



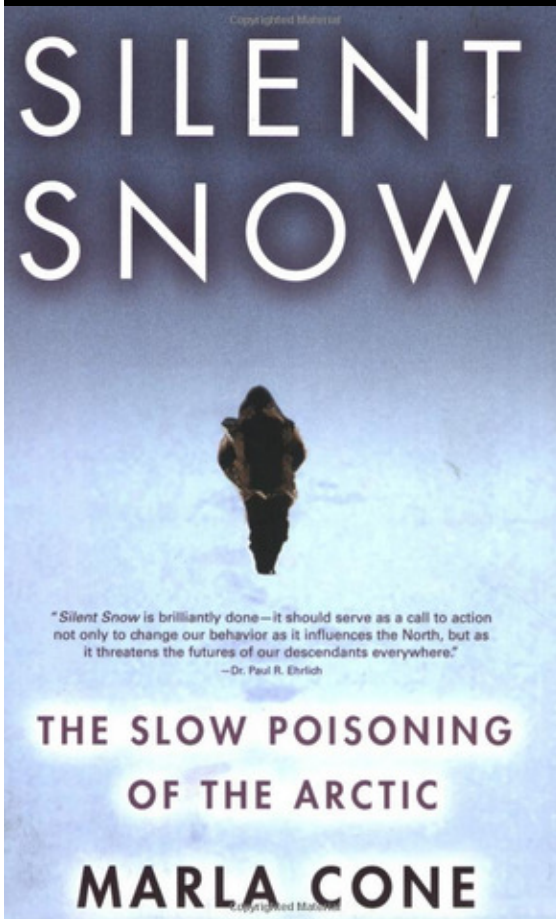
# **Green Science Policy Institute**

## **Flame Retardant Chemicals and Public Health: Fire Safety Without Harm**

**Arlene Blum PhD**

**[www.GreenSciencePolicy.org](http://www.GreenSciencePolicy.org)**

# The Arctic Paradox

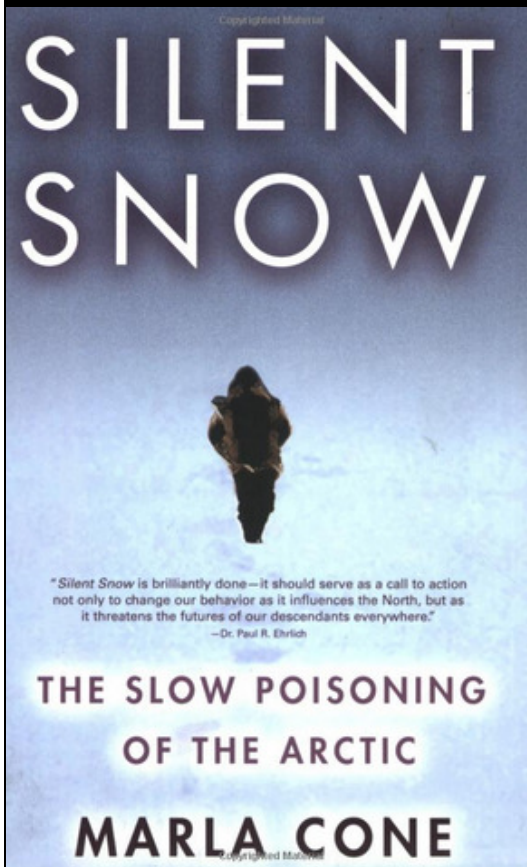


Upon learning Nunavik is the place most exposed to PCBs, Cone wrote:

“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) ?

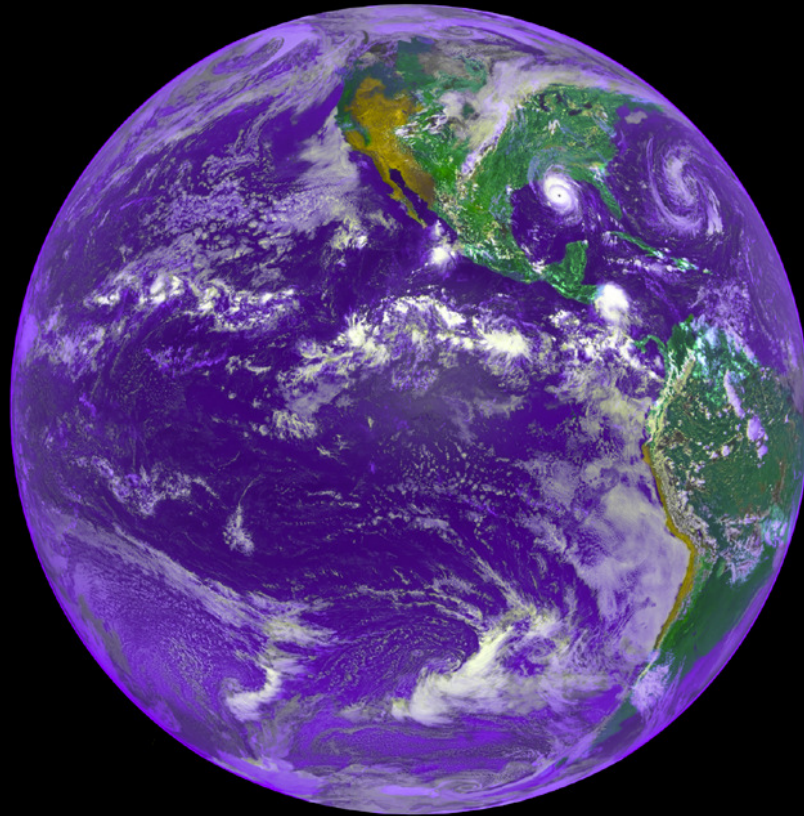
# U.S. Toxic Substances Control Act, 1976

- 62,000 previous chemicals “grandfathered”
- 20,000 new chemicals
  - 85 % have no health data
  - 67 % have no data at all





# 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

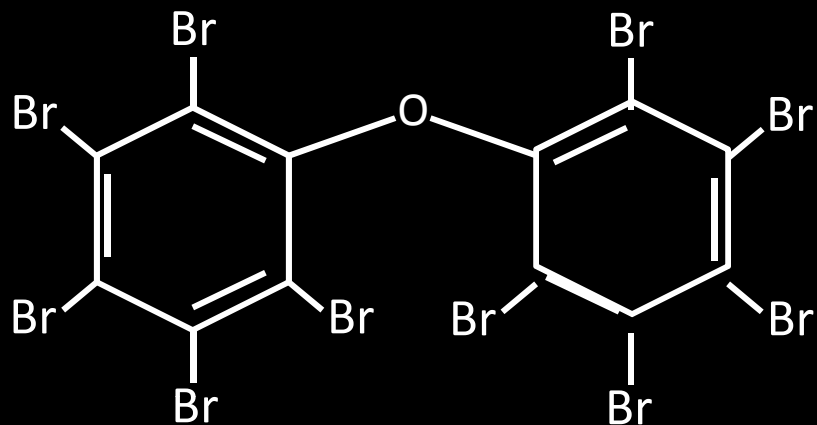
*Silent Snow*

# 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

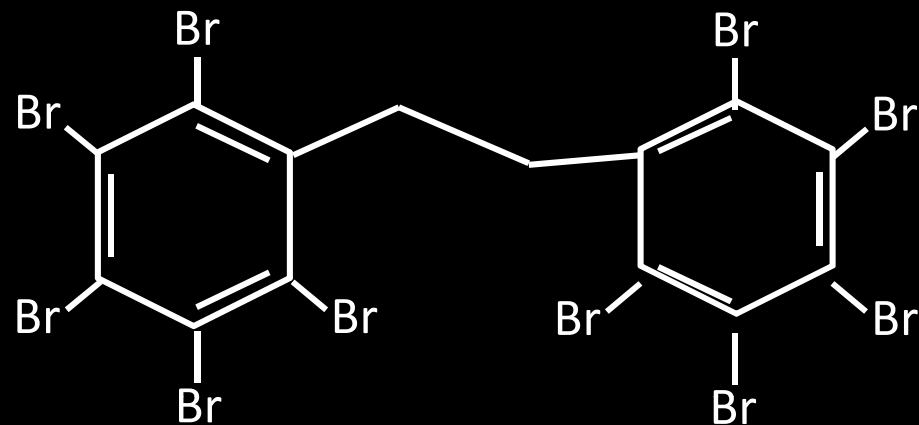
# Regrettable Substitution



Decabromodiphenyl  
ether

Concerns:

- Persistence
- Bioaccumulation
- Toxicity



Decabromodiphenyl  
ethane

Concerns:

- Persistence
- Bioaccumulation
- Toxicity

# One Solution: [SixClasses.org](http://SixClasses.org)

9 F
17 Cl
35 Br

## 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...

A mustard-colored sofa with two white pillows. The text "sixclasses.org" is overlaid on the sofa.

s i x c l a s s e s . o r g

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?



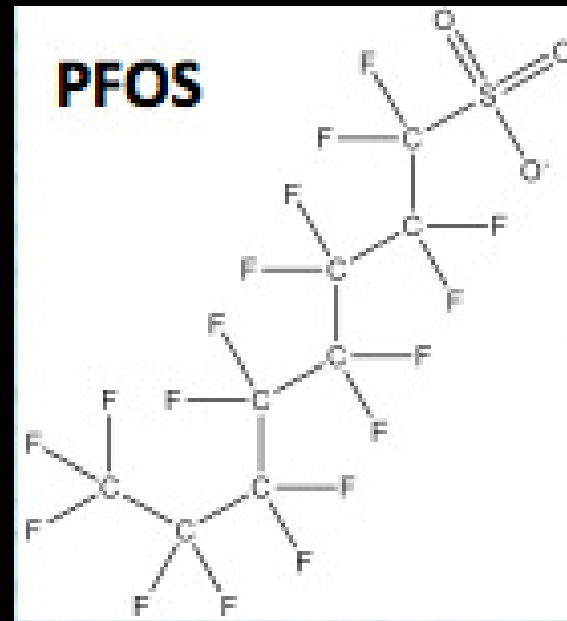
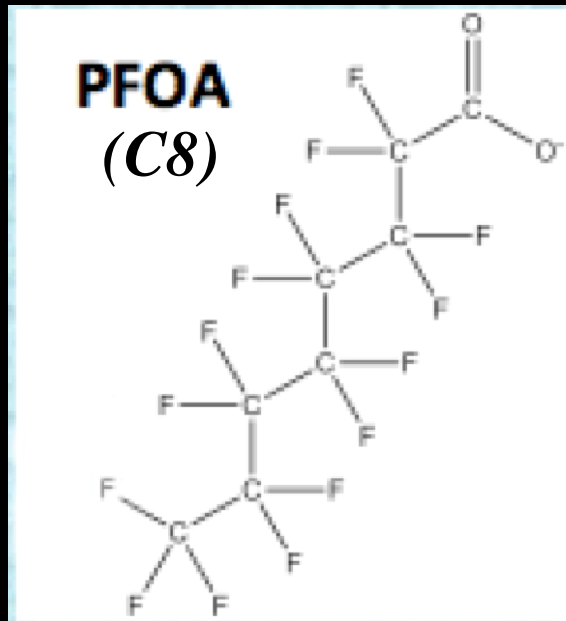
# Green Chemistry



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

# 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



# Fluorochemicals are used in:

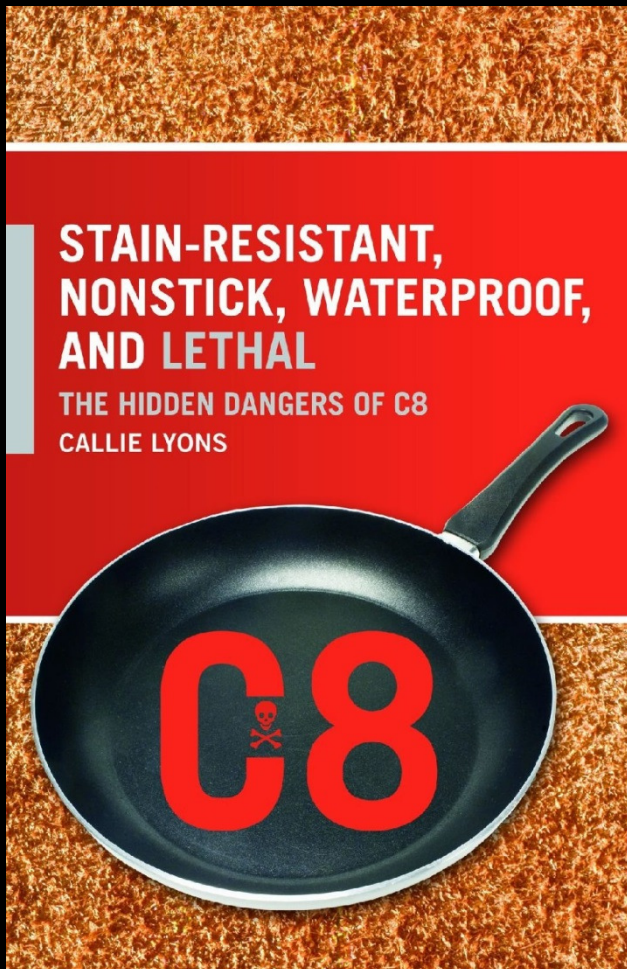


Found globally due to  
their mobility and long half lives  
(e.g. >2000 years for C8 or PFOA)



Some perfluorinated chemicals are harmful.

However, this is not well known



**GoodGuide** Search scientific product & company

Personal Care ▾ Food ▾ Household ▾ Babies & Kids ▾ Pet Food ▾ Apps ▾

Home » Ingredients » Perfluoroalkyl Acids  
**Perfluoroalkyl Acids Guide**

**perfluoroalkyl acids raises no health concern because:**

- It is not on any of GoodGuide's lists of toxic chemicals which cause suspected or recognized health effects
- It has not been detected in human tissue or urine
- It is not a high production volume chemical that lacks safety data

[Learn how we rate ingredients »](#)

**Personal Care**  
After Shave  
Body Wash & Cleanser  
Conditioner  
Deodorants & Antiperspirants  
Eye & Ear Care  
[View all »](#)

**Food**  
Breads & Baked Goods  
Breakfast  
Candy  
Canned Foods  
Coffee  
[View all »](#)

# 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



# 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

# 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.



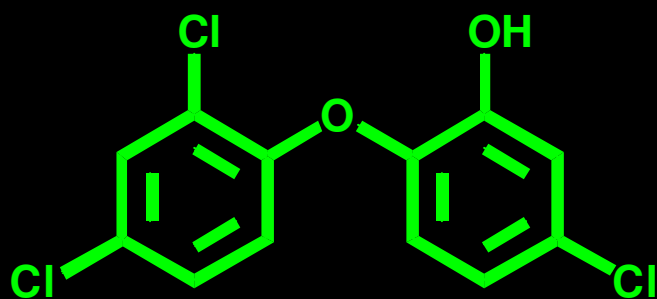
An International  
Symposium on  
Fluorinated Organics in  
the Environment

**July 12-14, 2015**  
**Golden, Colorado**

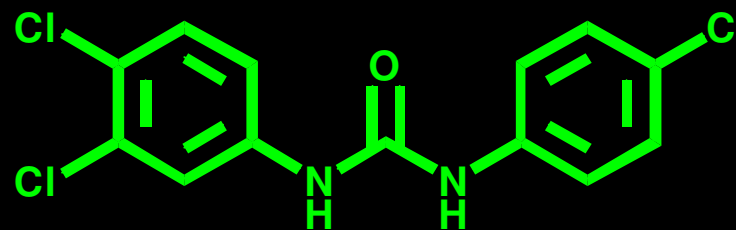
For more information, contact Chris Higgins at [chiggins@mines.edu](mailto:chiggins@mines.edu)

# Class 2: Antimicrobials

Triclosan

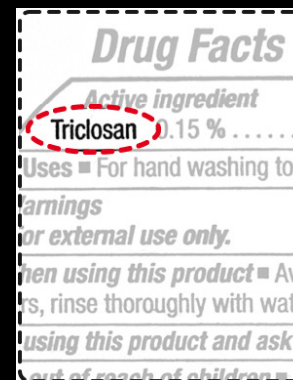


Triclocarban



# Antimicrobials are used in...

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



# 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



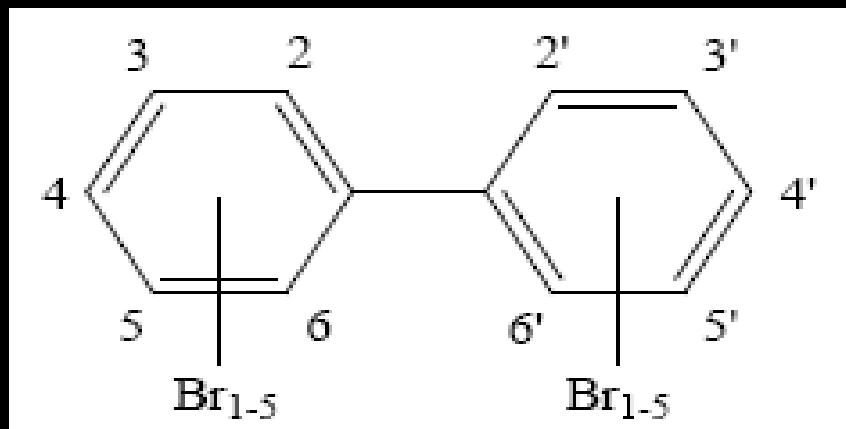


## Class 3. Flame retardants

### 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

GREEN SCIENCE POLICY INSTITUTE  
greensciencepolicy.org

# 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**

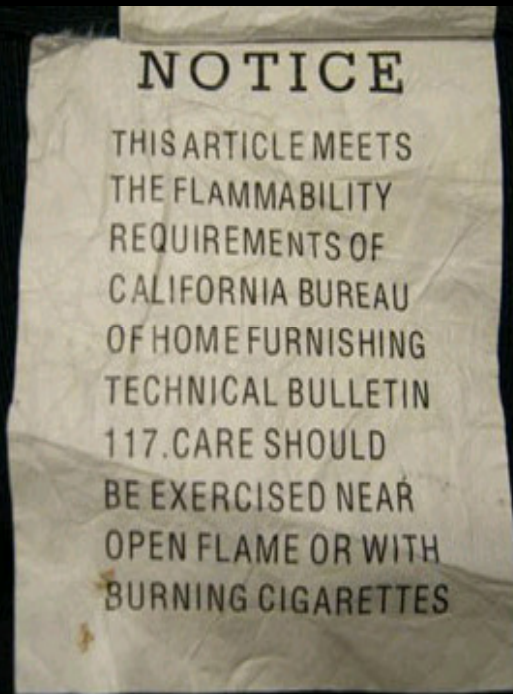
# TRIS-Treated Children's Garments Banned

April , 1977

Chlorinated Tris replaced Brominated Tris

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

# Technical Bulletin 117



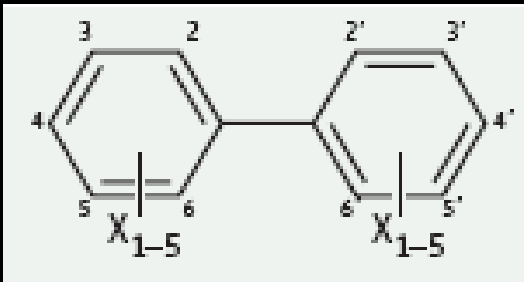
- Required furniture foam to withstand a small open flame for 12 seconds
- No significant fire safety benefit (fires start in exterior fabric not filling)



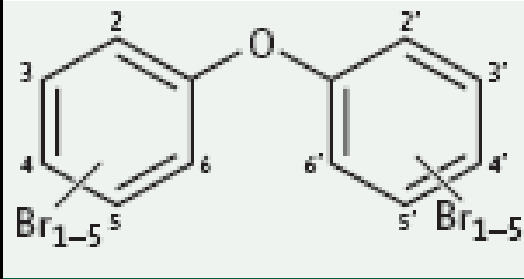
# PentaBDE Flame Retardant

Used from 1975 to 2004  
to meet TB117.

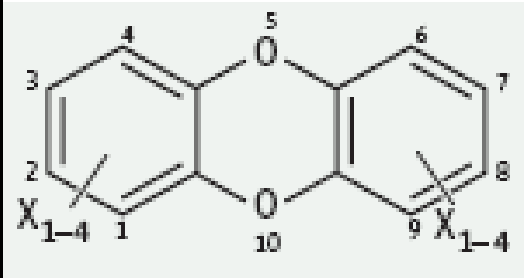
98% of use in North  
America



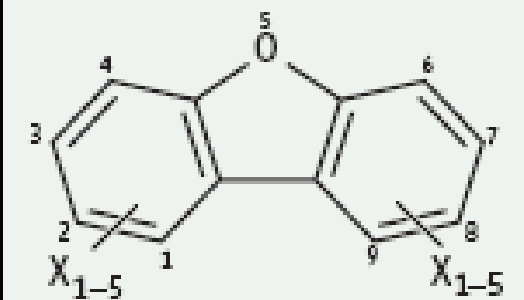
PCBs (X = Cl) and PBBs (X = Br)



PBDEs



Dioxins (X = Cl or Br)



Furans (X = Cl or Br)

# 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

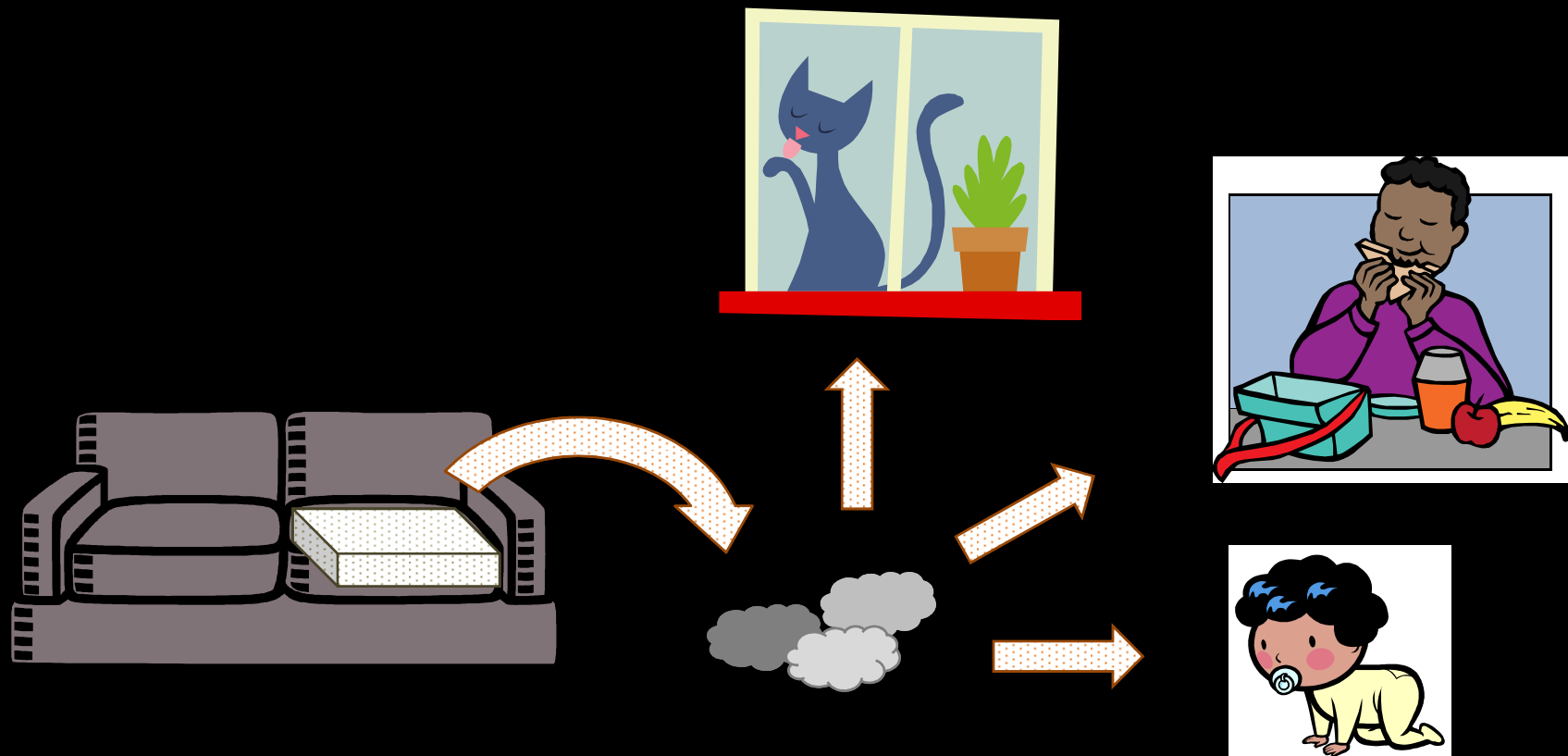
lower birth weight  
impaired attention  
poorer coordination  
lowered IQ



longer time to get pregnant  
altered thyroid hormones



# Products to People



# Global pollutants

Migrate towards north and south poles





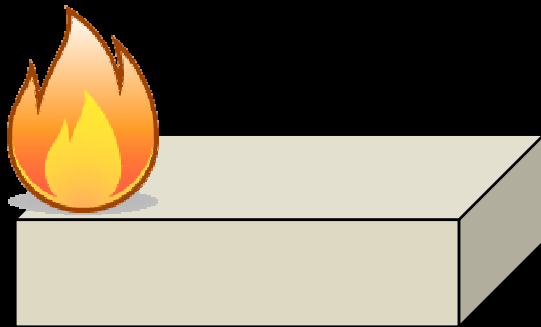


97 ppm to 3 ppm

# Open flame versus smolder

## TB117

12 second delay of  
ignition of filling  
inside furniture

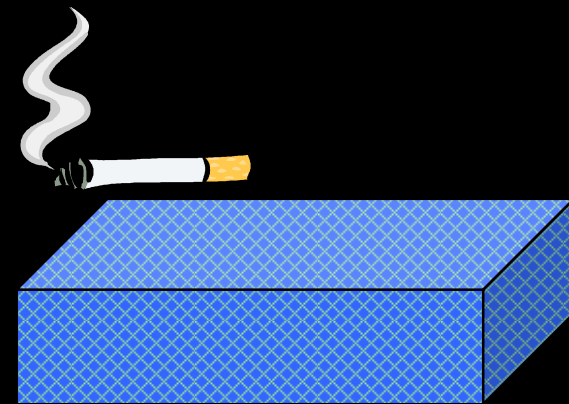


Flame retardants  
added to meet this  
small open flame  
standard

## TB117-2013

Most start with smoldering:

- Cigarettes
- Electrical sources

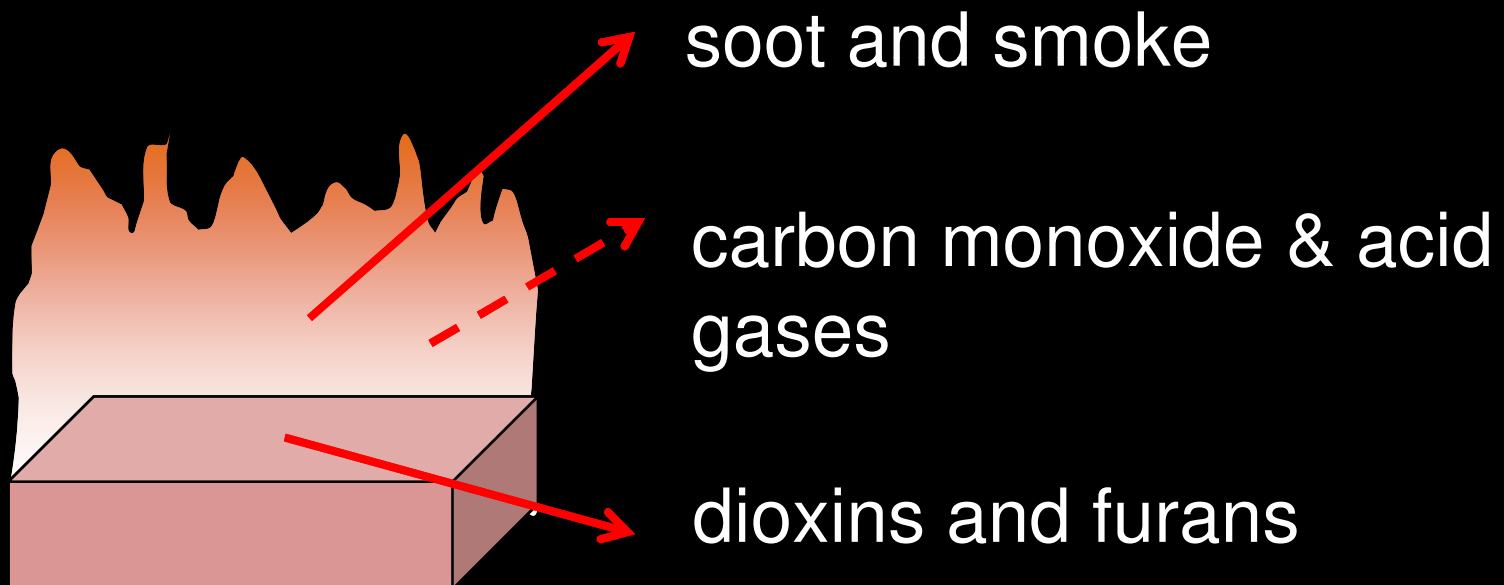


Prevented by smolder-  
resistant fabric

# Fire toxicity

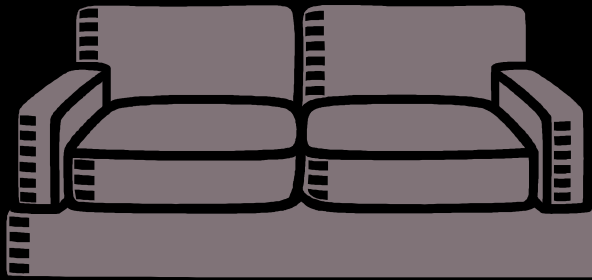
Flame retardants can delay,  
but do not prevent foam from burning

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



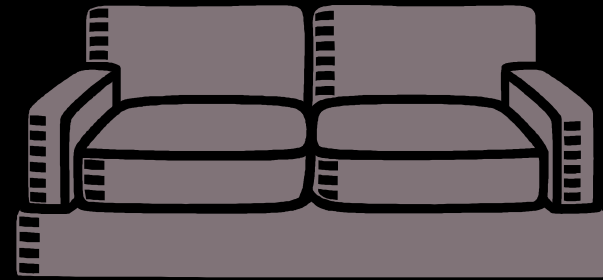
# TB117 Fire Safety Benefit?

TB117 foam



~

Non - TB117 foam



“No significant, consistent difference...”

# Increased fire safety without flame retardants



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





## 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

**D**r. 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.

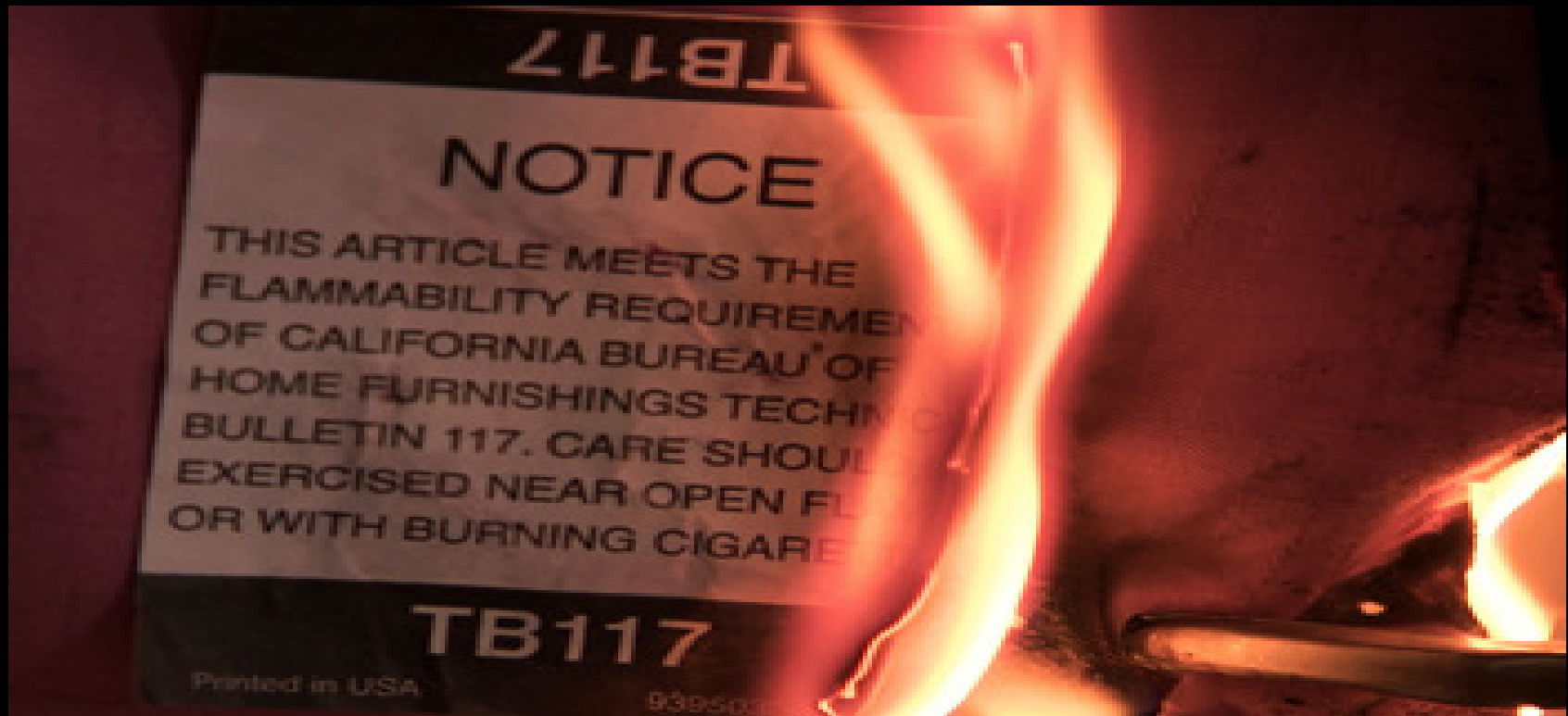
Today, scientists know that some flame retardants escape from household products and settle in dust. That's why toddlers, who play on the floor and put things in their mouths, generally have far higher levels of these chemicals in their bodies than their parents.

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>



Office of Governor  
**Edmund G. Brown Jr.**



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

## NOTICE

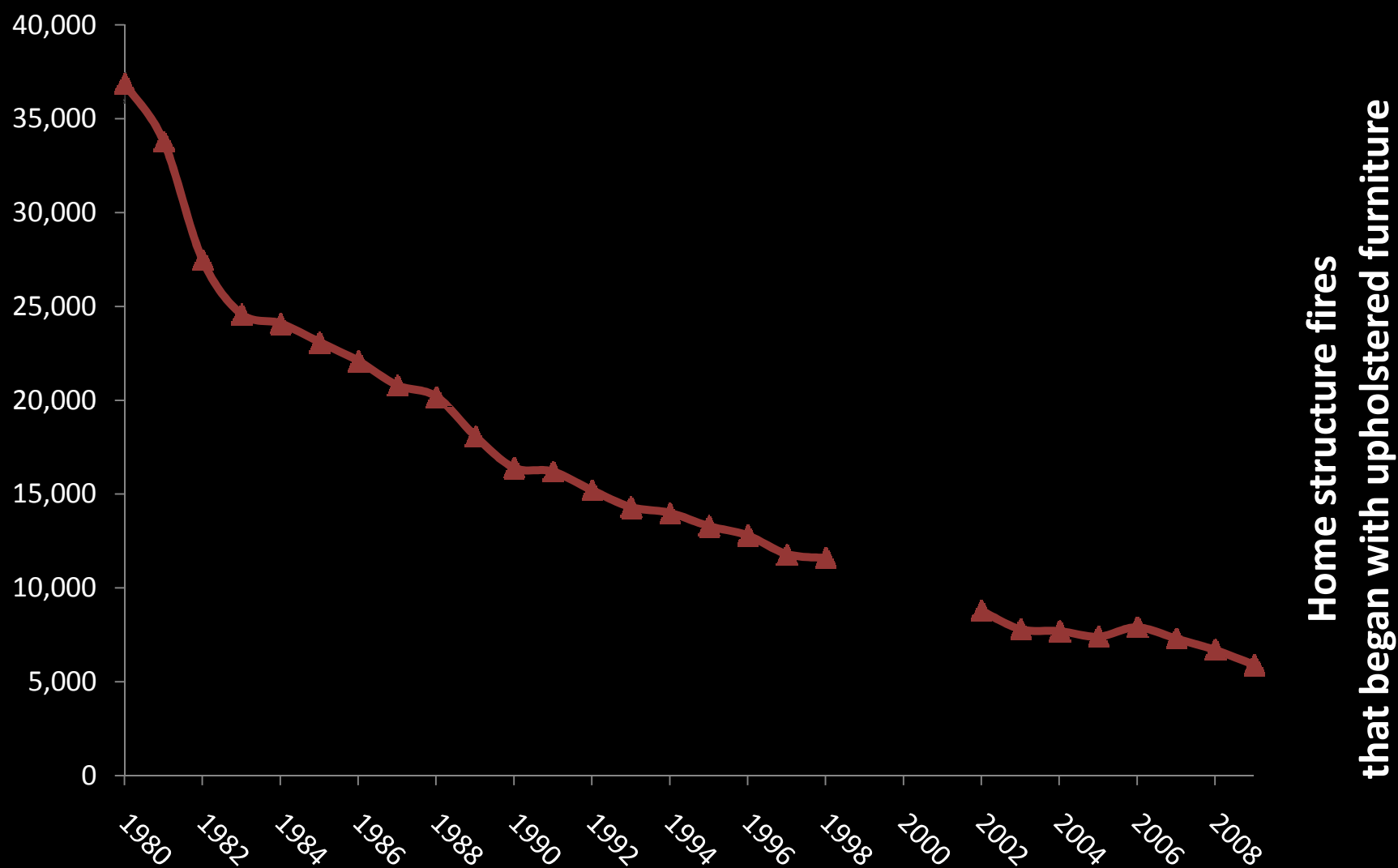
THIS ARTICLE MEETS THE FLAMMABILITY REQUIREMENTS OF CALIFORNIA BUREAU OF ELECTRONIC AND APPLIANCE REPAIR, HOME FURNISHINGS AND THERMAL INSULATION TECHNICAL BULLETIN 117-2013. CARE SHOULD BE EXERCISED NEAR OPEN FLAME OR WITH BURNING CIGARETTES.

The upholstery materials in this product:

☐ contain added flame retardant chemicals  
☒ 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.

# 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)

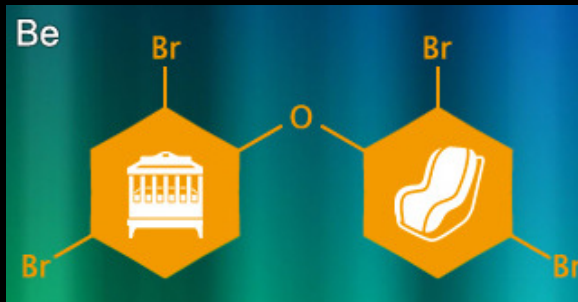
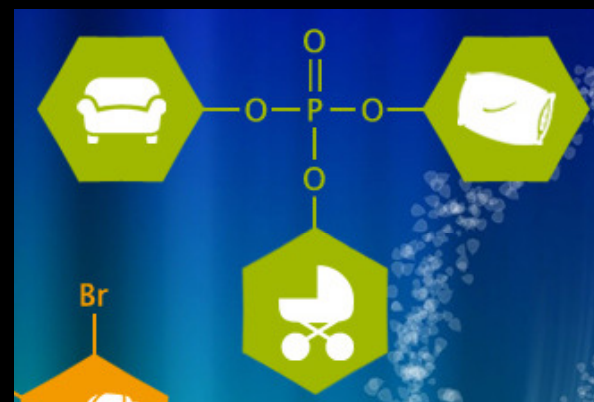
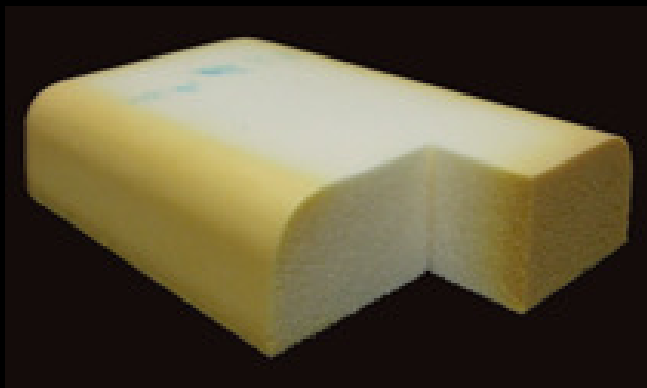
# What to do?

- 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



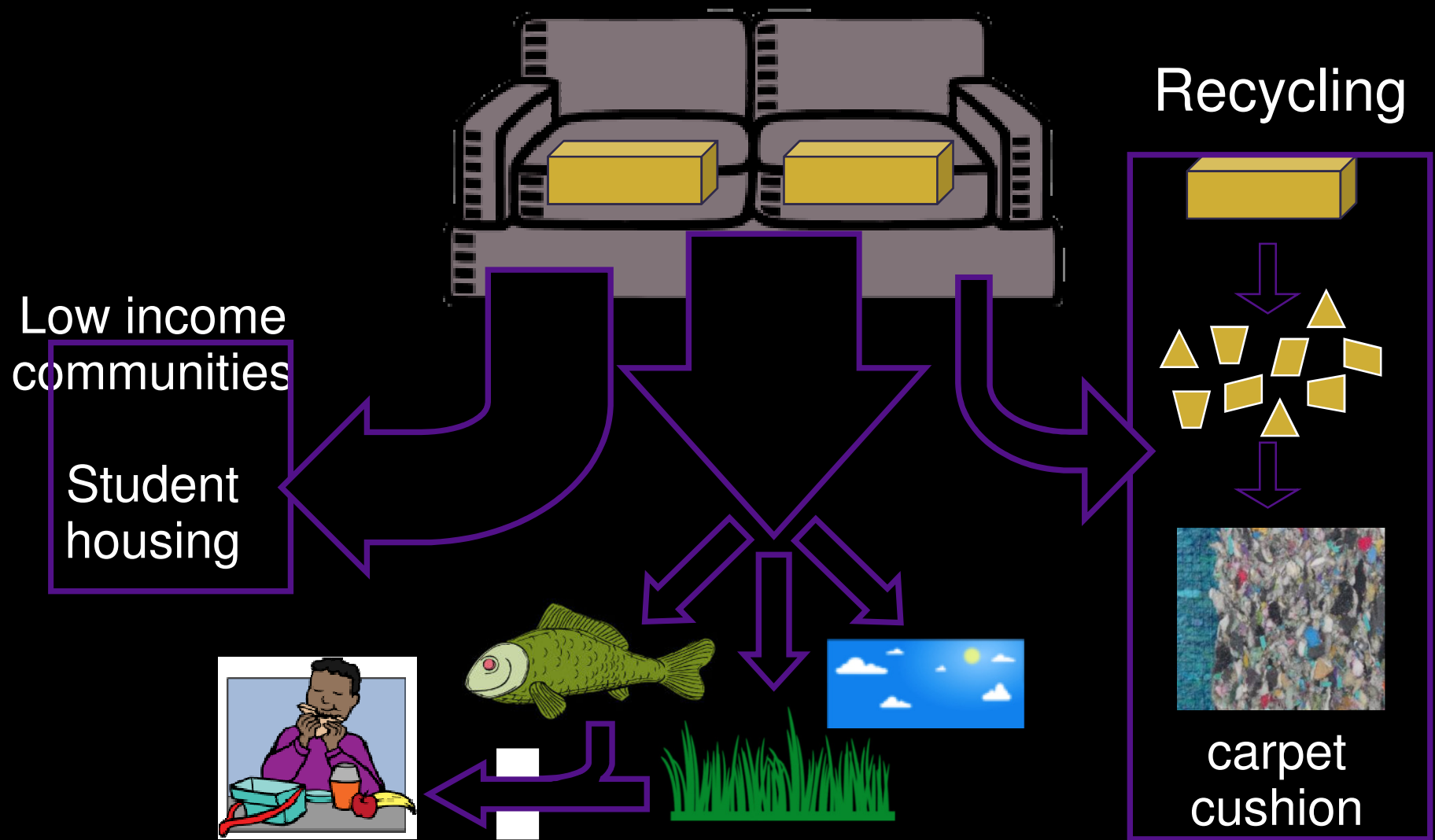
# Are there flame retardants in your furniture?

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

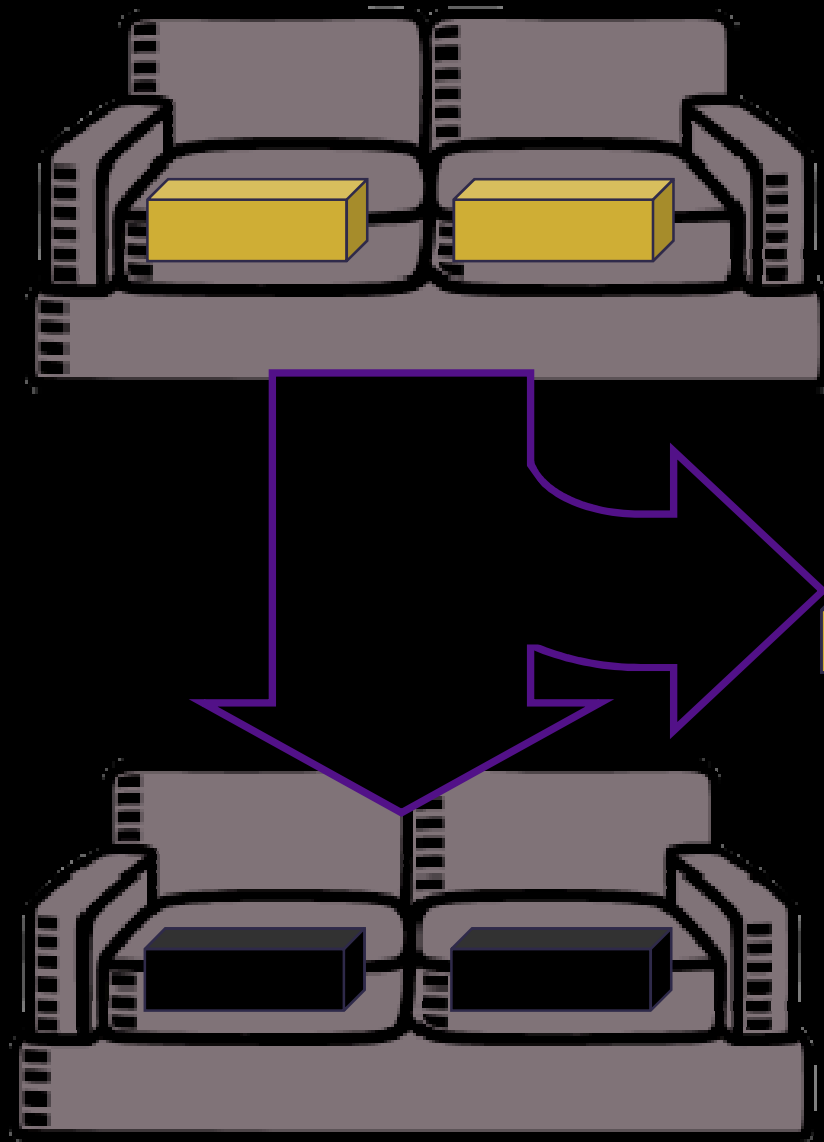


<http://foam.pratt.duke.edu/home>

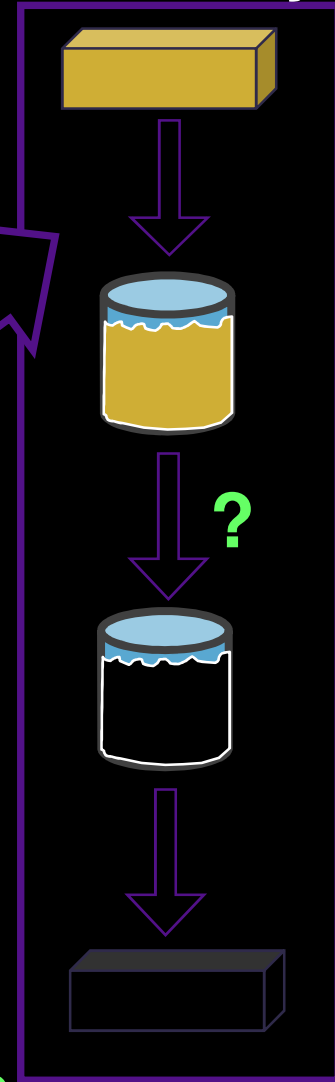
# Where does flame retarded foam end up?



# 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:

Donald Lucas

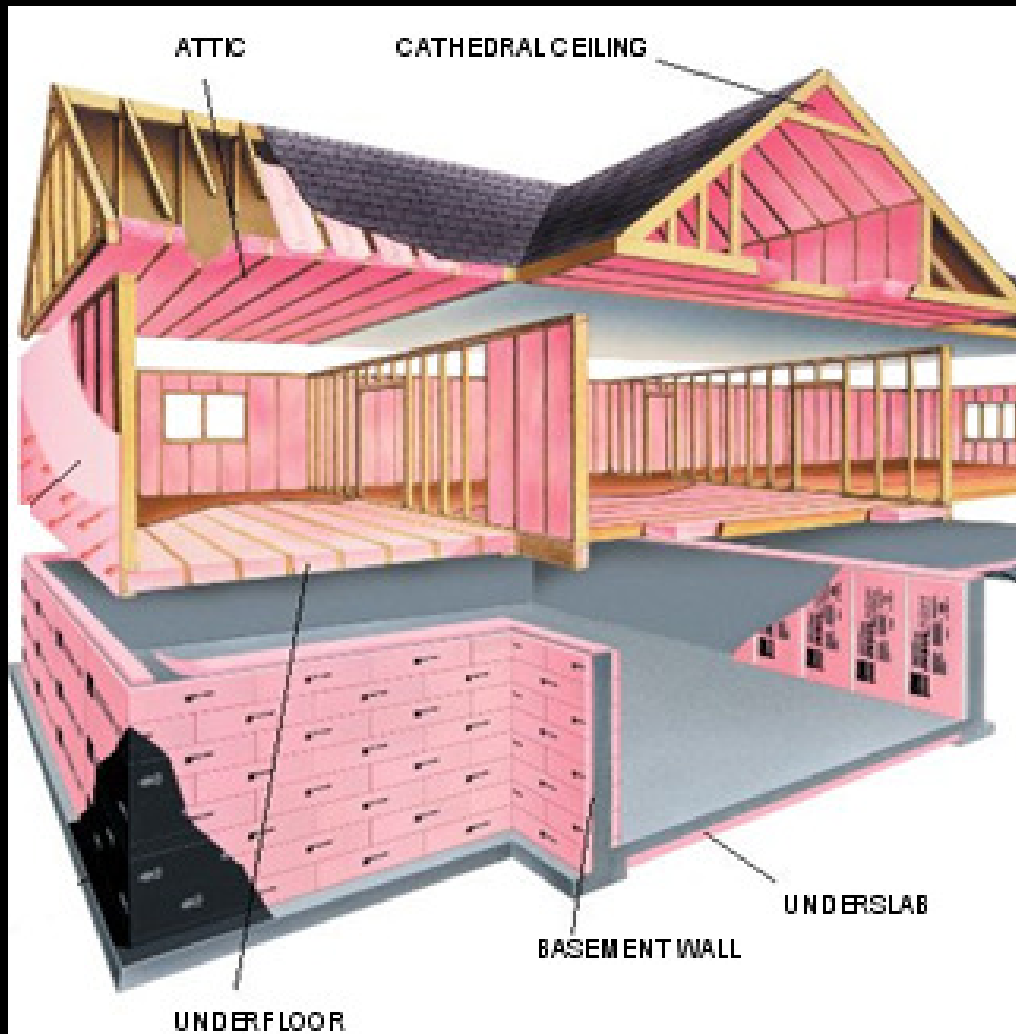
[D\\_lucas@lbl.gov](mailto:D_lucas@lbl.gov)

510-316-6764



# Foam Plastic Insulation

(polystyrene, polyurethane, polyiso, etc.)



Used increasingly for energy efficiency

Can be used:

- inside walls
- below grade
- attics, etc.

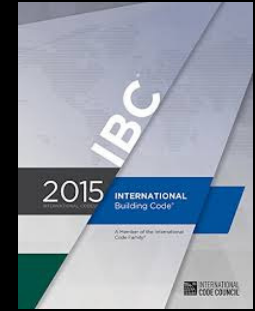


# California AB 127 (2013)

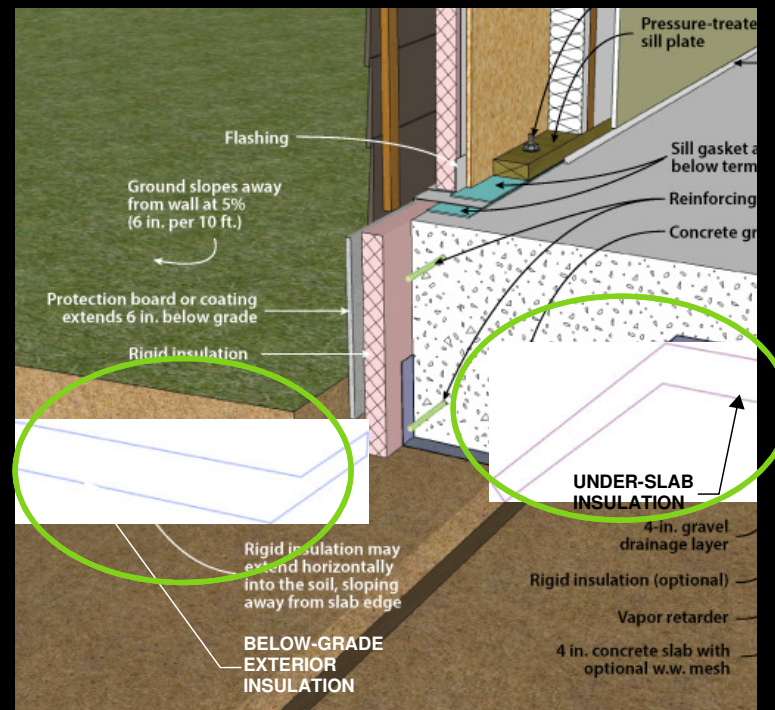
## Review of insulation flammability standards

- 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:



Fire Science and Technology Inc.



KAISER PERMANENTE®

SIEGEL & STRAIN Architects

PERKINS  
+ WILL

HKS



SUSTAINABLE DESIGN FOR  
THE BUILT ENVIRONMENT<sup>SM</sup>



USGBC CALIFORNIA



HAMMOND & COMPANY  
*Sustainable Development & Construction Services*



NATURAL RESOURCES DEFENSE COUNCIL  
THE EARTH'S BEST DEFENSE



INTERNATIONAL  
LIVING FUTURE  
INSTITUTE<sup>SM</sup>



Green Science  
Policy Institute



Development Center for  
Appropriate Technology

GREEN SCIENCE POLICY INSTITUTE  
[www.GreenSciencePolicy.org](http://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](mailto: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 7<sup>th</sup> International Symposium on Flame Retardants - BFR 2015
- Share research results and strategize how to reduce the use of harmful flame retardants



7th International Symposium on Flame Retardants

April 21-24 , 2015

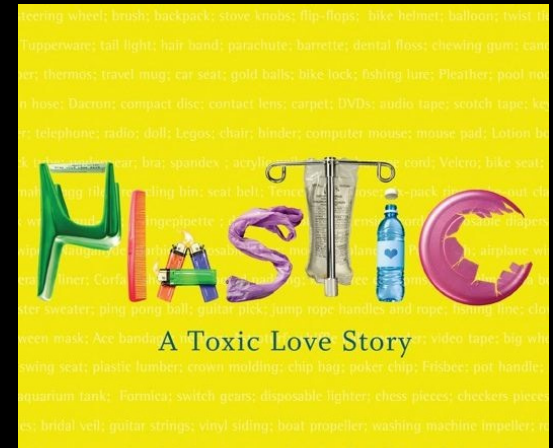
Jianguo Garden Hotel Beijing



# Class 4: Bisphenols and Phthalates

## Uses:

- **Bisphenols:** plastics, cash register receipts, adhesives, can linings
- **Phthalates:** plasticizers, lubricants, solvents, emulsifiers, fragrances



[http://www.susanfreinkel.com/books\\_Plastic.html](http://www.susanfreinkel.com/books_Plastic.html)





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



# Do we need them?

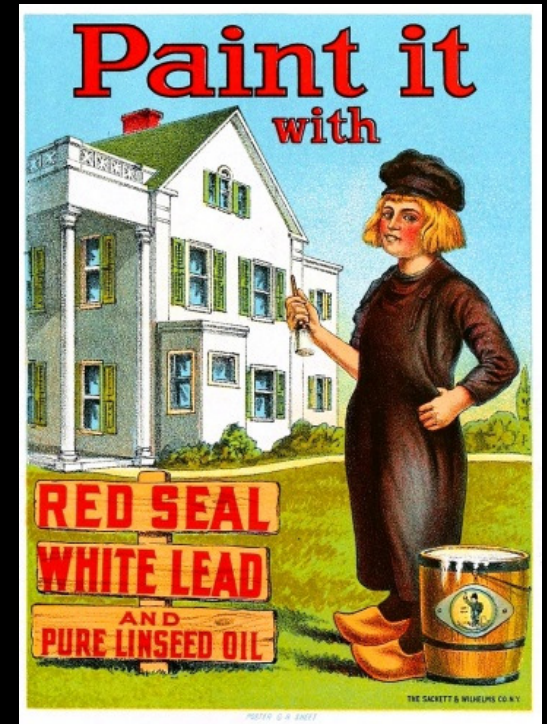
- Use Green Chemistry to improve efficiency and reduce solvent amount
- Switch to water-based products
- Other safer alternatives?



# Class 6: Certain Metals

(arsenic, cadmium, chromium, lead, mercury etc.)

- Can display toxicity at extremely low doses



# 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](http://www.greensciencepolicy.org)  
to join our e-list





A scenic mountain landscape. In the foreground, a dirt path leads through a field of green grass and red wildflowers. In the middle ground, there are rolling green hills and a dense forest of evergreen trees. In the background, a large, snow-capped mountain peak rises above a layer of white clouds. The sky is a clear, bright blue.

**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](http://www.greensciencepolicy.org)**

