Icahn School of Medicine at Mount Sinai

Children's Environmental Health Center
Department of Preventive Medicine

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Written Testimony of the Children's Environmental Health Center
Icahn School of Medicine at Mount Sinai
Before the Connecticut General Assembly Committee on Children

March 3, 2016

Testimony in Support of: HB 5299 AN ACT CONCERNING TOXIC FLAME RETARDANT CHEMICALS IN CHILDREN'S PRODUCTS AND UPHOLSTERED RESIDENTIAL FURNITURE

Dear Senator Bartolomeo, Representative Urban, and honorable members of the Committee on Children:

As pediatricians, researchers, and scientists at the Children's Environmental Health Center of the Icahn School of Medicine at Mount Sinai, which hosts one of 10 nationally funded Pediatric Environmental Health Specialty Units, we strongly support **Raised Bill 5299: An Act Concerning Toxic Flame Retardants in Children's Products and Upholstered Residential Furniture.** The proposed legislation puts forth a genuine effort to decrease the exposure of vulnerable populations—infants and children—to toxic chemicals.

Flame retardants chemicals are added to consumer products to meet regulatory standards for fire resistance. However, mounting evidence demonstrates that many of these chemicals are not effective at preventing fires[1]. Furthermore, recent studies suggest that human health risks associated with flame retardants may outweigh their benefits.

Flame retardants are ubiquitous in the environment due to their extensive use in polyurethane foams, electronic equipment, automobile interiors, building materials, and more. Because they are not tightly bound to the products that contain them, flame retardants migrate out and accumulate in soil, dust, air, and some foods. Thus they are inhaled, absorbed through the skin, or consumed on a daily basis. Flame retardants are considered to be persistent chemicals meaning they remain in the environment for many years. Due to their chemical properties, flame retardants are stored in the human body for long periods of time[2]. Exposures to flame retardants are orders of magnitude higher in the United States than in Europe[3,4,5]. This disparity is attributed to existing legislation in

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[1] http://www.chicagotribune.com/news/ct-met-flames-barriers-20120506-story.html
[2] DeWit C. An overview of brominated flame retardants in the environment. *Chemosphere*, 46, 583-634 (2002).
[3] Sjodin A *et al.* Serum concentrations of polybrominated diphenyl ethers (PBDEs) and polybrominated biphenyl (PBB) in the United States population: 2003-2004. *Environ Sci Technol*. 2008 Feb 15;42(4):1377-84.

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those countries regulating use and requiring safety assessment of flame retardants introduced into the market (Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals, or REACH) [6].

In the environmental health field, we are particularly concerned about the effects of toxic environmental exposures during early life. Children are exposed to greater quantities of flame retardants and are more vulnerable to their harmful effects than adults. Recent studies demonstrate a relationship between the number of baby products containing polyurethane foam in the home and urinary levels of flame retardants in the infant[7], evidence that these items are major sources of exposure. Young children have higher levels of some flame retardants in their bodies than adults, likely due to developmentally appropriate hand to mouth behaviors and higher breathing rates that place them at increased risk of exposure[8]. Flame retardants cross the placenta and are detected in breast milk, leading to fetal and neonatal exposures as well[9].

Rapidly developing organ systems are particularly sensitive to harmful chemical exposures. Exposure to flame retardants during early life has been linked to congenital disorders (e.g. cryptorchidism in boys)[5], alterations in brain development, alterations in growth (e.g. low birth weight)[10] and metabolism (e.g. obesity)[11], endocrine changes that influence key hormone levels during development[12], as well as changes in behavior, neurodevelopment and cognition[13]. Flame

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[4]Windham GC *et al.* Body burdens of brominated flame retardants and other persistent organo-halogenated compounds and their descriptors in US girls. *Environ Res.* 2010 Apr;110(3):251-7.

[5] Rose M *et al.* Environ Sci Technol. 2010 Apr 1;44(7):2648-53. doi: 10.1021/es903240g.
PBDEs in 2-5 year-old children from California and associations with diet and indoor environment.

[6] http://www.reach-serv.com/index.php?option=com_content&task=view&id=28&Itemid=49

[7] Hoffman K *et al.* 2015. High Exposure to Organophosphate Flame Retardants in Infants: Associations with Baby Products. *Environ Sci Technol*. Dec 15;49(24):14554-9.

[8] Craig M. Butt *et al.* Metabolites of Organophosphate Flame Retardants and 2-Ethylhexyl Tetrabromobenzoate in Urine from Paired Mothers and Toddlers *Environ. Sci. Technol.*, 2014, *48* (17), pp 10432–10438

[9] Main K, *et al.* Flame Retardants in Placenta and Breast Milk and Cryptorchidism in Newborn Boys. *Environmental Health Perspectives*, 115, 1519-1526 (2007).

[10] Harley KG *et al.* Association of prenatal exposure to polybrominated diphenyl ethers and infant birth weight. *Am J Epidemiol*. 2011 Oct 15;174(8):885-92

[11] Yanagisawa R *et al.* .Impaired lipid and glucose homeostasis in hexabromocyclododecane-exposed mice fed a high-fat diet. *Environ Health Perspect*. 2014 Mar;122(3):277-83.

[12]Moser VC *et al.* Neurotoxicological and thyroid evaluations of rats developmentally exposed to tris(1,3-dichloro-2-propyl)phosphate (TDCIPP) and tris(2-chloro-2-ethyl)phosphate (TCEP). Neurotoxicol Teratol. 2015 Nov-Dec;52(Pt B):236-47.

[13] Eskenazi B ***et al.*** In utero and childhood polybrominated diphenyl ether (PBDE) exposures and neurodevelopment in the CHAMACOS study. *Environ Health Perspect*. 2013 Feb;121(2):257-62.

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retardant exposure has been linked to hyperactivity, anxiety, and decreased performance in learning and memory tasks[14].

HB 5299 proposes to restrict flame retardants that belong to a class of flame retardants that pose known hazards to health, the halogenated flame retardants. Halogenated chemicals all contain one or more halogen group – either a chlorine, bromine, or fluorine. Due to their chemical composition, they are persistent in the environment and accumulate in the body. Halogenated compounds are additive chemicals, meaning they are not tightly bound to and easily migrate out of products into the environment. TDCPP or TDCP, also known as chlorinated tris, was banned for use in children's pajamas in 1977 due to its carcinogenic properties[15]. Nevertheless, TDCPP replaced PBDEs in many other products, including those targeted to children, and is currently the most common flame retardant in use[16]. Not surprising given its structural similarity to TDCPP, TCEP is listed as a carcinogen by the state of California[17] and as a Substance of Very High Concern by the EU due to reported reproductive toxicity. Likewise, although little is known about the safety of TCPP, its structural similarity to TDCPP suggests that it may have similar biological effects.

DecaBDE belongs to the polybrominated diphenyl ether (PBDE) group of brominated flame retardants. Once widely used in numerous products, PBDEs are now banned in the US and are known to be highly toxic, persistent, and bioaccumulative. Likewise, US manufacturers are voluntarily phasing out the use of DecaBDE. Hexabromocyclododecane (HBCDD) is restricted in the EU under REACH for reproductive toxicity and is classified as a Persistent Organic Pollutant (POP) by the Stockholm Convention. In 2007 the US Environmental Protection Agency placed HBCDD on its List of Chemicals of Concern, and in 2015 introduced a "Significant New Use Rule" requiring notification for the manufacture, import, or processing of HBCDD in some textiles in the US[18]. However, this rule exempts most current uses of HBCDD, which remains prevalent in many products such as automobile textiles. **For the reasons outlined above, we find sufficient scientific evidence to restrict the use of these chemicals in consumer products, including but not limited to those that are marketed for children.**

At the CEHC we receive numerous questions about the safety of flame retardant chemicals from concerned parents and caregivers. In response to these inquiries, we generated a fact sheet outlining the health risks associated with flame retardants as well as tips for reducing exposures (see

[14] Costa L, *et al.* Polybrominated diphenyl ether (PBDE) flame retardants: environmental contamination, human body burden and potential adverse health effects. *Acta Biomed*, 79(3), 172-183 (2008).
[15] OEHHA. Evidence on the Carcinogenicity of Tris(1,3-Dichloro-2-Propyl) Phosphate. Sacramento, CA:Reproductive and Cancer Hazard Assessment Branch, Office of Environmental Health Hazard Assessment, California Environmental Protection Agency (Jul 2011)
[16] Betts KS. Exposure to TDCPP appears widespread. Environ Health Perspect. 2013 May;121(5):a150.
[17] http://oehha.ca.gov/prop65/prop65_list/files/P65single120415.pdf
[18] http://www.epa.gov/assessing-and-managing-chemicals-under-tsca/hexabromocyclododecane

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attached). Unfortunately, the ubiquity of flame retardant chemicals in furniture and products marketed to children makes it virtually impossible to avoid exposures. Legislation that restricts the manufacture and sale of products containing flame retardant chemicals that are suspected to be harmful to children is the only way to ensure protection.

Historically, legislation mandating or restricting the use of flame retardants has been shown to significantly affect population-wide exposure to flame retardants. For example, in California, the TB117 flammability standard led to an increase in flame retardant use in comparison to other populations and directly resulted in higher blood levels of flame retardants in pediatric populations[5]. In response to mounting evidence that flame retardants are ineffective and pose a public health risk, TB117 regulations were recently revised to relax flame retardant requirements. In addition, several states have taken steps to restrict their use. New York State has banned pentaBDE, TDCCP, and TCEP due to clearly documented health effects, and PBDEs were subsequently banned at the federal level. In 2015, the state of Minnesota banned the manufacture and sale of products containing four of the flame retardant chemicals targeted by HB 5299, representing the most comprehensive flame retardant legislation to date. Legislative restrictions on flame retardants are effective; following a statewide ban on PBDEs in California, blood serum concentrations in pregnant women dropped by 65%[19] and by 40% in breast milk[20].

Current federal law does not require manufacturers to prove the safety of consumer products before they go to market. Thus, we would like to emphasize that to be effective this legislation must retain the current language on replacement chemicals in section (e). Replacements for chlorinated tris and PBDEs already in the marketplace such as Firemaster 550[21] and TBBPA (tetrabromobisphenol A)[22] are proving to be toxic humans and wildlife. While the process of proving the safety of flame retardants may be lengthy and costly, long-term costs and burden of developmental delays and congenital disorders that require medical treatment and impair societal productivity further support the attention required at a legislative level toward protecting children.

In summary, we find significant scientific evidence for the toxicity of the flame retardants included for restriction by HB 5299 and recommend its passage. This legislation serves as testimony to the fact that the state of Connecticut will not accept the addition of toxic flame retardants in mass-

[19] Zota AR *et al.* Temporal comparison of PBDEs, OH-PBDEs, PCBs, and OH-PCBs in the serum of second trimester pregnant women recruited from San Francisco General Hospital, California. *Environ Sci Technol.* 2013 Oct 15;47(20):11776-84.
[20] Guo W *et al*. PBDE levels in breast milk are decreasing in California. *Chemosphere*. 2015 Dec 13. pii: S0045-6535(15)30365-9. doi: 10.1016/j.chemosphere.2015.11.032. [Epub ahead of print]
[21] Patisaul HB *et al*. 2013. Accumulation and endocrine disrupting effects of the flame retardant mixture Firemaster® 550 in rats: an exploratory assessment. *J Biochem Mol* Toxicol 27(2):124–136.
[22] Cope RB *et al.* A reproductive, developmental and neurobehavioral study following oral exposure of tetrabromobisphenol A on Sprague-Dawley rats**.** *Toxicology*, 2015; 329: 49.

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produced children's products and furniture. It addresses parental concerns about the safety of children's products and the need for manufacturers to take responsibility for the chemicals they use. Given that the ability of these chemicals to save lives in a fire is questionable, it seems that the risk benefit ratio is shifting dramatically towards risk. In placing the onus on manufacturers to replace harmful chemicals with safer agents, HB 5299 will promote initiatives to create safer, sustainable alternatives.

We commend the Committee on Children for raising the proposed bill as it represents an important step forward in the process of chemical reform and in protecting the health of some of Connecticut's most vulnerable citizens.

Thank you for the opportunity to submit testimony at this important hearing. We would be happy to answer any questions that arise.

Sincerely,

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Flame Retardant Chemicals: What You Need to Know

Mount Sinai Children's Environmental Health Center

What are flame retardants?

Flame Retardants are chemicals added to a number of products to meet regulatory standards for a product's ability to resist catching on fire. However, mounting evidence demonstrates that many of these chemicals are not effective at preventing fires. Furthermore, recent studies suggest that human health risks associated with flame retardants may outweigh their benefits.

Where are flame retardants found?

Flame retardant chemicals are found in many everyday items, particularly those that contain polyurethane foam. Products commonly treated with flame retardants include:

- Upholstered Furniture
- Mattresses
- Carpet padding
- Baby products (e.g. car seats, changing pads, crib mattresses)
- Electronics

How are we exposed to flame retardants?

Flame retardant chemicals are released from everyday items that contain them and can then accumulate in house dust. Exposures are increased when foam is damaged or exposed. Flame retardant chemicals persist in the environment and accumulate in fatty tissues, which means they stay in the body for years. For these same reasons, animals may be exposed to flame retardants in the environment. Eating animal products can also be a source of exposure. All of the chemicals listed in Table 1 have been found in the bodies of both children and adults.

What are the health risks if I am exposed?

Animal studies of exposure during the early life period suggest adverse effects on the developing brain and reproductive systems. Human studies are limited, but emerging evidence suggests that children exposed to flame retardants *in utero* or through breastmilk may have increased risk of cognitive and behavioral problems. Some flame retardants are also suspected to cause cancer.

Who is most at risk from exposures?

- **Children** are at highest risk for exposure due to their proximity to the ground where dust settles and their hand-to-mouth behaviors. Infants in homes with a greater number of infant products (e.g. infant swings, nursery gliders, bouncer seats, changing pads etc.) have higher levels of some flame retardant chemicals in their bodies.
- **Fetuses:** Flame retardant chemicals have been shown to cross the placenta, and exposures during pregnancy are associated with hormonal, reproductive, cognitive, and behavioral changes in offspring in animal and human studies.
- **Firefighters** are at particular risk to exposures by inhalation as many building supplies and furnishings are treated with flame retardants which are released in the form of toxic smoke when they burn.

What can I do to reduce exposure to flame retardant chemicals?

- Reduce dust by wet dusting, wet mopping and vacuuming with a HEPA filter vacuum.
- Wash hands frequently, especially before eating.
- Ventilate indoor spaces.
- Choose fibers that are naturally flame resistant such as wool
- Avoid polyurethane foam products, particularly those with the TB117 label.
- If you purchase foam products produced after January 2015, look for the TB117-2013 label. These items no longer require flame retardant treatment of foam to fulfill regulatory standards (but use is now optional).
- Ask manufacturers and retailers if their products are flame retardant-free. Ask for it in writing.
- Replace, repair, or cover furniture with exposed foam.
- Support legislation at the local, state, and federal level to eliminate the use of toxic flame retardants. Visit www.greensciencepolicy.org and www.greeningourchildren.org to learn more.

Table 1. Common flame retardant chemicals

Chemical	Chemical Class	Where is it found?	What's the problem?
PBDEs (polybrominated diphenyl ethers)	Halogenated (bromine)	Banned because of toxic health effects. Still found in products made before 2005. In some kitchen items made from plastics from recycled electronics	Similar in chemical structure to cancer-causing PCBs and dioxins, PBDEs are persistent in the environment and bioaccumulative (accumulate in human tissue) Associated with hormonal, reproductive, cognitive, and behavioral changes
TDCPP (tris(1,3-dichloropropyl) phosphate and **TCPP** (tris (chloropropyl) phosphate)**;** also known as chlorinated tris	Chlorinated organophosphate	Replaced PBDEs in most products. Found in polyurethane foam in furniture and baby products Currently the most common flame retardant chemical	Closely related to TDBCPP, another flame retardant that was banned in children's clothing in 1977 due to its potential to cause cancer Causes tumors in lab animals and classified by the state of California as a known cancer causing agent May interfere with hormones in the body
TBBPA (tetrabromobishphenol A)	Halogenated (bromine)	PBDE replacement found in electronics and other products	Laboratory studies suggest that TBBPA may interfere with the immune system May interfere with hormones in the body
TPHP (triphenyl phosphate)	Organophosphate	PBDE replacement found in polyurethane foam in furniture and baby products	May interfere with hormones in the body
Firemaster 550	A mixture that includes halogenated (bromine) and organophosphate chemicals	Replaced PBDE. Found in polyurethane foam in furniture and baby products Currently the second most common flame retardant chemical	May interfere with hormones in the body Causes obesity, early puberty, and behavioral changes in laboratory animals Studies on human safety are non-existent

Further Reading

http://greensciencepolicy.org/
http://www.chicagotribune.com/news/ct-met-flames-barriers-20120506-story.html
http://www.pehsu.net/HealthProf_Polybrominated_Diphenyl_Ethers.html

OEHHA. 2014. Office Of Environmental Health Hazard Assessment, California Environmental Protection Agency. Safe Drinking Water And Toxic Enforcement Act Of 1986. Chemicals Known To The State To Cause Cancer Or Reproductive Toxicity. http://oehha.ca.gov/prop65/prop65_list/files/P65single032814.pdf

Horton MK *et al.* 2013. Predictors of serum concentrations of polybrominated flame retardants among healthy pregnant women in an urban environment: a cross-sectional study. *Environ Health.* Mar 8;12:23.

Stapleton HM *et al.* 2011. Associations between polybrominated diphenyl ether (PBDE) flame retardants, phenolic metabolites, and thyroid hormones during pregnancy. *Environ Health Perspect*. 119(10):1454-9.

Meeker JD, Stapleton HM. 2010. House dust concentrations of organophosphate flame retardants in relation to hormone levels and semen quality parameters. *Environ Health Perspect.* 118(3):318-23.

Patisaul H.B. *et al.* 2013. Accumulation and Endocrine Disrupting Effects of the Flame Retardant Mixture Firemaster 550 in Rats: An Exploratory Assessment. *J.Biochem. and Mol. Tox.* Feb;27(2):124-36. doi: 10.1002/jbt.21439.

Hoffman K *et al.* 2015. High Exposure to Organophosphate Flame Retardants in Infants: Associations with Baby Products. *Environ Sci Technol*. Dec 15;49(24):14554-9. doi: 10.1021/acs.est.5b03577.

Hoffman K *et al.* 2015. Monitoring indoor exposure to organophosphate flame retardants: hand wipes and house dust. *Environ Health Perspect.* Feb;123(2):160-5. doi: 10.1289/ehp.1408669.

Stapleton HM *et al.* 2011. Identification of flame retardants in polyurethane foam collected from baby products. *Environ Sci Technol.* 45(12):5323-31.

Cope RB *et al.* A reproductive, developmental and neurobehavioral study following oral exposure of tetrabromobisphenol A on Sprague-Dawley rats**.** *Toxicology*, 2015; 329: 49 DOI: 10.1016/j.tox.2014.12.013