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Supplemental Material

A human mixture risk assessment for neurodevelopmental toxicity associated with polybrominated diphenyl ethers used as flame retardants

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Table S1: PBDE congeners in breast milk samples (ng/g lipid weight)

Country	N	Statistic	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-196	BDE-197	BDE-201	BDE-202	BDE-203	BDE-206	BDE-207	BDE-208	BDE-209	Reference
Europe																			
France	77	mean	0.18	2.16	1.10	0.41	1.01	0.10	0.17	0.09	0.47	**0.12**	**0.10**	0.12	**0.55**	0.86	0.25	1.88	Antignac et al. (2009)
		min	0.04	0.34	0.13	0.05	0.29	0.01	0.03	0.01	0.07	0.02	0.01	0.01	0.11	0.10	0.02	0.39	
		max	1.62	12.04	5.26	3.91	10.45	0.69	1.88	0.32	2.10	1.18	1.44	1.50	2.27	2.59	1.35	6.80	
Sweden	9	median	0.031	3.01	0.50	0.56	**1.67**	**0.28**			0.08			*0.05*		*0.11*		0.22	Jakobsson et al. (2012)
		min	0.018	1.0	0.24	0.23	0.77	0.14			*0.05*			*0.05*		*0.11*		0.22	
		max	0.073	10.7	2.31	2.43	3.02	1.48			0.30			0.16		*0.11*		0.89	
Spain (Vallecas)	22	median	0.01	0.37	0.51	0.58	0.13	0.02	0.30	0.12	0.46							2.90	Gomara et al. (2007)
		min	0.01	0.03	0.30	0.18	0.03	0.01	0.12	0.00	0.02							0.16	
		max	0.10	3.60	3.30	1.90	3.20	2.00	3.90	4.40	5.50							52.00	
Spain (Getale)	9	median	*0.01*	0.22	0.38	0.46	0.10	*0.01*	0.28	0.05	0.47							2.80	
		min		0.00	0.15	0.15	0.02		0.01	0.00	0.06							0.16	
		max		1.20	1.00	1.00	1.20		6.50	1.40	2.80							33.00	
Africa																			
Ghana	42	mean	0.07	1.62	0.49	0.29	0.24	0.03	0.11	0.04	0.20				0.04	0.09		1.00	Asante et al. (2011)
		min	0.01	0.31	0.01	0.01	0.01	0.01	0.01	0.01	0.01				0.01	0.01		0.01	
		max	0.39	5.90	4.00	1.30	1.10	0.20	0.90	0.15	0.50				0.29	0.30		11.00	
Asia																			
India	10	mean	0.06	0.45	0.05	0.11	0.24	0.09	0.07	0.02	0.08				0.07	0.18		0.83	Devananthan et al. (2012)
		min	0.05	0.06	0.00	0.00	0.23	0.00	0.00	0.00	0.04				0.02	0.00		0.26	
		max	0.09	0.87	0.10	0.76	0.98	0.65	0.45	0.08	0.15				0.18	0.63		2.00	
Taiwan	32	mean	0.09	0.58	0.19	0.19	0.96	0.09	0.16	0.03	0.21			0.08	0.06	0.15	0.06	0.48	Koh et al. (2010)
		min	0.04	0.37	0.12	0.13	0.68	0.04	0.01	0.02	0.13			0.04	0.02	0.08	0.03	0.22	
		max	0.29	1.32	0.48	0.37	1.93	0.21	0.66	0.07	0.58			0.25	0.21	0.45	0.19	1.93	
Taiwan	70	mean	0.14	1.90	0.46	0.46	1.11	0.12	0.24	0.04	0.30			0.08	0.07	0.20	0.07	0.47	Chao et al. (2011)
		min	0.02	0.21	0.04	0.07	0.36	0.02	0.00	0.00	0.07			0.00	0.00	0.02	0.00	0.00	
		max	4.41	80.40	19.70	10.40	10.20	0.90	6.00	0.28	2.20			0.60	0.31	1.05	0.31	1.70	
China (Shangai)	48	mean	0.46	0.45	0.12	0.14	0.79	0.08	0.26	0.26	**1.46**			**0.46**	0.30	**1.13**	**0.43**	2.20	Ma et al. (2012)
		min	0.11	0.14	0.04	0.05	0.26	0.00	0.04	0.04	0.23			0.07	0.00	0.20	0.07	0.20	
		max	3.89	2.39	0.25	0.53	3.89	0.20	1.09	1.69	6.82			2.79	0.98	4.05	1.90	8.60	
China (Shijiazhuang)	48	mean	0.22	0.23	0.05	0.05	0.38	0.00	0.10	0.14	0.28					0.35		0.70	Sun et al. (2010)
		min	0.09	0.11	0.02	0.03	0.23	0.00	0.05	0.06	0.10					0.13		0.16	
		max	0.74	0.63	0.11	0.14	1.10	0.00	0.31	0.45	3.70					4.50		14.00	
China (Tianjin)	50	mean	0.38	0.35	0.06	0.06	0.38	0.04	0.07	0.08	0.34					0.17		0.30	
		min	0.44	0.34	0.04	0.03	0.10	0.01	0.03	0.02	0.10					0.05		0.30	
		max	3.20	2.00	0.32	0.25	0.78	0.07	0.16	0.13	0.72					0.33		2.50	
China (Yantai)	60	mean	**0.49**	0.74	0.09	0.14	0.66	0.05	0.12	0.09	0.52					0.20		0.22	
		min	0.26	0.41	0.05	0.06	0.42	0.03	0.06	0.05	0.23					0.10		0.12	
		max	1.10	2.00	0.25	0.32	1.20	0.10	0.29	0.17	1.30					0.45		0.50	
China	19	mean	0.28	0.49	0.12	0.15	0.78	0.07	0.22	**0.46**	0.95				0.21	0.83		**3.00**	Sudaryanto et al. (2008)
		min	0.04	0.11	0.03	0.06	0.00	0.00	0.00	0.00	0.26				0.00	0.17		1.30	
		max	0.65	1.40	0.52	0.13	1.50	0.14	0.53	1.60	2.50				0.61	2.50		5.20	

Country	N	Statistic	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-196	BDE-197	BDE-201	BDE-202	BDE-203	BDE-206	BDE-207	BDE-208	BDE-209	Reference
Asia (cont.)																			
Philippines	33	mean	0.30	**3.50**	**1.10**	**0.67**	0.56	0.13	**1.50**		0.22				0.06	0.20		1.70	Malarvannan et al. (2009)
		min	0.06	0.49	0.14	0.05	0.25	0.05	0.05		0.05				0.05	0.05		1.30	
		max	1.90	27.00	13.00	3.70	1.40	16.00	16.00		0.44				0.06	0.37		1.90	
Philippines	30	mean	0.14	1.30	0.37	0.22	0.27	0.02	0.07	0.02	0.19					0.08		0.50	Malarvannan et al. (2013)
		min	0.02	0.36	0.02	0.02		0.02	0.02	0.02	0.02					0.02		0.05	
		max	0.56	4.60	4.40	0.97		0.35	0.49	0.07	0.75					0.25		3.40	
Vietnam (Hanoi)	9	mean	0.03	0.13	0.06	0.04	0.10	0.00	0.03	0.01	0.05				0.00	0.03		0.00	Tue etal. (2010)
		min	0.02	0.07	0.00	0.00	0.06	0.00	0.00	0.00	0.02				0.00	0.00		0.00	
		max	0.07	0.25	0.12	0.10	0.14	0.04	0.04	0.02	0.11				0.06	0.06		0.00	
Australasia & New Zealand																			
New Zealand	33	mean	0.22	2.67	0.57	0.57	0.75	0.04	0.66	0.02	0.13			0.02	0.03			0.38	Coakley et al. (2013)
		min	0.05	0.32	0.07	0.07	0.14	0.01	0.12	0.00	0.05			0.00	0.00			0.07	
		max	0.75	7.71	1.29	1.82	3.82	0.10	0.51	0.04	0.32			0.05	0.20			3.14	
Highest mean (World)			0.49	3.51	1.10	0.67	1.88	0.32	1.50	0.46	1.46	0.12	0.10	0.46	0.55	1.13	0.43	3.00	
Highest mean (Europe)			0.18	3.51	1.10	0.64	1.88	0.32	0.30	0.12	0.47	0.12	0.10	0.12	0.55	0.86	0.25	2.90	

Values in bold were used to compile the row “Highest mean (World), the underlined values were used to compile the row “Highest mean (Europe). Shaded in grey are the data used in the mixture risk assessment for breast-feeding infants (see Table S14). Cells left empty mean that the congeners were not measured.

Table S2: PBDE intakes via food for children (1-3 years), ng/kg bw/d[a]

Food exposure scenario	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-209
High food consumption (95th percentile), upper bound median PBDE levels	0.79	10.38	4.14	1.86	1.75	1.90	1.78	10.54
Average food consumption, upper bound median PBDE levels	0.51	4.02	1.93	0.97	1.09	1.14	1.07	6.02
Average food consumption, lower bound median PBDE levels	0.03	3.50	1.18	0.47	0.13	0.13	0.05	2.61

[a] adapted from EFSA (2011), Table 23, p 74

Table S3: PBDE intakes via food for adults, ng/kg bw/d

Food exposure scenario	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-209
High food consumption (95th percentile), upper bound median PBDE levels[a]	0.29	1.97	0.67	0.64	0.48	0.53	0.42	3.02
Additional dietary PBDE exposure for high and frequent fish consumers, fish with >8% fat[b]	0.23	5.36	0.75	2.07	0.47	0.59	0.58	1.77
Average food consumption, upper bound median PBDE levels[c]	0.17	0.72	0.35	0.30	0.26	0.28	0.23	1.69

[a] from Table 18, p 64, EFSA (2011), used for scenarios 1 and 3 in Table 2, main text.

[b] from Table 24, p 75, EFSA (2011), assuming a consumption of 2.6 g fish/kg bw/day, used for scenario 1 in Table 2, main text.

[c] from Table 17, p 63, EFSA (2011), used for scenarios 2 and 4 in Table 2, main text.

Table S4. PBDE congeners in indoor dust samples (ng/g)

Country	N	Statistic	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-196	BDE-197	BDE-203	BDE-206	BDE-207	BDE-208	BDE-209	Reference
Homes - Europe																	
Sweden (houses)	10	median	1.3	42.0	52.0		6.6		12.0		5.1		0.0	10.0	3.0	320	Thuresson et al. (2012)
		min	0.1	0.5	1.0		0.6		0.7		1.0		30.0	2.0	3.0	51	
		max	5.6	230.0	140.0		23.0		49.0		40.0		140.0	96.0	52.0	3600	
Sweden (Apartments)	34	median	0.8	37.0	66.0		7.8		11.0		1.4		0.0	20.0	0.0	1100	
		min	0.1	0.5	1.0		0.2		0.7		1.0		30.0	2.0	3.0	50	
		max	9.2	280.0	1200.0		410.0		110.0		45.0		390.0	1000.0	430.0	100000	
Sweden	19	geometric mean	0.7	40.0	22.0	4.9	5.1	2.5	4.0		1.9	1.5	23.0	17.0	410.0	600	Björklund et al. (2012)
		min	0.2	8.5	2.3	0.9	1.0	0.6	1.1		0.6	0.6	7.9	6.6	180.0	190	
		max	12.0	250.0	130.0	33.0	14.0	8.3	31.0		7.6	10.0	220.0	210.0	5100.0	9300	
Sweden	5	mean	5.4	51.4	78.9	23.9	4.9	3.9	4.9	3.9			22.1	16.4		547	Karlsson et al. (2007)
		min	0.5	12.6	23.9	<2.21	2.4	2.4	<1.58	<1.56			2.1	1.9		44	
		max	9.2	160.0	194.0	92.3	7.1	4.9	16.6	5.7			44.0	41.7		1560	
Belgium	45	median	0.4	8.1	8.9	1.1	2.2	0.9	1.4	2.3	0.9	1.0				313	D'hollander et al. (2010)
		95th percentile	0.9	62.4	110.0	12.1	43.9	4.7	9.5	8.3	5.4	8.2				1513	
Portugal	11	mean		20.0	8.9	2.7	3.6	2.5	4.6				9.3	2.0		307	Cunha et al. (2010)
		min	*nd*	*nd*	*nd*	*nd*	*nd*	nd	*nd*	*nd*	*nd*	nd	*nd*	*nd*		*nd*	
		max	9.0	56.0	29.0	6.0	6.0	3.0	11.0	4.0	4.0	8.0	15.0	4.0		884	
Spain	6	mean		24.4	20.0	5.5	48.1	3.8	48.1	8.8	23.6	9.6		53.9		400	Regueiro et al. (2007)
		min		6.9	6.2	1.0	4.6	0.7	4.6	3.2	3.7	3.7		14.9		58	
		max		69.5	60.0	18.2	142.0	9.7	142.0	15.7	58.5	16.3		172.9		1615	
Czech Republic	25	mean	1.8	25.4	17.1	2.1	1.3	*0.1*	29.0	*0.8*	2.1	*0.8*	50.0	41.6		724	Kalachova et al. (2012)
		min	*0.1*	*0.1*	*0.1*	*0.1*	*0.3*		*0.8*		*0.8*		*2.5*	*2.5*		41	
		max	11.0	398.2	95.4	22.6	5.0		457.3		15.5		215.7	127.2		5481	
Homes – North America																	
United States	7	mean	6.1	571.1	842.7	136.0	58.7	49.6	10.9	3.0			65.4	45.7		1275	Wei et al. (2009)
		min	0.5	22.3	43.0	9.0	4.0	3.0	4.0	2.0			15.6	15.0		360	
		max	11.5	2075.0	2924.0	464.0	141.0	117.0	27.0	5.0			104.0	93.0		4156	
United States	17	mean	21.0	1220.0	1700.0	274.0	181.0	156.0	31.0	15.0	17.0		51.0	30.0	35.0	2090	Stapleton et al. (2005)
		min	2.9	103.0	162.0	25.9	11.7	11.8	1.3	*nd*	*nd*		*nd*	*nd*	*nd*	162	
		max	76.5	7610.0	13800.0	2090.0	1510.0	1250.0	168.0	38.6	77.2		239.0	109.0	108.0	8750	
United States	12	mean	0.3	93.0	176.0	30.6	30.2	17.4	18.0			*3.0*		*0.1*		2810	Johnson-Restrepo & Kannan (2009)
		min	*<0.1*	16.7	25.6	0.8	*<0.04*	2.5	*<21*			*<3*		*<0.1*		327	
		max	1.3	354.0	664.0	122.0	81.5	56.9	64.0			*<3*		*<0.1*		9210	
United States (Vacuum cleaner)	20	geometric mean	6.4	338.0	536.0	77.0	47.0	35.0	15.1	3.9	5.6	4.9	40.5	26.6	29.4	1811	Allen et al. (2008)
		min	1.6	22.5	86.6	5.2	1.8	0.5	2.6	0.1	*<0.1*	0.1	3.8	0.3	0.6	228	
		max	58.6	5596.0	8847.0	1475.0	783.5	626.4	410.9	89.5	198.9	85.2	1711.0	1427.0	1786.0	263000	

Country	N	Statistic	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-196	BDE-197	BDE-203	BDE-206	BDE-207	BDE-208	BDE-209	Reference
Homes – North America (Cont.)																	
United States (Living room)	20	geometric mean	16.3	**1865.0**	2460.0	436.0	**234.4**	**182.8**	27.9	3.6	2.7	3.6	76.3	45.9	35.6	4502	Allen et al. (2008)
		min	1.6	445.4	330.6	71.0	27.7	27.4	1.7	0.1	*<0.1*	0.1	8.1	1.2	1.9	792	
		max	120.5	16840.0	24510.0	4274.0	2377.0	2061.0	229.7	135.0	84.0	54.4	1484.0	599.8	536.4	184600	
United States (Bedroom)	20	geometric mean	10.5	837.0	1170.0	204.0	124.2	94.4	32.9	2.6	3.3	3.6	48.1	25.3	17.5	1703	
		min	0.7	54.3	56.5	11.4	4.2	4.3	0.1	0.1	0.1	0.1	4.5	0.3	0.7	24	
		max	119.4	15000.0	22850.0	3786.0	2870.0	2332.0	1617.0	315.2	802.4	293.6	803.3	539.3	531.4	36130	
United States (Infertile couples)	50	geometric mean	13.0	543.0	643.0	135.0	78.6	63.2	20.0			12.1	**163.0**	63.1	35.3	1906	Johnson et al. (2010)
		min	3.1	100.0	79.3	19.0	13.2	6.7	3.8	nd	nd	1.3	33.9	12.4	8.5	425	
		max	84.0	8627.0	12967.0	2164.0	1352.0	1093.0	688.0	nd	nd	243.0	3772.0	1492.0	853.0	32366	
Hawaii	1		**39.0**	1042.0	747.0	111.0	42.0	14.0	4.6				55.0	1.0		40	Wang et al. (2008)
Homes - Asia																	
China (E-waste recycling area)	10	median		8.0	13.0	1.5	11.3	3.3	26.6	20.2	13.8	20.5	105.6	65.0	36.1	1490	Zheng et al. (2011)
		min		4.7	7.2	*nd*	2.7	0.8	6.0	4.1	4.2	4.3	38.8	17.1	9.5	721	
		max		58.5	120.0	10.5	40.5	10.1	141.0	35.2	73.1	29.6	249.0	140.0	64.1	4920	
China (Urban area)	27	median		7.3	7.1	0.8	2.8	1.0	8.4	7.4	6.0	7.3	162.0	151.0	75.0	4040	
		min		0.8	0.7	0.2	0.3	*nd*	*nd*	*nd*	*nd*	*nd*	19.6	4.2	2.4	498	
		max		543.0	842.0	186.0	60.4	47.7	65.9	69.7	22.7	21.1	700.0	837.0	372.0	40500	
China (Rural area)	10	median		1.2	1.6		1.1		2.3	10.0	4.1	9.8	63.7	43.2	24.0	670	
		min		*nd*	*nd*	*nd*	0.6	*nd*	*nd*	5.4	0.1	5.0	26.6	19.9	11.7	182	
		max		3.9	5.1	0.3	4.1	1.8	5.6	16.5	18.1	17.9	101.0	60.0	37.7	1680	
China	23	median	37.0	102.0	75.0	85.0	11.0	8.4	78.0	12.0	15.0		50.0	47.0		975	Kang et al. (2011)
		min	7.0	27.0	15.0	22.0	0.0	0.0	14.0	1.5	2.3		13.0	13.0		346	
		max	122.0	2740.0	9447.0	221.0	650.0	714.0	797.0	36.0	277.0		564.0	635.0		15795	
Homes – Australasia & New Zealand																	
Australia	30	geometric mean	0.7	28.8	37.7	6.8	5.3	3.7	0.3	0.1	0.1	2.4	2.5	0.1	20.9	22	Stasinska et al. (2013)
		min	*nd*	2.6	2.9	0.5	*nd*	*nd*	0.5	*nd*	0.4	*nd*	*nd*	*nd*	*nd*	*nd*	
		max	10.0	391.0	372.0	71.2	59.9	31.7	44.0	784.0	51.2	410.0	12300.0	3390.0	934.0	82200	
Australia	5	mean		23.8	35.7	6.9	7.0	3.9	15.4	5.3	6.3		12.5	10.7		243	Toms et al. (2009)
		min		7.8	10.8	0.7	2.9	1.3	2.9	1.1	1.4		2.8	4.0		37	
		max		53.8	81.8	16.9	14.0	8.7	28.0	13.6	11.7		27.9	16.9		587	
New Zealand (floor)	33	mean	0.7	30.2	51.8	9.7	8.8	4.7	12.8	4.7	4.7	2.9	114.4			2505	Coakley et al. (2013)
		min	0.1	0.3	3.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.2			29	
		max	1.3	98.0	219.1	41.1	58.9	19.8	238.4	44.2	68.0	25.0	989.3			27394	
New Zealand (mattress)	16	mean	1.2	56.1	83.9	16.1	10.6	7.1	7.5	10.3	5.6	8.1	163.6			2703	
		min	0.1	6.5	8.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.5			106	
		max	7.7	288.4	540.3	94.1	58.2	43.1	21.1	34.3	17.5	30.3	1253.3			21956	

Country	N	Statistic	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-196	BDE-197	BDE-203	BDE-206	BDE-207	BDE-208	BDE-209	Reference
Offices - Europe																	
Belgium	10	median	2.1	21.1	45.4	6.8	12.1	5.5	23.8	6.6	9.5	4.7				443	D'hollander et al. (2010)
		95th percentile	5.3	61.5	133.0	20.3	663.0	87.1	3090.0	633.0	1200.0	453.0				6680	
Sweden	10	median	1.2	52.0	92.0		23.0		55.0		29.0		0.0	44.0	17.0	780	Thuresson et al. (2012)
		min	0.1	14.0	14.0		4.3		15.0		7.0		30.0	20.0	10.0	540	
		max	5.4	390.0	770.0		100.0		160.0		100.0		340.0	160.0	96.0	12000	
Offices – North America																	
United States	31	geometric mean	7.5	697.0	915.0	195.0	138.0	115.0	81.0	29.0	**32.0**	4.9	153.0	125.0	62.0	4204	Watkins et al. (2013)
		min	0.4	37.0	0.4	13.0	11.0	8.0	15.0	7.0	4.0	1.0	29.0	22.0	10.0	912	
		max	207.0	19494.0	32831.0	8672.0	5973.0	5202.0	12970.0	2858.0	6109.0	359.0	3395.0	4312.0	1710.0	106204	
United States	10	mean	18.0	1650.0	**3310.0**	**525.0**	126.0	95.0	**130.0**			**237.0**	117.0	**357.0**	**445.0**	6930	Batterman et al. (2010)
		min	*nd*	130.0	486.0	73.0	*nd*	17.0	*nd*			*nd*	*nd*	*nd*	*nd*	*nd*	
		max	87.0	6400.0	10600.0	1820.0	627.0	951.0	5060.0			722.0	431.0	1770.0	1400.0	29000	
United States (computer labs)	2	mean	14.3	456.0	776.0	135.0	144.0	95.0	130.0			109.0				7500	CARB (2005) in NCEA (2010)
Offices - Asia																	
China	55	median	23.0	109.0	186.0	144.0	25.0	18.0	28.0	7.4	9.5		65.0	62.0		1401	Kang et al. (2011)
		min	1.7	2.0	6.0	10.0	0.0	0.0	2.6	1.0	0.0		10.0	9.0		103	
		max	100.0	1586.0	10100.0	458.0	908.0	876.0	133.0	133.0	96.0		463.0	455.0		37440	
Offices – Australasia & New Zealand																	
Australia	3	mean		107.2	153.4	30.1	24.2	13.4	38.4	10.2	16.7		67.1	50.6		1299	Toms et al. (2009)
		min		46.6	49.4	9.2	6.0	3.9	12.1	4.2	5.5		20.9	15.9		401	
		max		210.0	294.0	61.2	33.8	25.0	63.8	14.7	27.1		94.3	63.4		2230	
Australia	2	mean		113.3	283.3	36.2	39.5		70.1	17.3	21.6		143.2	76.9		1212	Hearn et al. (2013)
Schools and day care centres - Europe																	
United Kingdom	43	mean	1.4	32.0	54.0	10.0	28.0	5.0	5.1	**77.0**	5.6	5.6				**8500**	Harrad et al. (2010)
		min	*nd*	1.6	1.1	*nd*	*nd*	*nd*	*nd*	*nd*	*nd*	*nd*				49	
		max	25.0	120.0	270.0	50.0	310.0	26.0	48.0	42.0	35.0	50.0				88000	
Sweden	10	median	2.8	120.0	110.0		12.0		6.5		4.2		0.0	15.0	8.0	580	Thuresson et al. (2012)
		min	0.1	31.0	42.0		6.0		2.7		1.7		30.0	7.0	4.0	180	
		max	8.2	910.0	550.0		19.0		15.0		6.5		110.0	58.0	29.0	3500	
Level 1 – highest overall mean			39.0	1865.0	3310.0	525.0	234.4	182.8	130.0	77.0	32.0	237.0	163.6	357.0	445.0	8500.0	
Level 2 (Europe only)																	
Highest mean, homes			5.4	51.4	78.9	23.9	48.1	3.9	48.1	8.8	23.6	9.6	50.0	53.9	410.0	1100	

Values in bold were used to compile the row "Level 1 - highest overall mean, the underlined values were used to compile the row "Highest mean, homes" (Europe). Shaded in grey are the data used in subsequent analyses. Cells left empty mean that the congeners were not measured; nd = not detected. The Values from Bjorklund et al. (2012) are for researcher-collected dust samples.

Table S5. PBDE congeners in serum and blood samples (ng/g lipid weight)

Country	N	Statistic	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-196	BDE-197	BDE-201	BDE-202	BDE-203	BDE-206	BDE-207	BDE-208	BDE-209	Reference
Adults, serum - Europe																			
France, mothers	91	mean	0.15	2.81	3.59	0.70	0.89	0.14	0.25	0.32	1.06	0.38	0.12	0.23	1.96	2.55	0.86	0.47	Antignac et al. (2009)
		min	0.04	0.56	0.53	0.11	0.06	0.01	0.03	0.06	0.10	0.05	0.04	0.06	0.22	0.19	0.05	0.79	
		max	0.39	4.84	18.02	4.19	9.66	0.94	2.16	0.98	5.04	3.00	0.27	0.83	10.08	10.55	7.07	37.43	
Sweden, mothers	9	median	0.34	1.46	0.20	*0.32*	1.67	0.25			0.69			0.45		0.88		3.17	Jakobsson et al. (2012)
		min	0.20	0.58	0.05	*0.32*	1.03	*0.03*			0.45			*0.15*		*0.31*		1.92	
		max	0.77	5.34	0.70	1.24	3.99	0.71			2.64			6.33		1.58		7.39	
Spain, mothers	61	median	0.06	2.40	2.60	1.60	0.86	*<0.10*	0.47	0.02	0.10							1.10	Gomara et al. (2007)
		min	*<0.06*	0.30	1.40	0.94	*<0.18*	*<0.10*	*<0.06*	*<0.02*	*<0.10*							*<1.1*	
		max	0.43	0.90	6.90	3.00	2.50	*<0.10*	2.30	1.20	1.30							20.00	
Spain, fathers	51	median	*<0.06*	2.30	2.30	1.60	0.81	0.10	0.60	0.02	0.10							1.10	
		min	*<0.06*	0.34	1.40	0.94	*<0.18*	*<0.10*	*<0.06*	*<0.02*	*<0.10*							*<1.1*	
		max	*<0.06*	7.30	5.30	*2.40*	3.20	0.11	2.60	3.50	11.00							59.00	
Spain, mothers	52	median	*<0.06*	2.60	2.30	1.20	0.77	*<0.10*	0.06		0.10							1.10	
		min	*<0.06*	0.51	1.10	0.77	*<0.18*	*<0.10*	*<0.06*	*<0.02*	*<0.10*							*<1.1*	
		max	*<0.06*	22.00	12.00	4.20	3.30	*<0.10*	2.50	*<0.02*	0.47							31.00	
Spain, fathers	53	median		2.70	2.40	1.30	0.86		0.06									1.10	
		min	*<0.06*	0.26	1.10	0.81	*<0.18*	*<0.10*	*<0.06*	*<0.02*	*<0.10*							*<1.1*	
		max	*<0.06*	6.30	5.90	2.10	4.60	*<0.10*	3.10	*<0.02*	*<0.10*							91.00	
Adults, serum – North America																			
United States, mothers	20	mean	0.72	12.00	1.70	1.80	7.60		0.00		0.33							1.70	Lunder et al. (2010)
		min	0.20	3.10	0.40	0.40	1.40		0.00		0.11							*0.94*	
		max	2.50	40.00	5.20	7.00	32.00		0.50		0.82							3.20	
Adults, serum - Asia																			
India[1]	20	mean		0.41	0.68	0.03	0.63	0.36	0.58		0.79					1.90		27.00	Eguchi et al. (2012)
		min		0.03	0.03	0.03	0.05	0.05	0.05		0.05					0.05		0.39	
		max		1.50	3.20	1.10	2.70	1.40	4.30		3.50					23.00		270.00	
China, e-waste workers	20	median	2.60	6.70	1.40	1.00	9.00	0.80	4.70	0.40	2.10			0.30	0.70	10.00	2.90	83.50	Qu et al. (2007)
		min	0.70	1.50	0.40	0.10	0.90	0.10	0.50	0.10	0.10			0.10	0.10	0.90	0.30	*nd*	
		max	148.00	161.00	29.70	6.30	245.00	3.50	60.20	2.80	31.20			8.00	11.00	66.20	18.70	3436	
China, Rural area	15	median	1.00	3.40	0.40	0.40	1.60	0.10	1.00	0.20	1.30			0.30	0.40	5.20	1.30	18.50	
		min	0.60	1.40	*nd*	*nd*	0.05	*nd*	*nd*	0.08	0.40			0.10	0.20	2.80	0.60	*nd*	
		max	2.30	5.70	1.50	1.30	133.00	0.80	39.70	0.40	5.80			0.50	0.60	7.90	1.70	377	
China	20	median	0.40	1.10	0.40	0.20	1.30	0.10	0.30		0.20					0.50		5.70	
		min	0.20	0.50	0.10	0.10	0.40	*nd*	*nd*	*nd*	*nd*			*nd*	*nd*	*nd*	*nd*	*nd*	
		max	2.70	3.60	7.40	2.30	6.40	1.20	1.30	0.10	0.50			0.10	1.20	4.30	1.30	63.20	
China, e-waste workers	26	mean	3.10	13.00	6.60	3.70	37.00	5.30	9.20	3.70	29.00			3.70	23.00	77.00	17.00	340	Bi et al. (2007)
		min	*nd*	*nd*	*nd*	*nd*	3.30	*nd*	*nd*	*nd*	0.27			*nd*	*nd*	*nd*	*nd*		
		max	78.00	180.00	61.00	26.00	270.00	31.00	200.00	35.00	2400			76.00	84.00	1400	210	3100	
China, Fishing community	21	median	0.58	1.30	1.10		4.60	0.41	1.40	0.99	9.30			2.00	11.00	39.00	9.00	130	
		min	*nd*	*nd*	*nd*	*nd*	*nd*	*nd*	*nd*	*nd*	*nd*			*nd*	*nd*	*nd*	*nd*	*nd*	
		max	2.00	4.30	3.50	*nd*	10.00	1.90	3.10	2.80	28.00			6.70	40.00	96.00	24.00	370	

[1] transformed from data reporting pg/g wet weight, assuming 1% lipid in serum

Country	N	Statistic	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-196	BDE-197	BDE-201	BDE-202	BDE-203	BDE-206	BDE-207	BDE-208	BDE-209	Reference
Adults, serum – Asia (cont.)																			
China	115	mean	0.38	1.19	0.95	0.25	0.48	0.15	0.59	0.23	1.72	0.36		0.28		2.08	1.08	36.40	Zhu et al. (2009)
		min	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00		0.00	0.00	*0.00*	
		max	2.88	11.50	5.22	1.26	2.65	2.09	7.10	12.50	12.50	11.60		18.00		78.60	48.10	1770	
Adults, blood - Asia																			
China, mothers	31	mean	1.15	2.24	0.71	0.20	3.06	0.22	0.41		2.64							5.05	Zhao et al. (2013)
		min	0.51	1.43	0.26	0.00	1.77	0.00	0.00		1.07							2.87	
		max	2.61	4.48	2.07	0.76	5.30	0.61	1.70		5.01							7.96	
Japan	72	mean	0.13	0.46	0.06	0.21	0.87	0.08	0.04	0.10	0.30				*0.05*	0.41		1.00	Uemura et al. (2010)
		25th percentile	0.05	0.20	0.03	0.09	0.45	0.03	0.02	0.04	0.19				*0.03*	0.32		0.60	
		75th percentile	0.14	0.58	0.07	0.23	1.10	0.08	0.07	0.12	0.36				0.07	0.49		1.30	
Children, serum																			
United States, 1.5-4 years old	20	median	1.00	31.00	6.20	6.20	13.00	3.20			0.49							1.70	Lunder at al. (2010)
		min	0.30	11.00	1.80	2.10	3.40	0.45	nd		0.13							0.90	
		max	2.20	65.00	15.00	14.00	32.00	38.00	1.70		2.00							19.00	
Sweden, 11 – 15 months old	24	geometric mean	0.085	1.4	0.27	0.29	0.93			0.12	0.47			1.1	0.27	0.61	0.16	2.1	Sahlstrom et al. (2014)
		median	0.057	1.3	0.22	0.28	1.2			0.088	0.42			0.81	0.28	0.48	0.13	1.5	
		max	0.61	5.6	2.8	2.6	17			1.2	6.5			8.8	2.8	13	2.0	45	
		min	0.042	0.18	0.11	0.11	0.17			0.078	0.27			0.71	0.14	0.28	0.053	1.6	
United States, 2-8 years old	68	geometric mean	2.3	62	13	12.7	16	1.1	0.2									2.8	Wu et al. (2015)
		95th percentile	11.6	364	78	64	87	5.3	0.8									9.6	
Children, blood - Asia																			
China, 9-12 years old	58	median	1.06	1.01	0.05	0.05	0.61	0.06	0.07		0.26							1.73	Zhang et al. (2011)
		min	0.27	0.10	0.05	0.05	0.08	0.06	0.07		0.26							1.73	
		max	4.49	6.18	1.37	0.50	4.74	9.74	2.50		6.37							13.30	

Values in italics are below limit of detection, nd = not detected, cells left empty mean congeners were not measured.

Data used in subsequent analyses are shaded grey.

Table S6: Mixture risk assessment for breast-feeding infants (0-3 months), supplemental information to Table 2, main text

Parameter		units	Statistic	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-196	BDE-197	BDE-201	BDE-202	BDE-203	BDE-206	BDE-207	BDE-208	BDE-209	Sum	Reference
Hazard assessment																					
A Level 1[a]	Reference dose	ng/kg/d		*1.68*	**68.8**	**1.68**	*1.68*	**3.84**	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	**17,000**		
B Level 2[b]		ng/kg/d		*68.8*	**68.8**	**1.68**	*1.68*	**3.84**	*3.84*	*3.84*	*17,000*	*17,000*	*17,000*	*17,000*	*17,000*	*17,000*	*17,000*	*17,000*	*17,000*	**17,000**		
C Level 3[c]		ng/kg/d			**68.8**	**1.68**		**3.84**											**17,000**		
Exposure assessment																					
D Scenario 0	High milk intake[d]	ng/kg/d	Highest reported mean (World)	3.4	24.2	7.6	4.6	11.5	1.9	10.4	3.2	10.1	0.8	0.7	3.2	3.8	7.8	3.0	20.7	116.5	Table S1, second last row
E Scenario 1	High milk intake[d]	ng/kg/d	Highest reported mean (Europe)	1.2	20.7	7.6	4.0	11.5	1.9	2.1	0.8	3.2	0.8	0.7	0.8	3.8	5.9	1.7	20.0	86.8	Table S1, last row
F Scenario 2	Average milk intake[d]	ng/kg/d	Medians	0.14	13.8	2.3	2.6	7.7	1.3	nd	nd	0.37	nd	nd	0.23	nd	0.5	nd	1.0	29.9	Table S1, Jakobsson et al. (2012)
G Scenario 3	Average milk intake[d]	ng/kg/d	Min	0.08	4.6	1.1	1.1	3.53	0.64	nd	nd	0.23	nd	nd	0.23	nd	0.5	nd	1.0	13.0	Table S1, Jakobsson et al. (2012)
Mixture risk assessment																				**Hazard Index**	
Level 1, scenario 0 D/A	Hazard quotients		high intake (world)	2.01	0.35	4.52	2.75	2.99	1.15	6.16	1.89	6.0	0.5	0.41	1.89	2.26	4.64	1.77	0.0	**37**	Table S1, second last row
Level 2, scenario 1 E/B	Hazard quotients		high intake (Europe)	0.02	0.30	4.52	2.38	2.99	0.50	0.54	0	0	0	0	0	0	0	0	0	**11**	Table S1, last row
Level 2, scenario 2 F/B	Hazard quotients		Average milk intake, median PBDE, Sweden	0.002	0.20	1.37	1.53	2.0	0.33	0	0	0	0	0	0	0	0	0	0	**5.4**	Table S1, Jakobsson et al. (2012)
Level 2, scenario 3 G/B	Hazard quotients		Average milk intake, min PBDE, Sweden	0.0	0.07	0.66	0.63	0.92	0.17	0	0	0	0	0	0	0	0	0	0	**2.4**	
Level 3, scenario 1 E/C	Hazard quotients		high intake (Europe)		0.35	4.52		3.38											0	**8**	Table S1
Level 3, scenario 2 F/C	Hazard quotients		Average milk intake, median PBDE, Sweden		0.20	1.37		2.00											0	**3.6**	Table S1, Jakobsson et al. (2012)
Level 3, scenario 3 G/C	Hazard quotients		Average milk intake, min PBDE, Sweden		0.07	0.66		0.92											0	**1.6**	

[a] Congeners without reference doses (italics) are assumed to be as potent as BDE-99 (Level 1 assessment)

[b] Missing reference doses were bridged by a read-across of the reference dose of the nearest neighbouring congener (italics) (Level 2 assessment)

[c] Only congeners with EFSA reference doses were used (Level 3 assessment)

[d] Calculated assuming 1200 ml milk consumption per day (high intake) or 800 ml per day (average intake), 3.5% fat and a body weight of 6.1 kg (EFSA 2011, p 67), based on the PBDE levels shown in Table S1

Table S7: Mixture risk assessment for small children (1-3 years), supplemental information to Table 2, main text

Parameter		units	Statistic	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-196	BDE-197	BDE-201	BDE-202	BDE-203	BDE-206	BDE-207	BDE-208	BDE-209	Sum	Reference
Hazard assessment																					
A Level 1[a]	Reference dose	ng/kg/d		*1.68*	**68.8**	**1.68**	*1.68*	**3.84**	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	**17,000**		
B Level 2[b]		ng/kg/d		*68.8*	**68.8**	**1.68**	*1.68*	**3.84**	*3.84*	*3.84*	*17,000*	*17,000*	*17,000*	*17,000*	*17,000*	*17,000*	*17,000*	*17,000*	*17,000*	**17,000**		
C Level 3[c]		ng/kg/d			**68.8**	**1.68**		**3.84**											**17,000**		
Exposure assessment																					
D	High food consumption	ng/kg/d	Upper bound median PBDE levels	0.79	10.38	4.14	1.86	1.75	1.9	1.78									10.54	33.1	Table S2, first row
E	Average food consumption	ng/kg/d	Upper bound median PBDE levels	0.51	4.02	1.93	0.97	1.09	1.14	1.07									6.02	16.8	Table S2, 2nd row
F	Moderate exposure via food	ng/kg/d	Lower bound median PBDE levels	0.03	3.50	1.18	0.47	0.13	0.13	0.05									2.61	8.1	Table S2, 3rd row
G	High exposure via dust	ng/kg/d	Highest mean PBDE levels from any location[d]	0.19	8.9	15.7	2.5	1.1	0.9	0.6	0.4	0.2			1.1	0.8	1.7	2.1	40.4	76.5	Table S4, row "Level 1 – highest overall mean"
H	High exposure via dust	ng/kg/d	Highest mean PBDE levels from homes, Europe[d]	0.03	0.24	0.37	0.11	0.23	0.02	0.23	0.04	0.11			0.05	0.24	0.26	1.95	5.23	9.1	Table S4, row "highest mean, homes"
I	Moderate exposure via dust (10 mg dust/day	ng/kg/d	Geometric mean PBDE levels, homes, Sweden[e]	0.0006	0.033	0.018	0.004	0.004	0.002	0.003	0	0.002			0.001	0.02	0.014	0.34	0.5	0.9	Table S4, Björklund et al. (2012)
J	Low exposure via dust (10 mg dust/day)	ng/kg/d	Min PBDE levels, homes, Sweden[e]	0	0.007	0.002	0.001	0.001	0.001	0.001	0.00	0.001			0.001	0.007	0.006	0.15	0.16	0.3	Table S4, Björklund et al. (2012)
Mixture risk assessment																				**Hazard Index**	
(D+G)/A Level 1	Hazard quotients		High exposure via food and dust, scenario 1	0.58	0.28	11.8	2.6	0.75	1.65	1.43	0.22	0.09			0.42	0.46	1.01	1.26	0	**23**	
(D+H)/B Level 2	Hazard quotients		High exposure via food and dust (EU), scenario 1	0.01	0.15	2.69	1.17	0.52	0.50	0.52		0			0	0	0	0	0.001	**5.6**	
(E+I)/B Level 2	Hazard quotients		Moderate exposure via food and dust, scenario 2	0.01	0.06	1.16	0.58	0.28	0.30	0.28		0			0	0	0	0	0	**2.7**	
(F+J)/B Level 2	Hazard quotients		Moderate exposure via food, low dust, scenario 3	0	0.05	0.70	0.28	0.03	0.03	0.01		0			0	0	0	0	0	**1.1**	
(D+H)/C Level 3	Hazard quotients		High exposure via food and dust (EU), scenario 1		0.15	2.69		0.52											0.001	**3.4**	
(E+I)/C Level 3	Hazard quotients		Moderate exposure via food and dust, scenario 2		0.06	1.16		0.28											0	**1.5**	
(F+J)/C Level 3	Hazard quotients		Moderate exposure via food, low dust, scenario 3		0.05	0.70		0.03											0	**0.8**	

[a] Congeners without reference doses (italics) are assumed to be as potent as BDE-99 (Level 1 assessment)

[b] Missing reference doses were bridged by a read-across of the reference dose of the nearest neighbouring congener (italics) (Level 2 assessment)

[c] Only congeners with EFSA reference doses were used (Level 3 assessment)

[d] Calculated assuming dust intake of 57 mg/day (95th percentile, Trudel et al. 2011) and a body weight of 12 kg (EFSA 2011).

[e] Calculated assuming dust intake of 10 mg/day (between 50th percentile, 1.7 mg dust/day, and 95th percentile, 57 mg dust/day, Trudel et al. 2011) and a body weight of 12 kg (US EPA 2011).

Table S8: Mixture risk assessment for adults, supplemental information to Table 2, main text

Parameter		units	Statistic	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-196	BDE-197	BDE-201	BDE-202	BDE-203	BDE-206	BDE-207	BDE-208	BDE-209	Sum	Reference
Hazard assessment																					
A Level 1[a]	Reference dose	ng/kg/d		*1.68*	**68.8**	**1.68**	*1.68*	**3.84**	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	*1.68*	**17,000**		
B Level 2[b]		ng/kg/d		*68.8*	**68.8**	**1.68**	*1.68*	**3.84**	*3.84*	*3.84*	*17,000*	*17,000*	*17,000*	*17,000*	*17,000*	*17,000*	*17,000*	*17,000*	*17,000*	**17,000**		
C Level 3[c]		ng/kg/d			**68.8**	**1.68**		**3.84**												**17,000**		
Exposure assessment																					
D	High food consumption	ng/kg/d	Upper bound median PBDE levels	0.29	1.97	0.67	0.64	0.48	0.53	0.42									3.02	8.0	Table S3, first row
E	Additional exposure via fish	ng/kg/d	Upper bound mean PBDE levels	0.23	5.36	0.75	2.07	0.47	0.59	0.58									1.77	11.8	Table S3, 2nd row
F	Average food consumption	ng/kg/d	Upper bound median PBDE levels	0.17	0.72	0.35	0.30	0.26	0.28	0.23									1.69	4.0	Table S3, 3rd row
G	High exposure via dust	ng/kg/d	Highest mean PBDE levels from any location[d]	0.05	2.6	4.6	0.73	0.32	0.25	0.18	0.11	0.04			0.33	0.23	0.49	0.62	11.8	22.3	Table S4, row "Level 1 – highest overall mean"
H	Moderate exposure via dust	ng/kg/d	Highest mean PBDE levels from homes, Europe[e]	0.004	0.037	0.056	0.017	0.034	0.003	0.034	0.006	0.017			0.007	0.036	0.038	0.293	0.79	1.4	Table S4, row "highest mean, homes"
Mixture risk assessment																				**Hazard Index**	
(D+E+G)/A Level 1	Hazard quotients		High exposure via food, fish and dust, scenario 1	0.34	0.14	3.58	2.05	0.33	0.82	0.70	0.06	0.03			0.20	0.14	0.29	0.37	0.001	**9.0**	
(D+E+G)/B Level 2	Hazard quotients		High exposure via food, fish and dust, scenario 1	0.01	0.14	3.58	2.05	0.33	0.36	0.31	0	0			0	0	0	0	0.001	**6.8**	
(E+F+H)/B Level 2	Hazard quotients		Exposure via fish, moderate via food and dust, scenario 2	0.006	0.09	0.69	1.42	0.20	0.23	0.22	0	0			0	0	0	0	0.0	**2.8**	
(D+H)/B Level 2	Hazard quotients		High exposure via food, moderate dust, scenario 3	0.004	0.03	0.43	0.39	0.13	0.14	0.12	0	0			0	0	0	0	0.0002	**1.25**	
(F+H)/B Level 2	Hazard quotients		Moderate exposure via food, moderate dust, scenario 4	0.003	0.01	0.24	0.19	0.07	0.07	0.07	0	0			0	0	0	0	0.0001	**0.66**	
(D+E+H)/C Level 3	Hazard quotients		High exposure via food, fish and dust, scenario 1		0.14	3.58		0.33											0.001	**4.0**	
(E+F+H)/C Level 3	Hazard quotients		Exposure via fish, moderate via food and dust, scenario 2		0.09	0.69		0.20											0.0	**0.98**	
(D+H)/C Level 3	Hazard quotients		High exposure via food, moderate dust, scenario 3		0.03	0.43		0.13											0.0002	**0.6**	
(F+H)/C Level 3	Hazard quotients		Moderate exposure via food, moderate dust, scenario 4		0.01	0.24		0.07											0.0001	**0.33**	

[a] Congeners without reference doses (italics) are assumed to be as potent as BDE-99 (Level 1 assessment)

[b] Missing reference doses were bridged by a read-across of the reference dose of the nearest neighbouring congener (italics) (Level 2 assessment)

[c] Only congeners with EFSA reference doses were used (Level 3 assessment)

[d] Calculated assuming dust intake of 96 mg/day (95th percentile, Trudel et al. 2011) and a body weight of 70 kg (US EPA 2011).

[e] Calculated assuming dust intake of 50 mg/day (US EPA 2011) and a body weight of 70 kg (US EPA 2011).

Table S9: Mixture risk assessment for fetuses (supplemental information to Table 3 of main text)

Parameter		units	Statistic	Value	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-197	BDE-209	Sum	Reference
A	Critical body burden[a]	ng/kg bw			*9,000*	**232,000**	**9,000**	*9,000*	**62,000**	*9,000*	*9,000*	*9,000*	**425,000**		EFSA (2011)
B	Critical body burden[a]	ng/kg bw			*232,000*	**232,000**	**9,000**	*9,000*	**62,000**	*62,000*	*62,000*	*425,000*	**425,000**		EFSA (2011)
Estimation of body burden															
b	Measured concentration in aborted Chinese fetuses	ng/g lw	mean		0.38	0.62	0.20	0.07	0.62	0.05	0.20	0.77	1.55	4.46	Zhao et al. (2013)
c			max		1.17	1.85	0.87	0.46	3.71	0.34	0.81	4.59	6.68	20.48	
d	Body fat	%	mean	1.07											
E = b*d	**Fetal body burden**	ng/kg	mean		4.1	6.6	2.1	0.7	6.6	0.5	2.1	8.2	16.6	47.7	
F = c*d		bw	max		12.5	19.8	9.3	4.9	39.7	3.6	8.7	49.1	71.5	219.1	
g	Measured concentration in livers (US fetuses and newborns)	ng/g lw	mean		0.6	10.7	4.5	1.9	1.1	0.3	0.3		3.5	23	Schecter et al. (2007)
h	Body fat	%	median	9.2											Hawkes et al. (2011)
i			95th percentile	14.4											
J = g*h	**Fetal body burden**	ng/kg	Median[b]		55.2	984.4	414	174.8	101.2	27.6	27.6		322	2107	Schecter et al. (2007)
K = g*i		bw	95th percentile[c]		86.4	1540.8	648	273.6	158.4	43.2	43.2		504	3298	
Mixture risk assessment														**Hazard Index**	
x	Assessment factor			2.5											
F*x/A	Hazard quotients, **Level 1** MRA		Max[d]		0.003	0.0002	0.003	0.001	0.002	0.001	0.002	0.014	0.0004	**0.027**	Zhao et al. (2013)
E*x/B	Hazard quotients		Mean[e]		0.00004	0.00007	0.00059	0.00021	0.00027	0.00002	0.00009	0.00005	0.0001	**0.001**	
F*x/B	**Level 2** MRA		Max[d]		0.0001	0.0002	0.0026	0.0014	0.0016	0.0001	0.0003	0.0003	0.0004	**0.007**	
J*x/B	Hazard quotients		Median[b]		0.0006	0.0106	0.115	0.0486	0.0041	0.0011	0.0011		0.0019	**0.18**	Schecter et al. (2007)
K*x/B	**Level 2** MRA		95th percentile[c]		0.0009	0.0166	0.180	0.0760	0.0064	0.0064	0.0017		0.0030	**0.29**	

[a] The PBDE body burden in rodents at a dose equivalent to the $BMDL_{10}$, from EFSA (2011), p 157, Table 40. Values in italics are read-across from the values in bold that were derived from available experimental data; see Level 2 procedure in Material and Methods (Bridging assumption made in the hazard assessment component of MRA), main text.

[b] Calculated assuming median body fat proportion according to Hawkes et al. (2011)

[c] Calculated assuming the 95th percentile of body fat proportion according to Hawkes et al. (2011)

[d] Calculated using maximum fetal PBDE levels, Zhao et al. (2013)

[e] Calculated using mean fetal PBDE levels, Zhao et al. (2013)

Table S10: Level 2 mixture risk assessment for small children based on body burdens estimated from PBDE serum levels (supplemental information to Table 3 of main text)

Parameter		units	Statistic	Value	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-196	BDE-197	BDE-203	BDE-206	BDE-207	BDE-208	BDE-209	Sum	Reference
A	Critical body burden[a]	ng/kg bw			*232,000*	**232,000**	**9,000**	*9,000*	**62,000**	*62,000*	*62,000*	*425,000*	*425,000*	*425,000*	*425,000*	*425,000*	*425,000*	**425,000**		EFSA (2011)
Estimation of body burden																				
b	Serum levels[b]	ng/g lw	median		0.057	1.3	0.22	0.28	1.2	nd	nd	0.088	0.42	0.81	0.28	0.48	0.13	1.5		Sahlstrom et al. (2014)
c			max		0.61	5.6	2.8	2.6	17	nd	nd	1.2	6.5	8.8	2.8	13	2.0	45		
d	Body fat	%	mean	29																
E = b*d	**Body**	ng/kg	median		16.5	377	64	81	348			25.5	122	235	81	139	38	435		
F = c*d	**burden**	bw	max		177	1624	812	754	4930			348	1885	2552	812	3770	580	13050		
g	Serum levels[b]	ng/g lw	median		1.0	31	6.2	6.2	13	3.2	nd	nd	0.5	nd	nd	nd	nd	1.7		Lunder et al. (2010)
h			max		2.2	65	15	14	32	38	1.7	nd	2.0	nd	nd	nd	nd	19		
i	Body fat	%	mean	29																
J = g*i	**Body**	ng/kg	median		290	8990	1798	1798	3770	928			142					493		
K = h*i	**burden**	bw	max		638	18850	4350	4060	9280	11020	493		580					5510		
l	Serum levels[c]	ng/g lw	Geometric mean		2.3	62	13	12.7	16	1.1	0.2	nd	nd	nd	nd	nd	nd	2.8		Wu et al. (2015)
m			95th percentile		11.6	364	78	64	87	5.3	0.8	nd	nd	nd	nd	nd	nd	9.6		
n	Body fat	%	mean	29																
R = l*n	**Body burden**	ng/kg bw	Geometric mean		653	17922	3770	3683	4669	322	58							800		
S=m*n			95th percentile		3364	105560	22591	18560	25143	1537	232							2784		
Mixture risk assessment																			**Hazard Index**	
x	Assessment factor			2.5																
E*x/A	Hazard		median		0.0002	0.004	0.018	0.023	0.014			0.0001	0.0007	0.0014	0.0005	0.0008	0.0002	0.0026	**0.1**	Sahlstrom et al. (2014)
F*x/A	quotients		max		0.002	0.0175	0.226	0.209	0.199			0.002	0.011	0.015	0.0047	0.022	0.003	0.076	**0.8**	
J*x/A	Hazard		median		0.003	0.097	0.499	0.499	0.152	0.037			0.0008					0.0029	**1.3**	Lunder et al. (2010)
K*x/A	quotients		max		0.007	0.203	1.208	1.128	0.374	0.444	0.02		0.0034					0.0324	**3.4**	
R*x/A	Hazard quotients		Geometric mean		0.007	0.193	1.047	1.023	0.1883	0.013	0.002							0.005	**2.5**	Wu et al. (2015)
S*x/A			95th percentile		0.036	1.137	6.275	5.156	1.0138	0.062	0.0093							0.0164	**13.7**	

[a] The PBDE body burden in rodents at a dose equivalent to the $BMDL_{10}$, from EFSA (2011), p 157, Table 40. Values in italics are read-across from the values in bold that were derived from available experimental data; see Level 2 procedure in Material and Methods (Bridging assumption made in the hazard assessment component of MRA), main text.

[b] for children 1-4 years of age

[c] for children 2-8 years of age

Table S11: Level 3 mixture risk assessment for small children based on body burdens estimated from PBDE serum levels (supplemental information to Table 3 of main text)

Parameter		units	Statistic	Value	BDE-47	BDE-99	BDE-153	BDE-209	Sum	Reference
A	Critical body burden[a]	ng/kg bw			**232,000**	**9,000**	**62,000**	**425,000**		EFSA (2011)
Estimation of body burden										
b	Serum levels[b]	ng/g lw	median		1.3	0.22	1.2	1.5		Sahlstrom et al. (2014)
c			max		5.6	2.8	17	45		
d	Body fat	%	mean	29						
E = b*d	**Body**	ng/kg	median		377	64	348	435		
F = c*d	**burden**	bw	max		1624	812	4930	13050		
g	Serum levels[b]	ng/g lw	median		31	6.2	13	1.7		Lunder et al. (2010)
h			max		65	15	32	19		
i	Body fat	%	mean	29						
J = g*i	**Body**	ng/kg	median		8990	1798	3770	493		
K = h*i	**burden**	bw	max		18850	4350	9280	5510		
l	Serum levels[c]	ng/g lw	Geometric mean		62	13	16	2.8		Wu et al. (2015)
m			95th percentile		364	78	87	9.6		
n	Body fat	%	mean	29						
R = l*n	**Body**	ng/kg	Geometric mean		17922	3770	4669	800		
S=m*n	**burden**	bw	95th percentile		105560	22591	25143	2784		
Mixture risk assessment										
x	Assessment factor			2.5					**Hazard Index**	
E*x/A	Hazard		median		0.004	0.018	0.014	0.0026	**0.038**	Sahlstrom et al. (2014)
F*x/A	quotients		max		0.0175	0.226	0.199	0.076	**0.5**	
J*x/A	Hazard		median		0.097	0.499	0.152	0.0029	**0.8**	Lunder et al. (2010)
K*x/A	quotients		max		0.203	1.208	0.374	0.0324	**1.8**	
R*x/A	Hazard		Geometric mean		0.193	1.047	0.1883	0.005	**1.4**	Wu et al. (2015)
S*x/A	quotients		95th percentile		1.137	6.275	1.0138	0.0164	**8.4**	

[a] The PBDE body burden in rodents at a dose equivalent to the $BMDL_{10}$, from EFSA (2011), p 157, Table 40. Values in italics are read-across from the values in bold that were derived from available experimental data; see Level 2 procedure in Material and Methods (Bridging assumption made in the hazard assessment component of MRA), main text.

[b] for children 1-4 years of age

[c] for children 2-8 years of age

Table S12: Level 2 mixture risk assessment for adults based on body burdens estimated from PBDE serum levels (supplemental information to Table 3 of main text) - France

Parameter		units	Statistic	Value	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-196	BDE-197	BDE-203	BDE-206	BDE-207	BDE-208	BDE-209	Sum	Reference
A	Critical body burden[a]	ng/kg bw			*232,000*	**232,000**	**9,000**	*9,000*	**62,000**	*62,000*	*62,000*	*425,000*	*425,000*	*425,000*	*425,000*	*425,000*	*425,000*	**425,000**		EFSA (2011)
Estimation of body burden																				
b	Serum levels	ng/g lw	mean		0.15	2.81	3.59	0.70	0.89	0.14	0.25	0.32	1.06	0.23	1.96	2.55	0.86	0.47		Antignac et al. (2009)
c			max		0.39	4.84	18.02	4.19	9.66	0.94	2.16	0.98	5.04	0.83	10.08	10.55	7.07	37.43		
d	Body fat	%	mean	29																
E=b*d	**Body**	ng/kg	mean		43.5	815	1041	203	258	41	73	93	307	67	568	740	249	136		
F=c*d	**burden**	bw	max		113	1404	5226	1215	2801	273	626	284	1461	241	2923	3060	2050	10855		
Mixture risk assessment																			**Hazard Index**	
x	Assessment factor			2.5																
E*x/A	Hazard		mean		0.0005	0.009	0.289	0.056	0.01	0.002	0.003	0.0006	0.002	0.0004	0.003	0.004	0.002	0.0008	**0.38**	
F*x/A	quotients		max		0.001	0.015	1.45	0.34	0.11	0.011	0.025	0.002	0.009	0.001	0.017	0.018	0.012	0.064	**2.07**	

[a] The PBDE body burden in rodents at a dose equivalent to the $BMDL_{10}$, from EFSA (2011), p 157, Table 40. Values in italics are read-across from the values in bold that were derived from available experimental data; see Level 2 procedure in Material and Methods (Bridging assumption made in the hazard assessment component of MRA), main text.

Table S13: Level 3 mixture risk assessment for adults based on body burdens estimated from PBDE serum levels (supplemental information to Table 3 of main text) - France

Parameter		units	Statistic	Value	BDE-47	BDE-99	BDE-153	BDE-209	Sum	Reference
A	Critical body burden[a]	ng/kg bw			**232,000**	**9,000**	**62,000**	**425,000**		EFSA (2011)
b	Serum levels	ng/g lw	mean		2.81	3.59	0.89	0.47		Antignac et al. (2009)
c			max		4.84	18.02	9.66	37.43		
d	Body fat	%	mean	29						
E=b*d	**Body**	ng/kg	mean		815	1041	258	136		
F=c*d	**burden**	bw	max		1404	5226	2801	10855		
Mixture risk assessment									**Hazard Index**	
x	Assessment factor									
E*x/A	Hazard		mean		0.009	0.289	0.01	0.0008	**0.31**	
F*x/A	quotients		max		0.015	1.45	0.11	0.064	**1.64**	

[a] The PBDE body burden in rodents at a dose equivalent to the $BMDL_{10}$, from EFSA (2011), p 157, Table 40. Values in italics are read-across from the values in bold that were derived from available experimental data; see Level 2 procedure in Material and Methods (Bridging assumption made in the hazard assessment component of MRA), main text.

Table S14: Level 2 mixture risk assessment for adults based on body burdens estimated from PBDE serum levels (supplemental information to Table 3 of main text) - USA

Parameter		units	Statistic	Value	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-196	BDE-197	BDE-203	BDE-206	BDE-207	BDE-208	BDE-209	Sum	Reference
A	Critical body burden[a]	ng/kg bw			*232,000*	**232,000**	**9,000**	*9,000*	**62,000**	*62,000*	*62,000*	*425,000*	*425,000*	*425,000*	*425,000*	*425,000*	*425,000*	**425,000**		EFSA (2011)
Estimation of body burden																				
b	Serum levels	ng/g lw	mean		0.72	12.0	1.7	1.8	7.6		0		0.3					1.7		Lunder et al. (2010)
c			max		2.50	40.0	5.2	7.0	32.0		0.5		0.8					3.2		
d	Body fat	%	mean	29																
E=b*d	**Body**	ng/kg	mean		209	3480	493	522	2204		0		96					493		
F=c*d	**burden**	bw	max		725	11600	1508	2030	9280		145		238					928		
Mixture risk assessment																			**Hazard Index**	
x	Assessment factor			2.5																
E*x/A	Hazard		mean		0.0023	0.038	0.137	0.145	0.089		0		0.0006					0.003	**0.41**	
F*x/A	quotients		max		0.008	0.125	0.42	0.56	0.37		0.006		0.001					0.005	**1.5**	

[a] The PBDE body burden in rodents at a dose equivalent to the $BMDL_{10}$, from EFSA (2011), p 157, Table 40. Values in italics are read-across from the values in bold that were derived from available experimental data; see Level 2 procedure in Material and Methods (Bridging assumption made in the hazard assessment component of MRA), main text.

Table S15: Level 3 mixture risk assessment for adults based on body burdens estimated from PBDE serum levels (supplemental information to Table 3 of main text) - USA

Parameter		units	Statistic	Value	BDE-47	BDE-99	BDE-153	BDE-209	Sum	Reference
A	Critical body burden[a]	ng/kg bw			**232,000**	**9,000**	**62,000**	**425,000**		EFSA (2011)
b	Serum levels	ng/g lw	mean		12.0	1.7	7.6	1.7		Lunder et al. (2010)
c			max		40.0	5.2	32.0	3.2		
d	Body fat	%	mean	29						
E=b*d	**Body**	ng/kg	mean		3480	493	2204	493		
F=c*d	**burden**	bw	max		11600	1508	9280	928		
Mixture risk assessment									**Hazard Index**	
x	Assessment factor									
E*x/A	Hazard		mean		0.038	0.137	0.089	0.003	**0.27**	
F*x/A	quotients		max		0.125	0.42	0.37	0.005	**0.92**	

[a] The PBDE body burden in rodents at a dose equivalent to the $BMDL_{10}$, from EFSA (2011), p 157, Table 40. Values in italics are read-across from the values in bold that were derived from available experimental data; see Level 2 procedure in Material and Methods (Bridging assumption made in the hazard assessment component of MRA), main text.

References

Allen JG, McClean MD, Stapleton HM, Webster TF. 2008. Critical factors in assessing exposure to PBDEs via house dust. Environment international 34:1085-1091.

Antignac JP, Cariou R, Zalko D, Berrebi A, Cravedi JP, Maume D, Marchand P, Monteau F, Riu A, Andre F, Le Bizec B. 2009. Exposure assessment of French women and their newborn to brominated flame retardants: Determination of tri- to deca- polybromodiphenylethers (PBDE) in maternal adipose tissue, serum, breast milk and cord serum. Environmental Pollution 157:164-173.

Asante KA, Takahashi S, Itai T, Isobe T, Devanathan G, Muto M, Agyakwah SK, du-Kumi S, Subramanian A, Tanabe S. 2013. Occurrence of halogenated contaminants in inland and coastal fish from Ghana: Levels, dietary exposure assessment and human health implications. Ecotoxicology and Environmental Safety 94:123-130.

Batterman S, Godwin C, Chernyak S, Jia C, Charles S. 2010. Brominated flame retardants in offices in Michigan, USA. Environment international 36:548-556.

Bi X, Thomas GO, Jones KC, Qu W, Sheng G, Martin FL, Fu J. 2007. Exposure of electronics dismantling workers to polybrominated diphenyl ethers, polychlorinated biphenyls, and organochlorine pesticides in South China. Environmental science & technology 41:5647-5653.

Bjorklund J, Sellstrom U, de Wit C, Aune M, Lignell S, Darnerud P. 2012. Comparisons of polybrominated diphenyl ether and hexabromocyclododecane concentrations in dust collected with two sampling methods and matched breast milk samples. Indoor Air 22:279-288.

Chao HR, Tsou TC, Huang HL, Chang-Chien GP. 2011. Levels of Breast Milk PBDEs From Southern Taiwan and Their Potential Impact on Neurodevelopment. Pediatric Research 70:596-600.

Coakley JD, Harrad SJ, Goosey E, Ali N, Dirtu AC, Van den Eede N, Covaci A, Douwes J, Mannetje A'. 2013. Concentrations of polybrominated diphenyl ethers in matched samples of indoor dust and breast milk in New Zealand. Environment international 59:255-261.

Cunha S, Kalachova K, Pulkrabova J, Fernandes J, Oliveira M, Alves A, Hajslova J. 2010. Polybrominated diphenyl ethers (PBDEs) contents in house and car dust of Portugal by pressurized liquid extraction (PLE) and gas chromatography-mass spectrometry (GC-MS). Chemosphere 78:1263-1271.

D'Hollander W, Roosens L, Covaci A, Cornelis C, Reynders H, Van Campenhout K, de Voogt P, Bervoets L. 2010. Brominated flame retardants and perfluorinated compounds in indoor dust from homes and offices in Flanders, Belgium. Chemosphere 81:478-487.

Devanathan G, Subramanian A, Sudaryanto A, Takahashi S, Isobe T, Tanabe S. 2012. Brominated flame retardants and polychlorinated biphenyls in human breast milk from several locations in India: potential contaminant sources in a municipal dumping site. Environ Int 39:87-95.

EFSA. 2011. EFSA Panel on Contaminants in the Food Chain (CONTAM); Scientific Opinion on Polybrominated Diphenyl Ethers (PBDEs) in Food. *EFSA Journal* 2011;9(5):2156.

Eguchi A, Nomiyama K, Devanathan G, Subramanian A, Bulbule KA, Parthasarathy P, Takahashi S, Tanabe S. 2012. Different profiles of anthropogenic and naturally produced organohalogen compounds in serum from residents living near a coastal area and e-waste recycling workers in India. Environ Int 47:8-16.

Gomara B, Herrero L, Ramos J, Mateo J, Fernandez M, Garcia J, Gonzalez M. 2007. Distribution of polybrominated diphenyl ethers in human umbilical. cord serum, paternal serum, maternal serum, placentas, and breast milk from Madrid population, Spain. Environmental science & technology 41:6961-6968.

Harrad S, Goosey E, Desborough J, Abdallah MA-E, Roosens L, Covaci A. 2010. Dust from UK Primary School Classrooms and Daycare Centers: The Significance of Dust As a Pathway of Exposure of Young UK Children to Brominated Flame Retardants and Polychlorinated Biphenyls. Environmental science & technology 44:4198-4202.

Hawkes CP, Hourihane JO, Kenny LC, Irvine AD, Kiely M, Murray DM. 2011. Gender- and gestational age-specific body fat percentage at birth. Pediatrics 128:e645-e651.

Hearn LK, Hawker DW, Toms LM, Mueller JF. 2013. Assessing exposure to polybrominated diphenyl ethers (PBDEs) for workers in the vicinity of a large recycling facility. Ecotoxicology and Environmental Safety 92:222-228.

Jakobsson K, Fang J, Athanasiadou M, Rignell-Hydbom A, Bergman A. 2012. Polybrominated diphenyl ethers in maternal serum, umbilical cord serum, colostrum and mature breast milk. Insights from a pilot study and the literature. Environment international 47:121-130.

Johnson PI, Stapleton HM, Slodin A, Meeker JD. 2010. Relationships between Polybrominated Diphenyl Ether Concentrations in House Dust and Serum. Environmental science & technology 44:5627-5632.

Kalachova K, Hradkova P, Lankova D, Hajslova J, Pulkrabova J. 2012. Occurrence of brominated flame retardants in household and car dust from the Czech Republic. Science of the Total Environment 441:182-193.

Kang Y, Wang HS, Cheung KC, Wong MH. 2011. Polybrominated diphenyl ethers (PBDEs) in indoor dust and human hair. Atmospheric Environment 45:2386-2393.

Karlsson M, Julander A, van Bavel B, Hardell L. 2007. Levels of brominated flame retardants in blood in relation to levels in household air and dust. Environment international 33:62-69.

Koh TW, Chen SC-C, Chang-Chien GP, Lin DY, Chen FA, Chao HR. 2010. Breast-milk levels of polybrominated diphenyl ether flame retardants in relation to women's age and pre-pregnant body mass index. International journal of hygiene and environmental health 213:59-65.

Lunder S, Hovander L, Athanassiadis I, Bergman A. 2010. Significantly Higher Polybrominated Diphenyl Ether Levels in Young US Children than in Their Mothers. Environmental science & technology 44:5256-5262.

Ma S, Yu Z, Zhang X, Ren G, Peng P, Sheng G, Fu J. 2012. Levels and congener profiles of polybrominated diphenyl ethers (PBDEs) in breast milk from Shanghai: Implication for exposure route of higher brominated BDEs. Environment international 42:72-77.

Malarvannan G, Isobe T, Covaci A, Prudente M, Tanabe S. 2013. Accumulation of brominated flame retardants and polychlorinated biphenyls in human breast milk and scalp hair from the Philippines: Levels, distribution and profiles. Science of the Total Environment 442:366-379.

Qu W, Bi X, Sheng G, Lu S, Fu H, Yuan J, Li L. 2007. Exposure to polybrominated diphenyl ethers among workers at an electronic waste dismantling region in Guangdong, China. Environment international 33:1029-1034.

Regueiro J, Llompart M, Garcia-Jares C, Cela R. 2007. Factorial-design optimization of gas chromatographic analysis of tetrabrominated to decabrominated diphenyl ethers. Application to domestic dust. Analytical and Bioanalytical Chemistry 388:1095-1107.

Sahlstrom LM, Sellstrom U, De Wit CA, Lignell S, Darnerud PO. 2014. Brominated flame retardants in matched serum samples from Swedish first-time mothers and their toddlers. Environ Sci Technol 48:7584-7592.

Schecter A, Johnson-Welch S, Tung KC, Harris TR, Papke O, Rosen R. 2007. Polybrominated diphenyl ether (PBDE) levels in livers of U.S. human fetuses and newborns. J Toxicol Environ Health A 70:1-6.

Stapleton HM, Dodder NG, Offenberg JH, Schantz MM, Wise SA. 2005. Polybrominated diphenyl ethers in house dust and clothes dryer lint. Environmental science & technology 39:925-931.

Stasinska A, Reid A, Hinwood A, Stevenson G, Callan A, Odland JO, Heyworth J. 2013. Concentrations of polybrominated diphenyl ethers (PBDEs) in residential Cross Mark dust samples from Western Australia. Chemosphere 91:187-193.

Sudaryanto A, Kajiwara N, Tsydenova OV, Isobe T, Yu H, Takahashi S, Tanabe S. 2008. Levels and congener specific profiles of PBDEs in human breast milk from China: Implication on exposure sources and pathways. Chemosphere 73:1661-1668.

Sun S, Zhao J, Leng J, Wang P, Wang Y, Fukatsu H, Liu D, Liu X, Kayama F. 2010. Levels of dioxins and polybrominated diphenyl ethers in human milk from three regions of northern China and potential dietary risk factors. Chemosphere 80:1151-1159.

Thuresson K, Bjorklund JA, de Wit CA. 2012. Tri-decabrominated diphenyl ethers and hexabromocyclododecane in indoor air and dust from Stockholm microenvironments 1: Levels and profiles. Science of the Total Environment 414:713-721.

Toms LM, Bartkow ME, Symons R, Paepke O, Mueller JF. 2009. Assessment of polybrominated diphenyl ethers (PBDEs) in samples collected from indoor environments in South East Queensland, Australia. Chemosphere 76:173-178.

Trudel D, Scheringer M, von Goetz N, Hungerbuhler K. 2011. Total consumer exposure to polybrominated diphenyl ethers in North America and Europe. *Environmental Science and Technology* 45:2391-2397.

Uemura H, Arisawa K, Hiyoshi M, Dakeshita S, Kitayama A, Takami H, Sawachika F, Yamaguchi M, Sasai S. 2010. Congener-specific body burden levels and possible determinants of polybrominated diphenyl ethers in the general Japanese population. Chemosphere 79:706-712.

Wang D, Atkinson S, Hoover-Miller A, Shelver WL, Li QX. 2008. Simultaneous use of gas chromatography/ion trap mass spectrometry - electron capture detection to improve the analysis of bromodiphenyl ethers in biological and environmental samples. Rapid Communications in Mass Spectrometry 22:647-656.

Watkins DJ, McClean MD, Fraser AJ, Weinberg J, Stapleton HM, Webster TF. 2013. Associations between PBDEs in office air, dust, and surface wipes. Environment international 59:124-132.

Wei H, Turyk M, Cali S, Dorevitch S, Erdal S, Li A. 2009. Particle size fractionation and human exposure of polybrominated diphenyl ethers in indoor dust from Chicago. Journal of Environmental Science and Health Part A-Toxic/Hazardous Substances & Environmental Engineering 44:1353-1361.

Wu XM, Bennett DH, Moran RE, Sjodin A, Jones RS, Tancredi DJ, Tulve NS, Clifton MS, Colon M, Weathers W, Hertz-Picciotto I. 2015. Polybrominated diphenyl ether serum concentrations in a Californian population of children, their parents, and older adults: an exposure assessment study. Environ Health 14:23.

Zhang X, Ruan X, Yan M, Zhao Y, Wei W, Qin Z, Yang Y, Xu H, Li Y. 2011. Polybrominated diphenyl ether (PBDE) in blood from children (age 9-12) in Taizhou, China. Journal of Environmental Sciences-China 23:1199-1204.

Zhao Y, Ruan X, Li Y, Yan M, Qin Z. 2013. Polybrominated Diphenyl Ethers (PBDEs) in Aborted Human Fetuses and Placental Transfer during the First Trimester of Pregnancy. Environmental science & technology 47:5939-5946.

Zheng J, Luo XJ, Yuan JG, Wang J, Wang YT, Chen SJ, Mai BX, Yang ZY. 2011. Levels and sources of brominated flame retardants in human hair from urban, e-waste, and rural areas in South China. Environmental Pollution 159:3706-3713.

Zhu L, Ma B, Hites RA. 2009. Brominated Flame Retardants in Serum from the General Population in Northern China. Environmental science & technology 43:6963-6968.