Online supporting information for the following article published in *Indoor Air*

DOI: 10.1111/ina.12130

**Polybrominated diphenyl ether (PBDE)** **Concentrations and Resulting Exposure in Homes in California: Relationships among Passive Air, Surface Wipe and Dust Concentrations, and Temporal Variability**

Deborah H. Bennett1\*, Rebecca E. Moran1, Xiangmei (May) Wu1, Nicolle S. Tulve2, Matthew Scott Clifton2, Maribel Colón2, Walter Weathers2, Andreas Sjödin3, Richard Jones3, Irva Hertz-Picciotto1

1 Department of Public Health Sciences, University of California, Davis, CA, United States

2 Human Exposure and Atmospheric Sciences Division, National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Research Triangle Park, NC, United States

3 Centers for Disease Control and Prevention, National Center for Environmental Health, Atlanta, GA, United States

\*Corresponding author: Department of Public Health Sciences, One Shields Avenue, MS1C, University of California at Davis, CA 95616; Tel: 1-530-754-8282; fax 1-530-752-3239; email: [dhbennett@ucdavis.edu](mailto:dhbennett@ucdavis.edu)

**QA/QC**

Table S1 presents the field blank concentration, estimated limit of quantification (ELOQ), method detection limit (MDL), and precision calculated from duplicate samples. The ELOQ for air and wipe samples was determined based on the lowest level that can be accurately quantified by the instrumentation in our laboratory. This is accomplished by analyzing standard solutions from very low, non-detectable concentrations to very high concentrations and generating least squares regression lines with a minimum of five points (r2>0.98). At the low end, analyte response will be influenced by noise, so we determine the lowest concentration where a particular analyte can be measured within a concentration + or - 25% (relative error) of the prepared concentration of the solution. Calibration ranges are also determined using this process. MDL is calculated using the same method as described in Clifton et al. (2013).

The procedure recommended by The International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use ([ICH Expert Working Group, 1994](#_ENREF_7)) in determining the limit of detection limit (LOD) and estimated limit of quantitation (ELOQ) for dust samples. Using this procedure, LOD = 3.3\*σ/S, where σ is the standard deviation of the y-intercept and S is slope of the regression line. The LOQ = 10\*σ/S.

Table S1. QA/QC information for air and wipe BDE samples.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Air | | | | Wipe | | | Dust |
| PBDEs | FB (N=9)  (ng/sample) | ELOQ (ng/sample) | MDL (ng/sample) | Precision (median % diff) | FB (N=17)  (ng/sample) | ELOQ (ng/sample) | Precision  (median % diff) | ELOQ (ng/g dust) |
| BDE47 | 0.04±0.03 | 25 | 0.01 | 29% | 3.0±2.6 | 10 | 15% | 59 |
| BDE99 | 0.05±0.04 | 25 | 0.01 | 54% | 3.3±2.8 | 25 | 15% | 96 |
| BDE100 | 0.08±0.05 | 25 | 0.06 | 92% | 3.6±6.3 | 10 | 30% | 20 |
| BDE153 | 0.10±0.09 | 25 | 0.004 | 53% | 6.9±4.1 | 25 | 21% | 19 |
| BDE154 | 0.02±0.02 | 25 | 0.01 | 42% | 2.2±2.1 | 10 | 28% | 17 |
| BDE209 | — | — | — | — | 16±17 | 50 | 49% | 78 |

Note: FB: field blank; ELOQ=estimated limit of quantification; MDL: method detection limit.

The ELOQ for air samples, 25 ng/sample, is equivalent to 0.33 ng/m3, assuming the sampling flow rate is 2.5 m3/day and the sampling time is 30 days.

The ELOQs for wipe samples, 10/25/50 ng/sample, are equivalent to 1.0/2.5/5.0 pg/cm2 for window wipe given the sampling area is 1 m2, and are equivalent to 0.67/1.7/3.3 pg/cm2 for floor wipe given the sampling area is 1.5 m2.

Table S2. Limit of Detection (LOD) of BDE congeners in serum samples.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Congeners | N | Arithmetic Mean | Std Dev | 10th% | 90th% | Range |
| BDE17 | 279 | 0.51 | 0.28 | 0.30 | 0.60 | 0.2~3.8 |
| BDE28 | 279 | 0.51 | 0.28 | 0.30 | 0.60 | 0.2~3.8 |
| BDE47 | 279 | 0.83 | 0.46 | 0.50 | 1.10 | 0.4~6.1 |
| BDE66 | 279 | 0.51 | 0.28 | 0.30 | 0.60 | 0.2~3.8 |
| BDE85 | 279 | 0.51 | 0.28 | 0.30 | 0.60 | 0.2~3.8 |
| BDE99 | 279 | 0.58 | 0.32 | 0.40 | 0.70 | 0.3~4.3 |
| BDE100 | 279 | 0.51 | 0.28 | 0.30 | 0.60 | 0.2~3.8 |
| BDE154 | 279 | 0.51 | 0.28 | 0.30 | 0.60 | 0.2~3.8 |
| BDE153 | 279 | 0.51 | 0.28 | 0.30 | 0.60 | 0.2~3.8 |
| BDE183 | 279 | 0.51 | 0.28 | 0.30 | 0.60 | 0.2~3.8 |
| BDE209 | 273 | 5.01 | 2.63 | 3.30 | 6.40 | 2.3~37.6 |

Table S3. Demographics of study population\*

|  |  |  |
| --- | --- | --- |
| Demographics | Northern California  Family Cohorta | Central California  Older Adult Cohort |
| N of Households | 90 | 49 |
| **Adult Sex**- female | 81 (90%) | 34 (69%) |
| **Adult Age** (Median: year) | 38.5 | 67.3 |
| **Child Sex-** female | 45 (50%) | — |
| **Child Age** (Median: year) | 55..5 | — |
| **Education** |  |  |
| High school | 8 (9%) | 5 (10%) |
| College degree or some college | 58 (64%) | 39 (80%) |
| Master, Doctor, and professional degree | 23 (26%) | 5 (10%) |
| **Job Status** |  |  |
| Employed | 38 (42%) | 18 (37%) |
| Unemployed (including stay-at-home parents) | 44 (49%) | 30 (61%) |
| Other | 6 (7%) | 1 (2%) |
| **Race/Ethnicity** |  |  |
| White (not Hispanic) | 60 (67%) | 37 (76%) |
| Asian (not Hispanic) | 7 (8%) | 0 (0%) |
| Black (not Hispanic) | 2 (2%) | 1 (2%) |
| Other (not Hispanic) | 7 (8%) | 5 (10%) |
| Hispanic (all races) | 13 (14%) | 6 (12%) |
| **Foreign Born** | 20 (22%) | 3 (6%) |
| **Homeowner** | 71 (79%) | 44 (90%) |
| **House Type** |  |  |
| Single house detached | 75 (83%) | 37 (76%) |
| Single attached house | 3 (3%) | 9 (18%) |
| Apartment | 11 (12%) | 3 (6%) |
| **Neighborhood Type** |  |  |
| Commercial | 0 (0%) | 1 (2%) |
| Residential | 72 (80%) | 41 (84%) |
| Rural | 5 (6%) | 2 (4%) |
| Combination of above | 11 (12%) | 5 (10%) |
| **Number of Children in the Household** (median) | 2 | 0 |

aDemographic information was missing for one household.

Table S4. Correlations among BDE congener concentrations within each environmental media.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | BDE47 | BDE99 | BDE100 | BDE153 | BDE154 |
| Air (N=136) |  |  |  |  |  |
| BDE99 | 0.90\*\* | 1 |  |  |  |
| BDE100 | 0.64\*\* | 0.75\*\* | 1 |  |  |
| BDE153 | 0.05 | 0.24\*\* | 0.35\*\* | 1 |  |
| BDE154 | 0.40\*\* | 0.46\*\* | 0.19\* | 0.14 | 1 |
| Window wipe (N=122) |  |  |  |  |  |
| BDE99 | 0.95\*\* | 1 |  |  |  |
| BDE100 | 0.88\*\* | 0.91\*\* | 1 |  |  |
| BDE153 | 0.47\*\* | 0.53\*\* | 0.67\*\* | 1 |  |
| BDE154 | 0.74\*\* | 0.81\*\* | 0.94\*\* | 0.77\*\* | 1 |
| BDE209 | 0.28\*\* | 0.29\*\* | 0.25\*\* | 0.09 | 0.22\*\* |
| Floor wipe (N=123) |  |  |  |  |  |
| BDE99 | 0.83\*\* | 1 |  |  |  |
| BDE100 | 0.86\*\* | 0.84\*\* | 1 |  |  |
| BDE153 | 0.59\*\* | 0.65\*\* | 0.73\*\* | 1 |  |
| BDE154 | 0.77\*\* | 0.77\*\* | 0.91\*\* | 0.72\*\* | 1 |
| BDE209 | 0.28\*\* | 0.20\* | 0.27\*\* | 0.16\* | 0.32\*\* |
| HVS3 dust (N=83) |  |  |  |  |  |
| BDE99 | 0.96\*\* | 1 |  |  |  |
| BDE100 | 0.97\*\* | 0.99\*\* | 1 |  |  |
| BDE153 | 0.91\*\* | 0.97\*\* | 0.96\*\* | 1 |  |
| BDE154 | 0.91\*\* | 0.96\*\* | 0.95\*\* | 0.97\*\* | 1 |
| BDE209 | 0.37\*\* | 0.40\*\* | 0.38\*\* | 0.41\*\* | 0.39\*\* |
| Vacuum bag dust (N=105) |  |  |  |  |  |
| BDE99 | 0.98\*\* | 1 |  |  |  |
| BDE100 | 0.97\*\* | 0.98\*\* | 1 |  |  |
| BDE153 | 0.89\*\* | 0.93\*\* | 0.94\*\* | 1 |  |
| BDE154 | 0.92\*\* | 0.95\*\* | 0.95\*\* | 0.93\*\* | 1 |
| BDE209 | 0.23\* | 0.24\* | 0.21\* | 0.22\* | 0.25\* |
| \*p<0.05; \*\*p<0.01 | | | | | |

**References**

Clifton, M.S., Wargo, J.P., Weathers, W.S., Colon, M., Bennett, D.H., Tulve, N.S. 2013. Quantitative analysis of organophosphate and pyrethroid insecticides, pyrethroid transformation products, polybrominated diphenyl ethers and bisphenol A in residential surface wipe samples. Journal of Chromatography A 1273, 1-11.

Shoeib, M.; Harner, T. 2002. Characterization and comparison of three passive air samplers for persistent organic pollutants. Environmental Science & Technology 36, 4142-4151.