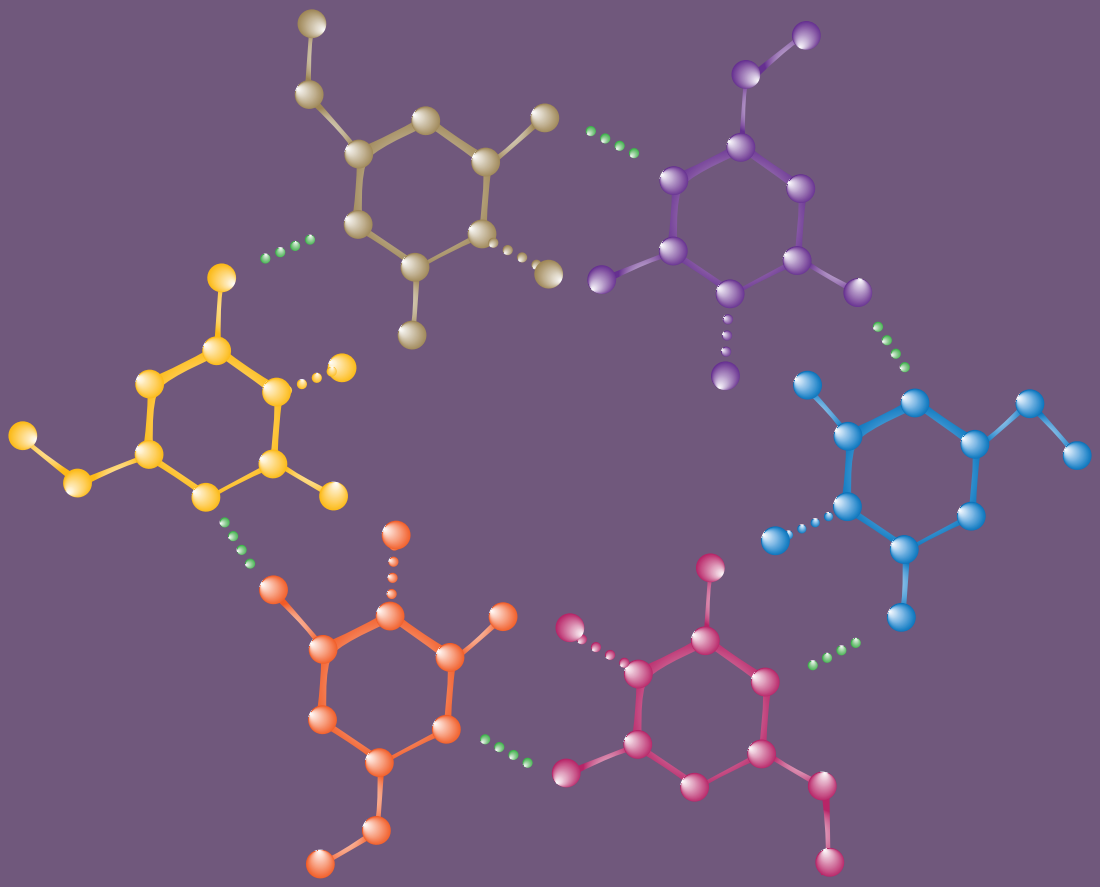
# New England Green Chemistry 2011/2012 Strategic Report



designing chemicals and processes that reduce or eliminate hazardous substances

**June 2011**

Executive Summary

# Letter from Curt Spalding

EPA embraces green chemistry as a pathway for a sustainable New England. We want to ensure that in our future, the design of chemical products and processes will reduce or eliminate exposure to highly toxic substances. Further, we want to ensure that the use of these products and processes will generate less hazardous byproducts and waste throughout a chemical products' life cycle, including its design, manufacture, and use.

Last summer and fall EPA convened more than 30 green chemistry leaders to assist us in providing direction for this effort. These leaders included representatives from state and federal government, education, business, academia, healthcare and non-profit organizations. As a result, we launched the New England Green Chemistry Challenge. We created a strategic plan to move this process forward. In December 2010, we hosted a very successful networking forum with more than 300 in attendance. The forum concluded with bringing together six workgroups. These groups worked through the winter to generate their best ideas to create a green chemistry future for New England. I'm thrilled to share the results from the New England Green Chemistry Challenge with you.

New England is in a unique position to foster green chemistry. It is clear that the combination of New England's concentration of bio-technology and pharmaceutical companies, healthcare and educational institutions, along with the commitment and effort from state government and our strong interstate organizations, creates a ripe environment for green chemistry to take hold and thrive. The energy and interest expressed during the December networking forum demonstrates the strong engagement in New England.

Our hope is that EPA can be a catalyst for green chemistry. The ideas and projects identified in this report represent the next step. We realize EPA is only one partner in this vision. I want to express my appreciation to the co-chairs of the six strategic working groups and all the participants who provided thoughtful guidance about how to advance green chemistry in their sector and for New England.

Our plan is to share this report widely. We trust that those who read this report will identify opportunities to turn these ideas into concrete projects. You have my commitment to champion a green chemistry future for New England and I look forward to doing that with your help and commitment.

Sincerely,

Curt Spalding, Regional Administrator
EPA New England

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Green Chemistry is "a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products."

*Green Chemistry: Theory and Practice* by Paul Anastas and John Warner.

# Introduction

Green chemistry provides a framework for a sustainable future by adopting safer practices and using less hazardous and non-toxic chemicals. It is the design of chemical products and processes without compounds hazardous to human health and the environment, that eliminates the need to protect humans and the environment against these exposures and stops and/or reduces waste before it is generated. The principles as described by Paul Anastas and John Warner in "Green Chemistry: Theory and Practice" teach how to design safer chemicals and products in the first place. These principles go to the very heart of sustainability and will strengthen the economy through the development of new chemistry, protecting the planet from toxic and hazardous materials and protecting public health.

The New England Green Chemistry Challenge was launched in 2010 by U.S. EPA Region I with support from EPA's Office of Research and Development. This Challenge is a collaborative effort with green chemistry leaders from New England State Governments, industry, academia and non-governmental organizations. The goal is to advance the knowledge and practice of green chemistry principles in business, education, and government. The Challenge is a catalyst to grow a sustainable economy through green chemistry in New England and beyond.

This Strategy Report presents ideas to consider in 2011-2012. These objectives and activities originate from the green chemistry stakeholders that took part in the Forum in December and in their continued work through the winter. The next step is to share these ideas and determine how, working collaboratively, we can begin implementation.

# Background

**Convening History**

In the summer and fall of 2010, EPA Region 1 convened a Green Chemistry Coordinating Committee. The committee was comprised of true green chemistry advocates and practitioners from government, business, education (K-12 and colleges/universities), and non-governmental organizations (NGOs) and chaired by Curt Spalding, U.S. EPA, and John Warner, Warner Babcock Institute of Green Chemistry.

To advance the goals of the New England Green Chemistry, the Coordinating Committee identified six sector based strategic groups:

- Policy (Government)
- Production & Work (Business),
- Investment & Development (Venture/Investment),
- Education (K-12, Colleges & Universities),
- Advocacy & Demand (Non-Government Organizations), and
- Healthcare (Environmental Health Organizations)

The six strategic groups convened at the New England Green Chemistry Networking Forum that was held in December 2010. These groups continued their work during the winter of 2010-2011, prioritizing ideas for activities, projects, and initiatives to promote and advance green chemistry. The table below identifies the strategic groups and their co-chairs. Support was provided by U.S. EPA Region 1 staff and facilitators from the Consensus Building Institute.

**The New England Green Chemistry Challenge will strive to:**

- Increase awareness and understanding of green chemistry.
- Understand the interrelationship of green chemistry and sustainability.
- Build consensus among government, business, education and other interest groups to focus energy towards a safer, greener approach.
- Support a transformative dialogue about new ways to achieve a safe and green sustainable future.
- Foster a New England economy that is based on local resources, labor force, research capacity and expert knowledge.
- Stimulate the New England economy and increase employment through innovative, green approaches to manufacturing and investment in new green businesses.
- Catalyze the prosperity of New England businesses and ensuring their sustainability through green solutions.

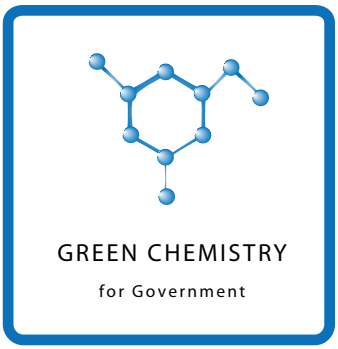
# Sectors & Co-Chairs

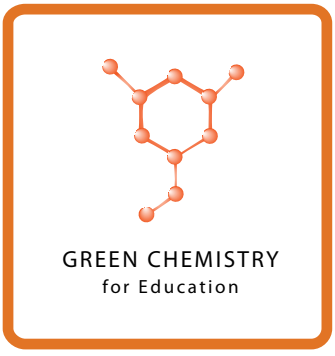
| Sectors | Co-Chairs |
|---|---|
| **Policy (Government)** | Terri Goldberg, NEWMOA<br>Rich Enander, RIDEM<br>Dwight Peavey, EPA Region 1 |
| **Education (K-12, Colleges & Universities)** | Amy Cannon, Beyond Benign<br>Edward Brush, Bridgewater State College<br>Irv Levy, Gordon College |
| **Production & Work (Business)** | Rose Perkins, The Dow Chemical Company<br>Michael (Mike) P. McGee, Nypro, Inc.*<br>Berkeley W. Cue, BWC Pharma Consulting*<br>Michael B. Korzenski, ATMI, Inc* |
| **Investment & Development (Venture /Investment )** | Rob Bettigole, Elm Street Venture<br>Chesley Chen, Burma Road Venture Advisors* |
| **Advocacy & Demand (Non-Government Organizations)** | Ken Geiser, UMass Lowell<br>Mark Rossi, Clean Productions Action<br>Gary Cohen, Environmental Health Fund |
| **Healthcare (Institutions)** | Bill Ravanesi, Health Care Without Harm<br>Jane Matlaw, Beth Israel Deaconess Medical Center |
| *These co-chairs provided their leadership through the New England Green Chemistry Networking Forum | |

# Proposed Activities

To advance green chemistry in New England the six strategic groups identified goals, prioritized objectives and identified actions. The table on pages 8-9 shows brief synopses of the objectives and actions identified by the strategic group and stakeholders. In the full report are details of the priority activities. As evidenced by the table, multiple groups raised several common activities. These cross-cutting activities serve to advance the knowledge and practice of green chemistry principles generally, across multiple sectors, interests, and backgrounds. To avoid duplication, we have included the cross-cutting actions only once, at the end of the strategic summaries.







# Summary Table of Proposed Activities

| | Government | Education | Business | Venture / Investment | Advocacy/NGO | Health-care |
|---|---|---|---|---|---|---|
| Web-based Regional Green Chemistry and Engineering Information Exchange (ie., clearinghouse) | ◆ | ◆ | ◆ | ◆ | ◆ | |
| Green Chemistry Case Studies written and webinars | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ |
| NE Green Chemistry Roundtable | ◆ | | ◆ | ◆ | ◆ | ◆ |
| EPA Regional Science Forum | ◆ | ◆ | ◆ | | ◆ | ◆ |
| University Intern Program | ◆ | ◆ | ◆ | | | |
| Funding and Networking Workshop | | | ◆ | ◆ | ◆ | |
| Technical Assistance for Small Business | | | | ◆ | ◆ | |
| ORD Partnership for research on chemical substitution for development of green chemistries | ◆ | | | | | ◆ |
| Regional Green Chemistry Awards Program | ◆ | | | | | |
| Integration of green chemistry and engineering into existing state capacity across all programs | ◆ | | | | | |
| Professional development for educators including, hands on training, curriculum and lesson plans | | ◆ | | | | |
| Create an on-line safety video for educational laboratories | | ◆ | | | | |
| Regional centers of excellence | | ◆ | | | | |
| Regional green chemistry science fair | | ◆ | | | | |
| Green chemistry commitment for universities, colleges and schools | | ◆ | | | | |
| Infuse green chemistry into state standards, accreditations and text books | | ◆ | | | | |
| Engage students in developing green chemistry materials | | ◆ | | | | |
| Market research potential market and industry sectors for green chemistry in NE | | | ◆ | | | |
| Maine Potato to Plastics | | | | | ◆ | |
| Green Chemistry Policy Analysis | | | | | ◆ | |
| Green Chemistry Evaluation Tools for Businesses | | | | ◆ | | |
| Research Potential Market and Industry Sectors for Green Chemistry and Engineering | | | | ◆ | | |
| Green Purchasing for Healthcare Pilot | | | | | | ◆ |
| Green Chemistry Lab Initiative | | | | | | ◆ |
| Green Chemistry Research and Development Benefits Report | | | | | ◆ | |

# Government

*The goal of this strategic group is to identify government initiatives, strategies, projects and opportunities to advance green chemistry in the region.*

**Proposed Objective 1:** Support state agencies to further green chemistry and green engineering.

- Dedicate Funding to Integrate Green Chemistry and Green Engineering into Existing State Agency Capacity Across Appropriate Programs: Provide funding dedicated to advance the implementation of green/sustainable materials, chemicals, products, and processes for state agencies. Support regional economic development around green chemistry development and applications.

**Proposed Objective 2:** Encourage regional adoption of green chemistry and green engineering.

- Northeast Green Chemistry and Green Engineering Awards Program: Recognize and reward green chemistry and green engineering accomplishments in the region, through integrating and expanding current regional and national award programs.

**Proposed Objective 3:** Connect people through a regional green chemistry and green engineering social media topic hub.

- Create a Green Chemistry Information Resource and Portal: Connect people using webinars, trainings, news items, interactive website, and peer information exchange. Include a help center and clearinghouse of state technical assistance capacities and efforts and link to needs in the region so as to create synergies among efforts.

**Proposed Objective 4:** Create regional partnerships to support development and evaluation of greener, safer and sustainable chemistries.

- Support a green chemistry and green engineering research initiative on chemical substitution for the development of greener, safer and sustainable chemistries through an ORD and Northeast partnership: This partnership will provide assistance to the green chemistry and green engineering challenges in the northeast. Actions include additional research, development and application of green chemistry solutions and creation of an expert panel to assist with green chemistry and green engineering answers and solutions.

- Establish an EPA and NE States Partnership for Collaboration, Standardization and Validation of Green Chemistry and Green Engineering Alternatives: This collaboration includes the following activities; verifying green claims for chemistries and/or processes, assisting in alternatives assessments including consistent approaches for life cycle assessments, providing evaluations of existing data and reports on green chemistry and green engineering and developing criteria to measure whether projects are moving towards "green chemistry."

# Education

*The goal of the Education Group is to implement and disseminate green chemistry in educational institutions throughout New England.*

**Proposed Objective 1:** Organize and sustain a multidisciplinary and highly collaborative community of educators and stakeholders around the topic of green chemistry education.

- Professional Development: Provide the education community with regular hands-on trainings to foster adoption of green chemistry in classrooms and laboratories.
- Tools and Resources: Provide access to tools and resources for educators at all levels through on-line resources.
    - Curriculum and Lesson Plans: Provide access to curriculum for implementation of green chemistry at all educational levels.
    - On-line Safety Video: Create an alternative safety video for use in introductory chemistry courses that includes green chemistry as a key strategy for safety in the chemistry laboratory.
- Regional Centers of Excellence: Create regional centers of excellence that can act as hubs for green chemistry information, training and dissemination.
- Green Chemistry Science Fair: Create a regional green chemistry science fair that engages both K-12 and college level students in order to promote awareness of green chemistry and disseminate green chemistry information.

**Proposed Objective 2:** Advance green chemistry education in primary, secondary and higher education by providing expertise, resources, opportunities, strategies and tools to educators at all levels and disciplines.

- Green Chemistry Commitment: A systematic response to the demand for safer, non-toxic products and processes, shifting our educational institutions to prepare students to enter the workforce armed with the skills and knowledge to create society's next generation of sustainable materials. The Commitment is a bottom-up approach, allowing for schools, colleges and universities to begin to change the education of a scientist today.
- Green Chemistry in State Standards and Accreditations: Evaluate, refine, advocate and infuse green chemistry throughout state standards and accreditation programs.
- Green Chemistry and Toxicology Textbooks: Collaborate with educators to create green chemistry infused textbooks, along with new resources such as toxicology textbooks for chemists.
- Student Involvement Program: Engage and involve students in the development of green chemistry materials and activities, in the recruitment of students, teachers and faculty and develop mentoring programs for peer-to-peer mentoring.

# Business

*The goal of the Business group is to advance the knowledge and practice of Green Chemistry principles in business as a catalyst to grow a sustainable economy in New England and beyond and facilitate the alignment of key social, environmental and economic drivers.*

**Proposed Objective :** Develop tools and resources that will support green chemistry application and advancement in small to medium sized businesses.

- Technical assistance network: Create a network of affordable, capable, third-party evaluation, patent and intellectual property resources that small businesses could contact for technical assistance.
- University intern program: Establish a program/approach to connecting university students in science and business management to businesses working in green chemistry.
- Evaluation tools: Identify, create, and disseminate simple tools to evaluate green chemistry products and processes.
- Market research: Conduct a study to identify the aggregate size of the potential market and industry sectors in New England with the greatest opportunity for green chemistry.

# Venture/Investment

*The goal of the Venture /Investment group is to advance the knowledge and practice of Green Chemistry principles by investors and the businesses that they invest in.*

**Proposed Objective:** Educate investors and venture capital firms about green chemistry in businesses.

- Present at Investor Forums: Organize a presentation on green chemistry principles and investment opportunities to be delivered at existing investors forums, such as Boston-based Angel-Investor and Venture Capital, and through convening new meetings.

# Advocacy

*The goal of the Advocacy group is to develop an integrated array of practical projects that can, in a reasonably short time, advance critical next steps in promoting green chemistry.*

**Proposed Objective 1:** Educate health and environmental professionals and health-affected constituencies on the threats of toxic chemicals and options where green chemistry investments can offer solutions to reduce those threats.

- Green Chemistry Health, Environment and Economic Benefits Report: Research and produce a public report that documents the significance of green chemistry-related funding to reduce the highest chemical threats in New England. The report would be used to educate the public about the importance of green chemistry R&D investment as an engine for both economic development and health and environmental protection.

**Proposed Objective 2:** Encourage critical economic sectors that rely on toxic chemicals in production and use to invest in green chemistry solutions.

- Maine Potatoes to Plastics Initiative: Support the consortium of Maine manufacturers, agricultural business interests, university researchers and an NGO to produce lactic acid from potato starch and wood sugars at scale and enhance the technical properties of PLA for final product applications (e.g. durability, heat resistance, etc.) through novel melt blends with other bio-based materials such as nano-cellulose.

**Proposed Objective 3:** Advocate policies that seek to replace unnecessary toxic chemicals with safer alternatives and create incentives to bring greener chemicals to market.

- Green Chemistry Policy Analysis: Conduct an assessment of in-region policy models that directly stimulate green chemistry R&D. The goal of the assessment is to build momentum and create awareness for green chemistry by highlighting existing leadership, best practices and policy innovations.

# Healthcare

*The goal of the Healthcare group is to advance the knowledge and practice of Green Chemistry principles into hospitals, laboratories and healthcare institutions.*

**Proposed Objective 1:** Establish a green and sustainable medical research practice in one academic/medical institution, to develop a model and a set of core knowledge that can spread across the healthcare sector.

- Toxic Reduction and Substitution Program for Research Labs at BIDMC: Establish an alternative and efficient program to reduce use of toxic, carcinogenic, corrosive and expensive chemicals and find their benign alternatives throughout the research laboratories at a major teaching hospital. The results from this project will be used as a national model for hospitals.

**Proposed Objective 2:** Research and introduce bio-polymers into the healthcare supply chain for a variety of durable and semi-durable applications.

- Bio-Plastics Pilot Research Project for Healthcare Sector: Health Care Without Harm is coordinating a Healthier Hospital Initiative (www.healthierhospitals.org), a sector wide sustainability strategy involving 1,000 hospitals including implementing a transition to safer chemicals. Within the context of this larger strategy, Partners Healthcare has agreed to be a beta site for piloting bio-polymers in specific applications as well as being a champion for green chemistry alternatives in their institution. Success in piloting bio-polymers in Partners will enable an acceleration of bio-based plastics into the larger healthcare sector.

# Cross-Sector

*The following objectives and actions were identified by one or more of the strategic groups.*

**Proposed Objective 1:** Educate and create opportunities for stakeholders from multiple sectors and geographies to share knowledge and practice of Green Chemistry principles in business, education, and government.

- EPA Regional Science Forum on Sustainable "Green" Chemistry: EPA will host a regional science forum, as part of its effort to serve as a catalyst for accelerating the implementation of green chemistry and engineering as a means to a more sustainable New England.

- New England Green Chemistry Roundtable: Convene a facilitated, business/investor/non-governmental organization roundtable to facilitate discussion and exchange of information about green chemistry topics and to increase engagement of businesses in green chemistry. The roundtable could meet periodically and include a combination of presentations, dialogue, and networking. Roundtable participation would be open to all interested parties with a particular focus on attracting business, investors, and leaders from non-governmental organizations.

- Funding/networking workshop: Host a funding workshop for innovators to meet and interact with funders from government, foundations, private investors, and venture capital firms.

**Proposed Objective 2:** Facilitate the exchange of information and ideas related to green chemistry resources and opportunities among academia, business, non-governmental, and government stakeholders.

- Web-based Regional Green Chemistry and Green Engineering Informational Exchange: Gather, develop, and post existing materials related to green chemistry on an easy to access, single website. Strategic groups including the business, venture capital, and non-governmental groups commented that it would be helpful to be able to access case studies, resource lists, videos, promotional materials, background information, links to businesses, and other general green chemistry collateral from a single, open website. The government group included the need for exchanging information and ideas using social media.

- Green Chemistry Case Studies: Develop a range of case studies on green chemistry uses and best practices. Case studies might include: examples of how small, medium, and large sized businesses have successfully made the businesses case for green chemistry, sector specific best practices for green chemistry, and life cycle assessments. Make these case studies available on a public website.

- Green Chemistry Webinars: Convene webinars on green chemistry issues for sector-specific audiences. Webinars topics might include current policies and regulations, best practices, market opportunities, or emerging trends or approaches.

EPA

LinkedIn is a social media tool available to help continue the conversation on green chemistry in New England. Please join the LinkedIn "New England Green Chemistry Networking Forum" Group.

For more information about green chemistry in New England:
www.epa.gov/region1/greenchemistry