

Supplemental Material

Exposure to PBDEs in the Office Environment: Evaluating the Relationship Between Dust, Handwipes and Serum

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Supplemental Material, Text: Spearman Correlations within Sample Type

Individual PBDE congeners in handwipes were correlated in a pattern reflecting the three commercial mixtures: Penta, Octa, and Deca. Penta congeners were all highly correlated with one another as well as with the sum Penta measure ($p < 0.0001$ for all comparisons). BDE 183 in handwipes was moderately correlated with the Penta sum measure ($r = 0.45$, $p = 0.01$) but BDE 209 was not ($r = 0.16$, $p = 0.39$). Individual PBDE congeners measured in office dust were also correlated with one another in a pattern that generally represents the three commercial PBDE mixtures. However, BDE 183 and BDE 209 were more highly correlated than expected ($r = 0.61$, $p = 0.0003$) based on earlier work in homes (Allen et al. 2008), suggesting a possible common source of Octa and Deca. As Octa and Deca were commonly used in acrylonitrile-butadiene-styrene (ABS) and high-impact polystyrene (HIPS) polymers, respectively, for the housings of office equipment (Birnbaum and Cohen Hubal 2006), they may often occur together in the office environment. Both BDE 183 and BDE 209 were also moderately correlated with the sum PentaBDE measurement ($r = 0.46$, $p = 0.009$ and $r = 0.45$, $p = 0.01$ respectively). Principal component analysis confirmed that PBDE congeners in both handwipes and office dust clustered by commercial mixture, consistent with our previous findings (Allen et al. 2008).

Supplemental Material, Table 1. Correlations of PBDE congeners in office dust

	BDE28/33	BDE47	BDE49	BDE66	BDE75	BDE85/155	BDE99	BDE100	BDE138	BDE153
BDE28/33	1.00	0.80343	0.50010	0.78527	0.29091	0.68860	0.75782	0.77639	0.54208	0.60969
<i>p-value</i>		<.0001	0.0042	<.0001	0.1124	<.0001	<.0001	<.0001	0.0016	0.0003
BDE47		1.00	0.70202	0.73952	0.30616	0.80605	0.87137	0.95202	0.68508	0.71411
<i>p-value</i>			<.0001	<.0001	0.0939	<.0001	<.0001	<.0001	<.0001	<.0001
BDE49			1.00	0.53589	0.30010	0.54234	0.57944	0.64073	0.53992	0.53145
<i>p-value</i>				0.0019	0.1009	0.0016	0.0006	0.0001	0.0017	0.0021
BDE66				1.00	0.39072	0.66935	0.71089	0.76331	0.58145	0.59637
<i>p-value</i>					0.0298	<.0001	<.0001	<.0001	0.0006	0.0004
BDE75					1.00	0.47972	0.40383	0.32936	0.39617	0.39132
<i>p-value</i>						0.0063	0.0243	0.0704	0.0274	0.0295
BDE85/155						1.00	0.94395	0.89153	0.90000	0.86935
<i>p-value</i>							<.0001	<.0001	<.0001	<.0001
BDE99							1.00	0.95565	0.84153	0.86855
<i>p-value</i>								<.0001	<.0001	<.0001
BDE100								1.00	0.79597	0.82177
<i>p-value</i>									<.0001	<.0001
BDE138									1.00	0.97016
<i>p-value</i>										<.0001
BDE153										1.00
	BDE154	BDE183	BDE196	BDE197	BDE201	BDE206	BDE207	BDE208	BDE209	ΣPentaBDE^a
BDE28/33	0.57154	0.37457	0.17740	0.16408	0.25227	0.19193	0.21756	0.22624	0.29001	0.81675
<i>p-value</i>	0.0008	0.0379	0.3397	0.3778	0.1710	0.3010	0.2397	0.2210	0.1135	<.0001
BDE47	0.68266	0.36653	0.28750	0.19597	0.31694	0.34194	0.35282	0.34758	0.37339	0.93992
<i>p-value</i>	<.0001	0.0426	0.1168	0.2907	0.0824	0.0597	0.0516	0.0554	0.0385	<.0001
BDE49	0.43871	0.31089	0.20403	0.10363	0.20645	0.38790	0.36855	0.35484	0.38226	0.63750
<i>p-value</i>	0.0136	0.0887	0.2709	0.5791	0.2652	0.0311	0.0413	0.0501	0.0338	0.0001
BDE66	0.58145	0.26290	0.09637	0.07097	0.15363	0.10968	0.13306	0.09274	0.18710	0.74718
<i>p-value</i>	0.0006	0.1530	0.6060	0.7044	0.4093	0.5570	0.4755	0.6197	0.3135	<.0001
BDE75	0.33764	0.15943	0.02926	0.03027	0.08254	0.01574	-0.03754	-0.06741	0.0121	0.36690
<i>p-value</i>	0.0632	0.3916	0.8758	0.8716	0.6589	0.9330	0.8411	0.7186	0.9948	0.0423
BDE85/155	0.85121	0.41089	0.30524	0.17540	0.37903	0.36008	0.34960	0.36855	0.39879	0.92177
<i>p-value</i>	<.0001	0.0217	0.0950	0.3453	0.0355	0.0466	0.0539	0.0413	0.0263	<.0001
BDE99	0.84758	0.46048	0.37984	0.24274	0.44274	0.43629	0.41411	0.42218	0.45242	0.97661
<i>p-value</i>	<.0001	0.009	0.0351	0.1883	0.0126	0.0141	0.0206	0.0180	0.0106	<.0001

Table S1. Correlations of PBDE congeners in office dust (cont.)										
	BDE154	BDE183	BDE196	BDE197	BDE201	BDE206	BDE207	BDE208	BDE209	ΣPentaBDE^a
BDE100	0.79355	0.45968	0.36734	0.27540	0.41976	0.40726	0.40565	0.39677	0.43105	0.98145
<i>p-value</i>	<.0001	0.0093	0.0421	0.1337	0.0187	0.0230	0.0236	0.0271	0.0155	<.0001
BDE138	0.86411	0.59597	0.49315	0.35202	0.51169	0.47218	0.47500	0.46532	0.49113	0.81532
<i>p-value</i>	<.0001	0.0004	0.0048	0.0521	0.0033	0.0073	0.0069	0.0083	0.0050	<.0001
BDE153	0.88750	0.67782	0.57984	0.44194	0.58306	0.48226	0.50202	0.47661	0.51008	0.84556
<i>p-value</i>	<.0001	<.0001	0.0006	0.0128	0.0006	0.0060	0.0040	0.0067	0.0034	<.0001
	BDE154	BDE183	BDE196	BDE197	BDE201	BDE206	BDE207	BDE208	BDE209	ΣPentaBDE^a
BDE154	1.00	0.48508	0.48589	0.27702	0.44556	0.41492	0.44274	0.42984	0.47097	0.80806
<i>p-value</i>		0.0057	0.0056	0.1314	0.0120	0.0203	0.0126	0.0158	0.0075	<.0001
BDE183		1.00	0.82782	0.92621	0.76613	0.57944	0.64435	0.57097	0.60847	0.46008
<i>p-value</i>			<.0001	<.0001	<.0001	<.0001	<.0001	0.0008	0.0003	0.0092
BDE196			1.00	0.83911	0.82419	0.70806	0.76613	0.68065	0.71048	0.55806
<i>p-value</i>				<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0011
BDE197				1.00	0.76331	0.54677	0.61694	0.52661	0.56774	0.32298
<i>p-value</i>					<.0001	0.0015	0.0002	0.0023	0.0009	0.0764
BDE201					1.00	0.77782	0.83629	0.81290	0.79597	0.26411
<i>p-value</i>						<.0001	<.0001	<.0001	<.0001	0.1511
BDE206						1.00	0.95968	0.95202	0.96978	0.42056
<i>p-value</i>							<.0001	<.0001	<.0001	0.0185
BDE207							1.00	0.97984	0.97218	0.41331
<i>p-value</i>								<.0001	<.0001	0.0208
BDE208								1.00	0.96250	0.41169
<i>p-value</i>									<.0001	0.0214
BDE209									1.00	0.44960
<i>p-value</i>										0.0112
ΣPentaBDE^a										1.00

^aΣPentaBDE comprises BDE28/33, 47, 99, 100, and 153 (congeners detected in >50% of samples within all three media: dust, handwipes, and serum).

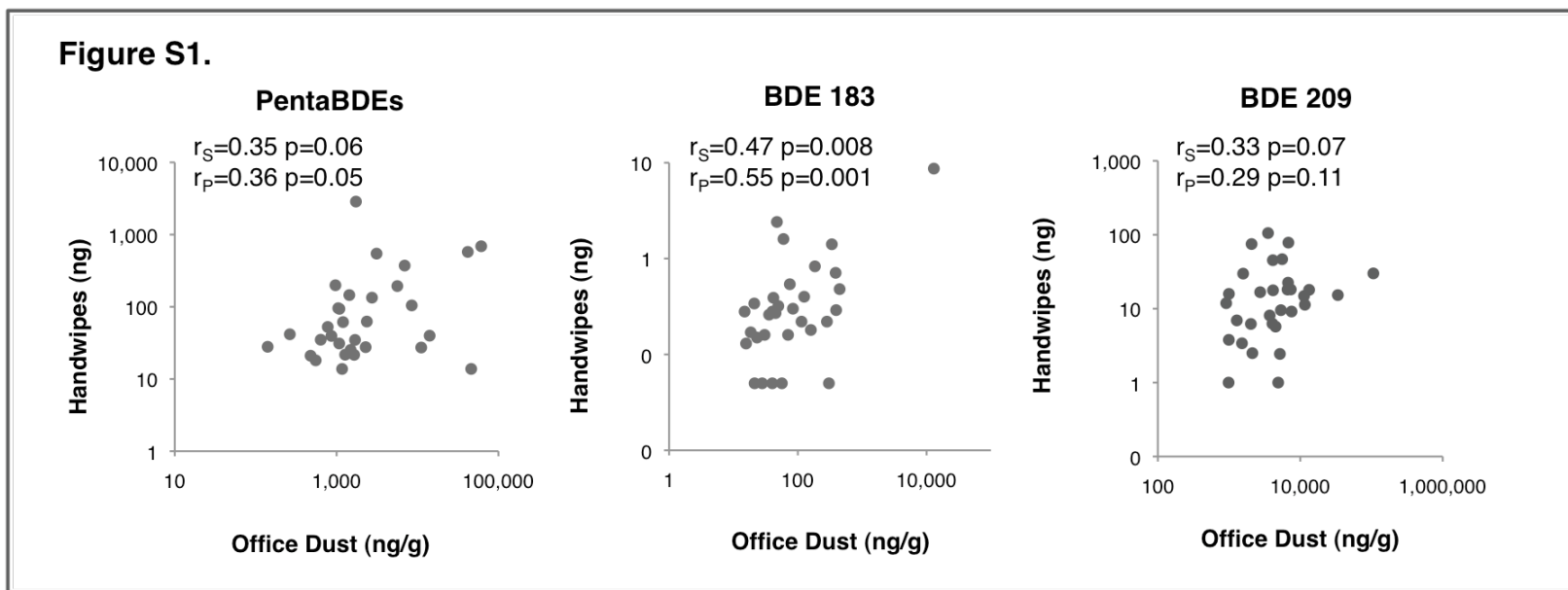
Supplemental Material, Table 2. Correlations of PBDE congeners in handwipes

	BDE28/33	BDE47	BDE49	BDE66	BDE75	BDE85/155	BDE99	BDE100	BDE138
BDE28/33	1.00	0.77022	0.72254	0.77362	0.41329	0.61467	0.72019	0.73008	0.66569
<i>p-value</i>		<.0001	<.0001	<.0001	0.0208	0.0002	<.0001	<.0001	<.0001
BDE47		1.00	0.82482	0.85152	0.58323	0.80851	0.93427	0.95323	0.88435
<i>p-value</i>			<.0001	<.0001	0.0006	<.0001	<.0001	<.0001	<.0001
BDE49			1.00	0.90741	0.55525	0.69517	0.81514	0.82220	0.76785
<i>p-value</i>				<.0001	0.0012	<.0001	<.0001	<.0001	<.0001
BDE66				1.00	0.52800	0.77772	0.88420	0.88541	0.83006
<i>p-value</i>					0.0023	<.0001	<.0001	<.0001	<.0001
BDE75					1.00	0.59869	0.70849	0.67571	0.71821
<i>p-value</i>						0.0004	<.0001	<.0001	<.0001
BDE85/155						1.00	0.89624	0.88918	0.85099
<i>p-value</i>							<.0001	<.0001	<.0001
BDE99							1.00	0.99476	0.95970
<i>p-value</i>								<.0001	<.0001
BDE100								1.00	0.95444
<i>p-value</i>									<.0001
BDE138									1.00
	BDE153	BDE154	BDE183	BDE197	BDE207	BDE208	BDE209	ΣPentaBDE^a	
BDE28/33	0.67736	0.69971	0.47983	0.30411	0.01928	-0.07048	0.05629	0.75368	
<i>p-value</i>	<.0001	<.0001	0.0063	0.0963	0.9180	0.7064	0.7636	<.0001	
BDE47	0.90583	0.91395	0.45832	0.21118	0.11059	0.00899	0.12844	0.97702	
<i>p-value</i>	<.0001	<.0001	0.0095	0.2541	0.5537	0.9617	0.4911	<.0001	
BDE49	0.79279	0.79754	0.34267	0.20432	-0.07673	-0.15965	-0.10879	0.83169	
<i>p-value</i>	<.0001	<.0001	0.0591	0.2702	0.6816	0.3909	0.5602	<.0001	
BDE66	0.86007	0.86202	0.40138	0.22138	-0.05596	-0.14438	-0.02118	0.87291	
<i>p-value</i>	<.0001	<.0001	0.0252	0.2314	0.7650	0.4384	0.9099	<.0001	
BDE75	0.70327	0.69350	0.32901	0.28711	0.26363	0.15859	0.38140	0.66883	
<i>p-value</i>	<.0001	<.0001	0.0707	0.1173	0.1519	0.3942	0.0343	<.0001	
BDE85/155	0.87837	0.88426	0.30443	0.11783	0.02430	0.10804	0.12555	0.86942	
<i>p-value</i>	<.0001	<.0001	0.0959	0.5278	0.8967	0.5629	0.5009	<.0001	
BDE99	0.99072	0.99082	0.44943	0.25081	0.09006	-0.00300	0.19236	0.98387	
<i>p-value</i>	<.0001	<.0001	0.0112	0.1735	0.6299	0.9872	0.2999	<.0001	
BDE100	0.98185	0.98315	0.45347	0.23988	0.08336	-0.00621	0.15687	0.99153	
<i>p-value</i>	<.0001	<.0001	0.0104	0.1937	0.6557	0.9736	0.3994	<.0001	

Table S2. Correlations of PBDE congeners in handwipes (cont.)								
	BDE153	BDE154	BDE183	BDE197	BDE207	BDE208	BDE209	ΣPentaBDE^a
BDE138	0.96294	0.95815	0.38869	0.17742	0.05976	-0.04355	0.18232	0.94249
<i>p-value</i>	<.0001	<.0001	0.0307	0.3397	0.7495	0.8160	0.3263	<.0001
BDE153	1.00	0.99627	0.45063	0.27903	0.08170	-0.02559	0.17868	0.96653
<i>p-value</i>		<.0001	0.0110	0.1285	0.6622	0.8913	0.3362	<.0001
BDE154		1.00	0.43721	0.26234	0.05973	-0.04520	0.17322	0.96863
<i>p-value</i>			0.0139	0.1539	0.7496	0.8092	0.3514	<.0001
BDE183			1.00	0.58038	0.64386	0.45749	0.38834	0.45186
<i>p-value</i>				0.0006	<.0001	0.0097	0.0309	0.0107
BDE197				1.00	0.40807	0.26564	0.24098	0.24609
<i>p-value</i>					0.0227	0.1487	0.1916	0.1820
BDE207					1.00	0.88315	0.59111	0.10095
<i>p-value</i>						<.0001	0.0005	0.5889
BDE208						1.00	0.44812	0.01135
<i>p-value</i>							0.0115	0.9517
BDE209							1.00	0.15828
<i>p-value</i>								0.3951
ΣPentaBDE^a								1.00

^aΣPentaBDE comprises BDE28/33, 47, 99, 100, and 153 (congeners detected in >50% of samples within all three media: dust, handwipes, and serum)

Supplemental Material, Figure 1. Scatter plot of PBDEs in office dust vs. handwipes (n=31)



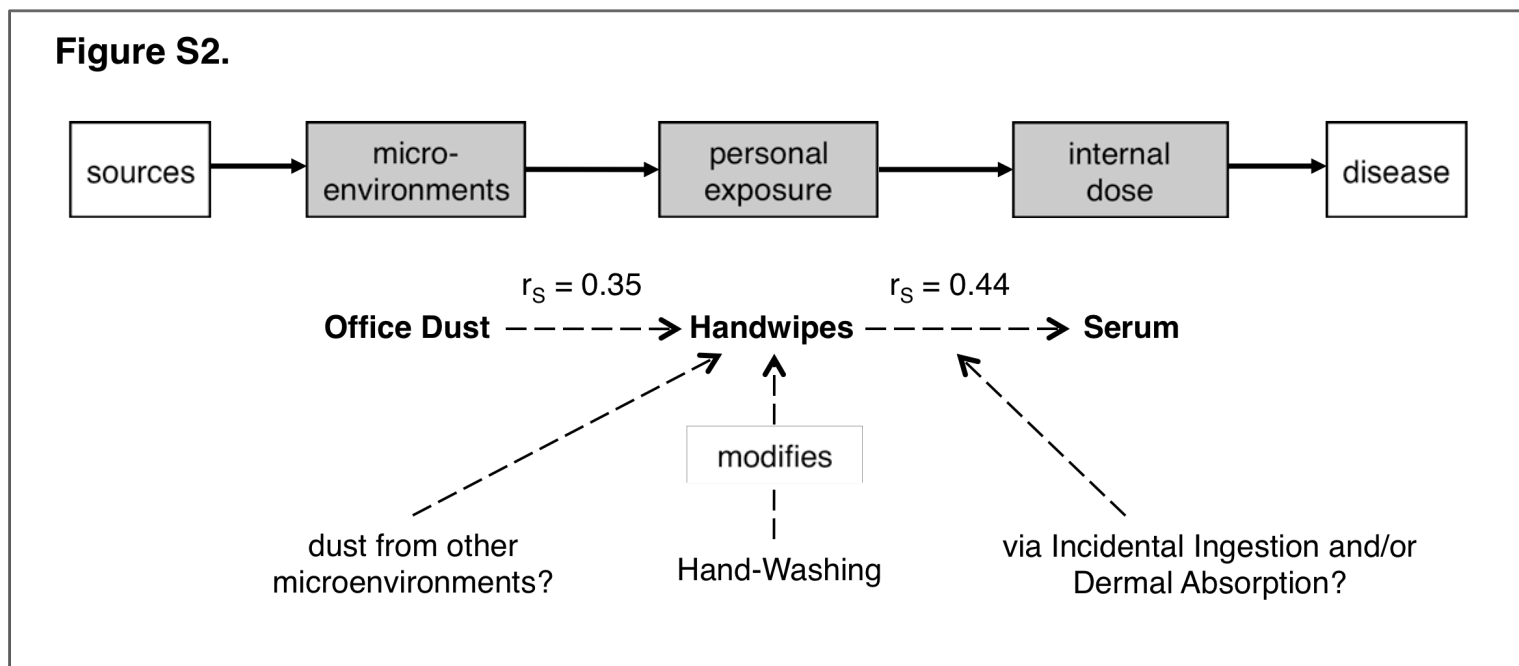
r_S =Spearman Correlation Coefficient; r_P =Pearson Correlation Coefficient of natural log-transformed data

Supplemental Material, Table 3. Correlations of PBDE congeners in serum

	BDE28	BDE47	BDE99	BDE100	BDE153	BDE209	ΣPentaBDE^a
BDE28	1.00	0.89412	0.75485	0.83517	0.75945	-0.05595	0.87614
<i>p-value</i>		<.0001	<.0001	<.0001	<.0001	0.7690	<.0001
BDE47		1.00	0.91340	0.96863	0.73807	-0.03834	0.96729
<i>p-value</i>			<.0001	<.0001	<.0001	0.8406	<.0001
BDE99			1.00	0.94365	0.76222	-0.02376	0.92563
<i>p-value</i>				<.0001	<.0001	0.9008	<.0001
BDE100				1.00	0.80303	0.02755	0.97529
<i>p-value</i>					<.0001	0.8851	<.0001
BDE153					1.00	-0.02308	0.85562
<i>p-value</i>						0.9036	<.0001
BDE209						1.00	-0.02074
<i>p-value</i>							0.9134
ΣPentaBDE^a							1.00

^aΣPentaBDE comprises BDE28/33, 47, 99, 100, and 153 (congeners detected in >50% of samples within all three media: dust, handwipes, and serum)

Supplemental Material, Figure 2. Conceptual Model of Exposure



Office dust is a measure of PBDEs in the microenvironment, handwipes a measure of personal exposure, and serum a measure of internal dose. r_s =Spearman Correlation Coefficient

References

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Birnbaum LS, Cohen Hubal EA. 2006. Polybrominated diphenyl ethers: A case study for using biomonitoring data to address risk assessment questions. *Environ Health Perspect* 114(11):1770-1775.