



**GREEN SCIENCE
POLICY INSTITUTE**

Flame Retardant Benefit and Harm: Past, Present, and Future

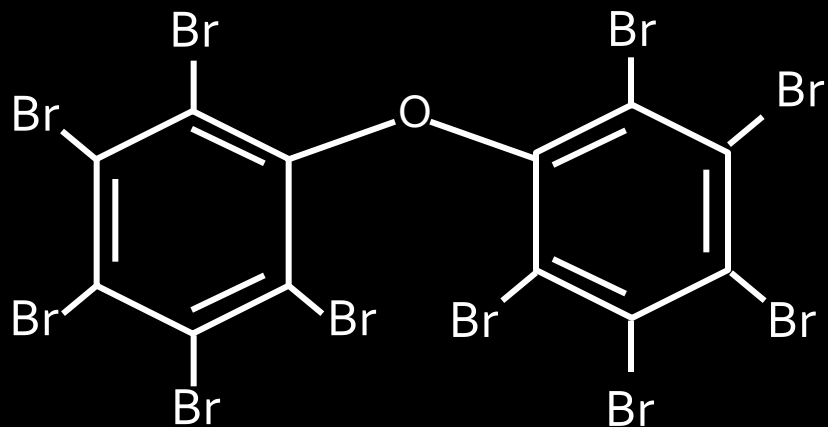
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Miriam Diamond

Dept. of Earth Sciences, University of Toronto, Canada

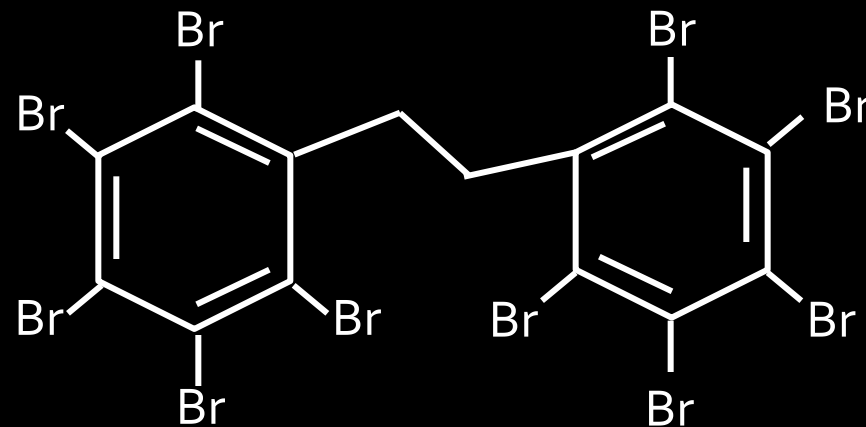
Regrettable Substitution



Decabromodiphenyl
ether

Concerns:

- Persistence
- Bioaccumulation
- Toxicity



Decabromodiphenyl
ethane

Concerns:

- Persistence
- Bioaccumulation
- Toxicity

Six Classes Four-Minute Videos

1

Highly
Fluorinated



2

Antimicrobials



3

Flame
Retardants



4

Bisphenols
+ Phthalates



5

Some
Solvents



6

Certain Metals



View: www.SixClasses.org

Is it necessary?

Is it worth it?

Is there a safer alternative?

Class 3 Flame retardants

1970s Flammability Standards

- Children's sleepwear --1976
- Furniture and baby product foam
- Foam plastic building insulation
- Plastic television cases

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

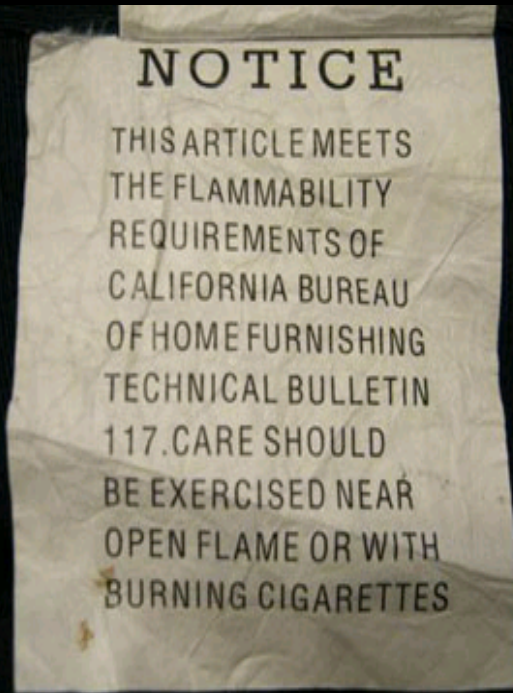
- Removed from pajamas in 1978
- Used in furniture until 2012

Flame retardants

Updating 1970s Flammability Standards

- Children's sleepwear --1976
- Furniture and baby product foam -- 2013
- Foam plastic building insulation
- Plastic television cases

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)

Furniture foam flame retardant (PentaBDE) associations with human health problems



Increased time to pregnancy
Altered thyroid hormone
Thyroid disease in women



Impaired attention
Poorer coordination
Lower IQ
Developmental toxicity
Baby boys' genital problems
Lower birth weight
Delayed puberty in girls
Earlier puberty in boys

*Main et al. 2007; Goodyer et al 2017;
Eskenazi et al., 2010, 2011, 2012; Herbstman et
al. 2010; Makey et al. 2016; Windham et al.
2015; Harley et al. 2017; Allen et al. 2016*

Flame retardants delay, but don't prevent ignition

Flame retardants can increase:



- Soot and Smoke
- Carbon Monoxide and Hydrogen Cyanide
- Dioxins and Furans

A DEADLY MISTAKE

Help stop the bill that will ban material used to make flame resistant products.

CALL YOUR STATE SENATOR TODAY AND TELL THEM TO **VOTE NO ON AB 706**

Call State Senator **Tom Torlakson** at **916-651-4007** and tell him to **VOTE NO** on AB 706.

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Permit #275

DON'T LET THE SACRAMENTO POLITICIANS BAN THE USE OF PROVEN FLAME RETARDANTS - IT COULD BE A DEADLY MISTAKE

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 scientists from 30 countries
- Documents health and environmental harm and lack of proven fire safety benefit



2010: Environmental Health Perspectives

Top Paper of 2011

Identification of Flame Retardants in Polyurethane Foam Collected from Baby Products

Heather M. Stapleton,^{*,†} Susan Klosterhaus,[‡] Alex Keller,[†] P. Lee Ferguson,[†] Saskia van Bergen,[§] Ellen Cooper,[†] Thomas F. Webster,^{||} and Arlene Blum[⊥]

[†]Nicholas School of the Environment, Duke University, Durham, North Carolina, United States

[‡]San Francisco Estuary Institute, Oakland, California, United States

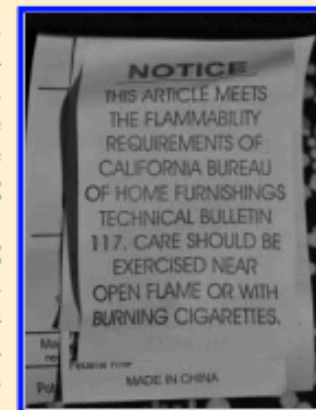
[§]East Bay Municipal Utility District, Oakland, California, United States

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S Supporting Information

ABSTRACT: With the phase-out of PentaBDE in 2004, alternative flame retardants are being used in polyurethane foam to meet flammability standards. However, insufficient information is available on the identity of the flame retardants currently in use. Baby products containing polyurethane foam must meet California state furniture flammability standards, which likely affects the use of flame retardants in baby products throughout the U.S. However, it is unclear which products contain flame retardants and at what concentrations. In this study we surveyed baby products containing polyurethane foam to investigate how often flame retardants were used in these products. Information on when the products were purchased and whether they contained a label indicating that the product meets requirements for a California flammability standard were recorded. When possible, we identified the flame retardants being used and their concentrations in the foam. Foam samples collected from 101 commonly used baby products were analyzed. Eighty samples contained an identifiable flame retardant additive, and all but one of these was either chlorinated or brominated. The most common flame retardant detected was tris(1,3-dichloroisopropyl) phosphate (TDCPP;



Couch Paper of 2012

Novel and High Volume Use Flame Retardants in US Couches Reflective of the 2005 PentaBDE Phase Out

Heather M. Stapleton,^{*,†} Smriti Sharma,[†] Gordon Getzinger,[†] P. Lee Ferguson,[†] Michelle Gabriel,[§] Thomas F. Webster,[‡] and Arlene Blum[§]

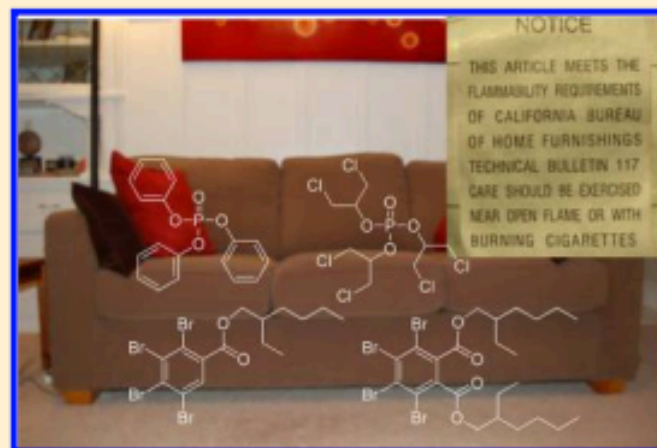
[†]Nicholas School of the Environment, Duke University, Durham, North Carolina, United States

[‡]Department of Environmental Health, Boston University School of Public Health, Boston, Massachusetts, United States

[§]Department of Chemistry, University of California, and Green Science Policy Institute, Berkeley, California, United States

Supporting Information

ABSTRACT: California's furniture flammability standard Technical Bulletin 117 (TB 117) is believed to be a major driver of chemical flame retardant (FR) use in residential furniture in the United States. With the phase-out of the polybrominated diphenyl ether (PBDE) FR mixture PentaBDE in 2005, alternative FRs are increasingly being used to meet TB 117; however, it was unclear which chemicals were being used and how frequently. To address this data gap, we collected and analyzed 102 samples of polyurethane foam from residential couches purchased in the United States from 1985 to 2010. Overall, we detected chemical flame retardants in 85% of the couches. In samples purchased prior to 2005 ($n = 41$) PBDEs associated with the PentaBDE mixture including BDEs 47, 99, and 100 (PentaBDE) were the most common FR detected (39%), followed by tris(1,3-dichloroisopropyl) phosphate (TDCPP;



Pulitzer Prize
Finalist

Goldsmith Prize
Investigative Reporting

Environmental
Journalists Society
Environmental Reporting

Gerald Loeb Award
Business and Financial Journalism

National Press Club
Consumer Award



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

stolen 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



California Flammability Standards TB117-2013

Mandatory January 1, 2015

Flame retardants not needed,
but can still be used

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.

California Bans Flame Retardants in furniture, children's products & mattress foam

AB 2998 Signed September 30, 2018



NO
Flame Retardants



PETITION HP 15-1

to the U.S. Consumer Product Safety Commission

Regarding Products Containing Organohalogen FRs

GRANTED – 20 September 2017

Declare as “banned hazardous substances” any:

- Children’s products
- Residential furniture
- Mattresses & mattress pads
- **Plastic electronics enclosures**



containing additive, non-polymeric organohalogen FRs

Flame retardants

Updating 1970s Flammability Standards

- Children's sleepwear --1976
- Furniture and baby product foam --2013
- Foam plastic building insulation –2019?
- Plastic television cases

Building codes drive FR use in insulation



BUILDING RESEARCH & INFORMATION (2012) 40(6), 738–755



INFORMATION PAPER

Flame retardants in building insulation: a case for re-evaluating building codes

Vytenis Babrauskas¹, Donald Lucas², David Eisenberg³, Veena Singla⁴,
Michel Dedeo⁴ and Arlene Blum^{4,5}

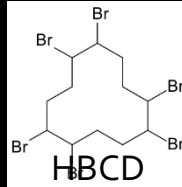
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²Lawrence Berkeley National Laboratory, 1 Cyclotron Road MS 70-0108B, Berkeley, CA 94720, US
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E-mail: strawnet@gmail.com

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E-mails: veena@greensciencepolicy.org, michel@greensciencepolicy.org and
arlene@greensciencepolicy.org

FR manufacture



Product manufacture



End of life

Recycling/ reuse;
combustion;
landfilling



Are we exposed to flame retardants
from building insulation?

Demolition



In-use
(Dust & Air)



Installation



Updated Codes

Sweden (2001) and Norway (2004) updated building codes to allow use of foam plastic insulation without flame retardants.

97% of polystyrene insulation in Sweden and Norway is flame retardant free

No accidental insulation fires in Norway since codes were updated



California Assembly Bill 127 (signed October, 2013):

- California fire marshal may propose updates that:
 - Maintain overall fire safety
 - Provide flexibility in meeting fire safety standards with or without chemical flame retardants

SUPPORTERS OF SAFER INSULATION



SIEGEL & STRAIN Architects



Google



LAKE | FLATO



SKANSKA

ARUP

SAN FRANCISCO FIREFIGHTERS
CANCER PREVENTION
FOUNDATION



FX FOWLE

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XL
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CANNONDESIGN Bergmeyer

TK&A
ARCHITECTS

boora
architects



USGBC CALIFORNIA



LMN

MAleco

PERKINS+WILL



Fire Science and Technology Inc.

ARKIN + TILT ARCHITECTS



Pankow



SMITHGROUP JJR WRNS STUDIO

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YOST GRUBE HALL
ARCHITECTURE

SEBESTA



GGLO
DESIGN



National Center for
Healthy Housing

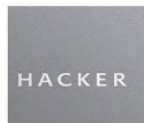


TERRAPIN
BRIGHT GREEN

BuildingGreen

The Durst
Organization

hellmuth + bicknese
architects



hbn
HEALTHY BUILDING NETWORK

HKS

HR

FAIR BUILDING TECHNOLOGY

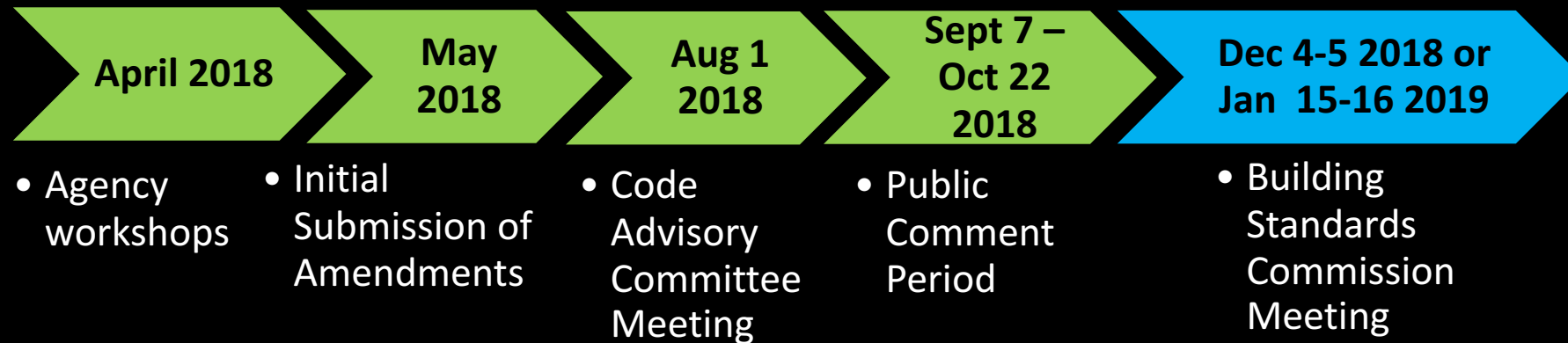


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STUDICE architecture pc

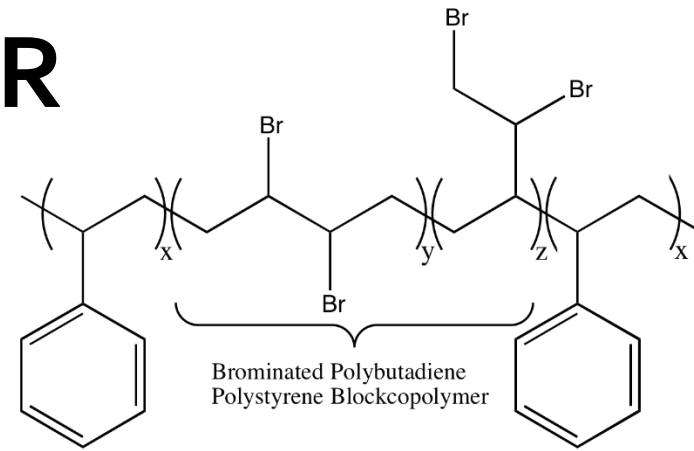
California Building Standards Commission (CBSC)

2018 Code Adoption Timeline



Polymeric FR

Adopted from C. Koch, M. Nachev, J. Klein, D. Köster, O.J. Schmitz, T.C. Schmidt and B. Sures



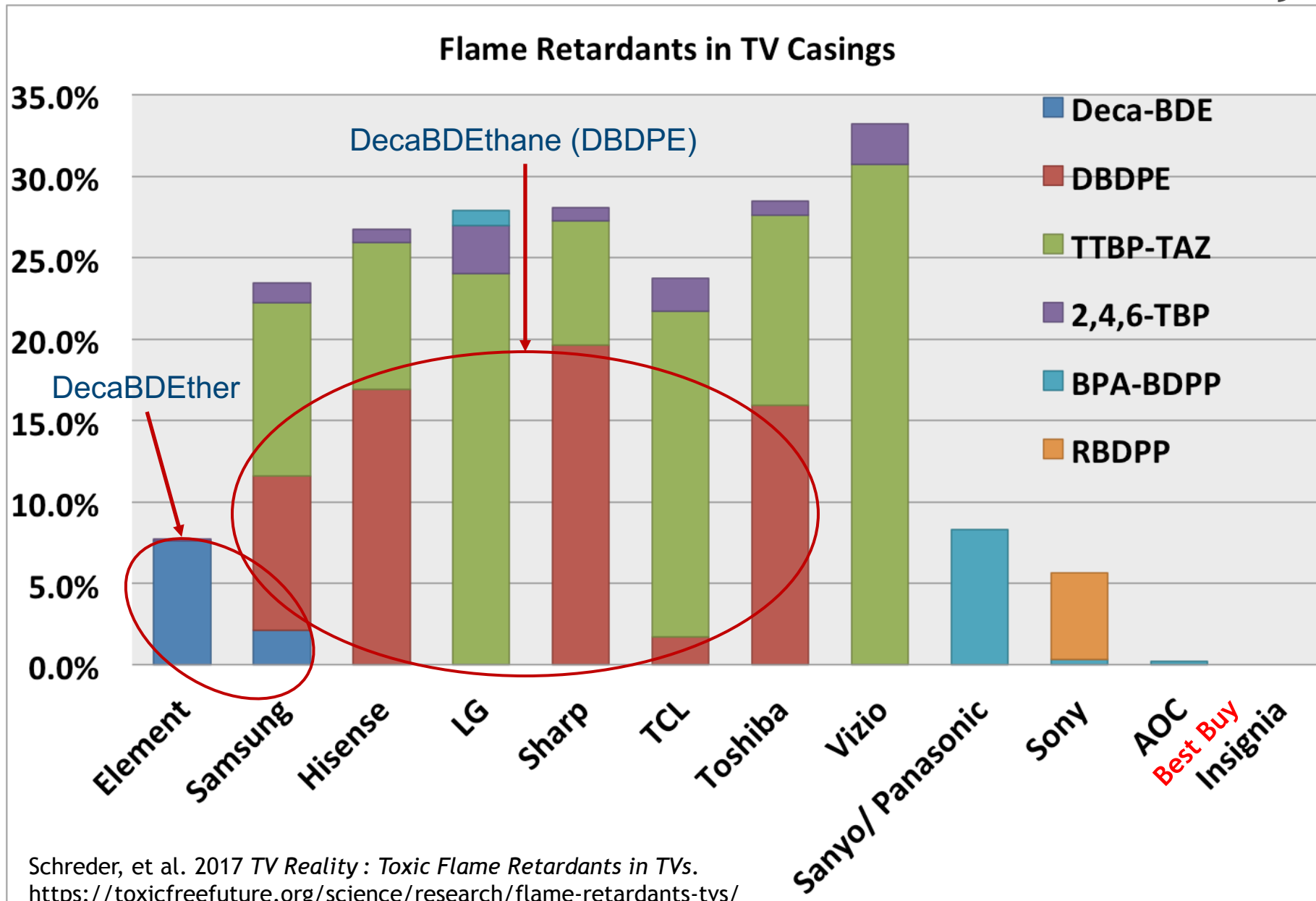
- Replacement for HBCD in polystyrene insulation (annually 26,000 MT)
- Degraded by heat and by UV exposure
- Brominated and other degradation products produced
- Limited acute toxicity for some degradation products
- Chronic toxicity likely for BFR degradation and possibly other products
- Polymeric FR is seen as a prototype for future polymers
- **Polymer degradation products are an important area for toxicological study**

Flame retardants

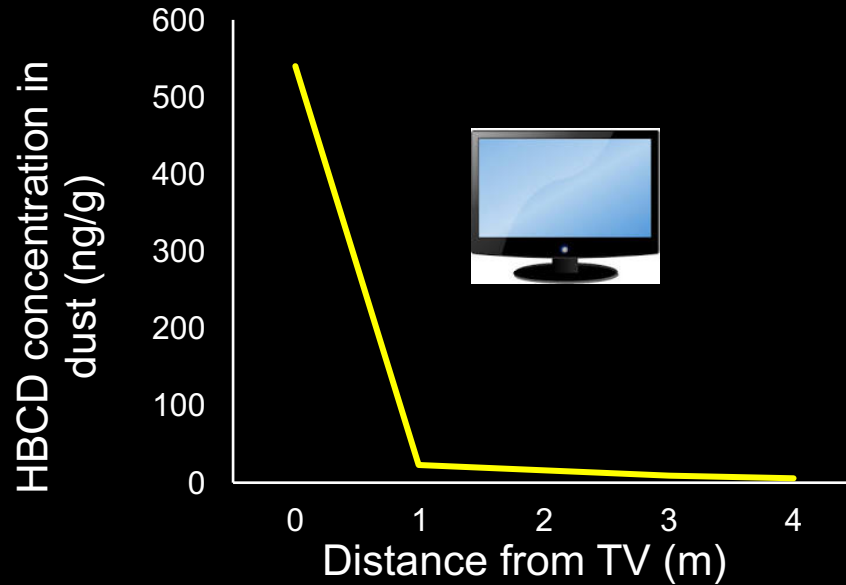
Updating 1970s Flammability Standards

- Children's sleepwear --1976
- Furniture and baby product foam --2014
- Foam building insulation –2019?
- Plastic television cases ??

Flame Retardants in TV Enclosures Case Study

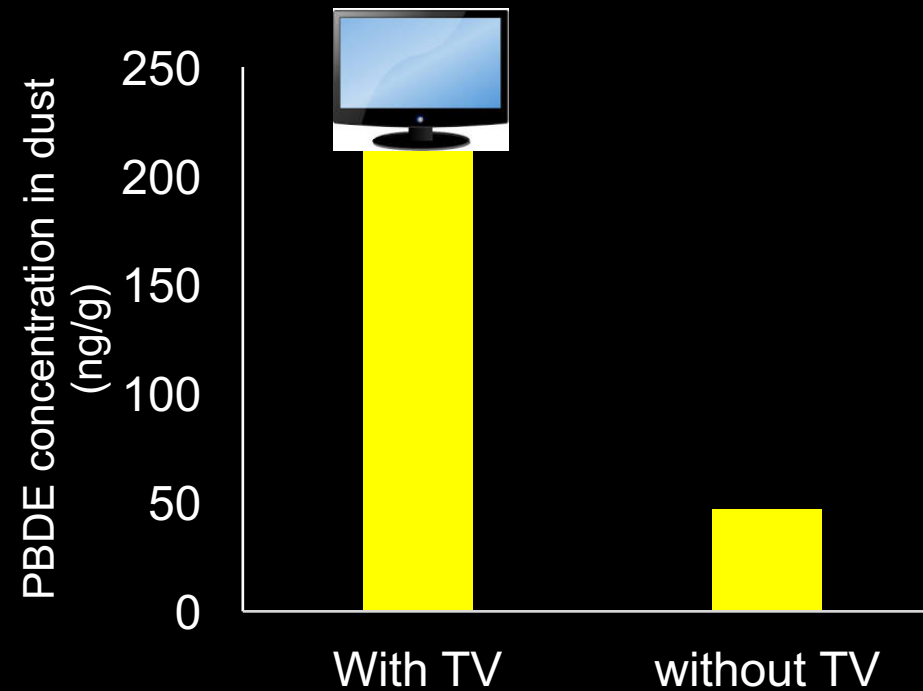


Flame Retardants Migrate from Electronics into Dust



Flame retardants levels in dust are highest within one meter of the television.

Flame retardants levels in dust are higher when televisions are present.



Electronic Housings Candle Ignition Requirements



International Electrotechnical Commission

2002 IEC candle standard process initiated

2008 Two IEC, one EU electronics standard prevented

2008 One U.S. and one Canadian standard prevented

2008 EU Candle standard for TVs passed

2012 IEC candle standards for TVs prevented

2013 EU candle standards for TVs rolled back

2014 EU Common modification prevented

2015 EU, IEC candle standard prevented

2015 Four new EU, IEC candle standards defeated in October



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

© | coffee life | Dr.estratone.com

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

Conformity, January 2009

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
- (Open flame standards have potential for harm)

The Flame Retardant Dilemma & Beyond



Government, industry, academics, non-profits and citizens discuss reducing toxics to protect health.

February 15, 2018 at UC Berkeley

By limiting use of the “Six Classes”

We can have a healthier world.

GreenSciencePolicy.org