

METHOD STATEMENT

Determinand:

Volatile organic compounds (VOC)

Matrix:

Groundwater, Surface water, Landfill leachates and Final effluents

Principle of Method:

An aliquot of water is transferred to a purge vessel and purged by the purge and trap system onto a tube containing a suitable sorbent material. Once purging is complete the sorbent tube is heated and back flushed with helium to desorb trapped compounds, which pass onto a gas chromatographic column prior to identification by a mass spectrometric detector.

The mass spectrometer may be operated in one of two modes: Full scan mode or selected ion monitoring mode.

Sampling and Sample Preparation:

This method requests a minimum of two 40ml VOC vials for each aqueous field sample to be submitted. Samples should be preserved with HCl to pH<2 unless site requirements preclude this. Samples should be stored prior to analysis at between 5±3°C. Samples are stable for 14 days (US EPA Method 8260) from sampling.

Interferences:

Any compound, which is purgeable, has a corresponding retention time to the target compounds and has similar ions to those being monitored, may interfere.

Performance of Method:

Range of Application: Reporting limit to 250 µg/l without dilution for each compound

See following pages for summary of performance characteristics.

References:

EPA SW846, Test methods for Evaluating Solid Waste, Physical/Chemical Methods, 3rd Edition, Update 111, Dec 1996.

Velocity XPT™ Accelerated Purge and Trap Sample Concentrator. User Manual.

Evaluation of New Moisture Management Techniques for the Analysis of Volatile Organic Compounds in Environmental Samples. *Kancler et al.* Tekmar Application Note.

ISBN 0-87553-161-X, Standard Methods for the Examination of Water and Wastewater.



METHOD STATEMENT

Standards - Precision and Bias:

Compound	LOD µg/l	MRL µg/l	Low Std.		High Std.	
			%RSD	%Recovery	%RSD	%Recovery
Dichlorodifluoromethane	0.608	1	17.63	83.39	12.87	83.15
Chloromethane	0.554	1	11.14	107.89	11.94	110.35
Chloroethane	0.510	1	8.71	107.22	11.77	117.35
Bromomethane	0.600	1	16.88	105.85	7.48	120.29
Vinyl Chloride	0.465	0.5	9.82	116.32	12.32	107.48
Trichlorofluoromethane	0.229	1	8.43	92.95	15.62	96.67
1,1,-Dichloroethene	0.452	1	6.79	100.47	13.31	104.86
Dichloromethane	0.451	1	7.64	104.48	13.35	108.42
MTBE	0.270	1	7.10	96.63	13.30	102.09
trans-1,2-Dichloroethene	0.330	1	7.41	100.68	12.81	105.29
1,1-Dichloroethane	0.261	1	6.65	102.97	12.38	107.4
cis-1,2-Dichloroethene	0.495	1	6.09	101.56	13.26	107.25
2,2-Dichloropropane	0.390	1	14.74	81.53	9.48	80.21
Chloroform	0.578	1	6.11	102.79	12.62	106.34
Bromochloromethane	0.356	1	6.20	100.84	12.82	106.44
1,1,1-Trichloroethane	0.257	1	5.60	97.65	12.35	102.51
1,1-Dichloropropene	0.481	1	6.19	95.80	15.61	101.40
Carbon Tetrachloride	0.271	1	5.73	94.24	12.98	99.73
1,2-Dichloroethane	0.259	1	7.09	104.42	12.94	105.37
Benzene	0.267	1	6.65	95.74	12.39	104.06
1,2-Dichloropropane	0.330	1	6.14	99.62	12.09	105.03
Trichloroethene	0.392	1	7.44	96.28	13.15	100.06
Bromodichloromethane	0.390	1	4.72	95.61	10.37	103.32
Dibromomethane	0.368	1	7.44	95.79	12.35	99.61
cis-1,3-Dichloropropene	0.206	1	5.46	89.76	13.32	99.94
Toluene	0.379	1	14.11	93.41	14.01	102.11
trans-1,3-Dichloropropene	0.203	1	12.31	82.30	13.40	99.22
1,1,2-Trichloroethane	0.324	1	13.89	94.72	16.52	101.82
1,3-Dichloropropane	0.305	1	8.96	96.74	17.11	101.53
Tetrachloroethene	0.309	1	14.72	92.97	17.89	95.62
Dibromochloromethane	0.337	1	6.11	90.48	11.70	100.45
1,2-Dibromoethane	0.315	1	7.29	93.71	13.03	99.00
Chlorobenzene	0.352	1	7.45	96.65	12.07	99.43
1,1,1,2-Tetrachloroethane	0.275	1	4.85	94.55	10.59	100.53
Ethyl Benzene	0.283	1	6.93	93.20	12.35	98.41
m,p-Xylene	0.572	1	6.82	92.52	12.10	100.10
o-Xylene	0.313	1	5.21	93.57	11.63	98.99
Styrene	0.307	1	6.44	93.19	11.63	99.17
Bromoform	0.432	1	6.34	88.33	10.13	96.56
Isopropylbenzene	0.342	1	6.82	90.5	12.94	96.05
1,1,2,2-Tetrachloroethane	0.314	1	7.93	94.72	13.44	96.11
1,2,3-Trichloropropane	0.445	1	9.88	94.74	14.07	95.13
n-Propylbenzene	0.410	1	9.33	88.95	13.49	94.57
Bromobenzene	0.382	1	8.48	96.20	12.00	98.88
2-Chlorotoluene	0.213	1	7.95	92.71	12.10	96.89
1,3,5-Trimethylbenzene	0.356	1	6.58	90.85	13.04	96.09
4-Chlorotoluene	0.404	1	8.37	93.81	13.03	97.27
tert-Butylbenzene	0.373	1	7.69	89.77	14.68	94.42
1,2,4-Trimethylbenzene	0.336	1	6.10	91.47	13.07	96.32
sec-Butylbenzene	0.405	1	9.00	86.64	13.91	92.48
p-Isopropyltoluene	0.421	1	8.26	86.92	14.07	92.71
1,3-Dichlorobenzene	0.363	1	8.90	93.32	12.64	96.53
1,4-Dichlorobenzene	0.402	1	9.28	95.10	13.47	96.65
n-Butylbenzene	0.517	1	8.60	84.63	17.60	90.71
1,2-Dichlorobenzene	0.283	1	7.80	94.27	11.84	97.55
1,2-Dibromo-3-chloropropane	0.568	2	10.66	80.97	13.49	90.11
1,2,4-Trichlorobenzene	0.525	1	12.05	86.46	13.07	92.66
Hexachlorobutadiene	0.786	1	17.12	95.38	16.67	90.69
Naphthalene	0.472	1	15.27	81.81	16.71	90.68
1,2,3-Trichlorobenzene	0.551	1	17.71	88.40	13.89	91.18



METHOD STATEMENT

Spiked Sample Recovery:

Determinand		Groundwater	Surface Water	Final Effluent	Landfill Leachate
Dichlorodifluoromethane	%Rec.	85.26	82.84	85.79	84.45
	%RSD	14.53	18.54	13.93	12.53
Chloromethane	%Rec.	104.35	105.55	104.44	104.92
	%RSD	6.19	7.56	8.72	5.47
Vinyl Chloride	%Rec.	100.67	100.61	101.57	102.15
	%RSD	6.66	8.26	7.80	5.07
Chloroethane	%Rec.	101.69	102.83	102.30	102.29
	%RSD	6.25	6.04	6.93	4.93
Bromomethane	%Rec.	100.54	99.80	100.45	100.84
	%RSD	8.59	8.14	7.69	6.40
Trichlorofluoromethane	%Rec.	93.91	94.94	95.85	95.64
	%RSD	7.41	6.88	6.63	5.46
1,1,-Dichloroethene	%Rec.	101.24	101.67	101.75	102.73
	%RSD	4.76	5.26	5.34	3.92
Dichloromethane	%Rec.	103.28	103.97	103.08	104.17
	%RSD	4.24	4.96	4.80	4.15
MTBE	%Rec.	103.81	102.93	102.79	105.33
	%RSD	4.86	5.49	5.20	5.50
trans-1,2-Dichloroethene	%Rec.	102.91	103.23	102.96	104.54
	%RSD	4.17	4.86	4.74	3.63
1,1-Dichloroethane	%Rec.	103.41	103.65	103.26	104.80
	%RSD	4.30	4.93	4.64	4.00
cis-1,2-Dichloroethene	%Rec.	103.71	104.11	103.55	105.23
	%RSD	4.07	4.88	4.67	3.66
2,2-Dichloropropane	%Rec.	89.54	84.04	87.21	88.43
	%RSD	11.13	10.54	13.40	10.67
Chloroform	%Rec.	103.74	104.11	103.67	105.35
	%RSD	4.27	4.82	4.55	3.82
Bromochloromethane	%Rec.	104.16	105.02	104.32	105.68
	%RSD	3.71	4.68	4.37	3.66
1,1,1-Trichloroethane	%Rec.	102.00	102.79	102.64	103.41
	%RSD	4.54	4.90	4.89	4.07
1,1-Dichloropropene	%Rec.	100.87	102.07	101.93	102.25
	%RSD	4.16	4.65	4.77	3.81
Carbon Tetrachloride	%Rec.	100.56	101.56	101.44	102.06
	%RSD	4.46	4.69	4.84	3.98
1,2-Dichloroethane	%Rec.	103.31	103.37	102.94	104.87
	%RSD	4.62	5.14	4.57	4.74
Benzene	%Rec.	102.14	103.23	102.56	102.78
	%RSD	1.89	3.24	3.17	2.51
1,2-Dichloropropane	%Rec.	102.56	103.33	102.47	103.18
	%RSD	2.02	3.28	3.00	2.69
Trichloroethene	%Rec.	101.26	102.56	101.73	102.15
	%RSD	2.00	2.93	3.10	2.72
Bromodichloromethane	%Rec.	102.65	103.21	102.67	103.77
	%RSD	2.00	3.20	2.83	2.84
Dibromomethane	%Rec.	102.75	103.57	102.95	104.23
	%RSD	3.12	3.39	3.63	3.65
cis-1,3-Dichloropropene	%Rec.	100.46	99.83	99.98	100.98
	%RSD	2.63	3.56	3.36	3.40
Toluene	%Rec.	101.68	102.69	101.97	102.26
	%RSD	2.09	3.03	2.89	2.89
trans-1,3-Dichloropropene	%Rec.	100.55	99.71	99.75	100.77
	%RSD	3.18	3.80	3.64	3.80
1,1,2-Trichloroethane	%Rec.	102.25	103.00	102.35	103.14
	%RSD	3.17	3.35	3.52	3.79
1,3-Dichloropropane	%Rec.	101.23	102.20	101.55	101.78
	%RSD	3.03	3.63	3.38	3.46
Tetrachloroethene	%Rec.	98.67	99.48	99.34	98.75
	%RSD	2.15	2.57	2.95	3.18
Dibromochloromethane	%Rec.	101.60	102.77	102.12	102.07
	%RSD	2.54	3.28	3.00	3.14



METHOD STATEMENT



Determinand		Groundwater	Surface Water	Final Effluent	Landfill Leachate
1,2-Dibromoethane	%Rec.	101.43	102.40	101.82	101.91
	%RSD	3.57	4.15	3.94	4.00
Chlorobenzene	%Rec.	100.88	102.02	101.32	101.10
	%RSD	1.92	2.73	2.39	2.77
1,1,1,2-Tetrachloroethane	%Rec.	101.60	102.84	102.01	101.77
	%RSD	2.70	2.62	2.76	2.16
Ethyl Benzene	%Rec.	100.20	101.56	100.95	100.70
	%RSD	1.99	2.67	2.60	2.81
m,p-Xylene	%Rec.	99.97	101.36	100.68	100.36
	%RSD	2.08	2.75	2.58	2.85
o-Xylene	%Rec.	100.38	101.94	101.11	100.86
	%RSD	2.27	2.73	2.33	2.74
Styrene	%Rec.	99.99	102.09	101.09	100.23
	%RSD	2.22	2.64	2.30	2.87
Bromoform	%Rec.	100.67	101.57	101.08	100.84
	%RSD	5.41	5.28	5.07	5.70
Isopropylbenzene	%Rec.	99.39	101.06	100.33	99.83
	%RSD	2.23	2.54	2.40	3.03
1,1,2,2-Tetrachloroethane	%Rec.	100.63	100.85	100.61	101.11
	%RSD	7.31	6.65	7.07	7.65
1,2,3-Trichloropropane	%Rec.	100.72	101.10	100.54	101.10
	%RSD	7.12	6.76	6.89	7.44
n-Propylbenzene	%Rec.	98.55	99.94	99.37	98.95
	%RSD	2.47	2.70	2.49	3.09
Bromobenzene	%Rec.	100.44	102.21	101.18	100.87
	%RSD	2.74	2.75	2.42	2.99
2-Chlorotoluene	%Rec.	99.36	101.06	100.24	99.79
	%RSD	2.30	2.77	2.51	3.03
1,3,5-Trimethylbenzene	%Rec.	98.97	100.79	99.98	99.40
	%RSD	2.45	2.66	2.42	3.16
4-Chlorotoluene	%Rec.	99.35	100.78	99.95	99.66
	%RSD	2.70	2.89	2.39	3.05
tert-Butylbenzene	%Rec.	98.67	100.84	100.08	99.30
	%RSD	2.63	2.46	2.39	3.05
1,2,4-Trimethylbenzene	%Rec.	99.15	100.78	100.08	99.46
	%RSD	2.44	2.70	2.48	3.08
sec-Butylbenzene	%Rec.	97.56	99.36	98.78	98.00
	%RSD	2.64	2.54	2.65	3.32
p-Isopropyltoluene	%Rec.	97.65	99.34	98.70	97.89
	%RSD	2.72	2.55	2.53	3.29
1,3-Dichlorobenzene	%Rec.	99.28	100.95	99.94	99.47
	%RSD	2.85	2.77	2.44	3.14
1,4-Dichlorobenzene	%Rec.	99.08	100.90	99.91	99.31
	%RSD	3.04	2.67	2.41	3.40
n-Butylbenzene	%Rec.	95.85	96.73	96.34	95.75
	%RSD	3.30	2.93	3.28	4.20
1,2-Dichlorobenzene	%Rec.	99.32	101.23	100.20	99.73
	%RSD	3.62	2.96	2.69	4.03
1,2-Dibromo-3-chloropropane	%Rec.	99.77	97.83	98.08	101.37
	%RSD	12.45	10.54	11.54	12.89
1,2,4-Trichlorobenzene	%Rec.	94.09	94.49	94.22	94.72
	%RSD	8.23	5.74	6.19	8.57
Hexachlorobutadiene	%Rec.	90.52	92.71	91.73	89.58
	%RSD	8.69	4.05	6.03	8.93
Naphthalene	%Rec.	97.13	93.75	94.53	99.57
	%RSD	12.20	10.47	11.73	13.13
1,2,3-Trichlorobenzene	%Rec.	93.09	91.48	91.69	94.86
	%RSD	11.77	9.56	10.24	11.83



METHOD STATEMENT

Uncertainty of Measurement

The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2, which gives a level of confidence of approximately 95%.

Determinand	Uncertainty of Measurement (%)
Dichlorodifluoromethane	44.89
Chloromethane	20.34
Vinyl Chloride	16.63
Chloroethane	15.04
Bromomethane	22.36
Trichlorofluoromethane	18.26
1,1,-Dichloroethene	13.12
Dichloromethane	13.78
MTBE	16.35
trans-1,2-Dichloroethene	13.20
1,1-Dichloroethane	14.28
cis-1,2-Dichloroethene	13.99
2,2-Dichloropropane	43.24
Chloroform	14.46
Bromochloromethane	14.22
1,1,1-Trichloroethane	13.58
1,1-Dichloropropene	12.14
Carbon Tetrachloride	12.30
1,2-Dichloroethane	14.27
Benzene	9.13
1,2-Dichloropropane	9.51
Trichloroethene	8.16
Bromodichloromethane	9.69
Dibromomethane	10.31
cis-1,3-Dichloropropene	8.54
Toluene	8.46
trans-1,3-Dichloropropene	8.70
1,1,2-Trichloroethane	9.35
1,3-Dichloropropane	9.65
Tetrachloroethene	6.51
Dibromochloromethane	8.43
1,2-Dibromoethane	9.52
Chlorobenzene	6.51
1,1,1,2-Tetrachloroethane	7.72
Ethyl Benzene	6.52
m,p-Xylene	7.38
o-Xylene	7.59
Styrene	7.39
Bromoform	11.55
Isopropylbenzene	7.10
1,1,2,2-Tetrachloroethane	15.18
1,2,3-Trichloropropane	14.67
n-Propylbenzene	7.66
Bromobenzene	8.10
2-Chlorotoluene	7.24
1,3,5-Trimethylbenzene	7.24
4-Chlorotoluene	7.31
tert-Butylbenzene	7.56
1,2,4-Trimethylbenzene	7.19
sec-Butylbenzene	7.99
p-Isopropyltoluene	8.07
1,3-Dichlorobenzene	7.54
1,4-Dichlorobenzene	7.19
n-Butylbenzene	12.14
1,2-Dichlorobenzene	7.86
1,2-Dibromo-3-chloropropane	23.64
1,2,4-Trichlorobenzene	20.12
Hexachlorobutadiene	21.11
Naphthalene	30.23
1,2,3-Trichlorobenzene	25.97

