New England Green Chemistry Consortium White Paper

Introduction

Green chemistry is a science-based approach to pollution prevention. It involves a set of established principles for reducing or eliminating the use or generation of hazardous substances in the design, manufacture or application of chemical products. Green chemistry seeks to focus on the earliest stage of materials and process design so that conventional treatment technologies can be avoided. Although Green Chemistry is rapidly gaining momentum throughout the country and around the world, the pace could be accelerated by the formation of a New England regional Green Chemistry consortium that would:

- 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.

- Improve Chemistry's image in the public eye through an out-reach program that responds to the communities concerns and includes tangible demonstrations of the importance of chemical research in providing solutions to environmental problems.

Organization of the Consortium

The central motivation to establish this Consortium is not to construct a large encompassing center, but to coordinate, expand, and disseminate Green Chemistry education, policy, and research in New England. The formation of this center is symbolic of the significant expansion of existing efforts at several area campuses to collaborate with industrial partners and Federal/State Agencies to investigate and address environmental issues associated with materials production and utilization. Therefore, this consortium has as part of its mission a well-defined outreach program for the education of students on the various campuses, as well as providing a forum for dialogue with the general public.

To ensure maximum leveraging of funds to research and out-reach activity, the administration aspect of the Consortium will be kept to an absolute minimum. A board of directors (BOD) will be formed that includes members from each New England state representing academia, industry, and government. The BOD will make decisions concerning the strategic direction of the Consortium as well as recommendations for the distribution of resources. We also propose that the administration of the three-pronged mission be carried out by existing administrative infrastructure at the participating Universities. For example, existing programs at the University of Massachusetts are prepared to administer the activities listed below.

- Technical Research – National Environmental Technology Institute, UMass Amherst
- Public Policy Support – Toxic Use Reduction Institute, UMass Lowell
- Education and Outreach – Green Chemistry Graduate Program, UMass Boston

The final distribution of administrative responsibilities would be determined by the selected BOD and is expected to include resources from the other participating State Universities.

With initial Federal funding of $15M/yr, distributed among the six New England states, and by relying on existing administrative infrastructure, administrative costs can be kept below 5% of the total requested Federal investment. By collaborating with existing research and technology centers, the Consortium will be able to take advantage of existing interactions with industrial participants interested in improving chemical technology. By using current University and industrial shared resources throughout New England, this Consortium benefits from having first-rate experimental facilities. By working with state legislatures, federal agencies and congressional support, the Consortium gains by having advocates who care about development of technology and its implementation. This consortium aims for the best science, highest impact, and maximum leverage in the funds it receives.

Technical Research

Initially this consortium will benefit from the leadership of several senior participants from the University of Connecticut, the University of Maine, the University of Massachusetts, the University of New Hampshire, the University of Rhode Island, and the University of Vermont. The principal investigators of these institutions have an extensive history of successful individual and collaborative research. Each individual has complementary interests and expertise that are in line with the mission goals of the Consortium. We anticipate that the research led by this team will prove to be significantly interconnected, which truly represents the collaborative nature of the university/industry/government members.

This team of senior investigators will be assisted by an external advisory board selected for their scientific expertise, familiarity with environmental issues, and understanding of the economic impact of the changing technology. The role of the external advisory board will be to identify the highest priority research projects and provide guidance through their continual input to the research being carried out at the Consortium. Environmental concerns impact every segment of our society and this fact should be reflected in the selection of members for the advisory board. Industrial scientists will bring their expertise and bring their needs and challenges to the attention of the faculty members of the Consortium. New issues of environmental concerns need also to be discussed. Very few other technologies are as closely coupled to governmental regulations. This reflects the concerns of society in general, and needs to be represented as well. The Board members will be closely involved in evaluation of scientific research as well as active participants in the outreach program. It is not only important to assimilate the research accomplished but also to apply it in various industrial and governmental laboratories. It is important that various industrial and governmental laboratories assimilate and apply the research and developments accomplished by consortium researchers. .

Public Policy Support

Preventing pollution by focusing on materials and process design requires thoughtful changes in environmental regulations and opens up new opportunities for environmental policy. Consideration of the Principals of Green Chemistry will encourage a more integrated and unified set of Government programs that seek to coordinate policies across conventional environmental media programs. Attention will naturally be drawn to material substitution and the re-design of conventional chemistry processes rather than to treatment technologies. Government policy must be re-directed to promote new materials, more efficient processes, better conservation of energy and natural resources, and more environmentally benign sources of energy. This will require more streamlined approaches to evaluating hazards, more comprehensive attention to life-cycle impacts, more training and technical assistance, and more resources and incentives for new chemistry research and development. Leading firms willing to innovate and pilot new processes and materials will need meaningful incentives and recognition, while slower firms will need support, encouragement and assistance.

Education and Outreach

The consortium will be uniquely positioned to help in education and outreach in several different ways. By linking industrial and governmental organizations with academia, professional training, and development of practicing chemists in New England, the latest breakthroughs in Green Chemistry technologies will become available. This should provide benefits to the New England economy and environment by introducing and updating corporation's skill levels and technology base in pollution prevention practices that have been validated in both technical and financial arenas.

An important component of this consortium will be to promote collaborations between government, academic and industrial organization's educational outreach activities with communities and K-12 schools. Because Green Chemistry has an inherent practical and positive message of science working to protect the environment, it is an excellent vehicle for enhancing scientific literacy in the general public. A major function of this consortium will be to pool and share resources, materials and "best practices" of outreach of the various states so as to maximize their potential impacts. Examples of how governmental and industrial organizations can take a more proactive role in these activities can be provided.

It is expected that this consortium will lead to a network of undergraduate and graduate students throughout universities in New England to become actively involved in the research and dissemination of Green Chemistry technologies. The industrial and governmental partners of this consortium will be able to provide seminars and discussions that will lend "real world" experiences to the student members.

Potential Impact

One of the goals in forming this consortium is to carry out and disseminate outstanding Green Chemistry research in defining the molecular mechanisms governing the formation and processing of environmentally appropriate materials. Another important goal is to provide the education of a cadre of students and post-doctoral fellows in the practice of Green Chemistry as well as provide them with the skills needed to engage in public forums so that they become responsible citizens and scientists. According to the American Chemistry Council, the business of chemistry accounted for more than 230 thousand jobs in New England, and shipments valued at more than $13.5 billion in 1999. By increasing local access to Green Chemistry Technology and a better-trained workforce, and simultaneously improving the public perception of chemistry, Industry will benefit from increased productivity and competitiveness, and reduced pressure to relocate outside of New England.

We also intend to measure our progress and accomplishments in the market place. Will the science that we invent be translated into technology adopted by industrial sector? This is the most direct measurement stick that can be applied to the research carried on at the consortium. Our goal is to set clear time spans for companies to adopt the technology developed at the consortium. The overall economic benefits of environmentally friendly research have been very difficult to define in a quantitative fashion. It is our intention to work closely with industrial and government representatives to develop these quantitative assessments. Therefore, the success of the research associated with this consortium can be measured in several forms using different criteria.

1. Are we successful in producing students (both undergraduate and graduate) and post-doctoral fellows who carry with them the Principals of Green Chemistry in their individual fields of expertise? Generally, scientific accomplishments are the most familiar and easiest to evaluate. Papers, theses, and meeting presentations are a necessary part of the education and evaluation process. Are they hired by the regional industries?

2. We feel that in this proposed research, we have identified several areas that are clearly deficient in technology, causing an adversarial relationship between a better environment and better

materials performance. It is therefore crucial to define the success of our research by measuring how many companies work with us. We would define success if the technology developed at this institute were adopted within the first five years of the initial funding period.

3. It is difficult to define in a quantitative manner the value of public perception or public image of companies supporting research on environmentally friendly materials. It is also difficult to evaluate the economic impact of removing toxic by-products. Finally, it is difficult to define the overall economic benefit to society if an alternative feedstock, such as biodegradable poly (lactic acid) is adopted, even at a higher price per pound compared to non-degradable polyolefins. How valuable is new technology to a company or locality when jobs are saved when the technology is introduced? Therefore, another goal of this consortium is to provide a forum to develop discussions of this type in order to evaluate the success criteria. The external advisory board with representatives from industry, regulatory agencies, and legislature should be a tremendous asset in dealing with this problem to define a measuring criterion.