Electronic Supplementary Material (ESI) for Analytical Methods.
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Supplementary Information for

Development and characteristics of a new certified reference material for landfill cover soil analysis with extraction by dilute hydrochloric acid

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Table S1 Mean elemental concentrations and variances of analytical data for four sub-samples in 10 bottles selected randomly from 404 bottles

Bottle serial No.	Al		Cd		Cr		Co		Cu	
	Mean	Variance	Mean	Variance	Mean	Variance	Mean	Variance	Mean	Variance
	%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
9	0.209	1.03	0.225	0.0000401	1.47	0.0147	2.67	0.00981	57.3	6.40
50	0.214	0.521	0.231	0.000351	1.51	0.00768	2.70	0.00485	57.5	2.56
94	0.208	1.88	0.221	0.000210	1.49	0.0177	2.64	0.0106	56.8	3.64
138	0.219	0.205	0.227	0.0000442	1.57	0.000168	2.74	0.000741	57.9	0.480
201	0.212	0.655	0.224	0.0000176	1.52	0.00448	2.68	0.00607	57.9	2.43
212	0.210	0.486	0.224	0.0000104	1.49	0.00131	2.66	0.00811	57.9	1.19
261	0.212	0.952	0.228	0.0000930	1.48	0.00721	2.68	0.00767	57.5	1.92
312	0.210	0.679	0.222	0.0000552	1.53	0.00172	2.64	0.0154	57.4	3.53
330	0.213	0.542	0.222	0.00000362	1.51	0.000338	2.72	0.0177	57.7	0.949
377	0.211	0.924	0.225	0.0000331	1.54	0.00423	2.67	0.0198	57.7	0.951

Bottle serial No.	Pb		Mn		Ni		V		Zn	
	Mean	Variance	Mean	Variance	Mean	Variance	Mean	Variance	Mean	Variance
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
9	33.7	1.09	208	28.4	2.12	0.0638	4.69	0.0638	86.2	5.13
50	33.5	0.696	210	36.0	2.13	0.0514	4.75	0.0242	87.2	4.78
94	32.5	3.30	204	89.0	2.03	0.0137	4.64	0.0801	85.8	15.6
138	34.1	0.0766	211	1.87	2.06	0.0166	4.82	0.00700	87.8	0.237
201	33.4	0.872	207	16.3	2.03	0.0142	4.73	0.0317	87.3	1.69
212	33.4	0.477	205	24.9	2.07	0.0117	4.70	0.0279	86.8	0.829
261	33.0	1.52	208	18.8	2.04	0.00239	4.71	0.0254	87.1	3.53
312	33.6	2.18	203	65.6	2.03	0.0147	4.67	0.0307	86.8	4.97
330	34.0	0.0986	207	55.2	2.10	0.0153	4.74	0.0139	87.7	2.55
377	33.5	1.08	207	119	2.05	0.0212	4.70	0.0381	86.5	4.89

Table S2 ANOVA data for between-bottle homogeneity test

Element	Source of variation	SS	Degrees of freedom	MS	s_{bb}^2 s_r
Al	Between bottles	3.48	9	0.386	-0.100
	Within bottles	23.6	30	0.788	0.00888
	Total	27.1	39		
Cd	Between bottles	0.000303	9	0.0000336	-0.0000137
	Within bottles	0.00257	29	0.0000886	0.00941
	Total	0.00287	38		
Cr	Between bottles	0.0345	9	0.00383	-0.000530
	Within bottles	0.178	30	0.00595	0.0771
	Total	0.213	39		
Co	Between bottles	0.0352	9	0.00391	-0.00154
	Within bottles	0.302	30	0.0101	0.100
	Total	0.337	39		
Cu	Between bottles	4.13	9	0.459	-0.486
	Within bottles	72.1	30	2.40	1.55
	Total	76.3	39		
Pb	Between bottles	7.26	9	0.807	-0.0829
	Within bottles	34.2	30	1.14	1.07
	Total	41.4	39		
Mn	Between bottles	226	9	25.1	-5.10
	Within bottles	30	30	45.5	6.75
	Total	40	39		
Ni	Between bottles	0.0527	9	0.00585	-0.00416
	Within bottles	0.675	30	0.0225	0.150
	Total	0.727	39		
V	Between bottles	0.0895	9	0.00994	-0.00609
	Within bottles	1.03	30	0.0343	0.185
	Total	1.12	39		
Zn	Between bottles	14.3	9	1.59	-0.708
	Within bottles	133	30	4.42	2.10
	Total	147	39		

SS: sum of square (ANOVA), MS: mean square (ANOVA), s_{bb}: between-bottle homogeneity standard deviation, s_r: standard deviation repeatability

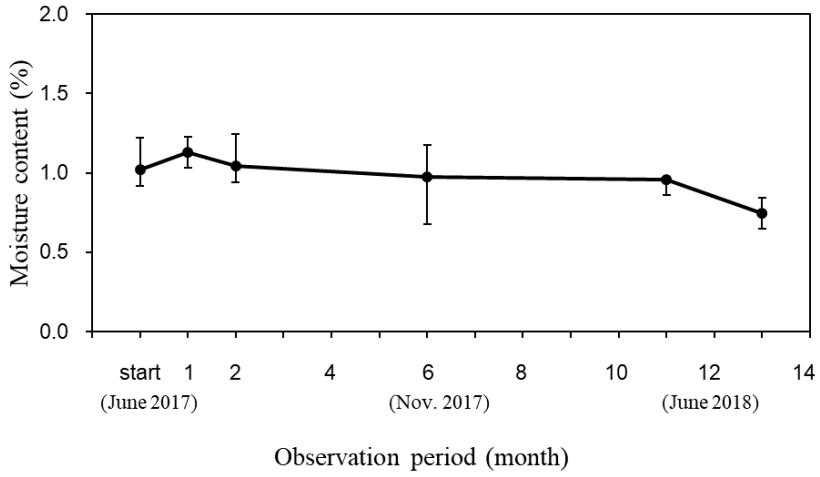

Figure S1 Variation of moisture content depending on the storage period from first opening the bottle. Moisture measurement commenced in June 2017 and then, thereafter. at 1,2, 6, 11 and 13 months. Subsampling (sample size *ca*. 0.5 g) from a single bottle was repeated several times. This bottle was stored in a desiccator, which was kept in the laboratory during the period in question. Typically, the exposure time to the indoor air per was about 5-10 minutes per session for removal of several sub-samples. Each black circular symbol represents the mean value and the upper and lower bars represent the maximum and minimum values, respectively.

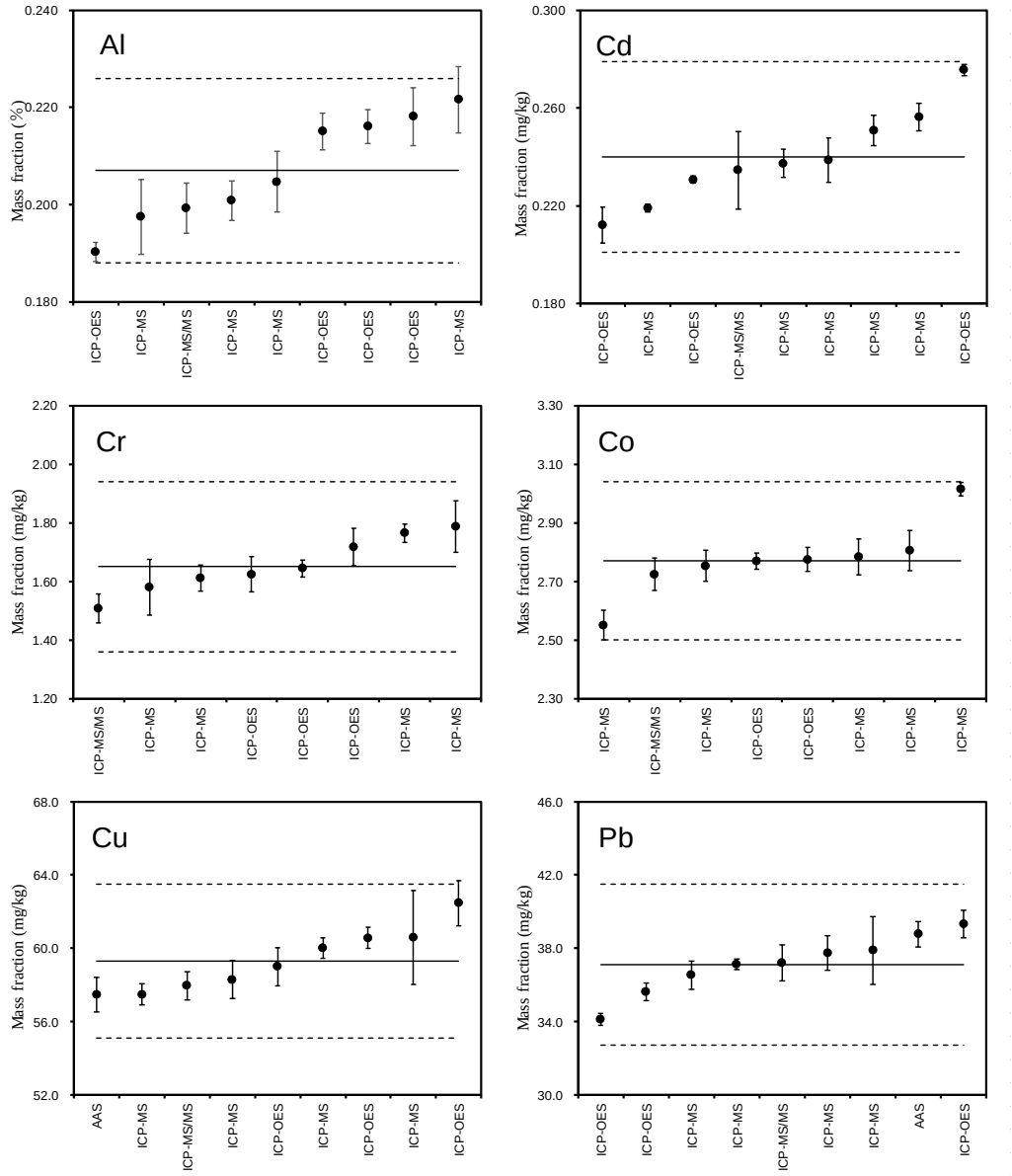

Figure S2 Analytical results for the elements in the CRM by different analytical techniques from the participating laboratories. The vertical bars in the round symbols represent the interval of twice the standard deviation. The full line represents the certified value and the dashed lines represent the interval of expanded uncertainty of the certified value.

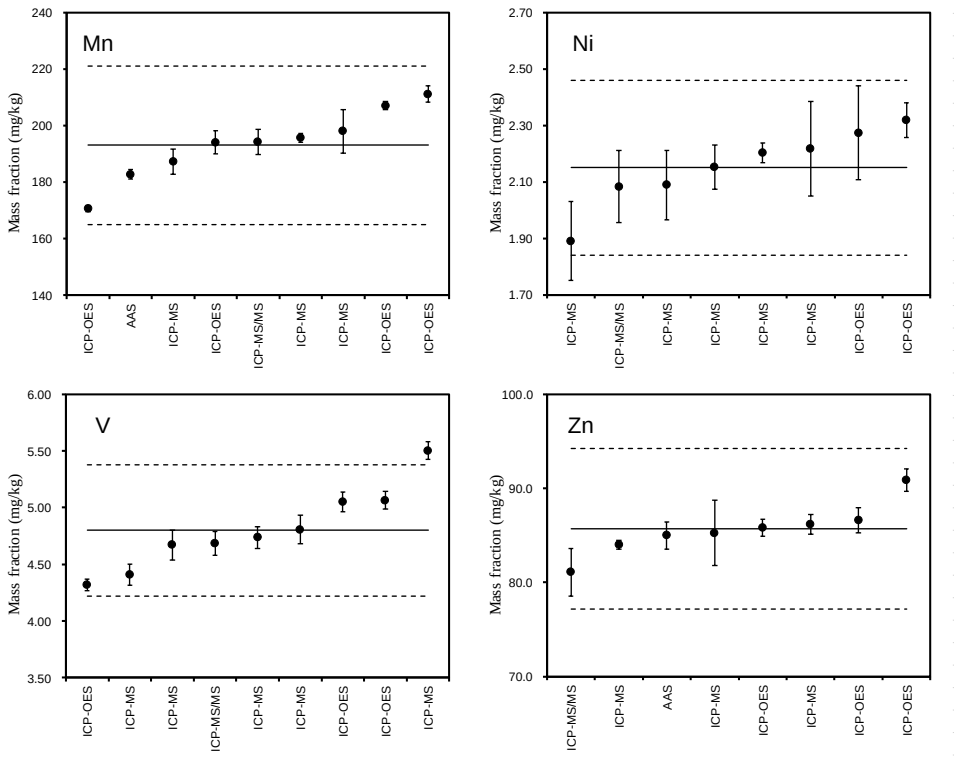

Figure S2 Continued.