STANDARD OPERATING PROCEDURES

MOBILE LABORATORY VOC GC/MS ANALYSIS OF WTC TEDLAR BAG AIR SAMPLES

CONTENTS

STANDARD OPERATING PROCEDURES

SOP: 1718
PAGE: 2 of 14
REV: 0.0
DATE: 11/19/01

**MOBILE LABORATORY VOC GC/MS ANALYSIS
OF WTC TEDLAR BAG AIR SAMPLES**

1.0   SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe the Gas Chromatography/Mass Spectrometry (GC/MS) analysis of air samples collected using Tedlar bags. The methods are applicable to the analysis of Volatile Organic Compounds (VOCs). The VOCs which can be routinely analyzed at the parts per billion by volume (ppbv) level are listed in Table 1.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required dependent on site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and described in the final report.

Mention of trade names or commercial products does not constitute United States Environmental Protection Agency (U.S EPA) endorsement or recommendation for use.

2.0   METHOD SUMMARY

Ambient air is drawn by vacuum into a Tedlar bag. An aliquot of sample is withdrawn by a gas tight syringe and subsequently injected into a modified purge & trap (P/T) concentrator. The VOC target analytes are thermally desorbed from the trap, separated by Gas Chromatography (GC) and analyzed by positive ion electron impact Mass Spectrometry (MS).

3.0   SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples collected in Tedlar Bag should be placed in a clean and cool environment (at room temperature) out of direct sun light. The bag samples should arrive at the mobile laboratory with the valve closed and an identification tag attached. Samples should be accompanied with a chain of custody (COC) record indicating sampling locations, sample numbers, date collected, sample matrix, and sample volumes. The COC record should agree with the information on the Tedlar bag labels and discrepancies should be noted on the COC record at the time of receipt by the laboratory. In addition, any obvious physical damage or contamination (e.g., broken valves, condensate in the bag, or bags being flat) should also be recorded on the COC record.

For best results, samples should be analyzed within the first 12 hours of collection. Samples must be analyzed within 24 hours after collection.

4.0   INTERFERENCES AND POTENTIAL PROBLEMS

- Structural isomers having co-eluting retention times and identical mass spectra will interfere with this method. The most common interference seen in these methods is between meta-xylene and para-xylene.

- Artifacts in Tedlar bags may result from a vendor's improper cleaning procedures, long term storage of blank Tedlar bags, sampling or sample storage.

- Organic compounds in the carrier gas, the GC/MS, the sample preparation system or solvent vapor in the laboratory may contribute to contamination problems.

5.0   EQUIPMENT/APPARATUS

STANDARD OPERATING PROCEDURES

SOP: 1718
PAGE: 3 of 14
REV: 0.0
DATE: 11/19/01

MOBILE LABORATORY VOC GC/MS ANALYSIS
OF WTC TEDLAR BAG AIR SAMPLES

- GC/MSD - gas chromatograph capable of sub-ambient temperature programming interfaced with a mass selective detector (Agilent Technologies 6890 GC/ 5973 MSD equipped with Chemstation software or equivalent).

- Sample Concentrator - capable of ambient to 350 temperature range, equipped with GC interface (O.I Analytical P/T concentrator or equivalent).

- Chromatographic column - capillary column, 20 m x 0.18 mm, 2.0 μm film thickness, (Restek, Inc. RTx-Volatile or equivalent).

- Tedlar bags - One - liter bags equipped with both sampling injection valves (SKC, Inc. or equivalent).

- Gas syringe - Micro - Mate hypodermic with Luer lock: 5,10,30,50,100, and 250 mL (Popper & Son, Inc. or equivalent).

- Syringe needles - Various gauges with Luer lock tip (Benton - Dickson Inc. or equivalent).

- Syringe sampling valves - On - off Teflon two way valves (Supelco, Inc., or equivalent).

6.0   REAGENTS

- Calibration standard - at approximately one part per million by volume (ppmv) in nitrogen (Scott Specialty Gases, Inc. or equivalent).

- p-Bromofluorobenzene (BFB)-at approximately one ppmv in nitrogen (Scott Specialty Gases, Inc, or equivalent), used as the mass spectrometer performance standard.

- Internal Standards -Bromochloromethane (BCM), 1,4-Difluorobenzene, and Chlorobenzene at approximately one ppmv in nitrogen (Scott Specialty Gases, Inc. or equivalent).

- Perfluorotributylamine (PFTBA) - for tuning the mass spectrometer (Hewlett Packard, Inc. or equivalent).

- Helium - ultra high purity 99.999% - 99.9999%, used as carrier gas and as purge gas in the thermal desorber.

7.0   PROCEDURES

7.1   Standard/Sample Injection

All standards and samples are introduced into GC/MS system via a modified O. I. Analytical purge and trap (P/T) concentrator. Standard/sample is first pre-concentrated in an adsorbent trap in the P/T unit. After one minute of dry purge to remove oxygen, the trap is thermally desorbed using helium so that all VOCs are swept onto the head of the GC column where VOCs are separated by temperature programming of GC oven. In operation, a glass syringe is inserted into the hold-tip connected to a two-valve assembly in the concentrator. When the vacuum pump is turned on and the two valve assembly is

**MOBILE LABORATORY VOC GC/MS ANALYSIS
OF WTC TEDLAR BAG AIR SAMPLES**

opened (see Figure 1 in the Appendix), the air in the syringe is drawn into the trap. After the injection, the pump is turned off and the two valves are closed. When the concentrator steps to dry purge, the unit automatically starts GC/MS acquisition. Operating conditions for the concentrator and trap should be set according to the manufacturer's instructions. Typical operating conditions for the concentrator are as follows:

Pre-Heat Temperature:	45 ^{o}C
Pre-Heat time:	1 minute
Trap Purge Temperature	25 ^{o}C
Purge Time:	10 minutes
Desorb Temperature:	190 ^{o}C
Desorb Time:	4 minutes
Bake Temperature:	200 ^{o}C
Bake Time:	8 minutes
Dry Purge Time:	1 minute
Transfer Line Temperature:	160 ^{o}C

7.2   GC/MS Calibration

7.2.1   Initial Calibration - Before any sample or blank analyses, calibrate the VOC GC/MS system using target analytes and internal standards contained in pressurized cylinders at a nominal one ppmv concentration in nitrogen. A multipoint calibration, typically a 5-point calibration, should be established before sample injection; a minimum of 3 calibration standards must be used. The initial calibration includes 5, 10, 25, 50, and 100 ppbv made by injecting 5, 10, 25, 50, and 100 mL of the 1 ppmv calibration standard. One of the calibration standards should be near the detection limit for the compound of interest. The 1 ppmv internal standard is spiked at 10 mL (equivalent to 10 nL). Following analysis of all calibration standards, prepare a calibration report listing the average response factor and the percent relative standard deviation (%RSD) which should be ≤30% for each VOC target analyte; 2 VOC target analytes may have a %RSD up to 40%. For each compound in the calibration, the retention time and relative abundance of selected ions are stored on the hard disk of the GC/MS computer for use in compound identification.

7.2.2   Continuing Calibration - For each day of analysis, the GC/MS continuing calibration at the 25 ppbv level is performed before sample analysis. The continuing calibration is acceptable when all VOC target analyte response factors are within ± 30% of the average response factor from the initial calibration curve. A list of the target compounds in the initial and continuing calibration standards is given in Table 1, Appendix A, along with the ions used for quantitation.

7.2.3   The equations of RF, RF$_{ave,}$ %RSD, and %D are listed in Table 3 of the Appendix.

7.2.4   GC/MS Operating Conditions

Typical GC/MS operating conditions for BFB and sample analyses are as follows:

Initial Temperature: 33°C

**MOBILE LABORATORY VOC GC/MS ANALYSIS
OF WTC TEDLAR BAG AIR SAMPLES**

Initial Time:	3.0 minutes
Ramp Rate:	10.0°C/min
Final Temperature:	240°C
Final Time:	0.5 minutes
Scan Rate:	3.26 sec^{-1}
Mass Scan Range:	35 to 250 AMU

An example of this is presented in Figure 2, Appendix B, which includes VOC target analytes and internal standards in elution order, and Figure 3, Appendix B, which shows the corresponding chromatogram.

8.0   CALCULATIONS

The concentrations of target compounds in air samples are calculated using GC/MS computer software.

9.0   QUALITY ASSURANCE/QUALITY CONTROL

The following quality assurance/quality control procedures apply:

9.1   Each day samples are analyzed, the GC/MS tune is monitored for PFTBA to meet the ion abundance criteria for BFB listed in Table 2. Appendix A. The tune is adjusted when necessary.

9.2   An acceptable three to five-point initial calibration should be performed before sample analysis begins. The initial calibration range is acceptable if the relative percent standard deviation (%RSD) is ≤30% for the average response factor for each VOC; two compounds may have a %RSD up to 40%. Samples are quantitated using the average response factor from the initial calibration range or the response factor from the continuing calibration standard.

9.3   A continuing calibration standard must be analyzed on each day of sample analysis. The 10ppbv continuing standard is compared to the average response factor from the initial calibration; if the response factor of any VOC differs by more than ±30% from the average response factor, re-analyze the continuing calibration standard. If the response factor of any VOC in the second continuing calibration standard differs by more than ±30% from the average response factor, perform a new initial calibration.

9.4   Internal standards, Bromochloromethane (BCM), 1,4-Difluorobenzene, and Chlorobenzene -d$_5$ are added to all calibration standards, blanks and samples. The internal standard area must differ by less than ±40% (60% - 140%) between the blank/sample and the continuing calibration standard. The retention time of the internal standard in the blank and sample must differ by less than 20 sec from retention time of the internal standard in the latest continuing calibration standard.

9.5   Method blanks are analyzed after the initial calibration standards and the continuing calibration standard prior to any sample analyses to assess possible laboratory contamination; they may also be necessary after analyzing samples with high levels of VOC target analytes and/or non-target VOCs (TICs).

A method or system blank consists of the spiked (with internal standards) volume of nitrogen gas equal to volume of air sample required to achieve the method detection limit (MDL).

**MOBILE LABORATORY VOC GC/MS ANALYSIS
OF WTC TEDLAR BAG AIR SAMPLES**

9.6   At a minimum, one replicate sample analysis should be performed each day.

9.7   Two criteria must be satisfied to verify the identification of a target compound:

a.   Retention Time - A sample target analyte retention time (RT) must be within ±0.50 minutes of the RT of the target analyte in the calibration standard. The calibration standard must be analyzed on the same day as the sample.

b.   Spectra - (1) All ions present in the standard mass spectra at a relative intensity greater than 10% (where the most abundant ion in the spectrum equals 100%) must be present in the sample spectrum. (2) The relative intensities of the ions specified above must agree within ±20% between the sample and the reference spectra.

9.8   All target analyte concentrations should be within the linear calibration range for Tedlar bag samples. Use the results of the initial analysis to determine an appropriate dilution factor (DF). The DF should bring the target analyte concentration within the initial calibration range.

9.9   Tentatively Identified Compounds

A library search should be performed for non-target VOCs present in method blanks and samples for the purpose of tentative identification. In this case, the NIST Mass Spectral Library (or equivalent reference mass spectra system) should be used for identification search.

1.   Guidelines for making tentative identification of a non-target compound:

- Relative intensities of major ions greater than 10% of the most abundant ion in the reference spectrum should be present in the sample spectrum.

- The relative intensities of the major ions should agree within ±20% between the standard and sample spectra. For example, if an ion has an abundance of 50% in the standard spectra, the corresponding sample ion abundance must be between 30-70%.

- Molecular ions present in reference spectrum should be present in sample spectrum.

- Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or the presence of co-eluting compounds.

- Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or the presence of co-eluting-compounds.

- The peak area for the non target compound is greater than 10% of the peak area of the nearest internal standard.

**MOBILE LABORATORY VOC GC/MS ANALYSIS
OF WTC TEDLAR BAG AIR SAMPLES**

NOTE: Data system library reduction programs can sometimes create these discrepancies.

2.   If all of the above conditions for a compound are met, that compound will be reported as a tentatively identified compound (TIC). If the mass spectral interpretation specialist indicates that no valid tentative identification can be made, the compound should be reported as *unknown*. The mass spectral interpretation specialist should give additional classification of the unknown compound, if possible. Up to 20 TICs and/or unknowns may be reported.

3.   An estimated concentration for tentatively identified compounds (TICs) should be calculated using the internal standard method. The nearest internal standard free of interferences should be used for quantitiation; a response factor of 1.0 will be used. All non-target analyte concentrations are reported to two significant figures for concentrations >10 ppbv and one significant figure for concentrations <10 ppbv.

9.10   A MDL study should be performed on an annual basis to evaluate precision, accuracy and sensitivity.

10.0   DATA VALIDATION

The mobile laboratory data may be reviewed using the Quality Assurance/Quality Control considerations listed in Section 9.0.

11.0   HEALTH AND SAFETY

When working with potentially hazardous materials, follow Scientific, Engineering, Response and Analytical Services (SERAS) SERAS, U.S. EPA, Occupational Safety and Health Administration (OSHA) and general laboratory health and safety practices.

12.0   REFERENCES

(1)   Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air U.S. EPA /625/R-96/010b, Compendium Method TO-14a, TO-15 and TO-17.,January 1999.

(2)   "Standard Operating Procedure for Preparation of Clean Absorbent Cartridges" EMSL/RTP-SOP-EMD-013 (USEPA).

13.0   APPENDICES

MOBILE LABORATORY VOC GC/MS ANALYSIS
OF WTC TEDLAR BAG AIR SAMPLES

APPENDIX A
Tables and Figure
SOP # 1718
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MOBILE LABORATORY VOC GC/MS ANALYSIS
OF WTC TEDLAR BAG AIR SAMPLES

TABLE 1. Method Target Analytes (Quant Ions) and Corresponding Internal Standards

Bromochloromethane (49)	1,4-Difluorobenzene (114)	Chlorobenzene-d5 (117)
Propylene (41)	Trichloroethene (130)	Chlorobenzene (112)
Chlorodifluoromethane (51)	1,2-Dichloropropene (63)	Ethylbenzene (91)
Dichlorodifluoromethane (85)	1,4-Dioxane (88)	m&p-Xylenes (91)
Dichlorotetrafluoroethane (85)	Methyl isobutyl ketone (43)	o-Xylene (91)
Chloromethane (50)	cis-1,3-Dichloropropene (75)	Styrene (104)
Vinyl chloride (62)	Toluene (91)	Bromoform (173)
1,3-Butadiene (39)	trans-1,3-Dichloropropene (75)	1,1,2,2,-Tetrachloroethane (83)
Bromomethane (94)	1,1,2-Tichloroethane (97)	4-Ethyltoluene (105)
Chloroethane (64)	2-Hexanone (43)	1,3,5-Trimethylbenzene (105)
Trichlorofluoromethane (101)	Tetrachloroethene (166)	1,2,4-Trimethylbenzene (105)
Isopropyl alcohol (45)	Dibromochloromethane (127)	1,3-Dichlorobenzene (146)
Acetone (43)	1,2-Dibromoethane (107)	1,4-Dichlorobenzene (146)
Trichlorotrifluoroethane (151)		Benzyl chloride (91)
1,1-Dichloroethane (61)		1,2-Dichlorobenzene (146)
3-Chloropropene (41)		1,2,4-Trichlorobenzene (180)
Methylene chloride (49)		Hexachloro-1,3-butadiene (225)
MTBE (73)		
trans-1,2-Dichloroethene (61)		
Hexane (57)		
1,1-Dichloroethane (63)		
Vinyl acetate (43)		
2-Butanone (43)		
cis-1,2-Dichloroethene (61)		
Ethyl acetate (43)		
Chloroform (83)		
Tetrahydrofuran (42)		
1,1,1-Trichloroethane (97)		
Cyclohexane (56)		
Carbon tetrachloride (117)		
1,2-Dichloroethane (62)		
Benzene (78)		
Heptane (43)		

**MOBILE LABORATORY VOC GC/MS ANALYSIS
OF WTC TEDLAR BAG AIR SAMPLES**

TABLE 2. GC/MS Performance Criteria for p-Bromofluorobenzene

m/z	Ion Abundance Criteria [1]
50	8-40% of mass 95
75	30-66% of mass 95
95	Base Peak, 100% relative abundance
96	5-9% of mass 95
173	Less than 2% of mass 174
174	50 - 120% of mass 95
175	4-9% of mass 174
176	93-101% of mass 174
177	5-9% of mass 176

[1] All ion abundances must be normalized to m/z 95, the nominal base peak.

**MOBILE LABORATORY VOC GC/MS ANALYSIS
OF WTC TEDLAR BAG AIR SAMPLES**

TABLE 3. Equations

$$RRF = \frac{A_i \cdot C_{10}}{A_{is} \cdot C_s}$$

where:

A$_i$ = area of analyte i
A$_{is}$ = area of internal standard
C$_i$ = concentration of analyte i

$$RF_{avg} = \frac{RF_1 + \ldots + RF_5}{5}$$

$$SD = \sqrt{\frac{\sum\limits_{i=} \left(F_i + RF_{ave} \right)^2}{4}}$$

$$\%D = \frac{RF_{ave} + RF_{cc}}{RF_{ave}} \, x \, 100$$

**MOBILE LABORATORY VOC GC/MS ANALYSIS
OF WTC TEDLAR BAG AIR SAMPLES**

TABLE 4.

The Method Detection Limit (MDL) in ppbv of TO-15 on GC/MSD

Calibration Files
1 =NYC047.D   2   =NYC048.D   3   =NYC049.D
4 =NYC050.D   5   =NYC051.D   6   =NYC052.D   7   =NYC053.D

Compound	1	2	3	4	5	6	7	Average	SD	%RSD	SD (ppbv)	MDL
1) Bromochloromethane	----	---	---	ISTD--	---	---	---	-----	-			
2) Propylene	0.644	0.880	0.854	0.830	0.766	0.861	0.793	0.804	0.081	10	0.50	1.6
3) Chlorodifluoromethane	0.354	0.386	0.421	0.422	0.386	0.382	0.398	0.393	0.024	6.0	0.30	0.95
4) Dichlorodifluoromethane	1.217	1.581	1.418	1.339	1.409	1.285	1.307	1.379	0.150	11	0.54	1.7
5) Dichlorotetrafluoroethane	1.803	2.746	2.433	2.382	2.225	2.382	2.292	2.320	0.282	12	0.61	1.9
6) Chloromethane	0.715	1.083	0.912	0.902	0.840	0.941	0.865	0.894	0.111	12	0.62	2.0
7) Vinyl Chloride	0.587	0.872	0.791	0.751	0.699	0.723	0.741	0.738	0.087	12	0.59	1.9
8) 1,3-Butadiene	0.537	0.802	0.718	0.670	0.687	0.698	0.678	0.681	0.079	12	0.58	1.8
9) Bromomethane	0.364	0.525	0.440	0.444	0.429	0.418	0.411	0.433	0.049	11	0.56	1.8
10) Chloroethane	0.261	0.373	0.332	0.326	0.316	0.316	0.319	0.323	0.033	10	0.51	1.6
11) Trichlorofluoromethane	1.351	1.880	1.620	1.647	1.561	1.545	1.542	1.592	0.158	10	0.50	1.6
12) Isopropyl Alcohol	0.742	1.058	0.888	0.887	0.856	0.834	0.807	0.864	0.097	11	0.56	1.8
13) Acetone	0.968	1.358	1.239	1.109	1.234	1.263	1.143	1.191	0.121	10	0.51	1.6
14) Trichlorotrifluoroethane	1.131	1.644	1.381	1.412	1.340	1.383	1.323	1.375	0.151	11	0.55	1.7
15) 1,1-Dichloroethene	0.921	1.294	1.125	1.092	1.067	1.092	1.090	1.100	0.109	10	0.49	1.6
16) 3-Chloropropene	0.949	1.290	1.106	1.135	1.126	1.049	1.089	1.106	0.103	9.3	0.46	1.5
17) Methylene Chloride	0.778	1.079	0.897	0.928	0.912	0.902	0.919	0.916	0.088	10	0.48	1.5
18) MTBE	1.466	1.941	1.712	1.763	1.717	1.578	1.650	1.690	0.149	8.8	0.44	1.4
19) trans-1,2-Dichloroethene	0.915	1.266	1.093	1.063	1.072	1.013	1.052	1.068	0.105	10	0.49	1.6
20) Hexane	1.127	1.571	1.329	1.312	1.312	1.293	1.330	1.332	0.130	10	0.49	1.5
21) 1,1-Dichloroethane	0.932	1.302	1.064	1.110	1.132	1.063	1.090	1.099	0.110	10	0.50	1.6
22) Vinyl Acetate	0.556	0.804	0.666	0.666	0.650	0.672	0.615	0.661	0.075	11	0.57	1.8
23) 2-Butanone	1.160	1.677	1.478	1.405	1.407	1.365	1.398	1.413	0.153	11	0.54	1.7
24) cis-1,2-Dichloroethene	0.854	1.230	1.029	1.057	1.075	0.992	1.036	1.039	0.112	11	0.54	1.7
25) Ethyl Acetate	1.461	2.133	1.847	1.805	1.799	1.693	1.734	1.782	0.201	11	0.56	1.8
26) Chloroform	0.901	1.285	1.127	1.100	1.109	1.027	1.077	1.089	0.115	11	0.53	1.7
27) Tetrahydrofuran	0.721	1.068	0.954	0.938	0.911	0.854	0.880	0.904	0.106	12	0.59	1.8
28) 1,1,1-Trichloroethane	0.870	1.225	1.093	1.059	1.029	0.982	1.002	1.037	0.109	11	0.53	1.7
29) Cyclohexane	1.105	1.726	1.433	1.438	1.385	1.382	1.355	1.401	0.182	13	0.65	2.0
30) Carbon Tetrachloride	0.982	1.434	1.259	1.248	1.214	1.155	1.166	1.208	0.136	11	0.56	1.8
31) 1,2-Dichloroethane	0.546	0.788	0.687	0.662	0.673	0.625	0.654	0.662	0.072	11	0.54	1.7
32) Benzene	1.368	1.913	1.620	1.620	1.653	1.515	1.579	1.610	0.165	10	0.51	1.6
33) Heptane	1.385	1.955	1.723	1.750	1.746	1.591	1.617	1.681	0.176	10	0.52	1.6
34) 1,4-Difluorobenzene	----	----	---	ISTD--	---	---	ISTD--	-----				
35) Trichloroethene	0.246	0.343	0.309	0.306	0.307	0.289	0.287	0.298	0.029	10	0.49	1.6
36) 1,2-Dichloropropane	0.138	0.196	0.171	0.167	0.176	0.159	0.159	0.167	0.018	11	0.53	1.7
37) 1,4-Dioxane	0.096	0.150	0.133	0.134	0.125	0.119	0.119	0.125	0.017	14	0.68	2.1
38) Methyl Isobutyl Keton	0.431	0.670	0.602	0.571	0.568	0.544	0.523	0.558	0.073	13	0.66	2.1
39) cis-1,3-Dichloroprope	0.243	0.352	0.320	0.319	0.312	0.296	0.294	0.305	0.033	11	0.55	1.7
40) Toluene	0.656	0.979	0.905	0.863	0.870	0.802	0.798	0.839	0.101	12	0.60	1.9
41) trans-1,3-Dichloroproene	0.171	0.261	0.245	0.234	0.231	0.220	0.220	0.226	0.028	12	0.62	2.0
42) 1,1,2-Trichloroethane	0.188	0.291	0.265	0.258	0.255	0.247	0.240	0.249	0.031	13	0.63	2.0
43) 2-Hexanone	0.279	0.425	0.403	0.392	0.370	0.366	0.341	0.368	0.048	13	0.65	2.0
44) Tetrachlorethene	0.335	0.508	0.458	0.442	0.446	0.409	0.411	0.430	0.053	12	0.62	2.0
45) Dibromochloromethane	0.269	0.427	0.384	0.358	0.358	0.336	0.332	0.353	0.049	14	0.69	2.2
46) 1,2-Dibromoethane	0.268	0.425	0.386	0.371	0.363	0.344	0.347	0.358	0.046	13	0.67	2.1
47) Chlorobenzene-d5	----	---	---	ISTD--	---	-----	---	ISTD--				
48) Chlorobenzene	0.691	1.039	0.977	0.943	0.945	0.797	0.806	0.885	0.123	14	0.69	2.2
49) Ethylbenzene	0.944	1.491	1.425	1.350	1.351	1.122	1.156	1.263	0.194	15	0.77	2.4
50) m&p-Xylenes	1.444	2.284	2.155	2.069	2.055	1.745	1.782	1.933	0.293	15	0.76	2.4
51) o-Xylene	0.693	1.106	1.076	1.018	1.002	0.841	0.832	0.937	0.155	17	0.83	2.6
52) Styrene	0.540	0.872	0.822	0.800	0.758	0.662	0.653	0.730	0.116	16	0.80	2.5
53) Bromoform	0.366	0.626	0.581	0.554	0.535	0.489	0.459	0.516	0.086	17	0.84	2.6
54) 1,1,2,2-Tetrachlorethane	0.362	0.610	0.581	0.570	0.557	0.488	0.482	0.521	0.085	16	0.81	2.6
55) 4-Ethyltoluene	0.837	1.433	1.502	1.412	1.344	1.161	1.049	1.248	0.242	19	0.97	3.0
56) 1,3,5-Trimethylbenzene	0.708	1.218	1.255	1.199	1.121	0.977	0.908	1.055	0.200	19	0.95	3.0
57) 1,2,4-Trimethylbenzene	0.606	1.067	1.108	1.071	0.978	0.874	0.791	0.928	0.182	20	0.98	3.1
58) 1,3-Dichlorobenzene	0.396	0.703	0.724	0.700	0.638	0.569	0.518	0.607	0.120	20	0.99	3.1
59) 1,4-Dichlorobenzene	0.392	0.657	0.700	0.673	0.612	0.545	0.506	0.584	0.110	19	0.94	2.9
60) Benzyl Chloride	0.227	0.381	0.400	0.375	0.357	0.315	0.282	0.334	0.062	19	0.93	2.9
61) 1,2-Dichlorobenzene	0.341	0.578	0.606	0.576	0.522	0.468	0.436	0.504	0.095	19	0.94	3.0
62) 1,2,4-Trichlorobenzene	0.112	0.143	0.163	0.152	0.130	0.148	0.116	0.138	0.019	14	0.69	2.2
63) Hexachloro-1,3-Butadiene	0.113	0.121	0.162	0.165	0.136	0.146	0.101	0.135	0.025	18	0.91	2.9

**MOBILE LABORATORY VOC GC/MS ANALYSIS
OF WTC TEDLAR BAG AIR SAMPLES**

FIGURE 1. Schematic Diagram of O.I. Analytical P/T Concentrator/GC-MS