Clean Production Action

the chemical footprint project™

BizNGO

GREEN SCREEN FOR SAFER CHEMICALS

Together, we're creating a safer and healthier future

Chemicals without Harm

Policies for a Sustainable World

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Lowell Center for Sustainable Production

March 14, 2016

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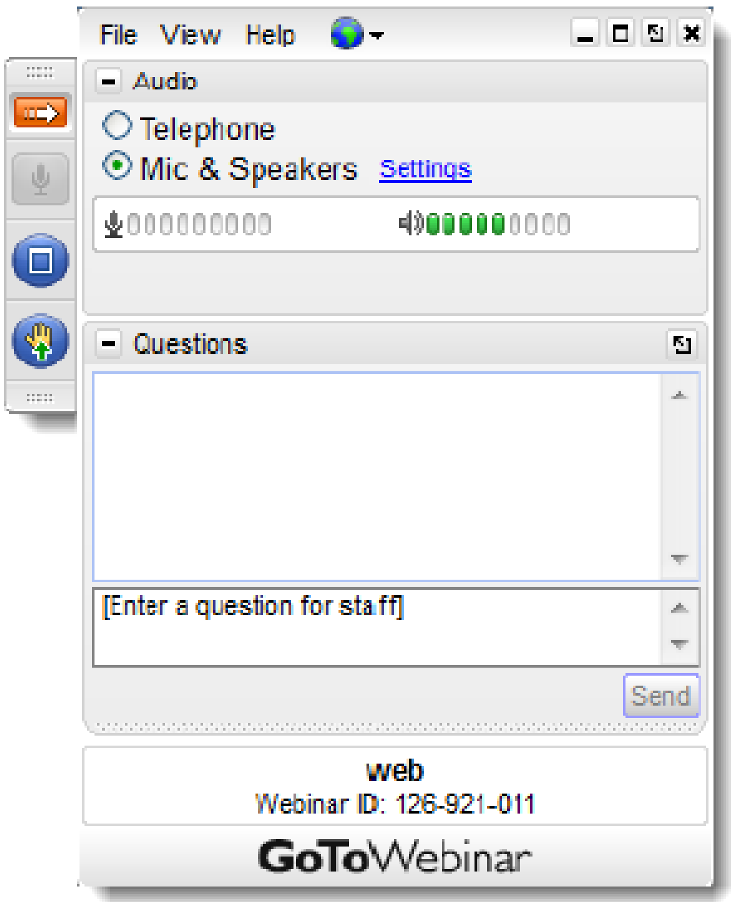
Questions?



- **Post your question to the Questions pane in your GoToWebinar Control Panel**

- Presentation and recording will be available at www.bizngo.org

Chemicals without Harm

Policies for a Sustainable World

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There is a problem with chemicals:

Too many of the products that we need and use are made with hazardous chemicals

Phthalates

BPA

PBDEs

PFCs

Lead

Formaldehyde

Toluene

BPA is found in 9 out of 10 Americans

232 toxic chemicals are found in umbilical cord blood of newborns in the US

The Conventional Federal Policy Response to Hazardous Chemicals

Federal Chemical Control Laws on the 1970s

- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
- Federal Food, Drug and Cosmetics Act (FFDCA)
- Toxic Substances Control Act (TSCA)
- Consumer Product Safety Act of (CPSA)

For some 40 years we have relied on government regulations to manage the risks of dangerous chemicals

Limits of Federal Chemical Control Laws

- The laws depended on government to determine risks
- The processes focused on exposure control (risks) rather than reducing inherent hazards

- The processes addressed chemicals one-by-one
- The laws did not generate sufficient chemical information

- The processes have been slow, adversarial and costly
- The laws have not stimulated green chemistry and safer chemicals

Reforming the Toxic Substances Control Act

- Senate –S. 697
- Creates Safety Assessments, Safety Standards, Safety Determinations
- EPA identifies 10 High Priority Substances per year with 25 maximum and 10 Low Priority Substances with 25 maximum
- States are pre-empted when EPA begins an assessment
- Develops a Sustainable Chemistry Program
- Sets a fee

- House—H.R. 2576
- EPA conducts 10 or more Risk Evaluations per year
- States are pre-empted when EPA finds a substance poses no unreasonable risk
- EPA publishes a list of Persistent, Bioaccumulative and Toxic Substances
- Sets a fee

TSCA reform will provide necessary, but modest improvements

The Push for Safer Chemicals is Widespread

- Consumers are looking for safer chemical products
- States are generating safer chemical laws and policies

- NGOs are driving safer chemical market campaigns
- Foreign and international governments are setting global chemicals policy

- Product manufacturers are establishing internal corporate chemicals policies
- Retailers are creating chemical screening programs

- Chemists are synthesizing new chemicals that are safer for human health and the environment

There are many safer chemical initiatives…

…however, they are fragmented and not scaled to adequately address the chemicals problem

We need to build a Comprehensive Safer Chemical Strategy

Consumer Awareness

State Legislation

NGO Campaigns

Brand Manufacturer Programs

Retailer Chemical Initiatives

International Government Policies

Green/Sustainable Chemistry

Safer Chemical Businesses

STRATEGY

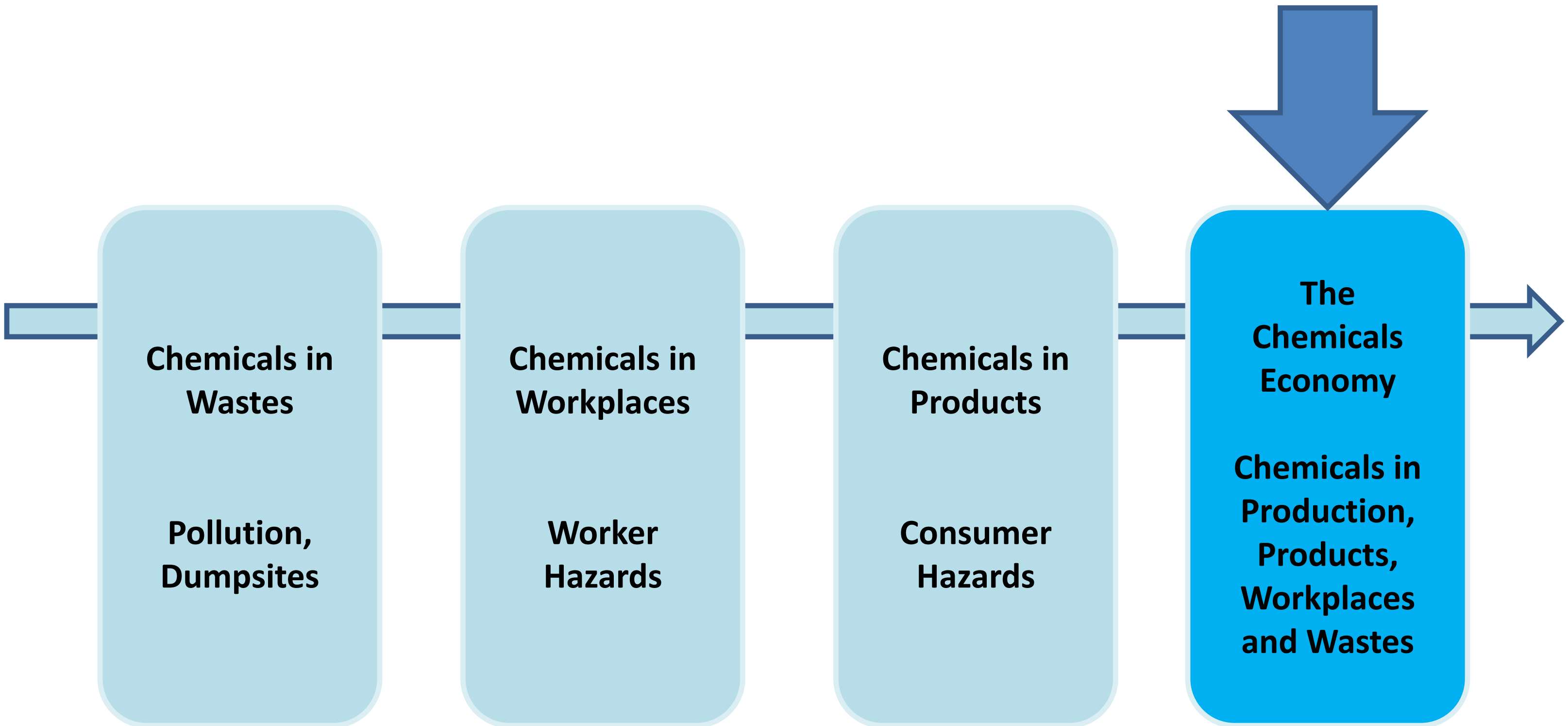
The Chemicals Problem:

The Chemicals Economy

First Step: Reframe the Chemicals Problem

- **Shift from a focus on controlling hazardous chemical risks in wastes, workplaces and products to a focus on converting the chemicals market and chemical industry to inherently safer chemicals**

Shifting the Chemicals Problem Focus



Second Step: Take a Systems Approach

- **Consider the chemicals economy as a vast chemical production and consumption system and locate and press the most promising levers for change**

Why focus on the Chemical Economy?

- Hazardous chemicals are the result of economic determinants
  - price, performance, competition, production efficiencies
- More fundamental solutions to can be achieved by examining the function and role hazardous chemicals play in the economy

- Raises questions such as:
  - What is the function of this chemical?
  - Is it necessary?
  - What other chemicals and functions are linked to this chemical?
  - Are there preferred alternatives on the market?

Why take a Systems Approach?

- Provides a big picture
- Incorporates life cycle thinking
- Reveals the linkages among chemicals

- Reveals the vulnerabilities and opportunities for intervening to make changes in the system
  - Regulate at the point of chemical use
  - Regulate at the point of chemical manufacture
  - Regulate at the point of emission or disposal
  - Provide technical assistance…where and to whom
  - Invest in research on alternatives

Principles for a Safer Chemicals Strategy

- **Comprehensive**—covers all chemicals
- **Transparent**—increases chemical information and public knowledge

- **Participatory**—engages multiple parties
- **Hazard-based**—focuses on intrinsic properties

- **Transformative**—transitions from high hazard to lower hazard substances
- **Innovative**—encourages research and green chemistry

Building Blocks for a Safer Chemicals Strategy

1. Set Goals and Plans

2. Characterize and Classify All Chemicals
3. Generate and Make Accessible Chemical Information
4. Work in Economic Sectors

5. Prioritize Chemical Groups in Sectors
6. Accelerate Substitution with Safer Alternatives
7. Promote Safer Alternatives

8. Reconstruct Government Capacity

1. Set National Goals and Plans

Models:

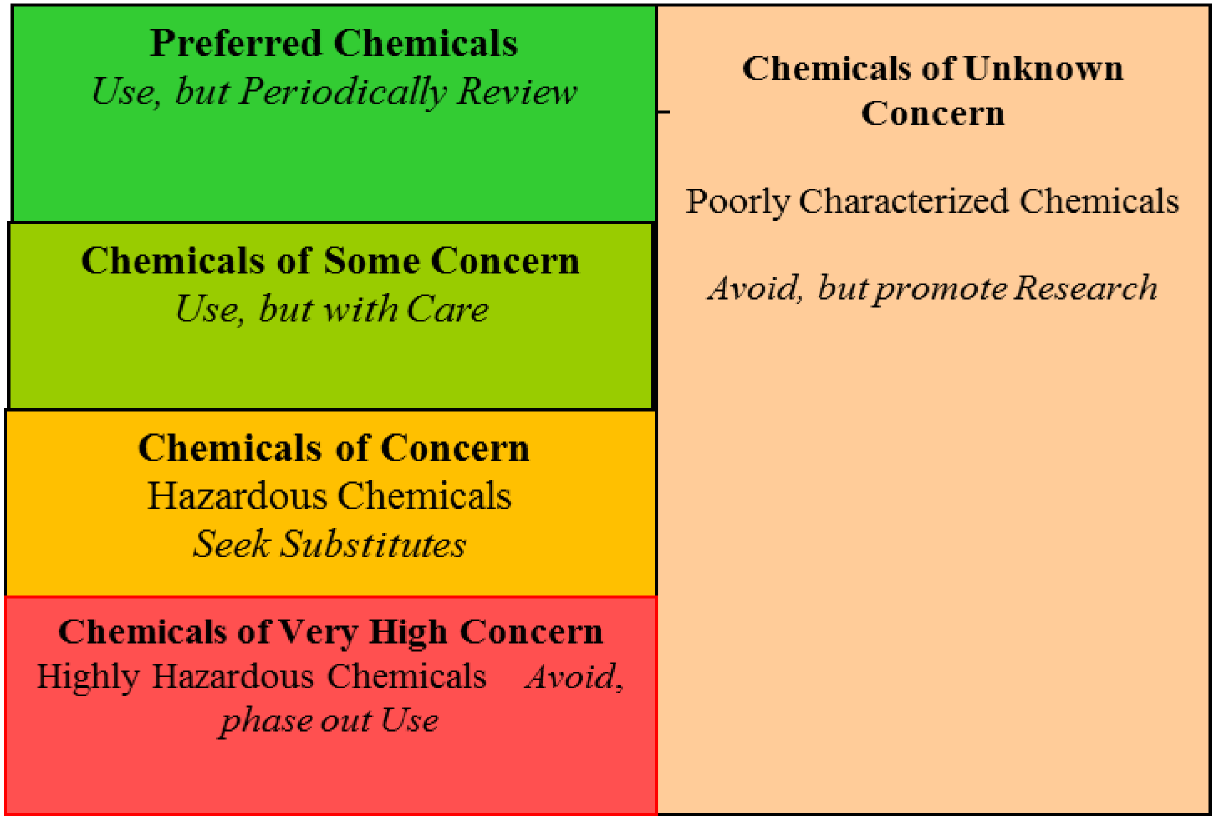
US EPA's Clean Water Action Plan, Climate Change Action Plan

State Mercury Reduction Plans

European Union "Generational Goal":

> **"By 2020…chemicals are only produced and used in ways that do not pose significant threats to human health or the environment"**

2. Characterize and Classify All Chemicals



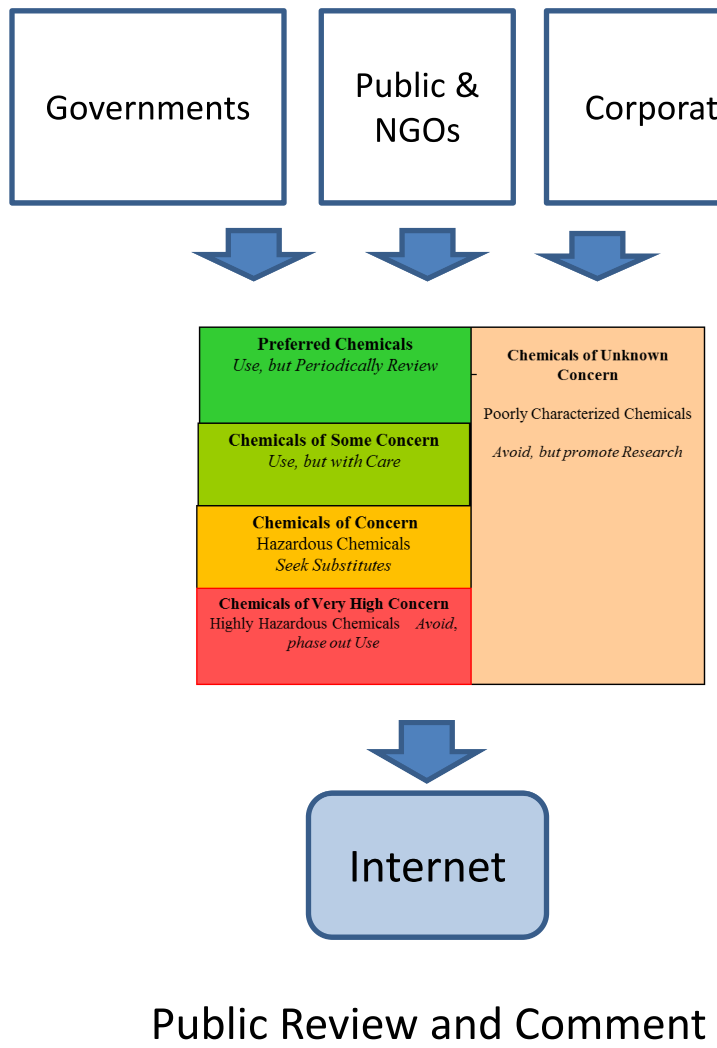
Universal Classification of Chemical Substances

Classifying Chemicals

Characterization Criteria

GHS—Globally Harmonized System for Classification and Labeling of Chemicals

WHO Recommended Classification of Pesticides by Hazard



AstraZeneca Solvent Selection Tool

AstraZeneca

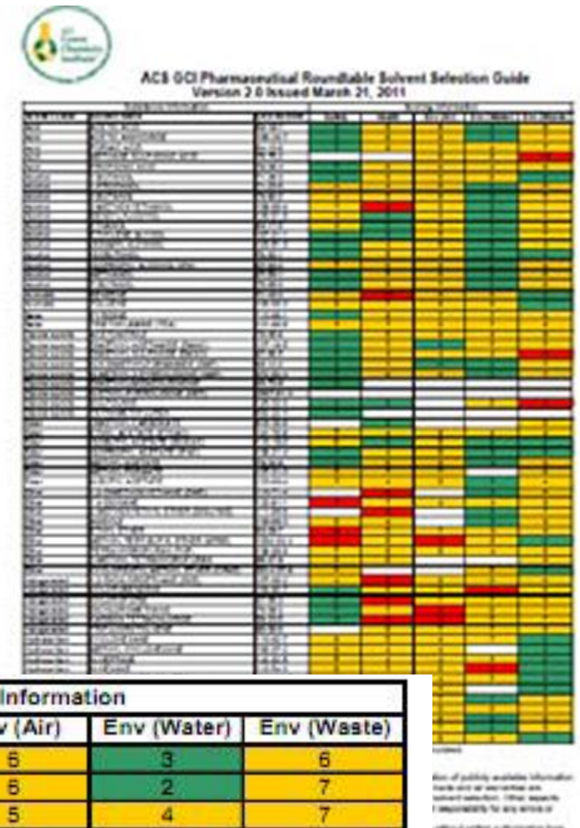
Solvent Selection Guide

Solvent selection is a key part of process development. Because of the volumes used, solvents can often result in the biggest SHE impact of a process. This summary table assigns a score from 1 to 10 for each solvent under the respective categories with 10 being of concern and 1 suggesting few issues. This is further simplified by using colour coding with scores between 1 and 3 being green, 4 to 7 yellow and 8 to 10 red.

Substance			Safety		Health	Environment						
	Name	CAS No.	Flammability	Static	Health	Impact in Air	VOC Potential	Impact in Water	Potential Biotreatment Plant Load	Recycle	Incineration	Life Cycle Analysis
Acids:	Methane sulphonic acid[1]	75-75-2	1	1	1	1	1	7	4	6	8	3
	Propionic acid	79-09-4	3	1	4	4	1	1	5	6	6	1
	Acetic acid (glacial)	64-19-7	3	1	8	6	3	1	5	6	6	3
	Formic acid	64-18-6	3	1	10	4	5	1	5	6	7	1
Alcohols:	Isoamyl alcohol	123-51-3	3	1	2	1	1	2	4	5	3	Data not available
	1-Pentanol	71-41-0	7	1	1	2	1	1	4	5	3	4
	Isobutanol	78-83-1	7	1	3	2	2	1	5	7	3	6
	n-Butanol	71-36-3	7	1	4	3	2	1	5	6	3	6
	Isopropanol	67-63-0	7	1	3	1	5	1	6	5	5	6
	IMS/Ethanol	64-17-5	7	1	2	2	5	1	7	5	5	1
	Methanol	67-56-1	7	1	5	3	6	1	7	4	5	1
	t-Butanol	75-65-0	7	1	6	2	4	3	7	5	5	1
	2-Methoxy ethanol	**109-86-4**	3	1	10	8	2	2	5	6	5	5
Alkanes:	Isopar G	90622-57-4	3	10	1	1	1	10	3	10	1	Data not available
	n-hepane	142-82-5	7	10	3	1	5	8	5	2	1	1
	Isooctane	540-84-1	7	10	3	1	5	10	5	2	1	2
	Cyclohexane	110-82-7	7	10	6	1	6	9	5	2	1	6
	Isohexane	107-83-5	7	10	6	1	8	10	6	1	1	1
Aromatics:	Xylene	1330-20-7	7	10	2	4	2	7	3	4	1	3
	Toluene	108-88-3	7	10	5	2	4	7	4	4	1	2
Basics:	Triethylamine	121-44-8	7	1	10	6	6	5	6	5	4	6
	Pyridine	110-86-1	7	1	9	10	3	4	7	6	6	8
Chlorinated:	Chlorobenzene	108-90-7	7	1	9	4	2	9	2	4	5	7
	Methylene chloride[2]	**75-09-2**	1	1	9	9	10	6	5	2	8	7
Esters:	n-Butyl acetate	123-86-4	7	1	2	3	2	3	3	4	3	4
	Isopropyl acetate	108-21-4	7	1	4	2	5	2	5	4	3	7
	Ethyl acetate	141-78-6	7	1	5	2	6	2	5	5	4	3
Ethers:	Diphenyl ether	101-84-8	1	1	1	4	1	8	3	4	2	6
	Anisole	100-66-3	3	10	2	1	1	4	3	6	2	5
	Tetrahydrofuran	109-99-9	7	1	8	1	7	3	7	6	5	8
	Diglyme	**111-96-6**	3	1	8	7	1	5	5	10	5	6
	2-Methyltetrahydrofuran	96-47-9	7	1	8	1	7	5	7	9	4	6
	MTBE	1634-04-4	7	1	9	2	8	7	7	5	3	1
	1,2 Dimethoxyethane	**110-71-4**	3	1	10	7	6	5	7	8	5	6
	1,4-Dioxane	123-91-1	7	10	9	3	4	4	6	9	5	5
	Diethyl ether	60-29-7	10	10	7	3	10	4	7	6	3	2

ACS Green Chemistry Institute Solvent Selection Guide

Scoring System: Five categories: safety, health, environment (air), environment (water), and environment (waste).



- Uses color coding to indicate rankings

- Range 1 to 3 shown as **green**
- 4 to 7 as **yellow**
- 8 to 10 as **red**

Substance Information		Scoring Information				
Solvent Name	CAS Number	Safety	Health	Env (Air)	Env (Water)	Env (Waste)
ACETIC ACID	64-19-7	3	6	6	3	6
ACETIC ANHYDRIDE	108-24-7	3	6	6	2	7
FORMIC ACID	64-18-6	2	6	5	4	7
METHANE SULPHONIC ACID	75-75-2			6	6	10
PROPIONIC ACID	79-09-4	2	5	6	4	6
1-BUTANOL	71-36-3	3	5	5	5	3
1-PROPANOL	71-23-8	4	4	6	2	6
2-BUTANOL	78-92-2	4	5	6	3	5
2-METHOXYETHANOL	109-86-4	4	9	5	3	7
BENZYL ALCOHOL	100-51-6	4	3	4	2	4
ETHANOL	64-17-5	4	3	5	1	6
ETHYLENE GLYCOL	107-21-1	3	3	5	1	7
ISOAMYL ALCOHOL	123-51-3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

3. Generate and Make Accessible Chemical Information

Promote Chemical Profiles on All Chemicals

Models:

- **High Production Volume Chemical Challenge**
- **European Union REACH Chemical Dossiers**
- **"No Data; No Market"**

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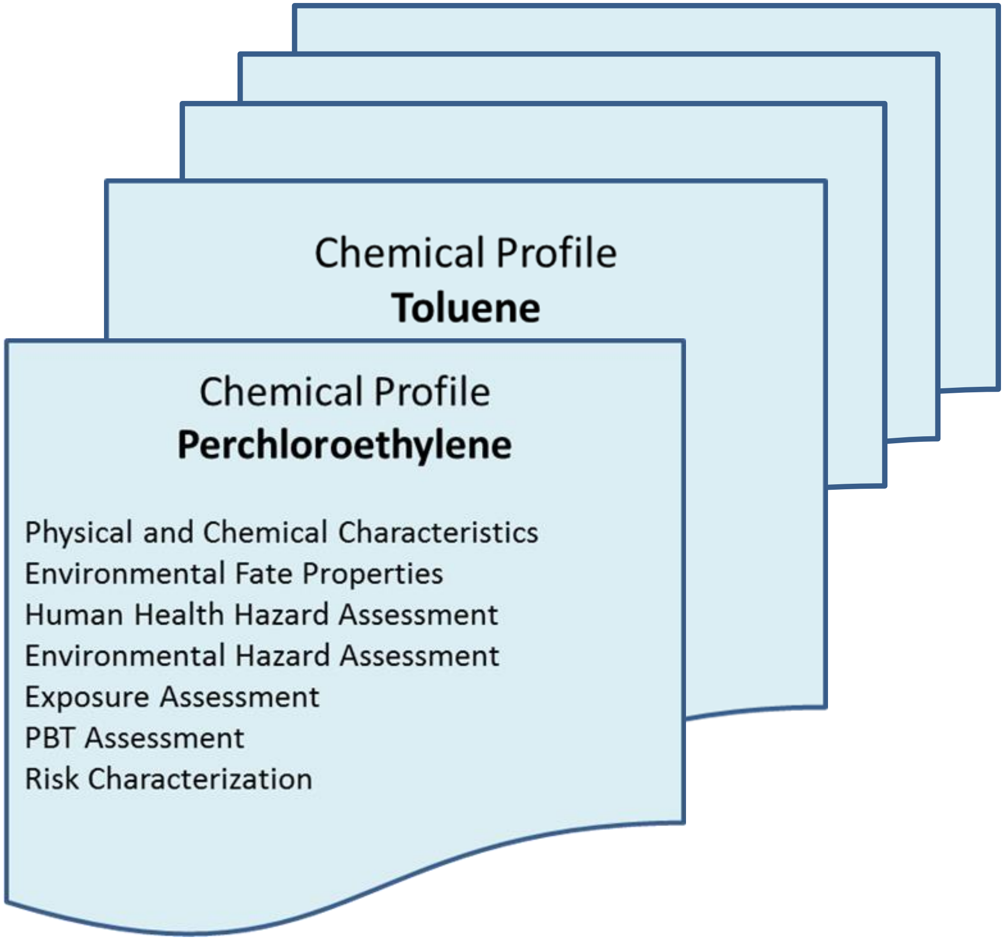


Tools for Generating Chemical Information

Models: EPA and European Tools for testing, screening, modeling, estimating

Hazard Assessments
Authoritative lists
SARs, QSARs
EPA's PBT Profiler, TEST
EPA's Oncologic, ECOSAR

Release and Exposure Assessments
TRI And PRTRs
EPA's EPI Suite, ChemSTEER, E-FAST

Biomonitoring

Chemical Inventories
EPA's CDR
EU's EINECS
Scandinavian product registries
NEMOA's IMERC

Chemical Testing
Invivo - *Invitro* lab testing
ToxCast , ToxRefDB
High throughput computational toxicology

4. Work in Economic Sectors

Why work in Sectors?

- Firms often use similar chemicals and have similar chemical problems
- Firms often share supply chains
- Multiple environmental problems can be solved at once

- Assessments of alternatives can be pre-competitive and considered collectively
- Firms can learn from and support each other
- Government initiative can leverage broader effects

Models: EPA's Sectors Program, Common Sense Initiative

Sectors with On-Going Safer Chemical Initiatives

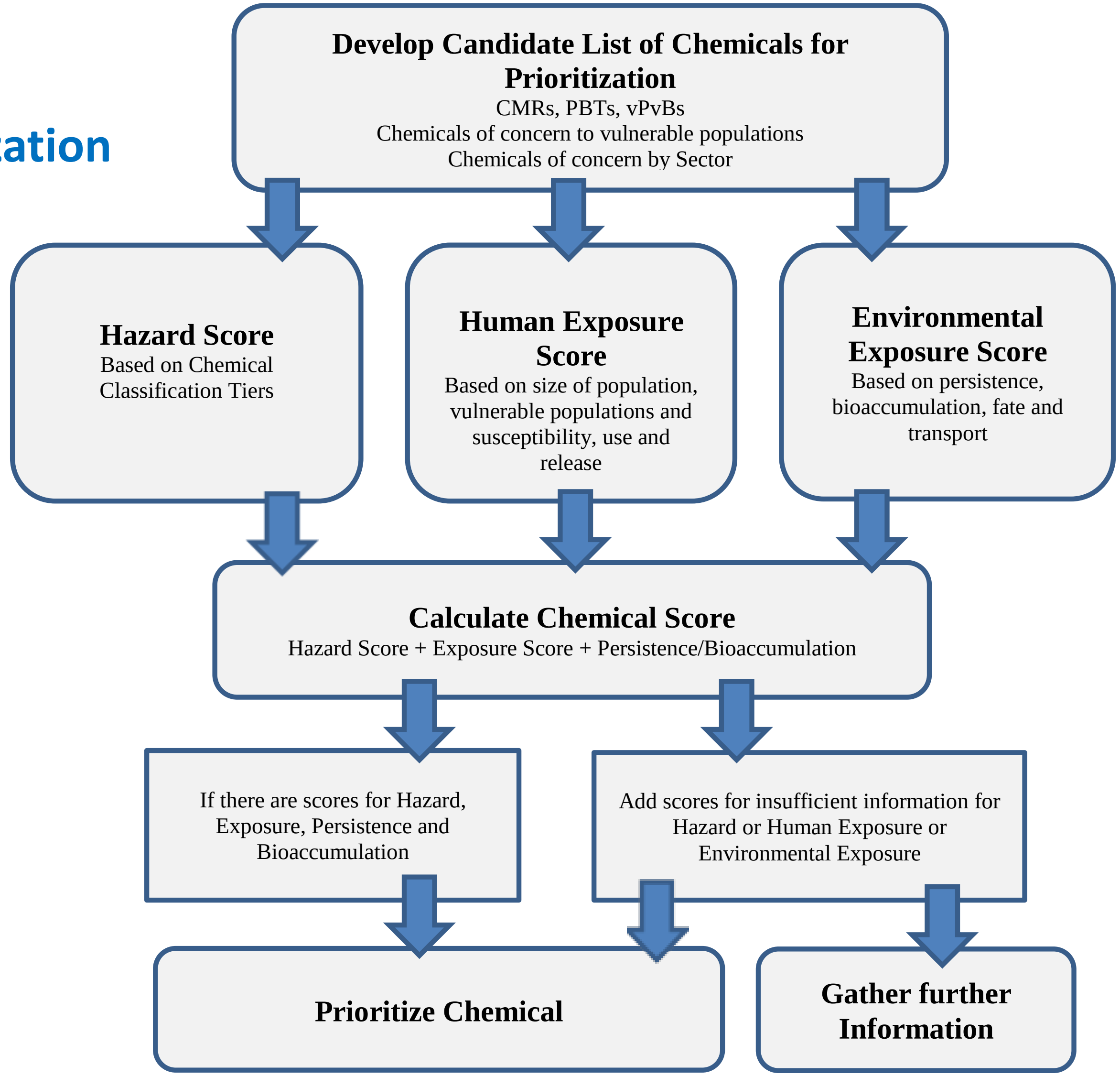
Sector	Promoters	Programs
Health care	Health Care without Harm, Practice Greenhealth	CleanMed, Green Guide to Health Care
Cosmetics and personal care products	Environmental Working Group, GoodGuide, Campaign for Safe Cosmetics	Skin Deep, Safe Cosmetics Compact, Safe Cosmetics Business Network, GoodGuide
Cleaning products	EPA, GreenBlue Institute,	CleanGredients, SaferChoice
Electronics	Green Electronics Council, Institute for Printed Circuits, Lead Free Soldering Partnership, International Electronics Manufacturing Initiative	EPEAT, JIG, Environmental Product Declarations
Clothing and apparel	American Apparel and Footwear Association, Sustainable Apparel Coalition, OIA	Eco-labels, Eco-Index, Higg Index, Joint Roadmap for Zero Discharge, Environmental Product Declarations
Building construction	USGBC, Healthy Building Network, Swedish Construction Federation	LEED, BASTA, Pharos, Environmental Product Declarations, Eco-labels
Agriculture	National Sustainable Agriculture Coalition, Northeast Organic Farming Association	Organic Farming, Integrated Pest Management, Integrated Nutrient Management
Automobile	Automobile assembly companies, Ecology Center	IMDS, GADSL, Consumer Action Guides
Pharmaceuticals	ACS Green Chemistry Institute	Green Chemistry Pharmaceutical Roundtable

Chemical Information Exchanges within Sectors

Program	*Sector*	*Information*
International Material Data System (IMDS)	**Automobile**	**Chemicals used in automobile assembly**
IPC 1752--Joint Industry Guide (JIG)	**Electronics**	**Chemicals used in electronics**
BOMCheck	**Electronics**	**Chemicals covered by REACH and the E,U. RoHS, Battery and Packaging Directives**
Outdoor Industry Association, Chemical Management Framework	**Footwear and Apparel**	**Chemicals used in footwear and clothing production**
Cleangredients	**Cleaning Products**	**Chemicals used in formulated cleaning products**

5. Prioritize Chemical Groups in Sectors

Model: TSCA Work Plan Chemicals Prioritization



Grouping Chemicals

Grouping chemicals goes beyond the singular chemical focus—

Options:

- by chemical family
  - PFCs, halogens, heavy metals
- by end point
  - cancer, endocrine disruption, aquatic toxicity
- by exposure pattern
  - occupational hazard, hazard to children
- by function
  - flame retardant, stain prevention, degreasing

6. Accelerate Substitution to Safer Alternatives in Economic Sectors

Develop Economic Sector-Based Substitution Plans

Models:

- Massachusetts Toxics Use Reduction Plans
- Washington State Chemical Action Plans
- US EPA Chemical Action Plans

Methods for Assessing Alternatives

Alternatives Assessment Frameworks

Models:
TURI/Lowell Center Framework
EU-ECHA Framework
Biz-NGO AA Framework
IC2 AA Framework

California Safer Consumer Product Regulation

NAS Chemical Alternatives Framework

Tools for Assessing Chemical Hazards

- TURI Pollution Prevention Options Analysis System (P2OASys)
- German Column Model
- EPA's SaferChoice (DFE Chemical Hazard Assessment) Framework
- Clean Production Action's *GreenScreen®*
- Washington State's Quick Chemical Assessment Tool (QCAT)

Table 9: Example of Two Halogenated Solvents

	Human - Group 1					Human - Group 2							Eco			Fate		Physical	
	C	M	R	D	E	AT	ST	N	SnS	SnR	Irs	IrE	AA	CA	Eo	P	B	Ex	F
Chlorinated	DG	L	L	L	DG	M	X	X	X	X	X	X	M	X	X	vH	vL	X	X
Fluorinated	L	L	L	L	DG	L	X	X	X	X	X	X	DG	X	X	vH	vL	X	X

	Grades		
	Initial	Data Gap	Final
Chlorinated	C	C	C
Fluorinated	B	[illegible]	[illegible]

7. Promote Safer Alternatives

Green Chemistry and Engineering Centers

Models: Warner Babcock Institute for Green Chemistry
Center for Green Chemistry, University of Oregon
Institute for Green Science, Carnegie-Mellon
Center for Green Chemistry, UC Berkeley
Center for Green Chemistry and Engineering, Yale
School of Green Chemistry and Engineering, University of Toledo

Funding for Green Chemistry Research

Models: NSF Green Chemistry Basic Research Program

Green Chemistry Research and Development Bill

SaferMade

State Sponsored Green Chemistry Programs

- Michigan's Green Chemistry Program
  - Green Chemistry Action Plan
  - Michigan Green Chemistry and Engineering Conference
  - Green Chemistry Governor's Awards

- Northwest Green Chemistry
  - Workshops and technical assistance
  - Safer Chemicals Champion's Awards

  - Center soon to be independent

Businesses Making Safer Chemicals

Company	*Characteristics*
Segentis	Phthalate-free plasticizers
Metabolix	Chemical intermediates used in the production of resins, fibers, solvents, personal care products
SoyClean	Cleaners derived from soy and citrus, vegetable and seed oils
Air Products	Nonylphenol ethoxylates-free surfactants made from palm oil
Soy Technologies	Ready-to-use formulations for cosmetics, personal care products, paints and coatings
Allylix	Terpenes and derivatives for crop protection, biocides, flavors, fragrances and pharmaceuticals
SyntheZyme	Polyhydroxyalkanoate polymers and biosurfactants

8. Reconstruct Government Capacity

Work within Current Federal Authorities

Promulgate new regulations and standards

Set national goals and plans
Collaborate in Economic Sector Work Groups

Generate chemical information and databases
Support Green Chemistry and Engineering

Expand Federal Authorities

Reform current Chemical Control Statutes

Create a new Chemicals Agency

A National Chemicals Agency

Develop a non-regulatory Federal Chemicals Agency

- collect and disseminate information
- promote chemical research
- conducts risk, life cycle and alternatives assessments
- promote safer alternatives

KEMI
Swedish Chemicals Agency

Models: Swedish Chemicals Agency (KemI)

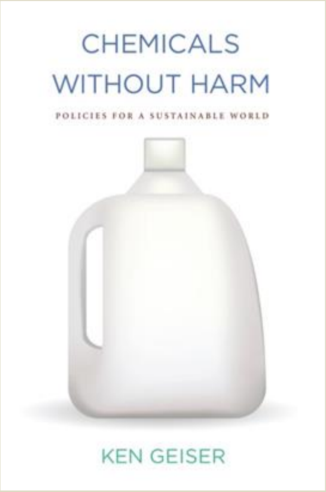
A supervisory authority that works within Sweden and the EU to promote legislation and programs that contribute to achieving “A Non-Toxic Environment”.

ECHA

European Chemicals Agency

The Agency’s mission is to ensure consistency in chemicals management across the EU and to provide technical and scientific advice, guidance and information on chemicals.

We can solve the Chemicals Problem
We can have a vibrant, productive and safer economy



It will take a broad and inclusive movement for safer chemicals

For more information

www.materialspolicy.org

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