

State of the Lakes Ecosystem Conference  
(SOLEC) Workshop

Laying the Foundation for a Great Lakes  
Green Chemistry Network

November 3, 2006

Milwaukee, WI

Report Back to BTS Integration Group Meeting

December 7, 2006

Chicago, IL

## Keynote Speakers:

**John Warner, PhD**

Director, University of Massachusetts, Lowell  
Center for Green Chemistry

**Berkeley W. Cue, Jr., PhD**

## Invited Discussants:

Clinton Boyd, Survey Research Group

Tracey Easthope, Ecology Center

Todd Nettesheim, USEPA

Michelle Smith, Rohm and Haas

Beverley Thorpe, Clean Production Action

John Weeks, SC Johnson

Chris Wolnik, Pollution Prevention Canada

# Goal of Workshop:

## To develop a plan for establishing a Green Chemistry network in the Great Lakes

### Questions Posed to Participants:

- What are the policy needs to push the development of green chemistry further in the Great Lakes?
- What are the barriers?
- What opportunities does green chemistry offer to Great Lakes industries?
- What role will Great Lakes academia and stakeholders play?



# Why a Great Lakes Green Chemistry Network?

- Currently there is a disconnect within and between agencies on who and where Green Chemistry work is being done;
- Also, a lack of coordination between agencies and Industry on GC, disparate departments working on various aspects of GC or sustainability with little coordination
- EPA GLNPO – GC is a component of work several programs, hard to have a dedicated person/program because of obligations with BTS or various Toxics Reduction, P2 projects/initiatives; perhaps through the proposed network these programs can connect up
- Setting up a network can fill these gaps, bridge the disconnect and educate within agencies in US and CA
- GC network as mechanism that integrates GC as a way to achieve goals of these various initiatives and programs
- GC network as a way to link up existing work in academia with needs of industry and promote new research directions to meet those needs

# Keynote:

## John Warner, PhD

Professor, Plastics Engineering  
Director, Center for Green Chemistry  
University of Massachusetts Lowell

In trying to understand the chemical problems of today and explain what green chemistry is, there is a recognition that both the *culprits and heroes* are the synthetic and industrial chemists. We need safe products and viable economies, and this leads to the questions:

“How did we get toxic products?”

“Who in their right mind would go in to a laboratory to make toxics?”

Well, for one thing, it is a result of a lack of science or language about environmental issues and impacts. Currently, there is no way or standard practice for how to speak, discuss, communicate with chemists about how to make something safe.

When we have an alternative that performs as well as the toxic product, that is green chemistry.

The point of defining *green chemistry* is to codify it so that one can teach it and create a science out of it – get those working at molecular level making safe molecules



- Over 13,000 US degrees (undergrad, master, doctoral) in chemistry were awarded in 2004 and for these degrees there was no toxicological knowledge requirement nor was there any knowledge requirement with respect to environmental impacts.
- *The primary disconnect is that chemistry students in the US are not required by their universities to know anything about toxicological impact of their creations.*
- In contrast, internationally, developing countries are way ahead of the U.S. in green chemistry education, research and design. India, for example, (where, incidentally, many U.S. jobs have gone) is requiring a course for their chemistry students. India's Ministry of Education has mandated that all chemistry undergraduates must take 1 year of Green Chemistry.
- China has opened a number of Green Chemistry Research Institutes

# Recommendations

- Create a partnership between academia, industry, government and ngo's.
- Create a "Associates Degree in Green Chemistry Technologies"
- Create a Great Lakes Green Chemistry Research Network
  - Pick several academic sites dedicated to green chemistry research.
  - Establish an identity.
  - Have twice a year "industry showcases" where academics describe their research AND industry presents their needs.
- Create a Great Lakes Green Chemistry Industrial Sabbatical Program
- Create "niche Green Chemistry Scholarships"



Keynote:

Berkeley W. Cue, Jr., PhD

American Chemistry Society Green Chemistry Institute

[In the war room,] high on the wall, hangs a big,  
white sheet of paper on which is written:

***" Culture eats strategy for  
breakfast."***

<http://www.noisebetweenstations.com/personal/weblogs/?p=1820>



## Communities of Practice



Communities of Practice (CoP) are defined by Etienne Wenger as:

“Groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise by interacting on an ongoing basis.”

# Consortium Success Criteria

(Daniel Watts, NJIT)

- Establish clear points of contact
- Produce regular reports/determine whether customers' needs are met
- Need research agility
- Inclusion - no one or two members dominate



# Consortia fail because

- Businesses consolidate, insufficient critical mass
- Business environment not supportive
- Research ideas are exhausted

# Different Models of Consortia

## Canadian Green Chemistry Network

- Exploit Canada's green advantage for the production of biobased chemicals and fuels.
- Invent reactions that reduce production of greenhouse gases.
- Adapt to work in environmentally benign solvents such as supercritical CO<sub>2</sub> or ionic liquids.
- Harvest electricity, a renewable energy, for chemical synthesis.
- Evolve enzymes for chemical synthesis of fine chemicals and pharmaceuticals.
- Convert biomass, e.g. lignin, to synthetic intermediates and fuels.
- Develop manufacturing methods using biocatalysis.
- Convert complex lignocellulosics to homogeneous thermoplastics.
- Evaluate whether new process really are green

# New England Green Chemistry Consortium (NEGCC)

In 2002 the New England Green Chemistry Consortium (NEGCC) was established to build strategic partnerships and alliances in the New England area among the six land-grant universities, small and large businesses and state and federal government.

The mission of the NEGCC is to educate, discover, develop, apply, and promote green chemistry in all its forms and thereby reduce the intrinsic hazards of the Chemical Enterprise. The NEGCC has a common goal of pursuing innovative research to examine, utilize and further develop the principles of green chemistry and better enable the competitiveness and productivity of industry.

A further objective is to promote green chemistry through education and outreach.



The NEGCC hopes to:

- Promote and support new and existing interdisciplinary, Green Chemistry research and development projects involving collaborations between New England Universities and Industry.
- Expand the relationship between area Universities and State and Federal Government to help identify potential mechanisms for accelerating the adoption of Green Chemistry technologies and help to remove potential barriers.
- Seek to incorporate Green Chemistry Principles into the education of current and future chemists and engineers, and demonstrate to the community that Chemistry must be a part of the solution.

# Green Chemistry in Commerce Council (GC3)

Created from a conference in 2005 cosponsored by  
University of Virginia/Darden Business School  
Batten Institute (Andy Larson) and  
University of Massachusetts, Lowell  
Center for Sustainable Production (Joel Tickner)

## Mission

Promote and support green chemistry and design for environment research and practices and purchases nationally among states, federal agencies and other companies by:

- Implementing green chemistry, green engineering, and design for environment throughout supply chains and share strategies to overcome barriers;
- Promoting education and information on safer chemicals and products that can increase demand by broad range of consumers; and
- Identifying existing and needed information on toxics hazards, risks, exposures and safer alternatives to promote "green chemistry" as defined in the 12 Principles of Green Chemistry.

- **Pharmaceutical Roundtable (GCIPR)**

A coalition between the Green Chemistry Institute (GCI) and pharmaceutical corporations united by a shared commitment to integrate the principles of green chemistry and engineering into the business of drug discovery and production.

Mission: To catalyze the implementation of green chemistry and engineering in the pharmaceutical industry globally.

- **Great Lakes Region Pollution Prevention Roundtable**

The Great Lakes Region Pollution Prevention Roundtable (GLRPPR) is a professional organization dedicated to promoting information exchange and providing networking opportunities.



# Some GLR Universities with Green Chemistry Programs



Cornell University



Source: Buzz Cue

## A Good Foundation for Building a Great Lakes Regional Green Chemistry Consortium Exists Already:

Michigan Green Chemistry Directive recently signed by  
Governor Granholm

Filed October 17, 2006 Executive Director 2006--6:

Promotion of Green Chemistry for Sustainable Economic Development and Protection of Public

- A. State departments and agencies shall seek pollution prevention and sustainable economic development through green chemistry by doing all of the following:
- 1. Encouraging the research, development, and implementation of innovative chemical technologies that accomplish pollution prevention in a scientifically sound and cost-effective manner.**
  - 2. Promoting the use of chemical technologies that reduce or eliminate the use or generation of hazardous substances during the design, manufacture, and use of chemical products and processes.**
  - 3. Encouraging the use of safer, less toxic, or non-toxic chemical alternatives to hazardous substances to promote sustainable economic development in Michigan.**



## *Resources for Industry: A Model from the State of Michigan*

Clinton Boyd, Sustainable Research Group

**West Michigan Regional Sustainable Manufacturing Initiative  
2-year project funded by US EPA**

*Key organization & partners:*

**West Michigan Strategic Alliance  
Right Place, Inc.**

**Sustainable Research Group  
Grand Valley State University**

Project components:

- **Green Supplier Network (GSN) assessments**
- **Manufacturer User Groups & Advisory Councils– Sustainable Manufacturing;**
- **Green Chemistry & Engineering; Bio Manufacturing; Bio-based materials;**
- **Emerging Technologies**
- **Industry Collaboration Projects (Eco-Industrial Park)**
- **Sustainability Key Performance Indicators**



# Policy Initiatives on National Level

## Federal Green Chemistry Legislation

- Create a national green chemistry R&D program to
  - Increase green chemistry research at NSF, EPA, DOE, NIST, and others
  - Examine federal incentives
  - Facilitate adoption of innovations
  - Expand education at all levels
  - Disseminate information
  - Provide venues for outreach and recognition
  - Convene public discussions and consensus conferences

# Key Points From Breakout Session

- Need to look at the question of the regional value added:
- Some things happen better at state-level, what makes sense regionally?

## Suggestions:

- mapping of regional institutions may be critical to answering this question, key players, contacts, etc.; it is critical to go with the flow; capitalize and compliment
  - looking at testimony for GC 1215 (proposed Federal legislation) which encompasses many takes on problems and solutions, and also opportunities, green chemistries not yet diffused to companies
  - a research agenda that we need to drive
  - disconnect between need and solutions, the best environment and performance profile
- Two things need to happen:
    1. Intellectual change, understanding
    2. Reorient, Eventual shift in manufacturing, a response to intellectual shift

Of the above, which lends it self best to a regional operation/network?

- Focus should extend into the arenas of engineering (environmental engineering currently in the *civil* engineering program) and business schools;
- Lesson from Pharmaceutical industry: bring in the engineers early on, they must have an impact in order to operationalize and integrate green chemistry for example into the plant operations
- Great Lakes economic situation
  - what does green chemistry offer our region?
  - new, impressive feedstocks – the Great Lakes need alternative feedstocks. Are there things we're suffering now in the Basin that GC could help?
- Innovation and design is something we can always look to if we invest in it
  - the process of design and innovation can stay in the GL



# Suggestions and Proposals for Future Work

- Regional conferences, offering opportunity for diffusion NOT proscriptively forcing the solutions;
- Suggest a special session or manager's session of IAGLR to begin the discussion of GC needs.
- Organize by material rather than industry sector to encourage cross-talk between chemists across many sectors, dissemination and provide a broad purview from which companies can pick, unanticipated discoveries open doors; consider a Wingspread conference bringing different sectors together.
- Create a small fluid, loose collaborative group to begin implementing the suggestions below Simply a commitment to participate and begin the discussion as to who needs to be at the table, who needs to be engaged, what is the scope.
- Look at other existing models for organization rather than developing a whole new organization; GLPRR, IAGLR, etc.

# Next Steps

- Create interim website to house resources and share information
- Planning teleconferences with interested parties to continue workshop discussions and explore for example:
  - developing a small committee to implement some workshop suggestions
  - mapping regional institutions
  - explore regulatory barriers to adoption of GC
  - a face to face conference in 2007 or 2008
  - Great Lakes Protection Fund as regional funding mechanism

## Ad Hoc Volunteer Coordinating Work Group

Todd Abel, Chlorine Chemical Council

Lin Kaatz Chary, Great Lakes United

Rachel Heckl, Great Lakes United

George Kuper, Council of Great Lakes Industries

Todd Nettesheim, GLPNPO

Beverly Thorpe, Clean Production Action

Hassimi Traore, Chair of Chemistry Department, University of WI, Lakeside

Chris Wolnick, Canadian Pollution Prevention

Michelle Smith of Rohm and Haas has also graciously offered to be a sounding board and advisor as discussions proceed



## For Further Discussion in BTS: Potential BTS Role?

- How does this work fit into discussion of what the BTS agenda will be in the future?
- BTS stakeholders participation in GC Network building, GC education module development
- BTS forum to launch or disseminate information on Green Chemistry
- Other??

## Thanks to All Who Participated in Workshop and Made it a Success!

- Clinton Boyd, Sustainable Research Group
- John Weeks, S. C. Johnson Company
- Evelyn Strader, Council of Great Lakes Industries
- Chris Wolnik, Canadian Centre for Pollution Prevention
- Ray Vaughan, NYS Attorney General's Office
- Edwina Lopes, Environment Canada
- Kate Taillan, Environment Canada – Toronto
- Todd Abel, Chlorine Chemistry Council
- Todd Nettesheim, EPA – GLNPO
- Hassimi Traore, University of Wisconsin – Whitewater
- Shawn Michajluk, Environment Canada
- Judith Gottlieb, Wisconsin DNR
- Michelle Smith, Rohm and Haas
- George Kuper, Council of Great Lakes Industries
- Rachel Heckl, Great Lakes United
- Lin Kaatz Chary, NWITAP / Great Lakes United
- Tracey Easthope, Ecology Center of Michigan
- Bev Thorpe, Clean Production Action
- John Warner, UMASS Lowell / Center for Green Chemistry
- Buzz Cue, Pfizer (retired) / Board of Directors American Chemistry Society