Lowell Center for Sustainable Production
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Alternatives Assessment 115 Webinar:

Identifying Safer Alternatives to Flame Retardants that are/contain Chemicals of Concern

NOVEMBER 4, 2013

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** If you would like to ask a question or comment during this webinar please type your question in the Q&A box located in the control panel.*

Goals

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- Continuing education and dialog
- To advance the practice of alternatives assessment for informed substitution across federal, state, and local agencies through networking, sharing of experiences, development of common approaches, tools, datasets and frameworks, and creation of a community of practice.

Purpose of this call

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- Addressing chemical flame retardants represents an important cross-agency chemicals management problem.
- Flame retardants serve important fire protection roles, but concerns have been raised about the environmental persistence and toxicity of many current flame retardants and their replacements.
- Restrictions on flame retardant chemicals of concern may have had the unintended consequence of their replacement by other problematic substances. In some cases, substitution has not been accompanied by careful alternatives assessments.
- Discussion has been increasing about the nature of and need for flame retardant requirements in some applications.
- This three part series will address flame retardant needs and problems, potential alternatives, how different agencies see the issue and potential solutions and possibilities for greater cross agency collaboration

Speakers

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- Pam Eliason , Massachusetts Toxics Use Reduction Institute
- Elizabeth Harriman, Massachusetts Toxics Use Reduction Institute
- Emma Lavoie, US EPA, Design for Environment Branch

Discussion Questions

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- What are the hazards of some of the flame retardant alternatives that have been identified?
- What types of alternatives other than chemical substitutes have been identified?
- What is the process of evaluating these alternatives and ensuring their safety and performance?

Webinar Discussion Instructions

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- Due to the number of participants on the Webinar, all lines will be muted.
- If you wish to ask a question, please type your question in the Q&A box located in the drop down control panel at the top of the screen.
- All questions will be answered at the end of the presentations.

Toxics Use Reduction Institute

The Commons Alternatives Assessment Principles

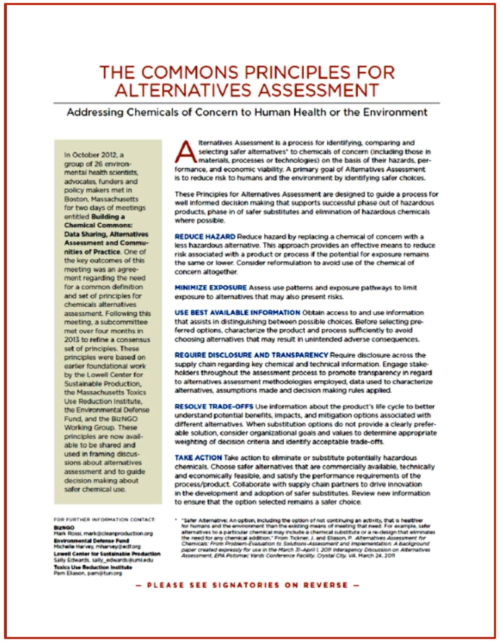
Pam Eliason
MA Toxics Use Reduction Institute
University of Massachusetts Lowell

Interagency Alternatives Assessment Webinar Series
Nov 4, 2013

TURI
TOXICS USE REDUCTION INSTITUTE
UMASS LOWELL

The Commons Alternatives Assessment Principles

- The principles are designed to guide a process for well informed decision making that supports successful:
  - Phase out of hazardous products,
  - Phase in of safer substitutions, and
  - Elimination of hazardous chemicals where possible.



THE COMMONS PRINCIPLES FOR ALTERNATIVES ASSESSMENT

Addressing Chemicals of Concern to Human Health or the Environment

In October 2012, a group of 26 environmental health scientists, advocates, funders and policy makers met in Boston, Massachusetts for two days of meetings entitled **Building a Chemical Commons: Data Sharing, Alternatives Assessment and Communities of Practice**. One of the key outcomes of this meeting was an agreement regarding the need for a common definition and set of principles for chemicals alternatives assessment. Following this meeting, a subcommittee met over four months in 2013 to refine a consensus set of principles. These principles were based on earlier foundational work by the Lowell Center for Sustainable Production, the Massachusetts Toxics Use Reduction Institute, the Environmental Defense Fund, and the BizNGO Working Group. These principles are now available to be shared and used in framing discussions about alternatives assessment and to guide decision making about safer chemical use.

Alternatives Assessment is a process for identifying, comparing and selecting safer alternatives* to chemicals of concern (including those in materials, processes or technologies) on the basis of their hazards, performance, and economic viability. A primary goal of Alternatives Assessment is to reduce risk to humans and the environment by identifying safer choices.

These Principles for Alternatives Assessment are designed to guide a process for well informed decision making that supports successful phase out of hazardous products, phase in of safer substitutes and elimination of hazardous chemicals where possible.

REDUCE HAZARD Reduce hazard by replacing a chemical of concern with a less hazardous alternative. This approach provides an effective means to reduce risk associated with a product or process if the potential for exposure remains the same or lower. Consider reformulation to avoid use of the chemical of concern altogether.

MINIMIZE EXPOSURE Assess use patterns and exposure pathways to limit exposure to alternatives that may also present risks.

USE BEST AVAILABLE INFORMATION Obtain access to and use information that assists in distinguishing between possible choices. Before selecting preferred options, characterize the product and process sufficiently to avoid choosing alternatives that may result in unintended adverse consequences.

REQUIRE DISCLOSURE AND TRANSPARENCY Require disclosure across the supply chain regarding key chemical and technical information. Engage stakeholders throughout the assessment process to promote transparency in regard to alternatives assessment methodologies employed, data used to characterize alternatives, assumptions made and decision making rules applied.

RESOLVE TRADE-OFFS Use information about the product's life cycle to better understand potential benefits, impacts, and mitigation options associated with different alternatives. When substitution options do not provide a clearly preferable solution, consider organizational goals and values to determine appropriate weighting of decision criteria and identify acceptable trade-offs.

TAKE ACTION Take action to eliminate or substitute potentially hazardous chemicals. Choose safer alternatives that are commercially available, technically and economically feasible, and satisfy the performance requirements of the process/product. Collaborate with supply chain partners to drive innovation in the development and adoption of safer substitutes. Review new information to ensure that the option selected remains a safer choice.

FOR FURTHER INFORMATION CONTACT:

BizNGO
Mark Rossi, mark@cleanproduction.org

Environmental Defense Fund
Michelle Harvey, mharvey@edf.org

Lowell Center for Sustainable Production
Sally Edwards, sally_edwards@uml.edu

Toxics Use Reduction Institute
Pam Eliason, pam@turi.org

* "Safer Alternative: An option, including the option of not continuing an activity, that is healthier for humans and the environment than the existing means of meeting that need. For example, safer alternatives to a particular chemical may include a chemical substitute or a re-design that eliminates the need for any chemical addition." From Tickner, J. and Eliason, P. *Alternatives Assessment for Chemicals: From Problem-Evaluation to Solutions-Assessment and Implementation: A background paper created expressly for use in the March 31–April 1, 2011 Interagency Discussion on Alternatives Assessment. EPA Potomac Yards Conference Facility, Crystal City, VA.* March 24, 2011

— PLEASE SEE SIGNATORIES ON REVERSE —

The Commons
Alternatives Assessment Principles

- Reduce Hazard
- Minimize Exposure
- Use Best Available Information
- Require Disclosure and Transparency
- Resolve Trade-Offs
- Take Action

Link to Commons Principles:

http://www.turi.org/Our_Work/Research/Alternatives_Assessment/Commons_Principles_for_Alternatives_Assessment

United States Environmental Protection Agency

Interagency Alternatives Assessment Webinar 115

Identifying Safer Alternatives to Flame Retardants of Concern

Emma Lavoie

Design for the Environment Program

US EPA

Topics

1. Identifying alternatives
2. How we assess alternatives
3. How assessment output is interpreted
4. Impact of DfE alternative assessments (AAs)

DfE Flame Retardant AAs

Flame Retardant AA – functional use	Number of substances or products	Date
PentaBDE "FFR" – polyurethane foam for furniture	12	2005
TBBPA – Printed Circuit Boards	12	2008 (draft)
DecaBDE – many polymers	32	2012 (draft)
HBCD – polystyrene building insulation	3	2013 (draft)
Updated pentaBDE – flexible polyurethane foam	17	Expected 2014

Sources and Steps for Identifying Relevant FRs

1. Flame retardant literature
2. Chemical manufacturers websites
3. Develop lists of likely alternatives
4. Review lists with relevant experts

   (e.g., chemical manufacturer's engineers, compounders and polymer manufacturers) and other stakeholders
5. Provide list of alternatives for public review

Firefox | Design for the Environment (DfE) Ho... | About the Furniture Flame Retardanc...

http://www.epa.gov/dfe/pubs/projects/flameret/about.htm

EPA United States Environmental Protection Agency

Design for the Environment An EPA Partnership Program

About the Furniture Flame Retardancy Report Update

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more.

About This Project | Milestones | Participants

Partnership goal and scope

In January 2013, EPA's Design for the Environment (DfE) began updating a 2005 report on its alternatives assessment for flame retardants used in polyurethane foam for furniture.

The update is addressing:

- New data on pentaBDE alternatives
- New flame retardant products for polyurethane foam
- Updates to DfE's hazard criteria

This update, informed by stakeholders, is identifying flame-retardant ...ls used to meet fire-safety requirements for upholstered consumer

September 24, 2013 -- EPA announces its plan to update the DfE Alternatives Assessment for flame retardants in flexible polyurethane foam. This document (PDF) (6pp, 37K) lists 17 flame retardant chemicals and 2 proprietary blends that will be evaluated in the updated report and this document (PDF) (6pp, 39K) lists flame retardant chemicals that DfE does not expect to evaluate. EPA developed these lists based on stakeholder input on use patterns for flame retardant in flexible polyurethane foam. For more information contact Emma Lavoie (lavoie.emma@epa.gov).

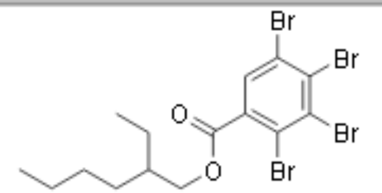
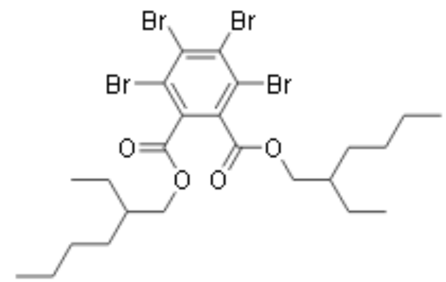
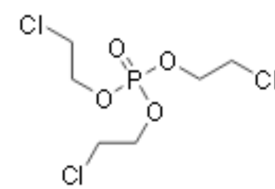
Top DfE Questions

- Frequently Asked Questions
- Where can I find a list of products with the DfE label?
- How do I apply to get the DfE label on my products?

www.epa.gov

Example – pentaBDE Update

Flame Retardants to be Evaluated in the DfE Furniture Flame Retardancy Update[a]
September 2013

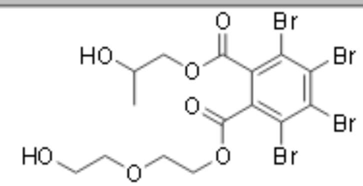
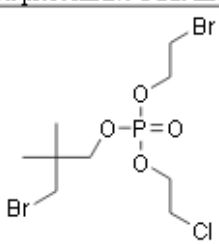
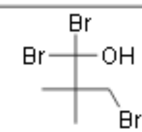
CAS RN	Preferred Chemical Abstract Index Name	Common Names and Acronyms[b]	Molecular Formula	Structure
Brominated Alternatives				
183658-27-7	Benzoic acid, 2,3,4,5-tetrabromo-, 2-ethylhexyl ester	TBB; EH-TBB	$C_{15}H_{18}Br_4O_2$	
26040-51-7	1,2-Benzenedicarboxylic acid, 3,4,5,6-tetrabromo-, 1,2-bis(2-ethylhexyl) ester	TBPH; BEH-TEBP	$C_{24}H_{34}Br_4O_4$	
Halogenated Phosphorus Alternatives				
115-96-8	Ethanol, 2-chloro-, phosphate (3:1)	TCEP; Tris(2-chloroethyl) phosphate	$C_6H_{12}Cl_3O_4P$	

Example – pentaBDE Update

Flame Retardants That Will Not be Evaluated in the DfE Furniture Flame Retardancy Update

Flame retardants listed here have been identified as being used in polyurethane or other plastics, but are not thought to be used in flexible polyurethane foam, or are not candidates for DfE's hazard assessment process.
DfE welcomes input from stakeholders having additional information on any production or use of these chemicals in flexible polyurethane foam.

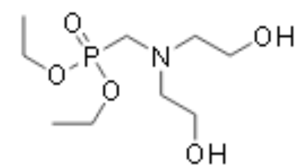
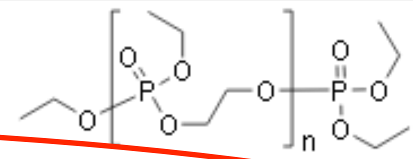
September 2013

CAS RN	Preferred Chemical Abstract Index Name	Common Names and Acronyms[a]	Molecular Formula	Structure	Reason for Exclusion[b]
Brominated Alternatives					
77098-07-8; 20566-35-2	1,2-Benzenedicarboxylic acid, 3,4,5,6-tetrabromo-, mixed esters with diethylene glycol and propylene glycol; 1,2-Benzenedicarboxylic acid, 3,4,5,6-tetrabromo-, 1-[2-(2-hydroxyethoxy)ethyl] 2-(2-hydroxypropyl) ester	Diester/ether diol of tetrabromophthalic anhydride; 2-(2-Hydroxyethoxy)ethyl 2-hydroxypropyl 3,4,5,6-tetrabromophthalate; HEEHP-TEBP	$C_{15}H_{20}Br_4O_9$; $C_{15}H_{14}Br_4O_7$	 Representative Structure	Appears to be used in rigid polyurethane foams only.
125997-20-8	Phosphoric acid, mixed 3-bromo-2,2-dimethylpropyl and 2-bromoethyl and 2-chloroethyl esters	BBDMP-CDMP-P	$C_9H_{18}Br_2ClO_4P$	 Representative Structure	Historical FR for polystyrene boards; no current production. Not reported in CDR[c].
36483-57-5	1-Propanol, 2,2-dimethyl-, tribromo deriv.	Tribromoneopentyl alcohol; TBNPA	$C_5H_9Br_3O$	 Representative Structure	Appears to have been an unsuccessful product.

[a] The last acronym listed for each substance is the "practical abbreviation" according to Bergman et al (2012)'s proposed standard approach for making acronyms for organic flame

How we Handle Confidential Substances

Flame Retardants to be Evaluated in the DfE Furniture Flame Retardancy Update[a]
September 2013

CAS RN	Preferred Chemical Abstract Index Name	Common Names and Acronyms[b]	Molecular Formula	Structure
2781-11-5	Phosphonic acid, P-[[bis(2-hydroxyethyl)amino] methyl]-, diethyl ester	N,N-(bis)-hydroxyethyl-aminomethane phosphonic acid diethyl ester; BHEAMP-DE	$C_9H_{22}NO_5P$	
184538-58-7	Phosphoric acid, triethyl ester, polymer with oxirane and phosphorus oxide (P_2O_5)	Oligomeric ethyl ethylene phosphate; Alkylphosphate oligomer	$(C_6H_{15}O_4P{\cdot}C_2H_4O{\cdot}O_5P_2)_n$	 Representative structure
New-to-Market Proprietary Blends				
Proprietary	Halogen-free flame retardant	Emerald Innovation NH-1		--
Proprietary	Halogen-free phosphorus-based	Fyrol HF-5		--

How we Assess Alternatives

Hazard Criteria for Environmental Endpoints

- Define very low, low, moderate, high, very high
- More distinguishing for some endpoints than standard regulatory thresholds of concern

Environmental Toxicity and Fate

Aquatic Toxicity	Very High	High	Moderate	Low	
Acute Aquatic Toxicity (LC50 or EC50) (mg/L)	< 1.0	1 - 10	> 10 - 100	> 100	
Chronic Aquatic Toxicity (LOEC) (mg/L)	< 0.1	0.1 - 1	> 1 - 10	> 10	
Environmental Persistence	**Very High**	**High**	**Moderate**	**Low**	**Very Low**
Persistence in water, soil or sediment	Half-life > 180 days or recalcitrant	Half life of 60 – 180 days	Half-life < 60 but ≥ 16 days	Half-life < 16 days OR passes Ready Biodegradability test not including the 10-day window.	Passes Ready Biodegradability test with 10-day window.
Persistence in air (half-life days)	For this endpoint, High/Moderate/Low etc. characterizations will not apply. A qualitative assessment of available data will be prepared.				
Bioaccumulation (BAF / BCF)	**Very High**	**High**	**Moderate**	**Low**	
BCF/BAF	> 5,000	5,000 – 1,000	<1,000 – 100	< 100	
Log BCF/BAF	>3.7	3.7-3	<3-2	<2	

Data Sources

One or more studies conducted in a manner consistent with established testing guidelines

↓

Experimentally valid but non-guideline studies (i.e., do not follow established testing guidelines)

↓

Reported data without supporting experimental details

↓

Estimated data using SAR methods or professional judgment based on an analog approach

↓

Expert judgment based on mechanistic and structural considerations

Application of Criteria (e.g., HBCD)

- Three levels of data communication

1

Chemical	CASRN	Acute Toxicity	Carcinogenicity	Genotoxicity	Reproductive	Developmental	Neurological	Repeated Dose	Skin Sensitization	Respiratory Sensitization	Eye Irritation	Dermal Irritation	Acute	Chronic	Persistence	Bioaccumulation
Hexabromocyclododecane (HBCD)	25637-99-4; 3194-55-6	L	*M*	L	M	H	*M*	M	L		VL	VL	VH	VH	H	VH

2

Genotoxicity		**LOW: Based on negative results for gene mutations in bacterial cells, a lack of chromosomal aberrations in human peripheral blood lymphocyte cells *in vitro*, and negative results in recombination and mouse micronucleus tests.**		
	Gene Mutation *in vitro*	Negative in *Salmonella typhimurium* (strains not specified) in the presence and absence of metabolic activation	EPA, 2005; NICNAS, 2012	Reported in a secondary source with limited study details.
	Gene Mutation *in vivo*			No data located.
	Chromosomal Aberrations *in vitro*	Negative, mammalian chromosomal aberration test with human peripheral blood lymphocytes in the presence and absence of metabolic activation Doses: 10, 19, 38, 75, 150, 300 and 600 µg/mL	EPA, 2005; NICNAS, 2012 3	Reported in a secondary source. Guideline study. Performed according to current EPA, OECD guidelines, and GLP.
	DNA Damage and Repair			No data located.
	Other *in vitro*	Positive, intragenic recombination test in Sp5/V79 and SPD8 hamster cells; cell lines developed by study authors Doses: 2-20 µg/mL	EPA, 2005; NICNAS, 2012	Reported in a secondary source. Non-guideline study. Not a standard test used by regulatory agencies to assess genotoxicity. Reliability and predictive ability is unknown.
		Negative, mouse micronucleus test Doses: 0, 500, 1,000 or 2,000 mg/kg in dimethyl sulfoxide (DMSO)	EPA, 2005	Reported in a secondary source. Guideline study. Performed according to current EPA, OECD guidelines and GLP.

Application of Criteria Cont. (HBCD)

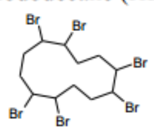
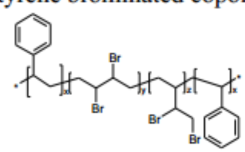
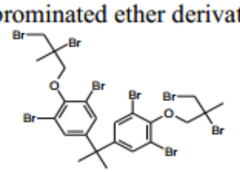
Chemical	CASRN	Acute Toxicity	Carcinogenicity	Genotoxicity	Reproductive	Developmental	Neurological	Repeated Dose	Skin Sensitization	Respiratory Sensitization	Eye Irritation	Dermal Irritation	Acute	Chronic	Persistence	Bioaccumulation
Hexabromocyclododecane (HBCD)	25637-99-4; 3194-55-6	L	*M*	L	M	H	*M*	M	L		VL	VL	VH	VH	H	VH

Bioaccumulation		VERY HIGH: The bioaccumulation designation for HBCD is based on measured BCF values. Available monitoring data demonstrate HBCD being detected in a range of organisms, including higher trophic level organisms.		
	Fish BCF	BCF = 8,974 (Measured) *Oncorhynchus mykiss* (whole fish) at a nominal concentration of 3.4 µg HBCD/L for 70 days long (25-day uptake, 35-day depuration); nominal concentrations based on γ−isomer The three stereoisomers of HBCD were present in *O. mykiss* in rough approximation to that of the commercial product used as test article	Drottar and Kruger, 2000; EINECS, 2008; EPA, 2005; NICNAS, 2012	Guideline study performed according to current EPA, OECD guidelines and GLP.
		BCF = 18,100 (Measured) (steady-state, log BCF 4.26) in *Pimephales promelas* at a mean water concentration of 6.2 µg HBCD/L for 32 days	EINECS, 2008; Veith et al., 1979	Non-guideline study that was conducted before the implementation of standardized test procedures for BCF.
	Fish BAF	4,100 (Estimated for 3194-55-6) 350,000 (Estimated for 25637-99-4)	EPI	These estimated results are from the BCFBAF v3.01 Arnot-Gobas method, reporting the upper trophic value with an entered measured Log K_{OW} value of 5.6.

Hazard Summary Table for Comparison (HCBD)

This table only contains information regarding the inherent hazards of flame retardant chemicals. Evaluation of risk considers both the hazard and exposure associated with substance including combustion and degradation by-products.
The caveats listed in the legend and footnote sections must be taken into account when interpreting the hazard information in the table.

VL = Very Low hazard L = Low hazard M = Moderate hazard H = High hazard VH = Very High hazard — Endpoints in colored text (VL, L, M, H, and VH) were assigned based on empirical data. Endpoints in black italics *(VL, L, M, H, and VH)* were assigned using values from predictive models and/or professional judgment.
[d] This hazard designation would be assigned MODERATE for a potential for lung overloading if >5% of the particles are in the respirable range as a result of dust forming operations.
§ Based on analogy to experimental data for a structurally similar compound.

Chemical (for full chemical name and relevant trade names see the individual profiles in Section 4.8)	CAS RN	Human Health Effects											Aquatic Toxicity		Environmental Fate	
		Acute Toxicity	Carcinogenicity	Genotoxicity	Reproductive	Developmental	Neurological	Repeated Dose	Skin Sensitization	Respiratory Sensitization[1]	Eye Irritation	Dermal Irritation	Acute	Chronic	Persistence	Bioaccumulation
Hexabromocyclododecane (HBCD) 	25637-99-4; 3194-55-6	L	*M*	L	M	H	*M*	M	L		VL	VL	VH	VH	H	VH
Butadiene styrene brominated copolymer 	1195978-93-8	L	*L*	L	L	L	*L*	L [d]	L		L	L	L	*L*	*VH*	*L*
TBBPA-bis brominated ether derivative 	97416-84-7	*L*§	*M*§	*M*§	*M*§	*M*§	*L*	*M*§	*L*§		*L*	*L*	*L*	*L*	*H*	*H*

[1] At this time, there are no standard test methods for respiratory sensitization; as a result there was no designation for this endpoint.

DecaBDE Draft Hazard Summary Table

Design for the Environment U.S. EPA

Chemical	CASRN	Human Health Effects											Aquatic Toxicity		Environmental Fate	
		Acute Toxicity	Carcinogenicity	Genotoxicity	Reproductive	Developmental	Neurological	Repeated Dose	Skin Sensitization	Respiratory Sensitization	Eye Irritation	Dermal Irritation	Acute	Chronic	Persistence	Bioaccumulation
DecaBDE and Brominated Flame Retardant Alternatives (BFRs)																
		DecaBDE and Discrete BFR Alternatives														
Bis(hexachlorocyclopentadieno) Cyclooctane	13560-89-9	L	*M*§	*M*§	VL	VL	L	M	L		VL	*L*	*L*	*L*	VH	*H*
Decabromodiphenyl Ethane	84852-53-9	L	*M*§	L	L	VL	*H*§	L	L		VL	VL	L	*L*	VH	*H*
Decabromodiphenyl Ether	1163-19-5	L	M	L	L	H	H	M	L		L	L	*L*	*L*	VH	*H*
Ethylene Bis-tetrabromophthalimide	32588-76-4	L	*M*§	L	*L*	L	*M*§	L	*L*		VL	VL	*L*	*L*	VH	*H*
Tetrabromobisphenol A Bis (2,3-dibromopropyl) Ether	21850-44-2	L	*M*	M	*M*	*M*	*L*	*M*	*M*		*L*	*L*	*L*	*L*	VH	*H*
Tris(tribromoneopentyl) Phosphate	19186-97-1	*L*	*M*	*M*	*L*	*H*	*H*	*M*	*H*		*L*	*L*	*L*	*L*	*H*	*M*
Tris(tribromophenoxy) Triazine	25713-60-4	L	*L*	L	*L*	*L*	*L*	L	L		L	VL	*L*	*L*	VH	*H*

Choosing an Alternative

- Do not pick or endorse
- Do observe obviously preferable alternatives
- Do summarize results (last chapter of report)
  - decaBDE 32 profiles compared by sub-grouping
  - HBCD 3 profiles with specific differences
- User has to decide how to compare and contrast results
  - DfE AAs provides information and interprets data
  - GreenScreen is an example of a decision analysis tool

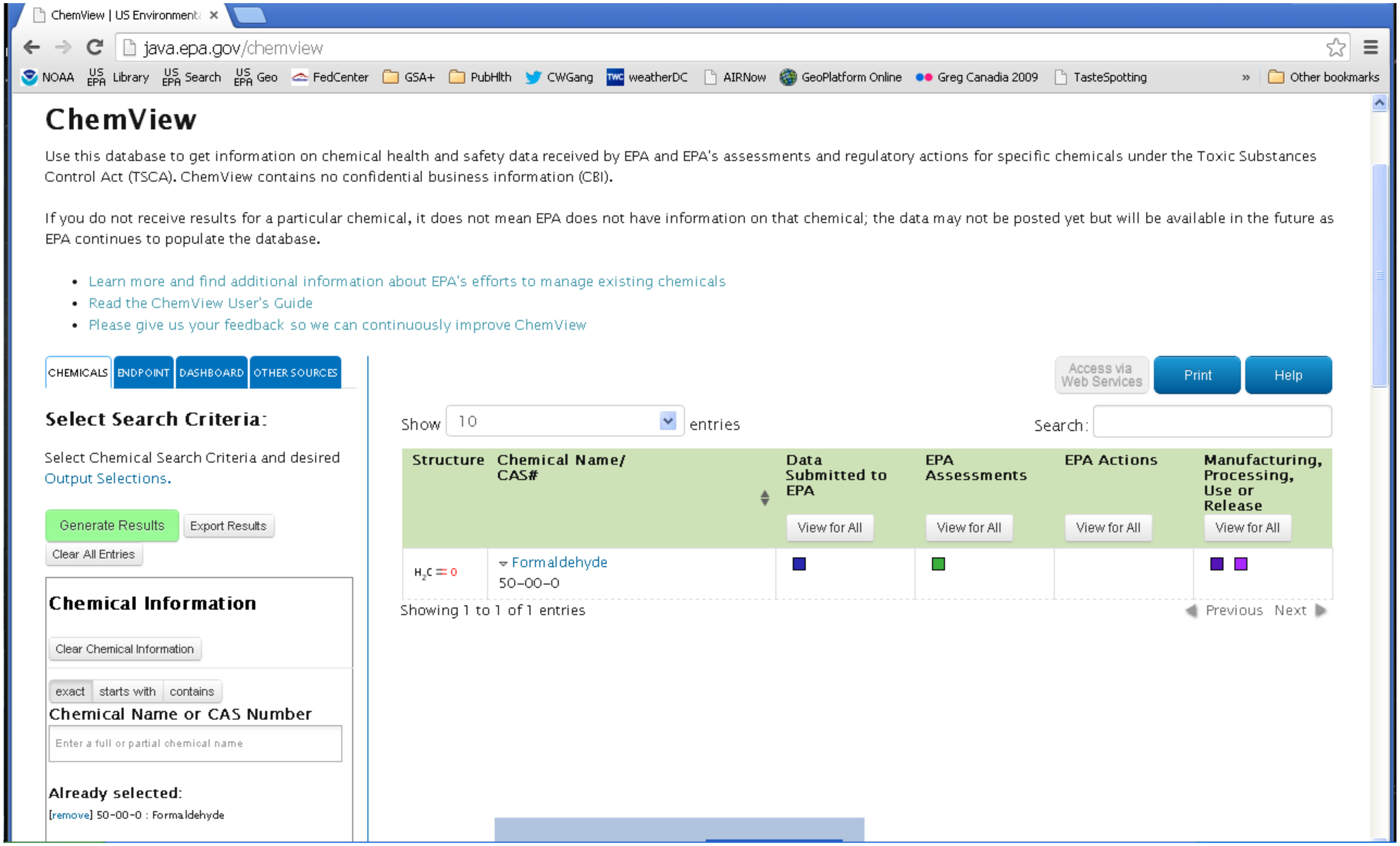
Impact of the AAs

1. Clarify FR uses and functional viability
   - Do not evaluate efficacy
   - Role is hazard profile
2. Forum for expressing viewpoints; all participants' expertise and perspectives are respected
   - Not exclusive or sector focused like many conferences
3. Educate different stakeholders involved

Impact of the AAs Continued

4. Estimated hazards yield data submissions
5. EPA manages confidential data and communicates it to the public
6. Industry is using the output
   – Hewlett Packard requires GreenScreens
   – Chemtura used DfE hazard tables to pitch to client
7. Information available to public while risk assessment and management activities are ongoing
   – And informs EPA scoping of risk assessments

Chemview



http://www.epa.gov/oppt/existingchemicals/pubs/ChemView_Public_UI_Guide.pdf

For more information:

DfE: http://www.epa.gov/dfe

http://www.epa.gov/dfe/alternative_assessments.html

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The opinions expressed in this presentation are those of the author and are not necessarily US EPA policy.

Toxics Use Reduction Institute

Alternatives Assessment for Flame Retardants

Determining Technical, Financial, and Environmental, Health and Safety Feasibility for Material and Product Alternatives

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Interagency Alternatives Assessment Webinar Series
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Assessing Alternatives for Flame Retardants

- Massachusetts Toxics Use Reduction program – our perspective
- Review Alternatives Assessment approach
- Focus on material and product FR alternatives

Massachusetts TURA

- Sustain and promote the competitive position of Massachusetts industry
- Promote reduction in the use of toxic and hazardous substances
- Require businesses to analyze their use of chemicals, to look for opportunities to reduce toxics use and waste.
  - TUR Options Assessment
- Publicly report their toxic chemical use
  - *In 2011, 686,000 lbs decaBDE used in MA by coatings, plastics compounders, wire and cable and textile companies*

Toxics Use Reduction Institute

- Information on toxic chemicals and safer alternatives, international chemical restrictions
- Education, training and tools for TUR Planners
- Supply Chain Workgroups
  - Electronics, Wire and Cable, Aerospace
    - Lead, brominated flame retardants, hexavalent chromium
- Research and demonstration of green chemistry and innovative technologies
- Grants for Community groups, businesses, NGOs
- Laboratory testing for surface cleaning
- Science and Policy

Product Objectives

- functional products, high performance throughout life cycle

- reasonable economy, financially feasible

- safer products throughout lifecycle for environment, human health and society

Alternatives Assessment

A. Define goal

B. ID Chemicals of High Concern

C. Identify Alternatives

D. Prioritize and Pre-Screen Alternatives

E. Alternatives Assessment

- Technical/Performance Assessment
- EH&S Assessment
- Financial Assessment

F. Analyze information

G. Select alternative

IC2 (Interstate Chemicals Clearinghouse)
Safer Alternatives Assessment Model

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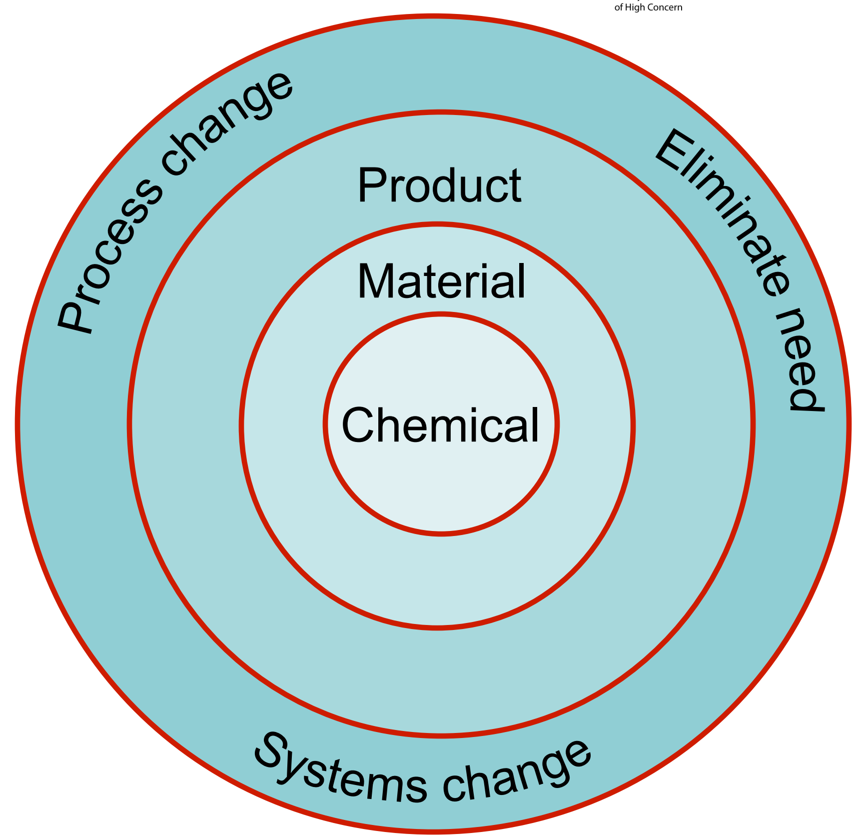
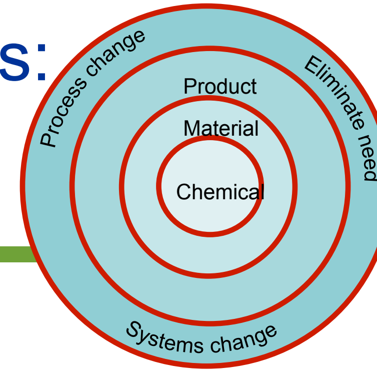
Identify Alternatives for Specific Uses

1. Chemical
2. Material
3. Product Re-design
4. Process Change
5. Eliminate the Use / Need for Function
6. Systems change



Identify Flame Retardant Alternatives: Polyurethane foam



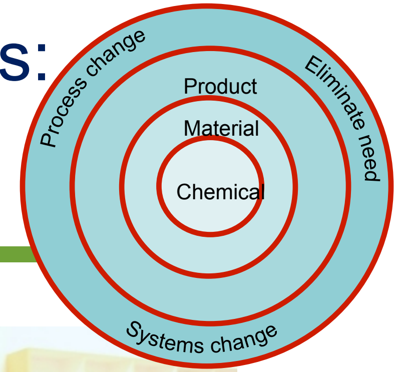
Polyurethane foam cushions in furniture

– Material: cotton or wool, feathers/ down

Dwell Studio, Inc

– Product: plastic mesh (no foam), barrier fabric over foam

Identify Flame Retardant Alternatives: Polyurethane foam



Polyurethane foam cushions in furniture (cont.)


Credit: William Schulz/C&EN

– Eliminate need: refine tests to determine whether FRs needed and in what products

Process change: sprinklers, other ways of extinguishing fires

– Systems change: less stuff, less of built environment from fuel

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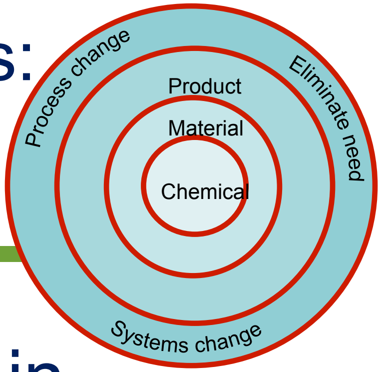
Identify Flame Retardant Alternatives: Polystyrene Foam

Dow Chemical

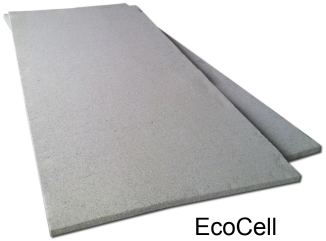


Building Insulation Foam – HBCDD used in rigid extruded polystyrene (XPS) foam

– Material – phenolic foam, fiberglass blanket, rock wool, cellulose

http://www.subsport.eu


CertainTeed Saint-Gobain

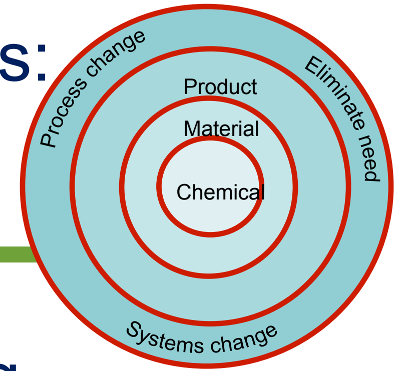

EcoCell

– Eliminate need – FR not required with thermal barrier (e.g., concrete)

Systems change: Code changes required

Building Science Corp.

Identify Flame Retardant Alternatives: Wire and Cable

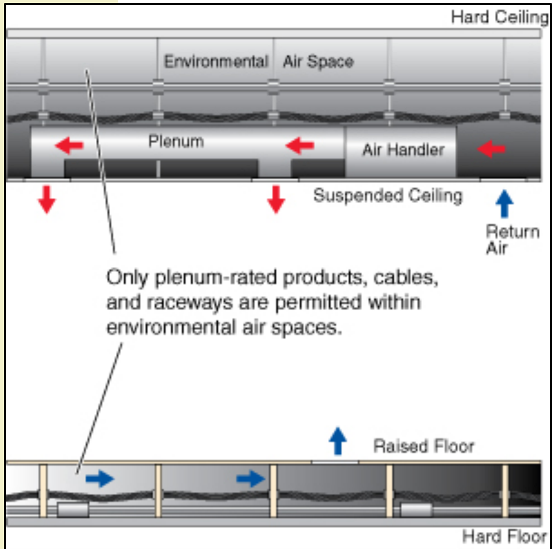


Wire and Cable Insulation and Jacketing

Belden, Inc.

– Material – Cross linked polyethylene (XLPE), polyphenylene oxide (PPO), thermoplastic polyurethane (TPU)

- May use non-halogen FRs (metal hydroxide, phosphorus, nano-clays)



Extron Electronics

» Systems change – building design, eliminating wire and cable from plenum spaces

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Assess Alternatives

- Technical Performance
  - functionality, availability and technical viability
- Environmental / human health
- Financial Assessment
- Life Cycle Thinking
- Sustainability; Social Impacts

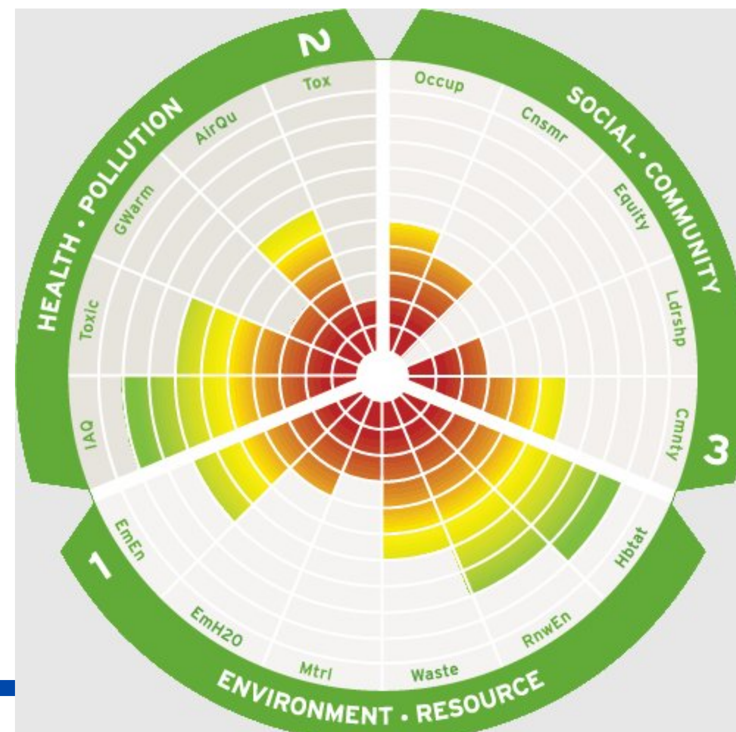
EH&S Assessment

- Consider:
  - Is this a preferable solution/material?
    - Comparison with existing material
    - Comparison with corporate/organizational criteria
    - Benchmarks
  - Health and environmental effects
  - Significant Life cycle effects (qualitative)
  - Significant potential exposure
  - Uncertainty

EH&S Assessment – tools for material and product comparisons

- Plastics Scorecard (BizNGO)

- Pharos Building Materials Selection Tool (Healthy Building Network)



EH&S Assessment – tools for material and product comparisons

- Compareing materials or products:
  - Environmental health and safety characteristics
  - Ability to meet technical specifications
  - Cost
  - Key societal impacts
  - Using Life cycle thinking

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Thank-you

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Discussion Questions

- What are the hazards of some of the flame retardant alternatives that have been identified?
- What types of alternatives other than chemical substitutes have been identified?
- What is the process of evaluating these alternatives and ensuring their safety and performance?

Next Webinars

Lowell Center for Sustainable Production
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Alternatives Assessment 116: Challenges in Selecting Alternatives and Implementing Substitution – Cross Agency Perspectives

TBD- December 2013

- Alissa Cordner, Whitman College
- Paul Yaroshak, US Department of Defense
- Chris Weis, NIEHS (Invited)

Webinar Audio & Slides

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The audio recording and slides shown during this presentation will be available at:

http://www.chemicalspolicy.org/alternativesassessment.webinarseries.php