

# Michigan Green Chemistry Conference

## **The Business Case for Green Chemistry**

Bill Stough, CEO  
Sustainable Research Group

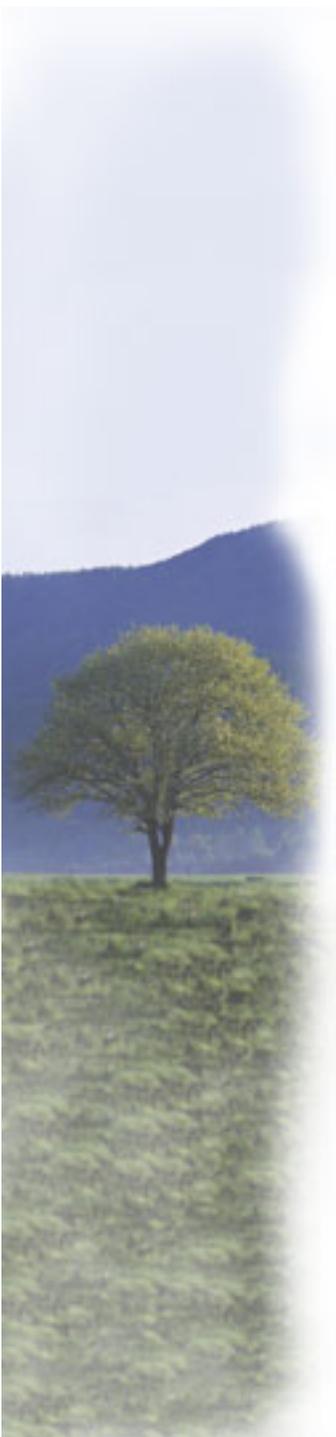




# Green Materials & Chemistry

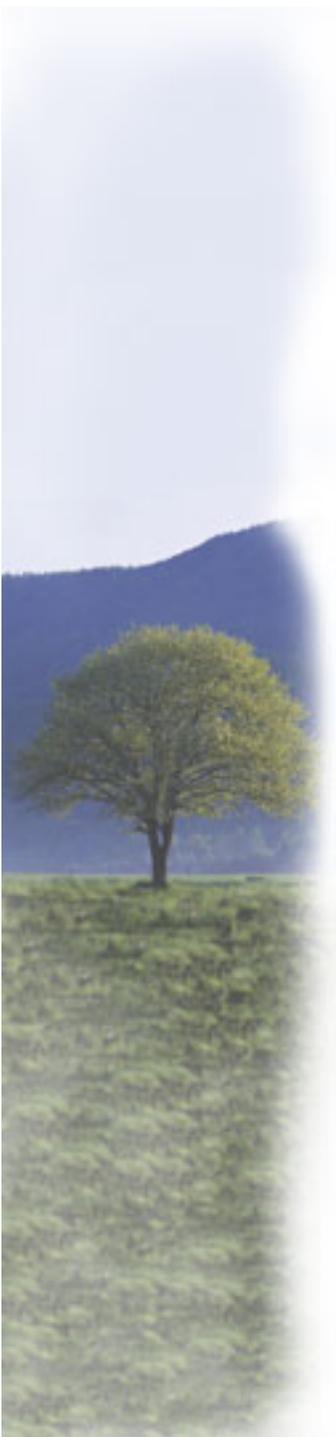
## Agenda

- Welcome and Introduction
- Our Toxic/Hazard Footprint
- TSCA Update
- What Leading Businesses are Doing
  - SC Johnson, Wal-Mart, HMI
  - BIFMA
- Advantages of Developing Strategic Links with Supply Chains
- Positioning your company “ahead of the curve”



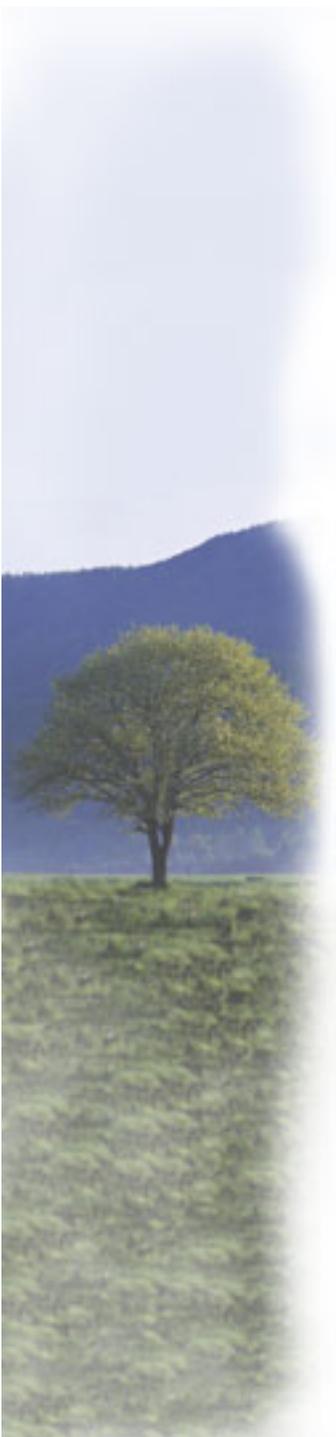
## **SRG's Mission**

Provide counsel to businesses, municipalities,  
and institutions on designing and implementing  
sustainable strategies



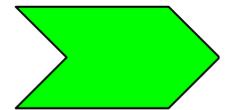
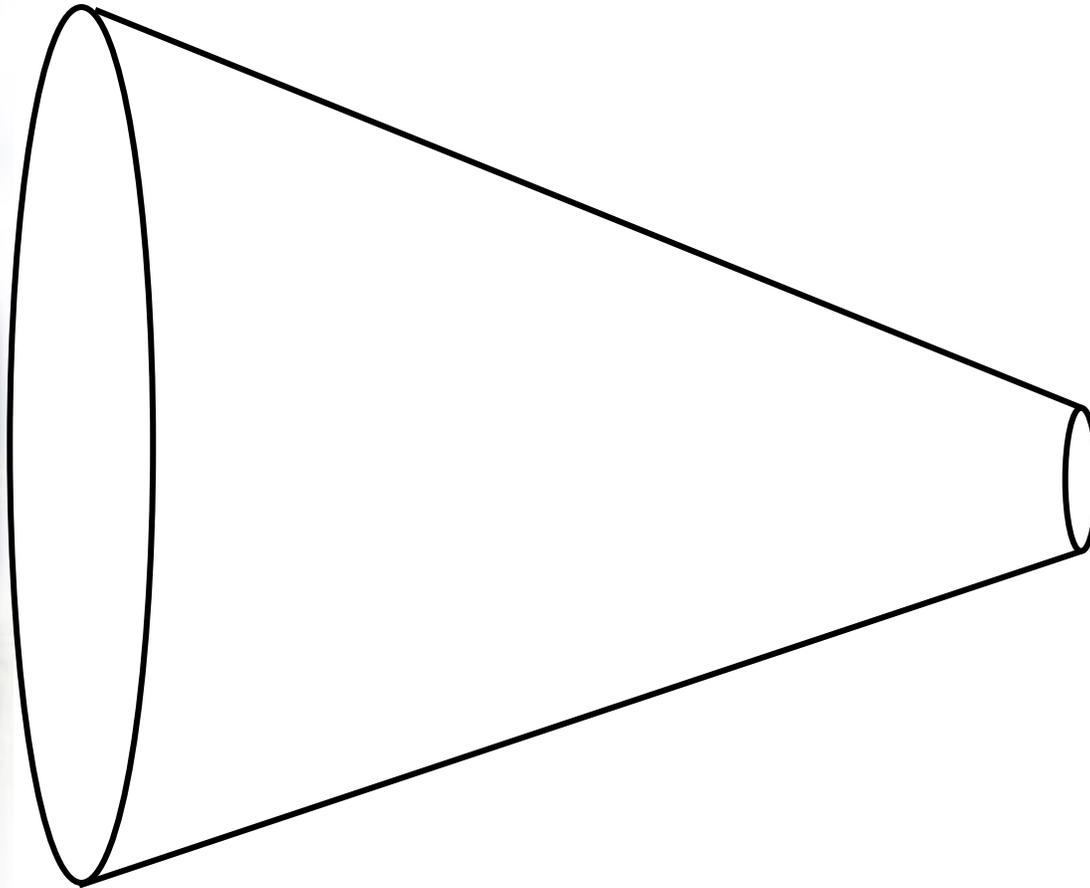
## SRG's Vision

To help create a new system of commerce for our partners that is, value-driven, life affirming and socially equitable.



## What is (environmental) Sustainability?

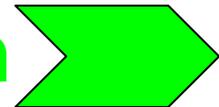
## The Concept of the Sustainability Funnel



## The Concept of the Sustainability Funnel

**Decline of Living Systems**

**Margin for Action**



**Population x Affluence x Technology**

## Population through the centuries: How we got to six billion

Through most of history, the number of deaths has been nearly the same as the number of births.

The result? Slow population growth.

Then, in the last thousand years, the curve starts to move upward.

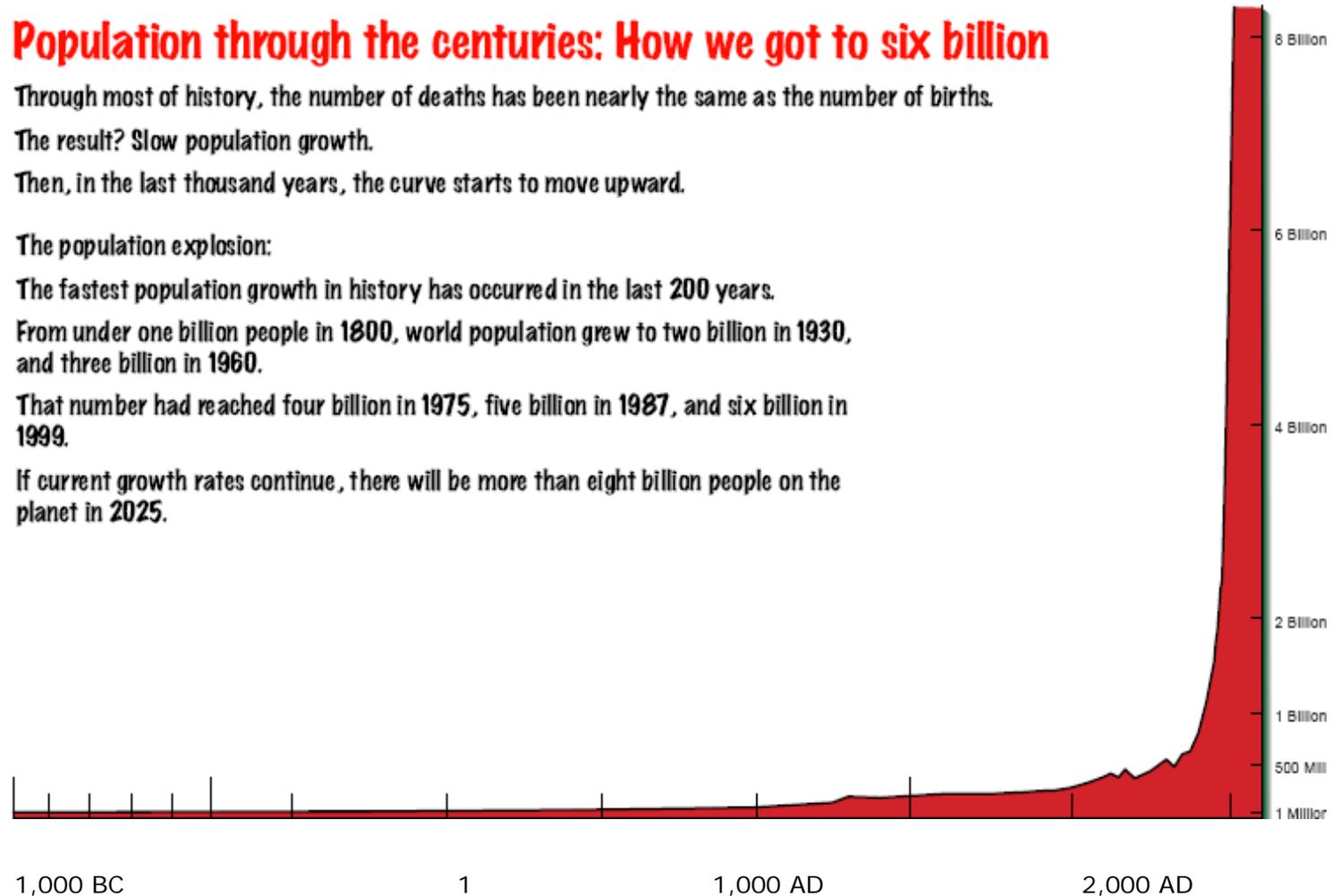
The population explosion:

The fastest population growth in history has occurred in the last 200 years.

From under one billion people in 1800, world population grew to two billion in 1930, and three billion in 1960.

That number had reached four billion in 1975, five billion in 1987, and six billion in 1999.

If current growth rates continue, there will be more than eight billion people on the planet in 2025.



10,000 BC

1,000 BC

1

1,000 AD

2,000 AD

Source: People and the Planet

# Green Materials & Chemistry

## Toxic/Hazard Footprint

A 2002 EPA sponsored study by the MDEQ and MSU estimated that there are approximately 100,000 chemicals in commercial use, of which 40,000 are in use in the Great Lakes Basin.

Defining Persistent, Bioaccumulative and Toxic Great Lake Contaminants and Research Needs, 2002

# Green Materials & Chemistry

## Toxic/Hazard Footprint

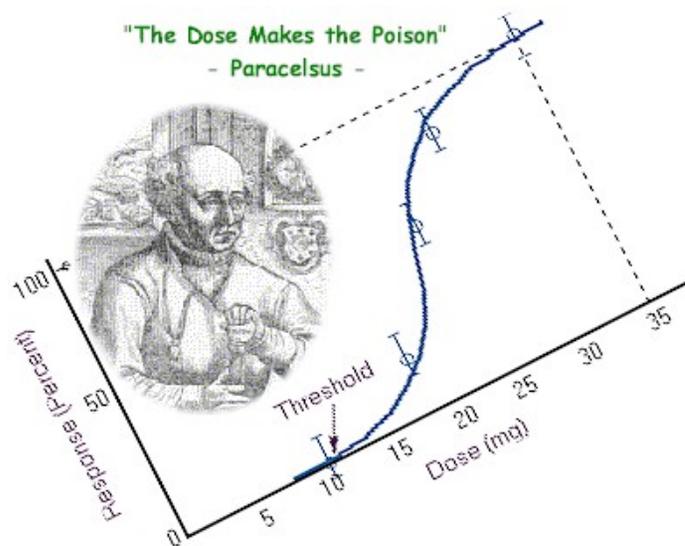
The World Wildlife Fund estimates that between 1930 and 2000 global production of man-made chemicals increased from 1 million to 400 million tons each year worldwide.

# Green Materials & Chemistry

## Toxic/Hazard Footprint

“All substances are poisonous, there is none which is not a poison; the right dose differentiates a poison from a remedy.”

Paracelsus circa 1538



# Green Materials & Chemistry

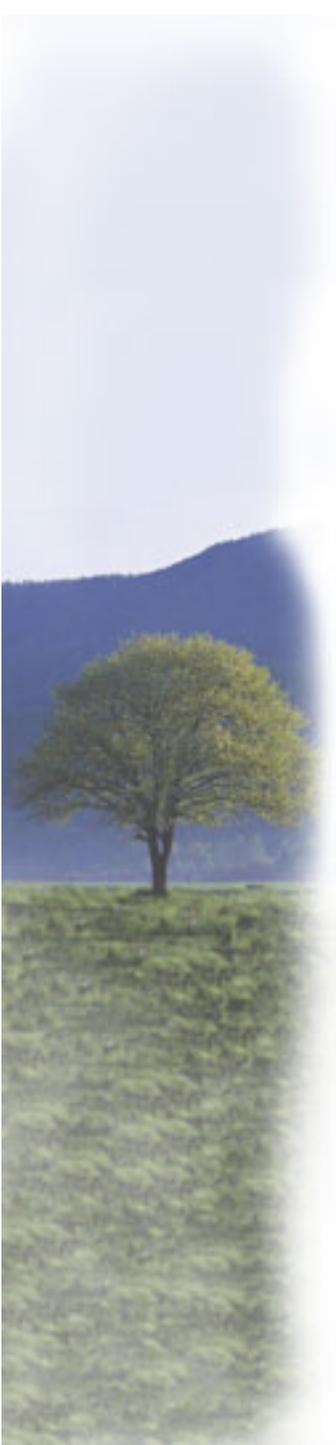
## Toxic/Hazard Footprint

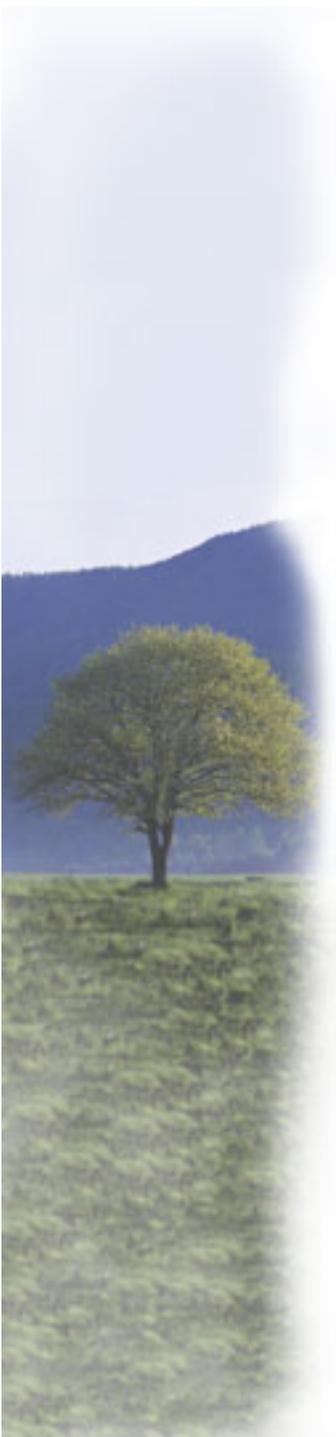
A **hazard** is a situation that poses a level of threat to life, health, property, or environment.

# Green Materials & Chemistry

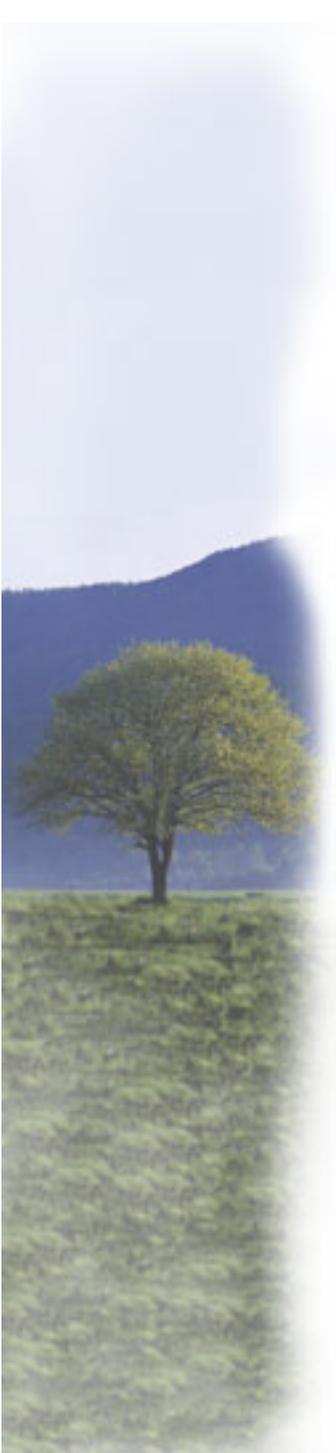
## Toxic/Hazard Footprint

Based on public, NGO and government actions, it's becoming increasingly clear that if your company has a high profile chemical in your product or your supply chain, the likelihood of you suffering toxic backlash from the marketplace and having your supply chain disrupted is rapidly increasing.

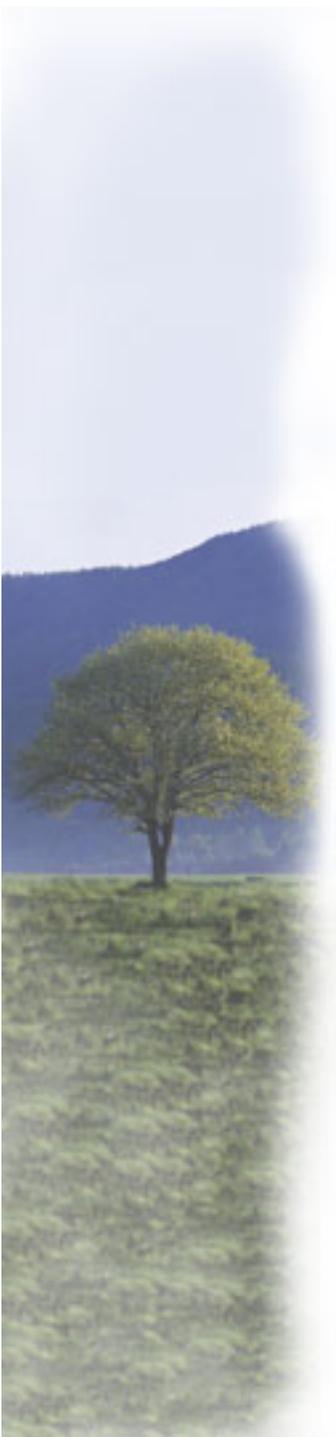
- 
- **Minnesota** enacted a new comprehensive chemical management law. It requires state officials to generate a list of chemicals of high concern and a list of priority chemicals in children's products, and by December 2010.
  - In late 2008, **California** enacted AB 1879, which directs the California Department of Toxic Substances Control to develop a framework for addressing chemicals of concern, evaluating alternatives, and moving toward safer chemical products



- In 2008 Maine enacted "Act to Protect Children's Health and the Environment from Toxic Chemicals in Toys and Children's Products."
- Also in 2008, Washington's "Children's Safe Products Act of 2008" was enacted.



On September 2007 – The U.S. House of Representatives voted to pass H.R. 2850, the Green Chemistry Research and Development Act. The legislation, introduced by **Subcommittee on Technology and Innovation Ranking Member Phil Gingrey, M.D. (R-GA)**, strengthens federal efforts to find safer alternatives to today's chemical products.



Senate Bill S2669 - The Green Chemistry Research and Development Act of 2008 provided for the implementation of a Green Chemistry Research and Development Program.

## Green Materials & Chemistry

### According to a Government Accounting Office Report to Congress in 2005 :

- Tens of thousands of chemicals are currently in commercial use in the United States;
- On average, over 700 new chemicals are introduced into commerce each year;
- In 1976 Congress passed TSCA to protect the public;

**Source:** GOA, Chemical Regulation, June 2005



## Green Materials & Chemistry

TSCA imposes the burden on government to prove actual harm in order to control or replace a dangerous chemical; and

TSCA perpetuates a failure by providing no incentives to industry to innovate toward inherently safer chemical and product design.

## Green Materials & Chemistry

**TSCA has serious flaws that impede it from ensuring chemical safety in the U.S. Specifically, TSCA:**

has failed to deliver the information needed to identify unsafe — as well as safer — chemicals;

forbids the federal government from sharing much of the limited information it does obtain (trade secrets, confidentiality);

## Green Materials & Chemistry

The Toxic Substance Control Act is in the process of being updated for the first time since 1976;

Interest groups are coming to a consensus on the need to modernize TSCA;

The first congressional reform hearings were held in February 2009.

# Green Materials & Chemistry

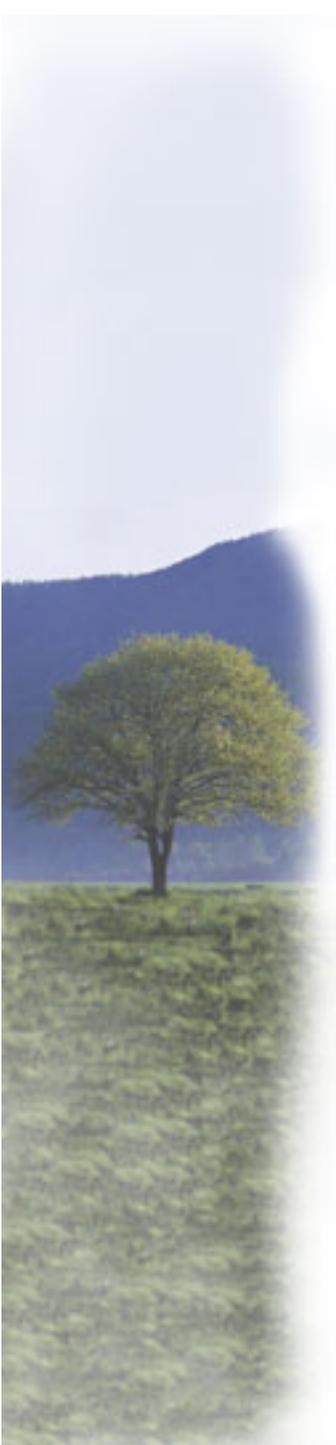
REACH which stands for Registration, Evaluation and Authorization of Chemicals came into effect in June 2007. It is designed to regulate the manufacture, import, marketing and use of chemicals in the European Union.

# REACH – Registration, Evaluation and Authorization of Chemicals

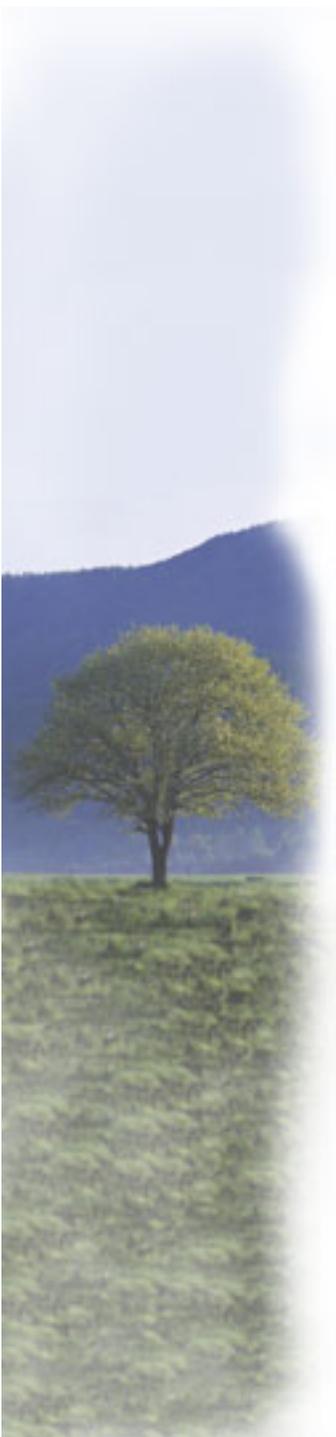
- REACH is an European Union law
- Effective 2010
- **Register** safety data for all chemicals produced in quantities above one metric ton.
- **Evaluate** safety data for higher volume chemicals and other chemicals of concern.
- **Authorize** chemicals of very high concern (i.e. really toxic ones).
- Implications for both chemical producers as well as product manufacturers.
- Must be able to document the chemical content in 'articles' down to 100 ppm and lower.

# Green Materials & Chemistry

The aim of REACH is to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances. At the same time, improve the innovative capability and competitiveness of the EU chemicals industry.



SIN is an acronym for "Substitute It Now," a list of 267 chemicals identified as "Substances of Very High Concern" based on criteria established by the European Union's new chemical management legislation, REACH.



The SIN list was generated by the European International Chemical Secretariat (CHEMSEC) and at this time is almost twenty times larger than the initial official list released by the European Chemicals Agency.

# Green Materials & Chemistry

REACH calls for the progressive substitution of the most dangerous chemicals when suitable alternatives have been identified.

## Green Materials & Chemistry

In a study spearheaded by the Environmental Working Group (EWG) researchers at two major laboratories found an average of 200 industrial chemicals and pollutants in umbilical cord blood from 10 babies born in August and September of 2004 in U.S. hospitals. Tests revealed a total of 287 chemicals in the group.

# Green Materials & Chemistry

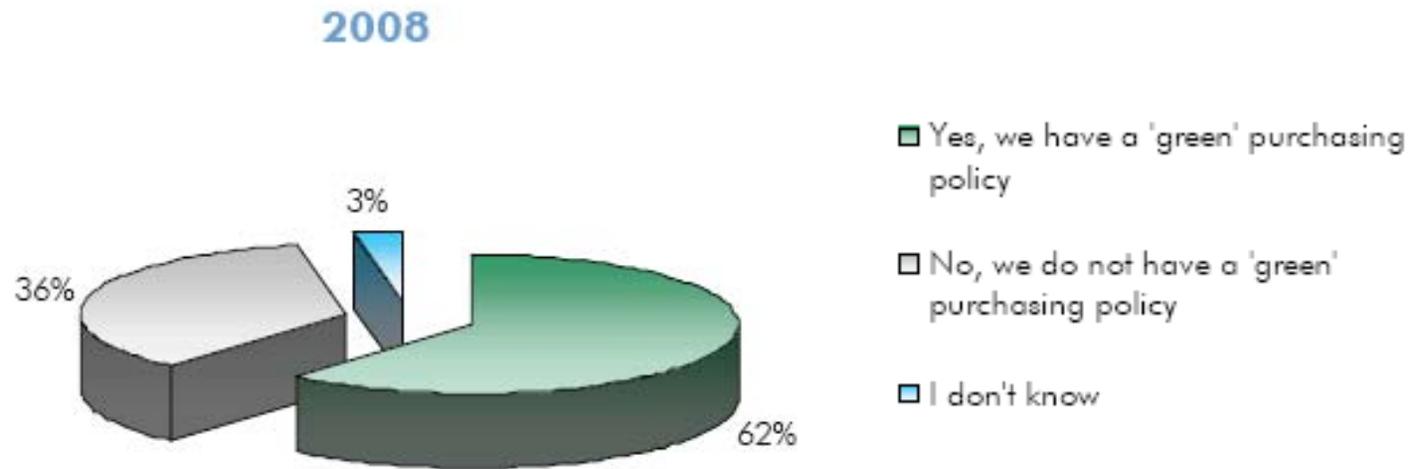
- **Mercury (Hg)** - tested for 1, found 1
- **Polyaromatic hydrocarbons (PAHs)** - tested for 18, found 9
- **Polybrominated dibenzodioxins and furans (PBDD/F)** - tested for 12, found 7
- **Perfluorinated chemicals (PFCs)** - tested for 12, found 9
- **Polychlorinated dibenzodioxins and furans (PBCD/F)** - tested for 17, found 11
- **Organochlorine pesticides (OCs)** - tested for 28, found 21
- **Polybrominated diphenyl ethers (PBDEs)** - tested for 46, found 32
- **Polychlorinated Naphthalenes (PCNs)** - tested for 70, found 50
- **Polychlorinated biphenyls (PCBs)** - tested for 209, found 147



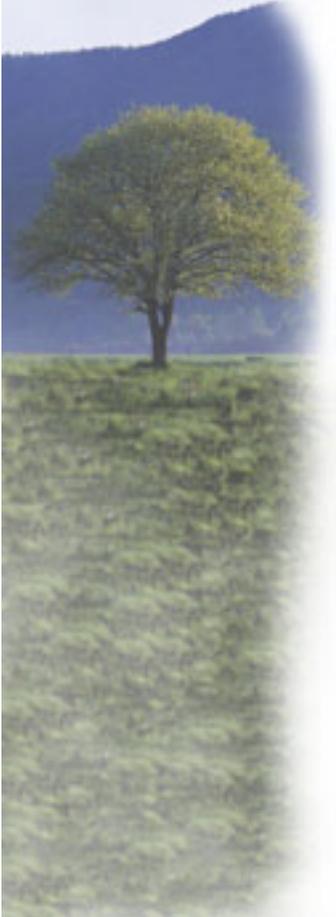
- In 2005 the Center for Disease Control conducted its 3<sup>rd</sup> report on Human Exposure to Environmental Chemicals. It analyzed human body burden from 38 chemical. Although many chemicals were lower than levels from the first report, many were high enough especially in ages 1 to 5 to cause concern.



## Market Factors



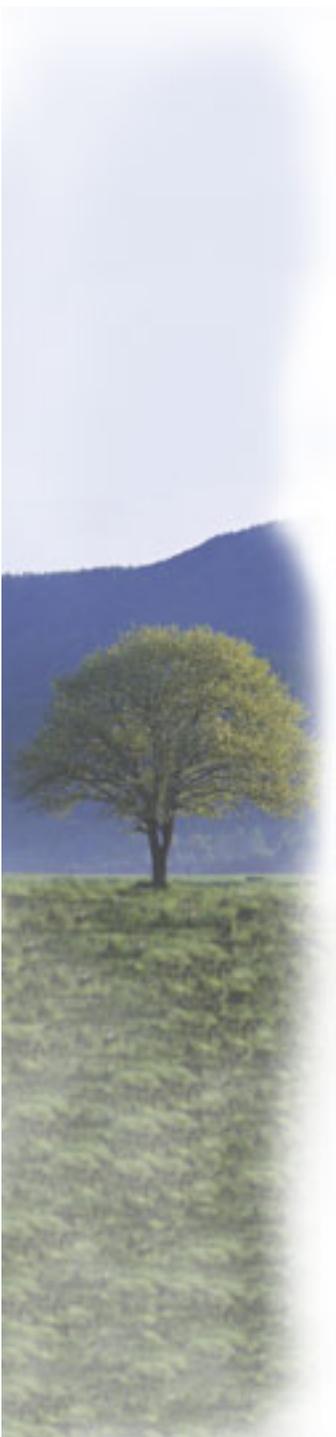
Source: TerraChoice, 7/2008



## Market Factors

In both 2007 and 2008, approximately one third of survey respondents indicated that at least **40% of their spending is influenced by environmental factors.**

Source: TerraChoice, 7/2008



## Market Factors

### Top 10 environmental concerns from purchasing professionals

1. Human Health
2. Energy Conservation
3. Toxics
4. Recyclability
5. Recycle Content
6. Water Pollution
7. Air Pollution
8. Water Conservation
9. Indoor Air Quality
10. Reduced Packaging

# Green Materials & Chemistry

Green Chemistry offers the promise to develop new products that are safe for humans and the ecosystem



## Green Materials & Chemistry

In The business case, any wastes released to the environment represent a lost economic investment for manufacturers. Green Chemistry seeks to design benign chemical processes and products at the molecular level, thereby eliminating potential wastes before they are ever produced – and ultimately saving companies money and protecting the environment.

# 12 Principles of Green Chemistry

1. Prevent waste
2. Design safer chemicals
3. Design less hazardous chemical syntheses
4. Use renewable feedstocks
5. Use catalysts, not stoichiometric reagents
6. Avoid chemical derivatives
7. Maximize atom economy
8. Use safer solvents and reaction conditions
9. Increase energy efficiency
10. Design chemicals and products to degrade after use
11. Analyze in real time to prevent pollution
12. Minimize the potential for accidents

**Source:** Anastas, Paul T., and Warner, John C. "Green Chemistry Theory & Practice"  
Oxford University Press, New York 1998

# Green Materials & Chemistry

- This June was the 14<sup>th</sup> year of the Presidential Green Chemistry Awards
- Over 12 US Colleges and Universities offer majors in Green Chemistry
- Michigan was the first state to issue a Green Chemistry Executive Order, California followed with a Green Chemistry initiative which was recently signed into law.

# Green Materials & Chemistry

## What are examples of green chemistry?

- Laundry detergents that inhibit dye transfer while cleaning clothes and reducing problematic discharges.
- Plastics designed with enzymes to degrade after use for computer casings.
- The use of enzymes instead of toxic chemicals to make pharmaceuticals.
- Enzymatic reactions that can detoxify hard-to-degrade toxic chemicals.

# Green Materials & Chemistry

## Examples of green chemistry in materials?

- Solvents, inks and other chemicals made from plants instead of petroleum.
- Plastics made from sustainably grown corn, grasses, and other renewable plants.
- Water purification processes that remove chlorinated pollutants, antibiotics, and other contaminants without generating toxic byproducts.

# Human & ecological health

Launched in 2001, SC Johnson's Greenlist program formalizes the classification of raw materials used in SC Johnson's products according to their impact on the environment and human health. To that end, Greenlist has helped SC Johnson continue to phase out certain raw materials, and use more materials considered to be environmentally "better" and "best." A 2006 Presidential Green Chemistry Award winner.





1-800-331-0085

www.walmartstores.com

## Sustainability Product Index: 15 Questions for Suppliers

### **Energy and Climate: Reducing Energy Costs and Greenhouse Gas Emissions**

1. Have you measured your corporate greenhouse gas emissions?
2. Have you opted to report your greenhouse gas emissions to the Carbon Disclosure Project (CDP)?
3. What is your total annual greenhouse gas emissions reported in the most recent year measured?
4. Have you set publicly available greenhouse gas reduction targets? If yes, what are those targets?

### **Material Efficiency: Reducing Waste and Enhancing Quality**

1. If measured, please report the total amount of solid waste generated from the facilities that produce your product(s) for Walmart for the most recent year measured.
2. Have you set publicly available solid waste reduction targets? If yes, what are those targets?
3. If measured, please report total water use from facilities that produce your product(s) for Walmart for the most recent year measured.
4. Have you set publicly available water use reduction targets? If yes, what are those targets?

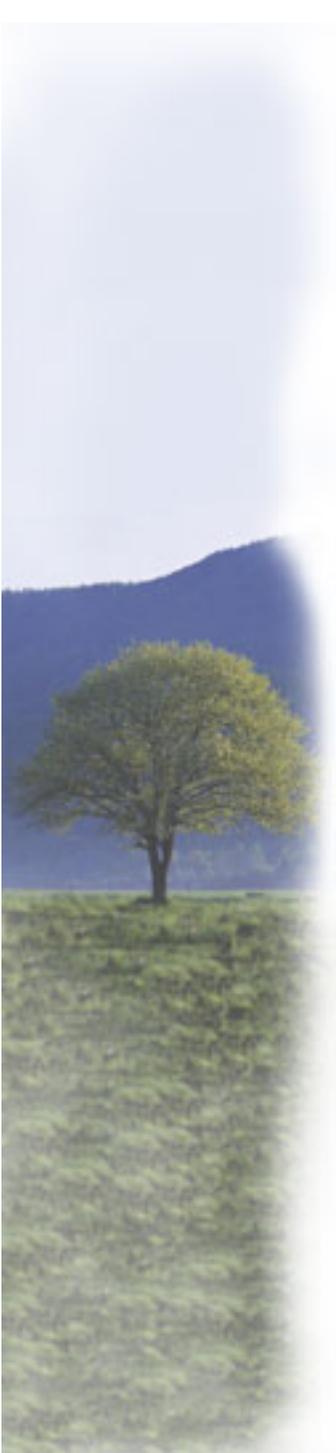
### **Natural Resources: Producing High Quality, Responsibly Sourced Raw Materials**

1. Have you established publicly available sustainability purchasing guidelines for your direct suppliers that address issues such as environmental compliance, employment practices and product/ingredient safety?
2. Have you obtained 3<sup>rd</sup> party certifications for any of the products that you sell to Walmart?

### **People and Community: Ensuring Responsible and Ethical Production**

1. Do you know the location of 100 percent of the facilities that produce your product(s)?
2. Before beginning a business relationship with a manufacturing facility, do you evaluate the quality of, and capacity for, production?
3. Do you have a process for managing social compliance at the manufacturing level?
4. Do you work with your supply base to resolve issues found during social compliance evaluations and also document specific corrections and improvements?
5. Do you invest in community development activities in the markets you source from and/or operate within?





Wal-Mart's new "Green WERCS Chemical Screening Tool" is in the implementation stage. Developed by a Wal-Mart contractor the tool identifies a chemicals' potential environmental impact and Wal-Mart is using it in hopes of driving green chemistry innovation.

The tool, scores and weights chemical product characteristics, such as how long chemicals persist in the environment and whether they build up in living systems, and whether they are linked to cancer, mutations and reproductive problems

# Certification Frameworks

BIFMA E3

# Contract Furniture Market Trends

- Environmental questions are in 85% of RFPs
- 25% Rank Environment at the Top
- LEED is driving market change
  - Recycled Content
  - Low emissions
- REACH is new EU legislation
  - Chemical Policy
- BIFMA & Cradle to Cradle & Smart
  - Product Standards

# Sustainability Certifications – A Complex World

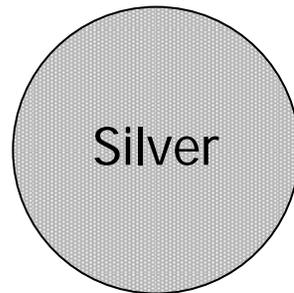
	MBDC - C2C	BIFMA - SAS	Australia	MTS	USGBC - LEED	REACH	GreenGlobes	EcoChoice Austr	Carpet Standard	ACT STS	FSC/SFI	SCS	Greenguard	SA8000	Climate Cool	CHPS/CARB	WGBC
<b>Impact Category</b>																	
Chemical Content																	
Process Chemicals																	
Certified Wood																	
Recycled Content																	
Rapidly Renewable Resources																	
Disassembly																	
Recyclability																	
Part Markings																	
End-of-Life																	
Carbon Footprint																	
Renewable Energy																	
Energy Efficiency																	
Embodied Energy																	
Emissions																	
Waste																	
Air																	
Water																	
Social Equity																	
Diversity																	
LCA																	
Product Emissions																	
ISO 140001																	



Source: Gabe Wing, HMI

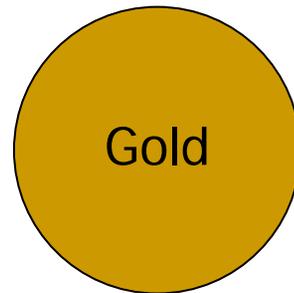
# BIFMA E3 Structure

- Point based system 90 point scale
- Mandatory prerequisites
- Categories
  - Materials
  - Energy
  - Human and Ecosystem Health
  - Social Responsibility



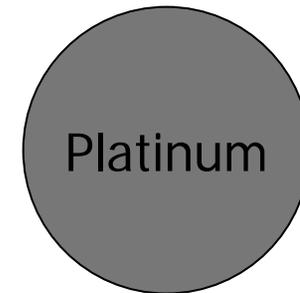
Silver

32-44



Gold

45-62



Platinum

>62

# Materials Credits

- DfE Program (prerequisite)
- Use Life Cycle Assessment
- Increase Materials Efficiency
- Biobased Materials
- Sustainable Wood – FSC/SFI
- Recycled Content – 40%
- Recyclable and Biodegradable
- Reclamation
  - Buy back, leasing programs
- End of Life Management
  - Disassembly Instructions
- Water Management
  - Inventory, Reduction



# Energy Credits



- Develop Energy Policy (prerequisite)
- Building Energy Inventory
- Energy Star Rating – 5% real estate portfolio
- Embodied Energy - Raw materials and Components
- Process Energy
- Finished Product Energy Consumption
- Transportation
- Facility Energy Usage – Green Energy
- On-Site Energy – Energy Center
- Carbon Footprint – Inventory & Reduction Targets

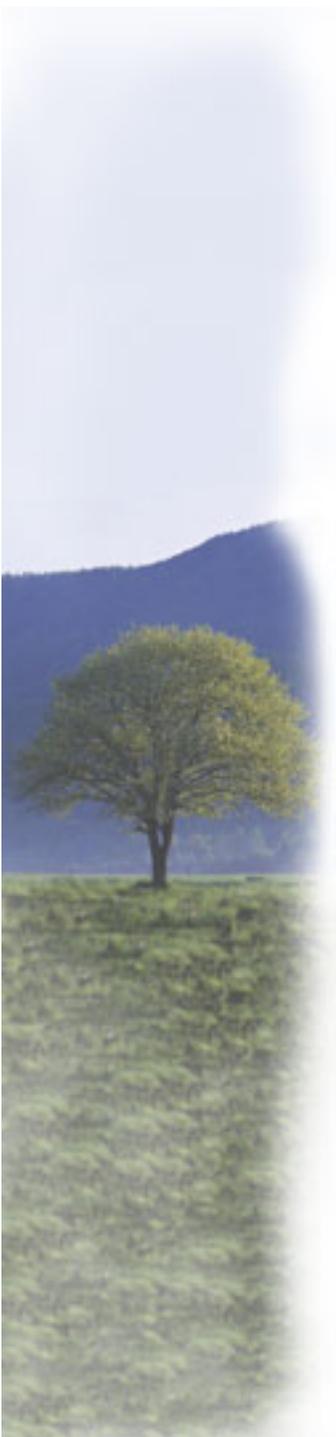
# Human & Ecosystem Health



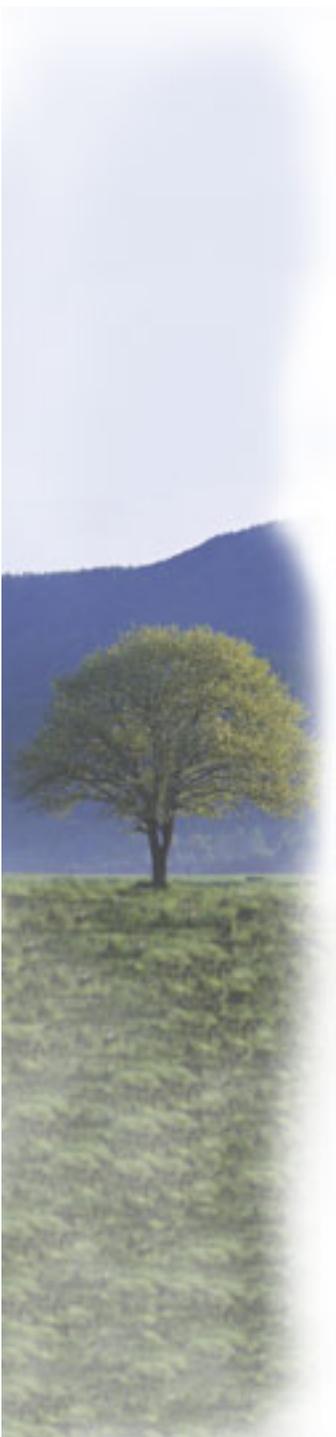
- Compliance Demonstration (prereq) – DEQ, EPA
- Key EMS Policies (prerequisite)
- Environmental Management System - ISO14001
- Chemical Management Plan (CMP)
- Assess Product Chemicals
- Assess Process Chemicals
- Assess Maintenance/Operations Chemicals
- Chemical Reduction Strategy
- Phase-out 'Red' Chemicals – Products and Process
- Reduce Hazardous Emission and Wastes
- Low Emitting Furniture – Greenguard/BIFMA

# Social Performance

- Employee Health and Safety Mgt (prereq)
- Labor and Human Rights (prerequisite)
- Policy on Social Responsibility
- External Health and Safety Management Standard
- Inclusiveness
- Engage in community outreach and involvement
- Social Responsibility Reporting
- Extend Social Responsibility into Supply Chain



## Final thoughts on a new direction



Go to the source to get material data.

- Material manufacturers
- Supplier information

## Avoid materials harmful to humans

- Known and suspected
- From mild to severe toxicity

# Focus on ecological health

- Ability to biodegrade
- Impact on climate
- Effect on plant and animal life



## Assess chemicals in a graduated way.



### **Green**

Little or no hazard; acceptable for use under the Cradle to Cradle Design Protocol.



### **Yellow**

Low to moderate hazard; acceptable for use until a green alternative is found.



### **Red**

High hazard; should be phased out as soon as possible.



### **Orange**

Incomplete data; no indication it is problematic but a complete assessment is not impossible.

# Green Materials & Chemistry

## How Else Can we take advantage of green In Michigan?

1. Analysis, education and instruction of the needs of companies in the state
2. Identify best practices
3. Create collaborative systems to identify safer chemicals
4. Increase connections to the market for greener chemicals and materials
5. Coordinate entire supply chain

# Green Materials and Chemistry

## A Manufacturer's Handbook of the Sustainable Use of Chemicals & Materials

[www.michigan.gov/documents/deq/deq-ess-p2](http://www.michigan.gov/documents/deq/deq-ess-p2)



## Green Chemistry User Group

*Green Chemistry - Solutions that are "benign by design"*

Translate green chemistry  
from theory into profitable  
practice

### User Group Description

Customers, investors and other corporate stakeholders are increasingly requesting information on the identity of the chemicals used by Original Equipment Manufacturers (OEMs) in their products and manufacturing processes. This pressure is driven by a demand for the reduction and elimination of chemicals that have negative impacts on human health and ecosystem health throughout the life-cycle of a chemical, material or product – so called "chemicals of concern". A need for such identification and assessment of chemicals is not only driven by market pressures, but also more stringent chemicals regulations, such as the European REACH regulation.

Furthermore, there is a growing market demand for "greener" materials that have a reduced impact on the environment. This is evident in the increased specification of materials that have recycled and/or biobased content, are low-emitting, free of chemicals of concern, and are compostable, biodegradable or recyclable at the end of the useful life of the material or products incorporating these materials.

In response, the Green Chemistry movement is accelerating in popularity as a conceptual framework and toolbox for developing safer chemicals and materials as substitutes for chemicals of concern. By definition, Green Chemistry states that the use of a hazardous/toxic chemical in a material, product or process should be seen as a "design flaw"; rather Green Chemistry advocates for solutions that are "benign by design".

### Output/Benefits for joining the Green Chemistry User Group:

The main challenge thus becomes how to determine if a chemical is a "chemical of concern" or represents a safer alternative? The Green Chemistry User Group will help its members tackle this question by developing appropriate resources, protocols, case studies and tools around green chemistry, human and ecosystem health end-points, life cycle impact categories, chemical assessment and policy/legislative initiatives.

The Green Chemistry User Group format will include site visits to manufacturing facilities and/or other destinations that highlight an aspect of green chemistry. Each participating companies will also benefit from an individualized site visit and chemical assessment conducted by the facilitating staff.



# Green Materials and Chemistry

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