Supporting Information for:

Estimation of polychlorinated biphenyl sources in industrial port sediments using a Bayesian semi-factor model considering unidentified sources

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Figure S1. Principal component score plots for Case A: PC1 vs PC2, 3, 4, 5; ▲: Muroran Port sediments in interior regions (Sites A–J), △: In regions near the entrance (Sites K–P), ◊: Outside the port (Sites R–U)

Figure S2. Principal component score plots for Case B: PC1 vs PC2, 3, 4, 5; ▲: Muroran Port sediments in interior regions (Sites A–J), △: In regions near the entrance (Sites K–P), ◊: Outside the port (Sites R–U)

Figure S3. Principal component score plots for Case C: PC1 vs PC2, 3, 4, 5; ▲: Muroran Port sediments in interior regions (Sites A–J), △: In regions near the entrance (Sites K–P), ◊: Outside the port (Sites R–U)

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Table S7. Posterior mean relative profiles of PCB sources in Muroran Port

Outline of sample analysis

The survey was conducted at 21 sites, including 17 inside (Sites A–Q) and four outside (Sites R–U) the Muroran port (see Figure S1). A 10-cm surface layer was sampled from each sediment area with a Birge–Ekman sampler in June 2008. Larger objects (e.g., pebbles, shellfish) were removed from the samples, after which the sediments were dried in air, and homogenized with a mortar. Several grams of the powder were taken, surrogates were added, and pressurized liquid extraction (ASE300 Dionex Co., USA) was conducted with toluene. This extract was treated with sulfuric acid, and then processed with a multi-layer silica-gel-column chromatograph, silver-sulfate silica-gel column, and a high-performance liquid chromatograph (LC-6C, Shimazdu, Japan). The eluent was then concentrated, and syringe spike substances were added to make a 20-μL nonane solution using a gentle N_2 stream.

The quantification of PCBs was performed using a high-resolution gas chromatograph (HP6890 Agilent Technologies, USA), and a high-resolution mass spectrometer (JMS700D, JEOL, Japan). An HT8-PCB capillary column (60 m, 0.25 mm id; Kanto Kagaku, Japan) was used for separation of the 209 PCB congeners. The PCBs were monitored in the selected ion monitoring mode. The concentrations of peaks were determined by isotope dilution quantification.

The LOD values for sediment samples were found to be 0.1–1 pg/g for each PCB congener. The surrogate recovery rates (calculated using syringe spikes) of PCBs were within the range of 50–120%, and mono-chlorinated biphenyl was within the range of 40–80%. Laboratory blanks were also checked regularly. Analysis of the extracts of reference material (sea sediment for PCB analysis, JSAC0452, KTYH0452) for quality assurance was performed using the same analytic procedure as for the samples. The results were within the range of certified values. The surrogate recovery rates of mono-chlorinated, and more highly chlorinated surrogates, from reference material extracts (n = 6) ranged from 45 to 58% (mean: 50%) and 66 to 120% (mean: 91%), respectively.

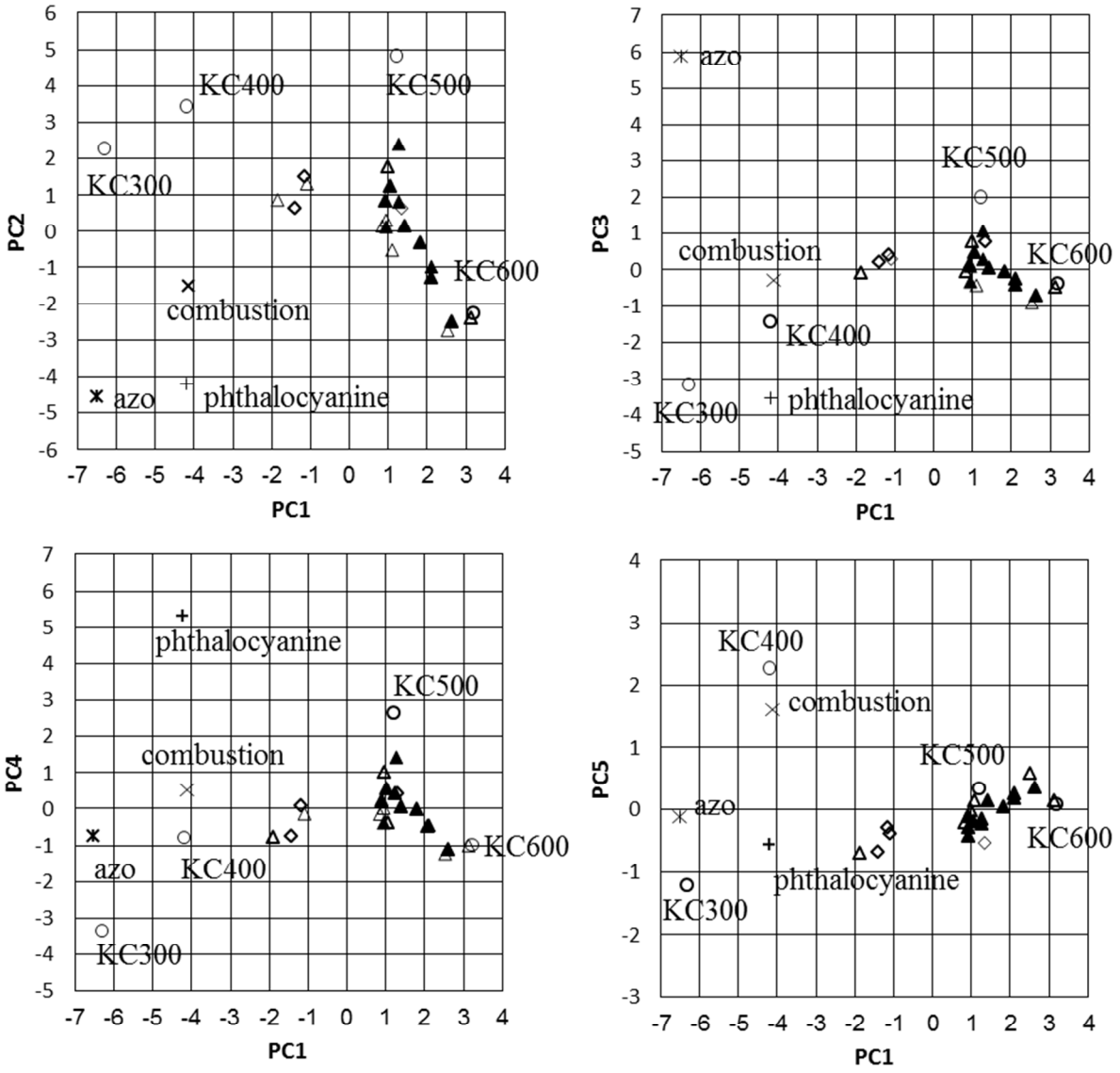

Figure S1. Principal component score plots for Case A: PC1 vs PC2, 3, 4, 5; ▲: Muroran Port sediments in interior regions (Sites A–J), ∆: In regions near the entrance (Sites K–P), ◊: Outside the port (Sites R–U)

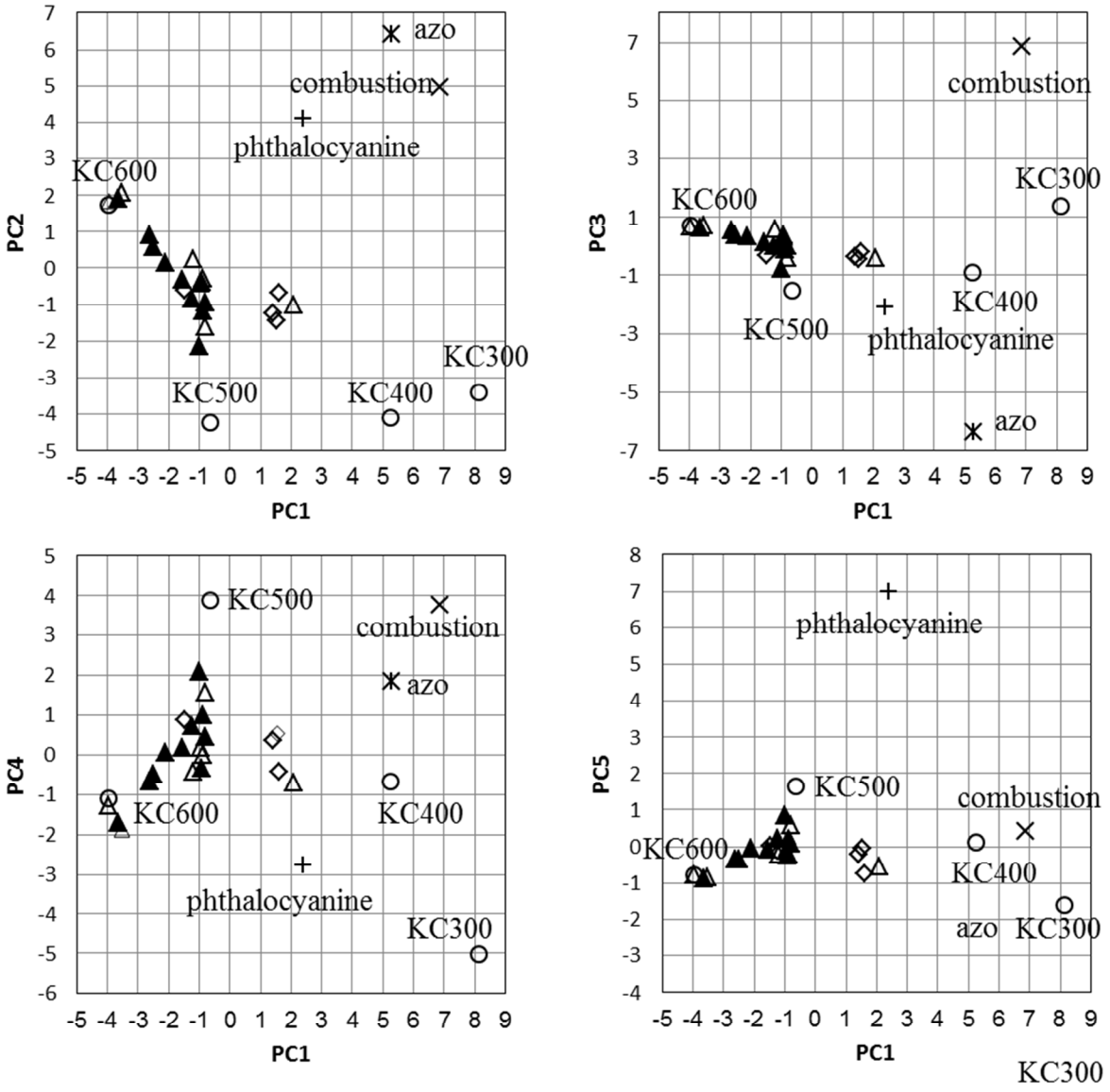

Figure S2. Principal component score plots for Case B: PC1 vs PC2, 3, 4, 5; ▲: Muroran Port sediments in interior regions (Sites A–J), △: In regions near the entrance (Sites K–P), ◊: Outside the port (Sites R–U)

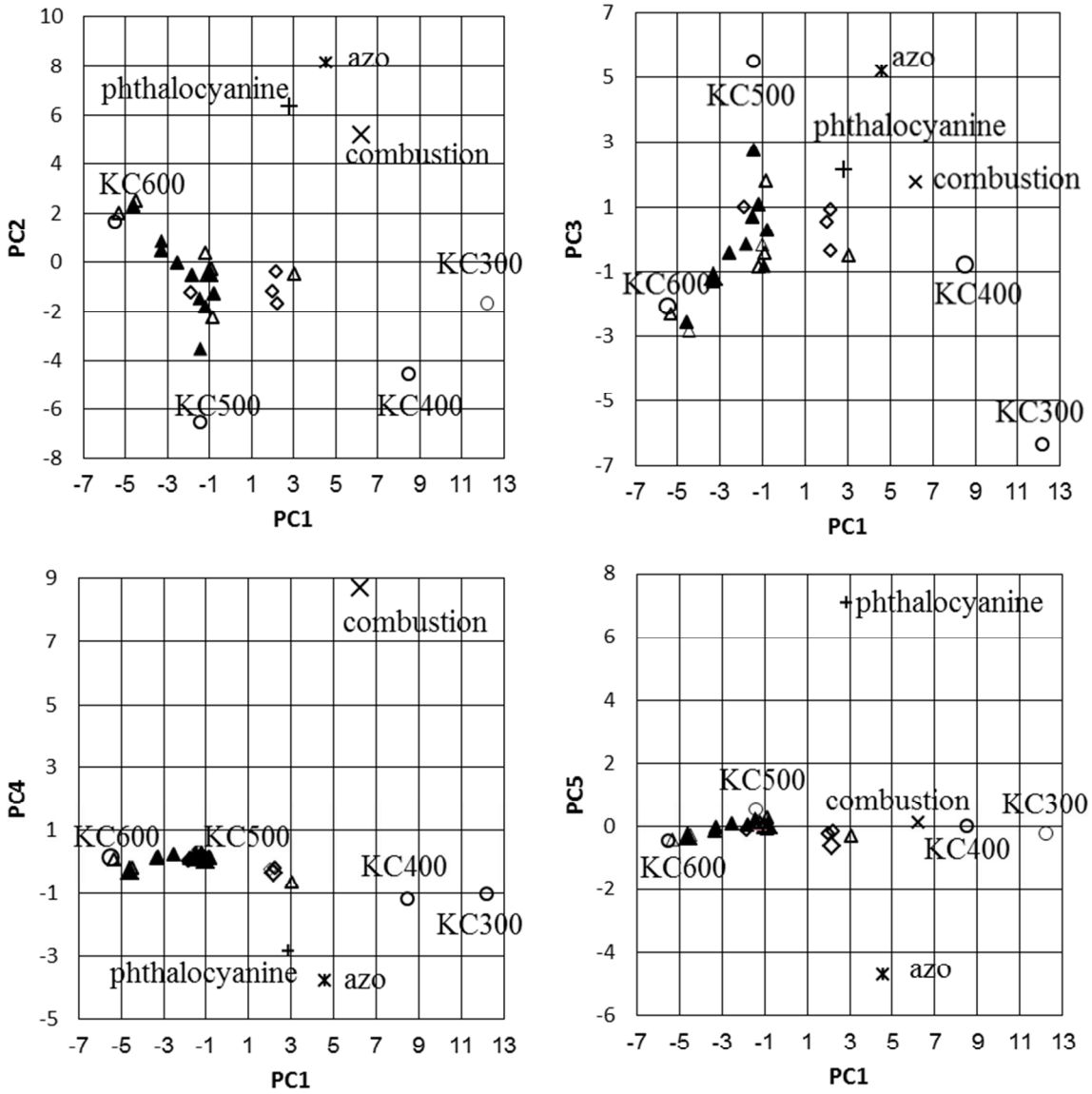

Figure S3. Principal component score plots for Case C: PC1 vs PC2, 3, 4, 5; ▲: Muroran Port sediments in interior regions (Sites A–J), ∆: In regions near the entrance (Sites K–P), ◊: Outside the port (Sites R–U)

Table S1. Percent composition of PCB congeners and homologues in Kanechlor, combustion products, and pigments

Source	Kanechlor					pigment	
	KC300	KC400	KC500	KC600	Combusion	Azo	Phthalocyanine
Congener							
PCB-5/8	4.6	0.66	0.17	0.07	1.8	0	0
PCB-11	0.11	0.02	0	0	2.7	93	0
PCB-15	1.3	0.23	0.04	0	2.2	0	0
PCB-16	2.9	0.6	0.1	0.03	0.27	0	0
PCB-17	3.1	0.62	0.12	0.04	0.28	0	0
PCB-18	7.9	2.0	0.28	0.09	0.49	0	0
PCB-20/33	7.8	2.9	0.31	0.08	1.3	0	0
PCB-22	4.0	1.7	0.16	0.04	0.46	0	0
PCB-28[b]	9.8	3.7	0.36	0.13	0.89	0	0
PCB-31	10	4.4	0.38	0.10	0.84	0	0
PCB-32	2.8	0.69	0.09	0.03	0.19	0	0
PCB-35	0.10	0.08	0.01	0	1.6	4.0	0
PCB-44	3.0	3.8	1.2	0.07	0.46	0	0
PCB-49	2.8	3.0	0.62	0.06	0.35	0	0
PCB-52[b]	3.6	4.7	4.2	0.31	0.80	0	0
PCB-56	1.8	4.1	0.37	0.04	0.75	0	0
PCB-64	2.2	3.0	0.39	0.05	0.36	0	0
PCB-66	3.4	6.8	0.71	0.08	0.94	0	0
PCB-70	3.7	8.2	2.8	0.15	1.1	0	0
PCB-74	2.0	3.9	0.59	0.05	0.53	0	0
PCB-77[a]	0.28	0.98	0.13	0.01	1.2	3.0	0
PCB-81[a]	0.02	0.03	0.03	0.01	0.61	0	0
PCB-87/115	0.18	1.4	3.5	0.37	0.40	0	0
PCB-93/95/98	0.31	1.9	6.1	2.5	0.63	0	0
PCB-97	0.16	1.1	2.1	0.08	0.34	0	0
PCB-99	0.21	1.3	2.4	0.07	0.34	0	0

PCB-101[b]	0.33	2.3	8.3	3.2	0.66	0	0
PCB-105[a]	0.15	1.8	2.6	0.08	0.73	0	0
PCB-110	0.39	3.3	9.6	1.6	0.72	0	0
PCB-114[a]	0.02	0.13	0.19	0.03	0.22	0	0
PCB-118[ab]	0.27	2.9	7.4	0.57	0.77	0	0
PCB-123[a]	0.07	0.09	0.08	0	0.14	0	0
PCB-126[a]	0	0.02	0	0	1.0	0	0
PCB-132	0.02	0.36	2.5	2.1	0.20	0	0
PCB-136	0.02	0.15	1.1	2.0	0.10	0	0
PCB-138[b]	0.04	1.0	6.2	5.2	0.38	0	0
PCB-139/149	0.05	0.62	4.7	8.4	0.47	0	0
PCB-141	0.01	0.19	1.1	2.1	0.15	0	0
PCB-151	0.01	0.13	0.91	3	0.14	0	0
PCB-153[b]	0.05	0.81	5.5	9.8	0.43	0	0
PCB-156[a]	0.01	0.30	1.2	0.16	0.53	0	0
PCB-157[a]	0	0.07	0.23	0.49	0.32	0	0
PCB-163/164	0.02	0.38	2.2	3	0.33	0	0
PCB-167[a]	0	0.10	0.40	0	0.23	0	0
PCB-169[a]	0	0	0	0	0.40	0	0
PCB-170	0	0.22	0.62	3.3	0.43	0	0
PCB-174	0	0.12	0.45	4.5	0.16	0	0
PCB-179	0	0.04	0.20	3.0	0.09	0	0
PCB-180[b]	0	0.35	0.93	10	0.36	0	0
PCB-182/187	0	0.11	0.39	5.7	0.17	0	0
PCB-183	0	0.08	0.29	3.0	0.16	0	0
PCB-189[a]	0	0.02	0.04	0.17	0.49	0	0
PCB-194	0	0.10	0.03	1.9	0.56	0	0
PCB-196	0	0.03	0.02	1.2	0.39	0	0
PCB-199	0	0.06	0.02	1.8	0.19	0	0
PCB-203	0	0.04	0.02	1.5	0.15	0	0
PCB-206	0	0.03	0	0.31	0.82	0	0.87
PCB-207	0	0	0	0.07	0.60	0	0.68
PCB-208	0	0	0	0.06	0.32	0	2.5

Homologue							
MoCBs	0.01	0.35	0	0	32	0	0
DiCBs	7.8	1.2	0.29	0.09	16	93	0
TrCBs	55	20	2.1	0.59	13	4.0	0
TeCBs	34	51	12	1.1	14	3.0	0
PeCBs	2.7	20	49	9.2	9.2	0	0
HxCBs	0.25	5.3	33	41	6.2	0	0
HpCBs	0	1.2	3.9	38	3.5	0	0
OcCBs	0	0.29	0.13	8.9	2.6	0	0
NoCBs	0	0.03	0	0.44	1.7	0	4.0
DeCB (PCB-209)	0	0	0	0	0.94	0	96
Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*

The percent compositions was referred based on Kanechlor from ref (37), combusion (n=24) from ref (2), and pigment (azo: n=21, phthalocyanine: n=7) from ref (11), respectively.

a DL-PCBs, b indicator PCBs

Table S2. Concentrations of PCBs in the surface sediments from Muroran Port

Station	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
Depth (m)	5.1	16.3	7.5	9.4	10.4	16.5	14.0	11.0	12.0	16.5	16.5	16.5	10.5	13.6	15.4	19.7	12.6	12.0	27.0	23.5	34.0
Congener (pg/g-dw)																					
PCB-5/8	26	110	63	79	91	110	100	81	120	17	23	11	16	18	17	9.7	18	8.4	3.1	4.3	5.1
PCB-11	70	340	73	180	210	340	280	150	260	65	130	78	110	110	100	98	93	110	50	73	82
PCB-15	34	140	62	100	110	120	120	91	140	17	25	11	20	20	16	6.1	20	6.6	5	6.1	5.1
PCB-16	8.6	47	31	29	39	33	38	31	55	5.9	6.5	13	5.1	5.8	14	2.9	6	4.3	1.7	3	2.6
PCB-17	15	73	47	49	73	51	58	52	78	8.7	9.5	16	9.5	7.9	16	6.6	9.7	6.6	2.4	3.2	2.9
PCB-18	30	140	95	94	130	95	110	99	150	21	22	30	17	17	37	11	19	17	5.3	6.9	6.6
PCB-20/33	58	280	160	160	240	230	230	200	320	33	38	51	39	37	54	21	37	20	9	12	13
PCB-22	41	200	110	120	160	140	150	120	230	21	25	35	25	25	32	12	23	12	6.1	8.1	9.8
PCB-28[b]	150	690	350	400	580	490	560	450	820	82	93	100	89	88	100	46	85	41	19	29	26
PCB-31	95	450	260	280	390	310	360	280	530	51	58	92	57	58	77	35	54	30	13	20	19
PCB-32	17	83	49	55	78	59	82	64	100	10	15	15	13	10	19	9.6	14	9.4	2.4	4.3	3.5
PCB-35	7.4	40	20	18	37	26	34	29	35	6.2	7	13	6.1	7.5	8.8	11	6.5	4.7	2.7	4.3	4.8
PCB-44	78	270	310	220	310	190	280	220	210	39	33	99	31	29	70	13	66	10	7.2	9.5	14
PCB-49	62	210	220	190	250	200	210	190	190	29	30	70	23	24	49	8.3	51	10	4.6	6.8	8.1
PCB-52[b]	110	410	580	360	450	350	460	330	310	73	50	130	46	42	160	17	110	17	11	16	22
PCB-56	92	260	180	180	260	230	210	190	210	28	29	130	27	28	53	9.3	40	9.1	4.9	7.4	9.8
PCB-64	50	160	140	130	170	150	140	120	130	19	20	59	18	17	39	6.9	33	7.8	3.6	4.9	6.3
PCB-66	210	620	430	490	630	600	540	540	520	71	80	150	72	69	110	23	120	21	13	19	21
PCB-70	220	710	660	580	730	670	650	540	540	91	89	200	82	77	160	23	160	26	17	23	32
PCB-74	86	280	220	200	280	290	240	200	230	34	34	75	33	31	55	10	63	9.2	6.4	8.7	10
PCB-77[a]	35	97	82	72	99	94	72	73	77	12	15	26	12	12	20	4.5	18	3.8	2.6	3.9	4.1
PCB-81[a]	3.5	3.9	15	8.1	4.1	7.2	4.1	5.9	4.0	0.8	0.6	1.2	1.3	2.8	8.3	n.d.	2.0	0.5	0.3	0.3	0.7
PCB-87/115	150	390	640	320	420	350	440	300	240.0	65	41	110	35	32	240	9.4	110.0	7.6	7.1	8.5	33
PCB-93/95/98	440	690	1100	840	1200	730	880	810	540	130	88	410	69	70	1100	18	170	16	14	17	49
PCB-97	140	370	510	280	430	380	440	400	270	62	51	68	36	39	120	9.1	98	7.1	5.7	7.3	23
PCB-99	250	700	760	490	810	101	740	770	540	94	97	110	72	72	150	14	230	14	9.5	14	32
PCB-101[b]	810	1200	1700	1200	1800	1200	1400	1300	900	200	160	600	120	120	1700	28	300	25	22	29	90
PCB-105[a]	230	610	620	500	620	590	570	520	390	85	76	120	54	57	160	14	170	12	8.6	13	30
PCB-110	730	1400	2200	1300	1900	1500	1800	1500	1100	230	190	390	150	140	960	34	390	26	25	30	93
PCB-114[a]	26	24	53	43	29	38	27	18	17	4.3	5.1	18	4.9	4.7	46	1.3	9.9	1.3	1.1	1.1	3.3
PCB-118[ab]	560	1300	1700	1200	1600	1500	1400	1400	1000	200	200	280	150	160	530	36	360	28	22	32	76
PCB-123[a]	9.4	24	26	21	31	23	23	26	17	3.4	3.7	4.7	2.9	2.5	4.8	0.5	8.1	0.6	0.4	n.d.	n.d.
PCB-126[a]	4.4	9.7	10	7.9	9.8	13	8.8	8.5	6.4	1.6	1.8	7.5	2.1	1.6	4.3	0.6	1.9	0.8	n.d.	n.d.	n.d.
PCB-132	620	440	660	790	970	500	530	600	410	74	58	480	52	50	1200	11	95	8.1	5.8	8.7	36
PCB-136	490	250	310	550	810	290	310	400	250	42	33	460	34	31	990	6.8	49	4.9	3.7	5.1	24
PCB-138[b]	1700	1500	1700	2300	2800	1600	1600	1800	1300	220	200	1300	180	160	3500	36	300	27	18	27	100

PCB-139/149	2700	1400	1500	2700	4000	1700	1700	2200	1400	230	210	2100	180	180	4700	35	280	27	17	26	120
PCB-141	670	310	330	650	950	310	320	440	280	44	34	560	34	31	1400	5.5	48	4.5	2.9	4.5	29
PCB-151	960	430	350	820	1400	2300	420	600	380	55	51	820	49	45	1800	9	61	7.3	5	7.6	35
PCB-153[b]	3600	2400	2100	3500	5400	2300	2600	3300	2300	330	330	2700	310	290	5800	57	470	45	27	43	180
PCB-156[a]	170	240	300	300	290	220	200	210	170	35	30	150	26	23	500	5.3	44	4.1	3.5	3.8	15
PCB-157[a]	130	46	71	50	61	49	54	54	28	6.5	7.1	16	4.8	6.9	31	1.2	12	1.1	0.8	0.6	3.8
PCB-163/164	1100	780	710	1300	1700	160	800	1000	700	110	110	850	91	91	2000	18	140	12	8.1	13	46
PCB-167[a]	61	99	120	120	180	100	120	120	95	16	14	56	12	11	150	1.8	20	2.3	1.3	1.3	8.0
PCB-169[a]	8.9	7.0	1.4	7.5	16	6.0	8.6	12	5.9	0.9	0.9	n.d.	2.3	n.d.	n.d.	n.d.	1.3	n.d.	n.d.	n.d.	n.d.
PCB-170	1300	520	360	1200	1600	710	560	840	550	69	89	1000	97	68	2300	10	84	6.5	4.2	6.5	28
PCB-174	2100	600	370	1500	2400	900	670	1100	700	75	100	1800	110	86	3000	14	99	10	3.9	8.5	39
PCB-179	1500	390	240	970	1500	710	450	670	440	51	69	1200	71	61	1800	12	65	8.3	4.2	6.8	49
PCB-180[b]	4400	1500	900	3300	5500	2200	1700	2600	1700	180	240	3600	290	220	7200	28	240	21	13	21	80
PCB-182/187	3100	1000	560	2100	3400	1500	1100	1700	1100	130	190	2300	190	160	3900	29	170	23	11	17	71
PCB-183	1300	400	250	990	1500	580	440	690	430	50	66	1100	71	61	2100	8	68	7.7	2.9	5.6	40
PCB-189[a]	30	25	20	44	81	27	35	47	30	4.6	3.8	38	3.8	5.2	98	1.1	6.0	0.3	0.4	0.9	2.8
PCB-194	760	340	150	800	1300	430	380	690	410	48	62	680	88	51	1300	7.4	50	5.5	3.7	5.1	12
PCB-196	420	150	59	420	590	270	160	280	190	20	32	380	36	23	650	3.1	21	2.3	1.2	2	7.1
PCB-199	800	310	130	750	1100	600	350	610	270	44	65	640	73	48	1000	7.2	49	5.3	3.1	5.4	12
PCB-203	580	190	91	550	760	350	220	400	220	26	40	440	56	28	780	4.7	32	4.0	2.4	3.7	11
PCB-206	180	120	64	170	350	110	130	180	2	13	17	170	28	17	260	2.1	16	2.3	1.7	2.5	3
PCB-207	37	21	10	31	60	26	21	32	23	2.5	3.2	33	5.9	3.7	47	0.6	3.4	0.2	0.4	0.5	0.9
PCB-208	39	21	11	35	57	36	22	35	21	2.8	3.6	33	5.2	3	42	0.6	3.7	0.6	0.3	0.5	0.7
Homologue (pg/g-dw)																					
MoCBs	52	210	44	83	120	120	130	81	120	29	48	29	45	40	35	32	36	33	16	21	23
DiCBs	150	680	240	420	480	640	570	380	590	110	190	100	160	170	150	120	140	120	61	88	96
TrCBs	530	2500	1400	1500	2100	1800	2000	1700	2900	290	340	470	330	320	440	190	320	190	78	120	110
TeCBs	1200	3800	3400	3000	4100	3500	3500	3200	3100	500	510	1200	440	420	910	150	810	150	90	130	160
PeCBs	3800	7900	11000	7200	10000	8200	9100	8300	5900	1300	1100	2400	820	820	5500	190	2200	160	140	180	500
HxCBs	14000	9600	10000	15000	22000	10000	11000	13000	8700	1400	1300	11000	1200	1100	25000	220	1900	170	110	170	700
HpCBs	18000	5800	3500	13000	20000	8400	6300	9900	6400	740	1000	14000	1100	860	26000	140	950	100	52	90	400
OcCBs	3600	1300	580	3500	5100	2300	1500	2700	1600	190	280	3000	350	210	5100	36	210	25	15	23	64
NoCBs	250	160	85	240	470	170	170	250	170	18	24	240	39	23	350	3.3	23	3.1	2.3	3.4	4.6
DeCB	8.1	18	11	18	45	18	19	15	14	2.0	3.5	4.8	3.7	3.2	7.5	3.1	3.4	1.7	1.3	2.5	1.1
Σ209PCB[c] (pg/g-dw)	41000	32000	30000	44000	65000	36000	34000	39000	29000	4500	4700	33000	4400	3900	64000	1100	6500	960	560	820	2100

n.d. not detected

[a] DL-PCBs

[b] indicator PCBs

[c] sum of concentrations of all congener.

Table S3. Result of principal component analysis of 18 explanatory variables (Case A)

Principal component	1	2	3	4	5
Eigenvalue	7.5	4.7	2.5	2.2	0.5
Contribution (%)	41.8	26	14.1	12	2.5
Cumulation contribution	41.8	67.8	81.9	93.9	96.4
Factor loading					
Explanatory variable					
PCB-11	-0.506	-0.373	0.743	-0.117	-0.090
PCB-28	-0.503	0.497	-0.355	-0.490	-0.342
PCB-35	-0.606	-0.366	0.635	-0.092	0.115
PCB-52	-0.336	0.877	-0.096	-0.067	0.203
PCB-101	0.561	0.692	0.310	0.289	-0.036
PCB-118	0.368	0.777	0.298	0.311	-0.054
PCB-138	0.931	0.269	0.183	0.044	-0.101
PCB-153	0.968	-0.006	0.060	-0.141	-0.130
PCB-180	0.826	-0.406	-0.139	-0.332	0.077
PCB-209	-0.304	-0.382	-0.435	0.713	-0.160
DiCBs	-0.599	-0.365	0.697	-0.141	-0.026
TrCBs	-0.644	0.396	-0.340	-0.487	-0.189
TeCBs	-0.543	0.631	-0.251	-0.287	0.368
PeCBs	0.379	0.795	0.301	0.331	0.050
HxCBs	0.981	0.066	0.101	-0.066	-0.034
HpCBs	0.829	-0.406	-0.134	-0.338	0.073
OcCBs	0.771	-0.425	-0.158	-0.347	0.140
NoCBs	-0.225	-0.505	-0.461	0.620	0.102

Table S4. Result of principal component analysis of 27 explanatory variables (Case B)

Principal component	1	2	3	4	5
Eigenvalue	10.2	5.9	3.8	3.2	2.6
Contribution (%)	37.7	22.0	13.9	11.9	9.5
Cumulation contribution	37.7	59.7	73.6	85.5	95.0
Factor loading					
Explanatory variable					
PCB-5	0.225	-0.074	0.242	-0.152	-0.114
PCB-11	0.117	0.202	-0.325	0.125	-0.254
PCB-15	0.189	0.049	0.369	0.130	-0.040
PCB-28	0.188	-0.219	0.081	-0.236	-0.154
PCB-31	0.205	-0.208	0.080	-0.260	-0.144
PCB-35	0.174	0.245	-0.112	0.217	-0.219
PCB-52	0.148	-0.332	0.005	0.071	0.006
PCB-70	0.147	-0.302	0.017	0.016	-0.027
PCB-77	0.197	0.193	-0.133	0.219	-0.225
PCB-101	-0.141	-0.263	-0.031	0.321	0.057
PCB-118	-0.078	-0.284	-0.038	0.332	0.075
PCB-126	0.131	0.158	0.363	0.231	0.028
PCB-138	-0.271	-0.143	0.036	0.157	-0.055
PCB-153	-0.294	-0.058	0.076	0.024	-0.125
PCB-169	0.118	0.163	0.369	0.232	0.030
PCB-180	-0.267	0.083	0.120	-0.154	-0.171
PCB-182	-0.268	0.068	0.115	-0.154	-0.184
PCB-189	0.046	0.163	0.406	0.231	-0.019
PCB-209	0.048	0.137	-0.105	-0.167	0.535
DiCBs	0.157	0.218	-0.241	0.149	-0.257
TrCBs	0.235	-0.152	0.136	-0.200	-0.157
TeCBs	0.211	-0.233	0.097	-0.032	-0.072
PeCBs	-0.075	-0.280	0.000	0.371	0.084
HxCBs	-0.291	-0.070	0.099	0.096	-0.097
HpCBs	-0.266	0.087	0.136	-0.144	-0.177
OcCBs	-0.240	0.111	0.204	-0.115	-0.178
NoCBs	0.049	0.227	0.140	-0.058	0.473

Table S5. Result of principal component analysis of 41 explanatory variables (Case C)

Principal component	1	2	3	4	5
Eigenvalue	17.0	9.3	5.5	3.8	2.7
Contribution (%)	41.5	22.7	13.5	9.3	6.7
Cumulation contribution	41.5	64.2	77.6	86.9	93.6
Factor loading					
Explanatory variable					
PCB-5	0.181	-0.016	-0.174	0.171	-0.026
PCB-11	0.065	0.165	0.188	-0.187	-0.353
PCB-15	0.130	0.044	-0.022	0.407	-0.020
PCB-18	0.177	-0.075	-0.221	-0.038	-0.029
PCB-20	0.192	-0.084	-0.208	0.020	-0.036
PCB-22	0.188	-0.106	-0.209	-0.017	-0.041
PCB-28	0.173	-0.117	-0.201	-0.032	-0.052
PCB-31	0.186	-0.108	-0.212	-0.038	-0.042
PCB-35	0.098	0.191	0.191	0.051	-0.315
PCB-44	0.172	-0.199	-0.095	-0.024	-0.024
PCB-52	0.137	-0.251	0.024	0.012	-0.007
PCB-56	0.161	-0.146	-0.090	0.032	-0.024
PCB-66	0.151	-0.180	-0.095	-0.002	-0.034
PCB-70	0.142	-0.221	-0.027	0.000	-0.021
PCB-77	0.122	0.152	0.189	0.030	-0.327
PCB-87	-0.026	-0.264	0.227	0.065	0.013
PCB-93	-0.088	-0.254	0.175	0.070	-0.011
PCB-101	-0.103	-0.257	0.172	0.054	-0.015
PCB-110	-0.065	-0.267	0.202	0.047	0.003
PCB-118	-0.050	-0.262	0.190	0.053	-0.003
PCB-126	0.071	0.106	0.058	0.452	0.003
PCB-132	-0.199	-0.160	0.031	0.056	-0.049
PCB-138	-0.203	-0.165	0.013	0.043	-0.056
PCB-139	-0.224	-0.066	-0.103	0.038	-0.075
PCB-153	-0.219	-0.086	-0.095	0.029	-0.076
PCB-163	-0.222	-0.094	-0.079	0.057	-0.072
PCB-169	0.062	0.108	0.055	0.457	0.007
PCB-170	-0.206	0.030	-0.194	0.060	-0.076
PCB-174	-0.197	0.050	-0.216	0.014	-0.075
PCB-180	-0.201	0.042	-0.213	0.018	-0.075
PCB-182	-0.200	0.032	-0.214	0.010	-0.084
PCB-189	0.006	0.098	0.018	0.480	-0.025
PCB-209	0.034	0.136	0.076	-0.141	0.504
DiCBs	0.092	0.179	0.181	-0.096	-0.351
TrCBs	0.200	-0.067	-0.184	0.048	-0.066
TeCBs	0.186	-0.156	-0.076	0.068	-0.044
PeCBs	-0.052	-0.266	0.203	0.105	-0.002
HxCBs	-0.221	-0.106	-0.053	0.080	-0.069
HpCBs	-0.201	0.044	-0.212	0.037	-0.081
OcCBs	-0.184	0.063	-0.212	0.113	-0.080
NoCBs	0.021	0.189	0.052	0.130	0.456

Table S6. Result of principal component analysis of 56 explanatory variables (Case D)

Principal component	1	2	3	4	5
Eigenvalue	24.0	12.3	8.1	3.9	3.4
Contribution(%)	42.8	22.0	14.5	7.0	6.1
Cumulation contribution(%)	42.8	64.9	79.3	86.3	92.4
Factor loading					
Explanatory variable					
PCB-5	0.153	0.013	0.143	0.181	0.039
PCB-11	0.042	0.138	-0.134	-0.098	-0.396
PCB-15	0.103	0.043	-0.001	0.407	0.074
PCB-16	0.153	-0.021	0.190	0.000	0.006
PCB-17	0.154	-0.027	0.190	-0.003	0.000
PCB-18	0.155	-0.029	0.193	-0.023	-0.001
PCB-20	0.168	-0.040	0.177	0.034	0.005
PCB-22	0.166	-0.059	0.177	-0.002	-0.006
PCB-28	0.155	-0.072	0.167	-0.016	-0.017
PCB-31	0.165	-0.060	0.181	-0.022	-0.011
PCB-32	0.155	-0.039	0.186	-0.023	-0.011
PCB-35	0.066	0.159	-0.148	0.127	-0.312
PCB-44	0.157	-0.147	0.090	-0.023	-0.004
PCB-49	0.162	-0.124	0.125	-0.027	-0.002
PCB-52	0.130	-0.197	0.003	-0.002	0.004
PCB-56	0.143	-0.108	0.074	0.036	0.004
PCB-64	0.159	-0.106	0.118	-0.017	-0.002
PCB-66	0.139	-0.140	0.075	0.003	-0.006
PCB-70	0.132	-0.176	0.029	-0.004	-0.003
PCB-74	0.145	-0.136	0.072	0.001	-0.001
PCB-77	0.089	0.126	-0.145	0.108	-0.324
PCB-87	-0.007	-0.238	-0.162	0.029	0.011
PCB-93	-0.060	-0.232	-0.114	0.034	0.002
PCB-97	-0.007	-0.248	-0.156	0.043	0.016
PCB-99	-0.020	-0.225	-0.131	0.024	0.011
PCB-101	-0.071	-0.239	-0.116	0.020	-0.003
PCB-105	0.003	-0.239	-0.153	0.083	0.019
PCB-110	-0.037	-0.247	-0.149	0.012	0.007
PCB-118	-0.025	-0.244	-0.150	0.022	0.006
PCB-126	0.048	0.085	-0.067	0.445	0.088

PCB-132	-0.158	-0.161	0.002	0.032	-0.013
PCB-136	-0.178	-0.070	0.105	0.029	-0.026
PCB-138	-0.160	-0.168	0.008	0.022	-0.017
PCB-139	-0.184	-0.080	0.102	0.031	-0.024
PCB-141	-0.177	-0.041	0.125	0.037	-0.022
PCB-151	-0.177	-0.016	0.154	0.029	-0.030
PCB-153	-0.178	-0.101	0.087	0.023	-0.026
PCB-163	-0.179	-0.108	0.076	0.047	-0.017
PCB-169	0.040	0.085	-0.066	0.449	0.093
PCB-170	-0.174	0.004	0.163	0.065	-0.012
PCB-174	-0.168	0.025	0.184	0.024	-0.023
PCB-179	-0.166	0.021	0.180	0.020	-0.032
PCB-180	-0.170	0.017	0.179	0.027	-0.020
PCB-182	-0.168	0.008	0.176	0.021	-0.028
PCB-183	-0.171	0.021	0.180	0.031	-0.025
PCB-189	-0.007	0.071	-0.030	0.473	0.080
PCB-208	0.022	0.151	-0.104	-0.142	0.397
PCB-209	0.023	0.136	-0.101	-0.217	0.377
DiCBs	0.063	0.151	-0.132	-0.008	-0.374
TrCBs	0.173	-0.027	0.155	0.068	-0.020
TeCBs	0.165	-0.114	0.066	0.075	-0.007
PeCBs	-0.027	-0.248	-0.154	0.071	0.016
HxCBs	-0.179	-0.119	0.059	0.066	-0.014
HpCBs	-0.171	0.018	0.178	0.045	-0.021
OcCBs	-0.158	0.032	0.167	0.122	-0.002
NoCBs	0.007	0.171	-0.093	0.056	0.401

Table S7. Posterior mean relative profiles of PCB sources in Muroran Port

Site	A		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	0.1	0.1	
KC400	1.5	0.8	○
KC500	2.7	1.9	
KC600	94.9	1.9	○
Combustion	0.4	0.2	
Azo	0.2	0.1	○
Phthalocyanine	0.0	0.0	
Unidentified	0.2	0.2	

Site	B		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	2.0	1.1	
KC400	16.4	3.0	○
KC500	32.5	4.8	○
KC600	45.6	3.7	○
Combustion	1.7	0.5	○
Azo	1.4	0.4	○
Phthalocyanine	0.0	0.0	
Unidentified	0.4	0.4	

Site	C		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	0.4	0.3	
KC400	8.7	1.6	○
KC500	65.3	3.0	○
KC600	23.8	2.1	○
Combustion	1.3	0.3	○
Azo	0.2	0.1	○
Phthalocyanine	0.0	0.0	
Unidentified	0.3	0.3	

Site	D		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	0.4	0.3	
KC400	7.7	1.4	○
KC500	14.3	3.2	○
KC600	76.1	2.9	○
Combustion	0.8	0.3	○
Azo	0.4	0.1	○
Phthalocyanine	0.0	0.0	
Unidentified	0.3	0.3	

Site	E		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	0.3	0.2	
KC400	7.2	1.3	○
KC500	11.1	3.1	○
KC600	79.9	2.8	○
Combustion	0.7	0.3	○
Azo	0.4	0.1	○
Phthalocyanine	0.0	0.0	○
Unidentified	0.5	0.3	

Site	F		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	0.7	0.6	
KC400	12.4	2.6	○
KC500	25.8	5.4	○
KC600	58.0	4.4	○
Combustion	1.6	0.6	○
Azo	1.1	0.4	○
Phthalocyanine	0.0	0.0	
Unidentified	0.3	0.3	

Site	G		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	1.2	0.7	
KC400	11.2	2.3	○
KC500	38.5	4.5	○
KC600	46.3	3.6	○
Combustion	1.4	0.5	○
Azo	1.0	0.3	○
Phthalocyanine	0.0	0.0	
Unidentified	0.5	0.4	

Site	H		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	0.6	0.5	
KC400	9.1	1.9	○
KC500	19.4	4.1	○
KC600	68.8	3.5	○
Combustion	1.1	0.4	○
Azo	0.4	0.2	○
Phthalocyanine	0.0	0.0	
Unidentified	0.4	0.3	

Site	I		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	4.7	1.5	○
KC400	14.1	3.2	○
KC500	20.4	4.7	○
KC600	58.1	3.8	○
Combustion	1.1	0.5	○
Azo	1.2	0.3	○
Phthalocyanine	0.0	0.0	
Unidentified	0.4	0.4	

a Standard deviation b Circle checks indicates significantly non-zero

Site	J		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	1.7	0.8	○
KC400	10.6	2.3	○
KC500	44.5	4.1	○
KC600	39.1	3.1	○
Combustion	2.0	0.5	○
Azo	1.8	0.4	○
Phthalocyanine	0.0	0.0	
Unidentified	0.3	0.3	

Site	M		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	2.0	1.2	
KC400	14.8	3.2	○
KC500	19.1	5.2	○
KC600	57.9	4.4	○
Combustion	2.4	1.0	○
Azo	3.1	0.9	○
Phthalocyanine	0.0	0.0	
Unidentified	0.7	0.6	

Site	P		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	22.4	3.1	○
KC400	14.6	4.5	○
KC500	24.4	3.9	○
KC600	22.1	2.6	○
Combustion	0.5	0.4	
Azo	14.9	2.2	○
Phthalocyanine	0.1	0.0	○
Unidentified	1.0	0.8	

Site	K		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	3.0	1.4	○
KC400	14.0	3.3	○
KC500	25.7	5.4	○
KC600	51.3	4.3	○
Combustion	2.0	0.7	○
Azo	3.6	0.9	○
Phthalocyanine	0.0	0.0	
Unidentified	0.3	0.4	

Site	N		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	2.7	1.3	○
KC400	15.6	3.3	○
KC500	20.5	5.1	○
KC600	55.2	4.2	○
Combustion	1.3	0.6	
Azo	4.2	1.0	○
Phthalocyanine	0.0	0.0	
Unidentified	0.4	0.5	

Site	Q		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	0.5	0.4	
KC400	11.7	2.3	○
KC500	52.7	4.9	○
KC600	31.5	3.7	○
Combustion	1.6	0.5	○
Azo	1.7	0.4	○
Phthalocyanine	0.0	0.0	
Unidentified	0.3	0.3	

Site	L		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	0.1	0.1	
KC400	2.8	0.9	○
KC500	2.2	1.6	
KC600	94.2	1.7	○
Combustion	0.2	0.1	
Azo	0.3	0.1	○
Phthalocyanine	0.0	0.0	
Unidentified	0.2	0.2	

Site	O		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	0.0	0.0	
KC400	0.3	0.2	
KC500	2.2	1.2	
KC600	97.1	1.2	○
Combustion	0.1	0.1	
Azo	0.2	0.1	○
Phthalocyanine	0.0	0.0	
Unidentified	0.1	0.1	

Site	R		
	Contribution Rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	13.1	2.7	○
KC400	15.8	4.3	○
KC500	24.8	4.5	○
KC600	29.3	3.2	○
combustion	1.3	0.7	
Azo	15.0	2.5	○
Phthalocyanine	0.2	0.1	○
Unidentified	0.7	0.7	

a Standard deviation b Circle checks indicates significantly non-zero

Site	S		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	10.0	2.1	○
KC400	17.8	3.9	○
KC500	39.3	4.3	○
KC600	18.8	2.5	○
Combustion	0.2	0.2	
Azo	13.4	1.9	○
Phthalocyanine	0.1	0.0	○
Unidentified	0.4	0.5	

Site	T		
	Contribution rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	10.2	2.1	○
KC400	17.8	3.8	○
KC500	32.6	4.2	○
KC600	24.5	2.7	○
Combustion	0.2	0.2	
Azo	13.8	2.0	○
Phthalocyanine	0.2	0.1	○
Unidentified	0.6	0.7	

Site	U		
	Contribution Rates (%)		
Source	Mean	S.D.[a]	check[b]
KC300	2.5	0.8	○
KC400	5.2	1.9	○
KC500	37.3	4.0	○
KC600	49.3	3.3	○
combustion	0.2	0.2	
Azo	5.3	0.9	○
Phthalocyanine	0.0	0.0	○
Unidentified	0.2	0.2	

a Standard deviation b Circle checks indicates significantly non-zero