WAGENINGEN EVALUATING PROGRAMS

FOR ANALYTICAL LABORATORIES

Certificate of Analysis

International Sediment Exchange for Tests on Organic Contaminants

REFERENCE MATERIAL

SETOC sample 696

WAGENINGEN
UNIVERSITY & RESEARCH

Certificate of Analysis SETOC 696

General Information

In this report an overview is given of analytical data for this sample collected in our proficiency testing program. The consensus values are calculated using a robust statistical model. With this NDA model, the mean and standard deviation are calculated using all reported data when at least 4 results are left after removal of reported 'lower than' (<) and 0 (= zero) values. No outliers are removed.

This report is divided into two sections: Consensus Values and Indicative Values. The division is made on the reliability of the data. Consensus Values are based on at least 8 results and a maximum relative uncertainty of 6.25%. Indicative Values are based on a maximum relative uncertainty of 35% and a minimum of 4 and maximum of 7 results, or a relative uncertainty greater than 6.25% when there are at least 8 results.

For each determinand the following parameters are given: mean, standard deviation, coefficient of variation, number of results, median, MAD (Median of Absolute Deviation), the uncertainty of the mean (consensus or indicative) value and the relative uncertainty.

Please note: Most WEPAL-QUASIMEME reference materials are found to be stable over the long term (>10 years) for most determinand/matrix combinations. There are a few exceptions known to us as being less stable over the long term. These are organotins in sediment (MS6), ASP in shellfish (BT7), some PAHs and PCBs in sediment (SETOC) and N-NH_4 (as N) in clay soils (ISE).

All values, expressed on a weight basis (kg or %), are reported as oven-dried (105°C) material. Moisture is reported in the material as received.

Sample information

WEPAL reference materials are from natural sources only. There is no spiking, mixing or other alterations of the samples. For sample preparation, the SETOC samples are dried at 40°C and milled to pass a 0.5 mm sieve.

This SETOC sample 696 of Sediment, from Netherlands, is prepared for the WEPAL proficiency programs. The sample has been used in 5 periods (or rounds). The results on which the values in this report are based were taken from the periods given in the following table:

Year	Round	Number
2026	1	1
2023	4	4
2021	2	3
2018	3	3
2016	2	2

Consensus Values SETOC 696

Method: Polycyclic aromatic hydrocarbons

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
naphthalene	µg/kg	343	151	44.1	146	342	104	15.7	4.56
acenaphthylene	µg/kg	84.5	34.0	40.3	112	87.6	21.9	4.02	4.76
acenaphthene	µg/kg	94.2	29.5	31.4	124	92.5	18.8	3.32	3.52
fluorene	µg/kg	136	48.1	35.3	125	136	32.8	5.38	3.95
phenanthrene	µg/kg	1072	182	17.0	149	1067	114	18.6	1.74
anthracene	µg/kg	382	81.8	21.4	148	384	53.8	8.41	2.20
fluoranthene	µg/kg	1878	259	13.8	148	1876	172	26.6	1.42
pyrene	µg/kg	1291	199	15.4	126	1291	127	22.1	1.71
chrysene	µg/kg	957	187	19.5	148	961	110	19.2	2.00
benz(a)anthracene	µg/kg	786	146	18.6	149	798	91.9	15.0	1.91
benzo(b)fluoranthene	µg/kg	1010	262	25.9	119	1000	160	30.0	2.97
benzo(k)fluoranthene	µg/kg	480	88.8	18.5	146	486	65.6	9.19	1.92
benzo(a)pyrene	µg/kg	672	118	17.6	149	675	74.8	12.1	1.81
dibenz(ah)anthracene	µg/kg	153	28.7	18.8	124	154	18.3	3.22	2.11
indeno(1,2,3-cd)pyrene	µg/kg	577	118	20.4	146	582	78.5	12.2	2.11
benzo(ghi)perylene	µg/kg	565	99.9	17.7	149	566	62.2	10.2	1.81
EPA ∑PAH(16)	µg/kg	10737	1725	16.1	85	10800	1116	234	2.18

Method: Polychlorobiphenyls

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
PCB 028	µg/kg	46.1	13.2	28.7	127	46.0	8.55	1.47	3.18
PCB 052	µg/kg	72.2	14.1	19.6	132	73.3	9.09	1.54	2.13
PCB 101	µg/kg	101	18.0	17.9	131	99.6	11.6	1.97	1.96
PCB 105	µg/kg	18.8	2.23	11.9	26	18.9	1.36	0.546	2.91
PCB 118	µg/kg	73.3	10.8	14.7	127	73.1	6.37	1.19	1.63
PCB 128	µg/kg	10.3	1.23	12.0	18	10.4	0.648	0.363	3.53
PCB 138	µg/kg	65.5	15.8	24.1	129	64.0	9.80	1.74	2.65
PCB 149	µg/kg	64.2	9.58	14.9	13	62.0	8.10	3.32	5.17
PCB 153	µg/kg	78.1	12.6	16.1	131	77.8	7.80	1.37	1.76
PCB 156	µg/kg	5.30	0.905	17.1	23	5.39	0.615	0.236	4.45
PCB 180	µg/kg	23.1	4.52	19.6	129	22.8	3.02	0.498	2.15
PCB 167	µg/kg	2.41	0.443	18.4	18	2.40	0.297	0.130	5.42
∑PCB(7)	µg/kg	467	72.7	15.6	61	469	42.6	11.6	2.50

Consensus Values SETOC 696

Method: Organochlorine pesticides

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
hexachlorobenzene	µg/kg	10.1	1.89	18.7	44	10.1	1.08	0.356	3.52
pentachlorobenzene	µg/kg	4.26	0.831	19.5	29	4.27	0.520	0.193	4.53
p,p`-DDE	µg/kg	4.42	0.831	18.8	35	4.33	0.476	0.176	3.97

Method: Other parameters

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Mineral oil, GC	mg/kg	366	79.1	21.6	110	360	50.0	9.43	2.58
Organic carbon	g/kg	36.2	3.00	8.3	65	36.0	1.70	0.466	1.29
CN - Total	mg/kg	5.90	0.962	16.3	39	5.78	0.576	0.193	3.27

Method: Metals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
As	mg/kg	23.2	2.11	9.1	65	22.9	1.25	0.327	1.41
Cd	mg/kg	3.43	0.277	8.1	66	3.42	0.181	0.043	1.24
Cr	mg/kg	122	14.8	12.1	67	123	10.5	2.26	1.85
Cu	mg/kg	83.1	7.06	8.5	68	82.7	4.85	1.07	1.29
Hg	mg/kg	1.80	0.178	9.9	66	1.81	0.100	0.027	1.52
Ni	mg/kg	44.0	4.56	10.4	68	44.5	3.51	0.692	1.57
Pb	mg/kg	128	11.8	9.2	67	128	6.00	1.80	1.41
Zn	mg/kg	516	40.7	7.9	68	520	23.5	6.17	1.20
Ba	mg/kg	433	29.1	6.7	48	437	16.2	5.25	1.21
Co	mg/kg	13.2	1.00	7.6	56	13.1	0.650	0.168	1.27
Mo	mg/kg	2.56	0.311	12.2	44	2.59	0.232	0.059	2.29
Sb	mg/kg	1.81	0.146	8.1	8	1.82	0.090	0.065	3.57
Sn	mg/kg	9.50	0.897	9.4	9	9.44	0.631	0.374	3.94

Method: Dibenzo-P Dioxin

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
1,2,3,7,8 Cl5DD	ng/kg	2.32	0.290	12.5	8	2.40	0.194	0.128	5.51

Method: Dibenzofuran

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
2,3,4,7,8 Cl5DF	ng/kg	16.3	1.68	10.3	9	16.1	0.930	0.701	4.29
1,2,3,4,7,8 Cl6DF	ng/kg	72.4	6.93	9.6	9	73.5	4.90	2.89	3.99
1,2,3,6,7,8 Cl6DF	ng/kg	28.5	1.18	4.1	9	28.8	0.780	0.491	1.72
1,2,3,4,7,8,9 Cl7DF	ng/kg	43.0	5.27	12.3	9	45.0	3.00	2.20	5.11
Cl8DF	ng/kg	1733	227	13.1	9	1741	126	94.5	5.45

Indicative Values SETOC 696

Method: Polycyclic aromatic hydrocarbons

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
VROM∑PAH10	µg/kg	7123	938	13.2	5	7381	567	525	7.37

Method: Polychlorobiphenyls

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
PCB 031	µg/kg	35.5	13.4	37.8	13	33.0	6.70	4.65	13.1
PCB 077	µg/kg	2.74	0.925	33.7	19	2.95	0.660	0.265	9.67
PCB 081	µg/kg	0.076	0.103	135.9	9	0.108	0.062	0.043	56.6
PCB 114	µg/kg	1.05	0.503	47.9	12	1.48	0.290	0.182	17.3
PCB 123	µg/kg	4.82	3.01	62.5	17	6.27	1.73	0.914	18.9
PCB 126	µg/kg	0.079	0.052	65.7	9	0.099	0.036	0.022	27.4
PCB 157	µg/kg	0.957	0.311	32.4	14	1.00	0.164	0.104	10.8
PCB 189	µg/kg	0.518	0.094	18.1	9	0.533	0.035	0.039	7.55

Method: Organochlorine pesticides

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
hexachlorobutadiene	µg/kg	2.75	0.943	34.3	32	2.73	0.722	0.208	7.57
1,2,3 trichlorobenzene	µg/kg	3.30	1.16	35.2	17	3.20	0.570	0.352	10.7
1,2,3,4 tetrachlorobenzene	µg/kg	2.88	0.700	24.3	19	2.95	0.536	0.201	6.97
1,2,4 trichlorobenzene	µg/kg	56.8	26.8	47.2	20	60.2	18.3	7.49	13.2
1,3,5 trichlorobenzene	µg/kg	37.0	12.0	32.4	21	37.2	9.88	3.27	8.82
alpha-HCH	µg/kg	0.356	0.311	87.3	10	0.425	0.190	0.123	34.5
beta-HCH	µg/kg	0.777	0.235	30.2	18	0.760	0.187	0.069	8.90
gamma-HCH	µg/kg	0.283	0.243	86.0	11	0.302	0.170	0.092	32.4
dieldrin	µg/kg	2.16	0.593	27.4	19	2.31	0.334	0.170	7.86
alpha-endosulfan	µg/kg	0.532	0.325	61.2	7	0.733	0.210	0.154	28.9
p,p`-DDT	µg/kg	1.61	0.512	31.7	27	1.63	0.353	0.123	7.63
o,p`-DDE	µg/kg	0.665	0.163	24.5	22	0.662	0.089	0.043	6.53
p,p`-DDD	µg/kg	2.36	0.692	29.3	33	2.51	0.493	0.151	6.38
o,p`-DDD	µg/kg	0.933	0.280	30.0	19	1.00	0.166	0.080	8.60
Sum trichlorobenzenes	µg/kg	114	23.0	20.2	6	116	16.3	11.7	10.3
Sum tetrachlorobenzenes	µg/kg	14.8	3.44	23.2	7	14.6	2.10	1.62	11.0
pentachlorophenol	µg/kg	3.60	1.27	35.2	5	3.50	0.649	0.708	19.7

Method: Other parameters

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
EOX	mg/kg	2.27	0.854	37.6	19	2.20	0.431	0.245	10.8
Inorganic carbon	g/kg	16.0	7.38	46.0	13	17.1	4.20	2.56	16.0

(cont.)

Method: Other parameters Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Particles < 2 µm	%	16.6	7.80	47.0	16	18.4	4.01	2.44	14.7
Particles < 63 µm	%	59.4	14.5	24.4	17	61.7	9.08	4.39	7.39
Particles > 63 µm	%	28.8	8.38	29.1	12	29.3	6.31	3.02	10.5
CN - Free	mg/kg	0.601	0.181	30.2	5	0.634	0.094	0.101	16.9
Particles < 16 µm	%	27.7	2.09	7.5	4	28.0	1.00	1.31	4.71
Particles < 50 µm	%	56.4	7.55	13.4	4	56.4	4.41	4.72	8.37
Particles < 2000 µm	%	99.6	5.61	5.6	4	99.6	0.405	3.50	3.52

Method: Metals Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
V	mg/kg	44.5	15.4	34.6	8	45.7	8.73	6.80	15.3

Method: Dibenzo-P Dioxin Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
2,3,7,8 Cl4DD	ng/kg	39.5	7.71	19.5	9	37.6	4.19	3.21	8.14
1,2,3,4,7,8 Cl6DD	ng/kg	2.70	0.544	20.2	8	2.68	0.392	0.240	8.92
1,2,3,7,8,9 Cl6DD	ng/kg	4.58	1.03	22.6	9	4.27	0.577	0.431	9.41
1,2,3,6,7,8 Cl6DD	ng/kg	7.09	1.29	18.2	9	7.51	0.914	0.539	7.60
1,2,3,4,6,7,8 Cl7DD	ng/kg	131	42.2	32.1	9	127	23.4	17.6	13.4
Cl8DD	ng/kg	1588	447	28.2	9	1514	160	186	11.7

Method: Dibenzofuran Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
2,3,7,8 Cl4DF	ng/kg	20.7	4.50	21.7	9	21.6	2.46	1.87	9.06
1,2,3,7,8 Cl5DF	ng/kg	18.2	3.24	17.8	9	17.2	1.54	1.35	7.43
1,2,3,7,8,9 Cl6DF	ng/kg	4.24	4.61	108.8	8	7.08	5.21	2.04	48.1
2,3,4,6,7,8 Cl6DF	ng/kg	16.3	3.04	18.7	9	15.8	1.81	1.27	7.78
1,2,3,4,6,7,8 Cl7DF	ng/kg	274	41.8	15.3	9	275	24.4	17.4	6.36

Method: Brominated Flame Retardants Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
BDE 028	ng/kg	436	143	32.8	9	427	68.1	59.5	13.6
BDE 047	ng/kg	3235	2527	78.1	11	3913	1293	953	29.4
BDE 099	ng/kg	3088	3199	103.6	11	3295	1555	1206	39.0
BDE 100	ng/kg	974	624	64.1	9	991	379	260	26.7
BDE 153	ng/kg	724	289	39.8	10	706	152	114	15.7
BDE 154	ng/kg	361	199	55.2	9	416	130	83.1	23.0

Method: Brominated Flame Retardants									(cont.)
Element	**Unit**	**Mean**	**Std.Dev.**	**CV %**	**N**	**Median**	**MAD**	**Uncertainty**	**Rel.Uncert. %**
BDE 209	ng/kg	56801	34491	60.7	6	54202	14025	17601	31.0

Method: Experimental									
Element	**Unit**	**Mean**	**Std.Dev.**	**CV %**	**N**	**Median**	**MAD**	**Uncertainty**	**Rel.Uncert. %**
Tributyl Tin (TBT)	µg/kg	7.95	4.12	51.8	16	8.00	2.70	1.29	16.2
DEHP	µg/kg	1766	656	37.1	10	1681	285	259	14.7