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Alternatives Assessment 103: Case Examples and Lessons Learned

APRIL 24, 2012

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

Goals

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- Continued 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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- Numerous federal and state-based alternatives assessment efforts
- Some focus on identifying alternatives to chemicals of concern; some focus on evaluating alternatives to functional uses of those chemicals; some focus on evaluation and application in a particular sector
- Various approaches have been undertaken in completing alternatives assessment for chemicals of concern
- Goal: To understand how alternatives assessment is being applied in three case examples, both at a comparative chemical hazard level and in testing alternatives to a chemical of concern. To understand what tools and approaches are being applied.

Speakers

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- Cal Baier-Anderson, USEPA, Design for Environment
- Alex Stone, Washington Department of Ecology
- Pam Eliason, MA Toxics Use Reduction Institute

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 question box located on the right side panel of your webinar control panel.

United States Environmental Protection Agency

Design for the Environment

Alternatives to BPA in Thermal Paper Partnership

Cal Baier-Anderson

Alternatives Assessment Program

- DfE Chemical alternatives assessments:
  - Identify and evaluate potentially safer alternatives
  - Involve stakeholders from across the spectrum of interested parties
- The outcome of an alternatives assessment:
  - Provides the best information on hazard from literature and models (Based on New Chemicals Program approaches)
  - Helps stakeholders choose safer alternatives
    - Provides information that manufacturers can use to create more sustainable products
    - Helps minimize the potential for unintended consequences by reducing the likelihood of moving to alternatives that could pose a concern

DfE Alternatives Assessments for Priority Chemicals

- Tetrabromobisphenol A (TBBPA) in Printed Circuit Boards
  - combustion testing underway
- Nonylphenol and nonylphenol ethoxylates (NP/NPE)
  - final report Spring 2012
- Bisphenol A (BPA) in Thermal Paper
  - draft report Spring 2012
- Flame Retardant Alternatives to decabromodiphenyl ether (decaBDE) used in many plastics
  - draft report Spring 2012
- Flame Retardant Alternatives to hexabromocyclododecane (HBCD) in insulation board
  - draft report Summer 2012
- Phthalates
  - list of potential alternatives Summer 2012

DfE Alternatives Assessment Criteria Endpoints

Human Health Toxicity

- Acute mammalian toxicity
- Carcinogenicity
- Mutagenicity/ Genotoxicity
- Reproductive Toxicity
- Developmental Toxicity
- Neurotoxicity
- Repeated Dose Toxicity
- Respiratory Sensitization
- Skin Sensitization
- Eye and Skin Irritation/Corrosivity
- Endocrine Activity

Environmental Fate & Effects

- Aquatic toxicity
- Environmental persistence
- Bioaccumulation

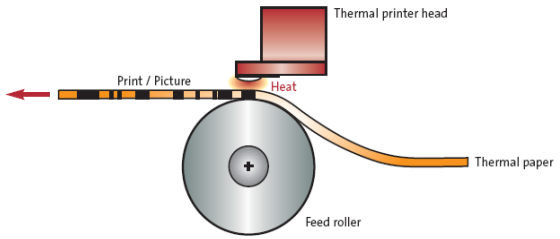
Additional Endpoints

- Physical hazards
- Ecotoxicity (birds, bees)
- And more

BPA Alternatives in Thermal Paper Partnership

- Why BPA?
  - "BPA is a reproductive, developmental, and systemic toxicant in animal studies and is weakly estrogenic, there are questions about its potential impact particularly on children's health and the environment."

    (see http://www.epa.gov/opptintr/existingchemicals/pubs/actionplans/bpa.html)
- Why BPA in thermal paper?
  - Unconjugated bisphenol A (BPA) is used in the manufacture of thermal paper
  - Some concern for direct human exposure via handling of receipts
  - Source of BPA releases into the environment via recycling and landfilling



From Koehler Product Brochure

Thermal Paper Uses

- Shopping receipts
- Credit card receipts
- ATM & banking receipts
- Ultrasound printouts
- EKG & ECG printouts
- Prescription labels
- Deli labels
- Tickets

http://www.zimbio.com/pictures/RD7q8nFOyKs/Jessica+Alba+Out+Beverly+Hills/Hndv07-2WS4/Meter+Maid

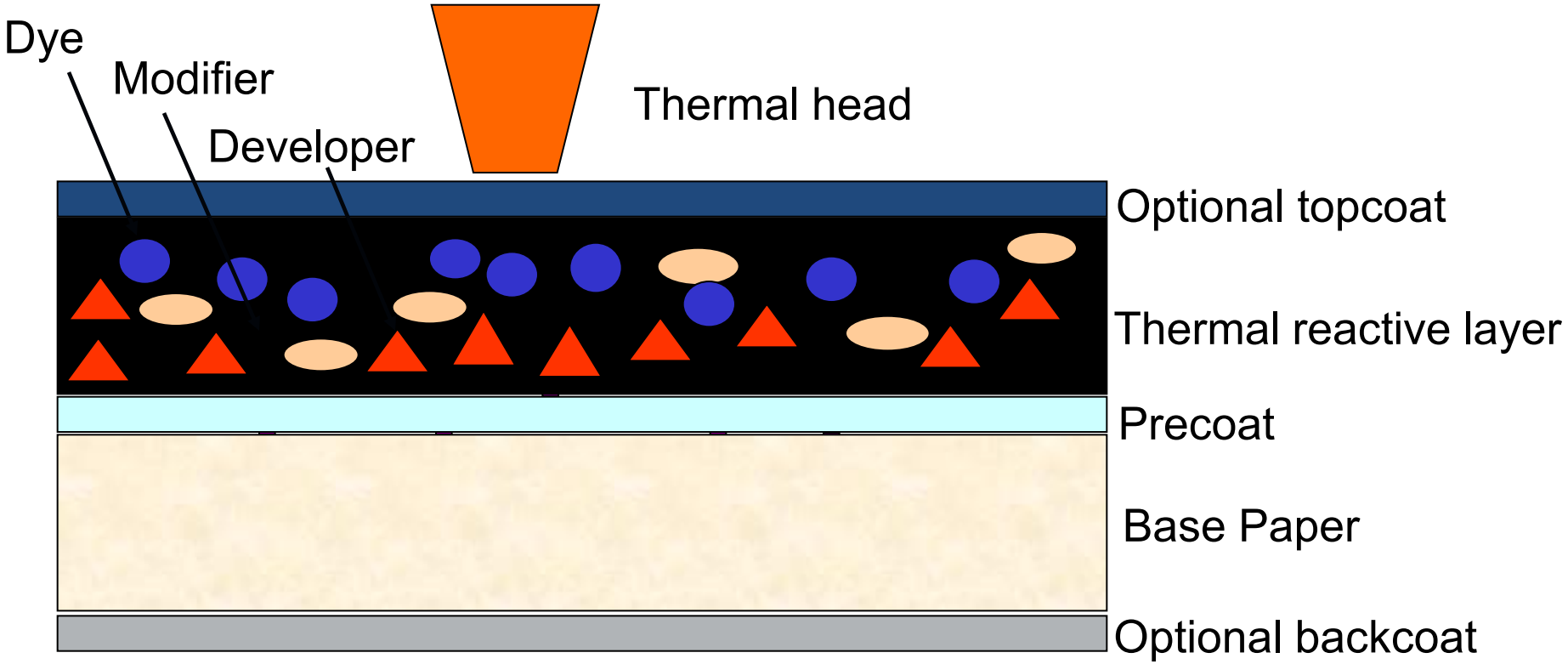
http://www.mohawkmedicalmall.com/2009_11_01_archive.html

http://www.jpihealthcare.com/ultrasound-paper

http://www.starmicronics.com/printer/Application/Application.aspx?i=11

http://www.nashua.com/ProdAndServices/LabelSupScale.aspx?Selected=LabelTrans

Cross section of thermal paper



Based on Koehler Product Brochure

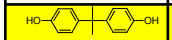
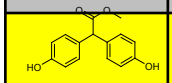
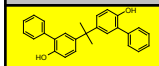
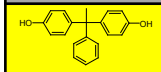
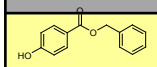
Scope

- Approximately 100 partners representing industry, government and NGOs
  - BPA in the news boosts interest
  - ~ 40 are actively involved, representing the supply chain
- Identified 19 alternatives
  - Many alternatives are currently in use
  - External surveys also indicate that ~40-50% receipts made with something other than BPA
- Many alternatives structurally similar to BPA
  - BPA-like, BPS-like and “other”
  - Very little data for most chemicals

Table 4-1 Screening Level Toxicology Hazard Summary – Structure Group Cross-Check

This table only contains information regarding the inherent hazards of the chemicals evaluated. Evaluation of risk considers both the hazard and exposure.
The caveats listed in the legend and footnote sections must be taken into account when interpreting the hazard information in the table below.

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 estimation software and professional judgment [(Quantitative) Structure Activity Relationships "(Q)SAR"].
◊ For representative component, most predominant oligomer, of mixture (MW <1,000).
‡ Based on highest concern oligomer with a MW <1,000
§ Based on analogy to experimental data for a structurally similar compound.
ϕ Based on expert judgment

			Human Health Effects											Aquatic Toxicity		Environmental Fate	
	Chemical	CASRN	Acute Toxicity	Carcinogenicity	Genotoxicity	Reproductive	Developmental	Neurological	Repeated Dose	Skin Sensitizer	Eye Irritation	Dermal Irritation	Respiratory Sensitization	Acute	Chronic	Persistence	Bioaccumulation
	Bisphenol A 2,2-bis(p-hydroxyphenyl)propane	80-05-7	L	*M*	L	H	H	*M*	M	M	M	M		H	H	VL	L
	Bisphenol F Bis(4-hydroxyphenyl)methane	620-92-8	L	*M*	L	*H*§	*H*§	*M*	H	L	VH	*M*§		M	*H*	L	L
	Bisphenol C 2,2'-Bis(4-hydroxy-3-methylphenyl)propane	79-97-0	*L*§	*M*	M	*H*§	*H*§	*M*	*M*§	*M*§	*VH*§	*M*§		*H*	*H*	M	*M*
	MBHA Methyl bis(4-hydroxyphenyl)acetate	5129-00-0	*L*§	*M*	*L*§	*H*§	*H*§	*M*	*M*§	L	*M*§	*M*§		*H*	*H*	*M*	*L*
	BisOPP-A 4,4'-Isopropyllidenebis(2-phenylphenol)	24038-68-4	*L*§	*M*	*L*§	*H*§	*H*§	*M*	*M*§	*M*§	*M*§	*M*§		*L*	*H*	*H*	*M*
	Bisphenol AP 4,4'-(1-Phenylethylidene)bisphenol	1571-75-1	*L*§	*M*	*L*§	*H*§	*H*§	*M*	*M*§	*M*§	*M*§	*M*§		*H*	*H*	*H*	*M*
	Substituted phenolic compound, PROPRIETARY #1		*L*§	*M*	L	*H*§	*H*§	*M*	*M*§	*M*§	*M*§	*M*§		*H*	*M*	*M*	*L*
	Substituted phenolic compound, PROPRIETARY #2		*L*§	*M*	*L*§	*H*§	*H*§	*M*	*M*§	*M*§	*M*§	*M*§		*H*	*H*	*H*	*H*
	PHBB Benzyl 4-hydroxybenzoate	94-18-8	L	*M*	*M*	*L*ϕ	*M*	*M*	*L*ϕ	*M*§	VL	VL		H	*H*	*L*§	*L*

Hazard Evaluation Results Summary

- Most of the alternatives can be grouped as either BPA-like or BPS-like based on chemical structure.
- Most chemicals have little data. Data gaps are filled based on expert judgment: analogs; structure-activity relationship; and computer models.
- Even the chemicals that are structurally different exhibit trade-offs. Stakeholders should consider trade-offs in substitution decision-making.
- Substitution may call for near-term risk mitigation responses. For example, refrain from recycling thermal paper.
- Longer term efforts should include broader sustainability considerations.

Challenges & Limitations

1. Data gaps
2. Need to refine use of additional “non-traditional” information in characterization
3. Weighing trade-offs
4. Timelines

For more information:

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

facebook.com/epadfe

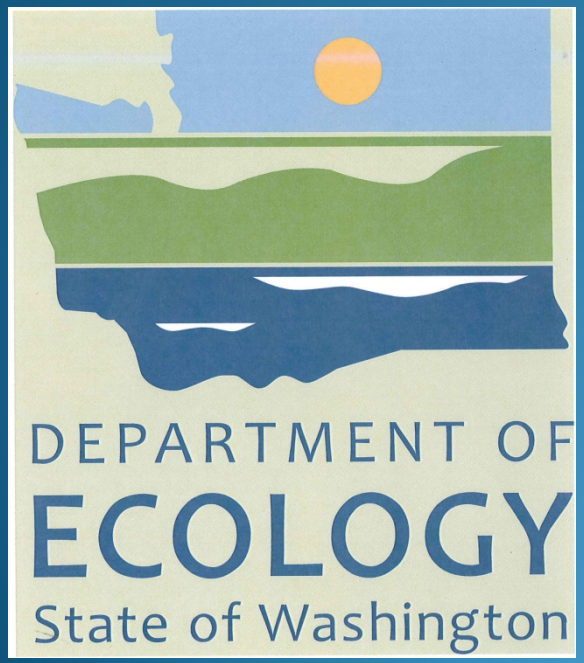
Draft report for public comment,

available this spring:

baier-anderson.caroline@epa.gov

http://www.epa.gov/dfe/pubs/projects/bpa/index.htm

Flame Retardant Alternatives to Decabromodiphenyl ether



Alex Stone, Sc. D.

Washington State Department of Ecology

24 April 2012

WA Legislation

- PBDE Chemical Action Plan issued in 2006
- Ban legislation passed and signed into law in 2007
  - Banned the use of Penta- and Octa-BDE mixtures
  - Banned the use of Deca-BDE in mattresses
  - Prohibited sale of Deca contained in:
    1. Electronic enclosures of TVs and computers
    2. Residential upholstered furniture
       - IF Fire Safety maintained
       - IF safer and technically feasible alternative(s) identified
- Alternative Assessment report completed Jan. 2009

WA Legislation (cont.)

Exemptions in WA:

- **Transportation, aviation, military and space applications, etc. exempted**
- **Established limit of < 0.1% (1,000 ppm) for reporting and/or new products containing recycled material, carpet pads for example**
- **Gave authority to adopt rules for implementation including compliance and enforcement**

Deca Alternatives Assessment

- **Built upon work done in PBDE Chemical Action Plan & subsequent work around the world**

- **Evaluated Current Deca Assessments**
  - What products/plastics included
  - What criteria used to evaluate alternatives
  - What alternatives evaluated
  - Conclusions
  - Strengths/weaknesses

'Safer' Considerations used in WA Deca Assessment

1. **Market and Technical Analysis**
   - Do alternatives exist?
   - Do they meet the same function?
2. **Toxicity Evaluation**
   - If failed toxicity concerns, no reason to address remaining issues
   - Essentially used the process developed by EPA's Design for the Environment Program as adapted by Clean Production Action's Green Screen
3. **Exposure Evaluation**
   - Assumed same for Deca and alternatives unless data proved otherwise

‘Safer’ Considerations (cont.)

4. **Engineering**
   - Can an alternative be used without changing process?
   - Can process be changed to use alternative?
   - Are there other viable alternatives (redesign product so chemical is not needed, etc.)
5. **Availability**
   - Is it currently being sold for intended application?
   - Is it currently being used in similar products?
6. **Cost**
   - What impact does switch have upon cost of final product?
   - Is it cost prohibitive?

Final remarks on Deca-BDE

- Our task was to identify if there was at least one viable alternative to Deca. Our report stated we believe there is.
  - Phosphate alternative (RDP) viable as replacement in electronic enclosures
  - Residential upholstered furniture can be manufactured to meet flammability standards without addition of chemical flame retardants
- Ecology does not have the authority to dictate what flame retardant is used in place of Deca.
- If a safer alternative exists, a toxic chemical should be removed from use regardless of exposure potential

Lessons Learned from Assessment Process

Positive:

1. Alternative Assessments are feasible
2. Procedures have been developed by TURI, Clean Product Action (the Green Screen), DfE, etc. to assist
3. Methodologies are comprehensive and based upon the most recent science and assessment methodologies

Negative:

1. Time and resource intensive
2. Requires expertise in chemistry, toxicology, process engineering, etc.
3. Does not look at full life cycle impacts
4. Always a risk that new data will alter conclusions

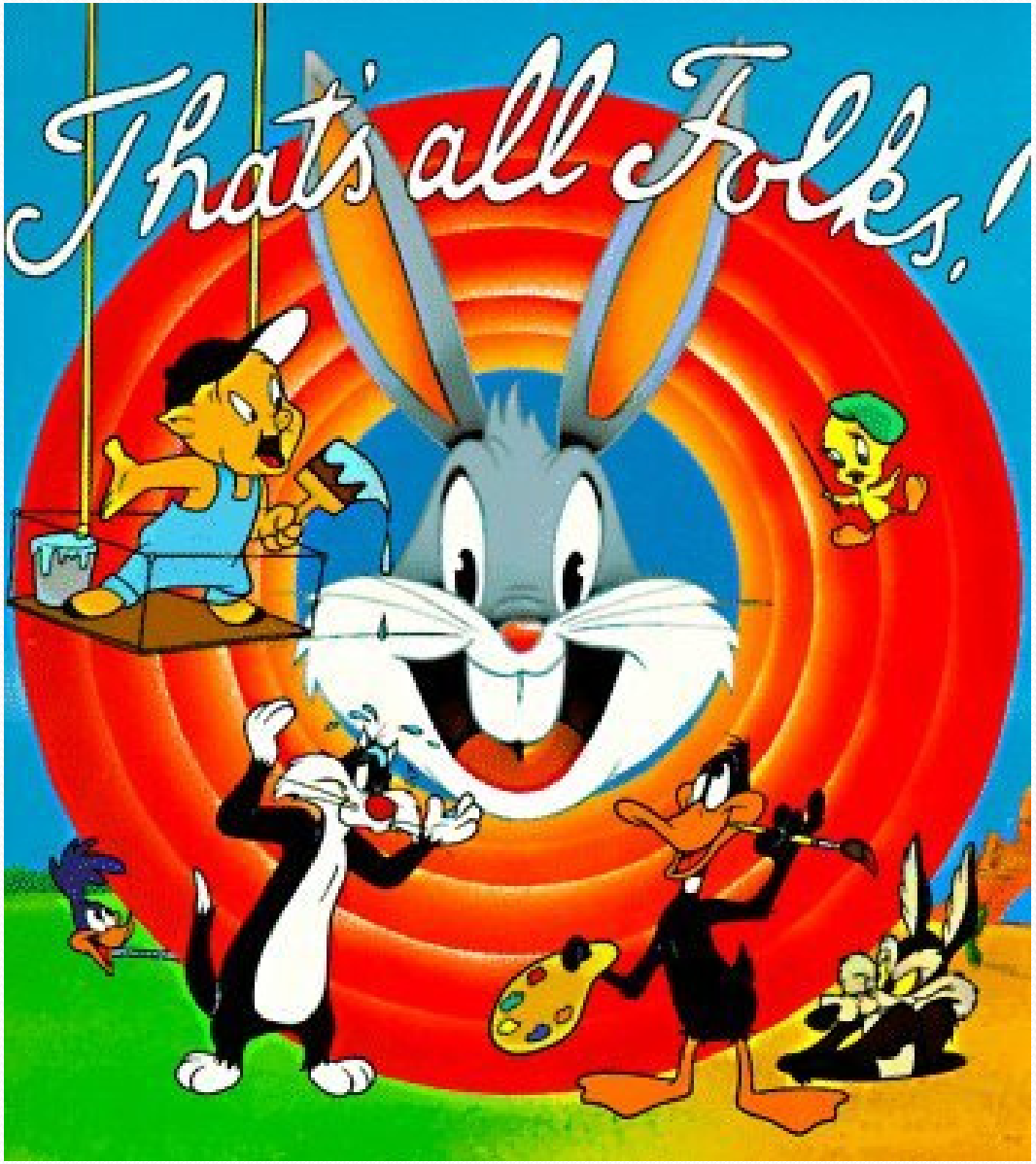
Current WA Alternative Assessment Work

Technical Alternative Assessment Guidance:

- Eight states working together on an AA guidance document
- Consists of 12 modules, most with several levels of increasing complexity
- Flexible document for a wide range of potential users
- More info available on Ecology website: http://www.ecy.wa.gov/programs/hwtr/ChemAlternatives/index.html

QCAT (Quick Chemical Assessment Tool):

- Stripped down version of GreenScreen™ hazard tool
- Version 1.2 (betamax) will be posted soon


That's all Folks!

References:

- **Washington State PBDE Chemical Action Plan, 2006:** http://www.ecy.wa.gov/biblio/0507048.html
- **Washington State Legislation RCW 70.76, 2007: Polybrominated diphenyl ethers — flame retardants** http://apps.leg.wa.gov/RCW/default.aspx?cite=70.76
- **Syracuse Research Institute for the WA Departments of Ecology & Health, 2006:** Flame Retardant Alternatives, http://www.ecy.wa.gov/programs/swfa/pbt/docs/flameRetard.pdf
- **Maine DEP and Maine CDC, 2007:** Brominated Flame Retardants, 3rd Annual Report to the Maine Legislature, http://mainegov-images.informe.org/dep/rwm/publications/legislativereports/pdf/finalrptjan07.pdf
- **Maine Legislation Title 38 Section 1609, 2007:** **www.mainelegislature.org/legis/statutes/38/title38sec1609.pdf**
- **Illinois EPA, 2007:** Report on Alternatives to the Flame Retardant DecaBDE: Evaluation of Toxicity, Availability, Affordability, and Fire Safety Issues, http://www.epa.state.il.us/reports/decabde-study/decabde-alternatives.pdf
- **WA Departments of Ecology & Health, 2008**: **'Alternatives to Deca-BDE in Televisions and Computers and Residential Upholstered Furniture', http://www.ecy.wa.gov/pubs/0907041.pdf**

Contact Information

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Safer Alternatives to Perc

Massachusetts Assessment of Alternatives for the Professional Garment Care Industry

Pam Eliason
Industry Research Program Manager
Toxics Use Reduction Institute ▪ UMass Lowell

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Presentation Overview

- Our audience
- Drivers for change
- Our approach
- Alternatives studied
- Results
- Promoting adoption of safer alternatives

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Our Audience

- Practitioners
  - Planners
- Shop Owners

- Perc designated as a higher hazard substance in 2008 – must report/plan if >1000 lb/yr used
- Shops have increasing pressures to switch

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Our Approach

- Balance deep dive with pragmatism
- Focus on key criteria to assist in decisions
  - Technical feasibility
  - Economic feasibility
  - EH&S impacts
- Conduct site visits with users of alternatives
- Review scientific and manufacturer data
- Promote adoption of safer alternatives

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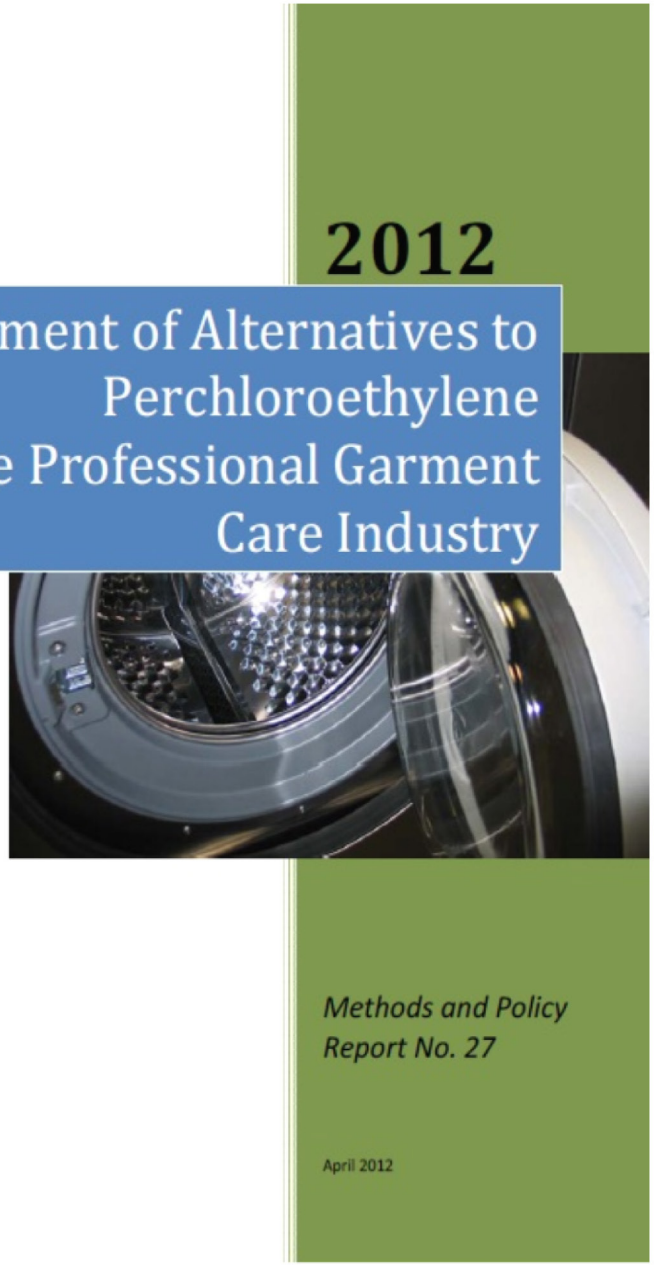
Alternatives Studied

- Wet cleaning
- CO_2
- High flash point hydrocarbons
- Acetals
- Propylene-glycol ethers
- Volatile methyl siloxanes
- n-Propyl bromide



Key Criteria

Technical/Performance

- Cycle time and load capacity
- Difficult materials
- Pretreatment and finishing requirements

Economic

- Equipment costs
- Chemical costs
- Energy costs

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Applicable Regulations

- Hazardous Air Pollutants
- Designated VOCs
- Massachusetts regulations
  - Listed toxics under TURA
  - Environmental Results Program
- Hazardous waste disposal issues
- Wastewater discharge restrictions

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Key EH&S Criteria

- Persistance, Bioaccumulation potential, aquatic Toxicity
- Recommended Exposure Limits
- Central Nervous System Effects
- Carcinogenic, Reproductive or Developmental Toxicant
- Flashpoint

Are Alternatives Effective and Affordable?

All options are technically feasible

- Some may have impact on throughput
- Some have limitations on the fabrics they can handle

Most options are affordable

- CO_2-based options not economically feasible (for majority of smaller MA shops)

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Are the Alternatives Safer than Perc?

All are less persistent, bioaccumulative and toxic in the environment

Most are safer … ***EXCEPT …***

- nPB is carcinogenic, reproductive toxic and neurotoxic – **NOT** a safer alternative
- **Data gaps** present concern for alternatives that are new to the market (e.g., Solvon K4 acetals)

Most options combustible or flammable, requiring additional control for safety

Several options are VOCs, or result in hazardous waste or wastewater disposal restrictions

Making the Data Available and Useful

- Fact sheet developed for shop owners and planners
- Table provides data on key criteria
- Full report (still draft) provides comprehensive discussion of feasibility of each option

Summary Table: Comparison of Perc and Seven Garment Cleaning Alternatives

Key Assessment Criteria		Perc (reference)	Wet Cleaning[1]	Carbon Dioxide	High Flashpoint Hydrocarbons	Acetals[2]	Propylene Glycol Ethers	Siloxanes	n Propyl Bromide
Common Trade Names / Manufacturers			Wascomat Miele Continental HwaSung AquaSolo	Cool Clean Technologies Solvair®	DF2000™ Fluid EcoSolv® ShellSol D60 PureDry Caled Hydroclene	Solvon K4	Solvair® Rynex 3® Impress®	Green Earth® D5 solvent (provided by Dow Corning, GE, Shin-Etsu)	Drysolv® Fabrisolv™ XL
Technical / Performance[3]	Cycle time (min)	45	20-40	35-45	60-75	60-65	>45	53-58	45
	Load capacity (lb)	50	20-75	60	35-90	40-90	43	55	50
	Materials system may have difficulty with	Leather, suedes, beads, delicates	Leather, suede and fur	Triacetates, specially dyed acetates	Vinyl appliqués	Appliqués or decorations glued to fabric	None identified	None identified	Leather, suedes, beads, delicates
	Spotting requirements	Moderate	Low to Moderate	High	Moderate	Low	Low	High	Low
Financial	Equipment	$30,000 - $65,000	$36,000 - $61,000	$100,000 - $150,000	$38,000 - $72,000	$50,000 - $100,000	$56,000	$30,500 - $55,000	$40,000 - $60,000
	Chemical cost per gallon	$18 - $28	$15 (detergent)	$0.18/lb CO_2 and $40/gal detergent	$16	$28	$15	$22-$28	$40-$64
	Electricity usage (kWhr/100 lb)	26.6	9.3	30.9	35.5	Similar to hydrocarbon	Unavailable	54.2	Unavailable
	Typical cost per pound cleaned[4]	$1.02	$1.10	$1.40	$0.88	Unavailable	$1.14	$1.71	Unavailable
Environmental	Persistence[5] (water, soil, sediment and/or air)	M (water), H (soil, sed, air)	L (water, soil, air), M (sed)	NA	L (water, soil, air), M (sed)	L (water, soil, air), M (sed)	L (water, soil, air), M (sed)	L (water), M (soil), H (sed, air)	L (water, soil), M (sed), H (air)
	Bioaccumulation[6]	Low	Low	NA	Moderate	Low	Low	Moderate	Low
	Aquatic Toxicity[7]	Moderate	Low to Moderate[8]	Low	High	Moderate[9]	Low	High	High
Human Health	Recommended Exposure limits	25 ppm[10]	NE	5000 ppm	171 ppm	NE	NE	10 ppm	10 ppm
	Central Nervous System Effects	Yes	No[11]	No[12]	Yes	No data available	Yes	Some Evidence	Yes
	Carcinogenicity	Probable human carcinogen	Not classified by IARC	Not classified by IARC	Not classified by IARC	Not classified by IARC	Not classified by IARC	Some evidence	Clear evidence in animal studies by NTP
	Reproductive / Developmental Toxicity	Yes	Negligible[13]	No data available	No data available	No data available	No[14]	Studies indicate concern	Yes
Physical / Safety	Flash Point/ Flammability	NA / Not Flammable	NA / Not Flammable	NA / Not Flammable	142°F / Combustible liquid	144°F / Combustible liquid	160-212°F / Combustible liquid	171°F / Combustible liquid	NA or 72°F / Flammable, depending on test method[15]
Applicable Regulations	Clean Air Act Hazardous Air Pollutant (HAP)	Yes, HAP	No	No	No	No	No	No	No
	Clean Air Act designated VOC	No, Exempt[16]	No[17]	No	VOC	VOC	VOC	No, Exempt[18]	VOC
	Massachusetts regulated (TURA, ERP)	TURA (Higher Hazard Substance), ERP	No	No	No	No	No	No	TURA
	Hazardous waste disposal required	Yes - Listed hazardous waste	No	No	Yes Waste Oil = Hazardous Waste in MA	No	No	No	No; monitor for residual perc if used in retrofitted machine
	Wastewater discharge restrictions	No	Discharge to sewer or holding tank[19]	No	No	No	No	No	No

NA = Not applicable; NE = Not established

Summary Table: Comparison of Perc and Seven Garment Cleaning Alternatives

Key Assessment Criteria		Perc (reference)	Wet Cleaning[1]	Carbon Dioxide	High Flashpoint Hydrocarbons	Acetals[2]	Propylene Glycol Ethers	Siloxanes	n Propyl Bromide
Common Trade Names / Manufacturers			Wascomat Meile Continental HwaSung AquaSolo	Cool Clean Technologies Solvair®	DF2000™ Fluid EcoSolv® ShellSol D60 PureDry Caled Hydroclene	Solvon K4	Solvair® Rynex 3® Impress®	Green Earth® D5 solvent (provided by Dow Corning, GE, Shin-Etsu)	Drysolv® Fabrisolv™ XL
Technical / Performance[3]	Cycle time (min)	45	20-40	35-45	60-75	60-65	>45	53-58	45
	Load capacity (lb)	50	20-75	60	35-90	40-90	43	55	50
	Materials system may have difficulty with	Leather, suedes, beads, delicates	Leather, suede and fur	Triacetates, specially dyed acetates	Vinyl appliqués	Appliqués or decorations glued to fabric	None identified	None identified	Leather, suedes, beads, delicates
	Spotting requirements	Moderate	Low to Moderate	High	Moderate	Low	Low	High	Low
Financial	Equipment	$30,000 - $65,000	$36,000 - $61,000	$100,000 - $150,000	$38,000 - $72,000	$50,000 - $100,000	$56,000	$30,500 - $55,000	$40,000 - $60,000
	Chemical cost per gallon	$18 - $28	$15 (detergent)	$0.18/lb CO_2 and $40/gal detergent	$16	$28	$15	$22-$28	$40-$64
	Electricity usage (kWhr/100 lb)	26.6	9.3	30.9	35.5	Similar to hydrocarbon	Unavailable	54.2	Unavailable
	Typical cost per pound cleaned[4]	$1.02	$1.10	$1.40	$0.88	Unavailable	$1.14	$1.71	Unavailable

Summary Table: Comparison of Perc and Seven Garment Cleaning Alternatives

Key Assessment Criteria		Perc (reference)	Wet Cleaning[1]	Carbon Dioxide	High Flashpoint Hydrocarbons	Acetals[2]	Propylene Glycol Ethers	Siloxanes	n Propyl Bromide
Environmental	Persistence[5] (water, soil, sediment and/or air)	M (water), H (soil, sed, air)	L (water, soil, air), M (sed)	NA	L (water, soil, air), M (sed)	L (water, soil, air), M (sed)	L (water, soil, air), M (sed)	L (water), M (soil), H (sed, air)	L (water, soil), M (sed), H (air)
	Bioaccumulation[6]	Low	Low	NA	Moderate	Low	Low	Moderate	Low
	Aquatic Toxicity[7]	Moderate	Low to Moderate[8]	Low	High	Moderate[9]	Low	High	High
Human Health	Recommended Exposure limits	25 ppm[10]	NE	5000 ppm	171 ppm	NE	NE	10 ppm	10 ppm
	Central Nervous System Effects	Yes	No[11]	No[12]	Yes	No data available	Yes	Some Evidence	Yes
	Carcinogenicity	Probable human carcinogen	Not classified by IARC	Not classified by IARC	Not classified by IARC	Not classified by IARC	Not classified by IARC	Some evidence	Clear evidence in animal studies by NTP
	Reproductive / Developmental Toxicity	Yes	Negligible[13]	No data available	No data available	No data available	No[14]	Studies indicate concern	Yes
Physical / Safety	Flash Point/ Flammability	NA / Not Flammable	NA / Not Flammable	NA / Not Flammable	142°F / Combustible liquid	144°F / Combustible liquid	160-212°F / Combustible liquid	171°F / Combustible liquid	NA or 72°F / Flammable, depending on test method[15]

Promoting the Adoption of Safer Alternatives in Massachusetts

- Fact sheet and assessment **report**
- **Training** on TUR planning for dry cleaners still using perc
- Incentive **grants** to cleaners who switch to dedicated wet cleaning
- **Case studies** highlighting benefits of switching
- Peer **demonstrations** of safer alternatives to address practical questions
- Community training and **outreach**

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Learn more

http://www.turi.org/Our_Work/Business/Small_Businesses/Dry_Cleaning

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Discussion Questions

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- How have the concepts and tools of alternatives assessment been applied to date in different agencies for different chemicals of concern?
- What are some of the challenges/issues that came up during the alternatives assessment and how were these addressed
- What are the key lessons from the alternatives assessment effort that could be applicable to other alternatives assessments or help shape future collaborations.

Next Webinar

Lowell Center for Sustainable Production
UNIVERSITY OF MASSACHUSETTS LOWELL

- Alternatives Assessment 104: Interagency alternatives assessment case example and lessons learned

- TBA early June

Webinar Audio & Slides

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

http://www.ic2saferalternatives.org/page/Logistics+and+Communications