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BAROMETRIC PUMPING OF BURIAL TRENCH SOIL GASES INTO THE ATMOSPHERE AT THE 740-G SANITARY LANDFILL (U)

by

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This document was modified to a Revision 1 status to meet DOE release requirements.

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EXECUTIVE SUMMARY

In 1991, a soil gas survey was performed at the Savannah River Site Sanitary Landfill as part of the characterization efforts required under the integrated Resource Conservation and Recovery Act (RCRA) Facility Investigation and Comprehensive Environmental Resource Conservation and Recovery Act (CERCLA) Remedial Investigation (RFI/RI) program. This survey identified several areas of the landfill that were releasing volatile organic compounds to the atmosphere at levels exceeding regulatory standards. Knowledge of the rates of VOC outgassing is necessary to protect site workers, provide input into the human health and environmental risk assessment documents and provide input into the remedial design scenario. Data from the characterization soil gas survey is presented in WSRC-RP-92-878.

It is suspected that the outgassing of volatile organics varies with barometric pressure, therefore an experiment was designed to evaluate selected areas of the landfill over time and compare the results with the measured barometric pressure at the time of the sampling. To accomplish this, air under four groundsheets was sampled and analyzed for the light hydrocarbons, C_1-C_4. Selected samples were analyzed for a number of volatile organic species.

The results of this study confirm that during periods of decreasing barometric pressure, VOC gaseous components of the burial trenches migrate through the soil cover into the near surface atmosphere. This variable migration may affect remedial designs such as clay barrier caps and methane ventilation systems. It is suggested that these data be further studied to determine the actual amounts of these volatile species which are injected into the atmosphere by barometric pumping at this and other "burial grounds" both at SRS and in the public sector as well.

I. INTRODUCTION

Data from the completion of a soil gas survey of the 740-G Sanitary Landfill (data provided in WSRC-RP-92-878), in support of the RCRA/CERCLA Facility Investigation/Remedial Investigation program, found several areas where the VOC emissions from the landfill trenches exceeded regulatory levels. Because these emissions could affect the human health risk assessment scenarios and also possibly affect remedial design criteria, an experiment was designed to evaluate the type and timing of soil gas emissions by barometric pumping. Four groundsheets were installed at selected locations at the landfill to test the hypothesis that landfill gases might be escaping through the soil cap over the burial trenches and that such gaseous migration was related to changes in barometric pressure. Groundsheets were utilized to restrict dilution and mixing of the gasses with air. Locations of each of the four groundsheets at the landfill relative to site locations of the landfill soil gas survey are shown on Figure 1. Samples were taken from beneath each groundsheet every four hours over a 2 week period between January 5 - 19, 1991.

These samples were analyzed for the light hydrocarbons including methane, ethane, propane, i-butane, n-butane, ethylene, and propylene. Methane was the component in highest concentration found in the burial trenches during the landfill soil gas survey. In some areas, burial trench methane exceeded 60% of the total gas. Light hydrocarbon concentrations (ppmv) under each of the four groundsheets are presented in Table 1 and methane concentrations are shown as a function of time on Figure 2.

II. BACKGROUND

A soil gas survey conducted in November and December, 1990 of some 252 locations at the 740-G Landfill, as shown on Figure 1, revealed the presence of numerous volatile organic species in the soil air of the burial trenches, e.g. see Figure 26. Not surprisingly, methane gas, presumably resulting from the bacterial degradation of cellulose and other organic materials, was found in large concentrations, exceeding 60% of the total soil air in some areas of the landfill as shown on the contour map of percent methane on Figure 3. Details of this soil gas survey of the 740-G Landfill are discussed in a separate report (WSRC-MS-92-878).

The observations of the large concentrations of volatile species, particularly methane, in the landfill burial trenches, suggested to SRS personnel the potential that these gases could move through the 2.5 - 3.0 foot soil layer covering the burial trenches, particularly during periods of rapidly decreasing barometric pressure. This suggestion was based on experience with soil gas observations and measurements of similar soil air/atmospheric pressure equilibrations near a leaking hydrocarbon storage well .

While it is a rather elementary concept that reduction of atmospheric pressure at the earths surface would cause air from the pore volume of the soil to rapidly equilibrate, resulting in flow of soil air into the atmosphere, it is a phenomenon which, to our knowledge, has not been widely studied. It is hoped that this dataset will provide impetus for further evaluation and quantification of the effects of barometric pumping and its implications with respect to the "storage" of volatile species in near surface soils.

III. EXPERIMENTAL

In order to implement this study, four 8' x 8' groundsheets were constructed. Each groundsheet consisted of an 8' x 8' frame made of 2" x 4" x 8' lumber which was covered with two sheets of 4' x 8' x 3/4" strand board. These materials were nailed together in a manner calculated to prevent or significantly impede convective flow of gases under the groundsheets by the wind. No attempt was made to make the groundsheets airtight, i.e., no glue or other sealants were used. It is acknowledged that some convection may have occurred, particularly toward the end of the sampling period due to the effects of weather on the groundsheets.

When each groundsheet was installed at the landfill, a trench, 1" to 1.5" deep, was dug to the dimensions of the frame. After the groundsheet was in place in the trench, the soil removed from the trench was replaced around the outside of the groundsheet to impede convective flows of air under the edge.

A 1/4" o.d. nylon sampling tube attached to the underside (center) of each groundsheet, was brought out under one edge and secured to the top of the groundsheet to allow ease of sampling. This tube was capped so as to prevent water from entering the tube during periods of rainfall.

Sampling from under the groundsheets began at approximately 10 am on January 5, 1991 and was repeated at a nominal interval of 4 hours until January 19, 1991. A total of 369 samples (including duplicates) were taken. A few samples from under groundsheet #4 could not be taken on January 15-16 when it was submerged by a heavy rain. This water was drained on January 16 and sampling was resumed.

Barometric pressure as a function of time was supplied by SRS from a meteorological station on the site. In hindsight it would have been useful to have recorded rainfall amounts at the landfill. Certainly, the water content of the soil affects its permeability and thus its response to barometric pressure changes.

IV. QUALITY ASSURANCE

The quality assurance/quality control procedures of the sampling subcontractor were followed for all field and laboratory analytical work. Documentation of applicable sampling and analytical methods and associated quality assurance procedures are included in this report in Appendix I.

A. Sampling Methods

Methods and quality assurance procedures used to obtain groundsheet air samples are a modification of those used for soil gas samples in Sampling Method SMI in Appendix I. In this case, since no hole was required, the sampling syringe was simply removed from the sample probe described in SM1 and was attached to the 1/4" nylon sampling tube as each groundsheet was sampled.

Samples were collected in previously evacuated 22 ml bottles fitted with butyl rubber septa. A duplicate sample and a blank was collected for every 10 samples. Field sample logs which document the details of the sample collection are in Appendix II.

B. Analytical Methods

Methods and quality assurance procedures for the analysis of light hydrocarbon soil gas samples are documented in Analytical Method AMI. Representative chromatograms of C_l-C_4 hydrocarbon samples from this data set are shown on Figures 4-7.

C. Accuracy

Calibration of the C_l-C_4 hydrocarbon gas chromatograph was accomplished using a certified commercial standard (Matheson Gas Products Inc.) which is of the order 10 ppm for methane and 1 ppm for the other light hydrocarbons and is called Standard "M"; and a second commercial standard (Scotty Specialty Gases, Can Mix 224, ICN #35) which contains only the C_l-C_4 straight chain hydrocarbons and is of the order 1000 ppmv for each hydrocarbon. A chromatogram of these standards (Standard "M" and "224") is shown on Figure 8.

D. Precision

We have estimated the working precision of this data from the repetitive analyses of hydrocarbon standards"M" and "224" as shown on Table 2. The percent standard deviation of the mean of 39 analyses of Standard "M" is less than 5% for each of the seven compounds. The percent standard deviation of the mean of 4 analyses of Standard "224" was $\leq$ 2%.

E. Minimum Detection Levels

Minimum detection levels reported in this survey for the light hydrocarbons, C_1-C_4, are 5 ppb. A 5 ppb standard (Microseeps Standard M diluted 200:1) is reliably determined with S/N >2. A chromatogram of the analysis of this diluted standard is shown on Figure 9.

F. Blanks

Results of the analyses of system blanks are included on Table 3 and representative chromatograms are shown on Figures 10 and 11.

G. Data On Magnetic Disk

All analytical data, including samples, duplicates, standards, and blanks are provided (one copy) on magnetic disk. All data are in units of parts per million by volume.

All data are in Lotus 123 (Release 2, 1985) spreadsheet format using DOS (Version 4.01). All analytical data were accumulated and processed automatically via a gas chromatographic data system. The processed data is transferred directly into the Lotus format thus ensuring the quality of the data.

V. RESULTS

The results of the analyses of light hydrocarbons in the air under each of the four groundsheets at the 740-G Landfill is presented in Table 1 and the methane concentration data is presented on Figure 2. Concentrations of the C_1-C_4 hydrocarbons which were determined in the landfill soil gas survey sites nearest each of the four groundsheets are shown in Table 4.

Upon inspection of Figure 2, it is clear that methane concentrations under all groundsheets varied considerably over the two weeks of observations; and that the measured concentrations under groundsheet #2 are considerably larger than those measured under groundsheets 1, 3, and 4. The methane concentrations under groundsheets 1, 3, and 4 are similar in magnitude. More careful study of Figure 2, reveals that changes in methane concentrations under all groundsheets are in phase, despite the obvious differences in magnitude mentioned above.

We have already suggested that one possible reason for observation of soil gas hydrocarbons in the air under the groundsheets was pressure equilibration of soil air with the atmosphere during periods of rapidly decreasing barometric pressure. Presented in Figures 12 - 24 are concentrations of selected components of the light hydrocarbons (ppmv) under each of the groundsheets and barometric pressure in millibars as a function of time.

Methane under groundsheet #2 and barometric pressure as a function of time is shown on Figure 12. It is immediately obvious that methane under this groundsheet increases dramatically during periods of decreasing barometric pressure. Closer study of Figure 12 reveals that even short periods of stable pressure in an overall decreasing pressure regime, causes cessation of the methane increase under the groundsheet. For example, the overall increase in methane between 10 am on January 6 and 6 am on January 7, is punctuated by a significant decreases in methane, which occurs during a short period of stable pressure between 6 pm on January 6 and 2 am on January 7. Again the increase in methane which begins late on January 10, peaks and decreases mid-day on January 11 before increasing dramatically early on January 12. (Note that on the time axis, each tick mark interval is four hours beginning at 10 am January 5. The tick mark opposite the indicated date January 6 - 19 is 2 am on that date.) The increases in methane after January 15 seem somewhat muted compared to the earlier data when the large pressure drop between January 15 and 16 is considered. This may be due to increased loss of methane from the groundsheet as its physical integrity degraded due to weathering, or to the effects of increased soil moisture resulting from the heavy rains during this period. Increases in soil moisture no doubt decrease the permeability of the soil and impede the pressure equilibration which causes the flow of soil air through the soil/atmosphere boundary. The heavier hydrocarbon homologs; ethane, ethylene, propane, propylene, and i-butane; also migrate through the soil/atmosphere boundary at groundsheet #2 as shown in Figures 13 - 17.

The effects of barometric pumping for selected hydrocarbons at groundsheets 1, 3, and 4 are shown in Figures 18 - 24. Levels of hydrocarbons measured at these groundsheets are smaller than those observed at groundsheet #2. This is despite the fact that the measured soil gas hydrocarbons in the burial trench beneath groundsheet #1 are higher than in the burial trench beneath groundsheet #2 as shown on Table 4 and Figure 3. This points to the important role of permeability in the overall process of vertical migration of gases in near surface soils.

Although not a part of the formal scope of this study, we were interested to qualitatively determine if the VOC's in the landfill burial trenches also migrated through the soil cap into the atmosphere. Selected sample bottles from groundsheet #2 from which we had already analyzed a portion of the contents for the light hydrocarbons were recovered. A quick check revealed that those selected still retained a slight positive pressure suggesting that little if any contamination of their contents had occurred since the C_1 -C_4 analysis in early January. Pressure in each of these 22 ml bottles was bled to atmospheric pressure using a syringe needle and 22 ml of nitrogen gas was then added with the sample syringe. This effectively diluted the concentration of the components of the sample by a factor of 2 relative to its original concentration before analysis of the light hydrocarbons. The selected samples were those collected across the large methane excursions which occurred between midnight on January 10 and 6 pm on January 12. Shown in Figure 25 are flame ionization detector profiles with three successively expanded scales of the sample collected under groundsheet #2 at 2 pm on January 11 during a methane concentration peak. The flame ionization detector profile of the VOC's from the burial trench beneath groundsheet #2 is shown in Figure 26. Although the match is not one-to-one, these data clearly show that volatile species which migrate through the soil/atmosphere boundary during periods of rapidly falling barometric pressure, are not limited to the light hydrocarbons, but extend to many if not all components of the burial trench gases. From the uppermost trace of the chromatogram of groundsheet gases in Figure 25, it is obvious that methane is by far the dominant organic species present. It may be that the higher molecular weight components are assisted in their migration through the soil cap by the large excess of methane.

These data could be modeled to set some limits on the total amounts of volatile species released at the 740-G Landfill per year and to assess the significance of these releases on the environment. The results of such a study and its implications for other "burial grounds" both at SRS and nationwide would seem to be of more than passing environmental interest.

VI. CONCLUSIONS AND RECOMMENDATION

Volatile species including , but not limited to the light hydrocarbons, were found to migrate through the soil/atmosphere boundary at the 740-G Landfill during periods of rapidly decreasing barometric pressure. Short periods of stable pressure during overall declining pressure regimes were sufficient to temporarily halt the vertical migration. The data suggest the importance of soil permeability to the overall rate of vertical migration.

It is suggested that these observations conclusively demonstrate that barometric pumping is a fundamental process which plays an important role in the movement of volatile species in the near surface soil and should be considered when evaluating VOC data for regulatory risk assessments and remedial/closure design. It is recommended that these data be studied and perhaps extended to determine the implications of this process to the injection of volatile species into the atmosphere.

Figures and Tables

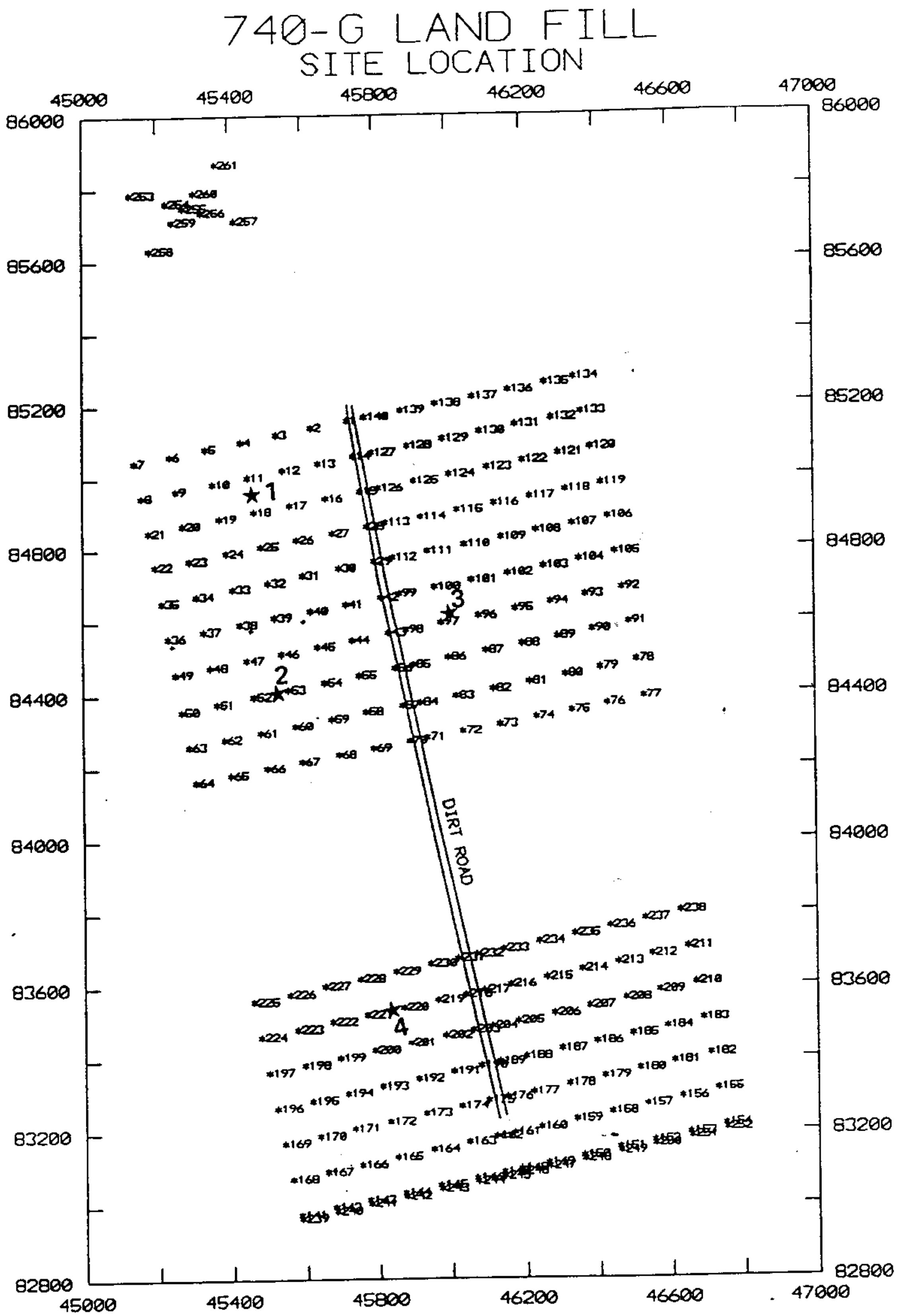


Figure 1. Locations (★) of Groundsheets for the 740-G Landfill Groundsheet Study Relative to Site Locations for the Soil Gas Survey

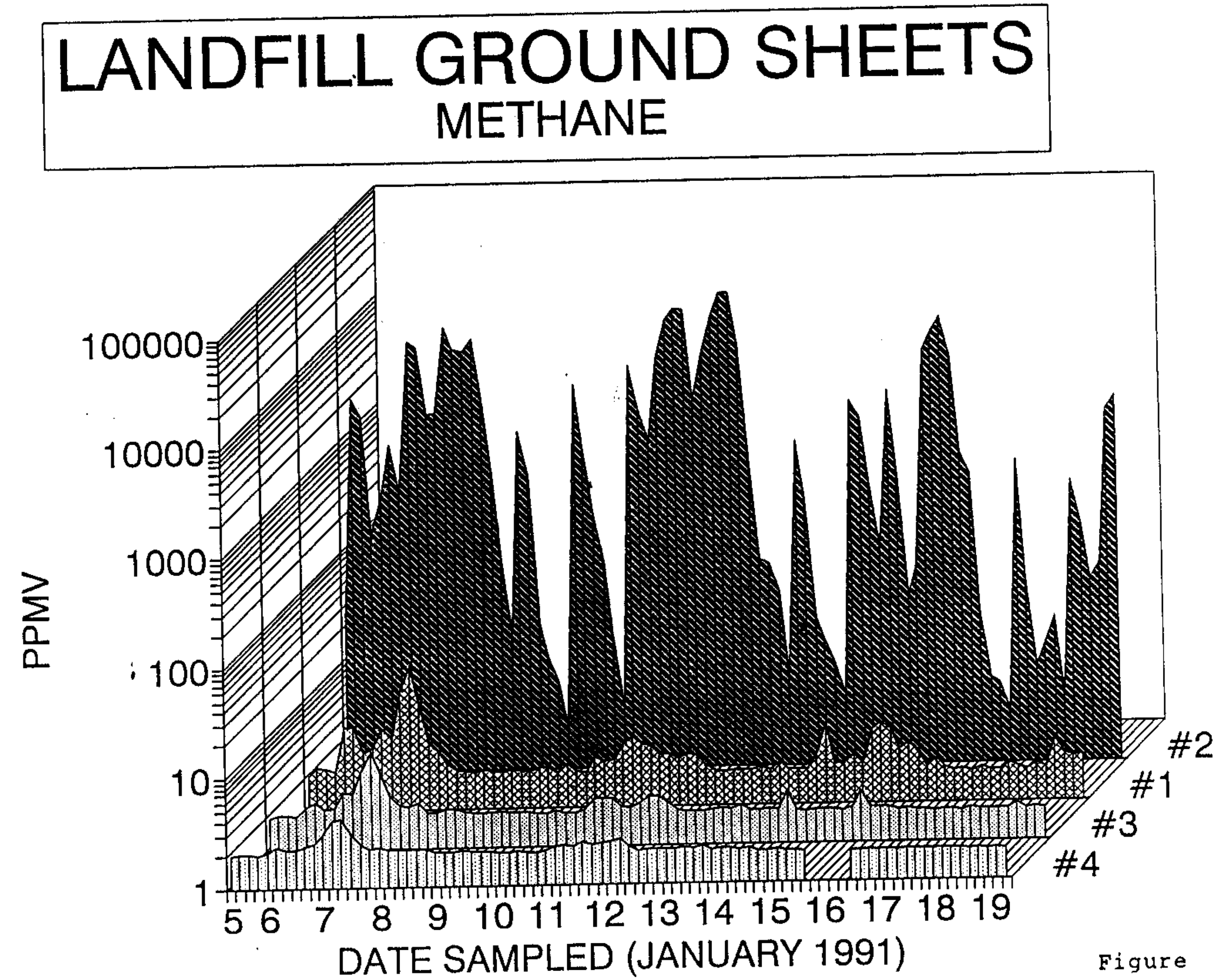
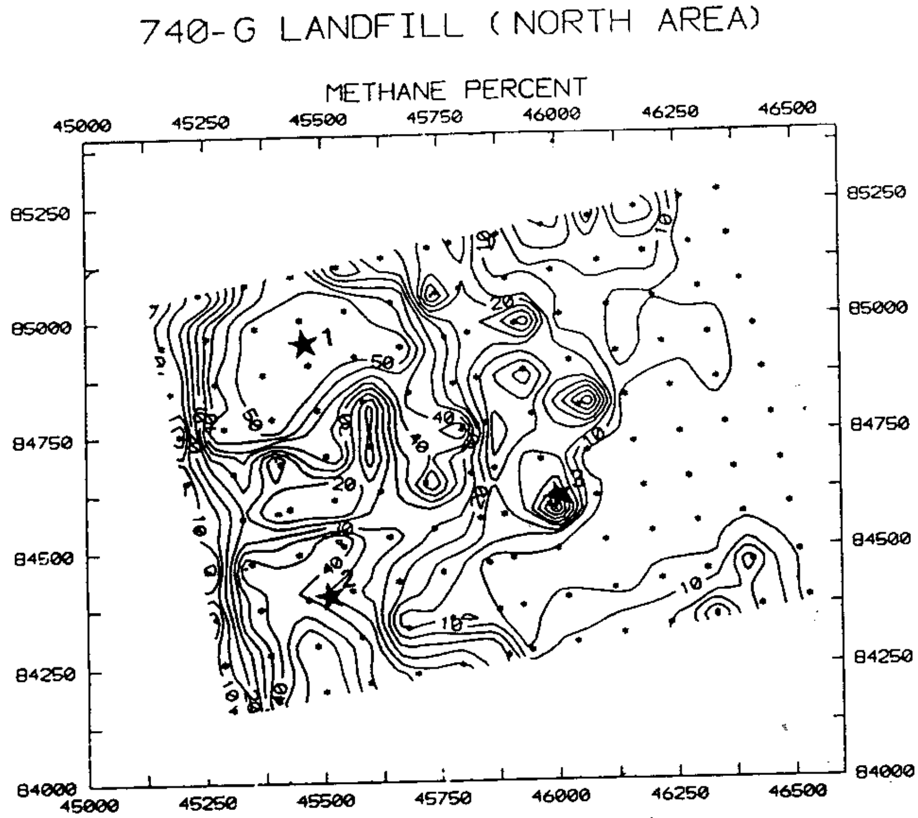

LANDFILL GROUND SHEETS
METHANE
PPMV
100000
10000
1000
100
10
1
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
DATE SAMPLED (JANUARY 1991)
#2
#1
#3
#4

Figure 2.



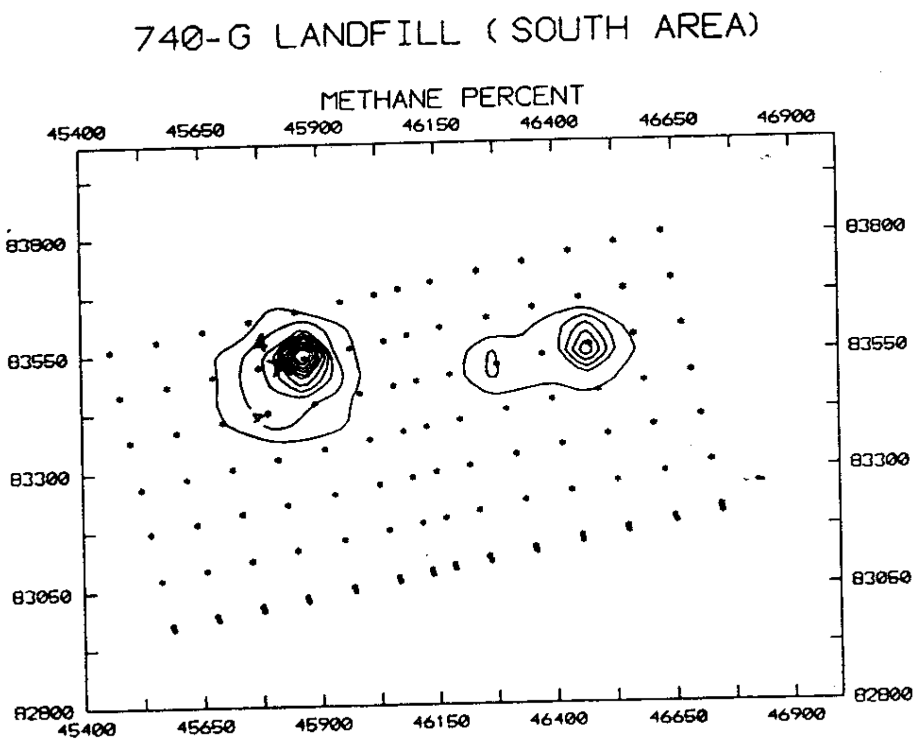
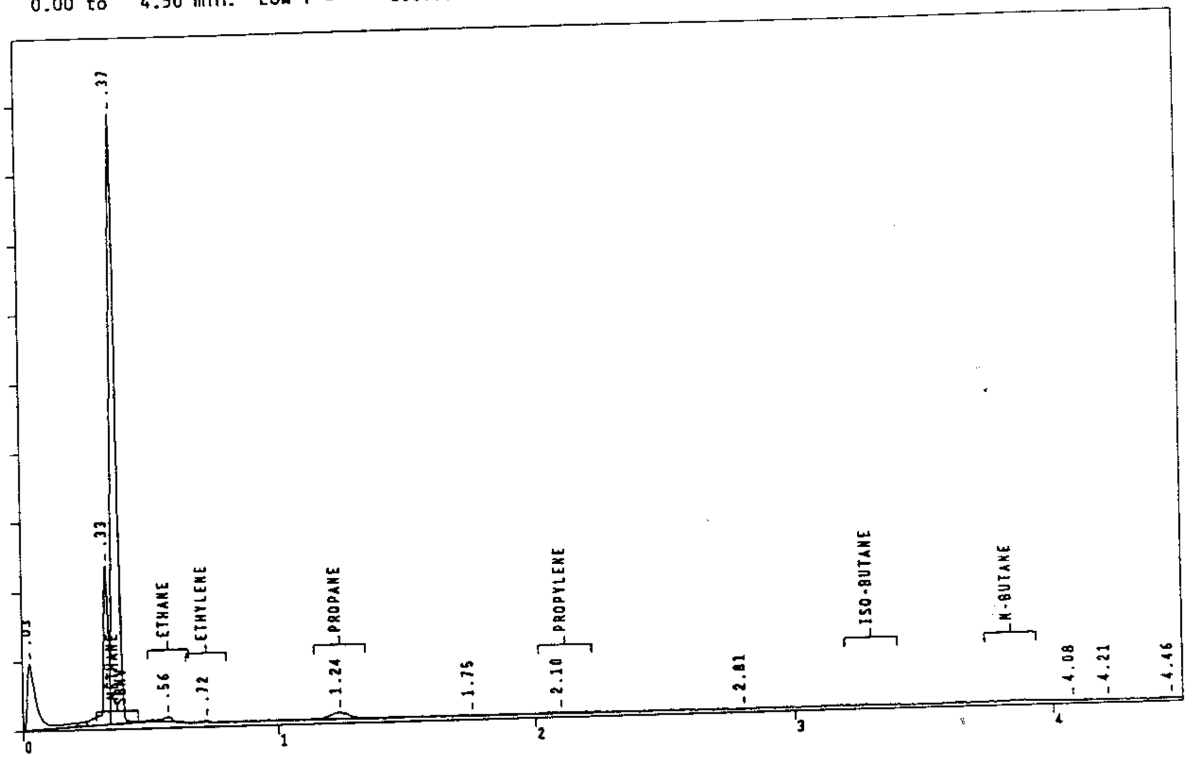


Figure 3. Soil Gas Percent Methane at the 740-G Landfill with Locations of the Groundsheets Indicated by ★

File=C:\CP\data2\GS3.10R Date printed = 03-27-1991 Time = 15:52:48
0.00 to 4.50 min. Low Y = 0.09991 mv High Y = 1.15534 mv Span = 1.05543 mv



File=C:\CP\data2\GS3.10R Date printed = 03-27-1991 Time = 15:54:43
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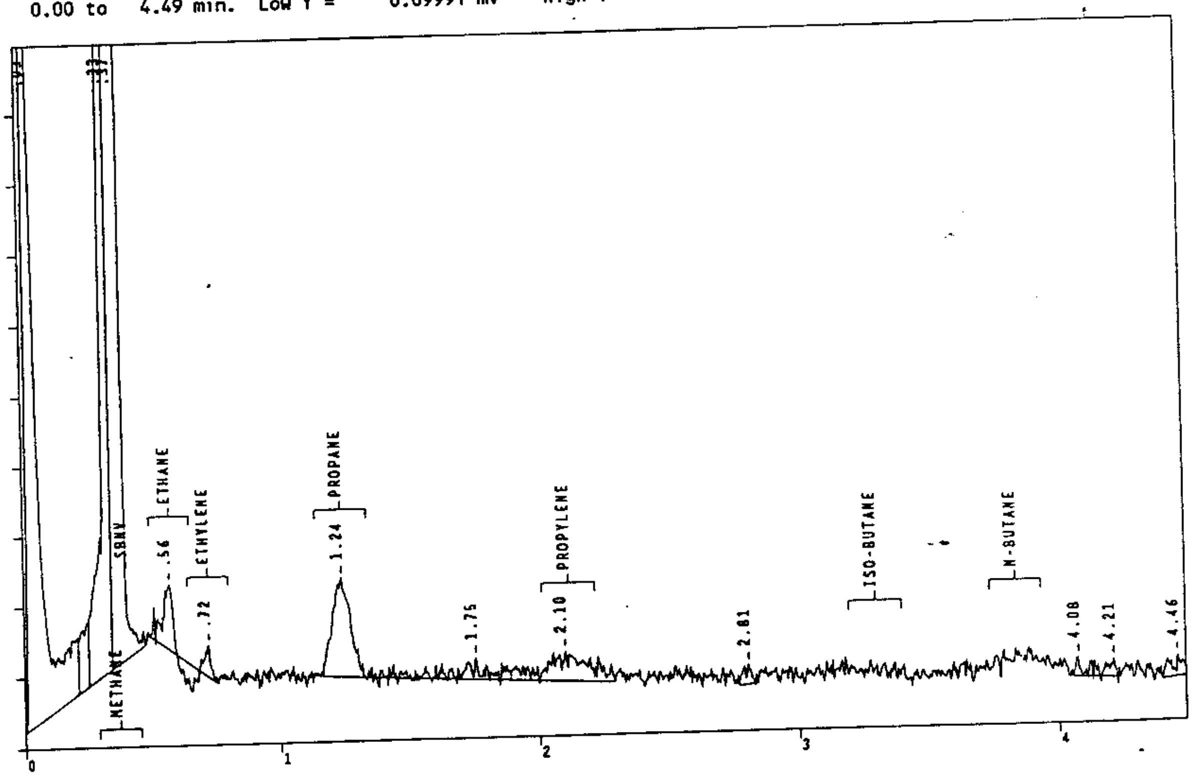


Figure 4. Representative Chromatogram of C1-C4 Hydrocarbons Under Groundsheet #1.

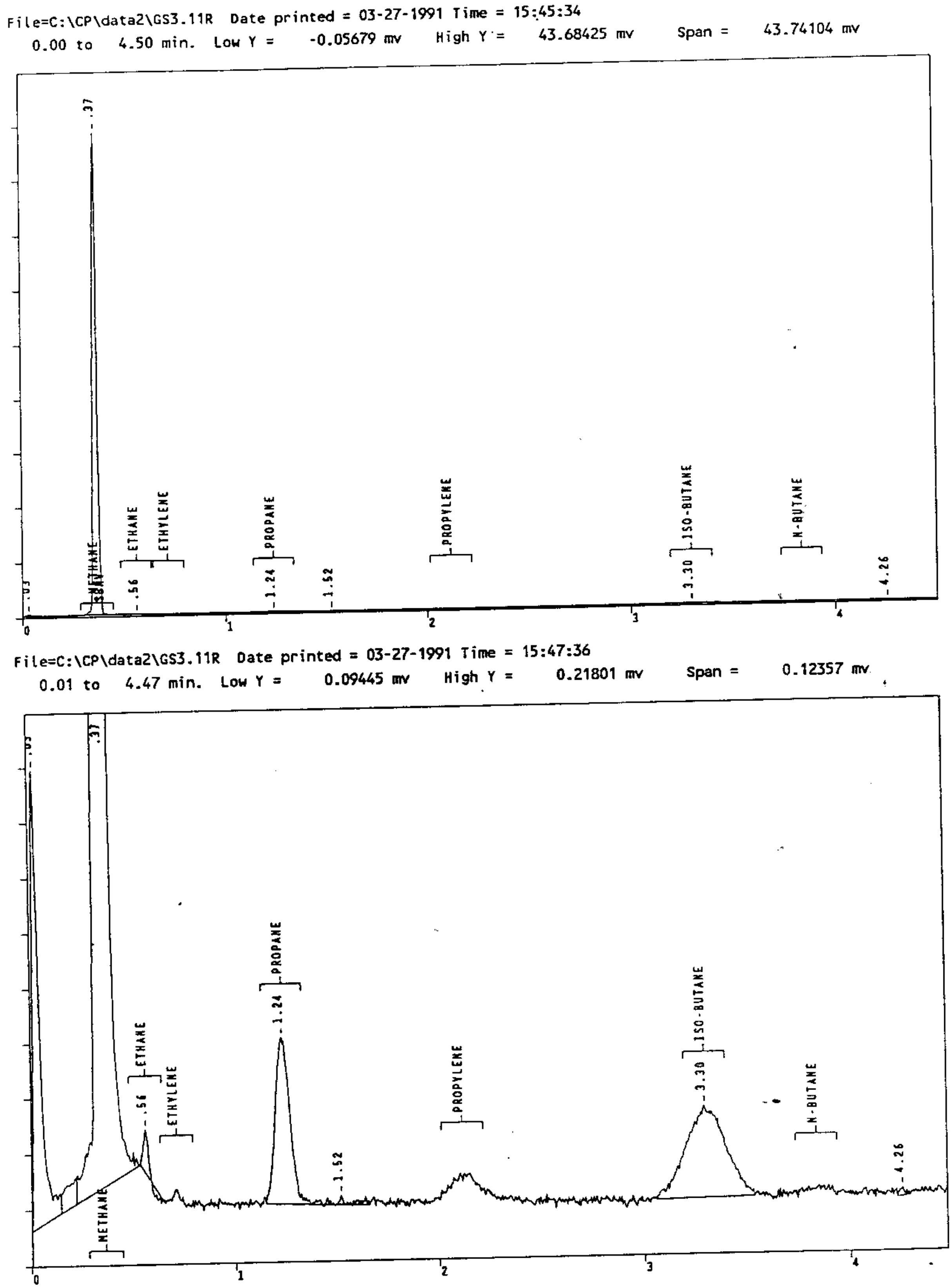
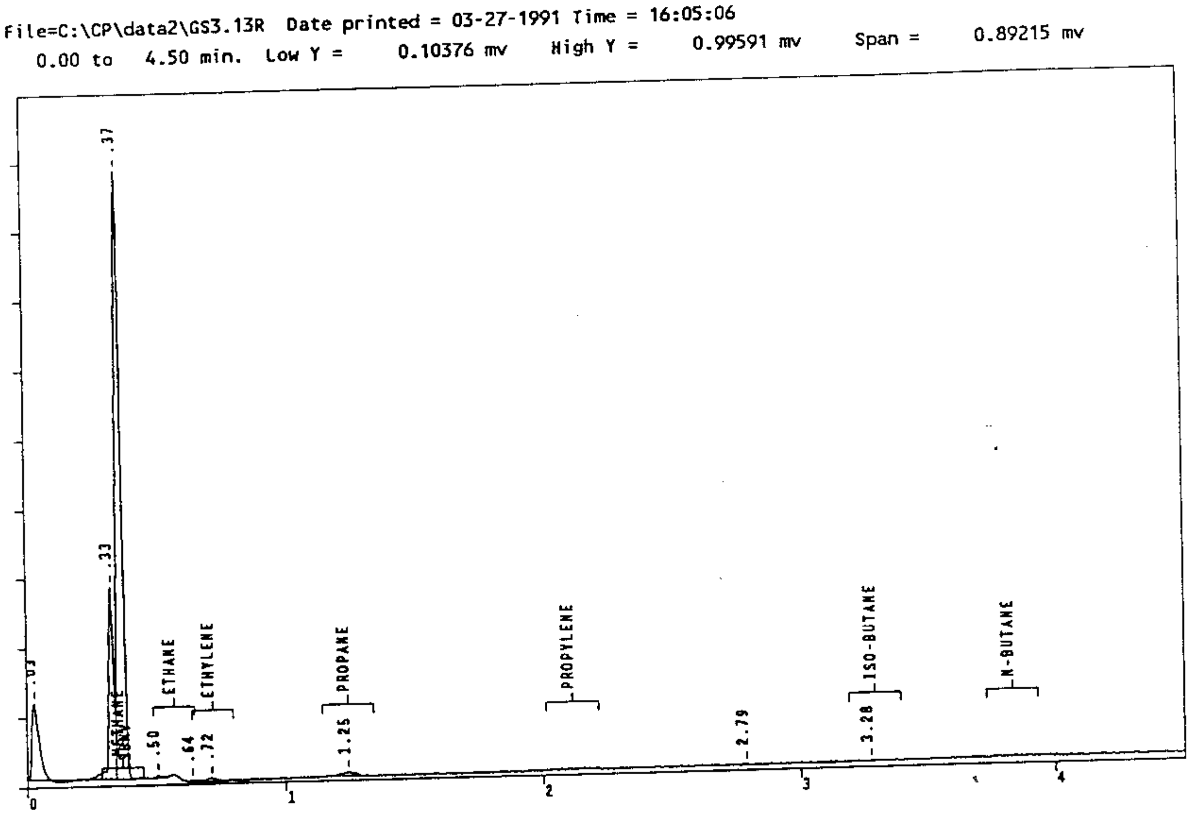


Figure 5. Representative Chromatogram of C1-C4 Hydrocarbons Under Groundsheet #2.



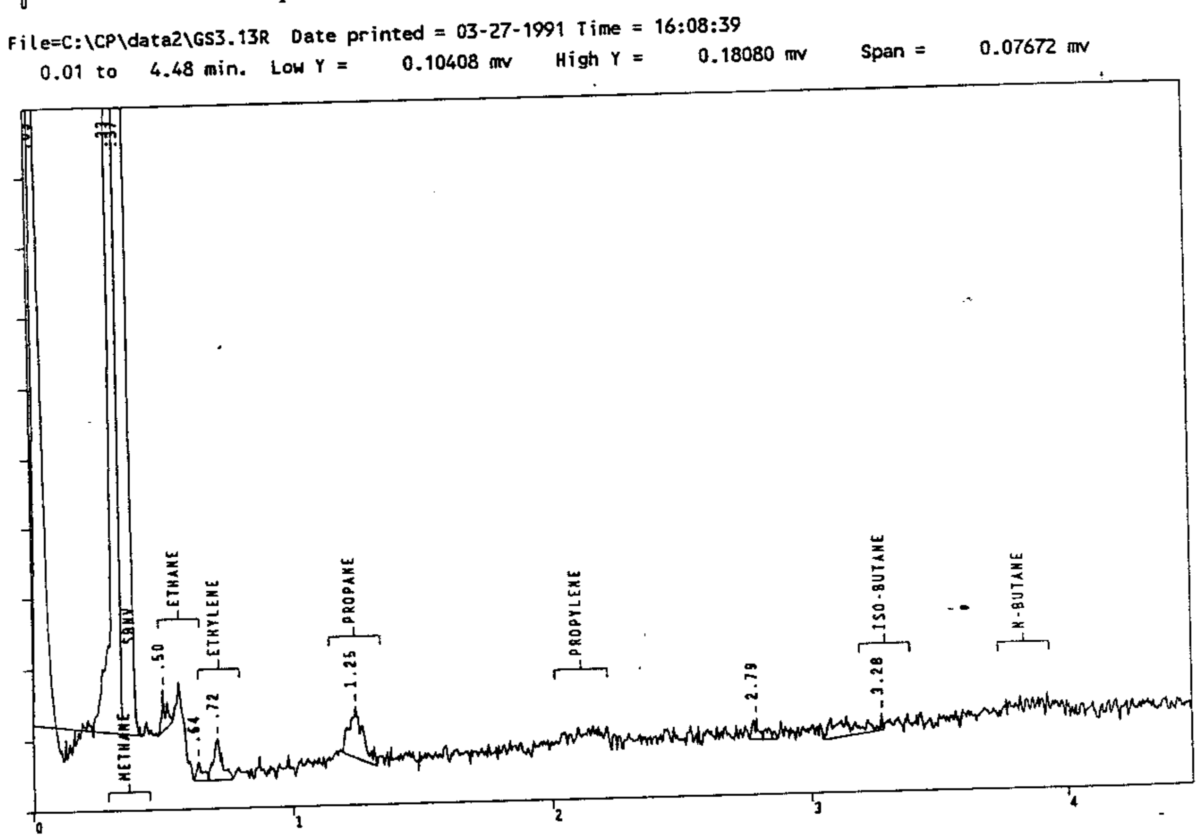


Figure 6. Representative Chromatogram of C1-C4 Hydrocarbons Under Groundsheet #3.

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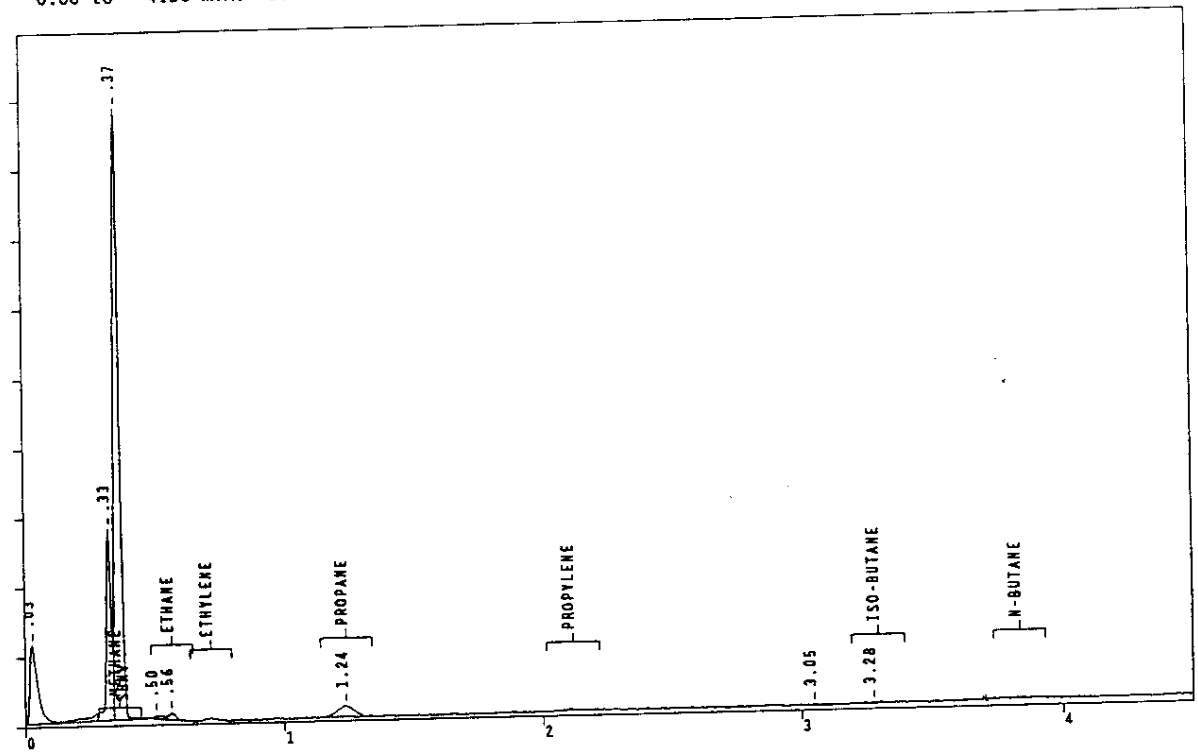
0.00 to 4.50 min. Low Y = 0.10310 mv High Y = 1.00218 mv Span = 0.89908 mv



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0.00 to 4.50 min. Low Y = 0.10310 mv High Y = 0.17432 mv Span = 0.07121 mv

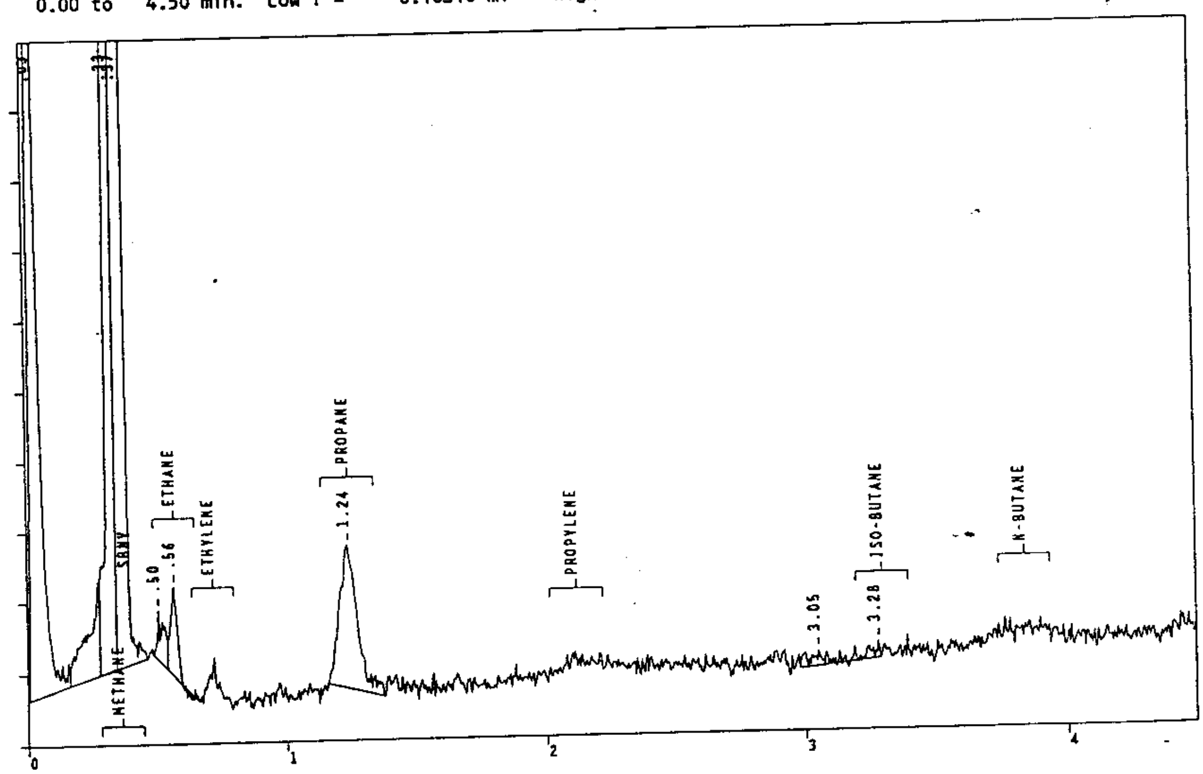


Figure 7. Representative Chromatogram of C1-C4 Hydrocarbons Under Groundsheet #4.

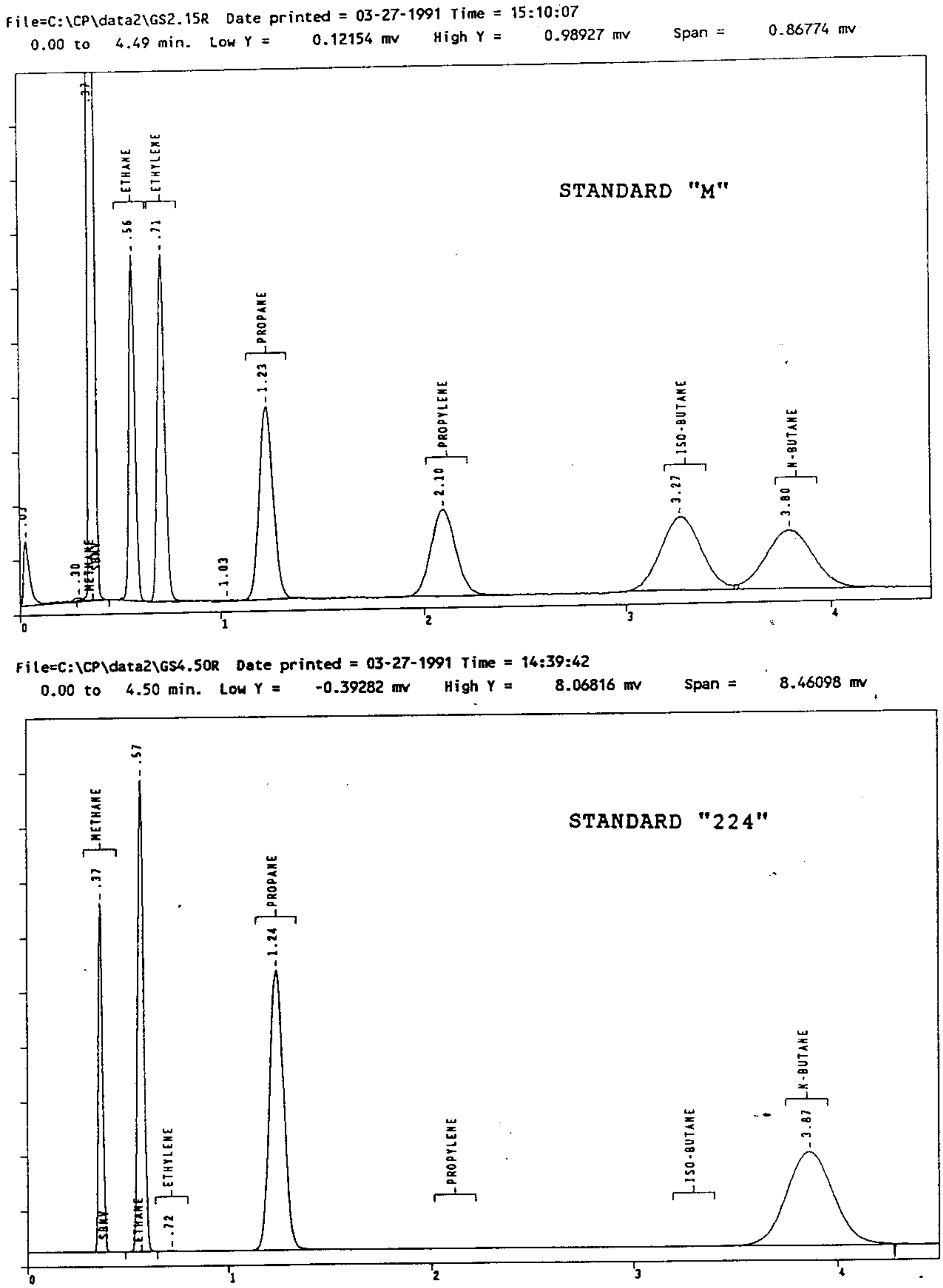
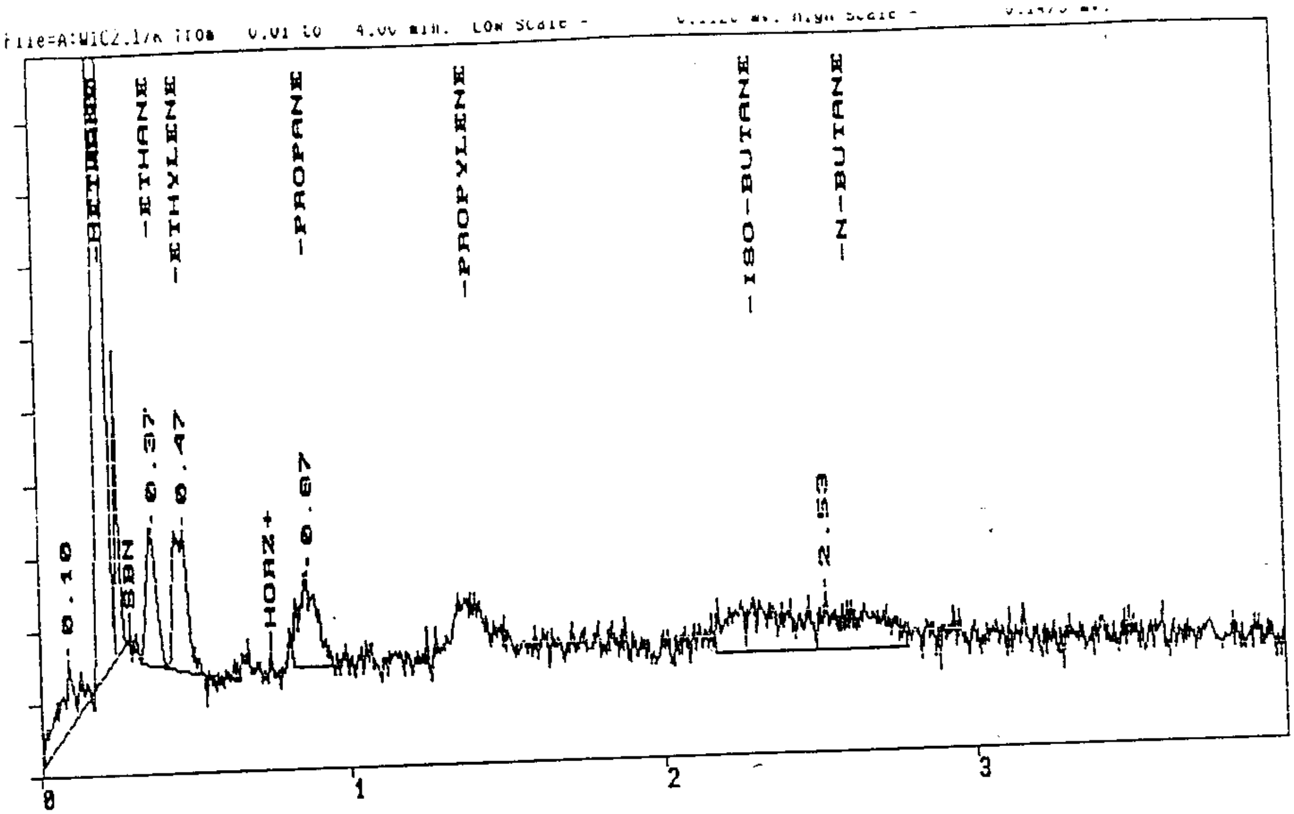


Figure 8. Representative Gas Chromatogram of C1-C4 Hydrocarbon Standard "M" and Standard "224".



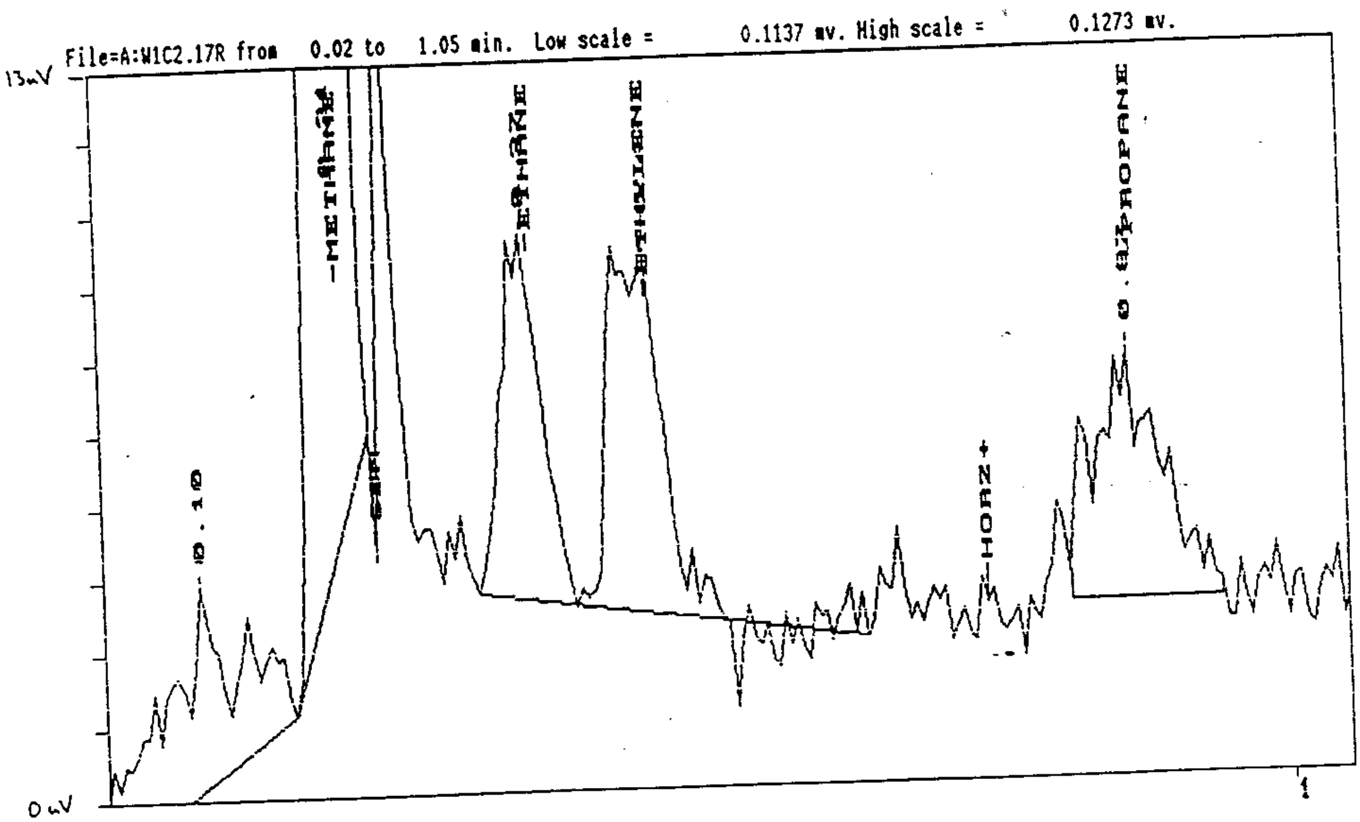


Figure 9. Gas Chromatogram of C1-C4 Hydrocarbon Standard M @ 200:1 Dilution in N2

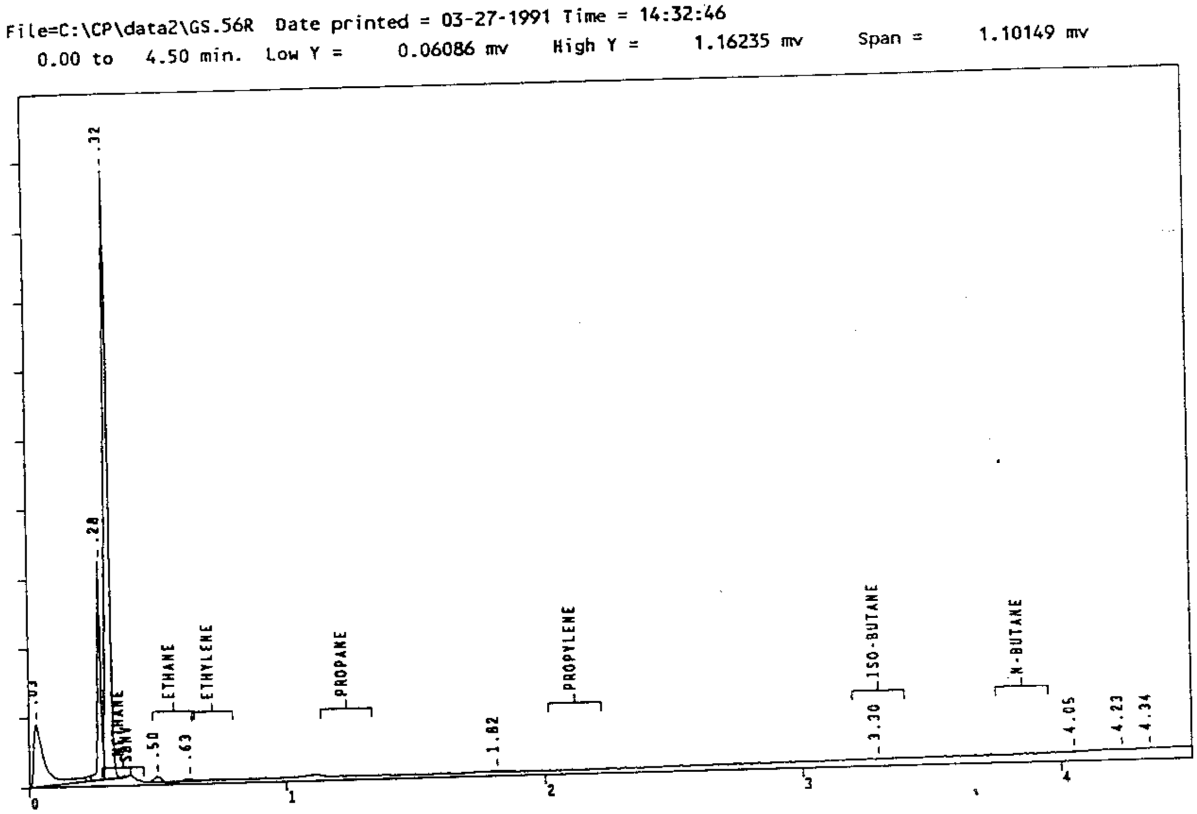
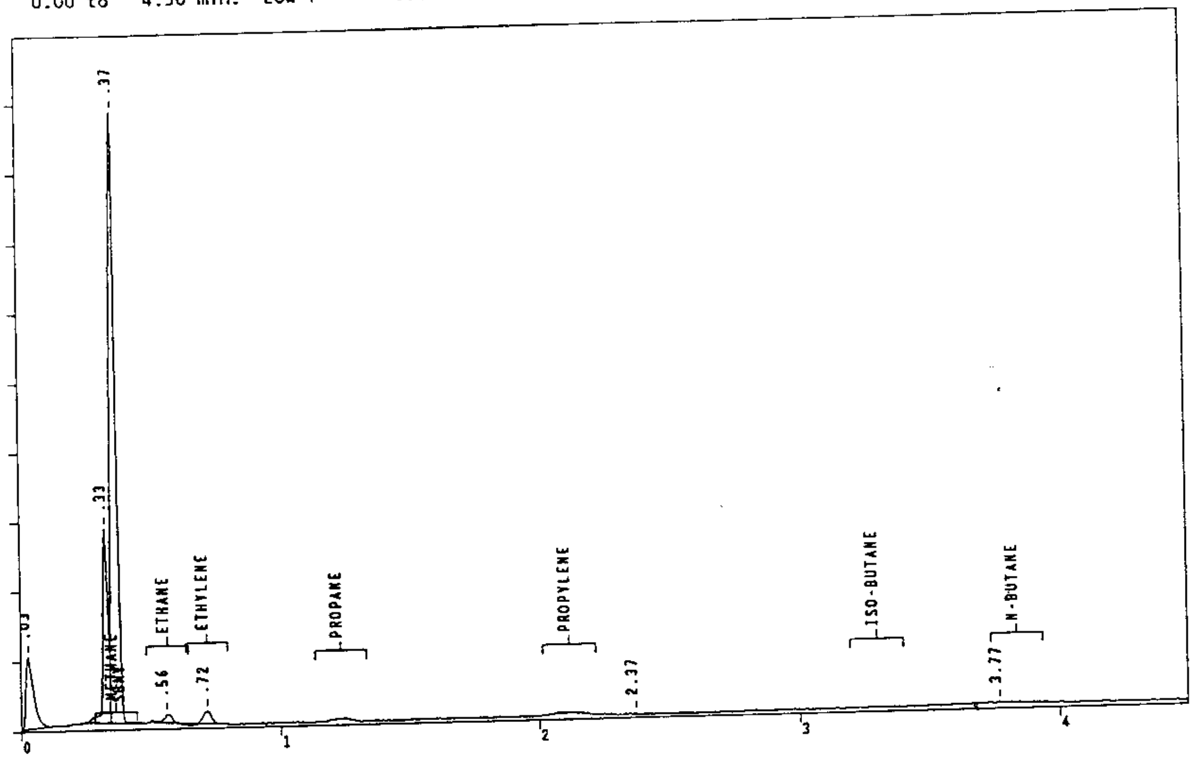


Figure 10. Representative Chromatogram of System Blank #5

File=C:\CP\data2\GS2.40R Date printed = 03-27-1991 Time = 15:26:43
0.00 to 4.50 min. Low Y = 0.11465 mv High Y = 1.05208 mv Span = 0.93744 mv



File=C:\CP\data2\GS2.40R Date printed = 03-27-1991 Time = 15:29:32
0.01 to 4.49 min. Low Y = 0.11465 mv High Y = 0.22534 mv Span = 0.11069 mv

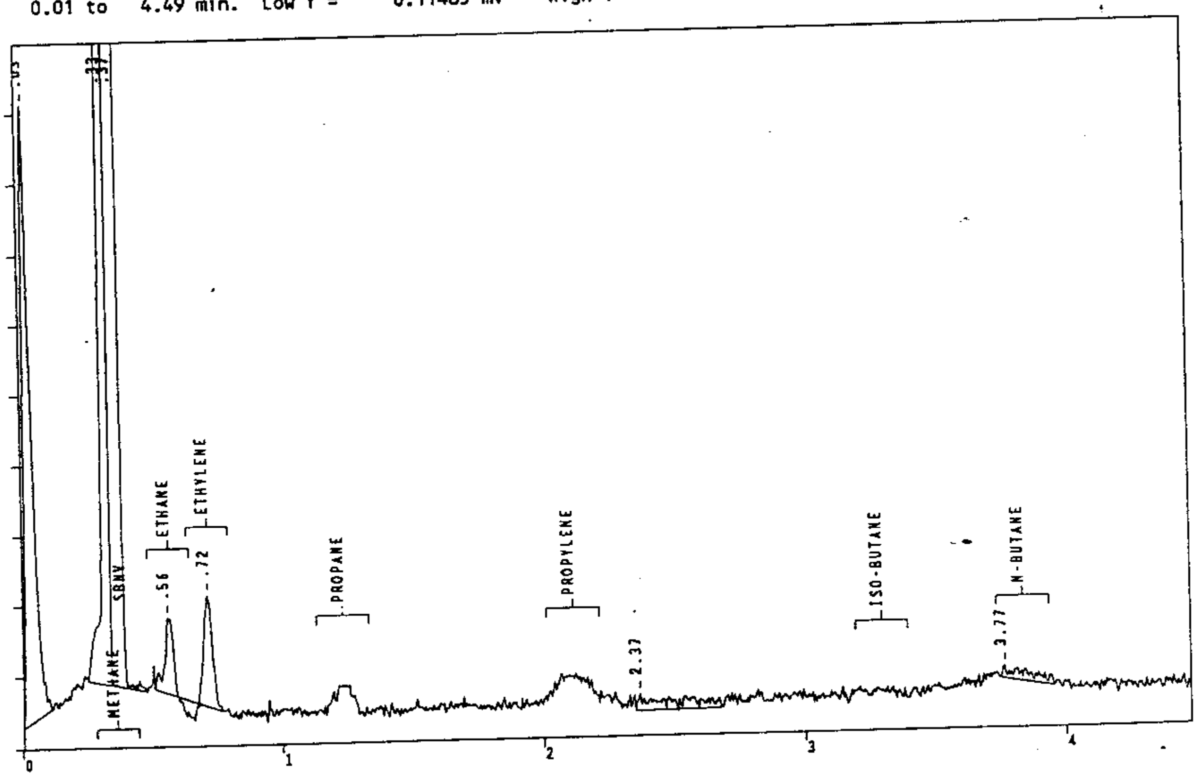


Figure 11. Representative Chromatogram of System Blank #19

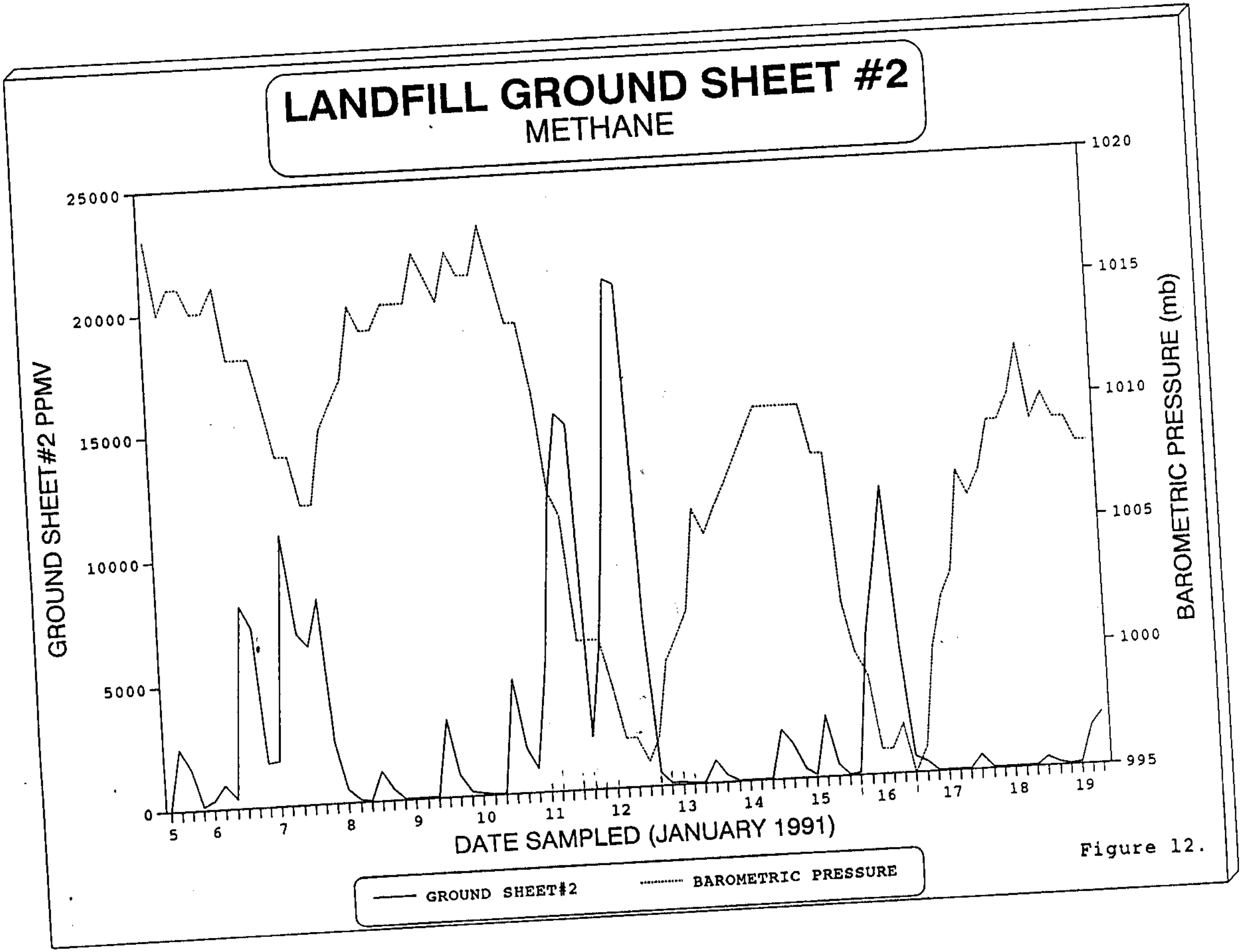

LANDFILL GROUND SHEET #2
METHANE
GROUND SHEET#2 PPMV
0
5000
10000
15000
20000
25000
BAROMETRIC PRESSURE (mb)
995
1000
1005
1010
1015
1020
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
DATE SAMPLED (JANUARY 1991)
GROUND SHEET#2
BAROMETRIC PRESSURE

Figure 12.

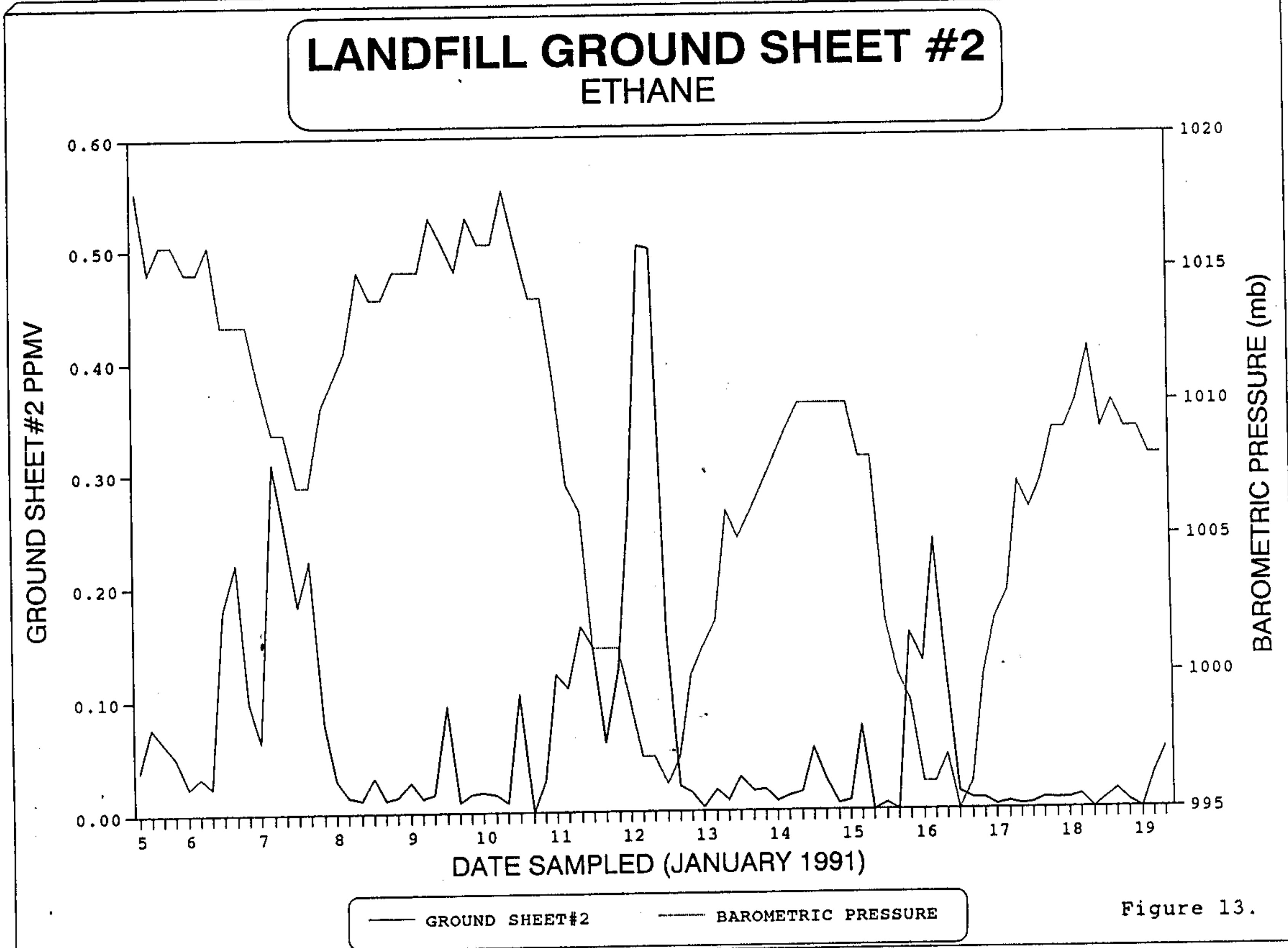

LANDFILL GROUND SHEET #2
ETHANE
GROUND SHEET#2 PPMV
0.60
0.50
0.40
0.30
0.20
0.10
0.00
BAROMETRIC PRESSURE (mb)
1020
1015
1010
1005
1000
995
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
DATE SAMPLED (JANUARY 1991)
GROUND SHEET#2
BAROMETRIC PRESSURE

Figure 13.

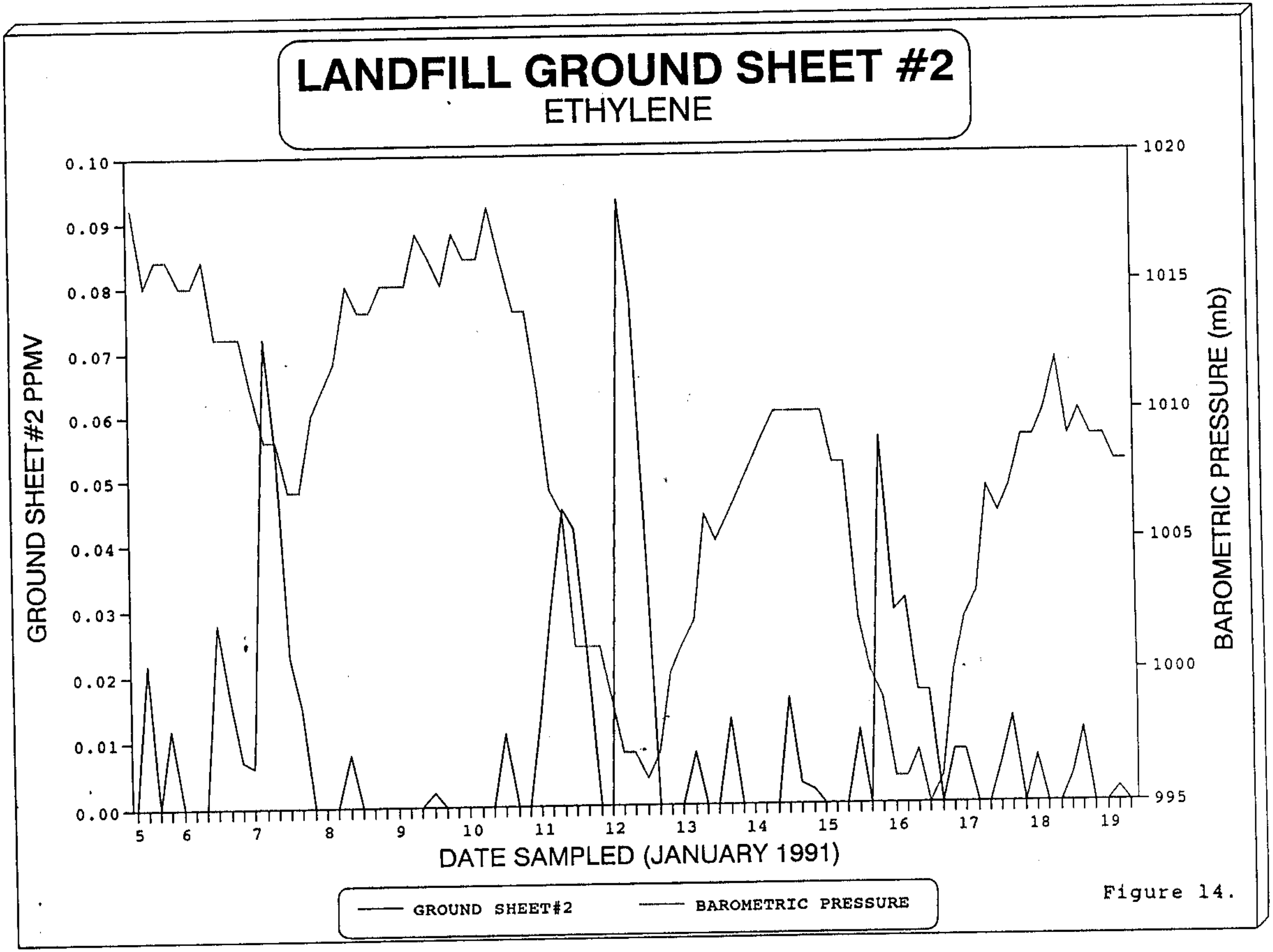

LANDFILL GROUND SHEET #2
ETHYLENE
GROUND SHEET#2 PPMV
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
BAROMETRIC PRESSURE (mb)
995
1000
1005
1010
1015
1020
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
DATE SAMPLED (JANUARY 1991)
GROUND SHEET#2
BAROMETRIC PRESSURE

Figure 14.

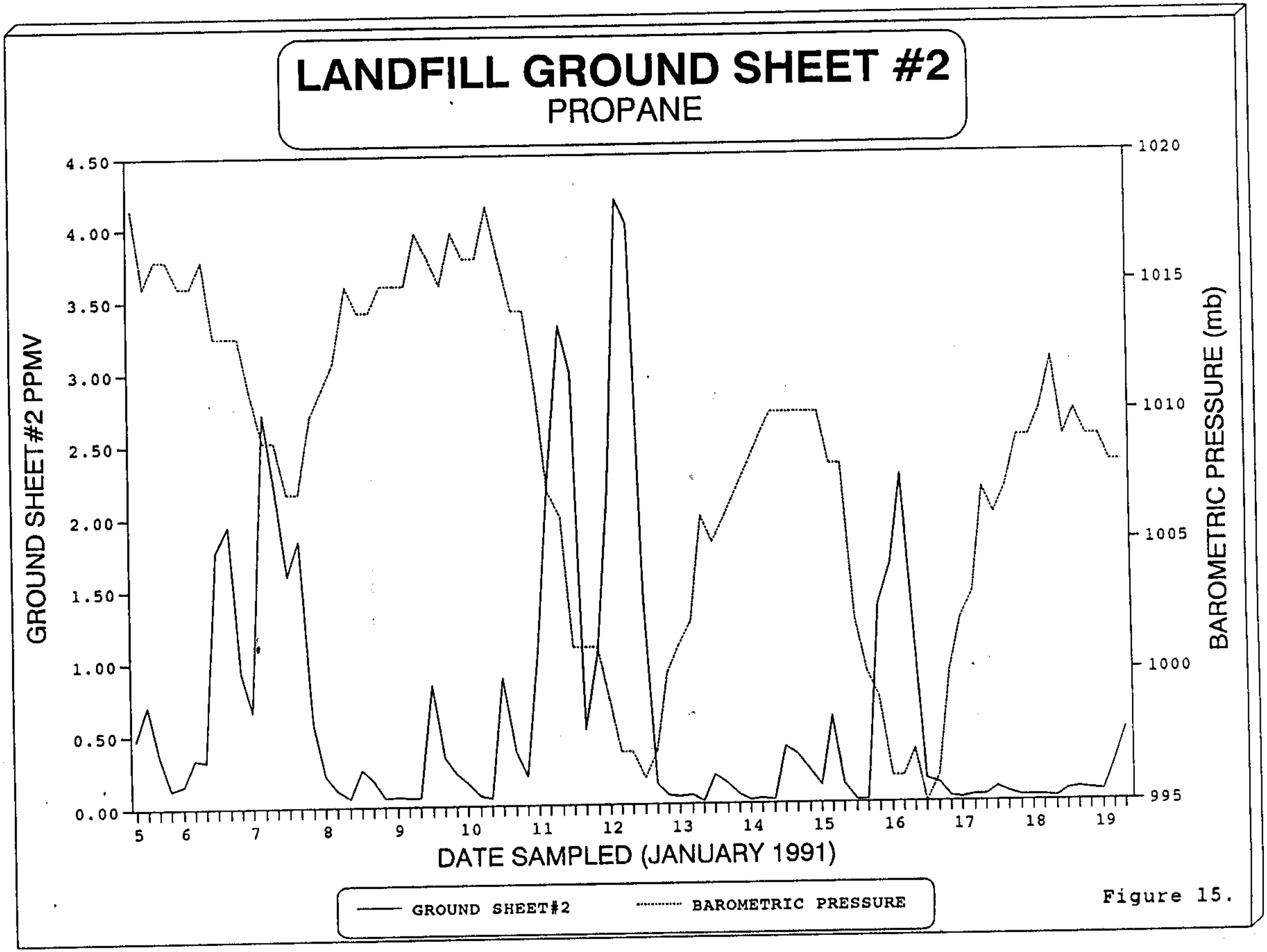

LANDFILL GROUND SHEET #2
PROPANE
GROUND SHEET#2 PPMV
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
BAROMETRIC PRESSURE (mb)
1020
1015
1010
1005
1000
995
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
DATE SAMPLED (JANUARY 1991)
GROUND SHEET#2
BAROMETRIC PRESSURE

Figure 15.

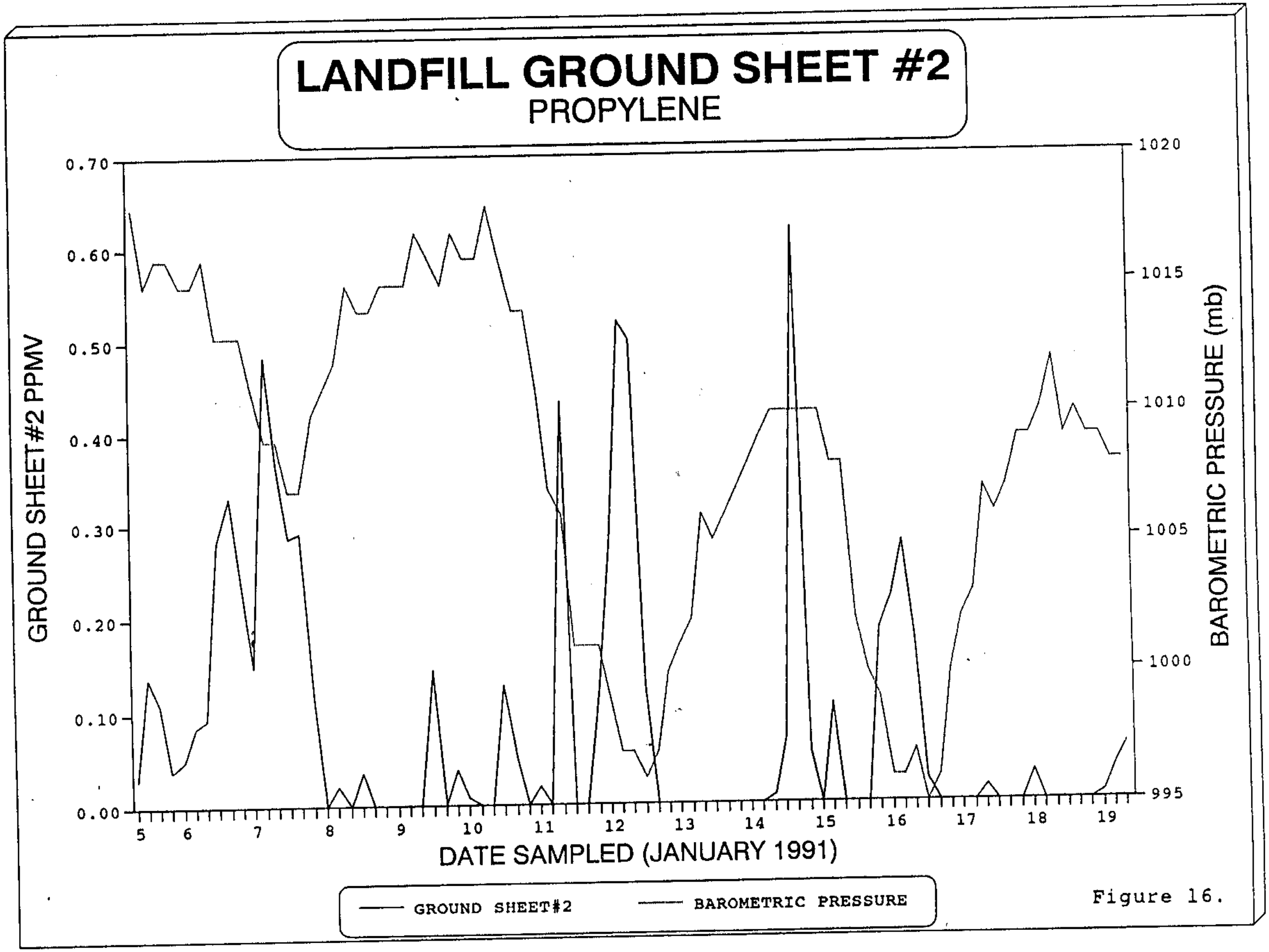
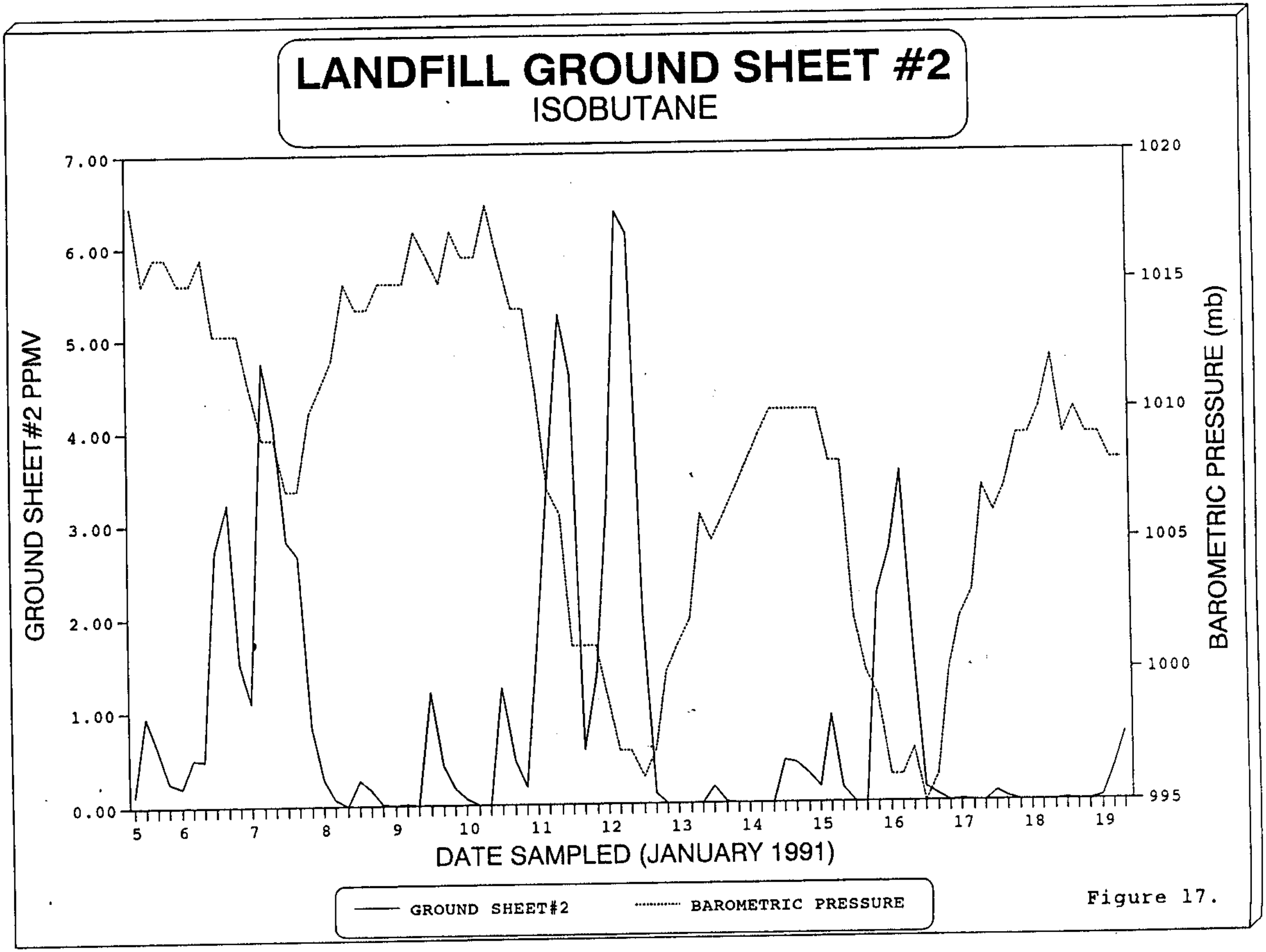
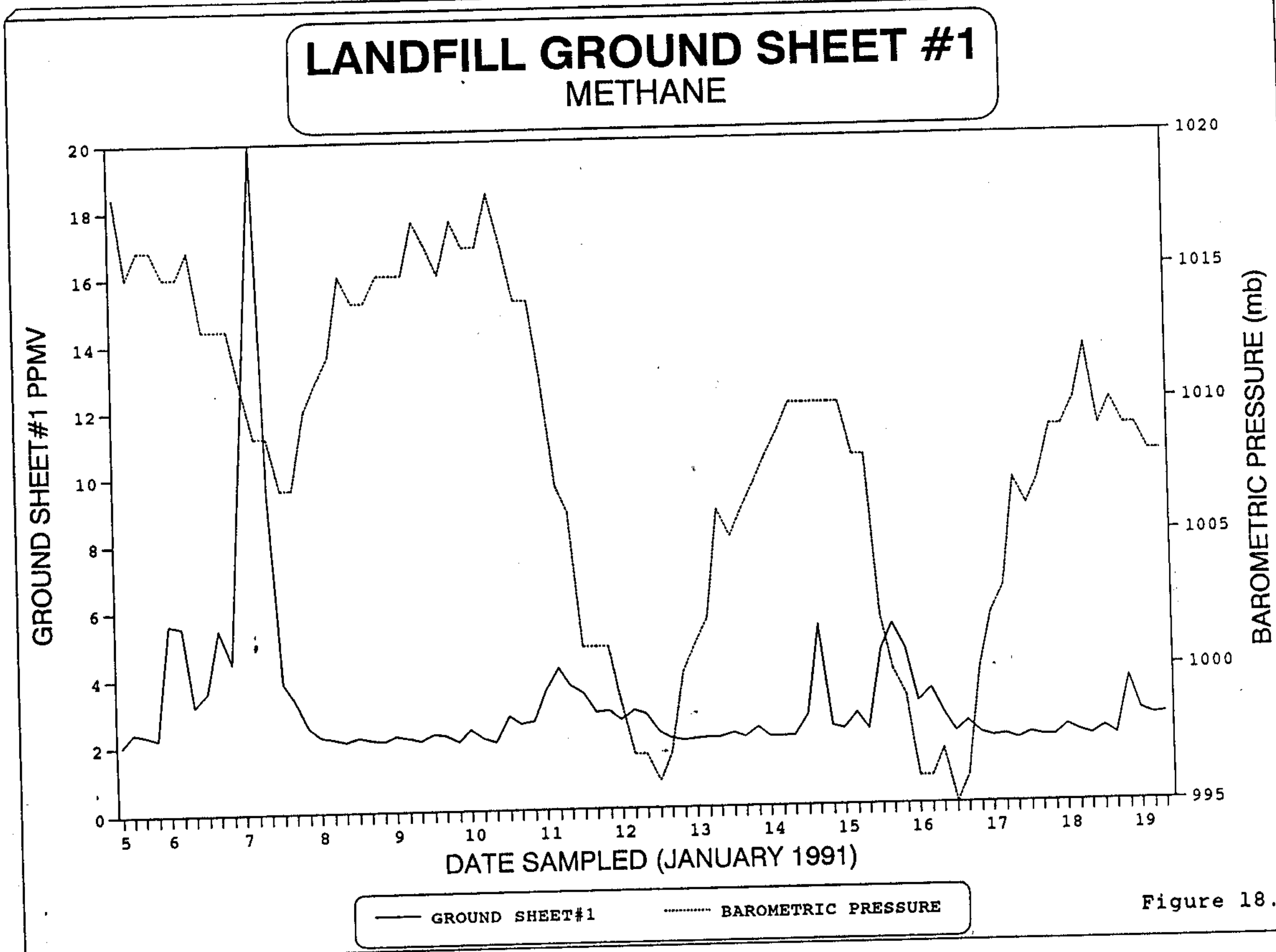

LANDFILL GROUND SHEET #2
PROPYLENE
GROUND SHEET#2 PPMV
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
BAROMETRIC PRESSURE (mb)
995
1000
1005
1010
1015
1020
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
DATE SAMPLED (JANUARY 1991)
GROUND SHEET#2
BAROMETRIC PRESSURE

Figure 16.



LANDFILL GROUND SHEET #2
ISOBUTANE
GROUND SHEET#2 PPMV
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
BAROMETRIC PRESSURE (mb)
995
1000
1005
1010
1015
1020
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
DATE SAMPLED (JANUARY 1991)
GROUND SHEET#2
BAROMETRIC PRESSURE

Figure 17.



LANDFILL GROUND SHEET #1
METHANE
GROUND SHEET#1 PPMV
0
2
4
6
8
10
12
14
16
18
20
BAROMETRIC PRESSURE (mb)
995
1000
1005
1010
1015
1020
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
DATE SAMPLED (JANUARY 1991)
GROUND SHEET#1
BAROMETRIC PRESSURE

Figure 18.

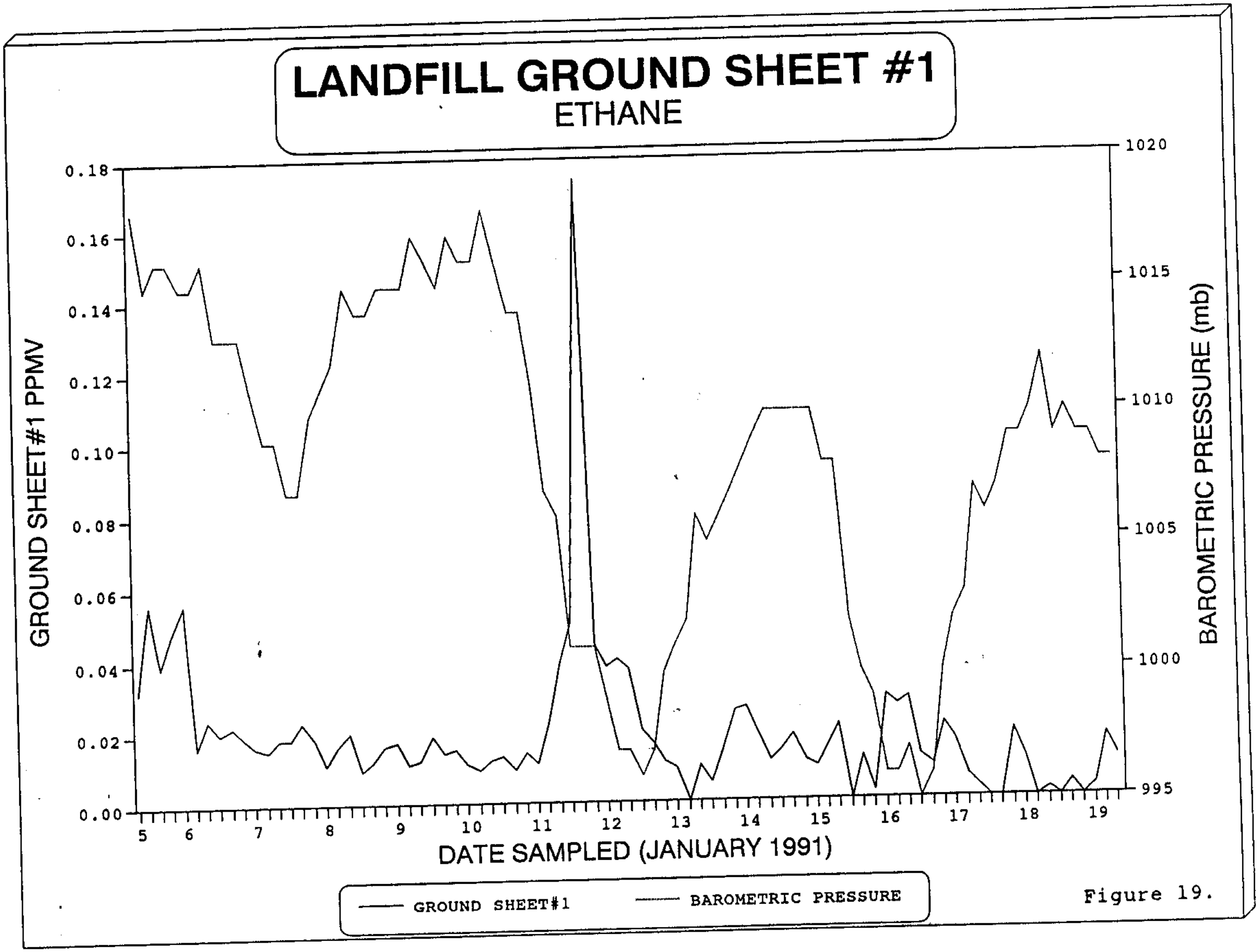

LANDFILL GROUND SHEET #1
ETHANE
GROUND SHEET#1 PPMV
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
BAROMETRIC PRESSURE (mb)
995
1000
1005
1010
1015
1020
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
DATE SAMPLED (JANUARY 1991)
GROUND SHEET#1
BAROMETRIC PRESSURE

Figure 19.

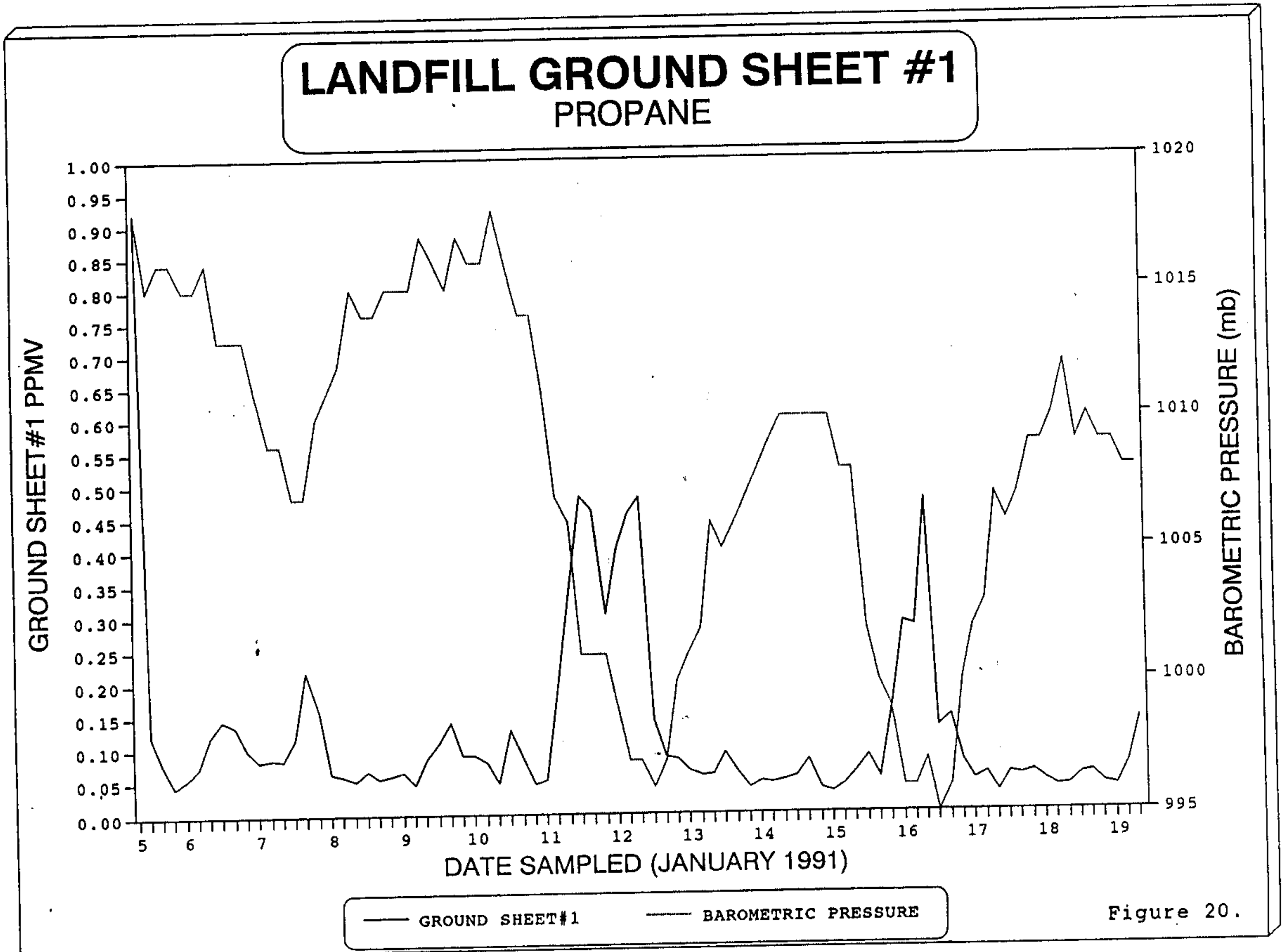

LANDFILL GROUND SHEET #1
PROPANE
GROUND SHEET#1 PPMV
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
BAROMETRIC PRESSURE (mb)
1020
1015
1010
1005
1000
995
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
DATE SAMPLED (JANUARY 1991)
GROUND SHEET#1
BAROMETRIC PRESSURE

Figure 20.

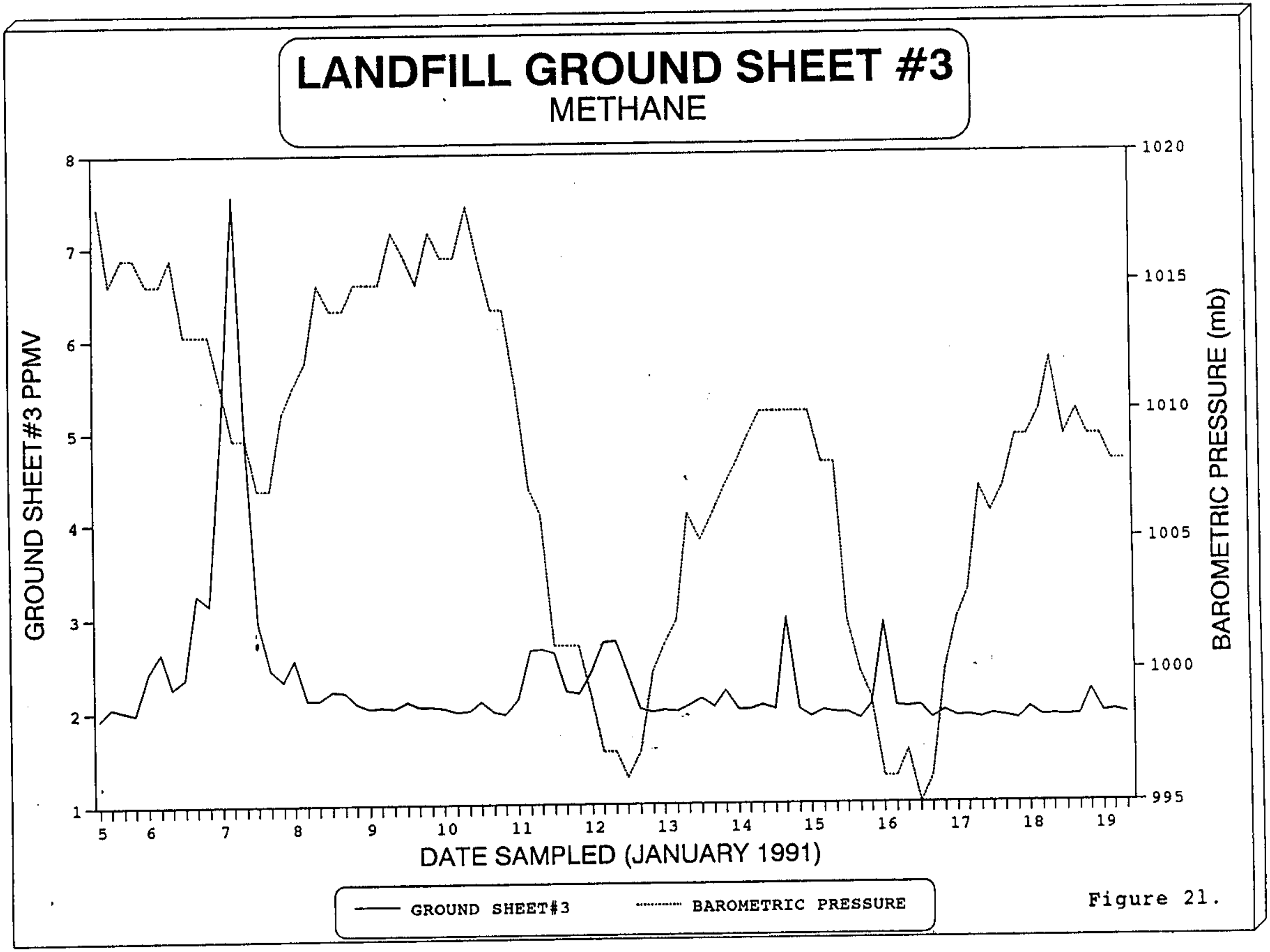

LANDFILL GROUND SHEET #3
METHANE
GROUND SHEET#3 PPMV
1
2
3
4
5
6
7
8
BAROMETRIC PRESSURE (mb)
995
1000
1005
1010
1015
1020
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
DATE SAMPLED (JANUARY 1991)
GROUND SHEET#3
BAROMETRIC PRESSURE

Figure 21.

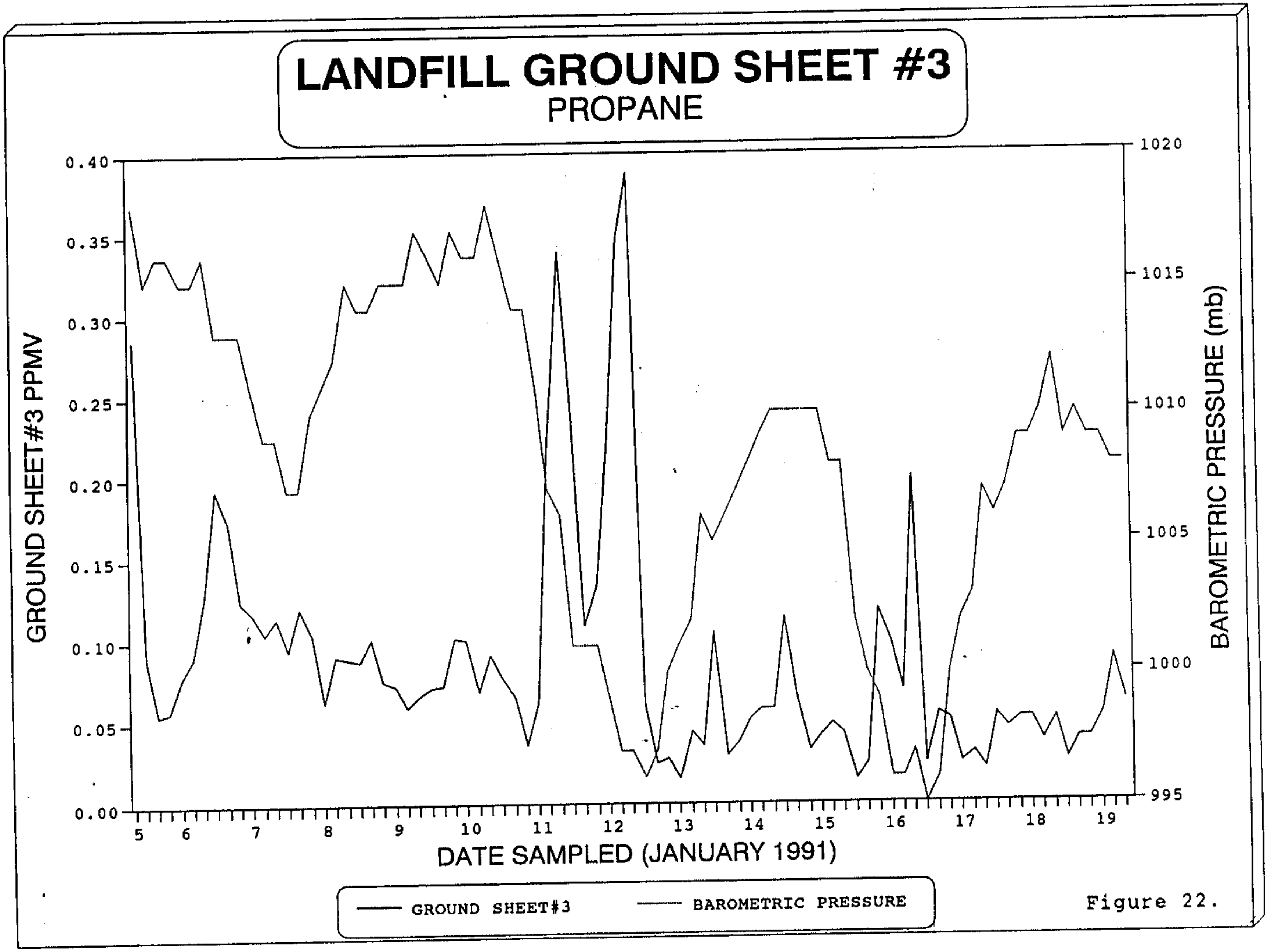

LANDFILL GROUND SHEET #3
PROPANE
GROUND SHEET#3 PPMV
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
BAROMETRIC PRESSURE (mb)
995
1000
1005
1010
1015
1020
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
DATE SAMPLED (JANUARY 1991)
GROUND SHEET#3
BAROMETRIC PRESSURE

Figure 22.

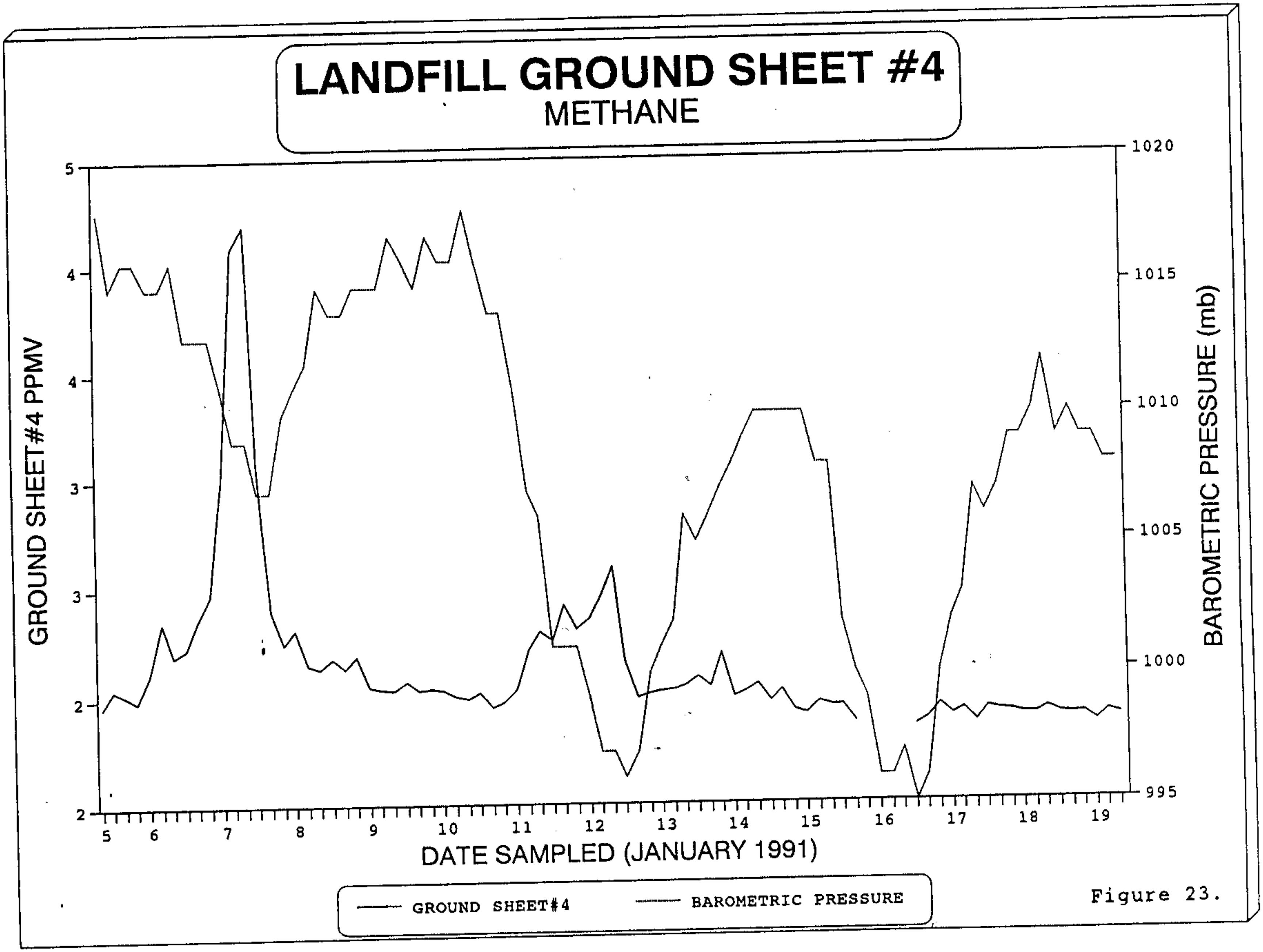

LANDFILL GROUND SHEET #4
METHANE
GROUND SHEET#4 PPMV
5
4
4
3
3
2
2
BAROMETRIC PRESSURE (mb)
1020
1015
1010
1005
1000
995
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
DATE SAMPLED (JANUARY 1991)
GROUND SHEET#4
BAROMETRIC PRESSURE

Figure 23.

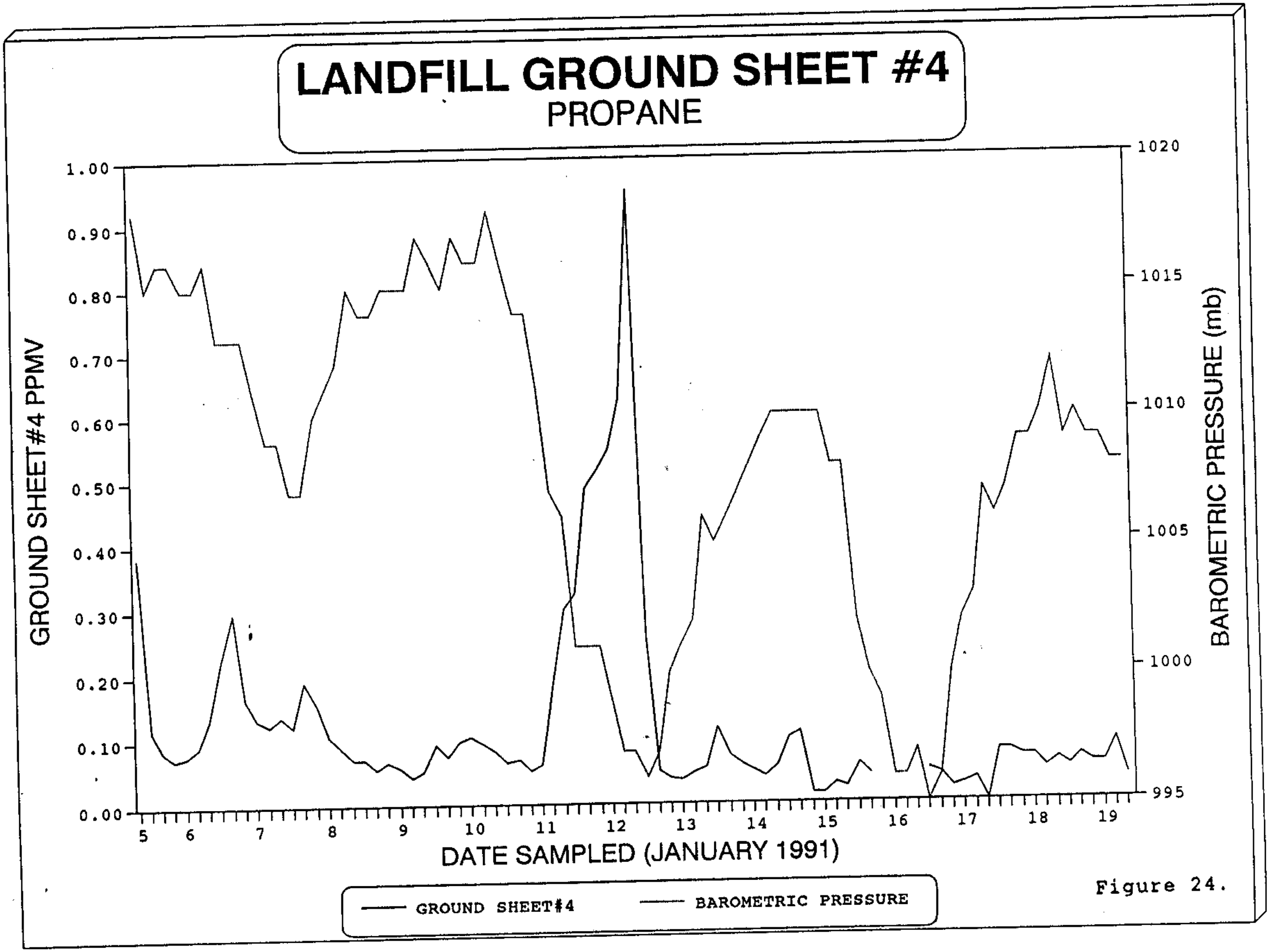
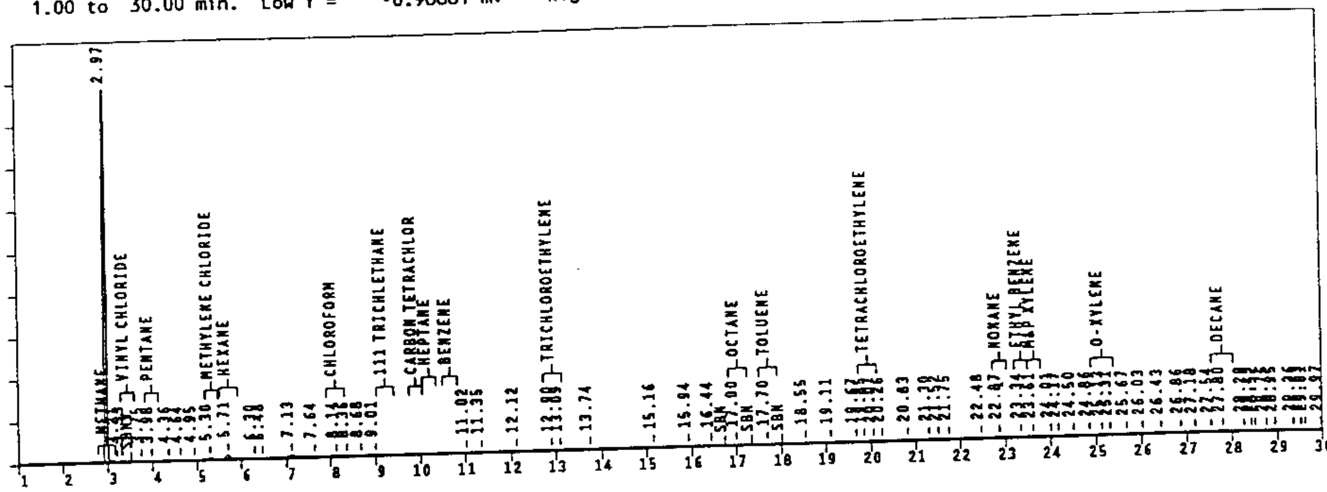
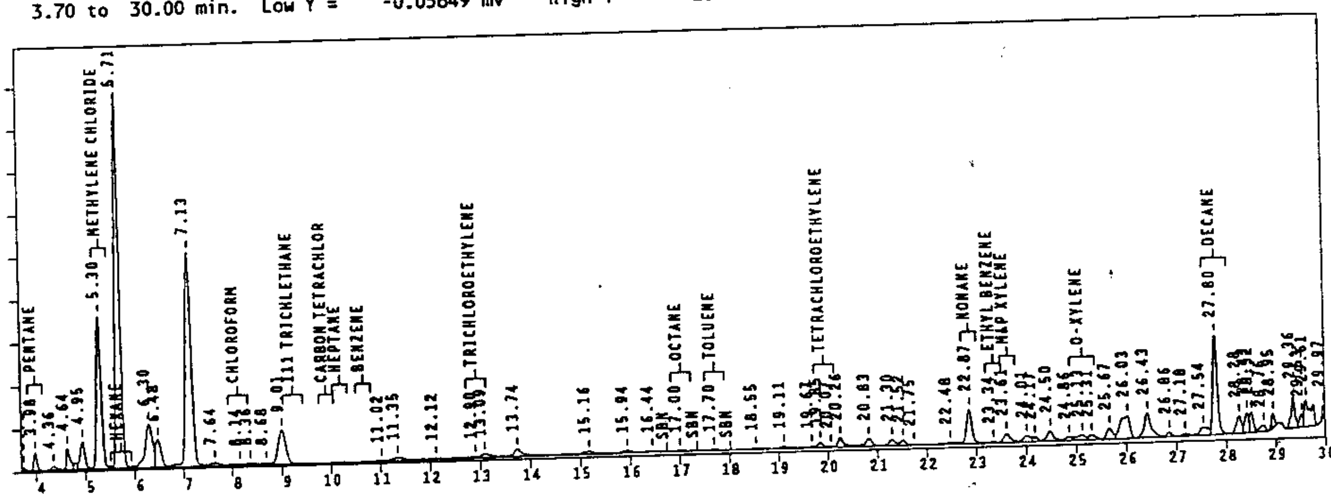

LANDFILL GROUND SHEET #4
PROPANE
GROUND SHEET#4 PPMV
BAROMETRIC PRESSURE (mb)
DATE SAMPLED (JANUARY 1991)
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
995
1000
1005
1010
1015
1020
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
GROUND SHEET#4
BAROMETRIC PRESSURE

Figure 24.

File=C:\CP\d5\W5A.36R Date printed = 03-27-1991 Time = 16:50:45
1.00 to 30.00 min. Low Y = -0.96881 mv High Y = 247.15326 mv Span = 248.12207 mv



File=C:\CP\d5\W5A.36R Date printed = 03-27-1991 Time = 16:51:59
3.70 to 30.00 min. Low Y = -0.05649 mv High Y = 2.47513 mv Span = 2.53163 mv



File=C:\CP\d5\W5A.36R Date printed = 03-27-1991 Time = 16:54:22
3.70 to 29.92 min. Low Y = -0.05649 mv High Y = 0.47969 mv Span = 0.53618 mv

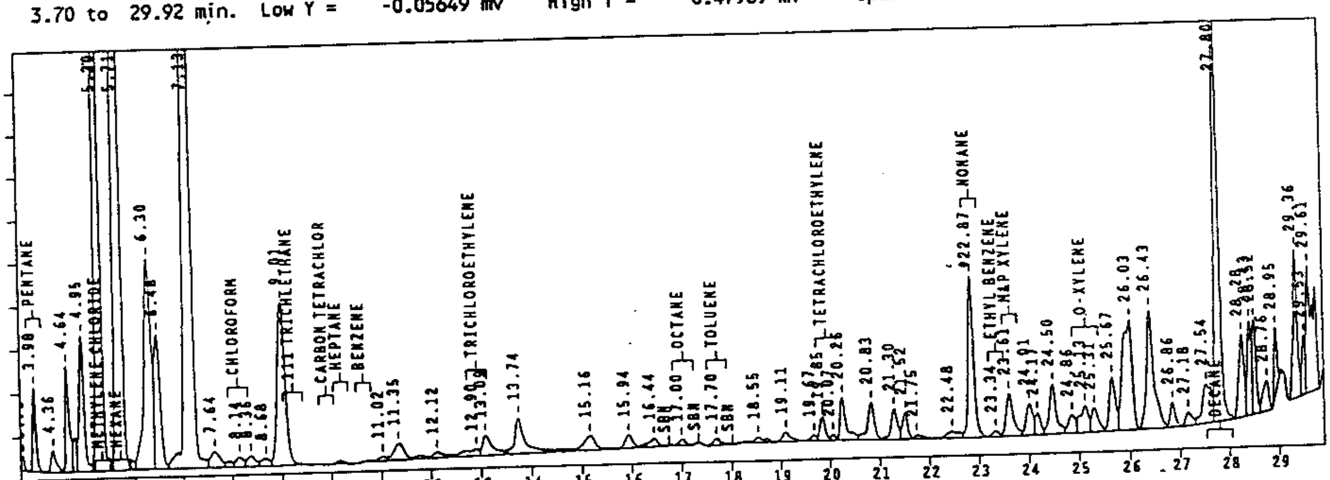


Figure 25. VOC's Under Groundsheet #2 During a Period of Falling Barometric Pressure. (Ordinate Scale successively expanded to reveal complex component distribution.)

File=C:\CP\data4\W2A.88R Date printed = 03-27-1991 Time = 17:36:46
4.00 to 29.96 min. Low Y = -0.28037 mv High Y = 0.83893 mv Span = 1.11930 mv

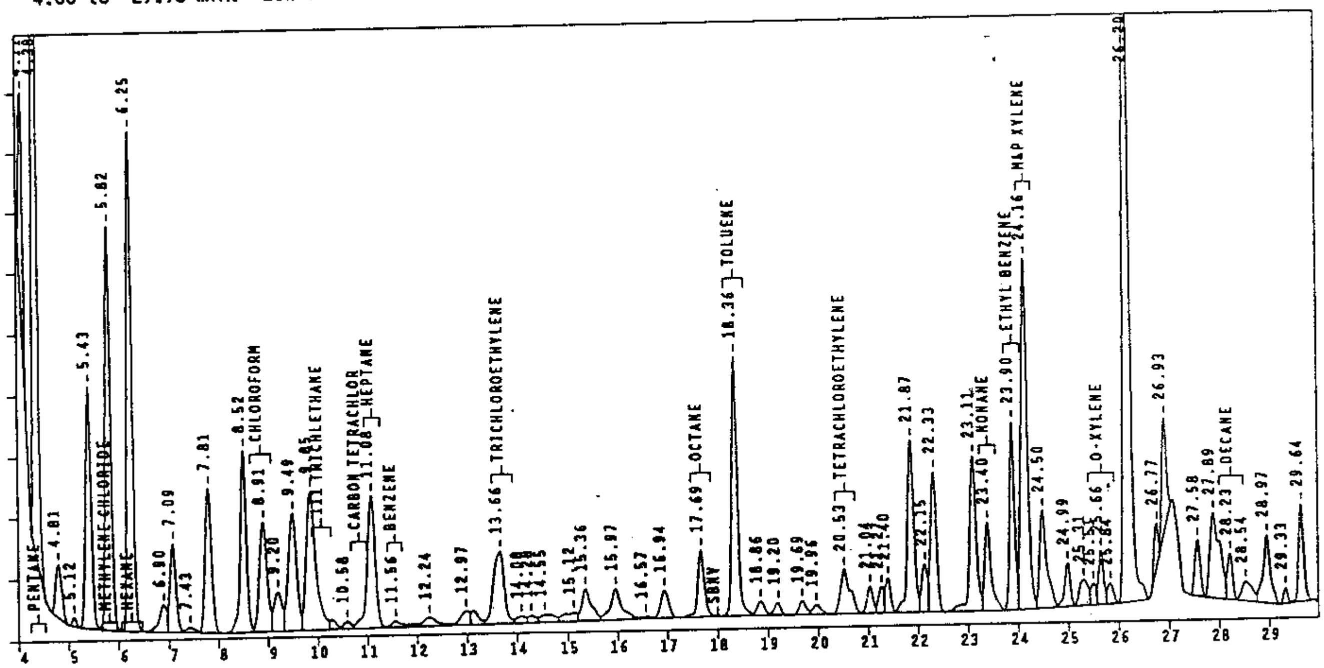


Figure 26. VOC's in the Burial Trench Beneath Groundsheet #2 from Soil Gas Site Location #52

02-Apr-91

Table 1.

----- WESTINGHOUSE SAVANNAH RIVER SITE -----
----- LANDFILL GROUNDSHEET STUDY -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	DATE	TIME	CYCLE #	METHANE	ETHANE	ETHYLENE	PROPANE	PROPYLENE	ISO-BUTANE	N-BUTANE
GS-1	1-5	1002	5	2.053	0.032	0.072	0.917	<.005	0.083	0.422
GS-1	1-5	1358	9	2.431	0.056	0.095	0.122	<.005	<.005	<.005
GS-1	1-5	1745	13	2.363	0.039	0.077	0.079	<.005	<.005	<.005
GS-1	1-5	2220	20	2.252	0.048	0.089	0.045	<.005	<.005	<.005
GS-1	1-6	155	49	5.630	0.056	0.031	0.057	<.005	<.005	<.005
GS-1	1-6	605	31	5.554	0.016	<.005	0.074	0.026	<.005	<.005
GS-1	1-6	1005	35	3.198	0.024	0.034	0.123	<.005	<.005	0.016
GS-1	1-6	1350	39	3.632	0.020	0.035	0.146	<.005	<.005	<.005
GS-1	1-6	1800	46	5.452	0.022	0.030	0.136	<.005	<.005	<.005
GS-1	1-6	2200	51	4.455	0.019	0.022	0.099	<.005	<.005	<.005
GS-1	1-7	135	58	11.722	0.016	0.015	0.083	0.011	<.005	<.005
GS-1	1-7	605	62	19.927	0.015	0.018	0.086	<.005	<.005	<.005
GS-1	1-7	1005	66	9.479	0.018	0.013	0.085	<.005	<.005	<.005
GS-1	1-7	1355	74	3.850	0.018	0.022	0.118	<.005	<.005	<.005
GS-1	1-7	1755	78	3.328	0.023	0.044	0.219	3.810	<.005	<.005
GS-1	1-7	2150	85	2.514	0.018	0.018	0.159	<.005	<.005	<.005
GS-1	1-8	137	89	2.243	0.011	0.007	0.064	<.005	<.005	<.005
GS-1	1-8	602	93	2.151	0.016	0.013	0.059	<.005	<.005	<.005
GS-1	1-8	1005	100	2.111	0.020	0.021	0.052	<.005	<.005	<.005
GS-1	1-8	1405	104	2.226	0.009	<.005	0.067	<.005	<.005	<.005
GS-1	1-8	1750	111	2.141	0.012	0.023	0.056	0.006	<.005	<.005
GS-1	1-8	2150	115	2.076	0.016	0.011	0.060	<.005	<.005	<.005
GS-1	1-9	150	119	2.228	0.017	<.005	0.065	<.005	<.005	<.005
GS-1	1-9	605	126	2.151	0.011	<.005	0.047	0.016	<.005	<.005
GS-1	1-9	955	130	2.084	0.012	0.008	0.084	<.005	<.005	<.005
GS-1	1-9	1355	137	2.298	0.019	<.005	0.109	<.005	<.005	0.018
GS-1	1-9	1755	141	2.253	0.014	0.007	0.140	0.007	<.005	<.005
GS-1	1-9	2150	145	2.051	0.015	0.005	0.090	0.020	0.006	<.005
GS-1	1-10	142	152	2.407	0.011	<.005	0.091	<.005	<.005	<.005
GS-1	1-10	600	156	2.122	0.009	<.005	0.078	<.005	<.005	<.005
GS-1	1-10	1005	164	2.032	0.012	<.005	0.048	<.005	<.005	<.005
GS-1	1-10	1355	168	2.781	0.013	<.005	0.129	<.005	<.005	<.005
GS-1	1-10	1755	172	2.539	0.009	<.005	0.084	<.005	<.005	<.005
GS-1	1-10	1015	179	2.640	0.014	<.005	0.046	<.005	<.005	<.005
GS-1	1-11	102	183	3.527	0.011	<.005	0.052	<.005	<.005	<.005
GS-1	1-11	600	190	4.221	0.022	0.027	0.186	<.005	<.005	<.005
GS-1	1-11	1001	194	3.672	0.039	0.025	0.346	0.038	<.005	<.005
GS-1	1-11	1402	198	3.453	0.050	0.035	0.481	0.081	<.005	0.103
GS-1	1-11	1820	205	2.849	0.174	0.075	0.460	<.005	<.005	<.005
GS-1	1-11	2210	378	2.911	0.044	0.038	0.303	0.010	<.005	0.006
GS-1	1-12	135	216	2.625	0.038	0.037	0.401	0.064	<.005	<.005
GS-1	1-12	603	220	2.887	0.040	0.036	0.455	0.050	<.005	0.053
GS-1	1-12	958	224	2.797	0.037	0.030	0.479	0.086	<.005	0.117
GS-1	1-12	1358	231	2.258	0.020	0.019	0.143	0.047	<.005	<.005
GS-1	1-12	1755	235	2.040	0.016	0.017	0.086	<.005	<.005	<.005
GS-1	1-12	2200	242	1.982	0.011	0.012	0.082	<.005	<.005	<.005
GS-1	1-13	125	246	2.010	0.009	0.013	0.065	<.005	<.005	<.005
GS-1	1-13	608	250	2.049	<.005	0.006	0.058	<.005	<.005	0.009
GS-1	1-13	1004	257	2.056	0.010	0.013	0.060	<.005	<.005	<.005
GS-1	1-13	1407	262	2.162	0.005	0.010	0.093	<.005	<.005	<.005
GS-1	1-13	1753	269	2.050	0.015	0.016	0.062	<.005	<.005	<.005
GS-1	1-13	2240	273	2.322	0.025	<.005	0.038	<.005	<.005	<.005
GS-1	1-14	147	277	2.048	0.026	0.013	0.048	<.005	<.005	<.005

Table 1. C1-C4 Hydrocarbon Concentrations (ppmv) and System Blanks in the 740-G Landfill Groundsheet Study

02-Apr-91

Table 1. (continued)

----- WESTINGHOUSE SAVANNAH RIVER SITE -----
----- LANDFILL GROUNDSHEET STUDY -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	DATE	TIME	CYCLE #	METHANE	ETHANE	ETHYLENE	PROPANE	PROPYLENE	ISO-BUTANE	N-BUTANE
GS-1	1-14	610	284	2.036	0.019	<.005	0.046	<.005	0.007	<.005
GS-1	1-14	1008	288	2.042	0.011	<.005	0.050	<.005	<.005	<.005
GS-1	1-14	1410	295	2.683	0.014	0.013	0.056	0.015	<.005	<.005
GS-1	1-14	1800	299	5.321	0.018	0.017	0.081	<.005	<.005	<.005
GS-1	1-14	2200	303	2.317	0.011	0.008	0.036	<.005	<.005	<.005
GS-1	1-15	155	310	2.262	0.009	<.005	0.030	0.021	<.005	<.005
GS-1	1-15	615	314	2.688	0.015	0.007	0.043	0.007	<.005	<.005
GS-1	1-15	1004	321	2.190	0.021	0.008	0.062	0.009	<.005	<.005
GS-1	1-15	1407	325	4.555	<.005	0.012	0.087	<.005	<.005	<.005
GS-1	1-15	1801	329	5.315	0.012	0.016	0.051	<.005	<.005	<.005
GS-1	1-15	2205	336	4.566	<.005	0.016	0.155	<.005	<.005	<.005
GS-1	1-16	144	339	2.995	0.029	0.024	0.287	0.013	<.005	<.005
GS-1	1-16	601	344	3.407	0.026	0.016	0.282	<.005	<.005	<.005
GS-1	1-16	1002	347	2.698	0.028	0.030	0.475	0.080	<.005	<.005
GS-1	1-16	1402	350	2.073	0.012	0.023	0.128	<.005	<.005	<.005
GS-1	1-16	1750	357	2.397	0.009	0.029	0.146	<.005	<.005	<.005
GS-1	1-16	2155	361	2.040	0.021	0.008	0.076	<.005	<.005	<.005
GS-1	1-17	230	368	1.946	0.016	0.010	0.048	<.005	<.005	<.005
GS-1	1-17	607	372	1.961	0.006	0.006	0.057	<.005	<.005	<.005
GS-1	1-17	1009	379	1.854	<.005	0.007	0.028	<.005	0.006	<.005
GS-1	1-17	1418	386	2.029	<.005	<.005	0.057	<.005	<.005	<.005
GS-1	1-17	1759	390	1.928	<.005	0.018	0.053	<.005	<.005	<.005
GS-1	1-17	2200	397	1.947	0.019	<.005	0.060	<.005	<.005	<.005
GS-1	1-18	137	401	2.241	0.011	0.007	0.046	<.005	<.005	<.005
GS-1	1-18	610	405	2.045	<.005	<.005	0.037	<.005	<.005	<.005
GS-1	1-18	1004	412	1.946	<.005	0.007	0.038	<.005	<.005	<.005
GS-1	1-18	1357	416	2.151	<.005	0.050	0.054	<.005	<.005	<.005
GS-1	1-18	1807	424	1.957	<.005	0.019	0.058	<.005	<.005	<.005
GS-1	1-18	2226	428	3.652	<.005	<.005	0.041	<.005	<.005	<.005
GS-1	1-19	147	432	2.651	<.005	0.009	0.037	<.005	<.005	<.005
GS-1	1-19	650	439	2.512	0.017	0.011	0.071	<.005	<.005	<.005
GS-1	1-19	1030	443	2.548	0.011	0.008	0.138	<.005	<.005	0.007
GS-2	1-5	1012	6	24.517	0.038	<.005	0.475	0.029	0.117	0.254
GS-2	1-5	1405	10	2447.979	0.077	0.022	0.701	0.138	0.949	0.203
GS-2	1-5	1750	14	1678.545	0.063	<.005	0.356	0.109	0.616	0.125
GS-2	1-5	2225	21	141.368	0.050	0.012	0.127	0.038	0.254	<.005
GS-2	1-6	200	25	311.009	0.023	<.005	0.153	0.049	0.197	<.005
GS-2	1-6	610	32	914.334	0.032	<.005	0.329	0.085	0.490	<.005
GS-2	1-6	1010	36	347.830	0.023	<.005	0.317	0.093	0.471	<.005
GS-2	1-6	1355	40	8121.346	0.179	0.028	1.762	0.282	2.724	0.474
GS-2	1-6	1805	47	7200.795	0.221	0.016	1.948	0.331	3.231	0.472
GS-2	1-6	2205	52	1747.099	0.098	0.007	0.940	0.237	1.529	<.005
GS-2	1-7	140	59	1805.625	0.063	0.006	0.656	0.149	1.092	<.005
GS-2	1-7	610	63	10887.042	0.309	0.072	2.717	0.484	4.747	0.693
GS-2	1-7	1010	67	6887.654	0.249	0.054	2.205	0.366	4.083	0.592
GS-2	1-7	1400	75	6372.776	0.183	0.023	1.592	0.286	2.831	0.347
GS-2	1-7	1800	79	8287.945	0.223	0.015	1.841	0.291	2.672	<.005
GS-2	1-7	2155	86	2470.374	0.080	<.005	0.562	0.115	0.820	<.005
GS-2	1-8	141	90	499.245	0.028	<.005	0.209	<.005	0.275	<.005
GS-2	1-8	606	94	79.923	0.013	<.005	0.105	0.021	0.058	<.005
GS-2	1-8	1010	101	16.882	0.011	0.008	0.054	<.005	<.005	<.005
GS-2	1-8	1410	105	1177.741	0.030	<.005	0.251	0.036	0.257	0.005

Table 1. (continued)

----- WESTINGHOUSE SAVANNAH RIVER SITE -----
----- LANDFILL GROUNDSHEET STUDY -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	DATE	TIME	CYCLE #	METHANE	ETHANE	ETHYLENE	PROPANE	PROPYLENE	ISO-BUTANE	N-BUTANE
GS-2	1-8	1755	112	469.964	0.011	<.005	0.177	<.005	0.150	<.005
GS-2	1-8	2155	116	20.805	0.013	<.005	0.057	<.005	<.005	<.005
GS-2	1-9	154	120	10.218	0.026	<.005	0.063	<.005	<.005	<.005
GS-2	1-9	610	127	6.039	0.012	<.005	0.054	<.005	<.005	<.005
GS-2	1-9	1000	131	2.256	0.016	<.005	0.054	<.005	<.005	0.005
GS-2	1-9	1400	138	3152.993	0.094	<.005	0.834	0.145	1.204	<.005
GS-2	1-9	1800	142	815.902	0.009	<.005	0.336	<.005	0.404	<.005
GS-2	1-9	2155	146	191.054	0.016	<.005	0.223	0.038	0.169	<.005
GS-2	1-10	146	153	72.897	0.017	<.005	0.154	0.007	0.056	<.005
GS-2	1-10	604	157	14.689	0.014	<.005	0.066	<.005	<.005	<.005
GS-2	1-10	1008	165	3.505	0.007	<.005	0.050	<.005	<.005	<.005
GS-2	1-10	1400	169	4614.336	0.104	0.011	0.879	0.128	1.246	<.005
GS-2	1-10	1800	173	1814.039	<.005	<.005	0.364	0.051	0.460	<.005
GS-2	1-10	1020	180	922.349	0.027	<.005	0.191	<.005	0.177	0.005
GS-2	1-11	105	184	5300.271	0.122	0.014	1.057	0.019	1.689	0.288
GS-2	1-11	604	191	11951.161	0.109	0.030	2.240	<.005	3.448	0.496
GS-2	1-11	1004	195	15119.392	0.163	0.045	3.313	0.433	5.244	0.851
GS-2	1-11	1406	199	14711.763	0.146	0.042	2.986	<.005	4.597	0.816
GS-2	1-11	1825	206	2129.815	0.060	0.023	0.518	<.005	0.567	<.005
GS-2	1-11	2215	210	5694.337	0.125	<.005	1.051	0.122	1.366	0.279
GS-2	1-12	140	217	12754.938	0.270	<.005	2.170	0.274	3.184	0.645
GS-2	1-12	606	221	20522.000	0.501	0.093	4.189	0.519	6.367	1.208
GS-2	1-12	1001	225	20324.857	0.499	0.078	4.015	0.499	6.125	1.237
GS-2	1-12	1401	232	6820.810	0.157	0.040	1.406	0.125	2.033	0.422
GS-2	1-12	1758	236	503.894	0.021	<.005	0.130	<.005	0.096	<.005
GS-2	1-12	2205	243	73.637	0.016	<.005	0.052	<.005	<.005	<.005
GS-2	1-13	129	247	67.313	<.005	<.005	0.049	<.005	<.005	<.005
GS-2	1-13	611	251	38.096	0.018	0.008	0.056	<.005	<.005	<.005
GS-2	1-13	1007	259	6.480	0.009	<.005	0.010	<.005	<.005	<.005
GS-2	1-13	1410	263	882.031	0.029	<.005	0.194	<.005	0.174	<.005
GS-2	1-13	1757	270	256.149	0.017	0.013	0.130	<.005	0.008	<.005
GS-2	1-13	2250	274	21.631	0.018	<.005	0.055	<.005	<.005	<.005
GS-2	1-14	152	278	13.770	0.008	<.005	0.025	<.005	<.005	0.006
GS-2	1-14	613	285	8.265	0.012	<.005	0.031	<.005	<.005	<.005
GS-2	1-14	1011	289	4.319	0.015	<.005	0.025	0.008	<.005	<.005
GS-2	1-14	1415	296	2010.711	0.055	0.016	0.386	0.069	0.434	<.005
GS-2	1-14	1804	300	1420.335	0.027	<.005	0.331	0.619	0.414	<.005
GS-2	1-14	2205	304	341.238	0.005	<.005	0.217	0.055	0.285	<.005
GS-2	1-15	159	311	94.182	0.008	<.005	0.113	<.005	0.149	<.005
GS-2	1-15	618	315	2464.269	0.074	<.005	0.590	0.105	0.926	0.137
GS-2	1-15	1007	322	452.955	<.005	<.005	0.122	<.005	0.145	<.005
GS-2	1-15	1411	326	33.514	0.005	0.011	0.016	<.005	<.005	<.005
GS-2	1-15	1804	331	60.816	<.005	<.005	0.014	<.005	<.005	<.005
GS-2	1-15	2210	337	5744.961	0.156	0.056	1.364	0.183	2.216	0.460
GS-2	1-16	149	340	8494.188	0.131	0.029	1.640	0.219	2.691	0.517
GS-2	1-16	605	345	11520.146	0.238	0.031	2.259	0.277	3.526	0.685
GS-2	1-16	1006	348	5110.497	0.119	0.017	1.183	0.175	1.675	0.332
GS-2	1-16	1406	351	658.530	0.014	0.017	0.149	0.023	0.145	<.005
GS-2	1-16	1755	358	421.314	0.009	<.005	0.122	<.005	0.066	<.005
GS-2	1-16	2200	362	23.322	0.009	0.008	0.033	<.005	<.005	<.005
GS-2	1-17	234	369	5.934	<.005	0.008	0.025	<.005	0.007	<.005
GS-2	1-17	609	373	5.232	0.005	<.005	0.037	<.005	<.005	<.005
GS-2	1-17	1012	380	2.947	<.005	<.005	0.035	0.016	<.005	<.005

02-Apr-91

Table 1. (continued)

----- WESTINGHOUSE SAVANNAH RIVER SITE -----
----- LANDFILL GROUNDSHEET STUDY -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	DATE	TIME	CYCLE #	METHANE	ETHANE	ETHYLENE	PROPANE	PROPYLENE	ISO-BUTANE	N-BUTANE
GS-2	1-17	1422	387	545.108	<.005	0.006	0.093	<.005	0.093	<.005
GS-2	1-17	1802	391	44.491	0.009	0.013	0.058	<.005	0.028	<.005
GS-2	1-17	2203	398	7.471	0.007	<.005	0.033	<.005	<.005	0.005
GS-2	1-18	141	402	11.808	0.007	0.007	0.029	0.031	<.005	<.005
GS-2	1-18	614	406	20.975	0.011	<.005	0.033	<.005	<.005	<.005
GS-2	1-18	1007	413	4.006	<.005	<.005	0.024	<.005	<.005	<.005
GS-2	1-18	1400	417	350.132	0.008	<.005	0.074	<.005	0.007	<.005
GS-2	1-18	1810	425	143.348	0.015	0.011	0.078	<.005	<.005	<.005
GS-2	1-18	2230	429	45.470	0.005	<.005	0.073	<.005	<.005	<.005
GS-2	1-19	150	433	61.819	<.005	<.005	0.065	0.008	0.035	<.005
GS-2	1-19	654	440	1544.672	0.029	<.005	0.267	0.037	0.341	<.005
GS-2	1-19	1036	444	2095.233	0.052	<.005	0.492	0.060	0.706	0.076
GS-3	1-5	1020	7	1.930	0.027	0.014	0.286	<.005	<.005	0.110
GS-3	1-5	1410	11	2.048	0.058	0.107	0.090	<.005	<.005	<.005
GS-3	1-5	1800	18	2.012	0.052	0.059	0.055	0.036	<.005	<.005
GS-3	1-5	2230	22	1.992	0.049	0.016	0.057	0.062	<.005	<.005
GS-3	1-6	205	26	2.411	0.023	0.015	0.079	<.005	<.005	<.005
GS-3	1-6	615	33	2.629	0.011	0.010	0.090	<.005	<.005	<.005
GS-3	1-6	1015	37	2.256	0.023	0.015	0.127	0.029	<.005	0.007
GS-3	1-6	1405	44	2.366	0.025	0.026	0.193	0.074	<.005	0.040
GS-3	1-6	1810	48	3.250	0.022	0.053	0.173	0.056	<.005	<.005
GS-3	1-6	2210	53	3.145	0.007	0.012	0.124	0.029	<.005	<.005
GS-3	1-7	145	60	5.059	0.018	0.019	0.117	0.039	<.005	<.005
GS-3	1-7	615	64	7.559	0.014	0.017	0.104	<.005	0.033	<.005
GS-3	1-7	1020	71	4.822	0.016	0.019	0.114	<.005	<.005	<.005
GS-3	1-7	1405	76	2.953	0.018	0.036	0.094	<.005	<.005	<.005
GS-3	1-7	1805	80	2.442	0.019	0.031	0.120	0.045	<.005	<.005
GS-3	1-7	2200	87	2.328	0.022	0.021	0.103	0.010	<.005	<.005
GS-3	1-8	145	91	2.550	0.019	0.016	0.062	<.005	<.005	<.005
GS-3	1-8	615	98	2.116	0.015	0.010	0.090	<.005	<.005	<.005
GS-3	1-8	1015	102	2.121	0.011	0.010	0.089	<.005	<.005	<.005
GS-3	1-8	1414	106	2.220	0.010	0.010	0.087	<.005	<.005	<.005
GS-3	1-8	1800	113	2.202	0.015	0.035	0.101	<.005	<.005	0.006
GS-3	1-8	2200	117	2.077	0.012	0.009	0.075	<.005	<.005	<.005
GS-3	1-9	203	124	2.034	0.010	<.005	0.072	<.005	<.005	<.005
GS-3	1-9	613	128	2.047	0.011	0.006	0.059	<.005	<.005	<.005
GS-3	1-9	1005	132	2.025	0.013	0.009	0.066	<.005	<.005	<.005
GS-3	1-9	1405	139	2.091	0.024	<.005	0.071	<.005	<.005	0.017
GS-3	1-9	1803	143	2.044	0.027	<.005	0.072	<.005	<.005	<.005
GS-3	1-9	2205	150	2.042	0.012	0.011	0.101	0.017	<.005	<.005
GS-3	1-10	150	154	2.025	<.005	<.005	0.100	<.005	<.005	<.005
GS-3	1-10	608	158	1.986	0.011	<.005	0.069	<.005	<.005	<.005
GS-3	1-10	1011	166	1.995	0.014	<.005	0.091	<.005	<.005	<.005
GS-3	1-10	1403	170	2.090	0.013	<.005	0.077	<.005	0.007	0.023
GS-3	1-10	1808	177	1.987	0.011	0.009	0.065	<.005	<.005	<.005
GS-3	1-10	1025	181	1.960	0.010	<.005	0.036	0.010	<.005	<.005
GS-3	1-11	109	185	2.116	0.012	<.005	0.062	<.005	<.005	<.005
GS-3	1-11	607	192	2.637	0.027	0.015	0.218	0.009	<.005	<.005
GS-3	1-11	1010	196	2.651	0.037	0.020	0.339	0.087	<.005	0.032
GS-3	1-11	1415	203	2.605	0.095	0.063	0.243	0.072	<.005	0.013
GS-3	1-11	1830	376	2.206	0.009	0.013	0.109	<.005	<.005	<.005
GS-3	1-11	2220	211	2.177	0.012	0.009	0.133	0.051	<.005	<.005

Table 1. (continued)

----- WESTINGHOUSE SAVANNAH RIVER SITE -----
----- LANDFILL GROUNDSHEET STUDY -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	DATE	TIME	CYCLE #	METHANE	ETHANE	ETHYLENE	PROPANE	PROPYLENE	ISO-BUTANE	N-BUTANE
GS-3	1-12	145	218	2.413	0.013	0.016	0.221	<.005	<.005	<.005
GS-3	1-12	610	222	2.713	0.025	0.007	0.346	0.083	0.008	0.055
GS-3	1-12	1009	229	2.731	0.028	0.023	0.387	<.005	<.005	0.055
GS-3	1-12	1405	233	2.407	0.018	0.006	0.060	0.008	<.005	<.005
GS-3	1-12	1801	237	2.017	0.011	<.005	0.024	<.005	<.005	<.005
GS-3	1-12	2210	244	1.976	0.012	0.005	0.027	<.005	<.005	<.005
GS-3	1-13	133	248	2.002	0.027	<.005	0.015	<.005	<.005	0.012
GS-3	1-13	618	255	1.990	0.017	0.008	0.043	<.005	<.005	<.005
GS-3	1-13	1011	260	2.038	0.011	0.005	0.035	<.005	<.005	<.005
GS-3	1-13	1414	264	2.122	0.013	0.014	0.104	<.005	0.005	0.005
GS-3	1-13	1801	271	2.032	0.007	<.005	0.029	<.005	<.005	<.005
GS-3	1-13	2303	275	2.200	0.979	<.005	0.037	<.005	<.005	0.007
GS-3	1-14	205	282	2.003	<.005	<.005	0.051	<.005	<.005	0.008
GS-3	1-14	618	286	2.003	0.015	<.005	0.057	<.005	<.005	<.005
GS-3	1-14	1013	290	2.046	0.011	0.006	0.057	<.005	<.005	0.035
GS-3	1-14	1420	297	2.000	0.026	0.021	0.113	<.005	<.005	<.005
GS-3	1-14	1809	301	2.964	0.014	0.017	0.064	<.005	<.005	<.005
GS-3	1-14	2214	308	2.003	0.005	<.005	0.032	0.215	<.005	<.005
GS-3	1-15	205	312	1.926	0.012	<.005	0.041	<.005	<.005	<.005
GS-3	1-15	621	316	1.991	<.005	0.009	0.048	<.005	<.005	<.005
GS-3	1-15	1010	323	1.962	0.016	0.008	0.042	0.005	<.005	<.005
GS-3	1-15	1414	327	1.954	0.005	0.016	0.014	<.005	<.005	<.005
GS-3	1-15	1812	334	1.899	<.005	0.023	0.024	<.005	<.005	<.005
GS-3	1-15	2215	338	2.043	0.007	0.020	0.118	0.031	<.005	<.005
GS-3	1-16	154	341	2.920	<.005	0.010	0.097	<.005	<.005	0.005
GS-3	1-16	611	346	2.027	<.005	0.013	0.069	0.009	<.005	<.005
GS-3	1-16	1011	349	2.017	0.006	0.014	0.199	0.040	<.005	<.005
GS-3	1-16	1413	355	2.032	<.005	0.020	0.024	<.005	<.005	<.005
GS-3	1-16	1800	359	1.897	<.005	0.016	0.054	0.008	<.005	<.005
GS-3	1-16	2203	363	1.976	0.010	0.011	0.050	<.005	<.005	<.005
GS-3	1-17	238	370	1.905	<.005	0.009	0.024	0.009	<.005	<.005
GS-3	1-17	613	374	1.915	0.009	0.006	0.030	<.005	<.005	<.005
GS-3	1-17	1018	384	1.888	<.005	0.015	0.020	<.005	<.005	<.005
GS-3	1-17	1426	388	1.928	0.023	0.014	0.053	<.005	<.005	<.005
GS-3	1-17	1806	392	1.901	0.023	0.017	0.045	<.005	<.005	<.005
GS-3	1-17	2206	399	1.883	0.016	0.008	0.051	<.005	<.005	<.005
GS-3	1-18	145	403	1.996	0.019	0.007	0.051	0.005	<.005	<.005
GS-3	1-18	621	410	1.908	<.005	<.005	0.037	<.005	<.005	<.005
GS-3	1-18	1011	414	1.923	<.005	0.007	0.051	<.005	<.005	<.005
GS-3	1-18	1403	418	1.903	<.005	<.005	0.026	<.005	<.005	<.005
GS-3	1-18	1813	426	1.927	0.013	0.017	0.039	<.005	<.005	<.005
GS-3	1-18	2234	430	2.183	<.005	0.007	0.039	<.005	<.005	<.005
GS-3	1-19	158	437	1.946	<.005	0.010	0.053	<.005	0.009	<.005
GS-3	1-19	658	441	1.955	<.005	0.007	0.089	<.005	<.005	<.005
GS-3	1-19	1040	445	1.931	<.005	0.010	0.061	<.005	<.005	<.005
GS-4	1-5	1028	8	1.963	0.063	<.005	0.383	0.048	<.005	0.202
GS-4	1-5	1415	12	2.044	0.056	0.022	0.119	0.053	<.005	<.005
GS-4	1-5	1810	19	2.017	0.052	0.112	0.085	0.060	<.005	<.005
GS-4	1-5	2235	23	1.988	0.050	<.005	0.072	<.005	<.005	<.005
GS-4	1-6	210	27	2.113	0.022	0.012	0.078	<.005	<.005	<.005
GS-4	1-6	620	34	2.350	0.019	0.016	0.092	<.005	<.005	<.005
GS-4	1-6	1020	38	2.191	0.021	0.020	0.135	<.005	<.005	<.005

02-Apr-91

Table 1. (continued)

----- WESTINGHOUSE SAVANNAH RIVER SITE -----
----- LANDFILL GROUNDSHEET STUDY -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	DATE	TIME	CYCLE #	METHANE	ETHANE	ETHYLENE	PROPANE	PROPYLENE	ISO-BUTANE	N-BUTANE
GS-4	1-6	1410	45	2.231	0.027	0.026	0.221	0.048	<.005	<.005
GS-4	1-6	1815	50	2.359	0.032	0.066	0.297	0.088	<.005	<.005
GS-4	1-6	2215	54	2.468	0.016	0.018	0.165	0.064	<.005	<.005
GS-4	1-7	150	61	3.013	0.017	0.016	0.134	0.041	<.005	<.005
GS-4	1-7	620	65	4.086	0.015	0.019	0.124	<.005	<.005	<.005
GS-4	1-7	1025	72	4.196	0.021	0.026	0.137	<.005	0.016	<.005
GS-4	1-7	1410	77	3.058	0.022	0.035	0.121	0.057	<.005	<.005
GS-4	1-7	1810	81	2.403	0.020	0.038	0.191	0.049	<.005	<.005
GS-4	1-7	2205	88	2.245	0.019	0.026	0.154	0.027	<.005	<.005
GS-4	1-8	150	92	2.309	0.019	0.022	0.107	0.026	<.005	<.005
GS-4	1-8	620	99	2.146	0.022	0.015	0.089	<.005	<.005	<.005
GS-4	1-8	1020	103	2.130	0.011	0.011	0.071	<.005	0.013	<.005
GS-4	1-8	1417	107	2.175	0.008	0.010	0.071	<.005	<.005	<.005
GS-4	1-8	1805	114	2.129	0.010	0.012	0.055	<.005	<.005	0.006
GS-4	1-8	2205	118	2.186	0.013	0.009	0.066	<.005	0.149	<.005
GS-4	1-9	209	125	2.042	0.013	0.010	0.056	<.005	<.005	<.005
GS-4	1-9	617	129	2.030	0.010	0.009	0.042	<.005	<.005	<.005
GS-4	1-9	1010	133	2.025	0.008	<.005	0.051	<.005	<.005	<.005
GS-4	1-9	1410	140	2.066	0.008	0.006	0.093	<.005	<.005	<.005
GS-4	1-9	1808	144	2.028	0.013	0.010	0.074	<.005	0.005	<.005
GS-4	1-9	2210	151	2.033	0.015	<.005	0.097	<.005	<.005	<.005
GS-4	1-10	154	155	2.027	0.010	0.008	0.104	<.005	0.012	<.005
GS-4	1-10	613	159	1.997	0.013	0.010	0.093	<.005	<.005	<.005
GS-4	1-10	1015	167	1.989	0.012	<.005	0.081	<.005	<.005	<.005
GS-4	1-10	1407	171	2.013	0.009	<.005	0.064	<.005	<.005	0.005
GS-4	1-10	1811	178	1.949	0.012	0.015	0.069	<.005	<.005	<.005
GS-4	1-10	1030	182	1.969	0.011	<.005	0.051	<.005	<.005	<.005
GS-4	1-11	113	186	2.025	0.007	0.005	0.061	<.005	<.005	<.005
GS-4	1-11	610	193	2.211	0.029	0.011	0.178	0.071	<.005	<.005
GS-4	1-11	1015	197	2.293	0.030	0.022	0.298	0.062	<.005	<.005
GS-4	1-11	1418	204	2.249	0.141	0.066	0.322	0.102	<.005	<.005
GS-4	1-11	1835	377	2.413	0.050	0.017	0.484	0.147	0.013	<.005
GS-4	1-11	2225	212	2.306	0.027	0.038	0.514	0.131	0.011	0.126
GS-4	1-12	150	219	2.352	0.047	0.025	0.544	0.124	<.005	0.099
GS-4	1-12	614	223	2.448	0.048	0.018	0.622	0.144	<.005	<.005
GS-4	1-12	1012	230	2.587	0.054	0.028	0.950	0.202	<.005	0.121
GS-4	1-12	1409	234	2.155	0.022	0.014	0.259	0.060	<.005	0.068
GS-4	1-12	1806	238	1.988	0.013	0.014	0.049	<.005	<.005	<.005
GS-4	1-12	2215	245	2.006	<.005	0.009	0.037	<.005	<.005	<.005
GS-4	1-13	137	249	2.016	0.007	<.005	0.035	<.005	<.005	<.005
GS-4	1-13	621	256	2.021	0.017	<.005	0.047	<.005	<.005	<.005
GS-4	1-13	1016	261	2.041	0.024	0.011	0.055	<.005	<.005	<.005
GS-4	1-13	1418	265	2.078	0.019	0.013	0.117	0.037	<.005	<.005
GS-4	1-13	1805	272	2.031	0.017	<.005	0.072	0.015	<.005	0.008
GS-4	1-13	2307	276	2.186	0.015	0.014	0.058	<.005	<.005	<.005
GS-4	1-14	210	283	1.986	0.007	<.005	0.049	<.005	<.005	<.005
GS-4	1-14	622	287	2.010	0.015	<.005	0.040	<.005	<.005	<.005
GS-4	1-14	1017	291	2.046	0.018	0.010	0.057	<.005	<.005	<.005
GS-4	1-14	1425	298	1.966	0.006	0.008	0.099	0.035	<.005	0.009
GS-4	1-14	1814	302	2.014	0.011	0.011	0.108	<.005	<.005	<.005
GS-4	1-14	2219	309	1.925	<.005	<.005	0.013	0.005	<.005	<.005
GS-4	1-15	210	313	1.908	<.005	0.007	0.012	<.005	0.008	<.005
GS-4	1-15	624	317	1.955	0.007	0.007	0.027	<.005	<.005	<.005

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Table 1. (continued)

----- WESTINGHOUSE SAVANNAH RIVER SITE -----
----- LANDFILL GROUNDSHEET STUDY -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	DATE	TIME	CYCLE #	METHANE	ETHANE	ETHYLENE	PROPANE	PROPYLENE	ISO-BUTANE	N-BUTANE
GS-4	1-15	1014	324	1.940	<.005	<.005	0.023	0.007	<.005	<.005
GS-4	1-15	1417	328	1.938	<.005	0.013	0.059	<.005	<.005	<.005
GS-4	1-15	1815	335	1.866	<.005	0.012	0.042	<.005	<.005	<.005
GS-4	1-15	2200								
GS-4	1-16	200		SAMPLES NOT COLLECTED DUE TO SURFACE WATER						
GS-4	1-16	600								
GS-4	1-16	1000								
GS-4	1-16	1430	356	1.851	<.005	<.005	0.048	<.005	0.010	<.005
GS-4	1-16	1804	360	1.876	0.006	<.005	0.042	0.008	<.005	<.005
GS-4	1-16	2206	364	1.942	0.016	<.005	0.020	<.005	<.005	<.005
GS-4	1-17	242	371	1.892	0.020	0.013	0.025	<.005	<.005	<.005
GS-4	1-17	618	375	1.916	0.018	<.005	0.033	<.005	<.005	<.005
GS-4	1-17	1021	385	1.861	<.005	<.005	<.005	<.005	<.005	0.028
GS-4	1-17	1430	389	1.924	0.010	0.007	0.078	<.005	<.005	<.005
GS-4	1-17	1810	393	1.910	0.015	0.008	0.078	0.029	<.005	<.005
GS-4	1-17	2209	400	1.906	0.009	<.005	0.068	<.005	<.005	<.005
GS-4	1-18	150	404	1.895	<.005	0.006	0.069	<.005	<.005	<.005
GS-4	1-18	624	411	1.894	<.005	0.010	0.049	0.023	<.005	<.005
GS-4	1-18	1015	415	1.918	<.005	0.009	0.062	<.005	<.005	<.005
GS-4	1-18	1407	419	1.893	0.016	<.005	0.051	0.006	<.005	<.005
GS-4	1-18	1816	427	1.890	<.005	0.007	0.068	<.005	<.005	<.005
GS-4	1-18	2239	431	1.896	<.005	<.005	0.057	<.005	0.007	<.005
GS-4	1-19	203	438	1.854	<.005	<.005	0.056	<.005	<.005	<.005
GS-4	1-19	702	442	1.899	0.016	0.011	0.094	<.005	<.005	<.005
GS-4	1-19	1047	446	1.881	0.011	<.005	0.035	0.005	<.005	0.005
GS-2A	1-5	1752	15	413.999	0.057	<.005	0.188	0.037	0.284	<.005
GS-2A	1-6	1400	41	12016.599	0.265	0.037	2.611	0.377	4.057	0.701
GS-2A	1-7	1012	68	5003.481	0.210	0.044	2.013	0.363	3.284	<.005
GS-2A	1-8	608	95	34.735	0.013	0.005	0.073	<.005	<.005	<.005
GS-2A	1-9	157	121	10.112	<.005	<.005	0.049	<.005	<.005	<.005
GS-2A	1-9	2156	147	180.609	0.011	<.005	0.196	<.005	0.120	<.005
GS-2A	1-10	1802	174	1901.128	0.021	0.006	0.390	0.061	0.576	<.005
GS-2A	1-11	1408	200	14961.635	0.149	0.042	3.011	<.005	4.627	0.835
GS-2A	1-12	1003	226	19766.281	0.485	<.005	3.981	0.474	6.039	1.175
GS-2A	1-13	613	252	38.308	<.005	0.006	0.054	0.014	<.005	<.005
GS-2A	1-14	154	279	12.668	0.012	<.005	0.028	<.005	<.005	<.005
GS-2A	1-14	2207	305	311.340	0.027	<.005	0.204	0.026	0.300	<.005
GS-2A	1-15	1806	332	53.815	0.005	<.005	0.015	<.005	<.005	<.005
GS-2A	1-16	1408	352	324.231	<.005	0.005	0.078	<.005	<.005	<.005
GS-2A	1-17	1014	381	2.685	<.005	<.005	0.031	<.005	<.005	<.005
GS-2A	1-18	616	407	20.746	0.010	<.005	0.033	<.005	0.009	<.005
GS-2A	1-19	152	434	63.968	<.005	<.005	0.068	<.005	0.051	<.005
GS-4A	1-6	213	28	2.119	0.017	<.005	0.083	<.005	<.005	<.005
GS-4A	1-6	2216	55	2.484	0.020	0.009	0.155	<.005	<.005	<.005
GS-4A	1-7	1812	82	2.367	0.021	0.019	0.255	0.053	<.005	0.105
GS-4A	1-8	1419	108	2.089	0.013	<.005	0.062	<.005	<.005	<.005
GS-4A	1-9	1012	134	2.027	0.008	0.009	0.056	<.005	<.005	<.005
GS-4A	1-10	615	160	2.007	0.010	<.005	<.005	<.005	<.005	<.005
GS-4A	1-11	115	188	2.072	0.016	<.005	0.068	<.005	<.005	<.005
GS-4A	1-11	2227	213	2.260	0.032	0.018	0.479	0.077	<.005	0.081
GS-4A	1-12	1809	239	2.021	0.020	<.005	0.050	<.005	<.005	<.005
GS-4A	1-13	1420	266	2.071	0.015	0.006	0.112	0.033	<.005	<.005

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Table 1. (continued)

----- WESTINGHOUSE SAVANNAH RIVER SITE -----
----- LANDFILL GROUNDSHEET STUDY -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	DATE	TIME	CYCLE #	METHANE	ETHANE	ETHYLENE	PROPANE	PROPYLENE	ISO-BUTANE	N-BUTANE
GS-4A	1-14	1019	292	2.037	0.019	<.005	0.061	0.008	<.005	<.005
GS-4A	1-15	626	318	1.953	0.007	<.005	0.013	0.009	<.005	<.005
GS-4A	1-16	2208	365	1.958	0.008	<.005	0.017	<.005	<.005	<.005
GS-4A	1-17	1812	394	1.887	0.017	<.005	0.063	<.005	<.005	<.005
GS-4A	1-18	1411	421	1.872	<.005	<.005	0.043	<.005	<.005	<.005
GS-4A	1-19	1048	447	1.860	<.005	<.005	0.032	<.005	<.005	<.005

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Table 2.

----- WESTINGHOUSE SAVANNAH RIVER SITE -----
----- LANDFILL GROUNDSHEET STUDY -----
----- STANDARD GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	CYCLE #	METHANE	ETHANE	ETHYLENE	PROPANE	PROPYLENE	ISO-BUTANE	N-BUTANE
STD M	2	9.928	0.960	0.999	0.984	1.010	0.980	0.972
STD M	3	9.580	0.935	0.975	0.972	0.933	0.946	0.975
STD M	17	10.122	1.037	1.064	0.994	1.013	1.034	1.044
STD M	30	9.917	0.978	0.990	1.027	0.959	1.067	1.079
STD M	43	10.116	0.982	0.990	1.008	0.977	1.010	0.989
STD M	57	10.013	0.978	0.973	0.991	0.972	0.992	0.978
STD M	70	9.796	0.967	0.949	0.981	0.985	0.968	0.944
STD M	73	10.092	1.008	1.008	1.003	1.017	1.004	0.988
STD M	84	9.988	1.008	1.009	1.004	0.998	1.013	1.018
STD M	97	9.920	0.984	0.984	0.993	0.985	0.983	0.994
STD M	110	9.885	0.991	0.994	1.011	1.002	0.983	1.006
STD M	123	9.756	0.977	0.989	0.986	0.991	1.004	1.002
STD M	136	9.958	0.987	0.987	0.992	0.969	0.989	0.958
STD M	149	10.010	0.993	0.983	1.016	0.989	1.030	0.994
STD M	162	10.231	1.007	1.009	1.026	1.007	0.956	0.963
STD M	163	9.861	0.991	0.992	0.997	1.006	1.026	1.025
STD M	176	9.842	0.995	0.992	1.006	0.956	1.007	0.982
STD M	187	10.415	1.016	1.033	1.021	1.070	1.074	1.097
STD M	202	10.444	1.000	0.977	0.978	0.938	0.974	0.971
STD M	215	9.239	0.903	0.904	0.894	0.904	0.878	0.903
STD M	228	10.097	0.997	1.003	1.004	1.010	1.029	1.043
STD M	241	10.089	1.023	1.019	1.015	1.014	1.006	1.031
STD M	254	9.813	0.979	0.978	0.981	0.976	0.965	0.927
STD M	258	10.267	1.032	1.029	1.033	0.926	1.047	1.067
STD M	268	10.188	1.019	1.015	1.013	1.020	1.003	1.024
STD M	281	10.310	1.029	1.037	1.034	1.021	1.025	1.045
STD M	294	9.352	0.929	0.915	0.932	0.927	0.907	0.931
STD M	307	9.889	0.981	0.982	0.994	0.987	1.006	0.996
STD M	320	10.034	0.989	0.988	0.980	0.972	0.973	0.940
STD M	330	9.710	0.959	0.955	0.950	0.933	0.955	0.960
STD M	343	9.674	0.948	0.947	0.952	0.956	0.872	0.889
STD M	354	9.936	0.981	0.977	0.990	0.971	0.995	0.967
STD M	367	10.251	1.029	1.021	1.023	0.996	1.003	1.018
STD M	383	10.234	1.021	1.011	1.015	0.997	1.007	1.026
STD M	396	10.207	1.017	1.009	1.017	1.011	0.978	0.986
STD M	409	9.930	0.980	0.981	0.958	0.946	0.983	0.987
STD M	420	9.959	0.985	0.981	0.981	0.969	0.948	0.921
STD M	423	9.894	1.002	1.003	1.018	1.060	1.038	0.949
STD M	436	9.968	0.989	0.997	0.992	0.994	0.919	0.930
MEAN		9.972	0.989	0.991	0.994	0.984	0.989	0.988
STD DEV		0.249	0.029	0.030	0.028	0.035	0.044	0.047
% STD DEV		2.501	2.896	3.018	2.838	3.557	4.445	4.739
STD 224	449	998.221	1002.513	NA	969.831	NA	NA	1004.721
STD 224	450	1016.468	1029.160	NA	996.794	NA	NA	1026.571
STD 224	463	985.311	980.327	NA	949.375	NA	NA	977.707
STD 224	473	989.705	982.623	NA	948.776	NA	NA	984.651
MEAN		997.426	998.656	NA	966.194	NA	NA	998.413
STD DEV		11.933	19.611	NA	19.595	NA	NA	19.045
% STD DEV		1.196	1.964	NA	2.028	NA	NA	1.907

Table 2. Analyses of C1-C4 Hydrocarbon Standard "M" and Standard "224" During the 740-G Landfill Groundsheet Study

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Table 3.

----- WESTINGHOUSE SAVANNAH RIVER SITE -----
----- LANDFILL GROUNDSHEET STUDY -----
----- SYSTEM BLANK CONCENTRATIONS (PPMV) -----

SAMPLE NAME	DATE	TIME	CYCLE #	METHANE	ETHANE	ETHYLENE	PROPANE	PROPYLENE	ISO-BUTANE	N-BUTANE
GS-BLK#1	1-5	1000	4	2.034	<.005	<.005	<.005	<.005	<.005	<.005
GS-BLK#2	1-5	1755	16	2.059	0.039	0.073	<.005	<.005	<.005	<.005
GS-BLK#3	1-6	216	29	2.067	0.021	0.014	0.016	<.005	<.005	<.005
GS-BLK#4	1-6	1402	42	3.701	0.023	0.007	0.007	<.005	<.005	<.005
GS-BLK#5	1-6	2217	56	2.145	0.014	0.008	<.005	0.008	<.005	<.005
GS-BLK#6	1-7	1015	69	2.302	0.010	0.012	<.005	<.005	<.005	<.005
GS-BLK#7	1-7	1814	83	2.014	0.010	<.005	<.005	0.008	<.005	<.005
GS-BLK#8	1-8	610	96	2.089	0.012	<.005	0.023	<.005	<.005	<.005
GS-BLK#9	1-8	1421	109	2.060	0.012	<.005	<.005	0.017	<.005	<.005
GS-BLK#10	1-9	159	122	2.103	0.011	0.006	<.005	<.005	0.006	<.005
GS-BLK#11	1-9	1015	135	2.026	0.008	0.005	0.011	<.005	<.005	<.005
GS-BLK#12	1-9	2157	148	1.990	0.009	<.005	<.005	<.005	<.005	<.005
GS-BLK#13	1-10	618	161	2.049	0.007	<.005	0.087	<.005	<.005	<.005
GS-BLK#14	1-10	1804	175	2.067	0.007	<.005	<.005	<.005	<.005	<.005
GS BLK#15	1-11	117	189	2.084	0.065	<.005	<.005	<.005	<.005	<.005
GS BLK#16	1-11	1410	201	3.645	0.025	<.005	0.010	<.005	<.005	<.005
GS-BLK#17	1-11	2229	214	2.057	0.007	<.005	<.005	<.005	<.005	<.005
GS-BLK#18	1-12	1005	227	3.653	0.010	<.005	0.007	<.005	<.005	0.008
GS-BLK#19	1-12	1813	240	2.004	0.015	0.026	<.005	<.005	<.005	<.005
GS-BLK#20	1-13	615	253	2.008	<.005	<.005	<.005	0.005	<.005	0.008
GS-BLK#21	1-13	1422	267	2.043	0.024	<.005	<.005	<.005	<.005	<.005
GS-BLK#22	1-14	200	280	2.003	0.005	0.013	<.005	<.005	<.005	0.024
GS-BLK#23	1-14	1021	293	1.985	0.005	<.005	<.005	<.005	0.007	<.005
GS-BLK#24	1-14	2209	306	1.962	0.020	0.008	<.005	<.005	<.005	0.125
GS-BLK#25	1-15	629	319	2.031	0.029	0.095	<.005	0.071	<.005	<.005
GS-BLK#26	1-15	1808	333	2.188	<.005	<.005	<.005	<.005	<.005	<.005
GS-BLK#27	1-16	200	342	1.787	0.014	<.005	<.005	<.005	<.005	<.005
GS-BLK#28	1-16	1410	353	1.908	0.006	<.005	0.014	<.005	<.005	<.005
GS-BLK#29	1-16	2210	366	1.936	<.005	<.005	0.010	<.005	<.005	<.005
GS-BLK#30	1-17	1016	382	1.894	0.012	<.005	<.005	<.005	<.005	<.005
GS-BLK#31	1-17	1813	395	1.880	<.005	<.005	0.008	<.005	<.005	<.005
GS-BLK#32	1-18	618	408	1.904	<.005	0.010	<.005	<.005	<.005	<.005
GS-BLK#33	1-18	1412	422	1.874	<.005	<.005	<.005	<.005	<.005	<.005
GS-BLK#34	1-19	154	435	1.876	0.012	0.014	<.005	<.005	<.005	<.005
GS-BLK#35	1-19	1051	448	1.843	<.005	<.005	<.005	<.005	<.005	<.005
MEAN				2.151	0.013	0.011	0.009	0.007	0.005	0.009
STD DEV				0.475	0.012	0.019	0.014	0.011	0.000	0.020
MEAN +2 STD DEV				3.100	0.037	0.049	0.037	0.030	0.006	0.049

Table 3. Analyses of System Blanks

Table 4.

MICROSEEPS

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---------------WESTINGHOUSE SAVANNAH RIVER SITE---------------
---- 740-G LANDFILL ----
-------LIGHT HYDROCARBON SOIL GAS CONCENTRATIONS @ 3 FT-------

SAMPLE #	METHANE %	METHANE PPB	ETHANE PPB	PROPANE PPB	I-BUTANE PPB	N-BUTANE PPB	ETHYLENE PPB	PROPYLENE PPB	SAMPLE #
740-G 11	61.0	610080000	ND	12461	19042	260	2088	2927	740-G 11
740-G 52	38.3	382810000	ND	25926	34516	7929	2403	3404	740-G 52
740-G 97	56.4	563750000	176420	297700	141170	202710	46632	73436	740-G 97
740-G 220	26.1	260900000	220490	683020	130170	169070	9002	6595	740-G 220

Table 4. Light Hydrocarbon Concentrations in Soil Gas Survey Sites Near Each Groundsheet

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Appendix I

Sampling Method SM1
Analytical Method AMI

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SAMPLING METHOD SM1

SOIL GAS PROBE SAMPLING

1.0 Scope and Application

1.1 Soil gas probe samples are collected with Microseeps unique, portable soil gas sampling probe which permits access to any area. In addition, the probe allows unlimited purging between sample sites and incorporates the capability to discard the volume of air in the sample probe before the soil gas sample at each site is taken.

2.0 Apparatus

2.1 Soil Gas Probe: The soil gas probe consists of a 1/2 inch diameter steel tube equipped with a rubber packer and a 1/8" o.d. ss sample tube inserted concentrically to the bottom of the 1/2" diameter tube to minimize dead space in the sample volume. The 1/8" o.d. sample tube is connected through a three way valve to a 250 cc gas tight syringe mounted as an integral part of the sample probe. The third port of the three-way valve is terminated with a syringe needle and serves two functions: first a small amount of gas equal to or larger than the dead space volume of the 1/8" o.d. sample tube is discarded through this port before each soil gas sample is taken; second, the syringe needle serves to facilitate transfer of the soil gas sample through a rubber septum into a previously evacuated sample vial, minimizing the possibility of contamination of any sample.

2.2 Slide Hammer Plunger Bar: The slide hammer plunger bar contains a 5.5 ft. x .5 in rod with a 9/16 inch ball. Fitted over one end of the rod is a weighted slide hammer. (Heath Consultants cat# 478).

2.3 Sample vials: The sample vials used are determined by the analytical method that is required for analysis. All vials should be free of interferences and meet the specifications described in the analytical method to be used.

3.0 Procedure

3.1 Prior to any sampling, the soil gas sampling probe should be purged clean of interferences, the syringe needle should be removed, and the three way valve should be in the stop flow position.

3.2 A 9/16 inch diameter hole is created to the desired depth using the slide hammer plunger bar.

3.3 The plunger bar is removed and the sample probe is inserted into the hole. A seal should be obtained to prevent ambient air from entering the hole when the soil gas sample is removed.

3.4 The three way valve is turned to the probe/syringe position.

3.5 A 10 cc volume of gas is drawn into the syringe.

3.6 The three way valve is turned to the syringe/needle position (needle removed as described in section 3.1) and the 10 cc sample is discarded.

3.7 The three way valve is turned to the probe/syringe position and the appropriate amount of soil gas is drawn into the syringe.

3.8 The three way valve is turned to the stop flow position

3.9 The needle is attached to the probe needle fitting.

3.10 An evacuated sample vial is attached by inserting the sample vial septum onto the needle.

3.11 The three way valve is turned to the syringe/needle position. The volume of the evacuated vial will be drawn into the sample vial. Additional volume (positive pressure) can then be added by depressing the plunger and displacing the remaining volume in the syringe.

3.12 The sample vial should be quickly removed once desired volume is displaced.

3.13 A volume of approximately 50 cc of ambient air should be drawn back through the needle.

3.14 Remove the needle.

3.15 Remove the sample probe from the hole.

3.16 Purge the sample probe clean of interferences.

4.0 <u>Sample Documentation</u>

4.1 All samples should be labeled immediately after collection with the following information:

1. Site number
2. Daily sequence number
3. Date and time
4. Samplers initials
5. Project

4.2 All samples taken in the field by Microseeps, Ltd. should be entered onto a Field Log Sheet. For each sample, the following entries will be made:

1. Site number
2. Daily sequence number
3. Date and time
4. Samplers initials
5. Project
6. Location
7. Sample description
8. Miscellaneous comments

4.3 When appropriate, samples will be security sealed and chain of custody records will be maintained.

5.0 Safety Precautions

5.1 Do not under any circumstances allow the pressure in the sampling syringe or sample vial to exceed 20 psig. Operations above 20 psig may cause the glass to burst which could possibly result in injury to the user or bystanders. Do not use a mechanical device to depress the sampling syringe plunger.

5.2 Do not attempt to collect soil gas probe samples without prior knowledge of the location of underground utilities and other possible environmental hazards.

5.3 Always cap or remove the soil gas probe syringe needle when transporting or handling the soil gas probe.

6.0 Preventive Maintenance

6.0 The soil gas sample probe should be cleaned when necessary or at the end of each day with soap and organic free water. It is especially important to keep the gas sampling syringe clean from fine soil particles as the particles will quickly deteriorate the teflon/glass plunger seal.

6.1 The glass wool filter plug (located in the probe tip) should be changed often and the probe tip should be kept clear of soil.

ANALYTICAL METHOD AM1

ANALYSIS OF C1-C4 HYDROCARBONS, HYDROGEN, HELIUM, IN SOIL GAS

1.0 Scope and Application

1.1 Method AM1 is used to determine the concentration of C1-C4 hydrocarbons, helium and hydrogen in soil gas samples. Specifically, Method AM1 may be used to detect the following substances:

methane
ethane
ethylene
propane
propylene
i-butane
n-butane
helium
hydrogen

1.2 This method is recommended for use by, or under the supervision of, analysts experienced in the operation of gas chromatographs and in the interpretation of chromatograms.

2.0 Summary of Method

2.1 Analysis of the above constituents of free soil gas is accomplished with a custom chromatograph, built by Microseeps. The custom, dual detector gas chromatograph provides a sequential output from two detectors. First, the C1-C4 hydrocarbons are detected with a flame ionization detector (FID), next helium and hydrogen are detected with a thermal conductivity detector (TCD). The sample (and standard calibration gas) is flowed through the gas chromatograph and introduced into the columns by the mechanical injection of two sample loops.

3.0 Interferences

3.1 Contamination by carryover can occur whenever high-level and low-level samples are sequentially analyzed. A non-restricted flow of pure nitrogen from a 10 psig source should be purged for 30 seconds through the sample loops prior to all analyses.

3.2 The analyst should demonstrate the absence of contamination by carryover by analysis of the contents of the sample loops when purged with nitrogen. This demonstration should be performed prior to the analysis of a sample set and when carryover contamination is suspected (after high samples). In the event that `ghost peaks' (peaks similar to previous sample) appear when a pure nitrogen sample is analyzed, measures should be taken to eliminate the carryover contamination.

3.3 Extra peaks in a chromatogram can be actual peaks from a previous run. Contamination from late eluting peaks can occur when injection to injection time is too short. The dual gas chromatograph is set up in the backflush pre-column valve arrangement to minimize this interference.

3.4 The analyst should be certain that all peaks have eluted from the previous analysis prior to analyzing any sample or standard. If samples or standard chromatograms contain suspected `extra peaks' the sample should again be analyzed after a clean baseline is established.

4.0 Apparatus and Materials

4.1 Sample vials: 125 ml glass vials (Wheaton #223748 or equivalent). Vials should be free of hydrocarbons, helium, and hydrogen prior to use. This can be accomplished by heating to 100 degrees C followed by purging with pure nitrogen.

4.2 Septums: Butyl rubber septums (Wheaton #224154 or equivalent) may be used provided vials are capped within two weeks prior to use. Other septums may be used, provided they are gas tight and do not produce interferences.

4.3 Gas Chromatograph: The chromatograph is equipped with two sets of the following: column oven, pre-column, analytical column, detector, injection port, sample valve and sample loop. The column and detector for determination of C1-C4 hydrocarbons are a granular 3 ft. x 3/16 in. alumina analytical column and a flame ionization detector. The alumina column is protected against contamination by heavy organics by a 3 in. x 3/16 in. pre-column which is back-flushed after butanes have entered the analytical column. This arrangement allows rapid turn-around for consecutive analyses and a clean baseline for accurate, reproducible results. The flame ionization detector is of a special design which allows considerably more sensitivity than commercially available models. In a laboratory setting, noise levels are commonly at the 500 ppt level. Although, these sensitivities are rarely realized in the field, 1 to 2 ppb is achievable and 5 ppb is routine. Hydrogen and helium, are simultaneously determined using a 3 ft. x 3/16 in. molecular sieve 5A (80/100 mesh) pre-column and 10 ft. x 3/16 in. analytical column connected to a thermal conductivity detector. Injection times and the signal output are sequenced so that the output of the two detectors is displayed in a single continuous chromatogram.

4.4 Data Collection: The output of the chromatograph is directed to a chart recorder and a Hewlett Packard (HP-3392A) Networking Integrator which passes the processed data to a microcomputer for data storage and/or further processing.

5.0 Sample Preparation and Analysis

5.1 Sample vial preparation: All sample vials should meet specifications as noted in sections 4.1 and 4.2 above. Vials should be tightly capped and evacuated to a pressure of less than 100 millitorr. The vial septum should be punctured with needles of 22 gauge or smaller.

5.2 The evacuated sample vials should be filled with sample gas to a pressure of 9 psig. A positive pressure capable of delivering at least 25 cc of sample must be available per each injection.

5.3 The pressurized sample vial is connected to the sample loops through a needle fitting and flow control valve. The flow is monitored by a flow meter connected to the out port on the gas chromatograph.

5.4 After the appropriate volume of sample (minimum 25 cc) has been flushed through the sample loops of the gas chromatograph, the injection valves may be activated. This is accomplished by switching on the cycle timer.

6.0 Calibration

6.1 The standard calibration gas should be introduced in the same manner as described in section 5.4 above. Measured peak areas are converted to concentrations in parts per million by volume using certified commercial gas standards traceable to NBS standards. (Matheson Gas Products Inc., or Scott Specialty Gases). The sample concentrations are calculated from calibration points near the concentration level of the sample.

6.2 At the beginning of a project or sample set, standards of appropriate calibration ranges will be run at least three times or until the results agree with a percent standard deviation no greater than 10%.

6.3 The instrument response (for any one subsequent standard in section 6.5 above) must not vary by more than 20%; or any two consecutive standards must not vary by more than 15% from the mean of the three previous standards.

7.0 Quality Control

7.1 If the parameters set forth in section 6.3 are not met, the analytical program will be terminated until the cause is determined and a solution is effected. The cause and the solution will be recorded in the Laboratory Notebook and signed by the operater, before the analytical program is resumed.

7.2 Before and during sample analysis, instrument blanks (sample loops filled with flush nitrogen) should be analyzed to assure the absence of interferences as described in section 3.0 above.

7.3 Standards analyzed during the course of analyzing samples are averaged into the calibration table as well as being used for peak identification. All chromatograms should be examined by an experienced analyst.

7.4 Throughout analysis the soil gas samples are injected mechanically to achieve a uniform sample size from a flow directly from the soil gas sample vial which has been pressured at the time of sampling. This pressuring preserves sample integrity since any leakage is out of the vial and does not result in contamination or sample dilution.

7.5 Calibration records are generated and stored. All such records will be maintained in the laboratory during the course of the project.

8.0 Instrument Conditions

8.1 Gas Chromatograph:

Injection Temp. ambient
Flame Ionization Detector Temp. ambient
Thermal Conductivity Detector Temp. 45 deg. C.
C1-C4 Oven Temp. 100 deg. C. isothermal
Helium/Hydrogen Oven Temp. 45 deg. C. isothermal
Initial T.C.D. Signal Range 10
Initial F.I.D. Signal Range 10E9
Carrier Gas Regulator Pressures:
T.C.D. 40 psig.
F.I.D. 17 psig.
Hydrogen Pressure 22 psig.
Flame Air Pressure 30 psig. (1.0 scfh)

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Appendix II

Soil Gas Collection Logs

MICROSEEPS LTD.

CLIENT: W.S.R.C.
LOCATION: SRS / LANDFILL (TASK #1)
PROJECT(#): LANDFILL GROUNDSHOOT
PAGE: 1 OF: ____

************ SAMPLE COLLECTION LOG **********

SAMPLER NAME(S): DJM-AGC-JS-JP-RJP

SAMPLE ID#	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE G	S	W	SAMPLE SIZE	COMMENTS	C.O.C.
GS-BIK#1	1-5-91	10:00	1	—	✓			22ml	System Blank	1-5-91
GS-1	1-5	10:02	2	0'					Cool 50° - windy 5-10 mph	
GS-2	1-5	10:12	3							
GS-3	1-5	10:20	4							
GS-4	1-5	10:28	5							
GS-1	1-5	13:58	6							
GS-2	1-5	14:05	7							
GS-3	1-5	14:10	8							
GS-4	1-5	14:15	9							
GS-1	1-5	17:45	10							
GS-2	1-5	17:50	11							
GS-2A	1-5	17:52	12						Duplicate Sample	
GS-BIK#2	1-5	17:55	13						System Blank	
GS-3	1-5	18:00	14							
GS-4	1-5	18:10	15							
GS-1	[illegible]	22:20	16						Dark But calm	
GS-2	1-5	22:25	17							
GS-3	1-5	22:30	18							
GS-4	1-5	22:35	19							AGC
GS-1	[illegible]	[illegible]	20						V. dark	1-6-91
GS-2	[illegible]	[illegible]	21						"	
GS-3	[illegible]	[illegible]	22						"	
GS-4	[illegible]	[illegible]	23						"	
GS-4A	[illegible]	[illegible]	24						Dup.	
GS-BIK#3	[illegible]	[illegible]	25						Blk "	
GS-1	1-6	0605	[illegible]						[illegible]	
GS-2	1-6	0610	[illegible]							
GS-3	1-6	0615	[illegible]							
GS-4	1-6	0620	[illegible]							
GS-1	1-6	10:05	[illegible]						Cool - Calm	
GS-2	1-6	[illegible]	[illegible]							
[illegible]	1-6	10:15	[illegible]							
GS-4	1-6	10:20	[illegible]							
GS-1	1-6	13:50	34						Sunny - Warm	
GS-2	[illegible]	13:55	35							
[illegible]	[illegible]	1400	36						Duplicate Sample	
[illegible]		1402	37						System Blank	
[illegible]		1405	[illegible]							
[illegible]		1410	[illegible]							
GS-1	[illegible]	[illegible]	[illegible]						[illegible]	
GS-2	1-6	1805	41							
GS-3	1-6	[illegible]	[illegible]							
GS-4	1-6	[illegible]	[illegible]							[illegible]

USE A NEW SHEET WHEN RESTARTING SEQUENCE #

MICROSEEPS LTD.

CLIENT: WSRC
LOCATION: SRS/Landfill 740-G
PROJECT(#): Landfill Groundsheet Task#1
PAGE: 2 OF: ____

*********** SAMPLE COLLECTION LOG **********

SAMPLER NAME(S): DJM, AGC, RJP

SAMPLE ID#	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE G	S	W	SAMPLE SIZE	COMMENTS	C.O.C.
GS-1	1-6-91	22:00	44	0'	✓			22 mL	DJM	1-6-91
GS-2	1-6	22:05	45						"	
GS-3	1-6	22:10	46						"	
GS-4	1-6	22:15	47						"	
GS-4A	1-6	22:16	48						" Dup	
GS-Blank#5	1-6	22:17	49						DJM SYS-BLK	AGC 1-7-91
GS-1	1-7	[illegible]	50						RJP	
GS-2	1-7	[illegible]	51						"	
GS-3	1-7	[illegible]	52						"	
GS-4	1-7	[illegible]	53						RJP	
GS-1	1-7	0605	54						AGC - Light Rain - Dense Fog 55-60° - Calm	
GS-2	1-7	0610	55							
GS-3	1-7	0615	56							
GS-4	1-7	0620	57							
GS-1	[illegible]	1005	58						Calm	
GS-2	[illegible]	1010	59							
GS-2A	1-7	1012	60						Dup	
GS-Blank#6	1-7	1015	61						Sys Blk	
GS-3	1-7	1020	62							
GS-4	1-7	1025	63							
GS-1	1-7	[illegible]	64						Windy + Rain	
GS-2	1-7	[illegible]	65							
GS-3	1-7	[illegible]	66							
GS-4	1-7	[illegible]	67							
GS-1	1-7	1755	68						Calm + Rain	
GS-2	1-7	[illegible]	69							
GS-3	1-7	[illegible]	70							
GS-4	1-7	1810	71							
GS-4A	1-7	1812	72						Dup	
GS-Blank#7	1-7	1814	73						Sys Blk	
GS-1	1-7	21:50	74						Windy, Cool DJM	
GS-[illegible]	1-7	[illegible]	75						"	
GS-[illegible]	1-7	22 00	76						"	
GS-[illegible]	1-7	22:05	77						" DJM	AGC
GS-[illegible]	1-8	0137	[illegible]						[illegible] Windy	1-8-91
GS-2	[illegible]	0141	[illegible]						Cool	
GS-[illegible]	[illegible]	0145	[illegible]						[illegible]	
[illegible]		[illegible]	[illegible]						[illegible]	
[illegible]	1-8	[illegible]	82						[illegible] - Cold-Rain	
[illegible]	8	[illegible]	83						Windy	
GS-[illegible]A	[illegible]	[illegible]	84						Dup	
[illegible]	[illegible]	[illegible]	85						[illegible]	
[illegible]		[illegible]	86							

USE A NEW SHEET WHEN RESTARTING SEQUENCE #

MICROSEEPS LTD.

CLIENT: WSRC
LOCATION: SRS- Landfill 740-6
PROJECT(#): Landfill Geosurvey Sheet Task #1
PAGE: 3 OF: ____

*********** SAMPLE COLLECTION LOG **********

SAMPLER NAME(S): DJM, AGC + RJP

SAMPLE ID#	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE G	S	W	SAMPLE SIZE	COMMENTS	
GS-4	1-8-91	0620	87	-0-	✓			22mL		COC AGC 1-8-91
GS-1	1-8	1005	88							1-9-91
GS-2	1-8	1010	89							
GS-3	1-8	1015	90							
GS-4	1-8	1020	91							
GS-1	1-8	1405	92							
GS-2	1-8	1410	93							
GS-3	1-8	1414	94							
GS-4	1-8	1417	95							
GS-4A	1-8	1419	96							
GS-BLK#9	1-8	1421	97							
GS-1	1-8	1750	98						Slight Drizzle	
GS-2	1-8	1755	99							
GS-3	1-8	1800	100							
GS-4	1-8	1805	101							
GS-1	1-8	21:50	102						Cool, Slight Breeze DJM	
GS-2	1-8	21:55	103						" "	
GS-3	1-8	22:00	104						" "	
GS-4	1-8	22:05	105						" "	
GS-1	1-9	0150	106						RJP	
GS-2	1-9	0154	107						"	
GS-2A	1-9	0157	108						"	
GS-BLK#10	1-9	0159	109						"	
GS-3	1-9	0203	110						"	
GS-4	1-9	0209	111						RJP	
GS-1	1-9	0605	112						Cold - Breezy	
GS-2	1-9	0610	113						"	
GS-3	1-9	0613	114						"	
GS-4	1-9	0617	115						"	AGC 1-9-91
GS-1	1-9	0955	116						"	COC
GS-2	1-9	1000	117						"	
GS-3	1-9	1005	118						"	
GS-4	1-9	1010	119						"	
GS-4A	1-9	1012	120						"	
GS-BLK#[illegible]	1-9	1015	121							
GS-1	1-9	1355	122						Cool	
GS-2	1-9	1400	123							
GS-3	1-9	1405	124							
GS-4	1-9	1410	125							
[illegible]	1-9	1755	126							
[illegible]	1-9	[illegible]	127							
[illegible]	1-9	1803	128							
[illegible]	-9	[illegible]	129							

USE A NEW SHEET WHEN RESTARTING SEQUENCE #

MICROSEEPS LTD.

CLIENT: WSRC
LOCATION: SRS - Landfill 740-G
PROJECT(#): Ground Sheet Task #1
PAGE: 4 OF: ____

*********** SAMPLE COLLECTION LOG **********

SAMPLER NAME(S): DJM + AGC + RJP

SAMPLE ID#	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE G	S	W	SAMPLE SIZE	COMMENTS	
GS-1	1-9	2150	130	-0-	✓			22mL	DJM	C.O.C.
GS-2		2155	131							
GS-2A		2156	132							
GS-BLK#12		2157	133							
GS-3		22:05	134							
GS-4	1-9	22:10	135						DJM	
GS-1	1-10	0142	136						RJP	
GS-2	1-10	0146	137							
GS-3	1-10	0150	138							
GS-4	1-10	0154	139						RJP	
GS-1	1-10	0600	140						Light Rain - Cold - Windy	
GS-2	1-10	0604	141							
GS-3	1-10	0608	142							
GS-4	1-10	0613	143							
GS-4L	1-10	0615	144							AGC
GS-BLK[illegible]	1-10	0618	145							1-10-91
GS-1	1-10	1005	146						Cool Windy	
GS-2	1-10	1008	147							
GS-3	1-10	1011	148							
GS-4	1-10	1015	149							
GS-1	1-10	1355	150							
GS-2	1-10	1400	151						Warm & Windy	
GS-3	1-10	1403	152							
GS-4	1-10	1407	153							
GS-1	1-10	1755	154						Drizzle	
GS-2	1-10	1800	155							
GS-2A	1-10	1802	156							
GS-BLK#4	1-10	1804	157							
GS-3	1-10	1808	158							
GS-4	1-10	1811	159							
GS-1	1-10	10:15	160						Light Rain - Cold DJM	
GS-2	1-10	10:20	161						" "	
GS-3	1-10	10:25	162						" "	
GS-4	1-10	10:30	163						" "	
GS-1	[illegible]	0102	164						KP	
GS-2		0105	165							
GS-3		0109	166						Lt. Rain	
[illegible]		0112	[illegible]						[illegible]	
GS-4L		0115	[illegible]							
GS-BLK#5		[illegible]117	[illegible]							
[illegible]		[illegible]	170						Rain	
[illegible]		[illegible]	[illegible]							
[illegible]		[illegible]	[illegible]							A[illegible]

USE A NEW SHEET WHEN RESTARTING SEQUENCE #

MICROSEEPS LTD.

CLIENT: WSRC
LOCATION: SRS Landfill - 740-G
PROJECT(#): Ground Sheet task #1
PAGE: 5 OF: ____

************** SAMPLE COLLECTION LOG *************

SAMPLER NAME(S): DJM + AGC

SAMPLE ID#	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE G	S	W	SAMPLE SIZE	COMMENTS	COC
GS-4	1-11	0610	173	-0-	✓			22mL	RAIN	COC AGC 1-11-91
GS-1	″	1001	174		/			/	″	
GS-2	″	1004	175						″	
GS-3		1010	176						″	
GS-4		1015	177						″	
GS-1		1402	178						Heavy Rain - Strong Wind	
GS-2		1406	179							
GS-2A		1408	180							
GS-BLK#16		1410	181							
GS-3		1415	182							
GS-4		1418	183							
GS-1		1820	184						DJM AGC	
GS-2		1825	185						″	
GS-3		1830	186						″	
GS-4		1835	187						″	
GS-1		22:10	188						DJM	
GS-2		22:15	189						″	
GS-3		22:20	190						″	
GS-4		22:25	191						″	
GS-4A		22:27	192						″	
GS-BLK#17		22:29	193						″	
GS-1	1-12	01:35	194						″	
GS-2		01:40	195						″	
GS-3		0145	196						″	
GS-4		0150	197						″	
GS-1		0603	198						AGC - Light Rain - Calm	
GS-2		0606	199							
GS-3		0610	200							COC
GS-4		0614	201							[illegible]
GS-1		0958	202						AGC - Windy - Warm	
GS-2		1001	203						″	
GS-2A		1003	204							
GS-BLK#18		1005	205						″	
GS-3		1009	206							
GS-4		1012	207							
GS-1		1258	208							
GS-2		1401	209							
GS-3		1405	210							
GS-4		1409	211							
[illegible]		1755	212							
[illegible]		1758	213							
[illegible]		1801	214							
[illegible]		[illegible]	215							

USE A NEW SHEET WHEN RESTARTING SEQUENCE #

MICROSEEPS LTD.

CLIENT: WSRC
LOCATION: SRS-Landfill 740-G
PROJECT(#): Groundsheet - Task #1
PAGE: 6 OF: ____

************ SAMPLE COLLECTION LOG **********

SAMPLER NAME(S): DJM + AGC

SAMPLE ID#	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE G	S	W	SAMPLE SIZE	COMMENTS	
GS-4A	1-12	1809	216	0ft.	✓			22mL	Windy + Warm	AGC COC
GS-BLK#19	1-12	1813	217						" "	
GS-1	1-12	2200	218							
GS-2	1-12	2205	219							
GS-3	1-12	2210	220							
GS-4	1-12	2214	221							
GS-1	1-13	0125	222							
GS-2	1-13	0129	223							
GS-3	1-13	0133	224							
GS-4	1-13	0137	225							
GS-1	1-13	0608	226						Cold + Calm	
GS-2	1-13	0611	227						"	
GS-2A	1-13	0613	228						"	
GS-BLK#20	1-13	0615	229						"	
GS-3	1-13	0618	230						"	1-13-9[illegible]
GS-4	1-13	0621	231						"	AGC.
GS-1	1-13	1004	232						Sunny - Cool - Breezy	
GS-2	1-13	1007	233						"	
GS-3	1-13	1011	234						"	
GS-4	1-13	1016	235						"	
GS-1	1-13	1407	236						Sunny - Warm - Breezy	
GS-2	1-13	1410	237						"	
GS-3	1-13	1414	238						"	
GS-4	1-13	1418	239						"	
GS-4A	1-13	1420	240						"	
GS-BLK#21	1-13	1422	241						"	
GS-1	1-13	1753	242						Cool - Calm	
GS-2	1-13	1757	243							
GS-3	1-13	1801	244							
GS-4	1-13	1805	245							
GS-1	1-13	1040	246							
GS-2	1-13	1050	247							
GS-3	1-13	1103	248							
GS-4	1-13	11:07	249							
GS-1	1-14	0147	250							
GS-2	1-14	0152	251							
GS-2A	1-14	0154	252							
GS-BLK[illegible]	1-14	0200	253							
[illegible]	1-14	0205	254							
GS-[illegible]	[illegible]	0210	255							
GS-1	1-14	0610	256						Cold - Calm - Frost on sheet.	
GS-2	1-14	0615	257							
GS-[illegible]	1-14	0618	258							[illegible]

USE A NEW SHEET WHEN RESTARTING SEQUENCE #

MICROSEEPS LTD.

CLIENT: WSRC
LOCATION: SRS-LANDFill 740-G
PROJECT(#): GroundSheet TASK #1
PAGE: 7 OF: ____

************ SAMPLE COLLECTION LOG **********

SAMPLER NAME(S): DJM & AGC + JP & JS

SAMPLE ID#	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE G	S	W	SAMPLE SIZE	COMMENTS	1-14-4 AGC
GS-4	1-14	0622	259	-0-	✓			22mL	Cold-Calm-Frost on Sheets	COC
GS-1	1-14	1008	260						Sunny-Calm-Cool	
GS-2	1-14	1011	261						"	
GS-3	1-14	1013	262						"	
GS-4	1-14	1017	263						"	
GS-4A	1-14	1019	264						"	
GS-BLK#23	1-14	1021	265						"	
GS-1	1-14	1410	266						DJM Sunny	
GS-2	1-14	1415	267							
GS-3	1-14	1420	268							
GS-4	1-14	1425	269							
GS-1	1-14	1800	270						AGC - Warm - Calm	
GS-2	1-14	1804	271						"	
GS-3	1-14	1809	272						"	
GS-4	1-14	1814	273						"	
GS-1	1-14	2200	274						"	
GS-2	1-14	2205	275							
GS-2A	1-14	2207	276							
GS-BLK#24	1-14	2209	277							
GS-3	1-14	2214	278							
GS-4	1-14	2217	279							
GS-1	1-15	0155	280							
GS-2	1-15	0159	281							
GS-3	1-15	0205	282							
GS-4	1-15	0210	283							
GS-1	1-15	0615	284						Cool - Calm AGC	
GS-2	1-15	0618	285						"	
GS-3	1-15	0621	286						"	
GS-4	1-15	0624	287						"	
GS-4A	1-15	0626	288						"	COC
GS-BLK#25	1-15	0629	289						"	AGC
GS-1	1-15	1004	290						[illegible]	
GS-2	1-15	1007	291							
GS-3	1-15	1010	292							
GS-4	1-15	1014	293							
GS-1	1-15	1407	294							
GS-2	1-15	1411	295							
GS-3	1-15	1414	296							
GS-4	1-15	1417	297							
GS-1	[illegible]	1801	298						[illegible]	
GS-2		1804	299							
GS-[illegible]		1806	300							
GS-BLK[illegible]		1808	301							

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************ SAMPLE COLLECTION LOG **********

SAMPLER NAME(S): AGC + DJM + RJP

SAMPLE ID#	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE G	S	W	SAMPLE SIZE	COMMENTS	
GS-3	1-15	1812	302	-0-	✓			22mL	Dark - calm	
GS-4	1-15	1815	303		/				"	
GS-1	1-15	2205	304	/	/				RAIN!!! DJM	
GS-2	1-15	2210	305	/					" "	
GS-3	1-15	2215	306		/				" "	
~~GS-4~~	~~1-15~~	~~2220~~							" SUCKED WATER (NO SAMPLE)	
GS-1	1-16	0144	307							
GS-2	1-16	0149	308							
GS-3	1-16	0154	309							
GS-4	1-16	—							} water / no	
GS-4-A	1-16	—							sample	
GS-BLK#27	1-16	0200	310							
GS-1	1-16	0601	311						AGC. WARm - Breezy	Drizzle
GS-2	1-16	0605	312						"	AGC
GS-3	1-16	0611	313						"	COC
GS-4	1-16	—	—						WATER - No Sample	1-16
GS-1	1-16	1002	314						WARm. WET no Rain	
GS-2	1-16	1006	315							
GS-3	1-16	1010	316							
GS-4	1-16	—							WATER in Line No Sample	
GS-1	1-16	1402	317						Sunny + Windy + WARm	
GS-2	1-16	1406	318							
GS-2A	1-16	1408	319							
GS-BLK#28	1-16	1410	320							
GS-3	1-16	1414	321							
GS-4	1-16	1430	322						Dug trench Drained Water	
GS-1	1-16	1750	323						WARm + windy	
GS-2	1-16	1755	324							
GS-3	1-16	1800	325							
GS-4	1-16	1804	326							
GS-1	1-16	2155	327							
GS-2	1-16	2200	328							
GS-3	1-16	2203	329							
GS-4	1-16	2206	330							
GS-4A	1-16	2208	331							
GS-BLK#29	1-16	2210	332						DJM	
GS-1	1-17	0230	333							
GS-2	[illegible]	0234	334							
GS-3		0238	335							
[illegible]		0242	[illegible]							
GS-1		0607	337						[illegible]	
GS-2		0609	338							
GS-3		0613	339							[illegible]

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************ SAMPLE COLLECTION LOG ************

SAMPLER NAME(S): AGC + DJM + RJP WS

SAMPLE ID#	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE G	S	W	SAMPLE SIZE	COMMENTS	
GS-4	1-17	0618	340	-0-	✓			22mL	AGC	AGC COC 1-17-9[illegible]
GS-1	1-17	1009	341							
GS-2	1-17	1012	342							
GS-2A	1-17	1014	343							
GS-BLK#30	1-17	1016	344							
GS-3	1-17	1018	345							
GS-4	1-17	1021	346							
GS-1	1-17	1418	347						Sunny, warm Slight breeze	
GS-2	1-17	1422	348							
GS-3	1-17	1426	349						"	
GS-4	1-17	1430	350						"	
GS-1	1-17	1759	351						Warm-Calm AGC	
GS-2	1-17	1802	352						"	
GS-3	1-17	1806	353						"	
GS-4	1-17	1810	354						"	
GS-4A	1-17	1812	355						"	
GS-BLK#31	1-17	1813	356						"	
GS-1	1-17	2200	357							
GS-2	1-17	2203	358							
GS-3	1-17	2206	359							
GS-4	1-17	2209	360							
GS-1	1-18	0137	361						RJP	
GS-2	1-18	0141	362						"	
GS-3	1-18	0145	363						"	
GS-4	1-18	0150	364						RJP	
GS-1	1-18	0610	365						AGC	
GS-2	1-18	0614	366						Cool-Calm	
GS-2A	1-18	0616	367							
GS-BLK#32	1-18	0618	368							1-18-9[illegible]
GS-3	1-18	0621	369							COC
GS-4	1-18	0624	370							AGC.
GS-1	1-18	1004	371						Cloudy-Windy-Cool	
GS-2	1-18	1007	372						"	
GS-3	1-18	1011	373						"	
GS-4	1-18	1015	374						"	
GS-1	1-18	1357	375						Sunny-Windy-Warm	
GS-2	1-18	1400	376						"	
GS-3	1-18	1403	377							
GS-4	1-18	1407	378							
GS-4A	1-18	1411	379						"	
GS-BLK#33	1-18	1412	380						"	
GS-1	1-18	1807	381							
GS-[illegible]	[illegible]	[illegible]	382							

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************** SAMPLE COLLECTION LOG *************

SAMPLER NAME(S): AGC + DJM + RJP

SAMPLE ID#	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE G	S	W	SAMPLE SIZE	COMMENTS
GS-3	1-18	1813	383	-0-		V		22 mL	
GS-4	1-18	1816	384						
GS-1	1-18	2226	385						RJP
GS-2	1-18	2230	386						"
GS-3	1-18	2234	387						"
GS-4	1-18	2239	388						"
GS-1	1-19-91	0147	389						"
GS-2	1-19	0150	390						"
GS-2A	1-19	0152	391						"
GS-BLK#34	1-19	0154	392						"
GS-3	1-19	0158	393						"
GS-4	1-19	0203	394						RJP
GS-1	1-19	0650	395						
GS-2	1-19	0654	396						
GS-3	1-19	0658	397						
GS-4	1-19	0702	398						
GS-1	1-19	1032	399						
GS-2	1-19	1036	400						
GS-3	1-19	1040	401						
GS-4	1-19	1047	402						
GS-4A	1-19	1048	403						
GS-BLK#35	1-19	1051	404						

the last v. dark night!

AGC

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