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Experts Fear Flame Retardants Are Triggering a Health Crisis

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STORY AT-A-GLANCE

- After one class of fire retardants was banned, another equally dangerous class was added to consumer products; both are associated with a reduction in IQ as well as fertility issues and a potential increased risk of diabetes
- One research team refers to it as a "regrettable substitution" and calls for safety evaluation of chemicals based on class
- Fire retardants, which are regulated, are found in car seats, infant mattresses and fabric blinds, yet the EPA phased out one class due to evidence of liver, thyroid and neurodevelopmental toxicity in children
- A team of scientists is concerned that manufacturers are programming children for diabetes, finding that one class of fire retardants permanently alters liver function and increases insulin resistance
- Help reduce your exposure by washing your hands before eating, using a vacuum with a HEPA filter, dusting with a damp cloth and seeking products without flame retardants

As discussed in this short video by Green Science Policy Institute, flame retardants are one of the six classes or families of chemicals that are found in consumer products and negatively affect health. The classes of concern include highly fluorinated products, antimicrobials, bisphenols and phthalates, some solvents, specific metals and flame retardants.

One simple and effective way to reduce your exposure is to practice regular hand-washing. According to the Environmental Protection Agency, you can reduce your child's exposure to flame retardant chemicals using simple hand-washing techniques. The chemicals are added to several consumer products with the intent to make them less prone to burn and to burn more slowly if and when they do.

Unfortunately, while the intent is good, the chemicals are ineffective. Additionally, they create a health burden as they leach from products and land in household dust. The EPA advises parents to have their children wash their hands frequently to reduce the health risks that are associated with exposure.

Until 2004,[1] the primary flame retarded chemicals were from a family of polybrominated diphenyl ethers (PBDEs), consisting of 209 possible brominated substances. By 2013, octaBDEs, used for business equipment made of plastic, were voluntarily withdrawn. Since this class of chemicals has a low water solubility it typically binds to sediment, such as soil and dust.

The replacement flame retardants, namely organophosphorus compounds, appear to have some of the same health risks and behave in much the same way in the environment as the predecessor class of PBDEs.[2] This new class of fire retardants was first found in surface sediment from the Pacific to the Arctic oceans in 2010.[3]

This May Be a Regrettable Substitution

PBDEs were phased out as the EPA[4] expressed a growing concern over the ability of the chemicals to bioaccumulate and persist in the environment. As traces were found in human blood and breastmilk, and evidence mounted the chemicals triggered liver, thyroid and neurodevelopmental toxicity, the EPA issued a rule regulating the phase-out of two of the most common PBDEs.

In a meta-analysis study published in Environmental Science and Technology Letters,[5] researchers posed the question of whether the use of organophosphate ester flame retardants (OPFRs), the replacement for PBDEs, was a better choice.

They compared OPFRs with PBDEs across a range of properties with regard to the interaction in the environment and evidence of levels measured indoors, among the general population and evidence of adverse health effects. They found the OPFRs are in the environment at higher concentration than PBDEs.[6]

Compounding the impact of OPFRs is the bioaccumulation and poor degradation of PBDEs in the environment. The researchers wrote:[7]

> *"The time has come for manufacturers, with the help of the scientific community, to stop moving from the use of one family of harmful chemicals to the next and to instead find innovative ways to reduce both fire hazard and the use of hazardous chemicals."*

Based on the number of dangerous flame retardants currently in use and those remaining in the environment, both indoors and outside, the researchers are calling for evaluation of chemicals based on classification and not on an individual basis.[8] They concluded:

> *"Here we have shown that, as with PBDEs in the past, OPFRs are now being used in large volumes, are sufficiently persistent to be detected globally, present health hazards, and may cause harm to humans, especially children, at current exposure levels. Given the large number of OPFRs on the market, obtaining the level of evidence a government often requires to regulate each compound would prove to be expensive and lengthy."*

Exposure Described as 'Ubiquitous'

In a review 100 pure reviewed studies, the scientists found OPFRs are often at levels 10 to 100 times higher in the water, air and dust than were PBDEs. Additionally, they were also found in nearly every person who participated in research studies.

In several studies data showed they were at levels high enough to negatively affect healthy brain development in children and fertility in adults. It was expected OPFRs would be less persistent then PBDEs in the environment. However, predicting their

presence is difficult to measure based on the compounds' physical and chemical properties.

OPFRs do have a higher vapor pressure and shorter half-life, which led experts to believe they would travel shorter distances and have lower concentrations in the environment. However, they are more soluble and can persist in water. Multiple measurements throughout the world have demonstrated concentrations higher than PBDEs from urban areas to remote areas of the North and South poles.

Measurements have also confirmed an abundance of OPFRs in locations not explained by local release. In addition to the burden on the environment, the researchers found evidence of high exposure to OPFRs as compared to PBDEs that appeared to originate from indoor air, food and house dust.

OPFRs are heavily used in the electronic industry and are detected at higher levels in indoor air. They are also used in consumer and construction plastics. Using OPFRs was identified by the researchers as a "regrettable substitution," or a replacement that lacked sufficient toxicity testing for a chemical being phased out as a known hazardous material.[9]

> *"Regrettable substitution occurs because of the difficulty of changing industrial processes and a lack of toxicological information, causing manufacturers to replace a phased-out chemical with a "drop in" substitute chemical that has a similar structure, function, and potential for harm."*

Are We Programming the Next Generation for Diabetes?

Although PBDEs are no longer used in manufactured products, those added to consumer products before 2013 are still in use and continue to affect your health. A recently published study[10] at the University of Massachusetts-Amherst found perinatal exposure to common flame retardants in permanently reprogramed liver metabolism in a study involving rats.

The researchers found this led to an increased risk of insulin resistance and nonalcoholic fatty liver disease as the mice matured. The team identified a potential mechanism responsible for the effect. They determined the epigenome, or heritable changes in gene expression, was altered with exposure to PBDEs through the umbilical cord and breast milk.

In the study, the females were fed PBDEs to mimic concentrations similar to those found in humans living in urban areas. While the pups were never directly exposed, the researchers found it altered the function of their liver throughout their lifetime. One researcher wrote:

> *"Normally when you remove the stressor, the organ will recover. But in this case, it's not recovering. Epigenetic changes can persist in a row of cellular divisions and can even propagate through generations."*

Based on their findings, the team garnered funding from the National Institute of Environmental Health Sciences to test their hypothesis in humans. They believe this may link exposure from flame retardants present in products used from birth through adulthood to an increased risk of diabetes and heart disease.

Although this particular classification of flame retardants is no longer being used in the industry, researchers have found the bioaccumulation and concentration is increasing in human tissue. It may be another 50 years before this exposure begins to decrease.

In the new study the team will use samples from a prospective cohort designed to investigate toxicity in children. Following the same individuals over time they hope to establish a link between exposure levels and changes in liver metabolism. They hypothesize this exposure leads to higher triglycerides during childhood and express a concern for the future health of children.

Potential Health Risks Rise With Exposure

As Green Science Policy Institute discussed in the video, the chemicals are added to meet flammability regulations, but have made the situation worse as they don't retard

fire and leach from the products into your home and air.

If they were effective, firefighters would be the strongest supporters, but instead are fighting to reduce exposure and impose a ban on all fire retardants.[11] The toxic fumes during a fire place the first responders at greater risk of health conditions, including cancer.

The chemicals are known to attach to dust particles. When these particles stick to your hands you can accidently ingest them, they may land in your food or be picked up and consumed by small children and pets. As mentioned in the video, the health cost associated with just one flame retardant, PentaBDE was estimated at $209 billion. Some of the common products flame retardants are found in are:

Car seats	Paints	Wire and cable coating
Carpet padding	Building insulation	Textiles
Infant mattresses	Television cases	Fabric blinds

Risks Increase With Higher Exposure

In other words, they are in nearly every home on the planet. The team of researchers from the featured study looked at epidemiological evidence for both PBDEs and OPFRs. Well-established scientific evidence demonstrates PBDEs are linked to neurodevelopmental issues.

In several in vitro evaluations, OPFRs and PBDEs “appear to have comparable developmental and neurodevelopmental toxicity potential” in processes crucial to neurodevelopment.

Reduce Your Exposure to Flame Retardant Chemicals

Fire retardant chemicals are also found in drinking water and local bodies of water. It is important to seek to reduce your exposure. Consider the options listed below:

- When purchasing items, ask if there is an option without flame retardants.
- Look for upholstered furniture with a TB117-2013 label stating the piece doesn't contain flame retardants
- To reduce your exposure, clean and dust with a damp cloth to trap the dust, use a vacuum with a hepa filter and wash your hands, especially before eating
- Avoid purchasing rebonded carpet padding unless sure it doesn't contain flame retardants
- When possible, purchase products without flame retardants

Sources and References

- [1] Agency for Toxic Substances and Disease Registry, March 2017, Page 1 last para; page 2 para 2
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- [4] Environmental Protection Agency, Polybrominated diphenylethers (PBDEs) Significant New Use Rules (SNUR), Why was this important?
- [5] Environmental Science and Technology Letters, 2019;6(11):638
- [6] Gizmodo, October 22, 2019, para 2
- [7] Environmental Science and Technology Letters, 2019;6(11):638 Looking forward last para
- [8] Science Daily, October 22, 2019 last paras
- [9] Environmental Science and Technology Letters, 2019;6(11):638 first para below table 1 in intro
- [10] University of Massachusetts Amherst, December 13, 2019
- [11] MPR News, May 23, 2019