Electronic Supplementary Material (ESI) for Environmental Science: Processes & Impacts

Journal Name

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Cite this: DOI: 10.1039/c0xx00000x

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ARTICLE TYPE

Heavy metals and organic compound contamination in soil from an e-waste region in South China

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Received (in XXX, XXX) Xth XXXXXXXXX 20XX, Accepted Xth XXXXXXXXX 20XX

DOI: 10.1039/b000000x

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Table S1 Heavy metal concentrations in soil samples from e-waste recycling activities area

Location	Type of soil or dust	Abbr	n	mg kg^{-1} dry weigh										Ref
				Cu	Cd	Pb	Hg	Zn	Cr	Ni	As	Co	V	
Guiyu, China	Reservoir area	RS	6	29.5-42.7	ND	79.4-93.1		44.2-106	84.1-150	5.47-20.3				[1]
	Rice field	RF	30	29.9-240	ND	56.9-155		7.9-114	81.9-509	3.37-434				[1]
	Area near an open-burning site	NOBS	8	59.4-114	ND	97.8-123		6.01-42.4	70.2-155	4.04-68.7				[1]
	At the open-burning site	OBS	5	1374-14253	5.51-42.9	856-7038		546-5298	137-477	85.2-722				[1]
Guiyu, China	Burnt plastic dump site			496	1.7	104		258	28.6	155				[2]
	Printer roller dump site			712	3.1	190		-	74.9	87.4				[2]
	Reservoir			9.2	ND	55.4		78.0	3.4	8.4				[2]
Guiyu, China	Paddy field near e-waste recycling workshop	S1		48	0.37	93	0.052	90	51	22	6.11			[3]
	Street in residential area	S2		54	0.11	62	0.10	67	12	6.5	7.21			[3]
	Adjacent street near scrap printed circuit board dismantling	S3		8.4	0.16	18	0.097	69	16	9.2	17.01			[3]
	Field of an abandoned workshop	S4		4800	1.21	150	0.21	330	2600	480	26.03			[3]
	Residue from municipal solid waste open burning site	S5		12700	10.02	480	0.19	3500	320	1100	52.10			[3]
	Paddy field near open-burning site	S6		140	1.60	62	0.27	130	48	30	23.09			[3]
	Paddy field near open-burning site	S7		27	0.16	54	0.12	96	42	25	5.02			[3]
	Field closed to storage of e-waste	S8		82	6.01	56	0.26	770	7.20	21	60.03			[3]
	Soils from the banks of a river	S9		66	0.10	32	0.27	230	45	20	22.06			[3]
Taizhou, China	Large-scale e-waste recycling plants	A-G	7	77.9-296.3	1.7-7.4	81.3-177.2	0.2-1.0	210.4-660.8	16.4-269.1	11.7-83.8				[4]
	Large-scale gold recovering plants	H	1	576.7	9.6	184.4	3.2	263.0	91.3	120.4				[4]
	Large-scale gold recovering plants	I	1	272.3	0.6	102.8	0.4	143.8	88.6	107.4				[4]
	Simple household e-waste recycling workshops	J	1	222.5	2.8	200.1	1.7	221.2	125.9	71.0				[4]
		K	1	361.7	7.9	295.2	654.1	437.3	65.9	53.3				[4]
Taizhou, China	Simple household e-waste recycling workshops	L	1	1641.3	12.5	2374.1	9.3	518.7	40.5	68.6				[4]
	Reference site	M	1	32.3	0.04	33.0	ND	157.8	56.5	ND				[4]

Location	Type of soil	Abbr	n	mg kg^{-1} dry weigh										Ref
				Cu	Cd	Pb	Hg	Zn	Cr	Ni	As	Co	V	
Qingyuan, China	Vegetable garden		16	210-450	0.26-1.17	73.3-134		92.4-142	9.66-19	7.04-10.3				[5]
	Paddy field		11	40.1-260	0.04-1.43	48.1-97		62.1-252	10.5-24.1	10.8-66				[5]
	Incineration		11	1500-21400	3.05-46.8	629-7720		682-8970	23.6-122	12.2-132				[5]
	Deserted soil		8	49.9-95.4	0.08-0.39	47.2-60.2		44.5-72.3	3.84-11.1	4.58-19.7				[5]
	Pond area		10	142-12900	0.57-18.3	37.9-7760		123-3800	14-105	18.9-44.9				[5]
Qingyuan, China	The center of the contamination source, Dingan village in Longtang	LT0	1	287.5	1.343	162.5	0.393	174.9	19.84	12.91	9.615	3.637		[6]
	Longtang- Yangshan direction	LY	6	6.10-19.08	0.09-2.56	30.6-45.45	0.05-0.22	29.7-95.8	10.8-40.7	6.76-19.7	6.1-31.2	1.65-12		[6]
	Longtang- Baiyun Mountain	LB	6	9.7-28.9	0.19-0.85	23.1-60.2	0.135-0.33	26.5-63.3	7.2-54.1	4.4-18.9	7.68-16.9	2-7.44		[6]
	Longtang-Zhaoqing direction	LZ	5	13.4-20	0.08-0.25	19-50	0.05-0.18	7.55-50.6	7.26-44.2	3.6-10.3	3.6-104.6	1.2-4.9		[6]
	Longtang-Conghua direction	LC	6	3.2-28.9	0.18-0.23	16.3-86	0.06-0.33	16-32.7	2.8-16.1	2.6-7.3	2.8-9.4	1.8-3.7		[6]
Qingyuan, China	Farmland soils including Paddy field or vegetable garden	FS[a]	27	64.3 (18.7-2903)	0.41 (0.1-3.0)	79.2 (26.7-556)	0.28 (0.08-2.14)	89.8 (35.8-368)	59.1 (27.9-99)	30.9 (9.2-85.9)	10.8 (2.1-65.9)	5.65 (1.7-16.8)	61.7 (19.7-192)	This study
	Dump site	EW1	1	149	0.69	106	0.07	140	79.3	22.4	11.2	5.82	104	This study
	Open burning site	EW2	1	948	2.29	514	0.40	469	61.3	27.3	11.7	6.57	69.3	This study
	From small mountain of soil which within acid leaching workshop, but few people ever visit	EW3	1	47.5	0.23	23.6	0.04	110	91.5	34.3	17.1	6.25	83.2	This study
	Dust from electromotor and water meter dismantling workshop yard	D4	1	16325	61	4808	57.7	5545	333	559	11.9	21	31.5	This study
Dutch standards	Optimum			36	0.8	85		140	100	35				[7]
	Action			190	12	530		720	380	210				[7]
China standards	Grade I			35	0.2	35	0.2	100	90	40				[8]
	Grade II (pH < 6.5)			50	0.3	250	0.3	200	250	40				[8]
	Grade III			400	1.0	500	1.5	500	500	200				[8]

[a] Data was given as median concentration and rang.

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Table S2 Concentration of PCBs (μg kg^{-1}) and comparisons with those in references associated with e-waste

Location	N[a]	soil type	Abbr	N[b]	Total concentration of PCBs(μg kg^{-1})			Ref
					Range	Average	Median	
Qingyuan, China	42	Total PCBs		38	1.2-1958.4	54.1	15.3	Current study
	36	Farmland soils including Paddy field or vegetable garden	FS	38	1.2-608.0	50.1	14.8	
	1	Dump site	EW1	38	135.81	135.81	135.81	
	1	Open burning site	EW2	38	61.58	61.58	61.58	
	1	From small mountain of soil which within acid leaching workshop, but few people ever visit	EW3	38	5.59	5.59	5.59	
	1	Electromotor and air-condition compressor workshop dust	D1	38	151.2	151.2	151.2	
	1	Electromotor, melted aluminum apparatus and chipped wires dismantling workshop dust	D2	38	1958.4	1958.4	1958.4	
	1	Electrical wire and cable dismantling workshop dust	D3	38	1674.68	1674.68	1674.68	
Guiyu, China	49	surface		36	ND-1443	na	na	1
Guiyu, China	12	surface		66	22.7-102	62.4	62.4	2
Southern china	1	surface			739.4	na	na	9
Zhejiang	5	paddy		9	na	42.2	na	10
Taizhou	10	surface		36	11.0-100.0	41	23.5	11
Taizhou	20	agricultural soil		20	11.3-173.2	70.6	na	12
China	52	surface		51	0.14-1.84	0.52	na	13

[a] Number of samples or sampling sites

[b] PCB congener numbers

[na] Not available

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Table S3 Principal component (PC) loading matrix for PBDEs in Farmland soils and E-waste soils

Component	1	2	3	Extraction
	41.73%	26.74%	20.67%	
BDE17	.179	**.844**	.320	.847
BDE28	.083	**.741**	.453	.761
BDE47	.027	**.907**	.344	.942
BDE66	.130	**.644**	.681	.896
BDE85	.749	.114	.189	.610
BDE99	.000	**.819**	.528	.950
BDE100	.050	**.914**	.129	.855
BDE138	.226	.414	**.850**	.944
BDE153	.155	.297	**.919**	.957
BDE154	.616	.599	-.287	.821
BDE183	.152	.288	**.811**	.763
BDE196	**.969**	.051	-.004	.942
BDE197	**.908**	.254	.201	.929
BDE203	**.982**	-.040	-.028	.967
BDE206	**.992**	.023	.072	.989
BDE207	**.966**	.095	.216	.990
BDE208	**.984**	.053	.083	.977
BDE209	**.894**	.103	.305	.903

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

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Table S4 The Spearman correlation between concentrations in soil samples

	Cd	Cu	Hg	Ni	Zn	Pb	Cr	As	Co	V	TriCB	Tetra-CB	Penta-CB	Hexa-CB	Hepta-CB	Octa-CB	Nona-CB	Deca-CB	Tri-BDE	Tetra-BDE	Penta-BDE	Hexa-BDE	Hepta-BDE	Octa-BDE	Nona-BDE
Cu	.809**																								
Hg	.424*	.488**																							
Ni	.266	.367	.436*																						
Zn	.780**	.945**	.426*	.438*																					
Pb	.763**	.873**	.518**	.378*	.863**																				
Cr	.441*	.388*	-.114	.408*	.457*	.418*																			
As	.401*	.195	-.005	.479**	.230	0.251	.687**																		
Co	.325	.222	-.092	.475**	.325	0.29	.551**	.450*																	
V	.369*	.252	-.102	.479**	.293	0.262	.746**	.669**	.777**																
Tri-CB	.654**	.822**	.682**	.470*	.785**	.735**	.241	.121	.160	.227															
Tetra-CB	.634**	.769**	.725**	.423*	.739**	.711**	.140	.021	.054	.123	.963**														
Penta-CB	.617**	.766**	.695**	.363	.733**	.727**	.084	-.025	.038	.086	.936**	.986**													
Hexa-CB	.586**	.755**	.702**	.352	.722**	.721**	.079	-.020	.008	.059	.937**	.977**	.991**												
Hepta-CB	.659**	.812**	.670**	.301	.790**	.761**	.084	-.052	.074	.070	.927**	.952**	.967**	.968**											
Octa-CB	.657**	.872**	.607**	.325	.826**	.786**	.181	.031	.102	.096	.905**	.900**	.900**	.912**	.946**										
Nona-CB	.687**	.891**	.438*	.300	.844**	.760**	.288	.151	.177	.200	.837**	.791**	.787**	.800**	.860**	.928**									
Deca-CB	.684**	.793**	.404*	.080	.684**	.706**	.257	.180	-.048	.100	.726**	.696**	.699**	.736**	.768**	.824**	.844**								
Tri-BDE	.562**	.761**	.186	.215	.738**	.567**	.511**	.206	.215	.438*	.716**	.632**	.616**	.632**	.644**	.690**	.766**	.677**							
Tetra-BDE	.438*	.599**	.297	.317	.590**	.461*	.285	.189	.127	.304	.718**	.726**	.732**	.735**	.665**	.637**	.666**	.524**	.786**						
Penta-BDE	.488**	.652**	.302	.356	.659**	.530**	.315	.209	.200	.342	.789**	.772**	.767**	.769**	.725**	.697**	.743**	.572**	.815**	.972**					
Hexa-BDE	.519**	.714**	.264	.327	.723**	.547**	.451*	.241	.140	.304	.717**	.696**	.691**	.687**	.664**	.691**	.753**	.592**	.800**	.872**	.876**				
Hepta-BDE	.537**	.740**	.198	.171	.698**	.594**	.391*	.046	.063	.185	.684**	.660**	.656**	.643**	.658**	.708**	.770**	.703**	.703**	.639**	.692**	.824**			
Octa-BDE	.517**	.720**	.426*	.393*	.782**	.567**	.273	.080	.034	.110	.737**	.737**	.720**	.702**	.734**	.757**	.694**	.533**	.587**	.519**	.568**	.731**	.664**		

Nona-BDE	.487**	.640**	.396*	.357	.733**	.485**	.255	.100	.040	.105	.603**	.612**	.599**	.579**	.607**	.621**	.569**	.392*	.516**	.453*	.462*	.642**	.466*	.934**	
Deca-BDE	.346	.595**	.373*	.491**	.672**	.471**	.260	.131	.130	.148	.559**	.544**	.515**	.502**	.516**	.590**	.535**	.316	.467*	.407*	.442*	.635**	.450*	.889**	.897**

*. Correlation is significant at the 0.05 level (2-tailed)

**. Correlation is significant at the 0.01 level (2-tailed)

Cite this: DOI: 10.1039/c0xx00000x

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Notes

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† Electronic Supplementary Information (ESI) available: Heavy metal concentrations in soil samples from e-waste recycling activities area (Table S1); Concentration of PCBs (μg kg^{-1}) and comparisons with those in references associated with e-waste (Table S2); Principal component (PC) loading matrix for PBDEs in Farmland soils and E-waste soils (Table S3); The Spearman correlation between concentrations in soil samples (Table S4). See DOI: 10.1039/b000000x/

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