U.S. EPA
Design for the Environment Program

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Steps to Conducting an Alternatives Assessment (AA)

1) Determine need
2) Refine boundary conditions – through research and preliminary stakeholder consultation
3) Convene stakeholders
4) Identify viable alternatives
5) Conduct hazard assessment
6) Develop the report
7) Apply the information in decision making

Step 1: Determine Need

- Consider whether alternatives are:
  - Commercially available and cost effective
  - Have the potential for an improved health and environmental profile
  - Are likely to result in lasting change
- The assessment should:
  - Consider economic and social factors
  - Interest the stakeholder community

Step 2: Refine Boundary Conditions

- Are alternatives in use and by whom?
- Are there limitations to use?
  - Technical
  - Cost
- How do practical considerations of commerce impact the analysis?
  - Chemical & infrastructure manufacturers
  - Chemical user (e.g., for BPA in thermal paper)
    - Paper fabricator, paper converter
    - Retailer
    - Cashier & customer
- Project Description

Step 3: Convene Stakeholders

- Build a web of stakeholder contacts
  - Up and down the supply chain (manufacturers to retailers)
  - Across the spectrum of interested parties (NGOs, trades)
  - Intensive and time-consuming engagement
  - Builds buy-in and a sense of ownership
- Stakeholders are key to technical understanding
  - Inform project methodology
  - Identify alternatives
  - Monitor implementation
- Enhances transparency and understanding
- Leads to adoption of safer alternatives & promotes technology transfer

Step 3: Stakeholders – BPA in Thermal Paper

- Paper Manufacturers
  - Appleton
  - Heartland Label Printers
  - Jujo Papers
  - Kanzaki
  - Koehler
  - Label World
  - Nashua
  - NCR
  - Prestige Label Co
  - Tighe & Bond
  - UPM Raflatac
- Chemical Manufacturers
  - BASF
  - ESCO
- POS Machine Manufacturers
  - Epson
- Retailers
  - Staples
  - Target
  - Walmart
  - Wegmans
  - Whole Foods
- Trades
  - ACC
  - ISRI
- NGOs
  - EDF
  - EWG
  - NRDC
  - Pew Trust
- Other
  - Warner Babcock Institute
- Trade Unions
  - United Food and Commercial Workers International Union
- Other Government Agencies
  - CPSC (invited)
  - FDA (invited)
  - NEWMOA
  - NIEHS
  - NIOSH
  - State of Connecticut
- International
  - EU (by phone)
- Members of the Press

Step 4: Identify Potential Alternatives

- Preliminary information on alternatives
  - Literature
  - Stakeholders
- Potential Alternatives
  - Nominated by chemical or product manufacturers
  - Proven viable by product manufacturers
  - Likely to be viable based on expert judgment

Step 5: Conduct Hazard Assessment to Help Identify Safer Alternatives

- Similar to NCP Standard Review; combines information from five sources:
  - Test data from literature
  - CBI test data
  - Structure-Activity-Relationship- (SAR) based estimations
  - Professional judgment of EPA staff
  - Company-confidential data
- Assign a value of high, moderate or low for each human health and environmental endpoint
- Characterize evidence for endocrine activity
- Chemical sponsor preview for EPA findings
- EPA review
- Broad stakeholder review for all hazard calls

Step 6: Develop the Report

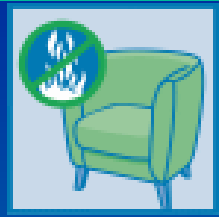
- Hazard Portion
  - Tables summarizing EPA assessment for environmental and human health endpoints
  - Detailed hazard reviews
- Information for context and decision-making
  - Manufacturing process
  - Use patterns & life-cycle thinking
  - Unconventional solutions
  - Decision-making tools
- EPA review
- Vet with stakeholder group
- Post as Final

Step 7: Applying the Information in Decision Making for Safer Substitutes

- Alternatives analyses can complement EPA's regulatory action
  - PentaBDE SNUR – Showed availability of safer, highly functioning alternatives
  - NP AWQC – Promoted compliance by reducing use of NP through SDSI
- Alternatives analyses can identify
  - Green Chemistry or best practices opportunities if safer alternatives are not available
  - Data needs for emerging alternatives
- Other organizations use alternatives analyses to drive change
  - Clean Production Action (CPA) developed GreenScreen™ for Safer Chemicals to assist manufacturers in selecting safer chemicals
  - HP and others are using to select safer alternatives to TBBPA in printed circuit boards

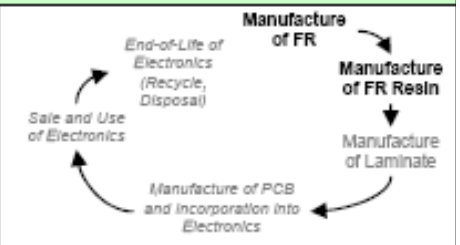
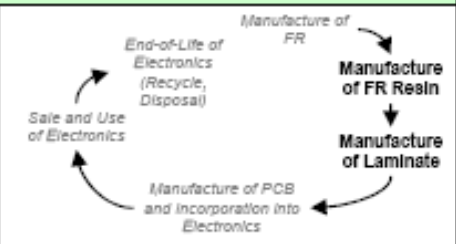
Furniture Example

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



Company	Chemical	% in Formulation[3]	Human Health Effects							Ecotoxicity		Environmental		Potential Routes of Exposure							Reactive or Additive?
														Worker			General Population				
			Cancer Hazard	Skin Sensitizer	Reproductive	Developmental	Neurological	Systemic	Genotoxicity	Acute	Chronic	Persistence	Bioaccumulation	Inhalation	Dermal	Ingestion	Inhalation	Dermal	Ingestion	Aquatic	
Albemarle	SAYTEX RZ-243																				
	Proprietary E Tetrabromophthalate diol diester		L	L	L*	L*	L	M*	L	L	H	L?	L	N	Y	Y	N	N	Y	Y	Additive
	Proprietary B Aryl phosphate		L	L	M*	M*	M	M*	L	H	H	L	M	N	Y	Y	N	Y	N	N	Additive
	Triphenyl Phosphate CAS # 115-86-6		L	L	L	L	L	M	L	H	H	L	L	Y	Y	Y	Y	Y	Y	Y	Additive
Ameribrom	FR513																				
	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																				
	Proprietary F Halogenated aryl ester		L	L	M	M	L	M	L	H	H	L?	L	N	Y	Y	N	Y	Y	Y	Additive
	Proprietary G Triaryl phosphate, isopropylated		L	L	M*	M*	M	M*	L	H	H	L	M	N	Y	Y	N	Y	N	N	Additive
	Triphenyl Phosphate CAS # 115-86-6		L	L	L	L	L	M	L	H	H	L	L	Y	Y	Y	Y	Y	Y	Y	Additive
	Proprietary H Halogenated aryl ester		L	L	M	M	L	M	L	H	H	L?	L	N	Y	Y	N	Y	Y	Y	Additive

Flame Retardants in Printed Circuit Boards

		Human Health Hazard Concern									Ecotoxicity Hazard Concern		Environmental Concern		
		Human Health Effects									Aquatic Toxicity		Environ-mental		Exposure Considerations
Chemical	CASRN	Acute Toxicity	Skin Sensitizer	Cancer Hazard	Immunotoxicity	Reproductive	Developmental	Neurological	Systemic	Genotoxicity	Acute	Chronic	Persistence	Bioaccumulation	Availability of flame retardants (FRs) throughout the lifecycle for reactive and additive FRs chemicals and resins
Reactive Flame Retardant Chemicals[2]															
Tetrabromobisphenol A (TBBPA) (Albemarle, Chemtura, and others)															
TBBPA	79-94-7	L	L	L	L	L	M	L	L	L	H	H	M	L	
DOPO (6H-Dibenz[c,e][1,2] oxaphosphorin, 6-oxide) (Samko Co., Ltd. and others)															
DOPO	35948-25-5	L	L	L	L	L	L	L	L	L	M	M	L	L	
Fyrolflex PMP (Aryl alkylphosphonate) (Supresta)															
Fyrolflex PMP	Proprietary	L	L	L	L	L	L	L	L	L	L	L	H	L	
Reactive Flame Retardant Resins[2]															
Reaction product of TBBPA - D.E.R. 538 (Phenol, 4,4'-(1-methylethylidene)bis[2,6-dibromo-, polymer with (chloromethyl)oxirane and 4,4'-(1-methylethylidene)bis[phenol]) (Dow Chemical)															
D.E.R. 538	26265-08-7	L	M	M◊	L	M◊	M◊	L	L	M	L	L	M	L	
Reaction Product of DOPO - Dow XZ-92547 (reaction product of an epoxy phenyl novolak with DOPO) (Dow Chemical)															
Dow XZ-92547	Proprietary	L	M	M◊	L	M◊	M◊	L	L	M◊	L	L	H	L	
Reaction product of Fyrolflex PMP with bisphenol A, polymer with epichlorohydrin (Representative Resin)															
Representative Fyrolflex PCB Resin	Unknown	L	L	M◊	L	M◊	M◊	L	L	M◊	L	L	H	L	

Thank you!

For more information:

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