Flame Retardant Chemicals and Public Health: Fire Safety Without Harm

Arlene Blum PhD

www.GreenSciencePolicy.org
The Arctic Paradox

Upon learning Nunavik is the place most exposed to PCBs, Cone wrote:

“How could the Arctic, seemingly untouched by contemporary ills, ......so natural, be home to the most contaminated people on the planet?

I had stumbled on what is perhaps the greatest environmental injustice on earth.”
The Arctic Paradox

- Birth defects in Alaska are twice as high as in the United States as a whole
- Alaska Native infants have twice the risk of birth defects as white infants born in Alaska
- Could this be related to their high levels of exposures to persistent organic pollutants (POPs)?
U.S. Toxic Substances Control Act, 1976

- 62,000 previous chemicals “grandfathered”

- 20,000 new chemicals
  - 85% have no health data
  - 67% have no data at all

Courtesy: Michael Wilson, Green Chemistry in California: http://coeh.berkeley.edu/news/06_wilson_policy.htm
Atmospheric transport of POPs to polar regions

Carried by wind, waves, and rivers, they migrate from cities of the US, EU, and Russia into the bodies of Arctic animals and people a world away

Silent Snow
“We are conducting a massive clinical toxicological trial, and our children and our children's children are the experimental subjects.”

- Herbert Needleman & Philip Landrigan
Regrettable Substitution

Decabromodiphenyl ether

Concerns:
• Persistence
• Bioaccumulation
• Toxicity

Decabromodiphenyl ethane

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• Persistence
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GREEN SCIENCE POLICY INSTITUTE
www.GreenSciencePolicy.org
One Solution: SixClasses.org

1. Highly fluorinated chemicals
   water and oil repellants, surfactants...

2. Antimicrobials
   triclosan, triclocarban...

3. Flame retardants
   brominated, chlorinated, phosphate

4. Bisphenols and phthalates
   plastic additives...

5. Hydrocarbon solvents
   benzene, methylene chloride...

6. Certain metals
   lead, mercury, chromium, cadmium, arsenic...
SixClasses.org

15-minute webinars on Six Classes containing harmful chemicals in consumer products.
Is it necessary?

Is it worth it?

Is there a safer alternative?
Green Chemistry

Green chemistry is the design of chemical products that reduces the use of hazardous substances.

Courtesy: Dr. Bob Peoples
Class 1: Fluorinated Chemicals (PFAS)

• C-F is one of the strongest bonds in nature
• This results in unique properties:
  • oil and water repellency
  • resistance to breakdown in the environment

Courtesy: Dr. Jennifer Field
Fluorochemicals are used in:
Found globally due to their mobility and long half lives (e.g. >2000 years for C8 or PFOA)
Some perfluorinated chemicals are harmful. However, this is not well known.
PFOS and PFOA persist in the body for years. Health effects linked to exposure to PFOA:

- Kidney, prostate, ovarian, and testicular cancer
- Thyroid disease
- Delayed puberty, decreased fertility (women) and early menopause
- Reduced testosterone levels
- Reduced immune response in children
- Elevated cholesterol

Courtesy: Dr. Jennifer Field
C8 replaced with thirty forms of C6

- Persistent, a family trait
- In groundwater, wastewater, & seawater
- Limited toxicology data
- Increasing C6 levels in human blood
- Can causes cell changes associated with tumors

Courtesy: Dr. Jennifer Field
The Madrid Statement

Documents the scientific consensus regarding the persistence and potential for harm of poly- and perfluoroalkyl substances (PFAS), and lays out a roadmap to gather needed information and prevent further harm.
FLUOROS 2015
An International Symposium on Fluorinated Organics in the Environment
July 12-14, 2015
Golden, Colorado

For more information, contact Chris Higgins at chiggins@mines.edu
Class 2: Antimicrobials

Triclosan

Triclocarban

Courtesy: Dr. Gary Ginsberg
Antimicrobials are used in...

- Disinfectants
- soap, mouthwash, detergent, shampoo
- Deodorant/clothing
- Toothpaste
- Cosmetics
- Kitchen supplies, furniture
- Toys, school supplies, sports equipment

Courtesy: Dr. Gary Ginsberg
Do we need them?

- Might be helpful in toothpaste for gum disease
- No proven benefit over soap & water
- Ineffective in flooring and plastic

NO EVIDENCE ANTIMICROBIALS REDUCE INFECTIONS

Courtesy: Dr. Gary Ginsberg
Class 3. Flame retardants

Flammability Standards set in 1970s

- Children’s sleepwear
- Furniture
- Foam plastic insulation
Michigan and Polybrominated Biphenyls (PBBs)


*The Poisoning of Michigan* by Joyce Egginton
Brominated Tris Flame Retardant
Tris (2,3-dibromopropyl) phosphate

- In children’s sleepwear 1975 to 1977
- Up to 10% of the weight of fabric
- In children’s urine
- Mutagen and possible carcinogen
Flame-Retardant Additives as Possible Cancer Hazards

The main flame retardant in children’s pajamas is a mutagen and should not be used.

Arlene Blum and Bruce N. Ames
TRIS-Treated Children's Garments Banned

April, 1977

Chlorinated Tris replaced Brominated Tris

- Removed from pajamas in 1978
- Used in furniture until 2012
Technical Bulletin 117

– Required furniture foam to withstand a small open flame for 12 seconds

– No significant fire safety benefit (fires start in exterior fabric not filling)
PentaBDE
Flame Retardant

Used from 1975 to 2004 to meet TB117.

98% of use in North America
International Association of Fire Fighters Resolution

• Flame Retardants, Toxic Chemicals, and their Relationship to the Increase of Cancer in Firefighters

ADOPTED, July 2014

“RESOLVED, That the IAFF work to ensure the use of carcinogenic flame retardants and other toxic chemicals are eliminated and safer alternatives or methods...are pursued”
Animal health effects

• Chronic toxicity: long term impacts
  – Endocrine disruption: Interference with thyroid hormone action
  – Neurodevelopment: Decreased memory, learning deficits, altered motor behavior, hyperactivity
  – Reproductive system effects: Abnormal gonadal development, reduced ovarian follicles, reduced sperm count
  – Immune suppression
  – Cancer
Human Health

Higher pentaBDE associated with lower birth weight, impaired attention, poorer coordination, lowered IQ, longer time to get pregnant, altered thyroid hormones.

Products to People
Global pollutants
Migrate towards north and south poles

© sebastian niedlich
97 ppm to 3 ppm
Open flame versus smolder

**TB117**
12 second delay of ignition of filling inside furniture

Flame retardants added to meet this small open flame standard

**TB117-2013**
Most start with smoldering:
- Cigarettes
- Electrical sources

Prevented by smolder-resistant fabric

NFPA, Ahrens 2011
Fire toxicity

Flame retardants can delay, but do not prevent foam from burning

When foam does burn, flame retardants can increase:

- soot and smoke
- carbon monoxide & acid gases
- dioxins and furans

Bocchini 2009; Mennear 1994
TB117 Fire Safety Benefit?

“No significant, consistent difference...”

Babrauskas et al. 2011; Talley 1995; Mehta (CPSC) 2012
Increased fire safety without flame retardants

Assembly Bill 706, Senate Bill 772, Senate Bill 1291, Senate Bill 147

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GreenSciencePolicy.org
Paid for by Californians for Fire Safety:

- Albemarle
- Chemtura
- Israel Chemicals LTD (ICL)
Playing with fire

A deceptive campaign by industry brought toxic flame retardants into our homes and into our bodies. And the chemicals don’t even work as promised.

DR. DAVID HEINBACH knows how to tell a story. Before California lawmakers last year, the noted burn surgeon drew gasps from the crowd as he described a 9-year-old baby girl who was burned in a fire started by a candle while she lay on a pillow that lacked flame retardant chemicals.

“She is a tiny little person, no bigger than my Italian greyhound at home,” said Heinbach, gesturing to approximate the baby’s size. “Half of her body was severely burned. She ultimately died after about three weeks of pain and misery in the hospital.”

His passionate testimony about the baby’s death made the long-term health concerns about flame retardants voiced by doctors, environmentalists and even firefighters sound abstract and petty.

But there was a problem with his testimony: It wasn’t true. Records show there was no dangerous pillow or candle fire. The baby he described didn’t exist.

Neither did the 9-year-old patient who Heinbach told the California lawmakers died in a candle fire in 2009. Nor did the 9-year-old patient who he told had been burned in a burn hospital in 2008.

Heinbach is not just a prominent burn doctor. He is a star witness for the manufacturers of flame retardants.

His testimony, the Tribune found, is part of a decades-long campaign of deception that has lured the furniture and electronics in American homes with pounds of toxic chemicals linked to cancer, neurological deficits, developmental problems and impaired fertility.

The tactics started with Big Tobacco, which wanted to shift focus away from cigarettes as the cause of five deaths, and continued as chemical companies worked to protect a lucrative market for their products, according to a Tribune review of thousands of government, scientific and internal industry studies the public’s fear of fire and helped organize and steer an association of top fire officials that spent more than $400,000 on a decades-long campaign for their cause.

Today, scientists know that some flame retardants escape from household products and settle in dust. That’s why toddlers, who play on the floor and put things in their mouths, generally have higher levels of these chemicals in their bodies than their parents.

Blood levels of certain widely used flame retardants doubled in adults every two to five years between 1970 and 2004. More recent studies show levels haven’t declined in the US, even though some of the chemicals have been pulled from the market. A typical American baby is born with the highest recorded concentrations of flame retardants among infants in the world.

People might be willing to accept the health risks if
Toxic Hot Seat

A film about stopping the use of the harmful and ineffective flame retardants in furniture and baby products
Rent it at http://vimeo.com/ondemand/toxichotseat
June 18, 2012

Governor Brown Directs State Agencies to Revise Flammability Standards

Fire safety with fewer flame retardants:

‘We must find better ways to meet fire safety standards by reducing and eliminating - wherever possible - dangerous chemicals.’
California Flammability Standard
TB117-2013

– Implemented January 1, 2014
– Mandatory January 1, 2015
– Flame retardants not needed, but can still be used
TB117 and baby products

– December 2010: three exempted

– January 1, 2014: 15 more exempted
Senate Bill 1019 (2014, Leno)

- Effective January 1, 2015 for products that meet TB117-2013
- Present in a covered product or component thereof at levels > 1,000 ppm
Fires that start in furniture are decreasing.
Fire safety tools

• Decrease in smoking/ fire-safe cigarettes
• Fire-safe candles, child-safe lighters
• Smoke detectors/ alarms
• Sprinklers
• Work of fire service
• Fire codes
• Fire safety education
• Furniture regulations
  – Smolder standard: TB117-2013
  – Open flame: TB117, TB133,
(Only open flame standards have potential for harm)
What to do?

• Replace the foam in your furniture.

• Buy furniture with a TB117-2013 label
  • Ask for products without added flame retardants

• Vacuum, wet mop, hand wash
Are there flame retardants in your furniture?

- Submit samples of polyurethane foam to Duke University
- Free testing; results within 45 days

http://foam.pratt.duke.edu/home
Where does flame retarded foam end up?

- Low income communities
- Student housing
- Recycling
- carpet cushion

Additional options for disposal or reuse:
Better Solutions

Chemical Recycling?

High Temp Combustion??
What to do with millions of foam and plastic items with harmful flame retardants

2 day workshop hosted by UC Berkeley and GSP
Fall, 2015
Washington, DC

For more information, contact:
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Foam Plastic Insulation (polystyrene, polyurethane, polyiso, etc.)

Used increasingly for energy efficiency

Can be used:
- inside walls
- below grade
- attics, etc.
California AB 127 (2013)
Review of insulation flammability standards

• State fire marshal may propose updates that:
  – Maintain overall fire safety
  – Provide flexibility in meeting fire safety standards with or without chemical flame retardants

• Possible proposal to the CA Building Standards Commission:
  – Insulation below grade may be used without FRs
2018 International Building Code (IBC)

- Allow foam plastic insulation without FRs when fully protected below grade
Rationale for these proposals

• Since no ignition or oxygen source exists to support a fire, there is no fire hazard

• Where there is no fire hazard, there is no justification for flame spread and smoke development requirements

• These requirements drive the use of harmful flame retardants in all foam plastic insulation available in the U.S. today
2018 International Building Code (IBC)

• We are seeking support:
  
• At ICC hearings:
  
  April 19 – 30, 2015  Memphis, TN
  Sept 30 – Oct 7, 2015  Long Beach, CA

• Letters  IBC Fire Safety Committee

• Contact:

  avery@GreenSciencePolicy.org
Join Our Science and Policy of Flame Retardants Meeting

• April 21, 2015, Beijing, China (the current largest consumer market for flame retardants in the world)
• Prior to the 7th International Symposium on Flame Retardants - BFR 2015
• Share research results and strategize how to reduce the use of harmful flame retardants
Class 4: Bisphenols and Phthalates

Uses:

- **Bisphenols**: plastics,
  - cash register receipts, adhesives, can linings

- **Phthalates**: plasticizers, lubricants, solvents, emulsifiers, fragrances

Courtesy: Dr. Miriam Diamond

Do we need them?
Class 5: Certain Solvents
(aliphatic, aromatic, halogenated, oxygenated)

- **Hydrocarbon solvents**
  - Aliphatic organic solvents (petroleum-based)
  - Aromatic organic solvents (toluene, xylene, benzene)

- **Chlorinated solvents**
  - E.g., Methylene chloride, perc, TCE

- **Oxygenated solvents**
  - Acetone, glycol ethers, alcohols

Courtesy: Dr. Liz Harriman
Do we need them?

- Use Green Chemistry to improve efficiency and reduce solvent amount
- Switch to water-based products
- Other safer alternatives?
Class 6: Certain Metals
(arsenic, cadmium, chromium, lead, mercury etc.)

- Can display toxicity at extremely low doses

Courtesy: Dr. Graham Peaslee
Do we need them?

NO!

YES?
Benefits of the Class Approach

- Minimize regrettable substitutions
- Simple tool for decision makers
- Facilitate better choices for manufacturers, retailers, large purchasers.

Effective at reducing harmful chemicals in products
For more information
www.greensciencepolicy.org
to join our e-list
Thanks to:

The New York Community Trust,
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The Green Science Policy Institute Team:

Arlene Blum
Caroline Clarke
Avery Lindeman
Don Lucas
Eileen Kramer
Gretta Goldenman
By reducing use of the Six Classes

We can have a healthier world.

For more information
Google: Green Science Policy
www.greensciencepolicy.org