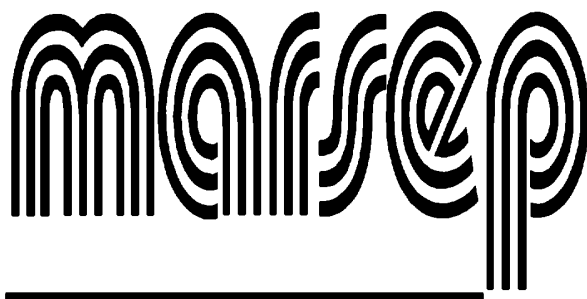




**WAGENINGEN EVALUATING PROGRAMS
FOR ANALYTICAL LABORATORIES**

Certificate of Analysis



International Manure and Refuse Sample Exchange Program

REFERENCE MATERIAL

MARSEP sample 277

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-NH₄ (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 MARSEP samples are dried at 40°C and milled to pass a 0.5 mm sieve.

This MARSEP sample 277 of Sewage sludge, from Switzerland, is prepared for the WEPAL proficiency programs. The sample has been used in 10 periods (or rounds). Only results from the last 5 periods are used. This way, the consensus values reflect the latest 'state of the art' analytical techniques used by the laboratories. The results on which the values in this report are based were taken from the periods given in the following table:

Year	Round	Number
2025	4	3
2022	2	1
2020	4	2
2020	3	1
2020	2	3

Consensus Values MARSEP 277

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Ag	µg/kg	4172	189	4.5	16	4216	99.5	59.2	1.42
Al	g/kg	20.9	1.60	7.7	60	20.8	1.15	0.259	1.24
As	mg/kg	4.73	0.610	12.9	55	4.80	0.390	0.103	2.17
B	mg/kg	36.4	7.60	20.9	43	36.2	5.20	1.45	3.98
Ba	mg/kg	327	39.2	12.0	28	325	24.8	9.27	2.84
Be	µg/kg	235	34.7	14.8	23	222	19.0	9.05	3.86
Ca	g/kg	47.7	2.47	5.2	113	47.5	1.60	0.290	0.609
Cd	mg/kg	0.788	0.079	10.1	108	0.790	0.046	0.010	1.21
Co	mg/kg	4.16	0.490	11.8	97	4.20	0.310	0.062	1.50
Cr	mg/kg	45.0	5.50	12.2	107	45.2	3.00	0.664	1.48
Cu	mg/kg	421	23.0	5.5	116	422	13.4	2.67	0.635
Fe	g/kg	17.7	1.53	8.6	87	17.5	1.00	0.205	1.16
Hg	µg/kg	514	46.7	9.1	93	515	32.0	6.05	1.18
K	g/kg	2.97	0.494	16.6	123	3.00	0.322	0.056	1.87
Mg	g/kg	9.78	0.490	5.0	118	9.76	0.275	0.056	0.576
Mn	mg/kg	421	24.2	5.8	86	419	12.7	3.27	0.776
Mo	mg/kg	6.47	0.562	8.7	92	6.55	0.380	0.073	1.13
Na	g/kg	0.820	0.091	11.0	71	0.819	0.049	0.013	1.64
Ni	mg/kg	33.2	2.88	8.7	109	33.2	1.78	0.345	1.04
N	g/kg	46.0	1.42	3.1	106	46.0	0.900	0.172	0.374
P	g/kg	33.7	1.85	5.5	124	33.6	1.19	0.208	0.618
Pb	mg/kg	48.1	4.05	8.4	108	48.0	2.55	0.487	1.01
Sb	µg/kg	2647	597	22.5	25	2650	358	149	5.63
Se	µg/kg	1862	405	21.8	30	1907	251	92.5	4.97
Sn	mg/kg	23.1	3.48	15.1	22	22.9	2.08	0.927	4.01
Sr	mg/kg	191	14.7	7.7	18	190	9.52	4.34	2.27
V	mg/kg	13.2	2.13	16.1	38	13.3	1.11	0.431	3.25
Zn	mg/kg	717	37.1	5.2	117	714	22.9	4.29	0.598
S	mg/kg	9459	985	10.4	54	9477	614	168	1.77
TC =totalC (org+inorg)	g/kg	307	11.0	3.6	30	308	5.00	2.50	0.814
U	mg/kg	3.03	0.198	6.5	8	3.02	0.135	0.088	2.89

Method: Other determinations

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
AOX	mg/kg	223	11.5	5.2	21	224	6.00	3.13	1.41
loss-on-ignition	%	58.4	0.657	1.1	98	58.4	0.400	0.083	0.142
residue-on-ignition	%	41.2	1.63	3.9	19	41.0	1.20	0.466	1.13

Consensus Values MARSEP 277

Method: Other determinations

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
dry weight	%	90.7	0.804	0.9	42	90.7	0.495	0.155	0.171

(cont.)

Indicative Values MARSEP 277

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Bi	µg/kg	13101	1251	9.5	5	13200	800	699	5.34
Cl	mg/kg	658	192	29.1	4	653	92.1	120	18.2
Li	mg/kg	6.02	1.23	20.4	10	6.26	0.827	0.485	8.06
N - NH4 (as N)	mg/kg	3061	1819	59.4	9	3258	602	758	24.8
S - SO4 (as S)	mg/kg	9381	3265	34.8	10	9212	1562	1291	13.8
Ti	mg/kg	117	33.3	28.5	11	126	19.0	12.6	10.7
Tl	µg/kg	87.2	14.8	17.0	9	86.0	9.31	6.17	7.08
TOC =total org.C	g/kg	285	53.3	18.7	4	281	27.2	33.3	11.7