

Environmental analysis

Uninterrupted analysis of volatile organic compounds in drinking water using single quadrupole GC-MS

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Keywords

EPA, VOCs, phthalates, trace analysis, gas chromatography, single quadrupole mass spectrometry, selected ion monitoring, sensitivity, GRO, THM, volatiles, environmental lab, environmental sample analysis, analytical testing laboratories

Goal

Demonstration of a routine analytical method that meets the requirements outlined in U.S. EPA Method 524.2 for the quantitation of volatile organic compounds in drinking water, using the Teledyne Tekmar Atomx XYZ purge and trap (P&T) system along with a Thermo Scientific[™] ISQ[™] 7610 MS system coupled with a Thermo Scientific[™] TRACE[™] 1610 Gas Chromatograph (GC) and Thermo Scientific[™] Chromeleon[™] Chromatography Data System (CDS). Method linearity, method detection limit (MDL), precision, and accuracy were assessed to evaluate method performance.

Introduction

It is essential that analytical testing laboratories monitor surface water, ground water, and drinking water for the presence of volatile organic compounds (VOCs). VOCs are human-made contaminants used and produced in the processing of, or as, paints, adhesives, petroleum products, pharmaceuticals, and refrigerants. If they are released into surface or ground water from industrial activities, they can have an adverse effect on natural environment, and ultimately the public. It is extremely important that analytical laboratories ensure both accurate and rapid detection and quantitation of VOCs to ensure public safety. U.S. EPA Method 524.2 is widely used in environmental analysis labs to test water samples for VOCs.¹ The method tests for a wide range of VOCs, including the four trihalomethane disinfection by-products that have sufficiently high volatility and low water solubility, so that they can be removed from water samples with P&T procedures.

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There are several challenges that analytical testing laboratories face when performing U.S. EPA Method 524.2. Laboratories must demonstrate the method acceptance criteria can be met, including detection limit requirements for an assortment of compounds over a wide range of concentrations. Another significant challenge is the management of the water sample matrix. Analysis of water samples can introduce moisture into the GC analytical column and cause damage if not properly managed. The resulting unproductive time of the analytical instrument can delay sample reporting, which could lead to public safety risks. The final challenge is to have a robust and reproducible method. If inconsistent results are produced with uncertainty, the samples will have to be reanalyzed, causing delays in sample reporting times.

This application note describes the use of the ISQ 7610 MS system coupled to a TRACE 1610 gas chromatograph (GC) and the Atomx XYZ P&T for U.S. EPA Method 524.2.

Experimental

Sample preparation

A 50 µg/mL (parts per million or ppm) calibration working standard was prepared in purge and trap grade methanol (Honeywell/Burdick & Jackson, P/N 232-1L) from the following Restek standards: Drinking Water VOA MegaMix[™] (P/N 30601), Ketone Mix (P/N 30602), and 502.2 Calibration Mix (P/N 30042). In total, the standards contained 81 compounds.

The calibration curve was prepared from 0.2 μ g/L to 50 μ g/L (parts per billion or ppb) for all compounds. The relative response factor (RRF) was calculated for each compound using one Restek internal standard: fluorobenzene (P/N 30030). Surrogate standards from Restek consisted of 4-bromofluorobenzene and 1,2-dichlorobenzene-d₄ (P/N 30607). Internal and surrogate standards were prepared in methanol from Restek standards at a concentration of 25 ppm, after which 5 μ L was then mixed with each 5 mL sample for a resulting concentration of 25 ppb.

A total of seven standards, each having a concentration of 0.2 μ g/L, were prepared in deionized water to calculate the MDL and precision for all compounds. Also, seven standards containing 10 μ g/L were prepared to determine the accuracy and precision of recovery of each compound. All calibration, MDL, and recovery standards were analyzed with the Atomx XYZ conditions in Table 1.

Table 1. Teledyne Tekmar Atomx XYZ Water method conditions

Table 1. Teledyne	Tekmar Atomx	XYZ Water method	d conditions
Standby	Variable	Desorb	Variable
Valve oven temp.	140 °C	Methanol needle rinse	Off
Transfer line temp.	140 °C	Water needle rinse volume	7.00 mL
Sample mount temp.	90 °C	Sweep needle time	0.25 min
Water heater temp.	90 °C	Desorb preheat temp.	245 °C
Sample cup temp.	20 °C	GC start signal	Begin desorb
Soil valve temp.	50 °C	Desorb time	4.00 min
Standby flow	10 mL/min	Drain flow	300 mL/min
Purge ready temp.	40 °C	Desorb temp.	250 °C
Purge	Variable	Bake	Variable
Sample equilibrate time	0.00 min	Methanol glass rinse	Off
Pre-sweep time	0.25 min	Water bake rinses	1
Prime sample fill volume	3.00 mL	Water bake rinse volume	7.00 mL
Sample volume	5.00 mL	Bake rinse sweep time	0.25 min
Sweep sample time	0.25 min	Bake rinse sweep flow	100 mL/min
Sweep sample flow	100 mL/min	Bake rinse drain time	0.40 min
Sparge vessel heater	Off	Bake time	2.00 min
Purge time	11.00 min	Trap bake temp.	260 °C
Purge flow	40 mL/min	MCS bake temp.	200 °C
Purge temp.	20 °C	Bake flow	200 mL/min
MCS purge temp.	20 °C		
Dry purge time	1.00 min	Тгар	9
Dry purge flow	100 mL/min	Chiller tray	Off
Dry purge temp.	20 °C	Purge gas	Nitrogen

GC-MS conditions

A TRACE 1610 GC was coupled to the ISQ 7610 mass spectrometer equipped with the Thermo Scientific[™] NeverVent[™] vacuum probe interlock (VPI) and ExtractaBrite[™] ion source. A Thermo Scientific[™] TraceGOLD[™] TG-VMS column, 20 m x 0.18 mm, 1 µm film (**P/N 26080-4950**), was used for compound separation. The injector was operated in split mode with a run time under 15 minutes. The ISQ 7610 mass spectrometer was operated in full scan mode, offering sufficient sensitivity to achieve the required limits of detection. Note: the instrument can also be operated in Selected Ion Monitoring (SIM) mode to increase selectivity. Expanded method parameters for the ISQ 7610 mass spectrometer are displayed in Table 2.

Table 2. GC-MS conditions

TRACE 1610 GC conditions					
Column	TraceGOLD TG-VMS, 20 m x 0.18 mm, 1 μm film (P/N 26080-4950)				
Carrier gas	Helium, 0.8 mL/min				
Oven profile	35 °C, 3 min, 12 °C/min to 85 °C, 25 °C/min to 225 °C, 2 min hold, run time 14.767 min				
Inlet	SSL at 200 °C, 50:1 Split, purge flow 0.5 mL/min				
	ISQ 7610 MS conditions				
Temp.	Transfer line 230 °C; ion source 280 °C				
Scan	Range 35 amu to 260 amu, solvent delay 0.50 min, dwell/scan time 0.15 s				
Current	Emission current 25 µA; gain 3.00E+005				

Instrument control and data processing

Data were acquired, processed, and reported using Chromeleon CDS software, version 7.3. This software can control both the GC-MS system and the Atomx XYZ P&T. This allows a single software to be utilized for the full workflow, simplifying the instrument operation. Figure 1 shows the Chromeleon CDS control of the Atomx XYZ P&T. The fully optimized method used within this application note is available for download via AppsLab. AppsLab contains all the parameters needed to acquire, process, and report the analytical data for U.S. EPA Method 524.2.²

Results and discussion Chromatography

Using the GC conditions described in Table 2, all compounds of interest were well resolved chromatographically. It is evident that there is minimal water transfer from the sample as there were no detrimental effects to peak shape due to moisture entering the analytical column. This resulted in optimized chromatography that was maintained in lower concentration samples. Figure 2 displays consistent peak shape and separation of a 10 ppb VOC standard with minimal water interference.

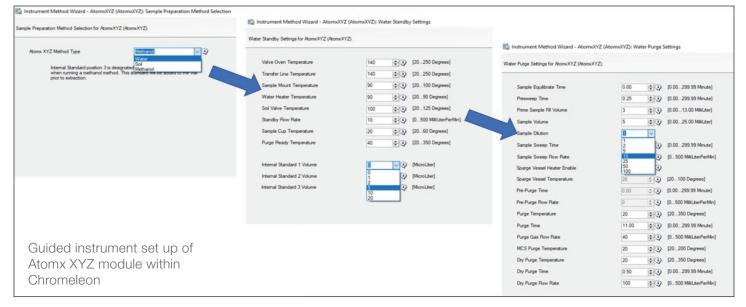


Figure 1. Chromeleon control of the Atomx XYZ P&T

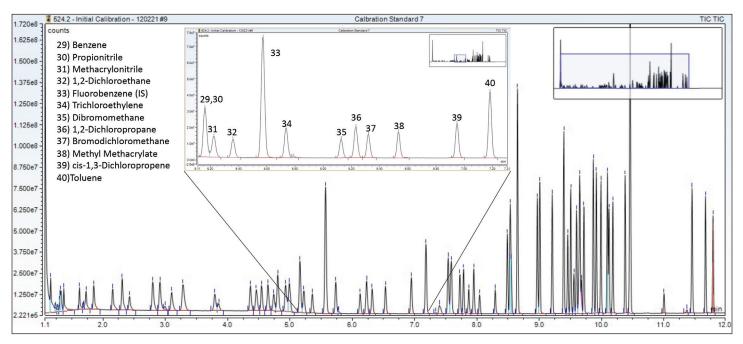


Figure 2. Total ion chromatogram (TIC) of a water method 10 ppb VOC standard with an inset indicating consistent peak shapes and separation with minimal water interference

Linearity and sensitivity

The calibration range of 0.2 ppb to 50 ppb was assessed for all compounds. Figure 3 demonstrates the quantitation of *o*-xylene at 0.2 ppb in a VOC standard with very good library spectral matching and calibration curve. Figure 4 demonstrates the same information for 1,3-dichloropropane. Appendix 1 displays the relative standard deviation (%RSD) of the response factors (RFs) which were less than 20% for all compounds, except for

acetone, 2-butanone, 2-nitropropane, hexachloroethane, and nitrobenzene, which used a linear calibration and achieved $R^2 > 0.99$ for these compounds. Appendix 1 also shows the MDL and precision (RSD%) for each analyte calculated by injecting n=7 injections of the 0.2 ppb water standard. Figure 3 shows a subset of the data with calculated MDLs and precision for 40 compounds.

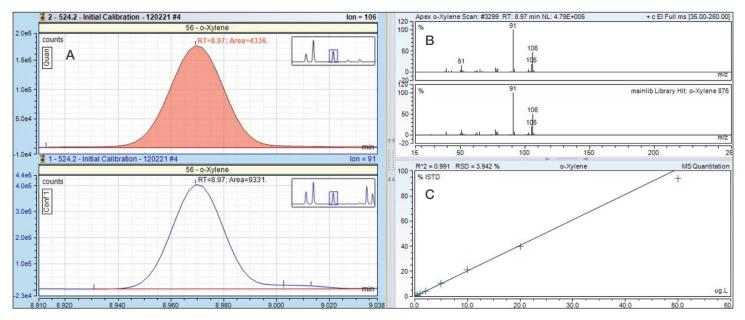


Figure 3. Chromeleon CDS results browser showing extracted ion chromatograms for *o*-xylene in the 0.2 ppb water standard, quantitation ion (m/z = 106), and one confirming ion (m/z = 91) (A), a matching measured spectrum to the NIST library (B), and a linear calibration over a concentration range of 0.2 ppb to 50 ppb (C)

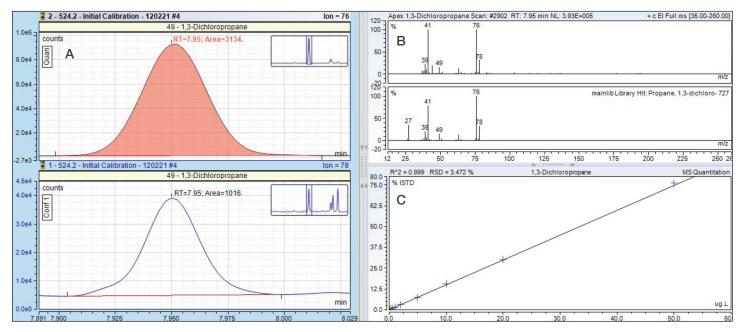
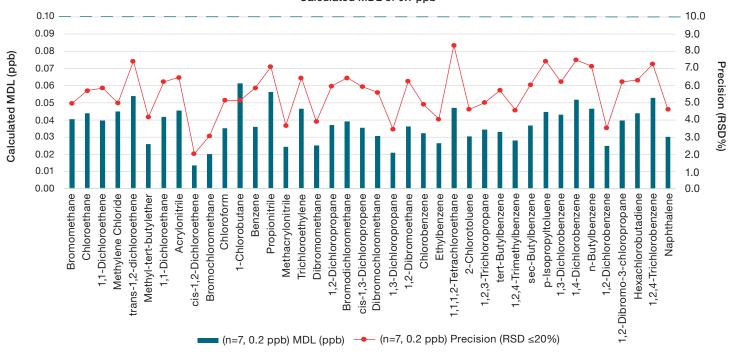


Figure 4. Chromeleon CDS results browser showing extracted ion chromatograms for 1,3-dichloropropane in the 0.2 ppb water standard, quantitation ion (m/z = 76) and one confirming ion (m/z = 78) (A), a matching measured spectrum to the NIST library (B), and a linear calibration over a concentration range of 0.2 ppb to 50 ppb (C)



Calculated MDL of 0.1 ppb

Figure 5. MDL and precision calculated for a subset of compounds (n=40) from n=7 injections of a 0.2 ppb water standard

Method robustness

Analytical testing labs must maximize the utilization of their GC-MS system to ensure results are delivered to customers in a timely manner. To assess the stability of the method, 10 ppb calibration check standards were injected at intervals 32 times over a sequence of 197 injections. This extended sequence is equivalent to 3 days of uninterrupted analysis. No maintenance

was performed on any part of the system during this extended test. Figure 6 shows the reproducibility of 6 of the compounds over 197 injections with excellent percentage RSDs. RSDs for all compounds were well below 30%, as required by the method. Appendix 2 shows the reproducibility results for all compounds over the 197-injection sequence.

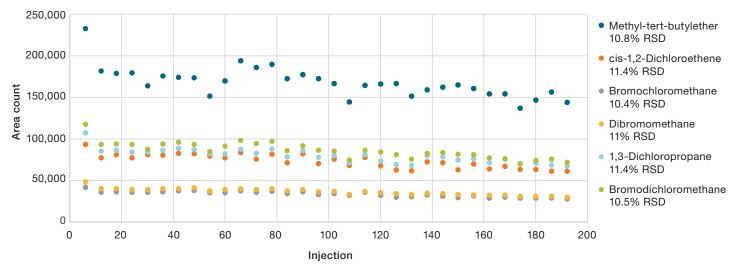


Figure 6. Repeatability of a 10 ppb VOC standard (n=32) (as absolute peak area counts) assessed over n=197 consecutive injections

Conclusion

The combined solution of the TRACE 1610 GC coupled with the ISQ 7610 system and the Atomx XYZ P&T system provides clear advantages for U.S. EPA Method 524.2. The Atomx XYZ concentrator's efficient trap cooling design reduces sample cycle time, enabling an increase in sample throughput. The moisture control system improves water vapor removal, thereby reducing peak interference and increasing GC column life span. The ISQ 7610 VPI and ExtractaBrite ion source allow users to exchange ionization sources and analytical columns without venting the instrument, significantly reducing instrument downtime and minimizing sample analysis interruptions. The Thermo Scientific[™] XLXR[™] detection system on the ISQ 7610 mass spectrometer provides an extended linear dynamic range, allowing extended calibration curves to be run on the system. The detector also has an extended lifetime, which significantly reduces the need for replacement. Combined, these technologies effectively address the challenges of routine VOC analysis and provide a robust, sensitive solution needed for ensuring maximized instrument output and routine regulatory method compliance for U.S. EPA Method 524.2:

 The ISQ 7610 VPI coupled with the Teledyne Tekmar Atomx XYZ P&T exceeds all the requirements outlined in U.S. EPA Method 524.2 for analysis of VOCs in water.

- Excellent linearity for all compounds was demonstrated with the %RSD of the calibration response factors passing all method requirements.
- MDL, precision, and accuracy for seven 0.2 ppb standards showed no interference from excessive water and produced very reproducible results.
- The precision for n=32 samples over 197 injections displayed <30% RSD for all compounds as the method requires and an average recovery of 103%.

References

- U.S. EPA Method 524.2. Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry. https://www.epa.gov/ sites/production/files/2015-06/documents/epa-524.2.pdf
- Thermo Scientific Application Note 65632: Routine Analysis of volatile organic compounds in drinking water using the Thermo Scientific ISQ 7000 MS system. https://appslab.thermofisher.com/App/4373/epa-5242-compounds-drinkingwater-by-gcms

Appendix 1. U.S. EPA Method 524.2 calibration, accuracy, and precision data

		Ca	alibration			and precision 0.2 ppb)		nt check 0 ppb)
Compound	Retention time	Quant ion	Linearity (RRF %RSD)	Average RF	MDL (ppb)	Precision (RSD ≤20%)	Precision (≤20%)	Accuracy (±30%)
Dichlorodifluoromethane	1.16	85	8.6	0.335	0.06	8.7	6.2	109
Chloromethane	1.32	50	6.5	0.634	0.04	7.1	5.1	114
Vinyl chloride	1.37	62	8.0	0.330	0.06	8.2	5.9	115
Bromomethane	1.62	94	11.9	0.279	0.04	5.0	7.9	119
Chloroethane	1.73	64	18.8	0.229	0.04	5.7	4.9	115
Trichlorofluoromethane	1.85	101	7.9	0.443	0.05	7.6	5.5	114
Diethyl ether	2.16	59	4.5	0.217	0.09	14.4	3.2	119
Carbon disulfide	2.31	76	11.3	0.369	0.05	6.5	5.3	107
1,1-Dichloroethene	2.31	96	10.1	0.234	0.04	5.9	5.2	105
Methyl iodide	2.43	142	9.5	0.386	0.03	8.4	7.3	90
Allyl chloride	2.80	76	7.0	0.142	0.05	8.4	5.2	109
Methylene chloride	2.91	84	16.5	0.325	0.05	5.0	4.1	102
Acetone ^{1,2,5}	2.99	43	0.998	0.114	0.86	12.5	3.0	130
trans-1,2-dichloroethene	3.10	96	11.9	0.253	0.05	7.4	5.3	107
Methyl-tert-butylether	3.29	73	5.5	0.678	0.03	4.2	2.6	119
1,1-Dichloroethane	3.80	63	5.9	0.454	0.04	6.2	4.2	115
Acrylonitrile	3.86	52	8.4	0.100	0.05	6.5	3.6	113
cis-1,2-Dichloroethene	4.37	96	7.1	0.299	0.01	2.0	3.9	109
2,2-Dichloropropane	4.46	77	8.3	0.317	0.07	11.1	7.5	82
Bromochloromethane	4.54	128	7.3	0.142	0.02	3.1	3.8	107
Chloroform	4.65	83	8.5	0.470	0.04	5.2	4.2	114
Carbon tetrachloride	4.74	117	6.4	0.306	0.09	11.6	5.0	116
1,1,1-Trichloroethane	4.80	97	7.4	0.350	0.07	10.0	9.2	100
Methyl acrylate	4.80	55	5.4	0.204	0.05	7.8	6.8	111
Tetrahydrofuran ⁶	4.80	71	12.9	0.046	0.14	8.5	5.2	112
1,1-Dichloropropene	4.93	75	7.3	0.269	0.05	7.5	5.3	111
2-Butanone ^{1,2,5}	4.97	43	0.997	0.195	0.57	6.3	6.6	114
1-Chlorobutane	4.99	56	9.0	0.405	0.06	5.2	4.5	113
Benzene	5.16	78	3.1	0.882	0.04	5.9	4.5	104
Propionitrile	5.20	54	7.7	0.045	0.06	7.1	6.3	108
Methacrylonitrile	5.22	67	6.3	0.120	0.02	3.7	3.6	106
1,2-Dichloroethane	5.36	62	4.0	0.288	0.02	3.2	2.9	120
Fluorobenzene (ISTD)	5.57	96	-	-	-	-	-	-
Trichloroethylene	5.73	95	5.8	0.247	0.05	6.5	4.8	115
Dibromomethane	6.13	93	5.1	0.170	0.03	3.9	4.1	106
1,2-Dichloropropane	6.23	63	3.5	0.255	0.04	6.0	3.5	112
Bromodichloromethane	6.32	83	3.6	0.330	0.04	6.5	3.2	112

Appendix 1 continued. U.S. U.S. EPA Method 524.2 calibration, accuracy, and precision data

Retention Linearly Linearly Linearly Average MUL Precision Model Precision Leaver Mathematical Linearly Leaver Mathematical Linearly Mathematical			Ca	alibration			and precision , 0.2 ppb)		nt check 0 ppb)
sis-1,3-Dichloropropene 6.95 75 2.7 0.371 0.04 5.9 3.6 106 oluane 718 92 3.5 0.615 0.03 4.8 4.3 103 Nitropropane ¹³ 7.32 0.997 0.004 0.95 12.7 7.6 103 ALDichtoropropane ¹³ 7.32 0.997 0.004 0.95 12.7 7.6 103 ALDichtoropropane ¹³ 7.54 166 7.2 0.365 0.04 4.8 4.6 130 Hernethyl-2-pentanone ¹³ 7.58 43 4.4 0.165 0.12 6.7 3.2 115 Icaran-1.3- 7.59 7.5 5.1 0.341 0.04 6.6 2.9 107 1/2-Trichlorophropane 7.79 69 4.0 0.316 0.02 2.5 2.6 113 Dichoropropane 7.87 7.9 6.7 0.217 0.03 5.6 2.7 109 .3 Dichoropropane 7.87 129 6.7 0.217 0.03 4.1 4.1 107 </th <th>Compound</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>Accuracy (±30%)</th>	Compound								Accuracy (±30%)
Bluene 7.18 92 3.5 0.615 0.03 4.8 4.3 103 Nitropropane ¹⁷ 7.32 0.997 0.004 0.95 12.7 7.6 103 J,IDichloropropanon ⁸ 7.41 43 11.2 0.000 0.14 8.8 4.8 96 etrachloropthene 7.54 166 7.2 0.365 0.04 4.8 4.6 130 ramsh.3- 7.58 4.3 4.4 0.165 0.12 6.7 3.2 115 marsh.3- 7.59 7.5 5.1 0.341 0.04 6.6 2.9 107 J,2-Trichloroethane 7.73 83 3.8 0.212 0.03 5.5 3.3 103 Dichloropropane 7.95 76 3.5 0.374 0.02 3.5 3.2 112 2-Dichloropropane 7.95 76 3.5 0.374 0.02 3.5 3.2 112 2-Dichloropropane 8.4	Methyl methacrylate	6.54	69	6.9	0.163	0.06	9.6	3.0	108
Nitropropane ¹⁷ 7.32 0.997 0.004 0.95 12.7 7.6 103 1,1Dichloropropanone ¹ 7.41 43 11.2 0.090 0.14 8.8 4.8 96 etrachloroethene 7.54 166 7.2 0.365 0.04 4.8 4.6 130 -metryl-2-pentanone ³ 7.58 43 4.4 0.165 0.12 6.7 3.2 115 rans-1.3- ichloropropane 7.59 7.5 5.1 0.341 0.04 6.6 2.9 107 1,12-Trichloroethane 7.73 83 3.8 0.212 0.03 5.5 3.3 109 1,12-Trichloroethane 7.67 6.6 0.02 3.5 3.2 112 2-Dibromochloromethane 7.67 7.6 0.37 0.031 0.04 6.3 3.1 109 2-Dibromochloromethane 8.04 101 0.133 0.14 8.3 2.7 112 2-Dibromochloroethane 8.5	cis-1,3-Dichloropropene	6.95	75	2.7	0.371	0.04	5.9	3.6	106
Libchloropropanone ⁹ 7.41 43 11.2 0.090 0.14 8.8 4.8 96 etrachloroethene 7.54 166 7.2 0.365 0.04 4.8 4.6 130 Innethyl2-pentanone ² 7.58 43 4.4 0.165 0.12 6.7 3.2 115 rans-1.3- Chloropropene 7.59 75 5.1 0.341 0.04 6.6 2.9 107 AL2-Trichloroethane 7.73 83 3.8 0.212 0.03 5.6 3.3 109 Jbromochloromethane 7.87 129 6.7 0.217 0.03 5.6 2.7 109 3-Dichloropropane 7.95 76 3.5 0.374 0.02 3.5 3.2 112 2-Dibromoethane 8.04 107 5.7 0.231 0.04 6.3 3.1 109 2-Dibromethane 8.64 91 6.0 1.202 0.03 4.1 4.1 107	Toluene	7.18	92	3.5	0.615	0.03	4.8	4.3	103
Totachlorothene 7.54 166 7.2 0.365 0.04 4.8 4.6 130 H-methyl-2-pentanone ³ 7.58 43 4.4 0.165 0.12 6.7 3.2 115 Sichloropropene 7.59 75 5.1 0.341 0.04 6.6 2.9 107 J.2-Trichkorethane 7.73 83 3.8 0.212 0.03 5.5 3.3 109 3.1/2-Trichkorethane 7.79 69 4.0 0.316 0.02 2.5 2.6 113 3.1/2-Trichkorethane 7.87 129 6.7 0.217 0.03 5.6 2.7 109 3.2-Dichkoropropane 7.95 76 3.5 0.217 0.03 4.3 101 9.133 0.14 8.3 2.7 112 2.1-Dikomoethane 8.04 112 4.1 0.77 0.03 4.1 4.1 107 1.1,2-Tetrachkoroethane 8.65 131 6.7 0.196	2-Nitropropane ^{1,7}	7.32		0.997	0.004	0.95	12.7	7.6	103
Hermethyl-2-pentanone ³ 7.58 4.3 4.4 0.165 0.12 6.7 3.2 115 Schlorgorpone 7.59 75 5.1 0.341 0.04 6.6 2.9 107 J.2-Trichborochane 7.73 83 3.8 0.212 0.03 5.5 3.3 109 J.2-Trichborochane 7.79 69 4.0 0.316 0.02 2.5 2.6 113 Nbromochloromethane 7.87 129 6.7 0.217 0.03 5.6 2.7 109 ,3-Dichloroppane 7.95 76 3.5 0.374 0.02 3.5 3.2 112 2-Dibromochlane 8.04 107 5.7 0.231 0.04 6.3 3.1 109 2-Hexanone ³ 8.30 4.3 10.1 0.133 0.14 8.3 2.7 112 2-Ibromethane 8.55 106 5.7 0.511 0.08 6.1 5.4 0.102	1,1,Dichloropropanone ³	7.41	43	11.2	0.090	0.14	8.8	4.8	96
rans-1,3- Dichloropropene 7.59 75 5.1 0.341 0.04 6.6 2.9 107 1,12-Tichloroethane 7.73 83 3.8 0.212 0.03 5.5 3.3 109 Bhyl methacrylate 7.79 69 4.0 0.316 0.02 2.5 2.6 113 Dibromochloromethane 7.87 129 6.7 0.217 0.03 5.6 2.7 109 3,Dichloropropane 7.95 76 3.5 0.374 0.02 3.5 3.2 112 2,Dibromoethane 8.04 107 5.7 0.231 0.04 6.3 3.1 109 2,2-Dibromoethane 8.49 112 4.1 0.717 0.03 4.9 4.0 102 2,112 2,10 0.11 0.136 0.14 8.3 2.7 112 2,10bromoethane 8.55 131 6.7 0.51 0.03 4.1 1.107 1,1,2-Tetrachloroethane 8.55 131 6.7 0.51 0.03 4.4 3.7 102	Tetrachloroethene	7.54	166	7.2	0.365	0.04	4.8	4.6	130
Dichloropropene 7.59 7.5 5.1 0.341 0.04 6.6 2.9 107 1,1_2-Trichloroethane 7.73 83 3.8 0.212 0.03 5.5 3.3 109 2thyl methacrylate 7.79 6.9 4.0 0.316 0.02 2.5 2.6 113 3/Dictoloropropane 7.85 76 3.5 0.32 112 2.03 5.6 2.7 109 3/Dictoloropropane 7.95 76 3.5 0.324 0.02 3.5 3.2 112 2-Dibromoethane 8.04 107 5.7 0.231 0.04 6.3 3.1 109 2-Dibromoethane 8.04 112 4.1 0.717 0.03 4.9 4.0 102 2hlobrobenzene 8.49 112 4.1 0.717 0.03 4.1 4.1 107 1,1,2-Tetrachloroethane 8.55 131 6.7 0.51 0.05 8.4 3.9 1106	4-methyl-2-pentanone ³	7.58	43	4.4	0.165	0.12	6.7	3.2	115
Thyl methacrylate 7.79 69 4.0 0.316 0.02 2.5 2.6 113 Dibromochloromethane 7.87 129 6.7 0.217 0.03 5.6 2.7 109 ,3-Dichloropropane 7.95 76 3.5 0.374 0.02 3.5 3.2 112 ,2-Dibromoethane 8.04 107 5.7 0.231 0.04 6.3 3.1 109 2-Dibromoethane 8.30 43 10.1 0.133 0.14 8.3 2.7 112 Chlorobenzene 8.49 112 4.1 0.717 0.03 4.9 4.0 102 Chlorobenzene 8.54 91 6.0 1.202 0.03 4.1 4.1 107 ,1,1,2-Tetrachloroethane 8.55 131 6.7 0.511 0.08 6.1 5.4 105 Atyrene 8.65 106 5.7 0.511 0.08 6.1 5.4 105 St	<i>trans-</i> 1,3- Dichloropropene	7.59	75	5.1	0.341	0.04	6.6	2.9	107
Normochloromethane 7.87 129 6.7 0.217 0.03 5.6 2.7 109 ,3-Dichloropropane 7.95 76 3.5 0.374 0.02 3.5 3.2 112 ,2-Dibromoethane 8.04 107 5.7 0.231 0.04 6.3 3.1 109 2-Hexanone ³ 8.30 43 10.1 0.133 0.14 8.3 2.7 112 Chlorobenzene 8.49 112 4.1 0.717 0.03 4.9 4.0 102 Chlorobenzene 8.54 91 6.0 1.202 0.03 4.1 4.1 107 1,1,2-Tetrachloroethane 8.55 131 6.7 0.511 0.08 6.1 5.4 105 -Xylene 8.65 106 5.7 0.511 0.08 6.1 5.4 105 Symene 9.01 104 6.0 0.870 0.03 4.9 3.9 103 spropylbenzene <td>1,1,2-Trichloroethane</td> <td>7.73</td> <td>83</td> <td>3.8</td> <td>0.212</td> <td>0.03</td> <td>5.5</td> <td>3.3</td> <td>109</td>	1,1,2-Trichloroethane	7.73	83	3.8	0.212	0.03	5.5	3.3	109
3-Dichloropropane 7.95 76 3.5 0.374 0.02 3.5 3.2 112 2-Dibromoethane 8.04 107 5.7 0.231 0.04 6.3 3.1 109 2-Hexanone ⁹ 8.30 43 10.1 0.133 0.14 8.3 2.7 112 2-Horobenzene 8.49 112 4.1 0.717 0.03 4.9 4.0 102 2-Horobenzene 8.54 91 6.0 1.202 0.03 4.1 4.1 107 1,1,2-Tetrachloroethane 8.55 131 6.7 0.511 0.08 6.1 5.4 105 5-Xylene 8.65 106 5.7 0.511 0.08 6.1 5.4 105 5-Xylene 8.97 106 3.9 0.508 0.03 4.4 3.7 102 3romoform 9.01 173 11.8 0.148 0.01 2.5 3.0 116 3tyrene 9.01 104 6.0 0.870 0.03 4.6 2.5 105	Ethyl methacrylate	7.79	69	4.0	0.316	0.02	2.5	2.6	113
2-Dibromethane 8.04 107 5.7 0.231 0.04 6.3 3.1 109 2-Hexanone ³ 8.30 43 10.1 0.133 0.14 8.3 2.7 112 2-Horobenzene 8.49 112 4.1 0.717 0.03 4.9 4.0 102 2-Horobenzene 8.54 91 6.0 1.202 0.03 4.1 4.1 107 1,1,2-Tetrachloroethane 8.55 131 6.7 0.511 0.08 6.1 5.4 105 0-Xylene 8.65 106 5.7 0.511 0.08 6.1 5.4 105 0-Xylene 8.97 106 3.9 0.508 0.03 4.4 3.7 102 3romoform 9.01 173 11.8 0.148 0.01 2.5 3.0 116 Bryrene 9.01 104 6.0 0.870 0.03 5.2 4.9 105 Bromofucrobenzene <td< td=""><td>Dibromochloromethane</td><td>7.87</td><td>129</td><td>6.7</td><td>0.217</td><td>0.03</td><td>5.6</td><td>2.7</td><td>109</td></td<>	Dibromochloromethane	7.87	129	6.7	0.217	0.03	5.6	2.7	109
Hexanone ³ 8.30 43 10.1 0.133 0.14 8.3 2.7 112 Chlorobenzene 8.49 112 4.1 0.717 0.03 4.9 4.0 102 Chlorobenzene 8.49 112 4.1 0.717 0.03 4.9 4.0 102 Ethylbenzene 8.55 131 6.7 0.195 0.05 8.4 3.9 110 n,p-Xylene 8.65 106 5.7 0.511 0.08 6.1 5.4 105 Sylene 8.97 106 3.9 0.508 0.03 4.4 3.7 102 Bromoform 9.01 173 11.8 0.148 0.01 2.5 3.0 116 Styrene 9.01 104 6.0 0.870 0.03 4.9 3.9 103 Soporpylbenzene 9.21 105 4.1 1.199 0.03 5.2 4.9 105 Bromofluorobenzene 9.40 95 5.4 0.439 3.6 1.1 102 Styrene <td>1,3-Dichloropropane</td> <td>7.95</td> <td>76</td> <td>3.5</td> <td>0.374</td> <td>0.02</td> <td>3.5</td> <td>3.2</td> <td>112</td>	1,3-Dichloropropane	7.95	76	3.5	0.374	0.02	3.5	3.2	112
Dhorobenzene 8.49 112 4.1 0.717 0.03 4.9 4.0 102 Ethylbenzene 8.54 91 6.0 1.202 0.03 4.1 4.1 107 1,1,2-Tetrachloroethane 8.55 131 6.7 0.195 0.05 8.4 3.9 110 n,p-Xylene 8.65 106 5.7 0.511 0.08 6.1 5.4 105 >Xylene 8.97 106 3.9 0.508 0.03 4.4 3.7 102 Bromoform 9.01 173 11.8 0.148 0.01 2.5 3.0 116 Styrene 9.01 104 6.0 0.870 0.03 4.9 3.9 103 sopropylbenzene 9.21 105 4.1 1.199 0.03 5.2 4.9 105 HBromofluorobenzene 9.40 95 5.4 0.439 3.6 1.1 102 Styrene 9.41 156<	1,2-Dibromoethane	8.04	107	5.7	0.231	0.04	6.3	3.1	109
thylbenzene 8.54 91 6.0 1.202 0.03 4.1 4.1 107 1,1,2-Tetrachloroethane 8.55 131 6.7 0.195 0.05 8.4 3.9 110 n,p-Xylene 8.65 106 5.7 0.511 0.08 6.1 5.4 105 o-Xylene 8.97 106 3.9 0.508 0.03 4.4 3.7 102 3romoform 9.01 173 11.8 0.148 0.01 2.5 3.0 116 Styrene 9.01 104 6.0 0.870 0.03 4.9 3.9 103 sopropylbenzene 9.21 105 4.1 1.199 0.03 5.2 4.9 105 -Bromofluorobenzene 9.40 95 5.4 0.439 3.6 1.1 102 3romobenzene 9.46 156 5.2 0.345 0.03 5.1 4.7 106 ,1,2,2-Tetrachloroethane 9.56 83 4.7 0.323 0.05 8.7 4.0 96 C	2-Hexanone ³	8.30	43	10.1	0.133	0.14	8.3	2.7	112
1,1,2-Tetrachloroethane8.551316.70.1950.058.43.9110n,p-Xylene8.651065.70.5110.086.15.4105>-Xylene8.971063.90.5080.034.43.71023romoform9.0117311.80.1480.012.53.0116Styrene9.011046.00.8700.034.93.9103sopropylbenzene9.211054.11.1990.035.24.9105-Bromofluorobenzene9.40955.40.4393.61.11023romobenzene9.461565.20.3450.034.62.5105-Propylbenzene9.51916.61.5490.035.14.7106.1,2,2-Tetrachloroethane9.66915.90.9370.034.64.5108.2,3-Trichloroppane9.64754.90.2580.035.03.5112.3,5-Trimethylbenzene9.68533.70.1130.068.94.1112-Chlorotoluene9.72917.31.0130.045.33.8107.2,2-Trinethylbenzene9.871194.50.9900.035.75.299.2,4-Trimethylbenzene9.921054.81.1410.034.64.9109.2,4-Trimethylbenzene9.99 <td< td=""><td>Chlorobenzene</td><td>8.49</td><td>112</td><td>4.1</td><td>0.717</td><td>0.03</td><td>4.9</td><td>4.0</td><td>102</td></td<>	Chlorobenzene	8.49	112	4.1	0.717	0.03	4.9	4.0	102
n,p-Xylene 8.65 106 5.7 0.511 0.08 6.1 5.4 105 P-Xylene 8.97 106 3.9 0.508 0.03 4.4 3.7 102 Bromoform 9.01 173 11.8 0.148 0.01 2.5 3.0 116 Styrene 9.01 104 6.0 0.870 0.03 4.9 3.9 103 sopropylbenzene 9.21 105 4.1 1.199 0.03 5.2 4.9 105 Heromofluorobenzene 9.40 95 5.4 0.439 3.6 1.1 102 Bromofluorobenzene 9.46 156 5.2 0.345 0.03 4.6 2.5 105 Inpropylbenzene 9.51 91 6.6 1.549 0.03 5.1 4.7 106 1,12,2-Tetrachloroethane 9.66 83 4.7 0.323 0.05 8.7 4.0 96 2,3-Trinethylbenzene 9.65	Ethylbenzene	8.54	91	6.0	1.202	0.03	4.1	4.1	107
Arrow 8.97 106 3.9 0.508 0.03 4.4 3.7 102 Bromoform 9.01 173 11.8 0.148 0.01 2.5 3.0 116 Styrene 9.01 104 6.0 0.870 0.03 4.9 3.9 103 sopropylbenzene 9.21 105 4.1 1.199 0.03 5.2 4.9 105 HBromofluorobenzene 9.40 95 5.4 0.439 3.6 1.1 102 Bromofluorobenzene 9.46 156 5.2 0.345 0.03 4.6 2.5 105 -propylbenzene 9.51 91 6.6 1.549 0.03 5.1 4.7 106 ,1,2,2-Tetrachloroethane 9.56 83 4.7 0.323 0.05 8.7 4.0 96 P-Chlorotoluene 9.60 91 5.9 0.937 0.03 4.6 4.5 108 ,2,3-Trichloropropane 9.6	1,1,1,2-Tetrachloroethane	8.55	131	6.7	0.195	0.05	8.4	3.9	110
Bromoform9.0117311.80.1480.012.53.0116Styrene9.011046.00.8700.034.93.9103sopropylbenzene9.211054.11.1990.035.24.9105HBromofluorobenzene9.40955.40.4393.61.1102Bromofluorobenzene9.461565.20.3450.034.62.5105Propylbenzene9.51916.61.5490.035.14.71061,2,2-Tetrachloroethane9.56834.70.3230.058.74.0962-Chlorotoluene9.60915.90.9370.034.64.5108,2,3-Trichloropropane9.64754.90.2580.035.03.5112,3,5-Trimethylbenzene9.68533.70.1130.068.94.1112-Chlorotoluene9.72917.31.0130.045.33.8107ert-Butylbenzene9.871194.50.9900.035.75.299,2,4-Trimethylbenzene9.991056.51.3540.046.05.5107	m,p-Xylene	8.65	106	5.7	0.511	0.08	6.1	5.4	105
Styrene9.011046.00.8700.034.93.9103sopropylbenzene9.211054.11.1990.035.24.9105-Bromofluorobenzene surr)9.40955.40.4393.61.1102Bromobenzene9.461565.20.3450.034.62.5105-propylbenzene9.51916.61.5490.035.14.71061,2,2-Tetrachloroethane9.56834.70.3230.058.74.0962-Chlorotoluene9.60915.90.9370.034.64.5108,2,3-Trichloropropane9.64754.90.2580.035.03.5112,3,5-Trimethylbenzene9.68533.70.1130.068.94.1112I-Chlorotoluene9.72917.31.0130.045.33.8107ert-Butylbenzene9.871194.50.9900.035.75.299,2,4-Trimethylbenzene9.921054.81.1410.034.64.9109ere-Butylbenzene9.991056.51.3540.046.05.5107	o-Xylene	8.97	106	3.9	0.508	0.03	4.4	3.7	102
Sopropylbenzene 9.21 105 4.1 1.199 0.03 5.2 4.9 105 I-Bromofluorobenzene surry 9.40 95 5.4 0.439 3.6 1.1 102 Bromofluorobenzene surry 9.46 156 5.2 0.345 0.03 4.6 2.5 105 Propoylbenzene 9.51 91 6.6 1.549 0.03 5.1 4.7 106 1,2,2-Tetrachloroethane 9.56 83 4.7 0.323 0.05 8.7 4.0 96 2-Chlorotoluene 9.60 91 5.9 0.937 0.03 4.6 4.5 108 ,2,3-Trichloropropane 9.64 75 4.9 0.258 0.03 5.0 3.5 112 ,3,5-Trimethylbenzene 9.65 105 4.8 1.108 0.03 4.5 5.4 109 rans-1,4-Dichloro-2- putene 9.68 53 3.7 0.113 0.06 8.9 4.1 112 <t< td=""><td>Bromoform</td><td>9.01</td><td>173</td><td>11.8</td><td>0.148</td><td>0.01</td><td>2.5</td><td>3.0</td><td>116</td></t<>	Bromoform	9.01	173	11.8	0.148	0.01	2.5	3.0	116
Bromofluorobenzene surr)9.40955.40.4393.61.1102Bromobenzene9.461565.20.3450.034.62.5105Propoylbenzene9.51916.61.5490.035.14.71061,1,2,2-Tetrachloroethane9.56834.70.3230.058.74.0962-Chlorotoluene9.60915.90.9370.034.64.51082,3-Trichloropropane9.64754.90.2580.035.03.51123,5-Trimethylbenzene9.651054.81.1080.034.55.4109rans-1,4-Dichloro-2- butene9.68533.70.1130.068.94.1112+Chlorotoluene9.72917.31.0130.045.33.8107ert-Butylbenzene9.871194.50.9900.035.75.299,2,4-Trimethylbenzene9.991056.51.3540.046.05.5107	Styrene	9.01	104	6.0	0.870	0.03	4.9	3.9	103
surr)9.40955.40.4393.61.1102Bromobenzene9.461565.20.3450.034.62.5105-propylbenzene9.51916.61.5490.035.14.7106,1,2,2-Tetrachloroethane9.56834.70.3230.058.74.0962-Chlorotoluene9.60915.90.9370.034.64.5108,2,3-Trichloropropane9.64754.90.2580.035.03.5112,3,5-Trimethylbenzene9.651054.81.1080.034.55.4109rans-1,4-Dichloro-2- outene9.68533.70.1130.068.94.1112-Chlorotoluene9.72917.31.0130.045.33.8107ert-Butylbenzene9.871194.50.9900.035.75.299,2,4-Trimethylbenzene9.921054.81.1410.034.64.9109ere-Butylbenzene9.991056.51.3540.046.05.5105	lsopropylbenzene	9.21	105	4.1	1.199	0.03	5.2	4.9	105
p-propylbenzene9.51916.61.5490.035.14.7106,1,2,2-Tetrachloroethane9.56834.70.3230.058.74.0962-Chlorotoluene9.60915.90.9370.034.64.5108,2,3-Trichloropropane9.64754.90.2580.035.03.5112,3,5-Trimethylbenzene9.651054.81.1080.034.55.4109rans-1,4-Dichloro-2- outene9.68533.70.1130.068.94.1112-Chlorotoluene9.72917.31.0130.045.33.8107ert-Butylbenzene9.871194.50.9900.035.75.299,2,4-Trimethylbenzene9.991056.51.3540.046.05.5107	4-Bromofluorobenzene (surr)	9.40	95	5.4	0.439		3.6	1.1	102
,1,2,2-Tetrachloroethane 9.56 83 4.7 0.323 0.05 8.7 4.0 96 2-Chlorotoluene 9.60 91 5.9 0.937 0.03 4.6 4.5 108 ,2,3-Trichloropropane 9.64 75 4.9 0.258 0.03 5.0 3.5 112 ,3,5-Trimethylbenzene 9.65 105 4.8 1.108 0.03 4.5 5.4 109 rans-1,4-Dichloro-2- butene 9.68 53 3.7 0.113 0.06 8.9 4.1 112 I-Chlorotoluene 9.72 91 7.3 1.013 0.04 5.3 3.8 107 ert-Butylbenzene 9.87 119 4.5 0.990 0.03 5.7 5.2 99 ,2,4-Trimethylbenzene 9.92 105 4.8 1.141 0.04 6.0 5.5 107 ec-Butylbenzene 9.99 105 6.5 1.354 0.04 6.0 5.5 107	Bromobenzene	9.46	156	5.2	0.345	0.03	4.6	2.5	105
P-Chlorotoluene9.60915.90.9370.034.64.5108,2,3-Trichloropropane9.64754.90.2580.035.03.5112,3,5-Trimethylbenzene9.651054.81.1080.034.55.4109rans-1,4-Dichloro-2- butene9.68533.70.1130.068.94.1112I-Chlorotoluene9.72917.31.0130.045.33.8107ert-Butylbenzene9.871194.50.9900.035.75.299,2,4-Trimethylbenzene9.921054.81.1410.034.64.9109rec-Butylbenzene9.991056.51.3540.046.05.5107	<i>n</i> -propylbenzene	9.51	91	6.6	1.549	0.03	5.1	4.7	106
,2,3-Trichloropropane9.64754.90.2580.035.03.5112,3,5-Trimethylbenzene9.651054.81.1080.034.55.4109rans-1,4-Dichloro-2- butene9.68533.70.1130.068.94.1112I-Chlorotoluene9.72917.31.0130.045.33.8107ert-Butylbenzene9.871194.50.9900.035.75.299,2,4-Trimethylbenzene9.921054.81.1410.034.64.9109ecc-Butylbenzene9.991056.51.3540.046.05.5107	1,1,2,2-Tetrachloroethane	9.56	83	4.7	0.323	0.05	8.7	4.0	96
,3,5-Trimethylbenzene 9.65 105 4.8 1.108 0.03 4.5 5.4 109 rans-1,4-Dichloro-2- butene 9.68 53 3.7 0.113 0.06 8.9 4.1 112 I-Chlorotoluene 9.72 91 7.3 1.013 0.04 5.3 3.8 107 ert-Butylbenzene 9.87 119 4.5 0.990 0.03 5.7 5.2 99 ,2,4-Trimethylbenzene 9.92 105 4.8 1.141 0.03 4.6 4.9 109 rec-Butylbenzene 9.99 105 6.5 1.354 0.04 6.0 5.5 107	2-Chlorotoluene	9.60	91	5.9	0.937	0.03	4.6	4.5	108
rans-1,4-Dichloro-2- butene 9.68 53 3.7 0.113 0.06 8.9 4.1 112 I-Chlorotoluene 9.72 91 7.3 1.013 0.04 5.3 3.8 107 ert-Butylbenzene 9.87 119 4.5 0.990 0.03 5.7 5.2 99 ,2,4-Trimethylbenzene 9.92 105 4.8 1.141 0.03 4.6 4.9 109 rec-Butylbenzene 9.99 105 6.5 1.354 0.04 6.0 5.5 107	1,2,3-Trichloropropane	9.64	75	4.9	0.258	0.03	5.0	3.5	112
9.68 53 3.7 0.113 0.06 8.9 4.1 112 I-Chlorotoluene 9.72 91 7.3 1.013 0.04 5.3 3.8 107 ert-Butylbenzene 9.87 119 4.5 0.990 0.03 5.7 5.2 99 ,2,4-Trimethylbenzene 9.92 105 4.8 1.141 0.03 4.6 4.9 109 iec-Butylbenzene 9.99 105 6.5 1.354 0.04 6.0 5.5 107	1,3,5-Trimethylbenzene	9.65	105	4.8	1.108	0.03	4.5	5.4	109
ert-Butylbenzene9.871194.50.9900.035.75.299,2,4-Trimethylbenzene9.921054.81.1410.034.64.9109rec-Butylbenzene9.991056.51.3540.046.05.5107	<i>trans-</i> 1,4-Dichloro-2- butene	9.68	53	3.7	0.113	0.06	8.9	4.1	112
,2,4-Trimethylbenzene9.921054.81.1410.034.64.9109sec-Butylbenzene9.991056.51.3540.046.05.5107	4-Chlorotoluene	9.72	91	7.3	1.013	0.04	5.3	3.8	107
rec-Butylbenzene 9.99 105 6.5 1.354 0.04 6.0 5.5 107	tert-Butylbenzene	9.87	119	4.5	0.990	0.03	5.7	5.2	99
-	1,2,4-Trimethylbenzene	9.92	105	4.8	1.141	0.03	4.6	4.9	109
p-lsopropyltoluene 10.09 119 5.5 1.107 0.04 7.4 5.6 107	sec-Butylbenzene	9.99	105	6.5	1.354	0.04	6.0	5.5	107
	p-lsopropyltoluene	10.09	119	5.5	1.107	0.04	7.4	5.6	107

Appendix 1 continued. U.S. EPA Method 524.2 calibration, accuracy, and precision data

Compound	Calibration			Accuracy and precision (n=7, 0.2 ppb)		Mid-point check (n=7, 10 ppb)		
Compound	Retention time	Quant ion	Linearity (RRF %RSD)	Average RF	MDL (ppb)	Precision (RSD ≤20%)	Precision (≤20%)	Accuracy (±30%)
1,3-Dichlorobenzene	10.12	146	7.7	0.701	0.04	6.2	4.5	104
1,4-Dichlorobenzene	10.18	146	10.6	0.725	0.05	7.5	4.9	102
n-Butylbenzene	10.38	91	8.3	1.152	0.05	7.1	6.3	105
1,2-Dichlorobenzene-d ₄ (surr)	10.46	152	6.2	0.463		3.8	3.9	104
Hexachloroethane ^{1,4,7}	10.46	117	0.999	2.650	1.06	13.7	7.6	108
1,2-Dichlorobenzene	10.46	146	9.2	0.723	0.02	3.5	4.2	104
1,2-Dibromo-3-chloropropane	11.00	75	9.0	0.063	0.04	6.2	4.0	115
Nitrobenzene ^{1,4,8}	11.35	51	0.998	0.027	0.31	10.2	3.6	107
Hexachlorobutadiene	11.44	225	7.8	0.113	0.04	6.3	4.4	115
1,2,4-Trichlorobenzene	11.45	180	12.1	0.501	0.05	7.3	5.0	105
Naphthalene	11.67	128	6.5	1.338	0.03	4.6	5.0	104
1,2,3-Trichlorobenzene	11.79	180	7.3	0.494	0.04	6.0	4.9	107

¹Compound used a linear regression calibration

²Calibration range 2.5–125 ppb

³Calibration range 0.5–125 ppb

⁴Calibration range 0.5–50 ppb ⁵MDL calculated using n=7, 2.5 ppb

⁶MDL calculated using n=7, 0.5 ppb

⁷MDL calculated using n=7, 2 ppb

⁸MDL calculated using n=7, 1 ppb

Appendix 2. Repeatability of a 5 ppb VOC standard (n=32) (as absolute peak area counts) assessed over n=197 consecutive injections

Company	Analyte recovery (197 injections, n=32 samples, 10 ppb)				
Compound	Precision (≤30%)	Accuracy (±30%)			
Dichlorodifluoromethane	22.7	72			
Chloromethane	18.7	80			
Vinyl chloride	14.9	86			
Bromomethane	10.0	90			
Chloroethane	9.3	111			
Trichlorofluoromethane	11.0	101			
Diethyl ether	5.2	118			
1,1-Dichloroethene	9.6	88			
Carbon disulfide1	7.0	64			
Methyl iodide	16.1	71			
Allyl chloride	9.2	99			
Methylene chloride	4.8	103			
Acetone ²	18.3	181			
trans-1,2-dichloroethene	7.6	90			
Methyl-tert-butylether	7.7	118			
1,1-Dichloroethane	6.0	129			
Acrylonitrile ³	10.7	135			

Compound Precision (<:30%)		Analyte recovery (197 injections, n=32 samples, 10 ppb)					
2.2-Dichloropropanel 28.5 78 Bromochloromethane 5.2 112 Chloroform ³ 8.7 131 Carbon tetrachloride 10.3 115 1,1,1-Trichloroethane 10.4 115 Methyl acrylate 11.8 126 Tetrahydrofuran 10.8 98 1,1-Dichloropropene 8.5 106 2-Butanone ³ 13.5 146 1-Chlorobutane 8.7 117 Benzene 6.9 89 Propionitrile 9.4 113 Methacrylonitrile 7.2 93 1,2-Dichloroethane 7.5 124 Flourobenzene (STD) - - Trichloroethylene 7.9 106 Dibromomethane 7.1 115 Methyl methacrylate 10.3 77 c/s-1,3-Dichloropropene 16.0 120 1,1,Dichloropropene 16.8 85 Tetrachloroethene 6.2 118 4-methyl-2-pen	Compound	Precision (≤30%)	Accuracy (±30%)				
Bromochloromethane 5.2 112 Chloroform ³ 8.7 131 Carbon tetrachloride 10.3 115 1,1,1-Trichloroethane 10.4 115 Methyl acrylate 11.8 126 Tetrahydrofuran 10.8 98 1,1-Dichloropropene 8.5 106 2-Butanone ³ 13.5 146 1-Chlorobutane 8.7 117 Benzene 6.9 89 Propionitrile 9.4 113 Methacrylonitrile 7.2 93 1,2-Dichloroethane 5.5 124 Fluorobenzene (ISTD) - - Trichloroethylene 7.9 106 Dibromomethane 7.1 115 Methyl methacrylate 10.3 77 <i>cis</i> -1,3-Dichloropropane 16.0 120 1,1,Dichloropropane 16.8 85 Tetrachloroethane 7.4 113 4-methyl-2-pentanone 7.8 112 <i>trans</i> -1,3	cis-1,2-Dichloroethene	6.3	116				
Chloroform ^a 8.7 131 Carbon tetrachloride 10.3 115 1,1,1-Trichloroethane 10.4 115 Methyl acrylate 11.8 126 Tetrahydrofuran 10.8 98 1,1-Dichloropropene 8.5 106 2-Butanone ^a 13.5 146 1-Chlorobutane 8.7 117 Benzene 6.9 89 Propionitrile 9.4 113 Methacrylonitrile 7.2 93 1,2-Dichloroethane 5.5 124 Fluorobenzene (ISTD) - - Trichloroethylene 7.9 106 Dibromomethane 7.1 115 Methyl methacrylate 10.3 77 cis-1,3-Dichloropropane 16.0 120 1,1.Dichloropropane 16.0 120 1,1.Dichloropropane 6.2 118 4-methyl-2-pentanone 7.8 112 trans-1,3-Dichloropropene 9.8 94 1,1,	2,2-Dichloropropane1	28.5	78				
Carbon tetrachloride 10.3 115 Carbon tetrachloride 10.4 115 Methyl acrylate 11.8 126 Tetrahydrofuran 10.8 98 1.1-Dichloropropene 8.5 106 2-Butanone ³ 13.5 146 1-Chlorobutane 8.7 117 Benzene 6.9 89 Propionitrile 9.4 113 Methacrylonitrile 7.2 93 1,2-Dichloroethane 5.5 124 Fluorobenzene (ISTD) - - Trichloroethylene 7.9 106 Dibromomethane 4.7 102 1,2-Dichloropropane 5.5 109 Bromodichloromethane 7.1 115 Methyl methacrylate 10.3 77 c/s-1,3-Dichloropropene 11.6 82 Toluene 11.1 80 2-Nitropropane 16.0 120 1,1,Dichloropropene 9.8 94 1,1,2-Trichloroethane </td <td>Bromochloromethane</td> <td>5.2</td> <td>112</td>	Bromochloromethane	5.2	112				
1,1,1-Trichloroethane 10.4 115 Methyl acrylate 11.8 126 Tetrahydrofuran 10.8 98 1,1-Dichloropropene 8.5 106 2-Butanone ³ 13.5 146 1-Chlorobutane 8.7 117 Benzene 6.9 89 Propionitrile 9.4 113 Methacrylonitrile 7.2 93 1,2-Dichloroethane 5.5 124 Fluorobenzene (ISTD) - - Trichloroethylene 7.9 106 Dibromomethane 7.1 115 Methyl methacrylate 10.3 77 cis-1,3-Dichloropropene 11.6 82 Toluene 11.1 80 2-Nitropropane 16.0 120 1,1,Dichloropropane 6.2 118 4-methyl-2-pentanone 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 8.2 108 1,3-Dichloropropane 5.5 102 1,1,2-Trichloroethane 6.2 118 4-methyl-2-pentanone 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 8.2	Chloroform ³	8.7	131				
Number 11.8 126 Tetrahydrofuran 10.8 98 1.1-Dichloropropene 8.5 106 2-Butanone ³ 13.5 146 1-Chlorobutane 8.7 117 Benzene 6.9 89 Propionitrile 9.4 113 Methacrylonitrile 7.2 93 1.2-Dichloroethane 5.5 124 Fluorobenzene (ISTD) - - Trichloroethylene 7.9 106 Dibromomethane 4.7 102 1.2-Dichloropropane 5.5 109 Bromodichloromethane 7.1 115 Methyl methacrylate 10.3 77 cis-1,3-Dichloropropene 11.6 82 Toluene 11.1 80 2-Nitropropane 6.2 118 4-methyl-2-pentanone 7.8 112 tras-1,3-Dichloropropane 9.6 85 Dibromochloromethane 7.4 113 tras-1,3-Dichloropropane	Carbon tetrachloride	10.3	115				
Tetrahydrofuran 10.8 98 1,1-Dichloropropene 8.5 106 2-Butanone ³ 13.5 146 1-Chlorobutane 8.7 117 Benzene 6.9 89 Propionitrile 9.4 113 Methacrytonitrile 7.2 93 1,2-Dichloroethane 5.5 124 Fluorobenzene (ISTD) - - Trichloroethylene 7.9 106 Dibromomethane 4.7 102 1,2-Dichloropropane 5.5 109 Bromodichloromethane 7.1 115 Methyl methacrylate 10.3 77 cis-1,3-Dichloropropene 11.6 82 Toluene 11.1 80 2-Nitropropane 16.0 120 1,1,Dichloropropane 6.2 118 4-methyl-2-pentanone 7.8 112 tras-1,3-Dichloropropene 9.6 85 Dibromochloromethane 8.2 108 1,3-Dichloropropa	1,1,1-Trichloroethane	10.4	115				
1.1-Dichloropropene 8.5 106 2-Butanone ^a 13.5 146 1-Chlorobutane 8.7 117 Benzene 6.9 89 Propionitrile 9.4 113 Methacrylonitrile 7.2 93 1,2-Dichloroethane 5.5 124 Fluorobenzene (ISTD) - - Trichloroethylene 7.9 106 Dibromomethane 4.7 102 1,2-Dichloropropane 5.5 109 Bernodichloromethane 7.1 115 Methyl methacrylate 10.3 77 c/s-1,3-Dichloropropene 11.6 82 Toluene 11.1 80 2-Nitropropane 6.2 118 4-methyl-2-pentanone 7.8 112 trans-1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 8.2 108 1,3-Dichloropropane 5.5 102 1,2-Dichloropropane 5.5 102 1,3-Dichloro	Methyl acrylate	11.8	126				
2-Butanone ³ 13.5 146 1-Chlorobutane 8.7 117 Benzene 6.9 89 Propionitrile 9.4 113 Methacrylonitrile 7.2 93 1,2-Dichloroethane 5.5 124 Fluorobenzene (ISTD) - - Trichloroethylene 7.9 106 Dibromomethane 4.7 102 1,2-Dichloropropane 5.5 109 Bromodichloromethane 7.1 115 Methyl methacrylate 10.3 77 c/s-1,3-Dichloropropene 11.6 82 Toluene 11.1 80 2-Nitropropane 16.0 120 1,1,Dichloropropanone 16.8 85 Tetrachloroethene 6.2 118 4-methyl-2-pentanone 7.8 112 trans-1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 8.2 108 1,3-Dichloropropane 5.5 102 1,2-Dibromochloromethane 8.2 103 1,3-Dichloropropane <	Tetrahydrofuran	10.8	98				
1-Chlorobutane 8.7 117 Benzene 6.9 89 Propionitrile 9.4 113 Methacrylonitrile 7.2 93 1,2-Dichloroethane 5.5 124 Fluorobenzene (ISTD) - - Trichloroethylene 7.9 106 Dibromomethane 4.7 102 1,2-Dichloropropane 5.5 109 Bromodichloromethane 7.1 115 Methyl methacrylate 10.3 77 cis-1,3-Dichloropropane 16.0 82 Toluene 11.1 80 2-Nitropropane 16.8 85 Tetrachloroethene 6.2 118 4-methyl-2-pentanone 7.8 112 trans-1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 5.2 108 1,3-Dichloropropane 5.2 108 1,3-Dichlo	1,1-Dichloropropene	8.5	106				
Benzene 6.9 89 Propionitrile 9.4 113 Methacrylonitrile 7.2 93 1,2-Dichloroethane 5.5 124 Fluorobenzene (ISTD) - - Trichloroethylene 7.9 106 Dibromomethane 4.7 102 1,2-Dichloropropane 5.5 109 Bromodichloromethane 7.1 115 Methyl methacrylate 10.3 77 c/s-1,3-Dichloropropene 11.6 82 Toluene 11.1 80 22 1,1,Dichloropropanone 16.0 120 11 1,1,Dichloropropanone 16.8 85 124 trans-1,3-Dichloropropene 9.8 94 11.2 113 trans-1,3-Dichloropropene 9.8 94 1,12 113 Ethyl methacrylate 9.6 85 102 114 1,3-Dichloropropane 5.2 109 1,2-Dibromoethane 5.5 102 2-Hexanone 103	2-Butanone ³	13.5	146				
Propionitrile 9.4 113 Methacrylonitrile 7.2 93 1,2-Dichloroethane 5.5 124 Fluorobenzene (ISTD) - - Trichloroethylene 7.9 106 Dibromomethane 4.7 102 1,2-Dichloropropane 5.5 109 Bromodichloromethane 7.1 115 Methyl methacrylate 10.3 77 cis-1,3-Dichloropropane 16.0 82 Toluene 11.1 80 22 2-Nitropropane 16.0 120 11 1,1,Dichloropropanone 16.8 85 112 trans-1,3-Dichloropropene 9.8 94 11.2 trans-1,3-Dichloropropene 9.8 94 11.2 trans-1,3-Dichloropropene 5.2 109 1.2-Dichloropropane 5.2 109 1,2-Trichloroethane 7.4 113 113 114 114 Ethyl methacrylate 9.6 85 102 12-Dichloropropane	1-Chlorobutane	8.7	117				
Methacrylonitrile 7.2 93 1,2-Dichloroethane 5.5 124 Fluorobenzene (ISTD) - - Trichloroethylene 7.9 106 Dibromomethane 4.7 102 1,2-Dichloropropane 5.5 109 Bromodichloromethane 7.1 115 Methyl methacrylate 10.3 77 c/s-1,3-Dichloropropene 11.6 82 Toluene 11.1 80 2-Nitropropane 16.0 120 1,1,Dichloropropanone 16.8 85 Tetrachloroethene 6.2 118 4-methyl-2-pentanone 7.8 112 <i>trans</i> -1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 8.2 108 1,3-Dichloropropane 5.5 102 1,2-Dibromoethane 5.5 102 1,2-Dibromoethane 5.5 102 <t< td=""><td>Benzene</td><td>6.9</td><td>89</td></t<>	Benzene	6.9	89				
1,2-Dichloroethane 5.5 124 Fluorobenzene (ISTD) - - Trichloroethylene 7.9 106 Dibromomethane 4.7 102 1,2-Dichloropropane 5.5 109 Bromodichloromethane 7.1 115 Methyl methacrylate 10.3 77 c/s-1,3-Dichloropropane 11.6 82 Toluene 11.1 80 2-Nitropropane 16.0 120 1,1,Dichloropropanone 16.8 85 Tetrachloroethene 6.2 118 4-methyl-2-pentanone 7.8 112 <i>trans</i> -1,3-Dichloropropane 9.8 94 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 8.2 108 1,3-Dichloropropane 5.5 102 2-Hexanone 5.5 102 2-Hexanone 6.9 90 Ethylbenzene 6.9 90 Ethylbenzene 8.2 111	Propionitrile	9.4	113				
Fluorobenzene (ISTD) - - Trichloroethylene 7.9 106 Dibromomethane 4.7 102 1,2-Dichloropropane 5.5 109 Bromodichloromethane 7.1 115 Methyl methacrylate 10.3 77 <i>cis</i> -1,3-Dichloropropene 11.6 82 Toluene 11.1 80 2-Nitropropane 16.0 120 1,1,Dichloropropanone 6.2 118 4-methyl-2-pentanone 7.8 112 <i>trans</i> -1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 8.2 108 1,3-Dichloropropane 5.5 102 1,2-Trichloroethane 5.5 102 1,3-Dichloropropane 5.5 102 1,3-Dichloropropane 5.5 102 1,3-Dichloropropane 5.5 102 1,2-Dibromoethane 6.9 90 1,2-Dibromoethane 6.9 90 Ethyl	Methacrylonitrile	7.2	93				
Trichloroethylene 7.9 106 Dibromomethane 4.7 102 1,2-Dichloropropane 5.5 109 Bromodichloromethane 7.1 115 Methyl methacrylate 10.3 77 cis-1,3-Dichloropropene 11.6 82 Toluene 11.1 80 2-Nitropropane 16.0 120 1,1,Dichloropropanone 16.8 85 Tetrachloroethene 6.2 118 4-methyl-2-pentanone 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloropropane 5.2 109 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 5.2 109 1,3-Dichloropropane 5.5 102 2-Hexanone 12.3 103 Chlorobenzene 6.9 90 Ethylbenzene 11.0 90 1,1,1,2-Tetrachloroethane 8.2 111	1,2-Dichloroethane	5.5	124				
Dibromomethane 4.7 102 1,2-Dichloropropane 5.5 109 Bromodichloromethane 7.1 115 Methyl methacrylate 10.3 77 cis-1,3-Dichloropropene 11.6 82 Toluene 11.1 80 2-Nitropropane 16.0 120 1,1,Dichloropropanone 16.8 85 Tetrachloroethene 6.2 118 4-methyl-2-pentanone 7.8 112 trans-1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 5.2 109 1,3-Dichloropropane 5.5 102 2-Hexanone 5.5 102 2-Hexanone 6.9 90 Ethylbenzene 6.9 90 Ethylbenzene 8.2 111	Fluorobenzene (ISTD)	-	-				
1,2-Dichloropropane 5.5 109 Bromodichloromethane 7.1 115 Methyl methacrylate 10.3 77 c/s-1,3-Dichloropropene 11.6 82 Toluene 11.1 80 2-Nitropropane 16.0 120 1,1,Dichloropropanone 16.8 85 Tetrachloroethene 6.2 118 4-methyl-2-pentanone 7.8 112 trans-1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 5.2 109 1,2-Dibromoethane 5.5 102 2-Hexanone 12.3 103 Chlorobenzene 6.9 90 Ethylbenzene 11.0 90 1,1,1,2-Tetrachloroethane 8.2 111	Trichloroethylene	7.9	106				
Bromodichloromethane 7.1 115 Methyl methacrylate 10.3 77 cis-1,3-Dichloropropene 11.6 82 Toluene 11.1 80 2-Nitropropane 16.0 120 1,1,Dichloropropanone 16.8 85 Tetrachloroethene 6.2 118 4-methyl-2-pentanone 7.4 112 trans-1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 5.2 109 1,2-Dibromoethane 5.5 102 2-Hexanone 12.3 103 Chlorobenzene 6.9 90 Ethylbenzene 11.0 90 1,1,2-Tetrachloroethane 8.2 111	Dibromomethane	4.7	102				
Methyl methacrylate 10.3 77 cis-1,3-Dichloropropene 11.6 82 Toluene 11.1 80 2-Nitropropane 16.0 120 1,1,Dichloropropanone 16.8 85 Tetrachloroethene 6.2 118 4-methyl-2-pentanone 7.8 112 trans-1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 5.2 109 1,3-Dichloropropane 5.5 102 2-Hexanone 12.3 103 Chlorobenzene 6.9 90 Ethylbenzene 11.0 90 1,1,1,2-Tetrachloroethane 8.2 111	1,2-Dichloropropane	5.5	109				
cis-1,3-Dichloropropene 11.6 82 Toluene 11.1 80 2-Nitropropane 16.0 120 1,1,Dichloropropanone 16.8 85 Tetrachloroethene 6.2 118 4-methyl-2-pentanone 7.8 112 trans-1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 5.2 109 1,3-Dichloropropane 5.5 102 2-Hexanone 12.3 103 Chlorobenzene 6.9 90 Ethylbenzene 11.0 90 1,1,1,2-Tetrachloroethane 8.2 111	Bromodichloromethane	7.1	115				
Toluene 11.1 80 2-Nitropropane 16.0 120 1,1,Dichloropropanone 16.8 85 Tetrachloroethene 6.2 118 4-methyl-2-pentanone 7.8 112 trans-1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 8.2 108 1,3-Dichloropropane 5.5 102 2-Hexanone 5.5 102 2-Hexanone 6.9 90 Ethylbenzene 11.0 90 1,1,2-Tetrachloroethane 8.2 111	Methyl methacrylate	10.3	77				
2-Nitropropane 16.0 120 1,1,Dichloropropanone 16.8 85 Tetrachloroethene 6.2 118 4-methyl-2-pentanone 7.8 112 trans-1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 8.2 108 1,3-Dichloropropane 5.5 102 2-Hexanone 12.3 103 Chlorobenzene 6.9 90 Ethylbenzene 11.0 90 1,1,2-Tetrachloroethane 8.2 111	cis-1,3-Dichloropropene	11.6	82				
1,1,Dichloropropanone 16.8 85 Tetrachloroethene 6.2 118 4-methyl-2-pentanone 7.8 112 trans-1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 8.2 108 1,3-Dichloropropane 5.2 109 1,2-Dibromoethane 12.3 103 Chlorobenzene 6.9 90 Ethylbenzene 11.0 90 1,1,1,2-Tetrachloroethane 8.2 111	Toluene	11.1	80				
Tetrachloroethene 6.2 118 4-methyl-2-pentanone 7.8 112 trans-1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 8.2 108 1,3-Dichloropropane 5.2 109 1,2-Dibromoethane 5.5 102 2-Hexanone 12.3 103 Chlorobenzene 6.9 90 Ethylbenzene 11.0 90 1,1,1,2-Tetrachloroethane 8.2 111	2-Nitropropane	16.0	120				
4-methyl-2-pentanone 7.8 112 trans-1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 8.2 108 1,3-Dichloropropane 5.2 109 1,2-Dibromoethane 5.5 102 2-Hexanone 12.3 103 Chlorobenzene 6.9 90 Ethylbenzene 11.0 90 1,1,1,2-Tetrachloroethane 8.2 111	1,1,Dichloropropanone	16.8	85				
trans-1,3-Dichloropropene 9.8 94 1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 8.2 108 1,3-Dichloropropane 5.2 109 1,2-Dibromoethane 5.5 102 2-Hexanone 12.3 103 Chlorobenzene 6.9 90 1,1,1,2-Tetrachloroethane 8.2 111	Tetrachloroethene	6.2	118				
1,1,2-Trichloroethane 7.4 113 Ethyl methacrylate 9.6 85 Dibromochloromethane 8.2 108 1,3-Dichloropropane 5.2 109 1,2-Dibromoethane 5.5 102 2-Hexanone 12.3 103 Chlorobenzene 6.9 90 Ethylbenzene 11.0 90 1,1,1,2-Tetrachloroethane 8.2 111	4-methyl-2-pentanone	7.8	112				
Ethyl methacrylate 9.6 85 Dibromochloromethane 8.2 108 1,3-Dichloropropane 5.2 109 1,2-Dibromoethane 5.5 102 2-Hexanone 12.3 103 Chlorobenzene 6.9 90 Ethylbenzene 11.0 90 1,1,1,2-Tetrachloroethane 8.2 111	trans-1,3-Dichloropropene	9.8	94				
Dibromochloromethane 8.2 108 1,3-Dichloropropane 5.2 109 1,2-Dibromoethane 5.5 102 2-Hexanone 12.3 103 Chlorobenzene 6.9 90 Ethylbenzene 11.0 90 1,1,1,2-Tetrachloroethane 8.2 111	1,1,2-Trichloroethane	7.4	113				
1,3-Dichloropropane5.21091,2-Dibromoethane5.51022-Hexanone12.3103Chlorobenzene6.990Ethylbenzene11.0901,1,1,2-Tetrachloroethane8.2111	Ethyl methacrylate	9.6	85				
1,2-Dibromoethane 5.5 102 2-Hexanone 12.3 103 Chlorobenzene 6.9 90 Ethylbenzene 11.0 90 1,1,1,2-Tetrachloroethane 8.2 111	Dibromochloromethane	8.2	108				
2-Hexanone 12.3 103 Chlorobenzene 6.9 90 Ethylbenzene 11.0 90 1,1,1,2-Tetrachloroethane 8.2 111	1,3-Dichloropropane	5.2	109				
Chlorobenzene 6.9 90 Ethylbenzene 11.0 90 1,1,1,2-Tetrachloroethane 8.2 111	1,2-Dibromoethane	5.5	102				
Ethylbenzene 11.0 90 1,1,1,2-Tetrachloroethane 8.2 111	2-Hexanone	12.3	103				
1,1,1,2-Tetrachloroethane 8.2 111	Chlorobenzene	6.9	90				
	Ethylbenzene	11.0	90				
<i>m,p-</i> Xylene 9.6 91	1,1,1,2-Tetrachloroethane	8.2	111				
	<i>m,p-</i> Xylene	9.6	91				

Appendix 2 continued. Repeatability of a 5 ppb VOC standard (n=32) (as absolute peak area counts) assessed over n=197 consecutive injections

Compound	Analyte recovery (197 injections, n=32 samples, 10 ppb)					
Compound	Precision (≤30%)	Accuracy (±30%)				
o-Xylene	11.5	81				
Bromoform	8.4	113				
Styrene	8.0	92				
lsopropylbenzene	12.5	88				
4-Bromofluorobenzene (surr)	2.8	111				
Bromobenzene	5.8	103				
n-propylbenzene	10.9	97				
1,1,2,2-Tetrachloroethane	13.3	93				
2-Chlorotoluene	8.4	101				
1,2,3-Trichloropropane	8.5	124				
1,3,5-Trimethylbenzene	10.0	97				
trans-1,4-Dichloro-2-butene	13.2	113				
4-Chlorotoluene	8.3	104				
tert-Butylbenzene	13.6	86				
1,2,4-Trimethylbenzene	10.0	98				
sec-Butylbenzene	12.2	98				
p-lsopropyltoluene	13.1	90				
1,3-Dichlorobenzene	7.0	106				
1,4-Dichlorobenzene	6.8	100				
n-Butylbenzene	14.1	94				
1,2-Dichlorobenzene-d ₄ (surr)	3.8	118				
Hexachloroethane	11.1	123				
1,2-Dichlorobenzene	6.2	107				
1,2-Dibromo-3-chloropropane	8.0	101				
Nitrobenzene	14.8	90				
Hexachlorobutadiene	13.5	104				
1,2,4-Trichlorobenzene	11.8	89				
Naphthalene	9.8	84				
1,2,3-Trichlorobenzene	7.7	101				

Appendix 2 continued. Repeatability of a 5 ppb VOC standard (n=32) (as absolute peak area counts) assessed over n=197 consecutive injections

¹This is a highly reactive compound, therefore, only 17 samples were analyzed.

²The laboratory has contamination of this compound, therefore, it recovered high.

³This is a highly reactive compound that started to recover high.

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