

# Green Chemistry and Pollution Prevention

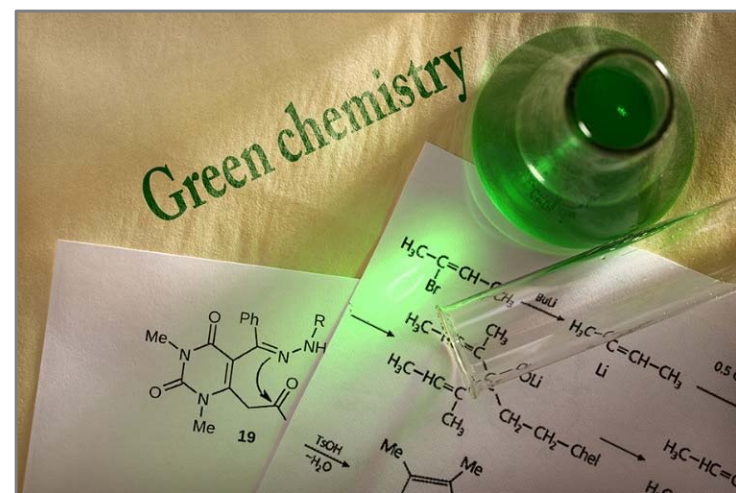
Dave Foulkes

Ohio EPA – Division of Environmental  
and Financial Assistance

Webinar – February 15, 2017

# Webinar Outline

- What is **Green** Chemistry?
- How does it relate to P2 and Sustainability?
- Supply chain examples
- Ohio success stories
- Available tools and resources



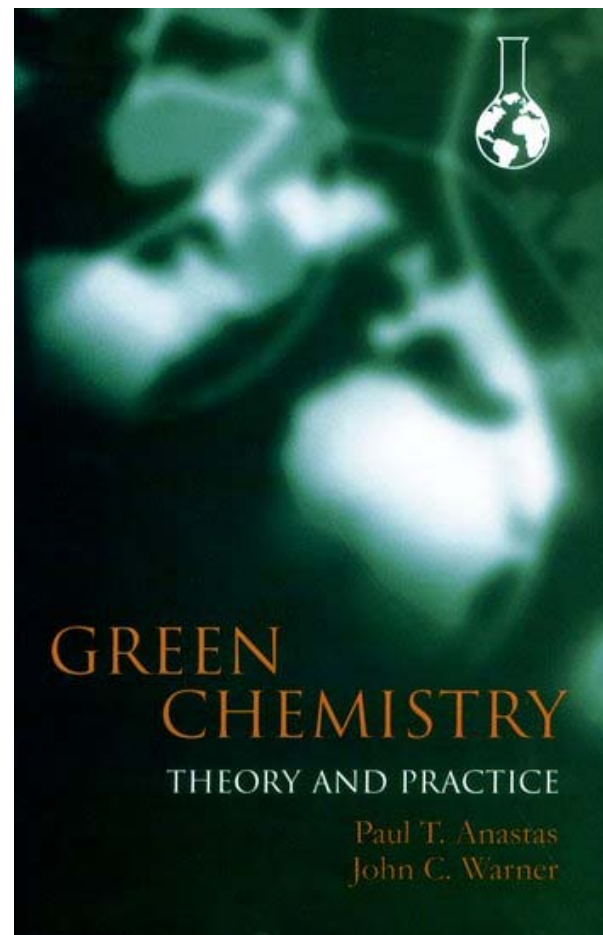
# What is Green Chemistry?

- Design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances.
- Across the life cycle of product
- Applies to all areas of chemistry
- Solutions to real-world problems

Source: [U.S. EPA's Basics of Green Chemistry](#)

# 12 Principles

1. Prevent Waste
2. Atom Economy
3. Less Hazardous Synthesis
4. Design Benign Chemicals
5. Benign Solvents & Auxiliaries
6. Design for Energy Efficiency



\*Anastas, P. T.; Warner, J. C. [Green Chemistry: Theory and Practice](#)

# 12 Principles

7. Use of Renewable Feedstocks
8. Reduce Derivatives
9. Catalysis (vs. Stoichiometric)
10. Design for Degradation
11. Real-Time Analysis for Pollution Prevention
12. Inherently Benign Chemistry for Accident Prevention



\*Anastas, P. T.; Warner, J. C. [Green Chemistry: Theory and Practice](#)

# Green Chemistry vs. P2/Sustainability

- 1<sup>st</sup> Principle is the PREVENT WASTE
- Applies across life cycle of product(s)
- Also known as sustainable chemistry
- P2 at the molecular level

*"If you build a better product, with superior performance and superior cost that, oh by the way, is more environmentally benign, it's a no-brainer."*

Dr. John Warner

*"In a few decades, it won't be special anymore...Everyone will be doing green chemistry."*

Professor Robert H. Crabtree  
Yale University  
Chemistry Department

# Green Chemistry in the Supply Chain

- Walmart's Sustainable Chemistry Policy
  - Transparency
  - Advance safer formulations
  - Safer Choice in brands
  - Monitor & Report



# Green Chemistry in the Supply Chain

## TARGET'S CHEMICAL POLICY



### TRANSPARENCY

We will strive for full visibility to chemicals contained in or used to make the products we sell and use in our operations.



### CHEMICAL MANAGEMENT

We will work with business partners to implement policies, practices and tools that facilitate the management of chemicals throughout our supply chain and across our operations.



### INNOVATION

We recognize that safer alternatives may not exist today for some chemicals, therefore we will actively pursue and promote new approaches to chemicals development and the commercialization of safer alternatives.



# Ohio Success Stories

- The Sherwin-Williams Company
  - [2011 Designing Greener Chemicals Award](#)
  - Water-based Acrylic Alkyd Technology
  - Made from PET, acrylics and soybean oil
  - 800,000 lbs. of VOC reduced



# Ohio Success Stories

- BASF Corporation
  - [2005 Greener Reaction Conditions Award](#)
  - UV-curable, low-VOC refinish primer
  - Third as much primer needed vs. conventional
  - 1.7 lbs. vs. 4.8 lbs. of VOC/gallon



# Ohio Success Stories

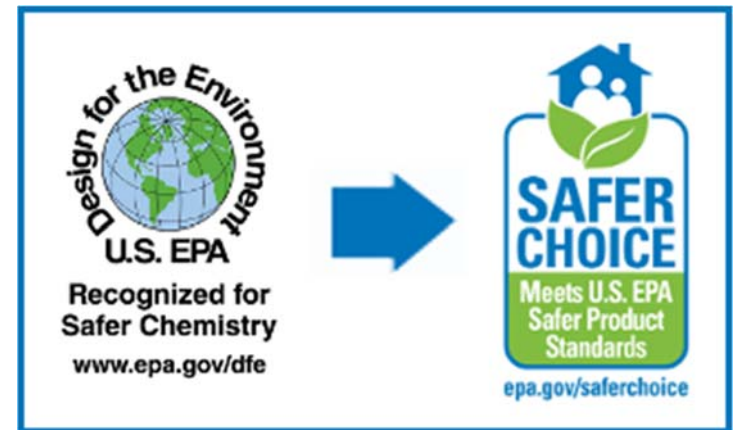
- Battelle
  - [2008 Greener Synthetic Pathways Award](#)
  - 400 million pounds toner used per year
  - Biobased Toner
  - Easier to remove toner from paper fiber
  - Save energy & more paper fiber recycled

# Ohio Success Stories

- Faraday Technology, Inc.
  - [2013 Small Business Award](#)
  - Tri-Chrome plating process
  - Nearly drop-in replacement
  - Could eliminate 13 million lbs. of Hex-Chrome

# What labels are available?

- Safer Choice Program
  - Increase awareness & recognition of label
  - Encourage innovation & development of safer chemicals
  - Evaluation & review process
  - 2,000 plus products carry label



# What labels are available?



- Green Seal

- Standards for cleaning products, paints, paper & packaging

- ECOLOGO Certification

- Multi-attribute, lifecycle-based environmental certification

- Building materials, cleaning products, office products, electronics, etc.



# Green Chemistry Tools

- Typical tools
  - ID & screen out hazards
  - Compare alternatives
  - ID preferred chemicals/products
  - Life-cycle analysis
- Tools vary
  - Some are free & some are not
  - Be aware of data gaps
  - Chemicals ranked differently

[Safe Products, Made Safely: Green Chemistry Tools for Business Resources Guide](#)

# Use in the supply chain

- Reasons for using tools in Supply Chain
  - Raw material/component supplier
    - Information to downstream user
  - Manufacturer/Assembler/OEM
    - Safer alternative materials
  - Retailer
    - Screen products
  - Corporate sustainability goals

[Safe Products, Made Safely: Green Chemistry Tools for Business Resources Guide](#)



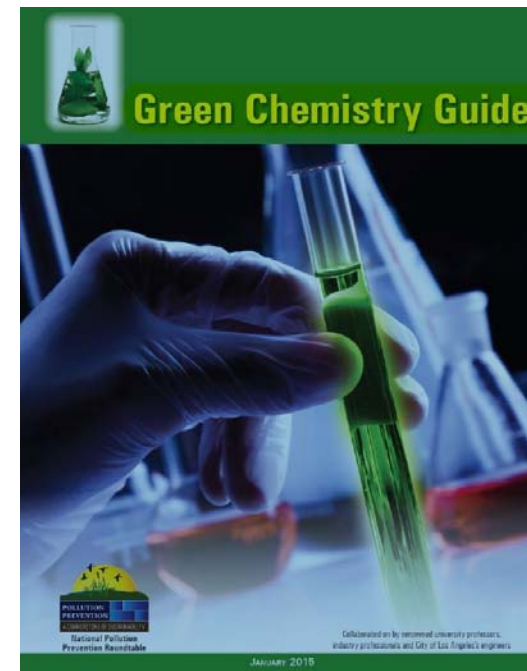
# Green Chemistry Tools

- What do you want to tool to do for you?
  - ID chemicals
  - Assess chemicals in use
  - Analyze lifecycles
  - Track materials, use and outputs
  - Look for alternatives/substitutions
  - Evaluate alternatives

[Safe Products, Made Safely: Green Chemistry Tools for Business Resources Guide, 2014](#)

# Green Chemistry Resources

- [Green Chemistry Guide](#)
  - Collaborative document
  - Tools, life-cycle thinking & how-to checklist
- [Safe Products, Made Safely:](#)  
*Green Chemistry Tools for Business Resources Guide*
  - How to choose the right tool
  - List of organizations that can help



# Green Chemistry Resources

- [BizNGO Chemical Alternatives Assessment Protocol](#)
  - ID alternatives
- [OECD Substitution and Alternatives Assessment Toolbox](#)
  - Compilation of resources
  - 4 resource areas

The screenshot shows the homepage of the OECD Substitution and Alternatives Assessment Toolbox. At the top, there is the OECD logo with the tagline "BETTER POLICIES FOR BETTER LIVES" and a navigation menu with links for HOME, ABOUT, RESOURCES, and GLOSSARY. A yellow banner prompts users to take a short survey. The main heading is "OECD Substitution and Alternatives Assessment Toolbox". Below this, a welcome message states: "Welcome to the OECD Substitution and Alternatives Assessment Toolbox (SAAT) — a compilation of resources relevant to chemical substitution and alternatives assessments. Visit the four resource areas below to learn more about chemical substitution and alternatives assessments and get practical guidance on conducting them." To the right, a callout box titled "What's an Alternatives Assessment?" explains the process: "A process for identifying, comparing and selecting safer alternatives to replace hazardous chemicals with the objective of promoting sustainable production and consumption. Read more definitions..." Below the welcome message, four resource areas are listed with brief descriptions and "Learn more" links:

- Alternatives Assessment Tool Selector**: A filterable inventory of chemical hazard assessment tools and data sources to help you identify tools most relevant to your substitution and alternatives assessment goals. A listing of non-hazard assessment tools is also available.
- Alternatives Assessment Frameworks**: A summary of the current frameworks that can be used to assess alternatives. Guides and other resources for conducting a chemical substitution or alternatives assessment are included.
- Case Studies and Other Resources**: Links to case studies, toolkits, and product rating systems that provide examples, insights, and lessons learned on substitution and alternatives assessment approaches.
- Regulations and Restrictions**: A list of regulations and restrictions throughout OECD member countries that are driving the increased need for chemical substitution and alternatives assessment approaches.

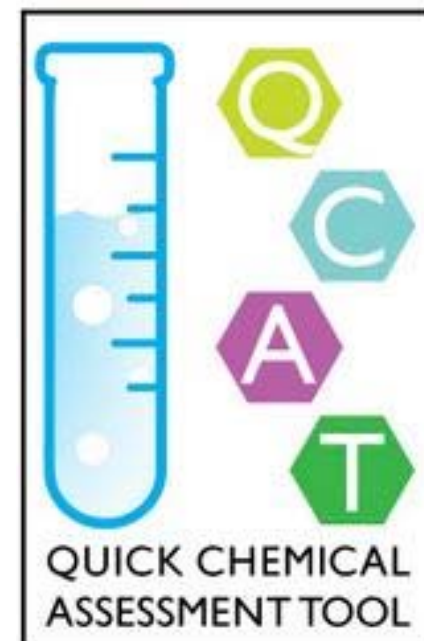
# Green Chemistry Resources

- [Interstate Chemicals Clearinghouse](#)
  - Collaborate & manage/analyze data
  - Offer training
- [GreenScreen<sup>®</sup> for Safer Chemicals](#)
  - Chemical hazard assessment
  - [GreenScreen<sup>®</sup> List Translator](#)



# Green Chemistry Resources

- [Quick Chemical Assessment Tool](#)
  - Simple, less expensive
  - Small business friendly
- [The Green Chemistry & Commerce Council](#)
  - Cross sectoral network
  - Promotes tools, polices and business practices



# Thank You!

- Dave Foulkes, Environmental Specialist
- Ohio EPA – Division of Environmental and Financial Assistance
- [dave.foulkes@epa.ohio.gov](mailto:dave.foulkes@epa.ohio.gov)
- (614) 644-3118