Polybrominated diphenyl ethers and novel flame retardants

associations between dust and human milk

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POLYBROMINATED DIPHENYL ETHERS AND NOVEL FLAME RETARDANTS: ASSOCIATIONS BETWEEN DUST AND HUMAN MILK

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Besides diet, house dust has been recognized as an important exposure media for polybrominated diphenyl ethers (PBDEs) [1]. Our previous work showed significant associations between levels in dust and in human plasma, for the congeners BDE-28, BDE-47 and BDE-100 as well as for $\Sigma PBDE_{tri\ hexa}$ [2]. Recent results from Sweden indicated that dust was a significant source of exposure for the octa- to decabrominated congeners in particular [3]. Moreover, several novel flame retardants (NFRs) have been detected in dust some of which might be replacement products of PBDEs [4].

Building on these findings, the objectives were to study whether i) the associations observed for plasma also existed for human milk, ii) the PBDE profiles in dust and milk could provide insights into the bioavailability and bioaccumulation of individual congeners, iii) NFRs were measurable in human milk, and iv) infants were exposed to significant amounts of NFRs via breast feeding.

PBDEs were detected in all of the 40 milk samples analysed in this study. $\Sigma PBDE_{tri\text{-}hepta}$ ranged from 0.98-45.8 ng/g lw, with a median of 2.26 ng/g lw. The main congener in milk was BDE-153, accounting for 35% of $\Sigma PBDE_{tri\text{-}hepta}$. This is much higher than in dust collected in the same residences, but comparable to plasma and placenta [2,5]. BDE-99 on the other hand, had clearly lower percentages in human milk than in dust. BDE-209 had a median concentration of 0.64 ng/g lw, which was similar to that of BDE-47 and confirmed that BDE-209 was taken up by humans and, despite its shorter half-life, accumulates to the extent that exposure of infants can occur.

As for plasma, PBDE-levels in milk samples were significantly correlated with dust levels (Spearman rank), this was most pronounced for the lower brominated congeners like BDE-28 ($p=0.03$) and 47 ($p=0.006$). Large intercorrelation was also observed, e.g. BDE-47 in milk was significantly correlated with most other congeners, though not with BDE-209. In contrast to the plasma results, significant correlation of BDE-99 in milk and dust was also observed ($p=0.003$). One explanation for this may be the higher detection frequency of BDE-99 in milk compared with plasma (100% vs. 37%).

Hexabromocyclododecane and the NFRs bis(2-ethylhexyl)tetrabromophthalate (BEH-TEBP), 2-ethylhexyl-2,3,4,5-tetrabromobenzoate (EH-TBB), 1,2-bis(2,4,6-tribromophenoxy)-ethane **(**BTBPE), decabromodiphenyl ethane (DBDPE), 2,3-dibromopropyl-2,4,6-tribromophenyl ether **(**TBP-DBPE) and dechlorane plus (DDC-CO) have been detected in the same dust samples previously analysed for PBDEs and are currently being analysed in the corresponding human milk samples.

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