Banned flame retardants pose ongoing concerns about potential effects on developing brains

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Credit: Brunel University

Additional measures may be needed to limit the potential effects of a mixture of flame retardants on the mental development of babies and young children, new research from Brunel University London concludes.

Chemicals that slow the spread of fire are routinely added to carpets, furniture, and plastic casings to meet flammability standards. They are then slowly released into their surroundings.

Most commercial mixtures of one group of flame retardants, PBDEs (polybrominated diphenyl ethers) have been banned because they degrade very slowly and persist in the environment.

Additionally, several PBDEs are suspected to affect brain development. In rodent studies conducted throughout the 2000s, exposed animals demonstrated changes in spontaneous behaviour, impaired habituation in new environments, and hyperactivity. Impaired learning in adult rodents exposed to the chemicals before birth has also been identified.

Despite the ban, PBDEs are still released from manufactured products as they break down over time and we continue to be exposed to them, mainly through food and dust.

Researchers from the Institute of Environment, Health and Societies at Brunel used data from existing published studies to model the predicted combined effects of levels of several PBDEs currently found in foods, dust or our own bodies from their known toxicity in mice, rather than evaluating each substance individually.

Their results, published in the journal *Environmental Health Perspectives*, raise concerns that despite the PBDE ban, the brains of babies and young children may not be sufficiently protected, echoing recent findings in epidemiological (human) studies.

The Brunel research team found that tolerable combined exposure to PBDEs may be exceeded across all age groups studied: breastfeeding infants, young children and adults.

Adults living among higher than average levels of dust, and those who have average or high food consumption, and a particularly high intake of fish, were more highly exposed and exceeded values for acceptable combined PBDE exposure.

While complex measures of developmental neurotoxicity in rodents cannot be equated directly with outcomes in humans, recent experimental research has also raised concerns about the potential for neurodevelopmental exposures in human babies and young children, potentially resulting in IQ loss and other consequences. Currently, neurodevelopmental toxicity in rodents has been the basis for setting limits for human exposure.

Brunel's researchers conclude that measures to control food contamination and expanding existing measures to manage the release of PBDEs should be considered.

Professor Andreas Kortenkamp, study lead author, explains: "Studies show that is likely PBDEs trigger a multitude of different pathways which all lead to neurotoxicity, for example, by producing thyroid hormone insufficiency via the induction of thyroid hormone-metabolising liver enzymes, or by direct toxic cytotoxicity on neurons, or both.

"Exposure should continue to decline because of existing bans, but environmental exposures will persist as PBDEs are released from manufactured products and break down over time. The results of our analysis add to concerns about the potential consequences of combined PBDE exposures for the mental development of young children and strongly support further risk-management levels aimed at limiting exposure.

"There's an ongoing need for maximum residue limits for regulating

PBDE contamination of food, and for the expansion of existing measures to manage the release of PBDEs from electronic waste to include other consumer products as well."

More information: A Human Mixture Risk Assessment for Neurodevelopmental Toxicity Associated with Polybrominated Diphenyl Ethers Used as Flame Retardants, *Environmental Health Perspectives* 24 August 2017. DOI: 10.1289/EHP826

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