Partnering with EPA's Design for the Environment to Promote Safer Products

ACWA

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Kelly Grant, AAAS Fellow

U.S. Environmental Protection Agency

Outline

- What is DfE?
- DfE Projects
- Best practices
- Lifecycle assessment
- Chemical alternatives assessment
  - Furniture flame retardants
  - Future assessments
- Safer Product Labeling

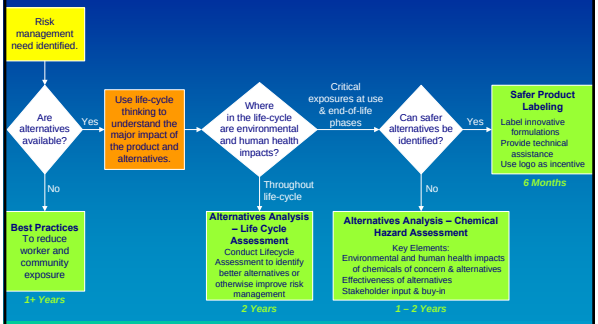
What is DfE?

- **Green Chemistry**
  - Hazard reduction through functional use approach
- **Informed chemical substitution**
- Provide information on chemicals and their alternatives
  - "Alternatives Assessments"
- Guide consumers towards safer choices
  - Safer Product Labeling

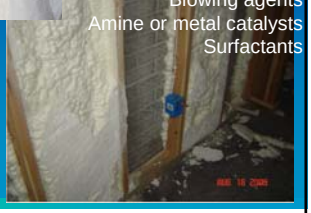
What DfE is About

- Goals
  - Safer Products
  - Safer chemical ingredients is baseline
  - Life cycle impacts are considered
  - Protecting Workers and Consumers – Especially Children
- Central Elements
  - EPA technical tools and expertise
  - Multi-stakeholder participation
  - Voluntary Program
- Results
  - Industry partners reduced more than 500 million pounds of chemicals of concern last year

Decision Logic for DfE Approaches



DfE Best Practices…SPF



Methylene diphenyl diisocyanate (MDI)
Polyol Blend/ Polyols
Flame retardants
Blowing agents
Amine or metal catalysts
Surfactants

http://www.epa.gov/dfe/pubs/projects/spf/spray_polyurethane_foam.html

Nanotechnology in Li-ion Batteries

- Life-cycle assessment (LCA) comparing current lithium-ion (Li-ion) battery technologies and a next generation battery component (anode) that uses single-wall carbon nanotube (SWCNT) technology.
- For energy systems for hybrid and electric vehicles
- Inform decisions: identify the materials or processes likely to pose risks to public health or the environment.
- Promote nanotechnology innovations that reduce environmental impacts

Kathy Hart – hart.kathy@epa.gov

Chemical Alternatives Assessments: Enabling safer substitution

Alternatives assessments provide information to help move to safer chemicals and prevent unintended consequences from un-informed substitution

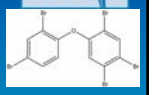
Moving away from chemicals of concern requires well characterized substitutes with lower health and environmental hazards

Understanding "functional use" and using chemistry and toxicology expertise are important facets

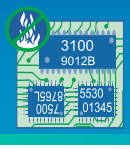
Alternatives Assessments: Flame Retardants

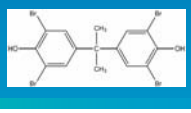
Furniture Flame Retardancy Partnership:

"Environmental Profiles of Chemical Flame-Retardant Alternatives for Low-Density Polyurethane Foam"



Flame Retardants in Printed Circuit Boards Partnership





Furniture Flame Retardancy Partnership
Alternatives Assessment (2003-2006)

- **Predominant flame retardant (pentaBDE) was being found increasingly in human tissue, breast milk and the environment.**
  - This flame retardant was phased-out at the end of 2004.
  - Need for fire safety will likely increase based on planned national standards.
  - Report provides data to inform industry.
  - Decision-making for alternatives to this 19-million-pound-per-year chemical.

- **The Report**
  - Summary assessments of chemicals in flame retardant formulations.
  - Tables summarizing EPA assessment for environmental and human health endpoints.
  - Detailed hazard reviews.

Furniture Flame Retardancy Partnership
Alternatives Report

Human Health Hazard Concern | Ecotoxicity Hazard Concern | Environmental Hazard Concern

Company	Chemical	% in Formulation*	Human Health Effects							Ecotoxicity	Environmental		Potential Routes of Exposure							
			Cancer Hazard	Skin Sensitizer	Reproductive	Developmental	Neurological	Systemic	Genotoxicity	Acute	Chronic	Persistence	Bioaccumulation	Worker			General Population			Reactive or Additive?
														Inhalation	Dermal	Ingestion	Inhalation	Dermal	Ingestion	
Albemarle	SAYTEX RZ-243																			
	Proprietary E Tetrabromophthalate diol diester		L	L	L*	L*	L	M*	L	L	M	L*	L	N	Y	Y	N	N	Y	Y	Additive
	Proprietary B Aryl phosphate		L	L	M*	M*	M	M*	L	H	M	L	M	N	Y	Y	N	Y	N	N	Additive
	Triphenyl Phosphate CAS # 115-86-6		L	L	L	L	L	M	L	H	M	L	L	Y	Y	Y	Y	Y	Y	Y	Additive
Ameribrom	PR513																			
	Tribromoneopentyl Alcohol CAS # 36483-57-5		M	L	M	M	M	M	M	M	M	L	L	Y	Y	Y	N	N	Y	Y	Reactive
Great Lakes	Firemaster 550																			

Potential Exposure

- **Chart is valued by industry as a decision-making tool**

USEPA Action Plans

- Existing chemicals for which EPA has concerns
- Show reasons for concern and proposed actions under Toxic Substances Control Act
- December 2009
  - Polybrominated diphenyl ethers (PBDEs)
  - Short chain chlorinated paraffins (SCCPs)
  - Phthalates
  - Perfluorinated chemicals
- April 2010 – bisphenol A
- Under development – HBCD, NPEs, benzidine dyes, isocyanates, siloxanes

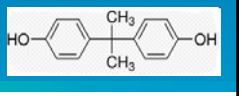
http://www.epa.gov/oppt/existingchemicals/pubs/ecactionpln.html

Why focus on BPA in thermal paper?

Concerns throughout life cycle:

- Unpolymerized BPA at milligram levels in a receipt.[1]
- BPA may persist through wastewater treatment during paper recycling.
- BPA from discarded receipts may leach from landfills.
- BPA may persist in recycled paper products.
- Potential for human exposure - workers and the public.

1. Personal communication from J. Warner



Alternatives Assessments for Decision Making

The assessments provide information … what next?

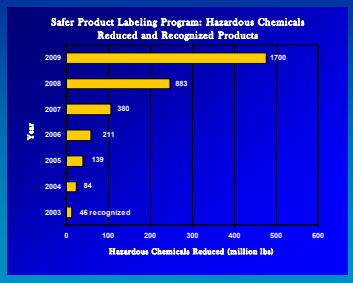
- How to choose the substitute?
- Clean Production Action - Green Screen
  - Hewlett Packard
- DfE Safer Product Labeling

taken from http://xkcd.com

DfE Safer Product Labeling

Current Sectors:

- Cleaning products
- Holding tank treatments
- Bioremediation products
- Deicers
- Industrial coatings
- Inks
- Athletic field paint
- Tire balancing liquid



Continuous Improvement:
As innovation occurs, continuum may shift

Continuum of Improvement

Formula Ingredient by Functional Class

Characteristics of Ingredient of Concern

Characteristics of Improved Ingredient

Characteristics of Sustainable Ingredient

DfE Safer Product Labeling

1. Expert Chemical Evaluation
   - Toxicity, fate, function, alternatives
2. Review every ingredient by functional use
3. Ensures that the safest chemicals are used for each functional category
4. Hazard oriented
5. Partners can use the logo to make the public aware of the safer choices.

Review – 3 Basic Components

1) Review <u>every</u> ingredient by functional use class
   - Lists
   - Literature
   - Analogous chemicals – SAR
2) Review formulation as a whole
   - Synergistic effects
   - pH
   - Performance testing
3) Partnership Agreement
   - 3 years
   - Audits

How to define "safer"?

- DfE Criteria for Safer Chemical Ingredients
  - Master Criteria and class specific criteria for
    - Surfactants
    - Solvents
    - Chelating Agents
    - Fragrances
    - Environmental Fate and Toxicity for Direct Release Products

- DfE's Standard for Safer Cleaning Products

DfE Criteria for Surfactants

- Safer surfactants degrade quickly to low toxicity degradates.

Acute Aquatic Toxicity (L/E/IC50 Value)	Rate of Biodegradation
≤1 ppm	May be acceptable if biodegradation[1] occurs within a 10-day window
>1 ppm and ≤10 ppm	Biodegradation[1] occurs within a 10-day window
>10 ppm	Biodegradation[1] occurs within 28 days without products of concern[2]

[1] Generally, >60% mineralization (to CO_2 and water) in 28 days.
[2] Products of concern are compounds with high acute aquatic toxicity (L/E/IC50 ≤ 10ppm) and a slow rate of biodegradation (greater than 28 days).

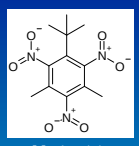
The DfE Criteria

- Master Criteria
  - Carcinogenicity
  - Genotoxicity
  - Reproductive toxicity
  - Developmental toxicity
  - Acute toxicity
  - Chronic toxicity
  - Mutagencity
  - Sensitization
  - Environmental fate
  - Ecotoxicity

Review: Data - SAR – experts

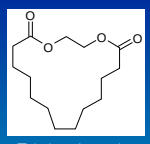
- Measured data are preferred
- If a lack of data:
  1. Predictive models – EPI Suite, Oncologic etc.
     - Sustainable futures: http://www.epa.gov/oppt/sf/tools/methods.htm
  2. Analog analysis in conjunction with estimated data
     - SAR
  3. Expert judgment
     - A room full of EPA science experts who meet biweekly
     - Critical to success
       - Predictive models need expert judgment ... Models, analogs or experts alone are not sufficient – all three yield better decisions.

Suggesting Safer Substitutes
(Fragrances)



Musk xylol

- Appears designed for maximum environmental persistence—nitro and t-butyl groups
- May bioaccumulate
- Potentially toxic to aquatic organisms
- May be an indirect toxicant, inhibiting the ability of cells to excrete harmful chemicals



Ethylene brassylate

- Faster biodegradation—ester linkages
- Fragrance houses have worked with EPA's Design for the Environment Formulator Program to replace musk xylol with ethylene brassylate

CleanGredients® - Marketplace for Green Chemistry Ingredients

- Helps answer the question: "Where can I find ingredients that meet DfE Criteria for Safer Chemistry?"
- Leverages EPA green chemistry expertise and tools
- CleanGredients is a marketplace…
  - for suppliers to showcase safer chemical ingredients for cleaning products, and
  - for formulators to find those ingredients.

www.cleangredients.org

DfE for Disinfectant Products

- Products may bear the logo starting in May
- DfE is evaluating submissions
- Pilot will last three years
- Inerts: Every inert must meet the DfE Standard
- Actives: Every ingredient must meet the DfE Master Criteria for Safer ingredients
  - Product must be registered through OPP and a label amendment made for the DfE recognition

What is SDSI?

- **Environmental stewardship program to encourage the use of safer surfactants**
- **Promotes the goals of EPA's Ambient Water Quality Criteria (AWQC) for Nonylphenol (NP)**
- **Harmonizes with international environmental protection efforts**
- **High-level Agency recognition for…**
  - Formulators
  - Chemical manufacturers
  - Retailers/Distributors
  - Institutional purchasers
  - Advocates

SDSI Champions

Auto-Chlor System
BASF Corporation
Barricade Fire Gel
Bissell Homecare Inc.
Chemco Corporation
ChemLink Laboratories LLC
Clean Control Corporation
Corporate Express, a Staples Company
Coverall Health-Based Cleaning System
Earth Friendly Products
Eco Concepts, Inc.
EcoDiscoveries
EPIC Cleaning Products
GEMTEK Products LLC
Georgia-Pacific Consumer Products LP
GreenBlue
ISSA – The Worldwide Cleaning Industry Association
JohnsonDiversey, Inc.
Klipper Group
Method
Multi-Clean Inc.
Natural Soap Formulas
Naturell
PDQ Manufacturing
Pure & Gentle Soap Inc. Reckitt Benckiser, Inc.
SafeWash Technologies
S.C. Johnson & Son, Inc.
Seventh Generation, Inc.
Sierra Club
Spurrier Chemical Companies Inc.
State Chemical Solutions
SYSCO Corporation
Textile Rental Services Association of America
The Dial Corporation, A Henkel Company
The Procter & Gamble Company
US Formula Technology
U.S. Polychemical Corporation
Virox Technologies Inc.
VASKA

Opportunities to partner

- Criteria development
- Identifying chemicals of concern
- Partnering on alternatives assessments
- Identifying product categories that need improvement
- Identifying green chemistry challenges
- Encourage participation in SDSI
- Outreach

Thank you to all our Partners….

- www.epa.gov/dfe
- Grant.kelly@epa.gov, 202-564-9910
- DfE staff:
  - Cal Baier-Anderson – BPA, phthalates, Product Labeling
  - Mary Cushmac – Best Practices - Spray Polyurethane Foam
  - Clive Davies - Branch Chief
  - David DiFiore – Safer Product Labeling
  - Kathy Hart – Life Cycle Assessment Partnerships
  - Emma Lavoie – Product Labeling, Flame Retardants in PCBs
  - Christa McDermott – Fellow, Product Labeling
  - Libby Sommer – Product Labeling, CleanGredients
  - Melanie Vrabel – Product Labeling, Flame Retardants in PCBs