

Health risk assessment of volatile organic compounds at daycare facilities

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Abstract

Children are particularly vulnerable to many classes of the volatile organic compounds (VOCs) detected in indoor environments. The negative health impacts associated with chronic and acute exposures of the VOCs might lead to health issues such as genetic damage, cancer, and disorder of nervous systems. In this study, 40 VOCs including aldehydes and ketones, aliphatic hydrocarbons, esters, aromatic hydrocarbons, cyclic terpenes, alcohols, and glycol ethers were identified and qualified in different locations at the University of Missouri (MU) Child Development Laboratory (CDL) in Columbia, Missouri. Our results suggested that the concentrations of the VOCs varied significantly among classrooms, hallways, and playground. The VOCs emitted from personal care and cleaning products had the highest indoor levels (2-ethylhexanol-1, 3-carene, homomenthyl salicylate with mean concentration of 5.15 $\mu\text{g}/\text{m}^3$, 1.57 $\mu\text{g}/\text{m}^3$, and 1.47 $\mu\text{g}/\text{m}^3$, respectively). A cancer risk assessment was conducted, and none of the 95th percentile dose estimates exceeded the age-specific no significant risk levels (NSRL) in all classrooms. Dimensionless toxicity index scores were calculated for all VOCs using a novel web-based framework called Toxicological Prioritization Index (ToxPi), which integrates multiple sources of toxicity data. According to the method, homomenthyl salicylate, benzothiazole, 2-ethylhexyl salicylate, hexadecane, and tridecane exhibited diverse toxicity profiles and ranked as the five most toxic