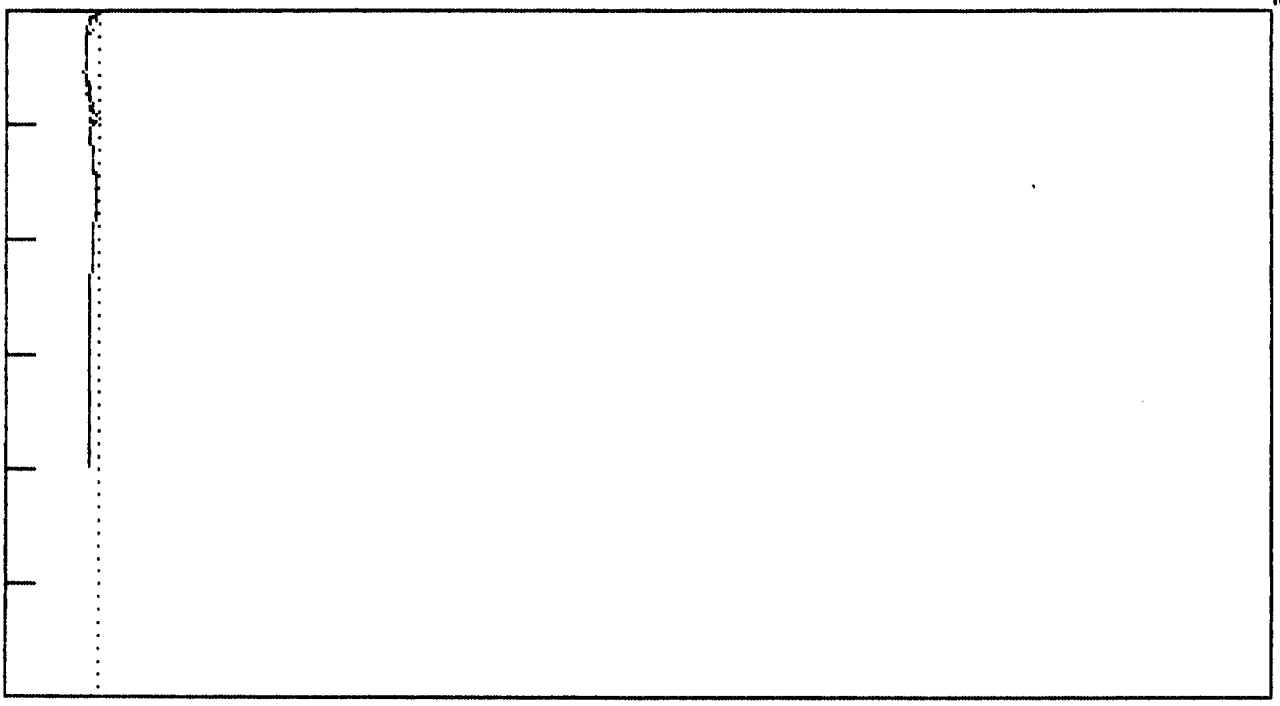


Retention	Area
0.583	203.97
1.966	205.53
	409.49

Operator : REP
Description : BFI outlet
Conditions : O-M18-1a
File : BFIo-16.CHR
Date : 09/02/1992
Time : 16:18:49

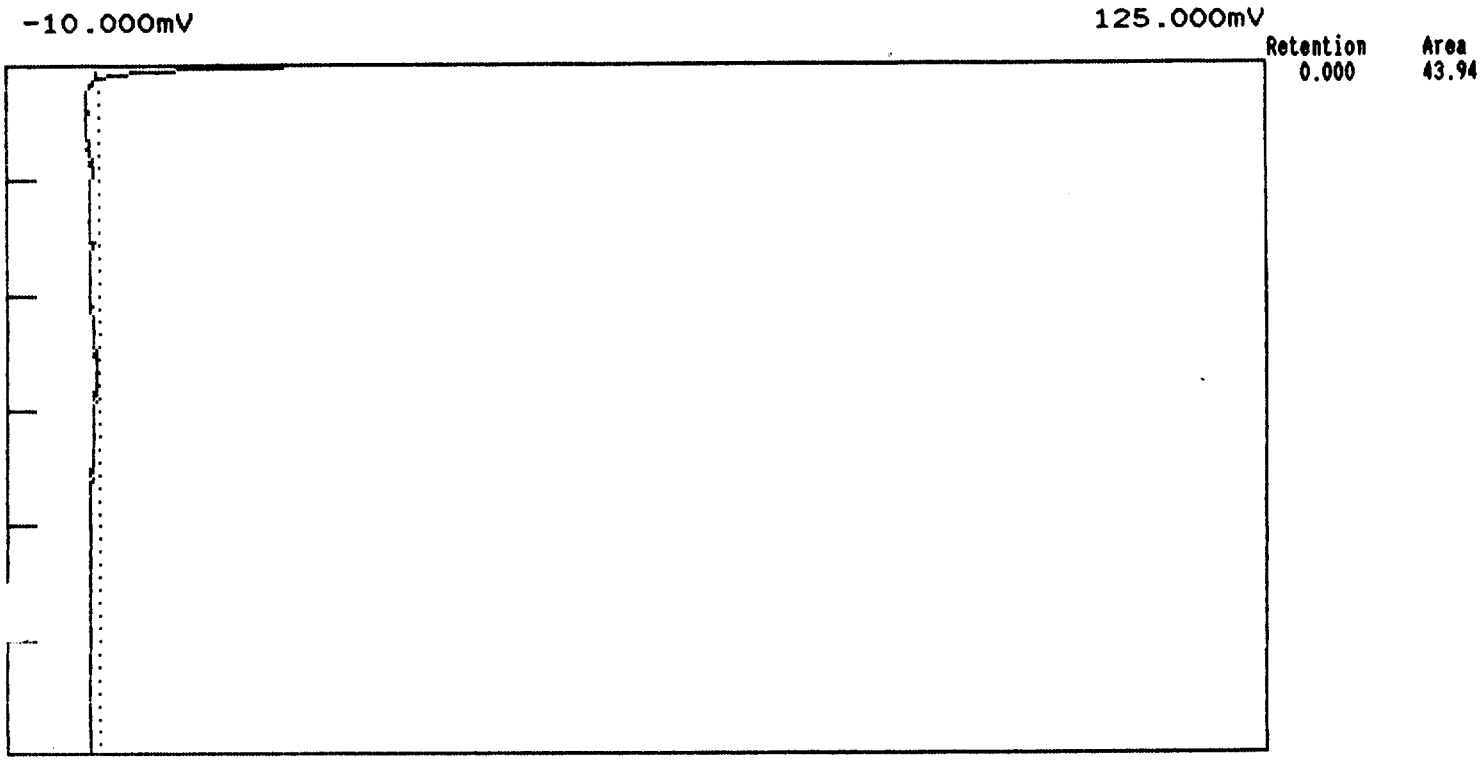
-10.000mV 125.000mV

Retention Area



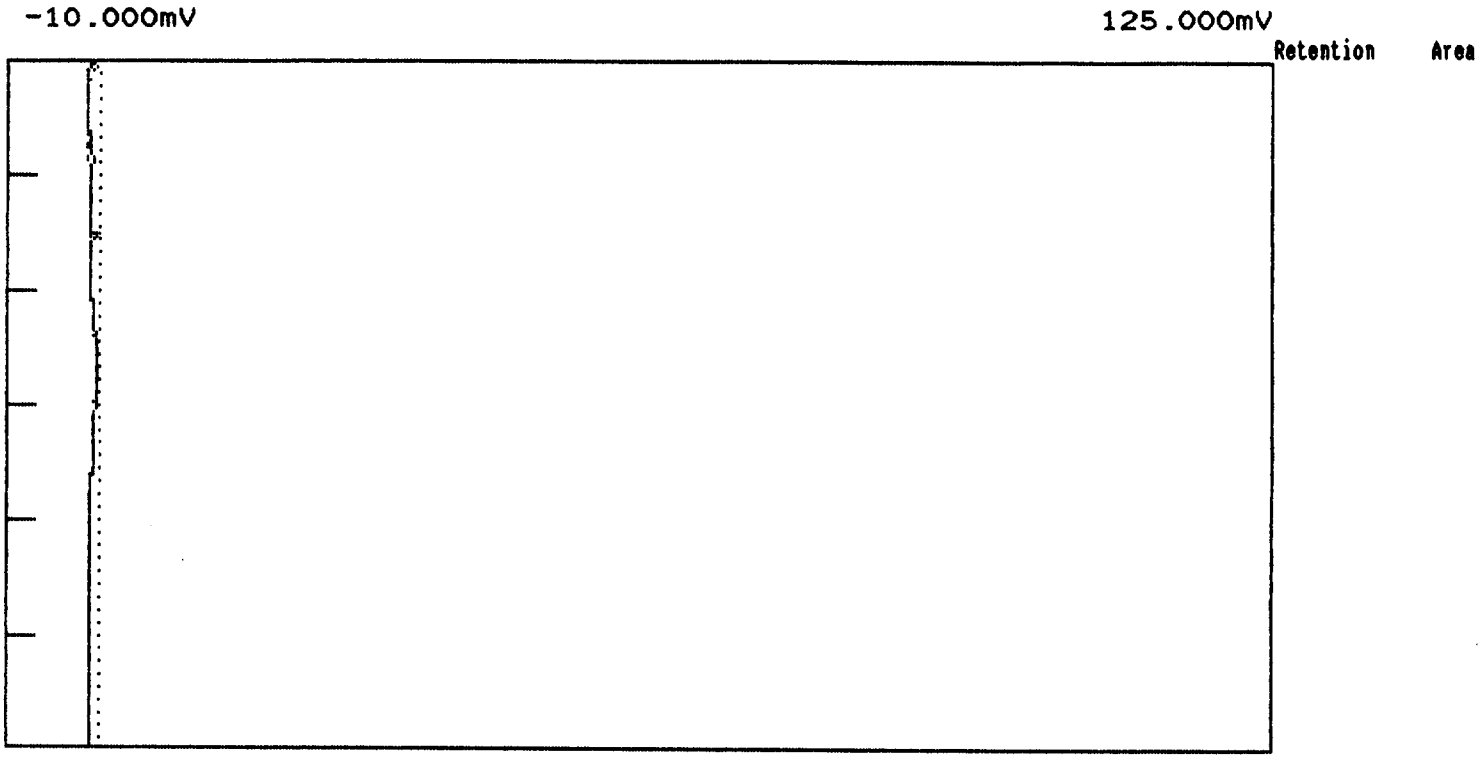
Retention	Area
	0.00

Operator : REP
Description : BFI outlet
Conditions : O-M18-1#6
File : BFIo-17.CHR
Date : 09/02/1992
Time : 16:27:38



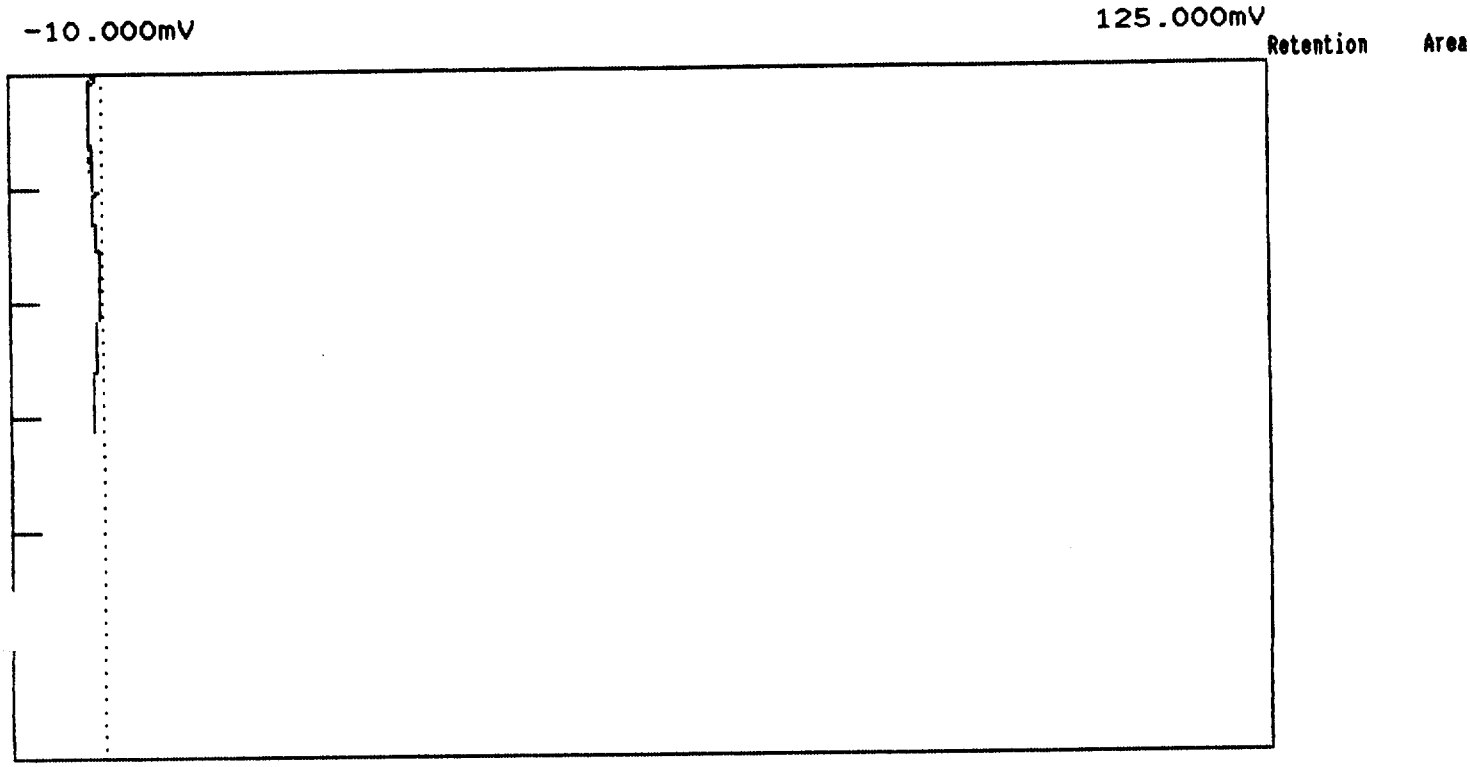
Retention	Area
0.000	43.94
	43.94

Operator : REP
Description : BFI outlet
Conditions : O-M18-1c
File : BFIo-18.CHR
Date : 09/02/1992
Time : 16:37:54



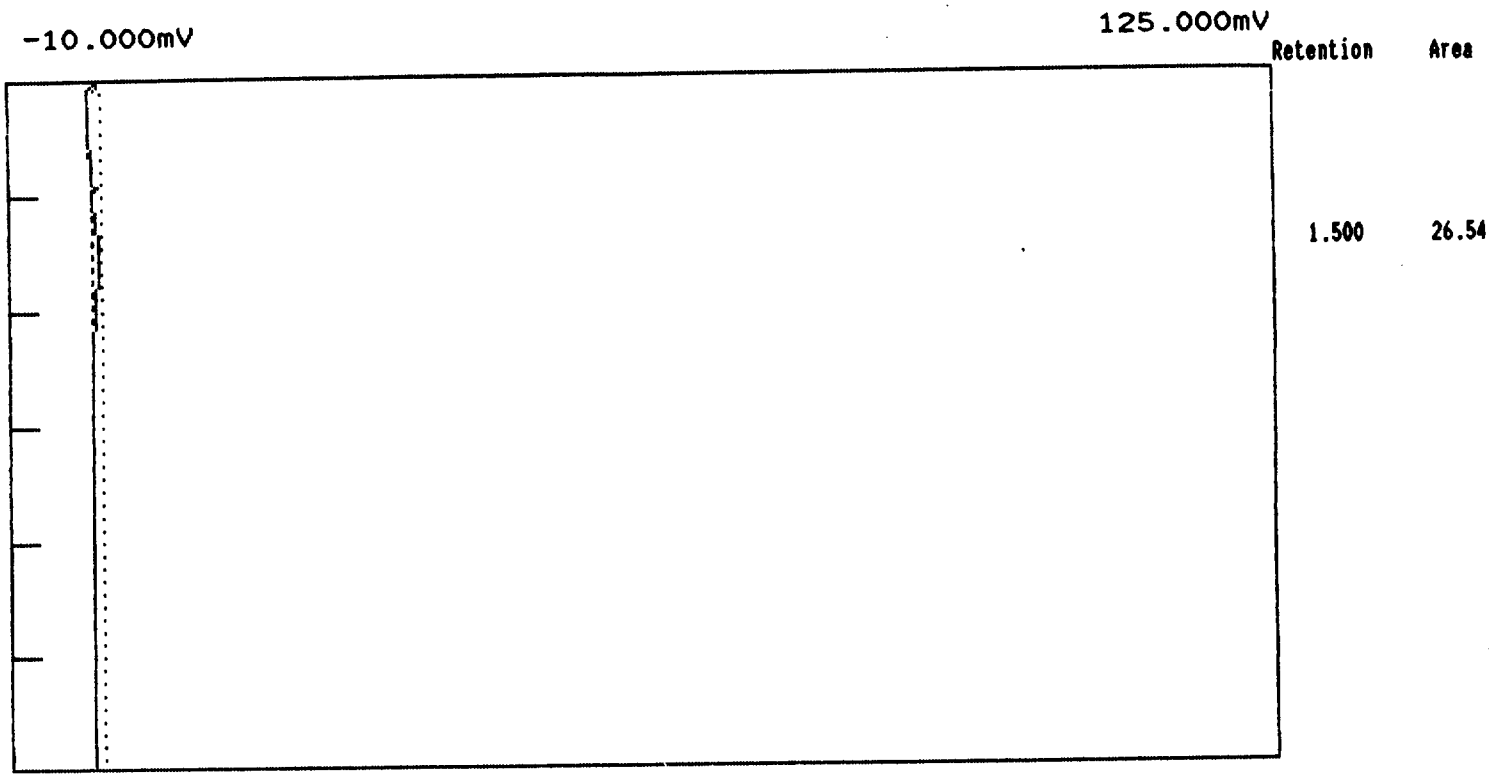
Retention	Area
	0.00

Operator : REP
Description : BFI outlet
Conditions : O-M18-1
File : BFIo-19.CHR
Date : 09/02/1992
Time : 16:53:48



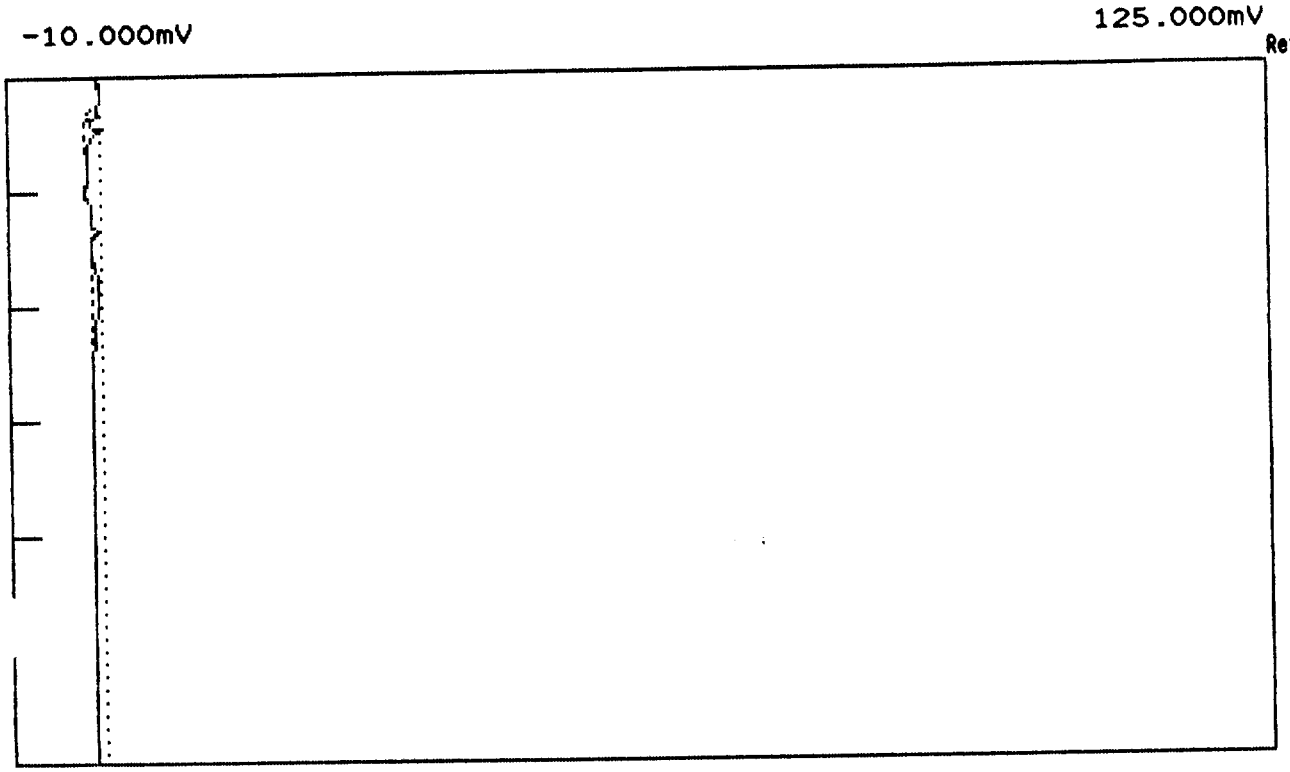
Retention	Area
	0.00

Operator : REP
Description : BFI outlet
Conditions : O-M18-1e
File : BFIo-20.CHR
Date : 09/02/1992
Time : 16:58:33



Retention	Area
1.500	26.54
	26.54

Operator : REP
Description : BFI outlet
Conditions : O-M18-1
File : BFIo-21.CHR
Date : 09/02/1992
Time : 17:07:42



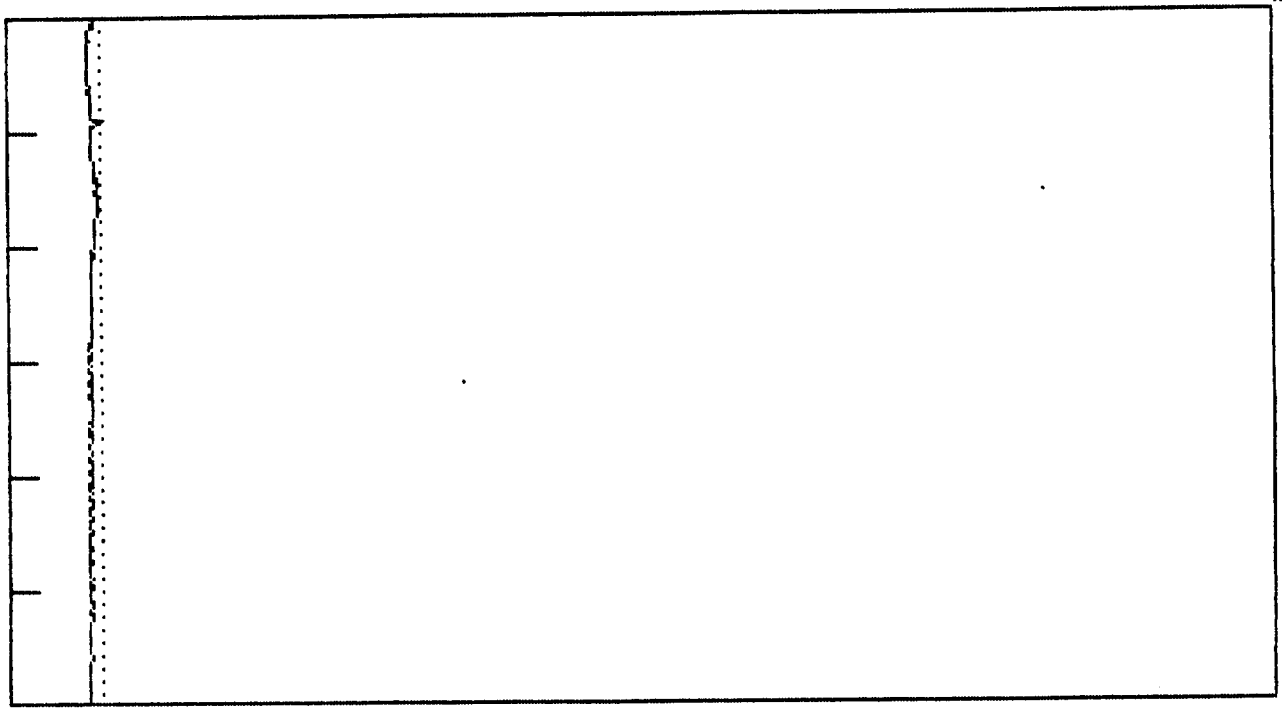
Retention	Area
0.441	13.98
1.883	24.15
	38.13

Operator : REP
Description : BFI outlet
Conditions : O-M18-1
File : BFIo-22.CHR
Date : 09/02/1992
Time : 17:21:33

-10.000mV

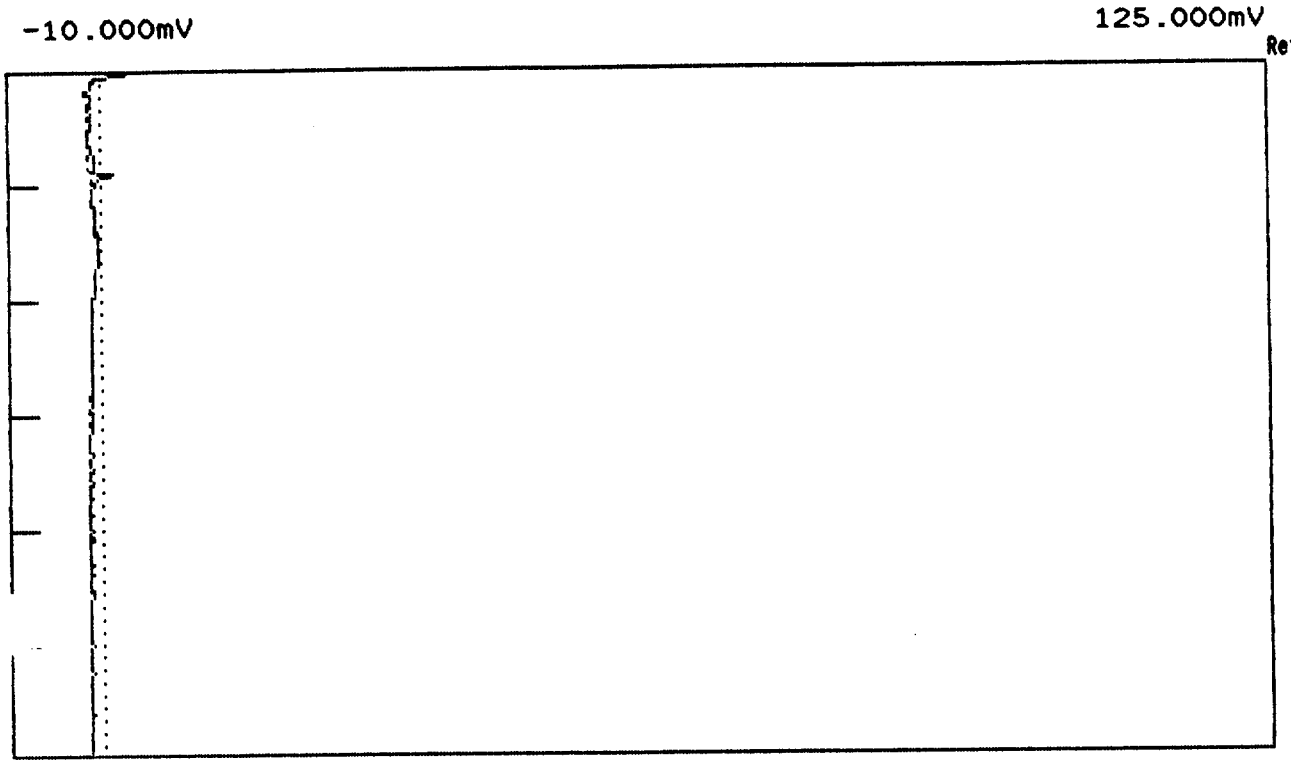
125.000mV

Retention Area



Retention	Area
	0.00

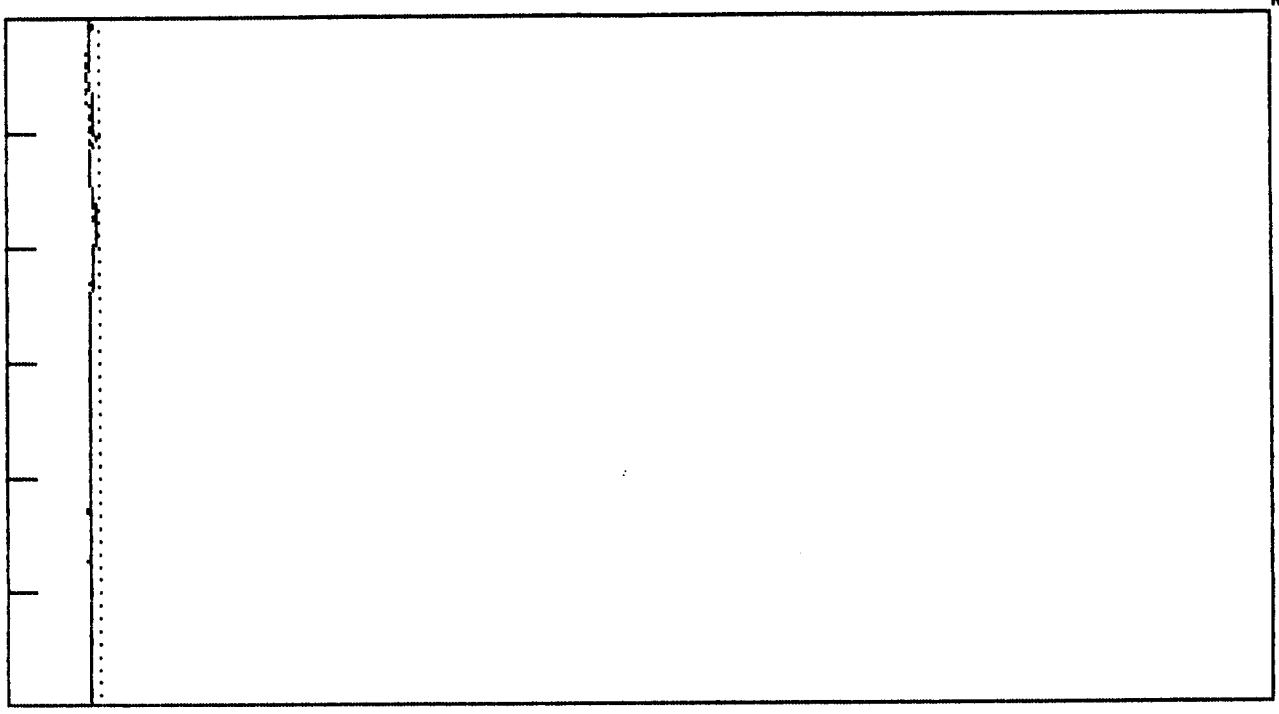
Operator : REP
Description : BFI outlet
Conditions : O-M18-2a
File : BFIo-24.CHR
Date : 09/02/1992
Time : 19:24:11



Retention	Area
0.875	16.97
	16.97

Operator : REP
Description : BFI outlet
Conditions : O-M18-25
File : BFIo-25.CHR
Date : 09/02/1992
Time : 19:34:19

-10.000mV 125.000mV



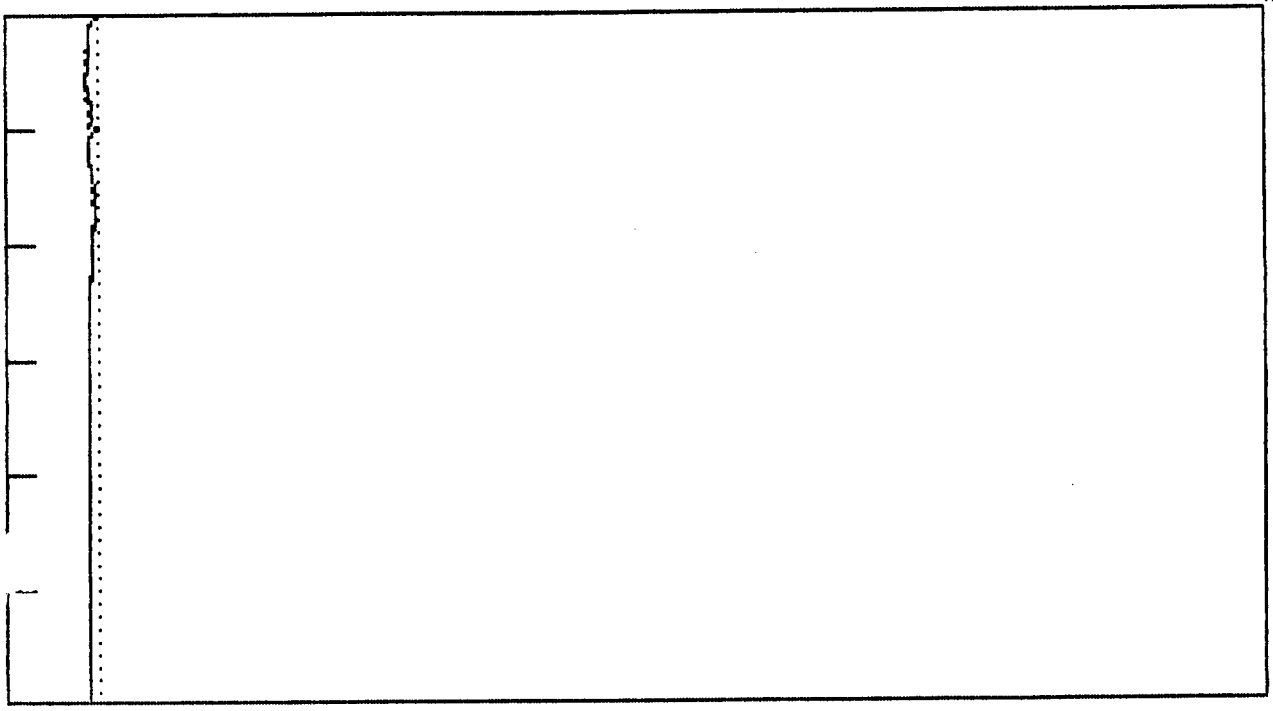
Retention	Area
0.816	11.32

Retention	Area
0.816	11.32
	11.32

Operator : REP
Description : BFI outlet
Conditions : O-M18-2c
File : BFIo-26.CHR
Date : 09/02/1992
Time : 19:45:03

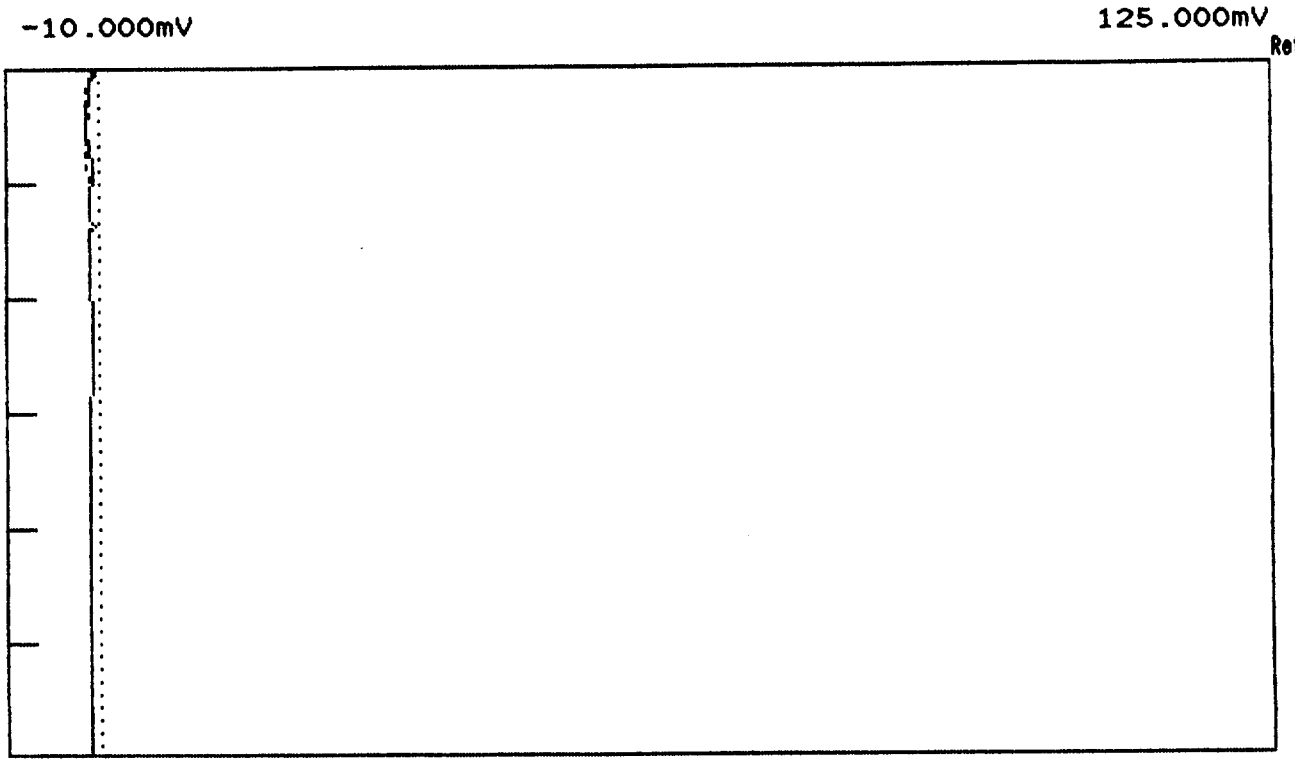
-10.000mV 125.000mV

Retention Area



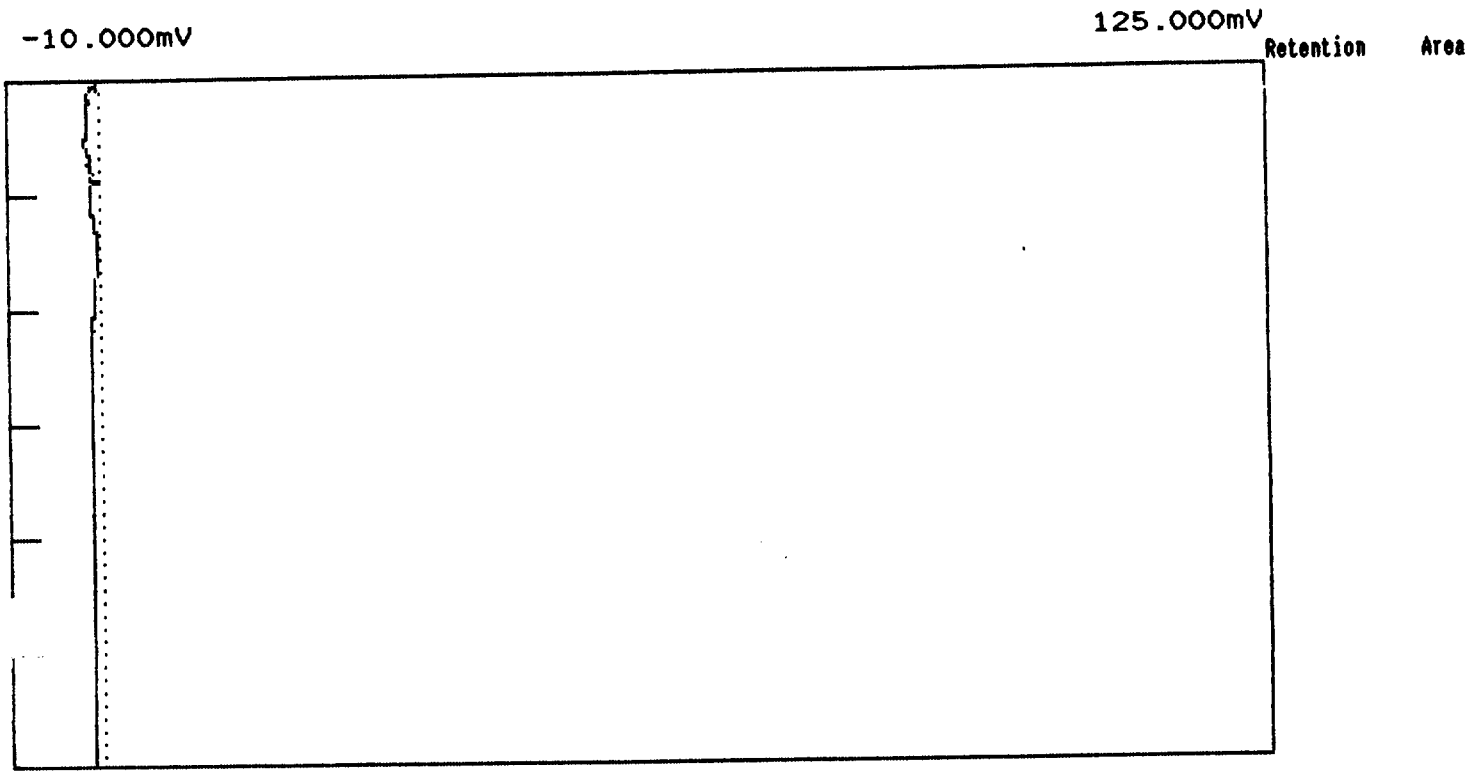
Retention	Area
	0.00

Operator : REP
Description : BFI outlet
Conditions : O-M18-2d
File : BFIo-27.CHR
Date : 09/02/1992
Time : 19:55:11



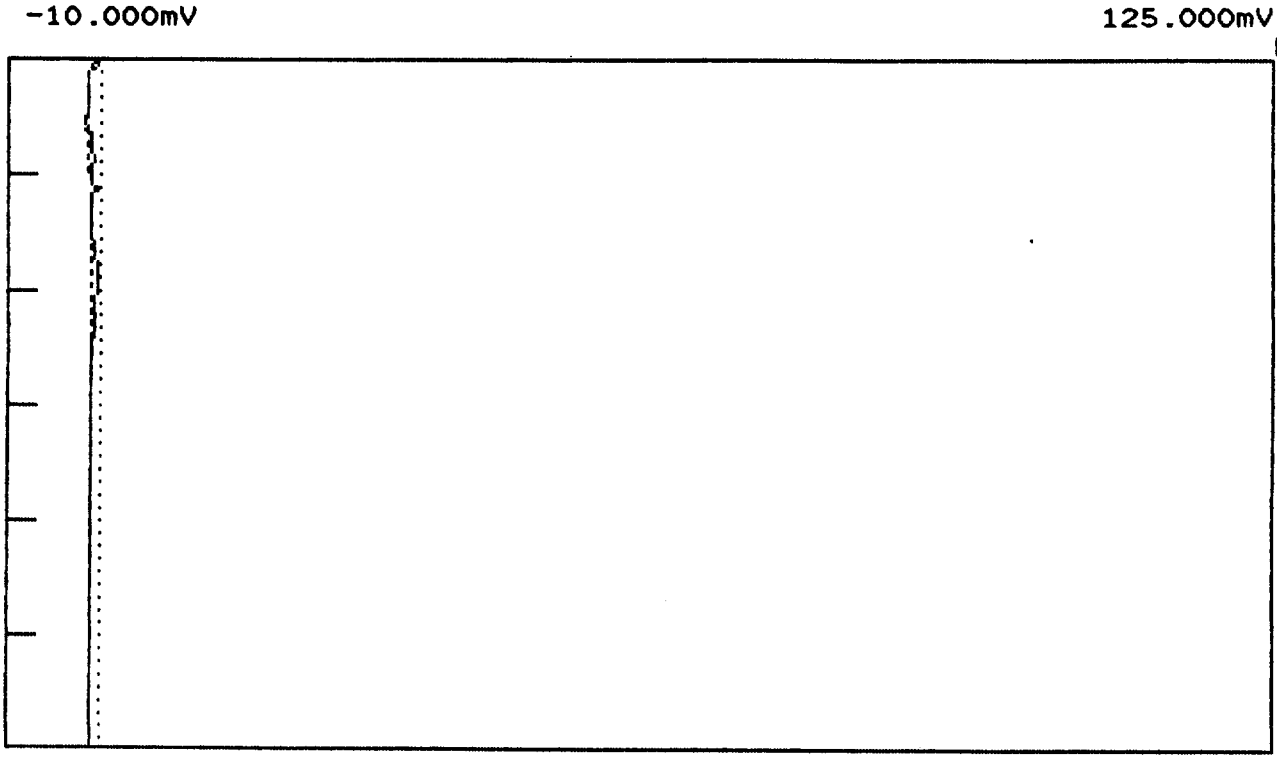
Retention	Area
0.841	11.16
	11.16

Operator : REP
Description : BFI outlet
Conditions : O-M18-2 e
File : BFIo-29.CHR
Date : 09/02/1992
Time : 20:08:54



Retention	Area
	0.00

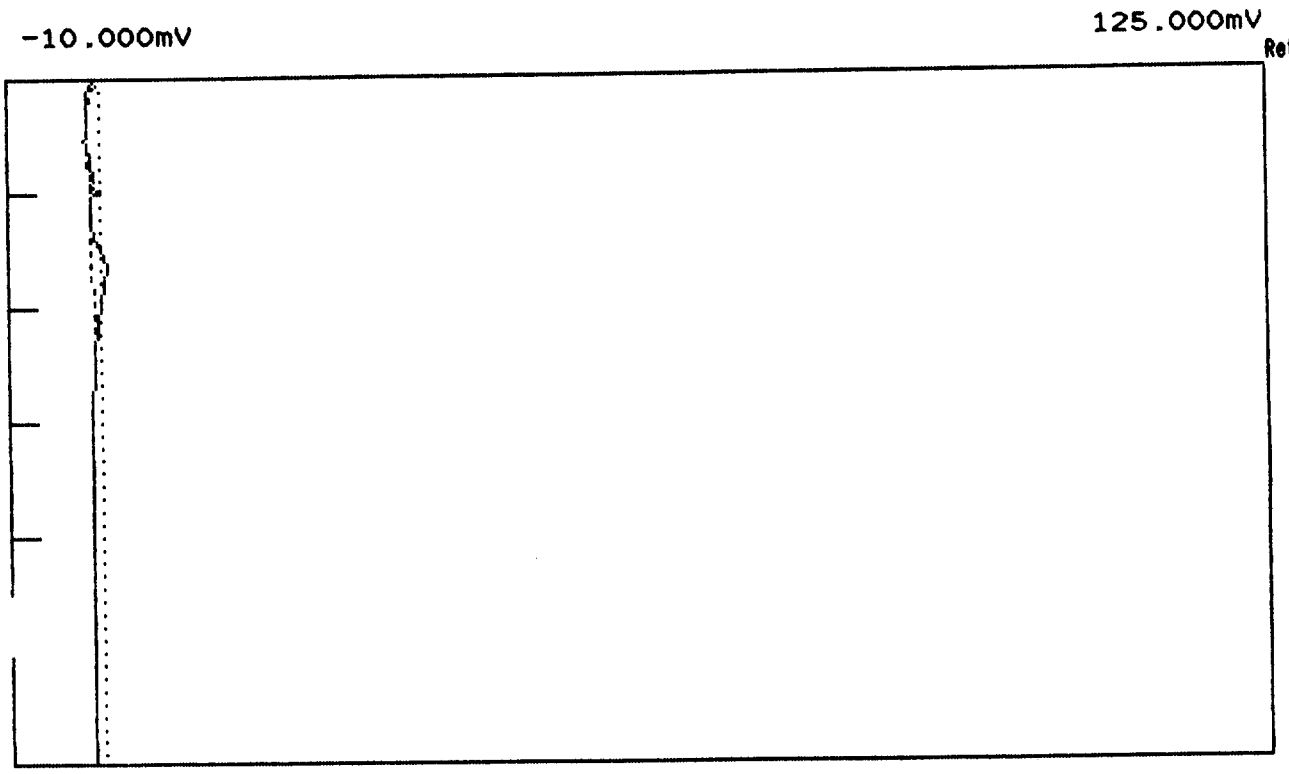
Operator : REP
Description : BFI outlet
Conditions : O-M18-2
File : BFIo-30.CHR
Date : 09/02/1992
Time : 20:15:57



Retention	Area
0.833	10.86
1.858	21.76

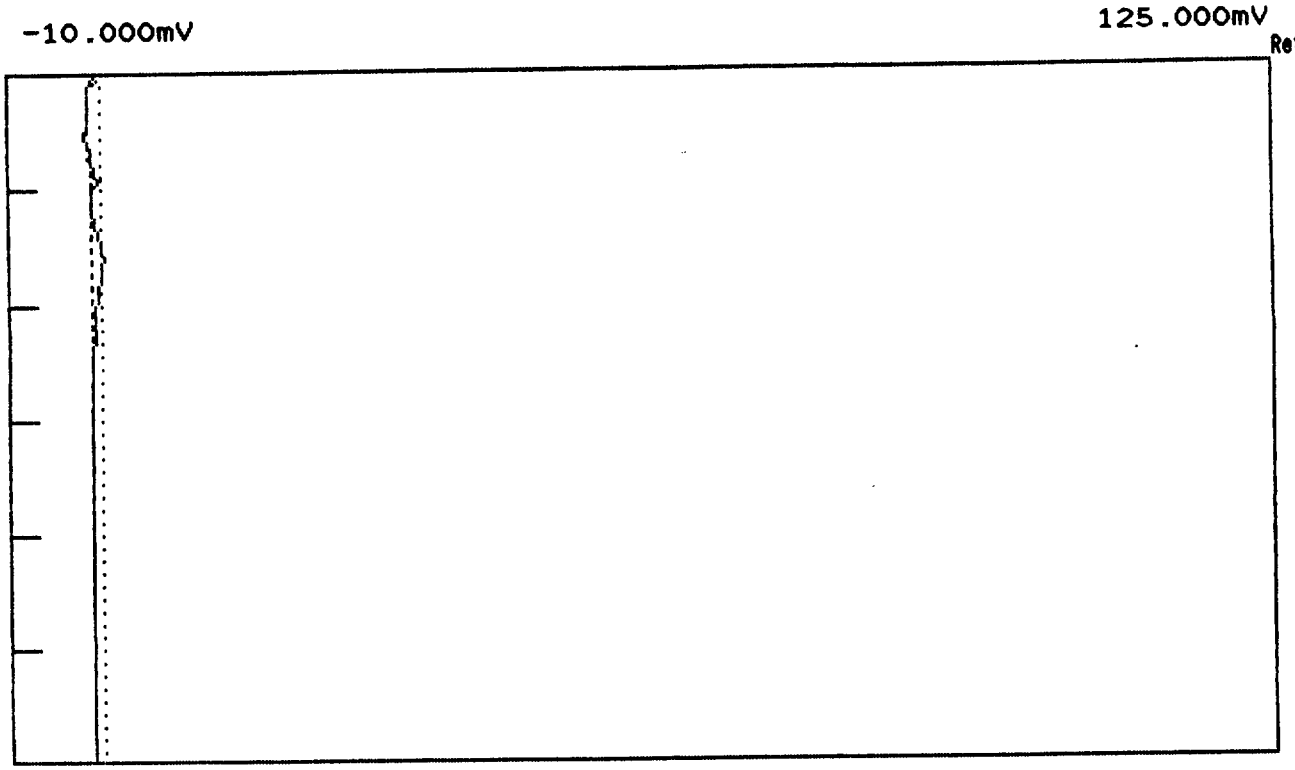
Retention	Area
0.833	10.86
1.858	21.76
	32.62

Operator : REP
Description : BFI outlet
Conditions : O-M18-2 9
File : BFIo-31.CHR
Date : 09/02/1992
Time : 20:26:37



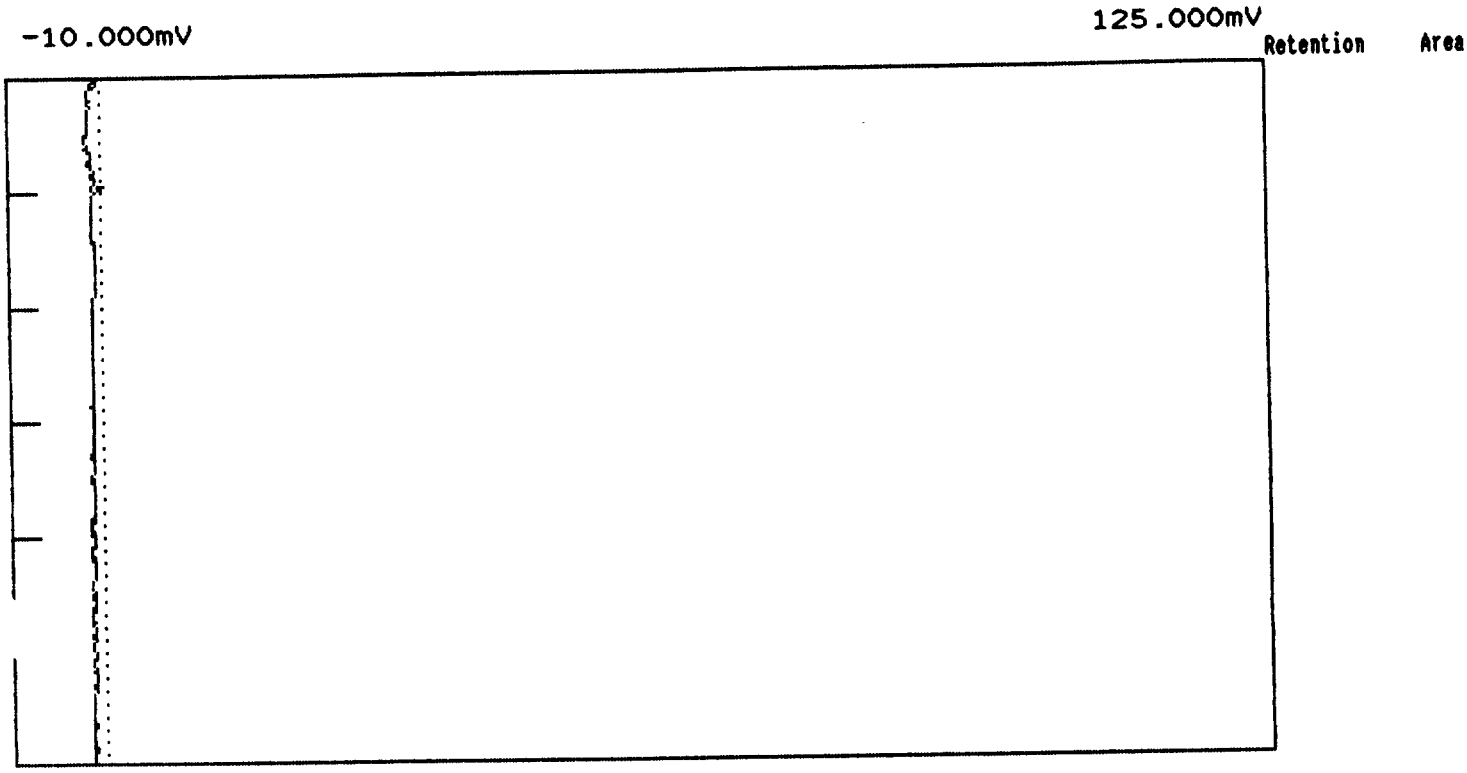
Retention	Area
1.675	48.50
	48.50

Operator : REP
Description : BFI outlet
Conditions : O-M18-3a
File : BFIo-34.CHR
Date : 09/02/1992
Time : 21:36:25



Retention	Area
1.591	40.67
	40.67

Operator : REP
Description : BFI outlet
Conditions : O-M18-3b
File : BFIo-35.CHR
Date : 09/02/1992
Time : 21:44:34



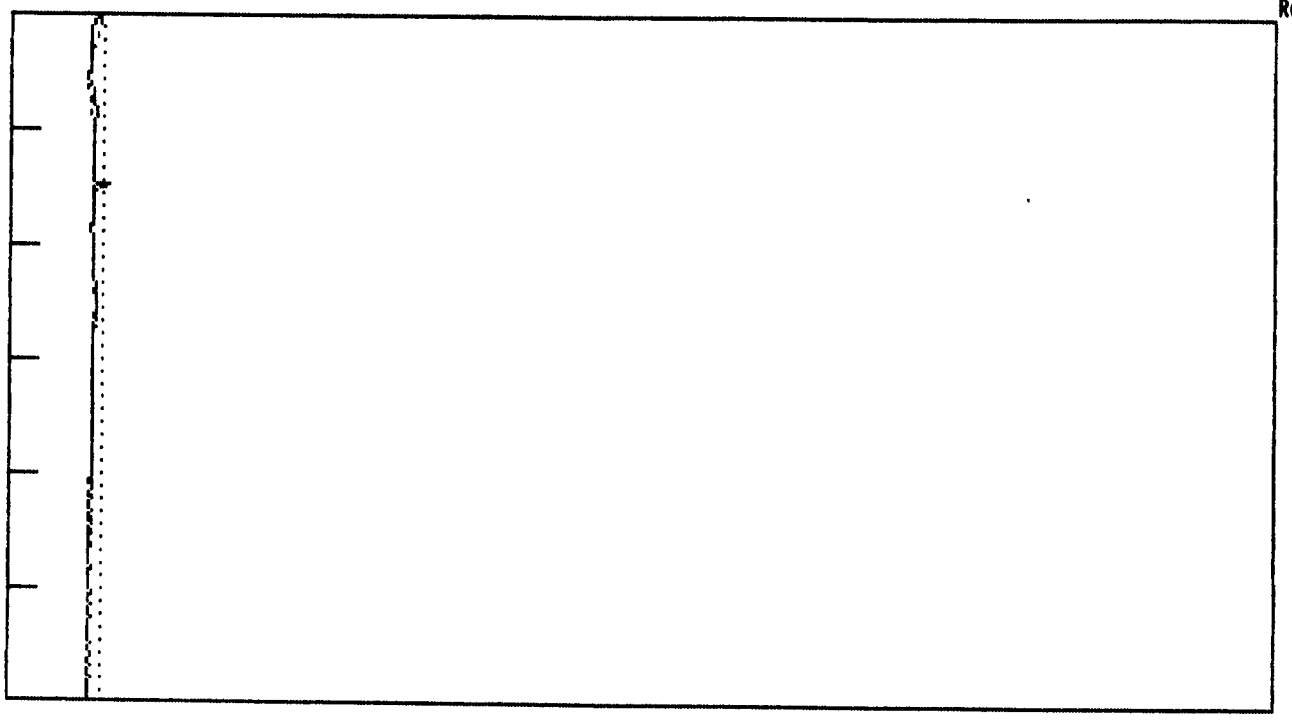
Retention	Area
	0.00

Operator : REP
Description : BFI outlet
Conditions : O-M18-3c
File : BFIo-36.CHR
Date : 09/02/1992
Time : 21:54:18

-10.000mV

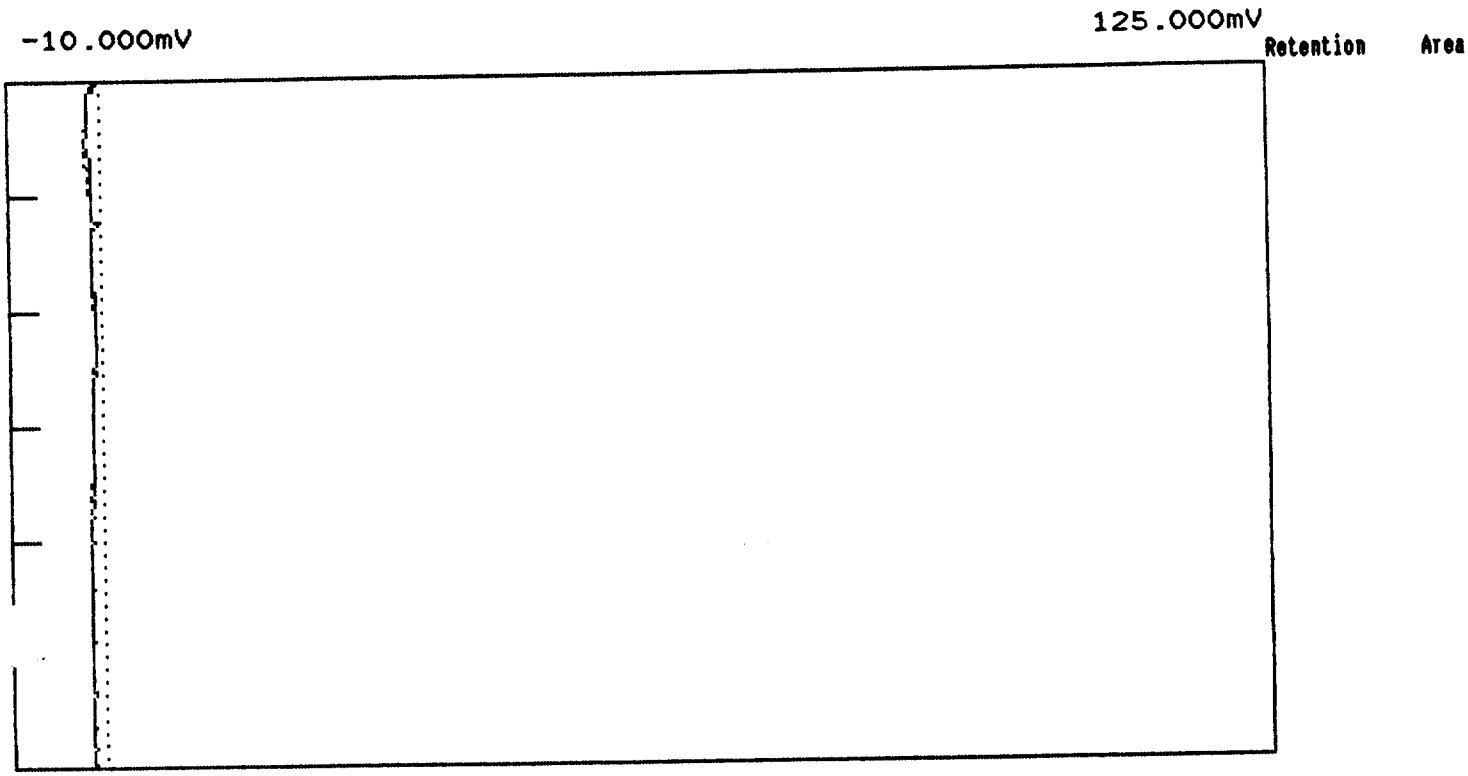
125.000mV

Retention Area



Retention	Area
	0.00

Operator : REP
Description : BFI outlet
Conditions : O-M18-3d
File : BFIo-37.CHR
Date : 09/02/1992
Time : 22:06:12

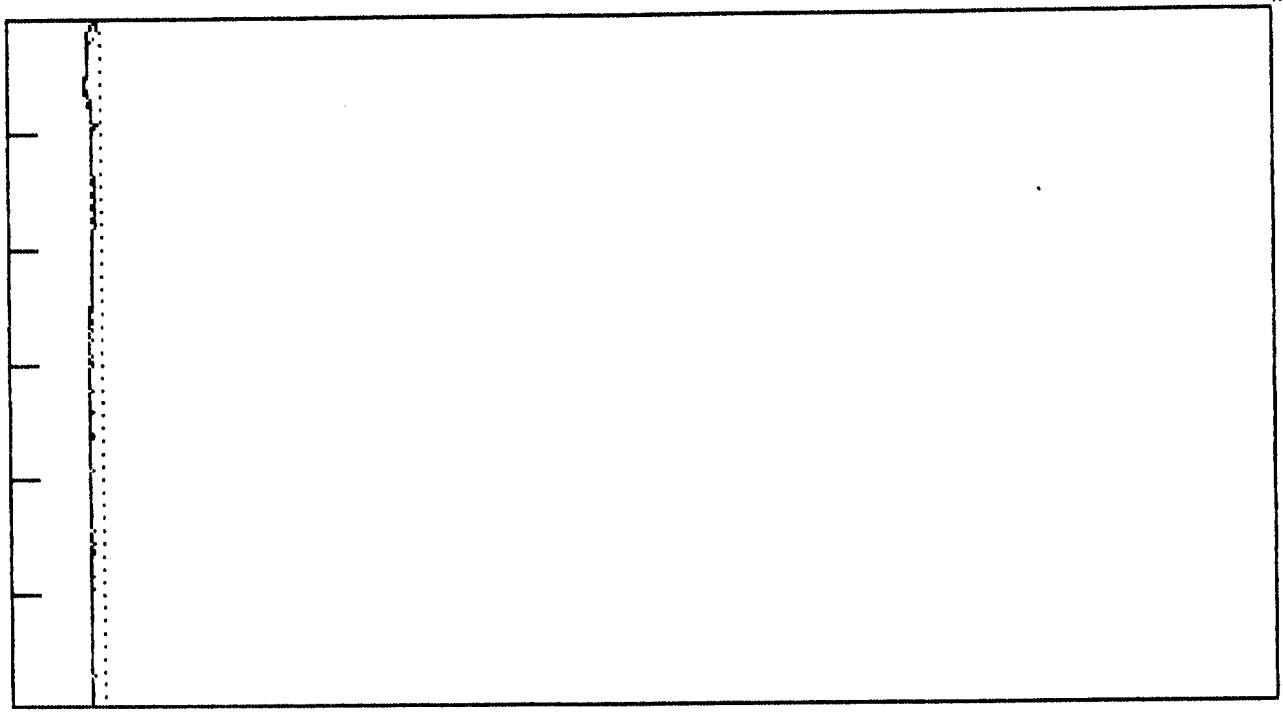


Retention	Area
	0.00

Operator : REP
Description : BFI outlet
Conditions : O-M18-3 e
File : BFIo-38.CHR
Date : 09/02/1992
Time : 22:15:23

-10.000mV

125.000mV



Retention	Area
1.491	17.98

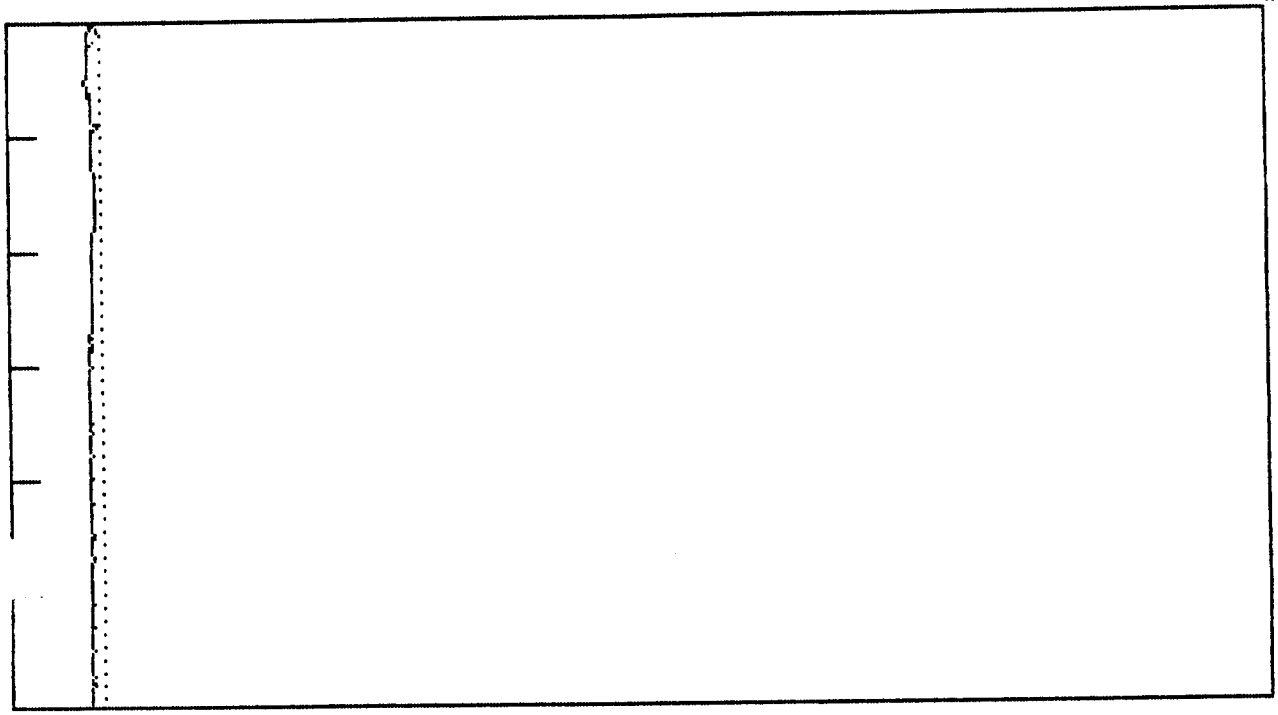
Retention	Area
1.491	17.98
	17.98

Operator : REP
Description : BFI outlet
Conditions : O-M18-3
File : BFIo-39.CHR
Date : 09/02/1992
Time : 22:25:24

-10.000mV

125.000mV

Retention Area

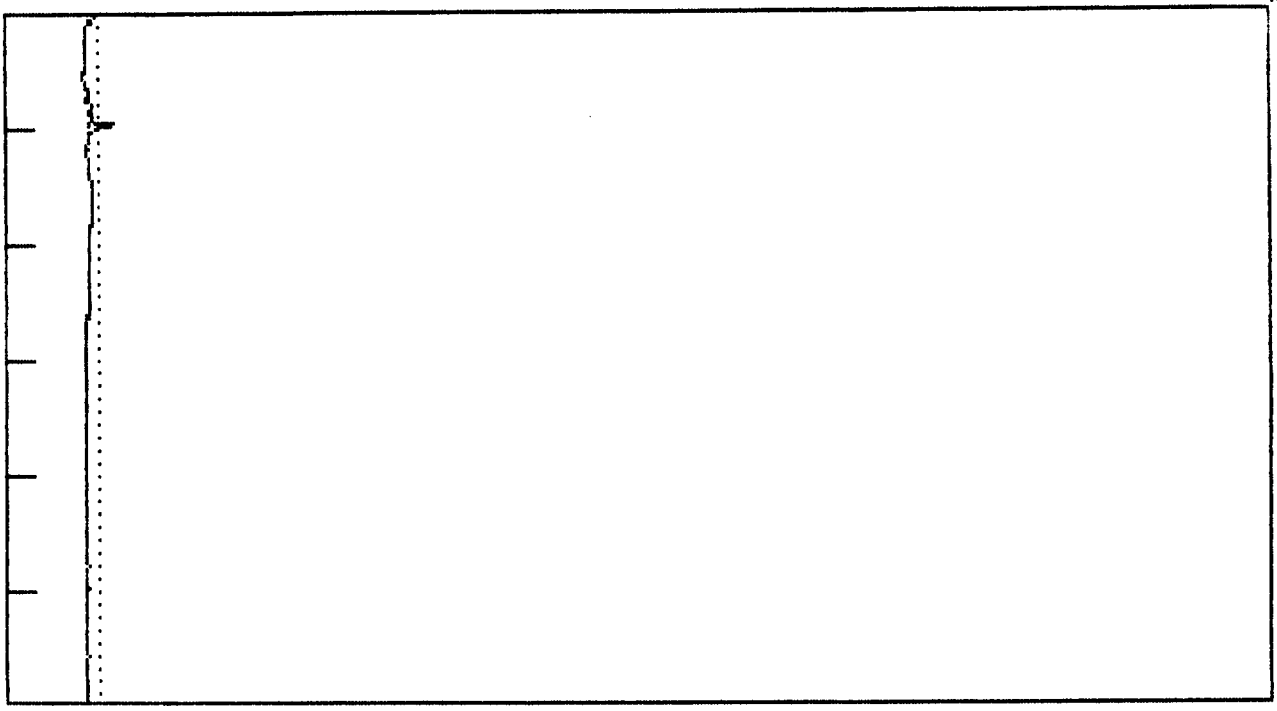


Retention	Area
	0.00

Operator : REP
Description : BFI outlet
Conditions : O-M18-3 g
File : BFIo-40.CHR
Date : 09/02/1992
Time : 22:36:16

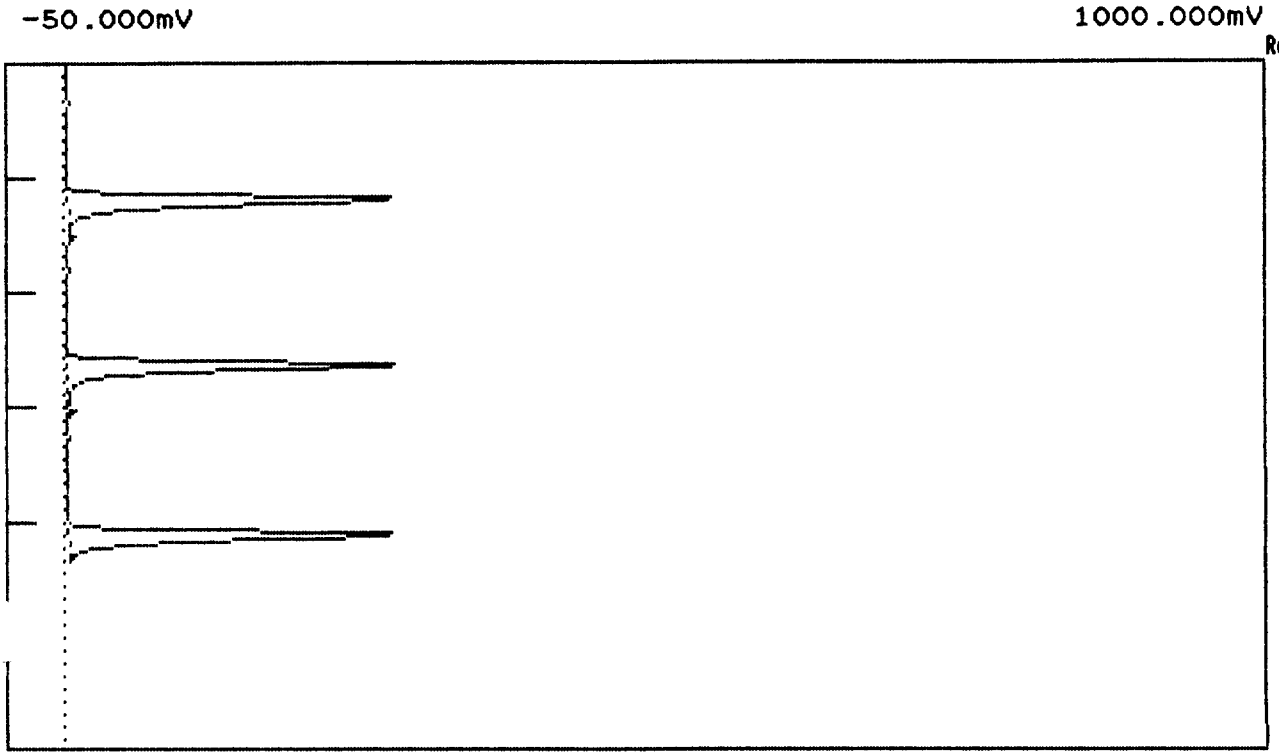
-10.000mV 125.000mV

Retention Area



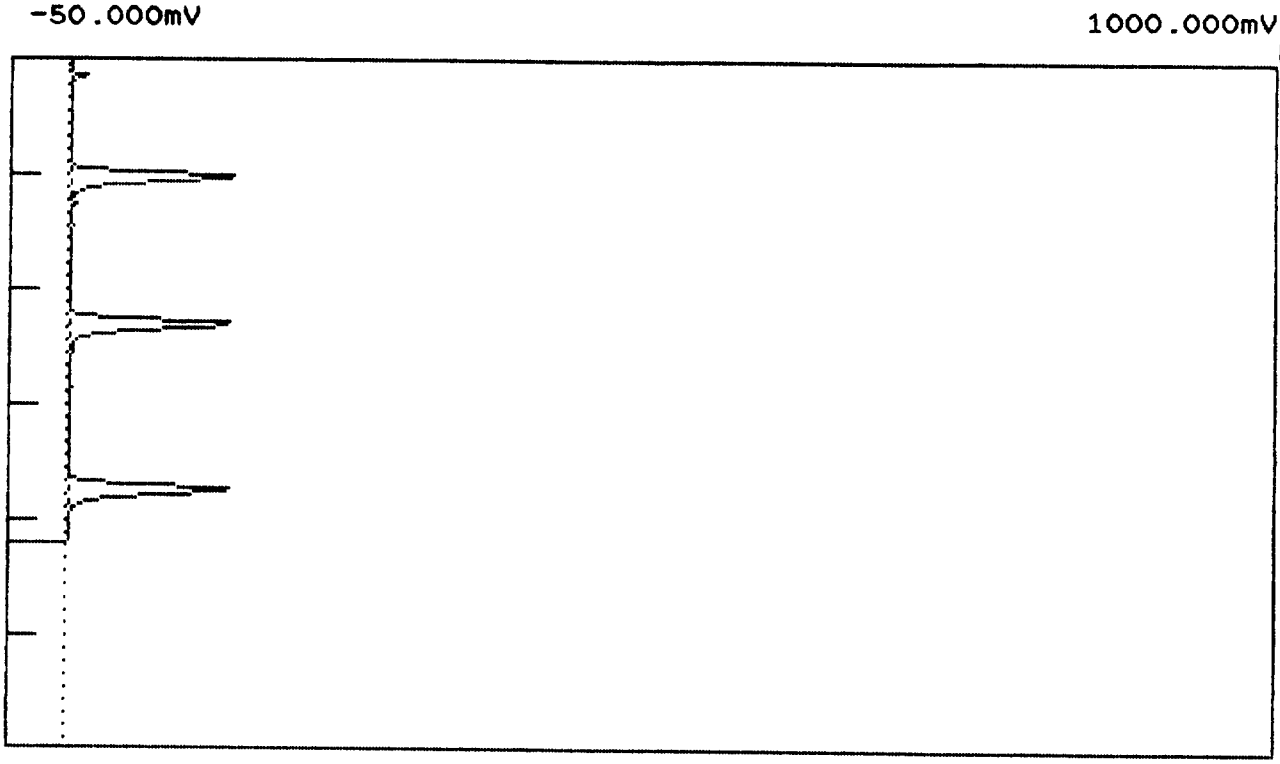
Retention	Area
	0.00

Operator :
Description : BFI inlet
Conditions : 6020 ppm CH4 direct cal
File : BFIin-11.CHR
Date : 09/02/1992
Time : 15:03:51



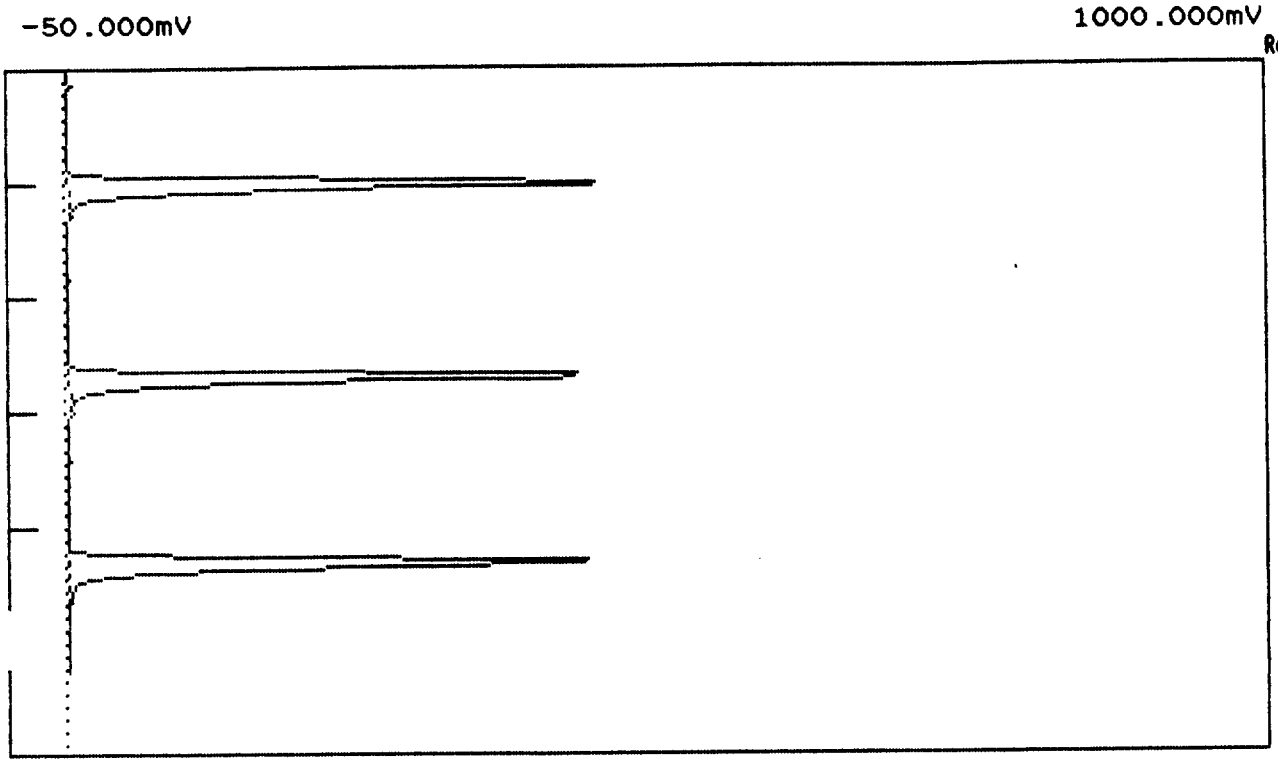
Retention	Area
0.033	12.45
0.325	10.79
1.175	1658.88
1.491	17.54
2.158	12.44
2.616	1650.20
3.016	17.39
3.241	11.48
3.591	11.32
4.091	1608.08
	5010.56

Operator : REP
Description : BFI inlet
Conditions : 3020 ppm CH4 direct cal
File : BFIin-12.CHR
Components :
Date : 09/02/1992
Time : 15:16:05



Retention	Area
0.141	37.38
1.000	805.58
2.283	832.29
3.716	792.05
	2467.31

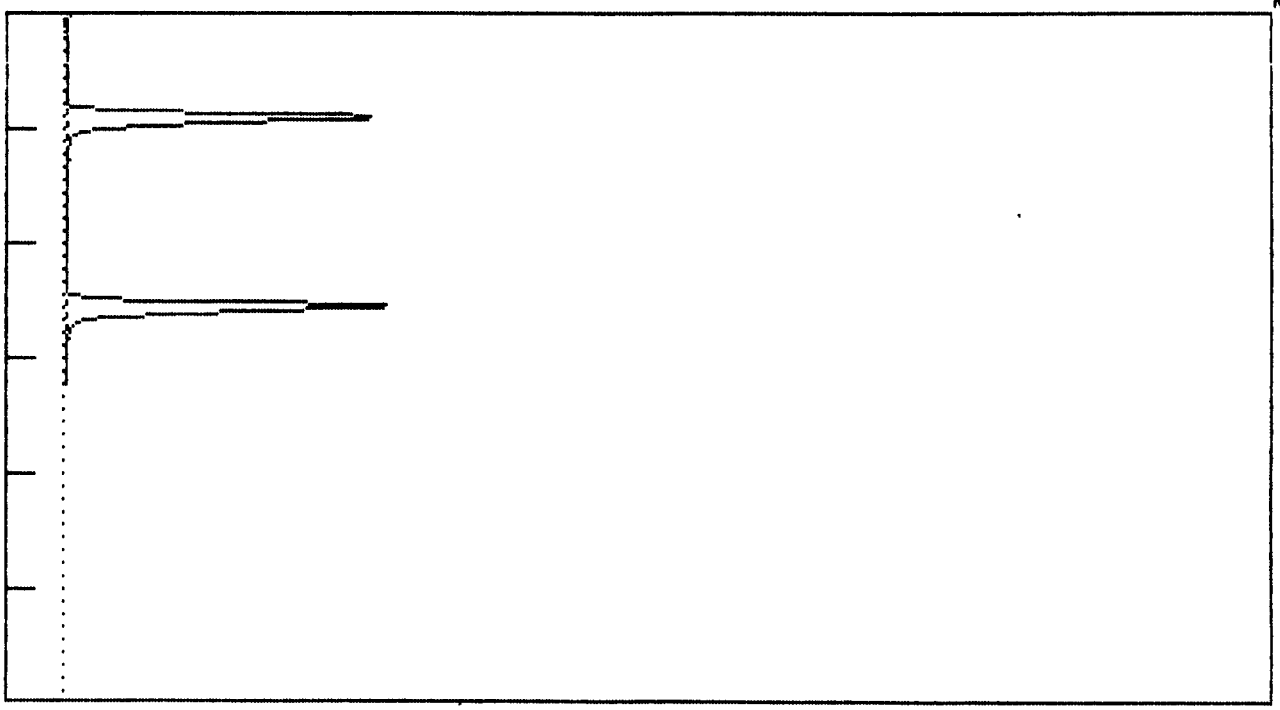
Operator : REP
Description : BFI inlet
Conditions : 10020 ppm CH4 direct cal
File : BFIin-13.CHR
Date : 09/02/1992
Time : 15:24:35



Retention	Area
0.133	16.30
0.991	2708.11
1.816	16.50
2.675	2654.55
3.400	11.64
4.283	2691.50

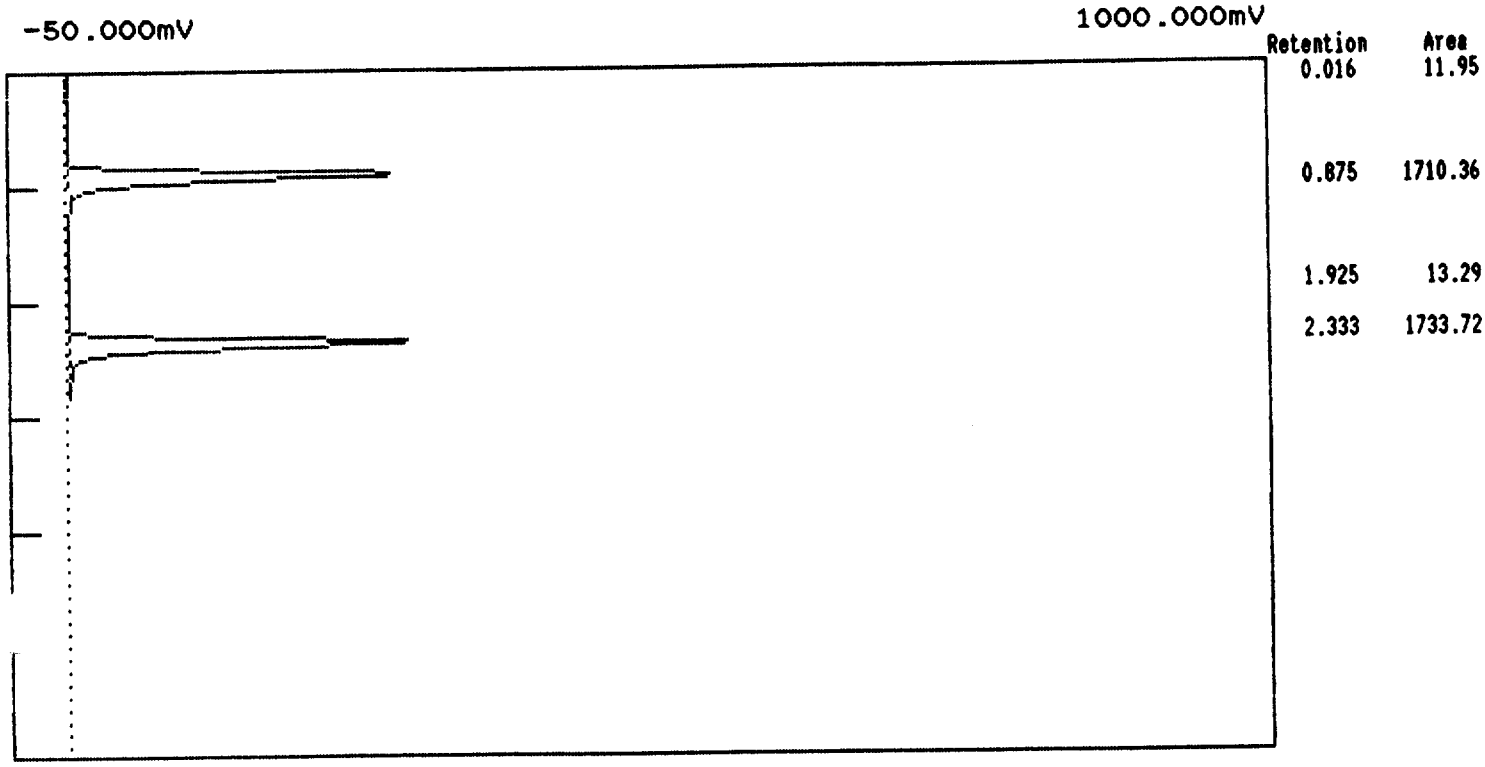
Retention	Area
0.133	16.30
0.991	2708.11
1.816	16.50
2.675	2654.55
3.400	11.64
4.283	2691.50
	8098.61

Operator : REP
Description : BFI inlet
Conditions : 3020 ppm CH4 inlet system calibration
File : BFIin-14.CHR
Date : 09/02/1992
Time : 15:43:40



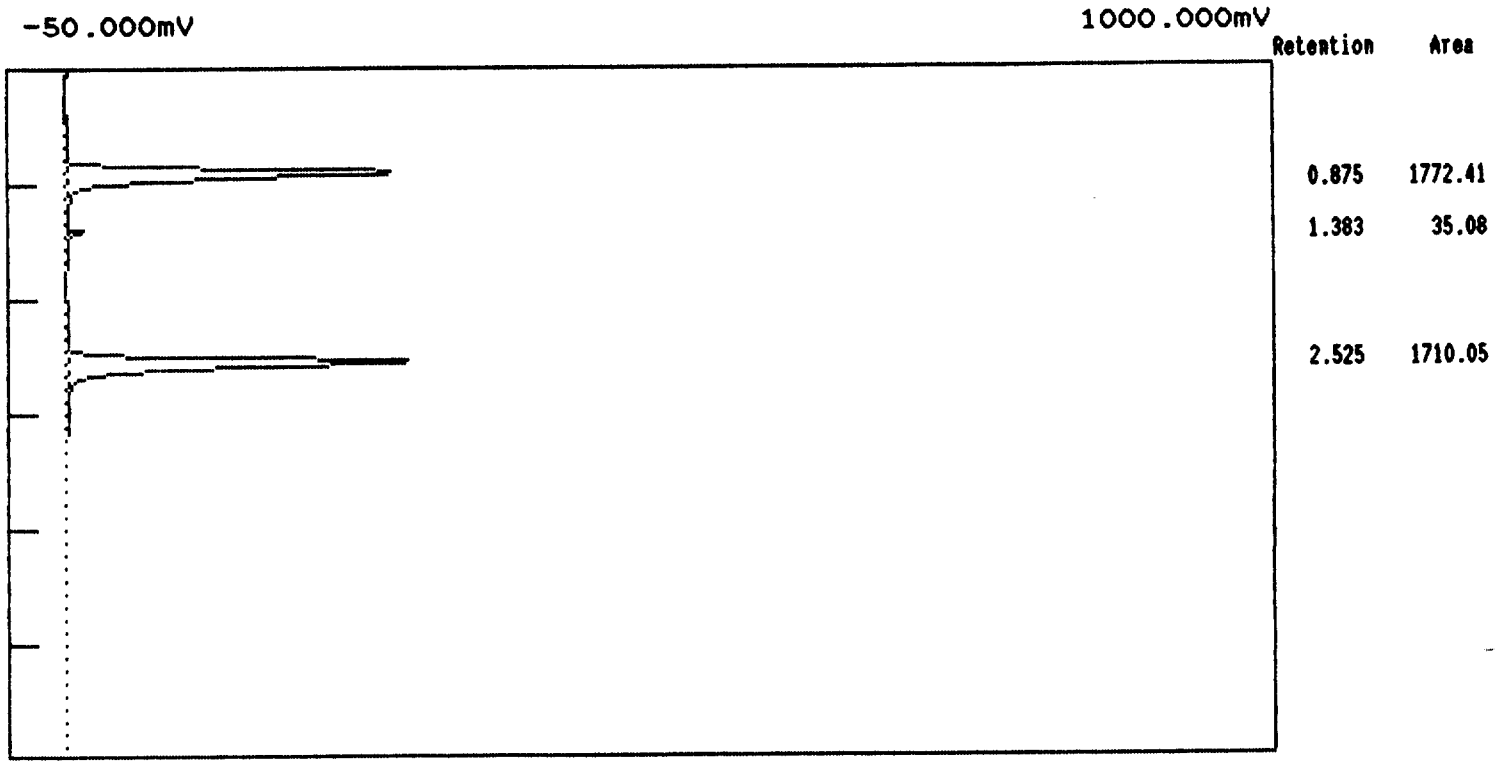
Retention	Area
0.016	20.93
0.875	1642.67
2.525	1593.30
	3256.90

Operator : REP
Description : BFI inlet
Conditions : 6020 ppm CH4 postrun 1 inlet system calibration
File : BFIin-23.CHR
Date : 09/02/1992
Time : 17:35:16



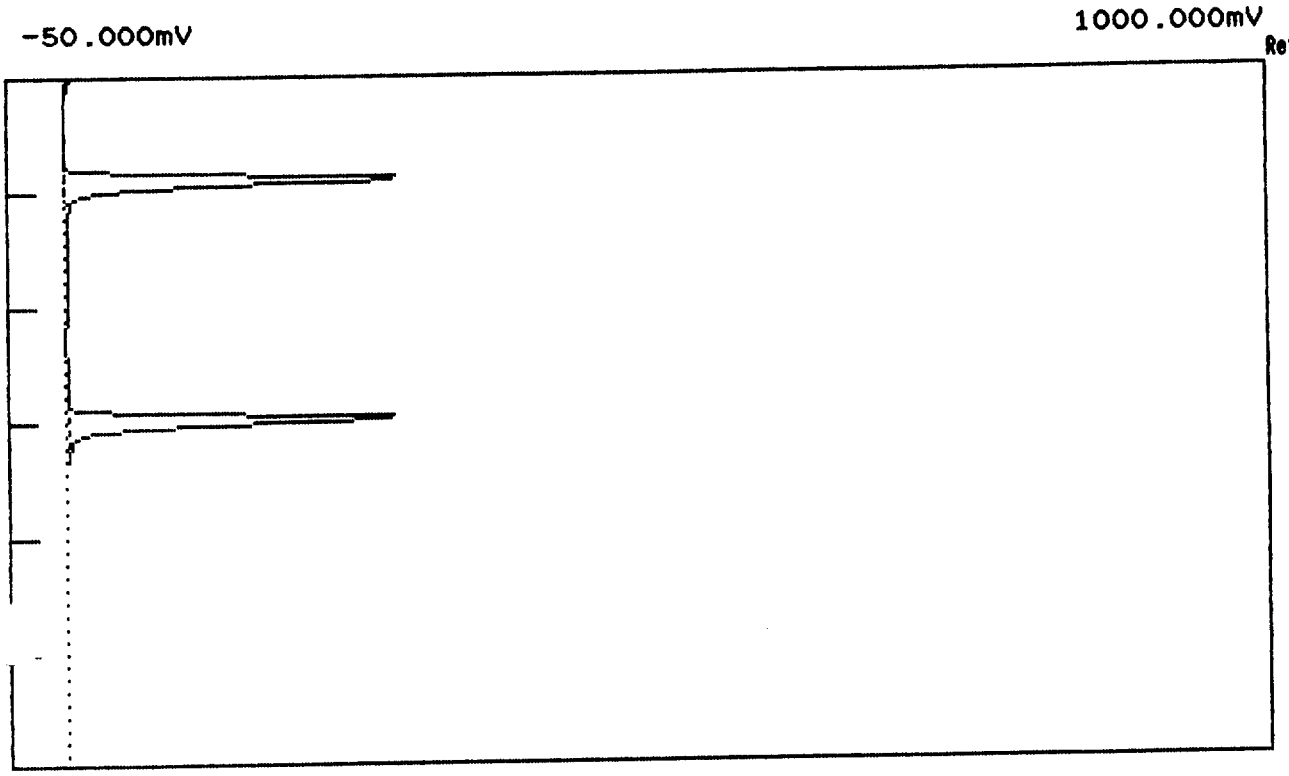
Retention	Area
0.016	11.95
0.875	1710.36
1.925	13.29
2.333	1733.72
	3469.32

Operator : REP
Description : BFI inlet
Conditions : 6020 ppm CH4 inlet posttest system calibration
File : BFIin-32.CHR
Date : 09/02/1992
Time : 20:40:19



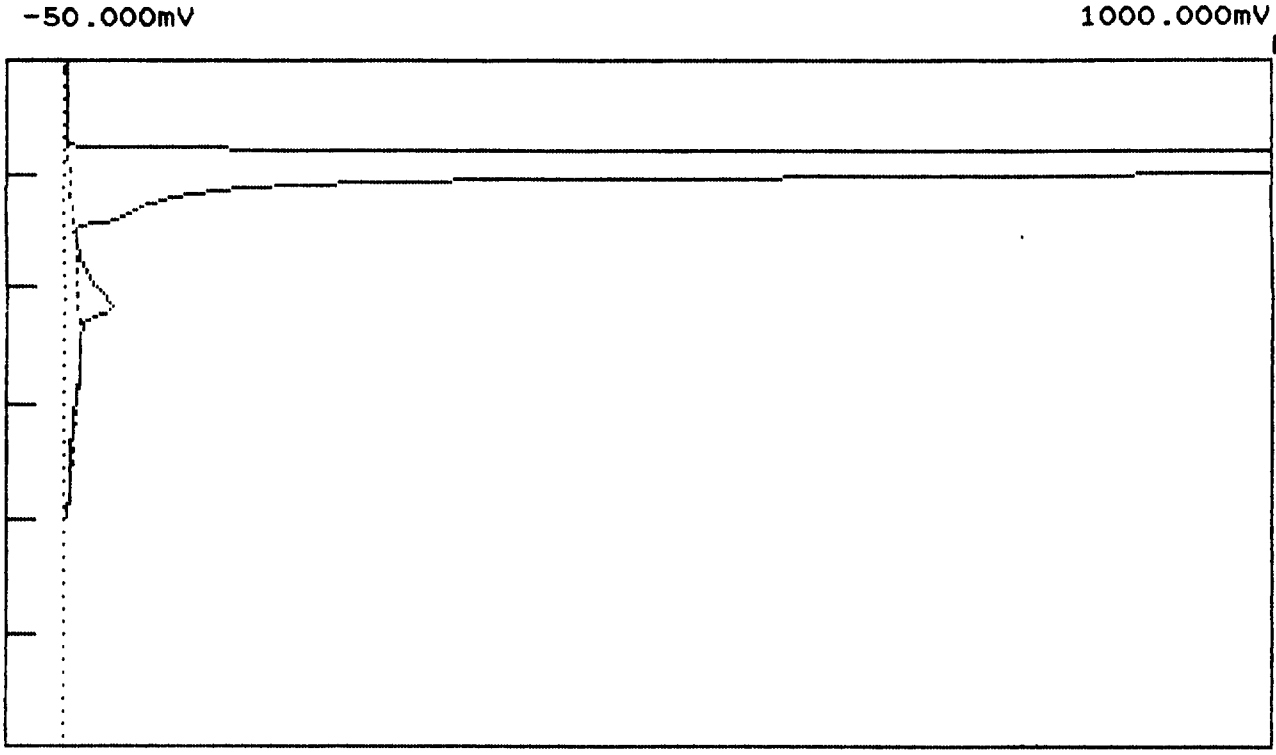
Retention	Area
0.875	1772.41
1.383	35.08
2.525	1710.05
	3517.53

Operator : REP
Description : BFI inlet
Conditions : 6020 ppm CH4 inlet posttest system calibration
File : BFIin-41.CHR
Date : 09/02/1992
Time : 22:46:09



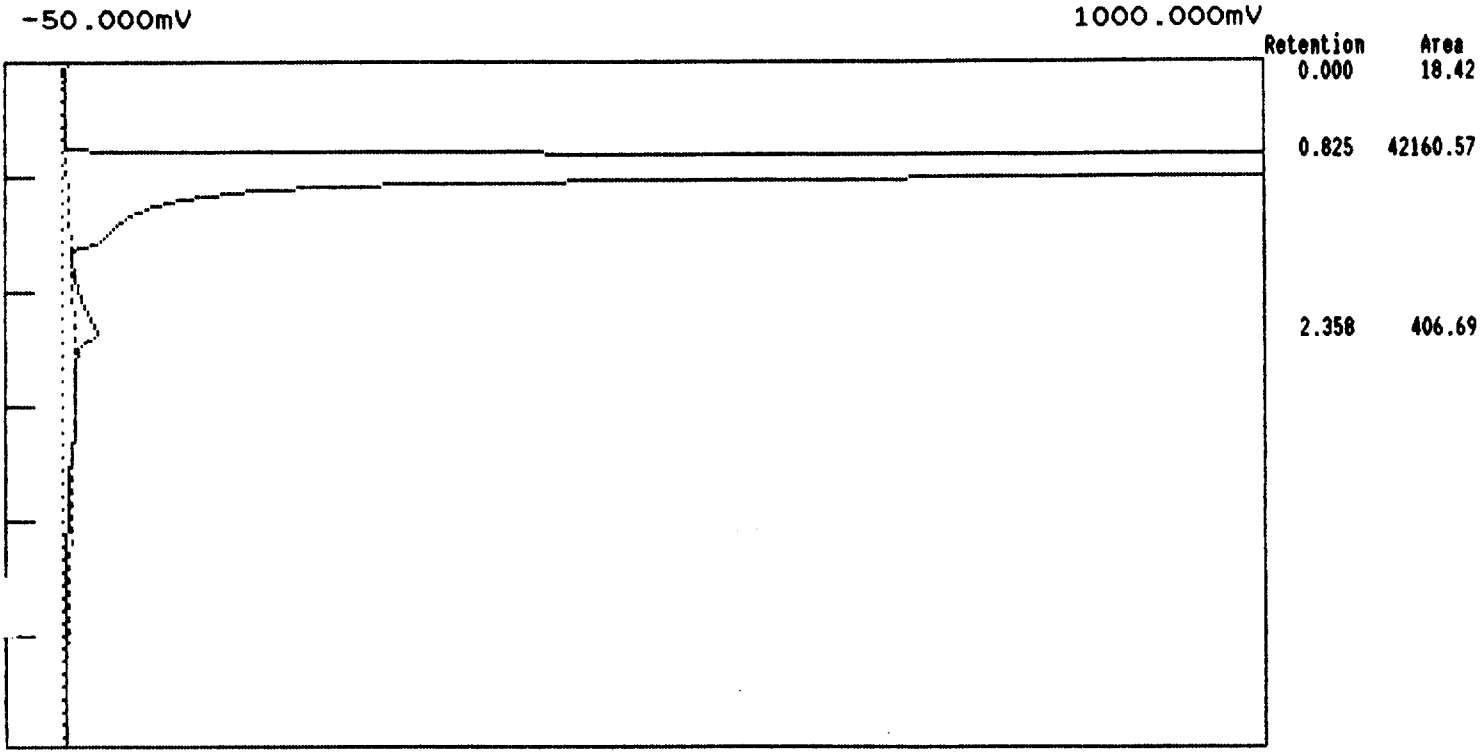
Retention	Area
0.008	23.52
0.866	1796.36
2.950	1739.40
	3559.28

Operator : REP
Description : BFI inlet
Conditions : I-M18-1a
File : BFIin-16.CHR
Date : 09/02/1992
Time : 16:18:49



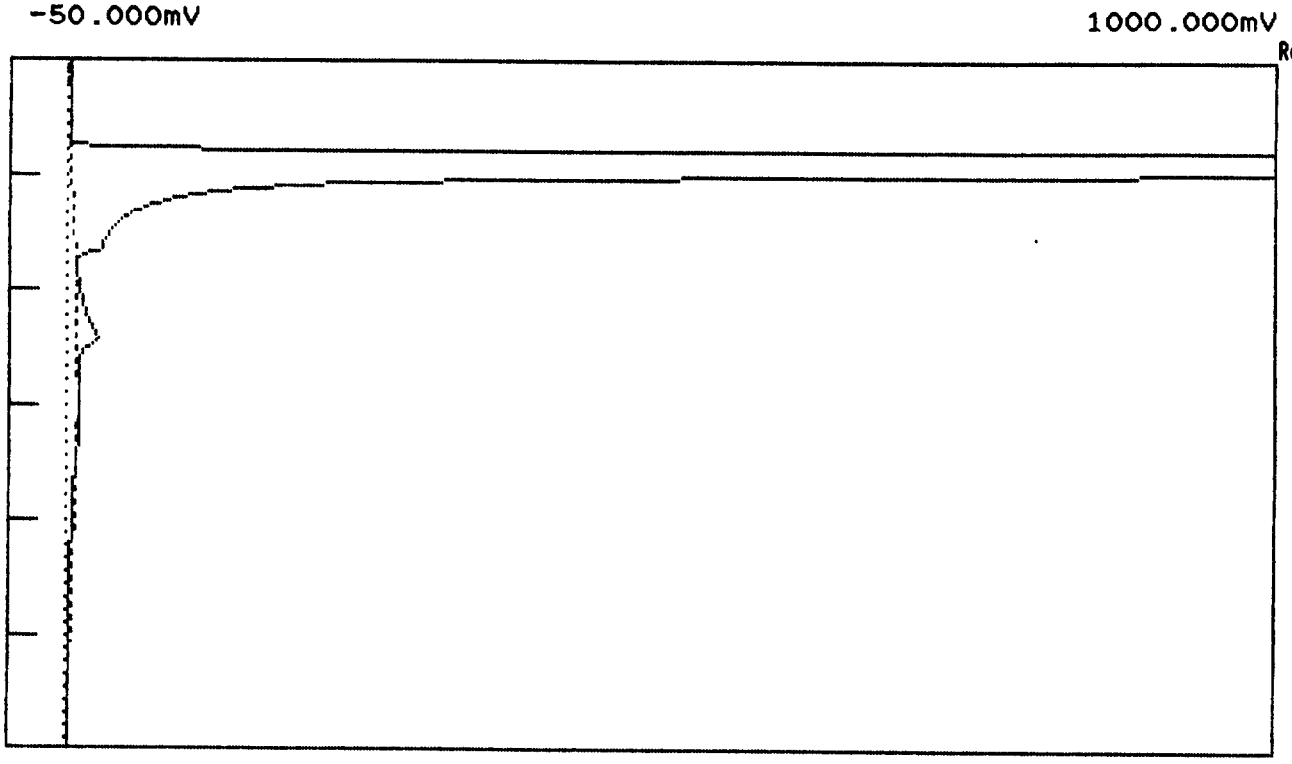
Retention	Area
0.808	42682.04
2.166	533.27
	43215.32

Operator : REP
Description : BFI inlet
Conditions : I-M18-1@b
File : BFIin-17.CHR
Date : 09/02/1992
Time : 16:27:38



Retention	Area
0.000	18.42
0.825	42160.57
2.358	406.69
	42585.67

Operator : REP
Description : BFI inlet
Conditions : I-M18-1C
File : BFIin-18.CHR
Date : 09/02/1992
Time : 16:37:54

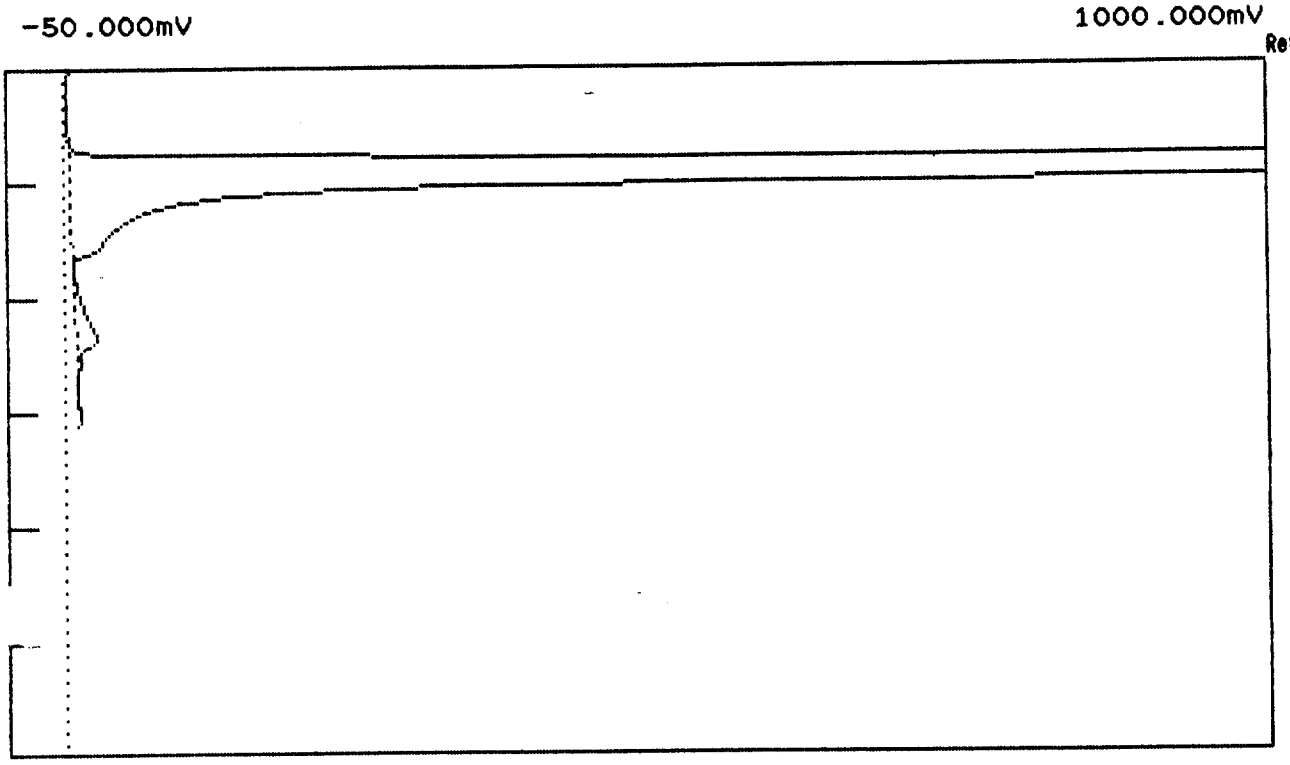


Retention	Area
0.000	15.41
0.800	42256.42
2.433	343.56

Retention	Area
0.000	15.41
0.800	42256.42
2.433	343.56

	42615.38

Operator : REP
Description : BFI inlet
Conditions : I-M18-1
File : BFIin-19.CHR
Date : 09/02/1992
Time : 16:53:48



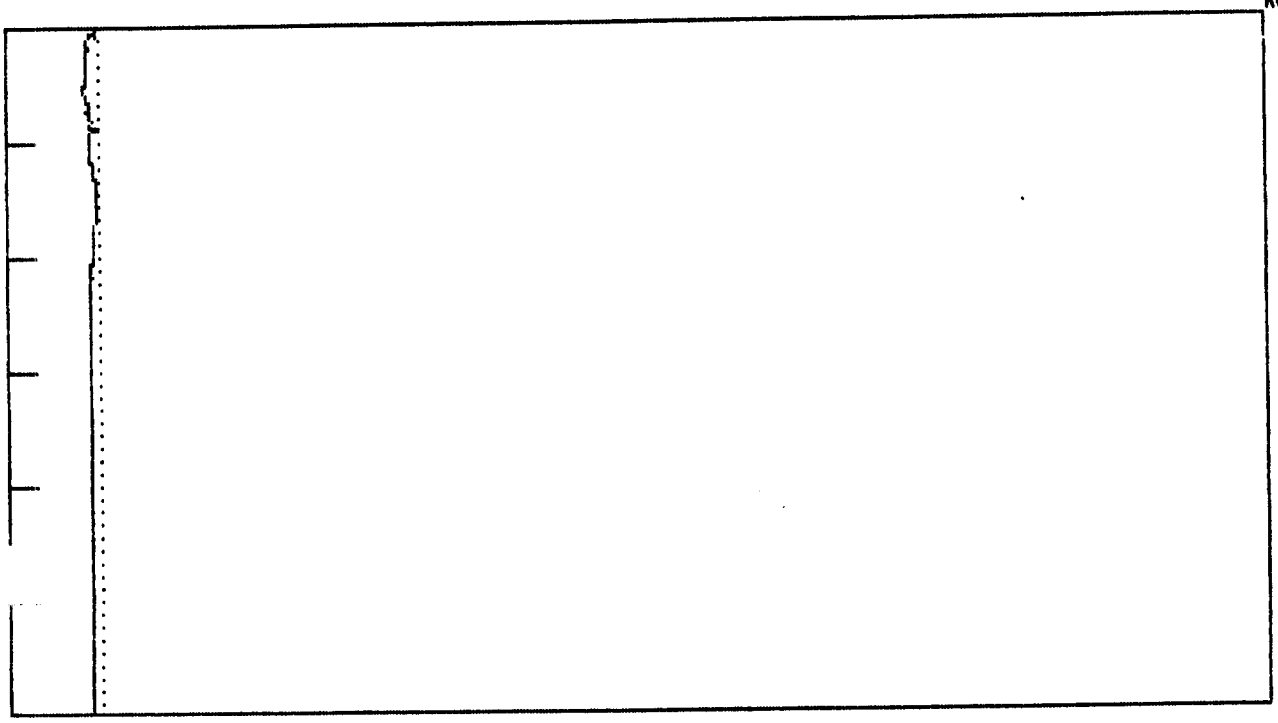
Retention	Area
0.000	14.46
0.800	42261.54
2.350	351.67
	42627.67

Operator : REP
Description : BFI outlet
Conditions : O-M18-2 e
File : BFIo-29.CHR
Date : 09/02/1992
Time : 20:08:54

-10.000mV

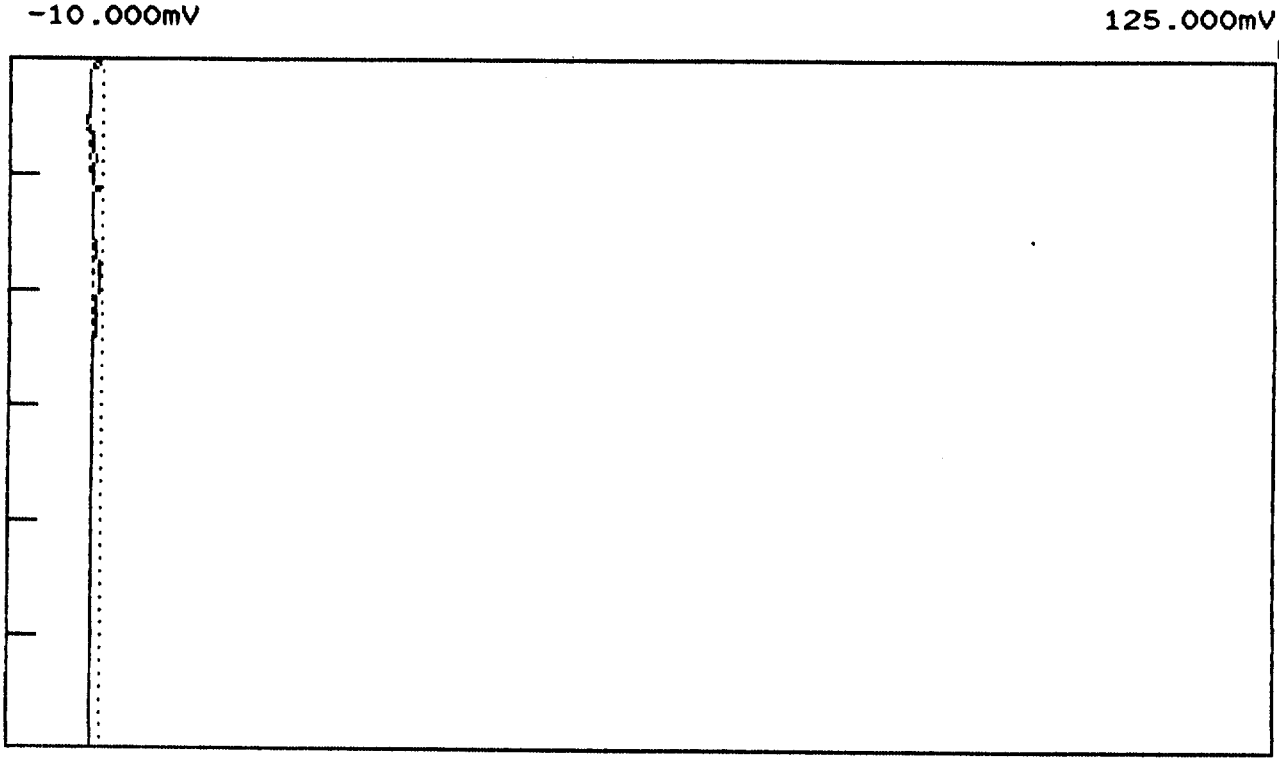
125.000mV

Retention Area



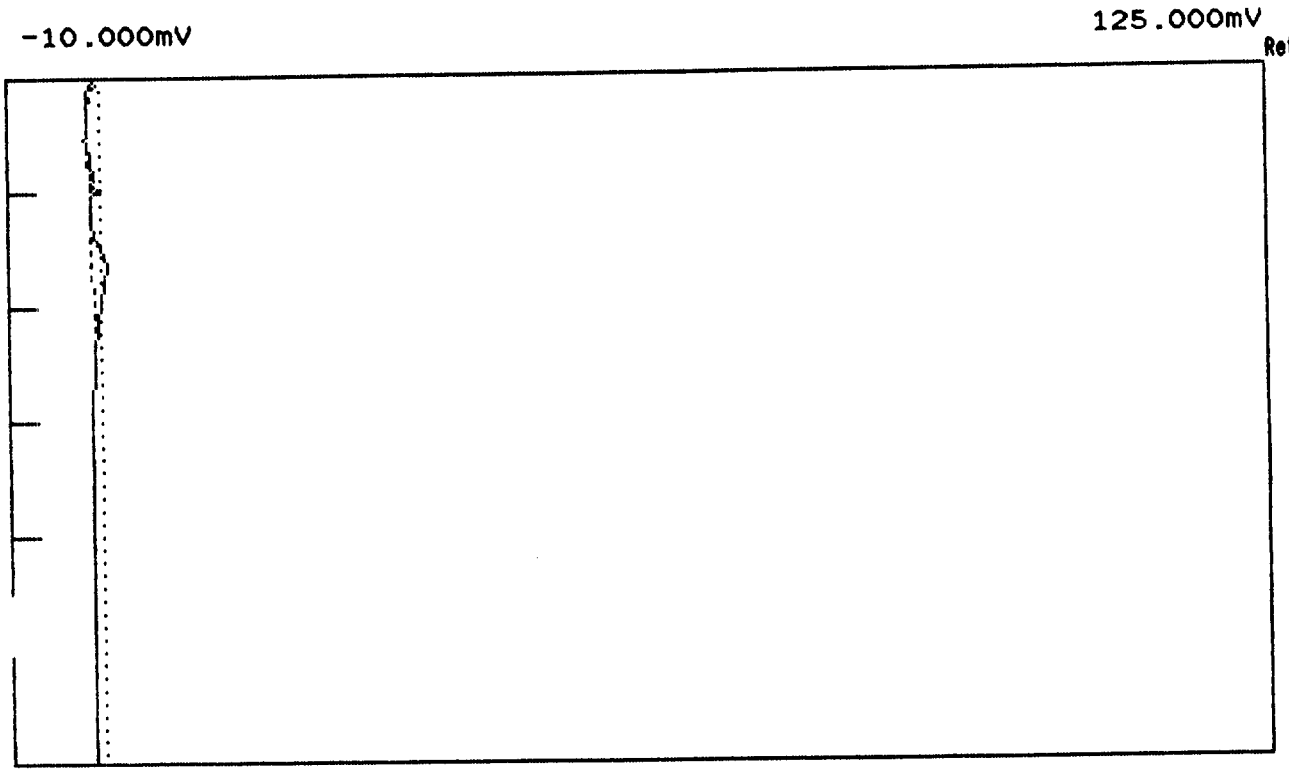
Retention	Area
	0.00

Operator : REP
Description : BFI outlet
Conditions : 0-M18-2
File : BFIo-30.CHR
Date : 09/02/1992
Time : 20:15:57



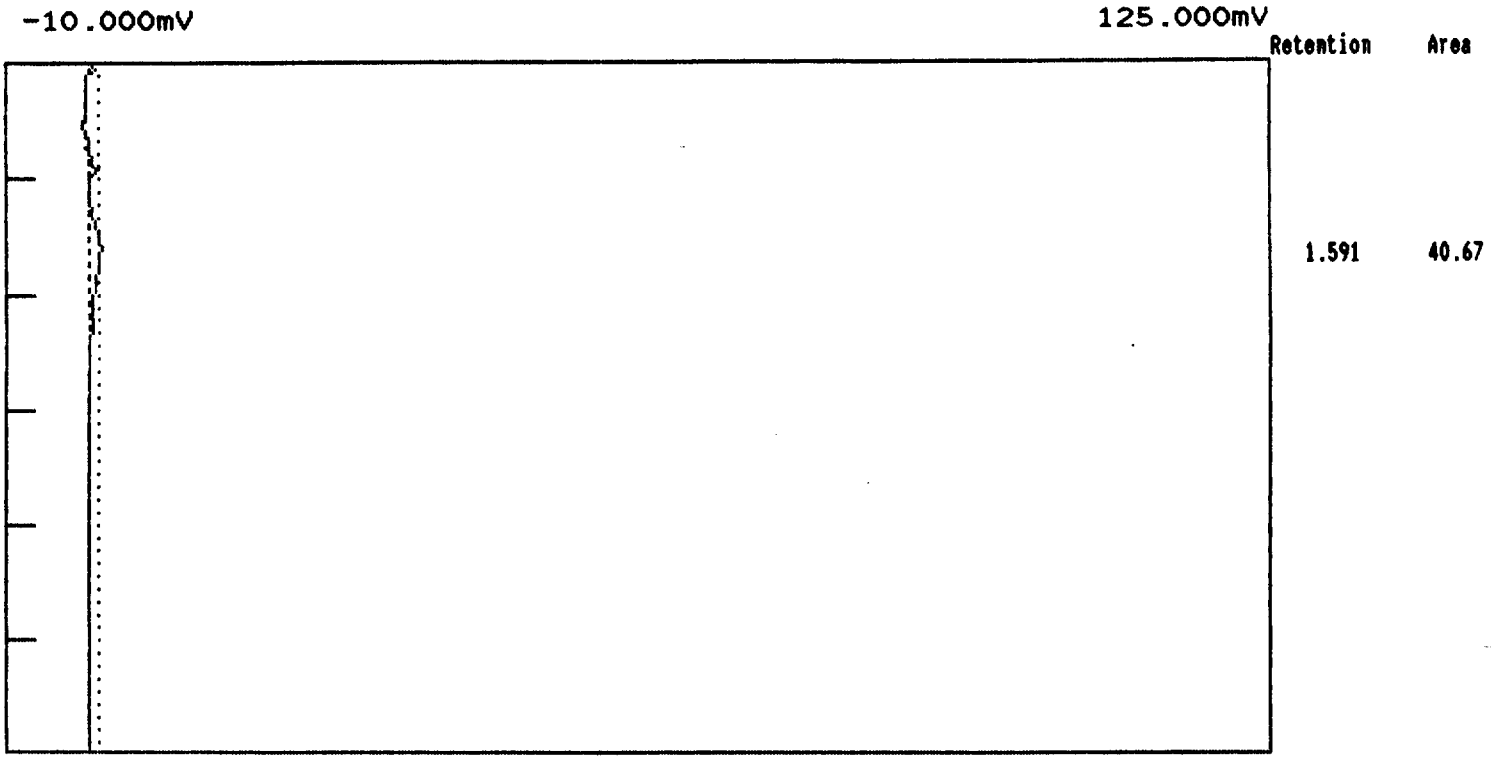
Retention	Area
0.833	10.86
1.858	21.76
	32.62

Operator : REP
Description : BFI outlet
Conditions : O-M18-2
File : BFIo-31.CHR
Date : 09/02/1992
Time : 20:26:37



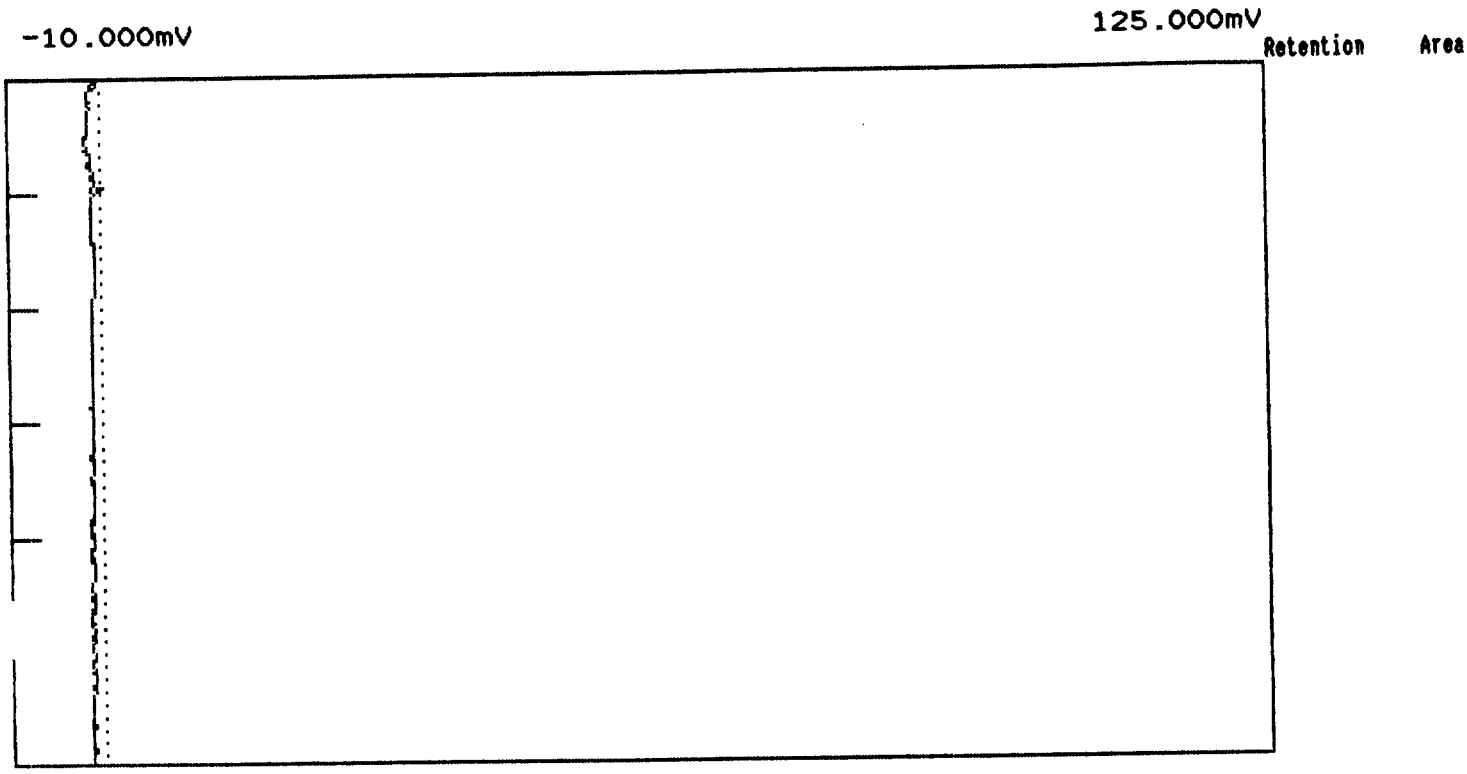
Retention	Area
1.675	48.50
	48.50

Operator : REP
Description : BFI outlet
Conditions : O-M18-3a
File : BFIo-34.CHR
Date : 09/02/1992
Time : 21:36:25



Retention	Area
1.591	40.67
	40.67

Operator : REP
Description : BFI outlet
Conditions : O-M18-3b
File : BFIo-35.CHR
Date : 09/02/1992
Time : 21:44:34



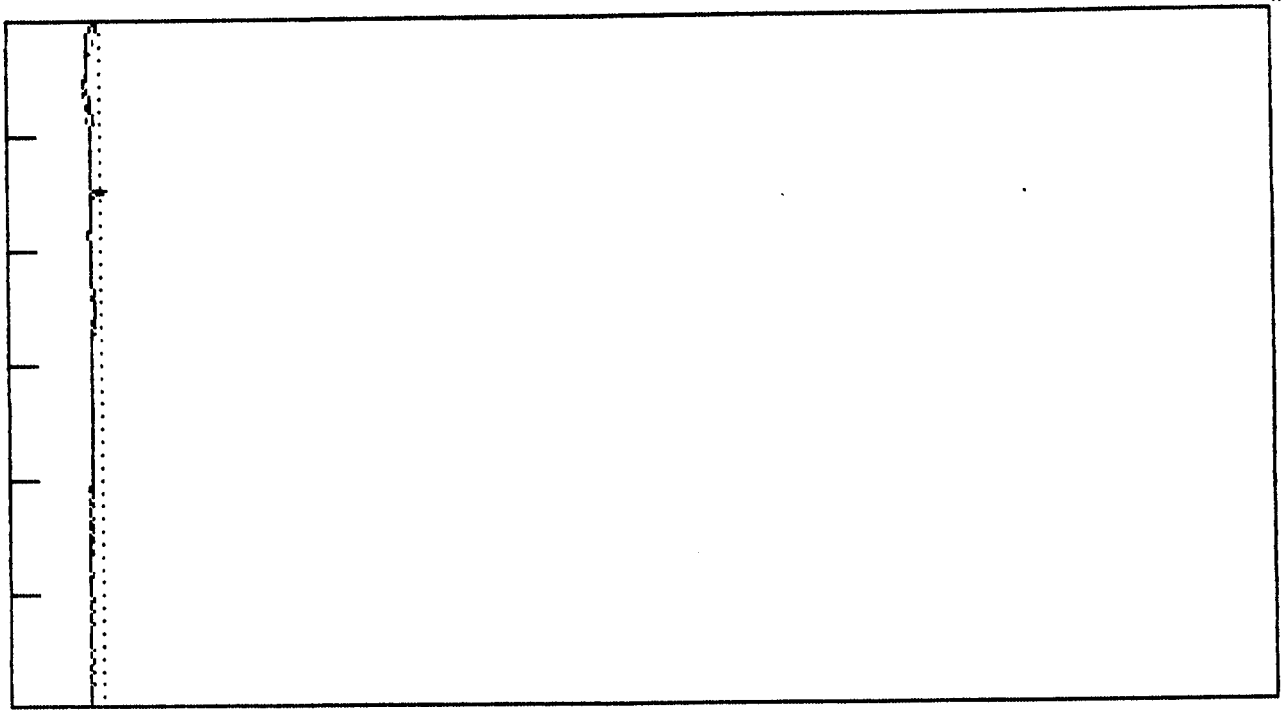
Retention	Area
	0.00

Operator : REP
Description : BFI outlet
Conditions : O-M18-3c
File : BFIo-36.CHR
Date : 09/02/1992
Time : 21:54:18

-10.000mV

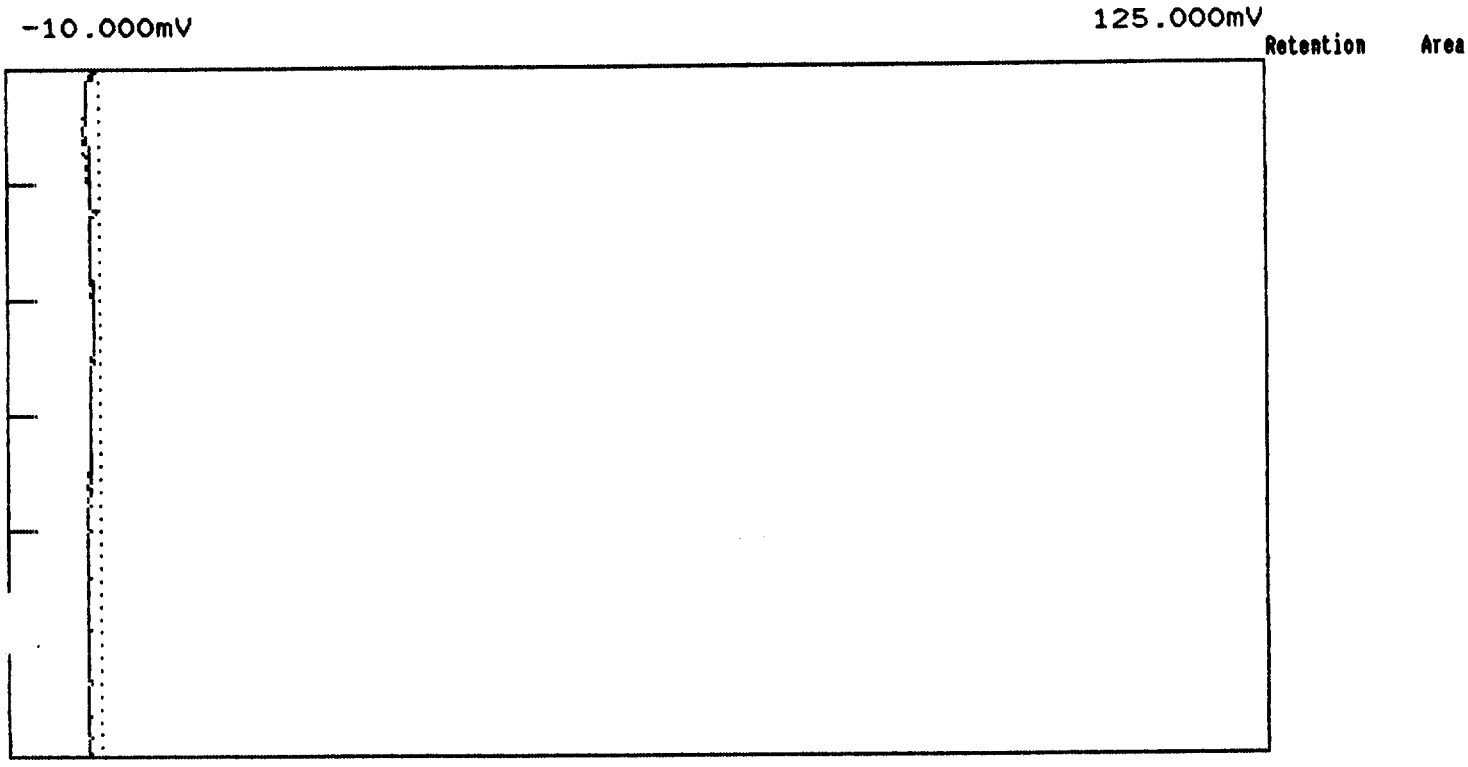
125.000mV

Retention Area



Retention	Area
	0.00

Operator : REP
Description : BFI outlet
Conditions : O-M18-3
File : BFIo-37.CHR
Date : 09/02/1992
Time : 22:06:12

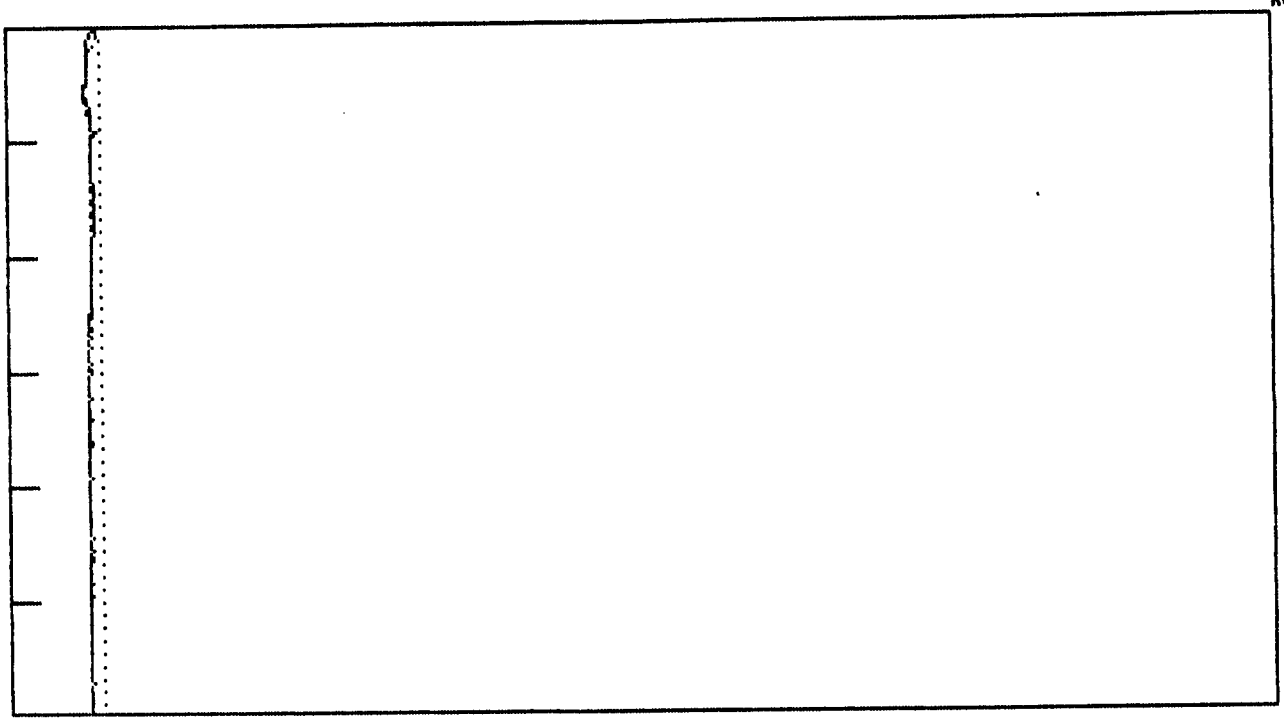


Retention	Area
	0.00

Operator : REP
Description : BFI outlet
Conditions : O-M18-3 e
File : BFIo-38.CHR
Date : 09/02/1992
Time : 22:15:23

-10.000mV

125.000mV



Retention	Area
1.491	17.98

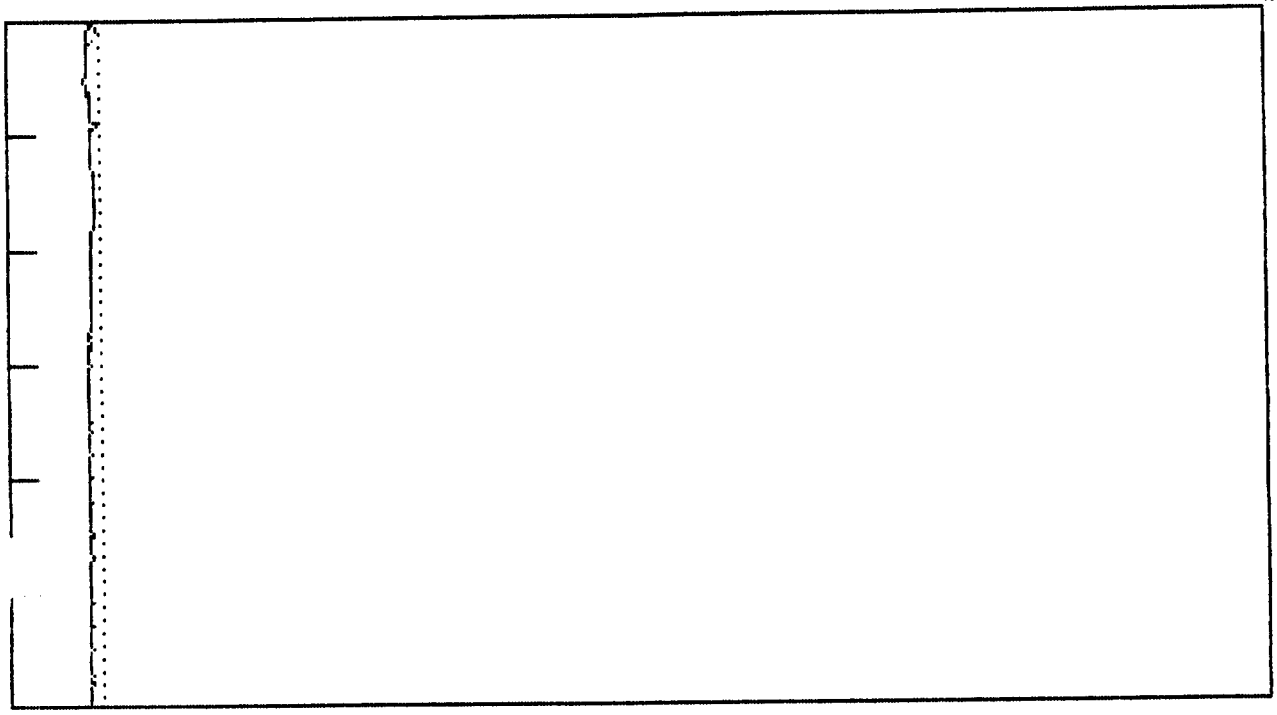
Retention	Area
1.491	17.98
	17.98

Operator : REP
Description : BFI outlet
Conditions : O-M18-3
File : BFIo-39.CHR
Date : 09/02/1992
Time : 22:25:24

-10.000mV

125.000mV

Retention Area

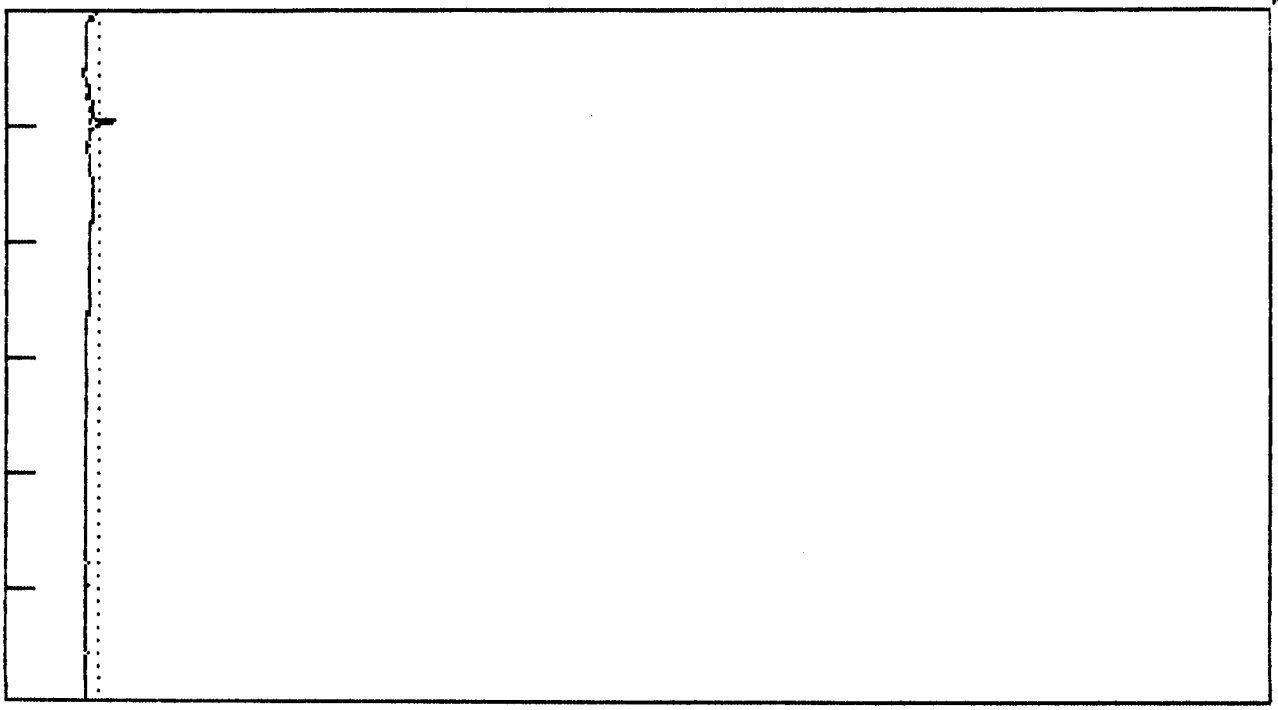


Retention	Area
	0.00

Operator : REP
Description : BFI outlet
Conditions : O-M18-3 g
File : BFIo-40.CHR
Date : 09/02/1992
Time : 22:36:16

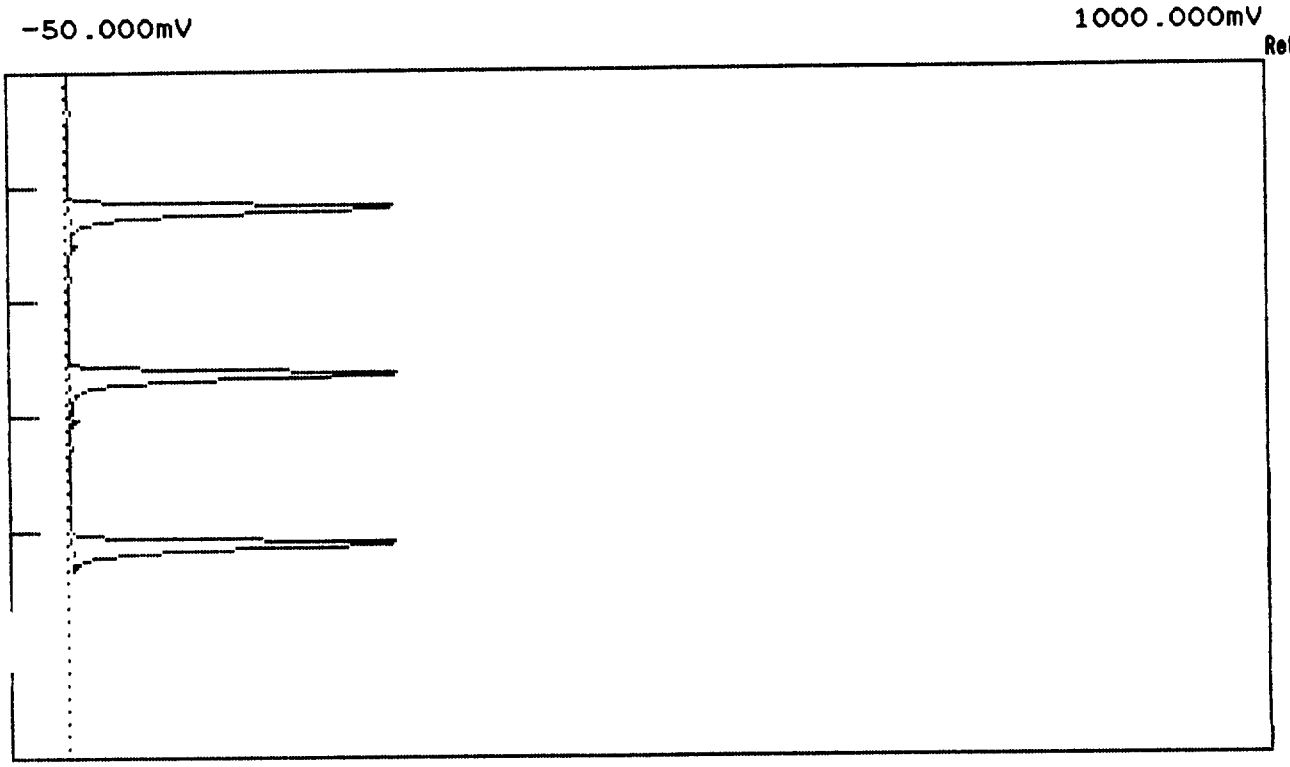
-10.000mV 125.000mV

Retention Area



Retention	Area
	0.00

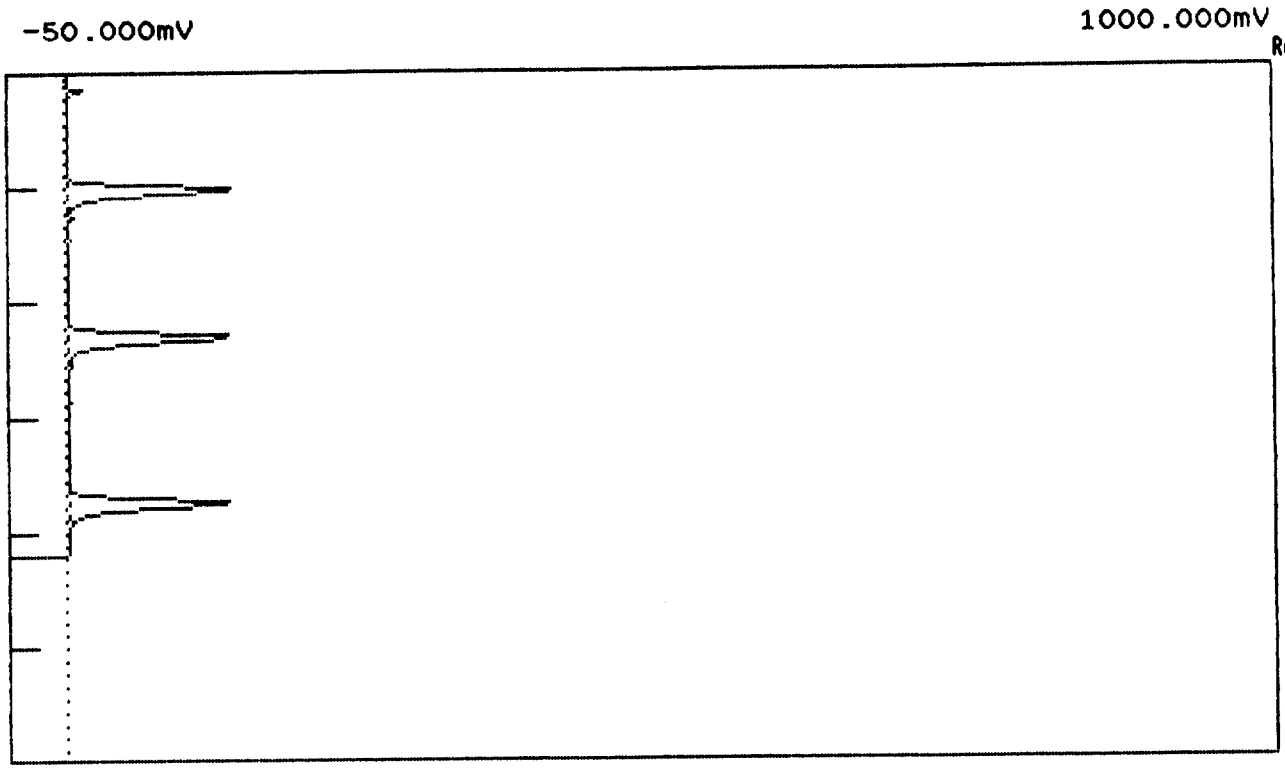
Operator :
Description : BFI inlet
Conditions : 6020 ppm CH4 direct cal
File : BFIin-11.CHR
Date : 09/02/1992
Time : 15:03:51



Retention	Area
0.033	12.45
0.325	10.79
1.175	1658.88
1.491	17.54
2.158	12.44
2.616	1650.20
3.016	17.39
3.241	11.48
3.591	11.32
4.091	1608.08

Retention	Area
0.033	12.45
0.325	10.79
1.175	1658.88
1.491	17.54
2.158	12.44
2.616	1650.20
3.016	17.39
3.241	11.48
3.591	11.32
4.091	1608.08
	5010.56

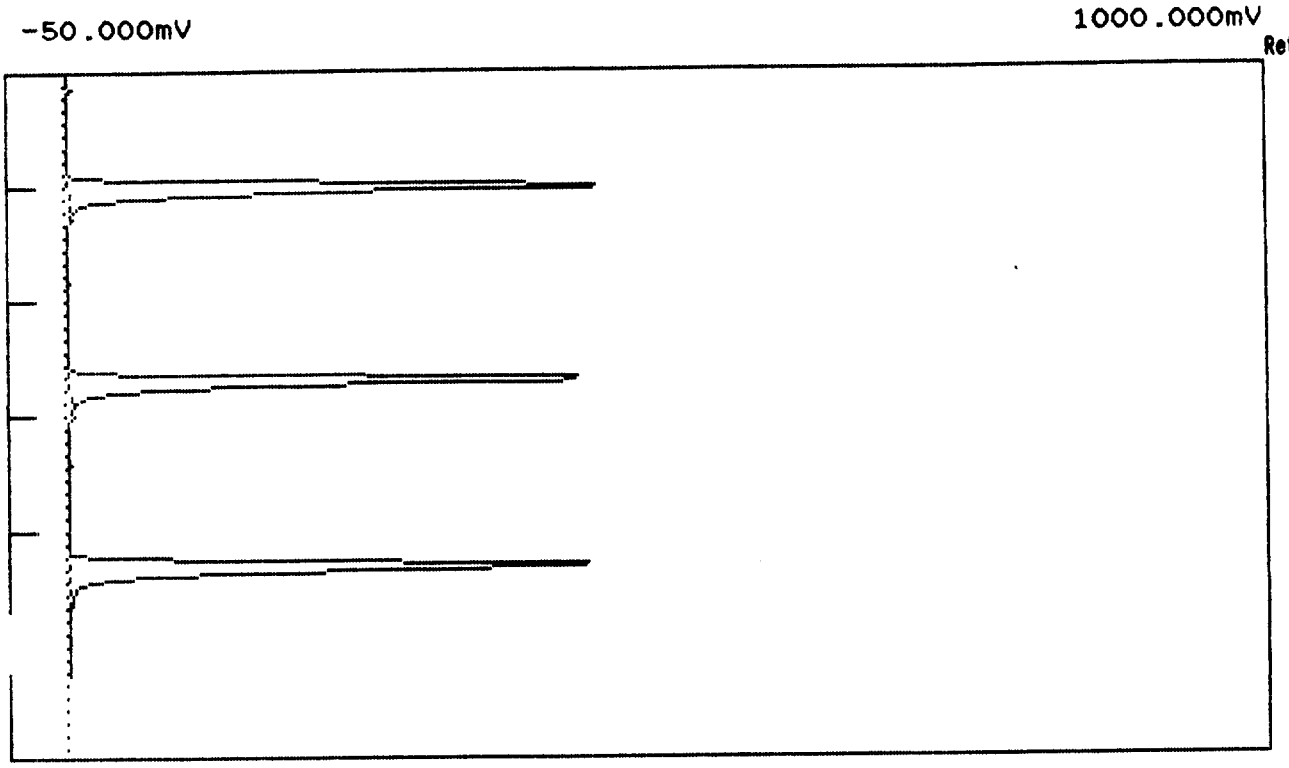
Operator : REP
Description : BFI inlet
Conditions : 3020 ppm CH4 direct cal
File : BFIin-12.CHR
Components :
Date : 09/02/1992
Time : 15:16:05



Retention	Area
0.141	37.38
1.000	805.58
2.283	832.29
3.716	792.05

Retention	Area
0.141	37.38
1.000	805.58
2.283	832.29
3.716	792.05
	2467.31

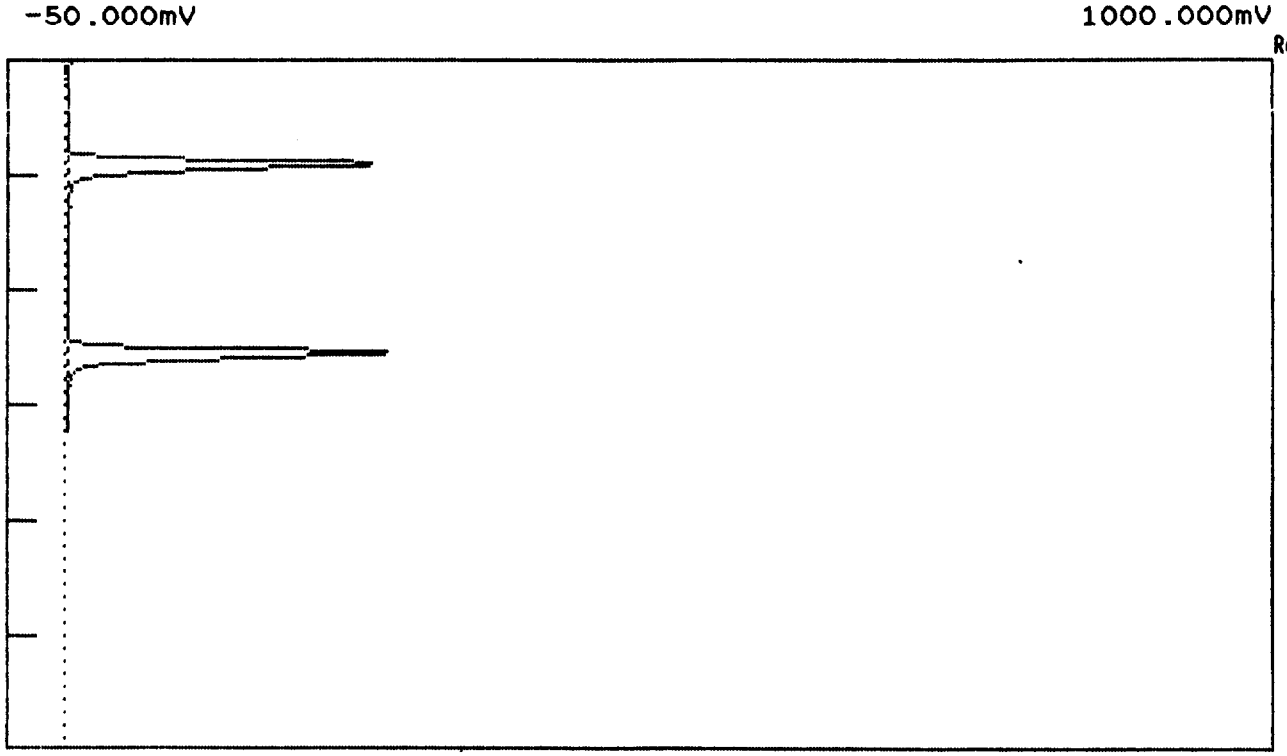
Operator : REP
Description : BFI inlet
Conditions : 10020 ppm CH4 direct cal
File : BFIin-13.CHR
Date : 09/02/1992
Time : 15:24:35



Retention	Area
0.133	16.30
0.991	2708.11
1.816	16.50
2.675	2654.55
3.400	11.64
4.283	2691.50

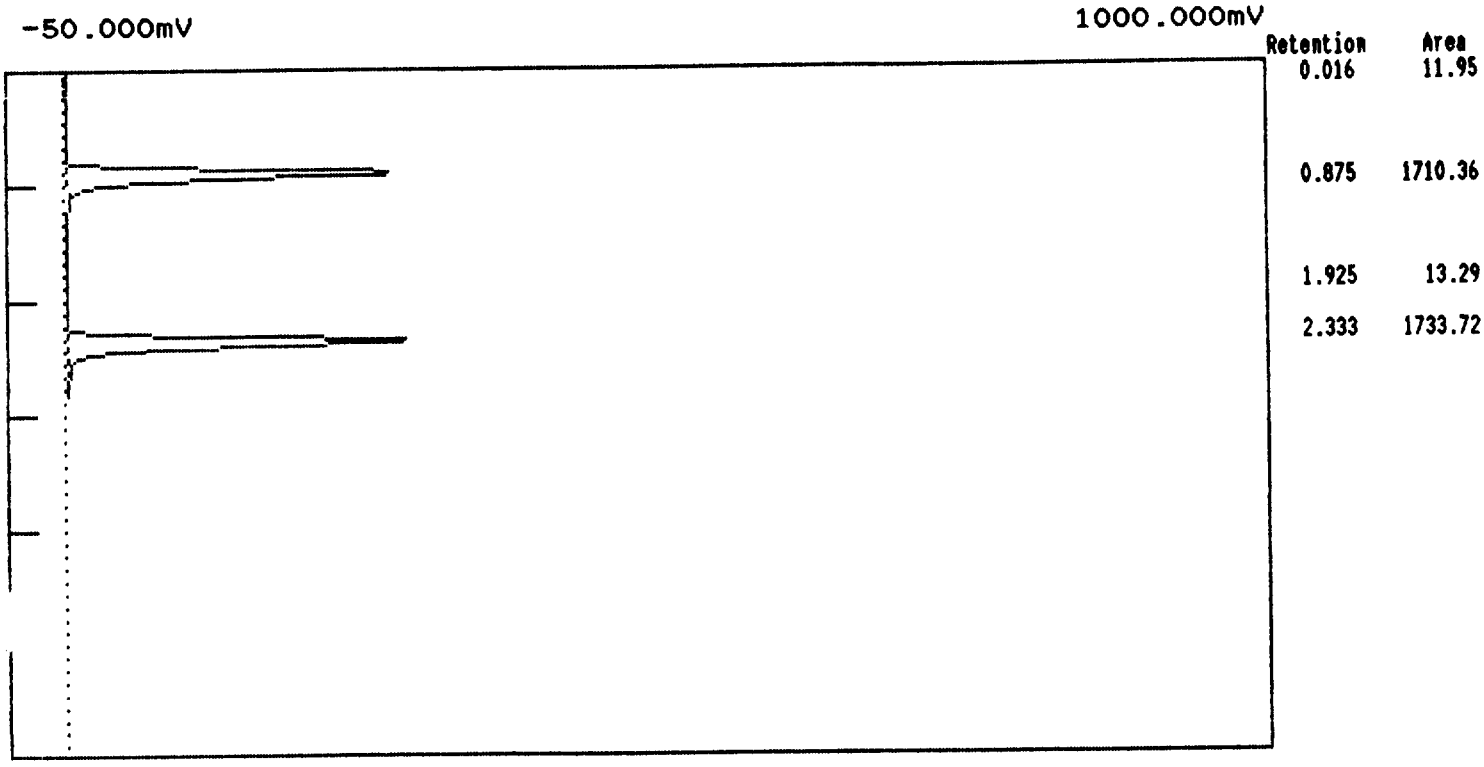
Retention	Area
0.133	16.30
0.991	2708.11
1.816	16.50
2.675	2654.55
3.400	11.64
4.283	2691.50
	8098.61

Operator : REP
Description : BFI inlet
Conditions : 3020 ppm CH4 inlet system calibration
File : BFIin-14.CHR
Date : 09/02/1992
Time : 15:43:40



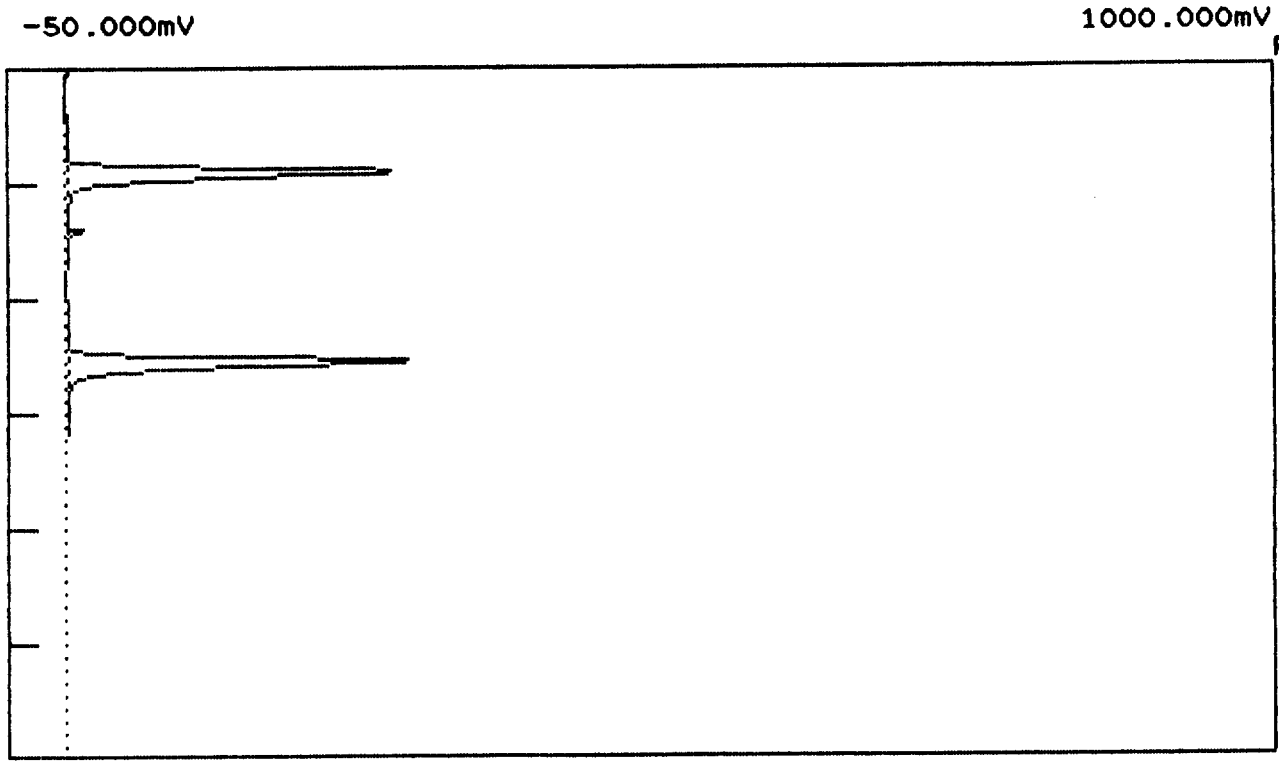
Retention	Area
0.016	20.93
0.875	1642.67
2.525	1593.30
	3256.90

Operator : REP
Description : BFI inlet
Conditions : 6020 ppm CH4 postrun 1 inlet system calibration
File : BFIin-23.CHR
Date : 09/02/1992
Time : 17:35:16



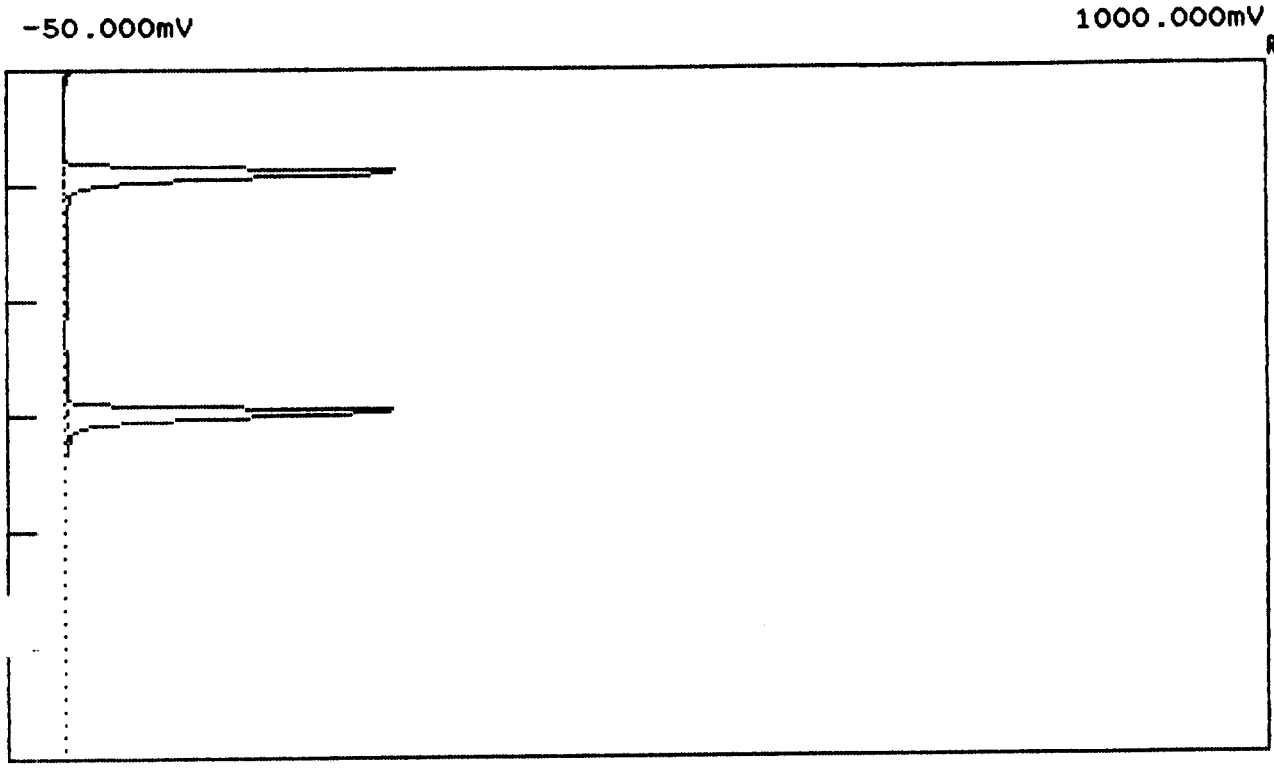
Retention	Area
0.016	11.95
0.875	1710.36
1.925	13.29
2.333	1733.72
	3469.32

Operator : REP
Description : BFI inlet
Conditions : 6020 ppm CH4 inlet posttest system calibration
File : BFIin-32.CHR
Date : 09/02/1992
Time : 20:40:19



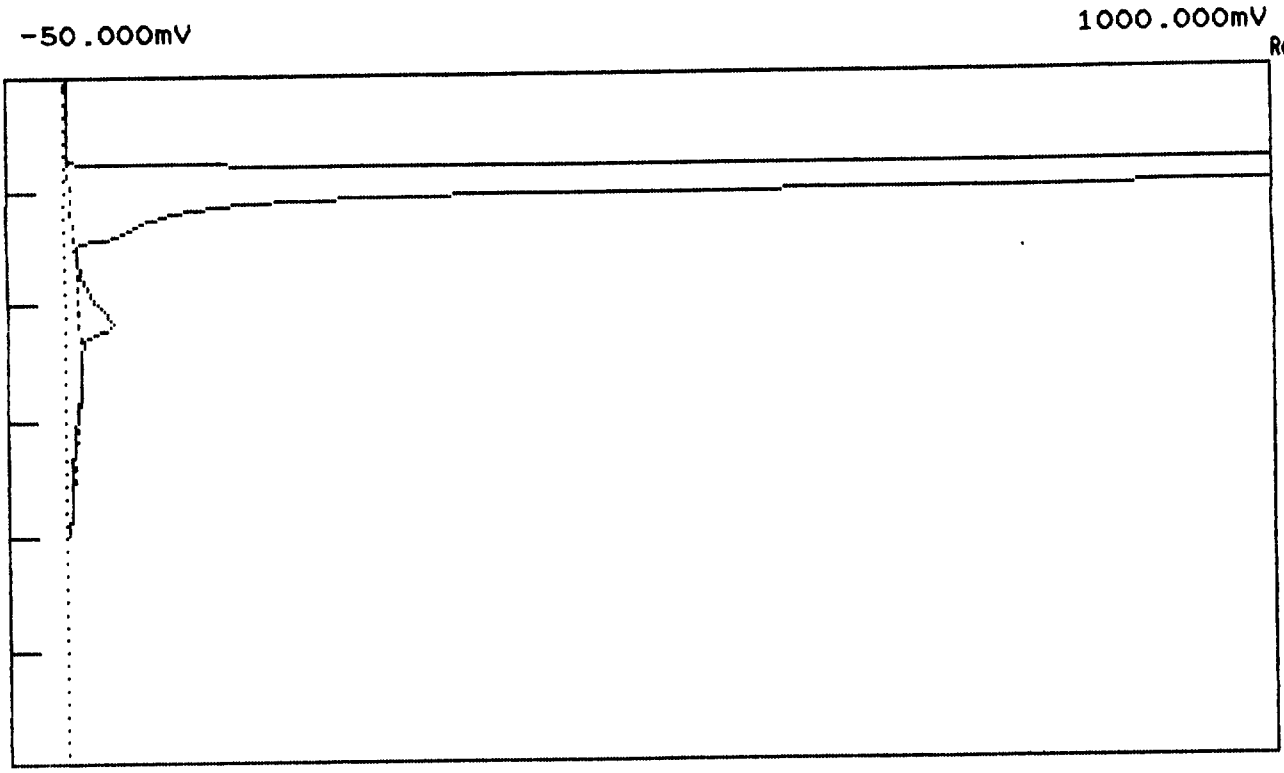
Retention	Area
0.875	1772.41
1.383	35.08
2.525	1710.05
	3517.53

Operator : REP
Description : BFI inlet
Conditions : 6020 ppm CH4 inlet posttest system calibration
File : BFIin-41.CHR
Date : 09/02/1992
Time : 22:46:09



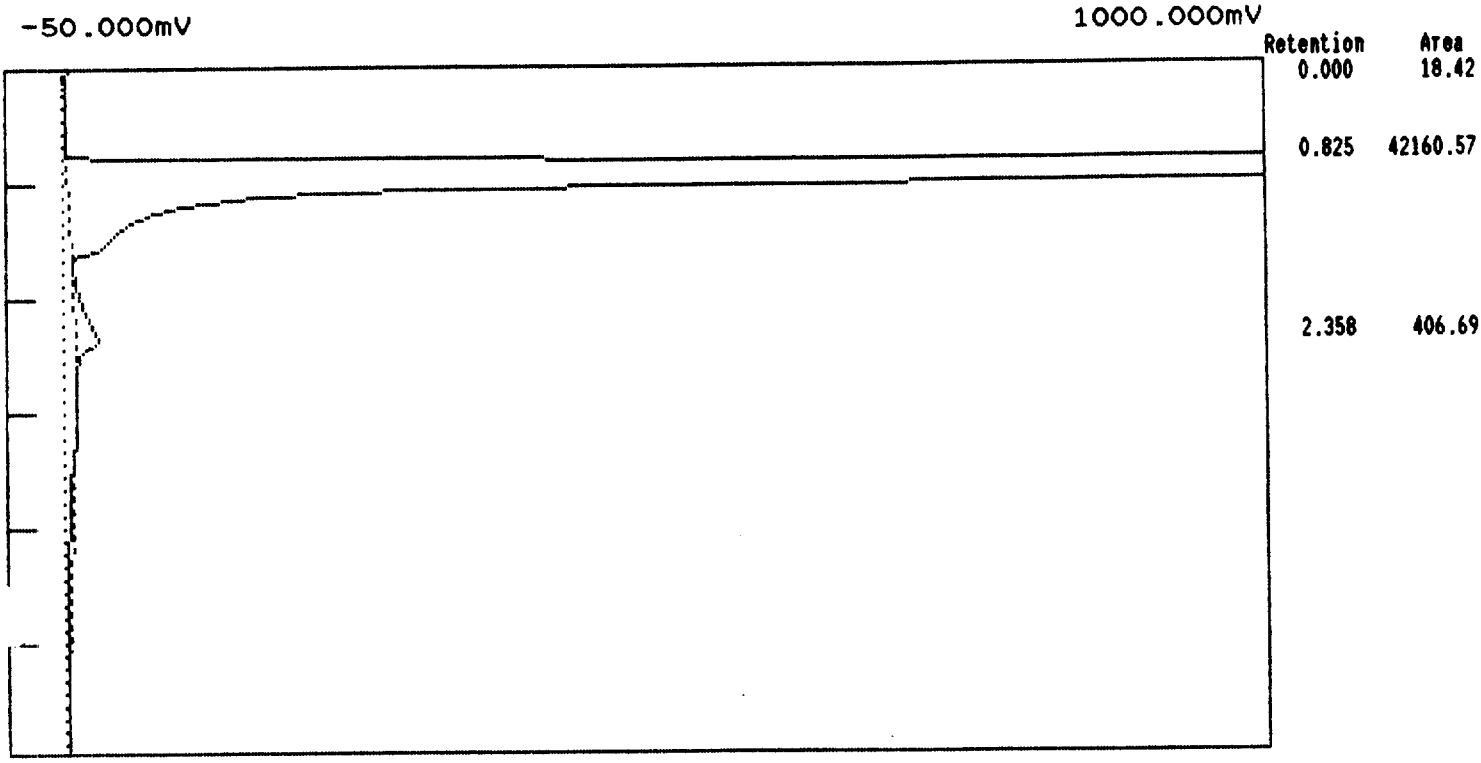
Retention	Area
0.008	23.52
0.866	1796.36
2.950	1739.40
	3559.28

Operator : REP
Description : BFI inlet
Conditions : I-M18-1a
File : BFIin-16.CHR
Date : 09/02/1992
Time : 16:18:49



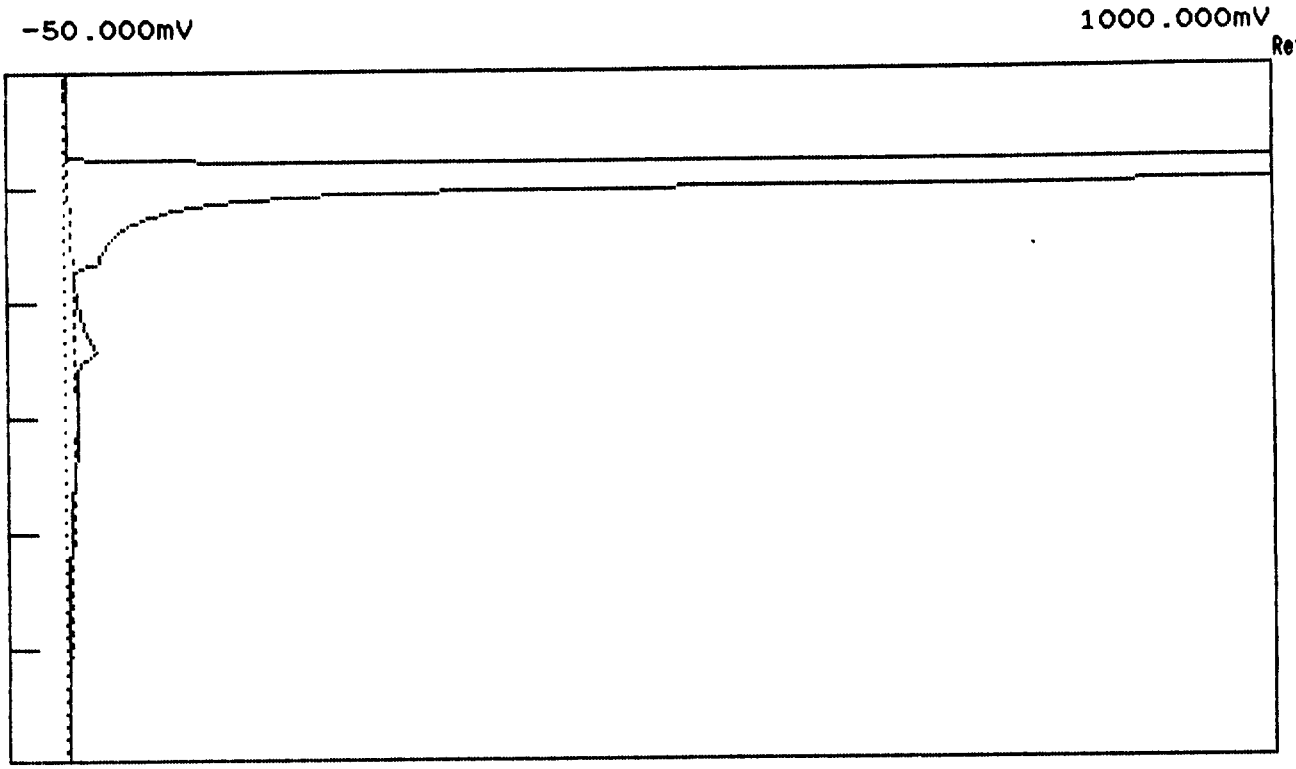
Retention	Area
0.808	42682.04
2.166	533.27
	43215.32

Operator : REP
Description : BFI inlet
Conditions : I-M18-1@b
File : BFIin-17.CHR
Date : 09/02/1992
Time : 16:27:38



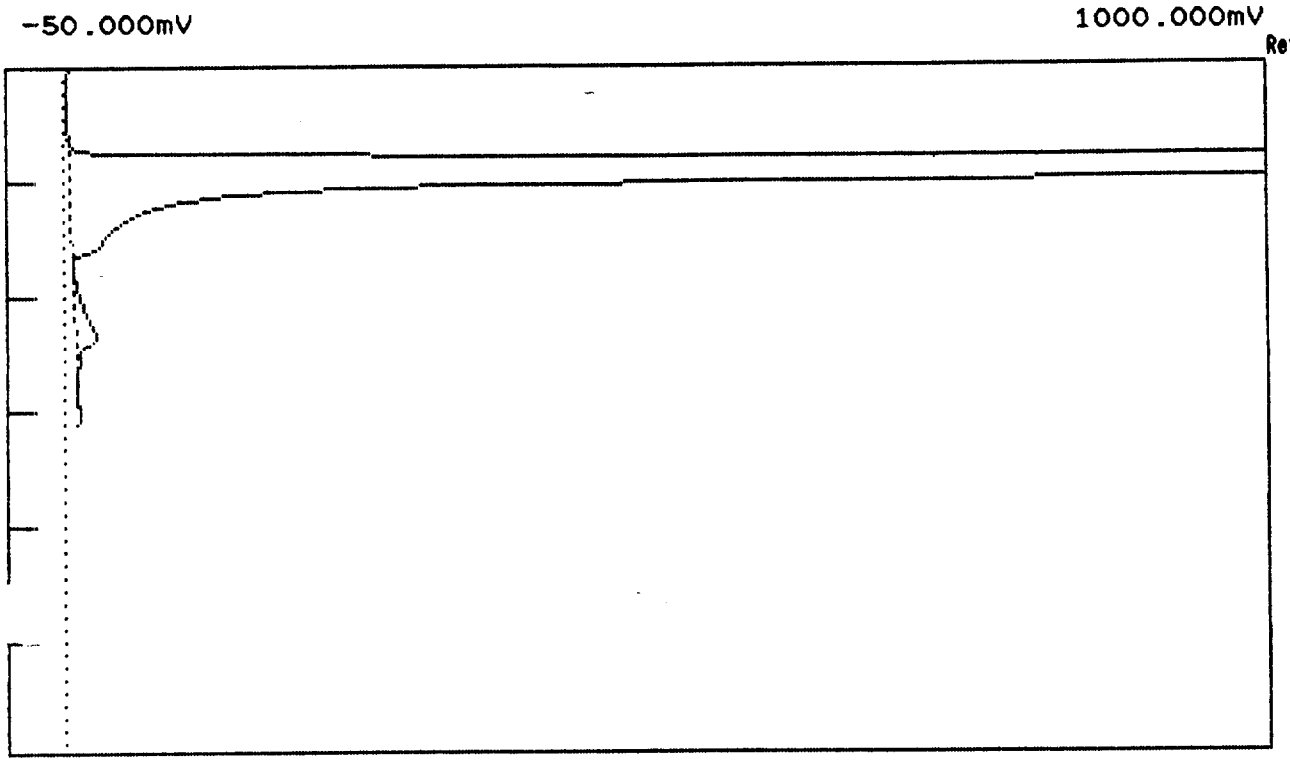
Retention	Area
0.000	18.42
0.825	42160.57
2.358	406.69
	42585.67

Operator : REP
Description : BFI inlet
Conditions : I-M18-1C
File : BFIin-18.CHR
Date : 09/02/1992
Time : 16:37:54



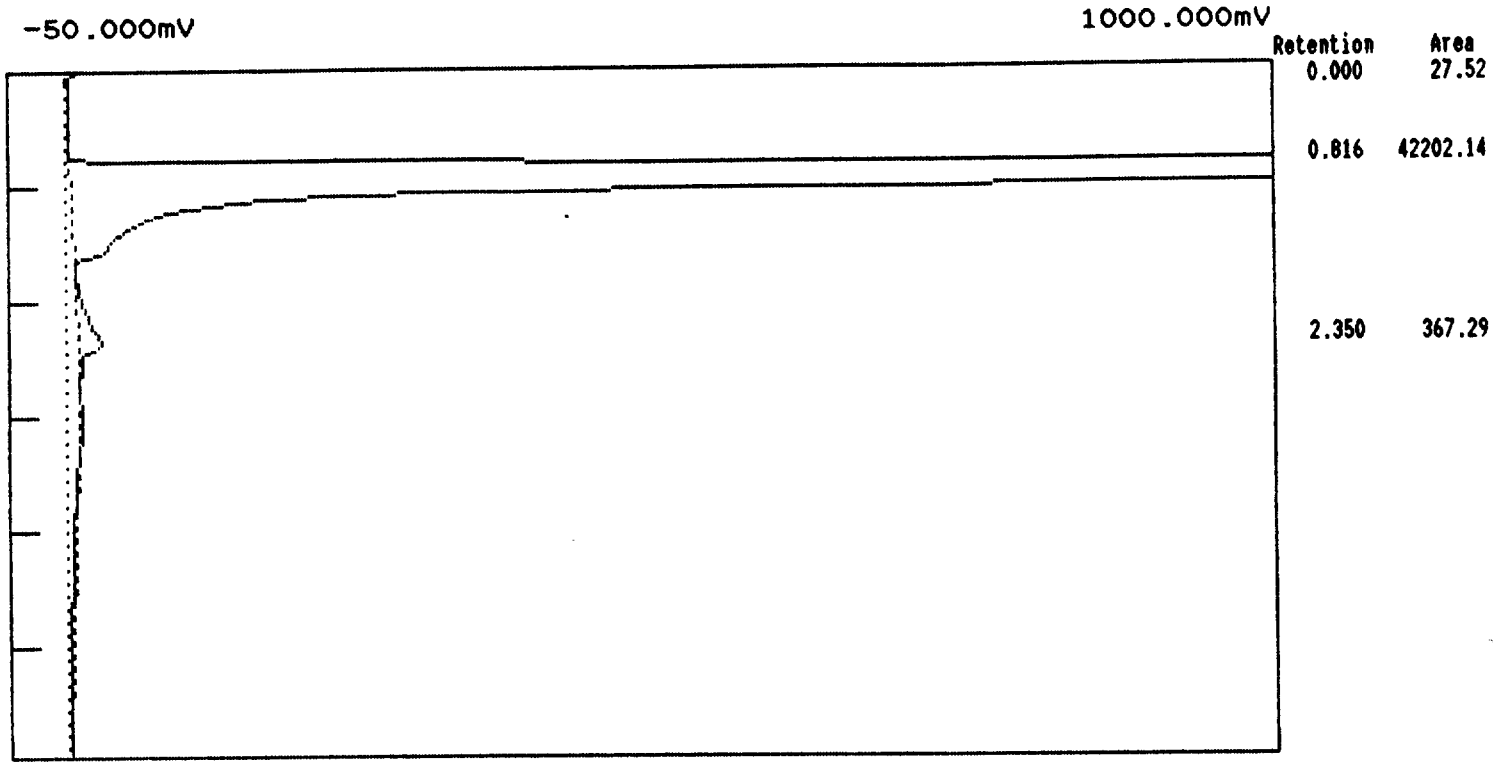
Retention	Area
0.000	15.41
0.800	42256.42
2.433	343.56
	42615.38

Operator : REP
Description : BFI inlet
Conditions : I-M18-1
File : BFIin-19.CHR
Date : 09/02/1992
Time : 16:53:48



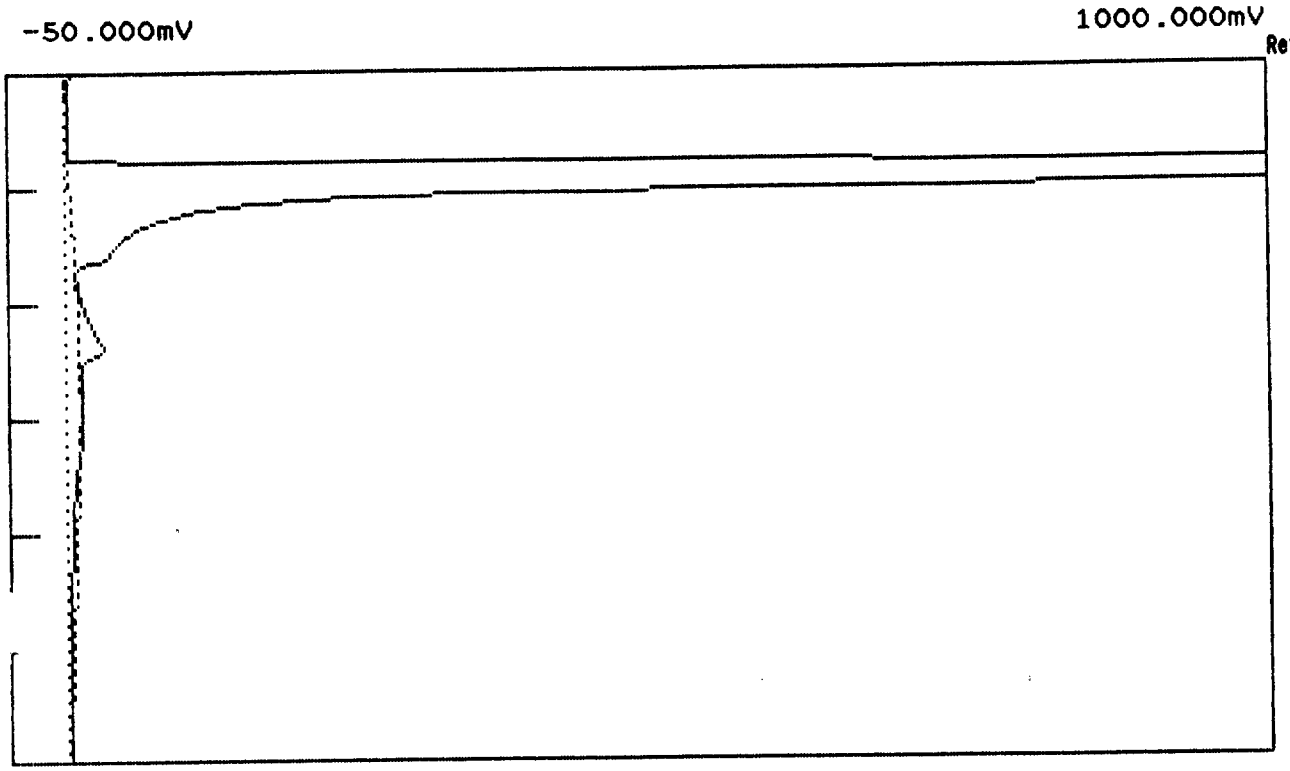
Retention	Area
0.000	14.46
0.800	42261.54
2.350	351.67
	42627.67

Operator : REP
Description : BFI inlet
Conditions : I-M18-1C
File : BFIin-20.CHR
Date : 09/02/1992
Time : 16:58:33



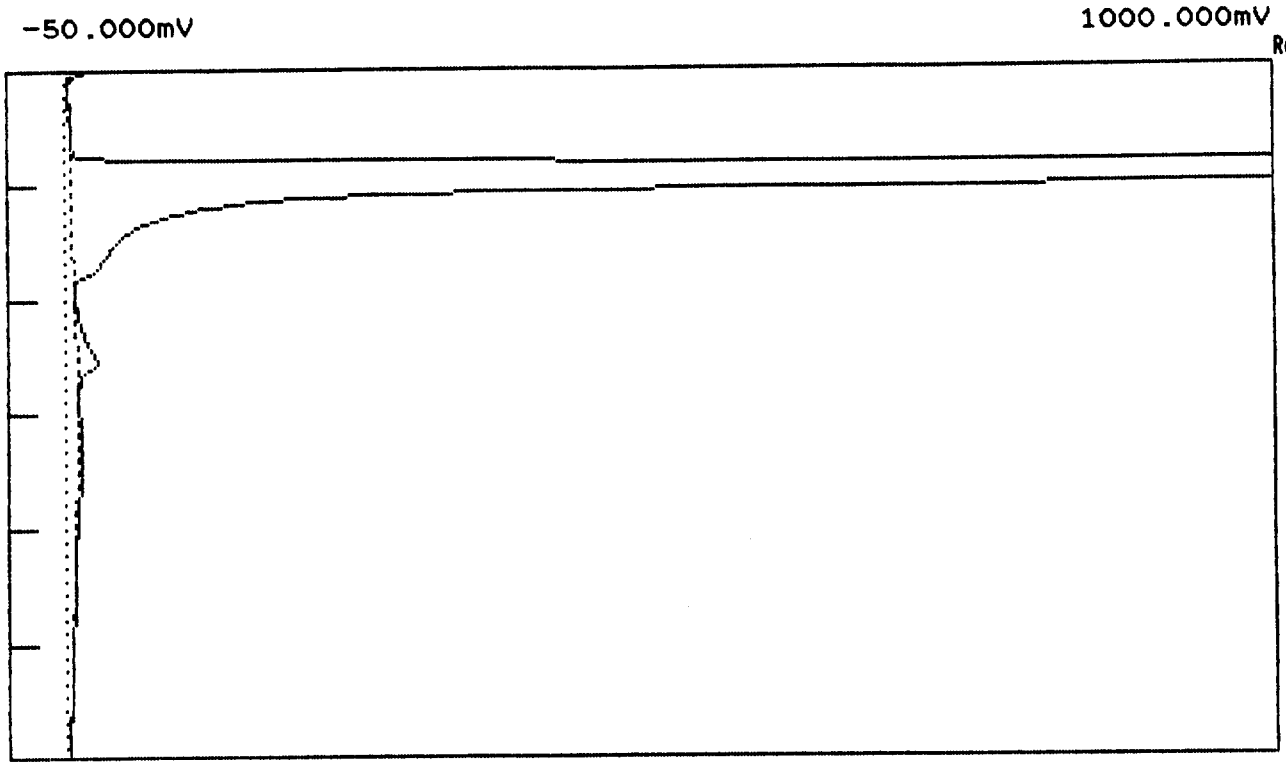
Retention	Area
0.000	27.52
0.816	42202.14
2.350	367.29
	42596.95

Operator : REP
Description : BFI inlet
Conditions : I-M18-1
File : BFIin-21.CHR
Date : 09/02/1992
Time : 17:07:42



Retention	Area
0.000	19.16
0.816	44523.48
2.383	432.00
	44974.64

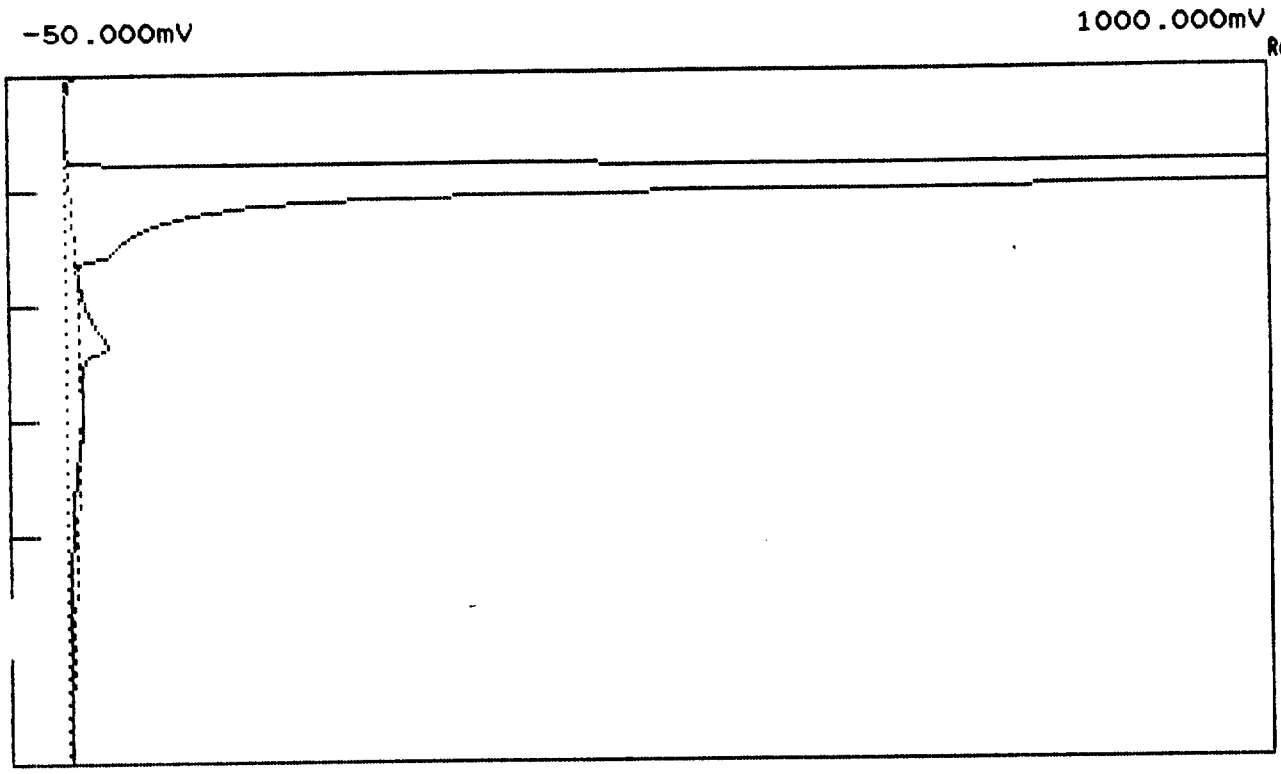
Operator : REP
Description : BFI inlet
Conditions : I-M18-19
File : BFIin-22.CHR
Date : 09/02/1992
Time : 17:21:33



Retention	Area
0.000	46.99
0.825	44614.60
2.541	294.03
3.491	157.53

Retention	Area
0.000	46.99
0.825	44614.60
2.541	294.03
3.491	157.53
	45113.15

Operator : REP
Description : BFI inlet
Conditions : I-M18-2 a
File : BFIin-25.CHR
Date : 09/02/1992
Time : 19:24:11

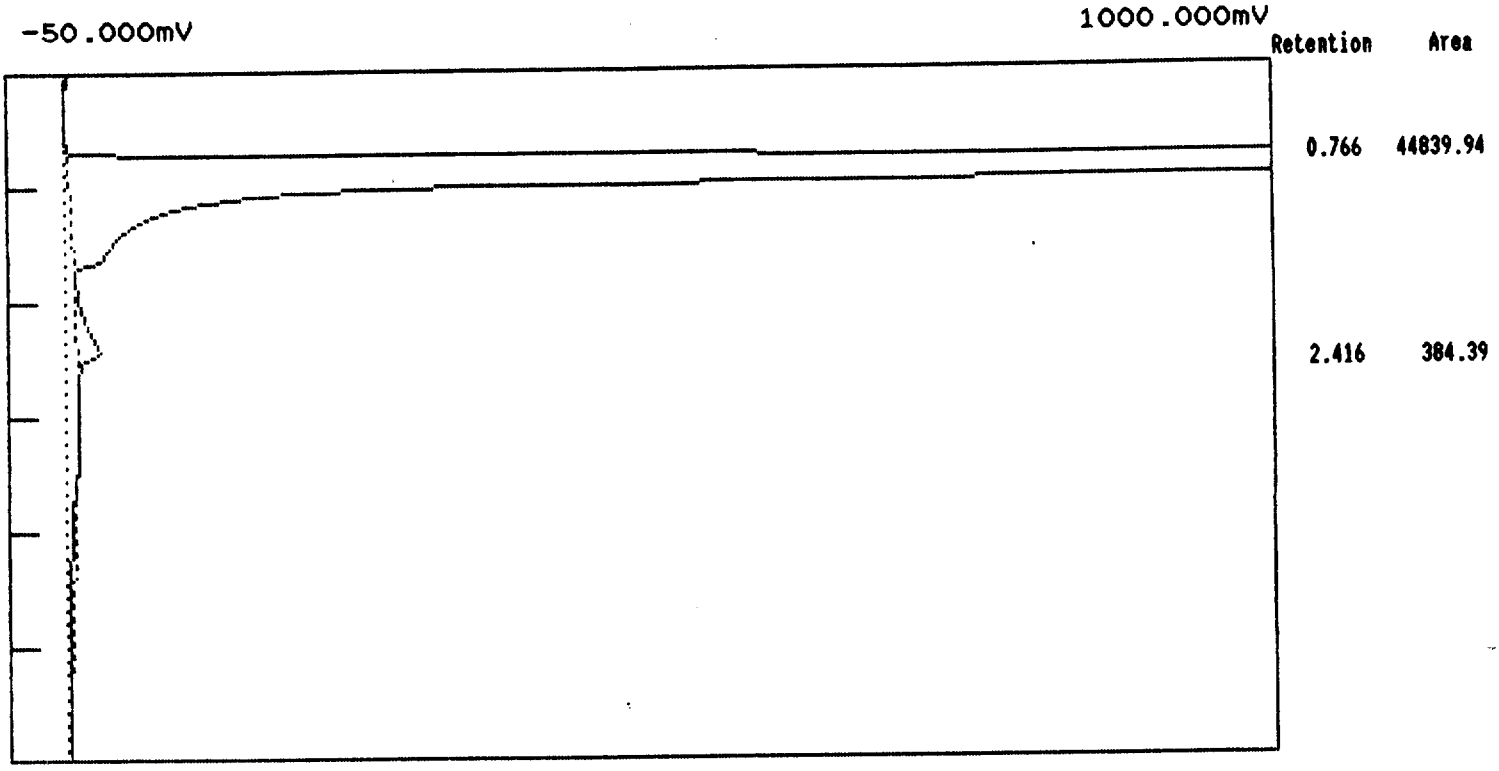


Retention	Area
0.000	27.05
0.825	44937.40
2.341	475.56

Retention	Area
0.000	27.05
0.825	44937.40
2.341	475.56

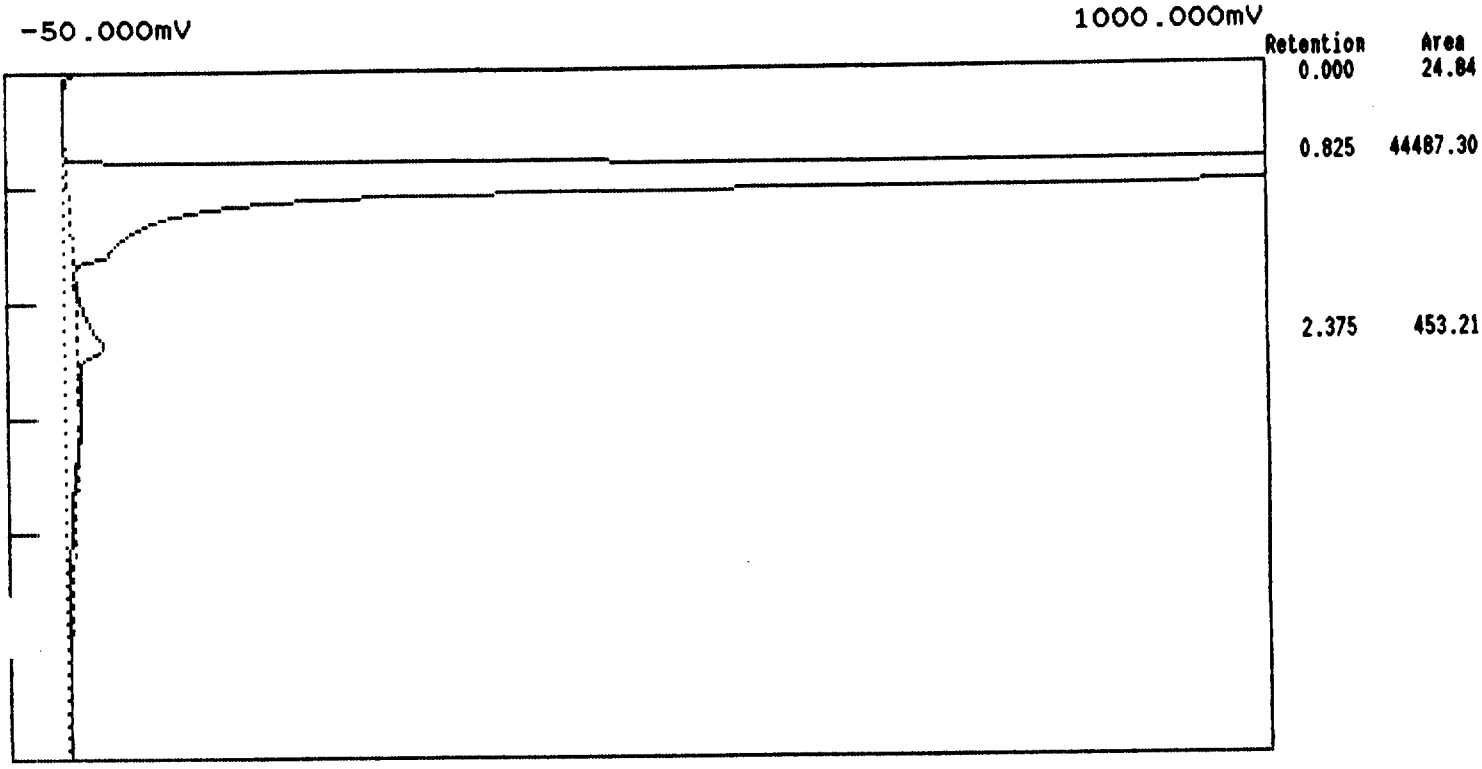
45440.02

Operator : REP
Description : BFI inlet
Conditions : I-M18-2 b
File : BFIin-26.CHR
Date : 09/02/1992
Time : 19:34:19



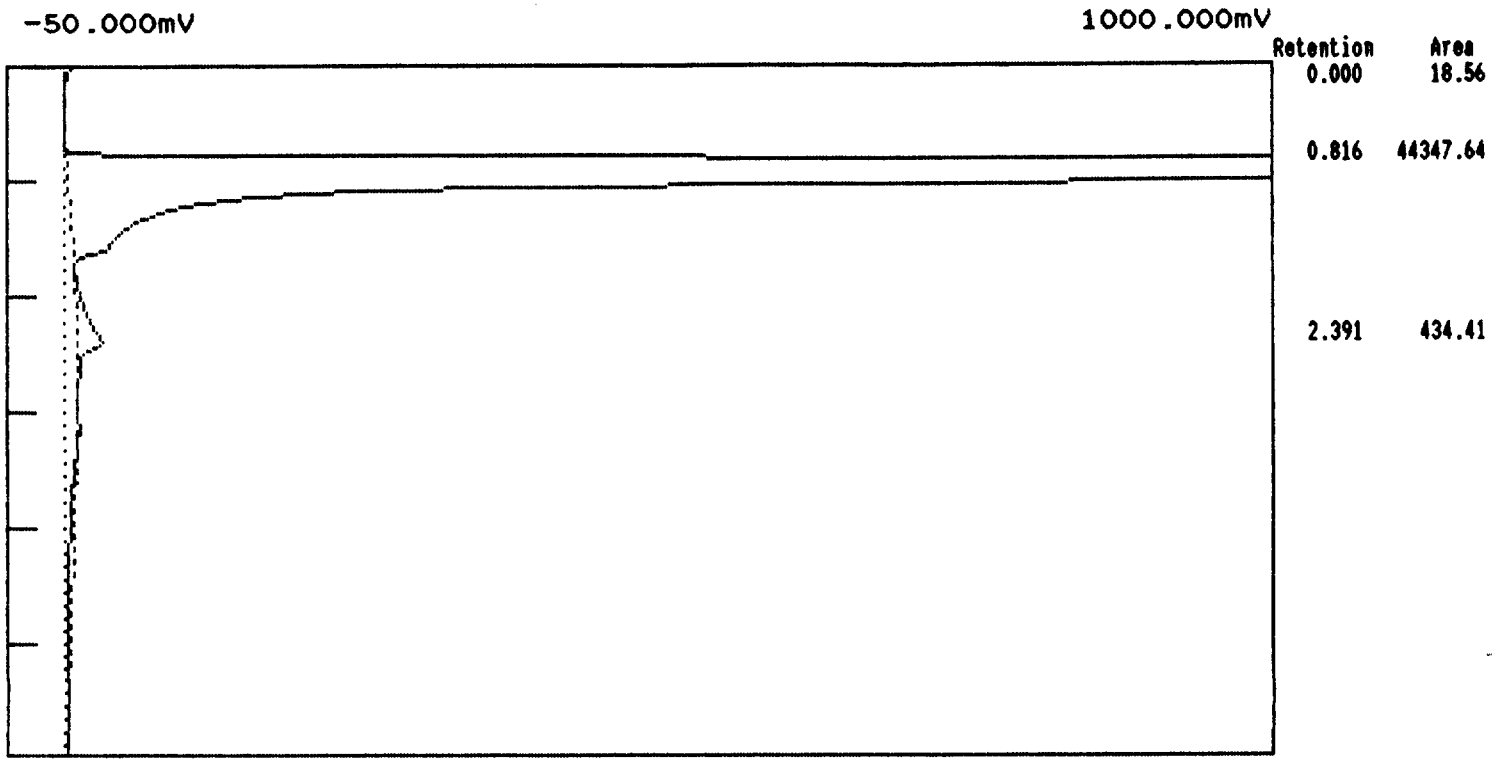
Retention	Area
0.766	44839.94
2.416	384.39
	45224.33

Operator : REP
Description : BFI inlet
Conditions : I-M18-2c
File : BFIin-27.CHR
Date : 09/02/1992
Time : 19:45:03



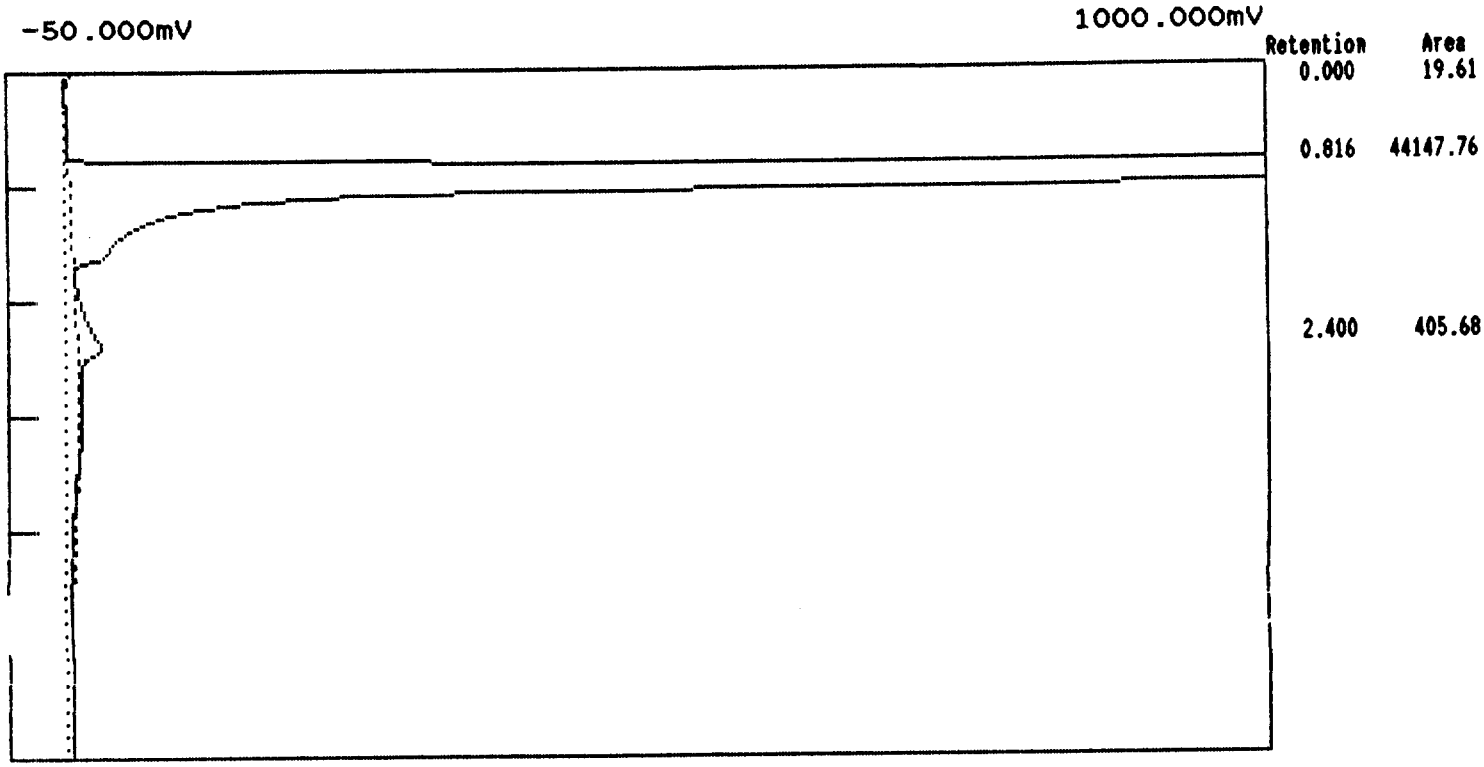
Retention	Area
0.000	24.84
0.825	44487.30
2.375	453.21
	44965.36

Operator : REP
Description : BFI inlet
Conditions : I-M18-2d
File : BFIin-28.CHR
Date : 09/02/1992
Time : 19:55:11



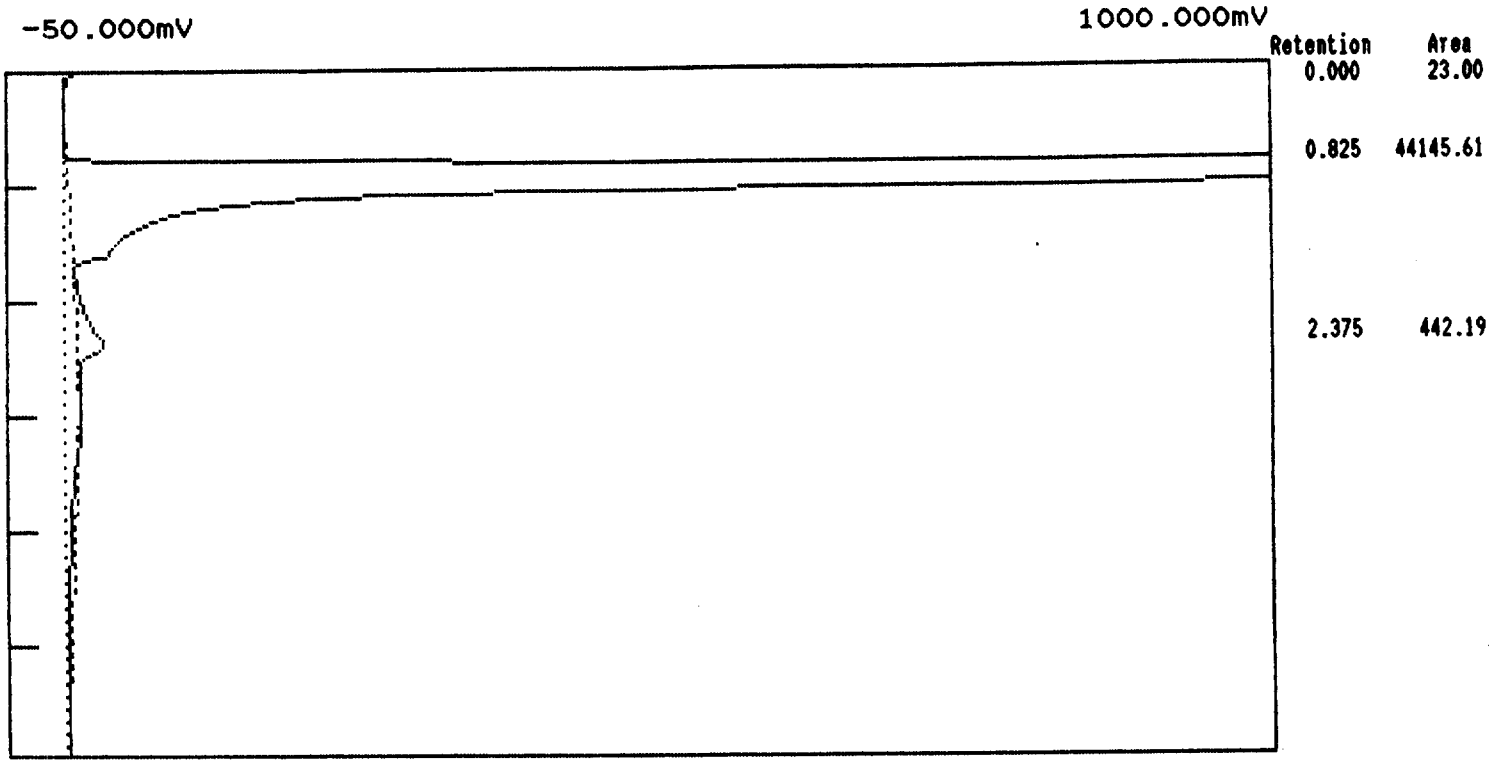
Retention	Area
0.000	18.56
0.816	44347.64
2.391	434.41
	44800.61

Operator : REP
Description : BFI inlet
Conditions : I-M18-2 e
File : BFIin-29.CHR
Date : 09/02/1992
Time : 20:08:54



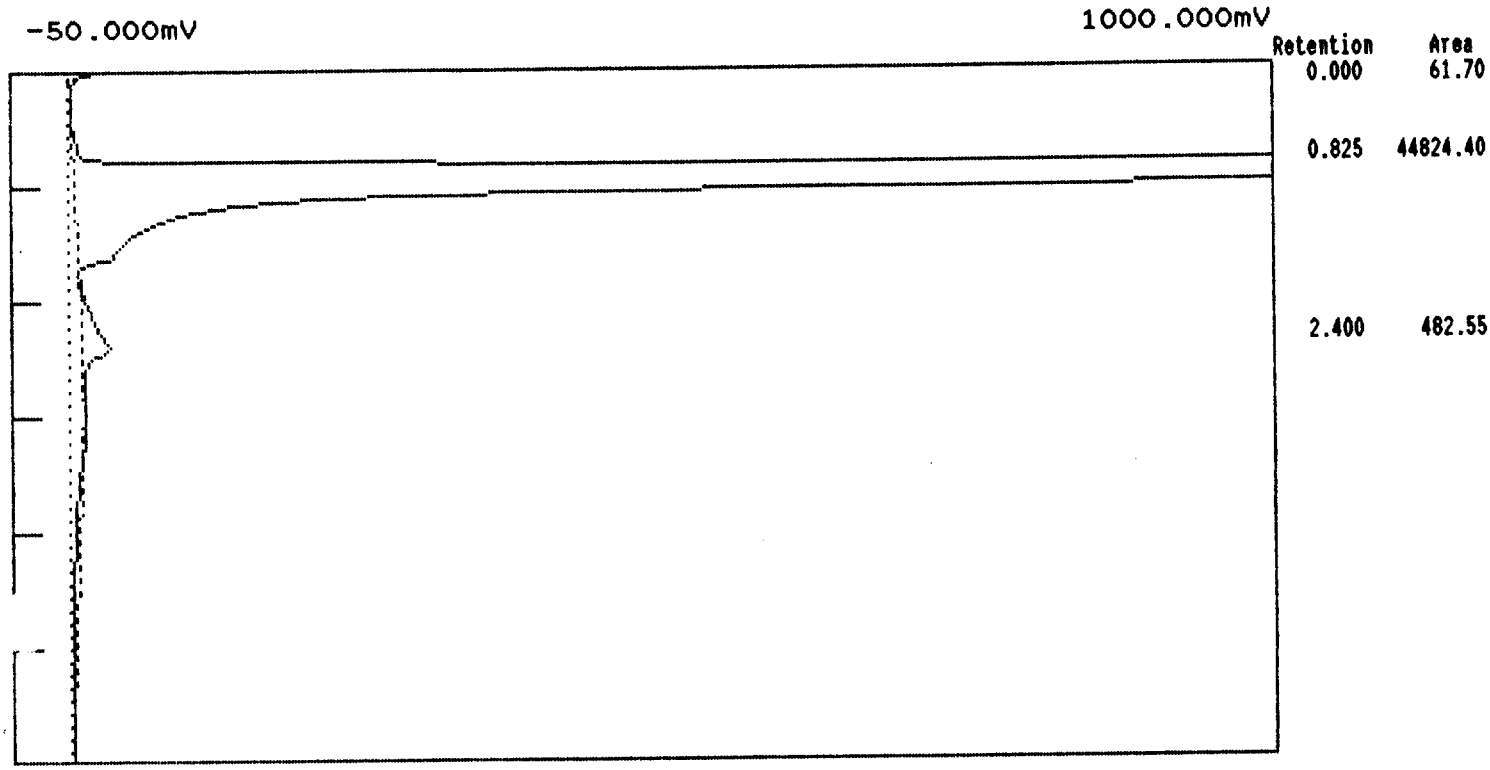
Retention	Area
0.000	19.61
0.816	44147.76
2.400	405.68
	44573.05

Operator : REP
Description : BFI inlet
Conditions : I-M18-2f
File : BFIin-30.CHR
Date : 09/02/1992
Time : 20:15:57



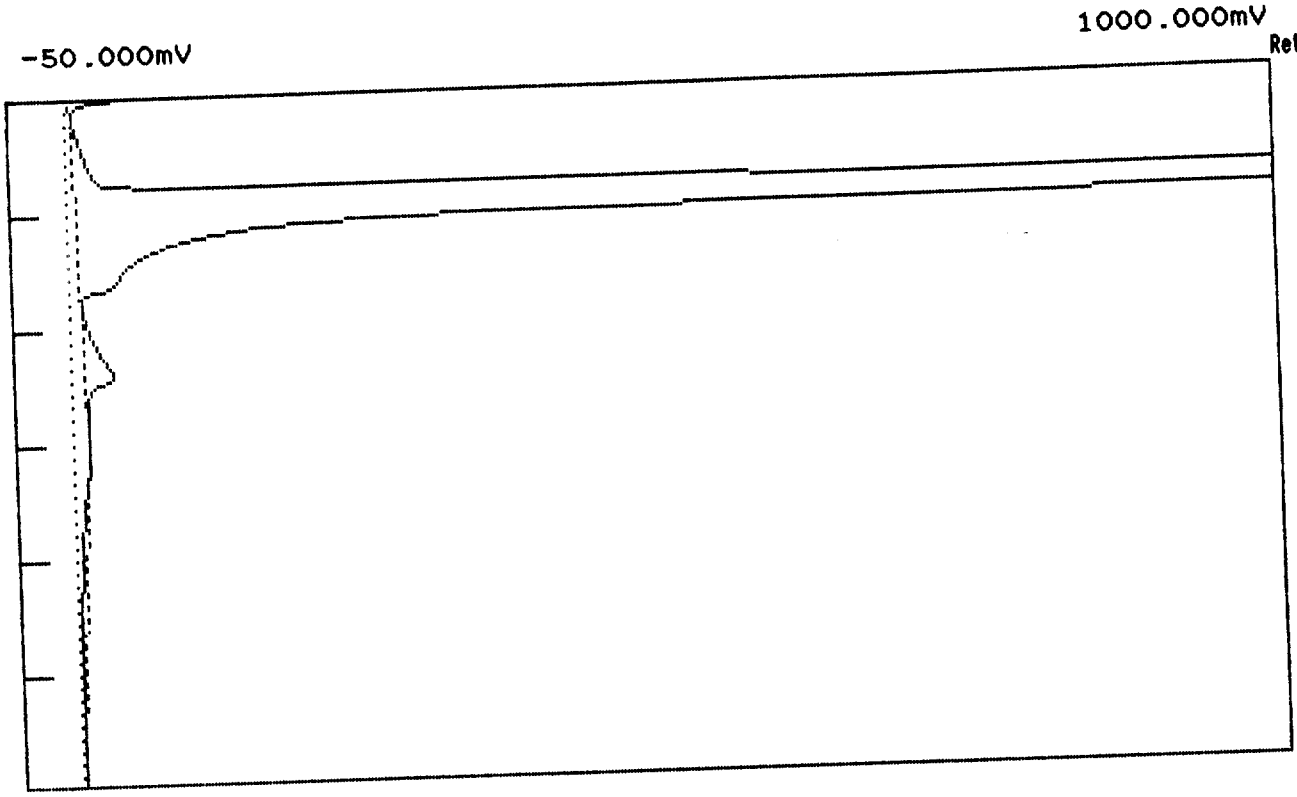
Retention	Area
0.000	23.00
0.825	44145.61
2.375	442.19
	44610.81

Operator : REP
Description : BFI inlet
Conditions : I-M18-2g
File : BFIin-31.CHR
Date : 09/02/1992
Time : 20:26:37



Retention	Area
0.000	61.70
0.825	44824.40
2.400	482.55
	45368.66

Operator : REP
Description : BFI inlet
Conditions : I-M18-3a
File : BFIin-34.CHR
Date : 09/02/1992
Time : 21:36:25

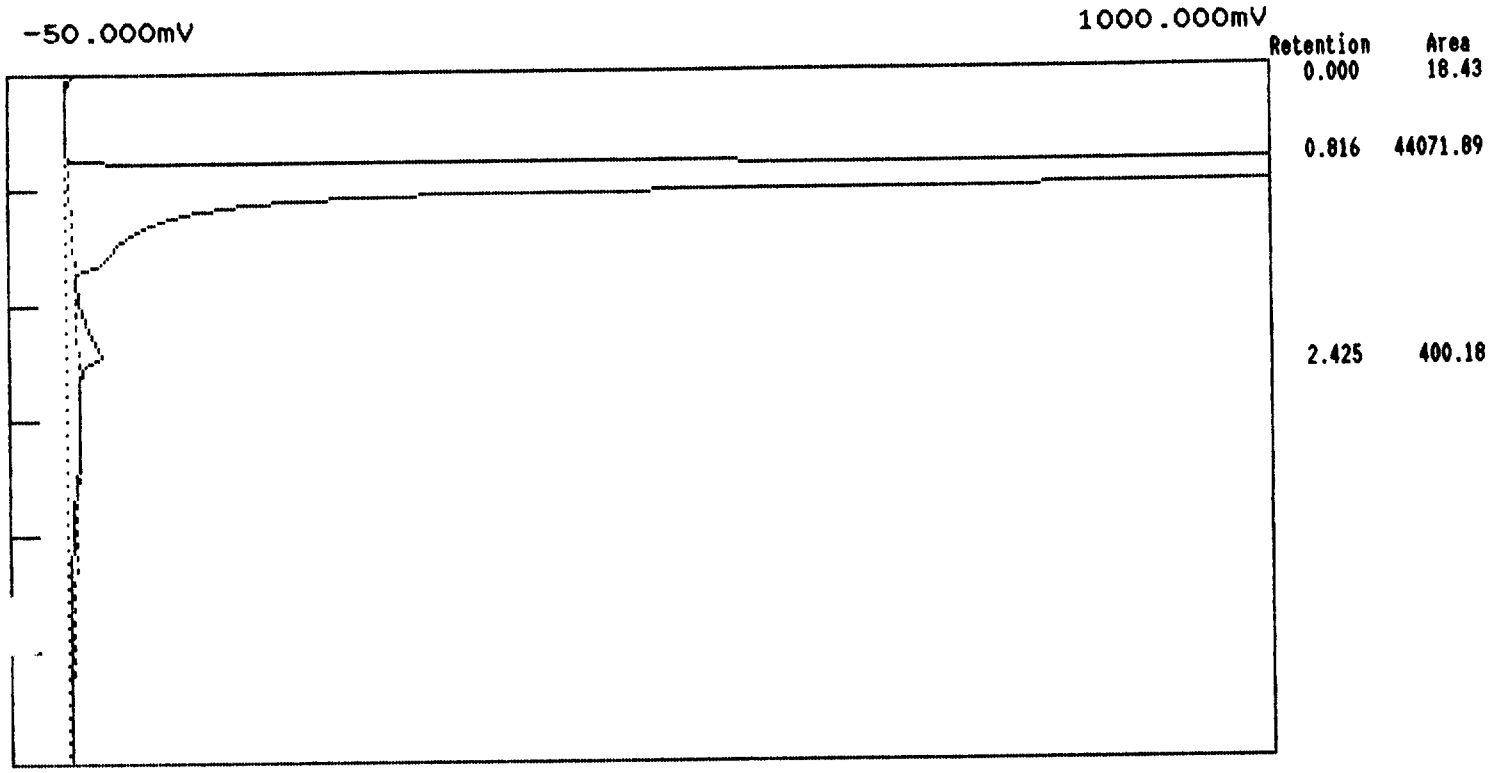


Retention	Area
0.000	91.88
0.816	45283.54
2.391	497.12

Retention	Area
0.000	91.88
0.816	45283.54
2.391	497.12

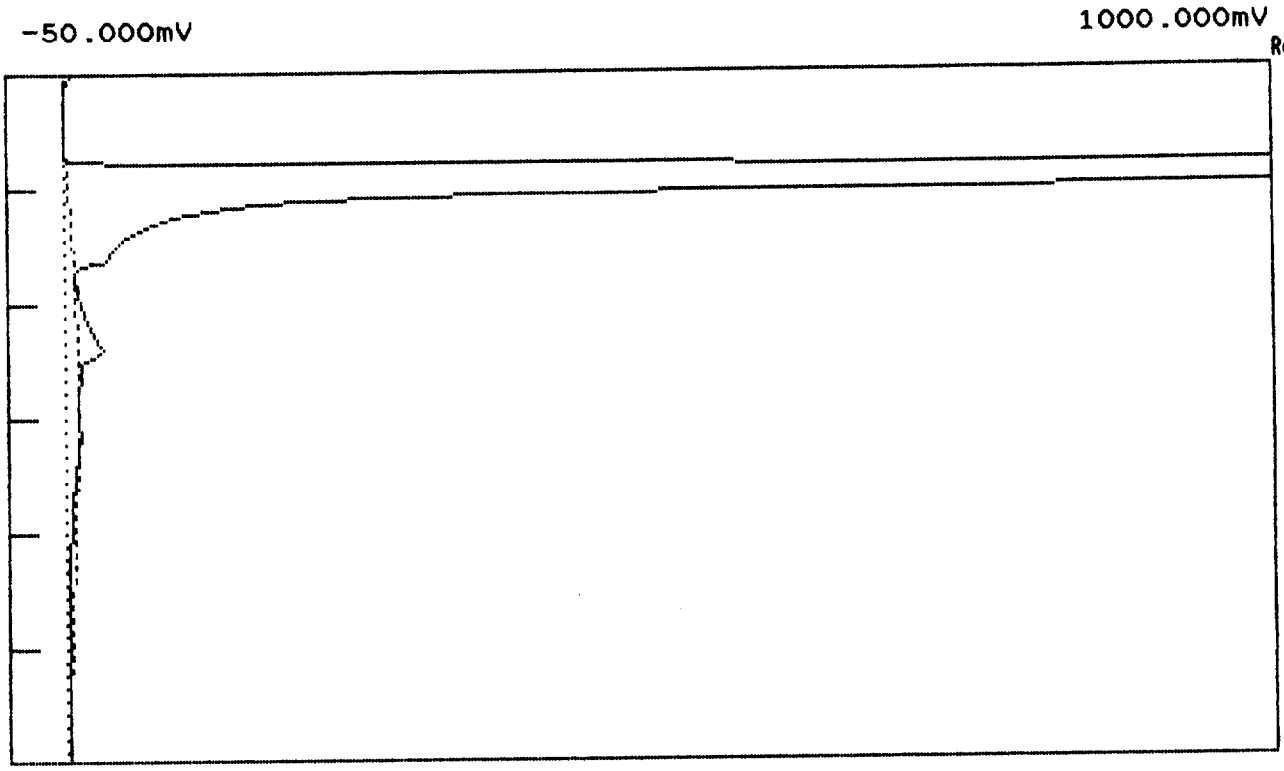
45872.54

Operator : REP
Description : BFI inlet
Conditions : I-M18-3 b
File : BFIin-35.CHR
Date : 09/02/1992
Time : 21:44:34



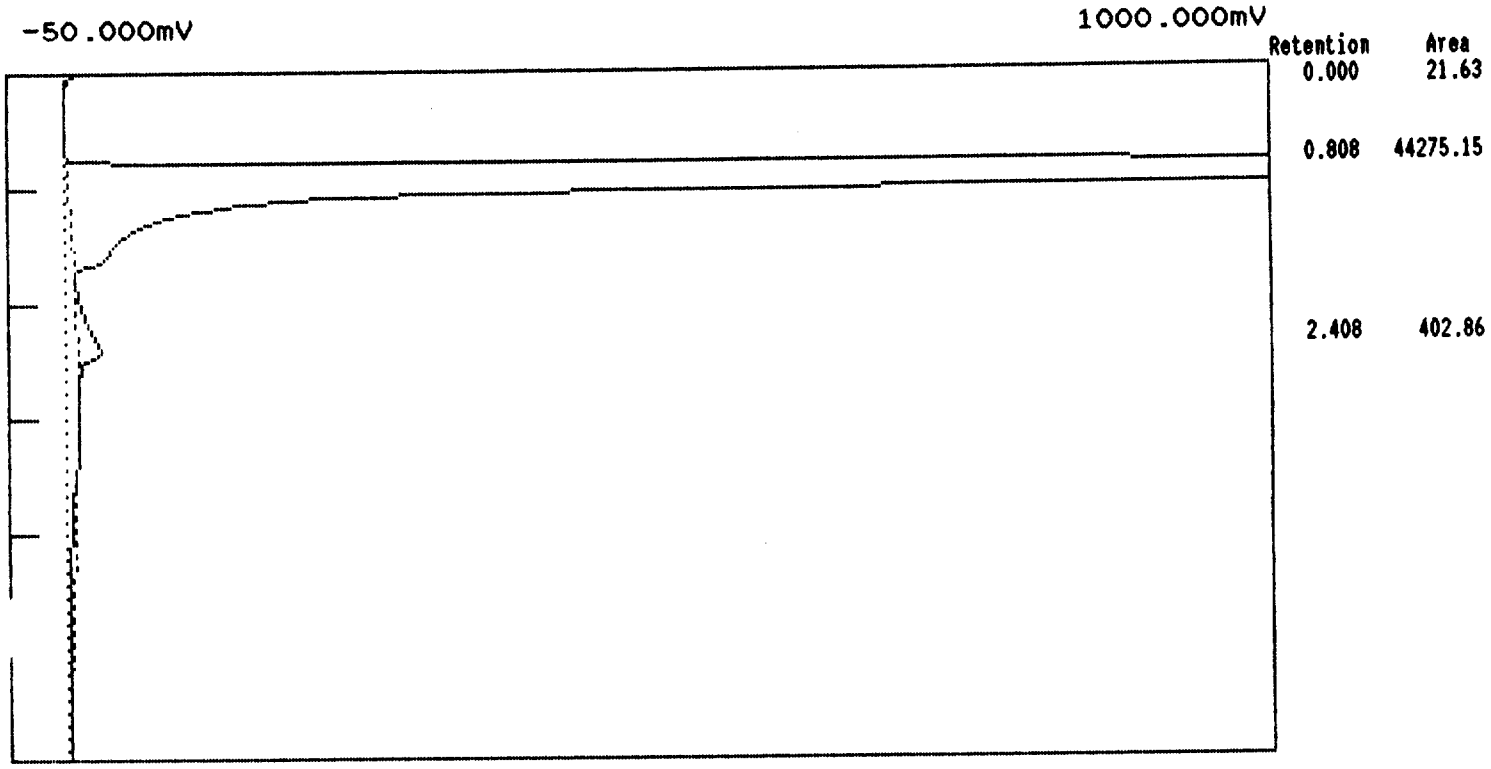
Retention	Area
0.000	18.43
0.816	44071.89
2.425	400.18
	44490.50

Operator : REP
Description : BFI inlet
Conditions : I-M18-3C
File : BFIin-36.CHR
Date : 09/02/1992
Time : 21:54:18



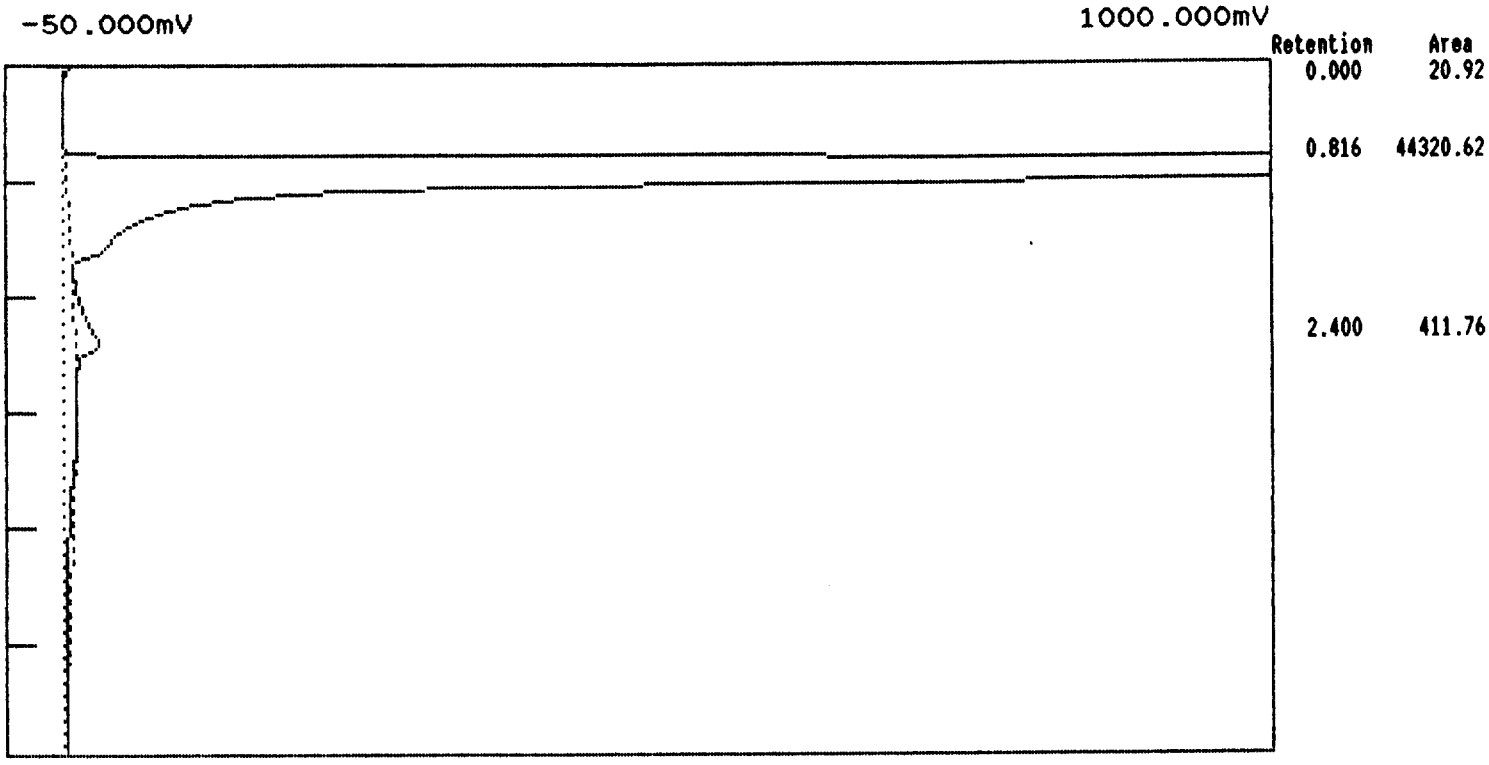
Retention	Area
0.000	19.59
0.825	44316.09
2.391	424.68
	44760.35

Operator : REP
Description : BFI inlet
Conditions : I-M18-3d
File : BFIin-37.CHR
Date : 09/02/1992
Time : 22:06:12



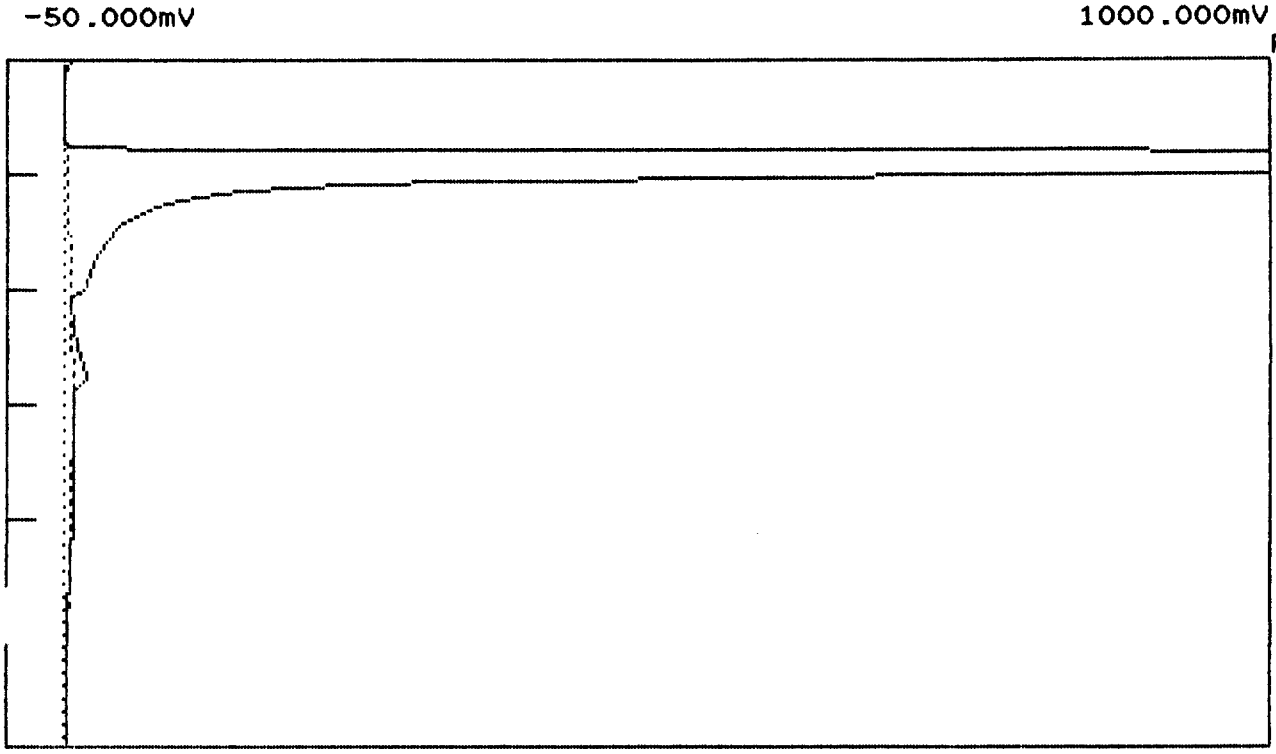
Retention	Area
0.000	21.63
0.808	44275.15
2.408	402.86
	44699.64

Operator : REP
Description : BFI inlet
Conditions : I-M18-3 e
File : BFIin-38.CHR
Date : 09/02/1992
Time : 22:15:23



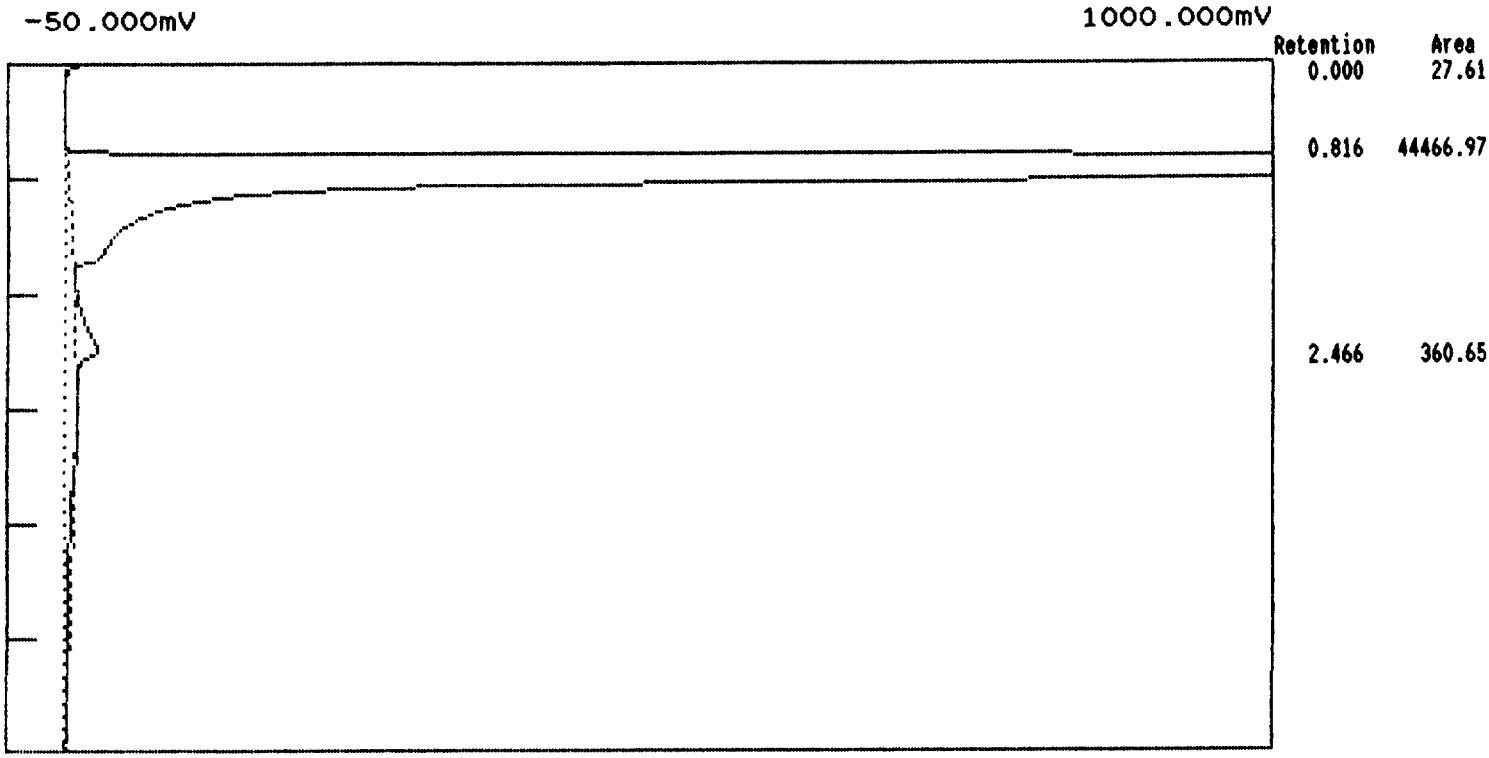
Retention	Area
0.000	20.92
0.816	44320.62
2.400	411.76
	44753.30

Operator : REP
Description : BFI inlet
Conditions : I-M18-3 f
File : BFIin-39.CHR
Date : 09/02/1992
Time : 22:25:24



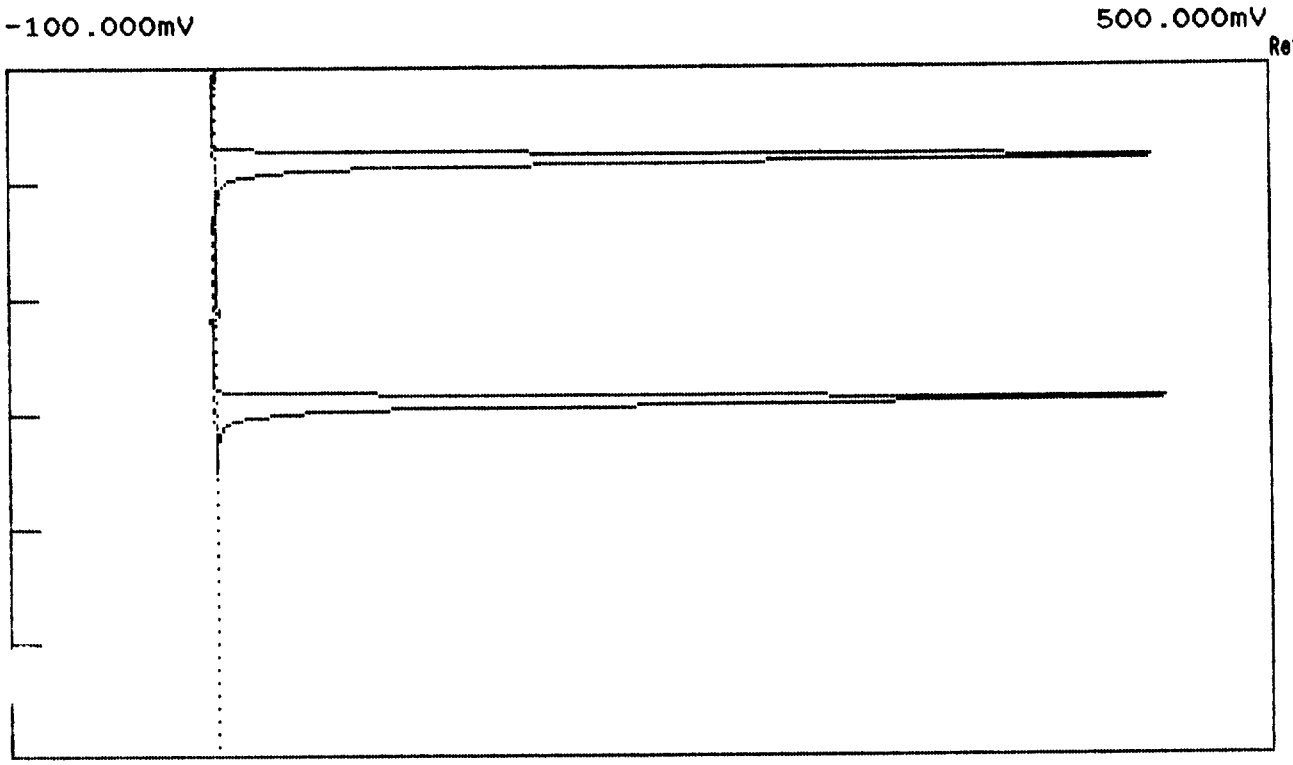
Retention	Area
0.000	21.64
0.816	45686.79
2.766	223.63
3.900	68.93
	46000.98

Operator : REP
Description : BFI inlet
Conditions : I-M18-3 g
File : BFIin-40.CHR
Date : 09/02/1992
Time : 22:36:16



Retention	Area
0.000	27.61
0.816	44466.97
2.466	360.65
	44855.22

Operator : REP
Description : BFI inlet
Conditions : I-M3-1 CH4 inlet; see dilution sheet
File : BFI-108.CHR
Date : 09/09/1992
Time : 13:12:45

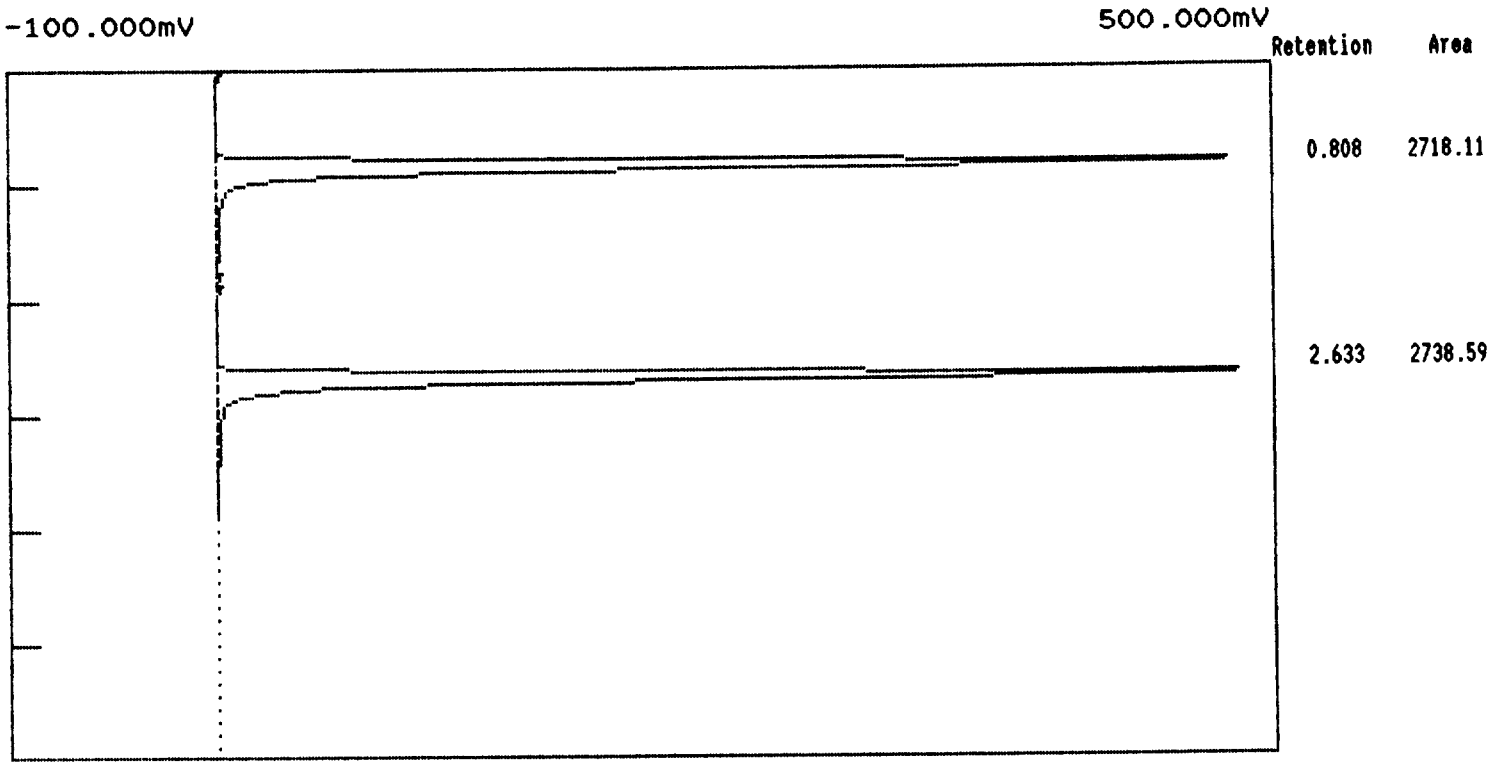


Retention	Area
0.766	2578.61
1.858	23.80
2.116	13.62
2.350	11.50
2.866	2598.30

Retention	Area
0.766	2578.61
1.858	23.80
2.116	13.62
2.350	11.50
2.866	2598.30

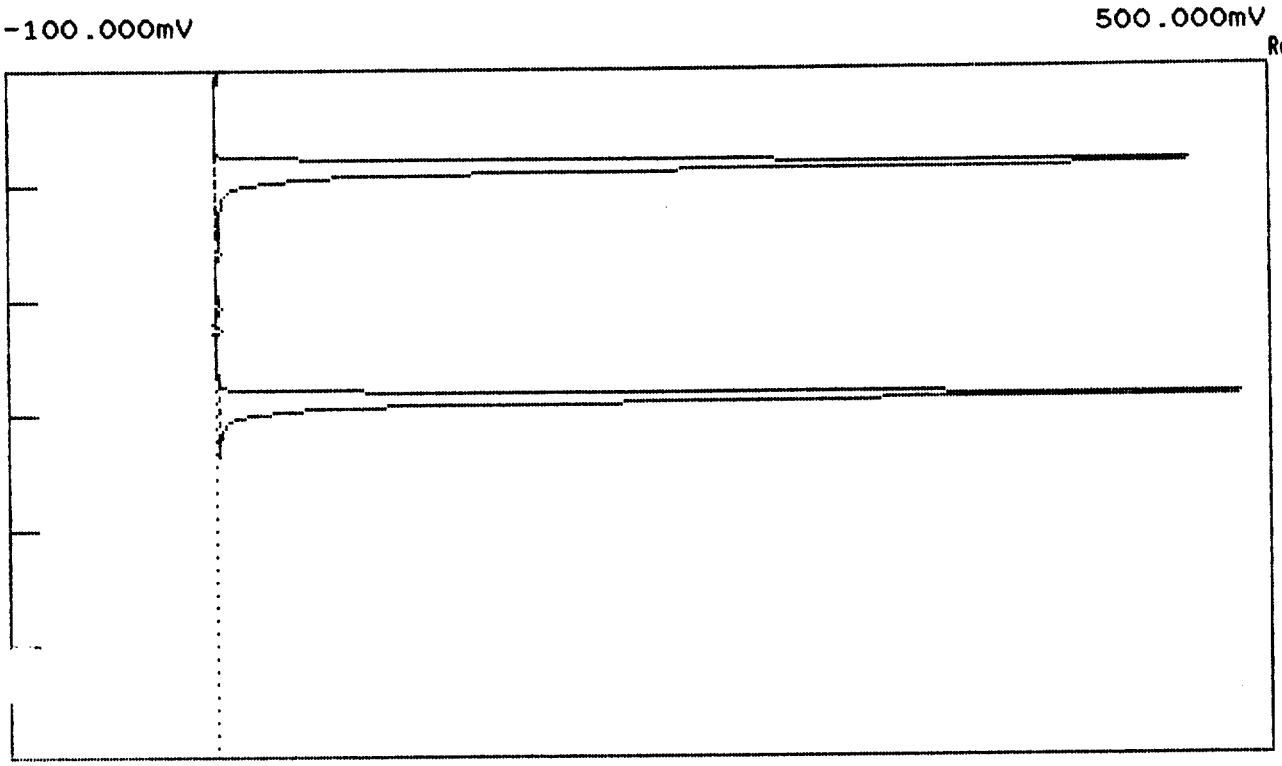
5225.84

Operator : REP
Description : BFI inlet
Conditions : I-M3-2 CH4 inlet; see dilution sheet
File : BFI-109.CHR
Date : 09/09/1992
Time : 13:20:34



Retention	Area
0.808	2718.11
2.633	2738.59
	5456.70

Operator : REP
Description : BFI inlet
Conditions : I-M3-3 CH4 inlet; see dilution sheet
File : BFI-111.CHR
Date : 09/09/1992
Time : 13:37:58



Retention	Area
0.808	2772.97
2.050	12.35
2.833	2675.26
	5460.58

Appendix C. Field Data Sheets and Analytical Results

Plant: Browning Ferris Industries
Sampling Location: Vapor Flare

		1	2	3
	Test Date	09/02/92	09/02/92	09/02/92
	Run Start Time	1619	1925	2135
	Run Stop Time	1721	2025	2235
Theta	Net Run Time, Minutes	60	60	60
Pbar	Barometric Pressure, In. Hg	29	29	29
	Flare Inlet Parameters			
Cp	Pitot Tube Coefficient	0.84	0.84	0.84
%H2O	Moisture Content, Percent by Volume	1.47	1.47	1.47
Mfd	Dry Mole Fraction	0.985	0.985	0.985
%CO2	Carbon Dioxide, Percent By Volume, Dry	31.3	31.4	31.3
%O2	Oxygen, Percent By Volume, Dry	3.4	3.3	3.3
%CO+N2	Est. CO + N2, Percent By Difference	32.0	29.3	29.1
Md	Gas Molecular Weight, lb/lb-Mole, Dry	29.22	28.91	28.86
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	29.06	28.75	28.70
Pg	Flue Gas Static Pressure, In. H2O	9.7	9.6	9.5
Ps	Absolute Flue Gas Pressure, In. Hg	29.71	29.71	29.70
ts	Temperature, Degrees F	130	130	128
Delta-p	Average Velocity Head, Inches H2O	2.6	2.6	2.6
vs	Gas Velocity, Feet/Second	95.72	96.23	96.18
A	Stack/Duct Area, Square Inches	95.0	95.0	95.0
Qsd	Volumetric Air Flow Rate, Dry SCFM*	3,319	3,336	3,345
	Methane			
%CH4w	Concentration, Percent By Vol., Wet	32.7	35.36	35.66
%CH4d	Concentration, Percent By Vol., Dry	33.2	35.9	36.2
	Non-Methane Organics as C			
Fwt	Formula Weight, lb/lb-mole	12.01	12.01	12.01
%NMOw	Concentration, Percent By Vol., Wet	0.143	0.148	0.138
%NMOd	Concentration, Percent By Vol., Dry	0.145	0.150	0.140
lb/hrNMO	Emission Rate, lb/hr	9.02	9.37	8.76
lb/hrTOT	Total Organics as C Emissions, lb/hr	2,069	2,248	2,273
	Flare Outlet Parameters			
%H2O	Moisture Content, Percent by Volume	9.3	12.4	12
Mfd	Dry Mole Fraction	0.907	0.876	0.880
%CO2	Carbon Dioxide, Percent By Vol., Dry	10	9.8	10.4
ppmCO	Carbon Monoxide, PPM By Volume, Dry	1.3	2.1	0
Qsd	Volumetric Air Flow Rate, Dry SCFM*	11,095	12,304	11,717
	Methane			
ppmCH4w	Concentration, PPM By Vol., Wet	0	0	0
ppmCH4d	Concentration, PPM By Vol., Dry	0	0	0
	Non-Methane Organics as C			
Fwt	Formula Weight, lb/lb-mole	12.01	12.01	12.01
ppmNMOw	Concentration, PPM By Vol., Wet	< 5.9	< 5.9	< 5.9
ppmNMOd	Concentration, PPM By Vol., Dry	< 6.50	< 6.74	< 6.70
lb/hrNMO	Emission Rate, lb/hr	< 0.135	< 0.155	< 0.147
lb/hrTOT	Total Organics as C Emissions, lb/hr	< 0.135	< 0.155	< 0.147
	Destruction Efficiency, Percent			
%DRE-NM	Non-Methane Organics	> 98.5%	> 98.3%	> 98.3%
%DRE-Tot	Total Organics	> 99.99%	> 99.99%	> 99.99%

* 68 Degrees F (20 Degrees C) -- 29.92 Inches of Mercury (Hg)

FIELD DATA AND RESULTS TABULATION

PLANT: Browning Ferris Industries

SAMPLING LOCATION: Incinerator inlet

		I-M3/18-1	I-M3/18-2	I-M3/18-3
Test Date		9/2/92	9/2/92	9/2/92
Run Start Time		1620	1925	2135
Run Finish Time		1720	2025	2235
= = = = = = Field Data = = = = = =				
Vmtk	Volume of Sample Tank, Liters	4.3	4.5	4.51
Vmstd	Volume of Gas Sampled, DSL*	3.849	4.076	4.065
Pbar	Barometric Pressures, Inches Hg			
	Field Pretest	29.02	29.02	29.02
	Field Post test	29.02	28.75	28.66
	1st Pressurization-field or lab	29.72	29.72	29.72
tt	Tank Temperatures, Deg F			
	Field Pretest	82	82	82
	Field Post test	76	70	68
	1st Pressurization-field or lab	70	70	70
Pt	Tank GAUGE Pressures, mm Hg			
	Field Pretest	-688	-696	-692
	Field Post test	0	0	0
	1st Pressurization-field or lab	806	806	810
= = = = Lab Analysis Data = = = =				
	Lab Temperature, Degrees F	70	70	70
	Lab Barometric Pressure, Inches Hg	29.72	29.72	29.72
	1st Pressurization Reading, mm Hg	NA	NA	NA
	GAUGE After Analysis	-640	-644	-644
	2nd Pressurization Readings, mm Hg			
	GAUGE After Pressurization	804	808	812
	GAUGE After Analysis	NA	NA	NA
	Methane			
ppmvd	Concentration, ppmvd			
	As Analyzed (Diluted), ppm	10,527	11,091	11,074
	Actual Sample, ppm	327,003	353,578	356,625

* 68 °F (20° C) -- 29.92 Inches of Mercury (Hg)

FIELD DATA AND RESULTS TABULATION

PLANT: Browning Ferris Industries, Pittsburgh, PA

SAMPLING LOCATION: Vapor Flare Stack

			O-M26-1	O-M26-2	O-M26-3
	Test Date		09/02/92	09/02/92	09/02/92
	Run Start Time Run Finish Time		1620 1720	1925 2025	2135 2235
	Net Sampling Points		1	1	1
Theta	Net Run Time, Minutes		60	60	60
Y	Dry Gas Meter Calibration Factor		0.9986	0.9986	0.9986
Pbar	Barometric Pressure, Inches Hg		29.0	29.0	29.0
Delta H	Avg. Pressure Differential of Meter, Inches H2O		1.71	1.68	1.70
Vm	Volume of Metered Gas Sample, Liters		123.410	121.650	122.810
tm	Dry Gas Meter Temperature, Degrees F		83	79	76
Vmstd	Volume of Metered Gas Sample, DSL*		116.652	115.833	117.598
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml		9.0	12.3	12.0
Vwstd	Volume of Water Vapor, SCF*		0.424	0.579	0.565
%H2O	Moisture Content, Percent by Volume		9.3	12.4	12.0
Qsd	Volumetric Air Flow Rate, Dry SCFM*		11,095	12,304	11,717
	<u>Chlorine</u>				
Fwt	Formula Weight, gm/gm-Mole		70.90	70.90	70.90
µg	Catch Weight, micrograms	<	79.1	< 79.1	< 79.1
ppmvd	Concentration, ppmvd	<	0.230	< 0.232	< 0.228
lb/hr	Emission Rate, lb/hr	<	0.0282	< 0.0315	< 0.0295
	<u>Hydrogen Chloride</u>				
Fwt	Formula Weight, Lb/Lb-Mole		36.46	36.46	36.46
µg	Catch Weight, micrograms		118	186	70.8
ppmvd	Concentration, ppmvd		0.667	1.06	0.397
lb/hr	Emission Rate, lb/hr		0.0420	0.0740	0.0264

* 68 °F (20 °C) -- 29.92 Inches of Mercury (Hg)

TABLE 1

CHLORINE AND HYDROGEN CHLORIDE TESTS SUMMARY

Vapor Flare Stack

		O-M26-1		O-M26-2		O-M26-3		Average
Test Date		09/02/92		09/02/92		09/02/92		
Run Start Time		1620		1925		2135		
Run Finish Time		1720		2025		2235		
Volume of Dry Gas Sample, DSL*		116.652		115.833		117.598		
Flue Gas Parameters								
Air Flow Rate, Dry SCFM*		11,095		12,304		11,717		11,705
Chlorine								
Concentration, ppmvd	<	0.230	<	0.232	<	0.228	<	0.230
Emission Rate, lb/hr	<	0.0282	<	0.0315	<	0.0295	<	0.0297
Hydrogen Chloride								
Concentration, ppmvd		0.667		1.06		0.397		0.708
Emission Rate, lb/hr		0.0420		0.0740		0.0264		0.0475

Cl2 Analytical Data Sheet (Version 05.06.92)

Job Name:	BFI	Job Num.	11117
File Pathway:	H:\JOBS\11117\LAB\CL2'S.WQ1	File:	Cl2's
Analyst:	**JB Nemet**	Date:	08-Sep-92
Sampling Location:	Vapor Flare Stack		

Chloride Standard Calibration Curve by Linear Regression

Cl- Conc. (ug/ml)	Standard Areas Inj. 1	Inj. 2	Average Area	% Diff.		Calculated Std Conc. (ug/ml)	% Deviation from Actual
0.5	10180	10725	10453	2.61%		0.53	5.40%
1.0	20204	18346	19275	4.82%		0.98	-2.01%
1.5	28884	29006	28945	0.21%		1.48	-1.59%
2.5	50612	47828	49220	2.83%		2.52	0.68%
		27360					
Standard Curve		Slope	19482	Y-Int	186		

Field Samples in: 0.1 N NaOH

Sample ID	Inj. 1 Area	Inj. 2 Area	Average Area	% Diff.	Dilution Factor	Sample Volume (ml)	Cl2 Catch (ugs)
Rgt Blank	<10453	<10453	<10453	0.00%	1	75	<79.1
O-M26-1	<10453	<10453	<10453	0.00%	1	75	<79.1
O-M26-2	<10453	<10453	<10453	0.00%	1	75	<79.1
O-M26-3	<10453	<10453	<10453	0.00%	1	75	<79.1

******* AUDIT REPORT *******

	Inj. 1 Area	Inj. 2 Area	Average Area	% Diff.	Expected mg/L Cl-	Calc. mg/L Cl-	% Deviation
IN-HOUSE	42519	39773	41146	3.34%	2.00	2.10	5.12%

******* SPIKE REPORT *******

Sample I.D.	Inj. 1 Area	Inj. 2 Area	Average Area	% Diff.	Expected mg/L Cl-	Calc. mg/L Cl-	% Recovery
O-M26-2	25810	26747	26279	1.78%	1.250	1.339	107.15%

Note: 8 mls of the above sample was spiked with 8 mls of a 2.5 mg/L chloride spike.

Printing Date 08-Sep-92 Printing Time 09:42 AM

HCl Analytical Data Sheet (Version 2.11.92)

Job Name:	BFI	Job Num.	11117
File Pathway:	H:\JOBS\11117\LAB\HCL'S.WQ1	File:	HCl's
Analyst:	JB Nemet	Date:	08-Sep-92
Sampling Location:	Vapor Flare Stack		

Chloride Standard Calibration Curve by Linear Regression

Cl- Conc. (ug/ml)	Standard Areas Inj. 1	Inj. 2	Average Area	% Diff.	Calculated Std Conc. (ug/ml)	% Deviation from Actual
0.5	25756	25445	25601	0.61%	0.51	1.31%
1.5	75406	75078	75242	0.22%	1.51	0.44%
2.5	123603	123403	123503	0.08%	2.48	-0.84%
5.0	248621	249457	249039	0.17%	5.01	0.16%

Standard Curve — Slope: 49638 — Y-Int: 455

Field Samples in: 0.1 N H2SO4

Sample ID	Inj. 1 Area	Inj. 2 Area	Average Area	% Diff.	Dilution Factor	Sample Volume (ml)	HCl Catch (ugs)
Rgt Blank	<10240	<10240	<10240	0.00%	1	75	**<15.2**
O-M26-1	76652	76614	76633	0.02%	1	75	**118**
O-M26-2	120429	120000	120215	0.18%	1	75	**186**
O-M26-3	45747	46336	46042	0.64%	1	75	**70.8**

***** AUDIT REPORT *****	Inj. 1	Inj. 2	Average Area	% Dev.	Expected mg/L Cl-	Calc. mg/L Cl-	Percent Diff.
IN-HOUSE	98444	99042	98743	0.30%	2.00	1.98	-1.00%

***** SPIKE REPORT ***** Sample I.D.	Inj. 1	Inj. 2	Average Area	% Dev.	Expected mg/L Cl-	Calc. mg/L Cl-	% Recovery
O-M26-2	123518	123822	123670	0.12%	1.25	1.28	102.07%

Note: 0.8 mls of the above sample was spiked with 0.8 mls of a 2.5 mg/L chloride spike.

Printing Date 08-Sep-92 Printing Time 12:53 PM

CALCULATION OF AVERAGE CARBON DIOXIDE CONCENTRATION

RUN: I-M3-1

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 % CO2	0.50	0.50	0.50
10.90 % CO2	10.90	10.90	10.90

$\bar{C}$ = 30.4 % CO2

CORRECTED RESULTS

31.3 % Carbon Dioxide

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: TEST METHOD 3A CORRECTION

TEST DATE: 09-02-92

RUN NUMBER: I-M3-1

SPAN VALUE: 50 % Carbon Dioxide

		------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)
CO2 ZERO GAS	0.50	0.50	0.00	0.50	0.00	0.00
CO2 UP-SCALE	10.90	10.90	0.00	10.90	0.00	0.00

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE CARBON DIOXIDE CONCENTRATION

RUN: I-M3-2

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 % CO2	0.50	0.50	0.50
10.90 % CO2	10.90	10.90	10.90

$\bar{C}$ = 30.5 % CO2

CORRECTED RESULTS

31.4 % Carbon Dioxide

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: TEST METHOD 3A CORRECTION

TEST DATE: 09-02-92

RUN NUMBER: I-M3-2

SPAN VALUE: 50 % Carbon Dioxide

		------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)
CO2 ZERO GAS	0.50	0.50	0.00	0.50	0.00	0.00
CO2 UP-SCALE	10.90	10.90	0.00	10.90	0.00	0.00

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE CARBON DIOXIDE CONCENTRATION

RUN: I-M3-3

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 % CO2	0.50	0.50	0.50
10.90 % CO2	10.90	10.90	10.90

$\bar{C}$ = 30.4 % CO2

CORRECTED RESULTS

31.3 % Carbon Dioxide

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: TEST METHOD 3A CORRECTION

TEST DATE: 09-02-92

RUN NUMBER: I-M3-3

SPAN VALUE: 50 % Carbon Dioxide

		------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)
CO2 ZERO GAS	0.50	0.50	0.00	0.50	0.00	0.00
CO2 UP-SCALE	10.90	10.90	0.00	10.90	0.00	0.00

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE OXYGEN CONCENTRATION

RUN: I-3-1

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 % Oxygen	0.10	0.10	0.10
12.03 % Oxygen	12.07	12.07	12.07

$\bar{C}$ = 3.5

CORRECTED RESULTS

3.4 % Oxygen

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITSBURG Pa.

TEST DATE: 09-02-92

RUN NUMBER: I-M3-1

SPAN VALUE: 25 % Oxygen

		------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)
02 ZERO GAS	0.02	0.20	0.72	0.20	0.72	0.00
02 UP-SCALE	12.03	12.07	0.16	12.07	0.16	0.00

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE OXYGEN CONCENTRATION

RUN: I-M3-2

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 % Oxygen	0.10	0.10	0.10
12.03 % Oxygen	12.07	12.07	12.07

$\bar{C}$ = 3.4

CORRECTED RESULTS

3.3 % Oxygen

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITSBURG Pa.

TEST DATE: 09-02-92

RUN NUMBER: I-M3-2

SPAN VALUE: 25 % Oxygen

		------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)
02 ZERO GAS	0.02	0.20	0.72	0.20	0.72	0.00
02 UP-SCALE	12.03	12.07	0.16	12.07	0.16	0.00

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE OXYGEN CONCENTRATION

RUN: I-M3-3

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 % Oxygen	0.10	0.10	0.10
12.03 % Oxygen	12.07	12.07	12.07

$\bar{C}$ = 3.4

CORRECTED RESULTS

3.3 % Oxygen

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITSBURG Pa.

TEST DATE: 09-02-92

RUN NUMBER: I-M3-3

SPAN VALUE: 25 % Oxygen

		------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)
02 ZERO GAS	0.02	0.20	0.72	0.20	0.72	0.00
02 UP-SCALE	12.03	12.07	0.16	12.07	0.16	0.00

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE OXYGEN CONCENTRATION

RUN: O-M3A-1

SOURCE: BFI PITTSBURG,Pa.

TEST DATE: 09-03-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 % Oxygen	0.06	0.07	0.07
12.03 % Oxygen	12.01	12.13	12.07

$\bar{C}$ = 9.66

CORRECTED RESULT
9.6 % Oxygen

Corrected Conc. = $[(Cma - Coa)/(Cm - Co)](\bar{C} - Cm) + Cma$

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITTSBURG,Pa.

TEST DATE: 09-03-92

RUN NUMBER: O-M3A-1

SPAN VALUE: 25 % Oxygen

		------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)
O2 LOW GAS	0.03	0.06	0.12	0.07	0.16	0.04
O2 UP-SCALE	12.09	12.01	-0.32	12.13	0.16	0.48

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE CARBON DIOXIDE CONCENTRATION

RUN: O-M3A-1

SOURCE: BFI PITTSBURG,Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 % CO2	0.40	0.50	0.45
10.90 % CO2	10.80	10.50	10.65

$\bar{C}$ = 9.8 % CO2

CORRECTED RESULTS

10.0 % Carbon Dioxide

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITTSBURG,Pa.

TEST DATE: 09-02-92

RUN NUMBER: 0-M3A-1

SPAN VALUE: 20 % Carbon Dioxide

		------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)
CO2 ZERO GAS	0.50	0.40	-0.50	0.50	0.00	0.50
CO2 UP-SCALE	10.90	10.80	-0.50	10.50	-2.00	-1.50

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE OXYGEN CONCENTRATION

RUN: O-M3A-2

SOURCE: BFI PITTSBURG,Pa.

TEST DATE: 09-03-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 % Oxygen	0.30	0.08	0.19
12.03 % Oxygen	12.12	12.11	12.12

$\bar{C}$ = 9.30

CORRECTED RESULT

9.2 % Oxygen

Corrected Conc. = $[(Cma - Coa)/(Cm - Co)](\bar{C} - Cm) + Cma$

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITTSBURG,Pa.

TEST DATE: 09-03-92

RUN NUMBER: 0-M3A-2

SPAN VALUE: 25 % Oxygen

		------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)
O2 LOW GAS	0.13	0.08	-0.20	0.07	-0.24	-0.04
O2 UP-SCALE	12.12	12.11	-0.04	12.13	0.04	0.08

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE CARBON DIOXIDE CONCENTRATION

RUN: O-M3A-2

SOURCE: BFI PITTSBURG,Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 % CO2	0.40	0.50	0.45
10.90 % CO2	10.90	10.90	10.90

$\bar{C}$ = 9.8 % CO2

CORRECTED RESULTS

9.8 % Carbon Dioxide

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITTSBURG,Pa.

TEST DATE: 09-02-92

RUN NUMBER: O-M3A-1

SPAN VALUE: 20 % Carbon Dioxide

		------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)
CO2 ZERO GAS	0.50	0.40	-0.50	0.50	0.00	0.50
CO2 UP-SCALE	10.90	10.90	0.00	10.90	0.00	0.00

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE CARBON DIOXIDE CONCENTRATION

RUN: O-M3A-3

SOURCE: BFI PITTSBURG,Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 % CO2	0.50	0.50	0.50
10.90 % CO2	10.90	10.90	10.90

$\bar{C}$ = 10.4 % CO2

CORRECTED RESULTS

10.4 % Carbon Dioxide

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITTSBURG,Pa.

TEST DATE: 09-02-92

RUN NUMBER: 0-M3A-3

SPAN VALUE: 20 % Carbon Dioxide

		------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)
CO2 ZERO GAS	0.50	0.50	0.00	0.50	0.00	0.00
CO2 UP-SCALE	10.90	10.90	0.00	10.90	0.00	0.00

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE OXYGEN CONCENTRATION

RUN: O-M3A-3

SOURCE: BFI PITTSBURG,Pa.

TEST DATE: 09-03-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 % Oxygen	0.08	0.10	0.09
12.03 % Oxygen	12.11	12.07	12.09

$\bar{C}$ = 9.30

CORRECTED RESULT

9.2 % Oxygen

Corrected Conc. = $[(Cma - Coa)/(Cm - Co)](\bar{C} - Cm) + Cma$

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITTSBURG,Pa.

TEST DATE: 09-03-92

RUN NUMBER: 0-M3A-3

SPAN VALUE: 25 % Oxygen

		------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)
O2 LOW GAS	0.08	0.10	0.08	0.07	-0.04	-0.12
O2 UP-SCALE	12.11	12.07	-0.16	12.13	0.08	0.24

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE SO2 CONCENTRATION

RUN: O-M6C-2

SOURCE: BFI PITTABURG Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 ppmSO2	0.40	0.50	0.45
50.50 ppmSO2	50.20	50.00	50.10

$\bar{C}$ = 1.8 ppmSO2

CORRECTED RESULTS

1.3 ppmSO2

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITTABURG Pa.

TEST DATE: 09-02-92

RUN NUMBER: 0-M6C-2

SPAN VALUE: 100 ppmSO2

	ANALYZER CAL. RESPONSE	------INITIAL VALUES------ SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	------FINAL VALUES------ SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
SO2 ZERO GAS	0.00	0.40	0.40	0.50	0.50	0.10
SO2 UP-SCALE	51.20	50.20	-1.00	50.00	-1.20	-0.20

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE SO2 CONCENTRATION

RUN: O-M6C-1

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 ppmSO2	0.20	0.00	0.10
50.50 ppmSO2	50.30	50.00	50.15

$\bar{C}$ = -1.4 ppmSO2

CORRECTED RESULTS

-1.5 ppmSO2

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

RUN NUMBER: 0-M6C-1

SPAN VALUE: 100 ppmSO2

		------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)
SO2 ZERO GAS	0.00	0.20	0.20	0.00	0.00	-0.20
SO2 UP-SCALE	50.50	50.30	-0.20	50.00	-0.50	-0.30

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE SO2 CONCENTRATION

RUN: O-M6C-3

SOURCE: BFI PITTABURG Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 ppmSO2	0.50	0.10	0.30
50.50 ppmSO2	50.00	50.80	50.40

$\bar{C}$ = 3.2 ppmSO2

CORRECTED RESULTS

2.9 ppmSO2

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITTABURG Pa.

TEST DATE: 09-02-92

RUN NUMBER: O-M6C-3

SPAN VALUE: 100 ppmSO2

		------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)
SO2 ZERO GAS	0.00	0.50	0.50	0.10	0.10	-0.40
SO2 UP-SCALE	51.20	50.00	-1.20	50.80	-0.40	0.80

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE NOx CONCENTRATION

RUN: O-M7E-1

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 ppmNOx	0.30	4.50	2.40
49.80 ppmNOx	50.00	49.70	49.85

$\bar{C}$ = 15.1 ppmNOx

CORRECTED RESULTS

13.3 ppmNOx

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

RUN NUMBER: O-M7E-1

SPAN VALUE: 1000 ppmNOx

		------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)
NOx ZERO GAS	0.00	0.30	0.03	4.50	0.45	0.42
NOx UP-SCALE	50.20	50.00	-0.02	49.70	-0.05	-0.03

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE NOx CONCENTRATION

RUN: O-M7E-2

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 ppmNOx	0.30	0.50	0.40
49.80 ppmNOx	49.50	49.40	49.45

$\bar{C}$ = 11.7 ppmNOx

CORRECTED RESULTS

11.5 ppmNOx

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

RUN NUMBER: O-M7E-2

SPAN VALUE: 100 ppmNOx

		------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)
NOx ZERO GAS	0.20	0.30	0.10	0.50	0.30	0.20
NOx UP-SCALE	50.00	49.50	-0.50	49.40	-0.60	-0.10

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE NOx CONCENTRATION

RUN: O-M7E-3

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 ppmNOx	0.50	-0.60	-0.05
49.80 ppmNOx	49.40	48.60	49.00

$\bar{C}$ = 10.5 ppmNOx

CORRECTED RESULTS

10.7 ppmNOx

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

RUN NUMBER: 0-M7E-3

SPAN VALUE: 100 ppmNOx

		------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)
NOx ZERO GAS	0.20	0.50	0.30	-0.60	-0.80	-1.10
NOx UP-SCALE	50.00	49.40	-0.60	48.60	-1.40	-0.80

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE CARBON MONOXIDE CONCENTRATION

RUN: 0-M10-1

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 ppm CO	0.20	0.00	0.10
302.00 ppm CO	304.00	302.80	303.40

$\bar{C}$ = 1.4 ppm CO

CORRECTED RESULTS

1.3 ppm CO

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

RUN NUMBER: 0-M10-1

SPAN VALUE: 500 ppm CO

		------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)
CO ZERO GAS	0.20	0.20	0.00	0.00	-0.04	-0.04
CO UP-SCALE	302.60	304.00	0.28	302.80	0.04	-0.24

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE CARBON MONOXIDE CONCENTRATION

RUN: O-M10-2

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 ppm CO	0.50	0.00	0.25
302.00 ppm CO	301.80	301.80	301.80

$\bar{C}$ = 2.4 ppm CO

CORRECTED RESULTS

2.1 ppm CO

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

RUN NUMBER: 0-M10-2

SPAN VALUE: 500 ppm CO

		------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)
CO ZERO GAS	0.00	0.50	0.10	0.00	0.00	-0.10
CO UP-SCALE	303.30	301.80	-0.30	301.80	-0.30	0.00

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

CALCULATION OF AVERAGE CARBON MONOXIDE CONCENTRATION

RUN: O-M10-3

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.00 ppm CO	0.00	0.10	0.05
302.00 ppm CO	301.80	301.80	301.80

$\bar{C}$ = 0.0 ppm CO

CORRECTED RESULTS

-0.1 ppm CO

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

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

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: BFI PITTSBURG Pa.

TEST DATE: 09-02-92

RUN NUMBER: 0-M10-3

SPAN VALUE: 500 ppm CO

		------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)
CO ZERO GAS	0.00	0.00	0.00	0.10	0.02	0.02
CO UP-SCALE	303.30	301.80	-0.30	301.80	-0.30	0.00

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

GASEOUS POLLUTANT FIELD DATA, METHOD m26

Plant Name BFI Run No. 0-m26-1

City/State Pittsburgh, Pa. Job No. 1117 Date 9/2/92

Sampling Loc. Flare Outlet Time Start 1620

Barometric Press. 29.0 In. Hg Ambient Temp. 83 °F Time Finish 1726

Sample Box No. HB-9 Operator PJW Assistant(s) CEH

Meterbox I.D. V-13 Gamma 0.9986 DGM Used (√) Singer ___ Rockwell ✓

Leak Check OK? (√) Pretest ✓ Posttest ✓ Purge Duration 5 Min.

Leak Check Readings (where applicable) B ___ B ___ B ___ B ___

E ___ E ___ E ___ E ___

Vacuum, In. Mercury pre 15 = 0.00 post 11 = 0.00 ___ ___

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		DGM Reading*	Rotameter	DGM Pressure	Train Vacuum	Temperature °F		STACK
Clock	Net	((l)(cf))	Reading	In. H_2O	In. Hg	DGM	Imp Exit	Temp
1620	0	~~108.67~~ ~~10.867~~	~~2.0~~ ~~10.867~~	1.70	3	82	59	1,750.00
1625	5	118.25	2.0	1.60	3	82	58	1,749.00
1630	10	127.90	2.0	1.65	3	82	55	1,738.00
1635	15	137.75	2.0	1.70	3	82	53	1,727.00
1640	20	148.10	2.25	1.70	3	83	51	1,730.00
1645	25	158.70	2.25	1.65	3	83	50	1,752.00
1650	30	169.40	2.25	1.75	3	83	49	1,728.00
1655	35	179.70	2.25	1.80	3	83	48	1,722.00
1700	40	190.00	2.25	1.80	9	83	48	1,726.00
1705	45	200.30	2.25	1.70	10	83	48	1,728.00
1710	50	210.68	2.25	1.80	11	83	47	1,722.00
1715	55	222.00	2.0	1.70	5	83	48	1,707.00
1720 End Test	60/0	232.08						

123.41 Vol. Metered (l)(cf)*

1.71 Average DGM WC

83. Average DGM °F

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ENTROPY

GASEOUS POLLUTANT FIELD DATA, METHOD 26

Plant Name BFI Run No. 0-M26-2

City/State Pittsburgh, Pa. Job No. 11117 Date 9/2/92

Sampling Loc. Flare outlet Time Start 1925

Barometric Press. 29.0 In. Hg Ambient Temp. 76 °F Time Finish 2025

Sample Box No. 14B-9 Operator RJW Assistant(s) CEH

Meterbox I.D. V-13 Gamma 0.9986 DGM Used (√) Singer ___ Rockwell ✓

Leak Check OK? (√) Pretest ✓ Posttest ✓ Purge Duration 5 Min.

Leak Check Readings (where applicable)				
B	___	___	___	___
E	___	___	___	___
Vacuum, In. Mercury	pre. 11 = 0.009	post 10 = 0.012	___	___

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		DGM Reading* (l)(cf)	Rotameter Reading	DGM Pressure In. H_2O	Train Vacuum In. Hg	Temperature °F		Stack Temp
Clock	Net					DGM	Imp Exit	
1925	0	238.65	2.20	1.60	3	78	58	1,714. ~~00~~
1930	5	248.90	2.10	1.70	3	78	57	1,730.00
1935	10	259.0	2.10	1.75	3	78	55	1,711.00
1940	15	268.80	2.10	1.70	3	79	53	1,732.00
1945	20	278.70	2.15	1.70	3	80	52	1,725.00
1950	25	289.00	2.15	1.70	3	80	50	1,732.00
1955	30	299.30	2.15	1.66	3	80	50	1,722.00
2000	35	309.40	2.15	1.65	3	80	49	1,724.00
2005	40	319.70	2.15	1.80	3	80	49	1,715.00
2010	45	329.98	2.15	1.65	3	79	48	1,745.00
2015	50	340.21	2.15	1.60	3	79	48	1,726.00
2020	55	350.39	2.15	1.70	3	79	48	1,738.00
End Test 2025	60/0	360.30						

121.65 Vol. Metered (l)(cf)*

1.68 Average DGM WC

79 Average DGM °F

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ENTROPY

GASEOUS POLLUTANT FIELD DATA, METHOD M26

Plant Name BFI Run No. 0M26-3

City/State Pittsburgh, Pa. Job No. 1117 Date 7/2/92

Sampling Loc. Flare Outlet Time Start 2135

Barometric Press. 29.6 In. Hg Ambient Temp. 74 °F Time Finish 2235

Sample Box No. MB-9 Operator PJM Assistant(s) CEH

Meterbox I.D. V-13 Gamma 0.9986 DGM Used (√) Singer ___ Rockwell ✓

Leak Check OK? (√) Pretest ✓ Posttest ✓ Purge Duration 5 Min.

Leak Check Readings (where applicable) B ___ B ___ B ___ B ___

E ___ E ___ E ___ E ___

Vacuum, In. Mercury Pre. 12 = 0.004 Post. 10 = 0.002 ___ ___

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		DGM Reading*	Rotameter	DGM Pressure	Train Vacuum	Temperature °F		Stack
Clock	Net	(l)(cf)	Reading	In. H_2O	In. Hg	DGM	Imp Exit	Temp
2135	0	374.51	2.15	1.60	3	77	58	1,716.00
2140	5	384.40	2.15	1.80	3	78	56	1,743.00
2145	10	394.80	2.15	1.80	3	76	55	1,720.00
2150	15	405.10	2.15	1.70	3	77	54	1,714.00
2155	20	415.40	2.15	1.75	3	76	51	1,723.00
2200	25	425.70	2.15	1.75	3	76	50	1,706.00
2205	30	435.80	2.15	1.65	3	75	49	1,711.00
2210	35	446.20	2.15	1.65	3	76	49	1,727.00
2215	40	456.30	2.15	1.60	3	74	48	1,719.00
2220	45	466.50	2.15	1.65	3	76	48	1,708.00
2225	50	476.68	2.15	1.70	3	74	49	1,702.00
2230	55	486.90	2.16	1.70	3	75	49	1,720.00
2235 End Test	60.0	497.32						

122.81 Vol. Metered (l)(cf)*

1.70 Average DGM WC

76 Average DGM °F

MOISTURE ANALYTICAL RESULTS

Plant Name BFI Job No. 11117

City/State Pittsburgh PA Sampling Loc. VAPOR FLARE OUTLET

Run Number	0-M26-1	0-M26-2	0-M26-3
Sampling Date	9-2-92	9-2-92	9-2-92
Analysis Date	9-2-92	9-2-92	9-2-92
Analyst	CEH	CEH	CEH
Reagent 1 (30ml 0.1N H_2SO_4)			
Final Weight, g	63.1	64.7	68.0
Tared Weight, g	54.9	54.5	57.0
Water Catch, g	8.2 ✓	10.2 ✓	~~11.0~~ 11.0 ✓
Reagent 2 (30ml 0.1N NaOH)			
Final Weight, g	52.5	54.2	54.4
Tared Weight, g	53.2	53.9	54.4
Water Catch, g	-.7 ✓	.3 ✓	0
Reagent 3 (_____)			
Final Weight, g			
Tared Weight, g			
Water Catch, g			
CONDENSED WATER, g			
Silica Gel			
Final Weight, g	73.5	79.0	72.1
Tared Weight, g	72.0	77.2	71.1
ADSORBED WATER, g	1.5 ✓	1.8 ✓	1.0 ✓
TOTAL WATER COLLECTED, g	9 ✓	12.3 ✓	12.0 ✓

Balance No. 11 Type (✓) Triple Beam ✓ Electronic ___ Reagent Box No. 108

Balance located in stable, draft-free area (✓)? Yes ✓ No ___ (If "No", explain below.)

Comments _____

EVACUATED TANK PARAMETERS

Plant Name BFI Job No. 11117

City/State Imperial PA Sampling Loc. Vapor Flare Inlet

Tank No. 174 Tank Volume, liters 4.30 Sampling Time Start 1620

From Sampling Run No. I-M3-1 Sampling Time Finish 1720

Sample Transfer Run No. I-M18-1 Sample Transfer Date & Time 9/2/92 1745

Parameter	Barometric Pressure * In. Hg	Barometric Pressure * mm Hg	Tank Temp. * °F	Tank Temp. * °C	Tank Pressure Gauge * In. Hg	Tank Pressure Gauge * mm Hg	Leak Check cm Hg change Tank	Leak Check cm Hg change System
Pretest		737	82		-	-688		
Posttest		737	76		-	0		
1st (Field) Pressurization					+			

Operator

Tank No. 221 Tank Volume, liters 4.50 Sampling Time Start 1925

From Sampling Run No. I-M3-2 Sampling Time Finish 2025

Sample Transfer Run No. I-M18-2 Sample Transfer Date & Time 9/2/92 2045

Parameter	Barometric Pressure * In. Hg	Barometric Pressure * mm Hg	Tank Temp. * °F	Tank Temp. * °C	Tank Pressure Gauge * In. Hg	Tank Pressure Gauge * mm Hg	Leak Check cm Hg change Tank	Leak Check cm Hg change System
Pretest		737	82		-	-696		
Posttest		730	70		-	0		
1st (Field) Pressurization					+			

Operator

Tank No. 242 Tank Volume, liters 4.51 Sampling Time Start 2135

From Sampling Run No. I-M3-3 Sampling Time Finish 2235

Sample Transfer Run No. I-M18-3 Sample Transfer Date & Time 9/2/92 2249

Parameter	Barometric Pressure * In. Hg	Barometric Pressure * mm Hg	Tank Temp. * °F	Tank Temp. * °C	Tank Pressure Gauge * In. Hg	Tank Pressure Gauge * mm Hg	Leak Check cm Hg change Tank	Leak Check cm Hg change System
Pretest		737	82		-	-692		
Posttest		728	68		-	0		
1st (Field) Pressurization					+			

Operator

* As applicable, use In. Hg or mm Hg, and °F or °C.

Note: mm Hg = In. Hg * 25.401

EVACUATED TANK PRESSURATION

ANALYSIS FOR CH_4

Plant Name BFI — P.O. No. NA

City/State Imperial PA — Date _____ — Job No. 20438

Sampling Loc. Vapor Flare Inlet — Analyst REP

Instrument Type GC/FID — Instrument I.D. SRI 8610

Run Number	I-M18-1	I-M18-2	IM18-3
Temperature, °F	70°F	70°F	70°F
Barometric Pressure			
In. Hg	_____	_____	_____
mm Hg	755	755	755
Tank Identification	171	271	242
Tank Gauge Pressures, mm Hg			
First Pressurization			
After Pressurization	+806 mm Hg	+806 mm Hg	+810 mm Hg
After Analysis	-640	-644	-644
Second Pressurization			
After Pressurization	+804	808	812
After Analysis	_____	_____	_____
Third Pressurization			
After Pressurization	_____	_____	_____
After Analysis	_____	_____	_____

Remarks _____

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ENTROPY

Sampling and Velocity Traverse Point Determination
EPA Method 1A

PLANT NAME BFI

CITY, STATE Imperial PA

SAMPLING LOCATION Vapor Flare Inlet

NO. OF PORTS AVAILABLE 2

NO. OF PORTS USED 2

PORT INSIDE DIAMETER 11.

DISTANCE FROM FAR WALL TO OUTSIDE OF PORT 23"

NIPPLE LENGTH AND/OR WALL THICKNESS 12"

DEPTH OF STACK OR DUCT ____

STACK OR DUCT WIDTH (IF RECTANGULAR) ____

EQUIVALENT DIAMETER:

$D_E = \frac{2 \times \text{DEPTH} \times \text{WIDTH}}{\text{DEPTH} + \text{WIDTH}} = \frac{2(\quad)(\quad)}{(\quad + \quad)} = $ ____

DISTANCE TO FLOW DISTURBANCES*

	PITOT TIP PLANE UPSTREAM	PITOT TIP PLANE DOWN	SAMPLING PORT UPSTREAM	SAMPLING PORT DOWN
DISTANCE				
DIAMETERS				

STACK/DUCT AREA = πR^2 = 95.03 IN²

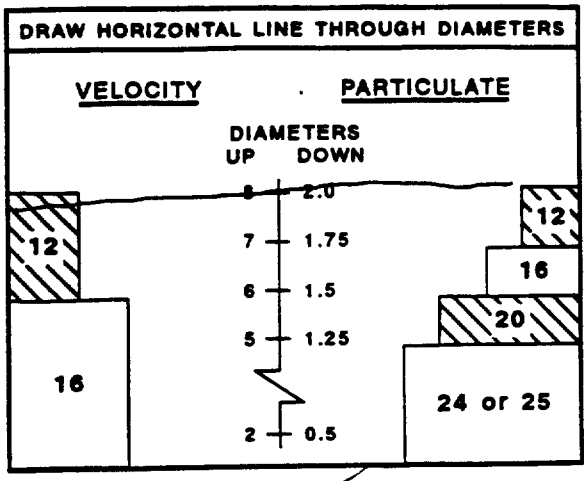
LOCATION OF POINTS IN CIRCULAR STACKS OR DUCTS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF POINTS IN RECTANGULAR STACKS OR DUCTS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

DRAW HORIZONTAL LINE THROUGH DIAMETERS



PITOT USED (✓) TYPE "S" ✓ STANDARD ____

USE UPSTREAM/DOWNSTREAM DIAMETERS THAT GIVE GREATEST NO. OF POINTS

POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	4.4	.495	12.495
2	14.6	1.6425	13.643
3	29.6	3.33	15.33
4	70.4	7.92	19.92
5	85.4	9.608	21.608
6	95.6	10.755	22.755
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

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*SEE REVERSE FOR FIELD USE CHECKLIST

AIR FLOW RATE DETERMINATIONS

Plant Name BF1 Run No. I-M2-1

City/State PITTSBURG/PA Date 9/2/92

Test Location INLET Personnel CKW

Barometric Pres. (Pbar) 29 In. Hg Static Pres. (Pg) SEE BELOW In. H_2O

Pitot/Orifice ID XP-60-2 Pitot Coef. (Cp) .84 Pres. Gauge Set ID MS-8

Thermocouple ID WB-23 Duct Length/Diameter 11" DIA. Width N/A

--Specify inches (") or feet (')--

VELOCITY TRAVERSES Start-Finish Times: 16:20 - 17:20

Point No.			Temp. °F
0	2.6	9.6	130
5	2.5	9.6	130
10	2.6	9.6	130
15	2.6	10.0	130
20	2.6	9.8	130
25	2.6	9.4	130
30	2.6	9.4	130
35	2.6	9.8	130
40	2.6	9.8	130
45	2.6	9.6	130
50	2.6	10.0	130
55	2.6	9.8	130
60	2.6	9.8	130
Avg.*	2.6		130

$\sqrt{\Delta P}$ = 9.7

* ΔP average is square of average square root.

ORSAT DATA

Sampling Time	Analysis Time	CO_2 (A) Reading	O_2 (B) Reading	$\%O_2$ (B-A)	$\%CO+N_2$ (100-B)
① 16:20-17:20					
②					
③					
	Average				

Bag No. 83 Pump

FYRITE DATA, % CO_2

MOISTURE DATA (WET BULB/DRY BULB)

Port	Time	Dry Bulb °F	Wet Bulb °F	Diff.	% H_2O

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

See page 2 for field flow rate calculations.

AIR FLOW RATE DETERMINATIONS

Plant Name BFI Run No. I-M2-2

City/State PITTSBURG / PA Date 9/2/92

Test Location INLET Personnel CKW

Barometric Pres. (Pbar) 29 In. Hg Static Pres. (Pg) SEE BELOW In. H_2O

Pitot/Orifice ID XP-60-2 Pitot Coef. (Cp) .84 Pres. Gauge Set ID MS-8

WET BULB/DRY BULB ID WB-23 Duct Length/Diameter 11" DIA. Width N/A

--Specify inches (") or feet (')--

VELOCITY TRAVERSES Start-Finish Times: 19:25 - 20:25

Point No.	ΔP in H_2O	STATIC PRESS. in H_2O	Temp. °F
19:25/0	2.8	9.6	130
19:30/5	2.7	9.6	130
19:35/10	2.6	9.4	130
19:40/15	2.6	9.4	130
19:45/20	2.7	9.6	130
19:50/25	2.6	9.4	130
19:55/30	2.6	9.6	130
20:00/35	2.6	9.6	130
20:05/40	2.6	9.6	130
20:10/45	2.6	9.4	130
20:15/50	2.6	9.6	130
20:20/55	2.5	9.6	129
20:25/60	2.6	9.8	129
Avg.*	2.6	9.6	130

ORSAT DATA

Sampling Time	Analysis Time	CO_2 (A) Reading	O_2 (B) Reading	$\%O_2$ (B-A)	$\%CO+N_2$ (100-B)
19:25 - 20:25					
	Average				

Bag No. 3 Pump

FYRITE DATA, % CO_2				

MOISTURE DATA (WET BULB/DRY BULB)

Port	Time	Dry Bulb °F	Wet Bulb °F	Diff.	% H_2O

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 BFI — Run No. I-MZ-3

City/State PITTSBURG / PA — Date 9/2/92

Test Location INLET — Personnel CKW

Barometric Pres. (Pbar) 29 In. Hg — Static Pres. (Pg) SEE BELOW In. H_2O

Pitot/Orifice ID XP-60-2 — Pitot Coef. (Cp) .84 — Pres. Gauge Set ID MS-8

WET BULB/DRY BULB WB 23 — Duct Length/Diameter 11" Ø DIA. — Width N/A

--Specify inches (") or feet (')--

VELOCITY TRAVERSES Start-Finish Times: 21:35 - 22:35

Point No.	ΔP in H_2O	Static Press in H_2O	Temp. °F
21:35/0	2.6	9.6	128
5	2.6	9.6	128
10	2.6	9.4	128
15	2.6	9.6	128
20	2.6	9.4	128
25	2.6	9.6	128
30	2.6	9.4	128
35	2.6	9.4	128
40	2.6	9.6	128
45	2.6	9.4	128
50	2.6	9.6	128
55	2.6	9.4	128
60	2.6	9.6	128
Avg.*	2.6	9.5	128

ORSAT DATA

Sampling Time	Analysis Time	CO_2 (A) Reading	O_2 (B) Reading	%O_2 (B-A)	%$CO+N_2$ (100-B)
21:35 - 22:35					
	Average				

Bag No. 9 — Pump

FYRITE DATA, % CO_2

MOISTURE DATA (WET BULB/DRY BULB)

Port	Time	Dry Bulb °F	Wet Bulb °F	Diff.	% H_2O

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 D. Calibration Data
- Pre- and Post-test Meterbox Calibrations
- Calibration Gas Certificates of Analysis

cott Specialty Gases a division of Scott Enviro..ental Technology, Inc.
PLUMSTEADVILLE, PA 18949 PHONE: (215) 766-8861 TWX: 510-665-9344

ENTROPY ENVIRONMENTALISTS
ATTN: KENT SPEARS
8724 GLENWOOD AVE.
RALEIGH, NC 27612

Date Shipped: 8-15-91
Our Project No.: 30033
Your P.O. No.: KS VERBAL
Page 2 of 2

RECERTIFICATION ANALYSIS – EPA PROTOCOL GASES*

(Concentrations are in mole % or ppm)

Cylinder Number AAL-5917 Certified Accuracy ±1 % NBS Traceable ____ Analysis Dates: Last 10-13-89 New 8-14-91

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS LAST	REPLICATE CONCENTRATIONS NEW
CARBON MONOXIDE	402ppm	2-14-93	NDIR	1680/1681	403.5 ppm	401.8 ppm
					403.0 ppm	400.8 ppm
					403.0 ppm	401.8 ppm
NITROGEN	BALANCE					

Cylinder Number ____ Certified Accuracy ____ % NBS Traceable Analysis Dates: Last ____ New ____

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS LAST	REPLICATE CONCENTRATIONS NEW

*We hereby certify the cylinder gas has been analyzed according to EPA Protocol No.: 1 Procedure G1

Analyst Alvaro Rojas Approved By Ted Lenna for M.S.

MARK S. SIRINIDES

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

CYLINDER NUMBER AAL-5917 PROJECT NO. 30033

STANDARD

TYPE (SRM,CRM,GMIS) GMIS

CYLINDER NUMBER ALM-011067

CONCENTRATION 500ppm CARBON MONOXIDE/NITROGEN

ANALYZER

MAKE HORIBA CO

MODEL CFA-310A

SERIAL NO. 474091

DATE OF CALIBRATION 6-13-91

RAW DATA (FOR CONCENTRATION LISTED UNDER "REPLICATE ANALYSIS" ON THE OTHER SIDE)

Z=ZERO GAS

COMPONENT CARBON MONOXIDE

FIRST ANALYSIS 10-13-89 UNITS _____

Z _____ R _____ T _____

R _____ Z _____ T _____

Z _____ T _____ R _____

SECOND ANALYSIS 8-14-91 UNITS mV

Z 0 R 512.3 T 414.1

R 512.4 Z 0 T 413.3

Z 0 T 413.7 R 512.9

THIS CYLINDER WAS BLENDED, ANALYZED AND SHIPPED FROM SCOTT SPECIALTY GASES
ROUTE 611
PLUMSTEADVILLE PA 18949

Scott Specialty Gases

PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

Date Shipped 11-2-89
Our Project No: 14746
Your P.O. No: 1568-89-KS
Page 2 of 2

ENTROPY ENVIROMENTALISTS

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES*

(Concentrations are in mole % or ppm)

Cylinder Number AAL 13499 cp=2000psig Certified Accuracy ±1 % NBS Traceable Analysis Dates: First 10-16-89 Last 10-31-89

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND
CARBON MONOXIDE	404ppm	5-1-91	NDIR	1681	403.0ppm	404.0ppm
					403.0ppm	403.0ppm
					403.0ppm	404.0ppm
NITROGEN	BAL					

D-3

Cylinder Number AAL 5917 cp=2000psig Certified Accuracy ±1 % NBS Traceable Analysis Dates: First 10-16-89 Last 10-31-89

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND
CARBON MONOXIDE	403ppm	5-1-91	NDIR	1681	403.0ppm	404.0ppm
					403.0ppm	403.0ppm
					403.0ppm	403.0ppm
NITROGEN	BAL					

*We hereby certify the cylinder gas has been analyzed according to EPA Protocol No: 1 PROCEDURE G1

Analyst Thomas C. Ludwig Jr. for TCL Approved By Mark S. Sirinides
MARK S. SIRINIDES

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

CYLINDER NUMBER AAL 5917 PROJECT NO. 14746

STANDARD

TYPE (SRM,CRM,GMIS) GMIS

CYLINDER NUMBER AL 9562

CONCENTRATION 499.4ppm CO/N2

2nd CRM
AAL 9143
970 ppm CO/N2

ANALYZER

MAKE HORIBA

MODEL CFA310a

SERIAL NO. 474091

DATE OF CALIBRATION 9-18-89

RAW DATA (FOR CONCENTRATION LISTED UNDER "REPLICATE ANALYSIS" ON THE OTHER SIDE)

Z=ZERO GAS

COMPONENT CO

FIRST ANALYSIS 10-16-89 UNITS mv

Z 0 R 505 T 409

R 505 Z 0 T 409

Z 0 T 409 R 505

SECOND ANALYSIS 10-31-89 UNITS mv

Z 0 R 960 T 410

R 960 Z 0 T 409

Z 0 T 409 R 960

THIS CYLINDER WAS BLENDED, ANALYZED AND SHIPPED FROM SCOTT SPECIALTY GASES
ROUTE 611
PLUMSTEADVILLE PA 18949

Scott Specialty Gases, Inc.

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ACCORDING TO SECTION 3.0.4
Certified per traceability Protocol 1 Procedure G1

ENTROPY ENVIRONMENTALISTS
KENT SPEARS
8724 GLENWOOD AVENUE
RALEIGH, NC 27612

CYLINDER NO. ALM-006819

CYLINDER PRESSURE 2000 PSIG

CERTIFIED ACCURACY +/- 1 % NIST TRACEABLE

SHIPPED FROM DURHAM

DATE SHIPPED 8-13-92 PROJECT 1202426

YOUR ORDER 3135-92-KS EXP. 2-13-94

	OXYGEN
CERTIFIED CONCENTRATION	20.5 %
BALANCE GAS	NITROGEN
REFERENCE STANDARD	GMIS
CYLINDER NO	K-014757
CONCENTRATION	24.1 %

GAS ANALYZER: HORIBA
MODEL # MPA21A
S/N 8506581304

LAST CALIBRATION DATE: 8-7-92
ANALYTICAL PRINCIPLES: PARAMAGNETIC

ANALYZER READINGS: Z=ZERO GAS T=TEST GAS R=REFERENCE GAS

FIRST ANALYSIS DATE 8-12-92		UNITS %
Z -0.002	R 24.130	Z -0.006
R 24.139	Z -0.005	T 20.545
T 20.557	T 20.569	R 24.129
	MEAN TEST ASSAY	20.530 %

SECOND ANALYSIS DATE		UNITS
Z	R	Z
R	Z	T
T	T	R
	MEAN TEST ASSAY	

ANALYST _____ J. ERNST

APPROVED _____ D. MARTIN

Scott Specialty Gases, Inc. 1750 E. Club Blvd Durham, NC 27706

Scott Specialty Gases, Inc.

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ACCORDING TO SECTION 3.0.4
Certified per traceability Protocol 1 Procedure G1

ENTROPY ENVIRONMENTALISTS
KENT SPEARS
8724 GLENWOOD AVENUE
RALEIGH, NC 27612

CYLINDER NO. AAL-19224
CYLINDER PRESSURE 1950 PSIG
CERTIFIED ACCURACY +/- 1 % NIST TRACEABLE
SHIPPED FROM DURHAM
DATE SHIPPED 8-17-92 PROJECT 1202505
YOUR ORDER 3151-92-KS EXP. 2-17-93

	CARBON DIOXIDE
CERTIFIED CONCENTRATION	17.51 %
BALANCE GAS	NITROGEN
REFERENCE STANDARD	GMIS
CYLINDER NO	K-014634
CONCENTRATION	18.01 %

GAS ANALYZER HORIBA
MODEL # AIA23
S/N 565607123

LAST CALIBRATION DATE: 6-23-92
ANALYTICAL PRINCIPLES: NDIR

ANALYZER READINGS: Z=ZERO GAS T=TEST GAS R=REFERENCE GAS

FIRST ANALYSIS DATE 8-13-92		UNITS %	
Z 0.002	R 18.037	Z 0.003	
R 18.015	Z 0.005	T 17.531	
T 17.527	T 17.535	R 18.027	
	MEAN TEST ASSAY	17.508 %	

SECOND ANALYSIS DATE		UNITS	
Z	R	Z	
R	Z	T	
T	T	R	
	MEAN TEST ASSAY		

ANALYST J. ERNST
APPROVED D. MARTIN

Scott Specialty Gases, Inc. 1750 E. Club Blvd Durham, NC 27706

Scott Specialty Gases, Inc.

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ACCORDING TO SECTION 3.0.4

Certified per traceability Protocol 1 Procedure G1

ENTROPY ENVIRONMENTALISTS
ATTN: KENT SPEARS
8724 GLENWOOD AVENUE
RALEIGH, NC 27612

CYLINDER NO. ALM-017454

CYLINDER PRESSURE 2000 PSIG

CERTIFIED ACCURACY+/- 1 % NIST TRACEABLE

SHIPPED FROM DURHAM

DATE SHIPPED 7-21-92 PROJECT 1202426

YOUR ORDER 3135-92-KS EXP. 1-21-94

	CARBON DIOXIDE
CERTIFIED CONCENTRATION	10.85%
BALANCE GAS	NITROGEN
REFERENCE STANDARD	GMIS
CYLINDER NO	K-014634
CONCENTRATION	17.97%

GAS ANALYZER	HORIBA
	MODEL # AIA23
	S/N 565607123
LAST CALIBRATION DATE	5/8/92
ANALYTICAL PRINCIPLES	NDIR

ANALYZER READINGS: Z=ZERO GAS T=TEST GAS R=REFERENCE GAS

FIRST ANALYSIS DATE 7-20-92			UNITS %	2ND ANALYSIS DATE		UNITS
Z -0.004	R 17.977	Z	-0.006	Z	R	Z
R 17.965	Z -0.004	T	10.852	R	Z	T
T 10.847	T 10.841	R	17.967	T	T	R
	MEAN TEST ASSAY		10.845%		MEAN TEST ASSAY	

FIRST ANALYSIS DATE		UNITS PPM	2ND ANALYSIS DATE		UNITS
Z	R	Z	Z	R	Z
R	Z	T	R	Z	T
T	T	R	T	T	R
	MEAN TEST ASSAY			MEAN TEST ASSAY	

FIRST ANALYSIS DATE		UNITS PPM	2ND ANALYSIS DATE		UNITS PPM
Z	R	Z	Z	R	Z
R	Z	T	R	Z	T
T	T	R	T	T	R
	MEAN TEST ASSAY			MEAN TEST ASSAY	

ANALYST J. ERNST

APPROVED D. MARTIN

Scott Specialty Gases, Inc. 1750 E. Club Blvd Durham, NC 27706

Scott Specialty Gases, Inc.

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ACCORDING TO SECTION 3.0.4
Certified per traceability Protocol 1 Procedure G1

ENTROPY ENVIRONMENTALISTS
8724 GLENWOOD AVENUE
RALEIGH, NC 27612

CYLINDER NO. ALM-028786
CYLINDER PRESSURE 1975 PSIG
CERTIFIED ACCURACY +/- 1 % NIST TRACEABLE
SHIPPED FROM DURHAM
DATE SHIPPED 8-26-92 PROJECT 120250S
YOUR ORDER 3151-92-KS EXP. 2-24-94

	CARBON MONOXIDE
CERTIFIED CONCENTRATION	302 PPM
BALANCE GAS	NITROGEN
REFERENCE STANDARD	GMIS
CYLINDER NO	ALM-000266
CONCENTRATION	478 PPM

GAS ANALYZER HORIBA
MODEL # AIA23AS
S/N 850658012

LAST CALIBRATION DATE: 06-11-92
ANALYTICAL PRINCIPLES: NDIR

ANALYZER READINGS: Z=ZERO GAS T=TEST GAS R=REFERENCE GAS

FIRST ANALYSIS DATE 8-17-92			UNITS PPM
Z 0.4	R 479.1	Z 0.3	
R 478.6	Z 0.2	T 301.3	
T 301.6	T 301.9	R 479.1	
	MEAN TEST ASSAY	300.9 PPM	

SECOND ANALYSIS DATE 08-25-92			UNITS
Z 0.5	R 474.3	Z 0.4	
R 474.4	Z 0.3	T 302.0	
T 302.0	T 302.0	R 475.2	
	MEAN TEST ASSAY	302.1 PPM	

ANALYST J. Ernst J. ERNST
APPROVED D. Martin D. MARTIN

Scott Specialty Gases, Inc. 1750 E. Club Blvd Durham, NC 27706

Scott Specialty Gases, Inc.

E. P. A. PROTOCOL CERTIFICATE OF ANALYSIS

Shipped from:
Scott Specialty Gases
Route 611
Plumsteadville, PA 18949
Purchase order :
6591-92-KS

Shipped to:
ENTROPY ENVIRON.
ATTN: KENT SPEARS
PO BOX 12291
RESEARCH TRIANGLE PK
RALEIGH NC 27612
Project No 0135005

Certified per E.P.A. Protocol # 1 Procedure #G1 Section # 3.0.4
Certified accuracy +/- 1 % NIST Traceable

Cylinder number	ALM020313	Cylinder pressure 2000 psig.	Date of assay: 2/12/92
Component		Certified concentration	Expiration date: 8/12/93
NITRIC OXIDE		49.7 ppm	
OXIDES OF NITROGEN		49.8	
NITROGEN		Balance	

Standard		Analyzer	
Type	GMIS	Make	: TECO
Concentration	75.5 ppm	Model	: 10
Cylinder #	AAL7351	Serial number	: 9741-111-S
		Analytical principle	: Chemiluminescence
		Date of calibration	: 1/9/92

Raw data units:	VOLTS	:	: Concentration of Customer Cylinder		:
First analysis	2/5/92	:	:		:
Z1=0.00	R1=6.94	T1=4.59	:	: 49.9 ppm	:
R2=6.95	Z2=0.00	T2=4.61	:	: 50.1 ppm	:
Z3=0.00	T3=4.61	R3=6.94	:	: 50.1 ppm	:
Second analysis:	2/12/92	:	:		:
Z1=0.00	R1=6.90	T1=4.51	:	: 49.4 ppm	:
R2=6.90	Z2=0.00	T2=4.52	:	: 49.5 ppm	:
Z3=0.00	T3=4.53	R3=6.90	:	: 49.5 ppm	:

Analyst _____ Approved by _____
Mark S. Sirinides/Ted Neeme

Scott Specialty Gases, Inc.

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ACCORDING TO SECTION 3.0.4
Certified per traceability Protocol I Procedure G1

ENTROPY ENVIRONMENTALISTS
ATTN: KENT SPEARS
8724 GLENWOOD AVENUE
RALEIGH, NC 27612

CYLINDER NO. ALM-028324

CYLINDER PRESSURE 2000 PSIG

CERTIFIED ACCURACY+/- 1 % NIST TRACEABLE

SHIPPED FROM DURHAM

DATE SHIPPED 7-21-92 PROJECT 1202426

YOUR ORDER 3135-92-KS EXP. 1-21-94

	OXYGEN
CERTIFIED CONCENTRATION	12.03%
BALANCE GAS	NITROGEN
REFERENCE STANDARD	GMIS
CYLINDER NO	K-014757
CONCENTRATION	24.1%
GAS ANALYZER	HORIBA
	MODEL # MPA21A
	S/N 8506581304
LAST CALIBRATION DATE	5/8/92
ANALYTICAL PRINCIPLES	PARAMAGNETIC

ANALYZER READINGS: Z=ZERO GAS T=TEST GAS R=REFERENCE GAS

FIRST ANALYSIS DATE 7-20-92		UNITS %	2ND ANALYSIS DATE		UNITS
Z -0.082	R 24.106	Z -0.073	Z	R	Z
R 24.087	Z -0.077	T 11.982	R	Z	T
T 11.999	T 11.995	R 24.114	T	T	R
	MEAN TEST ASSAY	12.030%		MEAN TEST ASSAY	
FIRST ANALYSIS DATE		UNITS PPM	2ND ANALYSIS DATE		UNITS PPM
Z	R	Z	Z	R	Z
R	Z	T	R	Z	T
T	T	R	T	T	R
	MEAN TEST ASSAY			MEAN TEST ASSAY	
FIRST ANALYSIS DATE		UNITS PPM	2ND ANALYSIS DATE		UNITS PPM
Z	R	Z	Z	R	Z
R	Z	T	R	Z	T
T	T	R	T	T	R
	MEAN TEST ASSAY			MEAN TEST ASSAY	

ANALYST J. ERNST

APPROVED D. MARTIN

Scott Specialty Gases, Inc. 1750 E. Club Blvd Durham, NC 27706

Scott Specialty Gases, Inc.

CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ACCORDING TO SECTION 3.0.4
Certified per traceability Protocol I Procedure G1

ENTROPY ENVIRONMENTALISTS
8724 GLENWOOD AVENUE
RALEIGH, NC 27612

CYLINDER NO. ALM-000915

CYLINDER PRESSURE 1900 PSIG

CERTIFIED ACCURACY+/- 1 % NIST TRACEAB

SHIPPED FROM DURHAM

DATE SHIPPED 6-22-92 PROJECT 1202137

YOUR ORDER 3059-92-KS EXPIRES 11-20-93

SULFUR DIOXIDE

CERTIFIED CONCENTRATION	88.1 PPM
BALANCE GAS	NITROGEN
REFERENCE STANDARD	GMIS
CYLINDER NO	AAL-14418
CONCENTRATION	94.2 PPM

GAS ANALYZER HORIBA
MODEL # AIA-23AS
S/N 850658161

LAST CALIBRATION DATE 3-26-92
ANALYTICAL PRINCIPLES NDIR

ANALYZER READINGS: Z=ZERO GAS T=TEST GAS R=REFERENCE GAS

FIRST ANALYSIS DATE 5-20-92 UNITS PPM

								UNITS
Z	0.0	R	94.4	Z	0.0	Z	R	Z
R	94.5	Z	0.0	T	88.2	R	Z	T
T	88.3	T	88.1	R	94.4	T	T	R

MEAN TEST ASSAY 87.98 PPM

SECOND ANALYSIS DATE 6-22-92 UNITS PPM

								UNITS
Z	0.0	R	94.2	Z	0.0	Z	R	Z
R	94.1	Z	0.0	T	88.2	R	Z	T
T	88.1	T	88.2	R	94.2	T	T	R

MEAN TEST ASSAY 88.20 PPM MEAN TEST ASSAY

ANALYST J. ERNST

APPROVED D. Martin
D. MARTIN

Scott Specialty Gases, Inc. 1750 E. Club Blvd Durham, NC 27706

Scott Specialty Gases, Inc.

E.P.A. PROTOCOL CERTIFICATE OF ANALYSIS

Shipped from:
Scott Specialty Gases
Route 611
Plumsteadville, PA 18949
Purchase order 660292ks

Shipped to:
Entropy
8724 Glenwood Avenue
Raleigh, NC 27612-9055
Project number 35520

Certified per E.P.A. Protocol #1 Procedure #G1 Section number 3.0.4
Certified accuracy +/- 2% NIST traceable

Cylinder number	Cylinder pressure	Date of assay
ALM028362	1950 p.s.i.g.	02-28-1992

Component	Certified concentration	Expiration date
Sulfur dioxide	**50.5 P.P.M.**	**8-28-1993**
Nitrogen	**Balance gas**	

Standard
Type : GMIS
Concentration : 59.5 P.P.M.
Cylinder number : AAL15976

Analyzer
Make : HORIBA SO2
Model : CFA-321A
Serial number : 56437102
Analytical principle : NDIR
Date of calibration : 02-07-1992

Raw data units	VOLT	Drift Compensation	Concentration of customer cylinder	Calibration curve equations
			X = T/10^XFACTOR	
			Y = E*X^4+D*X^3+C*X^2+B*X	
First analysis	02-21-1992		Conc = (Y*K+A)*10^YFACTOR	
	Z=-.00001 R=1.18410 T=1.00041	K= 1.001	50.3 P.P.M.	A= -.06558629
	R=1.18487 Z=0.00064 T=0.99882	K= 1.001	50.1 P.P.M.	B= 50.24388
	Z=0.00080 T=0.99838 R=1.18131	K= 1.004	50.3 P.P.M.	C= 0
			D= 0	
	Second Analysis 02-28-1992			E= 0
			X FACTOR = 0	
	Z=0.00461 R=1.17289 T=1.00418	K= 1.011	50.9 P.P.M.	Y FACTOR = 0
	R=1.17156 Z=0.00490 T=0.99905	K= 1.012	50.7 P.P.M.	
	Z=0.00462 T=0.99674 R=1.17020	K= 1.013	50.7 P.P.M.	

Analyst _____ Approved by _____

Jay Warren 02-28-1992

Mark S. Sirinides / Ted Neeme

NONISOKINETIC METERBOX CALIBRATION

PRETEST ✓ POSTTEST ___

Meterbox No. V13 Calibrated By P. Judd Date 8-29-92

EPA Method 6 Type DGM			VOST Type DGM		
MR_I (cf)	MR_F (cf)	ΔP_M* (" H_2O)	MR_I (l)	MR_F (l)	DGM (In. WC)
		.7	37.72	54.58	.5
		1.4	54.63	71.44	.9
		3.0	71.66	88.34	1.5

* ΔP_M must be ≤ 2.0" H_2O for Method 6 Type DGM and ≤ 3.0" for VOST Type DGM.

Flow Rate (lpm)**	Pbar (In. Hg)	t_{SPR} (°F)	P_{H2O} (In. Hg)	t_M (°F)	V_{SPR} (cf)	Y
.5	29.60	73	.82	73	.61	.9951
1.0	29.60	73	.82	73	.61	.9971
2.0	29.60	73	.82	73	.61	1.0035
					Average Y	.9986

** Spirometer

Prior Test Y ___ Date ___ % Dev. ___ Allowed Dev.: ±5%

MR_I = Initial Dry Gas Meter Reading
MR_F = Final Dry Gas Meter Reading
t_{SPR} = Temperature of Gas in Spirometer
P_{H2O} = Vapor Pressure of H_2O at T_{SPR}
t_M = Dry Gas Meter Temperature

DGM_{WC} = Dry Gas Meter Pressure, In. WC
ΔP_M = Reading from Manometer at DGM Inlet
V_{SPR} = Volume Displaced Within Spirometer
Pbar = Barometric Pressure
Y = Dry Gas Meter Coefficient (Gamma)

For Dry Gas Meter Reading in Cubic Feet per Hour (cfh; Method 6 Type) (i.e., $DGM_{WC} = 0$):

$$Y = \left[\frac{V_{SPR}}{MR_F - MR_I}\right]\left[1 - \frac{P_{H2O}}{Pbar + \frac{\Delta P_M}{13.6}}\right]\left[\frac{T_M + 460}{T_{SPR} + 460}\right]$$

For Dry Gas Meter Reading in Liters per Minute (lpm; VOST Type):

$$Y = \left[\frac{V_{SPR} / 0.03531}{MR_F - MR_I}\right]\left[1 - \frac{P_{H2O}}{Pbar + \frac{\Delta P_M}{13.6}}\right]\left[\frac{T_M + 460}{T_{SPR} + 460}\right]\left[\frac{Pbar}{Pbar + \frac{DGM_{WC}}{13.6}}\right]$$

NONISOKINETIC METERBOX CALIBRATION

PRETEST ___ POSTTEST ✓

Meterbox No. V13 Calibrated By P. Judd Date 9-4-92

EPA Method 6 Type DGM			VOST Type DGM		
MR_I (cf)	MR_F (cf)	ΔP_M* (" H_2O)	MR_I (l)	MR_F (l)	DGM (In. WC)
		.7	522.47	539.25	.5
		1.2	539.77	556.74	.9
		2.2	557.27	574.33	1.6

* ΔP_M must be ≤ 2.0" H_2O for Method 6 Type DGM and ≤ 3.0" for VOST Type DGM.

Flow Rate (lpm)**	Pbar (In. Hg)	t_{SPR} (°F)	P_{H2O} (In. Hg)	t_M (°F)	V_{SPR} (cf)	Y
.5	29.74	75	.88	75	.61	.9981
1.0	↓	↓	↓	↓	.61	.9859
2.0	↓	↓	↓	↓	.61	.9791
** Spirometer					Average Y	.9877

Prior Test Y .9986 Date 8-29-92 % Dev. 1.1 Allowed Dev.: ±5%

MR_I = Initial Dry Gas Meter Reading
MR_F = Final Dry Gas Meter Reading
t_{SPR} = Temperature of Gas in Spirometer
P_{H2O} = Vapor Pressure of H_2O at T_{SPR}
t_M = Dry Gas Meter Temperature

DGM_{WC} = Dry Gas Meter Pressure, In. WC
ΔP_M = Reading from Manometer at DGM Inlet
V_{SPR} = Volume Displaced Within Spirometer
Pbar = Barometric Pressure
Y = Dry Gas Meter Coefficient (Gamma)

For Dry Gas Meter Reading in Cubic Feet per Hour (cfh; Method 6 Type) (i.e., $DGM_{WC} = 0$):

$$Y = \left[\frac{V_{SPR}}{MR_F - MR_I}\right]\left[1 - \frac{P_{H2O}}{Pbar + \frac{\Delta P_M}{13.6}}\right]\left[\frac{T_M + 460}{T_{SPR} + 460}\right]$$

For Dry Gas Meter Reading in Liters per Minute (lpm; VOST Type):

$$Y = \left[\frac{V_{SPR} / 0.03531}{MR_F - MR_I}\right]\left[1 - \frac{P_{H2O}}{Pbar + \frac{\Delta P_M}{13.6}}\right]\left[\frac{T_M + 460}{T_{SPR} + 460}\right]\left[\frac{Pbar}{Pbar + \frac{DGM_{WC}}{13.6}}\right]$$

Appendix E. Reference Measurement System Performance Test Data
- Interference Checks
- NO_2-to-NO Converter Efficiency Test

NO_2 - NO CONVERTER EFFICIENCY

Analyzer Type TECO Model 10 EEI #1 Span 1000 ppm

Serial Number 10AR-5481-74 Date of Test 8-14-90

PEAK RESPONSE RECORDED DURING CONVERTER EFFICIENCY TEST: 742.4 ppm

RESPONSE RECORDED AT THE END OF THE 30-MINUTE TEST: 736.1 ppm

PERCENT DECREASE FROM PEAK RESPONSE: .0847% (99.15%)

SPECIFICATIONS (EPA METHOD 20): RESPONSE AT 30 MINUTES MUST NOT DECREASE BY MORE THAN 2% OF THE PEAK RESPONSE VALUE.

NO_2 - NO CONVERTER EFFICIENCY TEST PROCEDURES

ENTROPY followed the manufacturer's recommended set-up procedures contained in the analyzer manual. After the initial set-up procedures were completed, the electronics of the monitor were adjusted according to the manufacturer's guidelines. The monitor was then calibrated by flowing NO calibration gases into the instrument. A calibration gas was then diluted (1:1) with purified compressed air using an AIRCO Model #5-22-2 gas blender. The gas mixture was routed through a manifold into a Tedlar bag, which was previously leak tested and evacuated. This arrangement afforded sufficient volume to allow the sampling system to operate for the required 30 minutes. Immediately after the bag was filled, the manifold was connected to the sampling system. The system was turned on and the analyzer response was recorded on a strip chart. The strip chart was analyzed for the peak response and the response at the end of the 30 minute sampling period.

:O 10 EEI #1 CONVERTER EFFICIENCY TEST 08-14-1990

CHAN 6

TECO10

(1000 ppm SPAN)

TIME	ppmNOX	
08:47	739.6	
08:48	742.2	
08:49	741.7	
08:50	742.1	START TEST
08:51	741.7	
08:52	741.8	
08:53	742.3	
08:54	742.4	PEAK RESPONSE
08:55	742.2	
08:56	741.8	
08:57	742.0	
08:58	741.9	
08:59	741.3	
09:00	741.1	
09:01	740.3	
09:02	739.3	
09:03	738.8	
09:04	738.0	
09:05	737.3	
09:06	737.4	
09:07	737.9	
09:08	737.8	
09:09	736.9	
09:10	736.8	
09:11	736.4	
09:12	735.7	
09:13	735.4	
09:14	735.3	
09:15	735.3	
09:16	735.7	
09:17	735.3	
09:18	735.1	
09:19	735.9	
09:20	736.1	END TEST
09:21	735.5	
09:22	734.9	
09:23	734.8	
09:24	734.6	
09:25	734.2	
09:26	734.0	
09:27	733.3	
09:28	733.2	
09:29	733.0	
09:30	732.7	

INTERFERENCE RESPONSE

Analyzer Type CO EEI#5 Span 100

Serial Number 48-32500-242 Date of Test 8-6-91

GAS TYPE	CONCENTRATION	ANALYZER RESPONSE PPM CO	% OF SPAN [1]
NO/N_2	240 ppm	-0.8	-0.8
SO_2/N_2	49.5 ppm	-0.6	-0.6
CO_2/N_2	11%	-0.2	-0.2
O_2/N_2	12.66%	1.0	1.0
		TOTALS	-0.6 [2]

[1] % SPAN = $\frac{\text{ANALYZER RESPONSE}}{\text{INSTRUMENT SPAN}} \times 100$

[2] SPECIFICATION (EPA METHOD 20): SUM OF INTERFERENCE RESPONSES MUST NOT EXCEED 2% OF SPAN.

INTERFERENCE TEST PROCEDURES

ENTROPY followed the manufacturer's recommended set-up procedures contained in the analyzer manual. After the initial set-up procedures were completed, the electronics of the monitor were adjusted according to the manufacturer's guidelines. The monitor was calibrated by flowing CO calibration gases into the instrument. The SO_2, NO, CO_2, and O_2 calibration gases listed above were injected into the monitor and the responses were recorded on a strip chart, which was analyzed to determine if the gases caused interference (ie, deviations from a zero reading) in the CO monitor.

08-06-1991
CHAN 2

TIME	ppmCO
14:10	-0.2
14:11	-0.2
14:12	-0.2
14:13	-0.2
14:14	-0.2
14:15	-0.6
14:16	-0.8
14:17	-0.8
14:18	-0.1
14:19	0.9

AVERAGE VALUES FOR THE LAST 10 MINUTES

14:19	-0.2
14:20	1.0
14:21	1.0
14:22	0.6
14:23	-0.3
14:24	-0.6
14:25	-0.6

CO_2 11%

NOx 240 ppm

O_2 12.66 %

SO_2 49.5

INTERFERENCE RESPONSE

Analyzer Type Teledyne 320P-4 O_2 Span 0-25%

Serial Number 59718 Date of Test 1/13/87

GAS TYPE	CONCENTRATION	ANALYZER RESPONSE % O_2	% OF SPAN [1]
CO/N_2	454 ppm	0.025	0.1
NO/N_2	228 ppm	0.035	0.14
SO_2/N_2	203 ppm	0.0375	0.15
CO_2/N_2	11%	0.015	0.06
		TOTALS	[2]

[1] % SPAN = $\frac{\text{ANALYZER RESPONSE}}{\text{INSTRUMENT SPAN}} \times 100$

[2] SPECIFICATION (EPA METHOD 20): SUM OF INTERFERENCE RESPONSES MUST NOT EXCEED 2% OF SPAN.

INTERFERENCE TEST PROCEDURES

ENTROPY followed the manufacturer's recommended set-up procedures contained in the analyzer manual. After the initial set-up procedures were completed, the electronics of the monitor were adjusted according to the manufacturer's guidelines. The monitor was calibrated by flowing O_2 calibration gases into the instrument. The NO, CO, CO_2, and SO_2 calibration gases listed above were injected into the monitor and the responses were recorded on a strip chart, which was analyzed to determine if the gases caused interference (ie, deviations from a zero reading) in the O_2 monitor.

INTERFERENCE RESPONSE

Analyzer Type Western Research EFT #2 Span Ø - 100 ppm ; 300 ppm

Serial Number 90-721-AT2-7673 Date of Test 9-12-90

GAS TYPE	CONCENTRATION	ANALYZER RESPONSE PPM SO_2	% OF SPAN [1]
CO/N_2	246 ppm	Ø ppm | .06 ppm	0% | .01%
NO/N_2	243 ppm	.07 ppm | .7 ppm	.07% | .02%
CO_2/N_2	17.5%	.01 ppm | 1 ppm	.01% | .03%
O_2/N_2	3.0%	.05 ppm | .9 ppm	.05% | .03%
		.13 ppm | 2.66 ppm TOTALS	.13% | .09% [2]

[1] % SPAN = $\frac{\text{ANALYZER RESPONSE}}{\text{INSTRUMENT SPAN}} \times 100$

[2] SPECIFICATION (EPA METHOD 20): SUM OF INTERFERENCE RESPONSES MUST NOT EXCEED 2% OF SPAN.

INTERFERENCE TEST PROCEDURES

ENTROPY followed the manufacturer's recommended set-up procedures contained in the analyzer manual. After the initial set-up procedures were completed, the electronics of the monitor were adjusted according to the manufacturer's guidelines. The monitor was calibrated by flowing SO_2 calibration gases into the instrument. The NO, CO, CO_2 , and O_2 calibration gases listed above were injected into the monitor and the responses were recorded on a strip chart, which was analyzed to determine if the gases caused interference (ie, deviations from a zero reading) in the SO_2 monitor.

INTERFERENCE RESPONSE

Analyzer Type ACS FUJI 0-20/50% CO2 Span 0-20%

Serial Number 6 Date of Test 01-16-91

GAS TYPE *	CONCENTRATION	ANALYZER RESPONSE % CO_2	% OF SPAN [1]
CO/N_2	457.5	0.0	0.0
NO/N_2	450.0	0.0	0.0
SO_2/N_2	255.9	0.0	0.0
O_2/N_2	20.6	0.0	0.0
		TOTALS	[2]

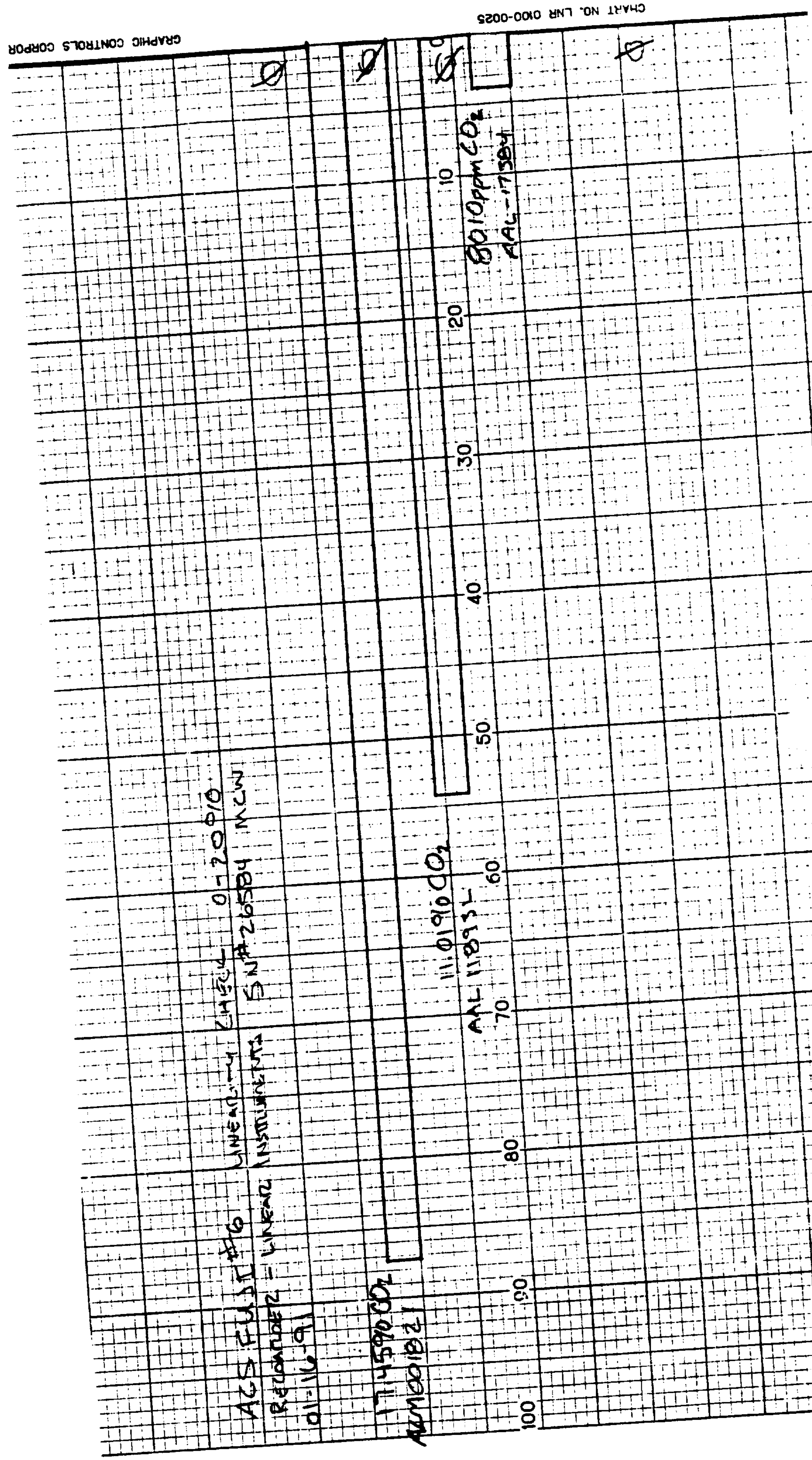
* CYL list on back of sheet.

[1] % SPAN = $\frac{\text{ANALYZER RESPONSE}}{\text{INSTRUMENT SPAN}} \times 100$

[2] SPECIFICATION (EPA METHOD 20): SUM OF INTERFERENCE RESPONSES MUST NOT EXCEED 2% OF SPAN.

INTERFERENCE TEST PROCEDURES

ENTROPY followed the manufacturer's recommended set-up procedures contained in the analyzer manual. After the initial set-up procedures were completed, the electronics of the monitor were adjusted according to the manufacturer's guidelines. The monitor was calibrated by flowing CO_2 calibration gases into the instrument. The NO, CO, SO_2, and O_2 calibration gases listed above were injected into the monitor and the responses were recorded on a strip chart, which was analyzed to determine if the gases caused interference (ie. deviations from a zero reading) in the CO_2 monitor.


GRAPHIC CONTROLS CORPOR
CHART NO. LNR 0100-0025
ACS FUJI #6 LINEARITY CHECK 0-20%
RECORDER = LINEAR INSTRUMENTS SN#26584 MCW
01-16-91
17.45% CO2
ALM001821
11.01% CO2
AAL 11893L
8010ppm CO2
AAL-17384
10
20
30
40
50
60
70
80
90
100

Appendix F. Permit Limits

Allegheny County Health Department

Post-it™ brand fax transmittal memo 7671 | # of pages ▸

To Greg Holesh	From E Taylor
Co. BFI Industries	Co. BAPC
Dept. Landfill Mgmt	Phone # 578-8138
Fax # 695-2143	Fax # 578-8052

301 39th Street
Pittsburgh, Pennsylvania 15201

June 3, 1992

Mr. George J. Paturalski
District Manager
Browning-Ferris Industries
of PA Inc.
P.O. Box 47
Imperial, PA 15126

PERMIT NO.: 92-I-0009-I
EQUIPMENT : Enclosed Ground Flare
LOCATION : Findlay Township
FIRST OPERATING PERMIT FEE:$1050

NOTICE OF INSTALLATION PERMIT APPROVAL

The subject installation has been conditionally approved for construction. The installation shall be made in conformity with the plans and specifications which are a part of your application. The installation must be inspected and approved by the Bureau before it is placed into operation.

This installation shall be subject to the following additional conditions:

1. Emissions from the subject equipment shall not exceed, at any time, the following limits:

Pollutant	Pounds/Hr	Tons/Yr
Total particulates	4.0	17
Sulfur dioxide	6.6	29
Nitrogen oxides	9.6	42
Carbon monoxide	36.0	157
Volatile organic compounds	6.5	28
Hydrochloric acid	14.4	63
Chlorine	0.3	1.3

2. The landfill gas collection system and the Enclosed Ground Flare shall be designed and operated in accordance with the following criteria:

   a. Negative pressure shall be maintained at all times at the landfill gas collection wells. Each gas collection well shall be equipped with a throttling valve to enable adjustment of the gas collection rate;

b. There shall be no landfill gas leaks which result in concentrations of 500 ppmv or more, measured as propane (or 1375 ppmv or more, measured as methane), at a distance of 0.5 inches from any of the landfill gas collection wells and any piping, or any other connections or fittings, along the landfill gas transfer paths of the landfill gas collection system;

c. The flare shall be designed to achieve and maintain a destruction/removal efficiency (DRE) of at least 98% (by weight) for nonmethane organic compounds;

d. The flare shall be an enclosed ground type which is shrouded, with no visible flame emitting from the flare;

e. The flare shall operate at a minimum temperature of 1600°F, and shall have a residence time of at least 0.5 seconds;

f. The flare shall be equipped with a continuous pilot ignition source, using only propane or natural gas as the auxiliary fuel;

g. The flare shall operate with a flame present at all times. The flare shall be equipped with an automatic shut-off mechanism designed to immediately stop the flow of gases when a flame-out occurs. During restart or start-up, there shall be sufficient flow of auxiliary fuel to the burners such that unburnt landfill gases are not emitted to the atmosphere;

h. The flare shall be designed for and operated with no visible emissions, except for periods not to exceed a total of 5 minutes during any two consecutive hours;

i. The flare fluegas temperature shall be continuously measured and recorded; and,

j. Flare fluegas temperature records shall be retained at the facility for at least two years and made available upon request to the Bureau for inspection and copying.

3. Prior to issuance of an Operating Permit, the installation shall require stack emission testing by BFI for particulate matter, SO_2, NO_x, CO, VOC, HCL and CL_2, and visible emission testing. Also, the fluegas exit temperature shall be measured to confirm the accuracy of the flare's temperature recording device, and the installation shall be tested for destruction/removal efficiency of total nonmethane organic compounds. All such testing shall be conducted in accordance with a Bureau-approved protocol. Such testing protocol shall be submitted by BFI in writing to the Bureau at least forty-five (45) days prior to the tests. The Bureau must be notified in writing at least ten (10) days prior to the date of any tests. A complete report of the results of all tests shall be submitted to the Bureau within sixty (60) days after completion of the tests.

A complete operating permit application must be submitted within sixty (60) days of achieving full production or one hundred twenty (120) days of start-up, whichever is earlier. The operating permit application must be accompanied by the fee listed above. When it is determined by the Bureau that the installation complies with all regulations, limitations, and approved permit conditions, an operating permit will be issued.

This Installation Permit shall be kept at the site during the construction period, and be made available for review by Bureau personnel upon request.

Permit Issued by:

BUREAU OF AIR POLLUTION CONTROL

Arthur H. Fieser

Arthur H. Fieser, Ph.D., P.E.
Chief - Engineering Section

EJT/ecr
Enclosure
cc: Bernie Turlinski (EPA)
Manny Miller (PADER-BWM)
John Schombert (ACHD-EH)

ALLEGHENY COUNTY HEALTH DEPARTMENT
AIR POLLUTION CONTROL
PERMIT - INCINERATOR

APC USE ONLY
Permit 92-I-0009-I
Check No. 224-001052
Receipt No. 2-18-92
Issued 6-3-92
Expires
Fee $145.00
Basis

COMPLETION DATE — INSTALLATION [X]
DATE INSTALLED — OPERATING [ ]

NAME: BFI of Pennsylvania, Inc. **ADDRESS:** P.O. Box 47 Imperial, PA 15126 **BUSINESS:** Municipal Landfill

EQUIPMENT OWNER: same **ADDRESS:** **PHONE:** 695-0900

INSTALLER OR CONTRACTOR: OWT Construction Company **ADDRESS:** 7550 Lucerne Drive, Middleburg Heights, OH 44130 **PHONE:** (216) 891-0300

AUTHORIZED REPRESENTATIVE: George J. Paturalski **TITLE:** District Manager **SIGNATURE:** Geo. J. Paturalski **PHONE:** 695-0900

NAME OF ~~INCINERATOR~~ Flare: IT McGill PCS **MODEL:** Enclosed Flare **CLASS:** N/A **PRIMARY AREA:** N/A SQ. FT. **FEE:** $ 145.00

TYPE WASTE: Landfill gas **BTU/LB AS FIRED:** 909.1 BTU/cu. ft. CH4 (std) **DAILY AMOUNT:** N/A LBS. **ESTIMATED** [X] **ACTUAL** [ ] **RATED CAPACITY:** 190.2MMBtu/Hr ~~LBS./HR~~

PRIMARY COMBUSTION CHAMBER: N/A — LENGTH FT. IN. — WIDTH FT. IN. — HEIGHT FT. IN. — VOLUME CU. FT — GRATE AREA SQ. FT. — HEARTH AREA SQ. FT. — BURNER CAPACITY BTU/HR — HEAT RELEASE BTU/HR/CU. FT.

SECONDARY COMBUSTION CHAMBER: N/A — LENGTH FT. IN. — WIDTH FT. IN. — HEIGHT FT IN. — VOLUME CU. FT. — SMALLEST AREA SQ. FT — FLUE GAS FLOW ACFM @ °F — EXCESS AIR % — BURNER CAPACITY BTU/HR — MAX. VELOCITY FT/SEC

OPERATING SCHEDULE: 24 HOURS/DAY 7 DAYS/WK. 52 WEEKS/YR
FUEL: Propane **AMOUNT/HR:** 4lbs/hr (start-up only) **% SULFUR:** Neg.

GAS CLEANER: — **GAS FLOW:** N/A SCFM **INLET TEMP.:** N/A °F **DUST LOADING:** N/A GR SCF **EFFICIENCY:** N/A % **PRESSURE DROP:** N/A "W

STACK HEIGHT: 40 ft FT. **STACK AREA:** 88.66 SQ. FT. **EXHAUST FLOW:** 1600°F 1 atm 15,174,935 ACFM **TEMPERATURE:** 1300° - 2000 °F **DUST LOADING:** N/A GR/SCF

EMISSION ANALYSIS	PARTICULATE	SO_2	CO	NO_x	HC	OTHER
POTENTIAL	Negligible	6.57 lbs/hr	48 lbs/hr	9.6 lbs/hr	120.9 lbs/hr	see Table 1
FINAL	"	"	"	"	"	"

EMISSION BASIS: MFG. DATA [X] EMISSION FACTORS [X] STACK TEST [X] COMPANY ESTIMATE [ ] SUBMIT SUPPORTING DATA FOR METHOD USED see attached

NEAREST BUILDING: HEIGHT 30.0 FT DISTANCE ≈200 FT. **COST OF EQUIPMENT:** $ see att. vendor guide **COST OF GAS CLEANING SYSTEM $:** N/A

DRAWING NO'S. AND TITLES: see attached gas extraction and enclosed flare description

REMARKS:
Please see attached

REVIEWED BY	TITLE	DATE	REVIEWED BY	TITLE	DATE
R. J. Tyler	APE	5/27/92			

REVIEWED BY	TITLE	DATE	PERMIT APPROVED BY	TITLE	DATE
Mark L. Schooley	A.P. Engr III	5/27/92	A.J. Fraser	Chief Engr.	6-3-92

See attached letter dated 6-3-92 for limitations & conditions of approval

Appendix G. EPA Methods 1, 2, 2B, 3A, 6C, 7E, 10, 18, and 26 and Alternate Method 4

AN ALTERNATIVE METHOD FOR STACK GAS MOISTURE DETERMINATION

Jon Stanley and Peter R. Westlin*

Introduction

Reference Method 4 "Determination of Moisture Content in Stack Gases" in Appendix A of Title 40 CFR Part 60, Standards of Performance for New Stationary Sources describes two sampling methods -a reference method and an approximation method. The reference method employs Smith-Greenburg impingers whereas the approximation method uses midget impingers. A study was conducted to determine if the approximation method sampling train and procedure could be modified and be used as an alternative method. In addition, a similar study was conducted with the Reference Method 6 train to determine if the procedure could be modified to simultaneously measure moisture content and SO_2 concentration.

Test results showed that the midget impinger sampling train can be used for accurate moisture determination. This paper describes the two alternative moisture measurement methods and presents a summary and analysis of results of the field tests with the methods.

Test Method

1. Apparatus. The sampling equipment is the same as specified for the moisture approximation method in Reference Method 4 and in Reference Method 6, except for the addition of a silica gel trap. (See Figures 1 and 2). The silica gel trap is a midget bubbler with a straight tube.

2. Reagents

a. For the modified approximation Method 4, add 10 ml of water to each of the first two impingers and approximately 15 g of silica gel in the bubbler.

* Emission Measurement Branch, Emission Standards and Engineering Division, Office of Air Quality PLanning and Standards, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, August, 1978.

b. For the modified Reference Method 6 train, add 15 ml of 80 percent isopropanol to the first impinger, 15 ml of 3 percent hydrogen peroxide in the next two impingers, and approximately 15 g of silica gel in the final bubbler.

3. Procedure

a. Apply silicone grease as necessary to the ground glass fittings of the impinger halves. Wipe any extra grease from the ball joint fittings and the outside of the impingers and weigh all the impingers at one time to the nearest hundredth gram. Record the weight.

b. Assemble the train as shown in Figure 1 or Figure 2.

c. Perform a leak check by disconnecting the first impinger from the probe and, while blocking the impinger inlet, activating the pump and opening the needle valve. An acceptable leak check is achieved when the rotameter indicates no flow, the dry gas meter is stationary for one minute, and bubbling in the impingers is limited to less than one bubble per second. Release the impinger inlet plug slowly, turn off the pump, and reconnect the probe.

d. Read and record the dry gas meter volume. Ice down the impingers and heat the probe as necessary. Read and record the barometric pressure.

e. Start the sample pump and adjust the sample flow. Maintain the flow for the modified approximation Method 4 between 1 and 4 lpm and the flow for Reference Method 6 at 1 lpm.