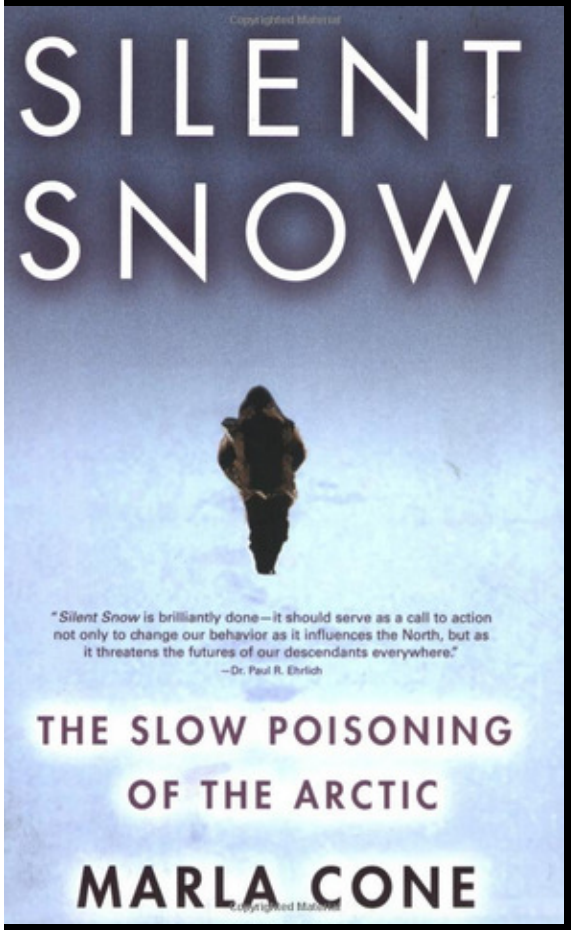
Flame Retardant Chemicals and Public Health: Fire Safety Without Harm

Arlene Blum PhD

www.GreenSciencePolicy.org

The Arctic Paradox

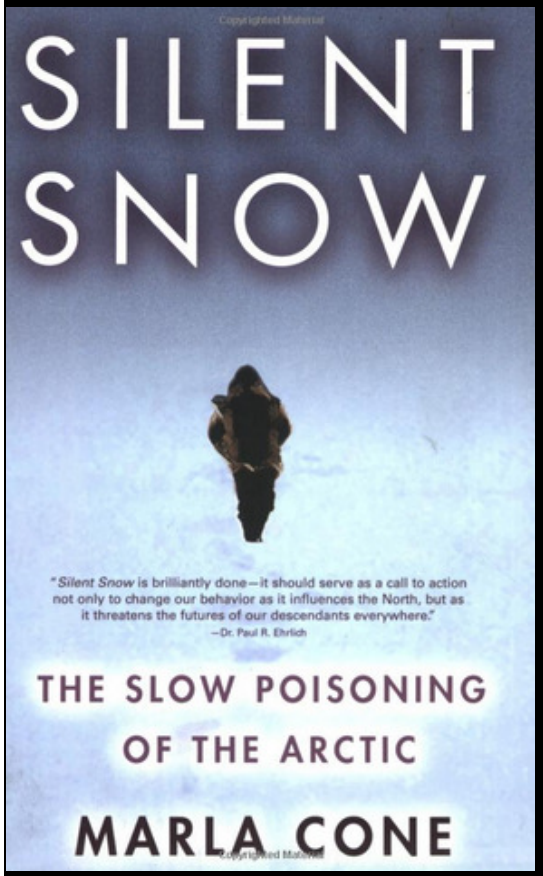


Upon learning Nunavik is the place most exposed to PCBs, Cone wrote:

"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



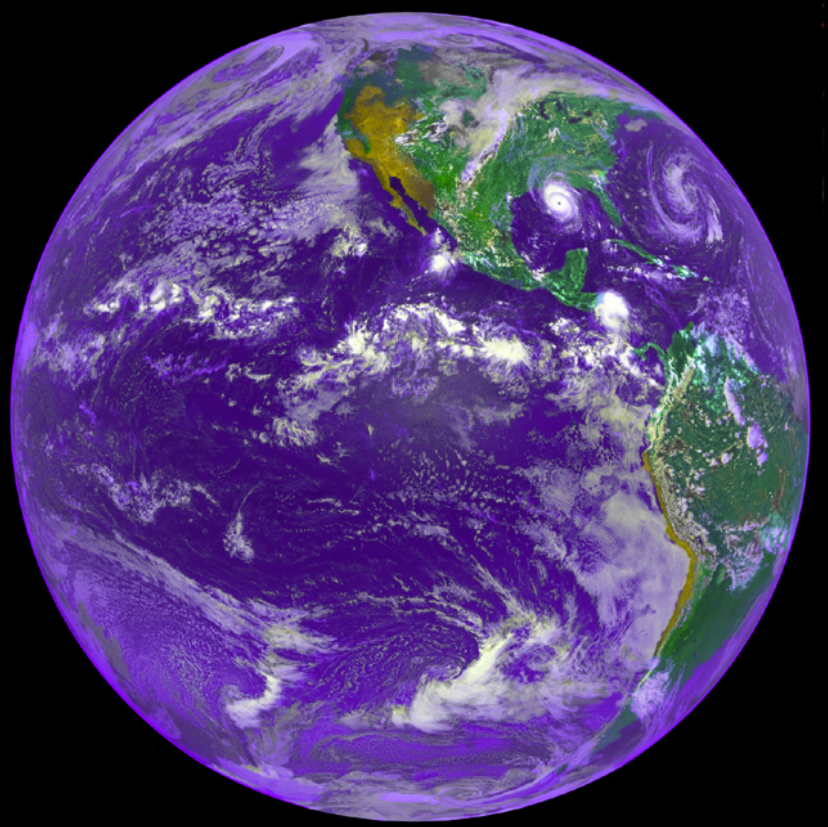
- Birth defects in Alaska are twice as high as in the United States as a whole
- Alaska Native infants have twice the risk of birth defects as white infants born in Alaska
- Could this be related to their high levels of exposures to persistent organic pollutants (POPs) ?

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

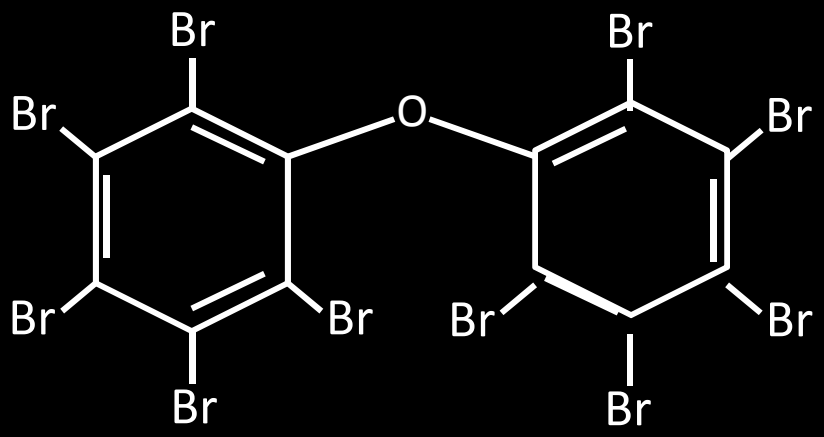
Silent Snow

Human Toxicological Trial?

"We are conducting a massive clinical toxicological trial, and our children and our children's children are the experimental subjects."

-Herbert Needleman & Philip Landrigan

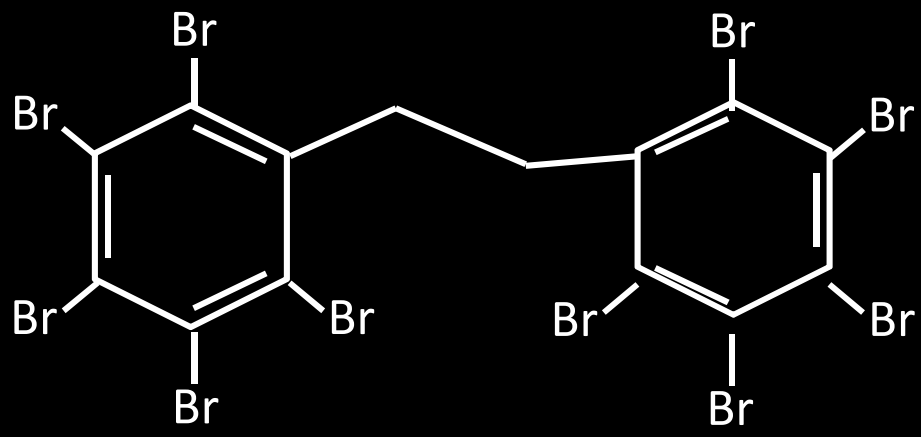
Regrettable Substitution



Decabromodiphenyl ether

Concerns:

- Persistence
- Bioaccumulation
- Toxicity



Decabromodiphenyl ethane

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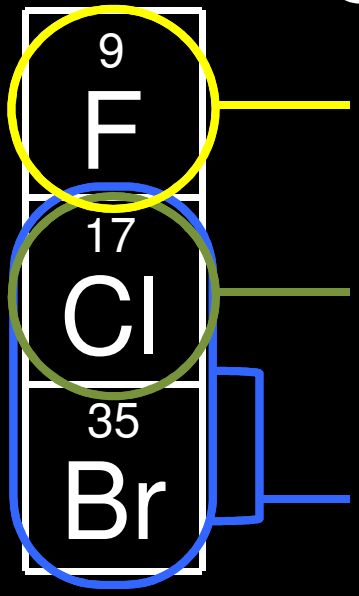
One Solution: SixClasses.org



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...

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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?

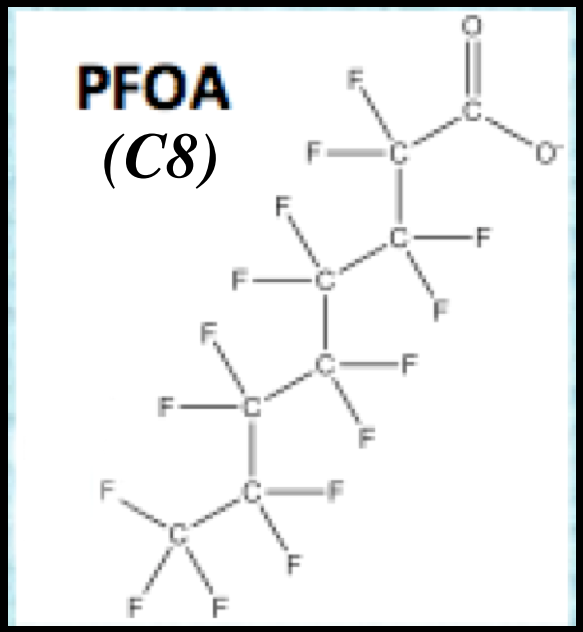
Green Chemistry

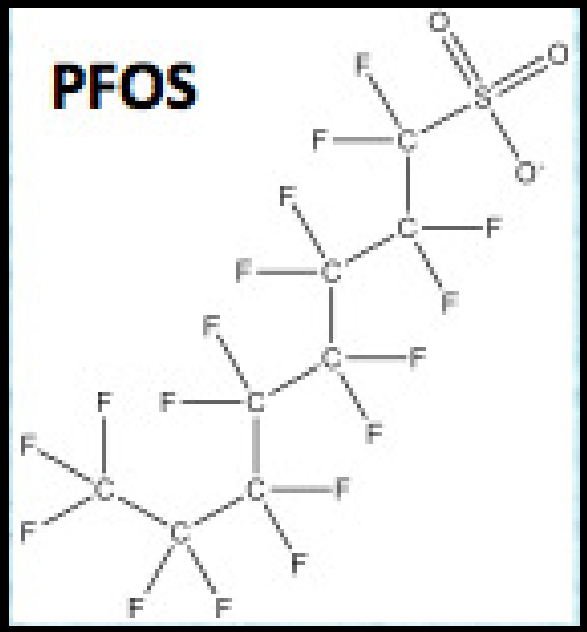
Green chemistry is the design of chemical products that reduces the use of hazardous substances.

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:

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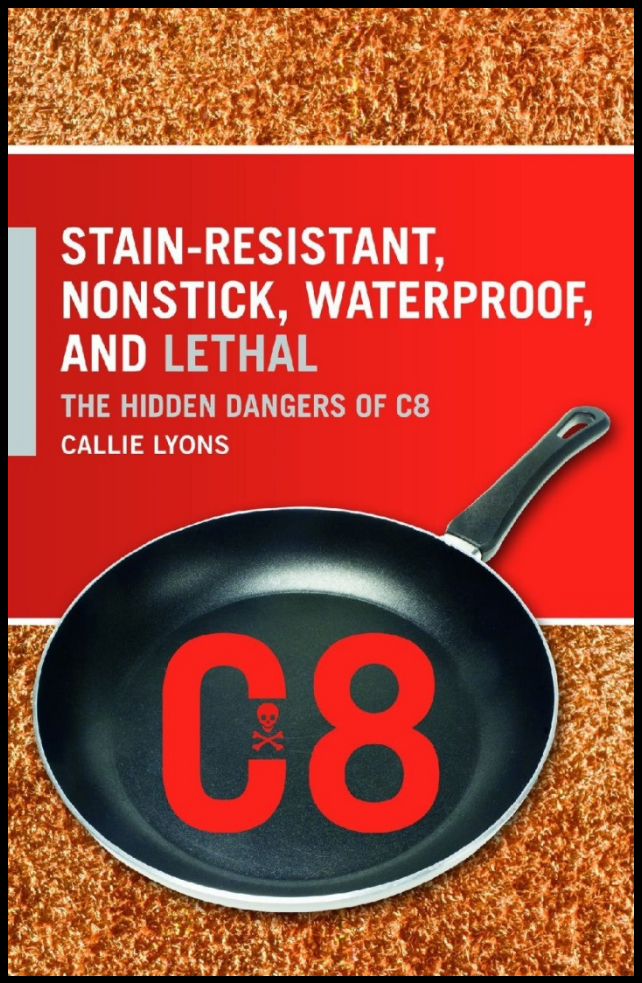
Found globally due to their mobility and long half lives (e.g. >2000 years for C8 or PFOA)

Some perfluorinated chemicals are harmful.

However, this is not well known



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Human Toxicology

- 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

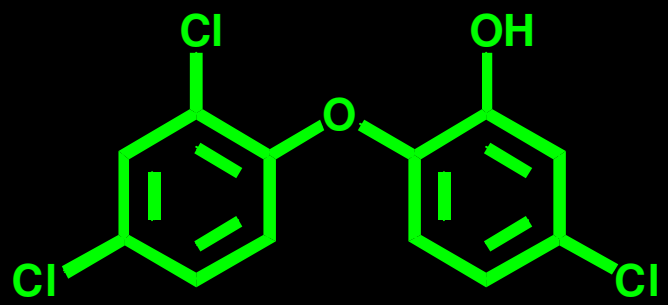
An International Symposium on Fluorinated Organics in the Environment

July 12-14, 2015
Golden, Colorado

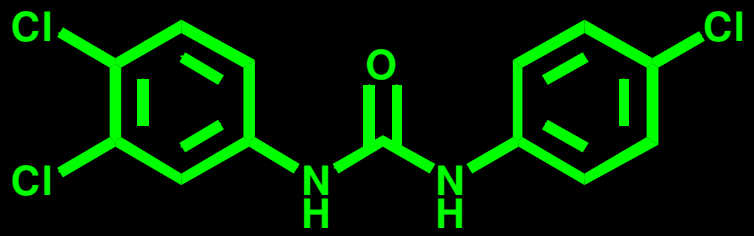
For more information, contact Chris Higgins at chiggins@mines.edu

Class 2: Antimicrobials

Triclosan



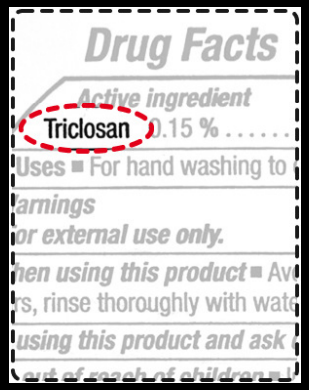
Triclocarban



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

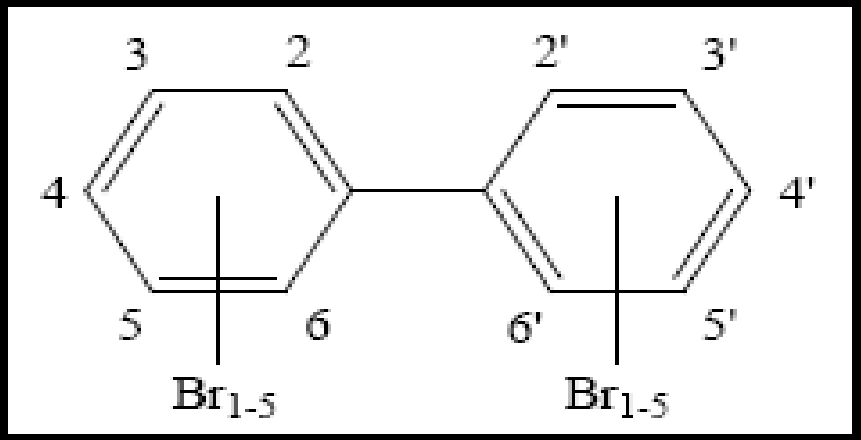
Courtesy: Dr. Gary Ginsberg

Class 3. Flame retardants

Flammability Standards set in 1970s

- Children's sleepwear
- Furniture
- Foam plastic insulation

Michigan and Polybrominated Biphenyls (PBBs)



PBBs mixed with livestock feed in 1973.
Reproductive problems, elevated cancer risks, miscarriage, and genitourinary conditions in male children of those exposed

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

Science, January 7, 1977

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

U.S. Consumer Product Safety Commission

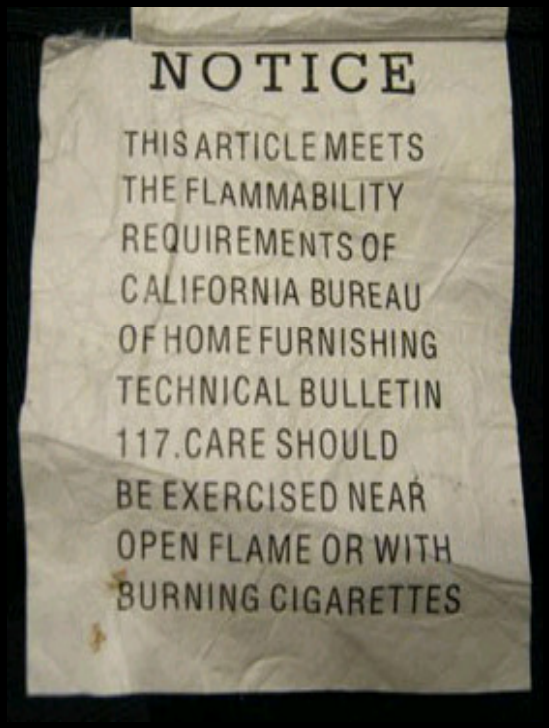
TRIS-Treated Children's Garments Banned

April , 1977

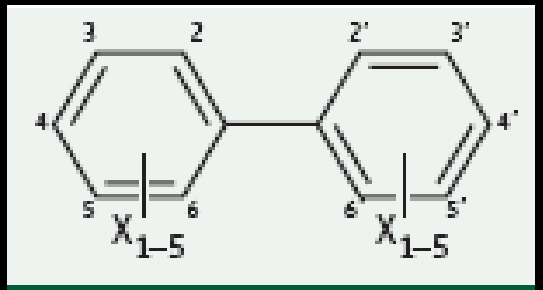
Chlorinated Tris replaced Brominated Tris

- Removed from pajamas in 1978
- Used in furniture until 2012

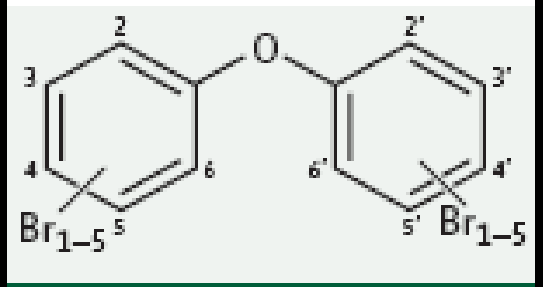
Technical Bulletin 117



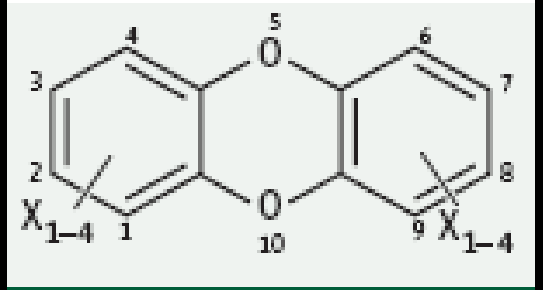
- Required furniture foam to withstand a small open flame for 12 seconds
- No significant fire safety benefit (fires start in exterior fabric not filling)



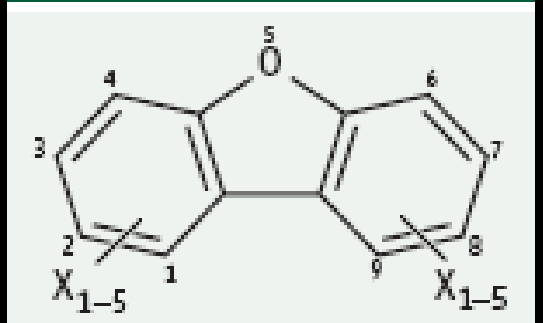
PCBs (X = Cl) and PBBs (X = Br)



PBDEs



Dioxins (X = Cl or Br)



Furans (X = Cl or Br)

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"

http://iaffconvention2014.org/resolution-no-34/

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

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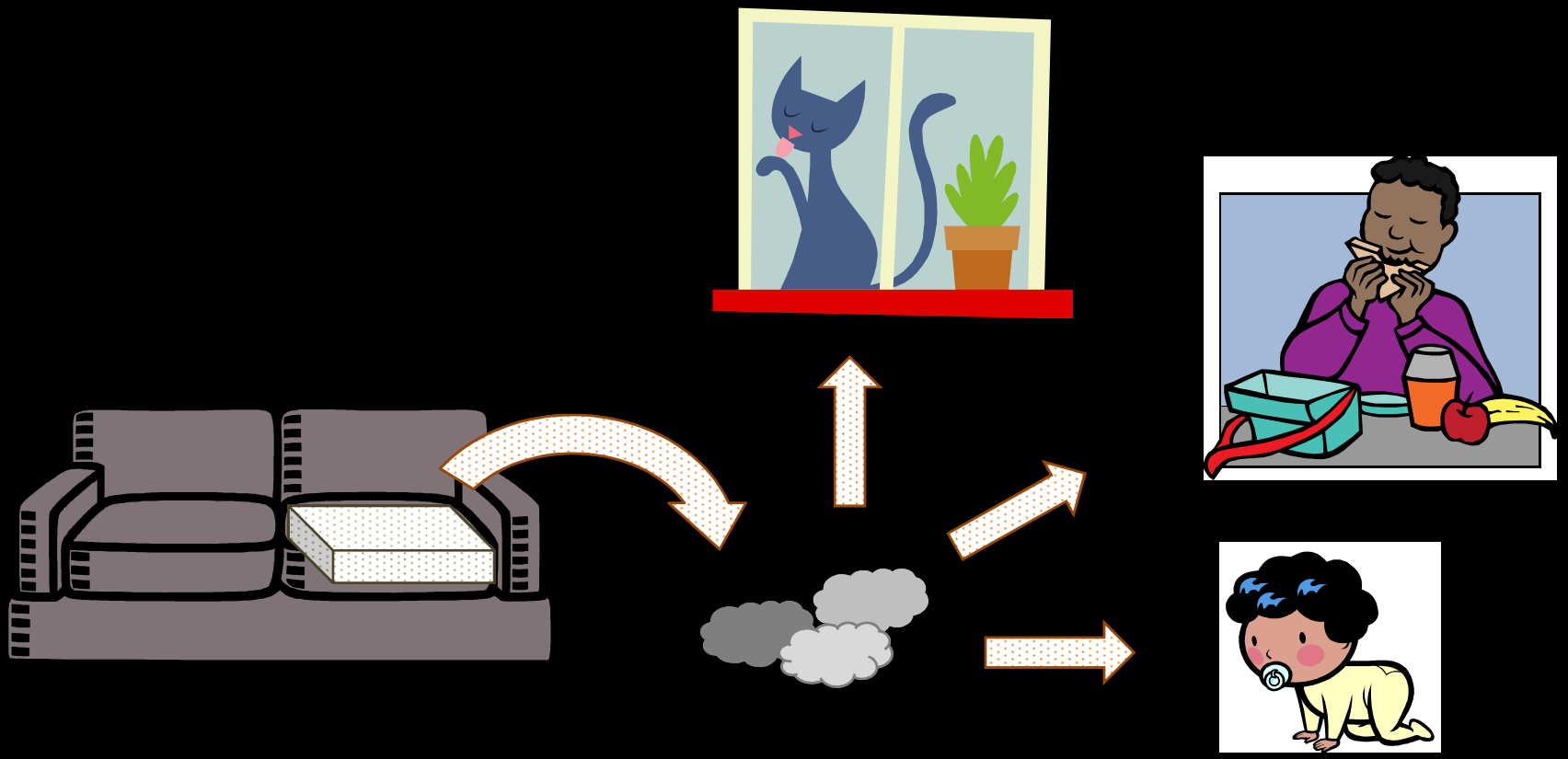
Eskenazi et al, 2010, 2011, 2012

Products to People



Global pollutants

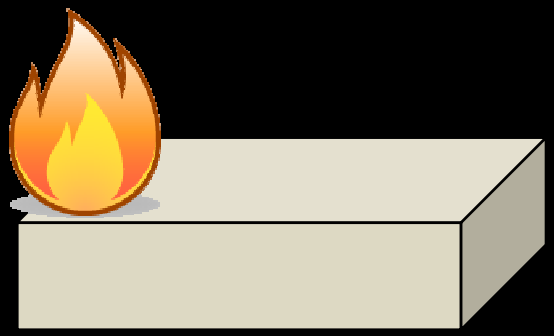
Migrate towards north and south poles

97 ppm to 3 ppm

Open flame versus smolder

TB117

12 second delay of ignition of filling inside furniture

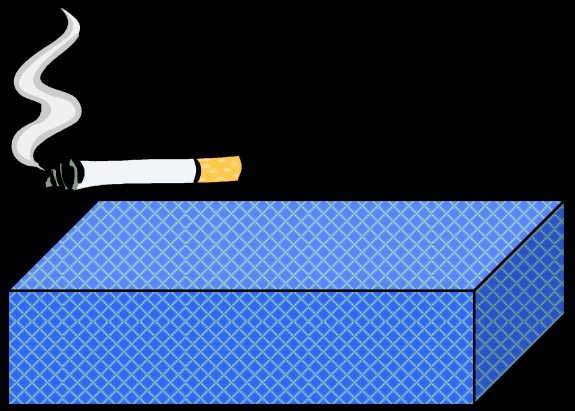


Flame retardants added to meet this small open flame standard

TB117-2013

Most start with smoldering:

- Cigarettes
- Electrical sources

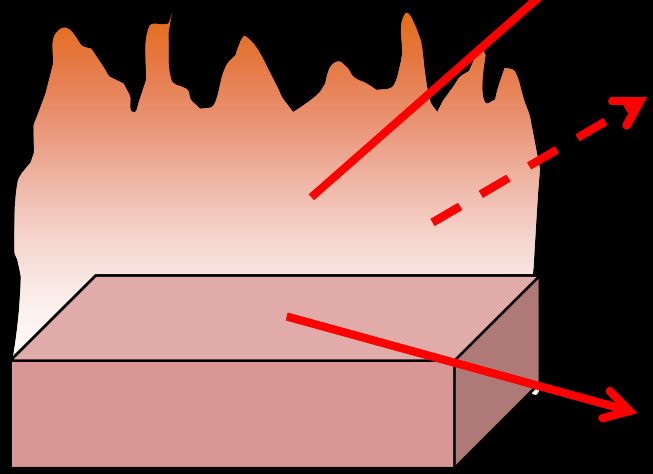


Prevented by smolder-resistant fabric

Fire toxicity

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

When foam does burn, flame retardants can increase....



soot and smoke

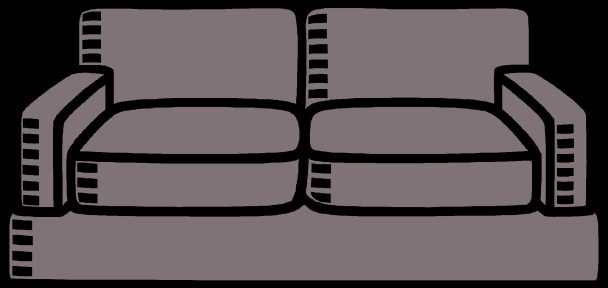
carbon monoxide & acid gases

dioxins and furans

Bocchini 2009; Mennear 1994

TB117 Fire Safety Benefit?

TB117 foam



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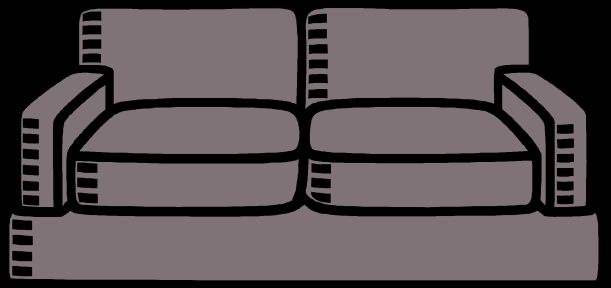
Non - TB117 foam



"No significant, consistent difference…"

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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 Bill147

Paid for by Californians for Fire Safety:

- Albemarle
- Chemtura
- Israel Chemicals LTD (ICL)

Pulitzer Prize
Finalist

Goldsmith Prize
Investigative Reporting

Environmental Journalists Society
Environmental Reporting

Gerald Loeb Award
Business and Financial Journalism

National Press Club
Consumer Award

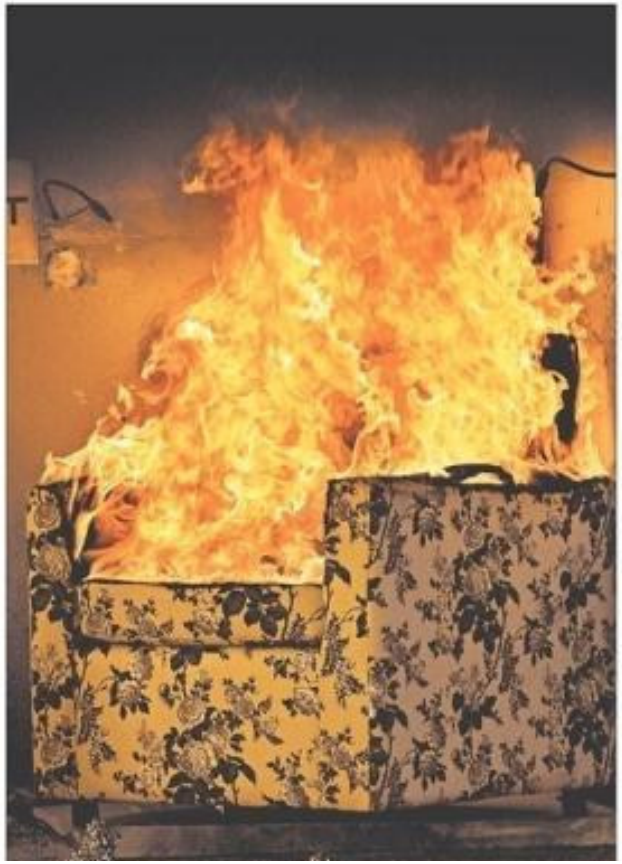
Chicago Tribune

Questions? Call 1-800-Tribune | Sunday, May 6, 2012 | Breaking news at chicagotribune.com

TRIBUNE WATCHDOG

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.



By Patricia Callahan and Sam Roe
Tribune reporters

Dr. David Heimbach knows how to tell a story.

Before California lawmakers last year, the noted burn surgeon drew gasps from the crowd as he described a 7-week-old baby girl who was burned in a fire started by a candle while she lay on a pillow that lacked flame retardant chemicals.

"Now this is a tiny little person, no bigger than my Italian greyhound at home," said Heimbach, 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."

Heimbach's 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-week-old patient who Heimbach told California legislators died in a candle fire in 2009. Nor did the 6-week-old patient who he told Alaska lawmakers was fatally burned in her crib in 2010.

Heimbach 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 loaded 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 fire deaths, and continued as chemical companies worked to preserve a lucrative market for their products, according to a Tribune review of thousands of government, scientific and internal industry

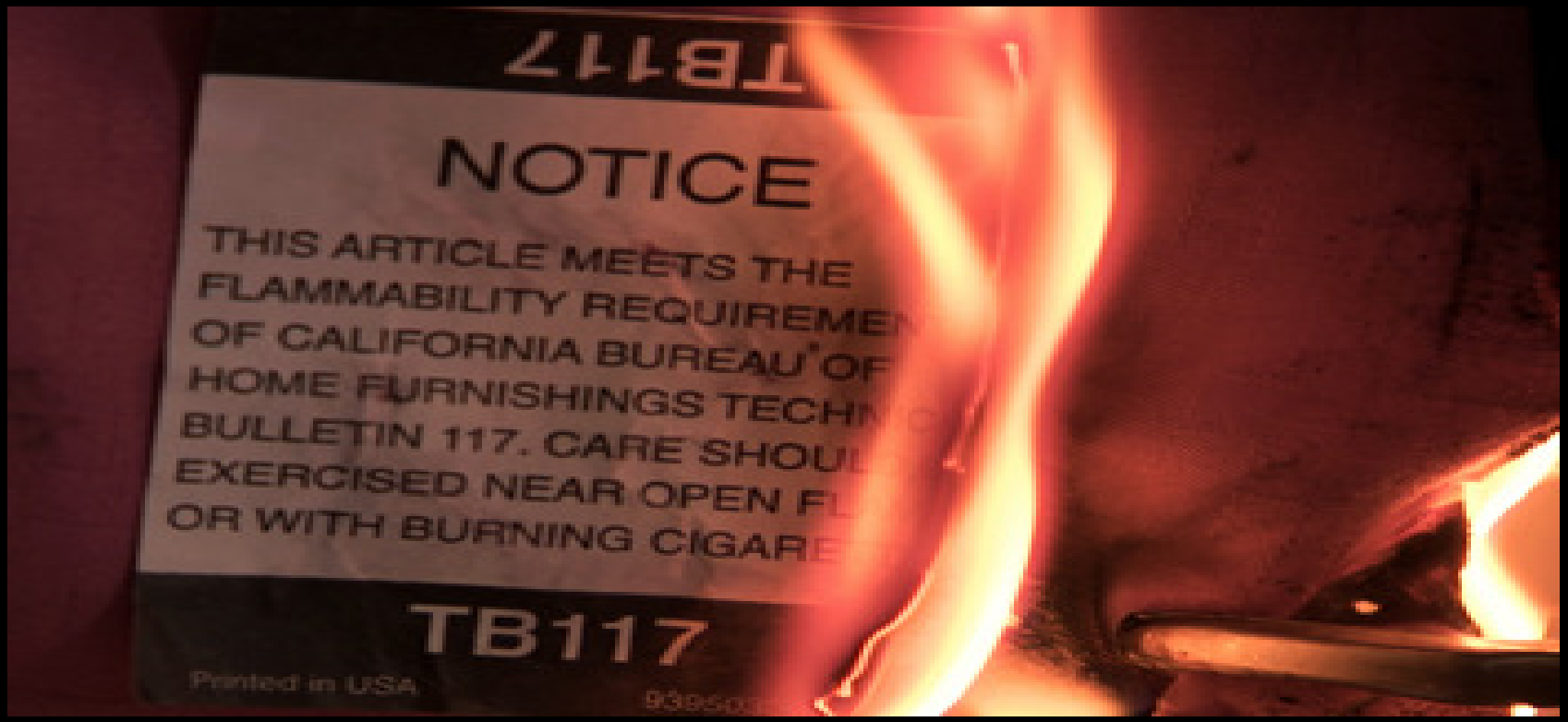
stoked the public's fear of fire and helped organize and steer an association of top fire officials that spent more than a decade campaigning for their cause.

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 far 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 U.S. 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 the

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.”

Press release, CA Office of Gov. Edmund G. Brown, Jr.

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

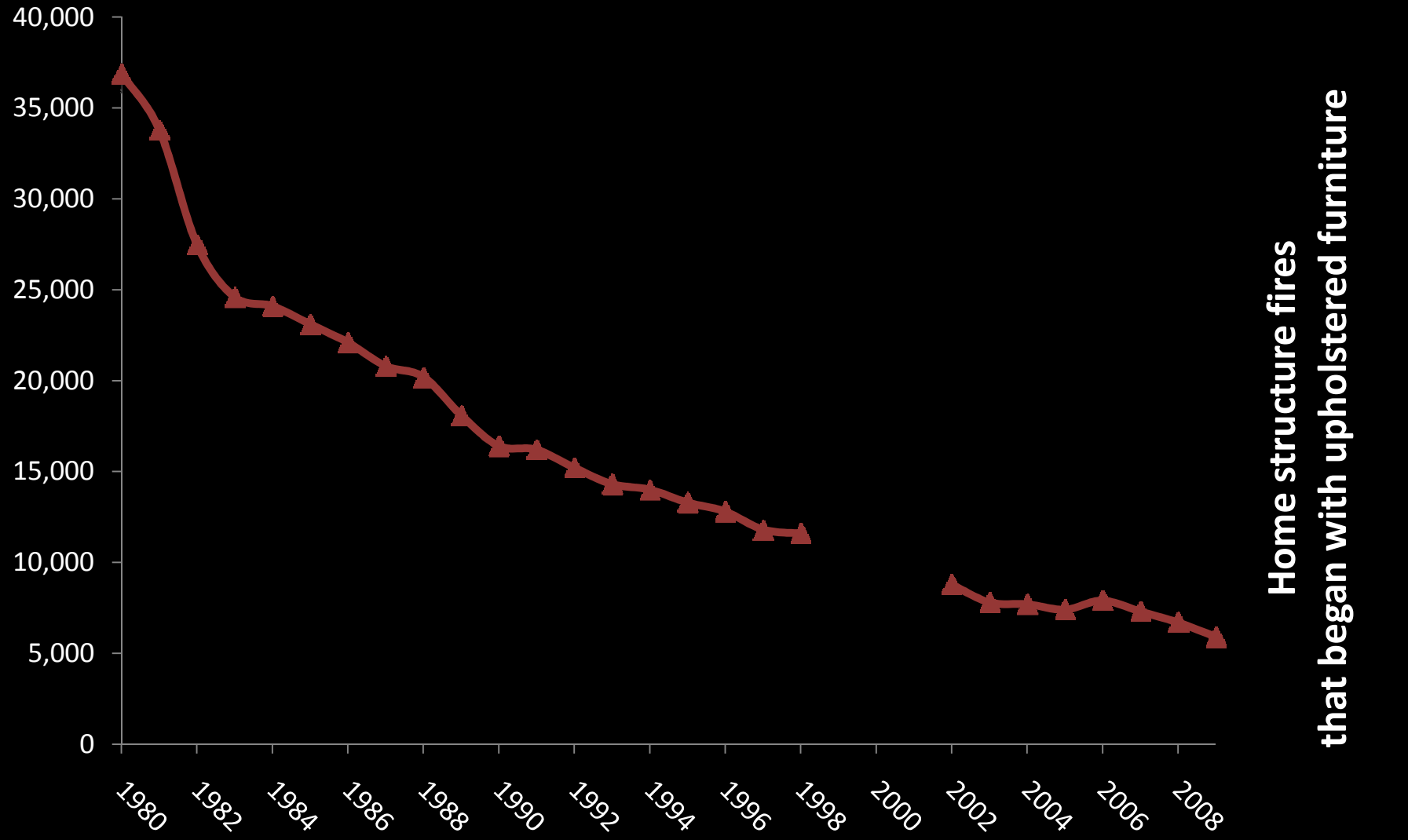
NOTICE
THIS ARTICLE MEETS THE FLAMMABILITY REQUIREMENTS OF CALIFORNIA BUREAU OF ELECTRONIC AND APPLIANCE REPAIR, HOME FURNISHINGS AND THERMAL INSULATION TECHNICAL BULLETIN 117-2013. CARE SHOULD BE EXERCISED NEAR OPEN FLAME OR WITH BURNING CIGARETTES.

The upholstery materials in this product:
____contain added flame retardant chemicals
__X__contain NO added flame retardant chemicals

The State of California has updated the flammability standard and determined the fire safety requirements for this product can be met without adding flame retardant chemicals. The State has identified many flame retardant chemicals as being known to, or strongly suspected of, adversely impacting human health or development.

www.bearhfti.ca.gov/about_us/sb_1019_faq.pdf

Fires that start in furniture are decreasing



Ahrens NFPA 2011

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,

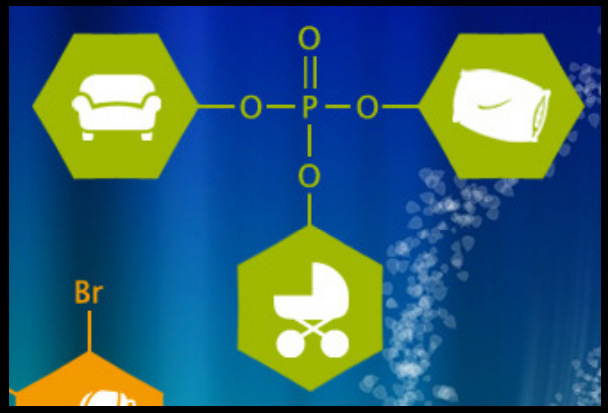
  (Only open flame standards have potential for harm)

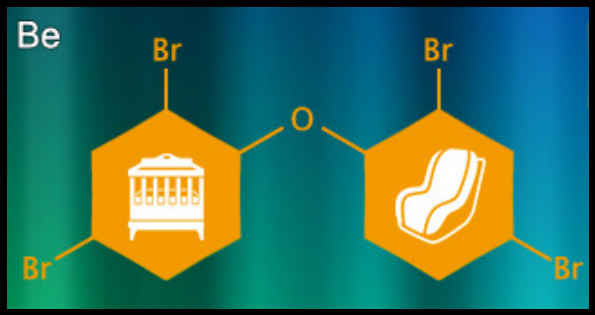
What to do?

- 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?

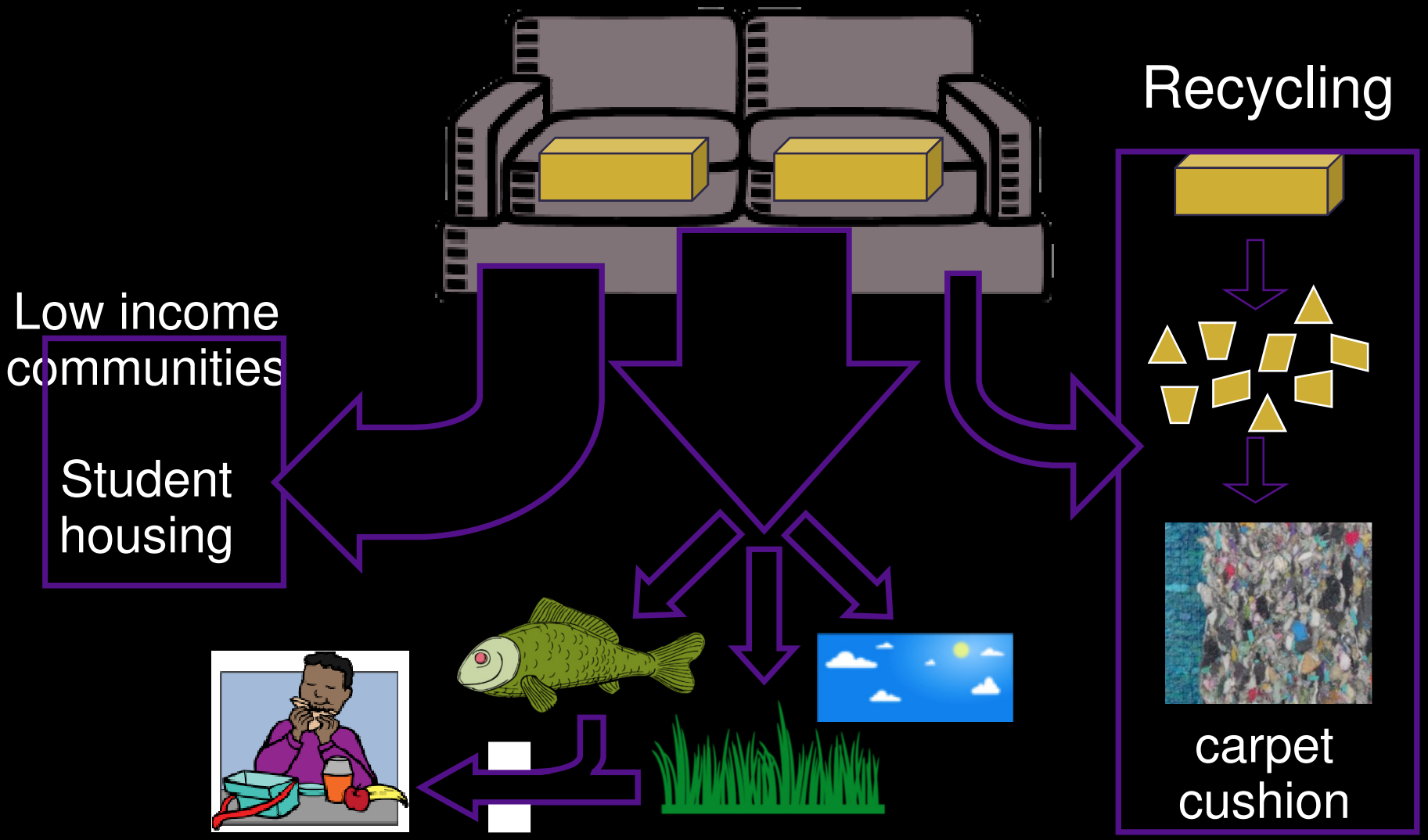
- Submit samples of polyurethane foam to Duke University
- Free testing; results within 45 days



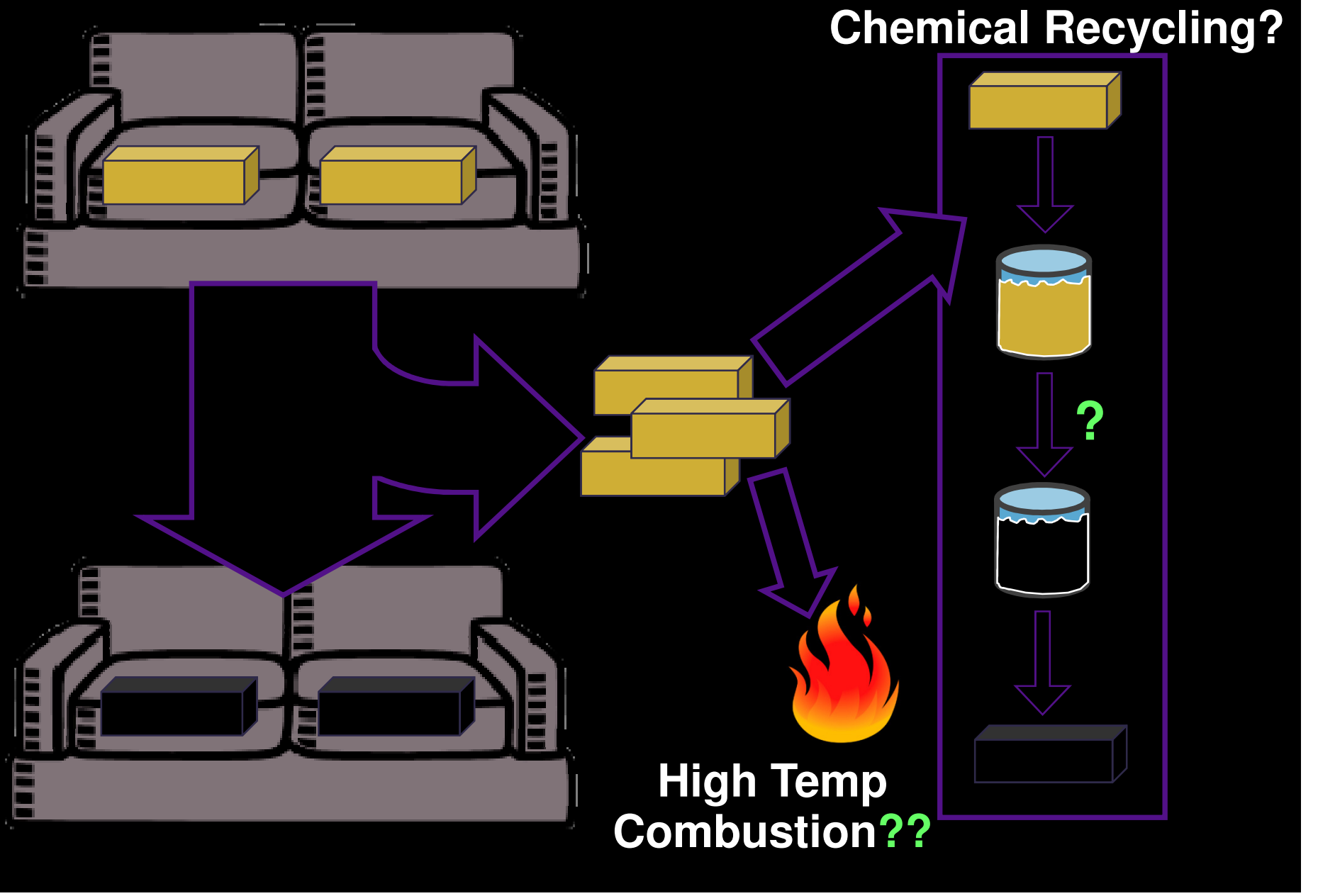


http://foam.pratt.duke.edu/home

Where does flame retarded foam end up?



Better Solutions



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

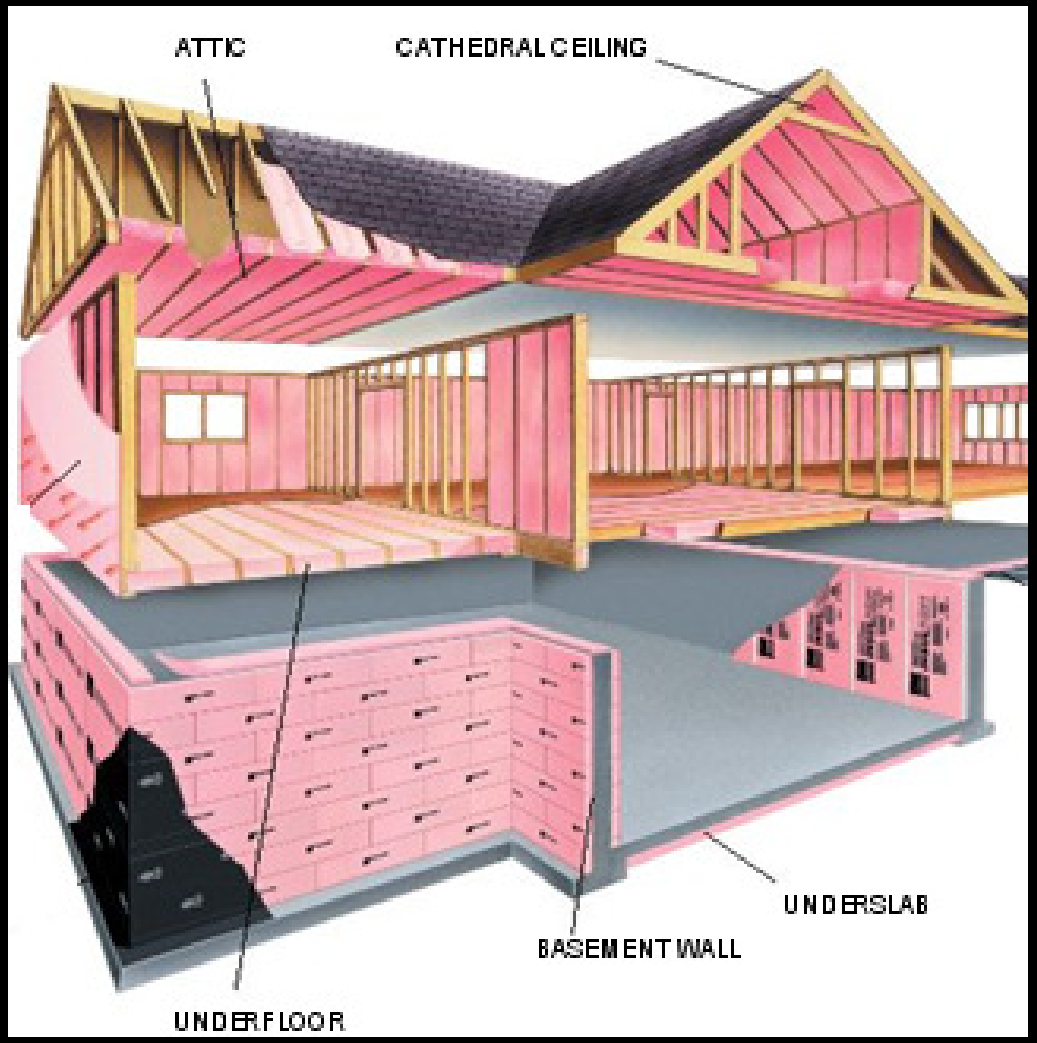
For more information, contact:

Donald Lucas

D_lucas@lbl.gov

510-316-6764

Foam Plastic Insulation
(polystyrene, polyurethane, polyiso, etc.)



Used increasingly for energy efficiency

Can be used:

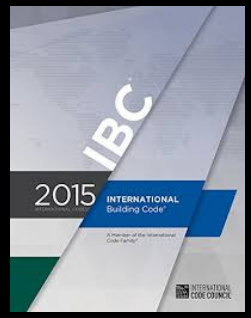
- inside walls
- below grade
- attics, etc.

California AB 127 (2013)

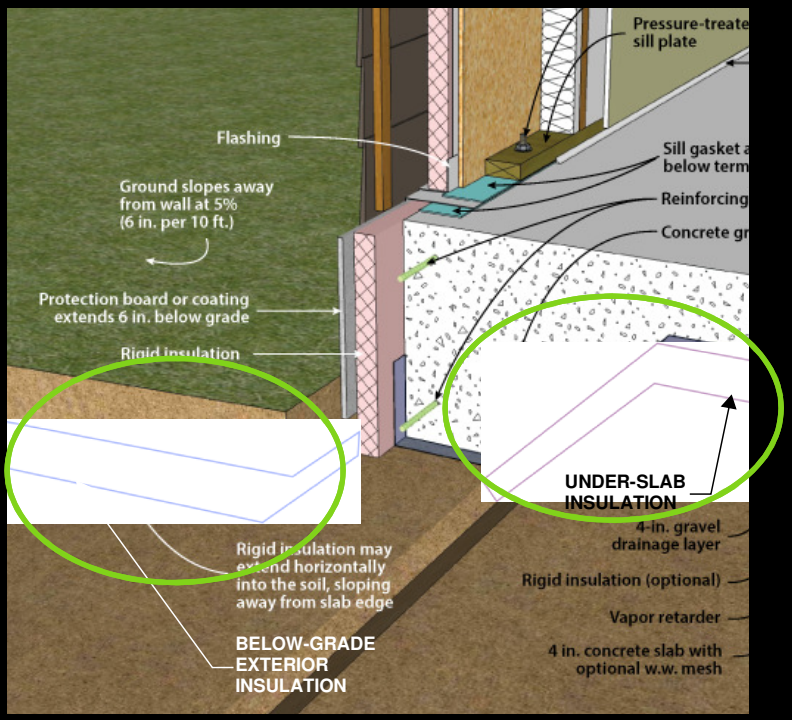
Review of insulation flammability standards

- 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

Proponents Include:

CODE UNLIMITED

SAN FRANCISCO FIREFIGHTERS CANCER PREVENTION FOUNDATION

FS&T Fire Science and Technology Inc.

hbn HEALTHY BUILDING NETWORK

KAISER PERMANENTE®

SIEGEL & STRAIN Architects

PERKINS + WILL

HKS

SERA SUSTAINABLE DESIGN FOR THE BUILT ENVIRONMENT℠

USGBC CALIFORNIA

HAMMOND & COMPANY
Sustainable Development & Construction Services

NRDC NATURAL RESOURCES DEFENSE COUNCIL
THE EARTH'S BEST DEFENSE

INTERNATIONAL LIVING FUTURE INSTITUTE℠

Green Science Policy Institute

DCAT Development Center for Appropriate Technology

GREEN SCIENCE POLICY INSTITUTE
www.GreenSciencePolicy.org

2018 International Building Code (IBC)

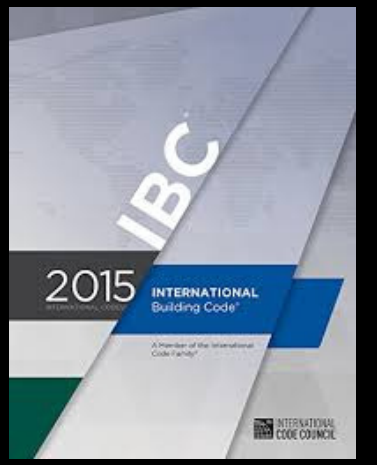
- We are seeking support:
  - At ICC hearings:

    April 19 – 30, 2015 Memphis, TN

    Sept 30 – Oct 7, 2015 Long Beach, CA

  - Letters IBC Fire Safety Committee
- Contact:

  avery@GreenSciencePolicy.org



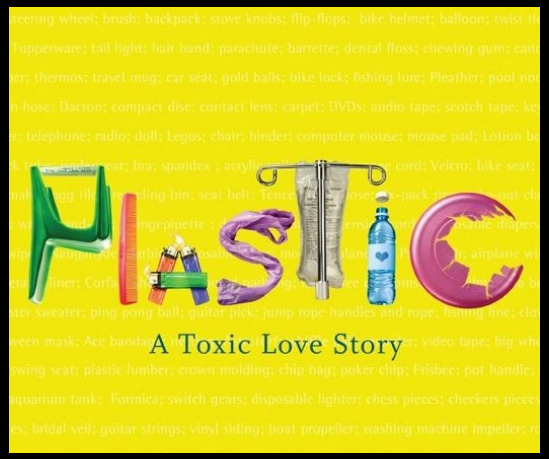
Join Our Science and Policy of Flame Retardants Meeting

- 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



http://www.susanfreinkel.com/books_Plastic.html

- 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

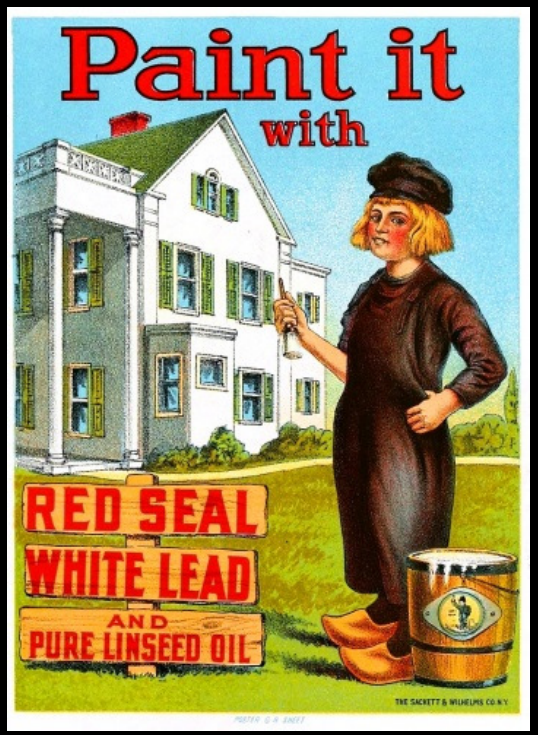
Do we need them?

- Use Green Chemistry to improve efficiency and reduce solvent amount
- Switch to water-based products
- Other safer alternatives?

Courtesy: Dr. Liz Harriman

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


MANY THANKS TO:
Thanks to:
The New York Community Trust,
Six Classes Retreat Attendees &
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