Recognized for Safer Chemistry
www.epa.gov/dfe

US EPA's Design for the Environment Program and the California Green Chemistry Initiative

NGO Perspectives and Practical Implications for DTSC

Lauren Heine, Ph.D.
Science Director Clean Production Action

DTSC Webinar
January 27, 2010

CLEAN PRODUCTION ACTION

Safe Chemicals in Society

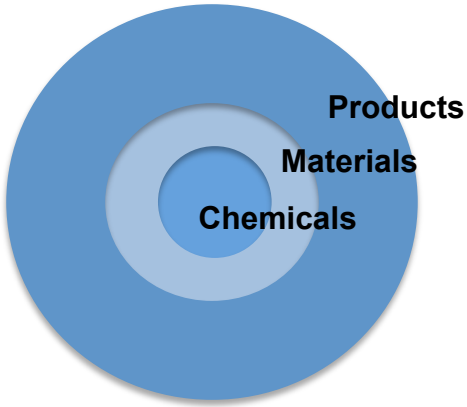
- Aspirational goal now demanded by society
- Focus now on how to benchmark progress on the roadmap to green chemistry
- Effective to identify the ideal and backcast from there
  - (e.g., Sweden's 16 Environmental Quality Objectives)

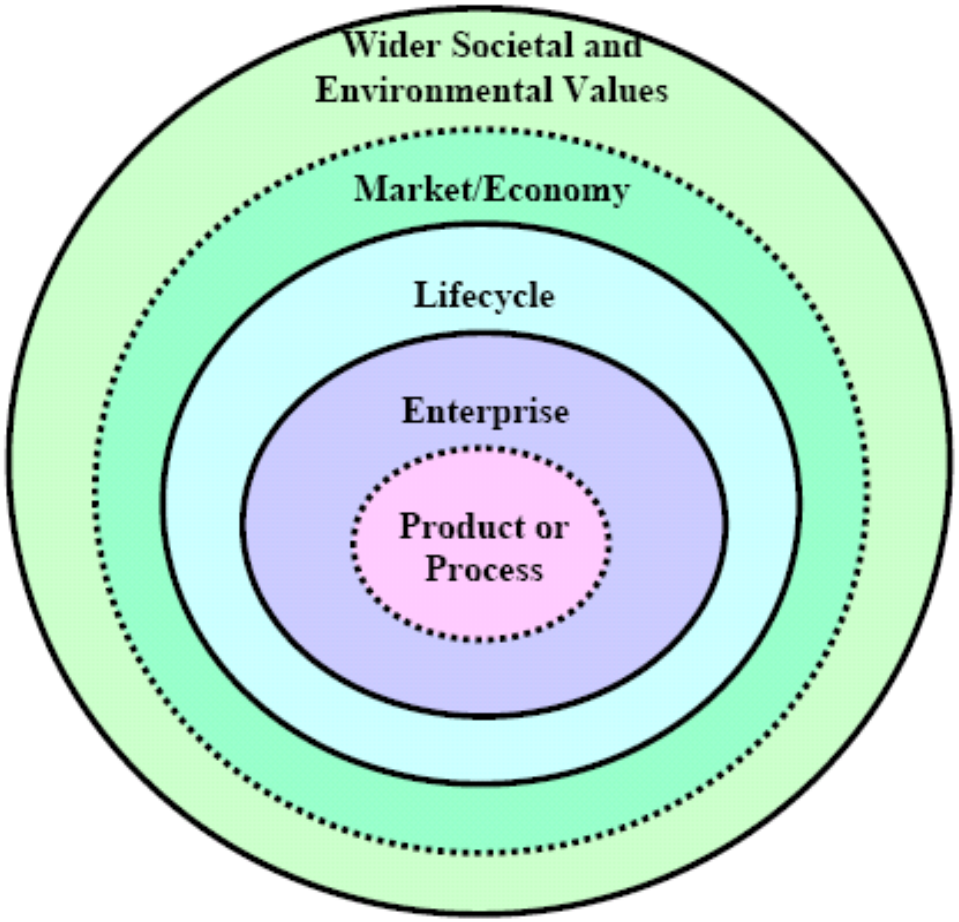
CLEAN PRODUCTION ACTION

Challenge of Integrating the CA GCI Recommended Policy Actions

1. Expand Pollution Prevention and product stewardship programs to more business sectors
2. Develop Green Chemistry Workforce Education and Training, Research and Development and Technology Transfer
3. Create an Online Product Ingredient Network
4. Create an Online Toxics Clearinghouse
5. Accelerate the Quest for Safer Products
6. Move Toward a *Cradle-to-Cradle* Economy

Replacing Toxics within a Complex System Needs Clear Transparent Decision Making





CLEAN PRODUCTION ACTION

Outline

1. Consensus views on EPA's DfE Program
2. DfE's decision logic for alternatives assessment approaches
   - Focus on identifying safer alternatives and best-in-class chemicals and products
3. Value of the comparative hazard assessment approach
4. Suggestions and shared challenges for DTSC and DfE

CLEAN PRODUCTION ACTION

Consensus Views on EPA's Design for the Environment (DfE) Program

- Letter prepared for Steve Owens, Assistant Administrator for the Office of Prevention, Pesticides, and Toxic Substances (OPPTS) and delivered Sept 2009
- Letter endorsed and meeting attended in DC by 20 organizations:
  - 6 NGOs
  - 3 Industry associations
  - 2 Raw material manufacturers
  - 9 Formulating companies and OEMs

CLEAN PRODUCTION ACTION

Consensus Views on EPA's Design for the Environment (DfE) Program

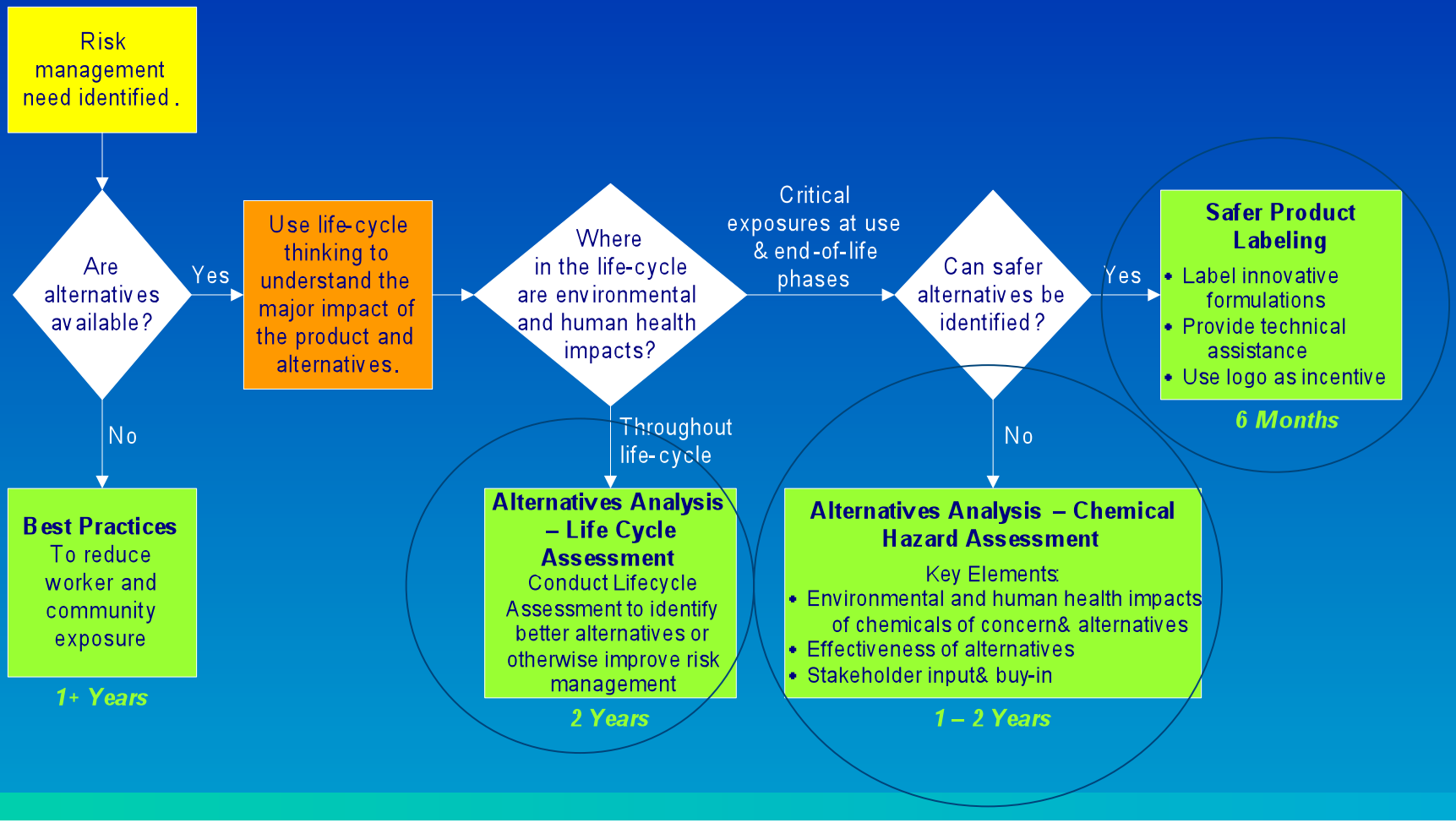
1. **DfE Fosters a Collaborative Approach**
   - Provides a productive, positive framework, inclusive of diverse perspectives
   - Works to identify common goals and methods and to synthesize solutions

2. **DfE Encourages Innovation**
   - Focus on informed substitution and continuous improvement
   - Encourages innovation in both raw materials and products
   - Valued technical resource for small formulators

3. **DfE's Science-Based Approach Encourages Green Chemistry**
   - Effective voluntary complement to regulations
   - Science-based and protective of human health and environment
   - Provides unifying, authoritative voice with aspirational goals and criteria
   - Can be used to address any product; regardless of market size

CLEAN PRODUCTION ACTION

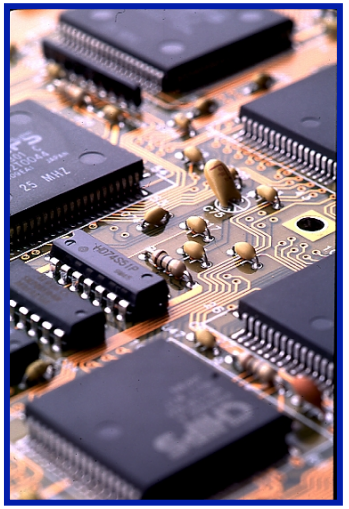
Decision Logic for DfE Approaches



Evolution of DfE Flame Retardancy Partnerships

1. **Flame-Retardant Alternatives for Furniture Foam**
   - Alternatives to penta-BDE phase-out

2. **Printed Circuit Boards (PCBs)**
   - TBBPA is highest volume brominated flame retardant used in printed circuit boards at ~ 330 million pounds/year
   - Assessment includes evaluation of combustion by-products



CLEAN PRODUCTION ACTION

Development of DfE Comparative Hazard Assessment Table 4-1 (aka "The Matrix")

L = Low hazard concern
M[4] = Moderate hazard concern
H = High hazard concern
L, *M*[1], or *H* = Endpoint assigned using estimated values and professional judgment (Structure Activity Relationships)

N = No
Y = Yes
P = Yes for pure chemical

*Ongoing studies may result in a change in this endpoint
▲Persistent degradation products expected[5]

Company	Chemical	% in Formulation[6]	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
Great Lakes	Firemaster 552																				
	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

N

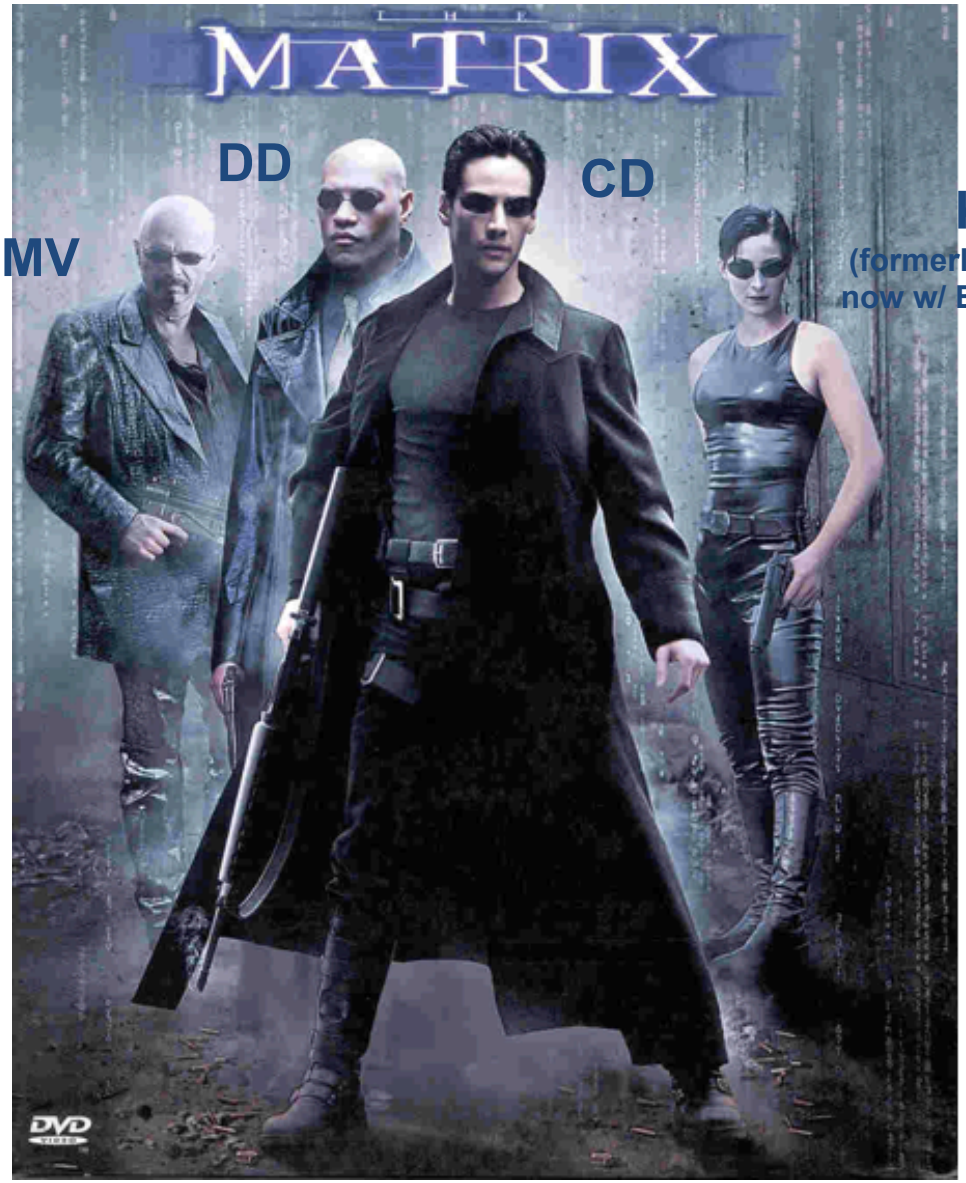
Table 4-1 (aka The Matrix)

EL

MK

LS

KD



KV

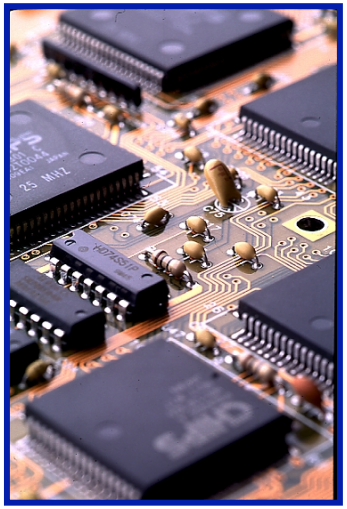
(formerly with DfE;
now w/ Energy Star)

Chemicals of VERY high concern

Evolution of DfE Flame Retardancy Partnerships

1. **Flame-Retardant Alternatives for Furniture Foam**
   - Alternatives to penta-BDE phase-out

2. **Printed Circuit Boards (PCBs)**
   - TBBPA is highest volume brominated flame retardant used in printed circuit boards at ~ 330 million pounds/year
   - *Assessment includes evaluation of combustion by-products based on end-of-life considerations (under development)*



CLEAN PRODUCTION ACTION

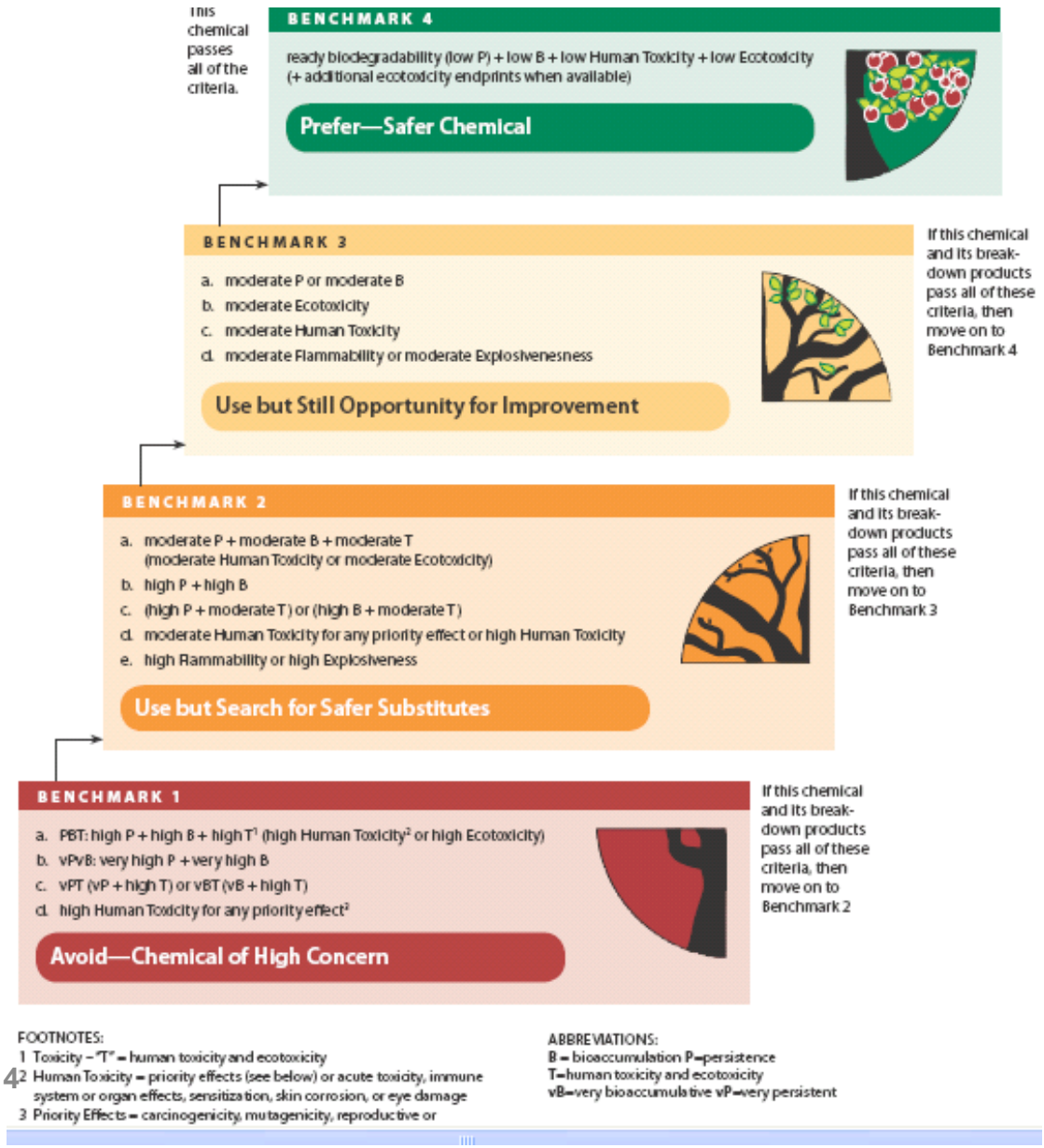
Development of The Green Screen for Safer Chemicals

- Developed by Clean Production Action (NGO)
- Consistent, repeatable, scientifically-robust method that builds on DfE chemical alternative assessment approach
- Looks at particular *combinations* of hazards for an overall benchmark score
- Now used by several leading OEMs and State governments as decision making support tool for advancing green chemistry

http://www.cleanproduction.org/Greenscreen.php

CLEAN PRODUCTION ACTION

Roadmap Clearly Benchmarked



CLEAN PRODUCTION ACTION

Defines the 'Ideal' and Allows Users to Chart Progress

Aim for the Top

Develop new, greener chemical products and processes; prefer chemical products that are fully assessed and that have low inherent hazard and life-cycle benefits

Practice Informed Substitution

Continual improvement toward chemicals with more data and lower inherent hazard

Bring up the Bottom

Move away from chemicals of concern

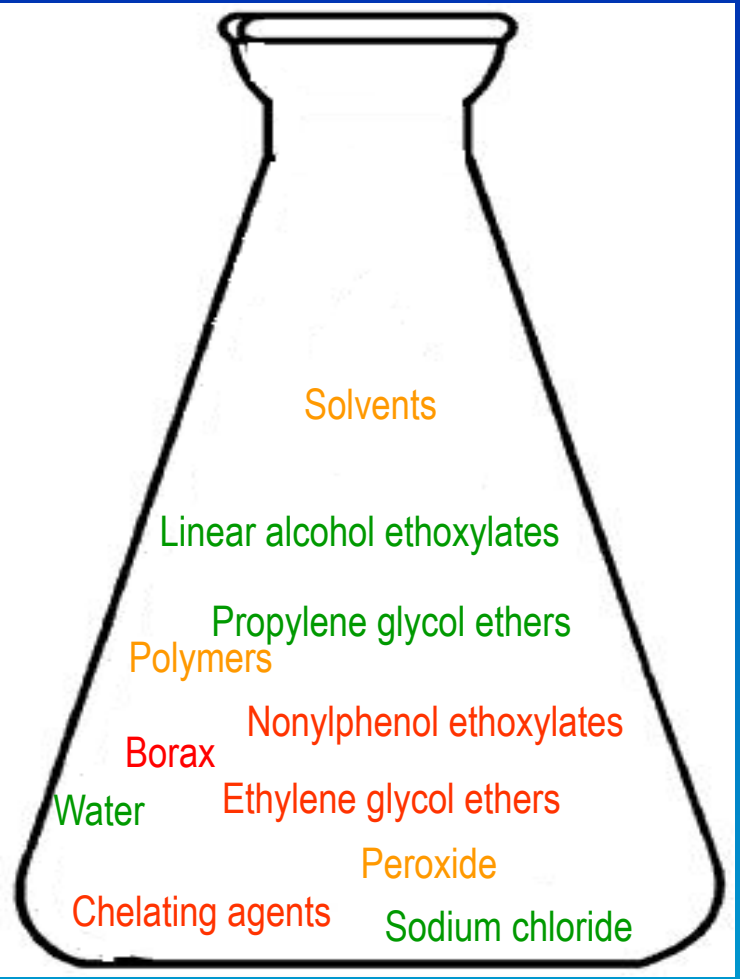
CLEAN PRODUCTION ACTION

DfE Safer Product Labeling

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

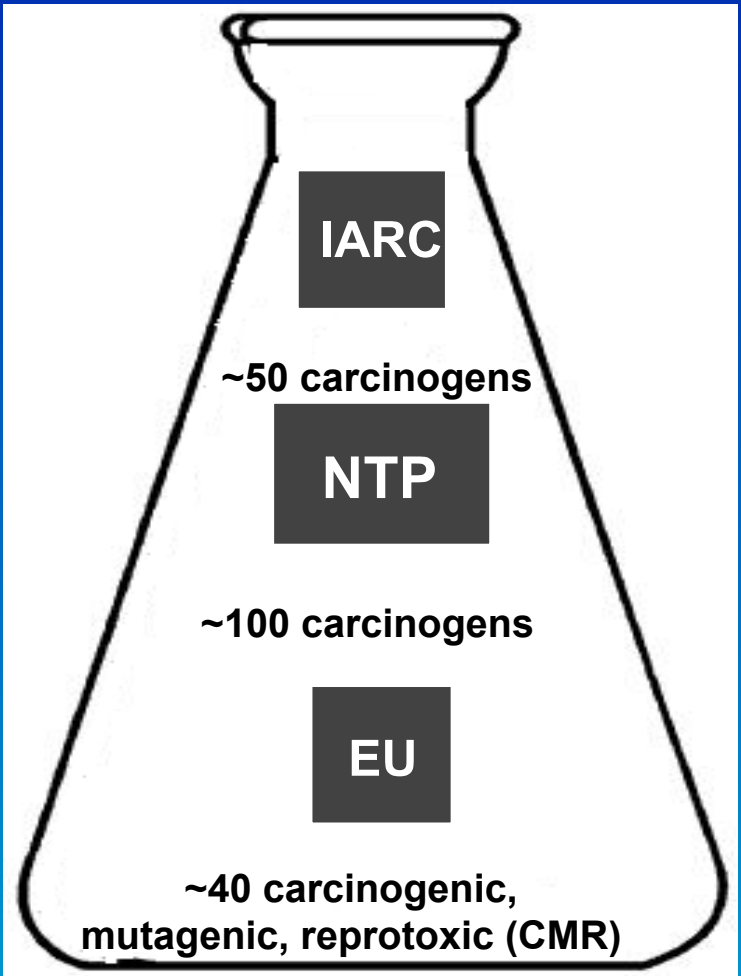
CLEAN PRODUCTION ACTION

A Stringent Approach for Differentiating Products



Tens of thousands of chemicals in commerce

A Stringent Approach for Differentiating Products

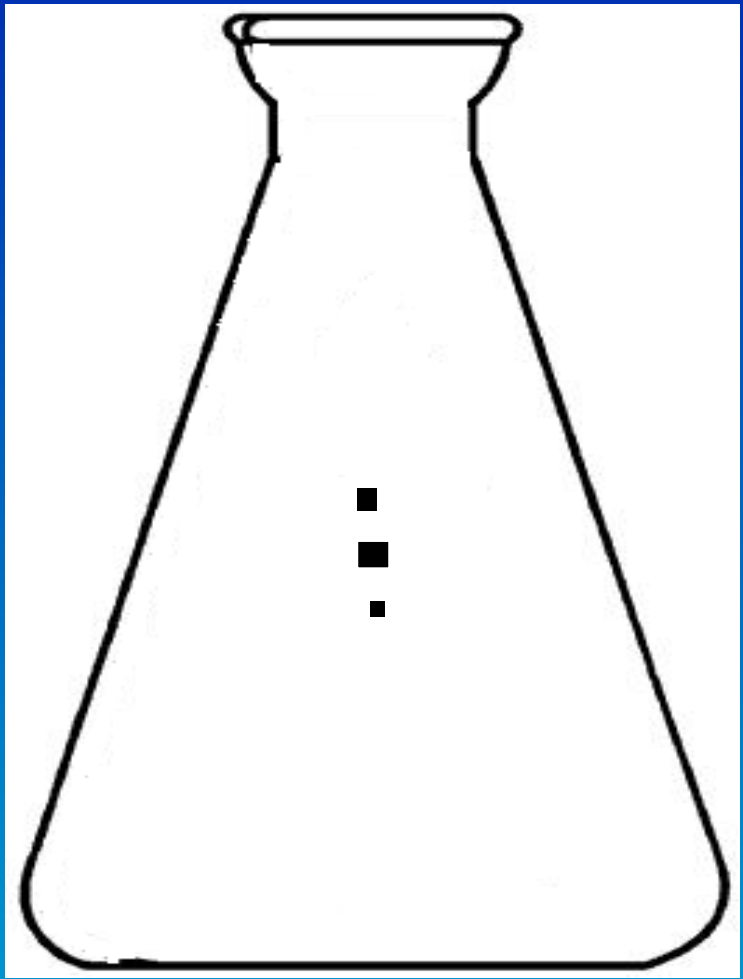


Tens of thousands of chemicals in commerce

One approach:

(1) Black list chemicals based on authoritative lists

A Stringent Approach for Differentiating Products



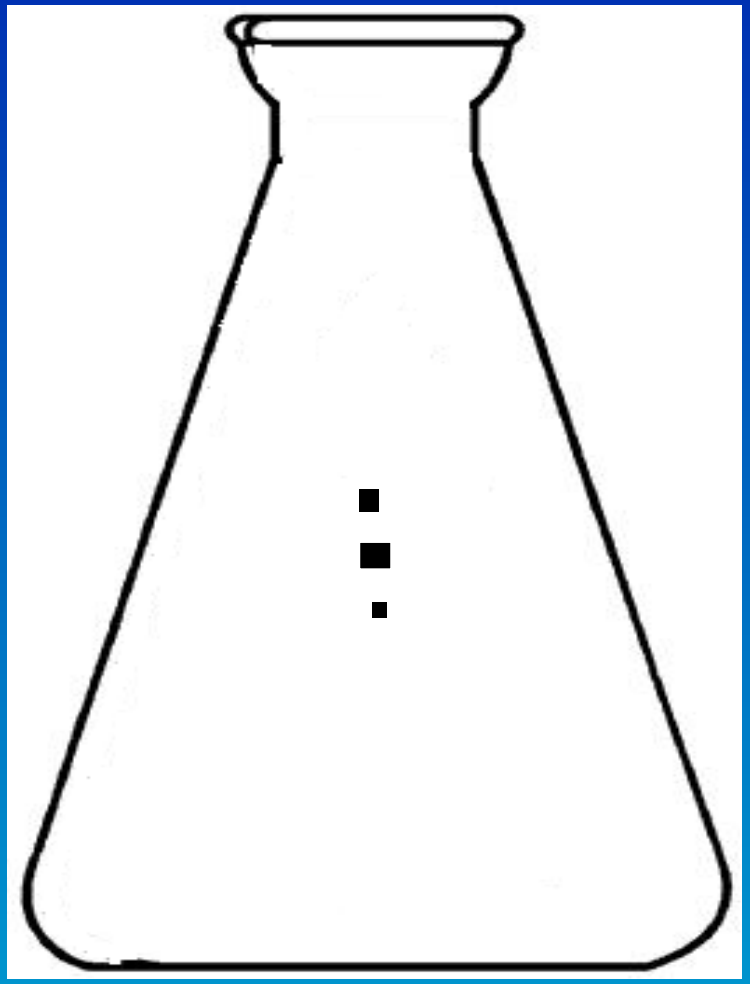
Tens of thousands of chemicals in commerce

One approach:

(1) Black list chemicals based on authoritative lists

- **These "black list" chemicals are only a tiny fraction of chemicals in commerce**

A Stringent Approach for Differentiating Products



Tens of thousands of chemicals in commerce

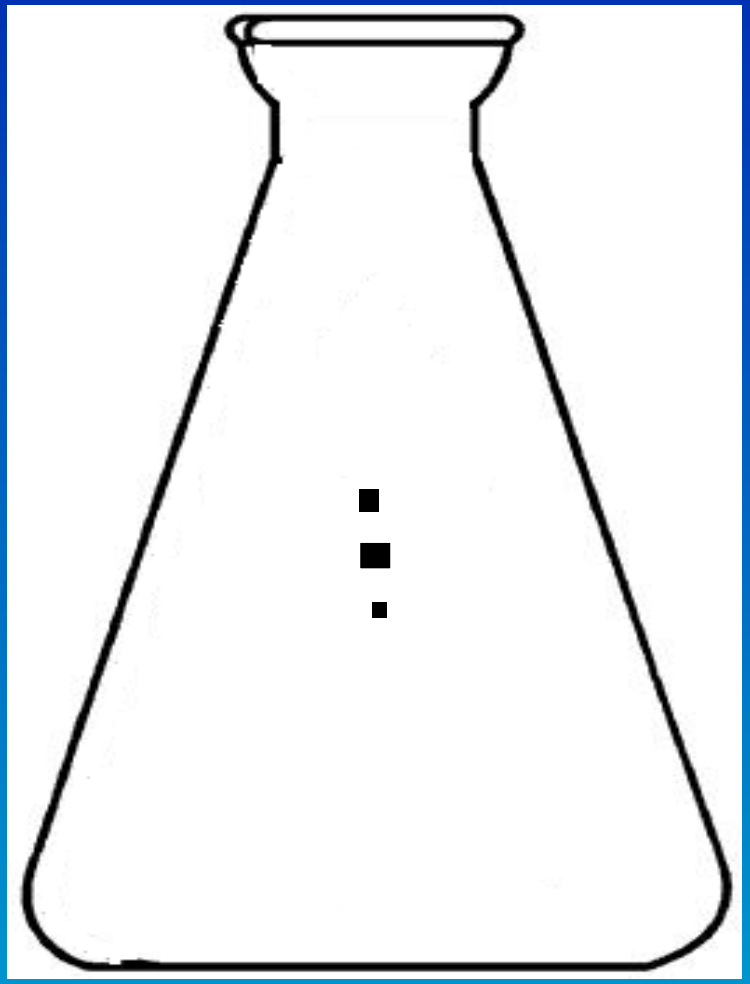
One approach:

(1) Black list chemicals based on authoritative lists

- **These "black list" chemicals are only a tiny fraction of chemicals in commerce**

(2) Conduct whole-product toxicity testing, focus on certain endpoints

A Stringent Approach for Differentiating Products



Tens of thousands of chemicals in commerce

One approach:

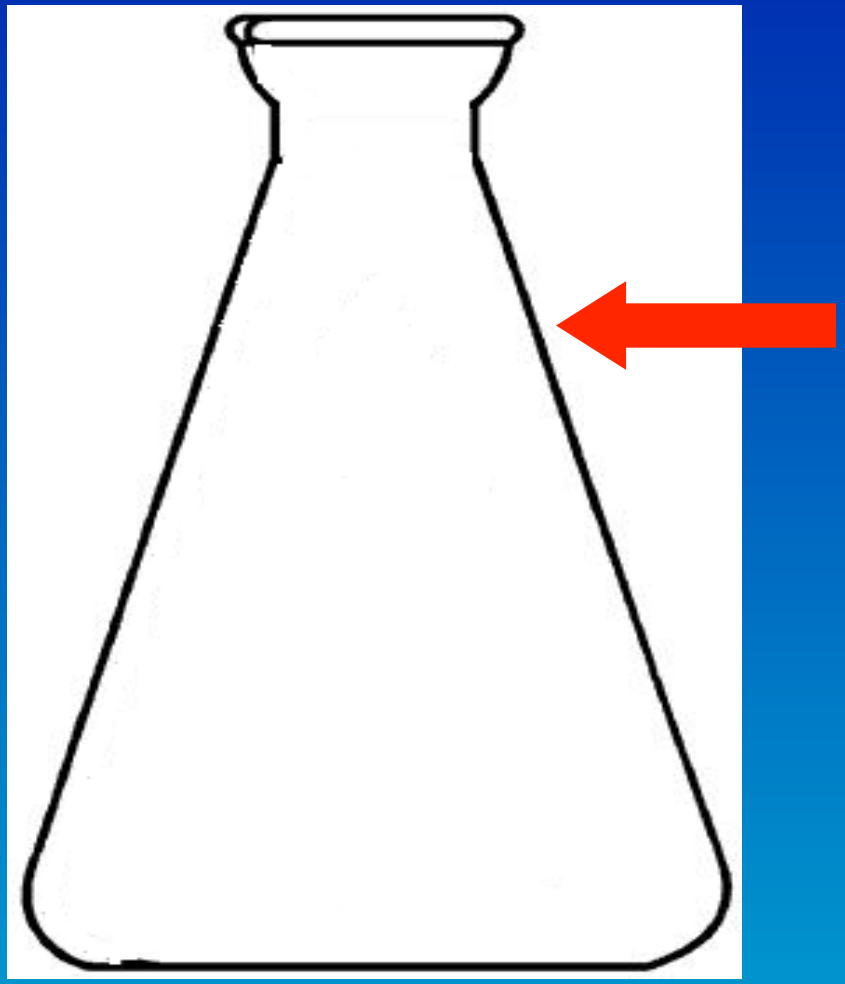
(1) Black list chemicals based on authoritative lists

- **These "black list" chemicals are only a tiny fraction of chemicals in commerce**

(2) Conduct whole-product toxicity testing, focus on certain endpoints

- **But more can be done…**

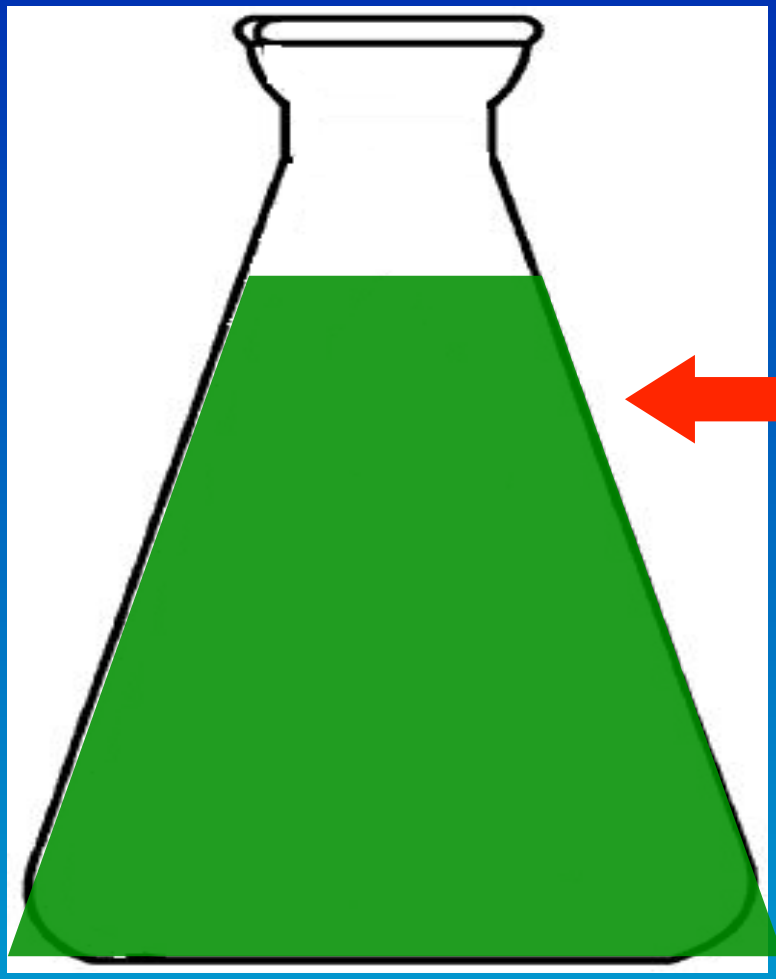
A Stringent Approach for Differentiating Products



Assess human health and environmental endpoints for *every* product ingredient:

Acute mammalian toxicity
Carcinogenicity
Genetic toxicity
Neurotoxicity
Repeated dose toxicity
Reproductive and developmental toxicity
Respiratory and skin sensitization
Environmental toxicity and fate

A Stringent Approach for Differentiating Products



Promotes the greenest possible chemistry

- Does not allow dilution of toxicity
- Ensures chemicals of known concern are not replaced with problematic but poorly understood chemicals
- Examines every chemical in the context of its functional class and includes
  - Fragrances & colorants
  - Stabilizers & impurities
  - Preservatives

DfE: Demonstrating the Value of Comparative Chemical Hazard Assessment

Reason #1: Replacing chemicals and materials multiple times is extremely expensive and undesirable

- Regulatory bodies are increasingly using hazard as a driver for material restriction, so hazard screening is an indicator of future restriction
- Want to select alternatives that won't be restricted in the future

DfE: Demonstrating the Value of Comparative Chemical Hazard Assessment

Reason #2: It is necessary to prioritize material substitution programs because of the complexity of supply chain management and because of finite resources to work on these issues

- Want to go after the materials that have the most impact

DfE: Demonstrating the Value of Comparative Chemical Hazard Assessment

Reason #3: It only makes sense to replace materials with alternatives that are indeed better with respect to EH&S

- Need a way to assess alternatives to ensure that they are inherently less hazardous (not just unrestricted)
- Want to be able to select into good materials (not just unrestricted)

DfE: Demonstrating the Value of Comparative Chemical Hazard Assessment

Reason #4: Comparative chemical hazard assessment supports continual improvement

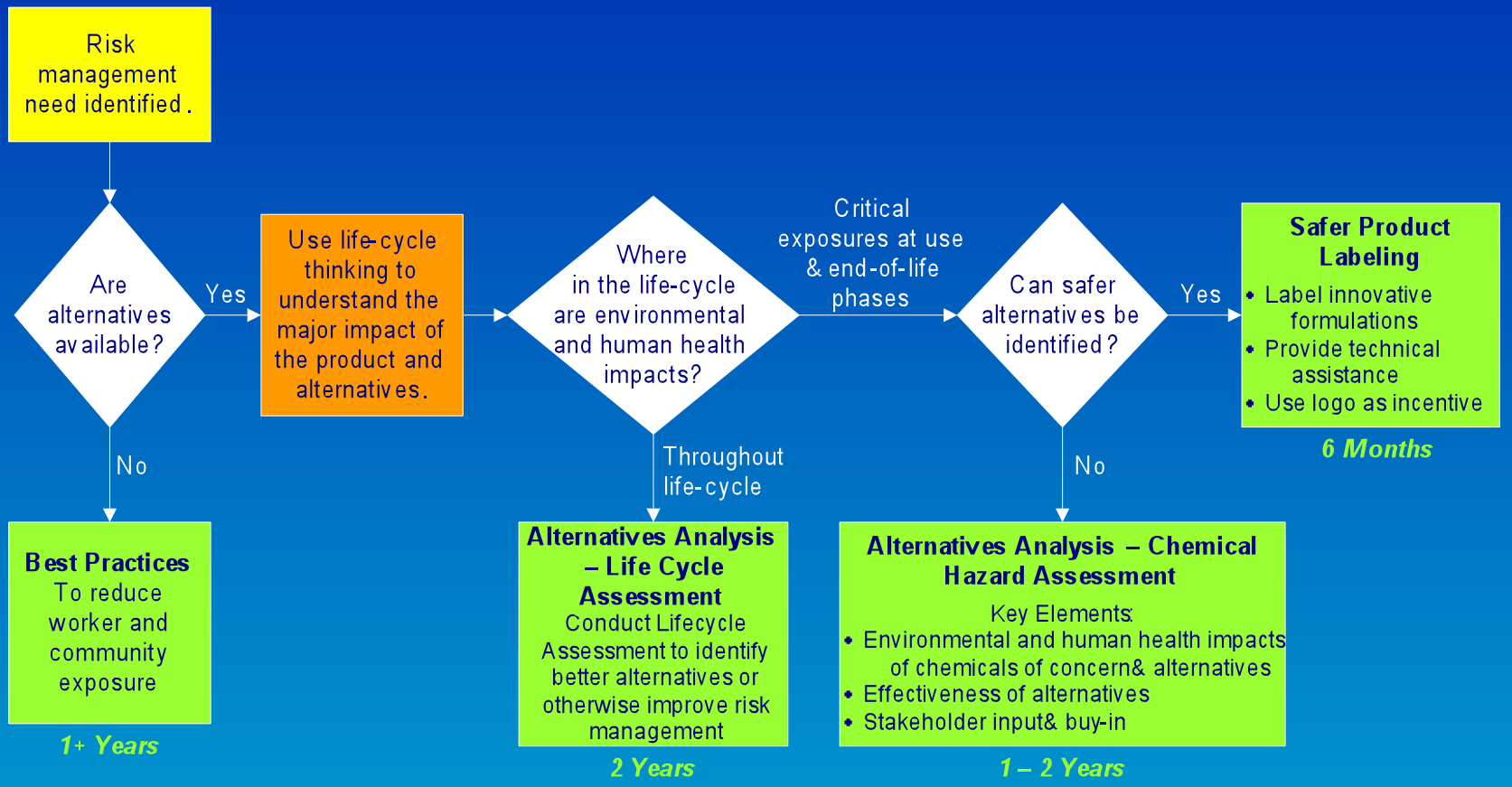
- Risk assessment helps to answer, *"Is it safe enough?"*
- Comparative chemical hazard assessment helps to answer, *"Which is safer?"*
  - When comparing chemicals for a similar functional use, reducing hazard can be roughly equivalent to reducing risk; part of the risk assessment paradigm

DfE: Demonstrating the Value of Comparative Chemical Hazard Assessment

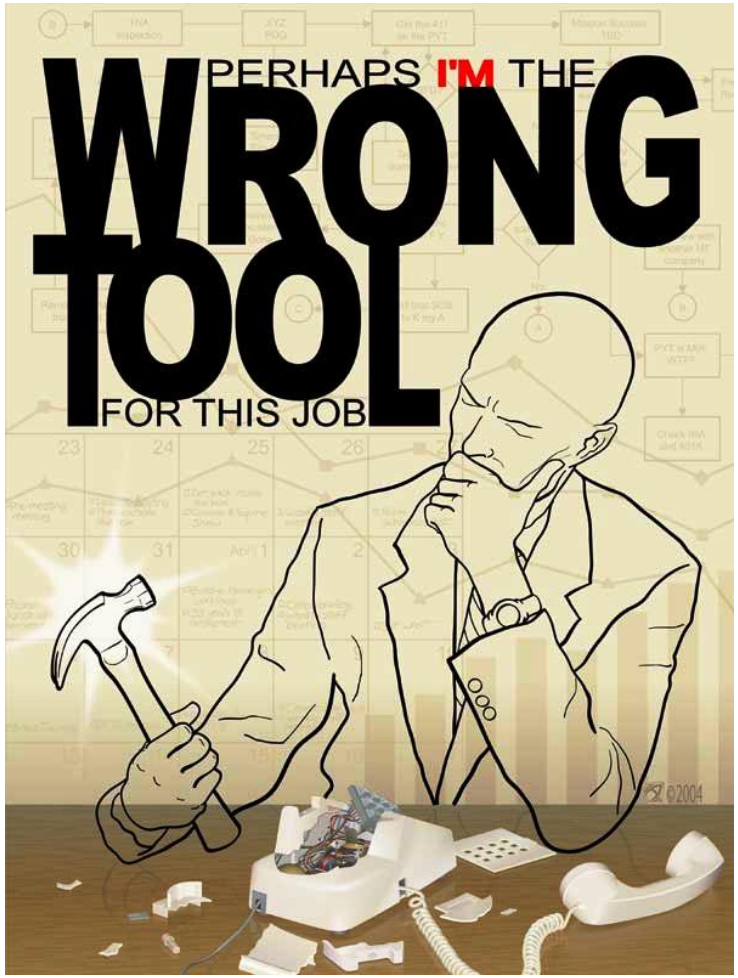
Reason #5: Clearly defined attributes and criteria can help to inform suppliers about what their customers are looking for

- The DfE Screens for Safer Chemicals (General Screen, Solvents, Surfactants, Chelating Agents, Fragrances) define what formulators need from their suppliers for DfE recognition
- Clearly defined attributes and criteria can drive innovation and green chemistry challenges (CleanGredients)

Decision Logic for DfE Approaches



Not All Alternatives Assessments are the Same



- Consider Decision Logic for the DfE Approaches; not just one approach
- Lifecycle thinking is key to identifying criteria for safer alternatives; but LCA may not be
  - Chemical hazard assessment can drive green chemistry and engineering
  - Need to continue to advance alternatives assessment for chemicals, materials, and articles,
    - e.g., *Cradle-to-Cradle* design addresses both hazard and material flows

CLEAN PRODUCTION ACTION

Lessons Learned

Recognized for Safer Chemistry
www.epa.gov/dfe

1. DfE has established its "brand" - Safer chemistry AND life cycle benefits –NOT safer chemistry OR life-cycle benefits
2. A focus on informed substitution using chemical hazard assessment to identify safer alternatives based on functional use is effective and valued by many in industry and NGOs
3. Methods have been developed to identify not only safer alternatives but chemicals that achieve a high benchmark for recognition and preference in the marketplace- part of the same system. Could DTSC translate this into:
    1. Green Products Registry?
    2. Green Chemicals Registry (by functional use, DfE Screens)?

CLEAN PRODUCTION ACTION

Suggestions

- Establish clear 'ideal' and backcast from there
  - (i.e., DfE Continuum of Improvement)
- Establish transparent, science-based decision making tools
- Engage in public/private partnerships to support informed substitution of toxic chemicals
- Identify strategies for recognizing safer products and use purchasing policies to reward
- Avoid trade-off of chemical hazard for other life cycle benefits
- Create a place for research, development and application of alternatives assessment methods – a vibrant field right now!
  - Continue to advance tools and methods to identify safer alternatives and best in class for chemicals, materials, and articles
  - Build on GCI recommendations re *cradle-to-cradle* design

CLEAN PRODUCTION ACTION

Shared Challenges for DTSC and DfE

- DfE and DTSC harmonize on a methodology for chemical alternatives assessment
- Identify chemicals of concern and prioritize them for alternatives assessment
- Fill data gaps
  - Share data and best practices re use of analogs, models and prioritization of data requirements based on chemical class
- Incorporate emerging science and engineering
  - Tension between available standard test methods and emerging science
- Determine role for product recognition/certification
  - In demonstrating compliance? Leadership?
  - Identifying target areas for alternatives assessment partnerships and product recognition (by sector, product class?); where is the most value in recognizing products (between supply chains or at consumer level)?
- Transparency challenges- stakeholder engagement and/or public outreach

CLEAN PRODUCTION ACTION