Supplemental Materials

Characterizing exposures to flame retardants, dioxins, and furans among firefighters responding to controlled residential fires

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**Table S1. Firefighter urine biomarker concentrations (μg/g creatinine) by sex compared to the general population.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Pre-fire Concentration** | | | **3-Hour Post-fire Concentration** | | | **6-Hour Post-fire Concentration** | | | **12-Hour Post-fire Concentration** | | |
| **Biomarker** | **Sex** | **N (N < LODA)** | **GM (GSD)** | **P-value**  **(vs. GP)** | **N (N < LODA)** | **GM (GSD)** | **P-value**  **(vs. GP)** | **N (N < LODA)** | **GM (GSD)** | **P-value**  **(vs. GP)** | **N (N < LODA)** | **GM (GSD)** | **P-value**  **(vs. GP)** |
| **DPhP** | **Males** | 32  (3) | 0.98  (1.96) | **<0.001C** | 32  (3) | 1.66  (1.96) | **<0.001C** | 32  (0) | 1.55  (1.98) | **<0.001C** | 32  (1) | 1.09  (1.99) | **<0.001C** |
|  | **General Pop. (Males)B** | 921  (85) | 0.61  (2.25) | Ref. | \*\* | \*\* | Ref. | \*\* | \*\* | Ref. | \*\* | \*\* | Ref. |
|  | **Females** | 4  (0) | 0.86  (2.35) | 0.711 | 4  (0) | 1.78  (1.90) | 0.189 | 4  (0) | 1.89  (1.90) | 0.155 | 4  (0) | 2.66  (2.50) | 0.130 |
|  | **General Pop. (Females)B** | 980  (102) | 1.03  (2.73) | Ref. | \*\* | \*\* | Ref. | \*\* | \*\* | Ref. | \*\* | \*\* | Ref. |
| **BDCPP** | **Males** | 32  (0) | 2.31  (2.17) | **<0.001C** | 32  (0) | 2.66  (1.97) | **<0.001C** | 32  (0) | 2.49  (1.97) | **<0.001C** | 32  (0) | 2.07  (1.96) | **<0.001C** |
|  | **General Pop. (Males)B** | 911  (69) | 0.72  (2.77) | Ref. | \*\* | \*\* | Ref. | \*\* | \*\* | Ref. | \*\* | \*\* | Ref. |
|  | **Females** | 4  (0) | 3.07  (1.73) | **0.019C** | 4  (0) | 3.07  (2.10) | **0.042C** | 4  (0) | 3.25  (2.52) | 0.064 | 4  (0) | 2.71  (2.35) | 0.074 |
|  | **General Pop. (Females)B** | 975  (105) | 0.86  (2.86) | Ref. | \*\* | \*\* | Ref. | \*\* | \*\* | Ref. | \*\* | \*\* | Ref. |
| **BCEtP** | **Males** | 32  (5) | 0.30  (2.84) | 0.216 | 32  (6) | 0.33  (1.98) | 0.268 | 32  (1) | 0.34  (1.72) | 0.291 | 32  (5) | 0.19  (2.03) | **<0.001D** |
|  | **General Pop. (Males)B** | 920  (105) | 0.38  (3.23) | Ref. | \*\* | \*\* | Ref. | \*\* | \*\* | Ref. | \*\* | \*\* | Ref. |
|  | **Females** | 4  (1) | 0.18  (5.09) | 0.347 | 4  (2) | 0.42  (3.39) | 0.925 | 4  (0) | 0.54  (2.66) | 0.724 | 4  (0) | 0.24  (2.21) | 0.215 |
|  | **General Pop. (Females)B** | 977  (135) | 0.45  (2.97) | Ref. | \*\* | \*\* | Ref. | \*\* | \*\* | Ref. | \*\* | \*\* | Ref. |
| 1. Limit of detection (LOD) for each analyte in μg/L: DPhP=0.16, BDCPP=0.11, BCEtP=0.08. 2. Ospina, M., Jayatilaka, N., Wong, L.-Y., Restrepo, P., Calafat AM., 2018 Exposure to organophosphate flame retardant chemicals in the U.S. general population: Data from the 2013–2014 National Health and Nutrition Examination Survey. *Environmental International*. 110, 32-41. Participants aged 18 and older are included. 3. Results were significantly higher than the general population. 4. Results were significantly lower than the general population.   \*\* GM and GSD of general population were listed in the pre-fire columns. | | | | | | | | | | | | | |

**Table S2. Firefighter urine biomarker concentrations (μg/g creatinine) by job assignment compared to the general population.**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Pre-fire Concentrations** | | **3-Hour Post-fire Concentration** | | | **6-Hour Post-fire Concentration** | | **12-Hour Post-fire Concentration** | |
| **Biomarker** | **Job Assignment** | **N (No. < LODA)** | **Range (Min-Max)** | | **N (No. < LODA)** | **Range (Min-Max)** | **N (No. < LODA)** | **Range (Min-Max)** | **N (No. < LODA)** | **Range (Min-Max)** |
| **BCPP** | **All Firefighters** | 36  (21) | <LOD-0.73 | | 36  (28) | <LOD-0.57 | 36  (16) | <LOD-0.41 | 36  (18) | <LOD-0.47 |
|  | **Exterior** | 12  (6) | <LOD-0.73 | | 12  (10) | <LOD-0.48 | 12  (5) | <LOD-0.41 | 12  (7) | <LOD-0.47 |
|  | **Interior** | 12  (6) | <LOD-0.37 | | 12  (10) | <LOD-0.57 | 12  (4) | <LOD-0.37 | 12  (5) | <LOD-0.30 |
|  | **Overhaul** | 12  (9) | <LOD-0.32 | | 12  (8) | <LOD-0.53 | 12  (7) | <LOD-0.22 | 12  (6) | <LOD-0.47 |
|  | **General Pop.B** | 1905  (797) | <LOD-4.28 | | \*\* | \*\* | \*\* | \*\* | \*\* | \*\* |
| **DBuP** | **All Firefighters** | 36  (20) | <LOD-0.52 | | 36  (18) | <LOD-5.50 | 36  (6) | <LOD-4.30 | 36  (17) | <LOD-0.94 |
|  | **Exterior** | 12  (7) | <LOD-0.52 | | 12  (8) | <LOD-4.63 | 12  (3) | <LOD-1.40 | 12  (4) | <LOD-0.91 |
|  | **Interior** | 12  (7) | <LOD-0.33 | | 12  (5) | <LOD-5.50 | 12  (2) | <LOD-4.30 | 12  (5) | <LOD-0.94 |
|  | **Overhaul** | 12  (6) | <LOD-0.38 | | 12  (5) | <LOD-0.26 | 12  (1) | <LOD-0.19 | 12  (8) | <LOD-0.24 |
|  | **General Pop.B** | 1903  (389) | <LOD-1.21 | | \*\* | \*\* | \*\* | \*\* | \*\* | \*\* |
| **DpCP** | **All Firefighters** | 36  (30) | <LOD-0.37 | | 36  (32) | <LOD-0.29 | 36  (31) | <LOD-0.21 | 36  (29) | <LOD-0.24 |
|  | **Exterior** | 12  (9) | <LOD-0.37 | | 12  (11) | <LOD-0.24 | 12  (11) | <LOD-0.21 | 12  (10) | <LOD-0.14 |
|  | **Interior** | 12  (12) | <LOD | | 12  (12) | <LOD | 12  (12) | <LOD | 12  (8) | <LOD-0.10 |
|  | **Overhaul** | 12  (9) | <LOD-0.10 | | 12  (9) | <LOD-0.26 | 12  (8) | <LOD-0.09 | 12  (11) | <LOD-0.24 |
|  | **General Pop.B** | 1904  (1697) | <LOD-0.38 | | \*\* | \*\* | \*\* | \*\* | \*\* | \*\* |
| **TBBA** | **All Firefighters** | 36  (35) | <LOD-0.37 | | 36  (36) | <LOD | 36  (36) | <LOD | 36  (35) | <LOD-0.24 |
|  | **Interior** | 12  (11) | <LOD-0.37 | | 12  (12) | <LOD | 12  (12) | <LOD | 12  (11) | <LOD-0.24 |
|  | **General Pop.B** | 1905  (1818) | <LOD-0.26 | | \*\* | \*\* | \*\* | \*\* | \*\* | \*\* |
| **DoCP** | **All Firefighters** | 36  (35) | <LOD-0.37 | | 36  (36) | <LOD | 36  (36) | <LOD | 36  (36) | <LOD |
|  | **Exterior** | 12  (11) | <LOD-0.37 | | 12  (12) | <LOD | 12  (12) | <LOD | 12  (12) | <LOD |
|  | **General Pop.B** | 1905  (1904) | <LOD-0.24 | | \*\* | \*\* | \*\* | \*\* | \*\* | \*\* |
| **DBzP** | **All Firefighters** | 36  (36) | <LOD | | 36  (36) | <LOD | 36  (36) | <LOD | 36  (36) | <LOD |
|  | **General Pop.B** | 1905  (1905) | <LOD | | \*\* | \*\* | \*\* | \*\* | \*\* | \*\* |
| 1. Limit of detection (LOD) for each analyte in μg/L: BCPP=0.10, DBuP=0.05, DpCP=0.05, TBBA=0.05, DoCP=0.05, DBzP=0.05. 2. Ospina, M., Jayatilaka, N., Wong, L.-Y., Restrepo, P., Calafat AM., 2018 Exposure to organophosphate flame retardant chemicals in the U.S. general population: Data from the 2013–2014 National Health and Nutrition Examination Survey. *Environmental International*. 110, 32-41. Participants aged greater than 18 are included.   \*\* N (No. <LOD) and Range (Min-Max) of general population were listed in the pre-fire columns. | | | | | | | | | | |

**Table S3.** **Firefighter PBDE serum concentrations (ng/g lipid) by sex compared to the general population.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Pre-fire Serum Concentration** | | | **Post-fire Serum Concentration** | | |  |
| **Analyte** | **Job assignment** | **N (No. < LODA)** | **GM**  **(ng/g lipid) (GSD)** | **P-value**  **(vs GP)** | **N (No. < LODA)** | **GM**  **(ng/g lipid) (GSD)** | **P-value**  **(vs GP)** | **P-value (Pre vs Post)** |
| **BDE-28** | **Males** | 32  (4) | 0.52  (2.35) | **0.037C** | 32  (2) | 0.56  (2.16) | 0.065 | 0.911 |
|  | **General Pop. (Males)B** | 767  (80) | 0.73  (1.76) | Ref. | \*\* | \*\* | Ref. |  |
|  | **Females** | 4  (0) | 0.61  (1.41) | 0.402 | 4  (0) | 0.39  (2.15) | 0.210 | 0.250 |
|  | **General Pop. (Females)B** | 870  (98) | 0.72  (1.80) | Ref. | \*\* | \*\* | Ref. |  |
| **BDE-47** | **Males** | 32  (0) | 8.45  (2.70) | **0.010C** | 32  (0) | 8.78  (2.59) | **0.012C** | 0.961 |
|  | **General Pop. (Males)B** | 767  (0) | 13.77  (1.81) | Ref. | \*\* | \*\* | Ref. |  |
|  | **Females** | 4  (0) | 8.84  (1.88) | 0.317 | 4  (0) | 5.69  (2.46) | 0.167 | 0.250 |
|  | **General Pop. (Females)B** | 870  (0) | 12.91  (1.96) | Ref. | \*\* | \*\* | Ref. |  |
| **BDE-99** | **Males** | 32  (0) | 1.56  (2.91) | **0.008C** | 32  (0) | 1.55  (2.83) | **0.006C** | 0.889 |
|  | **General Pop. (Males)B** | 767  (0) | 2.67  (1.99) | Ref. | \*\* | \*\* | Ref. |  |
|  | **Females** | 4  (0) | 1.70  (2.15) | 0.388 | 4  (0) | 1.08  (2.40) | 0.151 | 0.125 |
|  | **General Pop. (Females)B** | 870  (0) | 2.51  (2.22) | Ref. | \*\* | \*\* | Ref. |  |
| **BDE-100** | **Males** | 32  (1) | 1.55  (2.61) | **<0.001** | 32  (0) | 1.72  (2.32) | **0.001C** | 0.908 |
|  | **General Pop. (Males)B** | 767  (0) | 2.93  (1.80) | Ref. | \*\* | \*\* | Ref. |  |
|  | **Females** | 4  (0) | 1.83  (1.99) | 0.284 | 4  (0) | 1.31  (2.07) | 0.120 | 0.250 |
|  | **General Pop. (Females)B** | 870  (0) | 2.86  (1.94) | Ref. | \*\* | \*\* | Ref. |  |
| **BDE-153** | **Males** | 32  (0) | 5.94  (2.50) | **<0.001C** | 32  (0) | 5.75  (2.52) | **<0.001C** | 0.957 |
|  | **General Pop. (Males)B** | 767  (0) | 10.92  (1.87) | Ref. | \*\* | \*\* | Ref. |  |
|  | **Females** | 4  (0) | 3.85  (1.53) | **0.030C** | 4  (0) | 4.08  (1.78) | 0.075 | 0.875 |
|  | **General Pop. (Females)B** | 870  (0) | 8.88  (1.89) | Ref. | \*\* | \*\* | Ref. |  |
| **BDE-209** | **Males** | 32  (2) | 2.85  (1.84) | **0.007D** | 32  (0) | 2.94  (1.60) | **<0.001D** | 0.616 |
|  | **General Pop. (Males)B** | 767  (8) | 2.07  (1.74) | Ref. | \*\* | \*\* | Ref. |  |
|  | **Females** | 4  (0) | 3.44  (1.21) | **0.006D** | 4  (0) | 3.55  (1.29) | **0.011D** | 0.625 |
|  | **General Pop. (Females)B** | 870  (19) | 1.74  (1.53) | Ref. | \*\* | \*\* | Ref. |  |
| 1. LOD: limit of detection. Observations below the LOD were substituted using LOD/square root of 2. 2. The data are from the National Health and Nutrition Examination Survey (NHANES) (2020). 2015–2016 data documentation, codebook, and frequencies. Brominated Flame Retardants (BFRs) - Pooled Samples (BFRPOL\_I). Available at [https://wwwn.cdc.gov/Nchs/Nhanes/2015-2016/BFRPOL\_I.htm. Accessed 12 November 2020](https://wwwn.cdc.gov/Nchs/Nhanes/2015-2016/BFRPOL_I.htm.%20Accessed%2012%20November%202020). 3. Results were significantly lower than the general population. 4. Results were significantly higher than the general population.   \*\*GM and GSD of general population were listed in the pre serum columns. | | | | | | | | |

**Table S4. Firefighter PBDE serum concentrations (ng/g lipid) by job assignment compared to the general population.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | **Pre-fire Serum Concentration** | | **Post-fire Serum Concentration** | |
| **Analyte** | **Job assignment** | **N (No. < LODA)** | **Range (Min-Max)** | **N (No. < LODA)** | **Range (Min-Max)** |
| **BDE-17** | **All firefighters** | 36 (33) | <LOD-0.26 | 36 (33) | <LOD-0.32 |
|  | **Exterior** | 12 (12) | <LOD | 12 (12) | <LOD |
|  | **Interior** | 12 (11) | <LOD-0.20 | 12 (12) | <LOD |
|  | **Overhaul** | 12 (10) | <LOD-0.26 | 12 (9) | <LOD-0.32 |
|  | **General Pop.‡** | 1637 (1589) | <LOD-0.41 | \*\* | \*\* |
| **BDE-66** | **All firefighters** | 36 (32) | <LOD-0.57 | 36 (33) | <LOD-0.63 |
|  | **Exterior** | 12 (10) | <LOD-0.53 | 12 (11) | <LOD-0.20 |
|  | **Interior** | 12 (11) | <LOD-0.20 | 12 (11) | <LOD-0.23 |
|  | **Overhaul** | 12 (11) | <LOD-0.57 | 12 (11) | <LOD-0.63 |
|  | **General Pop.‡** | 1637 (1527) | <LOD-0.69 | \*\* | \*\* |
| **BDE-85** | **All firefighters** | 36 (21) | <LOD-1.79 | 36 (18) | <LOD-1.70 |
|  | **Exterior** | 12 (9) | <LOD-0.36 | 12 (9) | <LOD-0.35 |
|  | **Interior** | 12 (7) | <LOD-0.41 | 12 (5) | <LOD-0.46 |
|  | **Overhaul** | 12 (5) | <LOD-1.79 | 12 (4) | <LOD-1.70 |
|  | **General Pop.‡** | 1637 (1100) | <LOD-2.09 | \*\* | \*\* |
| **BDE-154** | **All firefighters** | 36 (19) | <LOD-1.50 | 36 (15) | <LOD-1.40 |
|  | **Exterior** | 12 (9) | <LOD-0.23 | 12 (1) | <LOD-0.23 |
|  | **Interior** | 12 (7) | <LOD-0.34 | 12 (6) | <LOD-0.35 |
|  | **Overhaul** | 12 (3) | <LOD-1.50 | 12 (8) | <LOD-1.40 |
|  | **General Pop.‡** | 1637 (788) | <LOD-1.94 | \*\* | \*\* |
| **BDE-183** | **All firefighters** | 36 (22) | <LOD-1.07 | 36 (23) | <LOD-0.99 |
|  | **Exterior** | 12 (10) | <LOD-1.07 | 12 (10) | <LOD-0.99 |
|  | **Interior** | 12 (7) | <LOD-0.33 | 12 (8) | <LOD-0.30 |
|  | **Overhaul** | 12 (5) | <LOD-1.00 | 12 (5) | <LOD-0.97 |
|  | **General Pop.‡** | 1637 (1377) | <LOD-1.77 | \*\* | \*\* |
| 1. LOD: limit of detection. Observations below the LOD were substituted using LOD/square root of 2. 2. ‡ The data are from the National Health and Nutrition Examination Survey (NHANES) (2020). 2015–2016 data documentation, codebook, and frequencies. Brominated Flame Retardants (BFRs) - Pooled Samples (BFRPOL\_I). Available at https://wwwn.cdc.gov/Nchs/Nhanes/2015-2016/BFRPOL\_I.htm. Accessed 12 November 2020.   \*\* N (No. <LOD) and Range (Min-Max) of general population were listed in the pre serum columns. | | | | | |
|  |  |  |  |  |  |

**Table S5. Firefighter** **brominated and chlorinated furan and chlorinated dioxin serum concentrations (pg/g lipid) by job assignment compared to the general population.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Pre-Fire Serum Concentration** | | | **Post-Fire Serum Concentration** | | |  |
| **Analyte** | **Job assignment** | **N (No. < LOD\*)** | **GM (GSD)** | **P-value**  **(vs GP)** | **N (No. < LOD\*)** | **GM (GSD)** | **P-value**  **(vs GP)** | **P-value (Pre vs Post)** |
| **2378-TeBDF** | **All firefighters** | 8 (7) | NC |  | 8 (7) | NC |  | NC |
|  | **Exterior** | 2 (2) | NC |  | 3 (3) | NC |  |  |
|  | **Interior** | 3 (3) | NC |  | 2 (2) | NC |  |  |
|  | **Overhaul** | 3 (2) | NC |  | 3 (2) | NC |  |  |
|  | **General Pop.** |  |  |  |  |  |  |  |
| **23478-PeBDF** | **All firefighters** | 8 (4) | NC |  | 9 (5) | NC |  | NC |
|  | **Exterior** | 3 (2) | NC |  | 3 (2) | NC |  |  |
|  | **Interior** | 2 (1) | NC |  | 3 (2) | NC |  |  |
|  | **Overhaul** | 3 (1) | NC |  | 3 (1) | NC |  |  |
|  | **General Pop.** |  |  |  |  |  |  |  |
| **123478-HxBDF** | **All firefighters** | 9 (8) | NC |  | 8 (7) | NC |  | NC |
|  | **Exterior** | 3 (3) | NC |  | 2 (2) | NC |  |  |
|  | **Interior** | 3 (3) | NC |  | 3 (3) | NC |  |  |
|  | **Overhaul** | 3 (2) | NC |  | 3 (2) | NC |  |  |
|  | **General Pop.** |  |  |  |  |  |  |  |
| **2378-TeCDD** | **All firefighters** | 6 (0) | 0.65 (1.57) | 0.095 | 6 (0) | 0.75 (1.12) | **0.005C** | 0.563 |
|  | **Exterior** | 2 (0) | 0.84 (1.13) | 0.403 | 2 (0) | 0.77 (1.07) | 0.147 |  |
|  | **Interior** | 2 (0) | 0.67 (1.25) | 0.274 | 2 (0) | 0.84 (1.07) | 0.230 |  |
|  | **Overhaul** | 2 (0) | 0.48 (2.23) | 0.440 | 2 (0) | 0.67 (1.07) | 0.085 |  |
|  | **General Pop.B** | 1910 (853) | 0.89 (1.80) | Reference | \*\* | \*\* | Reference |  |
| **12378-PeCDD** | **All firefighters** | 7 (0) | 2.50 (1.23) | **0.014C** | 9 (0) | 2.49 (1.11) | **<0.001C** | 0.813 |
|  | **Exterior** | 3 (0) | 2.63 (1.24) | 0.226 | 3 (0) | 2.56 (1.08) | **0.035C** |  |
|  | **Interior** | 1 (0) | 1.94 | - | 3 (0) | 2.47 (1.16) | 0.084 |  |
|  | **Overhaul** | 3 (0) | 2.59 (1.22) | 0.183 | 3 (0) | 2.45 (1.11) | **0.041C** |  |
|  | **General Pop.B** | 1910 (112) | 3.18 (1.88) | Reference | \*\* | \*\* | Reference |  |
| **123478-HxCDD** | **All firefighters** | 9 (0) | 2.24 (1.14) | 0.576 | 9 (0) | 2.05 (1.25) | 0.178 | 0.203 |
|  | **Exterior** | 3 (0) | 2.03 (1.07) | 0.103 | 3 (0) | 1.98 (1.17) | 0.244 |  |
|  | **Interior** | 3 (0) | 2.31 (1.17) | 0.981 | 3 (0) | 1.81 (1.38) | 0.321 |  |
|  | **Overhaul** | 3 (0) | 2.41 (1.13) | 0.597 | 3 (0) | 2.42 (1.10) | 0.472 |  |
|  | **General Pop.B** | 1910 (32) | 2.18 (2.01) | Reference | \*\* | \*\* | Reference |  |
| **123678-HxCDD** | **All firefighters** | 9 (0) | 12.76 (1.12) | **<0.001C** | 9 (0) | 12.49 (1.15) | **<0.001C** | 0.461 |
|  | **Exterior** | 3 (0) | 12.37 (1.17) | 0.074 | 3 (0) | 12.92 (1.14) | 0.075 |  |
|  | **Interior** | 3 (0) | 12.88 (1.07) | **0.008C** | 3 (0) | 11.80 (1.19) | 0.071 |  |
|  | **Overhaul** | 3 (0) | 13.04 (1.15) | 0.089 | 3 (0) | 12.79 (1.14) | 0.070 |  |
|  | **General Pop.B** | 1910 (32) | 16.18 (2.42) | Reference | \*\* | \*\* | Reference |  |
| **123789-HxCDD** | **All firefighters** | 9 (0) | 2.81 (1.12) | 0.779 | 9 (0) | 2.53 (1.13) | **0.018C** | **0.012C** |
|  | **Exterior** | 3 (0) | 2.99 (1.17) | 0.634 | 3 (0) | 2.64 (1.17) | 0.484 |  |
|  | **Interior** | 3 (0) | 2.90 (1.03) | 0.482 | 3 (0) | 2.45 (1.10) | 0.119 |  |
|  | **Overhaul** | 3 (0) | 2.57 (1.11) | 0.227 | 3 (0) | 2.50 (1.15) | 0.252 |  |
|  | **General Pop.B** | 1910 (24) | 2.71 (1.86) | Reference | \*\* | \*\* | Reference |  |
| **1234678-HpCDD** | **All firefighters** | 9 (0) | 16.34 (1.14) | **0.002C** | 9 (0) | 15.73 (1.13) | **<0.001C** | 0.301 |
|  | **Exterior** | 3 (0) | 15.35 (1.15) | 0.094 | 3 (0) | 15.19 (1.18) | 0.109 |  |
|  | **Interior** | 3 (0) | 17.24 (1.09) | 0.110 | 3 (0) | 15.65 (1.09) | **0.046C** |  |
|  | **Overhaul** | 3 (0) | 16.49 (1.19) | 0.211 | 3 (0) | 16.37 (1.15) | 0.146 |  |
|  | **General Pop.B** | 1910 (88) | 18.59 (1.90) | Reference | \*\* | \*\* | Reference |  |
| **OcCDD** | **All firefighters** | 9 (0) | 99.23 (1.13) | **<0.001C** | 9 (0) | 91.74 (1.19) | **<0.001C** | 0.164 |
|  | **Exterior** | 3 (0) | 100.2 (1.19) | **0.021C** | 3 (0) | 100.5 (1.23) | **0.029C** |  |
|  | **Interior** | 3 (0) | 104.3 (1.07) | **0.005C** | 3 (0) | 83.80 (1.21) | **0.016C** |  |
|  | **Overhaul** | 3 (0) | 93.48 (1.13) | **0.009C** | 3 (0) | 91.67 (1.13) | **0.009C** |  |
|  | **General Pop.B** | 1910 (32) | 181.6 (1.91) | Reference | \*\* | \*\* | Reference |  |
| **2378-TeCDF** | **All firefighters** | 6 (0) | 0.66 (1.83) | 0.095 | 6 (1) | 0.47 (2.71) | 0.704 | 0.219 |
|  | **Exterior** | 2 (0) | 0.55 (1.52) | 0.464 | 2 (1) | 0.23 (4.56) | 0.695 |  |
|  | **Interior** | 2 (0) | 1.10 (2.46) | 0.356 | 2 (0) | 1.09 (1.45) | 0.163 |  |
|  | **Overhaul** | 2 (0) | 0.47 (1.17) | 0.371 | 2 (0) | 0.41 (1.22) | 0.818 |  |
|  | **General Pop.B** | 1910 (1466) | 0.41 (1.36) | Reference | \*\* | \*\* | Reference |  |
| **12378-PeCDF** | **All firefighters** | 8 (0) | 0.70 (1.99) | 0.591 | 9 (0) | 0.60 (1.64) | 0.933 | 0.055 |
|  | **Exterior** | 2 (0) | 0.60 (1.37) | 0.940 | 3 (0) | 0.49 (1.32) | 0.298 |  |
|  | **Interior** | 3 (0) | 1.11 (1.89) | 0.244 | 3 (0) | 0.88 (2.02) | 0.462 |  |
|  | **Overhaul** | 3 (0) | 0.49 (2.26) | 0.687 | 3 (0) | 0.51 (1.32) | 0.371 |  |
|  | **General Pop.B** | 1910 (1859) | 0.62 (1.10) | Reference | \*\* | \*\* | Reference |  |
| **23478-PeCDF** | **All firefighters** | 9 (0) | 5.09 (1.24) | **0.021D** | 9 (0) | 4.37 (1.24) | 0.446 | **0.004C** |
|  | **Exterior** | 3 (0) | 4.64 (1.21) | 0.396 | 3 (0) | 3.90 (1.26) | 0.730 |  |
|  | **Interior** | 3 (0) | 5.69 (1.40) | 0.239 | 3 (0) | 4.52 (1.35) | 0.647 |  |
|  | **Overhaul** | 3 (0) | 5.00 (1.11) | 0.087 | 3 (0) | 4.72 (1.12) | 0.168 |  |
|  | **General Pop.B** | 1910 (32) | 4.10 (1.80) | Reference | \*\* | \*\* | Reference |  |
| **123478-HxCDF** | **All firefighters** | 9 (0) | 4.07 (1.22) | **<0.001D** | 9 (0) | 3.74 (1.31) | **0.004D** | 0.164 |
|  | **Exterior** | 3 (0) | 3.83 (1.16) | **0.047D** | 3 (0) | 3.47 (1.34) | 0.234 |  |
|  | **Interior** | 3 (0) | 4.48 (1.39) | 0.107 | 3 (0) | 3.79 (1.56) | 0.282 |  |
|  | **Overhaul** | 3 (0) | 3.93 (1.06) | **0.007D** | 3 (0) | 3.97 (1.03) | **<0.001D** |  |
|  | **General Pop.B** | 1910 (96) | 2.59 (1.80) | Reference | \*\* | \*\* | Reference |  |
| **123678-HxCDF** | **All firefighters** | 8 (0) | 4.32 (1.21) | **<0.001D** | 8 (0) | 3.93 (1.25) | **0.009D** | 0.148 |
|  | **Exterior** | 3 (0) | 4.03 (1.23) | 0.121 | 3 (0) | 3.68 (1.27) | 0.252 |  |
|  | **Interior** | 2 (0) | 5.26 (1.19) | 0.137 | 2 (0) | 3.91 (1.57) | 0.539 |  |
|  | **Overhaul** | 3 (0) | 4.07 (1.13) | **0.047D** | 3 (0) | 4.21 (1.08) | **0.018D** |  |
|  | **General Pop.B** | 1910 (24) | 2.97 (1.70) | Reference | \*\* | \*\* | Reference |  |
| **123789-HxCDF** | **All firefighters** | 9 (8) | 0.12 (1.72) | **0.003C** | 9 (9) | 0.09 (1.17) | - | **0.016C** |
|  | **Exterior** | 3 (3) | 0.11 (1.35) | - | 3 (3) | 0.09 (1.21) | - |  |
|  | **Interior** | 3 (2) | 0.17 (2.44) | 0.499 | 3 (3) | 0.09 (1.10) | - |  |
|  | **Overhaul** | 3 (3) | 0.10 (1.04) | - | 3 (3) | 0.08 (1.21) | - |  |
|  | **General Pop.B** | 1910 (1906) | 0.26 (1.02) | Reference | \*\* | \*\* | Reference |  |
| **234678-HxCDF** | **All firefighters** | 9 (0) | 1.77 (1.35) | **<0.001D** | 9 (0) | 1.63 (1.29) | **<0.001D** | 0.074 |
|  | **Exterior** | 3 (0) | 1.64 (1.40) | 0.084 | 3 (0) | 1.57 (1.29) | 0.058 |  |
|  | **Interior** | 3 (0) | 2.09 (1.48) | 0.061 | 3 (0) | 1.68 (1.51) | 0.112 |  |
|  | **Overhaul** | 3 (0) | 1.61 (1.21) | **0.031D** | 3 (0) | 1.63 (1.17) | **0.021D** |  |
|  | **General Pop.B** | 1910 (54) | 0.92 (1.60) | Reference | \*\* | \*\* | Reference |  |
| **1234678-HpCDF** | **All firefighters** | 9 (0) | 6.41 (1.19) | 0.121 | 9 (0) | 6.09 (1.20) | 0.436 | **0.039C** |
|  | **Exterior** | 3 (0) | 6.46 (1.28) | 0.530 | 3 (0) | 6.01 (1.31) | 0.833 |  |
|  | **Interior** | 3 (0) | 6.63 (1.25) | 0.402 | 3 (0) | 5.96 (1.28) | 0.850 |  |
|  | **Overhaul** | 3 (0) | 6.16 (1.08) | 0.312 | 3 (0) | 6.30 (1.04) | 0.068 |  |
|  | **General Pop.B** | 1910 (24) | 5.75 (1.45) | Refernece | \*\* | \*\* | Reference |  |
| **1234789-HpCDF** | **All firefighters** | 8 (3) | 0.27 (1.56) | 0.672 | 9 (2) | 0.27 (1.52) | 0.733 | 0.383 |
|  | **Exterior** | 3 (1) | 0.33 (1.58) | 0.405 | 3 (1) | 0.24 (1.41) | 0.787 |  |
|  | **Interior** | 2 (1) | 0.22 (1.53) | 0.713 | 3 (1) | 0.28 (2.06) | 0.836 |  |
|  | **Overhaul** | 3 (1) | 0.26 (1.69) | 0.985 | 3 (0) | 0.28 (1.21) | 0.425 |  |
|  | **General Pop.B** | 1910 (1819) | 0.25 (1.12) | Reference | \*\* | \*\* | Reference |  |
| **OcCDF** | **All firefighters** | 7 (3) | 0.27 (1.64) | - | 9 (7) | \* | - | 0.078 |
|  | **Exterior** | 2 (1) | 0.27 (2.38) | - | 3 (3) | \* | - |  |
|  | **Interior** | 2 (1) | 0.27 (1.60) | - | 3 (3) | \* | - |  |
|  | **Overhaul** | 3 (1) | 0.26 (1.65) | - | 3 (1) | \* | - |  |
|  | **General Pop.B** | 1910 (1910) | 1.84 (1.00) | Reference | \*\* | \*\* | Reference |  |
| 1. LOD: limit of detection. Observations below the LOD were substituted using LOD/square root of 2. 2. The data are from the National Health and Nutrition Examination Survey (NHANES) during 2009/10. 3. Results were significantly lower than the general population. 4. Results were significantly higher than the general population.   NC= Not calculated because detection frequency below 60%. | | | | | | | | |

**Table S6.** Concentrations of FRs (µg/g) in bulk samples of the burn room furnishings

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Compound Measured** | Carpet Padding (N=3) | Curtain Liner (N=1) | Inner Spring Mattress Foam (N=2) | Foam Topper for Bed (N=2) | Head-board Padding (N=1) | Chair Cushion (N=2) | Chair Cushion Liner (N=1) | Flat Screen TV Plastic (N=1) |
| **Labelling** | None | None | California TB-603 | None | None | California  TB-117 (1975) | None | None |
| **Polybrominated diphenyl ethers (PBDEs)** | | | | | | | | |
| BDE-47 | <0.1 - 0.41 | 0.19 | <0.1 | <0.1 - 0.74 | 5,600 | <0.1 - 4.1 | <0.1 | <0.1 |
| BDE-85 | <0.1 | <0.1 | <0.1 | <0.1 | 840 | <0.1 - 1.6 | <0.1 | <0.1 |
| BDE-99 | 0.11 - 0.56 | 0.25 | <0.1 - 0.44 | <0.1 - 2.9 | 15,000 | <0.1 - 25 | <0.1 | <0.1 |
| BDE-100 | <0.1 | <0.1 | <0.1 | <0.1 - 0.6 | 2,500 | <0.1 - 3.8 | <0.1 | <0.1 |
| BDE-153 | <0.1 - 5.6 | <0.1 | <0.1 | <0.1 - 2.0 | 2,000 | <0.1 - 13 | <0.1 | <0.1 |
| BDE-154 | <0.1 | <0.1 | <0.1 | <0.1 - 0.69 | 1,400 | <0.1 - 5.0 | <0.1 | <0.1 |
| BDE-183 | <0.1 - 1.1 | <0.1 | <0.1 | <0.1 - 2.0 | 67 | <0.1 | <0.1 | <0.1 |
| BDE-206 | <0.1 - 14 | 2.8 | <0.1 - 6.3 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| BDE-209 | 0.41 - 102 | 440 | <0.1 - 61 | <0.1 | <0.1 | <0.1 - 0.68 | <0.1 | <0.1 |
| **Non-PBDE brominated FRs (NPBFRs)** | | | | | | | | |
| TBBPA | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| TBB | 0.38 - 3.2 | 910 | <0.1 - 0.5 | <0.1 - 7.5 | <0.1 | 18,500 - 26750 | 68.5 | <0.1 |
| TBPH | 0.22 - 5.7 | 340 | <0.1 - 1.2 | <0.1 - 3.7 | <0.1 | 5,800 - 6,380 | 19.6 | <0.1 |
| DBDPE | <0.1 - 0.53 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| **Organophosphate FRs (OPFRs)** | | | | | | | | |
| TCEP | <0.1 | 1.4 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| TCPP | 59 - 630 | 5.4 | <0.1 | <0.1 | 8.4 | <0.1 - 1.3 | <0.1 | <0.1 |
| TDCPP | 240 - 9,100 | 1.2 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| TPhP | 0.43 - 3.8 | 4.0 | 0.16 - 0.23 | <0.1 - 1.3 | 1,690 | 1,400 - 7,380 | 22.6 | 19 |
| TCP | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |