Toxics Use Reduction Institute

Choosing Safer Alternatives

A systematic transition to safer processes, materials and products

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Choosing Safer Alternatives

- Massachusetts Toxics Use Reduction program
- Overview
- Alternatives Assessment
  - Methods and Approaches
  - Resources

Massachusetts TURA

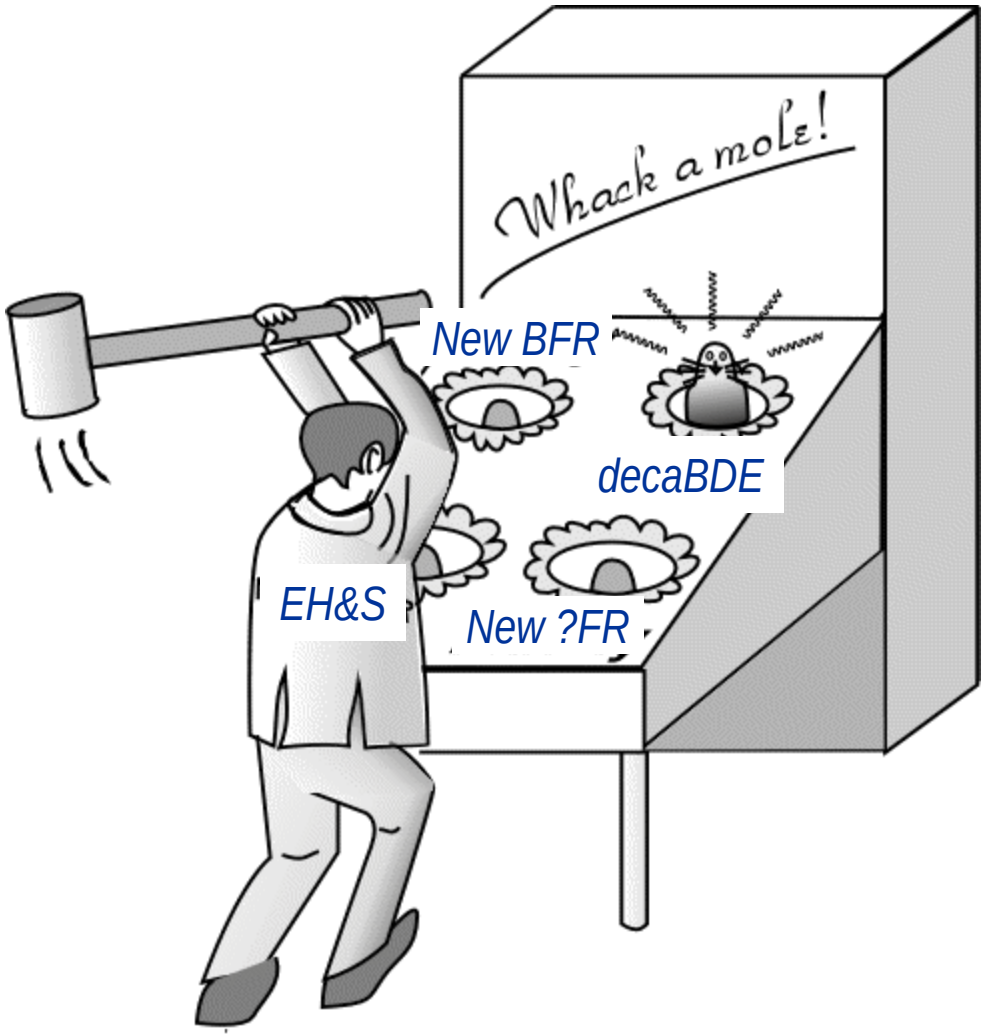
- Sustain and promote the competitive position of Massachusetts industry
- Promote reduction in the use of toxic and hazardous substances
- Require businesses to analyze their use of chemicals, to look for opportunities to reduce toxics use and waste.
  - TUR Options Assessment
- Publicly report their toxic chemical use

Toxics Use Reduction Institute

- Information on toxic chemicals and safer alternatives, international chemical restrictions
- Education and training for TUR Planners
- Supply Chain Workgroups
  - Electronics, Wire and Cable
    - Lead, brominated flame retardants
- Research and demonstration of green chemistry and innovative technologies
- Grants for Community groups and NGO's
- Laboratory testing for surface cleaning

Objective

- Choose the safest material that performs well
- Avoid risk-shifting, and transitions to substances that aren't much safer

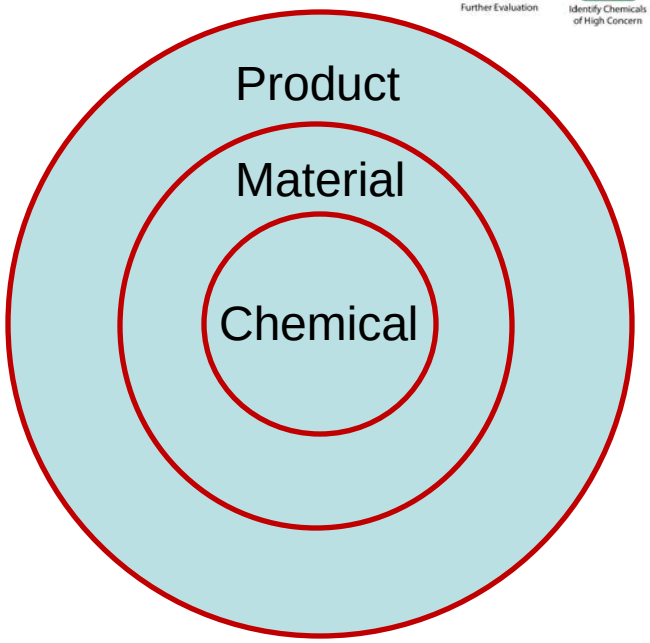


Alternatives Assessment

A. Identify Alternatives
B. Prioritize and Pre-Screen Alternatives
C. Alternatives Assessment
   - Technical/Performance Assessment
   - EH&S Assessment
   - Financial Assessment
D. Analyze information
E. Select alternative

IC2 (Interstate Chemicals Clearinghouse)
Safer Alternatives Assessment Wiki

A. 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

B. Pre-Screen Alternatives

1. Possible criteria for pre-screening
    1. PBTs
    2. Carcinogens
    3. CMRs
    4. Restricted Substances Lists
    5. Consider criteria for screening contaminants, mixtures, etc.

C. 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

D. Analyze

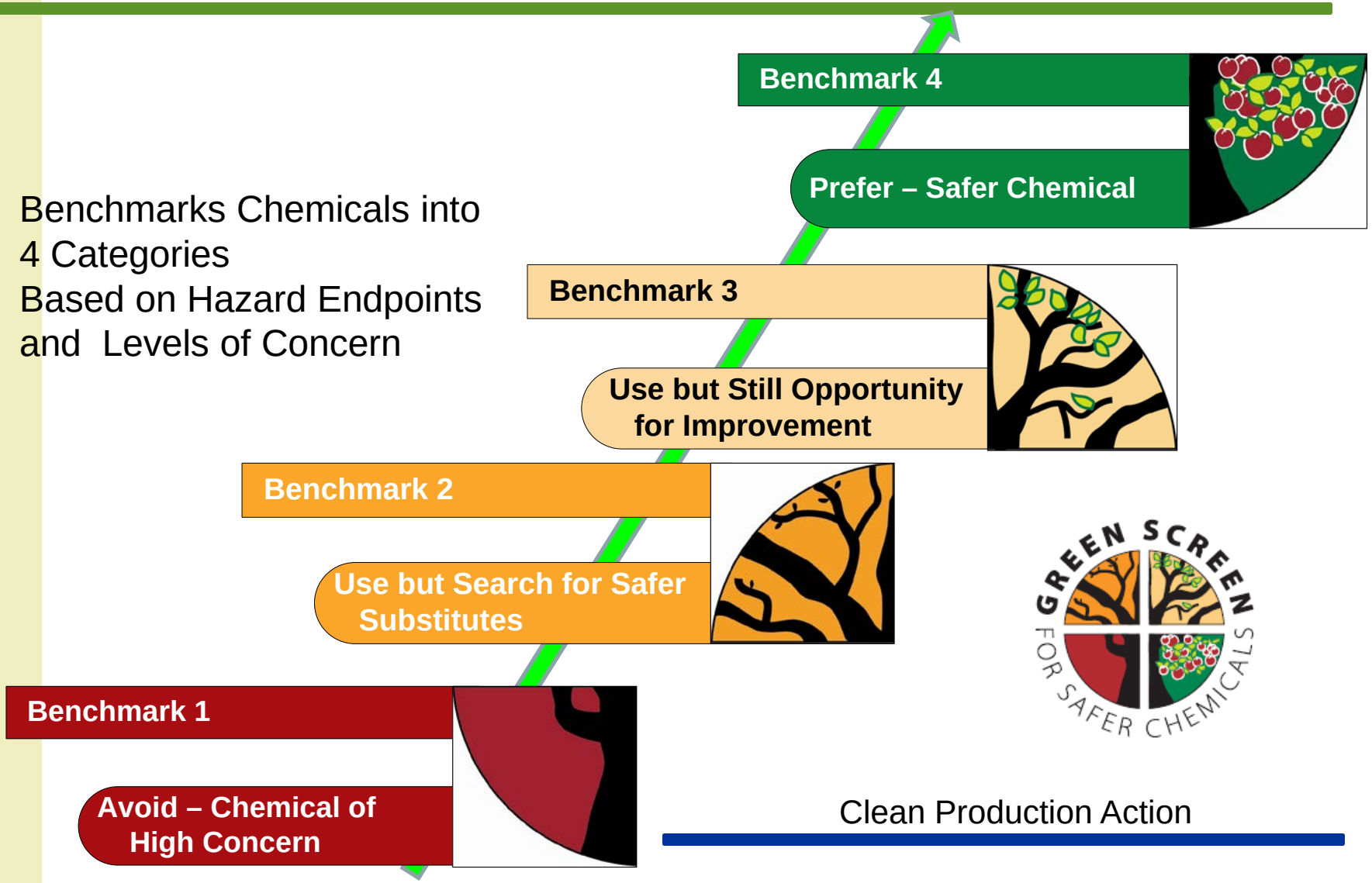
- Identify critical decision parameters
- Analyze:
  - Compare with existing chemical or benchmarks
  - Score
  - Display graphically

Chemical Assessment Tools

- Benchmark tools
  - Green Screen for Safer Chemicals
  - Cradle to Cradle® Certification
- Scoring tools
  - EPA DfE
  - P_2OASys
  - Pharos (building materials)
- Comparison tools
  - TURI Alternatives Assessment

Green Screen for Safer Chemicals

Benchmarks Chemicals into
4 Categories
Based on Hazard Endpoints
and Levels of Concern



GREEN SCREEN FOR SAFER CHEMICALS

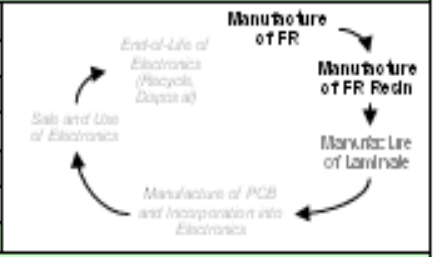
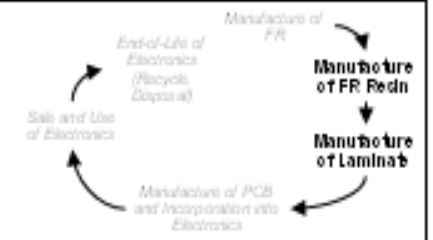
Clean Production Action

Green Screen - Benchmarking DecaBDE

Chemical	CAS#	% in Formulation	Human Health Effects													Ecotox.		Fate		Breakdown Products	
			Priority Effects																		
			Carcinogenic	Mutagenic	Reproductive	Developmental	Endocrine Disruption	Neurological	Acute Toxicity	Systemic/Organ Effects	Sensitization (skin)	Sensitization (respiratory)	Irritation/Corrosion (skin)	Irritation/Corrosion (eyes)	Immune System Effects	Acute	Chronic	Persistence	Bioaccumulation	Metabolites	Degradation Products
Decabromodiphenyl ether (decaBDE) - CAS# 1163-19-5																					
DecaBDE	1163-19-5	97	**M**	**L**	**L**	**M**	**M**	**M**	**L**	**L**	**L**	nd	**L**	**L**	nd	**L**	**L**	**vH**	**M**	penta- to nona-BDE	tri- to nona-BDE
Breakdown Products																					
PentaBDE	32534-81-9		nd	**L**	**M**	**M**	**H**	**M**	**L**	**H**	**L**	**L**	**M**	**M**	nd	**H**	**H**	**vH**	**vH**		
OctaBDE	32536-52-0		nd	**L**	**M**	**H**	**M**	**M**	**L**	**H**	**L**	nd	**L**	**L**	nd	**L**	**L**	**vH**	**M**	nd	low er PBDEs

Bold text = based on experimental data. ***Black italics text*** = based on analog data or expert judgment.

EPA Furniture Flame Retardants Partnership

Chemical	CASRN	Human Health Effects									Aquatic Toxicity		Environmental		Exposure Considerations
		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) (Sanko 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	

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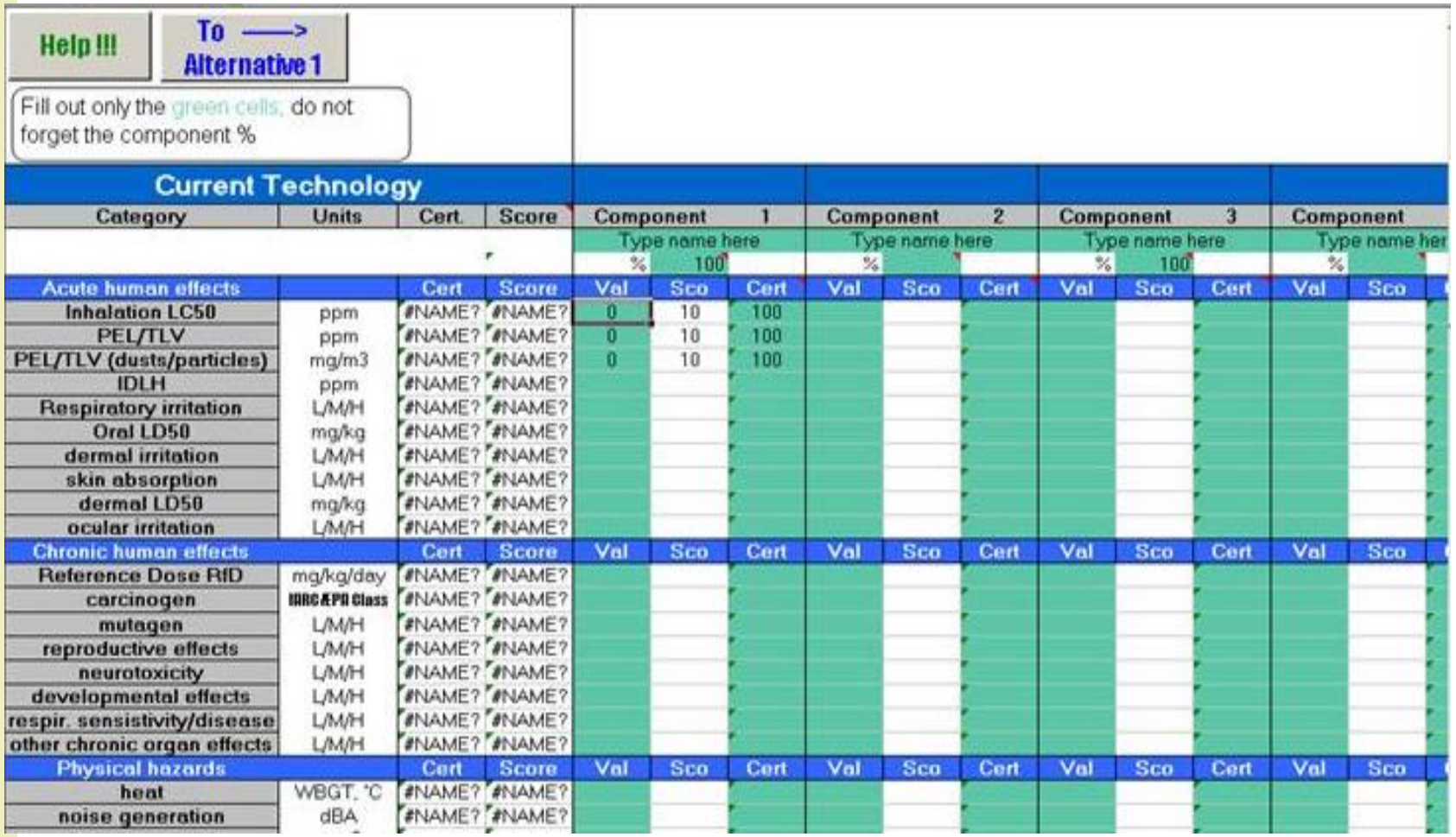


Help !!!

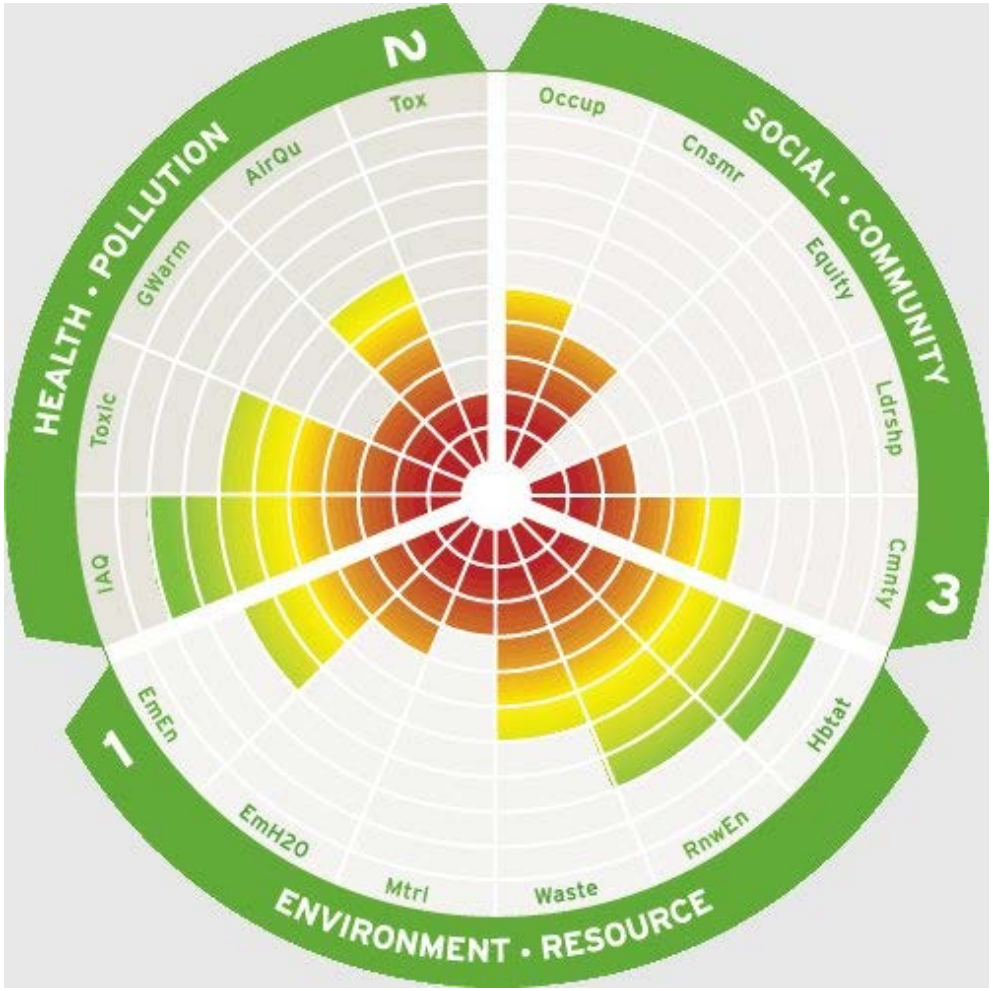
To ——> Alternative 1

Fill out only the green cells, do not forget the component %

Current Technology

Category	Units	Cert.	Score	Component 1			Component 2			Component 3			Component
				Type name here			Type name here			Type name here			Type name her
				%	100		%			%	100		%
Acute human effects		Cert	Score	Val	Sco	Cert	Val	Sco	Cert	Val	Sco	Cert	Val	Sco
Inhalation LC50	ppm	#NAME?	#NAME?	0	10	100								
PEL/TLV	ppm	#NAME?	#NAME?	0	10	100								
PEL/TLV (dusts/particles)	mg/m3	#NAME?	#NAME?	0	10	100								
IDLH	ppm	#NAME?	#NAME?											
Respiratory irritation	L/M/H	#NAME?	#NAME?											
Oral LD50	mg/kg	#NAME?	#NAME?											
dermal irritation	L/M/H	#NAME?	#NAME?											
skin absorption	L/M/H	#NAME?	#NAME?											
dermal LD50	mg/kg	#NAME?	#NAME?											
ocular irritation	L/M/H	#NAME?	#NAME?											
Chronic human effects		Cert	Score	Val	Sco	Cert	Val	Sco	Cert	Val	Sco	Cert	Val	Sco
Reference Dose RfD	mg/kg/day	#NAME?	#NAME?											
carcinogen	IRRC & PB Class	#NAME?	#NAME?											
mutagen	L/M/H	#NAME?	#NAME?											
reproductive effects	L/M/H	#NAME?	#NAME?											
neurotoxicity	L/M/H	#NAME?	#NAME?											
developmental effects	L/M/H	#NAME?	#NAME?											
respir. sensistivity/disease	L/M/H	#NAME?	#NAME?											
other chronic organ effects	L/M/H	#NAME?	#NAME?											
Physical hazards		Cert	Score	Val	Sco	Cert	Val	Sco	Cert	Val	Sco	Cert	Val	Sco
heat	WBGT, °C	#NAME?	#NAME?											
noise generation	dBA	#NAME?	#NAME?											

Pharos: Building Materials Selection Tool



Formaldehyde Alternatives Assessment Summary for Preserved Specimens for Educational Dissection

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COMPARISON KEY
+ Better = Similar - Worse ? Unknown

Assessment Criteria		Formalin-Fixed Specimen (Reference)	Comparison Relative to Specimens in Formalin			
			Form-alternate (propylene glycol based)	**STF** (includes Diazolid-inyl urea)	**Ward's** (glutar-aldehyde based)	**Video/ Virtual Dissection**
Technical/ Performance Criteria	Color	Not life-like	+	+	+	n/a
	Texture	Hardened	+	+	=	n/a
	Stiffness	Rigid	+	+	=	n/a
	Odor	Irritating	+	+	=	+
	Longevity	Indefinite	?	?	-	+
	Special handling	Extensive	+	+	+	+
	Availability	Good	=	=	=	=
	Educational value	Good	=	=	=	-
Financial Criteria	Cost (per specimen)	$5.60	+	+	+	n/a
Environ-mental Criteria	EcoToxicity	Not acutely toxic, except to zooplakton	-	-	-	+
	Hazardous Waste Storage/ Disposal	Regulated	+	+	+	+
	Carcinogen	Yes	+	+	+	+
Human Health Criteria	LD50 (oral rat)	100 mg/kg	+	+	+	+
	Sensitizer	Yes	+	+	=/+	+
	Skin Adsorption	Yes	=	=	=	+
	Irritation	Severe	+	+	+	+

Thank-you

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