

---

Workshop background paper, “Framing a Future Chemicals Policy”, Boston, April, 28-29, 2005

- The views expressed in these background papers are the views of the individual concerned, and do not necessarily reflect the views of their employers.
  - These papers are intended as a thought starter, asking key questions; they are not a comprehensive review of the issue.
- 

## **1. Green Chemistry Principles as a Catalyst for Corporate Innovation**

**Andrea Larson**  
**Darden Graduate School of Business Administration**  
**University of Virginia**

### **Summary**

Why are we having this session? Because a reframing of chemicals issues is needed to jettison anachronistic ideas and replace them with frameworks and tools that enable us to create the future, and not be chained to the past. Fortunately, a convergence of circumstances offers us this reframing opportunity. Science knowledge, NGO activism and proliferation, health consequences of pollution, population doubling in the next few decades, ecological limits and signs of stress, economic development trajectories in emerging economies, and earth system effects (human activity altering the carbon, nitrogen, and hydrologic cycles) – have converged in the past 20 years resulting in the scientific conclusion that the growth model that worked for the past 100 years cannot be sustained into even the next 50. Fortunately, the United States has the innovative capabilities to turn the circumstances into an opportunity for competitive advantage and leadership.

Despite dramatic changes in “operating conditions” for the human species, the conversation about chemicals management in the US has been gridlocked. This was due, at least in part, to industry’s opposition to government regulation and environmentalists’ belief that the big stick of tightly formulated rules and punishments were essential to discipline myopic firms seeking profits over the social good.

No single solution exists for chemicals management. The task is complex because the “answer” is a thoughtfully conceived configuration of policies and practices bridging the public, private and non-profit sectors. However, chemicals policy debates and the conventional preoccupation with regulation give insufficient attention to the high potential arena of solutions-based innovation by corporations. Many firms have moved toward more “sustainable” practices, and countless others would allocate their resources in this direction if informed regarding methods, tools, and benefits. Green chemistry innovation is the bench level practice that opens doors for cost reductions and product differentiation. As a pragmatic framework it applies to operations and strategic choices. This is not a “for chemists only” topic. Companies positioning themselves for near term market and competitive success can use green chemistry concepts as a strategic guidepost. As one of the conceptual pillars of sustainability thinking and value creation for businesses, it needs far more careful consideration than it has received.

This is an ironic reality because it is the private sector that will actually produce the overwhelming proportion of new technologies, new materials and process improvements to take

us toward balanced co-evolution with the natural systems on which society and the economy depend. Government has a role and a choice; it can catalyze and accelerate the transition that has begun, or stand in its way. The question is whether government officials and multiple stakeholders can come together around a future vision and work together to get us there. Innovation is a powerful tool; the question is to what extent will we use it.

## **Starting Point: Four Facts**

Four facts argue for far more attention paid to corporate innovation driven by green chemistry principles.

**1. It's Happening:** Forward-thinking and innovative companies are already demonstrating that green chemistry - a science based, non-regulatory, and economically driven approach to chemicals-related innovation - moves them toward cleaner, more benign methods and products as well as improved profitability

**2. It Offers a Strategic Response to Regulation:** Whether one agrees with public policies demanding closer monitoring of chemicals or not, they exist and are not likely to go away, only change shape depending on the political context. This is the reality of today's global political landscape. Companies must compete in this context of wide ranging regulatory requirements emanating from multiple political jurisdictions. Green chemistry innovation provides a strategy to avoid being subject to regulation, reduce liabilities and risk, and differentiate the company from its competition

**3. It Addresses Health and Environmental Concerns:** Evidence grows of the limits to the ability of natural systems – including the human body - to absorb and neutralize toxic chemical waste streams resulting from economic growth. In other words, when bench level chemistry scales up there can be serious disruptive consequences at the human health and ecosystem health levels. Green chemistry, because it works with the intrinsic structure of materials, holds the potential to address and potentially eliminate air, water and solid waste toxicity.

**4. Significant Barriers:** Despite the opportunities that exist, significant barriers remain for translating those opportunities into reality. If key barriers are not explicitly addressed by the options stakeholders generate to move this agenda forward, progress will be very slow.

### **Expansion on Point #1: It's Happening**

Green chemistry (GC) has moved from theory to practice as more companies specify GC design in products and processes GC also is under discussion at the strategic level in many firms. While the US government ultimately will fashion an approach appropriate for American economic, political and cultural circumstances, companies are not waiting. The firms pioneering innovative feedstock, process and product redesign around sustainability protocols are developing capabilities that position them favorably for future sales growth. Innovative leaders such as Coastwide in commercial cleaning products, Shaw in non-toxic and recyclable carpeting, Cargill and Toyota in corn-based plastics, BASF in plastics, Nike in shoe design, Rohner in commercial fabric, Pfizer in pharmaceuticals, Walden in kayaks made of recycled plastics, Whole Foods in organic produce, the list goes on - decision makers inside these companies understand that their continued competitiveness is enhanced by embracing the wisdom that economic performance, environmental performance, and human health considerations are mutually reinforcing objectives essential for healthy economic growth. Green chemistry principles provide foundational concepts for this transition.

## **Expansion on Point #2: Strategic Response to Regulation**

There is compelling evidence that a critical mass of industrialized and emerging economies are moving toward chemicals management policies (governmental policies) that demand companies incorporate environmental health and sustainability principles in one form or another. The view of many political jurisdictions, from local to international, that chemicals management deserves public policy attention is simply a fact. The critical questions are what regulatory frameworks, in what countries, covering what materials today and in the future? And then, how does a company respond to these shifts such that technical specialists who design processes and products adapt designs in anticipation of regulatory contingencies? Green chemistry (and the other sustainability frameworks that encourage innovation) offers a simple design and strategic opportunity in response to this complexity. However, corporate leadership that encourages innovation is critical. Executives who understand fiduciary responsibility to stockholders as well as obligations to stakeholders also understand that innovation is one of the keys to continued successful strategy and economic performance. Successful performance means staying ahead of regulation and market changes through careful trend monitoring. Winners at this strategic contest devise ways flexibly create the future through innovation. Green chemistry provides a vehicle.

## **Expansion on Point #3: Addresses Health and Environmental Concerns**

While many companies remain locked in past views on environmental topics with regard to chemicals use, evidence exists that a wave of innovative change is making its way through the chemical and related supply chain industries. It is moving beyond single companies, through networks via supply chain producers and buyers, to the end users. Health and environmental issues are not constrained to EH&S departments. Buyers increasingly demand cleaner, healthier products and provide specifications. Environmental health and physical sciences have generated compelling evidence of harm and system limits from continued diffusion of naturally occurring chemical and synthetic materials at unprecedented concentration levels. In response, innovative firms are moving to sequester market space in the growing competitive landscape for non-toxic and safe materials, products and processes. These companies have gone beyond EH&S mindsets about compliance to an understanding that there are opportunities when deeper health and ecological stress signals are addressed through product and process design. Going beyond R&D and manufacturing process, many now understand that the issues are strategic and therefore deserving of senior executive level attention.

## **Expansion on Point #4: Barriers**

The barriers to turning opportunities into improved prosperity are significant but surmountable. Priorities are the promotion of green chemistry through education and training, clarification of “sustainability” as the reason and context for green chemistry implementation, business case examples of benefits derived, and core metrics applicable to bench, business unit, and corporate reporting and analysis. Options for addressing these 4 categories can be discussed and expanded through discussion with stakeholders.

Other barriers can be addressed if the categories above are sufficiently covered. These include the fight for attention and time of key decision makers, the inertia of current practices and discipline siloes, the ever-present competition for resources in corporations and curriculum space in education, lack of accreditation agencies, proof of benefits, and the inaccurately narrow view of the issues as “environmental” when they are, in fact, central to business competitiveness and continued societal health and prosperity.

## **The Past**

Look back at the past 25 years of US economic activity with respect to chemicals extraction, selection, and use. Imagine a lens through which you view only the perspectives dominant in 1980-1995. Through that lens you would observe resistance to regulation by corporate lobbying. You also would see the growth of EH&S departments focused on reporting requirements to local, state and federal agencies and avoidance of fines and lawsuits. These reflect the dominant view that often persists today, one caught in the rut of corporate behavior characterized by the assumption that health and environmental concerns are about compliance, overhead costs, profit loss, liabilities, lawsuit threats, boycotts, risk and generally, problems. This outdated but persistent orientation to environmental concerns locks firms into rigid, dead ended and shallow positions such as “the government should stay out of business” and (from the environmentalist side, “companies cannot be trusted, they must be regulated and punished for transgressions.”

## **The Future?**

Imagine now adjusting that lens. The compliance, cost and punishment mode of thought blurs and an alternative perspective comes into sharp focus. This picture shows companies of all sizes active in creating alternative feedstock and molecular materials; designing out hazardous chemicals; redesigning process chemistry to reduce or eliminate steps, energy and water use, and toxins; and buyers specifying increasingly more benign components and finished products that can be disposed of safely or recycled back in closed loop material cycles and new products. Imagine a coordinated public policy approach designed to dramatically decrease oil imports, encourage alternative and safe materials selection, reward innovation breakthroughs in product design with tax deductions, spur capital investments to accomplish these goals with accelerated depreciation schedules for new equipment and production line redesign, and timely agency approval of materials and process changes that advance sustainability objectives. Imagine companies across different industries competing for leadership to set standards for sustainable design and practice. Imagine the US becoming a leading source for “green” know how and technology, transforming not only developed economies but emerging economies’ development paths as well.

## **The present**

There now exists an expanding market space that invites economic and revenue growth to coexist compatibly with steady reduction of ecological and human toxicity threats. Stakeholders in the chemical production, processing and application industries can join forces around the innovations that are being stimulated by green chemistry and other “sustainability” (triple bottom line) oriented frameworks. The train has left the station, but unfortunately many participants remain on the platform arguing with each other from the comfortable safety of outdated assumptions about their industry, the consequences of chemical use, as well as the role of government.

This is disturbing because there is perhaps no more important sector of the economy than the chemical feedstock industry and the supply chains that reach from those producers to the average citizen in the form of products used daily. Furthermore the chemical industry constitutes a fundamental foundation of the *global* economy. The chemical materials we extract, synthesize, process and apply toward an improved standard of living already have brought tremendous benefits and will continue to do so. The rules that have applied for many years to producers, processors, retailers, as well as the ultimate customer who literally consumes the product (as in pharmaceuticals) or uses the function of the product and then throws it away (as in everyday

plastic products) are outdated. Waste streams and emissions throughout the supply chain were seen as having no cost. The true cost of dispersing and accumulating concentrations of microscopic and visible waste are coming home to roost. New knowledge about limits to the capacities of natural systems to self-renew in the face of growing chemical concentrations and unintended effects of chemical use present us with tough choices from here forward. The situation can be viewed as threat or opportunity. We choose to focus on the opportunities for innovation. Why not, since companies are already actively and successfully pursuing these opportunities? Zero sum approaches lack imagination. Win-win outcomes are the inevitable outcome of green chemistry applications.

## **Conclusion**

Why shouldn't we view chemical selection, use, and end of life disposal as a cycle that needs to be closed when toxicity is involved or needs redesign to ultimately eliminate known hazards. If this seems unrealistic, zero injuries, zero inventory, and 6 sigma quality standards were seen as laughable when first announced. Now zero defects, zero waste, zero hazardous materials, and zero emissions are targets many companies have set for themselves. What once was seen as impossible becomes industry practice. We would suggest to the reader that design through industrial ecology frameworks, design for disassembly and product take-back, life cycle assessment, cradle-to-cradle management of products, all these will be part of accepted "best practices" for companies operating worldwide, Green chemistry principles offer the bedrock on which these reside. *Predicting* a future vision from current policies (corporate and governmental) fails the challenge at hand. An alternative future that incorporates sustainability concerns will be generated only by conscious commitment to that goal.

## **Key questions:**

- **What specific actions are needed to create a future that incorporates sustainability concerns?**
- **What are the priority barriers and how can they be removed to allow others to follow the pioneers?**
- **Are there education and training requirements?**
- **Incentives required?**
- **How might innovative firms be rewarded?**
- **What regulations will accelerate adoption of better practices?**
- **What other enabling options exist?**