No Escape

Tests Find Toxic Fire Retardants in Mothers – and Even More in Toddlers

ENVIRONMENTAL WORKING GROUP

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Environmental Working Group empowers people to live healthier lives in a healthier environment. We drive consumer choice and civic action with breakthrough research and an informed public.

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No Escape:

Tests Find Toxic Fire Retardants in Mothers – and Even More in Toddlers

Executive Summary

A new research study conducted by the Environmental Working Group and Duke University has found evidence of exposure to TDCIPP, a cancer-causing fire retardant, in the bodies of all 48 mothers and their children tested. In the children, the average concentration of a chemical biomarker left when TDCIPP breaks down was nearly five times that of the average in the mothers. In the most extreme case, a child had 23 times the level measured in the mother.

The EWG-Duke study, the first to evaluate children's exposure to TDCIPP, documents that children in critical windows of development are experiencing exposure to a chemical listed as a carcinogen by California health authorities.

The researchers analyzed the volunteer subjects' urine for a TDCIPP metabolite. (A metabolite is a compound produced by the breakdown of a chemical in the body.) When scientists conduct biomonitoring studies to investigate chemicals that make their way into people, they consider metabolites to be "biomarkers of exposure," meaning the trail of evidence left in the body by the substance under investigation.

Children are believed to ingest significantly more fire retardant chemicals than their mothers because they spend more time on the floor amid house dust contaminated by fire retardant chemicals that have migrated out of consumer products, and because they put their hands and objects—toys, for example—in their mouths more frequently than adults.

TDCIPP, a member of a family of chemicals known as chlorinated alkyl phosphates, is routinely used as a fire retardant in polyurethane foam manufactured for upholstered furniture, automotive cushioning and infant goods like changing table pads and nursing pillows.

The urine of the children in the study also contained metabolites of several other flame retardants, some of which are components of a fire retardant mixture marketed under the brand name Firemaster® 550. Firemaster® 550 is added to furniture cushioning and baby products. For all three Firemaster® 550 chemicals, the children's average metabolite levels were elevated compared to the mothers, indicating relatively greater exposure.

The results of the study are troubling for several reasons:

- TDCIPP causes cancer in laboratory animals and is listed as a carcinogen under Proposition 65 in the state of California. The U.S. Consumer Product Safety Commission considers it a probable human carcinogen.
- TDCIPP and the chemicals found in Firemaster® 550 are suspected of disrupting the endocrine system, which is the body's master regulator of hormone signaling. Endocrine function is critical to normal growth, metabolism and sexual development. Substances that interfere with hormone signaling have been linked to a wide variety of disorders and conditions, including obesity and developmental problems.

Replacement fire retardants aren't safer

The use of TDCIPP and Firemaster® 550 has been on the rise as a replacement for a class of fire retardant chemicals called polybrominated diphenyl ethers, or PBDEs. These fire retardants were removed from the market because they persisted and accumulated in the environment and people and because they were found to be toxic to humans. Scientific research linked PBDEs to neurodevelopmental problems in children and altered thyroid function in pregnant

women (Chevrier 2010; Stapleton 2011; Eskenazi 2013; Chen 2014).

Under intense pressure from EWG, other public health groups and the Environmental Protection Agency, the Great Lakes Chemical Corp. (now Chemtura Corp.) voluntarily halted production of two PBDE commercial mixtures in 2004. In 2009, after more negotiations with the EPA, two producers and one importer of fire retardant chemicals—Chemtura, Albemarle Corp. and ICL Industrial Products, Inc.—agreed to stop the use of a third PBDE commercial mixture by the end of 2013.

Even though sales of PBDEs have trickled to a halt, furniture treated with PBDE commercial mixtures often remains in Americans' homes for years. In 2008, a groundbreaking EWG study discovered that levels of PDBEs in toddlers were nearly three times those found in their mothers (Lunder 2010). This seminal study raised awareness of the dramatic extent to which potentially harmful chemicals were contaminating children's bodies.

The long-term effects of human exposure to the fire retardant chemicals studied in this project are not known, but there is ample reason to be concerned. House dust concentrations of TDCIPP and urinary concentrations of its metabolite, BDCIPP, have been associated with changes in hormone levels and decreased semen quality in men, conditions that might affect fertility (Meeker 2010; Meeker 2013). Studies in zebrafish, which can be used as a model to evaluate endocrine disruption and development, show that TDCIPP affects certain genes that regulate hormone signaling important for reproduction and development (Liu 2013a; Liu 2013b). One study also demonstrated that TDCIPP had equal or greater neurotoxicity on brain cells as the pesticide chlorpyrifos, which is considered a neurodevelopmental toxicant (Dishaw 2011). Its designation as a carcinogen in California came after thorough inquiry by scientists at the California Environmental Protection Agency.

The EWG-Duke study found the metabolite BDCIPP in all individuals tested, with the average level in children 4.9 times that of the mothers. The levels of BDCIPP in adults were two to six times greater than the median level reported in three previous studies, perhaps suggesting increasing use of TDCIPP (Carignan 2013; Cooper 2011; Hoffman 2014). Since the EWG-Duke study was the first to analyze BDCIPP in children, it is unknown whether the amount of this metabolite in children's bodies has been increasing over time.

Health data on Firemaster 550® chemicals are limited, but some evidence indicates they may be harmful. This question is important because, like TDCIPP, Firemaster® 550 is being used to replace PBDEs in polyurethane foam. A study led by scientists from North Carolina State University has shown that exposure to Firemaster® 550 can disrupt the endocrine system, cause obesity and alter behavior in rats (Patisaul 2013). The study linked exposure to this fire retardant mixture to early puberty in female rats and heart damage in males.

The EWG-Duke tests found metabolites of Firemaster® 550 in children in higher concentrations than adults. The metabolized remains of a Firemaster component called TPhP was detected in 98 percent of the study participants. On average, levels of the TPhP metabolite in children were three times those of their mothers.

TPhP has several industrial applications. In addition to its use as a fire retardant in furniture and other consumer products, it serves as a plasticizer to make some vinyl items that might include shower curtains and toys more flexible and less brittle. It is reasonable to assume that some portion of the TPhP metabolite detected in the mothers and children tested came from fire retardants, but it is impossible to fix responsibility precisely.

Weak toxic substance control laws and poorly designed flammability standards are the reasons for people's chronic and widespread exposure to fire retardant chemicals. They are ubiquitous in upholstered furniture largely because of a California flammability regulation enacted in the

1970s. This regulation, called TB117, required manufacturers to meet a standard called the "open flame" test that encouraged the heavy use of fire retardant chemicals. Yet studies conducted by the U.S. Department of Commerce and Consumer Product Safety Commission found no significant differences in the safety of furniture containing flame retardant foams and those containing untreated foams when exposed to open flame. Rather, the materials covering the foam proved to be a pivotal factor in markedly improving furniture fire safety (Department of Commerce 1985; CPSC 2012). California officials recently changed the TB117 rule to shift the focus of the test requirements away from open flame sources and toward smoldering sources, the leading cause of furniture fires (BHFTI 2013). This action eliminated the need for fire retardant chemicals and aimed to decrease the risk of smoking-related fires, the primary cause of upholstered furniture fire and related deaths. In flagrant disregard for public health and to protect corporate financial interests, Chemtura has filed a lawsuit challenging California's revised regulation.

Government policies must limit fire retardant chemicals, require labeling

The results of the EWG-Duke study make clear that government regulators and furniture makers must act responsibly, and quickly, to reduce people's exposures to fire retardant chemicals, especially children:

- The U.S. government must take regulatory action to decrease the presence of these chemicals in consumer products, particularly those intended for children and babies.
- Manufacturers should be required to label products that contain fire retardants so that consumers can seek alternatives.
- While some states have taken steps forward by banning or proposing to ban certain fire retardant chemicals in children's products and upholstered furniture, stronger federal regulation and reforms in chemical safety policies are clearly needed to address these issues on a national level. Banning the use of one toxic fire retardant, only to see another take its place in the market, is not progress.

Consumer Product Safety Commission weighing national standards

The Consumer Product Safety Commission may make a decision that could significantly increase Americans' exposure to toxic fire retardant chemicals on a national level and erase the progress recently made in California. The U.S. does not have a national flammability standard for upholstered furniture; the Consumer Product Safety Commission has been working on one for decades. Unsurprisingly, fire retardant makers are pressing for a standard that would encourage heavy use of their chemicals in upholstered furniture.

EWG strongly opposes such a standard and is urging the commission to adopt a policy similar to California's recently revised regulation, which allows manufacturers to avoid the use of toxic fire retardants. Any standard proposed by the commission that encourages or requires the use of fire retardant chemicals could lead to serious environmental and public health problems.

INSIDE THE EWG-DUKE STUDY

After PBDEs went off the market, the chemical fire retardant industry moved toward alternatives such as chlorinated and non-chlorinated organophosphates and brominated phthalate compounds. Exposure to these chemicals had not been studied in children.

To explore this important question, scientists at EWG and Duke University partnered with a pediatric clinic in New Jersey to collect paired urine samples from mothers and children to compare the levels of six alternative fire retardant metabolites. The children were between the ages of one and five, and in some cases we collected urine from more than one child in a household. The samples were collected between August of last year and January of this year.

In all, EWG and Duke tested the urine of 26 children and 22 mothers for six fire retardant metabolites:

- **BDCIPP**, also called bis(1,3-dichloro-2-propyl) phosphate. This is the principle metabolite formed when the body breaks down an organophosphate fire retardant called tris(1,3-dichloro-2-propyl)phosphate, or TDCIPP. This compound, a member of a family of fire retardant compounds called "chlorinated alkyl phosphates," was the most frequently detected chemical of this type in one study that tested couches and another that tested baby products (Stapleton 2011; Stapleton 2012b).
- **BCIPP**, also called bis(1-chloro-2-propyl) phosphate. Its parent compound, tris(1-chloro-2-propyl)phosphate, or TCIPP, was detected in baby products but in lower average concentrations than TDCIPP (Stapleton 2011). Like TDCIPP, TCIPP is a member of the chlorinated alkyl phosphate family.
- **DPhP**, also called diphenyl phosphate. This metabolite forms when the body breaks down an organophosphorous fire retardant called triphenyl phosphate, or TPhP. TPhP is a component of Firemaster® 550 and is also found in plastics, rubbers, lubricants, nail polish and photographic film. Firemaster® 550 chemicals are the second most frequently detected flame retardant compounds in couches purchased after 2005 and baby products.
- **tb-DPhP** and **ip-DPhP** are organophosphate metabolites similar in structure to DPhP. They are the breakdown products of t-butyl triphenyl phosphate, or tb-TPhP, and isopropyl triphenyl phosphate, or ip-TPhP. Firemaster® 550 contains ip-TPhP. A fire retardant called Phosphlex 71B, used in polyurethane foam, contains tb-TPhP.
- **TBBA**, or tetrabromobenzoic acid, is a metabolite of 2-ethylhexyl-2,3,4,5-tetrabromobenzoate, or EH-TBB. EH-TBB is a brominated compound and component of Firemaster® 550 and Firemaster® 600.

What we found

Four of six of these metabolites were found in children in higher concentrations than adults. BDCIPP, DPhP and ip-DPhP were detected in 100 percent, 98 percent and 96 percent of the test volunteers respectively. Overall, children had higher urinary levels of BDCIPP, DPhP, ip-DPhP and TBBA than their mothers.

Strikingly, the average level of BDCIPP in children one to five years old was 4.9 times that of the average in their mothers, and the average level of DPhP in children was nearly three times that of their mothers. TBBA was detected at a much higher frequency in children's samples than in those of their mothers. Table 1 shows summary results for all metabolites.

Notably, BDCIPP levels in adults were two to six times greater than levels reported in previous studies that measured this metabolite in urine collected between 2009 and 2012 (Carignan 2013; Cooper 2011; Hoffman 2014). The higher concentrations in urine samples collected by EWG and Duke in 2013

and 2014 might reflect the increasing use of this compound. Since the EWG-Duke study was the first to analyze BDCIPP in children, there was no basis for comparison to earlier studies.

HOW FIRE RETARDANTS GET INTO US

People end up with fire retardants in their bodies mainly by inhaling or swallowing dust. Scientists believe that small children may have higher exposures to fire retardants because they spend more time on the floor, where dust contaminated with these chemicals accumulates. A 2012 study by Duke researchers found that the levels of PBDE flame retardants on toddlers' hands predicted levels in their blood, supporting the role of hand-to-mouth contact as an exposure pathway (Stapleton 2012a). Children put their hands in their mouths more often than adults. Hand-washing may help reduce their exposure to contaminated dust. A study published earlier this year by the same Duke researchers reported that on average, children who washed their hands at least five times a day had levels of fire retardants on their hands 30 to 50 percent lower than children who washed their hands less frequently (Stapleton 2014).

The EWG-Duke study showed that children who washed their hands frequently had lower urinary levels of BDCIPP. Increased hand-to-mouth activity was significantly associated with higher DPhP levels. Thumb sucking was associated with higher DPhP levels but to a lesser degree. The findings indicate that hand-to-mouth behavior is an important predictor of fire retardant exposure in children.

In the study group, mothers whose levels of DPhP, BDCIPP, and ip-DPhP were higher than others also had children with higher levels of these metabolites. Mothers with comparatively lower levels generally had children with lower levels. This finding suggests that mothers and their children have similar exposure pathways because of their shared environments.

Where to find fire retardants in the home

A 2012 analysis of 102 samples of polyurethane foam from couch cushions detected at least one fire retardant in 85 percent of them (Stapleton 2012b). PentaBDE was the most common fire retardant found in couches purchased before 2005, when it was phased out. Among couches bought after 2005, 52 percent contained TDCIPP and 18 percent contained components of Firemaster® 550. This study showed that the use of fire retardants in furniture was

TABLE 1. DETECTION FREQUENCY AND AVERAGE LEVELS OF FIRE RETARDANT METABOLITES IN MOTHERS AND CHILDREN

	Mothers (n=22)			Children (n=26)*		
Metabolite	Detection Frequency	Average Level	Range	Detection Frequency	Average Level	Range
BCIPP	14%	NA	ND-0.64	4%	NA	ND-0.46
BDCIPP	100%	2.4	0.37-11.0	100%	5.6	0.89-251
DPhP	95%	1.9	ND-68.7	100%	3.0	0.68-140
ip-DPhP	100%	0.85	0.29-2.3	92%	1.0	ND-10.1
tb-DPhP	5%	NA	ND-0.13	19%	NA	ND-0.48
TBBA	27%	NA	ND-62.2	70%	7.4	ND-84.9

BCIPP, BDCIPP, DPhP, ip-DPhP and tb-DPhP concentrations are in ng/ml (parts per billion)
TBBA concentrations are in pg/ml (parts per trillion)
ND = not detectable
NA = not available (detection frequency was too low to perform a calculation)
*For TBBA analysis n=23 due to insufficient volume in three samples

increasing: 93 percent of couches purchased after 2005 contained significant levels of fire retardant chemicals compared to 76 percent of couches purchased prior to 2005.

An analysis of baby products showed a similar pattern of flame retardant use (Stapleton 2011). Eighty percent of samples collected from 101 baby products, including car seats, baby carriers and portable mattresses, contained fire retardants. TDCIPP was detected in 36 percent of the samples and Firemaster ® 550 components in 17 percent.

Many fire retardants are "additive." This means they are mixed with other product materials instead of bonded with a chemical reaction. As a result, they migrate out of products more easily. Because a variety of compounds are used as fire retardants, typically a mixture of these chemicals is present in dust. A study of house dust collected in California homes in 2006 and in 2011 found 41 different fire retardant chemicals in at least half of the samples (Dodson 2012). The same study reported significantly higher levels of Firemaster ® 550 compounds in 2011 compared to 2006, indicating increasing use. The levels of TDCIPP in some house dust exceeded the U.S. Environmental Protection Agency's health risk guidelines.

AMERICANS' EXPOSURE TO FIRE RETARDANT CHEMICALS IS WIDESPREAD

In a 2006 report, the federal Consumer Product Safety Commission estimated that children's exposure to TDCIPP was five times the level deemed safe and that children exceeded what was considered an acceptable cancer risk—one in a million—during the first two years of life (Babich 2006).

Biomonitoring studies that test human blood, urine and breast milk have routinely detected fire retardant chemicals in people (Frederiksen 2009). In 2011 California researchers detected some of the highest levels of PBDE fire retardants ever reported in the serum of pregnant women (Zota 2011). A follow-up study published last year by the same team reported that PBDE concentrations in pregnant women had declined significantly; total PBDE serum levels had decreased by 65 percent (Zota 2013). The authors of these studies speculated that the lower PBDE body burden was probably due to phase-outs but that greater concentrations of alternative fire retardant chemicals would likely increase over time. The EWG-Duke study supports this theory, finding that average levels of BDCIPP detected in the urine of adults was higher than those reported in previous years. Further analysis is needed to evaluate this trend.

HEALTH DANGERS OF FIRE RETARDANT CHEMICALS

The safety of fire retardant chemicals has been questioned for decades. Some chemicals have sparked enough concern to warrant regulatory action. A study published in the journal Science in the 1970s showed that children who wore pajamas treated with the fire retardant tris(2,3-dibromopropyl) phosphate, or TDBPP, had a mutagenic metabolite in their urine that was not present in children who never wore treated pajamas (Blum 1978). The Consumer Product Safety Commission banned TDBPP in children's clothing in 1977 after a National Cancer Institute study showed that it causes tumors in laboratory animals (NCI 1978). Shortly thereafter TDCIPP, which is closely related to TBCPP, was voluntarily phased out of children's sleepwear due to similar concerns (Gold 1978; CPSC 1977). Now that there is clear evidence that TDCIPP causes tumors in animals in multiple organs, the state of California has listed it as a chemical known to cause cancer (OEHHA 2011; OEHHA 2014). The Consumer Product Safety Commission considers TDCIPP a probable human carcinogen (Babich 2006).

In September of last year, TDCIPP was nominated for review and possible inclusion in the U.S. Department of Health and Human Services Report on Carcinogens (Federal Register 2013). The EPA is currently assessing human health risks associated with TDCIPP as part of its Toxic Substances Control Act Work Plan and Action Plan efforts.

TDCIPP's capacity to disrupt the endocrine system has been explored to a limited extent. A study that

compared the levels of TDCIPP in house dust to hormones and semen quality in men associated the chemical with a decrease in thyroxine, a thyroid hormone, and an increase in prolactin, which stimulates milk production and breast development in women (Meeker 2010). The same group found a correlation between TCDIPP's urinary metabolite, BDCIPP, and decreased sperm motility (Meeker 2013). Studies in zebrafish show that TDCIPP may alter the expression of certain genes involved in development and reproduction, including those that regulate the expression of sex hormones (Lui 2013a; Lui 2013b). And a study using rat nerve cells suggests that TDCIPP might be neurotoxic (Dishaw 2011). The 2006 risk assessment performed by the Consumer Product Safety Commission concluded that foam in upholstered furniture treated with TDCIPP "might present a hazard to consumers, based on both cancer and non-cancer hazards."

According to the most recent EPA reporting data, TDCIPP is a high production volume chemical, with 10 to 50 million pounds manufactured or imported in 2011 (EPA 2014a). One manufacturer, ICL Industrial Products, has pledged to stop production next year (Chemicals-Technology 2012). However, the company has announced plans to expand production of a replacement chemical, trademarked "Fyrol HF-5." No toxicity data on Fyrol HF-5 are currently available to the public. The Material Safety Data Sheet says the components of Fyrol HF-5 are a proprietary mixture containing TPhP (ICL 2012; ICL 2014). ICL appears to be swapping out one problematic chemical for a secret proprietary mixture lacking publically available toxicity data.

Firemaster® 550 safety must be investigated

Great Lakes Solutions, a subsidiary of Chemtura based in Indiana, has manufactured Firemaster® 550 since the mid-90s. Chemtura initially did not disclose the ingredients in this mixture, but Dr. Heather Stapleton, a co-author of this study, analyzed the components in her laboratory at Duke University and found that Firemaster® 550 contains TPhP, EH-TBB, TBPH (or bis(2-ethylhexyl)2,3,4,5-tetrabromophthalate) and a mixture of isopropylated TPhP isomers, including the precursors of ip-DPhP for which EWG and Duke tested in this study (Stapleton 2008).

TPhP is a constituent of Firemaster® 550 and is also used as a plasticizer in rubber and vinyl to help make these materials flexible and weather-resistant. It is a high production volume chemical. Earlier this year, EPA reported that nearly 10.8 million pounds were imported or manufactured (EPA 2014b). The toxicity data for TPhP are limited, and the available studies are mostly decades old or incomplete (Babich 2006). Little information is available on health effects in animals and people after long-term exposure. TPhP and its urinary metabolite DPhP are associated with increased prolactin and decreased sperm concentration (Meeker 2010; Meeker 2013). Studies published this year report that TPhP has estrogenic activity and can interfere with metabolism, indicating it can disrupt endocrine signaling (Belcher 2014; Zhang 2014).

EH-TBB is a component of Firemaster® 550. Results of industry-sponsored studies from 2008 that the EPA ordered from Chemtura show that a combination of EH-TBB and TBPH caused reproductive and developmental damage to lab animals, including fetal malformations and birth weight effects (MPI Research Study 1038-006, CN-2065; MPI Research Study 1038-008, CN-2065).

The toxicity of Firemaster® 550 as a mixture is poorly understood, but recent independent academic research indicates it might be harmful. One study shows that when rats ingested Firemaster ® 550 in doses similar to the amounts found in contaminated dust, they showed hormone changes and weighed more than unexposed animals (Patisaul 2012). Early puberty was observed in female rats, males showed changes in cardiac tissue, and both males and females exhibited behavior changes. These effects occurred at doses much lower than those that produced "no effect" according to the studies on EH-TBB and TBPH commissioned by Chemtura. A separate study showed that Firemaster® 550 also causes DNA damage in the liver cells of fish (Bearr 2010).

PBDES: A CAUTIONARY TALE

The story of PBDEs illustrates the inadequacy of the nation's chemical and fire safety laws. In the late 1990s, Swedish researchers found PBDE fire retardants in samples of breast milk. In the first study of its kind, EWG reported in 2008 that PBDE levels in American mothers were 75 times those found in European studies (EWG 2008a). (Despite the presence of fire retardants in breast milk, EWG encourages all mothers to breastfeed their children when possible; the benefits outweigh concerns about contaminants.)

In 2005 EWG released a startling report showing that umbilical cord blood had become contaminated with these fire retardants. All 10 of the newborns tested had detectable concentrations of PBDEs in their cord blood. In other words, exposure to these chemicals began before birth. A 2009 EWG report that tested the cord blood of 10 minority babies born between 2007 and 2008 found multiple PBDEs in every single sample.

Because PBDEs can affect neurodevelopment and thyroid hormone signaling that is critical to fetal health, exposure in the womb is of particular concern. As troubling were EWG's 2008 test results showing that toddlers' blood contained nearly three times the PBDEs of their parents (EWG 2008b).

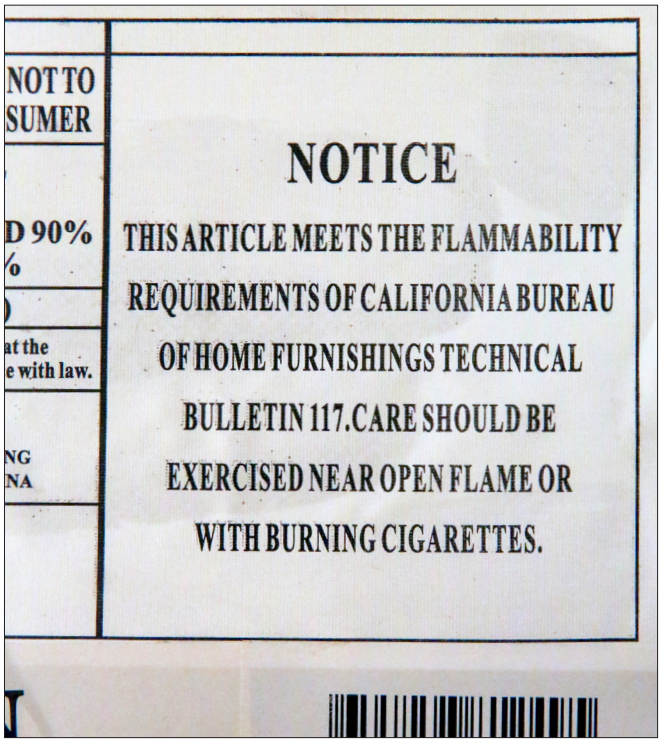
American children with higher PBDE exposures score worse on assessments of learning and attention, and these deficits appear to persist through childhood, according to a longitudinal study published by the Center for the Health Assessment of Mothers and Children of Salinas (Eskenazi 2013). Other studies have found that exposure to PBDEs may affect maternal thyroid hormones and could alter children's behavior if they were exposed prenatally (Chevrier 2010; Stapleton 2011; Chen 2014). Research has also shown that women with higher PBDE levels take longer to become pregnant (Harley 2010). Although PBDEs are off the market, these chemicals are still detected in people due to their persistence, tendency to bioaccumulate, and presence in old furniture and other consumer goods.

The EWG-Duke study suggests that the fire retardant chemicals that replaced PBDEs could likely follow the same trajectory. The implications for policy are unmistakable: the U.S. desperately needs chemical policy reform so that Americans don't have to fear they are taking unnecessary risks with the health of their children.

REGULATORY REFORM IS NEEDED

Everyone wants to be safe from fire. Yet *how* a government agency decides to test furniture for flammability makes an important difference. California's 1975 TB117 rule, which required that foam in all furniture sold in the state to withstand ignition from a small open flame for 12 seconds, is a case in point. The easiest and cheapest way for manufacturers to meet the standard was to apply large volumes of fire retardant chemicals to the foam—about 5 percent by weight of the foam (Stapleton 2012b). Yet this rule did not effectively prevent furniture fires, because it ignored the reality that the outer fabric would ignite first, and once ignited, the flames would be much larger than the flame retardants inside the foam could handle.

Previous TB117 label indicates that fire retardants were likely added to the furniture.



Many companies chose to treat *all* the polyurethane foam used in furniture with fire retardants so they would not need to manufacture one set of products for California and another for the rest of the country. Furniture containing fire retardants is now common throughout the U.S., and since there are no federal labeling laws, consumers cannot determine whether their couches and cushioned chairs contain these chemicals. Some labels contain wording such as, "This article meets the flammability requirements of the California Bureau of Home Furnishings Technical Bulletin 117," indicating the product likely contains fire retardants. Due to this problem, Duke researchers now offer free testing of furniture foam for fire retardants.

Conversely, not all treated products bear this label. Its absence does not guarantee a fire retardant-free product. For example, a 2012 study found that 60 percent of samples from couches without a TB117 label contained fire retardants (Stapleton 2012b). Furniture meeting the new California standard must bear a label reading "This article meets the flammability requirements of the California Bureau of Electronics and Appliance Repair, Home Furnishing and Thermal Insulation Technical Bulletin 117-2013," but this also does not mean the product is free of fire retardants. If fire retardants are added to a product, a label should spell out what those chemicals are so that consumers are not left in the dark.

In 2012 California Gov. Jerry Brown directed the state's Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation to revise TB117 due to the mounting environmental and human health concerns surrounding fire retardants (California Office of the Governor 2012). Effective Jan. 1, 2014, manufacturers of upholstered furniture were no longer required to meet open flame test in California.

The revised standard, TB117-2013, focused on smoldering ignition sources, the leading cause of fires in upholstered furniture and associated deaths (National Fire Protection Association 2011). When it established the new standard, the California agency concluded that TB117 had not adequately addressed the flammability of upholstery fabric and that flame retardant foam could actually increase fire danger from smoldering ignition sources like cigarettes (BHFTI 2013). It cited studies by the U.S. Department of Commerce and the Consumer Product Safety Commission that found no significant differences in the safety of furniture containing flame retardant foams formulated to pass TB117 and untreated foams (Department of Commerce 1985; CPSC 2012).

The new California regulation does not restrict the use of fire retardants. Rather, it eliminates the need for furniture makers to use these chemicals in order to pass the open flame test. California officials expect that many companies will choose to phase out fire retardants voluntarily.

No national flammability standards exist for upholstered furniture. In 2008 the Consumer Product Safety Commission proposed a standard that focused on preventing fires from smoldering ignition sources, similar in intent to the new California regulation (CPSC 2008). Manufacturers could meet the requirements of the Consumer Product Safety Commission proposal by using either smolder-resistant cover materials or an interior fire barrier, neither of which would require fire retardant chemicals. However, this rule has not been adopted. There are indications that agency may bow to industry pressure and develop an "open flame" standard that would likely strongly encourage the heavy use of chemical fire retardants—increasing people's exposure to toxic chemicals.

Some states banned the use of certain fire retardants, such as some chlorinated alkyl phosphate compounds. Last year, Vermont enacted a statute that banned the sale and manufacture of children's products and upholstered furniture containing TDCIPP and TCEP. New York passed legislation prohibiting the sale of products containing TCEP intended for children under three. A proposal now before the New York legislature would ban TDCIPP in children's products. Lawmakers in Maryland, Alaska, Connecticut, Delaware, Illinois and Massachusetts have proposed legislation to ban certain fire retardants, including chlorinated compounds such as TDCIPP, in children's products and/or upholstered furniture.

State-level actions do not guarantee that people's exposure to fire retardant chemicals will decrease. To

the contrary, bans on specific fire retardants will likely cause chemical companies to market replacement chemicals that might be just as bad or worse than those they purport to replace. As the EWG-Duke study shows, fire retardants formulated to replace PBDEs are showing up in people's bodies. And their use in consumer products is increasing.

The Toxic Substances Control Act of 1976 should be updated

Fire retardants and other chemicals in U.S. commerce are regulated by the Toxic Substances Control Act, which has not been significantly updated since its enactment in 1976. Under this law, chemical manufacturers are not required to conduct toxicity testing or demonstrate that their chemicals are safe. As a result many chemicals in commerce in the U.S. have not been adequately tested for toxicity. This compares poorly to the chemical regulatory framework in the European Union, where chemicals in commerce are required to have health and safety information.

When the Toxic Substances Control Act took effect, 60,000 chemicals already in commerce were "grandfathered" and were not evaluated for safety. The EPA has been able to require testing on only about 200 of the chemicals listed on its so-called TSCA Inventory, now numbering more than 84,000 (Jones 2013). Consequently, the potential human health dangers of many chemicals, including fire retardants, are unknown. The need for chemical policy reform is painfully obvious. Legislation to improve chemical policy should require manufacturers to provide toxicity data to substantiate safety before a product is introduced to the market.

EWG RECOMMENDATIONS

The American government must reform a regulatory system that allows a class of harmful chemicals such as PBDEs to be replaced with chemicals that may be just as toxic. The data presented in this study show that children are more highly exposed than adults to potentially harmful fire retardant compounds. The health of children constitutes a compelling reason for swift adoption of more health-protective policies and practices.

To address these serious issues, EWG recommends that:

1. Products with added fire retardants must be clearly labeled so that consumers have the power to make informed choices. The label should identify which specific fire retardant chemicals are present in the product.
2. Fire retardants should be prohibited in products intended for children and babies. Some of these compounds show evidence of hormone disruption and/or are carcinogenic. Exposure to such chemicals should be avoided during early development.
3. If the Consumer Product Safety Commission moves ahead with a national furniture flammability standard, it must adopt testing requirements that do not encourage or require chemical fire retardants. Instead of the open flame test, the focus should be on smoldering ignition sources such as cigarettes, which are the leading cause of upholstered furniture fires and deaths, or the use of non-flammable materials that would maintain fire safety without increasing chemical exposures.
4. Meaningful federal chemical policy reform must move forward in Congress. Reforms should require safety testing before chemicals are allowed in commerce.

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