Environmental Concerns Regarding Chemical Flame Retardants

Heather M. Stapleton
Associate Professor, Duke University, Nicholas School of the Environment, Durham, NC USA

Increased use of flame retardant chemical additives in furniture, electronics and construction material over the past few decades has led to concern about increasing exposure and health effects from these chemicals. To date a majority of the environmental research on flame retardants has focused on brominated flame retardants (BFRs), which primarily act in the gas phase as a flame retardant, but are often applied at levels ranging from 3-15% by weight of the polymer or resin to which they are applied. Research studies clearly indicate that BFRs migrate out of these treated polymers and resins over time, leading to ubiquitous detection and exposure in indoor environments. Polybrominated diphenyl ethers (PBDEs) are a class of BFRs and are characterized as persistent and bioaccumulative. Recent studies have observed associations between PBDE levels in pregnant women/children and deficits in children's neurodevelopmental outcomes. While PBDEs were phased-out starting in 2002, chronic human exposure to these chemicals is expected to occur for some time. In addition, new additive flame retardant chemicals are now being used as replacements for the phased-out PBDE commercial mixtures, and some of these replacements also migrate out of treated products and accumulate in indoor environments, similar to the PBDEs.

This presentation will discuss the latest findings on human exposure to PBDE flame retardants and several of the PBDE alternatives. Several current research studies are investigating exposure to PBDE replacements, particularly the organophosphate flame retardants (OPFRs). Data collected from studies in the US demonstrates that contact with indoor dust is a major pathway of human exposure, and that exposure is significantly higher for children relative to adults. Our laboratory has developed analytical methods to monitor OPFR metabolites in human urine and this presentation will compare and contrast exposure levels for PBDEs and OPFRs, particularly focusing on exposure via indoor dust. In addition, information on relative toxicity/health effects associated with PBDEs and OPFRs will be presented.