TECHNICAL BRIEF

Health Hazards of Building Dust

Dust and Human Exposure

Dust is a complex mixture of particles originating from various sources. It includes, but is not limited to fibers, soil minerals, organic and inorganic compounds, and metals. Dust can be a sink and repository for semi- and nonvolatile substances, which reflects contamination of the surroundings from long ago.[1] Dust and the compounds absorbed to it typically enter the human body via inhalation of suspended or resuspended particles, nondietary ingestion of settled dust, ingestion of particles adhering to food, and skin contact.[1,2] Various hazardous chemicals have been detected in indoor dust samples including flame retardants, plasticizers, polycyclic aromatic hydrocarbons (PAHs), and pesticides.[1,3–5] There can be numerous sources of these pollutants. For example, recent reports have shown the presence of PFAS chemicals in indoor dust, likely resulting from treatments on indoor furnishings. A large body of studies have indicated that dust can be an important route of toxicant exposure, and that exposure can be measured to assess health impacts of chemicals, including the impacts of long-term exposure.[1,5,6]

Examples of Chemical Exposure from Dust

Flame retardant chemicals are often added to consumer products to reduce the risk of residential fires. Certain types of flame retardants have been found to present hazardous health impacts to humans.[7–10] One exposure pathway to flame retardants is through inhalation and ingestion of dust. This occurs when the flame retardants migrate out of products and accumulate in settled dust over time.[8] Studies have confirmed that chemicals can be transferred into house dust, and certain flame retardants have been detected in indoor dust samples.[5,6] In addition, studies have shown a stong correlation between the existence of flame retardants in dust and their presence in human blood plasma, urine and breast milk samples.[11–13] This indicates that dust can be a source of flame retardant exposure in addition to the air. One study found that the intake of total polybrominated diphenyl ethers (PBDEs, a type of flame retardant) was mainly attributed to indoor dust, accounting for a 43%-65% exposure percentage for adults and 76%-93% for toddlers.[14]

Phthalates are used as plasticizers and in numerous consumer and personal care products. They can volatilize into the air and migrate into dust and therefore they are ubiquitously present in indoor environments.[4] Studies have shown that certain phthalates can disrupt human hormonal systems, sexual development and reproduction. In addition, exposure to phthalates can trigger asthma and dermal diseases in children and impact IQ or behavior during childhood.[15–17] Various phthalates have been measured in indoor dust samples.[4] Phthalate metabolites have also been found in human urine samples, which have shared patterns to those found in the dust, linking the exposure route.[4] Moreover, estimations show dust to be the main source of some phthalates in infants and toddlers.[4,17]

BHT (2,6-di-tert-butyl-4-hydroxytoluene), a synthetic phenolic antioxidant, is widely used in food, cosmetic and plastic products.[18] It has been detected in 99.5% of 224 house dust samples taken from homes and microenvironments.[19] Although still controversial, ingestion of BHT could pose a human risk, especially at high doses.[18]

Implications

Overall, chemical exposure from settled dust can be a health risk to humans. This exposure is likely associated with the release of chemicals from everyday products into dust or by entry of contaminated dust into indoor environments from external sources. Exposure to the dust leads to migration of the chemicals into the human body. Dust exposure is also unique since it can accumulate contaminants through time and retain complex mixtures of contaminants. Dust ingestion has been shown to be a major exposure route for infants and toddlers because of their hand to mouth behavior and the fact that they are low to the ground. These factors place them in a higher risk group. Because of the prolific presence of dust and the likelihood of exposure, more studies are recommended to understand the link between health responses and chemical exposure in dust.

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