



Dr. Arlene Blum,
Visiting Scholar, Chemistry, UCB
Green Science Policy Institute, Berkeley, California

On the toxicity of flame retardants
and what to do about it

For more information www.greensciencepolicy.org

THE PROBLEM:

Most Chemicals Are NOT Effectively Regulated in the U.S.

- The U.S. Toxic Substances Control Act (1976)
- 62,000 chemicals in commerce “grandfathered”
- 20,000 new chemicals have been introduced
 - 85% have no health data
 - 67% have no data at all





- 21 chemicals banned by the Stockholm Convention on Persistent Organic Pollutants (POPs)
- All are **organohalogen**s with carbon bonded to bromine, chlorine, or fluorine

PROTECT YOUR CHILDREN Against Disease-Carrying Insects!



TRIMZ DDT
REG. U. S. PAT. OFF.
**CHILDREN'S ROOM
WALLPAPER** and Ceiling
Paper

KILLS FLIES, MOSQUITOS, ANTS

... as well as moths, bedbugs, silverfish and other household pests after contact!

MEDICAL SCIENCE KNOWS many common insects breed in filth, live in filth and carry disease. Science also recognizes the dangers that are present when these disease-carrying insects invade the home. Actual tests have proved that one fly can carry as many as 6,600,000 bacteria! Imagine the health hazard—especially to children—from flies seriously suspected of transmitting such diseases as scarlet fever, measles, typhoid, diarrhea . . . even dread polio! Some types of mosquitos carry malaria and yellow fever. And any mosquito bite is painful and easily infected when scratched.

NON-HAZARDOUS to children or adults, to pets or clothes. Certified to be absolutely safe for home use. Tested and commended by *Parents' Magazine*.

GUARANTEED effective against disease-carrying insects for 1 year. Actual tests have proven the insect-killing properties still effective after 2 years of use.

NO SPRAYS! NO LIQUIDS! NO POWDERS! So convenient, so safe because the DDT is fixed to the paper. It can't rub off!

BEAUTIFUL! "Jack and Jill" or "Disney Favorites"—gay new patterns that protect as they beautify a child's room.

DDT CEILING PAPERS, TOO! Extra protection for your children's room—for every other room in the house. Choice

TESTED AND
COMMENDED
by
**PARENTS'
MAGAZINE**
CONSUMER
SERVICE

Pesticides & Flame Retardants

(Carbon bound to Bromine, Chlorine, Iodine)

- Pesticides
 - many banned
 - DDT, Mirex, Dieldrin, Aldrin, etc
 - found in very low and decreasing levels in food
- Flame Retardants
 - similar or identical to pesticides
 - Dechlorane flame retardant is Mirex; Dechlorane Plus in use
 - found in very low and increasing levels in food

Brominated Tris Flame Retardant

Tris (2,3-dibromopropyl) phosphate

- 1975 to 1977
- 10% of the weight of pajamas
- 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**

CPSC Bans TRIS-Treated Children's Garments

FOR IMMEDIATE RELEASE

April 7, 1977

Chlorinated Tris (TDCPP) replaced Brominated Tris

- Removed from pajamas in 1977
- Used today in furniture

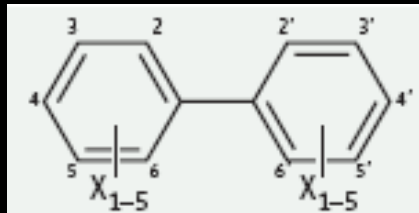


BUREAU OF HOME
FURNISHINGS AND
THERMAL INSULATION

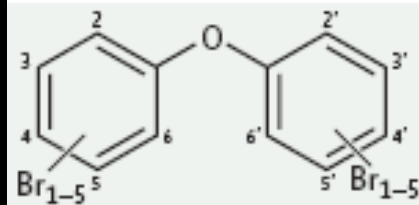
CALIFORNIA FURNITURE FLAMMABILITY STANDARDS

- TB 116:
Voluntary standard for fabric of upholstered furniture
- TB 117:
Twelve second open flame and smolder standard for filling materials used in upholstered furniture.
- TB 133:
Severe flammability composite test for furniture in public occupancies

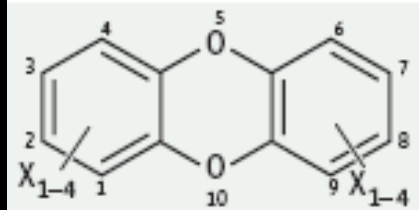
PentaBDE used to meet TB117



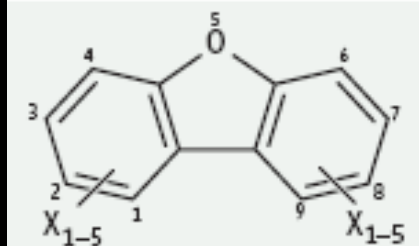
PCBs (X = Cl) and PBBs (X = Br)



PBDEs



Dioxins (X = Cl or Br)



Furans (X = Cl or Br)

97.5% of global use in North America (1999).

BFR2009
11th Annual Workshop on
Brominated Flame Retardants
May 19 and 20, 2009 in Ottawa, Ontario



BFR
KYOTO
2010

KYOTO, 7-9 APRIL 2010

Fifth international symposium on brominated flame retardants



ANIMAL HEALTH EFFECTS

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

PentaBDE Human Health Associations

- **Cryptorchidism**
- **Reproductive Hormone Effects**

Decrease in Androgens and LH;
Increase in FSH and Inhibin
Decrease in Testosterone

- **Reproductive Effects**

Low Birth Weight;
Altered Behaviors

Increased time to pregnancy

Neurological Effects

Decreased IQ

Decreased Sperm Quality

Diabetes

- Lim et al, 2008
- Turyk et al, 2009 (only in hypothyroid subjects)

Thyroid Homeostasis

elevated T4
elevated T4, TBG
Elevated T3
Low TSH
Low TSH during pregnancy



BUREAU OF HOME
FURNISHINGS AND
THERMAL INSULATION

Technical Bulletin 117

NOTICE

THIS ARTICLE MEETS
THE FLAMMABILITY
REQUIREMENTS OF
CALIFORNIA BUREAU
OF HOME FURNISHING
TECHNICAL BULLETIN
117. CARE SHOULD
BE EXERCISED NEAR
OPEN FLAME OR WITH
BURNING CIGARETTES

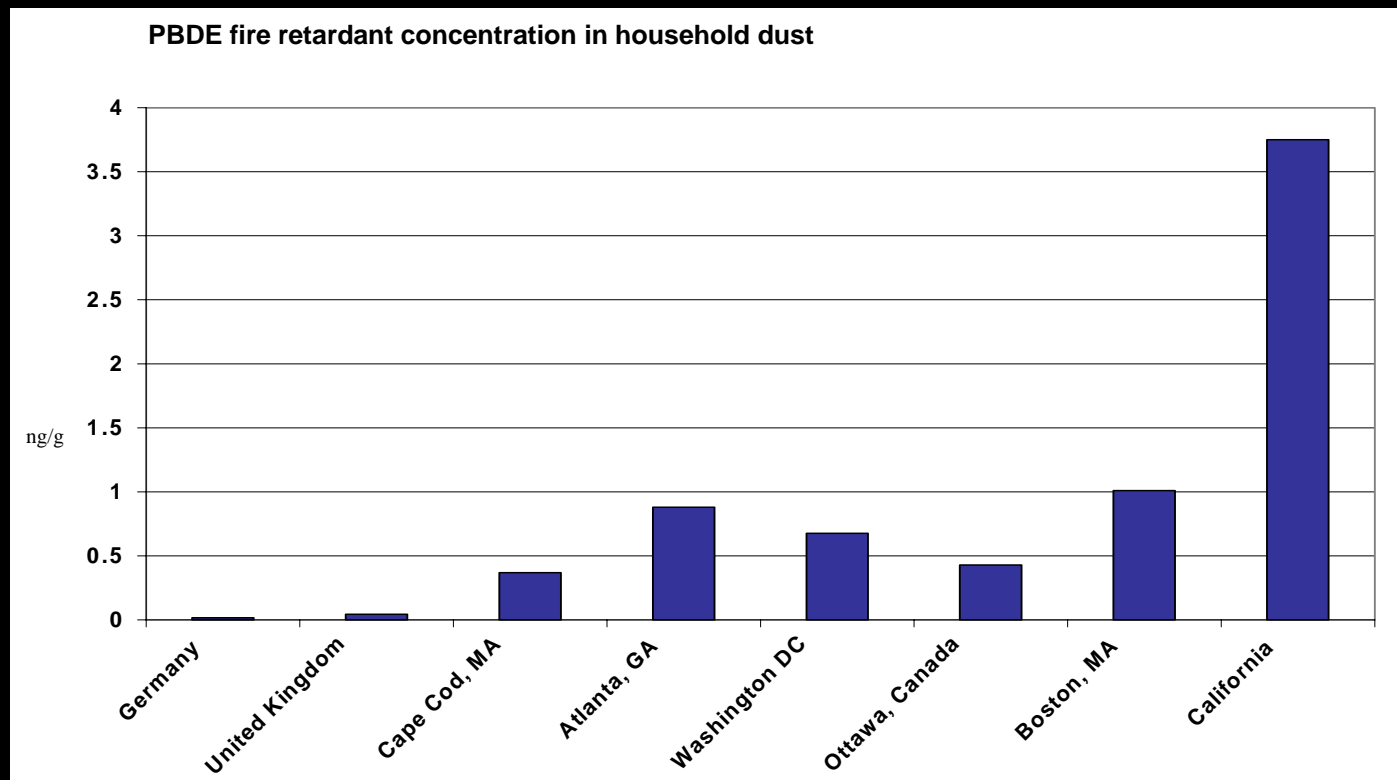
Human Exposure

- Flame retardants migrate into house dust

- Stapleton, H. M., J. G. Allen, S. M. Kelly, A. Konstantinov, S. Klosterhaus, D. Watkins, M. D. McClean, and T. F. Webster. 2008. Alternate and new brominated flame retardants detected in U.S. house dust. *Environ Sci Technol* 42 (18): 6910-6.

- Californians have higher levels in their house dust and body fluids than residents of other states

- Kellyn S. Betts, *Environmental Health Perspectives* 116, A202 - 208, 2008



Source: Elevated House Dust and Serum Concentrations of PBDEs in California: Unintended Consequences of Furniture Flammability Standards? Zota, Ami R., Rudel, Ruthann A., Morello-Frosch, Rachel A., and Brody, Julia Green, *Environ. Sci. Technol.*, 2008, 10.1021/es801792z

Mothers' Milk

Record levels of toxic
fire retardants found in
American mothers' breast milk

www.ewg.org





© Rita C

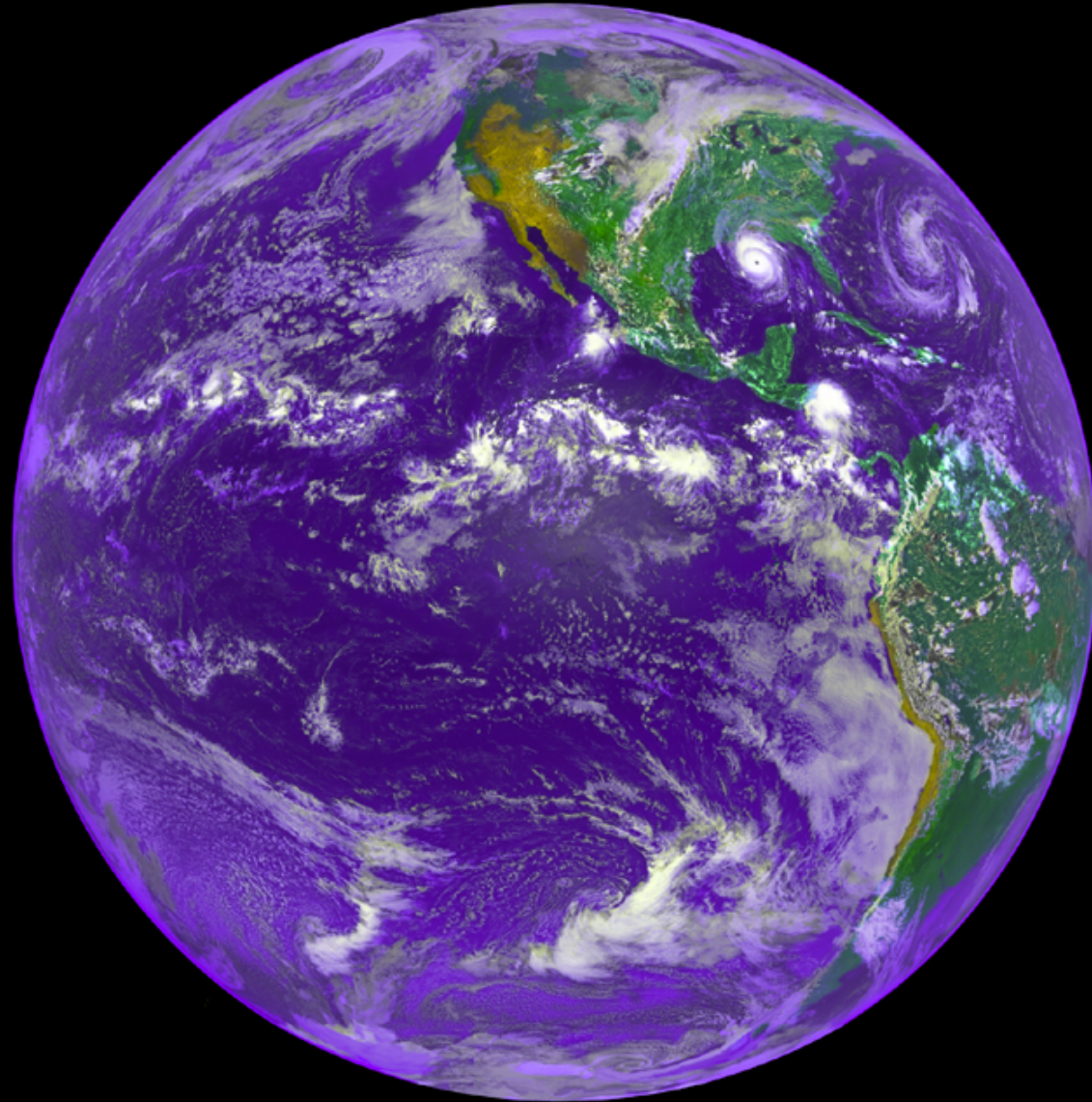




National Oceanic & Atmospheric Administration (NOAA) Finds Penta in Sediments & Bivalves



Atmospheric transport to polar regions



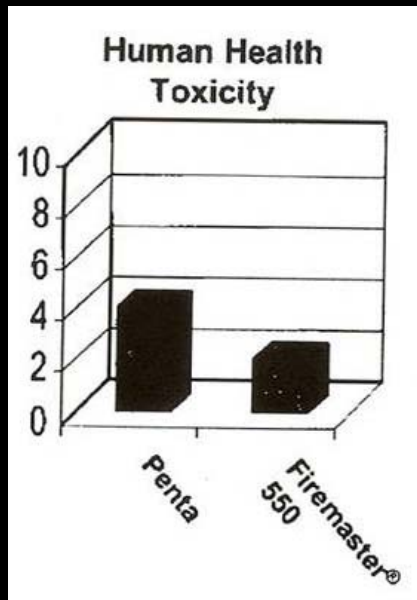


© sebastian niedlich

Banning chemicals

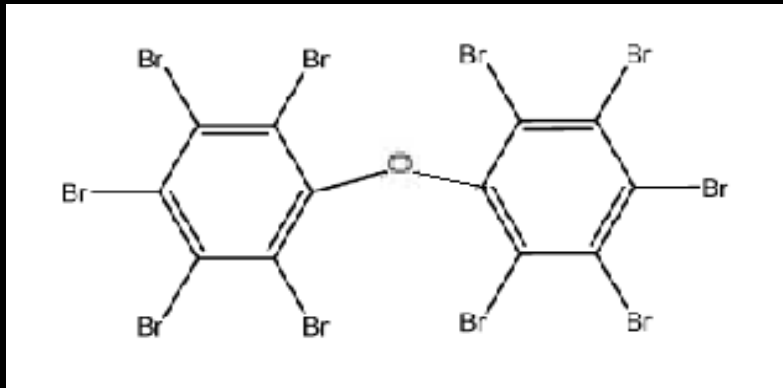
PentaBDE Replacements to meet TB117

Chlorinated Tris

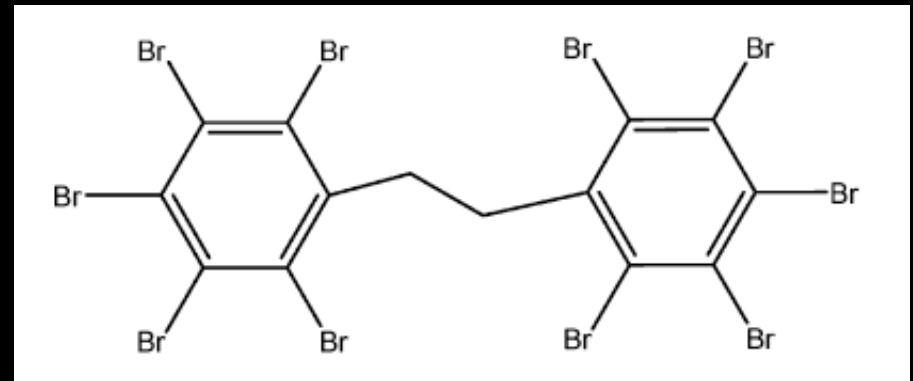


Firemaster 550

Deca ether replaced by Deca ethane



Decabromodiphenyl ether



Decabromodiphenyl ethane

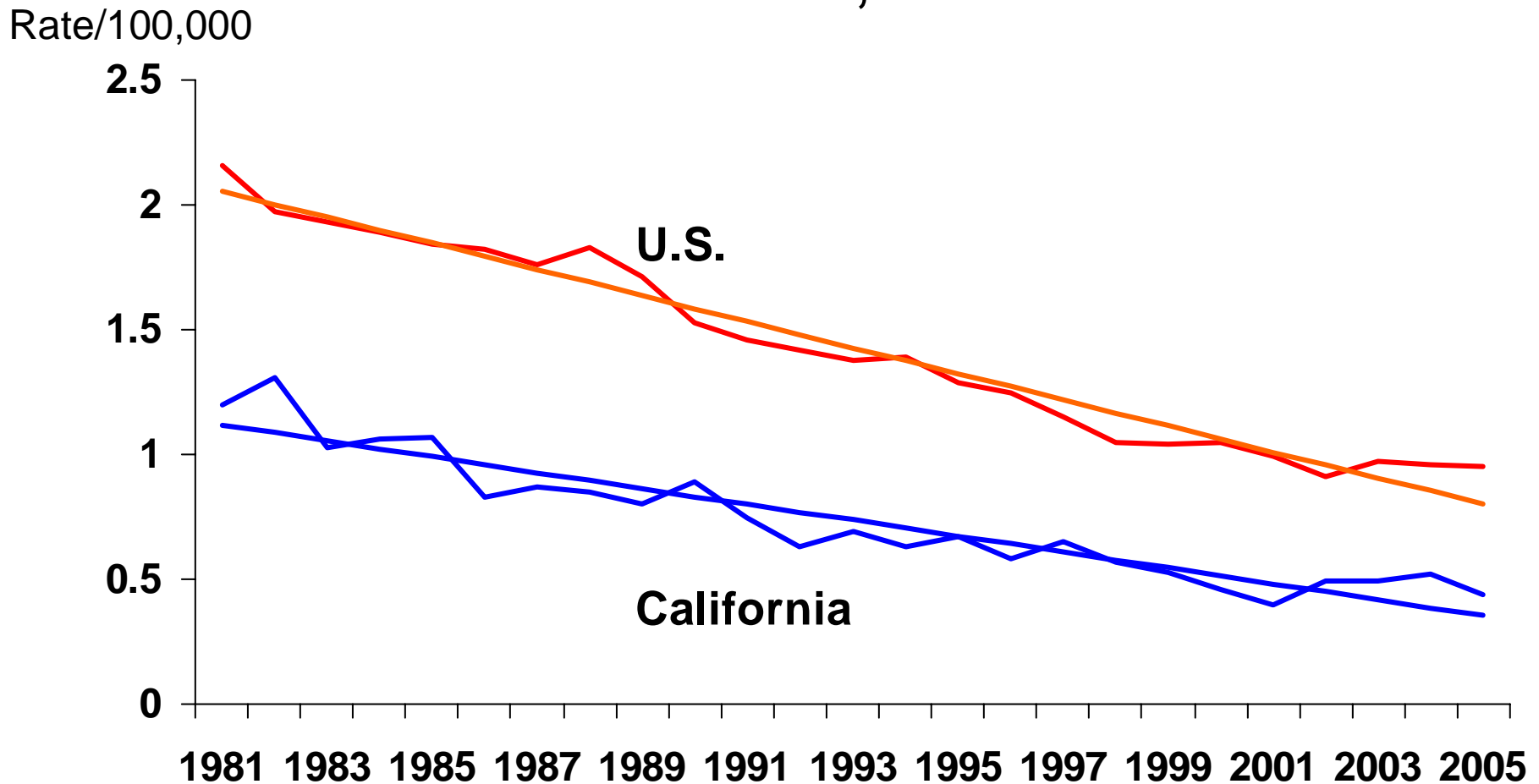
December 3, 2008

[Glut of data on “new” flame retardant documents its presence all over the world](#)



Now that DBDPE has been detected in more than a dozen species of animals in Asia and North America, scientists are calling for more research into its toxicology.

Residential Fire and Flame Death Rates in U.S. and California, trend data with linear estimation line, 1981-2005

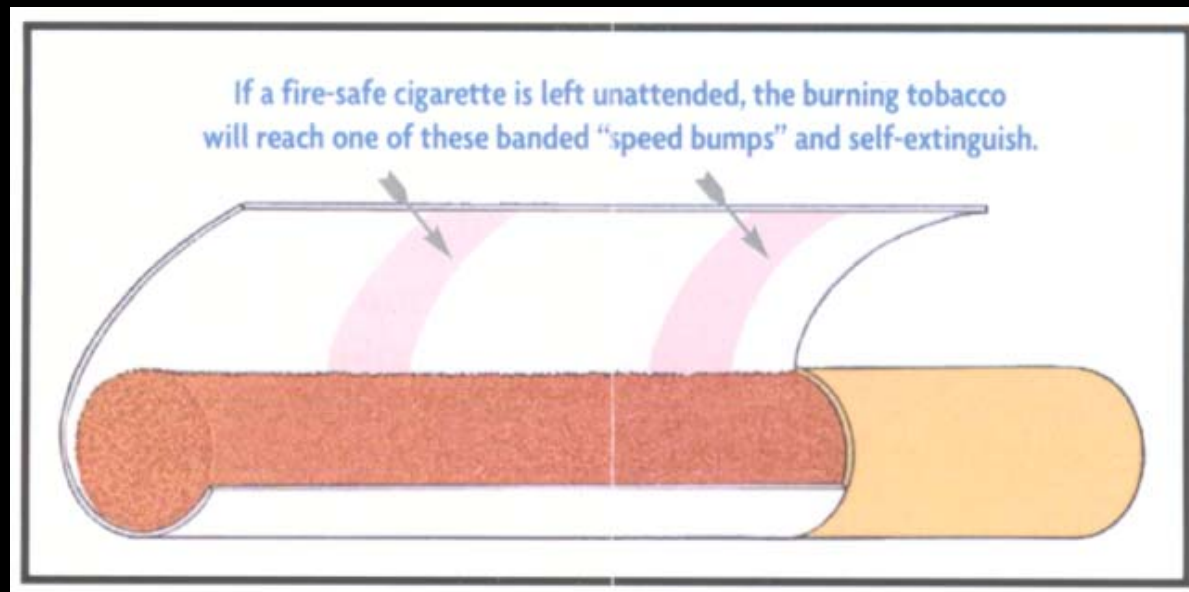


Source: WISQARS, Centers for Disease Control and Prevention

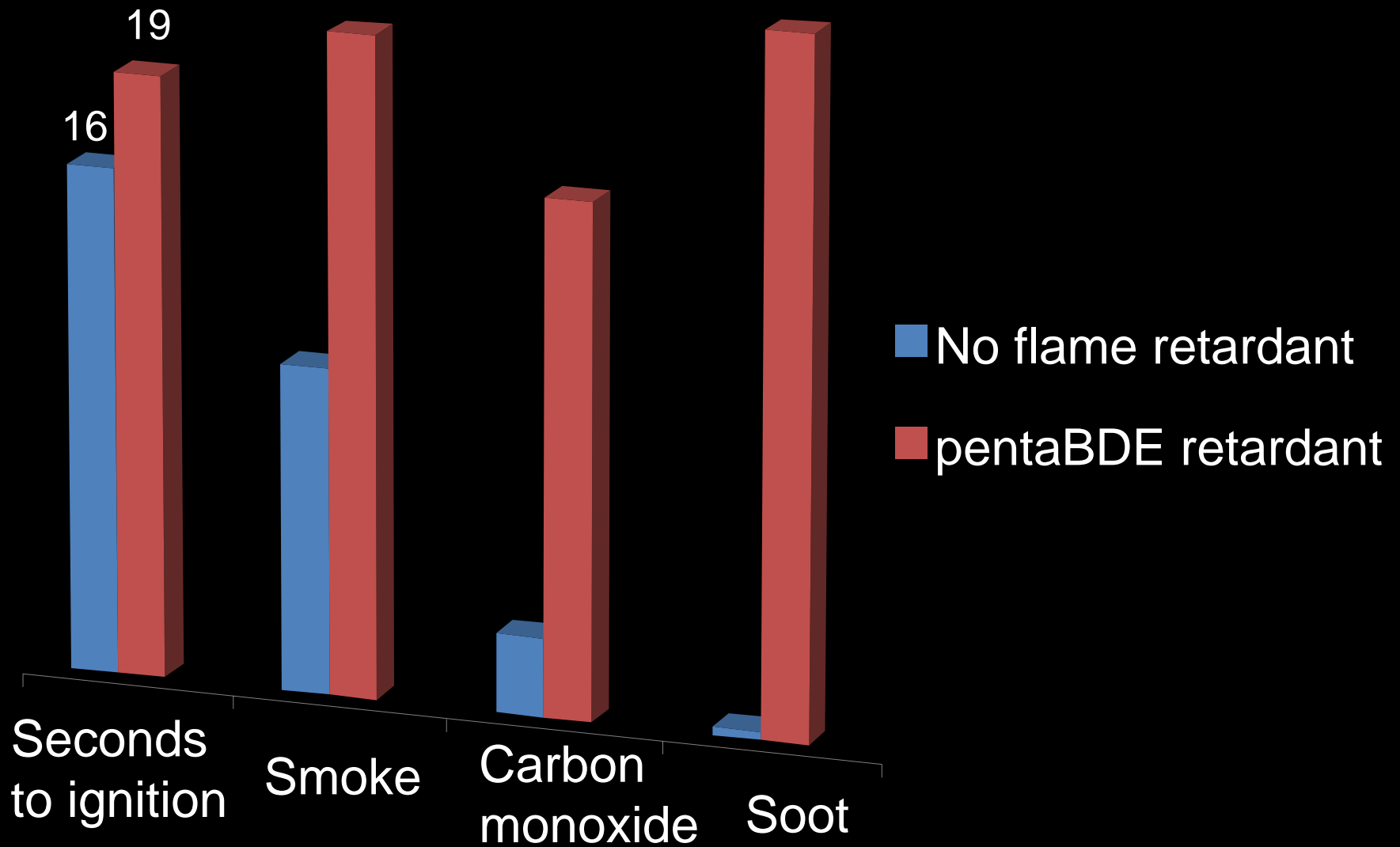
Prepared by: California Department of Public Health, EPIC Branch

Fire deaths in the US are declining:

- 50% decrease in smoking since 1980
- building, fire and electrical codes
- sprinklers and smoke detectors



Fire Toxicity



Halogenated Flame Retardants and Fire Toxicity

	No FR	Treated with chlorinated tris	With Penta-BDE
Time to Sustained Ignition (seconds)	16	18	19
Peak Heat Release Rate (kW/m²)	412	326	259
Smoke (m²/kg)	413	745	833
Carbon Monoxide (kg/kg)	0.02	0.08	0.13
Soot (kg/kg)	0.01	0.10	0.88

Chandra Jayakody, Dan Myers, Usman Sorathia, and Gordon L. Nelson. "Fire-Retardant Characteristics of Water-Blown Molded Flexible Polyurethane Foam Materials"
J. Fire Sciences, Vol. 18, pp 430-455, 2000.

Halogenated Flame Retardants

contain bromine, chlorine and carbon:

Uses by volume in the U. S.

1. Electronics
2. Insulation in Buildings
3. Furniture
4. Transportation
5. Fabrics

Plastic Insulation Contains Flame Retardants



- Batt Insulation
(Glass and Mineral Wool)



- Board Insulation
(Polyurethane, Polyisocyanurate, Polystyrene)



- Blown-in Insulation
(Cellulose, Fiberglass)



- Poured-in Insulation
(Perlite, Vermiculite)



- Foamed-in Insulation
(Polyurethane, Polyisocyanurate, Polyisocyanene)

All Polystyrenes Contain HBCD

Hexabromocyclododecane

- On first EU list of 13 “Substances of Very High Concern”.
- Proposed as a POP under the Stockholm Convention
- Found in household dust, breast milk, sewage sludge, wildlife



Material Safety Data Sheet

Material Name: Celfort® Extruded Polystyrene Insulation

MSDS No.: 15-MSD-24901-01-C

*** Section 1 - Chemical Product and Company Identification ***

Product Name(s): Celfort® 200, Celfort® 200 Cel-Lok® System, CodeBord (Celfort® 200), Celfort® 300, Celfort® 200 Cel-Drain, Foamular® 350, Foamular® 400, Foamular® 600, Foamular® 1000, Foamular® Thermapink, Pipe Fabrication Billet

Owens Corning
One Owens Corning Parkway, World Headquarters
Attn: Product Stewardship
Toledo, OH 43659, USA

Emergency Contacts:
Emergencies ONLY (after 5pm ET and weekends): 1-419-248-5330,
CHEMTREC (24 hours everyday): 1-800-424-9300,
CANUTEC (Canada - 24 hours everyday): 1-613-996-6666.

Health and Technical Contacts:
Health Issues Information (8am-5pm ET): 1-800-GET-PINK,
Technical Product Information (8am-5pm ET): 1-800-GET-PINK.

*** Section 2 - Composition / Information on Ingredients ***

CAS #	Component	Percent by Wt.
9003-53-6	Polystyrene	60-100
75-68-3	1-Chloro-1, 1-difluoroethane (HCFC-142B)	7-10
75-45-6	Chlorodifluoromethane (HCFC-22)	1-5
3194-55-6	Hexabromocyclododecane (HBCD)	0.5-1.5

Component Related Regulatory Information
This product may be regulated, have exposure limits or other information identified as the following: Nuisance particulates.

Component Information/Information on Non-Hazardous Components
No additional information available.

*** Section 3 - Hazards Identification ***

Appearance and Odor: Pink, white or green closed-cell foam board with no odor.

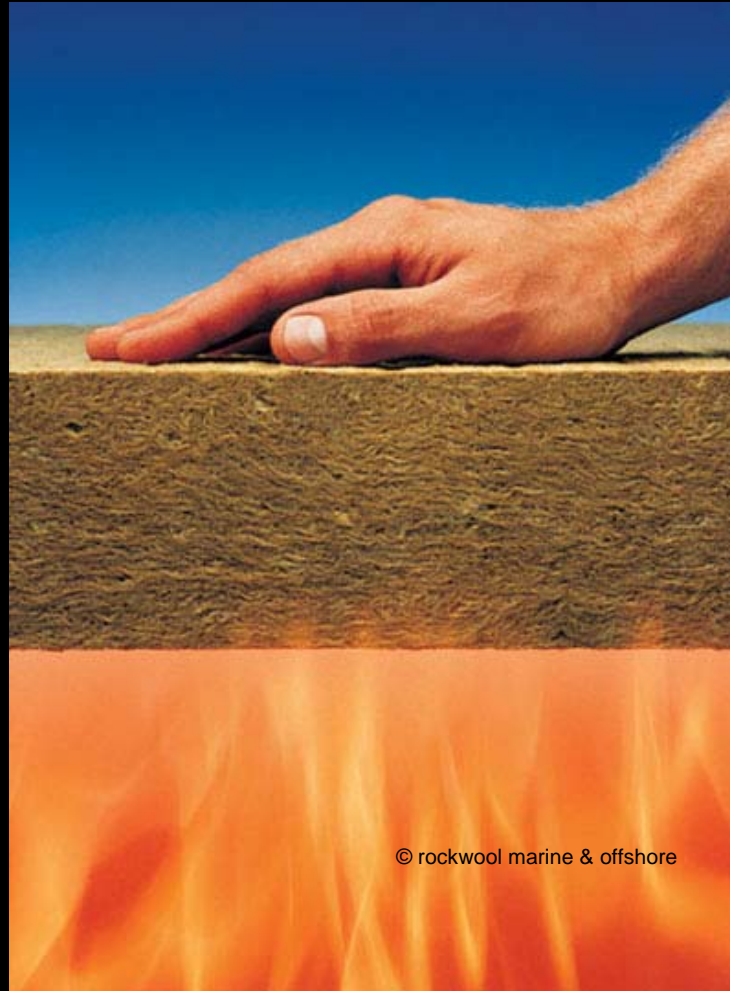
Emergency Overview

Exposure to dust may be irritating to eyes, nose, and throat.

To prevent ignition, avoid smoking, keep from open flames and high temperatures. Grinding, sawing or fabrication activities can produce dust particles, which may under certain conditions form explosive dust atmospheres that can be ignited.

Mineral Wool (Rockwool)

Slag wool fiber and/or basaltic rock, phenolic resin



© rockwool marine & offshore



LEED Pilot Credit Library

Pilot Credit 11: Chemical Avoidance in Building Materials

Intent

To reduce the quantity of indoor contaminants that are harmful to the comfort and well-being of installers and occupants.

Halogenated flame retardants, including, but not limited to the following brominated and chlorinated flame retardants:

- Hexabromocyclododecane (HBCD)
- Penta, octa, and decabromodiphenyl ethers
- Tetrabromobisphenol-A (TBBPA)
- Tris(2-chloroisopropyl) phosphate (TCPP)
- Tris(2-chloroethyl)phosphate (TCEP)
- Dechlorane Plus

RIGID INSULATIONS

	Product	Primary Form	Cost / sq.ft. / R (materials & labor)	Thermal resistance (R-value per inch)	Raw Materials	Known Health Issues	Fire Retardant	Water Resistant	Embodied Energy
CONTAINS HFR	Extruded Polystyrene (XPS)	Board	\$\$	5.0	Refined Petroleum + blowing agent (HCFC); up to 15% recycled content	CO in Smoke, Carcinogenic Fire Retardants, benzene	0.7% HBCD	Yes	High
	Expanded Polystyrene (EPS)	Board	\$\$	3.85	Refined Petroleum + blowing agent (pentane); up to 60% recycled content	CO in Smoke, Carcinogenic Fire Retardants, benzene	2.5% HBCD	Yes	High
	Polyisocyanurate	Board	\$\$	6.5	Refined Petroleum + blowing agent (pentane); up to 10% recycled content	CO in Smoke, Toxic Fire Retardants	5-10% TCPP	Yes	High
	Polyurethane	Foamed-on	\$\$	3.6-5.0	Refined Petroleum + blowing agent (HFC); up to 25% soy oil replacement	Toxic during installation, CO in Smoke	? % TCPP	Yes	High
DOES NOT CONTAIN HFR	Perlite	Board	\$	2.7	perlite, cellulose binders, and waterproofing agents	No known issues	NA	Yes	Low
	Mineral Wool (AKA Rockwool)	Board	\$\$	4.2	Slag wool fiber and/or basaltic rock, phenolic resin	Can irritate and congest lungs during installation	NA	Yes	Low (waste product)
	Cellular Glass Foam	Board	\$\$\$	3.45	Alumino-silicate cellular glass with a specially elaborated composition; totally inorganic; contains no binders	No known issues	NA	Yes	High
	Aerogel	Board	\$\$\$	10.0	Silica gel, PET, fiberglass	Can irritate and congest lungs during installation	NA	Yes	High
	Carbon Foam	Board	\$\$\$	6.67	Calcined Coke		NA	Yes	Low (waste product)
	Agrifiber	Board	\$\$	3.0	Rice hulls, mycelium roots, wheat or rice straw	No known issues	Borate	No	Low
	Cementitious Foam	Foamed-on	\$\$	3.9	Modified Oxychloride Cement	No known issues	NA	Yes	High
	Cellulose	Blown-In	\$	3.5	Shredded Newspaper	No known issues	Sodium Borate	No	Low (waste product)

Furniture?

Legislation to modify TB117 to Improve Fire Safety Without Chemicals failed due to bromine industry extreme lobbying



Based on Op-ed

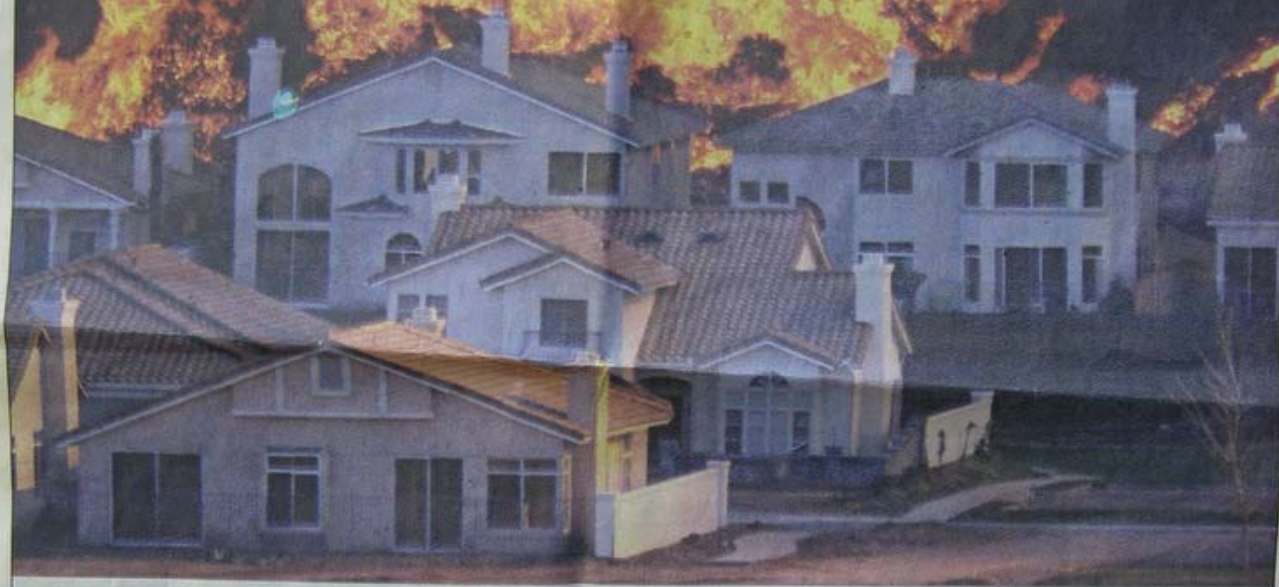


Introducing bill with Mary Brune (MOMS), Russell Long (FOE), Mark Leno, and Andrew McGuire




Industry \$10 million media blitz

Don't Let Sacramento Weaken Fire Safety.



California has some of the toughest, most progressive fire safety standards in the country — including the only regulation in the country that requires flame



Every Second Counts When Escaping A Fire

Presorted Standard
U.S. Postage
PAID
Rancho Cordova, CA
Permit #275

PAID FOR BY CALIFORNIANS FOR FIRE SAFETY

Paid for by Californians for Fire Safety

- Albemarle
- Chemtura
- IC-Ltd Industrial Products (Dead Sea Bromine)

[GO](#)[Advanced Search](#)[Cal-Access Home](#)[Campaign Finance](#)[Lobbying Activity](#)[Individual](#)[Lobbyists](#)[Lobbying Firms](#)[Lobbyist](#)[Employers](#)[\\$5,000 - Plus Payments To
Influence](#)[Daily Filings/
Directory Changes](#)[Resources](#)[For Filers Only](#)[Political Reform](#)[User's Manual](#)

Lobbying Activity

BURSON-MARSTELLER, ON BEHALF OF THE BROMINE SCIENCE AND ENVIRONMENTAL FORUM, ALSO DBA CALIFORNIANS FOR FIRE SAFETY

View:

- General Information
- Financial Activity/Filing History

Legislative Session

- 2007 through 2008
- Historical

As disclosed in quarterly reports filed with the Secretary of State, payments made by an organization to its own in-house lobbyists or to lobbying firms are reported here. Links to legislative bills or state agencies lobbied also are available.

2007-2008 LEGISLATIVE SESSION

LOBBYING PAYMENTS MADE			
SESSION	QUARTER	GENERAL LOBBYING	P.U.C. LOBBYING
2007-2008	5th	\$0.00	\$0.00
2007-2008	4th	\$330,854.96	\$0.00
2007-2008	3rd	\$6,169,810.99	\$0.00
2007-2008	2nd	\$148,278.78	\$0.00
2007-2008	1st	\$24,271.17	\$0.00

Albermarle's profits up 377% from an increase in BFR sales. Chemical and Engineering News

Chemtura Corp increased prices in all regions on brominated flame retardant HBCD by up to 25%' in the face of increasing costs to secure global supply, and continued advocacy efforts.

EDITORIAL



San Antonio Statement on Brominated and Chlorinated Flame Retardants

Article

Joseph DiGangi¹, Arlene Blum^{2,3}, Åke Bergman⁴, Cynthia A. de Wit⁵, Donald Lucas⁶, David Mortimer⁷, Arnold Schechter⁸, Martin Scheringer⁹, Susan D. Shaw¹⁰, Thomas F. Webster¹¹

1 International POPs Elimination Network, Berkeley, California, USA, **2** Department of Chemistry, University of California, Berkeley, California, USA, **3** Green Science Policy Institute, Berkeley, California, USA, **4** Department of Materials and Environmental Chemistry, and, **5** Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden, **6** Lawrence Berkeley National Laboratory, Berkeley, California, USA, **7** Food Standards Agency, London, United Kingdom, **8** University of Texas School of Public Health, Dallas, Texas, USA, **9** Institute for Chemical and Bioengineering, ETH Zürich, Zürich, Switzerland, **10** Marine Environmental Research Institute, Center for Marine Studies, Blue Hill, Maine, USA, **11** Department of Environmental Health, Boston University School of Public Health, Boston, Massachusetts, USA

Jump to

[Signatories](#)[Supplemental Material](#)

<http://greensciencepolicy.org/node/269>

California Flammability Standard

- Pillows
- Comforters,
- Mattress pads (memory foam)

Suspended



NOTICE OF SUSPENSION

**Technical Bulletin 604
Proposed Flammability Test Method
for Bedclothing Products**

The Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation (Bureau) has suspended its effort to begin the formal rulemaking process to implement Technical Bulletin 604, the proposed flammability standard for filled bedclothing products.



When Product Safety and the Environment Appear to Collide:
**The Defeat of the Candle
Flame Ignition Requirement**

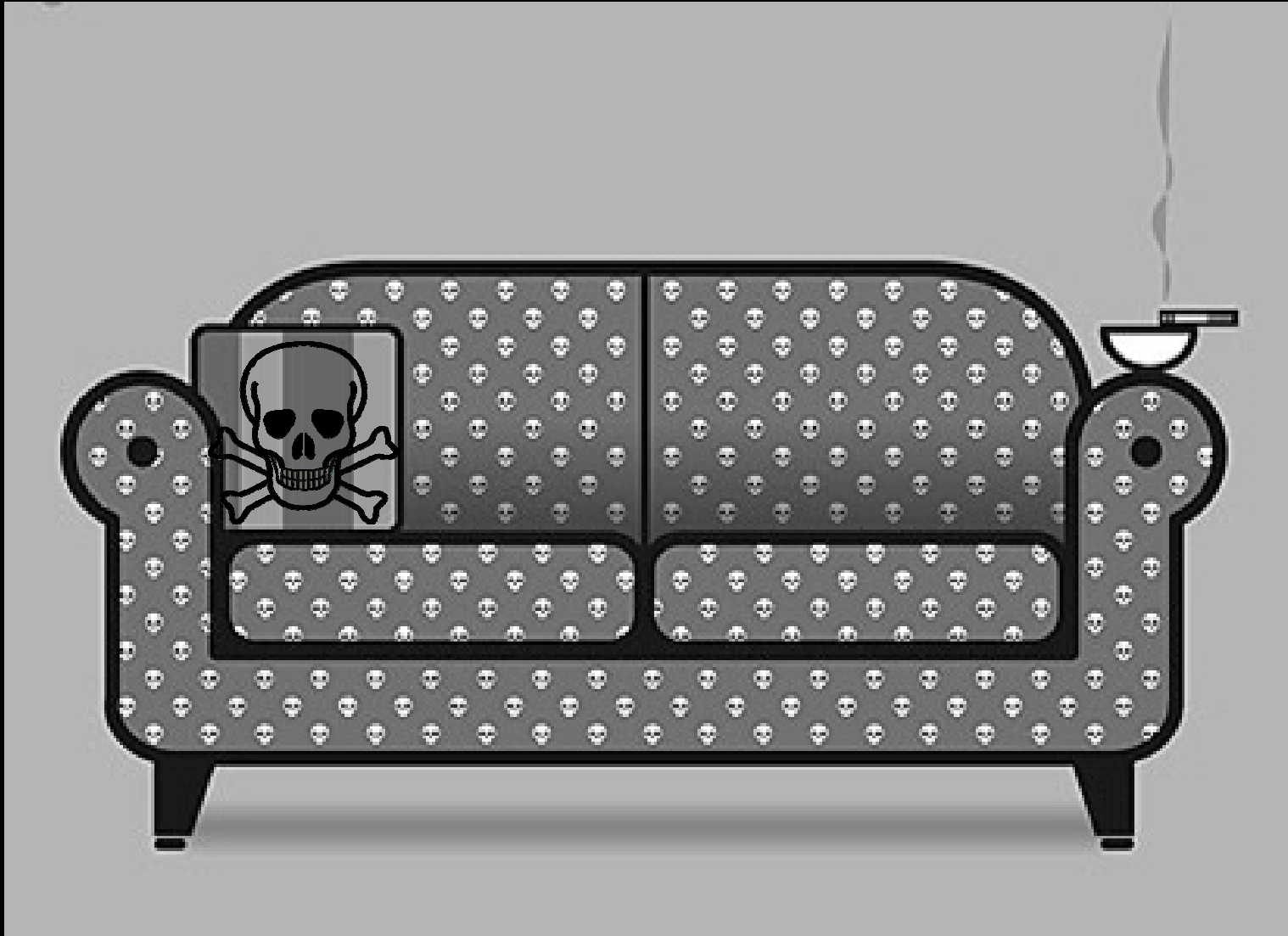
© iStockphoto.com | iStockphoto.com

by Michael Kirschner, Design Chain Associates, and
Arlene Blum, Ph.D., Green Science Policy Institute

Conformity, January 2009

GREEN SCIENCE POLICY INSTITUTE
greensciencepolicy.org

What is in your COUCH?



Email couchstudy@GMail.com to join the GSP study

Halogenated Flame Retardants?

Head support



Sleep Positioner



Car Seat



Carrier



Stroller



Changing Pad



Nursing Pillow



Green Science Policy Symposia



**February 11, 2011 at UC Berkeley
August 21 at Dioxin 2011 in Brussels
www.greensciencepolicy.org**



TEDxGreatPacificGarbagePatch - Arlene Blum

TEDxTalks



http://www.youtube.com/watch?v=6ID1b4N-_u4



Main points

- Flame retardants commonly used in furniture, baby products, electronic enclosures, and building insulation are not proven to improve fire safety
- Migrate into dust, humans, animals, and the supply food and are associated with reduced IQ, reduced fertility, cancer, endocrine and thyroid problems
- We can have greater fire safety and a healthier planet without toxic flame retardants.

Support Chemical Policy Reform

The Safe Chemicals Act 2010

The Toxic Chemical Safety Act

- Information on Chemicals Provided by Manufacturers
- Prioritize Chemicals of High Concern such as Halogenated Flame Retardants
- Reform Confidential Business Information



The toxic chemical problem is solvable

**With research & shared information,
we can have a healthier world.**

www.greensciencepolicy.org



For more information:
info@greensciencepolicy.org

www.greensciencepolicy.org