Chemicals used as fire retardants could be harmful, researchers say

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Polybrominated diphenyl ethers (PBDEs), chemicals used as fire retardants, can be found in numerous items in the home, such as the television, computer, toaster and the sofa. Now, as reported in a KNBC story on Nov. 28, they are being found in alarming concentrations, in human blood and breast milk – a potentially major concern for human health.

In addition, these industrial chemicals have been associated with cases of feline hyperthyroidism, a potentially fatal condition in cats.

UC Riverside scientists interviewed for the KNBC story have done research using rat tissue that shows that PBDEs disrupt mechanisms that are responsible for releasing hormones in the body. Moreover, their work has shown that like polychlorinated biphenyls (PCBs), whose manufacture in the U.S. was discontinued in 1977, PBDEs alter calcium signaling in the brain – a critical mechanism for transmitting information between and within brain cells, for learning and memory, and for regulating the release of hormones in the body.

“Long-term exposures to PBDEs may pose a human health risk, especially to infants and toddlers who are more likely to ingest household dust or acquire these chemicals through mother’s milk,” said Margarita Curras-Collazo, an associate professor of cell biology and neuroscience and one of the scientists interviewed for the KNBC story. “How much PBDE in the body is considered safe is yet to be determined and will require further federal and state research funding.”

PBDEs, which have different forms based on the number and location of bromine atoms they contain, closely resemble the molecular structure of PCBs. Because they can slow the spread of a fire, PBDEs currently are being produced for use as flame-retarding compounds in a variety of consumer goods, including electrical appliances, building materials, some foams and upholstery furnishings.

Because they are used as flame retardants, the volume of PBDEs in household goods is higher in states, such as California, that have enacted stringent flammability regulations for these products.

PBDEs mobilize into the indoor air and household dust from household goods, resulting in humans and pets getting exposed continuously to these toxicants. Over time, PBDEs, PCBs and similar organic toxicants leach into the environment when household wastes decompose in landfills or are incompletely incinerated. They are now found in air, water and soil as well as in wildlife and supermarket foods. When people ingest food contaminated with PBDEs, it adds to their body burden over their lifetime.

Some forms of PBDEs are subject to a ban that will become effective in California in January 2008. The form that is most commonly used in plastics such as computer casings is not subject to the ban, however, but may deteriorate to the more detrimental forms (including those that are banned) over time.

“It is clear that the environmental levels of PBDEs are increasing,” said Cary Coburn, a student in the Environmental Toxicology Graduate Program and a member of Curras-Collazo’s laboratory, who also was interviewed for the KNBC story. “The extent of their toxicity is currently being investigated by the U.S. Environmental Protection Agency as well as internationally by other toxicologists.”

In a paper to be published in a forthcoming issue of Neurochemical Research (the paper is available online), Curras-Collazo and Coburn, in collaboration with Prasada Rao S. Kodavanti, a senior research toxicologist at the U.S. Environmental Protection Agency, show that the regulation of calcium in neurons can be compromised by PBDEs and PCBs.

This summer, the three researchers reported in Toxicological Sciences that PBDEs, like PCBs, can disrupt the neuroendocrine system, which regulates the secretion of hormones such as those responsible for body water regulation and cardiovascular function.

“At present, one more mass-produced chemical is finding its way into our bodies – one with features similar to a banned substance,” Coburn said. “This in itself should be cause for concern, given that low level concentrations of hundreds of man-made compounds have been found in the human body and may act cooperatively to produce harmful health effects.”

Curras-Collazo is urging more research funding into the short- and long-term toxicity of PBDEs.

“Due in part to our lifestyles – electronic equipment, car and airplane travel, computers – PBDEs bioaccumulate, increasing their concentration in human and animal tissues over time,” she said. “They are difficult to get rid of, persisting in the environment and in our bodies.”

In the United States, 80-90 percent of industrial chemicals destined for use in commercial products are sold without any legally required premarket testing.

“We need a different legal strategy,” said Carl Cranor, a professor of

philosophy at UCR who researches legal philosophy, regulatory policy and philosophic issues in science and the law. “Unauthorized chemical invasions usurp important decisions over which, at a minimum, citizens should have considerable collective control. Invasions that also pose risks or harm are additional wrongs.”

With the help of funding from the University of California Toxic Substances Research and Teaching Program and the University of California Institute for Mexico and the United States (UC MEXUS), Curras-Collazo and Coburn now are studying other mechanisms, such as nitric oxide signaling, through which PBDEs act to cause neurotoxic effects. They also are researching the potential effect of the chemicals on blood pressure regulation, especially as a consequence of perinatal exposure such as that experienced by infants and children.

“While we plan to increase and continue our focus on the mechanisms of PBDE toxicity, our long-term goal is to investigate the neurodevelopmental effects of PBDEs,” Curras-Collazo said.

Source: University of California - Riverside