

Healthier Products, Healthier People: Reducing the Use of Classes of Chemicals of Concern

Highly Fluorinated, Antimicrobials, Flame
Retardants

Tom Bruton, PhD and Arlene Blum, PhD

Green Science Policy Institute

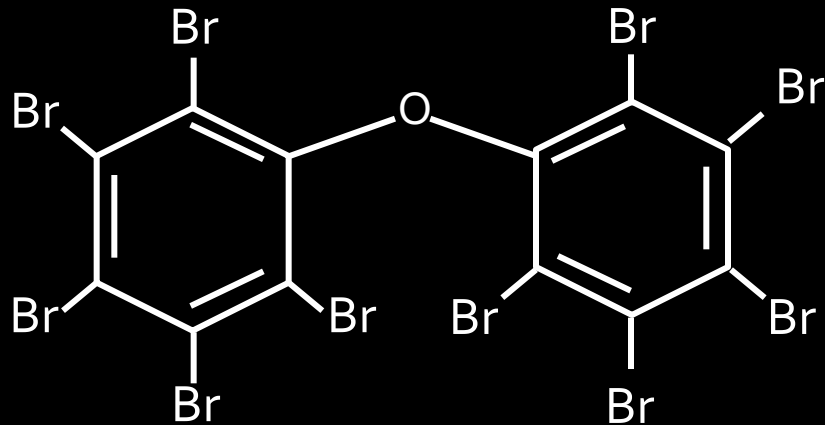
June 2017

U.S. Toxic Substances Control Act (1976)

- 62,000 previous chemicals “grandfathered”
- 23,000 new chemicals
 - 85% have no health data
 - 67% have no data at all



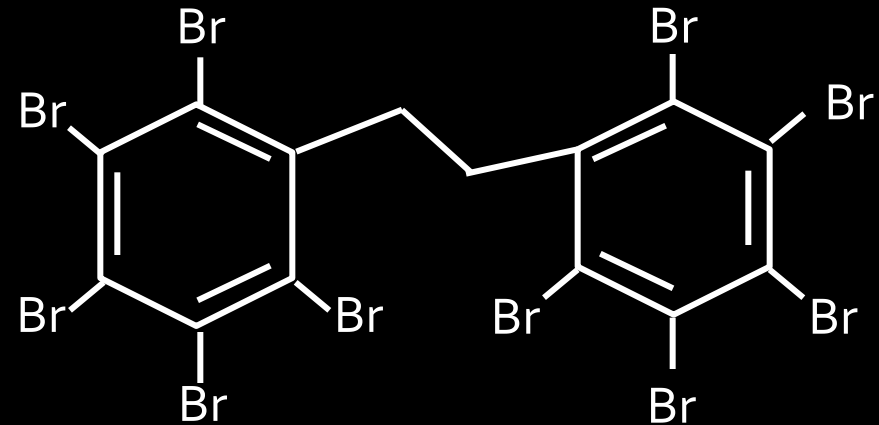
Regrettable Substitution



Decabromodiphenyl
ether

Concerns:

- Persistence
- Bioaccumulation
- Toxicity



Decabromodiphenyl
ethane

Concerns:

- Persistence
- Bioaccumulation
- Toxicity



GREEN SCIENCE POLICY INSTITUTE

Building Research & Information (2022) 48(6): 738-755

Building insulation: building codes

Environmental Science & Technology

Novel and High Volume Use Flame Retardants in US Couches

Reflective Coatings Phase Out

Fluorine PentabDE

Fluorine in U.S. Fast Food Packaging

Detection of Poly- and Perfluoroalkyl Substances (PFASs) in U.S. Drinking Water Linked to Industrial Sites, Military Fire Training Areas, and Wastewater Treatment Plants

Supporting Information

ABSTRACT: Drinking water contamination with poly- and perfluoroalkyl substances (PFASs) poses risks to the developmental, immune, metabolic, and endocrine health of consumers. We present a spatial analysis of 2013–2015 national drinking water PFAS concentrations from the U.S. Environmental Protection Agency's (USEPA) third Unregulated Contaminant Monitoring Rule (UCMR3) program. The number of industrial sites that manufacture or use these compounds, the number of military fire training areas, and the number of wastewater treatment plants are all significant

Hydrological units with detectable PFASs

Using the data



Education



Research

Retreats

Policy & Purchasing Change

The Six Classes

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

Is it necessary?

Is it worth it?

Is there a safer alternative?

Classes 1 to 3

Periodic table of elements

hydrogen 1 H 1.0079												Halogens					helium 2 He 4.0026	
lithium 3 Li 6.941	beryllium 4 Be 9.0122											boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180	
sodium 11 Na 22.990	magnesium 12 Mg 24.305											aluminium 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948	
potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80	
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29	
caesium 55 Cs 132.91	barium 56 Ba 137.33	57-70 ★	lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]
francium 87 Fr [223]	radium 88 Ra [226]	89-102 ★ ★	lawrencium 103 Lr [262]	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs [269]	meitnerium 109 Mt [268]	ununnium 110 Uun [271]	ununium 111 Uuu [272]	unubium 112 Uub [277]	ununquadium 114 Uuq [289]					

* Lanthanide series

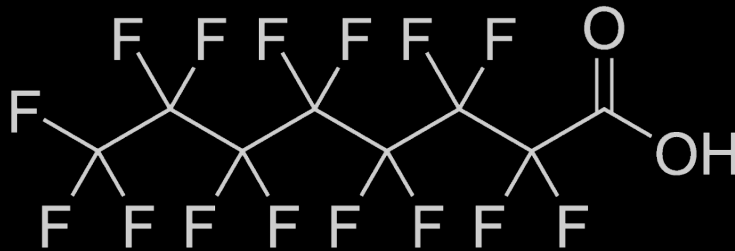
** Actinide series

lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]

Class 1: Highly Fluorinated Chemicals (aka PFCs, PFAS)

Carbon-Fluorine bond strength:

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



May 2015 The Madrid Statement on Highly Fluorinated Chemicals



“We call on the international community to cooperate in limiting the production and use of PFASs and in developing safer non-fluorinated alternatives.”

Signed by 230 scientists from 40 countries

2015: Environmental Health Perspectives

2015-16

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.

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
Intercept_

THE TEFLON TOXIN

DuPont and the Chemistry of
Deception



Sharon Lerner

Aug. 11 2015, 3:35 p.m.



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Home

The New York Times Magazine

The Lawyer Who Became DuPont's Worst Nightmare

Rob Bilott was a corporate defense attorney for eight years. Then he took on an environmental suit that would upend his entire career — and expose a brazen, decades-long history of chemical pollution.

By NATHANIEL RICH JAN. 6, 2016



Law: Claims in the Ohio Valley

(The Teflon Toxin Goes to Court, Sharon Lerner, The Intercept)

September 2015: 3,500 personal injury and 37 wrongful death claims in Ohio Valley against DuPont went to trial

October 2015: \$1.6 million for kidney cancer.

July 2016: \$5 million for testicular cancer.

January 2017: \$10.5 million for malice

February 2017: \$671 million to settle claims in Ohio Valley

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

EPA Drinking Water Health Advisory Levels

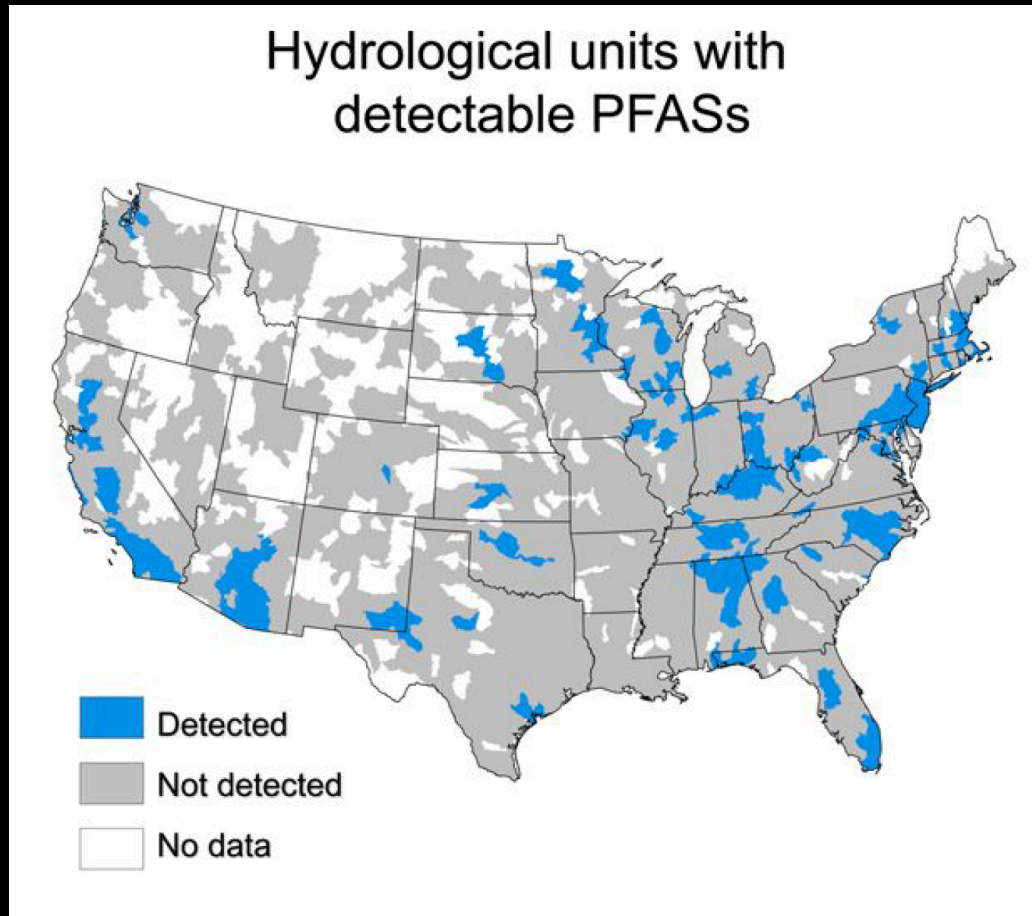
January 2009:

Provisional level of 400 ppt for PFOA and 200 ppt for PFOS

May 2016:

Lifetime level of 70 ppt for total of PFOA and PFOS

Six million Americans have PFAS in their drinking water at higher levels than EPA health advisory



Policy: Drinking Water Levels

May 2016:

US EPA Lifetime Health Advisory of 70 ppt for PFOA and PFOS

December 2016:

Vermont enforceable standard for 20 ppt for PFOA and and PFOS

September 2016:

Draft New Jersey Drinking Water Quality Institute recommended enforceable standard for PFOA of 14 ppt

May 2017:

Minnesota guidance values of 35 ppt for PFOA and 27 ppt for PFOS

Fluorinated Alternatives?



Fluorinated Alternatives: Myths versus Facts



Long-chain highly fluorinated chemicals — including PFOA, PFOS and other C8 compounds — were used for decades to give water-repellant, stain-resistant, and non-stick properties to furnishings, carpets, outdoor gear and other products. Exposure to PFOA has been linked to kidney and testicular cancer, elevated cholesterol, decreased fertility, thyroid problems and changes in hormone functioning in adults as well as adverse developmental effects and decreased immune response in children¹.

Due to such harmful effects, the long-chain chemicals were recently phased out and replaced by numerous similar compounds, including short-chain molecules called C6 and C4². Industry says these alternatives are safe, sustainable, and well-tested³. A look at the facts shows those claims don't stick.

THE BOTTOM LINE

Highly fluorinated chemicals pose a potential risk to human health and the environment, and they should only be used with safeguards when their function is essential.



MYTH: "PFOA-free" means safe.

FACT: Products advertised as "PFOA-free" often contain replacement chemicals made with the same **problematic chemical building blocks** as PFOA.

Since PFOA has been phased out, numerous related chemicals that are equally persistent and may pose similar health risks have replaced it⁴. To prevent such "regrettable substitutions", the entire class of highly fluorinated chemicals should be avoided.

MYTH: Short-chain fluorinated alternatives like the 6 and 4 carbon-based compounds have been thoroughly tested and are safe.

FACT: Recent studies suggest these alternatives may cause similar health problems as the long chain compounds.

[www.greensciencepolicy.org/
highly-fluorinated-chemicals/](http://www.greensciencepolicy.org/highly-fluorinated-chemicals/)

Policy: California



Scientific Guidance Panel voted unanimously to add entire class of Highly Fluorinated Chemicals (PFASs) to priority list of chemicals in November 2015.

Policy: New York, SF, Portland

US cities act on chemicals of concern in furniture

New York sets procurement rule, San Francisco and Portland sign green purchasing pledge

26 May 2017 / Biocides, Built environment, PFCs, Phthalates, United States

Several US cities and a state are making efforts to restrict or discourage the use of substances of concern in furniture.

New York State recently adopted a green procurement specification restricting the chemicals permitted in furniture purchased by state agencies and public authorities.



<https://chemicalwatch.com/56131/us-cities-act-on-chemicals-of-concern-in-furniture>

Policy: New York

APRIL 28, 2017 | Albany, NY

Governor Cuomo Announces State Agencies Save \$19.6 Million with Green Practices

ENVIRONMENT

- New York state's new purchasing requirements for single use food containers and packaging:
 - "...products purchased ...on State contracts shall not contain perfluorinated chemicals (PFCs)..."



Policy: Proposed State Legislation on Food Packaging

- California Assembly Bill 958 (Ting)
 - “A food provider shall not serve, offer for sale, or offer for promotional purposes prepared food in, on, or with fast food packaging that contains PFAS.”
- Vermont
- Washington

Purchasing: Popcorn Bags in Denmark

- High PFAS concentrations ¹⁻⁴
- Coop Denmark - halted popcorn sales in 2015 due to PFAS
- RESULT: PFAS-free popcorn bags



1. Zabaleta, I., et al. Talanta. 152, 353-363. (2016)
2. Zafeiraki, E., et al. Chemosphere. 94, 169-176. (2014)
3. Dolman, S. and Pelzing, B. J. Chrom. B. 879:22, 2043-2050. (2011)
4. Begley, T. H., et al. Food Add. and Cont. 22:10, 1023-1031. (2005)

IKEA

Phasing PFAS out from all products worldwide

Substance

- Perfluorinated compounds
 - PFOA/PFOS/PFOSA
 - Other perfluorinated or partially perfluorinated organic compounds
- In materials treated for oil, water and/or stain repellancy

Requirements

- PFOA/PFOS/PFOSA are not allowed to be used.
 - Contamination limit values:
 - PFOS 1 $\mu\text{g}/\text{m}^2$
 - PFOA 0.1 mg/kg



Phasing out PFASs

“If IKEA can do it, Kaiser Permanente can do it”

- The idea of tackling PFASs was sparked at a conference in which IKEA discussed its goal to phase out the use of fluorinated chemicals

- Global Business Briefing, February 2016

Kaiser Permanente

BULLETIN

BULLETIN #: 2016-01

Topic: Prohibition of Highly Fluorinated Chemicals (Fluorochemicals)

Date Issued: January 07, 2016

Contact: Jennifer MacDaniel

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NATIONAL FACILITIES SERVICES KP DESIGN PROGRAM BULLETIN

BRIEF DESCRIPTION OF CHANGE:

Effective immediately, specification of fluorochemical additives or treatments for fabric, furniture, finishes, and building materials are prohibited on any Kaiser Permanente project. This prohibition includes all Main Loan Fund, PM&R and Expense projects.

BRANDS ARE ELIMINATING HIGHLY FLUORINATED CHEMICALS

IKEA

H&M

Crate&Barrel

LEVI STRAUSS & CO.

PUMA

benetton

ESPRIT

adidas

MARKS &
SPENCER

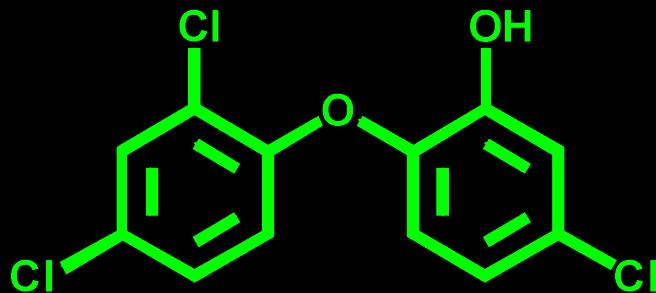
MANGO

BURBERRY[®]
LONDON

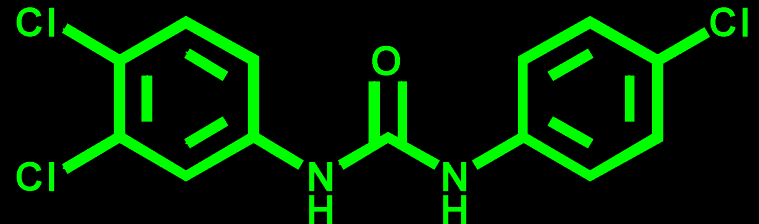
ZARA

Class 2: Antimicrobials

Triclosan

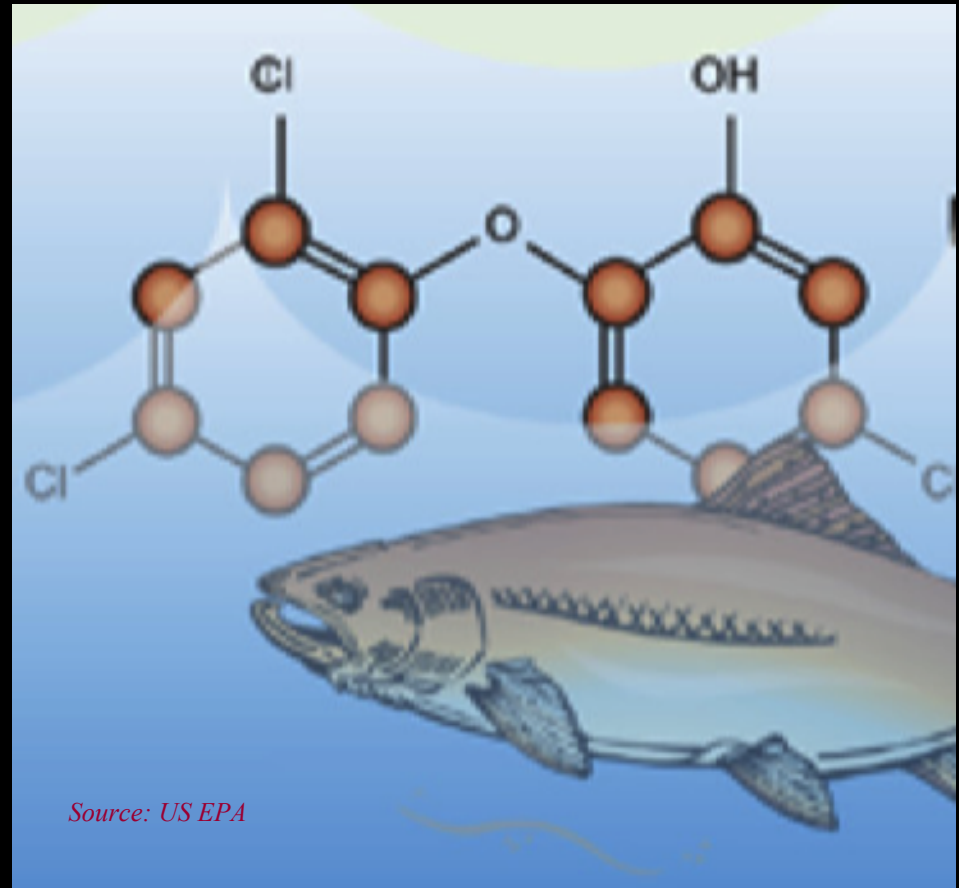


Triclocarban





5 – 10 Seconds
(ineffective)



**Lifetime exposure in
aquatic organisms**
(toxic)

Do we need them?

- Beneficial in certain medical applications
- No proven benefit over soap & water
- Ineffective in flooring and general-use plastic

Alternative Antimicrobials

	Toxic to Aquatic Organisms	Can Persist in the Environment	Can Contribute to Antimicrobial Resistance	Health Risks?
Triclosan & Triclocarban	✓	✓	✓	Hormone disruption Allergy sensitivity Altered microbiome
Quats	✓	✓	✓	Asthma Skin irritation Reproductive toxicant?
Nanosilver	✓	✓	✓	Significant data gaps

Coming Soon!

The Florence Statement on Triclosan and Triclocarban



Documents the scientific
consensus about:

- potential for harm
- recommendations to
prevent further harm

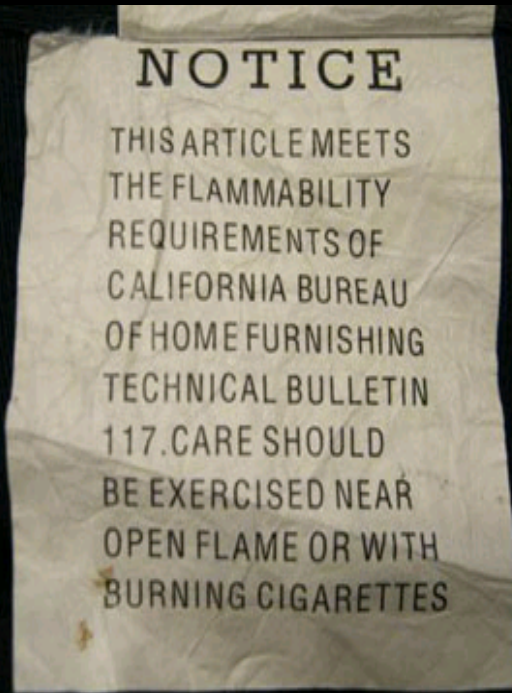
Signed by 205 international scientists

Class 3 Flame retardants

1970s Flammability Standards

- Children's sleepwear
- Furniture and baby product foam
- Foam building insulation

Technical Bulletin 117

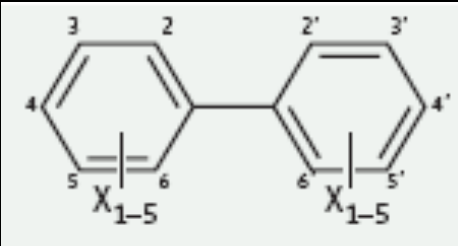


- Required furniture foam to withstand a small open flame for 12 seconds
- No significant fire safety benefit (fires start in exterior fabric not filling)

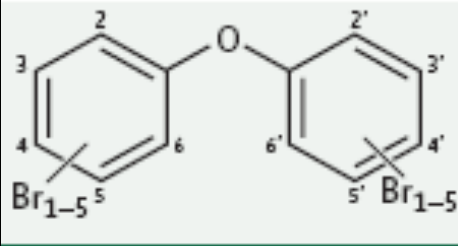
PentaBDE Flame Retardant

Used from 1975 to 2004
to meet TB117.

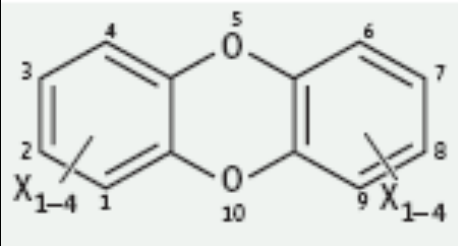
98% of use in US and
Canada in 2003



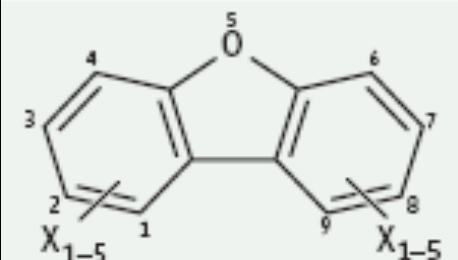
PCBs (X = Cl) and PBBs (X = Br)



PBDEs



Dioxins (X = Cl or Br)



Furans (X = Cl or Br)

Human Health

Higher pentaBDE

associated with

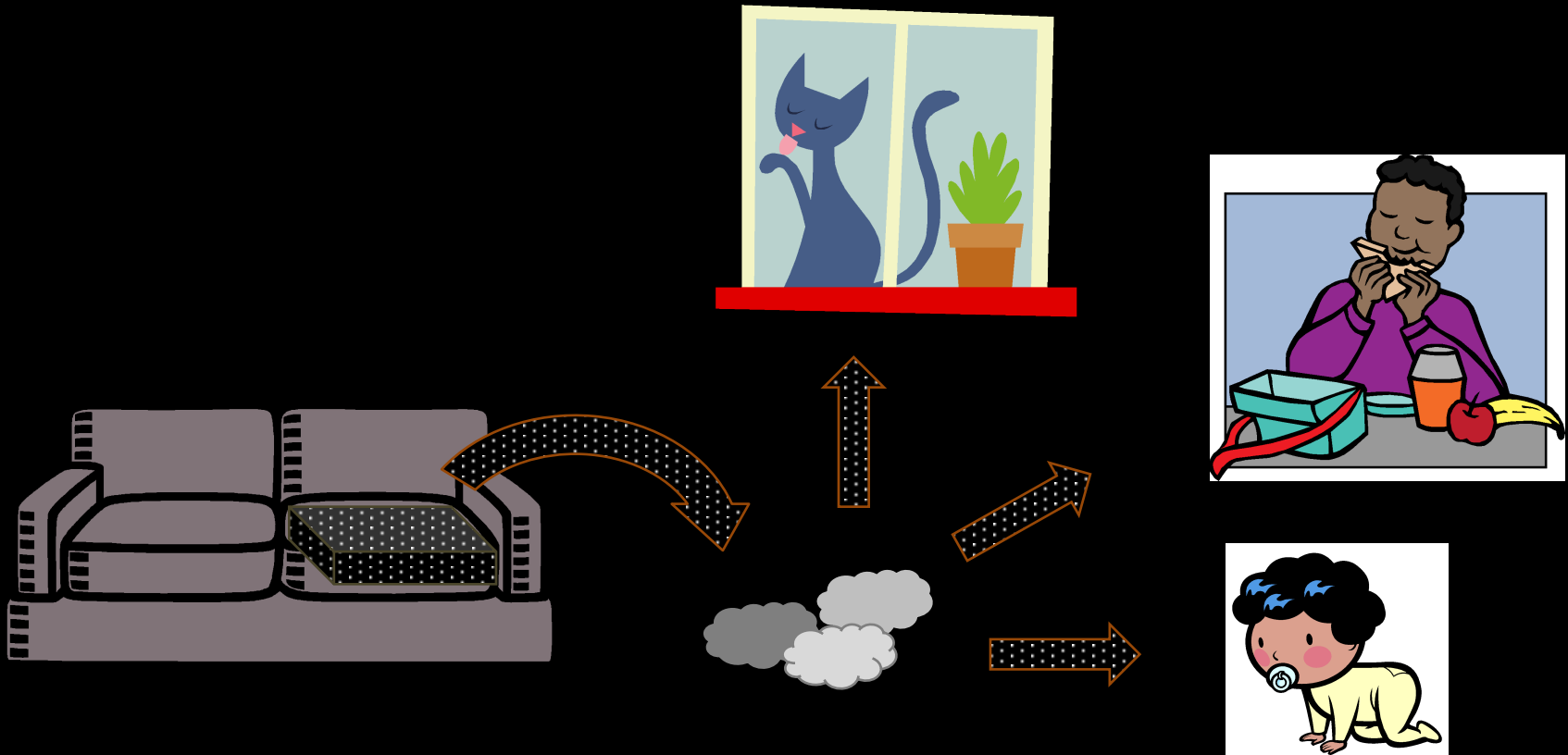
lower birth weight
impaired attention
poorer coordination
lowered IQ



longer time to get pregnant
altered thyroid hormones

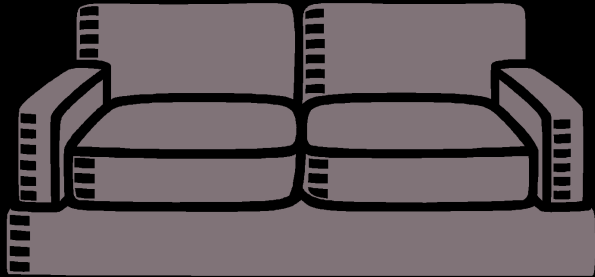


From Products to People



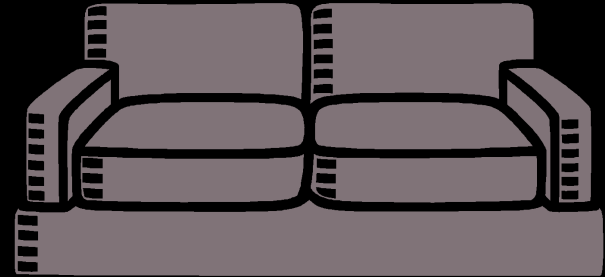
TB117 Fire Safety Benefit?

TB117 foam



~

Non - TB117 foam



“No significant, consistent difference...”

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

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

records that 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.



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

4-minute webinars on Six Classes -- www.SixClasses.org

June 22, 26, July 6, 2017 at 2:00 pm Eastern

Online Premiere: Four-Minute Videos

Conclusion

- Chemical treatments for furniture can be useful, but have health and environmental impacts
- Before using a chemical in the Six Classes, ask: “Is it really needed?”

WITH THANKS TO:

The Green Science Policy Institute Team:

Avery Lindeman

Sara Petty

Tom Bruton

Caroline Clarke

Veronica Chin

Raphael Tingley

Anna Soehl

Gretta Goldenman



By reducing use of Six Classes

We can have a healthier world.

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