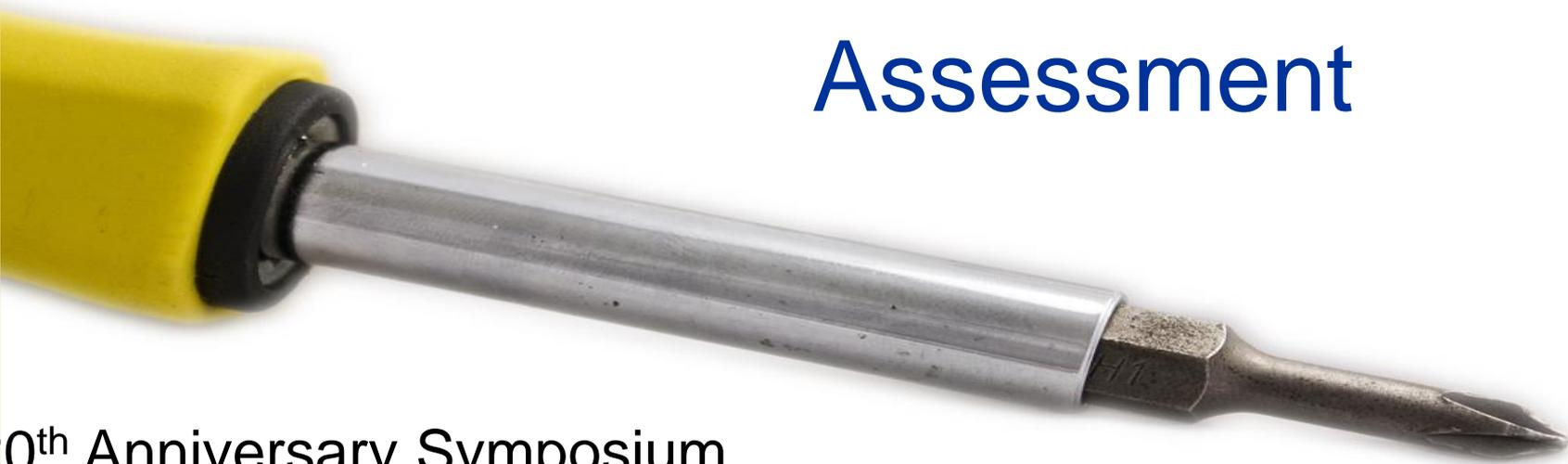




Massachusetts
Toxics Use Reduction



Product Design: Tools for Assessment



TURA 20th Anniversary Symposium
November 4, 2009
Bedford, Massachusetts

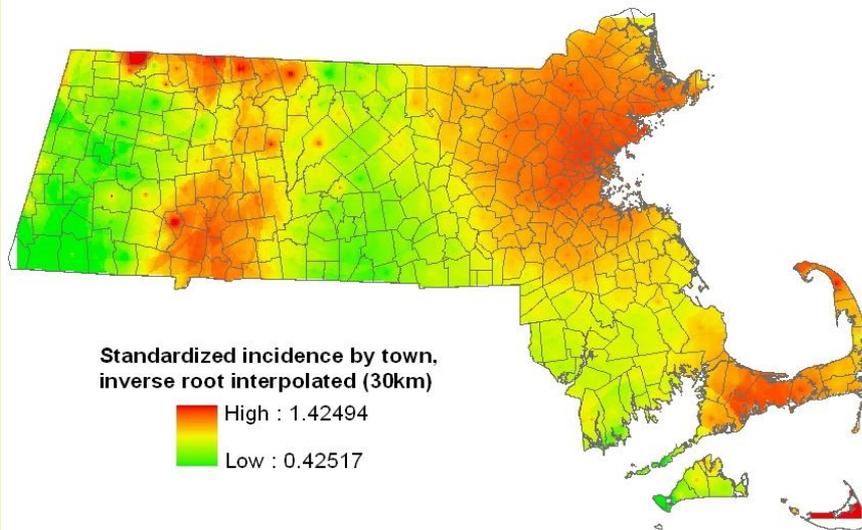


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Consumers



Invasive female breast cancer, MA 1999-2003



MassCOSH | Standing Together for Safe and Healthy Work

Industry



Government



Alternatives Assessment Draft Protocol

Define Scope and Set Goals

- A. Identify Chemicals of Concern
- B. Identify Alternatives
- C. Pre-Screen Alternatives
- D. Assess Alternatives
- E. Analyze
- F. Draw Conclusions
- G. Implement

Stakeholder Engagement

What's Your Goal?

A. Identify Chemicals of Concern

CHEMICALS



B. Identify Alternatives

C. Pre-Screen Alternatives

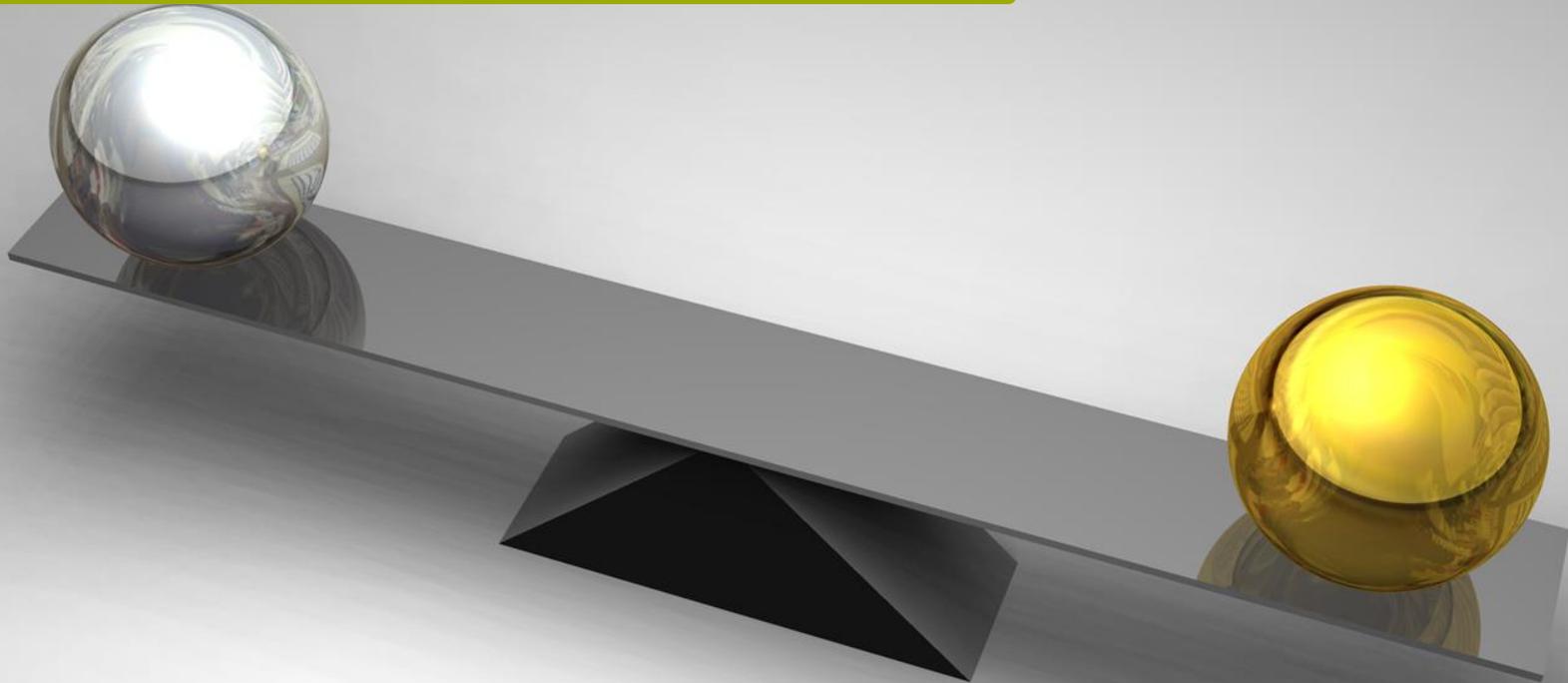


D. Assess Alternatives

Excellent
 Very good
 Good
 Average
 Poor

E. Analyze

F. Draw Conclusions



G. Implement





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TOXICS USE REDUCTION INSTITUTE

Involve Stakeholders

Assessment Tools

Comparison Tools
Scoring Tools
Benchmark Tools

Example: Formaldehyde Preserved Specimens for Educational Dissection



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
Environmental 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	+	+	+	+

P2OASys

Examine the potential environmental and worker impacts of options

Focus on total impacts of process changes

Go to http://www.turi.org/home/hot_topics/ and type in P2OASys

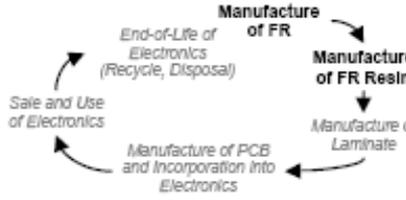
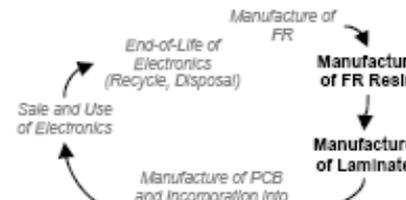
Category	Units	Cert.	Score	Component 1		
				TRICHLOROETHYLENE		1
				%	100	
				Val	Sco	Cert
Acute human effects						
Inhalation LC50	ppm					
PEL/TLV	ppm	100	4	100	4	100
PEL/TLV (dusts/particles)	mg/m3					
IDLH	ppm	100	2	1000	2	100
Respiratory irritation	L/M/H	100	8	m/h	8	100
Oral LD50	mg/kg	100	10	4	10	100
dermal irritation	L/M/H	100	4	l/m	4	100
skin absorption	L/M/H	100	2	l	2	100
dermal LD50	mg/kg					
ocular irritation	L/M/H	100	10	h	10	100
Chronic human effects						
Reference Dose RfD	mg/kg/day					
carcinogen	IRIS/IRIS Class	100	8	b	8	100
mutagen	L/M/H	100	2	l	2	100
reproductive effects	L/M/H	100	2	l	2	100
neurotoxicity	L/M/H	100	6	m	6	100
developmental effects	L/M/H	100	2	l	2	100
respir. sensitivty/disease	L/M/H					
other chronic organ effects	L/M/H	100	6	m	6	100
Physical hazards						
heat	WBGT, °C					
noise generation	dB(A)					
vibration	m/S ²					
ergonomic hazard	L/M/H					
psychosocial hazard	L/M/H					
Aquatic hazards						
Water Quality Criteria (HWQC)	mg/l					
aquatic LC50	mg/l	100	4	660	4	100
fish NOAEC	mg/l					
plant EC 50	mg/l	100	2	535	2	100
observed ecological effects	L/M/H	100	10	h	10	100
Persistence/bioaccumulation						
persistence	L/M/H					
BOD half-life	days	100	6	20	6	100
hydrolysis half-life	days	100	8	330	8	100
bioconcentration	log kow	100	10	253	10	100
bioconcentration factor (BCF)						
Atmospheric hazard						
greenhouse gas	Y/N					
ozone depletor	ODP units					
acid rain formation	Y/N					
NESHAP	Y/N					
Disposal hazard						
landfill	L/M/H					
EPCRA reportable quantity	lbs	100	6	100	6	100
incineration	L/M/H					
recycling	L/M/H					
Chemical hazard						
vapor pressure	mm Hg	100	8	57.8	8	100
solubility in water	mg/L					
specific gravity	N/A					
flammability	0,1,2,3,4	100	4	1	4	100
flash point	°C	100	6	32	6	100
reactivity	0,1,2,3,4	100	2	0	2	100
pH	pH units					
corrosivity	L/M/H	100	2	l	2	100
High pressure system	L/M/H					
High temperature system	L/M/H					
mixture/reaction potential	L/M/H	100	6	m	6	100
odor threshold	L/M/H	100	10	h	10	100
volatile organic compound						
Energy & resource use						
non renewable resource	L/M/H					
water use	L/M/H					
energy use	L/M/H					
Product hazard						
upstream effects	L/M/H					
consumer hazard	L/M/H	100	2	l	2	100
disposal hazard	L/M/H	100	8	m/h	8	100
Exposure potential						
Exposure potential	L/M/H	100	8	m/h	8	100

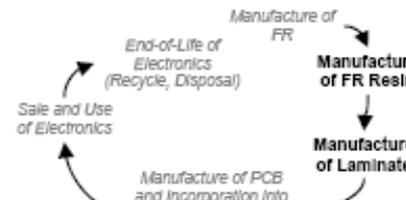
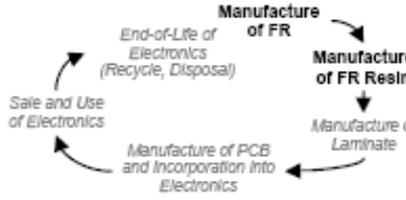
- The DfE Safer Product Labeling Program
- DfE Screens for Safer Chemical Ingredients
- DfE's Alternatives Assessments program



<http://www.epa.gov/dfe/>

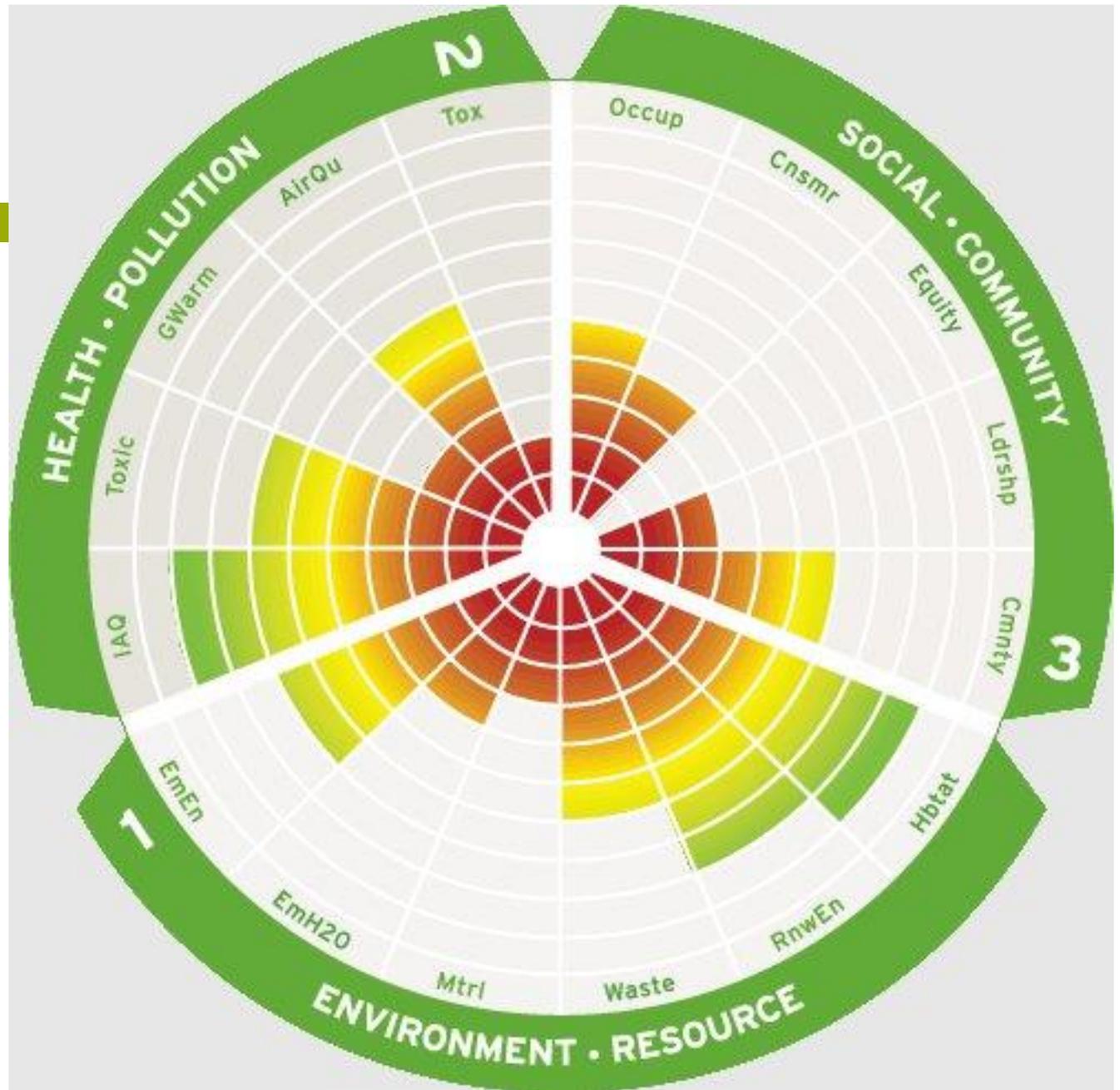
DfE Alternatives Assessment Results

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				
Reactive Flame Retardant Chemicals²																		
Tetrabromobisphenol A (TBBPA) (Albemarle, Chemtura, and others)³																		
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	M	M	L	L					
Fyrol PMP (Aryl alkylphosphonate) (Supresta)																		
Fyrol PMP	Proprietary	L	L	L	L	L	L	L	L	L	L	H	L					
Reactive Flame Retardant Resins²																		
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 ⁰	L	M ⁰	M ⁰	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 ⁰	L	M ⁰	M ⁰	L	L	M ⁰	L	L	H	L				
Reaction product of Fyrol PMP with bisphenol A, polymer with epichlorohydrin (Representative Resin)																		
Representative Fyrol PCB Resin	Unknown	L	L	M ⁰	L	M ⁰	M ⁰	L	L	M ⁰	L	L	H	L				



¹ The moderate designation captures a broad range of concerns for hazard, further described in Table 4-3.
² Reactive FR chemicals and resins may not completely react, and small amounts may be available during other parts of the lifecycle.
³ The EU has published a comprehensive risk assessment for TBBPA in reactive applications. This risk assessment is a valuable source of information for choosing flame retardants for printed circuit board applications.

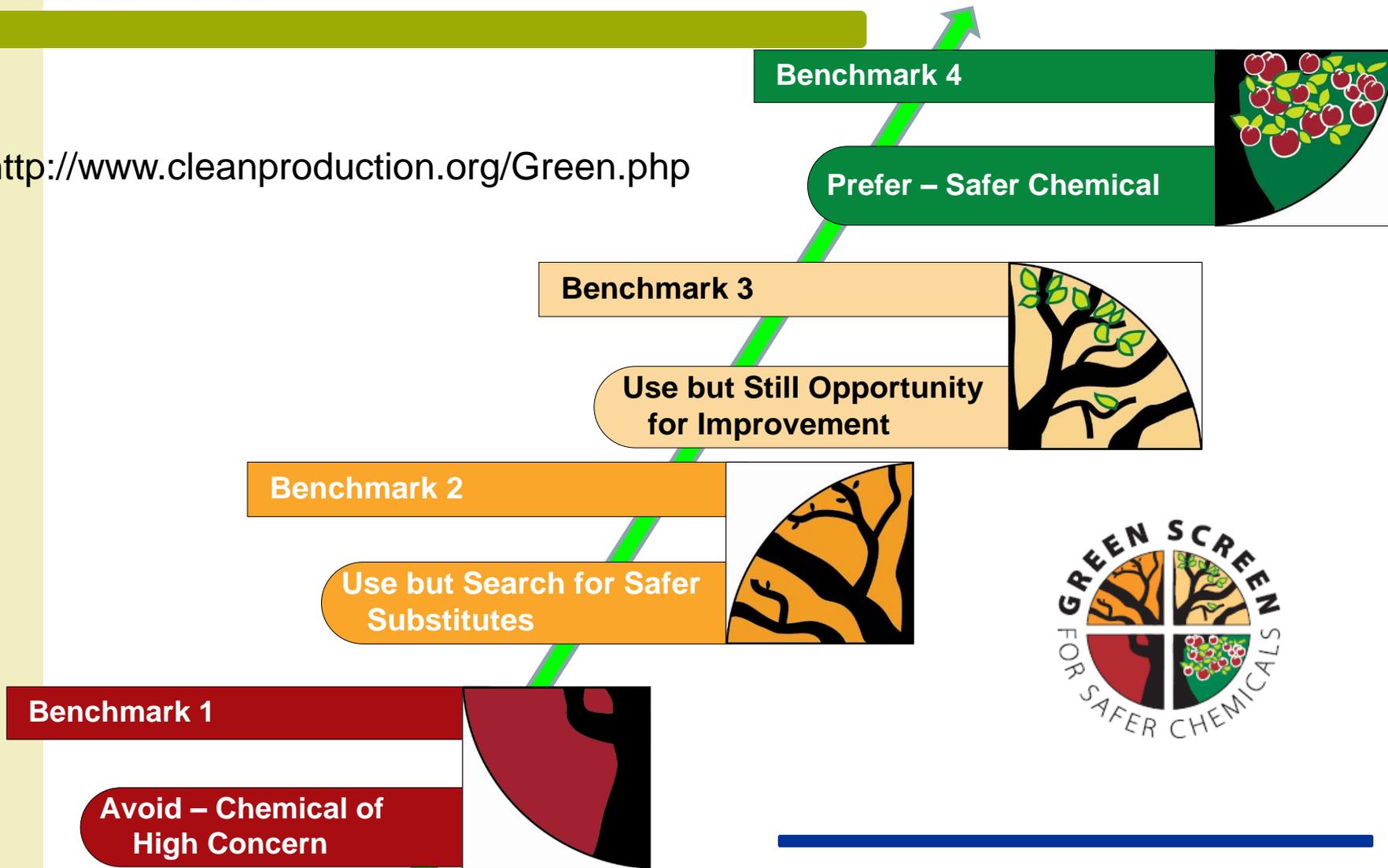
Pharos



<http://www.healthybuilding.net/news/061109pharos.html>

Green Screen for Safer Chemicals

<http://www.cleanproduction.org/Green.php>





Thank You!

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