UNITED STATES CONSUMER PRODUCT SAFETY COMMISSION

In re: 16 CFR § 1051 Petition for Rulemaking

No. _______________

Petitioners:

American Academy of Pediatrics
American Medical Women's Association
Consumer Federation of America
Consumers Union
Green Science Policy Institute
International Association of Fire Fighters
Kids in Danger
Philip J. Landrigan, M.D., M.P.H.
League of United Latin American Citizens
Learning Disabilities Association of American
National Hispanic Medical Association
Worksafe

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PETITION FOR RULEMAKING

Petitioners American Academy of Pediatrics, American Medical Women's Association, Consumer Federation of America, Consumers Union, Green Science Policy Institute, International Association of Fire Fighters, Kids in Danger, Philip J. Landrigan, M.D., M.P.H., League of United Latin American Citizens, Learning Disabilities Association of America, National Hispanic Medical Association, and Worksafe ("Petitioners"), hereby petition the Consumer Product Safety Commission ("CPSC") to adopt rules to protect consumers and children from the health hazards caused by the use of toxic flame retardant chemicals in four categories of household products. Specifically, we ask the CPSC to promulgate regulations under the Federal Hazardous Substances Act ("FHSA") declaring that children's products, furniture, mattresses and the casings surrounding electronics are banned hazardous substances if they contain any non-polymeric, additive organohalogen flame retardant.

I. Introduction

When used in non-polymeric,[1] additive[2] form, organohalogen flame retardants[3] migrate from consumer products, leading to widespread human exposures. As a result,

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[1] Due to their high molecular weights, polymeric organohalogen flame retardants are believed to be not readily bioavailable, and thus may be less likely to be harmful to humans. Therefore, they are not addressed by this petition. The term "organohalogen flame retardants" will be used henceforth in this petition to refer to non-polymeric chemicals only.

[2] Additive (as opposed to reactive) flame retardants are not chemically bound to the products containing them, thus they can migrate out of products, resulting in human exposure.

97 percent of people living in the United States have measurable quantities of organohalogen flame retardants in their blood, as estimated from the national biomonitoring program conducted by the Centers for Disease Control and Prevention ("CDC").[4] This presents serious public health concerns because all organohalogen flame retardant chemicals, as a class, are toxic due to their physical, chemical and biological properties. These chemicals have been associated with many adverse human health impacts, including: reproductive impairment (e.g., abnormal gonadal development, reduced number of ovarian follicles, reduced sperm count, increased time to pregnancy); neurological impacts (e.g., decreased IQ in children, impaired memory, learning deficits, altered motor behavior, hyperactivity); endocrine disruption and interference with thyroid hormone action (potentially contributing to diabetes and obesity); genotoxicity; cancer; and immune disorders. These chemicals also have a disproportionately negative health effect on vulnerable populations, including children.

The use of flame retardants in the four product categories at issue is not required by any legally binding flammability standard. In addition, exposures to flame retardants that migrate from consumer products into homes cannot be adequately prevented or controlled with warning labels. Knowledge that these toxic chemicals migrate from common household products into the indoor environment does not give

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[3] Organohalogen chemicals are created by combining carbon molecules with one of the halogen elements. Organohalogen flame retardants (also referred to as halogenated flame retardants) contain bonds between carbon and the elements bromine or chlorine. This class includes brominated and chlorinated phosphate ester flame retardants.

[4] Factual statements in this Introduction are addressed with citations in the accompanying statements and in the body of this Petition below.

consumers the ability to take meaningful measures to avoid exposures. This migration cannot be prevented, nor can people avoid ingesting small amounts of house dust, the mechanism by which most people are exposed to these chemicals.

To stop future exposures and minimize the resulting health risks, we ask the CPSC to declare, under its FHSA authority, that

- any durable infant or toddler product, children's toy, child care article, or other article intended for use by children (other than children's car seats), which contains additive organohalogen flame retardants, is a "banned hazardous substance"; and
- any article of furniture sold for use in residences and containing additive organohalogen flame retardants is a "hazardous substance" and a "banned hazardous substance"; and
- any mattress or mattress pad with additive organohalogen flame retardants is a "hazardous substance" and a "banned hazardous substance"; and
- any electronic article with additive organohalogen flame retardants *in its plastic casing* is a "hazardous substance" and a "banned hazardous substance."

It is imperative that CPSC's regulation cover all organohalogen flame retardants as a class. This class of chemicals is foreign to the mammalian body and inherently toxic, due to its physical, chemical and biological properties. Industry has historically responded to the dangers posed by one organohalogen flame retardant by replacing it with one or more other organohalogens that are, by virtue of their chemical properties, also harmful. This exposes consumers to a series of "regrettable substitutions" from one harmful flame retardant to another, as explained below. The way to end this cycle of toxicity is to ban all products in the categories at issue here if they contain any organohalogen flame retardant.

This petition is supported by the following statements, which we submit with this Petition:

Human Exposures from Presence in Consumer Products

- Miriam Diamond, Ph.D., Professor in the Department of Geography, Chemical Engineering and Applied Chemistry, University of Toronto, on the mechanisms and evidence for the migration of organohalogen flame retardants from consumer products when used in additive form.
- Ruthann Rudel, M.S., Director of Research at the Silent Spring Institute, and Research Associate in the Brown University Department of Pathology and Laboratory Medicine, on human exposure to organohalogen flame retardants from consumer products.

Known Human Health Risks Associated with Organohalogen Flame Retardants

- Kim Harley, Ph.D., Associate Adjunct Professor in Maternal and Child Health and Associate Director for Health Effects, Center for Environmental Research and Children's Health at UC Berkeley, on effects associated with the widely used organohalogen flame retardant pentabromodiphenyl ether (pentaBDE) in low-income Mexican-American children and their mothers in the Salinas Valley, California.
- Julie Herbstman, Ph.D., Assistant Professor in the Department of Environmental Health Sciences at the Columbia University Mailman School of Public Health, on the impact of prenatal exposure to pentaBDE on children's thyroid hormone levels, neurodevelopment, and IQ.
- Ted Schettler, MD, MPH, physician and the Science Director of the Science and Environmental Health Network, on the human health concerns associated with organohalogen flame retardants.
- Susan Kasper, Ph.D., Associate Professor in Environmental Health, University of Cincinnati College of Medicine, on the reproductive and carcinogenic effects of organohalogen flame retardants used as polybrominated diphenyl ethers (PBDE) replacements.

Hazards and Class Characteristics of Organohalogen Flame Retardants

- David Eastmond, Ph.D., Professor and Chair of the Department of Cell Biology and Neuroscience, and Research Toxicologist at UC Riverside, on hazardous properties of 83 non-polymeric organohalogen flame retardants.
- Terry Collins, Ph.D., Teresa Heinz Professor of Green Chemistry and Director of the Institute for Green Science at Carnegie Mellon University, on the intrinsic chemical properties of organohalogen flame retardants that result in a high potential for adverse human health effects.

- Rolf Halden, Ph.D., Director of the Center for Environmental Security at the Biodesign Institute, Professor in the Ira A. Fulton School for Sustainable Engineering and the Built Environment, Senior Sustainability Scientist in the Global Institute of Sustainability at Arizona State University, and adjunct faculty at the Johns Hopkins Bloomberg School of Public Health, on the characteristic hazards of organohalogen flame retardants and the need to regulate them as a class.
- David Epel, Ph.D., Jane and Marshall Steel Jr. Professor Emeritus of Biological and Marine Sciences at the Hopkins Marine Station of Stanford University, on the mechanisms through which most organohalogen flame retardants bypass cellular defenses, permeate cell membranes, and avoid metabolism and elimination.

<u>Toxicity and Health Risks from Burning Organohalogen Flame Retardants</u>

- Donald Lucas, Ph.D., scientist at the Lawrence Berkeley National Laboratory and Researcher in the School of Public Health at UC Berkeley (retired), on increased chronic and acute fire toxicity when organohalogen flame retardants are present in products that burn.
- Sharyle Patton, Director of the Commonweal Environmental Health Program in Bolinas, California, on biomonitoring studies of firefighters' levels of organohalogen flame retardants, dioxins and furans, possibly linked to higher cancer incidence in these workers.
- Roland Weber, Ph.D., independent consultant at POPs Environmental Consulting, on end-of-life concerns for products containing organohalogen flame retardants, including the production of dioxins and furans.

II. Interests of Petitioners

This petition is brought by the following physician and organizations on behalf of their patients, members and the entire United States population, virtually all of whom are exposed to hazardous flame retardant chemicals in the organohalogen class as a result of their use in consumer products.

Medical and Learning Disabilities Petitioners

The American Academy of Pediatrics is a non-profit professional organization of 62,000 primary care pediatricians, pediatric medical sub-specialists, and pediatric surgical specialists dedicated to the health, safety and well-being of infants, children, adolescents, and young adults.

The American Medical Women's Association ("AMWA") is an organization that functions at the local, national, and international level to advance women in medicine and improve women's health. Founded in 1915, AMWA is the oldest multi-specialty organization of women physicians. As the vision and voice of women in medicine for nearly a century, AMWA empowers women to lead in improving health for all, within a model that reflects the unique perspective of women.

Philip J. Landrigan, M.D. is a pediatrician, epidemiologist and Director of the Children's Environmental Health Center at Mt. Sinai School of Medicine in New York.

The Learning Disabilities Association of America ("LDA") is the country's oldest volunteer-run organization serving people with learning disabilities, their families, educators and health professionals, with affiliate offices in more than 40 states and thousands of members nationwide. LDA's "Healthy Children Project" seeks to raise awareness of environmental factors, including toxic chemicals, that are contributing to neurodevelopmental disorders, and to promote changes to policies and practices to reduce those factors. An area of particular concern for LDA is children's unique vulnerability to harm from toxic chemical exposures, beginning at conception.

Established in 1994, the National Hispanic Medical Association is a non-profit association representing the interests of 50,000 licensed Hispanic physicians in the United States. NHMA's vision is to be the national leader to improve the health of Hispanic populations. Our mission is to empower Hispanic physicians to lead efforts to improve the health of Hispanic and other underserved populations in collaboration with the state Hispanic medical societies, resident and medical student organizations, and other public and private sector partners.

Fire Fighters and Other Worker Petitioners

International Association of Fire Fighters ("IAFF") is the driving force behind nearly every advance in the fire and emergency services in the 21st century. With headquarters in Washington, DC, and Ottawa, Ontario, the IAFF represents more than 300,000 full-time professional fire fighters and paramedics in more than 3,100 affiliates. IAFF members protect more than 85 percent of the population in communities throughout the United States and Canada. In 2014, IAFF adopted a Resolution which committed the organization to "work to ensure that the use of carcinogenic flame retardants and other toxic chemicals are eliminated and safer alternatives or methods are pursued."[5]

Worksafe, Inc. is a California-based non-profit organization dedicated to promoting occupational safety and health through education, training, and advocacy. Worksafe pursues public policy initiatives related to the improvement of worker health

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[5] IAFF (2013). Resolution No. 34 – Flame retardants, toxic chemicals and their relationship to the increase of cancer in fire fighters. Retrieved March 3, 2015 from http://iaffconvention2014.org/resolution-no-34/.

and safety, including the elimination of toxic hazards that disproportionately impact the workers exposed and other vulnerable populations. Consumer product policies have significant implications for the people who are exposed to organohalogen flame retardants through their work, including during the manufacturing process when these chemicals are added to products, and during fires when products containing these chemicals burn and create toxic fumes that harm emergency responders.

<u>Vulnerable Population Petitioner</u>

With approximately 132,000 members throughout the United States and Puerto Rico, the League of United Latin American Citizens (LULAC) is the largest and oldest Hispanic Organization in the United States. Headquartered in Washington, DC, with 1,000 councils nationwide, LULAC advances the economic condition, educational attainment, political influence, housing, health and civil rights of Hispanic Americans. LULAC's programs, services and advocacy address the most important issues for Latinos, meeting critical needs of today and the future.

<u>Consumer Advocate Petitioners</u>

The Consumer Federation of America is an association of more than 250 non-profit consumer groups that, since 1968, has sought to advance the consumer interest through research, education, and advocacy.

Consumers Union, the public policy and advocacy division of Consumer Reports, is an expert, independent, nonprofit organization with more than one million online activists whose mission is to work for a fair, just, and safe marketplace for all consumers and to empower consumers to protect themselves. Consumer Reports is the world's largest independent product-testing organization, which uses its more than 50 labs, auto test center, and survey research center to rate thousands of products and services annually.

Kids In Danger is a nonprofit organization dedicated to protecting children by improving children's product safety. Banning children's products and other categories of goods that contain dangerous chemicals, organohalogens, is the only way to limit children's exposure.

Science Petitioner

Scientists from the Green Science Policy Institute have been at the forefront of research and communication around the hazards posed by organohalogen flame retardants in consumer products for decades. Their research in the 1970s documented exposure to and toxicity of brominated and chlorinated flame retardants in children's pajamas, and their product testing in the 2000s found that halogenated flame retardant chemicals were being used in a majority of furniture and children's products tested.

III. The Cycle of "Regrettable Substitution" of Organohalogen Flame Retardants Must End

Past attempts to protect consumers from organohalogen flame retardants in household products have been unsuccessful because when one toxic flame retardant is banned or phased out due to its toxicity, it is replaced with another chemical in the same class – a phenomenon that has been termed "regrettable substitution." As Deborah Rice, a former EPA toxicologist who works for the Maine Center for Disease Control and Prevention, told The Chicago Tribune with respect to regrettable substitution of flame retardants: "By the time the scientific community catches up to one chemical, industry moves on to another and they go back to their playbook of delay and denial."[6]

The experience with the polybrominated diphenyl ether ("PBDE") family of flame retardants illustrates the problem. Until 2005, pentabromodiphenyl ether commercial mixture ("pentaBDE") was widely used as a flame retardant in residential seating furniture and in baby products, and octabromodiphenyl ether commercial mixture ("octaBDE") was used in plastics for personal computers and small appliances. Until 2013, decabromodiphenyl ether ("decaBDE") was widely used as a flame retardant in plastic electronic enclosures and fabrics. These organohalogen PBDEs, however, have now been shown to present a range of very serious human health risks, including immune and endocrine disruption, and adverse reproductive and neurodevelopmental effects.[7,8,9,10,11,12,13] As a result, pentaBDE and octaBDE commercial mixtures have been

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[6] Michael Hawthorne, *Toxic Roulette*, Chicago Tribune, May 10, 2012, http://www.chicagotribune.com/news/watchdog/flames/ct-met-flames-regulators-20120510,0,4262292.story.

[7] Stapleton, H.M.; Eagle, S.; Anthopolos, R.; Wolkin, A.; & Miranda, M.L. (2011). Associations between polybrominated diphenyl ether (PBDE) flame retardants, phenolic metabolites, and thyroid hormones during pregnancy. *Environmental Health Perspectives*, 119(10), 1454-59. doi: 10.1289/ehp.1003235.

[8] Betts, K.S. (2010). Endocrine damper? Flame retardants linked to male hormone, sperm count changes. *Environmental Health Perspectives*, 118(3), A130. doi: 10.1289/ehp.118-a130b.

[9] Chevrier, J.; Harley, K.G.; Bradman, A.; Gharbi, M.; Sjödin, A.; & Eskenazi, B. (2010). Polybrominated diphenyl ether (PBDE) flame retardants and thyroid hormone during pregnancy. *Environmental Health Perspectives*, 118(10), 1444-49. doi: 10.1289/ehp.1001905.

[10] Gascon, M.; Vrijheid, M.; Martínez, D.; Forns, J.; Grimalt, J.O.; Torrent, M.; & Sunyer, J. (2011). Effects of pre and postnatal exposure to low levels of polybromodiphenyl ethers on neurodevelopment and thyroid hormone levels at 4 years of age. *Environment International*, 37(3), 605-11. doi: 10.1016/j.envint.2010.12.005.

banned in a dozen U.S. states[14] and phased out by the U.S. chemical industry. DecaBDE has been voluntarily phased out for most uses, including all consumer uses, by the three U.S. producers of flame-retardants, as a result of negotiations with the U.S. Environmental Protection Agency (EPA).[15] Due to their previous use, however, PBDEs remain in products found in millions of homes, are present in the bodies of almost all people living in this country, and will persist in the environment for decades.[16] Moreover, although the U.S.-based PBDE manufacturers agreed to phase out these products, no law or regulation prohibits products containing PBDEs from being imported into this country.

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[11] Herbstman, J.B.; Sjödin, A.; Kurzon, M.; Lederman, S.A.; Jones, R.S.; Raugh, V.; Needham, L.L.; Tang, D.; Niedzwiecki, M.; Wang, R.Y.; & Perera, F. (2010). Prenatal exposure to PBDEs and neurodevelopment. *Environmental Health Perspectives*, 118(5), 712-19. doi: 10.1289/ehp.0901340.

[12] Eskenazi, B.; Chevrier, J.; Rauch, S.A.; Kogut, K.; Harley, K.G.; Johnson, C.; Trujillo, C.; Sjödin, A.; & Bradman, A. (2013). In utero and childhood polybrominated diphenyl ether (PBDE) exposures and neurodevelopment in the CHAMACOS study. *Environmental Health Perspectives*, 121(2), 257-62. doi: 10.1289/ehp.1205597.

[13] Costa, L.G., & Giordano, G. (2007). Developmental neurotoxicity of polybrominated diphenyl ether (PBDE) flame retardants. *Neurotoxicology*, 28(6), 1047-67. doi: 10.1016/j.neuro.2007.08.007.

[14] *See* Cal. Health & Safety Code §§ 108920 to 108923; D.C. Code § 8-108.02; Haw. Rev. Stat. §§ 332D-1 to 332D-3; 410 Ill. Comp. Stat. 48/1 to 48/99; Me. Rev. Stat. tit. 38, § 1609; Md. Code Ann., Envir. §§ 6-1201 to 1205; Mich. Comp. Laws §§ 324.14721 to .14725; Minn. Stat. §§ 325E.385 and .386; N.Y. Envtl. Conserv. Law § 37-0111; R.I. Gen. Laws § 23-13.4-1; Vt. Stat. Ann. tit. 9, § 2973; Wash. Rev. Code §§ 70.76.005 to .110.

[15] U.S. EPA. *Polybrominated Diphenyl Ethers (PBDEs) Action Plan Summary*. Retrieved March 2, 2015, from http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/pbde.html.

[16] Centers for Disease Control and Prevention (2009). *Fourth National Report on Human Exposure to Environmental Chemicals*, at 311-13. Retrieved March 3, 2015, from http://www.cdc.gov/exposurereport/.

Of critical importance to this petition, the organohalogen flame retardants used since the PBDE phaseouts have many of the same properties as PBDEs: they are semi-volatile and migrate out of products into the environment, causing human exposures during normal use, and they have been shown to be toxic. For example:

- After pentaBDE was phased out in 2006 due to its toxicity, tris (1,3-dichloro-2-propyl) phosphate (TDCPP), also known as chlorinated tris, became one of the major pentaBDE replacements in polyurethane foam used in furniture and products for children and babies.[17] TDCPP was recently found by the state of California to be a "known carcinogen," and added to the list of chemicals requiring warning labels under California Proposition 65 law.[18] Research shows that TDCPP exposure is associated with altered hormone levels in men and lower semen quality.[19]

- One of the replacements for TDCPP in polyurethane foam is Firemaster® 550, a mixture of two organophosphate and two organohalogen chemicals, which are also now known to be toxic. Firemaster® 550 is an endocrine disruptor that has been associated with weight gain, early onset of puberty and cardiovascular health effects.[20] A senior EPA

[17] TDCPP has a dark history. After brominated tris (2,3-dibromopropyl) phosphate (TDBPP) was banned as a flame retardant in children's pajamas in the late 1970s as a mutagen and suspected carcinogen, it was replaced with chlorinated tris (TDCPP). Blum, A., & Ames, B.N. (1977). Flame-retardant additives as possible cancer hazards. *Science*, 195(4273), 17-23. doi: 10.1126/science.831254. After studies in the 1970s showed that TDCPP is also mutagenic, this chemical too was phased out from children's pajamas. *See* Gold, M. D.; Blum, A.; & Ames, B.N. (1978). Another flame retardant, tris-(1,3-dichloro-2-propyl)-phosphate, and its expected metabolites are mutagens. *Science*, 200(4343), 785-87. doi: 10.1126/science.347576. However, because TDCPP was not banned, it emerged as a replacement flame retardant for pentaBDE in furniture and children's products until its toxicity was "rediscovered."

[18] California EPA, Office of Environmental Health Hazard Assessment ("OEHHA"), Reproductive and Cancer Hazard Assessment Branch (2011). *Evidence on the Carcinogenicity of Tris(1,3-Dichloro-2-Propyl) Phosphate*. Retrieved March 3, 2015, from http://oehha.ca.gov/prop65/hazard_ident/pdf_zip/TDCPP070811.pdf. OEHHA, Chemicals Known to the State to Cause Cancer or Reproductive Toxicity (2014). Retrieved March 3, 2015, from http://oehha.ca.gov/prop65/prop65_list/files/P65single060614.pdf.

[19] Meeker, J.D., & Stapleton, H.M. (2010). House dust concentrations of organophosphate flame retardants in relation to hormone levels and semen quality parameters. *Environmental Health Perspectives*, 118(3), 318-23. doi: 10.1289/ehp.0901332.

[20] Patisaul, H.B.; Roberts, S.C.; Mabrey, N.; McCaffrey, K.A.; Gear, R.B.; Braun, J.; Belcher, S.M.; & Stapleton, H.M. (2013). Accumulation and endocrine disrupting effects of the flame retardant

administrator expressed serious concerns with this mixture and has doubts about its expedited approval as a replacement for pentaBDE.[21] Nonetheless, Firemaster® 550 continues to be used in large quantities in polyurethane foam in consumer products.

- One of the major replacements for decabromodiphenyl ***ether*** (decaBDE) in televisions and other electronics is decabromodiphenyl ***ethane*** (DBDPE). As sales and usage for the decaBDE have declined, sales and usage for the DBDPE have increased. These two chemicals are very similar in structure and properties. After a comparatively short period of usage, DBDPE has been measured in biota around the world at levels greater than those of the decaBDE, suggesting that it may be even more persistent and bioaccumulative than the very similar chemical it replaced.[22]

We must end this cycle of "regrettable substitutions" in which new organohalogen flame retardants are added to consumer products, only to find that—like the organohalogens they are replacing—they migrate from products, resulting in toxic exposures. To protect the public, we ask the CPSC to regulate all additive organohalogen flame retardants as a class in the categories of products at issue in this

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mixture Firemaster® 550 in rats: an exploratory assessment. *Journal of Biochemical and Molecular Toxicology*, 27(2), 124-36. doi: 10.1002/jbt.21439.

[21] Hawthorne, *Toxic Roulette*, *supra* note 6; Testimony of Jim Jones, Acting Assistant Administrator, Office of Chemical Safety and Pollution Prevention U.S. EPA, before the U.S. Senate Committee on Environment and Public Works (Jul. 24, 2012). Retrieved March 3, 2015 from http://www.epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=bef3d3ec-ff01-4d25-b0bd-ce38fb37edb3 ("EPA may have made a different determination in 1995 if TSCA required the submission of more robust hazard, exposure, and use data needed to adequately assess risk. . . ").

[22] Betts, K. (2009). Glut of data on "new" flame retardant documents its presence all over the world. *Environmental Science & Technology*, 43(2), 236-37. doi: 10.1021/es8032154.

petition.[23] As explained below, the CPSC has the authority to take this action, and we urge it to do so.

IV. The CPSC Has Authority to Regulate These Products

The CPSC has clear authority to take the actions requested in this petition. Under the FHSA, the CPSC "may by regulation declare to be a hazardous substance . . . any substance or mixture of substances,"[24] which is "toxic,"[25] if such substance "may cause substantial personal injury or substantial illness during or as a proximate result of any customary or reasonably foreseeable handling or use."[26] The FHSA defines "toxic" to mean any substance that has "the capacity to produce personal injury or illness to man through ingestion, inhalation, or absorption through any body surface."[27] CPSC's regulation explains that "[s]ubstantial personal injury or illness means any injury or illness of a significant nature. It need not be severe or serious. What is excluded by the word 'substantial' is a wholly insignificant or negligible injury or illness."[28] A household product classified as a "hazardous substance" cannot be sold without a warning label.

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[23] Regulating organohalogen flame retardants under the FHSA is not a complete solution to the hazards presented by toxic flame retardants migrating out of consumer products. As discussed below, newer flame retardants that are organophosphates rather than organohalogens are also semi-volatile and migrate out of products, and growing evidence suggests they may pose unacceptable human health risks.

[24] 15 U.S.C. § 1262(a)(1).

[25] 15 U.S.C. § 1261(f)(1)(A)(i).

[26] 15 U.S.C. § 1261(f)(1)(A).

[27] 15 U.S.C. § 1261(g).

[28] 16 C.F.R. § 1500.3(c)(7)(ii).

Any "article intended for use by children, which is a hazardous substance, or which bears or contains a hazardous substance in such manner as to be susceptible of access by a child," is automatically deemed a "banned hazardous substance."[29] In the case of a household article classified as a "hazardous substance," but not intended for use by children, the CPSC may classify it as a "banned hazardous substance" despite its labeling, if the CPSC determines that

> notwithstanding [any] cautionary labeling . . . , the degree or nature of the hazard involved in the presence or use of such substance in households is such that the objective of the protection of the public health and safety can be adequately served only by keeping such substance, when … intended or packaged [for use in the household], out of the channels of interstate commerce.[30]

The CPSC has recognized that the FHSA "defines the term 'toxic' very broadly," and "[t]his broad statutory definition covers both acute and chronic toxicity."[31] While the CPSC regulations and guidelines discuss the particular chronic hazards of cancer, neurotoxicity, and developmental or reproductive toxicity, "*the definition is not limited to these hazards, but includes other chronic hazards*."[32] The determination of what is "toxic" under the FHSA "is a complex matter requiring the assessment of many

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[29] 15 U.S.C. § 1261(q)(1)(A). Special rules apply to articles like chemical sets that are inherently hazardous if they are appropriately labeled and are intended for use by mature children. *Id*.

[30] 15 U.S.C. § 1261(q)(1)(B).

[31] *Labeling Requirements for Art Materials Presenting Chronic Hazards; Guidelines for Determining Chronic Toxicity of Products Subject to the FHSA; Supplementary Definition of "Toxic" under the Federal Hazardous Substances Act*, 57 Fed. Reg. 46,626, 46,656 (Oct. 9, 1992).

[32] *Id*. at 46657 (emphasis added).

factors."[33] There is no formula for what is "toxic," and no requirement that risks meet any particular threshold before regulation is warranted. As the Court of Appeals for the D.C. Circuit has explained: "There is no indication in the language of the [FHSA] or its legislative history that the Commission was bound to develop a precise 'body count' of actual injuries that will be reduced by each regulatory provision."[34]

Courts have not questioned the conclusion that a variety of household products containing chemicals, such as Drano (a drain declogger) and Liquid Wrench (a spray lubricant) are "hazardous substances" within the meaning of the FHSA.[35] In addition, under the Consumer Product Safety Improvement Act of 2008, Congress declared that

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[33] 57 Fed. Reg. 46,626, 46,657. In 2008, the FHSA was amended to make it easier for the CPSC to issue regulations finding that a substance is a "hazardous" or "banned hazardous" substance. Prior to the 2008 amendments, proceedings for the issuance of regulations under the FHSA were governed by section 701 of the Federal Food, Drug and Cosmetic Act ("FFDCA"). 21 U.S.C. § 371. Some case law suggested that the FFDCA set a high bar for regulation. *Cf*. *Consumer Fed'n of Am., v. CPSC*, 883 F.2d 1073 (D.C. Cir. 1989) (upholding the CPSC's denial of a petition to ban the use of methylene chloride in household products because it did not meet the FFDCA standard). Since that case was decided, Congress dropped the requirement that FHSA regulations meet the FFDCA's "reasonable grounds" standard. *See* Pub. Law 110-314 § 204(b)(2) (Aug. 14, 2008). Instead, proceedings to ban a "hazardous substance" are governed solely by provisions of the FHSA. 15 U.S.C. § 1261(q)(2) ("Proceedings for the issuance . . . of regulations [related to banning a "hazardous substance"] shall be governed by the provisions of subsections (f) through (i) of section 1262 of this title," except in the event of imminent hazard when more streamlined procedures may apply). The 2008 amendment signifies Congressional intent to make it easier for the CPSC to regulate under the FHSA.

[34] *Forester v. CPSC*, 559 F.2d 774, 788 (D.C. Cir. 1977).

[35] *See Miles v. S.C. Johnson & Son, Inc.*, No. 00 C 3278, 2002 Westlaw 31655188, at *1 (N.D. Ill. Nov. 25, 2002) ("CPSC has determined that sodium hydroxide, the primary ingredient in Drano, is a hazardous substance."); *Wagoner v. Exxon Mobil Corp*., 832 F. Supp. 2d 664, 668 (E.D. La. 2011) ("Defendant does not argue that its Liquid Wrench product contains a banned hazardous substance"); *cf. Leibstein v. LaFarge N. Am., Inc*., 689 F. Supp. 2d 373, 381 (E.D.N.Y. 2010) (it is undisputed that cement product is a "hazardous substance" because it is corrosive).

any children's product containing lead over a certain level is a "banned hazardous substance" within the meaning of the FHSA.[36]

Courts have also given significant deference to the CPSC's determinations that a product is a "hazardous substance." For example, the Second Circuit Court of Appeals agreed with the CPSC that foam spray paint (essentially food-colored shaving cream) intended for use by children is a "hazardous substance" under the FHSA.[37] The court "defer[red] to the agency's interpretation of the substantial injury requirement" because it was not arbitrary, capricious or manifestly contrary to law.[38] The court emphasized that the statute only required that the product "may cause" substantial injury, and did not require that the product would "likely" cause injury.[39]

There is solid precedent for regulating chemicals as a class under the FHSA. In *Toy Manufacturers of America, Inc. v. CPSC*, 630 F.2d 70 (2d Cir. 1980), a trade association of toy manufacturers challenged a rule issued under the FHSA, which banned toys intended for use by young children that present hazards because of small parts. The toy industry argued that the FHSA was intended to deal only with specific, individual articles, and "not with a broad range of products at the same time."[40] The court soundly rejected this argument, saying: "Certainly, nothing in the FHSA explicitly

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[36] 15 U.S.C. § 1278a(a)(1).

[37] *United States v. Articles of Banned Hazardous Substances Consisting of an Undetermined Number of Cans of Rainbow Foam Paint*, 34 F.3d 91 (2d Cir. 1994).

[38] 34 F.3d at 97.

[39] *Id*. at 97-98.

[40] 630 F.2d at 74.

limits the employment of its banning procedures to situations involving only individual products . . . ."[41] The court went on to note that "[t]he legislative history appears clear in favoring general prescriptive regulations of *the broadest, most comprehensive type* and would favor case-by-case proceedings only where such general prescriptive regulations prove impossible."[42] The court relied on language from the FHSA legislative history in which the Senate Report states:

> It is intended that most determinations made by the (CPSC) will be in the form of general prescriptive rules, further amplifying the definition of . . . hazardous substances where necessary.[43]

More recently, in the context of a petition under the FHSA to ban sulfuric acid drain openers, a request the CPSC had received and rejected several times before, Commissioner Thomas H. Moore wrote separately to explain why the CPSC was again denying the request. Commissioner Moore stated:

> Each time the Commission has dealt with this issue it has expressed unease and concern about the severity of the injuries that can be caused by drain openers. What has stymied the Commission each time, I think, is that *the remedy proposed by the petitioners—the banning of one particular type of chemical drain opener, those made with sulfuric acid—is not expected to solve the problem because of the likelihood that consumers will simply switch to other chemical drain openers, either acid or alkaline, which can be just as dangerous as the sulfuric acid drain openers they would be replacing*. The Commission is not limited to taking the narrow action proposed by the petitioners. Instead of continuing to express concern, but dismissing the issue because of the limitations of

[41] *Id.*

[42] *Id.* (citation omitted) (emphasis added).

[43] S. Rep. No. 91-237, 91st Cong., 1st Sess. 5 (1969).

> the proposed remedy, *perhaps we should be examining the entire class of chemical drain openers to see what can be done to make them **all** safer*.[44]

The class of organohalogen flame retardants in the product categories at issue here is like small parts in toys: these chemicals are intrinsically dangerous by virtue of their inherent characteristics. And like the chemical drain openers discussed by Commissioner Moore, it makes no sense for CPSC to regulate one organohalogen flame retardant only to see it replaced with another flame retardant with the same physico-chemical properties. Based on the understanding that the FHSA "favor[s] general prescriptive regulations of the broadest, most comprehensive type and would favor case-by-case proceedings only where such general prescriptive regulations prove impossible,"[45] and the strong evidence described below that all chemicals in this class – due to their physico-chemical properties – are toxic and may cause substantial injury or illness, organohalogen flame retardants as a class must be understood as "hazardous substances" within the meaning of the FHSA.[46] Indeed, former CPSC Chair Tenenbaum recently said as much. In declaring that there is no need for crib mattresses to be manufactured with *any* chemical flame retardants, Chair Tenenbaum stated: "The law

[44] U.S. Consumer Product Safety Commission (2006). *Statement of the Honorable Thomas H. Moore on petition HP 04-2 request to ban sulfuric acid drain openers for consumer use*. Retrieved March 3, 2015, from http://www.cpsc.gov/pr/sado_moore.pdf.

[45] 630 F.2d at 74.

[46] Under the authority of the FHSA, products containing several chemical substances have been found to be "hazardous substances," requiring labeling. These include: diethylene glycol; ethylene glycol; products containing 5% or more benzene; methyl alcohol; turpentine; toluene, and xylene. When the FDA (which administered the FHSA at the time these regulations were adopted) first proposed to regulate products containing these chemicals as "hazardous substances," it said it was doing so based on "human experience" and "together with opinions of informed medical experts." 28 Fed. Reg. 2686, 2686 (Mar. 19, 1963).

strictly prohibits children's products from having hazardous chemicals [meaning any flame retardant] that children could be exposed to and could foreseeably cause substantial illness or injury."[47]

V. Regulating Products Containing Flame Retardants Should Be a Commission Priority

Household products to which organohalogen flame retardants have been added fall squarely within the priorities for CPSC regulation. The CPSC has long been aware of and concerned about the use of toxic flame retardants in consumer products. In recent years, Commissioners have explicitly recognized that the use of organohalogen flame retardants is unnecessary and dangerous.[48] The Chicago Tribune reported that at a congressional hearing in July 2012, then-Chair Tenenbaum "urged lawmakers to grant special authority that could speed the removal of hazardous flame retardants from new upholstered furniture, including sofas that can contain up to two pounds of the chemicals in their foam cushions."[49] The only measure that would ensure hazardous

[47] Patricia Callahan & Michael Hawthorne, *Chemicals in the Crib*, Chicago Tribune, Dec. 8, 2012, http://articles.chicagotribune.com/2012-12-28/news/ct-met-flames-test-mattress-20121228_1_tdcpp-heather-stapleton-chlorinated-tris.

[48] For example, six years ago, when the CSPC proposed a national residential furniture flammability standard, it said that it "developed the proposed standard *mindful of the continuing uncertainty about potential health and environmental effects of FR [flame retardant] chemical usage*, with an objective of achieving significant reductions in fire deaths and injuries from upholstered furniture fires caused by smoking materials while minimizing reliance on FR additives in fabrics and filling materials to meet that objective." *Standard for the Flammability of Residential Upholstered Furniture*, 73 Fed. Reg. 11,702, 11,709 (proposed Mar. 4, 2008) (emphasis added).

[49] Subsequently, Chair Tenenbaum stated:

organohalogen flame retardants are absent from furniture is for the CPSC to ban furniture containing those chemicals under the FHSA, as we seek here.

It is fully consistent with the CPSC's "Policy on establishing priorities for commission action"[50] to prioritize the regulation of all organohalogen flame retardants in order to prevent future injuries, especially to children, given the pervasiveness of these chemicals in consumer products and the inability of consumers to avoid contact with them. Under the CPSC's "Policy on establishing priorities for commission action," the agency must prioritize action on:

- products where the probability of exposure to the hazard is high due to "the number of units of the product that are being used by consumers, the frequency with which such use occurs, and the likelihood that in the course of typical use the consumer would be exposed to the identified risk of injury";[51]
- preventing product-related injury to children, the handicapped, and senior citizens;[52] and
- "products, although not presently associated with large numbers of frequent or severe injuries, [where] … there is reason to believe that the products will in the future be associated with many such injuries.[53]

> I was pleased to read that the Governor of California recently directed that state's Bureau of Home Furnishings to revisit state rules that effectively require the use of flame retardant in many household upholstered furniture items, and I know Commission staff is monitoring this work closely. I am hopeful that Commission staff will generate a rule that will bring safer, more fire resistant upholstered furniture into homes across the nation.

US Consumer Product Safety Commission (Aug. 2, 2012). *Statement of Inez M. Tenenbaum, Chairman, U.S. Consumer Product Safety Commission, Before the U.S. House Committee on Energy and Commerce Subcommittee on Commerce, Manufacturing, and Trade; "Oversight of the Consumer Product Safety Commission."* Retrieved March 3, 2015, from http://www.cpsc.gov//PageFiles/121027/tenenbaum08022012.pdf.

[50] 16 C.F.R. § 1009.8.

[51] 16 C.F.R. § 1009.8 (c)(7).

[52] 16 C.F.R. § 1009.8 (c)(6).

All of these considerations are present here: 1) the affected products are ones that most people use daily, such as chairs, sofas, mattress pads, computers and other electronics; 2) children are at particular risk for several reasons: they tend to spend more time on or near the floor (crawling, playing, and so on) where they are exposed to hazardous dust; they have hand-to-mouth behaviors that result in their ingestion of this material; they may be exposed during critical developmental windows of rapid growth and brain development during which they are particularly vulnerable to these toxins; and children's products in particular are likely to contain flame retardants; and 3) there is strong reason to believe that continued use of additive organohalogen flame retardants in the four product categories will result in future illness and injury, just like the now-banned or discontinued PBDEs.

The CPSC has additional cause to act swiftly to protect consumers and children from organohalogen flame retardants in the products at issue in this petition. As described below in Section VII-B, for reasons that are not fully understood, the highest human levels of harmful flame retardants in the general population have been found in young children from communities of low socio-economic status, and communities of color.[54] This presents an environmental injustice. Pursuant to Executive Order 12898, the CPSC must act to "achiev[e] environmental justice . . . by . . . addressing . . . [the]

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[53] 16 C.F.R. § 1009.8 (c)(3).

[54] Quirós-Alcalá, L.; Bradman, A; Nishioka, M.; Harnly, M.E.; Hubbard, A.; McKone, T.E.; & Eskenazi, B. (2011). Concentrations and loadings of polybrominated diphenyl ethers in dust from low-income households in California. *Environment International*, 37(3):592-96. doi: 10.1016/j.envint.2010.12.003.

disproportionately high and adverse human health or environmental effects of its programs [and] policies . . . on minority populations and low-income populations."[55] The CPSC's failure to regulate household products containing hazardous substances in the form of organohalogen flame retardants, despite the abundant evidence that these chemicals are pervasive in the homes and bodies of people across the country, and especially in people of color and of lower incomes, must be corrected as soon as possible.

For all these reasons, eliminating all additive organohalogen flame retardants from the relevant product categories should be a priority for the CSPC.

VI. Organohalogen Flame Retardants Are Pervasive in the Product Categories Covered by This Petition, But Are Not Required by Any Flammability Standard

In Section VI-A below, we present evidence that organohalogen flame retardants are often present in the four product categories at issue here. In Section VI-B below, we explain that these flame retardants are not used to meet any flammability standard.

A. Additive Organohalogen Flame Retardants Are Used Extensively in the Consumer Product Categories Covered by This Petition

Organohalogen flame retardants in additive form are present in a large percentage of the product categories at issue in this petition, as detailed below.

[55] Exec. Order No. 12,898 (Feb. 11, 1994), at 1.

1. <u>Infant and Children's Products</u>

Testing has identified organohalogen flame retardants in the foam in nursing pillows, crib mattresses, strollers, baby carriers, sleep mats, and changing table pads. For example:

A. A 2011 study of baby products sold throughout the United States found flame retardant chemicals in a range of foam-containing products, such as nursing pillows, crib mattresses, strollers, baby carriers, sleep mats, and changing table pads.[56] Out of foam samples collected from 101 commonly used baby products, 80 samples were found to have an identifiable flame retardant additive, and 79 of these contained organohalogens.

B. In 2012, the Chicago Tribune analyzed foam used in crib mattresses, and found that three then-popular brands of baby mattresses tested positive for organohalogen flame retardants.[57]

C. A 2012 survey of flame retardants in sleep products found evidence for the presence of organohalogen flame retardants in all foam samples from 29 sleeping mats from nursery schools and day care centers in the California Bay Area.[58]

D. A study published in 2012 documents extensive use of organohalogen flame retardants in infants' and children's products. The report provides the results of tests carried out on 20 foam-containing products purchased across the United States at major retailers, including baby changing mats and nursing pillows. Seventeen (85%) of the 20 products tested contained organohalogen flame retardants.[59]

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[56] Stapleton, H.M.; Klosterhaus, S.; Keller, A.; Ferguson, P.L.; van Bergen, S.; Cooper, E.; Webster, T.F.; & Blum, A. (2011). Identification of flame retardants in polyurethane foam collected from baby products. *Environmental Science & Technology*, 45(12), 5323-31. doi: 10.1021/es2007462.

[57] Patricia Callahan, *Chemicals in the Crib*, *supra* note 47.

[58] Gaw, C. (2012). *Sleeping on Toxins? A Study of Flame Retardants in Sleep Products*. Retrieved March 3, 2015, from http://nature.berkeley.edu/classes/es196/projects/2012final/GawC_2012.pdf.

[59] Organohalogen flame retardants identified included tris (1,3-dichloro-2-propyl) phosphate (TDCPP), tris (2-chloroethyl) phosphate (TCEP), and tris (1-chloro-2-propyl) phosphate (TCPP), with chlorinated Tris (TDCPP) found in 80% of the products tested. Washington Toxics Coalition and Safer States (2012). *Hidden Hazards in the Nursery*. Retrieved March 3, 2015, from http://watoxics.org/publications/hidden-hazards.

The fact that a significant proportion of tested juvenile products has been found to contain organohalogen flame retardants suggests that a high percentage of *all* infant and children's products contain these chemicals.

2. Residential Furniture

Most residential seating furniture in use in this country contains additive organohalogen flame retardants. One 2012 study tested 102 samples of polyurethane foam from residential sofas purchased across the United States between 1985 and 2010 and found that 85% contained flame retardants.[60] One of the objectives of this study was to determine which chemicals were being used after the phase-out of pentaBDE in 2005. In furniture purchased before 2005, organohalogen flame retardants were detected in 63% of the samples tested (pentaBDE in 39% of the samples, followed by TDCPP in 24%). In furniture purchased in 2005 or later, organohalogen flame retardants were detected in over 90% of the samples (most common being TDCPP in 52% and components associated with the Firemaster® 550 mixture in 18% of the samples). In other words, the 2005 phase-out of pentaBDE led to the use of other organohalogen flame retardants in polyurethane foam used in upholstered furniture.

3. Mattresses and Mattress Pads

An informal 2012 survey of 28 foam mattresses and 55 mattress pads used by adults found organohalogen flame retardants in 29% and 50% of the samples

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[60] Stapleton, H.M.; Sharma, S.; Getzinger, G.; Ferguson, P.L.; Gabriel, M.; Webster, T.F.; & Blum, A (2012). Novel and high volume use flame retardants in US couches reflective of the 2005 PentaBDE phase out. *Environmental Science & Technology*, 46(24), 13,432-39. doi: 10.1021/es303471d.

analyzed.[61] This was confirmed by the website of the American Chemistry Council / North American Flame Retardant Alliance, which lists foam mattresses as one of the product areas where flame retardants are used.[62]

4. Electronics Enclosures

Flame retardants in additive form are commonly used in plastic casings for televisions and other electronic devices.[63] (To be clear, this petition does not address the flame retardants in reactive form in electronic circuit boards where the flame retardants are chemically bound to the product. This petition focuses exclusively on organohalogen flame retardants in additive form used in the plastic casings for electronic devices.) DecaBDE was commonly used in plastic casings for televisions and electronics before it was phased out by the EPA due to its toxicity. Although decaBDE is no longer used in plastic electronic casings, other similar organohalogen flame retardants such as DBDPE have replaced it.[64]

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[61] Gaw, C., Singla, V.; Peaslee, G.; & Busener, S. (2013). Flame retardants in foam from various consumer products. On file with Green Science Policy Institute.

[62] North American Flame Retardant Alliance lists foam mattresses as one of the products in which flame retardants are commonly used. North American Flame Retardant Alliance, American Chemistry Council. *Flame Retardant Basics*. Retrieved March 03, 2015, from http://flameretardants.americanchemistry.com/FR-Basics.

[63] North American Flame Retardant Alliance lists Electronics and Electrical Devices as one of the four product areas where flame retardants are commonly used including in casings for televisions and other electronic devices. *Id*.

[64] Betts, Glut of data, *supra* note 22.

B. Flame Retardants Are Not Required by Any Federal or State Flammability Standard

The widespread use of organohalogen flame retardants described immediately above is not needed to comply with any government-adopted flammability standard. The extensive use of organohalogen flame retardants in juvenile products and residential furniture began with a 1975 California flammability standard called Technical Bulletin 117 (TB 117).[65] However, after an extensive regulatory review process, the California Bureau of Electronics and Appliance Repair, Home Furnishings and Thermal Insulation ("BEARHFTI") recently revised TB 117, replacing the old flammability standard with a new one that can be met without flame retardants,[66] and exempting 17 juvenile products from flammability requirements.

In addition, no federal furniture flammability standard has been adopted, and the flammability standard proposed by the CPSC in 2008 was specifically designed so it

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[65] State of California, Department of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation (2000). Technical Bulletin 117: Requirements, Test Procedure and Apparatus for Testing the Flame Retardance of Resilient Filling Materials Used in Upholstered Furniture. Retrieved March 3, 2015, from http://www.bhfti.ca.gov/industry/117.pdf. The TB 117 requirements included a 12-second open flame test for furniture and juvenile products filling materials. This requirement was often met by adding flame retardant chemicals to polyurethane foam filling. In part because of the size of the California market, TB 117 became a *de facto* national standard, resulting in nationwide sale of furniture and juvenile products containing flame retardant chemicals.

[66] State of California, Department of Consumer Affairs, Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation (2013). Initial Statement of Reasons. Retrieved March 3, 2015, from http://www.bhfti.ca.gov/about/laws/isr.pdf. TB 117-2013 categorically exempts 17 categories of juvenile products made with foam (including strollers, infant carriers, nursing pillows, booster seats, bassinets, and highchairs) from regulation. Cal. Code Regs tit. 4, § 1374.2(c).

could be met without use of flame retardants.[67] Thus, no flammability standard currently in effect requires chemical flame retardants to be added to residential furniture or juvenile products, with the exception of car seats,[68] which are not covered by this petition.

As of 2006, the CPSC has two flammability standards that apply to adult mattresses – a smolder standard in 16 C.F.R. section 1632, and an open flame standard in 16 C.F.R. section 1633. Flame retardants are not needed to meet either of these standards. Like the TB 117-2013 furniture smolder standard discussed above, the mattress smolder standard can be met by selecting smolder-resistant fabrics. In addition, the open flame standard was designed so manufacturers have the option of not using flame retardant chemicals, as confirmed by a "Question and Answer" document prepared by CPSC Staff:

> The regulation does not specify the use of FR chemicals to meet the 12 requirements. Manufacturers are free to choose the means of complying with the regulation and this may include the use of inherently flame resistant materials and FR barriers, in addition to FR chemicals. If the manufacturer

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[67] In the preamble to the 2008 Notice of Proposed Rulemaking for a federal furniture flammability standard, the CPSC states:

> In October 2004, the staff held a public meeting to present the direction of what would become the staff's 2005 draft standard. The staff analyzed comments received at that meeting as well. The proposed standard takes account of that analysis. Staff received comments on its 2005 draft standard, continued its research and analysis *and developed a revised, 2007 draft proposal that focused primarily on preventing smoldering ignitions and reducing the need for flame retardant chemicals. This notice presents the 2007 draft as the Commission's proposed standard*.

Standard for the Flammability of Residential Upholstered Furniture, *supra* note 48.

[68] Children's car seats are regulated by the National Highway Traffic Safety Administration.

> chooses to use FR chemicals, the regulation does not require tests for durability after exposure to moisture.[69]

Indeed, former CPSC Chair Tenenbaum acknowledged that barrier technologies could be used to meet the CPSC's mattress standards. She stated that the CPSC "strongly encourage[s] all mattress manufacturers to comply with our performance standard through the use of barrier technologies and *to avoid using any potentially harmful chemicals to which children can be exposed*."[70]

Finally, there are no federal or state regulations requiring the use of flame retardant chemicals in plastic electronic enclosures.

VII. Use of Additive Organohalogen Flame Retardants in Household Products Leads to Human Exposure

A. Organohalogen Flame Retardants Are Semi-Volatile, Meaning They Are Released into the Air, Persist and Lead to Human Exposures

Two considerations greatly influence the likelihood that a chemical substance will migrate out of a consumer product: (1) whether the substance is additive or reactive, and (2) whether or not it is semi-volatile. Unlike reactive flame retardants, additive flame retardants are not chemically bound to the material of the consumer product and are thus more likely to be released into the home environment, leading to human exposure. Additionally, as explained in Dr. Miriam Diamond's accompanying

[69] U.S. Consumer Product Safety Commission, Office of Compliance, Standard for the Flammability (Open Flame) of Mattress Sets, 16 C.F.R. Part 1633, Questions and Answers. Retrieved March 3, 2015, from https://www.cpsc.gov//PageFiles/117413/mattqa.pdf.

[70] Patricia Callahan, *Chemicals in the Crib*, *supra* note 47.

statement, organohalogen flame retardants as a class are semi-volatile organic compounds ("SVOCs"). When used in additive form, SVOCs are released slowly from products and, once released, tend to adsorb onto other solid phases such as dust particles, human and animal skin, clothes, and so on. In addition, exposures occur as a result of direct transfer when touching a product containing additive flame retardants is followed by hand-to-mouth contact. This is true of all additive organohalogen flame retardants. In addition, all organohalogen flame retardants are, by their nature, persistent in the indoor environment.[71,72] In sum, based on the physico-chemical properties of additive organohalogen flame retardants as a class, these chemical substances will migrate out of consumer products and persist in the indoor environment, leading to human exposures.

Extensive empirical evidence supports this conclusion. Many studies show that organohalogen flame retardants are present in indoor air and house dust. Most research is on the PBDE flame retardants because they have been in use the longest. For instance, a 2004 Canadian study measured concentrations of PBDEs in indoor air from 74 homes and in outdoor air at seven sites.[73] The researchers detected PBDEs in

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[71] Weschler, C.J. & Nazaroff, W.W. (2008). Semivolatile organic compounds in indoor environments. *Atmospheric Environment*, 42(40), 9018-40. doi: 10.1016/j.atmosenv.2008.09.052.

[72] Shin, H.; McKone, T.E.; Tulve, N.S.; Clifton, M.S.; & Bennett, D.H. (2013). Indoor residence times of semivolatile organic compounds: model estimation and field evaluation. *Environmental Science & Technology*, 47(2), 859-67. doi: 10.1021/es303316d.

[73] Wilford, B.H.; Harner, T.; Zhu, J.; Shoeib, M.; & Jones, K.C. (2004). Passive sampling survey of polybrominated diphenyl ether flame retardants in indoor and outdoor air in Ottawa, Canada: implications for sources and exposure. *Environmental Science & Technology*, 38(20), 5312-18. doi: 10.1021/es049260x.

all indoor air samples, but not in all of the outdoor air samples, with levels indoors approximately 50 times higher on average than outdoors. A 2006 UK study also found that PBDE concentrations were one order of magnitude higher indoors compared to outdoors.[74] These higher incidences and levels of PBDEs in indoor air are consistent with the migration of flame retardants from indoors consumer products.

A recent study of 139 California households found PBDEs in the majority of dust samples and many floor wipe samples.[75] Another study found measurable levels of PBDEs, as well as three other additive organohalogen flame retardants – hexabromobenzene, tris (1-chloro-2-propyl) phosphate (TCPP), and tetrabromobisphenol A (TBBPA) – emitted from office equipment to indoor air.[76]

Newer studies on the organohalogen flame retardants used as PBDE replacements show that these too migrate from products into the air and end up in dust. For example, a 2006 study in Boston, Massachusetts, analyzed dust samples from 19 homes and found several alternate and new brominated flame retardants: hexabromocyclododecane (HBCD), 1,2-bis (2,4,6,-tribromphenoxy) ethane (BTBPE), DBDPE, and the brominated components found in Firemaster® 550: 2-ethylhexyl 2,3,4,5-

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[74] Harrad, S.; Hazrati S.; & Ibarra, C. (2006). Concentrations of polychlorinated biphenyls in indoor air and polybrominated diphenyl ethers in indoor air and dust in Birmingham, United Kingdom: implications for human exposure. *Environmental Science & Technology*, 40(15), 4633-38. doi: 10.1021/es0609147.

[75] Bennett, D.H.; Moran, R.E.; Wu, X.M.; Tulve, N.S.; Clifton, M.S.; Colon, M.; Weathers, W.; Sjödin, A.; Jones, R.; & Hertz-Picciotto, I. (2014). Polybrominated diphenyl ether (PBDE) concentrations and resulting exposure in homes in California: relationships among passive air, surface wipe and dust concentrations, and temporal variability. *Indoor Air*. doi: 10.1111/ina.12130.

[76] Destaillats, H.; Maddalena, R.L.; Singer, B.C.; Hodgson, A.T.; & McKone, T.E. (2008). Indoor pollutants emitted by office equipment: A review of reported data and information needs. *Atmospheric Environment*, 42(7), 1371-88. doi: 10.1016/j.atmosenv.2007.10.080.

tetrabromobenzoate (TBB) and bis (2-ethylhexyl) 3,4,5,6-tetrabromophthalate (TBPH).[77] As described in the accompanying statement from Ruthann Rudel, the Silent Spring Institute tested dust in California homes for the presence of flame retardants between 2006 and 2011, and found that over 50% of those homes contained 41 different organohalogens, and at least one contained as many as 55 flame retardant chemicals.[78] Most commonly found were: PBDE mixtures; components of Firemaster® 550; HBCD; TBBPA; tetrabromobisphenol A-bis(2,3-dibromopropylether) (TBBPA-BDBPE); DBDPE; TDBPP; TDCPP; TCPP; and TCEP. The study also found that concentrations of Firemaster® 550 components TBB, TBPH and triphenyl phosphate (TPhP) increased from 2006 to 2011, as the use of Firemaster® 550 increased to replace the pentaBDE commercial mixture. On the other hand, levels of pentaBDE (which was phased-out in 2005) decreased significantly in dust samples from those households that had purchased new consumer products between 2006 and 2011.[79,80] Similarly, a study of 26 foam-containing consumer products purchased between 2003 and 2009 in the U.S. found TDCPP and TCPP in 15 and 4 of the samples respectively, and detected them in

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[77] Stapleton, H.M.; Allen, J.G.; Kelly, S.M.; Konstantinov, A.; Klosterhaus, S.; Watkins, D.; McClean, M.D.; & Webster, T.F. (2008). Alternate and new brominated flame retardants detected in U.S. house dust. *Environmental Science & Technology*, 42(18), 6910-16. doi: 10.1021/es801070p.

[78] Dodson, R.E.; Perovich, L.J.; Covaci, A.; Van den Eede, N.; Ionas, A.C.; Dirtu, A.C.; Brody, J.G.; & Rudel, R.A. (2012). After the PBDE phase-out: a broad suite of flame retardants in repeat house dust samples from California. *Environmental Science & Technology*, 46(24), 13,056-66. doi: 10.1021/es303879n.

[79] *Id.*

[80] This is evidence that once flame retardants are removed from consumer products, their presence in household dust eventually decreases, thus leading to decreased exposure.

house dust at levels comparable, or even greater, than the levels of PBDEs.[81,82] In one study, a significant positive correlation ($p<0.05$) was found between concentrations of the organohalogen flame retardants BTBPE, DBDPE and TBPH in mattresses and the corresponding concentrations in floor dust (n=16).[83]

Of particular concern is that organohalogen flame retardants – both PBDEs and their replacements – are ubiquitous in dust found in child care centers and preschools: PBDEs, brominated components of Firemaster® 550, tris (2-chloroethyl) phosphate (TCEP) and TDCPP (all organohalogen flame retardants) were detected in 100% of the dust sampled in 40 California early childhood educational facilities between May 2010 and May 2011.[84]

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[81] Stapleton, H.M.; Klosterhaus, S.; Eagle, S.; Fuh, J.; Meeker, J.D.; Blum, A.; & Webster, T.F. (2009). Detection of organophosphate flame retardants in furniture foam and U.S. house dust. *Environmental Science and Technology*, 43(19), 7490-95. doi: 10.1021/es9014019.

[82] Measurable amounts of four non-PBDE organohalogen flame retardants were also found in house dust in Belgium: BTBPE and DBDPE were identified in 85% and 100% of Belgium house dust samples respectively; TBB and TBPH were found in 31% and 97% of house dust samples respectively. Ali, N.; Harrad, S.; Goosey, E.; Neels, H.; & Covaci, A. (2011). "Novel" brominated flame retardants in Belgian and UK indoor dust: implications for human exposure. *Chemosphere*, 83(10), 1360-65. doi: 10.1016/j.chemosphere.2011.02.078.

[83] Ali, N.; Dirtu, A.C.; Van den Eede, N.; Goosey, E.; Harrad, S.; Neels, H.; 't Mannetje, A.; Coakley, J.; Douwes, J.; & Covaci, A. (2012). Occurrence of alternative flame retardants in indoor dust from New Zealand: indoor sources and human exposure assessment. *Chemosphere*, 88(11), 1276-82. doi: 10.1016/j.chemosphere.2012.03.100.

[84] Bradman, A.; Castorina, R.; Gaspar, F.; Nishioka, M.; Colón, M.; Weathers, W.; Egeghy, P.P.; Maddalena, R.; Williams, J.; Jenkins, P.L.; & McKone, T.E. (2014). Flame retardant exposures in California early childhood education environments. *Chemosphere*, 116, 61-66. doi: 10.1016/j.chemosphere.2014.02.072.

B. The Migration of Organohalogen Flame Retardants out of Products Leads to Human Exposure

Humans are exposed to organohalogen flame retardants that migrate from consumer products into the air and settle in house dust. The inadvertent ingestion and absorption of contaminated house dust is a major pathway of exposure to organohalogen flame retardants for the general population.[85] An EPA review published in 2008 found that ingestion of organohalogen flame retardants in household dust accounted for over 80% of the overall exposure of study participants to these chemicals, with the remaining exposure primarily due to ingestion of contaminated food products.[86] A 2007 Massachusetts study found that inhalation of PBDEs from indoor air due to their presence in consumer products may also account for a significant proportion of human exposures to these chemicals.[87] More recent research suggests that product-to-hand transfer followed by hand-to-mouth transfer is the main path of exposure to organohalogen flame retardants.[88,89]

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[85] Jones-Otazo, H.A.; Clarke, J.P.; Diamond, M.L.; Archbold, J.A.; Ferguson, G.; Harner, T.; Richardson, G.M.; Ryan, J.J.; & Wilford, B. (2005). Is house dust the missing exposure pathway for PBDEs? An analysis of the urban fate and human exposure to PBDEs. *Environmental Science & Technology*, 39(14), 5121-30. doi: 10.1021/es048267b.

[86] Lorber, M. (2008). Exposure of Americans to polybrominated diphenyl ethers. *Journal of Exposure Science & Environmental Epidemiology*, 18(1), 2-19. doi: 10.1038/sj.jes.7500572.

[87] Allen, J.G.; McClean, M.D.; Stapleton, H.M.; Nelson, J.W.; & Webster, T.F. (2007). Personal exposure to polybrominated diphenyl ethers (PBDEs) in residential indoor air. *Environmental Science & Technology*, 41(13), 4574-79. doi: 10.1021/es0703170.

[88] Watkins, D.J.; McClean, M.D.; Fraser, A.J.; Weinberg, J.; Stapleton, H.M.; Sjödin, A.; & Webster T.F. (2011). Exposure to PBDEs in the office environment: evaluating the relationships between dust, handwipes, and serum. *Environmental Health Perspectives,* 119(9), 1247-52. doi: 10.1289/ehp.1003271.

Biomonitoring studies confirm that flame retardants are present in people. The 2003-2004 National Health and Nutrition Examination Survey ("NHANES") conducted by the Centers for Disease Control and Prevention ("CDC"), found at least one PBDE congener in 97% of the study participants, reported to be representative of the U.S. population.[90] The latest CDC report[91] found several PBDEs and 2,2',4,4',5,5'-hexabromobiphenyl (BB 153, known commercially as Firemaster® BP-6) at levels ranging from 1.2 to 28.2 ng/g lipid in human serum. Teenagers (ages 12 to 19) had higher body burdens than adults for all flame retardants measured. Mexican Americans and non-Hispanic blacks had higher levels than the non-Hispanic white population. The fact that communities of color bear disproportionately high levels of flame retardant chemicals, coupled with the disproportionate exposure and toxicity borne by children (and developing fetuses) presents environmental justice concerns. Another recent study detected 2,3,4,5-tetrabromobenzoic acid (TBBA), a urinary metabolite of the Firemaster® 550 component TBB, in 72.4% of the 64 study participants, indicating widespread exposure to Firemaster® 550 in the home environment.[92]

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[89] Stapleton, H.M.; Eagle, S.; Sjödin, A.; & Webster, T.F. (2012). Serum PBDEs in a North Carolina toddler cohort: associations with handwipes, house dust, and socioeconomic variables. *Environmental Health Perspectives,* 120(7), 1049-54. doi: 10.1289/ehp.1104802.

[90] Sjödin, A.; Wong, L.; Jones, R.S.; Park, A.; Zhang, Y.; Hodge, C.; Dipietro, E.; McClure, C.; Turner, W.; Needham, L.L.; & Patterson Jr., D.G. (2008). Serum concentrations of polybrominated diphenyl ethers (PBDEs) and polybrominated biphenyl (PBB) in the United States population: 2003-2004. *Environmental Science & Technology*, 42(4), 1377-84. doi: 10.1021/es702451p.

[91] Centers for Disease Control and Prevention (2015). *Fourth National Report on Human Exposure to Environmental Chemicals, Updated Tables, February 2015*. Retrieved March 4, 2015, from http://www.cdc.gov/exposurereport/.

[92] Hoffman, K.; Fang, M.; Horman, B.; Patisaul, H.B.; Garantziotis, S.; Birnbaum, L.S.; & Stapleton, H.M. (2014). Urinary tetrabromobenzoic acid (TBBA) as a biomarker of exposure to the flame

Studies have also documented exposure of pregnant women to organohalogen flame retardants, which is of particular concern because there are strong links between prenatal exposures to these chemicals and reduced IQ and greater hyperactivity in children.[93] All pregnant participants in the 2003-2004 NHANES study had measurable levels of at least one PBDE in their bodies.[94] A study of 416 predominantly immigrant pregnant women living in Monterey County, California, detected pentaBDE congeners in 97% of serum samples.[95] In addition, flame retardant chemicals are transferred from the mother to the baby during breastfeeding,[96] a potentially major route of exposure for infants. Fetuses and newborn infants are especially at risk when exposed to toxics such as organohalogen flame retardants because their brains and organ systems are in a critical developmental window.

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retardant mixture Firemaster® 550. *Environmental Health Perspectives,* 122(9), 963-69. doi: 10.1289/ehp.1308028.

[93] Chen, A.; Yolton, K.; Rauch, S.A.; Webster, G.M.; Hornung, R.; Sjodin, A.; Dietrich, K.N.; & Lanphear, B.P. (2014). Prenatal polybrominated diphenyl ether exposures and neurodevelopment in U.S. children through 5 years of age: The HOME study. *Environmental Health Perspectives*, 122(8), 856-62. doi: 10.1289/ehp.1307562.

[94] Woodruff, T.J.; Zota, A.R.; & Schwartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. *Environmental Health Perspectives*, 119(6), 878-85. doi: 10.1289/ehp.1002727.

[95] Castorina, R.; Bradman, A.; Sjödin, A.; Fenster, L.; Jones, R.S.; Harley, K.G.; Eisen, E.A.; & Eskenazi, B. (2011). Determinants of serum polybrominated diphenyl ether (PBDE) levels among pregnant women in the CHAMACOS cohort. *Environmental Science Technology*, 45(15), 6553-60. doi: 10.1021/es104295m.

[96] Schecter, A.; Pavuk, M.; Päpke, O.; Ryan, J.J.; Birnbaum, L.; & Rosen, R. (2003). Polybrominated diphenyl ethers (PBDEs) in U.S. mothers' milk. *Environmental Health Perspectives*, 111(14), 1723-29. doi: 10.1289/ehp.6466.

In general, exposure to flame retardants in house dust is highest for toddlers and young children.[97] A study of 20 mothers and their children aged 1.5 to 4 found that the children had typically 2.8 times higher total PBDE levels than their mothers.[98] The authors suggest that this occurs due to the young children's frequent hand-to-mouth activity, dietary preferences, and breastfeeding. In a North Carolina study, levels of PBDEs on toddlers' hands correlated with serum PBDE levels, suggesting that the frequent hand-to-mouth contact exhibited by young children is a major exposure pathway.[99] In a separate study, toddlers in homes with contaminated house dust had up to 100-fold greater estimated exposure levels compared to toddlers who were not exposed to contaminated dust.[100] CPSC exposure estimates suggest that infants could be exposed to higher levels of the organohalogen flame retardant TDCPP from juvenile products compared to the average child's or adult's exposure from upholstered furniture.[101,102,103] A recent study of 21 US mother-toddler pairs confirmed that toddlers have significantly higher concentrations of TDCPP metabolites in their urine compared

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[97] Stapleton, H.M.; Dodder, N.G.; Offenberg, J.H.; Schantz, M.M.; & Wise, S.A. (2005). Polybrominated diphenyl ethers in house dust and clothes dryer lint. *Environmental Science & Technology*, 39(4), 925-31. doi: 10.1021/es0486824.

[98] Lunder, S.; Hovander, L.; Athanassiadis, I.; & Bergman, A. (2010). Significantly higher polybrominated diphenyl ether levels in young U.S. children than in their mothers. *Environmental Science and Technology*, 44(13), 5256-62. doi: 10.1021/es1009357.

[99] Stapleton, H.M., Serum PBDEs, *supra* note 89.

[100] Jones-Otazo, H. A., Is house dust the missing exposure pathway, *supra* note 85.

[101] *Id*.

[102] Stapleton, H. M., Identification of flame retardants, *supra* note 56.

[103] Babich, M. A., U.S. Consumer Product Safety Commission (2006). CPSC Staff Preliminary Risk Assessment of Flame Retardant (FR) Chemicals in Upholstered Furniture Foam. Retrieved March 4, 2015, from http://www.cpsc.gov//PageFiles/106736/ufurn2.pdf.

to their mothers, consistent with increased hand to mouth behavior and elevated dust exposure.[104]

The highest levels of harmful flame retardants in the general population are found in young children from communities of low socioeconomic status and communities of color. For instance, a North Carolina study of 80 toddlers found PBDEs in 100% of the blood samples, and the sum of BDE-47, -99 and -100 (three of the pentaBDE congeners) was negatively associated with the father's level of education.[105] Similarly, Zota et al. (2008), using data from the NHANES, found that individuals in lower income households (<$20,000/year) had significantly higher PBDE exposures.[106] Rose et al. (2010) also found higher body burdens of nearly all measured congeners (including BDE-47, -153, and -209) in 2-5 year-old Californian children in born to mothers with lower education.[107] In another study of ethnically diverse 6-8 year-old girls in California, measured pentaBDE levels were higher in children with less educated care-givers.[108]

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[104] Butt, C.M.; Congleton, J.; Hoffman, K.; Fang, M.; & Stapleton, H.M. (2014). Metabolites of organophosphate flame retardants and 2-ethylhexyl tetrabromobenzoate in urine from paired mothers and toddlers. *Environmental Science & Technology*, 48(17), 10432-38. doi: 10.1021/es5025299.

[105] Stapleton, H.M., Serum PBDEs, *supra* note 89.

[106] Zota, A.R.; Rudel, R.A.; Morello-Frosch, R.A.; & Brody, J.G. (2008). Elevated house dust and serum concentrations of PBDEs in California: unintended consequences of furniture flammability standards? *Environmental Science & Technology*, 42(21), 8158-64. doi: 10.1021/es801792z.

[107] Rose, M.; Bennett, D.H.; Bergman, Å.; Fängström, B.; Pessah, I.N.; & Hertz-Picciotto, I. (2010). PBDEs in 2-5 year-old children from California and associations with diet and indoor environment. *Environmental Science & Technol*ogy, 44(7), 2648-53. doi: 10.1021/es903240g.

[108] Windham, G.C.; Pinney, S.M.; Sjödin, A.; Lum, R.; Jones, R.S.; Needham, L.L.; Biro, F.M.; Hiatt, R.A.; & Kushi, L.H. (2010). Body burdens of brominated flame retardants and other persistent organo-halogenated compounds and their descriptors in US girls. *Environmental Research*, 110(3), 251-57. doi: 10.1016/j.envres.2010.01.004.

This study also found that black preadolescent girls had significantly higher levels than white girls.[109] Similarly, using NHANES data, Sjödin et al. (2008) showed that, after adjusting for age, levels of BDE-47 and BDE-99 (but not BDE-100 and BDE-153) were significantly lower in white children as compared to Mexican American and black children.[110]

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In sum, additive organohalogen flame retardants are present in the four categories of consumer products addressed by this petition (although no mandatory flammability standard requires this), and body burden testing demonstrates that humans are exposed to and absorb these chemicals when they migrate from household products. As shown below, these exposures present serious health risks due to the physical-chemical properties of organohalogen flame retardants as a class, which renders them toxic to humans.

VIII. Consumer Products in the Four Petition Categories Containing *Any* Organohalogen Flame Retardant in Additive Form Are "Hazardous Substances" Within the Meaning of the FHSA

Due to the toxicity of organohalogen flame retardants, the presence of any chemical in this class in the product categories at issue here, renders these products "hazardous substances" within the meaning of the FHSA, because:

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[109] *Id.*

[110] Sjödin, A., Serum concentrations of polybrominated diphenyl ethers (PBDEs), *supra* note 90.

a. Human exposure to all *studied* organohalogen flame retardants is associated with long-term chronic health effects, as described in the accompanying expert statements from Dr. Kim Harley, Dr. Julie Herbstman, Dr. Susan Kasper, Ruthann Rudel, and Dr. Ted Schettler.

b. Inherent physical, chemical, and biological characteristics of organohalogen chemicals and the historical evidence of regrettable substitution within this chemical class suggest that the entire class of organohalogen flame retardants have (or are vey likely to have) adverse health effects and therefore should be regulated as a class, as explained in the accompanying expert statements from Dr. David Eastmond, Dr. Terry Collins, Dr. Rolf Halden, and Dr. David Epel.

c. When all organohalogen flame retardants burn, they release toxic byproducts, such as acutely toxic soot and smoke, and dioxins and furans, which are associated with long-term chronic health effects, as explained in the accompanying expert statements from Dr. Roland Weber, and Dr. Donald Lucas.

In sum, the use of *any* organohalogen flame retardant chemical in additive form in a consumer product results in the product's having "the capacity to produce personal injury or illness" in humans when inhaled, swallowed, or absorbed through the skin – whether the injury or illness is acute or chronic.[111] This "may cause substantial personal injury or substantial illness during or as a proximate result of any customary or reasonably foreseeable handling or use."[112] Because of these risks, any product in the four categories at issue here containing an organohalogen flame retardant chemical in additive form should be declared a "hazardous substance" and "banned hazardous substance" under the FHSA.

[111] 15 U.S.C. § 1261(g).

[112] 15 U.S.C. § 1261(f)(1)(A).

A. Exposure to Organohalogen Flame Retardants from Consumer Products Puts Human Health at Risk

All organohalogen flame retardants that have been studied have the capacity to cause long-term adverse health effects in humans who are exposed to them. Because PBDEs were used in consumer products for decades, large segments of the U.S. population were unwitting subjects in an experiment regarding how PBDEs affect human health. Over the last several years, scientists have studied the impacts of ongoing exposure to PBDEs and concluded that there are associations with neurotoxicity, adverse developmental and reproductive effects, and immune and endocrine disruption. The accompanying statements from Dr. Kim Harley, Dr. Susan Kasper and Dr. Julie Herbstman explain their key research findings on the impacts of PBDEs on human health.

The evidence that the newer organohalogen flame retardants are also toxic to humans is compelling, and most are also persistent and/or bioaccumulative. For example:

- TDCPP was recently added to California's Proposition 65 list of chemicals "known to the State to cause cancer."[113] TDCPP levels in house dust were associated with altered hormone levels in men recruited through an infertility clinic.[114] An *in vitro* study suggests that TDCPP is toxic to the nervous system and affects cell development and DNA synthesis.[115]

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[113] California EPA, *Evidence on the Carcinogenicity of Tris(1,3-Dichloro-2-Propyl) Phosphate*, *supra* note 18; OEHHA, *Chemicals Known to the State to Cause Cancer or Reproductive Toxicity*, *supra* note 18.

[114] Meeker, J. D., House dust concentrations of organophosphate flame retardants, *supra* note 19.

[115] Dishaw, L.V.; Powers, C.M.; Ryde, I.T.; Roberts, S.C.; Seidler, F.J.; Slotkin, T.A.; & Stapleton, H.M. (2011). Is the PentaBDE replacement, tris (1,3-dichloro-2-propyl) phosphate (TDCPP), a

- TCEP was added to California's Proposition 65 list of chemicals "known to the State to cause cancer" in 1992. In addition to cancer, TCEP has also been linked to reproductive toxicity[116,117] and neurotoxicity[118,119,120] based on animal studies. The EU classifies TCEP as a "Substance of Very High Concern" based on reproductive toxicity.[121]
- One of the brominated components of Firemaster® 550, TBPH, is a structural analogue of the phthalate di(2-ethylhexyl) phthalate (DEHP), which is listed under Proposition 65 as known to the state of California to cause cancer and developmental and reproductive toxicity. DEHP's monoester metabolite is the toxicologically active species. Studies in rats showed that TBPH's monoester metabolite also had toxicological activity, affecting thyroid hormone levels in pregnant dams and potentially affecting fetal testes development.[122] This raises concern that ingested TBPH could lead to toxicological effects in people. One epidemiological study found that the amount of TBPH in house dust was positively

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developmental neurotoxicant? Studies in PC 12 cells. *Toxicology and Applied Pharmacology*, 256(3), 281-89. doi: 10.1016/j.taap.2011.01.005.

[116] European Union (2009). *European Union Risk Assessment Report: Tris(2-chloroethyl)phosphate, TCEP. CAS 115-96-8; EINECS 204-118-5. Final Approved Version*. Retrieved March 4, 2015, from http://www.baua.de/en/Chemicals-Act-biocide-procedure/Documents/RAR-068.pdf?__blob=publicationFile&v=1.

[117] Washington State Department of Health (2011). *Children's Safe Products Act Rationale for Chemicals listed under Reporting Requirements*. Retrieved March 4, 2015, from http://www.cj-elec.com/UploadPicFile/20121123141853694.pdf.

[118] European Chemicals Agency (2009). *Support Document for Identification of Tris(2-Chloroethyl)Phosphate as a Substance of Very High Concern Because of its CMR Properties*. Retrieved March 4, 2015, from http://echa.europa.eu/documents/10162/d0f5c171-5086-49c3-a6a3-3a31cb4e08eb.

[119] European Union, *European Union Risk Assessment Report. Tris(2-chloroethyl)phosphate, TCEP*, *supra* note 116.

[120] Minnesota Department of Health (2013). *Toxicological Summary for Tris(2-chloroethyl)phosphate*. Retrieved March 4, 2015, from http://www.health.state.mn.us/divs/eh/risk/guidance/gw/tcep.pdf.

[121] European Chemicals Agency, *Support Document for Identification of Tris(2-Chloroethyl)Phosphate as a Substance of Very High Concern*, *supra* note 118.

[122] Springer, C.; Dere, E.; Hall, S.J.; McDonnell, E.V.; Roberts, S.C.; Butt, C.M.; Stapleton, H.M.; Watkins, D.J.; McClean, M.D.; Webster, T.F.; Schlezinger, J.J.; & Boekelheide, K. (2012). Rodent thyroid, liver, and fetal testis toxicity of the monoester metabolite of bis-(2-ethylhexyl) tetrabromophthalate (TBPH), a novel brominated flame retardant present in indoor dust. *Environmental Health Perspectives*, 120(12), 1711-19. doi: 10.1289/ehp.1204932.

correlated with thyroid hormone levels in men seeking treatment for infertility.[123]

- Tetrabromobisphenol A (TBBPA), which is commonly used in plastic electronics enclosures, inhibited neurotransmitter uptake in rat brain synaptosomes,[124] showed teratogenic effects for frog embryos,[125] and affected thyroid hormone functioning[126] and the reproductive system in experimental animals.[127] A recent cancer bioassay found clear evidence of carcinogenicity in female rats.[128]

- Hexabromocyclododecane (HBCD) caused reproductive effects in experimental animals,[129] interfered with thyroid hormone homeostasis,[130] and inhibited neurotransmitter uptake in rat brain

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[123] Johnson, P.I.; Stapleton, H.M.; Mukherjee, B.; Hauser, R.; & Meeker, J.D. (2013). Associations between brominated flame retardants in house dust and hormone levels in men. *Science of the Total Environment*, 445-446, 177-84. doi: 10.1016/j.scitotenv.2012.12.017.

[124] Mariussen, E., & Fonnum, F. (2003). The effect of brominated flame retardants on neurotransmitter uptake into rat brain synaptosomes and vesicles. *Neurochemistry International*, 43(4-5), 533-42. doi: 10.1016/S0197-0186(03)00044-5.

[125] Shi, H.; Qian, L.; Guo, S.; Zhang, X.; Liu, J.; & Cao, Q. (2010). Teratogenic effects of tetrabromobisphenol A on Xenopus tropicalis embryos. *Comparative Biochemistry and Physiology Part C: Toxicology & Pharmacology*, 152(1), 62-68. doi: 10.1016/j.cbpc.2010.02.013.

[126] Van der Ven, L.T.; Van de Kuil, T.; Verhoef, A.; Verwer, C.M.; Lilienthal, H.; Leonards, P.E.; Schauer, U.M.; Cantón, R.F.; Litens, S.; De Jong, F.H.; Visser, T.J.; Dekant, W.; Stern, N.; Håkansson, H.; Slob, W.; Van den Berg, M.; Vos, J.G.; & Piersma, A.H. (2008). Endocrine effects of tetrabromobisphenol-A (TBBPA) in Wistar rats as tested in a one-generation reproduction study and a subacute toxicity study. *Toxicology*, 245(1-2), 76-89. doi: 10.1016/j.tox.2007.12.009.

[127] Zatecka, E.; Ded, L.; Elzeinova, F.; Kubatova, A.; Margaryan, H.; Dostalova, P.; & Peknicova, J. (2013). Effect of tetrabrombisphenol A on induction of apoptosis in the testes and changes in expression of selected testicular genes in CD1 mice. *Reproductive Toxicology*, 35, 32-39. doi: 10.1016/j.reprotox.2012.05.095.

[128] Dunnick, J.K., et al., National Toxicology Program ("NTP"), National Institutes of Health, Public Health Service, US Department of Health and Human Services (2013). *NTP Technical Report on the Toxicology Studies of Tetrabromobisphenol A (CAS NO. 79-94-7) in F344/NTac Rats and B6C3F1/N Mice and Toxicology and Carcinogenesis Studies of Tetrabromobisphenol A in Wistar Han [Crl:WI(Han)] Rats and B6C3F1/N Mice (Gavage Studies) - NTP TR 587*. Retrieved March 5, 2015, from http://ntp.niehs.nih.gov/ntp/about_ntp/trpanel/2013/october/draft_tr-587.pdf.

[129] Ema, M.; Fujii, S.; Hirata-Koizumi, M.; & Matsumoto, M. (2008). Two-generation reproductive toxicity study of the flame retardant hexabromocyclododecane in rats. *Reproductive Toxicology*, 25(3), 335-51. doi: 10.1016/j.reprotox.2007.12.004.

[130] Darnerud, P.O. (2003). Toxic effects of brominated flame retardants in man and in wildlife. *Environment International*, 29(6), 841-53. doi: 10.1016/S0160-4120(03)00107-7.

synaptosomes.[131] Neonatal exposure to HBCD was found to significantly affect spontaneous behavior, learning and memory in mice.[132,133]

- Tetrabromoethylcyclohexane (TBECH), a flame retardant used in electrical cable coatings and high-impact plastic parts of appliances, is a mutagen[134] and a strong androgen agonist, binding to and activating the human androgen receptor in human liver cells.[135]

- 2,2-bis (bromomethyl) 1,3-propanediol (DBNPG) was found by the NTP to show clear evidence of carcinogenicity in rats and mice of both sexes in two-year cancer bioassays. It is listed as causing cancer under Proposition 65 and classified by the International Agency for Research on Cancer (IARC) as 2B carcinogen (i.e., possibly carcinogenic to humans). A recent review identified DBNPG as a chemical likely to lead to premature ovarian failure in descendants following prenatal exposure based on studies in mice.[136]

- 1,2-bis (2,4,6,-tribromophenoxy) ethane (BTBPE) was found in house dust, with levels positively associated with thyroid hormone levels in men

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[131] Mariussen, E., The effect of brominated flame retardants, *supra* note 124.

[132] Eriksson, P.; Viberg, H.; Fischer, C.; Wallin, M.; & Fredriksson, A. (2002). A comparison on the developmental neurotoxic effects of hexabromocyclododecane, 2,2',4,4',5,5'-hexabromodiphenylether (PBDE 153) and 2,2',4,4',5,5',-hexachlorobiphenylether (PCB 153). *Organohalogen Compounds*, 57, 389-90. See http://www.dioxin20xx.org/pdfs/2002/02-346.pdf.

[133] Eriksson, P.; Fischer, C.; Wallin, M.; Jakobsson, E.; & Fredriksson, A. (2006). Impaired behaviour, learning and memory, in adult mice neonatally exposed to hexabromocyclododecane (HBCDD). *Environmental Toxicology and Pharmacology*, 21, 317-22. doi: 10.1016/j.etap.2005.10.001.

[134] McGregor, D.B.; Brown, A.G.; Howgate, S.; McBride, D.; Riach, C.; Caspary, W.J; & Carver, J.H. (1991). Responses of the L5178Y mouse Lymphoma cell forward mutation assay. V: 27 coded chemicals. *Environmental and Molecular Mutagenesis*, 17(3), 196-219. doi: 10.1002/em.2850170309.

[135] Larsson, A.; Eriksson, L.A.; Andersson, P.L.; Ivarson, P.; & Olsson, P.E. (2006). Identification of the brominated flame retardant 1,2-dibromo-4-(1,2-dibromoethyl)cyclohexane as an androgen agonist. *Journal of Medicinal Chemistry*, 49, 7366-72. doi: 10.1021/jm060713d.

[136] Béranger, R.; Hoffmann, P.; Christin-Maitre, S.; & Bonneterre, V. (2012). Occupational exposures to chemicals as a possible etiology in premature ovarian failure: a critical analysis of the literature. *Reproductive Toxicology*, 33(3), 269-79. doi: 10.1016/j.reprotox.2012.01.002.

recruited through an infertility clinic.[137] Additionally, one of its identified metabolites, 2,4,6-tribromophenol, is a thyroid disruptor.[138,139]

- Tetrabromobisphenol A-bis (2,3-dibromopropylether) (TBBPA-BDBPE) inhibited sulfation of estradiol *in vitro* studies,[140] suggesting that it could also affect normal endocrine activity.

The Statement from Ruthann Rudel and accompanying bibliography and table identify additional studies on health effects of organohalogen flame retardants, including non-PBDE chemicals.

B. Organohalogen Flame Retardants Are Inherently Hazardous Substances and Therefore Should Be Regulated as a Class

Due to their inherent physical, chemical and biological structures and properties, organohalogen flame retardants have the capacity, as a class, to "produce personal injury or illness," and they have the potential, as a class, to cause "substantial personal injury or substantial illness."[141] Thus, as a class, organohalogen flame retardants should be considered and designated as "hazardous substances."

In order to assess the hazards of the class of organohalogen flame retardants, a research group at the University of California, Riverside performed a hazard screen of 83

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[137] Johnson, P.I., Associations between brominated flame, *supra* note 123.

[138] Hamers, T.; Kamstra, J.H.; Sonneveld, E.; Murk, A.J.; Kester, M.H.; Andersson, P.L.; Legler, J.; & Brouwer, A. (2006). *In vitro* profiling of the endocrine-disrupting potency of brominated flame retardants. *Toxicological Sciences*, 92(1), 157-73. doi: 10.1093/toxsci/kfj187.

[139] Suzuki, G.; Takigami, H.; Watanabe, M.; Takahashi, S.; Nose, K.; Asari, M.; & Sakai, S. (2008). Identification of brominated and chlorinated phenols as potential thyroid-disrupting compounds in indoor dusts. *Environmental Science & Technology*, 42(5), 1794-800. doi: 10.1021/es7021895.

[140] Hamers, T., In vitro profiling, *supra* note 138.

[141] 15 U.S.C. § 1261(f)(1)(A) (defining "hazardous substance"); 15 U.S.C. § 1261(g) (defining "toxic").

non-polymeric organohalogen flame retardants, which included all such chemicals that this research group could identify as in use or available for potential use in consumer products in 2012.[142] The hazard screen, which was performed using the Washington State Department of Ecology's Quick Chemical Assessment Tool (QCAT®) methodology,[143] is described in detail in the accompanying statement from Dr. David Eastmond.

The 83 chemicals were screened for nine priority hazard categories (acute mammalian toxicity, carcinogenicity, reproductive toxicity, developmental toxicity, mutagenicity/genetic toxicity, endocrine disruption, acute aquatic toxicity, persistence, and bioaccumulation) and then each chemical was assigned a grade (A, B, C, D, or F). Some hazard data were available for about a third of the organohalogen flame retardants screened; for the others, the researchers employed Structure Activity Relationship (SAR) models. The initial grade results, which were based solely on available data or models and did not include "penalties" for data gaps (missing data), were:

- F for 48 organohalogen flame retardants (58%), meaning that the chemicals are toxic and should not be used**;**
- D for 26 organohalogen flame retardants (31%), meaning that the chemicals are of high concern and should be avoided; and

[142] It is important to note that this study used all organohalogen flame retardants that could be identified as listed in use or potentially in use; the 83 chemicals were not selected on the basis of suspected toxicity.

[143] Eastmond, D.A.; Bhat, V.S.; & Capsel K. (2012). *A Screening Level Assessment of the Health and Environmental Hazards of Organohalogen Flame Retardants*. Collegium Ramazzini, Capri, Italy.

- C for 9 organohalogen flame retardants (11%), meaning that the chemicals raise moderate concern and safer alternatives need to be found.

None of the chemicals studied received initial grades higher than C. To get the final grade, under the QCAT Hazard Assessment Methodology, penalties are assessed for excessive data gaps. In the case of the 83 organohalogen flame retardants, 78 chemicals (94%) received a final grade of F (due to toxicity and/or excessive data gaps), and the remaining five chemicals (6%) received a final grade of D (high concern). In other words, when the data gaps were taken into account, all of the organohalogen flame retardants screened were either of high concern or toxic. Based on these results, Dr. Eastmond concluded that all the organohalogen flame retardants with adequate available data "have the potential to pose significant hazards for human or environmental health."

This conclusion is consistent with determinations made by California Environmental Protection Agency ("CalEPA") as part of the California Environmental Contaminant Biomonitoring Program. Under this program, CalEPA designates chemicals for future biomonitoring studies. "Designated chemicals" are "chemicals that are known to, or strongly suspected of, adversely impacting human health or development, based upon scientific, peer-reviewed animal, human, or in vitro studies."[144] Notably, all members of the chemical group "brominated and chlorinated organic compounds used as flame retardants" – in other words, organohalogen flame retardants – are "designated chemicals," meaning they all are known to, or strongly suspected of,

[144] Cal. Health & Safety Code § 105440(b)(6).

adversely impacting human health or development, based upon scientific, peer-reviewed animal, human, or in vitro studies."[145]

This conclusion is further supported by the accompanying statements of Dr. Epel, Dr. Collins, and Dr. Halden. Dr. Epel presents strong empirical evidence that their physical, chemical, and biological properties render the organohalogen flame retardants with low water solubility inherently toxic. They are able to pass into cells easily without being recognized by efflux transporters (the primary line of defense against toxic substances in the cell membranes of all organisms) and, once inside a cell, they are difficult to metabolize, leading to accumulation and potential adverse health effects. Furthermore, preliminary evidence suggests they can inhibit a cell's defense system, and thus exacerbate the harmful effects of other chemicals. Because of their novelty to mammalian cells, even the more water-soluble organohalogen flame retardants may also bypass the cell's defenses. Indeed, there are no naturally occurring chemicals in mammals that contain bromine or chlorine bonded to carbon, which is found in all organohalogen flame retardants.

Dr. Collins' statement explains how organohalogen flame retardants can modify a cell's DNA or disrupt its function, which can lead to cancer and/or epigenetic effects. In addition, some are known to have the potential to disrupt hormone action, which can cause adverse human health effects, even at very low levels of exposure.

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[145] See Biomonitoring California (2014). Designated Chemicals, October 2014. Retrieved March 3, 2015, from http://biomonitoring.ca.gov/sites/default/files/downloads/DesignatedChemicalList_October2014.pdf.

Dr. Rolf Halden's statement further describes, the evidence that all organohalogen flame retardants have the potential to cause significant adverse health effects and should be regulated as a class.

C. Organohalogen Flame Retardants Also Warrant Regulation as a Class Because Hazardous Combustion Products from Products Containing these Chemicals Can Result in Significant Short- and Long-Term Health Impacts

The presence of organohalogen flame retardants also poses risks to consumers if the product in which they are used burns. Flame retardants can delay ignition, but do not prevent it. Products containing flame retardants will burn after seconds to minutes when exposed to a heat source. As explained in the accompanying statement from Dr. Don Lucas, when products containing organohalogen flame retardants burn, the combustion produces poisonous gases such as hydrochloric acid, hydrobromic acid, and phosgene, along with increased amounts of carbon monoxide and hydrogen cyanide relative to products that do not contain these chemicals. Inhalation of such toxic gases and carbon monoxide is the main cause for fire deaths and injuries during fires.[146] The presence of these flame retardants in products that burn can also increase the amount of smoke and soot, which hinders escape from fire.[147] Therefore, the addition of halogenated flame retardants to furniture and other products can actually result in an increased likelihood of injury or death during a home fire due to increased levels of

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[146] Hall Jr., J.R., National Fire Protection Association (2011). *Fatal Effects of Fire*. Retrieved March 3, 2015 from http://www.nfpa.org/research/reports-and-statistics/demographics-and-victim-patterns/fatal-effects-of-fire.

[147] *Id*.

carbon monoxide, soot and other toxic combustion products. Not only does this endanger individuals inside the burning home, it increases risks for first responders.

Furthermore, when products containing organohalogen flame retardants burn, brominated and chlorinated dioxins and furans can be formed.[148] Dioxins and furans are known carcinogens,[149] immune suppressors, and endocrine disruptors,[150] and chlorinated dioxins and furans are carcinogenic and listed as unintentional persistent organic pollutants under the Stockholm Convention.[151] This is discussed in more detail in Dr. Roland Weber's accompanying statement.

Firefighters, who are routinely exposed on the job to the byproducts of burning consumer products, have disproportionately high levels of four cancers associated with dioxin exposure – testicular cancer, melanoma, brain cancer, and esophageal cancer.[152,153] The International Association of Fire Fighters (IAFF) recognizes the

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[148] Ebert, J. & Bahadir, M. (2003). Formation of PBDD/F from flame-retarded plastic materials under thermal stress. *Environment International*, 29(6), 711-16. doi: 10.1016/S0160-4120(03)00117-X.

[149] IARC (2015). *Agents Classified by the IARC Monographs, Volumes 1–112*. Retrieved March 4, 2015, from http://monographs.iarc.fr/ENG/Classification/ClassificationsGroupOrder.pdf.

[150] Pohl, H.; Llados, F.; Ingerman, L.; Cunningham, P.; Raymer, J.; Wall, C.; & Gasiewicz, T. (1998). Toxicological profile for chlorinated dibenzo-p-dioxins. Retrieved March 3, 2015, from http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=366&tid=63.

[151] United Nations Environment Programme. The 12 initial POPs under the Stockholm Convention. Retrieved March 5, 2015, from http://chm.pops.int/TheConvention/ThePOPs/The12InitialPOPs/tabid/296/Default.aspx.

[152] LeMasters, G.K.; Genaidy, A.M.; Succop, P.; Deddens, J.; Sobeih, T.; Barriera-Viruet, H.; Dunning, K.; & Lockey, J. (2006). Cancer risk among firefighters: a review and meta-analysis of 32 studies. *Journal of Occupational and Environmental Medicine*, 48(11), 1189-202. doi: 10.1097/01.jom.0000246229.68697.90.

[153] Bates, M.N. (2007). Registry-based case-control study of cancer in California firefighters. *American Journal of Industrial Medicine*, 50(5), 339-44. doi: 10.1002/ajim.20446.

likelihood of an association between these high cancer rates and the presence of flame retardant chemicals in household products and resolves to “work to ensure that the use of carcinogenic flame retardants and other toxic chemicals are eliminated and safer alternatives or methods are pursued . . . .”[154] The impact of flame retardants in consumer products on firefighters’ health is reviewed in the accompanying statement from Sharyle Patton.

The fact that the smoke from flame-retardant-treated products is more toxic than the smoke from un-treated products is a factor the CPSC must consider when it evaluates the toxicity of products containing organohalogen flame retardants.

Moreover, the concern about formation of furans and dioxins from the breakdown of organohalogen flame retardants may not be limited to firefighters. At least one study has found that the presence of additive brominated flame retardants such as decaBDE in plastic electronics casings can lead to the formation of brominated furans simply from exposure to sunlight during normal use.[155]

D. Organohalogen Flame Retardants in the Four Product Categories at Issue Here Need Not Be Replaced With Other Chemical Alternatives

The fact that organohalogen flame retardants are the focus of this Petition does not mean that Petitioners endorse their replacement with halogen-free organophosphate flame retardants. Non-halogenated organophosphate flame

[154] IAFF, Resolution No. 34, *supra* note 5.

[155] Kajiwara, N.; Noma, Y.; & Takigami, H. (2008). Photolysis studies of technical decabromodiphenyl ether (DecaBDE) and ethane (DeBDethane) in plastics under natural sunlight. *Environmental Science and Technology*, 42 (12), 4404-09. doi: 10.1021/es800060j.

retardants are also semi-volatile and, when used in additive form, migrate out of consumer products. They have already been detected in house dust, at levels often higher than those of PBDEs,[156,157] as well as in sediment, sewage sludge, and wildlife.[158,159] Several non-halogenated organophosphate flame retardants have also been detected on hand wipes rubbed on children's skin,[160] in human blood,[161] in the urine of pregnant women,[162] and in breast milk.[163] Blood levels in children tend to be higher than in their mothers who would have been in many of the same places as their children.[164]

Growing evidence suggests potential health concerns from exposures to non-halogenated organophosphate flame retardants. For instance, the non-halogenated

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[156] Van der Veen, I., & de Boer, J. (2012). Phosphorus flame retardants: Properties, production, environmental occurrence, toxicity and analysis. *Chemosphere*, 88(10), 1119-53. doi: 10.1016/j.chemosphere.2012.03.067.

[157] Stapleton, H.M., Detection of organophosphate flame retardants, *supra* note 81.

[158] Van der Veen, I., Phosphorus flame retardants, *supra* note 156.

[159] Sundkvist, A.M.; Olofsson, U.; & Haglund, P. (2010). Organophosphorus flame retardants and plasticizers in marine and fresh water biota and in human milk. *Journal of Environmental Monitoring*, 12(4), 943-51. doi: 10.1039/b921910b.

[160] Stapleton, H.M.; Misenheimer, J.; Hoffman, K.; & Webster, T.F. (2014). Flame retardant associations between children's handwipes and house dust. *Chemosphere*, 116, 54-60. doi: 10.1016/j.chemosphere.2013.12.100.

[161] Jonsson, O.B.; Dyremark, E.; & Nilsson, U.L. (2001). Development of a microporous membrane liquid-liquid extractor for organophosphate esters in human blood plasma: identification of triphenyl phosphate and octyl diphenyl phosphate in donor plasma. *Journal of Chromatography B: Biomedical Sciences and Applications*, 755(1-2): 157-64. doi: 10.1016/S0378-4347(01)00055-X.

[162] Hoffman, K.; Daniels, J.L.; & Stapleton, H.M. (2014). Urinary metabolites of organophosphate flame retardants and their variability in pregnant women. *Environment International*, 63, 169-72. doi: 10.1016/j.envint.2013.11.013.

[163] Sundkvist, A.M., Organophosphorus flame retardants and plasticizers, *supra* note 159.

[164] Butt, C.M., Metabolites of organophosphate flame retardants, *supra* note 104.

organophosphate components of Firemaster® 550 affect development and cause heart defects in zebrafish.[165] Higher dust levels of the Firemaster® 550 component triphenyl phosphate (TPhP) were associated with hormone changes and decreased sperm counts in men.[166] A recent study also found evidence that TPhP may act as an obesogen,[167] and another in vitro study found that it has the potential to disrupt metabolism and act as a cytotoxicant.[168] In a recent study on reporter gene assays, TPhP and tricrecyl phosphate (TCP) showed estrogen receptor agonistic activity; tributyl phosphate (TBP), TPhP and TCP showed androgen receptor antagonistic activity; and TBP, tris (2-ethylhexyl) phosphate (TEHP), tris (2-butoxyethyl) phosphate (TBEP), TPhP and TCP displayed pregnane X receptor agonistic activity.[169] This indicates that some organophosphate flame retardants are potential endocrine disruptors.

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[165] McGee, S.P.; Konstantinov, A.; Stapleton, H.M.; & Volz, D.C. (2013). Aryl phosphate esters within a major PentaBDE replacement product induce cardiotoxicity in developing zebrafish embryos: potential role of the aryl hydrocarbon receptor. *Toxicological Sciences*, 133(1), 144-56. doi: 10.1093/toxsci/kft020.

[166] Meeker, J.D., House dust concentrations of organophosphate flame retardants, *supra* note 19.

[167] Pillai, H.K.; Fang, M.; Beglov, D.; Kozakov, D.; Vajda, S.; Stapleton, H.M.; Webster, T.F.; & Schlezinger, J.J. (2014). Ligand binding and activation of PPARγ by Firemaster® 550: Effects on Adipogenesis and Osteogenesis *in Vitro*. *Environmental Health Perspectives*, 122(11), 1225-32. doi: 10.1289/ehp.1408111.

[168] Belcher, S.M.; Cookman, C.J.; Patisaul, H.B.; & Stapleton, H.M. (2014). In vitro assessment of human nuclear hormone receptor activity and cytotoxicity of the flame retardant mixture FM 550 and its triarylphosphate and brominated components. *Toxicology Letters*, 228(2), 93-102. doi: 10.1016/j.toxlet.2014.04.017.

[169] Kojima, H.; Takeuchi, S.; Itoh, T.; Iida, M.; Kobayashi, S.; & Yoshida, T. (2013). In vitro endocrine disruption potential of organophosphate flame retardants via human nuclear receptors. *Toxicology*, 314(1), 76-83. doi: 10.1016/j.tox.2013.09.004.

Organohalogen flame retardants are the focus of this petition because they are more pervasive and well studied. Non-halogenated organophosphate flame retardants have not been as extensively studied yet, however more research is underway. Aromatic phosphate flame retardants were nominated by the CPSC for investigation by the NTP due to their structural similarities to known toxicants and the high risk of exposure to children.[170] Non-halogenated aromatic phosphates are also on the Designated Chemicals list for the California Environmental Contaminant Biomonitoring Program.[171]

Accordingly, we ask CPSC not to adopt any regulation that would have the effect of increasing the use of non-halogenated phosphate-based flame retardants.

IX. We Urge CPSC to Fill the Regulatory Gap That Puts Consumers at Risk

Despite the widespread and growing recognition that use of organohalogen flame retardants in several categories of consumer products poses genuine – and avoidable – health risks, no federal regulations protect consumers from these toxic products.

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[170] CPSC Staff (2005). Nomination of FR chemicals for NTP testing. Retrieved March 5, 2015 from http://ntp.niehs.nih.gov/ntp/htdocs/chem_background/exsumpdf/cpscfrsnomination_supp_062_508.pdf.

[171] *See* Biomonitoring California (2014). Designated Chemicals, June 2014. Retrieved March 3, 2015 from http://biomonitoring.ca.gov/sites/default/files/downloads/DesignatedChemicalsList_June2014.pdf. California Health and Safety Code section 105440 defines "designated chemicals" as "those chemicals that are known to, or strongly suspected of, adversely impacting human health or development, based upon scientific, peer-reviewed animal, human, or in vitro studies . . . ." Cal. Health & Safety Code § 105440(b)(6).

Although several states prohibit the manufacture of products containing PBDEs[172] and the manufacture of PBDEs in the U.S. has been "voluntarily" phased out, no federal law or regulation prohibits the *use* of PBDEs in consumer products.[173] Moreover, PBDEs are still being produced in other countries such as China, yet no federal law or regulation prohibits the import of consumer products containing PBDEs that are manufactured outside of the United States.[174] Without action by the CPSC, imported chairs, sofas and juvenile products containing PBDEs can still be sold in this country, despite the clearly documented health risks.

Legislatures and regulatory bodies around the globe have started to restrict the use of organohalogen flame retardants used as PBDE replacements. For instance, TDCPP and TCEP are banned in children's products and/or furniture in Maryland, New York and Vermont,[175] and regulated under California's Proposition 65 as known

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[172] *See* note 14, *supra*.

[173] PentaBDE and octaBDE are listed as Persistent Organic Pollutants (POPs) in Annex A of the Stockholm Convention, requiring elimination of their production and use by parties to the Convention. United Nations Environment Programme. *Convention on Persistent Organic Pollutants (Stockholm Convention), as amended in 2009*. Retrieved March 9, 2015, from http://chm.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx. The U.S. is not a party to the Convention.

[174] EPA proposed a Significant New Use Rule under the Toxic Substances Control Act for certain PBDEs, which would require notice to EPA before articles containing PBDEs could be imported. Certain Polybrominated Diphenylethers; Significant New Use Rule and Test Rule, 77 Fed. Reg. 19,862 (proposed April 2, 2012). It is unclear if the Proposed Rule will be finalized.

[175] *E.g.*, Md. Code Ann., Health-Gen. § 24-306 (banning TCEP and TDCPP in child care products); N.Y. Envtl. Conserv. Law § 37-0701, et seq. (banning TCEP and TDCPP in child care products); Vt. Stat. Ann. tit. 9, § 2974 (banning TCEP and TDCPP in residential upholstered furniture and children's products); *see generally* Safer States Bill Tracker, available at: http://www.saferstates.com/bill-tracker/.

carcinogens.[176] TCEP is also included on Maine's and Minnesota's lists of "Chemicals of High Concern,"[177,178] and on Washington's list of "Chemicals of High Concern to Children."[179] Three flame retardant chemicals —TCEP, TCPP, and TDCPP — are banned in the European Union (EU) above trace amounts in toys intended for use by children younger than 3 years old due to the risk of adverse health effects from these chemicals.[180] However, no federal law or regulation prevents the use of any organohalogen flame retardant in any consumer products sold nationally, and there is overwhelming evidence that their use is pervasive.[181]

To protect human health from the prenatal stage forward, we urge CPSC to regulate the four product categories described in this petition when they contain *any* organohalogen flame retardant – just as it broadly regulates small parts in toys and, as Commissioner Moore suggested, it should regulate all chemical drain openers.

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[176] OEHHA, *Chemicals Known to the State to Cause Cancer or Reproductive Toxicity*, *supra* note 18.

[177] Maine Department of Environmental Protection. *Chemicals of High Concern*. Retrieved March 3, 2015, from http://www.maine.gov/dep/safechem/highconcern/.

[178] Minnesota Department of Health (2013). *Toxic Free Kids Act: Chemicals of High Concern*. Retrieved March 4, 2015, from http://www.health.state.mn.us/divs/eh/hazardous/topics/toxfreekids/highconcern.html.

[179] Department of Ecology, State of Washington. *Children's Safe Products Act: The Reporting List of Chemicals of High Concern to Children (CHCC)*. Retrieved March 4, 2015, from http://www.ecy.wa.gov/programs/swfa/cspa/chcc.html.

[180] European Commission Directive D029354/03, amending Appendix C of Annex II to Directive 2009/48/EC of the European Parliament and of the Council on the safety of toys, as regards TCEP, TCPP and TDCP. Retrieved March 4, 2015, from http://ec.europa.eu/transparency/regcomitology/index.cfm?do=Search.getPDF&zEhJKHDiw8RP6FEoZ1GKtqDbby3gYP7DoFPCzj0pZY65SVAw47eF02NzJJLXFBE77kGvLzo2Pu5uyjPyPE0HGhn1Yyu8a5hceFqN5ixnqYI=.

[181] *See* Section VI, *infra*.

X. Labeling Will Not Protect Human Health

The FHSA empowers the CPSC to ban "hazardous substances" in products if "notwithstanding [any] cautionary labeling . . . the degree or nature of the hazard involved in the presence or use of such substance in households is such that the objective of the protection of the public health and safety can be adequately served only by keeping such substance, when … intended or packaged [for use in the household], out of the channels of interstate commerce." In this circumstance, the CPSC may declare the substance to be a "banned hazardous substance."[182] Children's products containing "hazardous substances" are automatically "banned hazardous substances," irrespective of labeling.[183]

The consumer products at issue in this Petition meet the definition of "banned hazardous substances" when they contain any chemical in the organohalogen flame retardant class because labeling is not an adequate means of protecting public health. The knowledge that toxic chemicals migrate out of furniture, juvenile products, mattresses, mattress pads, and the casings of electronics and attach to house dust does not enable consumers to take protective action. The CPSC should not assume that consumers can vacuum and wipe up all of the dust contaminated with organohalogen

[182] 15 U.S.C. § 1261(q)(1)(B). The CPSC has promulgated regulations finding a variety of chemical substances to be "banned hazardous substances" under the FHSA, including: mixtures that are intended for application to interior masonry walls as a water repellant treatment and that are "extremely flammable"; carbon tetrachloride and mixtures containing it; liquid drain cleaners containing 10 percent or more by weight of sodium and/or potassium hydroxide; products containing soluble cyanide salts; and paint containing lead over a certain level. 16 C.F.R. § 1500.17.

[183] 15 U.S.C. § 1261(q)(1)(A).

flame retardants that is present in the average U.S. household. The only way to protect consumers from the genuine risks posed by these hazardous substances is to declare all products in the four specified categories to be "banned hazardous substances" if they contain any chemical in the organohalogen flame retardant class.

XI. Conclusion

In sum, to the extent that their health effects have been studied, specific organohalogen flame retardants have been found to present unacceptable risks and have often been discontinued. Compelling evidence shows that this class of chemicals is inherently toxic. And experience shows that, as studies reveal the risks of existing flame retardants, manufacturers will continue to replace them with others that are not well studied, leaving consumers as victims of an endless game of toxic "whack-a-mole." Given the evidence that organohalogen flame retardants migrate from products and are absorbed by humans, and that these exposures – especially during the earliest stages of human life – are associated with serious adverse health impacts, we petition the CPSC to regulate additive organohalogen flame retardants as a class in the four consumer product categories discussed above.

Dated: March 31, 2015

Respectfully submitted,

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Rachel Weintraub, Consumer Federation of America

On behalf of

American Academy of Pediatrics
American Medical Women's Association
Consumer Federation of America
Consumers Union
Green Science Policy Institute
International Association of Fire Fighters
Kids in Danger
Philip J. Landrigan, M.D., M.P.H.
League of United Latin American Citizens
Learning Disabilities Association of American
National Hispanic Medical Association
Worksafe

FLAME RETARDANTS REFERENCED IN THIS PETITION

Chemical	*Abbreviation*
1,2-bis (2,4,6,-tribromphenoxy) ethane	BTBPE
2,2',4,4',5,5'-hexabromobiphenyl (Firemaster® BP-6)	BB 153
2,2-bis (bromomethyl) 1,3-propanediol	DBNPG
2,3,4,5-tetrabromobenzoic acid	TBBA
2-ethylhexyl 2,3,4,5-tetrabromobenzoate	TBB
Bis (2-ethylhexyl) 3,4,5,6-tetrabromophthalate	TBPH
Decabromodiphenyl ethane	DBDPE
Decabromodiphenyl ether	decaBDE
Di(2-ethylhexyl) phthalate	DEHP
Hexabromocyclododecane	HBCD
Octabromodiphenyl ether	octaBDE
Pentabromodiphenyl ether	pentaBDE
Polybrominated diphenyl ether	PBDE
Tetrabromobisphenol A	TBBPA
Tetrabromobisphenol A-bis (2,3-dibromopropylether)	TBBPA-BDBPE
Tetrabromoethylcyclohexane	TBECH
Tributyl phosphate	TBP
Tricrecyl phosphate	TCP
Triphenyl phosphate	TPhP
Tris (1-chloro-2propyl) phosphate	TCPP
Tris (1,3-dichloro-2-propyl) phosphate ("chlorinated tris")	TDCPP
Tris (2-butoxyethyl) phosphate	TBEP
Tris (2-chloroethyl) phosphate	TCEP
Tris (2-ethylhexyl) phosphate	TEHP
Tris (2,3-dibromopropyl) phosphate	TDBPP