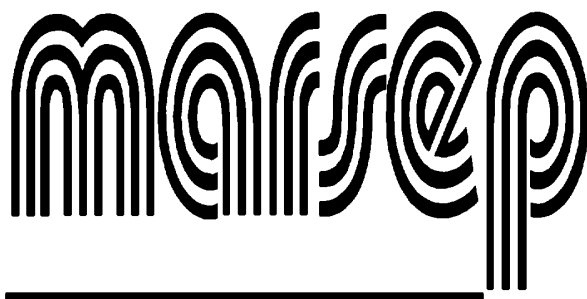




**WAGENINGEN EVALUATING PROGRAMS
FOR ANALYTICAL LABORATORIES**

Certificate of Analysis



International Manure and Refuse Sample Exchange Program

REFERENCE MATERIAL

MARSEP sample 276

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.

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 276 of Sewage sludge, from Switzerland, is prepared for the WEPAL proficiency programs. The sample has been used in 7 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
2024	1	4
2023	1	3
2021	2	1
2019	4	4
2017	4	3

Consensus Values MARSEP 276

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Ag	µg/kg	4037	392	9.7	17	4110	210	119	2.95
Al	g/kg	15.9	1.97	12.4	65	16.0	1.12	0.306	1.93
As	mg/kg	5.91	0.665	11.3	68	5.91	0.450	0.101	1.71
B	mg/kg	43.9	7.90	18.0	52	44.6	5.63	1.37	3.12
Ba	mg/kg	548	52.1	9.5	32	557	44.0	11.5	2.10
Be	µg/kg	257	57.5	22.4	21	257	37.0	15.7	6.10
Bi	µg/kg	9539	1281	13.4	8	9040	850	566	5.94
Ca	g/kg	53.4	3.06	5.7	128	53.3	1.92	0.338	0.633
Cd	mg/kg	1.27	0.120	9.4	129	1.27	0.070	0.013	1.04
Co	mg/kg	11.5	0.894	7.8	111	11.4	0.610	0.106	0.923
Cr	mg/kg	44.2	5.54	12.5	127	44.1	3.37	0.615	1.39
Cu	mg/kg	279	21.2	7.6	137	277	11.6	2.26	0.812
Fe	g/kg	62.8	5.24	8.3	98	62.1	2.71	0.661	1.05
Hg	µg/kg	594	65.2	11.0	107	588	44.0	7.87	1.33
K	g/kg	1.76	0.579	32.9	144	1.78	0.385	0.060	3.43
Li	mg/kg	6.74	1.23	18.3	17	6.57	0.850	0.373	5.54
Mg	g/kg	5.95	0.474	8.0	136	5.96	0.282	0.051	0.854
Mn	mg/kg	505	33.0	6.5	96	504	19.6	4.21	0.833
Mo	mg/kg	6.17	0.581	9.4	107	6.14	0.340	0.070	1.14
Na	g/kg	0.603	0.078	13.0	74	0.604	0.053	0.011	1.89
Ni	mg/kg	29.5	2.48	8.4	126	29.4	1.60	0.276	0.936
N	g/kg	35.8	1.24	3.5	129	35.8	0.800	0.137	0.381
P	g/kg	33.2	1.95	5.9	143	33.0	1.20	0.204	0.615
Pb	mg/kg	51.6	5.34	10.4	126	51.6	3.70	0.595	1.15
Sb	µg/kg	9542	1263	13.2	28	9580	725	298	3.13
Se	µg/kg	1711	290	17.0	27	1700	204	69.8	4.08
Sn	mg/kg	25.7	4.15	16.1	25	25.8	3.19	1.04	4.03
Sr	mg/kg	274	25.8	9.4	21	273	18.0	7.02	2.56
V	mg/kg	22.1	3.13	14.1	46	22.2	1.95	0.577	2.61
Zn	mg/kg	816	56.7	6.9	139	811	36.0	6.01	0.736
S	mg/kg	7892	1039	13.2	55	7808	682	175	2.22
TC =totalC (org+inorg)	g/kg	266	12.7	4.8	34	266	7.38	2.72	1.02
U	mg/kg	3.14	0.345	11.0	11	3.22	0.225	0.130	4.14
TOC =total org.C	g/kg	273	29.6	10.8	8	267	19.5	13.1	4.79

Consensus Values MARSEP 276

Method: Other determinations

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
AOX	mg/kg	200	16.1	8.0	29	200	11.0	3.73	1.86
loss-on-ignition	%	50.2	0.783	1.6	105	50.1	0.450	0.096	0.190
residu-on-ignition	%	49.6	1.37	2.8	17	49.7	0.780	0.416	0.838
dry weight	%	92.4	0.896	1.0	46	92.4	0.525	0.165	0.179

Indicative Values MARSEP 276

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Ga	µg/kg	3547	365	10.3	5	3659	229	204	5.75
N - NH4 (as N)	mg/kg	776	906	116.8	8	832	517	401	51.6
S - SO4 (as S)	mg/kg	8114	514	6.3	5	8022	296	287	3.54
Si	g/kg	56.9	15.3	26.9	6	54.0	8.55	7.79	13.7
Ti	mg/kg	196	195	99.4	13	190	123	67.5	34.4
Tl	µg/kg	97.2	18.7	19.2	12	100	12.8	6.75	6.94