



Bi C, Maestre JP, Li H, Zhang G, Givehchi R, Mahdavi A, Kinney K, Siegel JA, Horner S, Xu Y. 2018. Phthalates and organophosphates in settled dust and HVAC filter dust of U.S. low-income homes: Association with season, building characteristics, and childhood asthma. *Environment International*, **121**, 916-930. DOI: [10.1016/j.envint.2018.09.013](https://doi.org/10.1016/j.envint.2018.09.013)

Shortened Abstract

Phthalates and organophosphates are ubiquitous indoor semi-volatile organic contaminants (SVOCs) that have been widely used as plasticizers and flame retardants in consumer products. Although many studies have assessed their levels in house dust, only a few used dust samples captured by filters of building heating, ventilation, and air conditioning (HVAC) systems. HVAC filters collect particles from large volumes of air over a long period of time and thus provide a spatially and temporally integrated concentration. This study measured concentrations of phthalates and organophosphates in HVAC filter dust and settled floor dust collected from low-income homes in Texas, United States, in both the summer and winter seasons. The most frequently detected compounds were benzyl butyl phthalate (BBzP), di-(2-ethylhexyl) phthalate (DEHP), di-n-octyl phthalate (DnOP), tris (1-chloro-2-propyl) phosphate (TCIPP), triphenyl phosphate (TPHP), and tris (1,3-di-chloroisopropyl) phosphate (TDCIPP). The median level of TCIPP in settled dust was 3- to 180-times higher than levels reported in other studies of residential homes. Significantly higher concentrations were observed in HVAC filter dust as compared to settled dust for most of the frequently detected compounds in both seasons, except for several phthalates in the winter.

Practical Implications

- SVOC concentrations in settled dust in winter were generally higher than in summer.
- Settled dust samples from homes with vinyl flooring contained significantly higher levels of BBzP and DEHP as compared to homes with other types of floor material.
- The concentration of DEHP and TDCIPP in settled dust was significantly associated with the presence of carpet.
- Cleaning activities to remove dust from furniture increased the levels of certain compounds in HVAC filter dust, while frequent vacuuming of carpet

helped to decrease the concentrations of some compounds in settled dust.

- The size and age of a given house also correlated with the levels of some pollutants in dust.
- We found a statistically significant association between DEHP concentration in HVAC filter dust in summer and the severity of asthma in children.

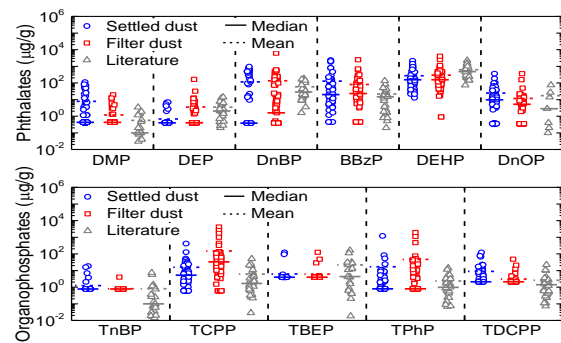


Figure 1. Comparison of measured concentrations of (a) phthalates and (b) organophosphates in dust with median values reported in literature for residential homes (over 4000 homes in 42 studies).

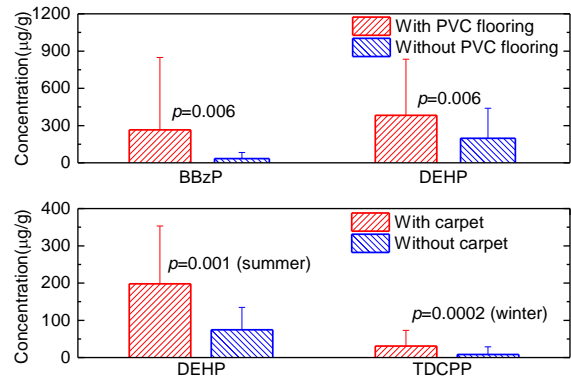


Figure 4. Phthalate and organophosphate concentrations in settled dust in relation to the presence of PVC flooring (a) and carpet (b). The p-values were calculated using the Mann-Whitney U-test and $p < 0.05$ indicates a statically significant difference.

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