



# Michigan Green Chemistry Governor's Award Program

## Nomination Package for 2011 Awards

### Introduction

The Michigan Green Chemistry Governor's Award Program (Award Program) was established by the Michigan Green Chemistry Roundtable to recognize innovations in green chemistry.

This nomination package contains concise instructions on how to enter the Award Program. The Award Program is open to individuals, groups, and organizations in Michigan, both nonprofit and for profit, including academia and industry. **Entries must be sent no later than August 5, 2011.** Winners will be notified prior to the official public announcement, which will be made on October 27, 2011, in Ann Arbor, Michigan.



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### **Background**

In October 2006, former Governor Jennifer M. Granholm issued Executive Directive No. 2007-6 (Directive), "Promotion of Green Chemistry for Sustainable Economic Development and Protection of Public Health," that established state policy encouraging the use of safer, less toxic, or non-toxic chemical alternatives to hazardous substances and the research, development, and implementation of green chemistry in Michigan.

The Department of Environmental Quality (DEQ) has been given primary responsibility to implement the Directive, including establishing a Michigan Green Chemistry Program and convening a Michigan Green Chemistry Roundtable (Roundtable). The Roundtable, which is comprised of experts representing business, academia, and environmental interests groups, has played an active role in the development of the Award Program.

The DEQ and Roundtable are committed to establishing Michigan as a leader in green chemistry; recognizing state specific innovations is an important milestone in celebrating Michigan's success.

### **Scope of Program**

The Award Program recognizes advances that either incorporate the principles of green chemistry into chemical design, manufacture, or use, or that promote activities which support or implement those technologies. The directive of green chemistry is to either reduce or eliminate the use and/or generation of hazardous substances from chemical products and processes. Green chemistry improves upon all types of chemical products and processes by constraining their impacts on human health and the environment relative to competing technologies.

In the context of the Award Program, green chemistry is defined as the use of chemical or engineering practices for the purpose of source reduction. Source reduction prevents the formation/accumulation of any hazardous substance in any chemical product or process. Source reduction is the highest tier of the risk management hierarchy as described in the Pollution Prevention Act of 1990. Whenever possible, source reduction is preferable to recycling, treatment, control, or disposal.

Green chemistry technologies encompass all aspects of chemical processes including syntheses, catalyses, reaction conditions, separations, purification, distribution, and monitoring. A green chemistry technology can be an entirely new chemical product/process or an influential incremental improvement on an existing process/protocol. For example, a green chemistry approach may be to substitute a greener feedstock, reagent, catalyst, or solvent in an existing synthetic pathway. A green chemistry technology also can involve substituting an improved product or an entire synthetic pathway. Ideally, a green chemistry technology incorporates the principles of green chemistry at the earliest design stages of a new product or process. Benefits to human health and the

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environment may occur at any point in the technology's lifecycle: feedstock, synthesis, use, and ultimate fate.

### **Award Focus Areas**

A nominated green chemistry achievement should be an example of one or more of the following four focus areas, but must be Michigan specific and illustrate how the innovation supports Michigan's growth, will be advanced, and benefits Michigan's economy, environment, and health.

#### **1. Greener Synthetic Pathways**

This focus area involves implementing a novel, green pathway for a new chemical product or material. It may also involve using a novel, green pathway to redesign the synthesis of an existing product. Examples include synthetic pathways that:

- a. Use greener feedstocks that are innocuous or renewable (e.g., biomass, natural oils).
- b. Use novel abundant, reagents or catalysts, including biocatalysts.
- c. Are natural processes, such as fermentation or biomimetic synthesis.
- d. Are atom-economical.

#### **2. Greener Reaction Conditions**

This focus area involves improving conditions other than the overall design or redesign of a synthesis. Examples include reaction conditions that:

- a. Replace hazardous solvents with reaction media that have a reduced impact on human health and the environment.
- b. Use solventless reaction conditions and solid-state reactions.
- c. Use novel processing methods.
- d. Eliminate energy- or material-intensive processing (e.g., separation and purification).
- e. Improve energy efficiency, including reactions running closer to ambient conditions.
- f. Develop novel catalysts which are more efficient and robust.

#### **3. Design or Implementation of Greener Chemicals and Materials**

This focus area involves designing or deploying chemical products or materials that are less hazardous than the products or technologies they replace. Examples include chemical products or materials that are:

- a. Less toxic to humans than current products.
- b. Inherently safer with regard to accident potential.
- c. Recyclable or biodegradable after use.
- d. Safer for the atmosphere (e.g., do not deplete ozone or form smog).

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### 4. **Design, Implementation, or Advocacy of Greener Processes**

This focus area involves advocating for, designing, or deploying a process where chemicals (particularly hazardous and/or toxic chemicals) were used in such a way that the resulting process will be environmentally benign, economically sound, and readily operated, while still ensuring product quality. Examples include designing, implementing, or advocating for:

- a. Greener processes or technologies in the market and/or community.
- b. Cleaner chemical manufacturing processes.
- c. Cleaner electroplating and automotive coating processes.
- d. Elimination, reduction, or recycling of chemicals containing waste, such as water waste.
- e. Cleaner pharmaceutical manufacturing processes.

Many green chemistry technologies fit into more than one focus area. Technologies that do not fit within at least one focus area may not be within the scope of the Award Program.

### **Award Categories**

The Roundtable plans to present one award in each of the following categories:

- **Small Business:** A small business for a green chemistry technology in focus areas 1, 2, or 3. Any small business located and operated in the state of Michigan with annual sales of less than \$40 million, including all domestic and foreign sales by the company, its subsidiaries, and its parent company is eligible to apply.
- **Academic:** Academic research and development efforts in focus areas 1, 2, or 3.
- **Student:** Undergraduate and graduate research efforts in focus areas 1, 2, or 3.
- **Education:** Green chemistry education efforts at any level, from high school to post graduate; in any of the four focus areas.
- **Public:** Community reform that recognizes efforts from advocates, local government, service organizations, and/or the general public in any of the four focus areas.
- **Focus Area 1:** An industry sponsor located and operated in the state of Michigan, for a technology that uses greener synthetic pathways.
- **Focus Area 2:** An industry sponsor located and operated in the state of Michigan, for a technology that uses greener reaction conditions.
- **Focus Area 3:** An industry sponsor located and operated in the state of Michigan, for a technology that includes the design or implementation of greener chemicals and materials.

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### **Selection Criteria**

Nominated chemistry technologies will be judged based on the content provided and must fall within the scope of the program. Technologies that meet the scope will then be judged on how well they meet the following criteria:

1. **Michigan specific**

The nominated chemistry technology must be Michigan specific and illustrate how the innovation supports Michigan's growth, will be advanced, and benefits Michigan's economy, environment, and health.

2. **Science and innovation**

The nominated chemistry technology should be innovative and of scientific merit. The technology should be, for example:

- Original (i.e., never employed before).
- Scientifically valid. That is, can the nominated technology or strategy stand up to scientific scrutiny through peer review? Does the nomination contain enough chemical detail to prove its scientific validity? Has the mechanism of action been elucidated through scientific research?

3. **Human health and environmental benefits**

The nominated chemistry technology should offer human health and/or environmental benefits at some point in its lifecycle from resource extraction to ultimate disposal. The technology might, for example:

- Reduce toxicity (acute or chronic) or the potential for illness or injury to humans, animals, or plants.
- Reduce flammability or explosion potential.
- Reduce the use or generation of hazardous substances, the transport of hazardous substances, or releases to air, water, or land.
- Improve the use of natural resources, for example, by substituting a renewable feedstock for a petrochemical feedstock.

Quantitative statements of benefits are more useful to judges than are qualitative statements.

4. **Applicability and impact**

The nominated chemistry technology should have a significant impact. The technology may be broadly applicable to many chemical processes or industries; alternatively, it may have great impact on a narrow range of chemistry. Commercial implementation can support the applicability and impact of a technology. Nominations for pre-commercial technologies should discuss economic feasibility. The nominated technology should offer at least the following:

- A practical, cost-effective approach to green chemistry.
- A remedy to a real environmental or human health problem.
- One or more technical innovations that can be transferred readily to other processes, facilities, or industry sectors.

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**Important:** To make the strongest presentation of your technology for the judges, you should include as much nonproprietary detail as possible in your nomination. The judges will pay close attention to the specifics of your chemistry, including detailed reaction pathways, comparisons to existing technology, toxicity data, quantities of hazardous substances reduced or eliminated, degree of implementation in commerce, and other technical, human health, environmental, and economic benefits. The judges recognize that some sponsors will not be able to conduct a full lifecycle analysis, but like to see a discussion of impacts across the lifecycle. In addition, the Michigan Green Chemistry Program strongly encourages you to compare the cost, performance, and environmental profile of your technology with any competing technologies. This may help you demonstrate the broad applicability of your technology.

### How to Enter

Self-nominations are allowed and expected. There is no entry fee and no standard entry form, but nominations must meet the following requirements:

- Single-spaced and no longer than eight pages, with type no smaller than 12-point.
- When printed on 8½-by-11-inch paper, they must have margins of at least 1 inch.
- Chemical reactions, tables, graphs, photographs, and other illustrations may be included as part of the eight pages.
- Nominations should not require color for interpretation since the judging panel may read submittals in black and white print.

### **Nominations that do not meet these requirements may be rejected.**

A nomination must include the following:

**Cover Page:** include the project title followed by the date of the nomination and the complete names (with titles as appropriate), addresses, telephone numbers, and email addresses of the following individuals or organizations:

- Primary sponsor(s): the individual or organizational owner of the technology.
- For academic nominations, the primary sponsor is usually the principal investigator. Please note that the award will recognize this individual or organization.
- Contact person: the individual who is responsible for communicating with the judging panel. For academic nominations, the contact person is usually the principal investigator. For other nominations, the contact should be the project manager.
- Contributors: those individuals or organizations that have provided financial or technical support for development or implementation of the nominated technology. Providing information on contributor(s) is optional.

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**Second Page:** include the following information:

- Project title.
- Abstract not to exceed 350 words that describes the nominated achievement, the problem it addresses, and its benefits.
- Short description of the most recent milestone, with date, that the nominated achievement has reached within the past five years. Advocacy efforts should describe the most recent milestone achieved. Examples include, but are not limited to: critical discovery made, results published, patent application submitted or approved, pilot plant constructed, technology implemented or commercialized, and relevant regulatory review. Note: technologies in the design stage or conceptual stage are accepted.
- Statement indicating which of the award categories the nominated achievement best represents.
- Statement indicating which one of the four focus areas best describes the nominated achievement (i.e., the primary focus area). If the nominated achievement falls within more than one focus area, a secondary focus area may be included. Choose a primary focus area that best fits your achievement and list any other appropriate focus areas.
- Description of the research, development, education, advocacy, implementation, or other aspects of the achievement that occurred within Michigan. Note: if product sales are the only aspect conducted within Michigan, the nomination may not meet the scope of the Award Program.

**Remaining Pages:** explain in detail how the nominated achievement meets the scope of the program and the selection criteria. Explain the following:

- The chemistry of the nominated achievement, emphasizing how the idea is innovative and of scientific merit. Consider including chemical structure diagrams rather than using simple text to describe the relevant chemistry of your system. Patent numbers or references to peer-reviewed publications may also strengthen the nomination. The judges recognize the interdisciplinary nature of green chemistry. To be eligible for an award, however, the technology must include a significant chemistry component, even though it is probably the result of collaborations with engineers, biologists, toxicologists, etc.
- The problem (environmental or human health risk) that the submission addresses and how it solves the problem. Consider including positive or negative effects throughout the system's lifecycle.
- The impact of the educational or advocacy efforts in Michigan.

A person may nominate more than one achievement, but must submit a separate nomination for each one. Please combine multiple applications of the same general achievement in a single nomination.

All entries received will be considered public information. No material will be returned. The Award Program is not responsible for lost or damaged entries. The judging panel will acknowledge receipt of nominations by email. A person

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who has not received an acknowledgment by August 12, 2011, should contact the Award Program at [greenchemistry@michigan.gov](mailto:greenchemistry@michigan.gov) or 800-662-9278.

Submit an electronic copy of the nomination in such a format that the judging panel is able to select and copy text from it. Please include the primary sponsor's name in the file name. It may be advantageous to submit the nomination as a .pdf file to minimize possible reading errors, but the Award Program will accept and is able to read all common file types. Please email the electronic copy to [greenchemistry@michigan.gov](mailto:greenchemistry@michigan.gov). If the file cannot be sent via email, please send it on a CD, clearly labeled with the sponsor, computer format (Windows or Macintosh), and file name(s). **The nomination must be sent no later than August 5, 2011.**

To send a CD, please use the following address:

Michigan Green Chemistry Governor's Award  
Attn: Karen Edlin  
MDEQ-OEA, CH-1N  
P.O. Box 30473  
Lansing, MI 48909-7973

### **Judging**

A panel of technical experts convened by the Roundtable will judge nominations. These experts might include members of the scientific, industrial, governmental, environmental and academic communities. The judges may request verification of any chemistry described or claims made in nominations that are selected as finalists. The judges will select award recipients based on the green chemistry achievements that best meet the selection criteria.

### **Winner Notification**

Winners will be notified prior to the official public announcement. Awards will be presented during the 2011 Michigan Green Chemistry and Engineering Conference: Advancing Innovation for a Sustainable Future, which is scheduled to take place at the North Campus Research Complex at the University of Michigan on October 27, 2011.

### **Additional Information**

Questions about eligibility, nomination procedures, or the Award Program should be directed to the Michigan Green Chemistry Program at [greenchemistry@michigan.gov](mailto:greenchemistry@michigan.gov) or 800-662-9278.