SILENT SPRING INSTITUTE

RESEARCHING THE ENVIRONMENT AND WOMEN'S HEALTH

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I, Ruthann Rudel, am writing this statement to provide information relevant to the Petition to the CPSC to regulate four categories of household products containing non-polymeric additive organohalogen flame retardants.

1. I, Ruthann Rudel, am Director of Research at the Silent Spring Institute, and Adjunct Research Associate in the Brown University Department of Pathology and Laboratory Medicine. I have a B.A. in chemistry and neuroscience from Oberlin College, and an M.S. in environmental management and policy from Tufts University. I have served on the US National Toxicology Program Board of Scientific Counselors and the Regulatory Affairs and Legislative Assistance Committee of the Society of Toxicology, and have participated in numerous environmental regulatory reviews for the US EPA, Health Canada, Toxicology Excellence for Risk Assessment, and others. I have attached my CV and list of publications.

2. For almost 20 years, I have been co-leading Silent Spring Institute's exposure and toxicology research programs focusing on endocrine active chemicals and on the mechanisms by which chemicals may influence breast cancer risk. I also direct Silent Spring Institute's Household Exposure Study, which was described by Environmental Science & Technology as the "most comprehensive analysis to date" of exposures in homes. I have expanded the initial study to include indoor and outdoor air, house dust, urine, blood, and self-reported exposure data from 170 participants in California and Massachusetts, leading to over 30 highly-cited peer-reviewed exposure-related papers.

3. Our 2003 Household Exposure Study was the first to test US homes for the flame retardant PentaBDE (a commercial mixture of polybrominated diphenyl ethers (PBDE)), which was then used as flame retardant in furniture foam. We found that levels of PBDEs in US homes were ten times higher than in Europe. In 2006, we discovered that, due to unique furniture flammability standards, exposures to PentaBDE congeners (BDE 47, 99 and 100) were 4 to 10 times higher in California than in the rest of the US, and two orders of magnitude higher than in Germany and the UK. Californians also had nearly twice as high blood levels of PBDEs (sum of BDE-28, -47, -99, -100, -153, and -154 congeners) compared to other US residents[1]. These results show that flammability standards influence exposures and risks[2].

5. In 2011, we tested again the same 16 California homes from the 2006 study, to understand exposure to a wider range of flame retardants. This time we screened for 49 flame retardants (organohalogens and organophosphates), chosen due to evidence for their widespread use and potential harmful health effects.

6. We found that the current levels of exposure to the organohalogen flame retardants are often above health based guidelines[3]. House dust concentrations of six chemicals, including the carcinogens TCEP (Tris (2-chloroethyl) phosphate) and TDCPP (chlorinated "Tris"), were higher than EPA health risk guidelines in at least one home, and levels in 13 of 16 homes exceeded at least one health guideline level. TCEP and TDCPP (both listed as carcinogens under California's Proposition 65) were found at levels of up to 0.01% in dust, higher than previously reported in the US. Our study was also the first to detect TDBPP (brominated "Tris") in house dust, in 75% of the homes studied.

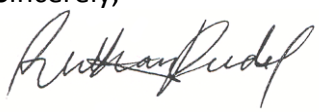
7. Our 2011 study also showed that exposure to flame retardants from house dust had changed since 2006, after the phase out of PentaBDE and OctaBDE. PentaBDE levels decreased in homes that added new furniture, electronics, and flooring. Similarly, households that reported purchasing new electronics had lower levels of TBBPA in 2011 compared to 2006. Instead, households that added new furniture and other flame retardant products between 2006 and 2011 had higher levels of tris(1-chloro-2-propyl) phosphate (TCPP), suggesting its use as PentaBDE replacement[4].

8. Our 2003, 2006 and 2011 study results prove that, if added to consumer products in additive form (i.e. not chemically-bound to the material), organohalogen flame retardant chemicals migrate out of products and get into dust. This house dust is thought to be a major source of flame retardants in people's bodies, especially in children[5].

9. In particular, I wish to point out that our 2011 study indicated that banning individual flame retardants is ineffective because manufacturers tend to replace them with other chemicals with similar structures and hazards, including chemicals with uncharacterized toxicity. Some of the chemicals found in homes at the highest levels are carcinogenic, and are structurally similar to banned chemicals. Many of the chemicals detected in households show evidence of hormone disruption. The attached table from the Silent Spring study by Dodson et al. (2012)[6] summarizes the known health concerns and the data gaps for some of the high production volume flame retardants we found in homes.

10. Based on these findings, my professional opinion is that, in order to reduce people's exposure to hazardous chemicals in homes, it is best to use inherently non-flammable materials or smolder-resistant flammable materials. Continued use of non-polymeric additive organohalogen flame retardants would lead to continued exposure and may cause adverse health effects, particularly to vulnerable populations.

Sincerely,



Ruthann Rudel, MS
Director of Research, Silent Spring Institute

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[1] 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? *Environ. Sci. Technol. Lett.* 42(21):8158-64. doi: 10.1021/es801792z.

[2] Dodson R.E., Perovich L.J., Covaci A., den Eede N.V., 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. *Environ. Sci. Technol.* 46(24):13056-66. doi: 10.1021/es303879n.

[3] Dodson R.E., BFR 2013.

[4] Dodson R.E., Perovich L.J., Covaci A., den Eede N.V., 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. *Environ. Sci. Technol.* 46(24):13056-66. doi: 10.1021/es303879n.

[5] Lorber M. (2008). Exposure of Americans to polybrominated diphenyl ethers. *J Expos Sci Environ Epidem* 18(1):2–19. doi: 10.1038/sj.jes.7500572.

[6] Dodson R.E., Perovich L.J., Covaci A., den Eede N.V., Ionas A.C., Dirtu A.C., Brody J.G., Rudel R.A. Supporting Information for: After the PBDE phase-out: A broad suite of flame retardants in repeat house dust samples from California. *Environ. Sci. Technol.* 46(24):13056-66. doi: 10.1021/es303879n.