



# **Green Science Policy Institute**

**Six Chemical Classes:  
For Better Environmental  
Policy and Purchasing**

**Arlene Blum PhD**

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

# Annapurna

A WOMAN'S PLACE

The dramatic  
story of the first  
American ascent of  
one of the world's  
highest peaks



ARLENE BLUM

20TH ANNIVERSARY EDITION

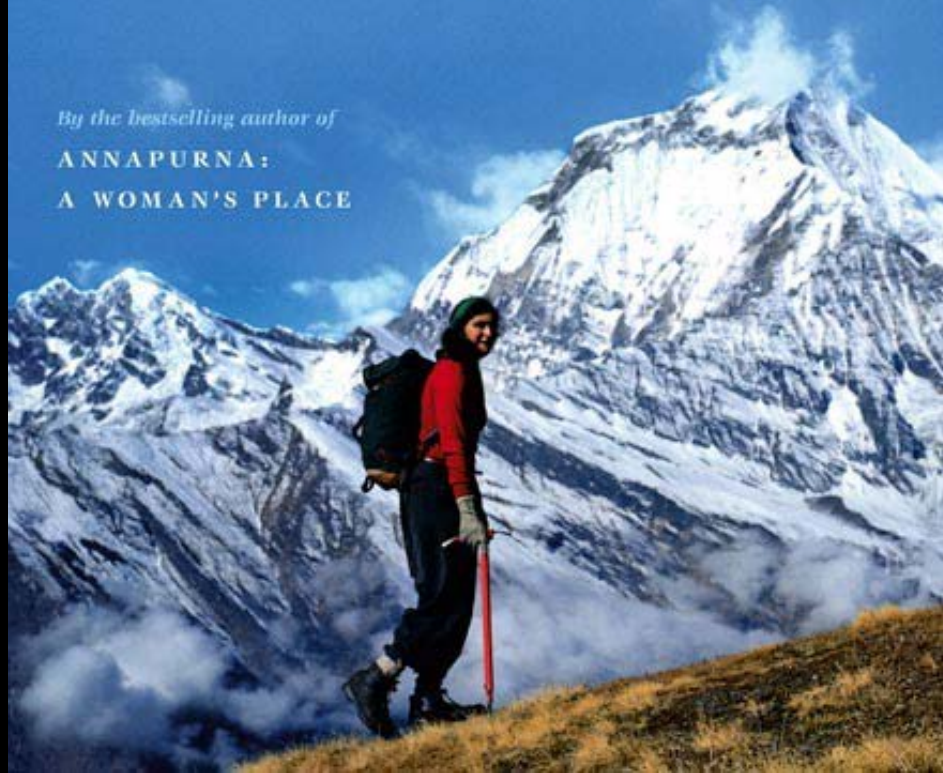
With a new Preface and Afterword by the author

Arlene Blum

# BREAKING TRAIL

*A Climbing Life*

*By the bestselling author of*  
**ANNAPURNA:  
A WOMAN'S PLACE**





# Problem

## 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



# Problem

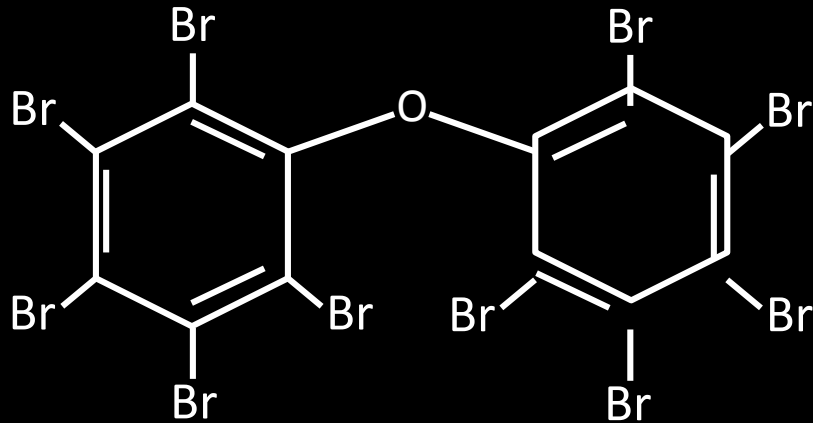
## Human Toxicological Trial?

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

-Herbert Needleman & Philip Landrigan

# Problem

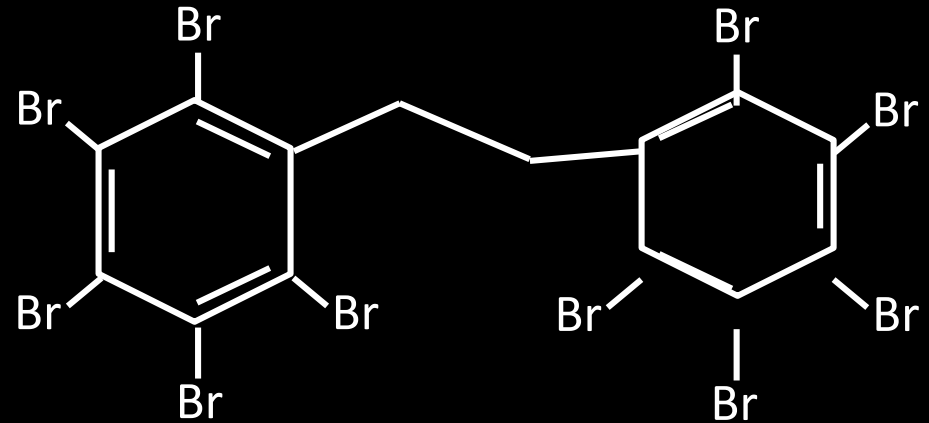
## Regrettable Substitution



Decabromodiphenyl  
ether

Concerns:

- Persistence
- Bioaccumulation
- Toxicity



Decabromodiphenyl  
ethane

Concerns:

- Persistence
- Bioaccumulation
- Toxicity



# A Solution: The Six Classes

1. **Highly fluorinated chemicals (PFAS)**  
stain and water repellants
2. **Chlorinated antimicrobials**  
triclosan and triclocarban
3. **Flame retardants**  
brominated, chlorinated, phosphate
4. **Bisphenols and phthalates**  
phthalates, BPA, PBS etc.
5. **Organic solvents**  
benzene, methylene chloride, xylene, etc.
6. **Certain metals**  
lead, mercury, chromium, cadmium, arsenic,

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.





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

SixClasses.org

15-minute webinars on Six Classes  
containing chemicals of concern

# Purchasers are Key

- Manufacturers of consumer products
- Large retailers
- Corporate, educational, & institutional buyers
- Consumers

# Buyer's Club



- Require transparency from manufacturers
- Utilize collective purchasing power to create a demand for healthy products and materials

# Harvard also plans a Buyer's Club

## Targeting Harmful Chemicals on Campus



Sustainability





# Housing Partnership Network

## 100 affordable housing nonprofits

# The Six Classes

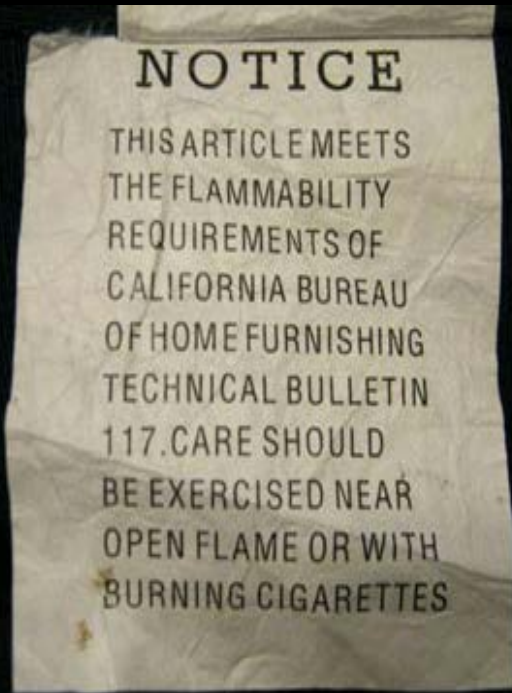
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# Class 3 Flame retardants

## 1970s Flammability Standards

- Children's sleepwear
- Furniture
- Foam plastic building insulation

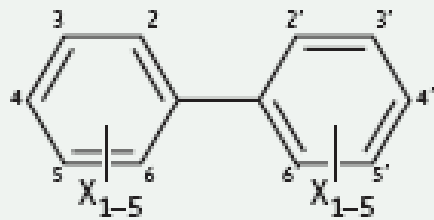
# Technical Bulletin 117



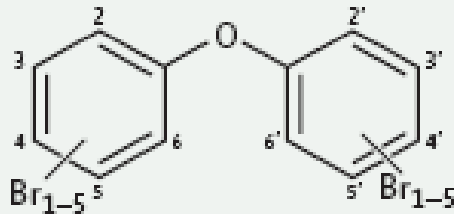
- Required furniture foam to withstand a small open flame for 12 seconds
- No significant fire safety benefit (fires start in exterior fabric not filling)



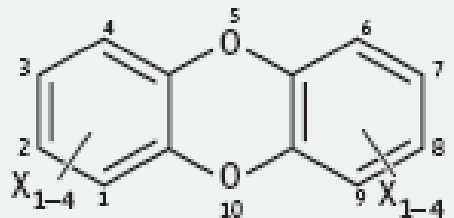
# PentaBDE Flame Retardant



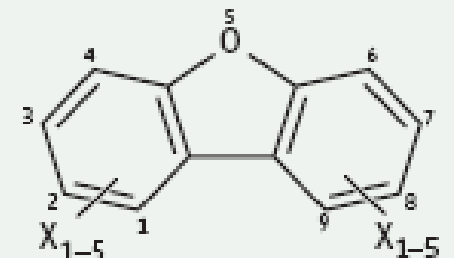
PCBs (X = Cl) and PBBs (X = Br)



PBDEs



Dioxins (X = Cl or Br)



Furans (X = Cl or Br)

Used from 1975 to 2004  
to meet TB117.

98% of use in US and  
Canada in 2003

# Human Health

Higher pentaBDE

associated with

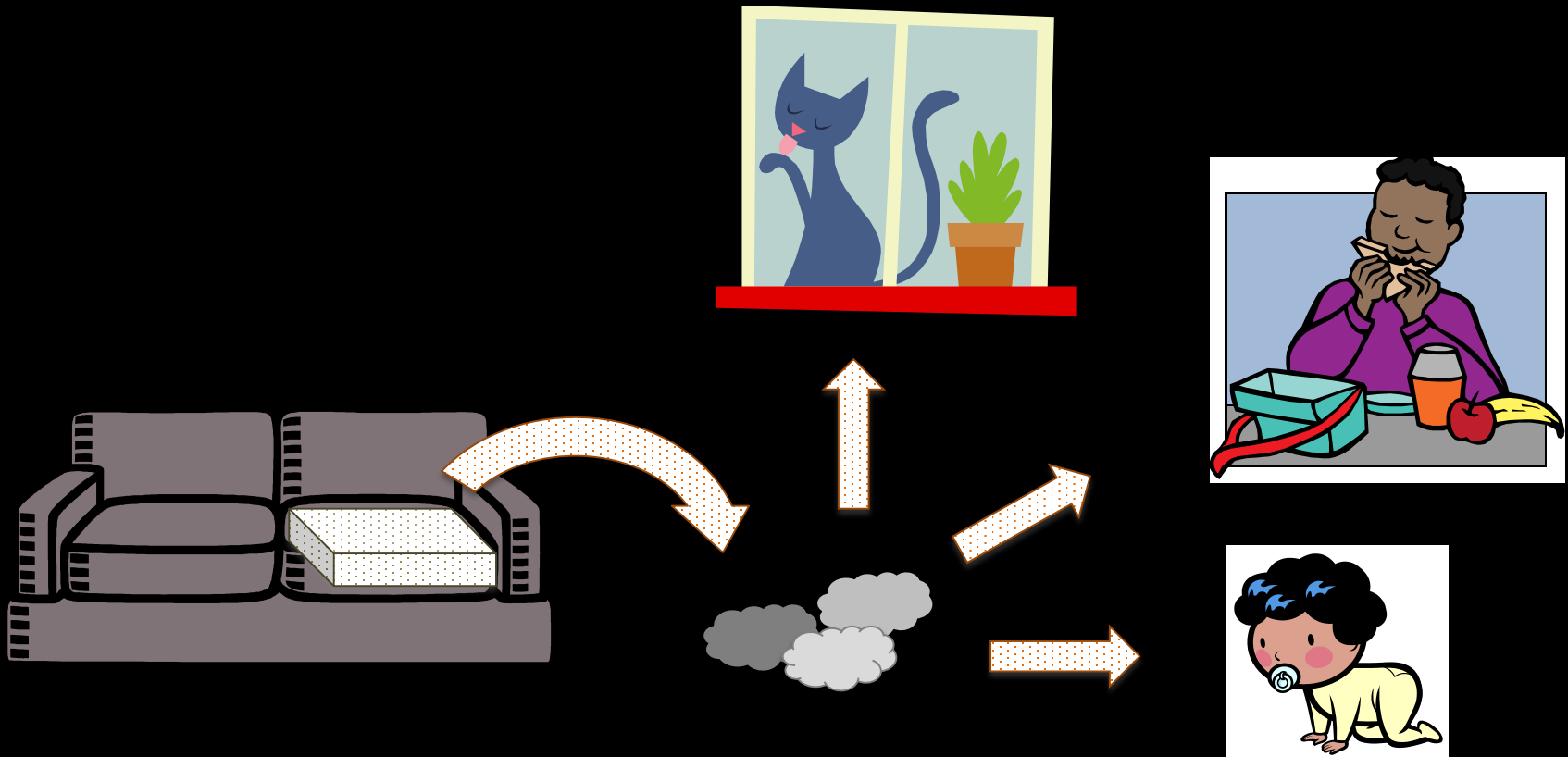
lower birth weight  
impaired attention  
poorer coordination  
lowered IQ



longer time to get pregnant  
altered thyroid hormones

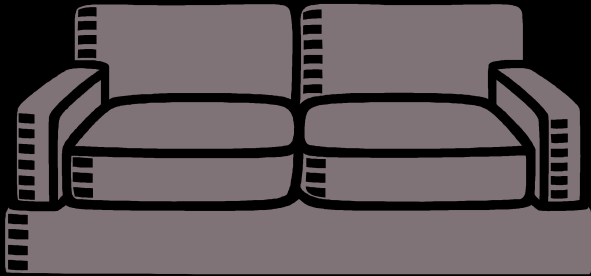


# From Products to People



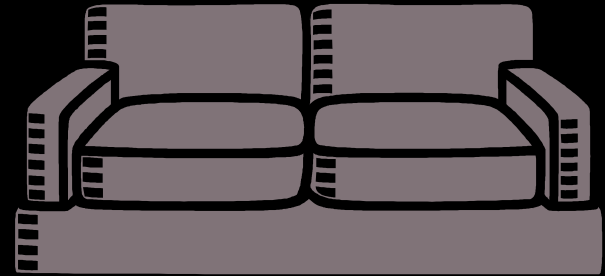
# TB117 Fire Safety Benefit?

TB117 foam



~

Non - TB117 foam



“No significant, consistent difference...”



# Four bills for 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)

# San Antonio Statement on Brominated and Chlorinated Flame Retardants

- Signed by over 200 scientist's from 30 countries
- Documents health and environmental harm and lack of proven fire safety benefit





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

records. The campaign 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







Office of Governor

**Edmund G. Brown Jr.**



June 18, 2012

## Governor Brown Directs State Agencies to Revise Flammability Standards

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

# California Flammability Standard TB117-2013

Mandatory January 1, 2015

Flame retardants not needed,  
but can still be used

Product Labels Required

## 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.

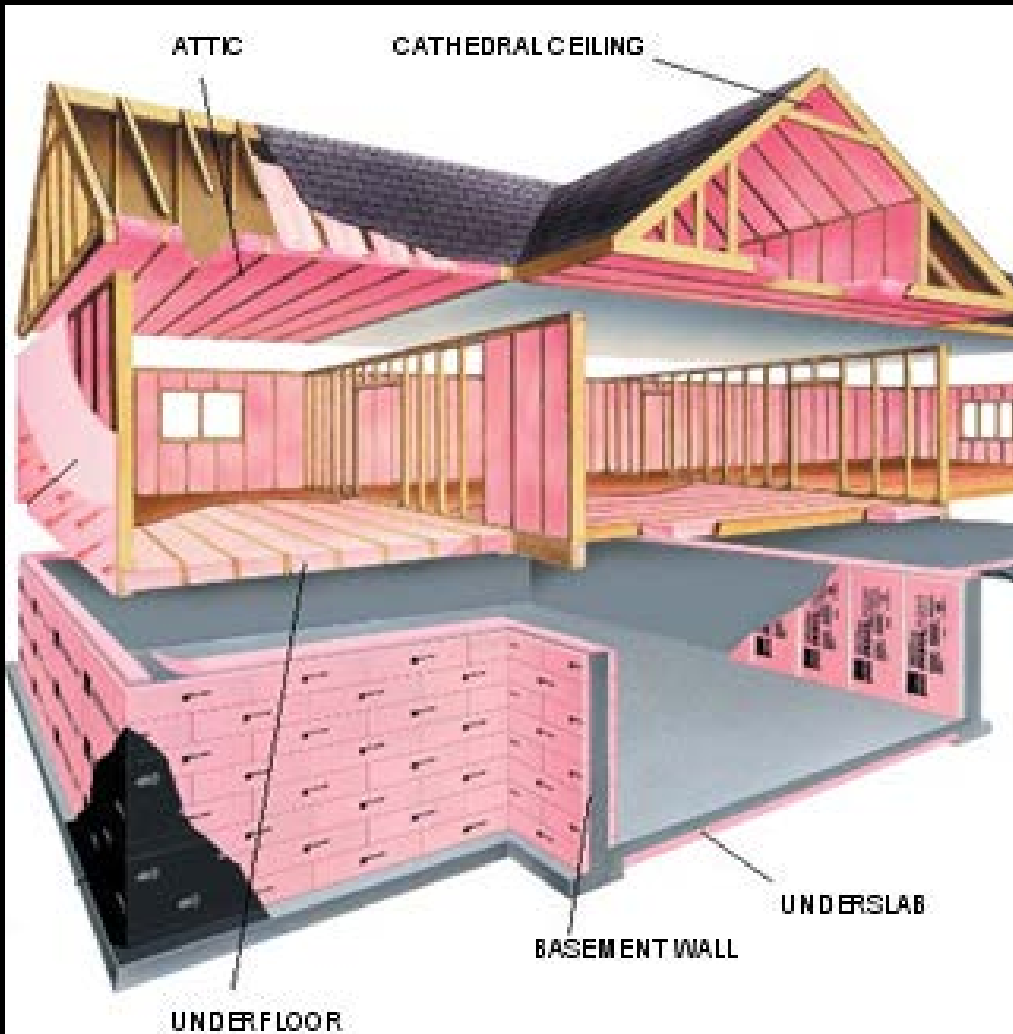
The upholstery materials in this product:

☐ 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.

# Foam Plastic Insulation

(polystyrene, polyurethane, polyiso, etc.)

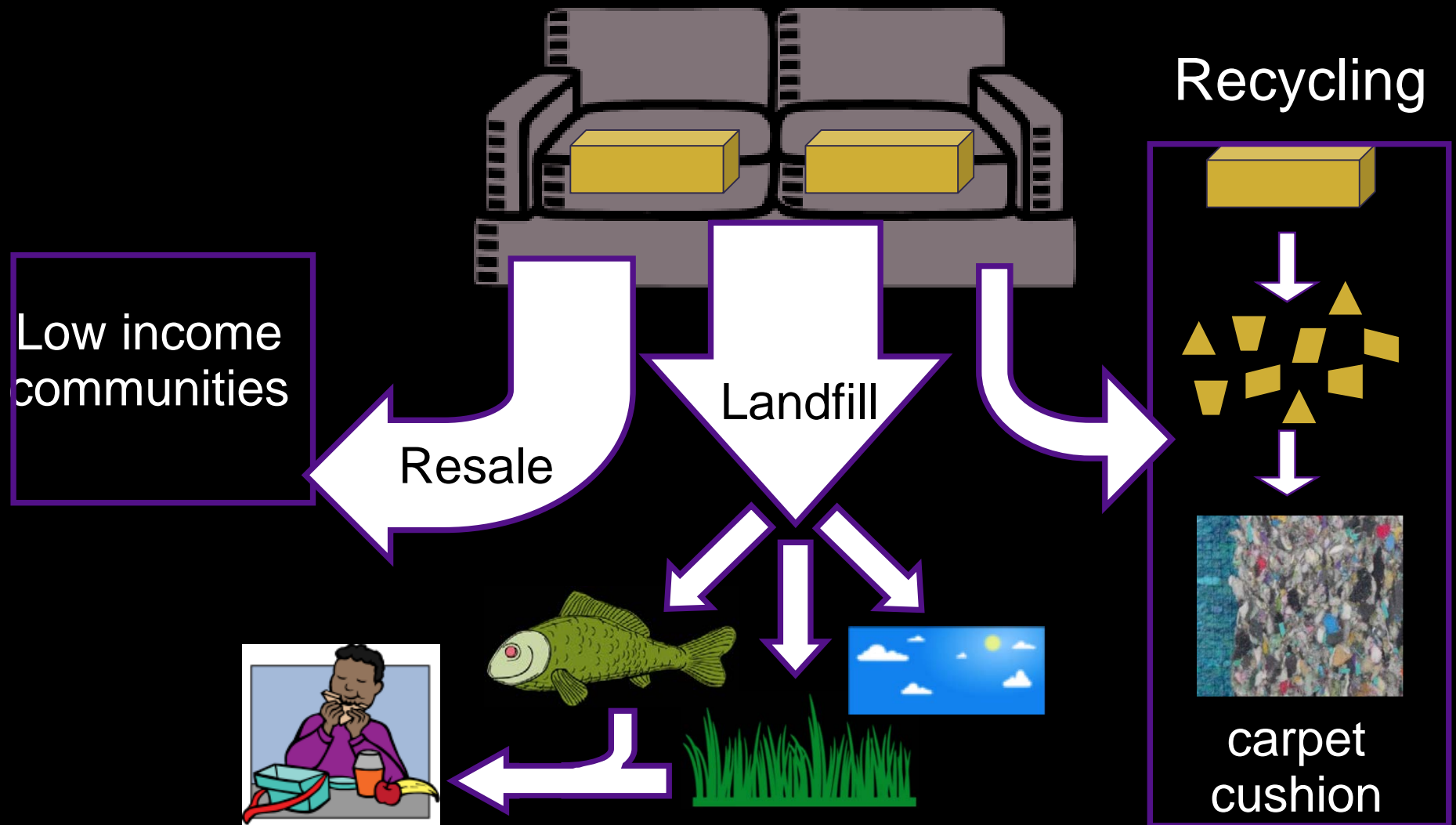


Used increasingly for energy efficiency

Can be used:

- inside walls
- below grade
- attics, etc.

# Where does flame retarded foam end up?





# Housing Partnership Network

## 100 affordable housing nonprofits



# Six Classes

1. **Highly fluorinated chemicals (PFAS)**  
stain and water repellants
2. **Chlorinated antimicrobials**  
triclosan and triclocarban
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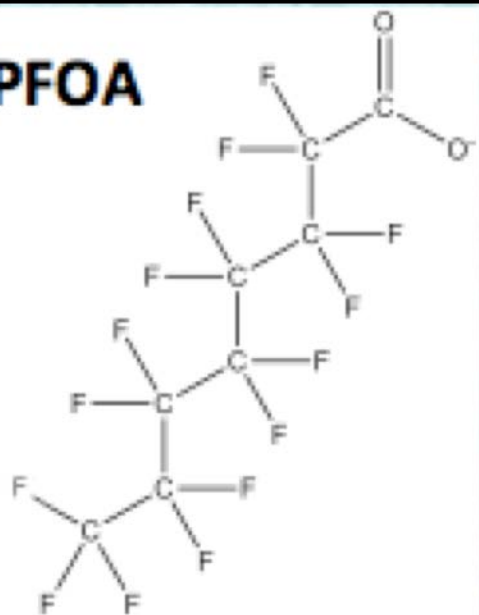
# Class 1: Highly Fluorinated Chemicals

Carbon-Fluorine bond strength:

- Leads to oil and water repellency
- Lasts for geologic times!



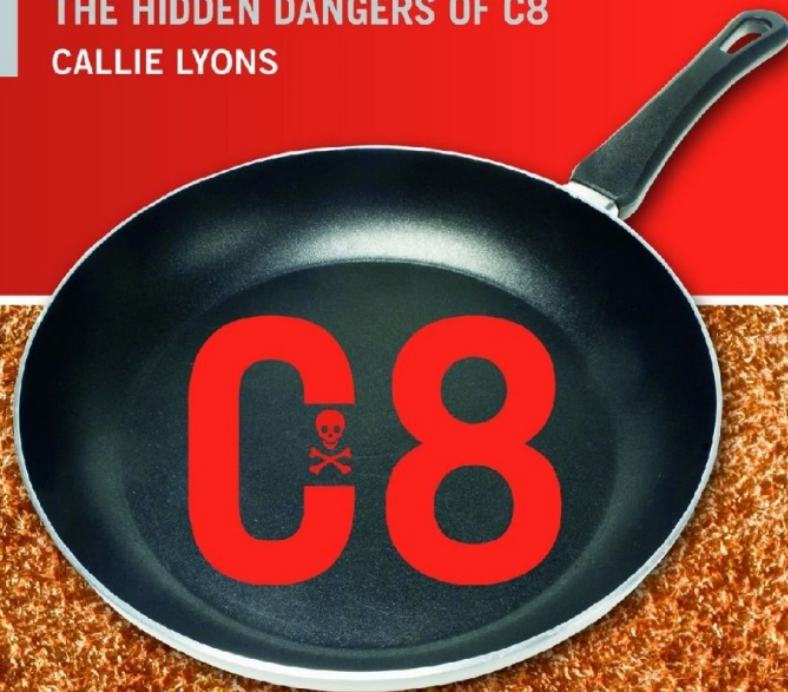
**PFOA**



**STAIN-RESISTANT,  
NONSTICK, WATERPROOF,  
AND LETHAL**

**THE HIDDEN DANGERS OF C8**

**CALLIE LYONS**



# C8 Human Toxicology

- PFOS and PFOA persist in the body for years
- Health effects linked to exposure to PFOA:
  - Kidney and testicular cancer
  - Elevated cholesterol
  - Thyroid disease
  - Delayed puberty, decreased fertility (women) and early menopause
  - Reduced immune response in children

# The Teflon Toxin Goes to Court.

The first of 3,500 personal injury and 37 wrongful death claims against DuPont went to trial in Ohio in September . [The Intercept](#).

“If the chemical were really dangerous, DuPont attorneys contend, government agencies would have regulated it. “



# Highly Fluorinated Chemicals are in:



# C8 replaced with forty forms of C6



- Persistent, a family trait
- In groundwater, wastewater, & seawater
- Increasing C6 levels in human blood
- Show signs of possible human health harm

# The Madrid Statement on Highly Fluorinated Chemicals (PFASs)



flickr @ Marc

Documents the scientific consensus:

- potential for harm
- roadmap to prevent further harm

Signed by 230 scientists from 40 countries

# Stories about Non-Stick

HEALTH TOXINS

## These 9 Common Products May Contain a Potentially Dangerous Chemical

Sarah Begley @SCBegley | May 1, 2015



PFASs are in goods like pizza boxes and outdoor clothing

Health officials and advocates [called for](#) new research on the group of chemicals known as PFASs (or PFCs) on Friday, raising concerns that the substances could pose health risks.

TIME

## These Chemicals in Pizza Boxes and Carpeting Last Forever

More than 200 scientists around the world document the threats of perfluorinated compounds and call for more government control.

By **Lindsey Konkel**, National Geographic

PUBLISHED MAY 01, 2015



NATIONAL GEOGRAPHIC

The Opinion Pages | OP-ED COLUMNIST

The New York Times

## Chemicals in Your Popcorn?

JUNE 4, 2015



Nicholas Kristof

What do a pizza box, a polar bear and you have in common?

[All carry a kind of industrial toxicant](#) called poly- and perfluoroalkyl substances, or PFASs, that do two things: They make life convenient, and they also appear to increase the risk of cancer.

## Massive Group Of Scientists Thinks You Shouldn't Use Non-Stick

By **Dan Nosowitz** on May 19, 2015

modern farmer



A group of 200 scientists just published what's being called "The Madrid Statement," a wide-ranging criticism of the category of chemicals used to create non-stick, grease-proof and waterproof coatings. Will it get you to stop using non-stick pans?



# Brands eliminate fluorinated chemicals



MANGO

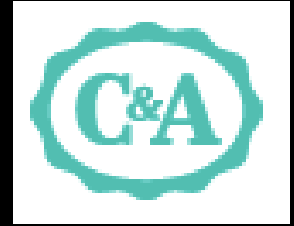
As of July 2013



As of August 2014



As of October 2014



As of January 2015

As of January 2013



By July 2015



By July 2015



By December 2015



By December 2015



By December 2015



By December 2015



By July 2016



By July 2016



By December 2017

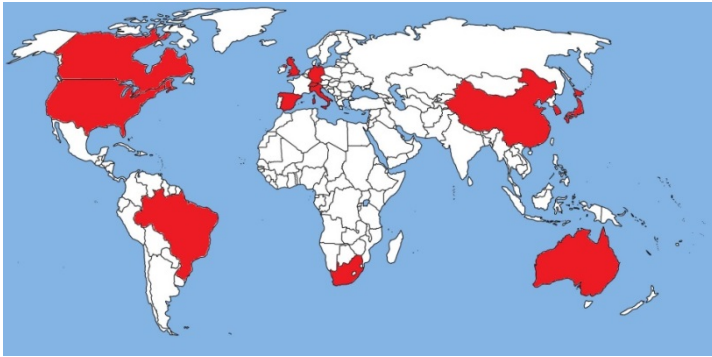


99% PFAS-free by  
December 2017



# Fluorinated Chemicals

Product Category	With	Without
Flooring	241	13
Carpet face fibers	20	16
Carpet backing	8	21
Floor finishes and coatings	13	1



**PFASs have been detected worldwide in surface water, wastewater, groundwater, drinking water, and landfill leachates.**

**UCMR3 requires monitoring for six PFASs in US drinking water. Monitoring began in 2013, and latest data release was January 2015.**

<b>PFAS</b>	<b>MRL (ng/L)</b>	<b>Occurrence (%)</b>	<b>Max (ng/L)</b>
C7	10	0.66	82 (NY, DE, PA)
C8	20	0.96	349 (PA)
C9	20	0.05	55.8 (NJ, PA)
PFBS	90	0.03	150 (CO, PA, AL)
PFHxS	30	0.61	680 (DE, PA, CO)
PFOS	40	0.81	1,800 (DE, CO, PA)

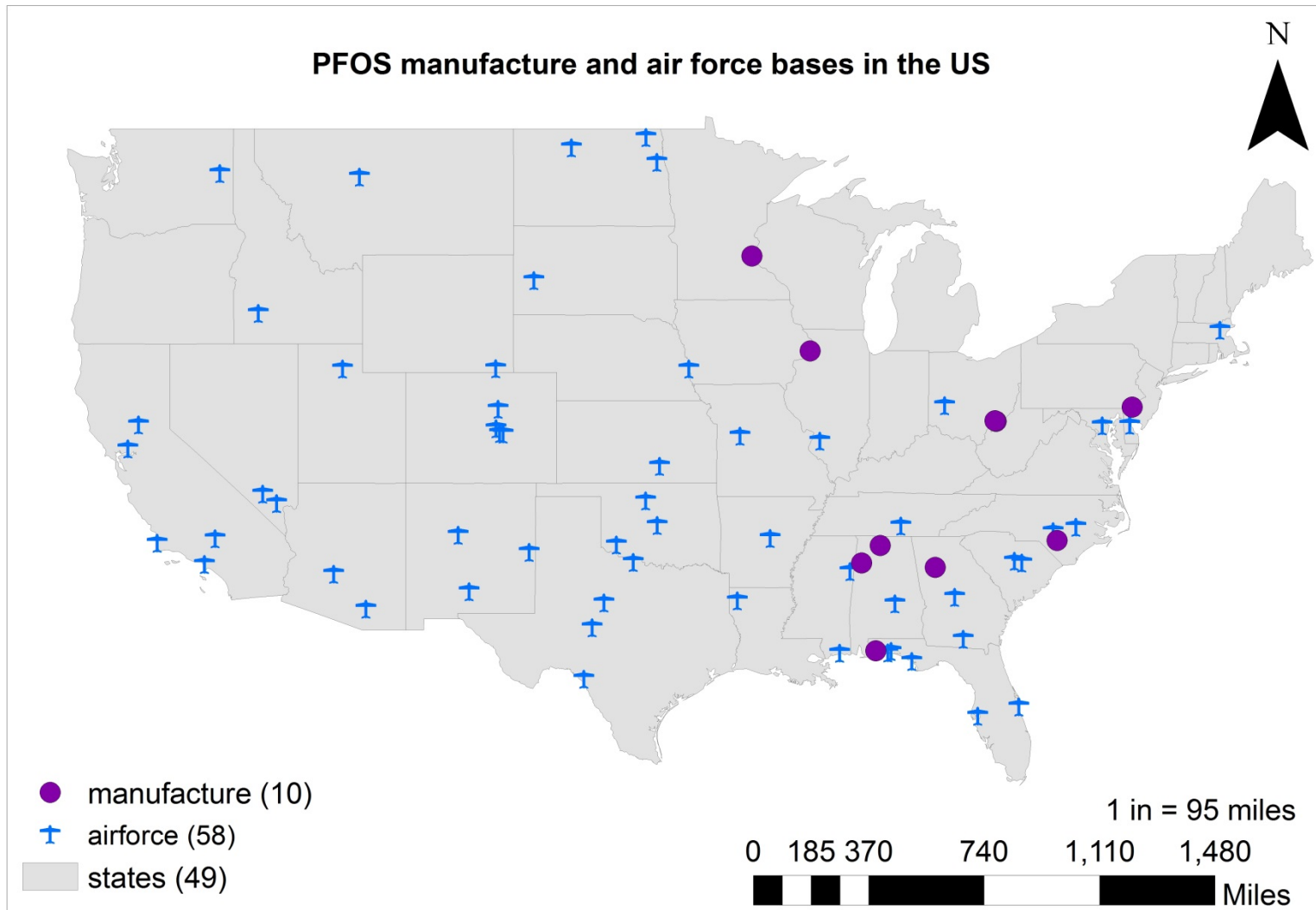
To date: 22,942 samples from 3,605 PWSs

PFAS detects: 351 samples (1.5%) from 132 PWSs (3.7%)

Of samples with PFAS detects: 22.8% derived from surface water

Slide courtesy Andy Lindstrom USEPA

# Result1: Major sources



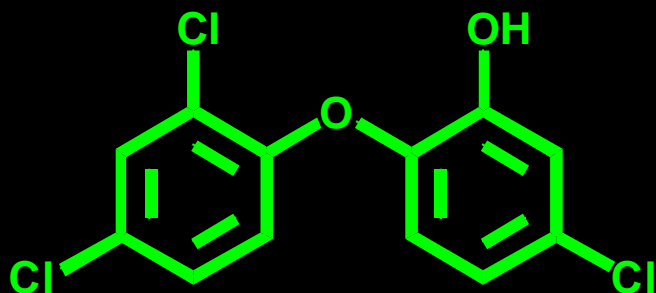
Courtesy, Cindy Hu Harvard School of Public Health

# The Six Classes

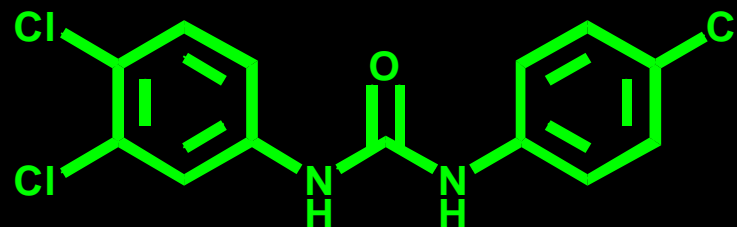
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# Class 2: Antimicrobials

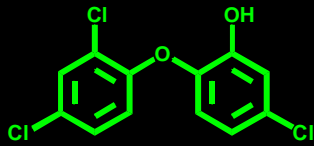
## Triclosan



## Triclocarban







FDA Draft  
Monograph  
on lack of efficacy  
and safety

First  
detection  
in fish

Patented

1964

1974

1984

1994

Several dozen  
antimicrobials;  
FDA removes  
them from  
drug category

2002

Top ten water  
contaminant

2007

Endocrine disruptor;  
Detectable in 97% of  
breast milk samples

2013

2,000 antimicrobial  
products.

2014

40<sup>th</sup> anniversary  
of FDA Draft  
Monograph –  
still no ruling

## A History of Triclosan in the U.S.

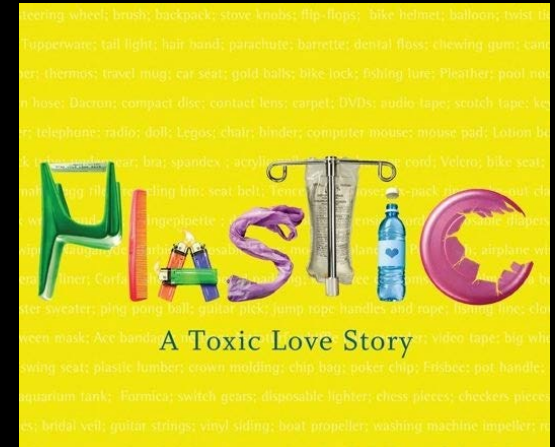
# Antimicrobials

Product Category	With	Without
Countertops	1	14
Floor finishes	6	1
Ceilings	13	1
Interior paint <b>Interior infishes</b>	144	4

# 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)



# Class 5: Organic Solvents

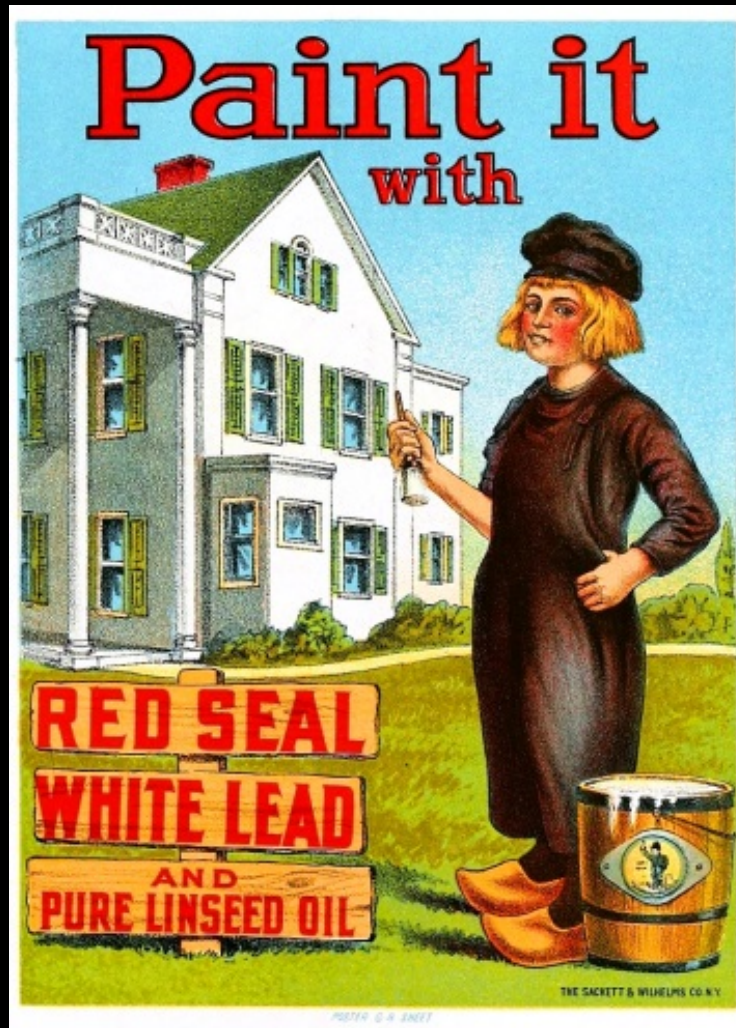
(aliphatic, aromatic, halogenated, oxygenated)

- 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



# Class 6: Certain Metals

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



Courtesy: Dr. Graham Peaslee



# Retailers

- Many retailers are only selling furniture without flame retardants
- Home Depot, Lowe's and Menards will phase out phthalates in flooring by the end of 2015





# IKEA's successes using the class approach

- Highly fluorinated chemicals banned (2015)
- Triclosan banned (2002)
- Ban on brominated flame retardants (2000)
- Ban on bisphenols in food contact materials (2015)
- Ban phthalates for childrens & food contact products
- Ban chlorinated solvents in children articles (2006)
- Ban lead, cadmium, mercury and their compounds



# A Policy and Purchasing Challenge

Can the use of one or more of the Six  
Classes in consumer products be  
reduced by 50% in five years?

A full-page background image showing a mountain climber in a yellow helmet and dark gear ascending a steep, snow-covered mountain ridge. The sun is shining brightly from the upper left, creating a lens flare effect. The sky is a deep blue.

For e-newsletters  
[www.greensciencepolicy.org](http://www.greensciencepolicy.org)

**Please give Arlene your card  
Or sign our e-list**



**By reducing use of Harmful Chemical Classes**

**We can have a healthier world.**

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