QUASIMEME

Quality assurance of information for marine environmental monitoring

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Certificate of Analysis

Sediment

REFERENCE MATERIAL

Sediment sample 15

WAGENINGEN
UNIVERSITY & RESEARCH

Certificate of Analysis Sediment 15

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 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 10 results while the relative uncertainty is smaller than 6.25%. Indicative Values are based on a relative uncertainty of maximum 35% with at least 4 and less than 10 results or a relative uncertainty higher than 6.25%.

For each determinand the following parameters are given: mean, standard deviation, coefficient of variation, number of results, median, MAD (Median of Absolute Deviation) and the uncertainty in the assigned value. The confidence limits (at 95 % probabilty) are calculated for these determinands.

The results of each determinand is expressed on dried sediment.

Sample information

QUASIMEME reference materials cover a range of natural Marine sediment species from contaminated waters from the North Sea and/or Mediterranean. There is no spiking, mixing or other alterations of the samples. For sample preparation the sediment samples are dried at 40 oC and milled to pass a 0.5 mm sieve.

This Sediment sample 15 of Estuarine sediment from Clyde estuary, Scotland is prepared for the QUASIMEME proficiency programs. The results on which the values in this report are based were taken from the periods given in the following table.

Year.Round	Program	Sample Round Id
2023.2	MS1	QTM144MS
2019.2	MS1	QTM128MS
2016.2	MS3	QPH091MS
2016.1	MS6	QSP056MS
2015.2	MS1	QTM112MS

Consensus Values MS1

Method: Real totals - MS1

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Aluminium-RT	%	6.38	0.957	15.0	43	6.47	0.602	0.182	6.08 - 6.67
Arsenic-RT	mg/kg	18.4	2.26	12.3	41	18.4	1.40	0.44	17.7 - 19.1
Cadmium-RT	µg/kg	1993	274.3	13.8	40	1987	161.9	54.2	1905 - 2080
Chromium-RT	mg/kg	342	28.5	8.4	44	341	20.0	5.4	333 - 350
Copper-RT	mg/kg	189	19.0	10.0	43	189	12.1	3.6	184 - 195
Iron-RT	%	4.98	0.297	6.0	44	5.01	0.176	0.056	4.89 - 5.07
Lead-RT	mg/kg	238	21.0	8.8	43	239	13.0	4.0	231 - 244
Lithium-RT	mg/kg	46.6	6.63	14.2	33	47.4	4.70	1.44	44.3 - 49.0
Manganese-RT	mg/kg	771	57.6	7.5	37	772	36.2	11.8	752 - 791
Mercury-RT	µg/kg	700	62.5	8.9	42	695	42.7	12.0	681 - 720
Nickel-RT	mg/kg	56.1	6.16	11.0	46	56.9	3.45	1.14	54.3 - 57.9
Zinc-RT	mg/kg	678	47.4	7.0	43	668	34.0	9.0	663 - 692
Magnesium-RT	mg/kg	10886	1537.4	14.1	14	10695	904.0	513.6	10000 - 11770
Phosphorus-RT	mg/kg	4686	329.8	7.0	12	4670	195.0	119.0	4479 - 4894
Potassium-RT	mg/kg	13373	1837.3	13.7	11	13009	1424.0	692.5	12150 - 14590
Titanium-RT	mg/kg	5433	634.0	11.7	11	5440	350.0	239.0	5013 - 5854
Barium-RT	mg/kg	506	71.0	14.0	20	518	43.9	19.8	473 - 539
Calcium-RT	g/kg	8.77	1.270	14.5	15	8.94	0.700	0.410	8.07 - 9.47
Vanadium-RT	mg/kg	100	8.8	8.8	29	99.5	5.3	2.0	96.8 - 103.5
Cobalt-RT	mg/kg	20.4	1.87	9.1	25	20.3	0.95	0.47	19.7 - 21.2
Strontium-RT	mg/kg	171	15.9	9.3	19	170	9.0	4.6	163 - 178
Molybdenum-RT	mg/kg	3.90	0.504	12.9	11	3.91	0.320	0.190	3.57 - 4.24
Uranium-RT	mg/kg	2.68	0.229	8.5	11	2.64	0.132	0.086	2.53 - 2.84

Method: Acid extractable (So-called totals) - MS1

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Aluminium-AE	%	3.89	1.102	28.4	43	3.67	0.918	0.210	3.55 - 4.23
Arsenic-AE	mg/kg	17.2	2.29	13.3	59	16.8	1.50	0.37	16.6 - 17.8
Cadmium-AE	µg/kg	1948	202.4	10.4	65	1915	128.5	31.4	1897 - 1998
Chromium-AE	mg/kg	306	25.0	8.2	62	306	15.2	4.0	299 - 312
Copper-AE	mg/kg	185	14.5	7.9	70	185	8.9	2.2	181.2 - 188.1
Iron-AE	%	4.58	0.316	6.9	59	4.59	0.199	0.051	4.50 - 4.66
Lead-AE	mg/kg	233	17.4	7.5	68	231	11.5	2.6	229 - 237
Lithium-AE	mg/kg	40.2	5.42	13.5	29	40.5	4.00	1.26	38.1 - 42.2
Manganese-AE	mg/kg	724	53.9	7.5	61	726	37.8	8.6	710 - 738
Mercury-AE	µg/kg	687	75.4	11.0	62	686	44.0	12.0	668 - 706

Nickel-AE	mg/kg	51.6	4.86	9.4	65	51.9	3.57	0.75	50.3	-	52.8

Method: Acid extractable (So-called totals) - MS1 (cont.)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Zinc-AE	mg/kg	651	43.3	6.6	69	648	24.4	6.5	641	-	661
Magnesium-AE	mg/kg	10138	1499.4	14.8	16	9872	1001.4	468.6	9340	-	10930
Phosphorus-AE	mg/kg	4595	475.1	10.3	15	4590	290.0	153.4	4334	-	4857
Barium-AE	mg/kg	316	50.6	16.0	26	321	35.3	12.4	295	-	336
Calcium-AE	g/kg	7.93	0.952	12.0	13	7.88	0.750	0.330	7.36	-	8.50
Vanadium-AE	mg/kg	72.7	12.15	16.7	36	74.8	7.48	2.53	68.6	-	76.9
Cobalt-AE	mg/kg	18.4	2.16	11.7	30	18.3	1.30	0.49	17.6	-	19.2
Strontium-AE	mg/kg	121	15.0	12.4	15	120	12.0	4.8	113	-	129
Uranium-AE	mg/kg	1.45	0.184	12.7	11	1.46	0.100	0.069	1.33	-	1.57

Method: Carbon - MS1

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
TOC	%	6.42	0.494	7.7	39	6.48	0.371	0.099	6.26	-	6.58

Indicative Values MS1

Method: Real totals - MS1

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Scandium-RT	mg/kg	10.9	0.73	6.7	9	10.9	0.40	0.30	10.3 - 11.4
Sodium-RT	mg/kg	15872	1078.6	6.8	9	15640	449.0	449.4	15060 - 16690
Sulfur-RT	mg/kg	8304	690.2	8.3	7	8110	414.0	326.1	7690 - 8920
Selenium-RT	mg/kg	-	-	-	5	1.95	0.1	-	- - -
Cesium-RT	µg/kg	-	-	-	4	3486	69.0	-	- - -
Thallium-RT	µg/kg	600	105.2	17.5	7	595	68.5	49.7	506 - 694
Rubidium-RT	mg/kg	51.3	14.34	27.9	9	51.0	10.51	5.98	40.5 - 62.2
Cerium-RT	mg/kg	-	-	-	4	65.9	2.5	-	- - -

Method: Acid extractable (So-called totals) - MS1

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Scandium-AE	mg/kg	9.37	1.232	13.1	7	9.61	1.100	0.582	8.27 - 10.5
Sodium-AE	mg/kg	-	-	-	5	8326	986.0	-	- - -
Potassium-AE	mg/kg	7960	1108.3	13.9	6	7793	461.5	565.6	6850 - 9070
Titanium-AE	mg/kg	-	-	-	5	791	481.0	-	- - -
Gallium-AE	µg/kg	-	-	-	5	15891	2109.0	-	- - -
Selenium-AE	mg/kg	1.74	0.376	21.6	13	1.80	0.287	0.130	1.51 - 1.96
Thallium-AE	µg/kg	371	146.7	39.6	10	384	101.0	58.0	267 - 474
Molybdenum-AE	mg/kg	2.92	0.546	18.7	13	2.85	0.250	0.189	2.60 - 3.25

Method: Carbon - MS1

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Inorganic-Carbonate	%	0.200	0.1831	91.3	22	0.251	0.1300	0.0488	0.120 - 0.281

Consensus Values MS3

Method: Polycyclic aromatic hydrocarbons - MS3

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Chrysene + Triphenylene	µg/kg	1171	124.2	10.6	11	1150	52.7	46.8	1088 - 1253
Phenanthrene	µg/kg	1146	202.8	17.7	24	1148	127.5	51.8	1061 - 1232
Pyrene	µg/kg	1713	298.4	17.4	24	1704	191.6	76.1	1588 - 1839
Fluoranthene	µg/kg	2003	498.9	24.9	25	1970	291.0	124.7	1798 - 2209
Benzo[a]anthracene	µg/kg	994	220.5	22.2	24	996	132.2	56.3	901 - 1087
Benzo[a]pyrene	µg/kg	737	182.2	24.7	25	730	155.0	45.6	662 - 812

Method: Carbon - MS3

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
TOC	%	6.11	0.774	12.7	11	6.10	0.694	0.292	5.59 - 6.62

Indicative Values MS3

Method: Polycyclic aromatic hydrocarbons - MS3

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Benzo[e]pyrene	µg/kg	1015	188.8	18.6	12	1007	82.0	68.1	897 - 1134
Indeno[1,2,3-cd]pyrene	µg/kg	909	299.8	33.0	25	872	220.1	74.9	786 - 1033
Benzo[g,h,i]perylene	µg/kg	958	277.6	29.0	26	928	151.6	68.1	846 - 1070
Benzo[b]fluoranthene	µg/kg	1406	505.5	36.0	23	1331	295.0	131.8	1188 - 1624
Naphthalene	µg/kg	295	99.1	33.6	23	314	57.5	25.8	252 - 337
Dibenz[a,h]anthracene	µg/kg	194	67.1	34.5	23	196	34.3	17.5	165 - 223
Benzo[k]fluoranthene	µg/kg	628	156.4	24.9	23	598	83.8	40.8	561 - 696
Anthracene	µg/kg	185	49.4	26.8	25	193	41.0	12.4	164 - 205
Fluorene	µg/kg	97.1	26.18	27.0	23	97.5	19.40	6.82	85.8 - 108
Acenaphthene	µg/kg	111	32.2	29.0	24	112	19.9	8.2	97.5 - 125
Acenaphthylene	µg/kg	47.1	27.54	58.5	21	47.0	14.19	7.51	34.6 - 59.6
Dibenzothiophene	µg/kg	115	28.4	24.7	12	117	14.8	10.2	96.9 - 133
3-6-dimethylphenanthrene	µg/kg	139	62.5	44.9	6	136	37.2	31.9	76.7 - 202
2-methylphenanthrene	µg/kg	352	67.2	19.1	6	353	44.7	34.3	285 - 419
Perylene	µg/kg	274	95.4	34.8	11	275	63.0	36.0	211 - 338
Chrysene	µg/kg	1009	307.2	30.4	16	1021	175.7	96.0	846 - 1172
C1-phenanthr.+anthrac.	µg/kg	1377	479.1	34.8	8	1326	270.3	211.7	987 - 1768
C2-phenanthr.+anthrac.	µg/kg	1973	1008.2	51.1	8	1904	504.5	445.6	1150 - 2790
C3-phenanthr.+anthrac.	µg/kg	1457	665.6	45.7	6	1433	397.0	339.7	793 - 2120
C1-pyrenes+fluoranthenes	µg/kg	-	-	-	5	1258	175.1	-	- - -
C1-chrysenes	µg/kg	-	-	-	4	1136	177.6	-	- - -

Indicative Values MS6

Method: Organometals - MS6

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits
Tributyltin (TBT)	µg Sn/kg	18.5	8.38	45.2	17	19.6	6.14	2.54	14.3 - 22.8
Dibutyltin (DBT)	µg Sn/kg	33.5	8.78	26.2	16	33.4	5.55	2.74	28.8 - 38.1
Monobutyltin (MBT)	µg Sn/kg	125	39.3	31.4	13	133	21.9	13.6	102 - 149