

Thank you for the opportunity to talk about our hopes for the Green Chemistry initiative in Michigan.

I have worked at the Ecology Center for almost 20 years. For much of that time, I've worked at the end of the pipe or at the end of the industrial process - after chemicals or materials have already been designed and manufactured and released into communities, or waterways, or the air. At that point, if problems surface, they are usually very complicated and controversial and often expensive to address. Sometimes the damage is irreversible.

I've noticed something very important about these kinds of problems - nobody ultimately wins. There may be short term gains, but over the long term, there are no winners - not the companies or their employees - not the communities, not our ecological systems- not the government, which is usually criticized by somebody for something - and despite what people say, not even environmentalists win.

These statistics are probably not new to those in the room.

Global chemical production is expected to double every 25 years - this increasing volume of chemicals will eventually enter the planet's finite ecosystem. Between now and 2033, the EPA estimates hundreds of new hazardous waste sites will be created each month, costing an estimated 250 billion dollars to mitigate. Tens of thousands of workers are diagnosed each year with chronic diseases that are

attributable to chemical exposures on the job. The cost of pediatric illness attributed to environmental exposures for just four conditions is estimated at 54 billion annually. The loss of fisheries and other ecosystem services is also significant.

The number and complexity of regulations has increased exponentially in the last 30 years, complicating operations for business. But at the same time, there have been a series of reviews of the regulation of toxic chemicals by agencies like the Government Accountability Office, the National Academy of Sciences, the Congressional Office of Technology Assessment, the EPA, the University of California and others concluding chemical regulation is not adequate. Just last month, the editor of Science Magazine editorialized that our system for managing chemicals in products is still ineffective after all these years.

The production of chemicals is largely dependent on oil and natural gas as both a feedstock and as a fuel for chemical production. The production of chemicals accounts for 30% of U.S. industrial energy consumption. The volatility of oil and natural gas prices, and the now overwhelming consensus that aggressive action to address global warming is required, are likely to lead to sea changes in chemical production.

So, how do we respond? We could continue to do the same things in the same way, having the same conversations and the same fights. Instead, we'd like to participate in a new conversation – in a conversation about design and hazard reduction up front that has multiple winners and multiple benefits. We are sincerely seeking ways to engage with all stakeholders in this conversation.

Al Gore said in his Nobel acceptance speech the other day said he believes we must adopt, “principles, values, laws, and treaties that release creativity and initiative at every level of society in multifold responses originating concurrently and spontaneously.”

That sounds right, not just for global warming, but also for the challenge that faces us with chemicals. We want to figure out a way to generate that kind of flowering of innovation and initiative and creativity here in Michigan. That's the challenge before us.

And why not Michigan? We have the manufacturing base, the research & development capacity within industry and academia, and a beautiful and vulnerable ecosystem to protect. A restored and protected environment promises to be an unparalleled economic engine far into the future. The lakes represent the largest reservoir of fresh water in the world. Geologically, the lakes are relatively new, and new ecosystems tend to be less complex, and more vulnerable to perturbations. The lakes also have a long residence time, so

chemicals tend to stay here, particularly persistent bioaccumulative chemicals, cycling through the food web on which we all depend. The International Joint Commission, in a review by their Science Advisory Board in 2005, reaffirmed that the presence of chemicals in the Great Lakes today still pose risks to people and wildlife at current levels of exposure.

The public understands these issues, and is longing for visionary solutions. Polling data suggests the residents of Michigan are concerned, link pollution issues to their health, and want action.

Green Chemistry promises the kind of visionary action people are longing for. There are opportunities for real business growth and economic development. Michigan is well placed to capitalize on the expected explosive growth in biochemicals and biomaterials, particularly bioplastics. This may provide greater value added and at a more sustainable scale than the current biofuels focus. Michigan has the third most plastics industry employees in the nation.

Bioplastics production is expected to increase from less than one percent now to more than 25% of total production in the next 25 years. But challenges remain for many applications, and innovation is necessary. Michigan is well-placed to be a center of innovation in biomaterials. Solutions that are truly sustainable and green and equally well-performing will have an advantage in the marketplace.

Biochemicals and biocatalysis have similar growth projections, and present similar opportunities.

While each of us might characterize the problems and the opportunities slightly differently, I believe we have common cause here today.

Wendell Berry, the ecologist and writer, talks about **solving for pattern**. By that he means finding solutions that solve multiple problems at the same time, while not creating new problems. I think that's an elegant description of Green Chemistry.

We are committed to working with stakeholders that are interested in implementing this directive in a visionary, non-regulatory but genuinely innovative and progressive way to make Michigan a center of Green Chemistry research and innovation and adoption.

We have a few ideas about some first steps, but we are very interested to hear from everyone at this table about what they would need to make things happen here in Michigan.

We hope the state will move forward to create a roundtable made up of a small group of committed people to shepherd the initiative as the ED anticipates.

Understanding barriers to the adoption of Green Chemistry is crucial, so we first propose that the new green chemistry group hold a series of roundtables with different topics related to advancing Green Chemistry in the state. Each topic might then attract different experts. Roundtable topics might include advancing green chemistry education, barriers to business adoption and solutions, effective incentives for green chemistry research and adoption, integrating green chemistry into existing state programs, etc.

These recommendations are based on an analysis of some of the barriers to Green Chemistry adoption we've heard about from chemists, researchers, industry representatives, and others.

We learned from leading companies was that they were actually paying for the training of high school science teachers, and prospective employees to learn about green chemistry because they weren't getting enough candidates with these skills applying for positions at their company.

Second, in the area of general recognition of Green Chemistry - with the goal of increasing the profile and buzz around Green Chemistry, and the stature of those working in the area:

- We recommend a Green Chemistry gubernatorial award be launched next year that expands and improves on the national

model. We have some suggestions on improvements to expand those who are eligible for recognition.

- We recommend providing some money with the award, (perhaps from a private donor) particularly for promising graduate students or small businesses where a small amount of money would make a big difference.

Third, in the area of Green Chemistry education – with the goal of increasing the number of students exposed to Green Chemistry training, and rewarding instructors who provide this instruction (in the most cost-effective way possible).

- One roundtable topic idea is to brainstorm ideas to advance green chemistry education in Michigan at all levels.
- Another idea would be to pilot Green Chemistry curriculum at each level of science education in the state in the first year, and use those pilots to refine and expand the training in subsequent years. There are many science educators who have approached us with an interest in this area, and some curriculum that have been developed by the leading green chemists. Community colleges may be good places to focus initial efforts in the first year. Some small funding to advance this work could make a difference.
- We also recommend providing a fund for graduate assistants that work with professors at research institutions that are working on green chemistry.

- Massachusetts may have a model in providing a training program in Green Chemistry for continuing adult education

Third, we need to accelerate adoption of green chemistry across businesses.

- Ask businesses what would work - could use the sustainable business roundtables to seek input on state-level policy changes that would accelerate research and adoption of green chemistry innovation
- Businesses hiring chemistry graduates could begin requiring green chemistry training for new hires
- Provide incentives for the retraining of engineers and chemists in the state and provide seminars for working chemists in the state
- Host major conference on Green Chemistry in 2008.
- Develop the most effective support grants for green chemistry

Fourth, explore the possibility of a bio-based initiative like the one in Maine that is attempting to use Maine products to create locally produced bioplastics for local companies.

In the longer term, we are very supportive of developing a truly independent, Green Chemistry/Toxics Use Reduction Institute to provide direct support to businesses wanting to adopt green chemistry

We developed a long list of potential state actions that we would be happy to provide to others.

Finally, I'd like to provide some information on how we, as public advocates, will evaluate the success of this initiative.

We will be watching closely, and reporting back to our constituencies, on this effort. Our criteria will include

- Are we attempting to advance and make the biggest leaps toward sustainability with this initiative? Are we accelerating and rewarding those efforts that solve for pattern without creating new problems?
- Is it truly about hazard reduction rather than risk reduction?
- Are we helping to advance Michigan as a center of activity on green chemistry? Will our priorities help lead to innovations that distinguish the state as a leader in Green Chemistry
- Are we faithfully upholding the definition of Green Chemistry as outlined in the Directive?
- Is the effort self sustaining and helping to develop long term infrastructure for continuous innovation?
- Does it create a buzz around Green Chemistry?
- Have we increased the practice and teaching of progressive green chemistry in the state?
- Are our efforts directed toward seeking to advance Green Chemistry principles in their totality as the end goal?
- Are our efforts properly focused on rewarding and accelerating design level changes that are truly sustainable?

- Do our efforts serve the needs of all downstream users– or are they dominated or defined by a single company or industry sector interest – is the effort perceived as being captured?
- Are our efforts focused on the needs of user industries for solutions to design problems that will improve Michigan’s environment in substantial ways. Is it helping to address some of our bigger problems in Michigan?

This is a voluntary initiative, so we are expecting our efforts to focus on those that are really visionary – efforts that make real leaps in innovation. While incremental change will be necessary, we hope this initiative will always keep its eye on the prize of **a material economy that is actually compatible with human and ecosystem health, is restorative rather than depleting, and is compatible with a finite system.**