

## Supporting Information

Accumulation of polybrominated diphenyl ethers, hexabromobenzene and 1,2-dibromo-4-(1,2-dibromoethyl)cyclohexane (TBECH) in earthworm (*Eisenia fetida*) – effects of soil type and ageing

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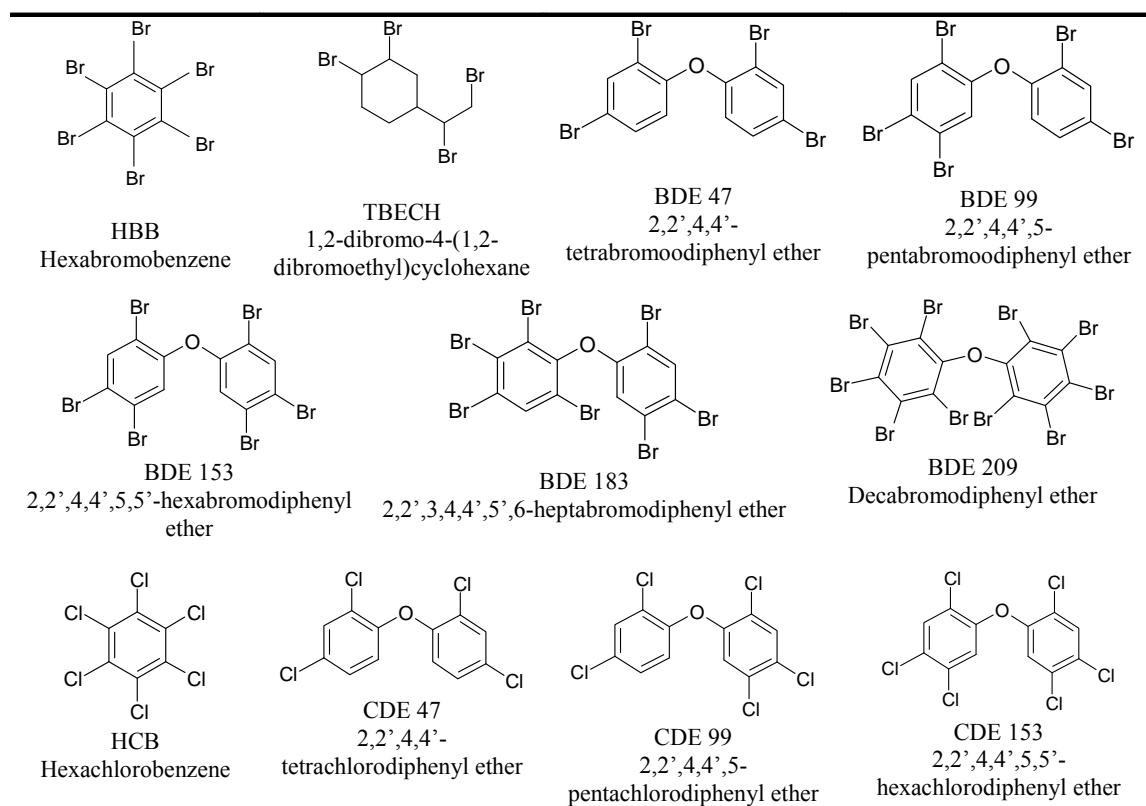


Figure S1. Chemical structures, abbreviations, and chemical names of the tested BFRs and chlorinated analogues.

Table S1. Composition of the test solution used to spike the soils, and Log Kow and water solubility values of the chemicals. The chemicals in bold are those considered in the present study. Log Kow and water solubility values were derived in EPISUITE. BDE 209 = decabromodiphenyl ether, TBECH = 1,2-dibromo-4-(1,2-dibromoethyl)cyclohexane, HBB = hexabromobenzene, CDE 47 = 2,2'4,4'-tetrachlorodiphenyl ether, CDE 99 = 2,2',4,4',5-pentachlorodiphenyl ether, CDE 153 = 2,2',4,4',5,5'-hexachlorodiphenyl ether, HCB = hexachlorobenzene, 246ClPh = 2,4,6-trichlorophenol, 246BrPh = 2,4,6-tribromophenol, TBBPA = tetrabromobisphenol A, TBBPA OHEE = tetrabromobisphenol A 2-hydroxyethyl ether, HBCD = hexabromocyclododecane, 2BrSty = 2-bromostyrene. The commercial PentaBDE-mix Bromkal 70-5 consists of BDE 47, BDE 99, BDE 100, BDE 153 and BDE 154. The commercial OctaBDE-mix Octa LM consists mainly of BDE 183.

	<i>Log Kow</i>	<i>S<sub>w</sub> (mg/L)</i>	<i>Experiment I and II</i>	<i>Experiment III</i>
<b>PentaBDE-mix: Bromkal 70-5</b>			X	X
<b>OctaBDE-mix:Octa LM</b>			X	
<b>BDE 209</b>	<b>12.1</b>	<b>2,84E-11</b>	X	
<b>TBECH</b>	<b>5.24</b>	<b>0.069</b>	X	X
<b>HBB</b>	<b>7.33</b>	<b>0.002</b>	X	X
<b>CDE 47</b>	<b>5.79</b>	<b>0.091</b>		X
<b>CDE 99</b>	<b>6.43</b>	<b>0.024</b>		X
<b>CDE 153</b>	<b>7.08</b>	<b>0.008</b>		X
<b>HCB</b>	<b>5.86</b>	<b>0.192</b>		X
246ClPh	3.45	121		X
246BrPh	4.18	9.13	X	X
TBBPA	7.20	0.001	X	X
TBBPA OHEE	6.78	1,59E-04	X	
HBCD	7.74	2,09E-05	X	
2BrSty	3.15	108	X	

Table S2. Weight of the ten earthworms, before and after exposure in treated soil, and lipid content of the earthworms after exposure.

		<i>Exposure time (days)</i>	<i>Weight before exposure (mg)</i>	<i>Weight after exposure (mg)</i>	<i>Difference</i>	<i>Lipid content</i>
Experiment I	High level OECD	0		1600		**
		2	1604	1470	-8%	**
		4	1268	1158	-9%	**
		7	2123	1865	-12%	**
		11	1563	1279	-18%	**
		21	2109	1616	-23%	**
		28 a	1809	1420	-22%	**
		28 b	1707	1382	-19%	**
		28 c	1827	1137	-38%	**
	28 control		1488	1179	-21%	**
	Medium level OECD	0		2271		**
		2	2202	2243	2%	**
		5	2243	1829	-18%	**
		8	2331	1875*	-11%	**
		10	2387	1896	-21%	**
		13	2254	1557*	-23%	**
		21	2308	1833	-21%	**
		28 a	2229	1703	-24%	**
		28 b	2281	1996	-12%	**
		28 c	2379	2053	-14%	**
		35	2173	1653	-24%	**
	Elimination	3	2353	1638	-30%	**
		7	2293	1453	-37%	**
		14	2379	1385*	-35%	**
	Low level OECD	28 a	2471	1771	-28%	**
		28 b	2120	1393	-34%	**
		28 c	2420	1893	-22%	**
Experiment II	aged OECD	28 a	2331	3270	40%	**
	aged OECD	28 b	2581	3143	22%	**
Experiment III	Lanna	28 a	2864	1971*	-24%	1.25%
		28 b	2217	1565*	-22%	1.45%
		28 c	2227	1828	-18%	1.51%
	Kloten	28 a	2807	3345	19%	2.24%
		28 b	265	3262	23%	2.03%
		28 c	2488	3181	28%	1.76%
	OECD	28 a	2750	2241	-19%	2.34%
		28 b	3016	2586	-14%	2.39%
		28 c	2374	2066	-13%	1.92%

\*only nine earthworms were found after the exposure period

\*\*lipid content was determined in separate samples, and an average lipid content of 1.5% was used in the calculations of BSAFs

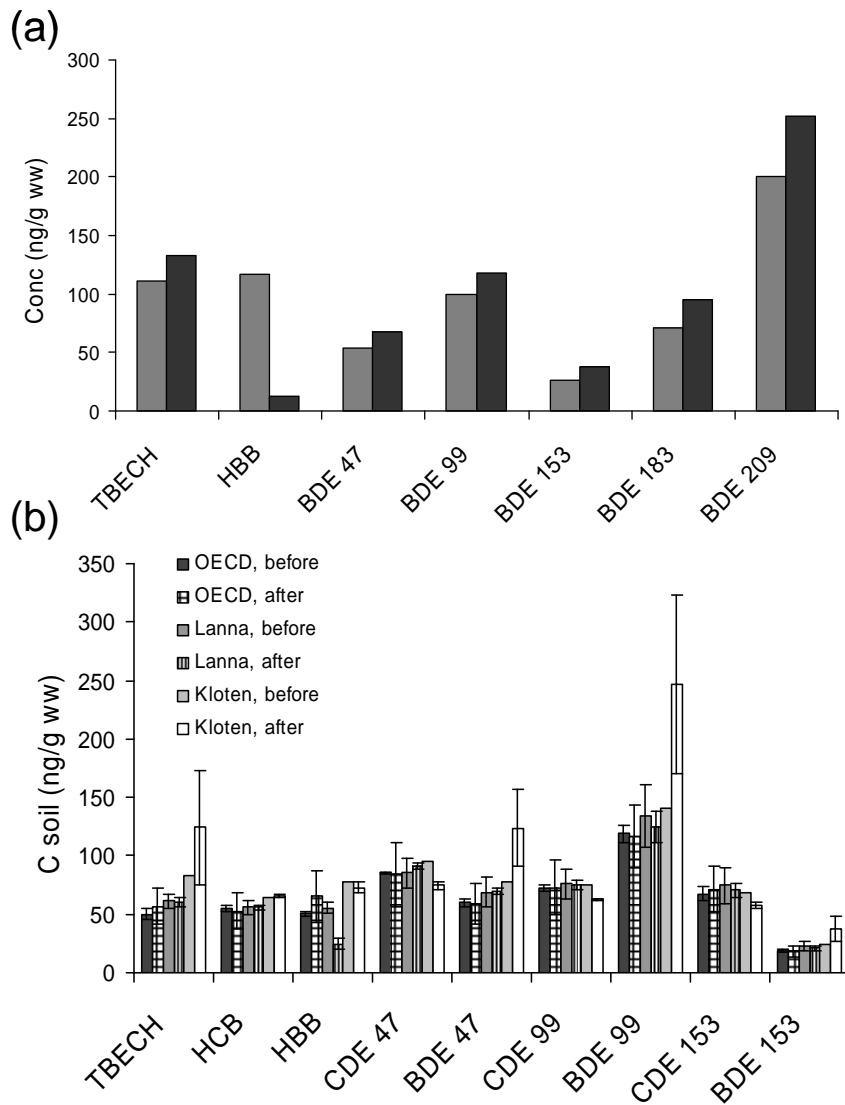


Figure S2. Measured concentrations in ng/g wet weight (ww) of (a) 1,2-dibromo-4-(1,2-dibromoethyl)cyclohexane (TBECH), hexabromobenzene (HBB), and bromodiphenyl ethers (BDEs) 47, 99, 153, 183, and 209 in medium level treated OECD soil used in Experiment I (grey bars), and after approximately two years of ageing in Experiment II (black bars), (b) TBECH, hexachlorobenzene (HCB), HBB, chlorodiphenyl ethers (CDEs) 47, 99, and 153, and BDEs 47, 99, and 153 in OECD, Lanna, and Kloten soils before and after exposure of worms in the soils for 28 days.

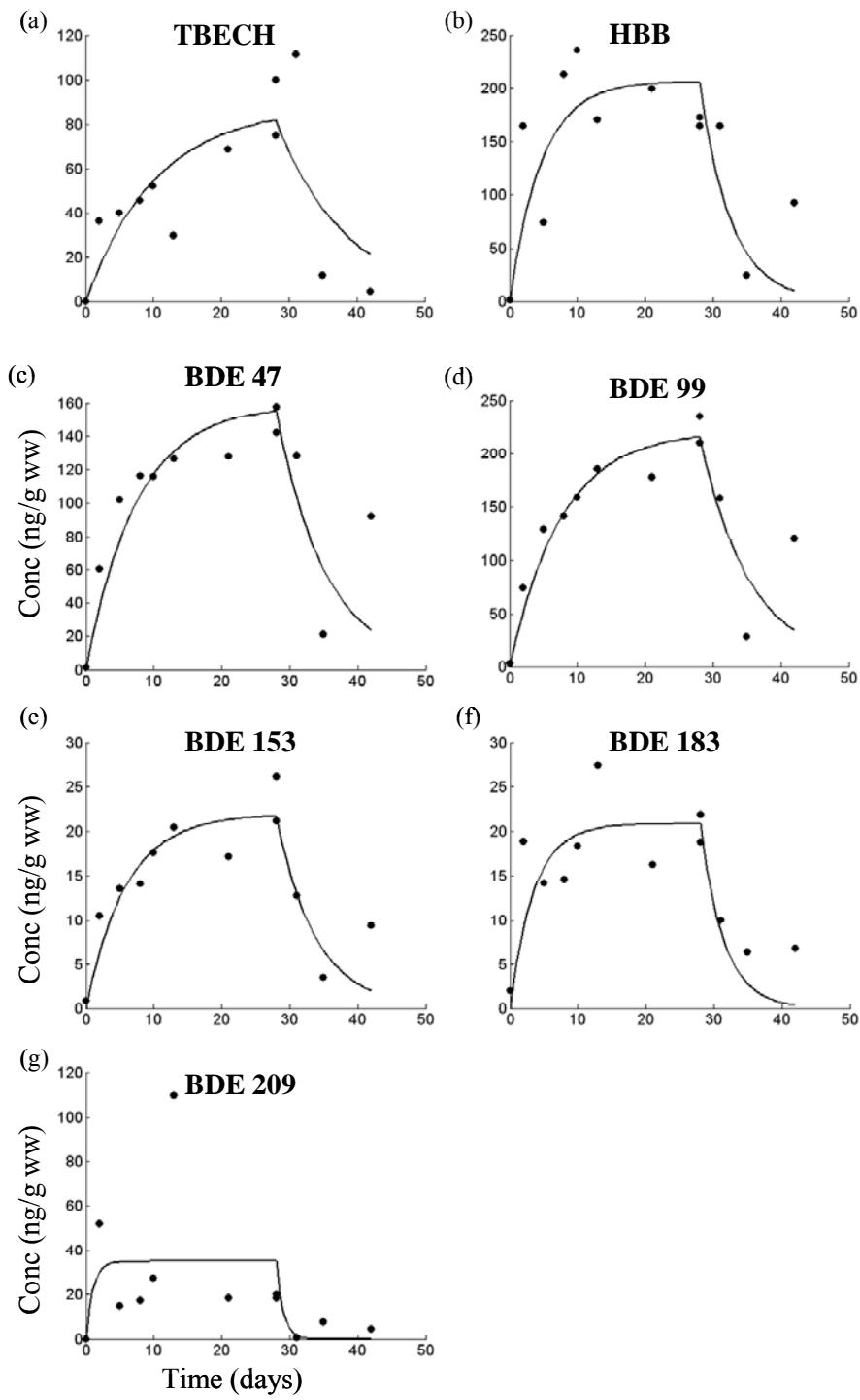


Figure S3. Modeled uptake and elimination in earthworms of (a) 1,2-dibromo-4-(1,2-dibromoethyl)cyclohexane (TBECH), (b) hexabromobenzene (HBB), and (c-f) bromodiphenyl ethers (BDE) 47 (c), 99 (d), 153 (e), 183 (f), and 209 (g) exposed in the medium level OECD soil. One of the worm samples (ten pooled worms) after 28 days exposure showed very high concentrations of the PBDEs and deviated from the other observations (having up to five times higher concentrations) and was excluded from the modeling.

Table S3. Bioaccumulation parameters derived in the modeling of concentration data

	$ks^1$	$ke^2$	$R2^3$	Modeled steady-state concentration <sup>4</sup>	Modeled concentration at day 28 <sup>4</sup>
<i>High concentration (μg/g wet weight)</i>					
<b>TBECH</b>	0.43	0.28	0.93	32	32
<b>HBB</b>	0.12	0.24	0.59	12	12
<b>BDE 47</b>	0.13	0.12	0.93	17	16
<b>BDE 99</b>	0.07	0.07	0.97	38	33
<b>BDE 153</b>	0.03	0.05	0.96	7.8	5.9
<b>BDE 183</b>	0.01	0.06	0.91	11	9.5
<b>BDE 209</b>	0.002	0.21	0.66	4.7	4.7
<i>Medium concentration (ng/g wet weight)</i>					
<b>TBECH</b>	0.07	0.10	0.59	88	82
<b>HBB</b>	0.38	0.22	0.49	206	206
<b>BDE 47</b>	0.40	0.14	0.65	159	155
<b>BDE 99</b>	0.29	0.13	0.75	221	216
<b>BDE 153</b>	0.14	0.17	0.78	22	22
<b>BDE 183</b>	0.08	0.29	0.56	12	12
<b>BDE 209</b>	0.007	1.0	0.24	35	35

<sup>1</sup>uptake rate in ng day<sup>-1</sup>g<sup>-1</sup> worm

<sup>2</sup>elimination rate constant in day<sup>-1</sup>

<sup>3</sup>regression coefficient

<sup>4</sup>calculated using equation 1

Table S4. BSAFs determined after 28 days exposure of earthworms in experiment I, II, and III. Low level  $\approx$  10 ng/g, medium level  $\approx$  100 ng/g, high level  $\approx$  10000 ng/g of each BFR.

	Experiment I			Experiment II	Experiment III			Sellström et al. 2005
	<i>High level in soil</i>	<i>Medium level in soil</i>	<i>Low level in soil</i>	<i>Aged soil (Medium level)</i>	<i>OECD (Medium level)</i>	<i>Lanna (Medium level)</i>	<i>Kloten (Medium level)</i>	<i>Field data</i>
BDE 47	4.7	11	10	8.5	8.4	5.0	2.3	5.0
BDE 99	3.7	9.3	7.6	5.8	5.9	3.2	2.2	4.2
BDE 153	1.8	3.8	3.0	2.5	2.7	1.3	1.1	2.5
BDE 183	0.6	1.2	3.4	1.1				
BDE 209	0.03	0.4	1.6	0.5				0.3
TBECH	6.1	3.5	2.2	0.9	3.5	1.5	1.8	
HBB	2.3	7.8	6.1	2.8	8.9	5.6	2.6	
CDE 47					7.9	6.4	2.1	
CDE 99					9.5	6.4	3.5	
CDE 153					11	6.1	4.9	
HCB					9.3	14	3.9	