Fanning the Flames

How Banning Flame Retardant Chemicals Puts Consumers at Risk

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Executive Summary

In July 2015, a coalition of environmental activist groups asked the Consumer Product Safety Commission (CPSC) to ban certain uses of an entire class of flame retardant chemicals based on faulty claims about the risks. Specifically, they petitioned the CPSC to ban the use of all organohalogen flame retardant products in upholstered furniture sold for home use in mattresses, mattress pads, and in the plastic casing of all electronic devices.[1] These groups allege that trace exposures of these chemicals pose health risks, and that products that contain them provide no benefits. Both claims fall apart under scrutiny.

The CPSC has received comments and held hearings. It is now deliberating on whether such bans are necessary, with a decision expected later this year. Congress should pay attention and provide oversight as needed, because such bans or overly burdensome flame retardant regulations could undermine public health and safety and contribute to fire risks.

Evidence is scant that trace human exposures to organohalogens through consumer products pose a significant public health risk, while fire risks are real, verifiable, and substantial.[2] Moreover, because not all organohalogens are the same, banning this entire class of chemicals makes no scientific sense. Banning even a limited number of uses for an entire category of flame retardant chemicals is not only unwarranted, it will eliminate currently valuable uses and market development of future uses. The regrettable result could be unnecessary and preventable loss of life from fires that expand faster in the absence of these products.

Although there is on ongoing debate about the efficacy of flame retardants in certain applications, there is sufficient research and data to demonstrate that organohalogens provide benefits in many applications and have the potential for valuable new uses in the future.

Despite the petitioners' claims to the contrary, there is no shortage of safety regulations covering these products. The U.S. Environmental Protection Agency is already evaluating the safety of these products and other flame retardant chemicals under a number of initiatives. Overregulation and alarmism about these products will do more harm than good by forcing valuable products off the market.

In addition to safety regulations related to potential effects of flame retardant chemicals, regulators also set flammability standards that may encourage the use of such chemicals. In fact, CPSC's flammability standards and standards set by the State of California play a major role in this marketplace, and may have helped advance markets for chemical flame retardants. Activist groups may have a legitimate complaint about flammability standards that essentially force, or at least strongly push, manufactures to choose products and applications that may not provide the best protection and lock other options out of the market.

There is debate among fire safety experts within industry and private standard-setting organizations about what type of standards make the most sense for various materials and types of consumer products. This debate is best conducted within the private sector, allowing for private certification systems to compete and for manufacturers to select which ones best apply to their products. Consumers should also be free to select products based upon their own research and preferences.

Ideally, rather than ban chemicals, a better approach would allow a more dynamic market process that relies on private standards and certification systems for flammability standards. Such private systems allow for innovation and swift adjustments to technologies in accordance with improving information and technology, as well as changes in product designs, consumer demand, and lifestyles. As detailed in this paper, the regulatory history reveals that governments are ill-equipped to make such decisions, and their bad decisions are difficult—if not impossible—to reverse. In fact, government involvement, starting with mandatory flammability standards has launched this issue as a "problem," which is now being exacerbated with yet more governmental regulation and bans.

Introduction

In July 2015, a coalition of environmental activist groups petitioned the Consumer Product Safety Commission (CPSC) to ban certain uses for an entire class of flame retardant chemicals based on faulty claims about the risks. Since then, the CPSC has received comments and held hearings. It is now deliberating on whether such bans are necessary, with a decision expected later this year. Congress should pay attention and provide oversight as needed, because such bans and related regulations could undermine public health and safety and contribute to fire risks.

The environmental activist group Earth Justice filed this petition on behalf of several "physician" and "consumer advocate" organizations. Specifically, they petitioned the CPSC to ban the use of organohalogen flame retardant products in upholstered furniture sold for home use in mattresses, mattress pads, and in the plastic casing of all electronic devices.[3] In addition, these groups allege that trace exposures of these chemicals pose health risks, and they maintain that the products provide no benefits. Both claims fall apart under scrutiny.

As detailed in this paper, there is little data to show that trace exposures through consumer products pose any significant health risks. And while it may well be true that these products are not as efficacious in all applications as originally believed, there is certainly a place for their usage and research supports their beneficial attributes.

Currently, two federal agencies have primary authority to regulate flame retardants and their use: the Environmental Protection Agency (EPA), which takes the lead on reviewing safety profiles under the Toxic Substances Control Act (TSCA), and the Consumer Product Safety Commission, which takes a lead with setting of certain flammability standards under the authority of the Flammable Fabrics Act. Under the authority of the Federal Hazardous Substances Act, CPSC may also ban products it deems dangerous. In addition, the State of California has set flammability standards for upholstered furniture that manufacturers that sell nationally apply to their entire inventory. This makes California's rule a de facto national standard for those companies.

The primary concern regulators must examine when considering banning any product is whether the risks it poses outweigh any benefits it may provide. In this case, flame retardant chemicals are coming under scrutiny largely because of misleading news stories that focus on hazard alone. But hazard is not a good regulatory tool, because *everything* poses a hazard. Therefore, hazard-based standards make regulation arbitrary. Regulations based on risk demand that policy

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makers employ a scientific process to assess risk before they remove technologies that have societal benefits. And as it stands now, the science related to trace chemicals in consumer products in general, including flame retardants, does not offer a strong enough case to ban them.

A Categorical Mistake

The activists' proposal to ban such a large class of chemicals is based on the erroneous assumption that all these chemicals are essentially the same and all pose unacceptable dangers to humans and wildlife at any level of exposure.

Organohalogens do have some things in common. According to the *Encyclopedia Britannica*, organohalogens are "any of a class of organic compounds that contain at least one halogen (fluorine [F], chlorine [Cl], bromine [Br], or iodine [I]) bonded to carbon."[4] This is a large class of *both naturally occurring* and *synthetic* chemicals that have both benefits and risks for humans and wildlife. Dartmouth University chemist Gordon Gribble provides some details about the benefits in a 2004 *American Scientist* article that is worth quoting:

> Less well known—even to many scientists—is that nature produces an abundance of similar, and in some cases identical, halogenated compounds, some of which predate the beginning of life on Earth. … Many naturally occurring organohalogens exhibit biological activity that may offer unprecedented benefits to humankind. Vancomycin is a lifesaving antibiotic that is often the last line of defense against multi-drug-resistant bacteria. With respect to mosquito larvae, the chlorinated seaweed metabolite telfairine is as potent an insecticide as the compound lindane (benzene hexachloride), which consumer advocates have criticized because of its suspected toxicity to humans. A chlorinated fungal metabolite called maracen is active against mycobacteria, the cause of tuberculosis, and the chlorine-containing punaglandins, from a South Pacific soft coral, have potent antitumor activity and may soon find clinical use.[5]

Gribble does not claim that all effects are beneficial. Some may be harmful to people and nature at certain exposure levels. The risks and benefits of each are distinct and depend on a wide range of factors. To address the potential risks posed by some does not justify eliminating all of them (which is not even possible). Rather, we need a deliberative process to manage risks so we can enjoy the benefits.

When it comes to flame retardants, organohalogens are included in a wide

range of products used to reduce fire risks in everything from furniture to electronics. In an article for *Fire Protection Engineering*, fire control expert Vytenis Babrauskas and Duke University environmental science and policy professor Heather M. Stapleton list 15 chemicals that fit into this area.[6] These products fall within two broad categories: Brominated flame retardants and Chlorinated flame retardants.

No Increased Cancer Risk

There is no compelling body of evidence that anyone has ever had a significant risk of cancer from trace exposures to synthetic chemicals contained in consumer products, including flame retardants. In fact, CPSC initiated its ban of the flame retardant tris(2,3-dibromopropyl)phosphate, commonly known as "tris," back in 1977 based on scientific assumptions that have since been proven wrong.

During the 1960s and 1970s, scientists relied heavily on rodent testing to assess a chemical's cancer risk, believing these tests where highly conclusive. These animal tests were time-consuming and required using hundreds of live rodents. To reduce costs and time, scientist Bruce Ames developed a faster, more affordable test to screen chemicals for potential carcinogenicity. Eventually dubbed the "Ames test," it uses bacteria and liver cells from humans or rats to determine if a chemical might trigger cell mutations.[7] The Ames test is still used worldwide for initial screening of chemicals' potential to cause cell mutations.

In 1971, Ames, then very concerned about human exposure to industrial chemicals, conducted his Ames test on tris. At the time, tris was used in sleep-wear, and the Ames test showed that it caused cell mutations, which alarmed Ames. "I didn't want to put my kids in these pajamas, so we bought their pajamas in Europe when we were there," he noted in a 2014 interview.[8]

In a January 1977 article for *Science*, Ames and coauthor Arlene Blum, one of the current petitioners seeking to ban organohalogen flame retardants, urged CPSC to ban tris in pajamas, noting: "Bacterial tests showing that tris-BP is a mutagen suggest that it is likely to be a carcinogen, but animal studies are necessary for more conclusive evidence."[9] Such rodent tests were completed by the National Cancer Institute (NCI) later that year, and they seemingly confirmed what Ames and Blum feared: tris caused cancer in rodents. Those rodent tests became the sole basis for the CPSC ban of this chemical.

In the *Federal Register* notice of this decision, CPSC explained:

> The Commission has no conclusive data that establish TRIS has

While CPSC admitted that it has "no conclusive data" to prove that tris caused health effects in humans, it also admitted that flame retardants had important benefits. But CPSC banned tris anyway and assumed alternatives would be sufficient.

> caused cancer in humans. ... The Commission's Office of the Medical Director (OMD) believes that once a substance is established as an animal carcinogen it can never be assured as a safe substance for human exposure. In addition, OMD believes that all known human carcinogens have been shown to be carcinogenic in laboratory animals. Dr. Marvin Schneiderman of NCI has told the Commission that he knows of no chemicals that provide a high risk in animals but not to humans.[10]

While CPSC admitted that it has "no conclusive data" to prove that tris caused health effects in humans, it also admitted that flame retardants had important benefits. A 1977 CPSC news release noted: "However, CPSC continues to strongly support the need for flame-resistant sleepwear. Recent investigations indicate that burn injuries to children wearing flame-resistant sleepwear are significantly less severe than those to children wearing non-flame-resistant sleepwear."[11] But CPSC banned tris anyway and assumed alternatives would be sufficient.

While Blum has continued her crusade against rodent carcinogens and flame retardants, Bruce Ames has taken a different, more scientifically critical path. He and his colleague Lois Swirsky Gold systematically tested a wide range of chemicals for carcinogenic effects—moving from synthetic chemicals to naturally occurring ones. They found that the rodent tests on which regulators and cancer researchers relied had serious defects. These tests would dose rodents with chemicals at the highest level possible that would not immediately kill the animals—a dose known as the maximum tolerated dose (MTD).

In 1987, Ames and Gold reported that naturally occurring chemicals found in healthy food cause as many cancers in rodents as do synthetic chemicals, and they called for "more balance in animal cancer testing to emphasize the forgoing factors and natural chemicals as well as synthetic chemicals." A few years later, Ames and Gold reported in *Science* that about half of all naturally occurring chemicals caused cancer in rodent tests, which was about the same proportion found for synthetic chemicals. They concluded: "[T]hus, without studies of the mechanism of carcinogenesis, the fact that a chemical is a carcinogen at the MTD [maxium tolerated dose] in rodents provides no information about low-dose risk to humans."[12]

They explained that it was more likely that the *high doses*, rather than the chemicals themselves, caused cancers. "High doses can cause chronic wounding of tissues, cell death, and consequent chronic cell division of neighboring cells, which is a risk factor for cancer. Each time a cell divides the probability increases that

a mutation will occur, thereby increasing the risk of concern," they explain in another research article.[13]

Ames and Gold eventually concluded that there was no reason to believe that trace exposures to synthetic chemicals pose any significant cancer risk to consumers. Ames's research has also focused on the benefits of chemicals that far outweigh these very low risks from trace exposures. In particular, while trace levels of pesticides on fruits and vegetables pose negligible cancer risks, the use of pesticides makes produce more affordable and widely available. As a result, consumers can eat more fruits and vegetables, which helps reduce cancer risks.[14]

Flame retardants also have benefits that should not be ignored, considering the very low level of risks associated with trace chemical exposures overall. Cancer concerns are not a compelling reason to ban any of these chemicals. In fact, cancer is largely a disease related to aging. While environmental factors play a role, cancer results largely from long-term high level exposures.

In their landmark 1981 study of the issue, epidemiologists Richard Doll and Richard Peto set out to determine the causes of preventable cancer in the United States. According to Doll and Peto, pollution accounts for 2 percent of all cancer cases, and geophysical factors account for another 3 percent. They note that 80 percent to 90 percent of cancers are caused by "environmental factors." Although activists often use this figure as evidence that industrial society is causing cancer, Doll and Peto explained that environmental factors are simply factors other than genetics—not pollution alone. Environmental factors include smoking, diet, occupational exposure to chemicals, and geophysical factors. Geophysical factors include naturally occurring radiation, man-made radiation, drugs, medical radiation, and pollution. Tobacco use accounts for about 30 percent and dietary choices for 35 percent of annual cancer deaths.[15]

While it is true that some flame retardants have been listed as "classified carcinogens" by some government agencies, that does not mean they have ever *caused* cancer. Such classification systems do not tell us anything about *actual risks* because they are hazard-based. They simply indicate that *at some exposure level* and *under some circumstance* a substance *might* increase cancer risk, and even then maybe by an insignificant amount.

For example, when the International Agency for Research on Cancer (IARC) classified processed meat as a carcinogen, it explained: "The classification indicates the weight of the evidence as to whether an agent is capable of causing cancer (technically called 'hazard'), but it does not measure the *likelihood* that cancer will occur (technically called 'risk') as a

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result of exposure to the agent."[16] [Emphasis added]

Classifying substances or activities as "hazardous" is not particularly helpful. For example, walking your dog, when you might slip and fall, and skydiving both present the hazard of bone breakage, but the risks are vastly different. Yet IARC's reasoning could place dog walking and skydiving in the same "hazardous" category. This explains why "smoking tobacco" is listed as a carcinogen along with wood dust, salted fish (Chinese style), and painting houses for a living.[17] Regulators and consumers should not confuse such classifications with assessments of actual risks, particularly for chemicals in consumer products where exposure appears at trace levels.

Unfounded Fears over Endocrine Disrupters

Having largely lost the debate about trace chemicals and cancer, anti-chemical activists have turned their attention to some synthetic chemicals that may be "hormonally active." Supposedly, any man-made or synthetic "endocrine disrupters" are capable of mimicking human hormones and disrupting chemical processes in the body, leading to everything from cancer to neurodevelopmental effects. The petitioners make such claims about the entire class of organohalogens.

Yet, there is little evidence that any trace synthetic chemicals found in consumer products have a significant impact on human health. In reality, trace chemicals found in consumer products and in the environment simply do not have enough potency to produce any such effects. Still, some anti-chemical groups point to the use of the drug/hormone diethylstilbestrol (DES) as evidence that synthetic chemicals pose endocrine disruption risks.[18] But the administration of this drug to women is in no way relevant to trace exposures to chemicals from such things as sitting on a couch.

Between 1940 and 1970, many women took DES to prevent miscarriages, but it was eventually discovered to provide no such benefit and that it helped cause cancer. Clearly, the relevance of these cases to low-level environmental exposures to synthetic chemicals is highly tenuous, as many researchers have pointed out. Toxicologist Stephen Safe notes: "DES is not only a potent estrogen, but it was administered at relatively high doses. … In contrast, synthetic environmental endocrine-disrupting compounds tend to be weakly active."[19]

Indeed, a National Research Council report on such "hormonally active agents" shows synthetic chemicals used in consumer products are too weakly active and their exposures are too low to pose any significant risks, particularly compared to human hormones and

naturally occurring hormonally active agents.[20] In fact, if weakly active trace chemicals can impact our endocrine systems, then we should really fear Mother Nature, who produces a host of such "disrupters" far more potent than synthetic chemicals.[21] For example, soy and nuts naturally contain such substances that are far more potent and at levels that are tens of thousands of times higher than levels from man-made chemicals.[22] If such endocrine mimicking chemicals were a problem, these foods would be wreaking havoc on human health. But they are not. Instead, these healthy foods contribute to people today living longer, healthier lives than ever before.[23]

Jumping to Conclusions on Neurodevelopmental Effects

Anti-chemical activists claim that trace exposures to flame retardants from consumer products can produce adverse neurodevelopmental effects. But this area of research is largely inconclusive and plagued with numerous weak and barely "suggestive" studies that do not warrant a regulatory response. Still, petitioners mischaracterize the risk to push for unwarranted regulations.

For example, during a CPSC hearing on December 9, 2015, Maureen Swanson of the Healthy Children Project of the Learning Disabilities Association of America made the following claims: "We are witnessing an alarming increase in neuro-developmental disorders that cannot be fully explained by changes in awareness or diagnosis." Swanson continued: "In 2000, the National Academy of Sciences stated that environmental factors including exposures to toxic chemicals in combination with genetics contribute to at least a quarter of all neurodevelopmental disorders in the U.S."[24]

Swanson does not provide a source for this claim, but it appears she is referring to a National Research Council (NRC) report published in 2000. In that report, NRC notes that the total frequency of developmental defects is only "vaguely known." NRC did not indicate that such disorders have increased at an alarming rate.[25] And while the number of cases reported may have increased in recent years, there are some not-so-alarming explanations.

For example, in a review of the research on this topic, Eric Fombonne, M.D. of McGill University's Department of Psychiatry finds:

> Although it is clear that prevalence estimates have gone up over time, this increase most likely represents changes in the concepts, definitions, service availability, and awareness of autistic-spectrum disorders in both the lay and professional public.[26]

In regard to autism, Fombonne maintains:

> As it stands now, the recent upward trend in estimates of *prevalence* cannot be directly attributed to an increase in the *incidence* of the disorder. There is good evidence that changes in diagnostic criteria, diagnostic substitution, changes in the policies for special education, and the increasing availability of services are responsible for the higher prevalence figures.[27]

Other analyses of autism also do not report alarming increases. For example, in a review of the epidemiological data for the journal *Psychological Medicine*, researchers reported: "After accounting for methodological variations, there was no clear evidence of a change in prevalence for autistic disorder or other ASDs between 1990 and 2010. Worldwide, there was little regional variation in the prevalence of ASDs."[28]

Moreover, the NRC report's definitive statements about the causes of such developmental problems do not support Swanson's claims. The report states that about 3 percent of developmental problems result from "chemicals and physical agents, including environmental agents." It notes that "it is thought that" environmental factors in combination with genetic predispositions contribute to "perhaps"—rather than at least—25 percent of neurodevelopmental problems. Here is the report's statement:

> In all, about 3 percent of developmental defects are attributable to an exposure of the mother to chemicals and physical agents, including environmental agents. A much larger faction, perhaps 25%, are thought to be due to multifactorial causes resulting from exposure of genetically predisposed individuals to environmental factors (e.g., infections, nutritional deficiencies and excesses, hyperthermia, ultra-violet radiation, X-rays, and manufactured and natural chemicals.)[29]

"Environmental factors" span a wide range, and chemicals used in consumer products appear to be a very small part of that universe. Many are well-known and demonstrated risks to fetal development, such as pregnant women's exposure to infectious agents, nutritional deficiencies, smoking behavior, alcohol consumption, and use of both legal and illegal drugs.

Swanson claims that since the NRC report's release, there are even more data showing that chemicals and potentially flame retardants are among these serious and dangerous environmental factors. A keyword search at PubMed reveals a number of recent studies reporting associations between

certain flame retardant chemicals and human neurodevelopmental health problems. But associations do not prove cause-and-effect relationships, findings are mixed and not all consistent, and sample sizes are often too small to be useful for drawing conclusions.

Accordingly, it is misleading to suggest the body of research is compelling or conclusive. For example, one analysis that reviewed key studies on the topic found research on the health impacts from flame retardants used in consumer products to be merely "suggestive" and that more research is needed before it is reasonable to draw any conclusions. It notes:

> In conclusion, limited epidemiological data, weak and inconsistent associations across studies, lack of comparative and large studies with appropriate exposure assessment in humans, and incomplete understanding of biological mechanisms precludes the establishment of a causal relationship when assessing the evidence through conventional epidemiological approaches.[30]

The authors do say there are "biologically plausible associations" between brominated flame retardants and various health effects that *may* be worthy of study. Arguably, however, limited resources are probably better spent researching more likely causes and potential cures to actual health problems.

When Safety Regulation Undermines Safety

Despite there being little to fear from trace exposures to flame retardants from consumer products, many products are facing regulatory scrutiny and some have been pulled off the market unnecessarily. In fact, policy makers should be more concerned about overregulation that could undermine consumer safety by eliminating the most valuable, time-tested, and studied flame retardant chemicals on the market. Indeed, the EPA is using hazard-based programs that can push products off the market without sufficient risk assessment.

Consider the evolution of policy and markets related to three Polybrominated Diphenyl Ethers (PBDEs) flame retardants: penta-BDE (used for foam furniture), octa-BDE (used in plastics for business equipment), and deca-BDE (used in electronics such as television sets). These chemicals are disappearing from the marketplace not because of studies showing actual verifiable risks. Instead, mere hazard-based concerns and the failure of industry to defend its products has enabled the EPA to essentially ban these flame retardant chemicals.

Associations do not prove cause-and-effect relationships.

Perhaps the reason the EPA did not want to conduct risk assessments is because that would not give it sufficient power to ban these products.

The EPA's first product removal resulted from its 2006 "significant new use rule" (SNUR) for two of the three PBDE flame retardants, penta-BDE and octa-BDE. While the SNUR for these two chemicals does not represent an all-out ban, it effectively keeps the chemicals off the market by eliminating the authorized uses under the Toxic Substances Control Act. Anyone seeking to use these products in the future faces a substantial regulatory hurdle to get new uses approved by the agency.

The EPA did not take this action because there was some significant or imminent—or any for that matter—public health risk associated with these or other organohalogen chemicals. Rather, the Chemtura Corporation (then called Great Lakes Chemical Corporation) decided in 2004 to phase out these chemicals. According to the EPA, its SNUR is "built on" Chemtura's phase out and does not mean that products using these chemicals pose any risk or concern.[31] On its website, the agency explains:

> [T]he EPA does not believe that there is a need to remove or replace products that may contain these chemicals. EPA has not concluded that PBDEs pose an unreasonable risk to human health or the environment. However, due to growing concerns, EPA believes that the phase out and the regulatory action taken in this announcement are useful steps to minimize and ultimately help prevent further exposure to these chemicals.[32]

In 2009, following Chemtura's phase out of penta-BDE and octa-BDE, the EPA pressured two U.S. producers (Chemtura and Albemarle) and one importer (Israel's ICL Industrial Products) of deca-BDE to "voluntarily" phase it out as well, ending production and importation by 2013. Having secured that deal, the agency released a proposed SNUR in 2012 to make both domestic manufacturing and imports of all PBDEs subject to new use rules.[33] All of this was done without the EPA examining the weight of evidence about these chemicals' risks versus benefits.

But perhaps the reason the EPA did not want to conduct risk assessments is because that would not give it sufficient power to ban these products. The fact sheet on these chemicals, published by the Agency for Toxic Substances Disease Registry at the Centers for Disease Control and Prevention (CDC), reveals that none of the PBDEs have been shown to cause any health problems in humans exposed to trace amounts from furniture or other consumer products.[34] Instead, concerns stem from the fact that rodents suffer from health effects when exposed to very high levels, which is of limited relevance to humans

exposed to very low levels.[35] There are some concerns about the presence of such chemicals in the human body. But as the CDC has noted, chemicals in the human body are not necessary a cause for alarm. CDC has explained:

> The presence of an environmental chemical in people's blood or urine does not mean that it will cause effects or disease. The toxicity of a chemical is related to its dose or concentration, in addition to a person's individual susceptibility. Small amounts may be of no health consequence, whereas larger amounts may cause adverse health effects. The toxicity of a chemical is related to its dose or concentration in addition to a person's susceptibility.[36]

The EPA is also leveraging its position regarding flame retardant chemicals under the auspices of its hazard-based program now called "Smart Choice," which was originally launched as Design for the Environment (DfE).[37] This program has long focused on "voluntary" substitution of "hazardous" chemicals without risk assessment. The agency conducts hazard assessment, demonizes products, and essentially gets industry to voluntarily remove them. That allows the EPA to remove allowed uses under TSCA without having to undergo risk assessment.

In August 2015, DfE released a hazard-based "alternatives analysis" for flame retardant chemicals used in flexible foam padding for furniture. It provides hazard information on 19 products (16 chemicals and three mixtures). The alternatives' "assessment" does not "assess" risk, but instead complies hazard data for these chemicals.[38] It may allow some of these alternative flame retardants to enter the market. Ironically, after industry conducts its research, gains approvals, and incorporates these chemicals into products, the EPA may eventually use the hazard information to pressure for their removal. It is a vicious regulatory cycle.

The EPA's efforts are not limited to regulating PBDEs. It also has initiatives on hexabromocyclododecane (used in insulation, textiles, and fabrics) and is examining a number of other chemicals as part of its TSCA Work Plan.[39] There is no shortage of federal regulation, although there appears to be a shortage of common sense.

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Truly Regrettable Substitutions: The Real Safety Concern

Green activists claim these chemicals should be banned as a category for specified uses because if we ban one, it may be replaced by something more dangerous, a phenomenon known as a "regrettable substitution." But such regrettable substitutions are the result of misguided regulations, and cannot be prevented by banning whole

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categories of chemicals. Rather than allowing the market to find the best products, banning chemicals will produce fewer options and potentially increase fire risks.

Consider the real-life example related to government bans on asbestos. Like organohalogens, not all asbestos pose the same risks. Asbestos health risks are related to the length, shape, and diameter of asbestos fibers.[40] A study produced by the American Council on Science and Health (ACSH) details the research findings on asbestos, particularly risk differences between the various fibers. It points out that amphibole fibers are associated with the greatest risks because they are long and thin and easily embed in human tissue. When inhaled, amphibole fibers remain in lung tissue for a long duration. High exposures over a long period of time increase the propensity for cancer, mesothelioma (cancerous or benign tumors), and asbestosis (scarring of lung tissue that can impede breathing) late in life. Long-term relatively high occupational exposures to asbestos have resulted in cancer and mesothelioma. Fortunately, as ACSH points out, improved safety measures in the workplace greatly reduces this risk.

The asbestos most commonly used in the United States are chrysotile asbestos fibers. These fibers are short and wide structures that do not easily embed into human tissue and pose a far lower risk. They comprise more than 99 percent of asbestos uses in United States.[41] Numerous studies on workers exposed to chrysotile asbestos in friction control industries—such as workers for brake manufacturers and automotive break repair workers—do not find a significant cancer risks. ACSH concluded:

> Ambient asbestos exposure does not appear to be a significant risk factor for asbestosis, lung cancer, or mesothelioma for the general population. These diseases have historically been largely confined to occupational settings in which asbestos exposures were not adequately controlled, or as a result of significant overexposure, often involving years of occupational exposure. Despite some divergence from earlier thinking, more recent analyses of certain occupational settings (e.g., brake industry workers, automechanics) suggest that asbestos exposures in these industrial settings were not causally related to respiratory disease or lung cancer.[42]

History shows that the politically forced substitution of asbestos that did not differentiate between the dangerous fibers and the relatively benign chrysotile fibers has had serious consequences. Fires at theaters and other public places, such as schools, regularly took human lives until asbestos insulation for tiles, curtains,

and the like was introduced, as detailed in several case studies by CEI Senior Fellow John Berlau.[43]

The campaign against asbestos by the EPA and its environmentalist allies lumped all asbestos products in one category, rather than differentiate based on the risks of each type. As a result, many useful and low-risk applications were abandoned. For example, the campaign against all kinds of asbestos prompted the Port Authority of New York and New Jersey to halt the use of the largely benign chrysotile asbestos when building the World Trade Center's Twin Towers. As a result, builders did not apply any asbestos-based products to the top floors of the first tower and none were used in the second tower.[44]

Had the Port Authority used asbestos instead of switching to a substitute product, explains Berlau, heat from the fire may have been controlled at least long enough for thousands of more people to escape before the buildings collapsed on 9/11. The replacement product, fiberglass, breaks down at 1,100º Fahrenheit, whereas asbestos hold up to 2,100º Fahrenheit.[45] A report produced after 9/11 by the National Institute of Standards and Technology concluded that the temperatures during the fires in the World Trade Center never rose beyond 1,800 º Fahrenheit.[46] "Even with the airplane impact and jet-fuel ignited multi-floor fires, which are not normal building fires, the buildings would likely not have collapsed had it not been for the fireproofing," noted the lead investigator on the report.[47]

Sadly, the unwarranted elimination of all kinds of asbestos in many places continues to pose a threat. In February 2003, highly flammable foam sound-proofing tiles at a nightclub in West Warwick, Rhode Island, caught fire, killing about 100 people. Before the political crusade against them, asbestos were also the product of choice for soundproofing tiles.[48] Had they, rather than the substitute, been used in the nightclub, the fire likely would not have spread, or even started. Unfortunately, there are many other examples, both recorded and unrecorded, of fire-related injuries and deaths that could have been prevented or significantly mitigated with asbestos-related products.

The risks associated with traces of flame retardants do not warrant bans.

Flammability Standards

The risks associated with traces of flame retardants do not warrant bans, but is it fair to force people to buy product containing these chemicals? That is effectively what government flammability standards do. The petitioners' concern that certain types of government standards may encourage the use of flame retardant chemicals when other, perhaps better options, exist has some merit (although their "solution" of banning an entire

Government officials do not simply make objective, evidence-based decisions; they make political ones.

category of chemicals lacks any merit whatsoever).

Flammability standards strive to impact product design to make consumer products both less prone to ignite and to burn slowly when they do. Theoretically, all regulators need to do is set a standard and then manufacturers can respond with appropriate technologies. However, there is considerable debate about what kind of standards make sense and what products or methods of meeting them are most efficacious. To make matters more difficult, fire risks are not static—they change as the types of consumer products on the market and in homes changes and as consumer behavior changes. For example, in 1975 there were far fewer electronics found in the home and smoking rates were far higher than they are today. That means the potential causes of fire and the materials that burn may require very different risk management approaches. Moreover, our understanding of fire control is an evolving science that should continually help us improve how we address product flammability.

While some people may argue, as the National Fire Protection Association (NFPA) does, that federal standards are necessary, government regulators are ill-equipped to address all these factors. First, government regulations are hard to change even when they are misguided, which means regulators lack the flexibility necessary to respond to changing circumstances in a timely manner. Regulators also lack both expertise and situation-specific information that best serves the needs of consumers with varied interests.

Moreover, government officials do not simply make objective, evidence-based decisions; they make political ones. Accordingly, if industry voices have a stronger place in the debate, they may encourage regulators to use mandates to create markets for those industries. But when activist sound alarms, whether justified or not, regulators respond with bans and regulations, as science takes a back seat.

Consider the current situation. There is a robust ongoing debate among fire safety experts, private certification organizations, and industry about what types of standards make sense and what types of flame retardant measures are most effective. This is a healthy debate that should be sorted out in the marketplace, but government regulators muddy the waters. Their regulations would effectively lock in a single approach for all upholstered furniture—even if better options exist, or might emerge, and despite the fact that not all consumers want the same thing.

To comprehend this debate, we need to understand how fires start and spread and how flame retardants impact that process. A paper produced by the American Council on Science and Health explains this process:

> Solid materials don't burn directly. In a process known as pyrolysis, heat must first decompose the materials, releasing flammable gases. When these gases burn with oxygen in the ambient air, visible flames appear.[49]

Hence, a fire can spread faster than the movement of the initial flames by heating up items inside an enclosed space, which releases the flammable gases and causes all of those items to ignite simultaneously, a phenomenon known as "flashover." Flame retardants are designed both to prevent a fire from starting and to prevent or delay flashover to give people more time to escape.

To inhibit heat and flashover, flammability standards can employ "open flame," "smoldering" tests, or both. Fire experts are debating which approaches are most appropriate for upholstered furniture. The "open flame" test requires that a product not burn when exposed to a small open flame, such as from a candle or a lighter, for a number of seconds. The "smoldering" test requires that a product not ignite when exposed to a smoldering heat source, such as a cigarette, for a number of seconds. Apparently, it is technically feasible for manufacturers to meet the smoldering standard without applying chemicals. However, the open flame standard could best be met with the application of flame retardant chemicals on the foam underneath the fabric covering.

Under the authority of the Flammable Fabrics Act, CPSC has set both the open flame standard and a smoldering cigarette standard for mattresses.[50] The State of California applied both the open flame and smoldering tests in its 1975 flammability standard (Technical Bulletin 117 or TB 117) for foam padding used for upholstered furniture and mattresses used in homes. Given the size of the California market, this standard had become a de facto national standards for many furniture manufacturers.

This means that people who did not want the chemicals on their upholstered furniture or mattresses have had few other options. Although the risks are negligible, the perception of risk and the fact that people felt forced into buying chemically treated furniture fueled the debate about flame retardants. Activists eventually sounded the alarm and launched their anti-chemical campaign.

The California state government responded by revising the standard in 2013 to eliminate the open flame standard. According to the California Bureau of Electronics and Appliance Repair, Home Furnishings and Thermal Insulation, it made these changes simply to improve the standard.[51] In reality, the change was prompted by politics.

The presence of chemicals does not prove anything about their risks.

California Governor Jerry Brown had ordered the Bureau to revise the standard, citing an Environmental Working Group (EWG) "study" alleging health risks. Brown's press release noted: "Toxic flame retardants are found in everything from high chairs to couches and a growing body of evidence suggests that these chemicals harm human health and the environment. … We must find better ways to meet fire safety standards by reducing and eliminating—wherever possible—dangerous chemicals.[52]

Indeed, Brown's actions followed a long series of efforts to advance activists' anti-flame retardant campaign. EWG and other environmental activists, such as Arlene Blum's Green Policy Institute, have been clamoring for regulation of flame retardant chemicals, while conducting studies showing that furniture contained them and that traces show up in the human body. Yet, the presence of such chemicals does not prove anything about their risks. Nonetheless, these groups generated media coverage that culminated in a series of "investigative" articles published in the *Chicago Tribune*.

The *Tribune*'s six-part series, which ran in 2012, garnered much attention among media and politicians. It contained much misinformation and unwarranted alarmism about the risks associated with flame retardants.[53]

It is probably not a coincidence that Brown's demand that the state reform its flammability standard came in June 2012, just over a month after the *Tribune* published the fourth article in this series.

Not everyone agreed with this change in California's flame retardant law. Fire experts at the National Fire Protection Association disagreed. As *NFPA Journal* reports:

> NFPA's position on the revision is that testing that focuses primarily on smoldering cigarette ignitions misses important aspects of the role upholstered furniture can play in real-world fire scenarios. …. as part of the public comment period for TB 117, NFPA President James Shannon cited a recent NFPA analysis of national statistics on home fire losses related to upholstered furniture. The analysis, conducted by Dr. John Hall, division director of Fire Analysis & Research at NFPA, found that upholstered furniture is the leading item involved in home fire deaths, accounting for 24 percent of all home fire deaths in recent years. (This percentage includes both fires beginning with upholstered furniture and fires that grow and spread primarily through involvement of upholstered furniture.) Of those deaths,

45 percent can be attributed to cigarette ignition. An additional 21 percent can be attributed to flaming ignition from another burning item—typically a larger open flame source—and 10 percent can be attributed to small open flame ignition. Hall's findings are included in the "Upholstered Furniture Flammability" white paper.[54]

Some fire experts disagree with NFPA. Vytenis Babrauskas, Ph.D. of Fire Science and Technology, Inc., expresses doubt about the efficacy of flame retardant chemicals, claiming the tests demonstrating benefits—including one he himself conducted in 1988 for the National Institute for Standards and Technology (NIST)—have been misinterpreted. Along with another author in the journal *Fire Protection Engineering* he explained: "The NIST study … showed that if a room is outfitted exclusively with FR [flame retardant] products formulated on a 'cost-is-no-object' basis, fire development is not going to take place. But … the amount of FR chemicals added to consumer products is the minimum needed to pass pertinent regulations, not the maximum that engineering technology can offer."[55] In testimony to CPSC, Babrauskas reiterated this view and maintains that small flame tests do not reflect how fires actually start. He argued that by the time the fabric is burned off, the fire is already too large and hot for flame retardant chemicals on the foam to make any difference.[56]

It may be true that some flame retardants do not work as well as originally believed in all applications. But Babrauskas advocates banning the use of on *all* organohalogen flame retardants for the applications listed in the petition, claiming they pose unacceptable risks. This seems a rather extreme position for anyone in the fire safety field, particularly given the substantial risks associated with fire itself. In fact, Babrauskas admits, albeit with qualifications, that flame retardant chemicals may well have benefits in some circumstances.

In *Fire Protection Engineering*, Babrauskas noted: [T]his type of favorable result for FR materials only holds for tests where a very small flame is presented to the specimen. In real-life fires, the flames may just as well come from a burning wastebasket as from a cigarette lighter, and an entirely different outcome will ensue."[57] He also noted in his public comments before the Consumer Product Safety Commission: "Modest FR loadings can help pass some small-flame tests, but are ineffective when larger flames are involved, as in most realistic scenarios."[58] Babruauskas dismisses such benefits as insignificant, and says the use of flame retardant

Governmental actors will respond to the political tides, but will not resolve scientific disputes.

chemicals "provides no *meaningful* fire safety benefit" because most fires are not started by small flames.[59] [Emphasis added]

But according to the NFPA, 10 percent of upholstery fires do start with small flames.[60] In addition, there has been more research conducted since Babruauskas's 1988 study that cannot simply be dismissed. Matthew S. Blais, Ph.D. offered a compelling testimony and video demonstrating the evolution of an open flame fire on a chair. Of course, this was not an "accidental" fire, but despite Babrauskas claim that such tests are not helpful, it demonstrated empirically how flame retardants can slow and even help extinguish a fire.

There are many others who have documented benefits. In a study on the topic, the American Council on Science and Health maintains that there is plenty of evidence that flame retardants work in many applications:

> A study of the safety benefits of decaBDE and other brominated flame retardants (BFRs) in the U.S. found that an estimated 190 lives are saved annually because of the use of these flame retardants in television cabinets alone. Their use in electrical wire/cable insulation is estimated to save an additional 80 lives per year, and their application to draperies likely saves 10 more lives a year. All told, decaBDE and other flame inhibitors save an estimated 280 lives in the U.S. each year. (BFRIP 2002). ... Cumulatively, from 1988 to 2002, it is estimated the 1988 UK furniture regulations alone saved 1,150 lives and prevented 13,442 injuries.... Smoke alarms in Britain and the upholstered furniture regulations combined prevented an estimated 44,314 residential fires, saved 4,287 lives, and prevented 39,257 non-fatal injuries. As for property damage, the savings from 1988 to 2000 is calculated at £182 million per year (or around $300 million) or a 12-year total of about £2.2 billion (or about $3.6 billion). (Surrey 2005).[61]

In addition, the National Fire Protection Association apparently disagrees with Dr. Babruauskas and is working to develop a new open flame standard.[63] It is not clear what the right answer is to this question, which may change over time. But it is clear that a single standard denies consumers choice. It is also clear that governmental actors will respond to the political tides, but will not resolve scientific disputes.

Flammability standards can be a helpful part of the solution, but they should come from private entities rather than government. There are already multiple standard-setting organizations, both for profit that manufactures may

hire and nonprofit whose standards they may apply. Organizations include ASTM International, Underwriters Laboratories (UL), the National Fire Protection Association, the American National Standards Institute (ANSI), and others.

Furniture manufacturers should be free to apply any standard that meets both the specifications of their particular products and consumer demands—which includes applying no standard at all. There is little reason to believe that furniture will be less safe without government standards; the opposite is more likely. Government standards tend to be too rigid, hard to change, and are governed by politics rather than consumer demand and good science. Government regulations also demand a one-size-fits-all approach, unlike multiple competing standards, which can be easily adjusted to better apply improvements in fire science and to better meet consumer demand.

You do not need to be a fire engineer to understand that a product's suitability for reducing fire risks depends on a wide range of factors, such as the source of a fire (such as from an open flame candle, cigarette, electrical source, or cooking-related grease fire), the materials being burned, and the kinds and amounts of flame retardants involved. Approaches to reducing fires will change as both scientific understanding and technologies evolve. For example, changes in personal habits (such as less smoking), new electronics, and different furniture finishes all have impacts that government regulations cannot adequately address. These are issues that fire experts, standard-setting organizations, flame retardant producers, and furniture manufactures need the freedom and flexibility to sort out. A voluntary, flexible market-based system will allow standard-setting organizations and furniture manufactures to adjust standards as knowledge evolves, and provide the chemical and non-chemical products and methods used to meet such standards.

Moreover, a voluntary system will allow manufacturers to select different flammability standards for various products based on what works best for the materials they use, which cannot happen when regulators select a single set of standards for a broad category of goods. In addition, manufacturers can develop niche markets to meet consumer demands in regard to flame retardants.

For example, some furniture companies might partner with the NFPA or UL and advertise the fact that they meet that organization's high flammability standards by labeling products accordingly. Many consumers who want flame retardant furniture likely would choose such products based on the reputation of the NFPA and UL. Other manufactures could market to consumers who desire a different standard or no flame retardants at

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all. In this process, flame retardant chemical manufactures would need to demonstrate the value of their products in the marketplace rather than lobby government to mandate markets for them.

In this situation, Arlene Blum and the other petitioners may purchase "flame retardant-free" furniture, but no valuable products need to be banned. Indeed, the petitioners should not be forced to select from only chemically treated couches. Likewise, no one should be deprived of the right to buy chemically treated, flame-retardant furniture. Other consumers may well look for the NFPA, UL, or other certification that furniture meets flammability standards.

Such voluntary approaches work well for other consumer products. For example, some shoppers prefer organic food, while others choose conventional products, and thus, there are robust markets for both. There is little reason to believe that we cannot have similar choices for products with and without flame retardant chemicals.

Conclusion

Given the remote probability that flame retardant chemicals represent a significant health threat, the policy focus should be on how to ensure we use them most effectively. It may be true that these products do not always deliver as much as we would like in all applications, as their critics note, but that does not warrant an extreme approach that tosses the baby out with the bathwater.

There is plenty of evidence that these products have important value that cannot simply be dismissed. In addition, researchers may find new applications for certain organohalogens that provide even greater benefits, but those innovations will never come to pass if regulators blindly ban this or any other category of flame retardant chemicals.

Any reforms in this field should focus on transitioning to a private, voluntary system of flame retardant standard setting. After all, the assumption behind governmental flammability standards is the idea that regulators have enough knowledge to select a standard that will work under a wide array of situations and meet the demand of all consumers. Not only do government regulators lack the necessary information and ability to respond, they serve political interests often at the expensive of science and even public safety. There are many private organizations with competing standards from which manufacturers should be free to choose, allowing standards to keep up with science and giving consumers the choices they demand.

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