

METHOD STATEMENT

Determinand:

Polynuclear Aromatic Hydrocarbons (PAH)

Matrix:

Raw waters, effluents and leachates

Principle of Method:

Polynuclear Aromatic Hydrocarbons (PAH) are extracted from aqueous solution using n-Pentane and quantified by gas chromatography with mass spectrometric detection (GC-MS).

Sampling and Sample Preparation:

250ml glass bottles should be used fitted with PTFE lined screw caps.

Samples should be stored between 5 ± 3°C.

Samples are stable for 7 days (In-House Data) from sampling.

Interferences:

Any co-extracted substance with a corresponding GC retention time, and with the same ions as those being monitored, may interfere.

Performance of Method:

Determinand	CAS Number	Range of Application ng/l	LOD ng/l	Low Standard		High Standard	
				% RSD	% Bias	% RSD	% Bias
Naphthalene	91-20-3	6 - 2500	5.797	4.37	2.20	4.37	2.20
Acenaphthylene	208-96-8	6 - 2500	5.450	4.68	2.60	4.68	2.60
Acenaphthene	83-32-9	7 - 2500	6.660	5.78	2.00	5.78	2.00
Fluorene	86-73-7	3.0 - 2500	2.933	8.81	2.20	8.81	2.20
Phenanthrene	85-01-8	9 - 2500	8.404	5.36	2.70	5.36	2.70
Anthracene	120-12-7	8 - 2500	7.030	6.26	4.00	6.26	4.00
Fluoranthene	206-44-0	6 - 2500	5.104	6.41	2.10	6.41	2.10
Pyrene	129-00-0	4.7 - 2500	4.681	4.12	0.30	4.12	0.30
Benzo(a)anthracene	56-55-3	4.0 - 2500	3.966	6.12	11.20	6.12	11.20
Chrysene	218-01-9	5.0 - 2500	4.970	8.91	4.20	8.91	4.20
Benzo(b)fluoranthene	205-99-2	8 - 2500	7.941	7.81	2.20	7.81	2.20
Benzo(k)fluoranthene	207-08-9	9 - 2500	8.567	6.03	1.70	6.03	1.70
Benzo(a)pyrene	50-32-8	7 - 2500	6.556	8.33	0.50	8.33	0.50
Indeno(123cd)pyrene	193-39-5	7 – 500	6.022	9.18	0.50	9.18	0.50
Dibenzo(ah)anthracene	53-70-3	9 – 500	8.335	8.28	0.90	8.28	0.90
Benzo(ghi)perylene	191-24-2	3.9 – 500	3.873	6.35	2.10	6.35	2.10



METHOD STATEMENT



20% Low Spiked samples

Determinand	Finham FE		Trade		Wolston FE		Groundwater	
	% RSD	% Bias	% RSD	% Bias	% RSD	% Bias	% RSD	% Bias
Naphthalene	3.75	-4.40	17.13	-6.00	3.57	-2.90	3.60	-4.70
Acenaphthylene	4.60	-1.70	5.04	-1.00	4.26	-5.30	3.38	-1.10
Acenaphthene	7.98	-4.80	8.58	-4.20	9.28	-10.30	8.23	-4.10
Fluorene	10.19	-3.50	10.64	-0.60	11.30	-9.50	9.57	-3.30
Phenanthrene	4.18	-0.90	5.23	-0.60	4.97	-8.80	3.88	-1.10
Anthracene	3.79	0.50	6.42	2.60	7.11	-5.80	3.82	0.50
Fluoranthene	4.18	-0.10	5.63	-0.30	6.11	-5.20	4.38	-1.20
Pyrene	4.11	-1.40	4.87	-1.40	6.10	-4.90	4.29	-1.30
Benzo(a)anthracene	5.20	5.90	9.60	10.20	7.27	-2.40	4.42	6.40
Chrysene	7.83	0.50	9.91	3.30	7.44	-7.10	4.47	0.00
Benzo(b)fluoranthene	9.63	-6.60	8.83	-4.00	14.66	-4.50	8.14	-5.90
Benzo(k)fluoranthene	8.47	-8.90	7.15	-6.70	14.46	-8.40	6.99	-7.30
Benzo(a)pyrene	11.84	-9.70	8.41	-3.80	13.73	-9.90	9.79	-8.00
Indeno(123cd)pyrene	6.04	-4.20	10.58	-0.30	5.12	-6.30	6.42	-7.80
Dibenzo(ah)anthracene	6.05	-15.00	7.51	-12.70	7.83	-16.00	5.54	-10.30
Benzo(ghi)perylene	6.32	-6.10	6.48	-4.70	5.31	-9.50	6.01	-4.80

Determinand	Landfill Leachate		Soil Leachate		Surface Water	
	% RSD	% Bias	% RSD	% Bias	% RSD	% Bias
Naphthalene	5.89	-6.10	3.82	-7.20	3.05	-5.40
Acenaphthylene	4.88	-2.30	3.01	-5.60	3.22	-2.90
Acenaphthene	9.97	-0.60	3.95	-7.80	3.22	-2.90
Fluorene	10.21	-1.20	3.95	-8.80	3.22	-2.90
Phenanthrene	5.18	-1.40	2.97	-3.90	3.22	-2.90
Anthracene	4.28	1.80	4.73	-3.80	3.22	-2.90
Fluoranthene	7.30	-0.70	3.16	-6.50	3.22	-2.90
Pyrene	7.28	-1.40	3.57	-5.20	3.22	-2.90
Benzo(a)anthracene	7.78	4.00	5.32	1.10	3.22	-2.90
Chrysene	9.28	-1.00	4.26	-10.80	3.22	-2.90
Benzo(b)fluoranthene	7.76	-9.30	6.47	-2.30	3.22	-2.90
Benzo(k)fluoranthene	6.72	-11.70	7.29	-9.30	3.22	-2.90
Benzo(a)pyrene	11.58	-9.10	8.33	-12.50	3.22	-2.90
Indeno(123cd)pyrene	6.65	-6.90	7.11	-8.00	3.22	-2.90
Dibenzo(ah)anthracene	3.74	-12.10	4.03	-5.30	3.22	-2.90
Benzo(ghi)perylene	5.86	-5.30	4.12	-4.60	3.22	-2.90



METHOD STATEMENT



80% High Spiked samples

Determinand	Finham FE		Trade		Wolston FE		Groundwater	
	% RSD	% Bias	% RSD	% Bias	% RSD	% Bias	% RSD	% Bias
Naphthalene	3.59	5.40	4.72	6.40	3.58	-4.50	3.14	6.70
Acenaphthylene	3.84	5.80	4.95	6.90	4.18	-5.90	3.69	6.60
Acenaphthene	6.93	11.50	7.51	13.40	7.73	-8.60	6.27	11.80
Fluorene	7.29	10.50	8.63	12.40	9.15	-6.90	7.35	12.80
Phenanthrene	2.97	6.60	3.12	7.20	4.85	-6.20	3.17	6.80
Anthracene	3.76	4.00	4.01	4.80	4.81	-6.70	4.48	5.70
Fluoranthene	2.90	7.90	3.42	8.50	3.76	-3.30	3.14	8.20
Pyrene	2.42	6.50	2.29	5.90	4.33	-3.90	2.50	6.20
Benzo(a)anthracene	7.03	11.40	7.21	13.90	5.05	-7.00	6.78	13.80
Chrysene	7.76	10.40	7.75	12.40	6.53	-6.80	6.30	14.50
Benzo(b)fluoranthene	6.98	0.80	4.50	7.60	6.38	-4.50	7.39	0.70
Benzo(k)fluoranthene	4.72	0.90	6.73	7.80	7.28	-9.00	7.33	5.80
Benzo(a)pyrene	8.89	-3.50	4.31	5.50	6.33	-12.00	8.97	0.50
Indeno(123cd)pyrene	4.87	4.30	7.23	7.50	3.54	-4.40	8.57	2.00
Dibenzo(ah)anthracene	5.61	-11.90	6.81	-6.50	5.48	-14.60	8.70	-3.60
Benzo(ghi)perylene	4.07	2.40	2.61	6.10	4.65	-9.40	3.62	5.70

Determinand	Landfill Leachate		Soil Leachate		Surface Water	
	% RSD	% Bias	% RSD	% Bias	% RSD	% Bias
Naphthalene	3.79	5.80	5.96	-1.30	3.91	5.10
Acenaphthylene	4.03	5.10	3.65	-0.80	4.37	5.70
Acenaphthene	8.31	12.30	3.20	-3.70	4.37	5.70
Fluorene	6.61	8.10	4.27	-5.10	4.37	5.70
Phenanthrene	3.58	5.90	3.32	-2.00	4.37	5.70
Anthracene	5.34	6.00	4.24	-1.20	4.37	5.70
Fluoranthene	4.51	7.70	3.28	-3.90	4.37	5.70
Pyrene	2.97	6.00	3.41	-3.00	4.37	5.70
Benzo(a)anthracene	10.18	10.20	2.52	0.60	4.37	5.70
Chrysene	10.05	8.40	3.89	-6.20	4.37	5.70
Benzo(b)fluoranthene	7.49	-1.60	5.60	0.20	4.37	5.70
Benzo(k)fluoranthene	6.92	-2.60	4.42	-3.70	4.37	5.70
Benzo(a)pyrene	8.35	-3.70	9.15	-6.70	4.37	5.70
Indeno(123cd)pyrene	5.95	-0.10	7.17	2.80	4.37	5.70
Dibenzo(ah)anthracene	6.07	-9.00	5.35	4.20	4.37	5.70
Benzo(ghi)perylene	5.44	3.00	5.74	1.70	4.37	5.70



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 %
Naphthalene	19.43
Acenaphthylene	17.32
Acenaphthene	25.19
Fluorene	25.63
Phenanthrene	19.03
Anthracene	18.45
Fluoranthene	17.26
Pyrene	18.27
Benzo(a) Anthracene	29.79
Chrysene	23.92
Benzo(b) Fluoranthene	27.09
Benzo(k) Fluoranthene	30.00
Benzo(a)pyrene	31.29
Indeno(1,2,3)c-d pyrene	19.11
Dibenzo(a,h)anthracene	31.26
Benzo(g,h,i)perylene	19.35

References:

Methods for the Examination of Waters and Associated Materials. The determination of 6 Specific Polynuclear Aromatic Hydrocarbons in waters (with notes on the determination of other PAH) 1986, HMSO, London. ISBN.0117520322.

