Lecture highlights flame retardants

By Sara Mishamandani

Human exposure to flame retardants in household products and their potential endocrine-disrupting effects were the topics of a talk by Heather Stapleton, Ph.D., March 19 at NIEHS, sponsored by Gregory Travlos, Ph.D., and the NTP Cellular and Molecular Pathology branch. Stapleton *(http://www.cee.duke.edu/faculty/heather-m-stapleton)* and colleagues at the NIEHS-funded Duke University Superfund Research Program (SRP) *(https://sites.nicholas.duke.edu/superfund/)* have conducted a variety of studies on exposure to flame-retardant mixtures, including polybrominated diphenyl ethers (PBDEs) and other chemicals, which are released from furniture and other household items.

An NIEHS Outstanding New Environmental Scientist (ONES) awardee, Stapleton is an associate professor of environmental sciences and policy at the Duke University Nicholas School of the Environment. She also leads a project as part of the Duke SRP. (Photo courtesy of Steve McCaw)

"We have found high levels of PBDEs in household furniture and house dust, and we are very interested in understanding how flame-retardant applications in furniture relate to human exposure and internal dose," said Stapleton. "We are investigating how humans are chronically exposed in the home environment, to better understand the potential health impacts on the population."

Known and alternative flame-retardant chemicals

According to Stapleton, the use of one flame-retardant mixture, known as PentaBDE (PBDE), was phased out in 2004, due to concerns about its tendency to concentrate in human tissues and lead to potential human health effects. Other chemicals are currently used to meet flammability requirements, but little information is available on how people are exposed to these new flame retardants or their potential health effects.

Addressing a capacity audience, Stapleton described the chemicals found in her analysis of furniture foam. Stapleton and her team are working to identify new chemicals used to meet flammability standards, and to understand the health effects of different flame retardant chemical mixtures. (Photo courtesy of Steve McCaw)

Stapleton and colleagues collected dust samples, blood samples, and hand wipes from a group of children in North Carolina to study exposure to PBDEs. Their findings suggest that toddlers have significant exposure, due to transfer of house dust particles from their hands, and objects such as toys, to their mouths. They also found that there was a strong correlation between the PBDE levels found on the hand wipes and the levels measured in the blood (see story).

Stapleton's lab also tested furniture foam for a long list of chemicals, because many flame-retardant mixtures are proprietary. They found that it contained, on average, about five percent flame-retardant chemicals, by weight. In furniture produced after 2004, the chemical tris (1,3-dichloro-2-propyl) phosphate (TDCPP) was prevalent, likely as a replacement for PBDE. In the 1970s, TDCPP was voluntarily phased out of children's pajamas after studies suggested it had mutagenic properties.

Stapleton worked with another Duke SRP scientist, Theodore Slotkin, Ph.D., to determine if TDCPP might be neurotoxic as well. The study *(http://www.ncbi.nlm.nih.gov/pubmed/21255595)* found that TDCPP, as well as other replacement flame retardants may affect neurodevelopment with similar, or even greater, potency than chemicals already known or suspected to be neurotoxicants.

Tackling another flame retardant alternative

The flame-retardant mixture Firemaster® 550 (FM 550) came into use as a replacement for the phased-out PBDE. Stapleton and her research team performed a small-scale study to examine health effects of high and low exposures to FM 550 on pregnant rats.

The study *(http://www.ncbi.nlm.nih.gov/pubmed/23139171)* showed that perinatal exposure to FM 550 is associated with endocrine-disrupting effects. The research team observed weight gain, early puberty onset, and cardiovascular health effects at exposure levels lower than the no observable adverse effect level

reported by the manufacturer.

"There is a lot of misinformation out there about flammability standards and chemicals used in household products," said Stapleton. "Some furniture manufacturers don't even know what is in their foam, because the mixtures are proprietary. We are continuing to measure foam samples from household products to track human exposure and inform about health risk."

(Sara Mishamandani is a research and communication specialist for MDB Inc., a contractor for the NIEHS Superfund Research Program and Division of Extramural Research and Training.)

Discover the chemicals in your sofa

Scientists at Duke SRP, led by Stapleton, are inviting the general public to be part of this research and learn more about what chemicals may be in their home, by testing furniture samples for flame-retardant chemicals at no cost to the public. Because manufacturers are not required to label products with the flame retardants used, only laboratory testing can determine whether flame retardants are in consumers' home furnishings.

Data collected from this testing will help the research team understand which flame-retardant chemicals are currently used in furniture. They can then study how people are exposed to these chemicals, to better understand if the chemicals may impact human health.

Anyone interested in sending a sample of foam for testing should complete the Submit a Sample Form. *(http://foam.pratt.duke.edu/submit-sample)*
For more information on the study, visit the Duke Superfund Analytical Chemistry Core website. *(http://foam.pratt.duke.edu/)*
website.

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