Framing a Future Chemicals Policy

A Working Forum for Stakeholders

Final Report

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Lowell Center for Sustainable Production
UNIVERSITY OF MASSACHUSETTS

www.sustainableproduction.org
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Meeting Summary

Around the world, forward-thinking businesses, governments, and non-governmental organizations are beginning to think about chemicals and chemical substances differently. Frameworks for chemicals policy and management established in the 1970s are being challenged, reconsidered, and revised. These reforms are aimed at ensuring businesses and industries that are innovative, versatile and competitive; good jobs; and a natural environment that supports the health and well being of children, adults, and ecosystems.

The Lowell Center for Sustainable Production hosted a multi-stakeholder forum to begin a dialogue about framing future directions in chemicals policy in Boston on April 28 and 29, 2005. The forum brought together chemical producers, product manufacturers, representatives of government and non-government organizations, and others for broad discussions on key elements of a future chemicals policy. The forum focused on the realities we now face and on how the creativity and imagination of leading thinkers could create new approaches for a future of more sustainable chemicals.

The forum was organized with the hope that smaller workshops in combination with speakers from different stakeholders involved in chemicals management would launch a deeper understanding of what a future chemicals policy should accomplish, and the roles and responsibilities of different societal actors in the future.

The outcomes of the forum are:

1. This meeting summary;
2. A set of papers prepared prior to the forum to set the context for the workshop discussions;
3. Individual workshop reports, summarizing discussion and key outcomes; and
4. A strong commitment to future multi-stakeholder work to continue the discussions initiated at the April 2005 forum.

This meeting summary provides a brief overview of presentations made at the conference, as well as key conclusions. Power point slides of some presentations are available on the Lowell Center for Sustainable Production's Chemicals Policy website www.chemicalspolicy.org.

Presentation Overview

Plenary Session 1: Sustainable chemicals management - looking forward

Joel Tickner, Lowell Center for Sustainable Production

During the past half-century, thousands of chemical substances have been developed and put into commerce. These modern chemicals are critical components of many everyday products that enhance our quality of life. Many of these chemical substances also present environmental and public health dangers. However, we can achieve the functions that chemicals provide while using less harmful materials and stimulating innovation.

For the large majority of chemical substances in commerce, a basic lack of information exists internationally on potential environmental and health impacts, as well as volumes and movement through the economy. New and existing chemicals are treated unequally in most regulatory systems. A much higher burden of proof of safety is required for new chemicals, while minimal or no data is required for existing chemicals. Chemical by chemical risk assessment and management processes are often slow and inefficient. Countries lack an integrated, modernized, and forward-looking approach to chemicals management. There is a lack of incentives to stimulate development of safer substitutes. Meanwhile, concern about chemicals is increasing in the face of low public confidence in government and industry.

The way a problem is framed helps to define the types of solutions one seeks. A broader, more inclusive framing can help lead to deeper, longer-lasting solutions. There is likely to be some disagreement, however, on the nature of the problem (and the solutions).

There is a unique opportunity to advance chemicals policy that provides understanding and information on chemicals, addresses chemical hazards/risks and promotes innovation. Moving forward requires new strategies, new thinking, new collaborations and creative, open thinking. We need to move our frame from reaction to proactive solutions and remember that change will be a long process.

Panel 1 — Sustainable chemicals management – views from Government officials and international organizations

Ethel Forsberg, Swedish Chemicals Inspectorate (KEMI)

One of the main goals of the 1999 "Swedish Environmental Quality Objectives," which outlines 15 environmental quality objectives to be attained by 2020, is to achieve a "non-toxic environment." The goal states that "The environment must be free from man-made substances and metals that represent a threat to health of biological diversity. This means that the levels of substances that occur naturally in the environment must be close to background levels; the levels of man-made substances in the environment must be close to zero."

The Government Committee charged with implementing this objective concluded that all potentially harmful chemicals must have basic testing completed by 2010 to be allowed on the market; that policies to address chemicals must also address hazards associated with their use in products; and that certain chemicals with particularly harmful qualities should be phased out over time.

Towards this objective, the Swedish Chemicals Inspectorate (KemI) has developed proposals for providing information on the presence of hazardous chemicals in articles. Information would always be provided for substances of very high concern, including metals. For other hazardous substances, information would be provided for articles used by vulnerable groups, such as children or the elderly. Additionally, there would be a right to request information on whether any substance classified as hazardous was present in an article.

Charles Auer, US EPA

EPA's Office of Pollution Prevention and Toxics, charged with implementing the Toxic Substances Control Act and the 1990 Pollution Prevention Act, has established a number of voluntary initiatives designed to generate information on chemical substances and minimize adverse impacts. Among others, in the High Production Volume Challenge and the Voluntary Children's Chemical Evaluation Program, chemical manufacturers agree to test and provide information on substances of concern. With its Design for the Environment program, EPA works directly with industry and other stakeholders to identify and develop innovative approaches for meeting technological needs of industry, while taking full account of health and environmental concerns.

Laurence Musset, OECD Environment Directorate

The OECD (Organization for Economic Cooperation and Development) New Chemicals Task Force is undertaking a pilot of the Mutual Acceptance of Notifications (MAN). MAN would allow companies to submit one notification (assessment dossier) and then, after national review and assessment of the risks, market anywhere. This parallel process would facilitate the more efficient introduction of new chemicals to the marketplace and improve decision-making.

John Arseneau, Environmental Protection Service, Environment Canada

The unequal level of information we have with respect to existing chemicals and new chemicals presents a tremendous barrier to delivering on the promise of certain ideas like green chemistry, design for the environment, sustainable chemicals use, etc. As a result of REACH, information being gathered in Canada, and the High Production Volume challenge in the US, this should be changing in the coming years.

In both the United States and Canada, there has been a rethinking of the public trust equation with respect to government's role and industry's role in protecting the public interest. This must be addressed by both government and industry.

Information flows are extremely important, not only to reestablish trust and an understanding of what's going on, but also to make the market and society work. Old systems of addressing chemicals one by one will not keep up with the pace of new products being developed, including nanotechnology.

There is a need to look at things in an objective way and with our mutual interests in the long term very clearly aligned.

Eva Sandberg, European Commission Directorate General Environment, Brussels, Belgium

The Globally Harmonized System of Classification and Labeling of Chemicals (GHS) integrates the technical work of three organizations, the International Labour Organisation, the Organisation for Economic Cooperation and Development, and the United Nations Committee of Experts on the Transport of Dangerous Goods. GHS is a voluntary system that provides a platform upon which countries can build their own chemical safety programs. GHS will facilitate trade and promote the sound management of chemicals. GHS establishes:

- Criteria for the intrinsic hazards of chemicals.
- Classification processes that use available data on chemicals and compare it with defined hazard criteria.
- Tools for communication on labels and Safety Data Sheets.

Commitment to adopt GHS is widespread. Countries are conducting detailed analyses to determine what will be required to implement GHS within existing legal frameworks. Implementation will require long-term collaboration with international organizations, industry, and labor.

The UNEP (United Nations Environment Programme) Governing Council has adopted a plan to develop a strategic approach to international chemicals management (SAICM) by 2006. SAICM is an opportunity to advance the international sound management of chemicals through the co-ordination of multi-lateral agreements, funding agencies, and capacity-building efforts. A key feature of SAICM is that all stakeholders have been brought to the table in an effort to develop a shared sense of responsibility. SAICM will consist of an overarching policy strategy, a global plan of action, and high-level declaration. The US would like to see SAICM develop a set of strategic priorities with time lines and targets that could be incorporated into aid programs.

Sustainable chemicals management from a workers' perspective

Andy King, United Steel Workers, Canada

The Health and Safety Committee and Environment Committees of the Canadian Labor Congress, which is affiliated to the International Confederation of Free Trade Unions, has undertaken a number of worker health and environmental protection activities with regards to chemicals. In 1993, the Committee adopted a national policy on regulating hazardous substances that recognized for the first time the link between environmental and health and safety concerns. In 1998, a subsequent review took place, which shifted attention to pollution prevention and zero discharge of pollutants, with a tax on the corporate use of chemicals and the use of collective bargaining to reach these goals.

Labor still faces challenges in engaging a larger percentage of the labor movement in environmental concerns, in the lack of political will to regulate, and in threats made by management. For industries that want to make environmental improvements, recommendations are difficult, given the paucity of information on alternatives.

Opportunities exist in building coalitions between environmental groups and labor and by exposing the impact the legacy of toxic chemicals, such as chemical-related illness.

Panel 2 — Future sustainable chemicals management – views from stakeholders

Mike Walls, American Chemistry Council

In the chemical industry's view, it is already a sustainable industry, though a work in progress. Incentives and other voluntary approaches to produce products in new ways complement basic regulatory approaches. The chemical industry has participated in international conversations on chemical policy. However, it views sustainability in a larger context, which includes the economic sustainability of the industry.

The chemical industry would like for its expertise in science and risk management to be respected. It would like more information on how chemicals are distributed and used through the chain of commerce. The industry would like the regulatory system to focus on the most significant risk to health and the environment first. The industry would also like to see more clarity in objective and in terminology, so that it can be determined what information is necessary to promote better decision making.

Wendy Porter, Interface Fabrics Division

Interface, Inc., a major carpet and textiles manufacturer, has undertaken two review processes to prioritize the chemicals they use. In its first review, the company relied on material safety data sheets (MSDS), which it found frustrating. MSDSs provide information on products as they relate to worker safety and minimum OSHA requirements, which was inadequate for the company's needs. Further, information that was provided was of poor quality and attempts to contact chemical manufacturers for better information were often met with resistance.

In its second review, Interface required suppliers and vendors to disclose all ingredients. Using an interdepartmental team and a labor-intensive process, the company then decided which chemicals it would use and which prohibited. The company has developed a product line using entirely screened chemicals that saves $300,000 annually in chemical costs. Interface has educated the marketplace about its work and the choices this affords the customer, thereby creating further value for its efforts.

Nadia Haiama-Neurohr, Greenpeace European Unit, Brussels, Belgium

The Greenpeace European Unit in Brussels monitors and tries to influence European Union (EU) policymaking on toxics and hazardous chemicals. Its vision for the future is one free of toxic chemicals, where the production of hazardous chemicals is identified and phased out based on intrinsic chemical properties, notably persistence and bioaccumulation. Greenpeace believes that chemicals should be regulated by groups or classes, not individually, that basic safety and health information is needed on all chemicals, and that no new hazardous chemicals should be created.

The NGO (non-government organization) community has been progressively more disappointed with the development of the EU's REACH policy since its initial proposal in a 2001 white paper. The NGO community does believe that REACH is important in that it is a systematic approach eliminating the distinction between new and existing chemicals and placing the burden of proof on industry to provide basic safety data. Among other objections, however, the NGO community believes that mandatory substitution should be required for very hazardous chemicals, that authorization to use them if adequately controlled should not be permitted, as is now proposed.

Darryl Ditz, Center for International Environmental Law

A fundamental chemical policy design question is the allocation of responsibility for the safety of products among those in the supply chain. Groups around the world have been having similar conversations on chemical policy for many years. These conversations are important, producing evolving principles, for example, the Precautionary Principle. Some of those principles are being turned into policy, as is the case with REACH.

The goals of environmental health advocacy organizations are outlined in the Louisville Charter, a statement endorsed by over 50 organizations:

- Require safer substitutes and solutions.
- Phase-out persistent, bioaccumulative, or highly toxic chemicals.
- Give the public and workers the full right-to-know and participate.
- Act on early warnings.
- Require comprehensive safety data for all chemicals.
- Take immediate action to protect communities and workers.

Plenary Session 2: Solutions for sustainable chemicals management

Paul Anastas, Green Chemistry Institute

Green chemistry is the design of chemical products and processes that reduce or eliminate the use and generation of hazardous substances throughout production, use, and disposal. In 1990, President Clinton introduced the Presidential Green Chemistry Challenge Awards, which have been replicated in Australia, Italy, Japan, Spain, and the UK. The Green Chemistry Institute, born from a partnership between EPA and the American Chemical Society, promotes research, education, and sharing of information between stakeholders and has 30 branches in 30 countries. Educational materials through EPA and American Chemical Society partnership ensure that green chemistry innovations are being incorporated into college students' chemistry education. EPA works with companies to integrate green chemistry considerations into new chemicals design.

Green chemistry is being applied to a wide range of products, including agriculture, personal care, automotive, and electronics. Examples of green chemistry innovations include a pesticide targeted to a particular biological mechanism in the target pest, lead-free paint coatings for cars, and plastics made from renewable feedstocks.

While EPA has been a leader in promoting green chemistry, its implementation in practice has suffered from a general lack of funding. The eventual passage of the Green Chemistry Research and Development Act now being debated in Congress will hopefully elevate the importance and funding for green chemistry efforts.

John Strong, Consorta

Consorta is a corporation and the purchasing cooperative for 13 Catholic health care systems, with an annual purchase volume of approximately $4.1 billion. Consorta is committed to “conduct business in a socially responsible and ethical manner that protects the safety of its employees, and its Shareholders' patients and employees, as well as the environment.” To meet this goal, it has prioritized chemicals of concern and requires disclosure of their presence in products when evaluating potential suppliers. In five years, Consorta has established 67 contracts with environmentally preferred products.

Obtaining information on chemicals in products has proven challenging. Suppliers themselves often do not know the composition of finished products, since so many manufacturers are involved in the supply chain. Consorta has found that the lack of a strong national chemical policy creates a burden for healthcare organizations, which must operate in uncertainty and face potential liability from the use of hazardous materials.

David C. Long, SC Johnson

SC Johnson is a family-owned company that manufactures a variety of consumer products, including Ziploc containers, Windex glass cleaner, and Off! insect repellent. The company’s CEO, Fisk Johnson, established its Greenlist initiative to reduce the environmental “footprint” of SC Johnson products. Greenlist is a process that compares the environmental and biological impacts of chemical choices, ranking them as “best,” “better,” “acceptable,” or “restricted use material”. Using results from Greenlist, SC Johnson reformulated Windex Blue Glass Cleaner, eliminating one million kilograms of VOCs while improving product performance and increasing sales by eight percent. Overall, the company has eliminated over 11 million kilograms of less desirable material and increased the use of materials it rated “better” or “best’ by 13 million kilograms. However, despite these successes, the company has struggled to obtain adequate data on chemical toxicity from suppliers and as a result must conduct many of its own analyses.

Key outcomes

In both the workshops and plenary sessions, common themes became apparent, presented below. Consensus was not a goal of the forum, and consensus was not reached on these themes or their resolution. However, it was clear that stakeholders do want to continue the discussions to identify areas of common ground – for example innovation in safer chemistry.

1. There is a need to develop, access, and share information on chemical properties and uses.

Information is critical for companies, authorities, and the public to understand and act on risks and to stimulate safer and cleaner alternatives. There remain serious information gaps in a number of areas, including chemical properties, effects on human populations, including workers, effects on ecosystems, and alternatives. Information is also lacking on how chemicals are used, the efficiency with which they are used, where and in what volumes they move through commerce, and opportunities for preventative interventions. Further, no system exists to provide ready access to appropriate information at the appropriate time by those who need it.

Mechanisms are needed to develop and communicate this information. A wide range of views exists regarding just how much and what information is necessary, for whom, in what form and for what purpose, and whose responsibility it should be to generate and disseminate the information.

Information serves no purpose if it not used. Right to know efforts in the US have demonstrated the power of public information for prevention. As such, provision of information needs to be an active requirement of firms. Chemical producers are best situated for generating data on the health and environmental effects of their products and understanding how those products are distributed and used in commerce. While such public provision of information does need to be balanced with protection of legitimate confidential business information, trade information protections should not occur at the expense of public health.

Transparency regarding the properties and use of chemicals, and the content of products is vitally important in enabling stakeholders to make informed decisions. Communities that host facilities that make or use chemicals need science and business information to have effective discussions with local companies, including more information on good companies and good chemicals. Manufacturers and workers that use chemicals need information to decide whether and how to switch to more benign inputs. Clear, simple labels would help educate consumers to make wise choices, as well as recognize leading manufacturers.

2. There is a need to greatly increase the use of green chemistry.

There is widespread agreement that green chemistry, wherein chemicals are designed at the molecular level to accomplish a task effectively while remaining benign to environmental and human health, is highly desirable. However, budgets to support green chemistry are minimal. A significant increase in funding is needed to establish and strengthen mechanisms that support the development and use of green chemistry solutions.

Legislation and market forces can institute willingness to embrace technological innovation by forcing data collection and action on particular chemicals and by instituting a culture of sustainable chemicals management. Through regulation, government can set minimum standards and prevent less innovative companies from undermining leaders. Government can also require firms to institute comprehensive planning processes to consider the implications of substitution or reduction on process and product design or health.

More than willingness, the capacity to change, supported by technical assistance, information, and research support, is often as important or more important for stimulating innovation. Government should provide support through:

- Education, training, and outreach on substitution methods and development of tools for chemical assessment.
- Research and development funding for safer substances.
- Direct technical support to firms for substitution.
- Recognition of leading companies and research.

A comprehensive effort should be made to provide education about chemistry and the relationship of chemicals in commerce to environmental and human health, and green chemistry in particular. Education is needed at all levels, including K – 12, college, and professional, as well as teacher education for K – 12 and college levels. Curriculum development is necessary before any large-scale effort can take place.

3. There is a need to establish norms for the sound management of chemicals

International cooperation will be necessary to achieve the goal of sound management of chemicals. The industrialized nations share responsibility for the assessment and management of the risks of new and existing chemicals in commerce; the high production volume chemical data collection efforts in Europe, Canada, and the US offer a partial solution to this problem.

Forum participants suggested six options for integrating U.S. and global chemical initiatives:

- Implement the Globally Harmonized System of Classification and Labeling Chemicals (GHS) in the U.S.
- Develop protocols that allow for data sharing data between the U.S. and other political entities.
- Address Confidential Business Information (CBI) issues.
- Ratify the Stockholm Convention on Persistent Organic Pollutants in the U.S.
- Expand the High Production Volume (HPV) data collection program.
- Convene a stakeholder working group to further cultivate areas of agreement.

Next Steps:

The Forum on Framing a Future Chemicals Policy spurred important dialogue on how chemicals policies at the state, federal, international, and corporate levels can more effectively prevent chemical hazards while stimulating innovation in safer chemistry and chemicals management. It is critical that these discussions continue – to find new opportunities for collaboration and critical reflection. To follow on the forum discussions, the Lowell Center will undertake the following activities:

The Lowell Center for Sustainable Production and the Darden Business School at the University of Virginia will host a November 2005 conference for businesses interested in discussing the challenges of moving toward greener chemistry within supply chains. This meeting will explore opportunities for improved supply chain communication about chemical hazards, uses, and alternatives.

The Lowell Center is organizing on-going discussion groups to follow on two key issues identified at the forum: Improving information flows through supply chains through the application of the Globally Harmonized System of Classification and Labeling; and improving decision-making on chemicals within firms. These groups will hold phone discussions periodically and produce working papers to advance discussions in these areas.

Background Forum Overview: The Need for a New Frame

Chemicals are a key element of the global economy and form part of a more sustainable society. They are incorporated into millions of products we use every day, and they are essential to society. However, many chemicals have dangerous or environmentally damaging characteristics, and their use needs to be controlled to avoid harm to workers, the public, and the environment. And for many more chemicals, we simply don't know enough to determine whether they are safe in the manner they are – or could be – used. How can we improve the way in which many chemicals are managed to avoid their safety problems, particularly those that are chronic, subtle, and poorly understood? How can we more effectively address the continuing lack of available safety information on some chemicals, missing information on supply chain uses, and lack of understanding on material flows? How can innovation in green chemistry and design for environment be promoted and supported?

Businesses are being held increasingly accountable for the economic, social, and environmental consequences of their activities. There is also an increasing global awareness about the potential impacts of chemicals on health and ecosystems, driving an increasingly environmentally conscious market-place. This new reality has created exciting opportunities for innovation and change, and many firms are responding. In some cases companies are developing their own chemicals management policies – however their efforts are limited by difficulties in determining which chemicals are safer.

The United States for many years has been a leader in chemicals management. However, U.S. chemicals policy is aging – the primary federal chemicals management statute, TSCA, has not been revised since it was enacted more than 25 years ago. While many of the problems of chemicals management remain largely unchanged since TSCA was enacted, newer information on chemicals, such as knowledge on low dose effects and vulnerable subpopulations (and the challenges of acting on the basis of uncertain knowledge) poses new challenges to federal chemicals management systems. Additionally, new solutions such as pollution prevention and green chemistry have, for the most part, not formed a central part of federal policy, receiving only minimal funding and policy attention.

Outside the U.S., there has been a vigorous multi-stakeholder dialogue in Europe focused on designing new approaches to chemicals management, as well as an international dialogue driven by the Stockholm and Rotterdam Conventions, the Globally Harmonized System for Classification and Labeling, and the United Nation's Strategic Approach to International Chemicals Management. Similar discussions are also beginning at the state level in the United States, in Canada, and in the context of the NAFTA Commission on Environmental Cooperation. These international discussions and policy initiatives provide both a challenge to U.S. companies having to comply with stricter norms in other parts of the world, but also an opportunity for these companies to innovate in safer materials and products and increase their global competitiveness.

These discussions in Europe and internationally also provide a unique opportunity to examine the U.S. experience in promoting sustainable chemicals management. There are many unique aspects of the U.S. experience in chemicals management that could provide useful insight into emerging U.S. and international discussions on sustainable chemicals management. These include: 1) extensive experience in using and developing rapid screening tools for chemicals, such as (quantitative) structural activity relationships; voluntary initiatives to gather data and promote pollution prevention, such as the High Production Volume Challenge and the Design for Environment Program, and 2) global leadership in the establishment and promotion of green chemistry. Further, some states have implemented successful chemicals management programs. For example, through a combination of regulatory requirements and non-regulatory technical services, the Massachusetts Toxics Use Reduction program has resulted in a more than 40% reduction in targeted toxic chemical use and 80% reduction in the releases of those chemicals, while saving industry millions of dollars.

Given this context, we believe that a multi-stakeholder dialogue focused on the elements of a sustainable, integrated chemicals policy is a necessary first step for reforming chemicals management in the US. The Lowell Center for Sustainable Production has organized "Framing a Future Chemicals Policy: A Working Stakeholder Forum" to jumpstart this dialogue. We hope to make this forum a collective first step toward a future we can live with: businesses and industries that are innovative, versatile and competitive, and a natural environment that supports the health and well being of children, adults, and ecosystems.

The overall goal of the Forum is to engage a diverse multi-stakeholder dialogue on solutions to address current limitations in chemicals management efforts as well as opportunities for policies and tools that can be instituted at the firm, state, national and international levels to promote innovation in green chemistry and sustainable product design. We define policy broadly, to include public policy as well as the corporate policies that guide materials choices and competitive behavior.

Consistent with the goals of the Johannesburg World Summit on Sustainable Development, the Forum is designed to encourage creative thinking on the design of a future chemicals economy that solves the problems of the past while stimulating innovation for safer chemicals and products that are of high quality and affordable. We need to focus now on the legacy we want to leave to future generations.

Presentations will be made from representatives of many stakeholder groups from varied backgrounds and perspectives, with work sessions designed to examine the different issues in more depth. This will give participants a chance to more fully understand the barriers and complications faced by the different players in the chemical system.

Work Sessions

A key part of the forum will be a set of work sessions which examine a number of aspects of chemicals policy in more depth. The Forum Organizing Committee, made up of representatives from industry, government, non-governmental organizations, and academia developed a set of seven elements that should form a critical part of any sustainable chemicals management system. These form the basis of the work session topics. These include:

1. Promotion of innovation, green chemistry and alternative materials.
2. Defining and obtaining good quality information for decision making.
3. Improving Information Flows – in Supply Chains and Beyond.
4. Integration of US and Global chemical initiatives.
5. Promotion and development of substitution and alternatives assessment.

6. Integrating improved chemicals management into business processes, including product design.
7. Improving our understanding of substance flows through the economy.

Each work session has a short introductory paper, posing some key questions. Note that these papers are not intended to be a definitive statement on the issue, but that they are intended to inform the discussion, start the dialogue and provide some key questions.

The Work Sessions will be convened twice. Therefore, each participant will be able to attend two work sessions. The work sessions are not expected to generate any consensus positions. Instead, they are intended to refine and develop the individual elements of a future chemicals framework and to generate a range of options, some of which may be contradictory, which can then contribute to future dialogues.

The expected outcome of the conference

We are not expecting this conference to generate simple solutions. However, we will be producing a conference report that elaborates on the elements of a more sustainable chemicals management framework and presents the options developed in the work sessions, and discussed in the plenary panel discussions. We hope that this report will be a useful resource for future discussions on this issue. Thus, this conference and its report are the start of a process not the end.

We also hope that everyone who participates will find this opportunity to have an in-depth discussion on the many issues with a diverse group of stakeholders that is both stimulating and useful for their own work. If we all understand the views of others better and recognize our differences as well our agreements at the end of the forum, then we should be closer to finding solutions for a more sustainable future.

Workshop 1: Green Chemistry Principles as a Catalyst for Corporate Innovation

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

Background Paper
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 silos, 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 the 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?**

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

- These reports are intended to reflect the discussion in the workshop, but have been written by one or more of the workshop team and have not been agreed by the other participants.
- These reports should be read with the background paper for the workshop
- The views expressed in these workshop reports are the views of the individuals concerned and the workshop participants, and do not necessarily reflect the views of their employers.

Workshop Report

Promotion of Green Chemistry, Innovation, and Alternative Materials

Workshop team: Andrea Larson, Karen O’Brien, Eileen Gunn, Tom Eastabrook

This report discusses the set of options generated by workshop 1 participants. The workshop had a strong turn-out both days with about 30 people attending Thursday and approximately 25 on Friday. The first pages highlight options supported by a broad range of stakeholders present. The second section provides detail on key options considered, then lists valid suggestions around which there was less group agreement.

The workshop’s starting premise was that benign substitutes, produced by corporate innovation through the application of green chemistry and other sustainability principles, were proliferating and could be viewed as a logical and productive response to regulation. The workshop, while not ignoring regulatory issues, focused more on the opportunity for solutions-based innovation. Options were discussed that would allow health and environmental concerns associated with chemical use to be translated into improved products *and* more valuable outcomes for all parties along the supply chain. This view was contrasted with more conventional business thinking that assumes environmentally and socially responsible management of business results in higher costs to firms and increased prices for consumers. Non-corporate participants expressed frustration with mainstream business thinking that excluded these considerations and the seeming futility of getting businesses to change. Hearing that green chemistry, and other frameworks and tools, offered alternatives, there was enthusiasm expressed for identifying and pursing strategies for positive solutions, whether positive incentives through regulatory mechanisms or support for innovative solutions-oriented leaders (individuals or institutions) in business.

There was agreement that government must play a regulatory role to set a minimum standard below which companies should not fall. Regulations also prevent laggards from undermining leaders through price cutting. There also was a strong voice for government spending to support a transition to more benign alternatives through investments in research, product development, and broad education initiatives. Public policy sets the guidelines, provides carrots and sticks, with enforcement of “sticks” providing signal of

The history of environmental activism dredges up images of battles between environmentalists defined as tree-hugging, anti-business, Berkenstock-wearing idealists on the one hand, and evil business (and ineffective regulators that support evil business), on the other. For many who have been fighting *against* a variety of actions (unregulated deforestation, product toxicity, wetlands destruction, rollbacks in environmental regulation), the opportunity to embrace a strategy *for* innovation – a positive step - is appealing. There was an appreciation for those in business actively working to improve chemical materials selection and to create healthier product designs. Thus, discussion covered ways to assist business people who are aligned with healthy alternatives. The form of the support spanned a range from stringent regulatory requirements on information accessibility across the value chain to immediate education of younger children to shift attitudes and spending patterns. It was expressed that the basic notion of the economy residing within the natural world seems to have been forgotten, and while obvious to those participating here, it needs to be emphasized more with broader audiences. This view is mirrored in the "externalities" argument that assumes social and environmental impacts are outside the domain of companies and therefore not financially relevant.

The challenge of knowing how to create "the good" products and processes and then how buyers can assess "good" options was discussed at length. Through development of scientific tools and feedback flows from animal and human health studies we have new information on what causes harm. Consequently we know materials should be discouraged if not banned in commerce, but how do we determine what constitutes a preferred alternative?

This challenge ripples throughout the supply chain. How do companies determine what is "good", then how do large scale purchasers (including governments) screen their procurement decisions in favor of better products? In reality (given new links between exposure to toxins and health harm), whether you are a feedstock provider, formulator, processor, assembler, manufacturer, retailer, consumer or waste disposal administrator, there is a disturbing lack of information on materials and safe alternatives. If new material choices are available, how might they be screened across the value chain? There was widespread agreement that lack of information along the value chain was a real and serious barrier that impedes all stakeholders. This is not simply an immediate hazard problem for those exposed, but also a long term risk and liability issue for firms.

The following information was presented on the last afternoon of the conference **summarizing the issues and priorities raised in the <u>two</u> discussions.**

The participants generated and ranked a set of alternatives, a synthesis of which is captured in the four <u>option categories</u> below.

- **Primary Research**
- **Education**
- **Transparency**
- **Market Campaigns**

A high proportion of the discussions and options generated revolved around these four areas. Many expressed desire for a strong government role to create change, others were less sure the government was the sole or most appropriate driver of the option (obviously government would not be appropriate for item #4). A request for written preference voting at the end of each workshop confirmed which options were most important. This information was summarized in slides presented on the last day of the conference. Duplication of these slides, with short explanatory comments, follows. **The groups expressed strong support for:**

Primary Research in Green Chemistry

- **Green chemistry funding** by federal agencies (NSF, NIH, DOE, DOD…) – needs significant increase – including R&D, substitute materials development, barrier removal, education and incentives for companies and educators moving toward more health- and environmentally-aware practices – innovators need to be recognized and rewarded for creating substitutes;
- **State level partnerships** (like TURI) – build more of these
- **Study government procurement policies** - to be certain green products are not inadvertently discriminated against; create positive incentives

Education

- **Educate the educators** – professors of higher education in chemistry, engineering, business – as well as training for chemistry taught below college level
- **Curriculum development** – major need here – at all levels – government needs to lead
- **K-12** – key is to educate younger children, now
- **Higher ed** – creation and integration of curricula ASAP
- **Industry funding** – needs to be a priority for industry

Transparency – stakeholders' right to know & companies' duty to care

- **Credible 3rd party certification** – trust = a key issue
- **Labeling for consumers** – they need simple, clear signals
- **Alternative assessment requirement** – federal regulation needed to require companies show they have explored alternatives
- **Better information for communities** – fence line communities need science and business information to have effective discussions with local companies; more info on good companies, good chemicals
- **Better information for manufacturers and labor**– through legislation if necessary, to allow accelerated change-over to more benign inputs – Use NJ and MA as models for product information. Labeling and clarity of information is essential; however, it is not clear what information is needed by different stakeholders: toxicity, hazard, exposure, physical chemistry, all of these? What information is sufficient, how should it be prioritized, what about mixtures and interactions? Information currently provided to those exposed during manufacturing is insufficient, particularly around multiple chemical exposures, who will make it available and relevant? Reformulation information is unavailable – common criteria and standards needed. All stakeholders need to know what chemicals should be off the market, avoided, or considered highly suspect. Complaint that even when information is available it is hard to use.

- **Better reporting out of green practices by firms –** this information is needed by consumer, NGOs. TRI-type information communicating what is safe and available.
- **Content information for large buyers –** latter need information to meet demand of end users (for example, hospital group purchasing organizations) – creation of clearinghouse for green chemicals suggested
- **Value chain communication –** toxicity of materials and components must be communicated to meet changing demand and liability threats, and to stimulate innovation/substitution

Market Campaigns

- **Retailer focus –** best leverage is to target retailers, not consumers – need more activity with more groups involved in different sectors and more communication with innovator firms to understand alternatives
- **Identify leaders and laggards –** supporting innovative leaders is critically important

Other options discussed and that received support:

1. build sustainability & green chemistry criteria into city, state, federal procurement policies
2. remove regulatory barriers for government purchasing of innovator companies' preferable products; create specifications that reward innovation
3. study and report on common themes across corporate success stories to use in education
4. convene product development oriented chemists, green chemistry specialists, and environmental health specialists to communicate across traditional divides and to develop curricula
5. patent life extensions for sustainability & green chemistry innovations
6. require safest alternatives be mandated by government
7. study existing market-based financial resources to expand this capital pool
8. study political strategies at local and state levels that have moved this agenda forward, and that are likely to move it forward in the future – communicate these
9. develop awards – more recognition needed for leaders and innovators
10. train country leaders – sounds challenging to implement but must be done
11. create centers of information that would make available condensed information for a wide range of groups – cover green chemistry, business approaches ("translations" of science and business ideas into useful material for non-chemists, non-business people)
12. declare green chemistry U.S. national policy
13. elevate discussion of economic models to include work of ecologically oriented economic analysts – some of whom have been working for several decades at the margins of the economics field - to respond to the conventional economic view that the status quo makes "good economic sense" when, in fact, it may not when viewed in systems terms or on an intermediate or longer time horizon

14. provide information summaries to assist neighborhood activist groups achieve short term cleaner production goals with nearby company facilities – for example, how to integrate zero toxicity thinking with total quality management, lean production, clean production, full cost accounting, etc. (to clean up existing sites)
15. metrics for investors – report on existing approaches, and develop more effective metrics, for investor groups to assess preferred companies and less risky stocks

Miscellaneous – we need visionary, inspirational goals, not fighting *against* as much as identifying things to fight FOR
We may be missing needed discussion about trade barriers because we do not have trade reps here.

Workshop 2: Information needs for decision-making that protects health and ecosystems and spurs innovation

Background Paper

Information needs for decision-making that protects health and ecosystems and spurs innovation

Joel Tickner, Lowell Center for Sustainable Production
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Information is critical to the sound management of chemicals, including prevention and innovation in safer chemicals, processes, and products. Much of the international discussion on chemicals management has focused on toxicity information needs, particularly on government risk assessment and risk management processes. However, less attention has been placed on information pertaining to materials flows, alternative technologies, and exposure potential, or how information can be applied to facilitate decision-making and innovation. Further, historically, most of the current data collection exercises at the national and international levels have focused on information for government and chemical industry decision-makers and may not fully consider workers, downstream users and retailers, and the general public as users of chemical information.

Having processes in place to provide optimal levels of information necessary to facilitate timely and effective decision-making is a crucial element of sustainable chemicals management. Such information must be as current and valid as possible, acknowledging uncertainties in scientific knowledge, and it must be accessible to a range of different “users”. The paper raises questions about specific data needs and uses.

1. The importance of information for decision-making

1.1 Information is critical for companies, governments and the public to understand and act on risks and to stimulate innovation in safer alternatives. Data on chemical toxicity, ecotoxicity and exposure are needed along with information on materials flows that illustrate how chemicals are used, the efficiency with which they are used and so forth. Information on how best to synthesize data and compare options is important for government agencies, firms, and others attempting to make decisions regarding chemicals and chemical processes.

1.2 Users of chemical information include government, industry (manufacturers, downstream users, retailers), workers and the public. In general, government agencies, companies, and, to a lesser degree, workers are the main consumers of toxicity-related information, and are thus the focus of this paper. However, while the public (and in many cases, small and medium-sized firms) would not be expected to use technical data, their “agents”, such as health and environmental groups, labor unions and small business organizations, can and do use toxicity information and information pertaining to substitute products and processes. Assuring access by these groups to chemical information, including raw data, increases accountability for both industry and government with respect to data accuracy and actions taken in response to data. The U.S. experience with the Toxics Release Inventory demonstrates the effectiveness of publicly available data for influencing pollution prevention activities.

2. Types of information necessary for decision-making

The type of information needed to make preventive decisions regarding toxic substances differs by the type of decision being made and who is making it (governments, firms, consumers). These types of decisions include:

- Pre-manufacture/pre-market review
- Prioritization for testing and/or risk management actions
- Regulatory controls/limits
- Hazard communication
- Substitution options
- Purchasing decisions

Depending on the decision-making process, simple or comprehensive data may be needed. Nonetheless, there are four considerations that are germane to chemical information: (a) knowing the robustness of the information and being clear about data limitations and uncertainties; (b) matching the degree of robustness to the type of decision being made; (c) having an ability to update information quickly to identify and act on early warnings; and (d) ensuring adequate transparency to improve accountability.

There are several types of information that are useful in this context, including:[1]

2.1 Physiochemical and environmental fate properties

Generic properties of chemicals can be important for determining whether a chemical could be problematic. For example, explosivity, flash point, boiling point, bioaccumulation, persistence etc. are all useful for characterizing the hazardousness and fate of a substance and for grouping chemicals with similar properties. Understanding physiochemical properties of substances at the molecular level is a central element of green chemistry. These properties are established through relatively simple tests and predictive models.

2.2 Toxicity (Human/Ecological)

2.2.1 The intrinsic properties of toxicity and ecotoxicity play a role in understanding the implications of exposure to a substance or group of substances. Often such data may be enough to take preventive action. Data can be “screening level” or detailed. It can be based on direct testing of a particular substance or on surrogate measures, such as quantitative structure activity relationships (QSAR) or other methods. Through the OECD’s Screening Information Dataset (SIDS) program, the International Council of Chemical Association’s (ICCA) screening program

[1] We focus here on data about individual chemicals. Understanding the potential cumulative and interactive effects of multiple chemical and physical exposures, while important, is beyond the scope of most scientific analyses at this time. Identifying ways to determine the potential for cumulative or interactive effects should be pursued with more rigor, given the multiple substances and other stressors to which humans and ecosystems are exposed.

and the U.S. EPA's High Production Volume (HPV) Challenge, some screening-level toxicity information on high volume chemicals is being developed. While there are substantial limitations to these data, including a lack of exposure data, a lack of data on the great majority of toxicological endpoints and a lack of attention to medium and lower production chemicals, these approaches provide useful input for prioritizing future testing and risk management efforts. The European Union's Registration, Evaluation and Authorization of Chemicals (REACH) proposal will require more extensive, tiered testing on a broader range of chemicals. It is challenging to define the quantity of data that is needed to adequately characterize a chemical's potential to cause problems, or the quantity that is necessary to raise concern. Answers to these questions likely depend on particular circumstances and the nature of the decisions to be made. Clearly, there are trade-offs between obtaining actual test data for every chemical (in both time and cost) and using more rapid methods such as QSARs.

2.2.2 In general, there are three types of information that can serve to improve understanding of the toxicity of a chemical: in vivo tests, in vitro alternative methods, and QSARs. Epidemiologic data, of course, are lacking for the great majority of chemicals and are essentially unobtainable for practical, fiscal and ethical reasons.

- Direct in-vivo testing has benefits in most cases over other test methods for understanding chemical toxicity but can be costly and is problematic from an animal welfare point of view.
- Alternative test models and in-vitro screens are being improved but are not likely to be available and validated for some years.
- QSARs, while having been improved over the years, are still limited for predicting some endpoints.

There is a need for mechanisms that would improve rapid toxicity screening and allow for effective prioritization. Data from efforts such as SIDS, REACH, and HPV could provide critical data for improving predictive models and design.

2.3 Chemical Purpose, Use, and Flow through the Supply Chain

2.3.1 While data on chemical properties are important for understanding chemical hazards, data on materials flows are equally important for understanding how chemicals are used, the efficiency with which they are used, their distribution throughout a supply chain, and opportunities for preventive interventions. For example, industry research has demonstrated that chemical producers often know very little about the uses of their chemicals more than one or two steps down the supply chain. It is essentially impossible to effectively manage chemicals without this information. Experience with implementation of the Massachusetts Toxics Use Reduction Program (www.turi.org) and similar programs (such as in New Jersey) has shown that many companies are inefficient in managing chemicals, and that information on chemicals is "dispersed" among numerous players in the firm. In Massachusetts, materials accounting has been important for stimulating toxics use reduction activities, particularly in firms that are downstream users of chemicals, where chemicals provide a "service" that can often be provided by less toxic substances. (See the chemical flows background paper).

2.4 Exposure

2.4.1 Exposure assessment is the process of evaluating exposure by characterizing the sources, paths and internal dose of chemicals that come in contact with living beings and the environment. Simple exposure assessment strategies are essential to priority-setting in chemicals policy. On the other hand, exposure assessment is limited in important ways. While the inherent *toxicity* and other physical properties of a chemical are testable and verifiable (even though the interpretation of tests can be debated), the results themselves do not change depending on how the chemical is used. Exposure, on the other hand, is highly variable between people, tasks, time and (in the case of modeling) the assumptions of the assessor. While efforts are underway to standardize exposure *methodologies* for use in public policy, at present basic exposure data on most chemicals are not available. For U.S. states, this includes the identity of chemicals in commerce, where and how the chemicals are used, in what volume, for what purpose, and the ways in which they might come in contact with workers, members of the public, and the environment. Exposure assessment is often the most challenging and uncertain aspect of characterizing chemical risks.

2.4.2 The challenge of exposure assessment is particularly apparent in the case of persistent and bioaccumulative chemicals. Because these chemicals accumulate in the environment and in the human body, it is possible that their effects could materialize gradually, over time and across generations. Some of these chemicals are also known today to be toxic; that is they are "persistent, bioaccumulative *and* toxic", or "PBT". Simple exposure assessment models can be useful for setting policy priorities for PBT chemicals. For example, identifying PBT chemicals that are likely to come in contact with children would represent an appropriate application of exposure assessment. Conversely, analyses that attempt to characterize in detail the nature of exposure among children but in the process delay the introduction of safer substitutes would represent an inappropriate application of exposure assessment methods

2.4.3 The Canadian government, through its prioritization of chemicals process under the Canadian Environmental Protection Act, is developing exposure assessment tools (SimET and ComET) to prioritize chemical risk assessment and risk management activities. Linking a set of basic chemical toxicity data with data on chemical properties, together with simple exposure assessment models (such as volume in commerce and the locations and types of uses) is a potentially effective approach to priority-setting in chemicals policy.

2.5 Alternatives and Substitutes (chemicals, processes, designs)

2.5.1 Internationally, most data collection efforts on chemicals have focused on the toxicity of, and exposure to, individual chemicals or groups. Less information has been generated on alternative chemicals, processes or product designs that would reduce risks. Having good information about substitutes and alternative designs can facilitate decision-making, particularly when there is a clearly superior alternative, such as a safer chemical substitute or process design that eliminates use of a toxic chemical. Government agencies and academic institutions can provide important technical support to firms in evaluating alternative technologies, undertaking demonstration projects and networking firms working on similar problems. In the state of Massachusetts, for example, work by the Surface Solutions Laboratory at the University of Massachusetts Lowell has been critical to the substitution of chlorinated solvents (see.www.cleanersolutions.org).

2.6 Measurements of progress towards reduction/prevention – product registers, surveillance, etc. for early warnings

2.6.1 It is not possible to evaluate the impact of chemicals policies without data on change that occur in chemical use or emissions. Information on chemical consumption and flow can be a useful evaluation tool. The Massachusetts Toxics Use Reduction Act's chemical use reporting database provides information on chemical use in the state, including data normalized per unit of product. The Nordic Product registry keeps track of the types and quantities of chemicals used in products and has been compiled into the SPIN database; to date, however, no publicly available studies of changes in chemical use have been conducted using the data. The lack of post-implementation data collection represents a critical gap in many chemicals management efforts at the firm and government levels that limits the broader adoption of innovative policy approaches.

Questions:

- **Who should be responsible for generating chemical information and who should review it?**
- **What are the most effective ways of ensuring useful and comprehensive data on chemical exposure throughout a supply chain?**

3. Putting information together for decision-making

3.1 Information serves no purpose if it is not useable. Detailed quantitative risk assessments, for example, often do not facilitate timely decision-making because of their cost, the years required for their development, and the intractable debates they often engender. These problems have been a key driver for reform in the European Union. In most cases, rapid approaches for developing and implementing safer alternatives are more useful than quantitative risk assessments.

3.2 A number of government agencies and private organizations have developed schemes for rapid chemicals assessment and risk management prioritization, including US EPA's PBT Profiler and Pollution Prevention Framework, the Swedish government's PRIO process and the Dutch SOMS process. The Massachusetts Toxics Use Reduction Institute is currently conducting an analysis of rapid screening and alternatives assessment tools.

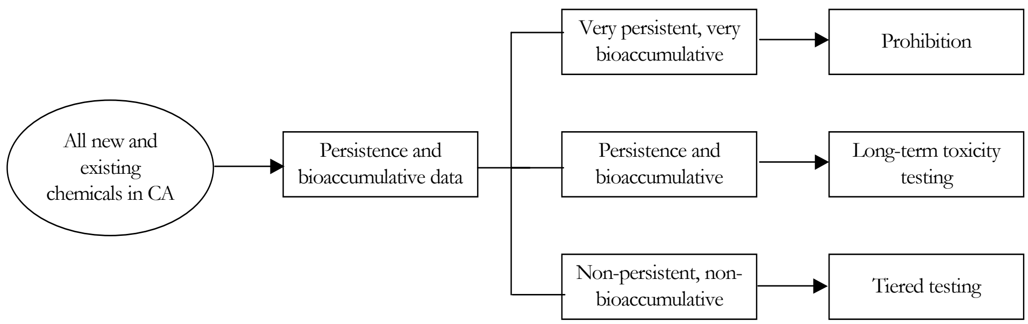
Questions:

- **Is information on physiochemical properties, for example, enough to take preventive actions?**
- **Are quantitative risk assessments needed or are qualitative estimates sufficient?**

3.3 A key question in the context of decision-making in chemicals policy is whether a basic set of information is needed on *all* chemicals, or if it is possible to prioritize efforts on particular types of chemicals, uses, or concerns using readily available information. Chemical prioritization mechanisms have been proposed that use the "volume in commerce" or "inherent chemical properties". Volume in commerce, of course, is not necessarily an accurate proxy for exposure, while information on "inherent chemical properties" is extremely limited. A key challenge with the second approach is identifying the type of information that is necessary and sufficient for priority-setting, whilst avoiding a de-prioritization of chemicals for which little safety information is available.

3.4 One example of the second approach is screening for persistence (P) and bioaccumulative (B) potential, regardless of volume in commerce, as illustrated in a Swedish model for prioritizing both new and existing chemicals in Figure I.

Figure I Proposed Swedish strategy for chemical priority-setting.



Questions:

- **Where does one err in the case of uncertain data about hazard or risk?**
- **How do data needs differ by the type of decision being made?**
- **To what extent can decisions be reviewed and updated when new information emerges and how can that enter the decision-making process?**
- **What is the right balance between resources dedicated to gathering additional data and resources dedicated to preventive actions?**

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Workshop Report
Information needs for decision-making that protects health and ecosystems and spurs innovation

Authors: Mike Wilson and Joel Tickner.

Overarching issue: The workshop focused on the following statement, drawn from the paper submitted by Joel and Mike and edited by the group on day 2:

“Credible information is critical for companies, workers, government and the public to understand and make better decisions and to stimulate innovation in safer chemicals and processes.”

This workshop focused specifically on the first two words of this statement; that is, the issues associated with “credible information.” Discussion focused in the following questions:

1. What is the current status of information on chemicals?

- There have been some positive steps recently, such as HPV and REACH, to improve basic chemical information. However, in the U.S. there remains serious information gaps in a number of areas.
- There is a lack of information on chemical *properties*. This includes toxicity, environmental effects, environmental fate, measures of persistence and bioaccumulative potential and others. There is need for tools to improve information, regardless of who produces it, without having to use animal toxicity tests. It was noted that these tests are becoming more viable and will continue to do so over time.
- There is a lack of information on chemical *effects* in the human population. This includes health effects across the full range of possible toxic endpoints, and the effects of chemical mixtures both acutely and over a lifetime of exposure.
- There is a lack of information on chemical *effects* in the ecosystem. This includes the long-term effects of persistent and bioaccumulating chemicals.
- There is a lack of information on chemicals *uses*, volumes in commerce and other qualitative measures of exposure, such as dispersion in the environment, uses in occupational settings, uses in consumer products.

- There is a lack of information on chemical *life cycles*, and the points in each cycle that represent possible areas of contact with humans and the environment.
- There is a lack of information on chemical *alternatives* that is publicly available and usable by a wide range of businesses, governmental agencies, non-governmental organizations and the public.
- It was noted by NGO representatives that these information gaps undermine the ability of the market to reflect people's choices, and values, which essentially supports the continued production and use of chemicals that might be hazardous. It also undermines the ability of green chemistry and other clean technologies to gain a competitive advantage in the market. The current information gaps therefore represent a market failure engendered by deficiencies in the current regulatory system under TSCA.

2. Who should be responsible for producing these kinds of data, and what issues does responsibility for providing information raise?

- Chemical producers are best situated for generating data on the health and environmental effects of their products and understanding how those products are distributed and used in commerce. This is a basic component of Responsible Care, as noted in the first group by industry representatives.
- The primary concern raised was assuring the credibility of the information produced by industry. Industry representatives noted that at present, toxicity testing is almost entirely carried out by contract laboratories that conform to international standards of best practice and accountability. It was noted by an NGO representative that this would not necessarily assure adequate study design and data interpretation. One solution proposed was the establishment of reasonable penalties for firms that manipulate or otherwise misrepresent chemical testing data.
- The transparency of the testing process and data interpretation was viewed as essential to chemicals policy by NGO representatives, whereas industry representatives raised concerns over protecting intellectual property and issues of liability.
- While government involvement in testing was considered important, it was noted that government also requires outside oversight to assure accountability and prevent "capture" of an agency by industry. NGO representatives reiterated the importance of a participatory process with public disclosure of "raw" data, rather than data summarized by either industry or government.

3. What kinds of information are needed?

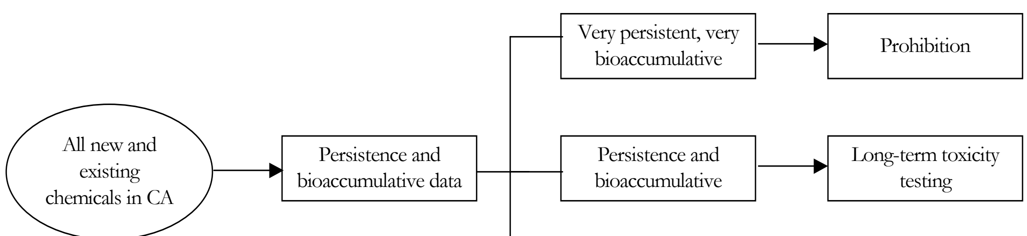
- It was clear from the workshops that information needs vary widely depending on the user of the information. These include the following:
  - Chemical producers need extensive toxicity and environmental effects information and information on how their products are distributed and used in commerce.
  - Industrial formulators of chemical products need standardized, robust toxicity and environmental information to assure the safety of their workers and the safety of the products they produce. They also need easily accessible information on chemical alternatives and access to technical assistance in order to produce products that are both

efficacious and safe, without having to create their own toxicology program. It was noted that this is particularly important for small and medium-sized operations.

- Retailers need a more concise body of information that is standardized for purposes of comparing a wide range of products.
- Government agencies and policymakers need robust, standardized health and environmental information in order to identify, evaluate, prioritize and address chemical hazards within their areas of responsibility.
- Workers and their representatives need summarized, standardized information that allows for rapid decision-making and selection of safer alternatives.
- Consumers need a standardized set of information or labels that effectively communicate hazard or lack of information, again for rapid decision-making and selection of safer alternatives.

4. What is the minimum amount of information needed for decision-making?

- The groups agreed that screening tools for evaluating chemical toxicity and environmental effects are necessary and appropriate.
- The groups agreed that quantitative risk assessment is not a necessary or appropriate prerequisite for a business or government to act to reduce a perceived risk.
- A Swedish model proposed by a research group was presented for discussion:



- Industry representatives expressed concern over screening tools that moved directly from identification of “very persistent, very bioaccumulative” properties for a substance to policies that would remove that substance from commerce; i.e. “prohibition”. They felt additional information on exposure potential and the possibility of dispersion into the environment is needed before such policies should be considered. The European representatives expressed the point of view that substances with “vPvB” properties cannot be adequately controlled and should be presumptively removed from commerce, regardless of questions of exposure and use.
- Screening on the basis of persistence and bioaccumulative potential, however, was supported by both groups as a reasonable process, assuming the parameters of the tests were agreed upon.

5. What kinds of policy options should be considered at this point?

- Mechanisms to increase the body of information on chemical toxicity, environmental effects, uses in the chain of commerce and alternatives, and make that information available to the public, businesses and governments.
- Mechanisms to support the development of tools for rapid screening, and a vehicle for reaching consensus on parameters of these tools and their appropriate use.
- Mechanisms to better ensure a duty of care on the part of chemical producers.
- Mechanisms that would combine regulatory and incentive-based approaches to encourage and support innovation in, and use of, safer chemicals and chemical processes.
- Mechanisms to bring information on safer chemical alternatives into the public arena and to provide for technical assistance to businesses that seek ways of using these materials.
- Mechanisms to it encourage greater attention to health and environment in the design, production and use of chemicals.
- Mechanisms to support education and research in universities in green chemistry and other clean chemical technologies.

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Workshop 3: Improving Information Flows – in Supply Chains and Beyond

"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.

Background Paper

Improving Information Flows – In Supply Chains and Beyond

Richard A. Denison, PhD, Senior Scientist
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A free flow of chemical information is a critical element of a sustainable chemicals policy, enabling and empowering those affecting – or affected by – chemical production, use and disposal to make informed decisions that minimize risk.

This paper provides a brief look at experience with, opportunities for and barriers to information flow at various steps in the chemical "value chain",[2] extending from chemical producers to users of chemical products and ultimately to the public at large. Roles and responsibilities of actors in generating, communicating, receiving and acting on chemical information are delineated.

Introduction

Few would argue with the proposition that effectively identifying and managing chemical risks requires, first and foremost, access to information. It follows that sufficiently managing the generation of chemical information[3] and its flow – providing ready access to appropriate information at the appropriate time by the actors who need it to make informed decisions about chemicals – is a cornerstone of a sustainable chemicals policy.

A useful way of thinking about information flows is provided by considering the linkages among the actors along a chemical "value chain," extending from chemical producers to users of chemical products and ultimately to the public at large. At each link, the roles and responsibilities of actors at that stage in generating, communicating, receiving and acting on information about the chemicals that are themselves flowing along the same chain can be delineated.

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[2] The term "value chain" is used herein to encompass the traditional concept of the chemical supply chain, but also to extend to "stakeholders" such as workers, consumers and the general public, in short all those who are involved in production or use of, or exposure to, chemicals and chemical products. It can also be thought of as representing the full lifecycle of a chemical.

[3] The term "chemical information" is used herein as shorthand for the diverse range of information about a chemical and its uses relevant to providing a full context for and understanding of its health and environmental risks and means for reducing such risks.

This paper will briefly touch on some of the features of, barriers to and opportunities for a richer and freer flow of information at each of several points in the chemical value chain. At the end of each section is a suggested question for further discussion in the conference workshop.

1. Information flow between producers and downstream industrial users of chemicals

Traditionally, the flow of chemical information at this step is limited and largely one-way (downstream), with both producers and downstream users having little incentive to share information. Information communicated from producers is largely limited to information relating to performance and appropriate handling, and – to the extent available – basic hazard information conveyed through relatively formulaic means such as Material Safety Data Sheets (MSDSs), as required by law. For their part, downstream users have little incentive to provide other than basic specifications and business needs information to their suppliers.

Disincentives for freer flow of information abound and include:

- Competition among suppliers for customers: Producers are reluctant to seek more information regarding how their chemical is handled and used for fear of losing business.
- Confidential business information: For example, producers regard their process and sales information, and downstream users regard their use and sales information, as highly proprietary.
- Liability: Both producers and users have concerns over being assigned responsibility for problems that arise with their products. This creates disincentives not only with respect to the sharing of information, but to the generation of the information in the first place.
- "Middlemen": Many chemicals are sold and bought through intermediate distributors or brokers who as a rule have even less incentive to share information upstream or downstream.

Yet both producers and downstream users possess considerable information the sharing of which (both with each other and with government and non-government stakeholders) is critical to the broader objective of safer chemical management. For example: Chemical producers have access to information on chemical identity, composition and form, and key properties; production volume, methods and processes; and the needs, practices and associated releases and exposures arising from handling, initial processing, storage and transport. Chemical users know about the intentional or residual presence of the chemical in their products, the uses and functions it serves, performance needs, additives and reaction or breakdown products, and their own needs, practices and associated releases and exposures arising from handling, initial processing, storage and transport.

These and other actors in the value chain have need for such information for a wide range of purposes, including meeting regulatory obligations or supplier/customer requirements, disclosure and labeling, and assessing risk, to name a few.[4]

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[4] A useful discussion of information needs, barriers to information flow and approaches to overcoming the barriers is contained in the proceedings of a June 2004 OECD workshop; see "Workshop on Exchanging Information Across a Chemical Product Chain," OECD Document ENV/JM/MONO(2004)29, 14 December 2004, available at www.olis.oecd.org/olis/2004doc.nsf/LinkTo/env-jm-mono(2004)29.

A number of voluntary and regulatory initiatives have as a stated aim increasing the flow of information along the supply chain, especially between chemical producers and users. A few examples:

- The latest status report of Responsible Care, the voluntary global chemical industry initiative "to improve the industry's health, safety and environmental performance, communications and accountability," points to adoption of its principles by European chemical distributors and efforts to improve the quality of MSDSs in Asian countries as examples of improved product stewardship through enhanced information flow along the supply chain.[5]
- The Chemical Strategies Partnership began the Chemical Management Services (CMS) Forum, which brings together chemical producers and industrial users to reorient the supplier-customer relationship toward a service model that includes fundamental changes in the exchange of information about chemical use along the supply chain.[6]
- The European Union's REACH proposal would mandate and facilitate two-way information exchange between suppliers and their customers and associated actions. For example, suppliers would be required to communicate safety information to, and identify safety procedures to be followed by, its customers. Downstream users would in general be required to communicate information about their uses of a chemical to their suppliers for inclusion in the risk assessment and chemical safety report required of chemical producers.[7]
- **Question: Given the barriers noted above, how much of this information flow can be achieved through voluntary means, or is regulation such as proposed in REACH needed to "force" it?**

2. Information flow to (and from) workers producing and using chemicals and chemical products

Traditionally, this information flow too has been largely one-way and restricted to companies' provision of information about chemicals to workers through Safety Data Sheets, training and similar means, mostly as dictated by law. For professional-grade products containing toxic chemicals at concentrations exceeding certain thresholds, hazard communication requirements apply in some countries that may require labeling and identification of safe handling requirements.

In an effort to harmonize such requirements across countries, the "Globally Harmonized System of Classification and Labelling of Chemicals (GHS)" has been developed under the auspices of the United Nations.[8] The GHS (which can also apply to consumer products and pesticides) includes: (a) harmonized criteria for classifying substances and mixtures according to their health, environmental and physical hazards; and (b) harmonized hazard communication elements, including requirements for labeling and safety data sheets.

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[5] See, for example, *Responsible Care Status Report 2002*, available at www.icca-chem.org/pdf/icca004.pdf.
[6] See www.cmsforum.org/index.html.
[7] See REACH, Articles 29-36, at http://europa.eu.int/eur-lex/en/com/pdf/2003/act0644en03/1.pdf.
[8] See www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html.

Labor organizations have generally supported legislative efforts to increase the amount and quality of chemical information available to workers, arguing that, left to their own, companies consistently fail to provide enough information. For example, the European Trade Union Confederation (ETUC) recently communicated its strong support for the EU's REACH proposal to members of the European Parliament, arguing that REACH is needed to address the continuing high incidence of chemical-related occupational disease resulting (in part) from "the lack of basic information about chemical substances" and "failings in conveying product safety information to the different users." ETUC's letter continues: "The information generated by the REACH system and the expected improvements in their transmission along the entire length of the production chain will help employers to detect the presence of hazardous chemicals in the workplace, a crucial step without which other obligations simply could not be met."[9]

In addition to being the recipients of chemical information, workers' direct interface with chemicals and chemical products argues that they can and should be far better utilized as a *source* of chemical information, especially concerning exposure potential, effectiveness of measures intended to communicate hazard and risk and controls used to reduce exposure, health effects, etc.

- **Question: How might workers best be tapped as a source of information about chemical hazards, exposures, and the need for and effectiveness of risk management measures? Consider this in the context of both improving chemicals management within companies and informing governmental policies.**

3. Information flow to end consumers of chemical products

The U.S. Federal Hazardous Substances Act,[10] administered by the Consumer Product Safety Commission, requires labeling of certain hazardous household products (excluding pesticides; see below) to alert consumers to the presence of a hazardous substance, the potential hazards, and measures to protect against those hazards. Labeling is required for any product (or constituent in a product) that is "toxic,[11] corrosive, flammable or combustible, an irritant, a strong sensitizer, or that generates pressure through decomposition, heat, or other means requires labeling, if the product may cause substantial personal injury or substantial illness during or as a proximate result of any customary or reasonable foreseeable handling or use, including reasonable foreseeable ingestion by children." Labeling takes the form of identifying the substance and the hazard, where required the use of certain "signal words" such as "Poison," "Danger," Warning," and "Caution," and handling instructions and precautions.[12] These requirements do not extend to all products, nor do they require the identification of the amount of a hazardous substance in a product.

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[9] Letter dated 16 February 2005 from the European Trade Union Confederation to members of the European Parliament, signed by John Monks, General Secretary and Joël Decaillon, Confederal Secretary. See also tutb.etuc.org/uk/dossiers/dossier.asp?dos_pk=1.
[10] See www.cpsc.gov/businfo/fhsa.html.
[11] In addition to acute toxicity, "toxicity" includes the following categories of chronic toxicity: known or probable carcinogens and neurological, reproductive or developmental toxicants.
[12] See 16 CFR, Title 16, Chapter II, Part 1500.3, available at a257.g.akamaitech.net/7/257/2422/12feb20041500/edocket.access.gpo.gov/cfr_2004/janqtr/pdf/16cfr1500.3.pdf.

Pesticide labeling in the U.S. is governed by the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA),[13] administered by USEPA. In general, pesticide active ingredients must be identified by name, and their weight percentage in the product must be stated. So-called "inert ingredients" need not be named but their total weight percentage must be disclosed. As with the hazardous products regulated by CPSC described above, signal words and handling instructions and precautions must appear on the label, along with information pertaining to first aid, storage and applicable empty container disposal requirements.[14]

In some countries, MSDSs[15] are often provided voluntarily by companies for their products,[16] although they are often out-of-date, cite broad weight percent ranges for individual ingredients, and are notoriously incomplete and inaccurate.[17] Some efforts to use product label and MSDS information to develop product ingredient databases (e.g., the Household Products Database of the National Library of Medicine[18]) have been mounted, but are plagued by the limitations of the available information.

Calls for required disclosure of more complete product information, especially with respect to hazardous ingredients, continue to be made in the context of a consumer "right to know," with industry countering that confidential business information (CBI) would be unduly compromised by further disclosure requirements.

- **<u>Question</u>: Do consumers have a right to know which chemicals in what amounts are in the products they buy? If so, how could such information be provided in a manner that was both useful to consumers and respecting of the legitimate CBI concerns of their manufacturers?**

4. Information flow to the public

The concept of the public's "right-to-know" (RTK) in the context of chemical information has become increasingly ensconced in chemicals policy in the U.S. and elsewhere. The spread of Pollutant Release and Transfer Registers (PRTRs), modeled after the U.S.'s Toxics Release Inventory (TRI),[19] is one example, with the legally-binding Kiev Protocol on PRTRs adopted in 2003 under the auspices of the UN Aarhus Convention now signed by 36 countries.[20]

PRTRs focus exclusively on pollutant releases, of course, only one aspect of a broader chemical RTK. The Aarhus Convention itself is described as a "Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters."[21] Various initiatives are aimed at increasing the scope of chemical information that is made

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[13] See www4.law.cornell.edu/uscode/7/ch6.html.
[14] See www.epa.gov/oppfod01/labeling/lrm/.
[15] Material Safety Data Sheets, actually required under U.S. Occupational Safety and Health Adminstration regulations; see 29 CFR Part 1910.1200(g), available online at www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10099#1910.1200(g).
[16] See, e.g., Procter & Gamble's "Science in the Box" website, scienceinthebox.com/en_UK/main/index_en.html.
[17] See Ritter, Stephen K., "Material Safety Data Sheets Eyed," *Chemical and Engineering News*, 7 February 2005, p. 24, available online (with account password) at pubs.acs.org/isubscribe/journals/cen/83/i06/html/8306gov1.html. In response to criticism, OSHA recently announced a MSDS quality enforcement initiative; see www.osha.gov/dsg/hazcom/MSDSenforcementInitiative.html.
[18] See hpd.nlm.nih.gov/index.htm.
[19] See www.epa.gov/tri/.
[20] See www.unece.org/env/pp/prtr.htm.
[21] See www.unece.org/env/pp/welcome.html.

publicly available, facilitating full public access to such information, and providing for greater involvement of the public in decisions about chemicals.

Some examples of initiatives seeking to expand the scope of available chemical information include:

- Toxics use reporting: The Massachusetts Toxics Use Reduction Act, a law passed in 1989, mandates companies that manufacture, process or use certain toxic chemicals to identify the uses, report quantities used (including in products), and prepare plans that assess options for reducing use.[22] New Jersey has a similar program.[23]
- Hazard information on high-production-volume (HPV) chemicals: Spurred by public attention drawn to the dearth of publicly available data characterizing the toxicity and environmental fate of even the most widely used industrial chemicals,[24] the voluntary U.S. HPV Challenge Program[25] (part of EPA's Chemical RTK Program) is developing and making publicly available a base set of screening-level hazard data on HPV chemicals; opportunity for public participation in the review of data submissions is a key element. An analogous international program, the OECD's Screening Information Data Set (SIDS) Program,[26] is generating data and hazard assessments for HPV chemicals produced in the 30+ OECD member countries, and while data ultimately are made public, opportunities for public participation are quite limited.
- REACH (see above). REACH has been criticized by environmental NGOs because in several respects it does not provide for sufficient public involvement and access to data.[27] Among the concerns: Information flow about a chemical ceases once it enters an "article," and procedures for requesting information are too cumbersome.

With respect to improving public access to chemical information, a number of key principles have been suggested:[28]

- *Public input into design of databases and portals*: Involve representatives of the public and other stakeholders (e.g., consumers, workers, tribes) early in the development and vetting of database and portal design and functionality. Different user groups will have different needs, expectations and uses for the data, which need to be anticipated in the design and modes of access to the information.
- *Make data directly available, "unfiltered"*: Many in industry argue that government should only provide public access to chemical data that has been "placed in proper

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[22] See www.turadata.turi.org/.
[23] See www.state.nj.us/dep/opppc/index.html.
[24] See Environmental Defense Fund. *Toxic Ignorance: The Continuing Absence of Basic Health Testing for Top-Selling Chemicals in the United States*. New York, NY: Environmental Defense Fund, 1997. (available online at www.environmentaldefense.org/documents/243_toxicignorance.pdf)
[25] See the EPA program website at www.epa.gov/chemrtk/volchall.htm and Environmental Defense's reports on the program at www.environmentaldefense.org/system/templates/page/subissue.cfm?subissue=14
[26] See www.oecd.org/document/21/0,2340,en_2649_34379_1939669_1_1_1_1,00.html
[27] See the position statement on REACH of the European Environmental Bureau, available at www.eeb.org/activities/chemicals/20031210-EEB-position-on-REACH.pdf, and the Copenhagen Chemicals Charter, www.eeb.org/activities/chemicals/Copenhagen%20Chemicals%20Charter2310.pdf, and.
[28] See, for example, presentations of Richard Denison, Environmental Defense, and Michael Warhurst, WWF-European Policy Office, at the U.S.-EU Transatlantic Conference on Chemicals, held in Charlottesville, VA on 26-28 April, 2004, available from USEPA, Office of Pollution Prevention and Toxics, Washington, DC.

context" lest the data be misinterpreted or misused. But an integral part of right-to-know is that the public and its representatives have unfettered access to data, so that those who use and are exposed to chemicals (not just those who make them) have the ability to independently assess the data and decide on actions they wish to take or advocate for. Supplementing this full disclosure can be the provision of tools and technical assistance to ensure maximum utility of the data to as broad a public audience as possible.

- *Tightly bound any exclusions of confidential business information (CBI)*: While there can be legitimate reasons for certain information to be held as CBI, a strong and public rationale needs to be provided for making any data off-limits to the public, and any data relevant to assessing the hazard, exposure or risk posed by a chemical should not qualify as CBI. Provision can and should be made for protecting companies' right to ownership of data, but that need not require it be regarded as CBI.
- *Find ways to share data across countries*: Data being generated and made public in various national and regional programs need to be shared. Officials point to various potential barriers to such data-sharing; for example, USEPA has indicated that the U.S. might not be able to receive CBI data submitted under REACH due to TSCA restrictions.[29]
- **<u>Question</u>: Does government have an obligation or prerogative to "interpret" chemical information before it is provided to the public? Would such interpretation reduce the likelihood of miscontrual or misuse of such information by the public, or would it deny the public's "right-to-know"?**

[29] See Pat Phibbs, *International Environment Daily*, Volume: 2004 Number: 81, April 28, 2004, available online at ehscenter.bna.com/pic2/ehs.nsf/id/BNAP-5YGGJS?OpenDocument.

- These reports are intended to reflect the discussion in the workshop, but have been written by one or more of the workshop team and have not been agreed by the other participants.
- These reports should be read with the background paper for the workshop
- The views expressed in these workshop reports are the views of the individuals concerned and the workshop participants, and do not necessarily reflect the views of their employers.

Workshop Report

Improving Information Flow – In Supply Chains and Beyond

Rapporteur’s Report: Richard A. Denison, PhD, Senior Scientist
Environmental Defense, Washington, DC
Facilitator: Liz Harriman, TURI

These workshop sessions focused on the desirability of, opportunities for improving and obstacles to a freer flow of information along the links of the chemical “value chain”,[30] extending from chemical producers to users of chemical products and ultimately to the public at large. In each session, participants represented a good cross-section of the sectors represented at the conference, including government, academia, chemical producers and industrial users, labor and NGO; Canada and the EU were represented along with the US.

Summary of discussion

Each session was begun by revisiting the main premises of the thought-starter paper, namely: “that effectively identifying and managing chemical risks requires, first and foremost, access to information. It follows that sufficiently managing the generation of chemical information[31] and its flow – providing ready access to appropriate information at the appropriate time by the actors who need it to make informed decisions about chemicals – is a cornerstone of a sustainable chemicals policy.”

Overall there was general agreement that both more information and its freer flow are needed. The sentiment that the value of information lies in its use, and the corollary that information should not be collected or communicated merely for information’s sake, were also strongly supported across the spectrum of stakeholders present. However, there was a more diverse range of views regarding just how much and what information is needed, by whom, in what form and for what purpose, and whose responsibility it should be to generate and disseminate the

[30] The term “value chain” is used herein to encompass the traditional concept of the chemical supply chain, but also to extend to “stakeholders” such as workers, consumers and the general public, in short all those who are involved in production or use of, or exposure to, chemicals and chemical products. It can also be thought of as representing the full lifecycle of a chemical.

[31] The term “chemical information” is used herein as shorthand for the diverse range of information about a chemical and its uses relevant to providing a full context for and understanding of its health and environmental risks and means for reducing such risks.

information. Participants identified and were largely in agreement on the need to address a number of barriers to freer flow of information, including confidential business information (CBI) constraints, liability associated with information disclosure, and incentives for maintaining secrecy, such as competitive forces and protection of data ownership.

There was considerable discussion especially in the first session as to the adequacy of Material Safety Data Sheets (MSDS) as vehicles for information flow. MSDS were regarded by most or all participants as necessary but not sufficient to meet all legitimate information needs. While some industry participants argued that MSDS do serve their intended purpose of hazard communication, other stakeholders from all sectors believed their utility is low even for this purpose, because of inconsistent, inaccurate, poor-quality and outdated information, compounded by a lack of enforcement of requirements governing MSDS content. Other needs identified as not addressed by MSDS include the need for information about: chemicals' presence in articles (end products); actual composition, not just hazards, of chemicals and chemical products (e.g., contaminants, byproducts, weight percentages of constituents in mixtures); lifecycle (e.g., end-of-life management or disposal) concerns; transformations of chemicals resulting from downstream processing, use or environmental forces.

Two major discussion items emerged from the workshops:

- What and how much information should be provided, and by whom?
- How might the current scope of CBI claims be "dissected" so as to identify means to limit its constraining effect while still protecting legitimate business needs?

What and how much information should be provided, and by whom?

Key features of the wide-ranging discussion on this question (on which there was *not* consensus) included the following:

- Responsibility for generating and communicating information needs to flow down chemicals supply chains, and should not rest solely with producers, who may not know how their chemicals are actually being used or transformed through downstream processing.
- Beyond a description of potential hazards, compositional information (e.g., material declarations) provided by suppliers was viewed as vital by a number of downstream industrial chemical users to their own product stewardship efforts, yet access to such information is often highly constrained.
- More than hazard (i.e., risk) information is needed in the workplace. Workers need to understand how to handle dangerous chemicals, how exposures can occur, and what are the nature and magnitude of the resulting risks.
- Some producers argued that they should be expected to provide information only where the purpose or intended use for the information is clear, and then only that information needed to serve that purpose. Most other stakeholders (downstream users, labor, NGOs) believed that the decision as to what information is needed, the use and interpretation of that information, and the determination of the appropriate decision framework in which that information is used, should be the prerogative of the user and not be left to the provider only.

- The public's perceived or actual ability to understand information should never be used as an excuse to withhold it, although the needs of the intended audience should be considered in determining in which form(s) the information is to be provided.

The crux of the debate on this question came down to these two positions:

- 1. Essentially as much information as possible in as "unfiltered" a form as possible should be provided to as broad a potential audience as possible, so that a range of potential users can decide how they wish to use the information. This information can and should then be "distilled" for specific uses by various users, a process that may involve the providers, users or both.
- 2. Information should be provided that is sufficient and in a form appropriate for a specific use and user, with the provider of the information centrally involved in such decisions.

Options for facilitating and defining the nature of chemical information flow were offered by different stakeholders:

- Chemical producers suggested an open process be used to identify information needs by sector/product type/user, as a means to determine what information in what form needs to be provided to whom; depending on the context, a voluntary or regulatory approach may be appropriate to make such decisions.
- Environmental NGOs tended more toward regulatory requirements or strong incentives to require/ensure release of a relatively comprehensive chemical information, so that a range of users can decide for themselves how they wish to use it.
- Downstream user industry representatives suggested that a defined set of information be required to be provided on essentially all chemical substances, and made available though a government database. Two options were offered as to what information should be required.
  - At least initially, the data needed to address each of the elements for which the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)[32] has defined classification criteria could be required.
  - The model of materials declarations for chemical substances and products used in several manufacturing sectors (e.g., automotive and electronics) should be considered in defining requirements; these declarations typically detail the material's composition, identifying and quantifying the constituents, including contaminants and byproducts, present in the material.
- Labor representatives proposed that employers should be required, not only to communicate to workers any chemical information they receive from suppliers, but also to assess the risks to workers of all chemicals used in the workplace.

[32] See www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html.

How might the current scope of CBI claims be "dissected" so as to identify means to limit its constraining effect while still protecting legitimate business needs?

There was surprisingly broad agreement that opportunities exist to reduce the extent to which CBI concerns limit disclosure of chemical information. Among the options (again not necessarily with consensus) discussed were the following:

- Draw a clearer distinction between CBI and proprietary information – that is, between information that needs to be *withheld* to avoid disclosing information that could compromise a business' ability to operate effectively in the marketplace, and information that is created and/or owned by a company, for which the concern is that disclosure could result in effective relinquishment of ownership rights without fair compensation. A number of participants argued that this distinction is blurred in U.S. law.
- Identify the settings and conditions under which law and regulations providing for CBI protection currently allow chemical identity to be claimed as CBI. Discuss the relative merits in each case of retaining, modifying or eliminating such protection, in light of the legitimate business and health and environmental concerns. For example, producers argue that divulging chemical identity for new chemicals would compromise the first-to-market advantage due the developer of the chemical by allowing competitors to know of its existence. In contrast, it is far harder to see any justification for current provisions allowing chemical identity of an existing chemical to be claimed CBI even in the context (e.g., under TSCA Section 8(e)) of a required disclosure of information pertaining to the potential substantial risk posed by that chemical. Withholding chemical identity effectively renders such risk information useless to the public – yet is allowed despite regulatory policies that preclude the withholding of health and environmental information about industrial chemicals.
- Explore means to provide data ownership protection while allowing or even rewarding disclosure of the information. For example:
    - Any company submitting chemical information, for example, to comply with regulatory requirements, could be required to demonstrate either that it is the owner of or otherwise has rights to the information in question, or that it has fairly compensated the owner or holder of such rights for its use of the information.
    - The market exclusivity rights and other incentives that accompany patents, which also require full disclosure of the nature and basis of the patent, may provide a useful model to consider in designing a system that rewards disclosure while providing for at least temporary marketplace advantage.
    - Means can also be explored whereby purchasers of chemicals and chemical products (whether industrial, institutional or individual) can reward in the marketplace those companies that disclose chemical information relative to those that do not, through preferential purchasing policies and practices.
- A related issue was also discussed: the role of liability in impeding (or in rarer cases serving as an incentive for) chemical information disclosure. While this issue may be worth further discussion, schemes that would reduce liability (e.g., limits on punitive

damages) in exchange for greater disclosure are fraught with complexities and a level of understanding of the issues involved that went well beyond the workgroup's charge.

Workshop 4: Integration of US and Global chemical initiatives

“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.

Background Paper
Integration of US and Global Chemical Initiatives

Robert Donkers, Delegation of the European Commission to the USA
John Arseneau and Bill Smith, Environment Canada

Summary

International cooperation will be necessary to achieve the goal of the sound management of chemicals by 2020. The goal of the World Summit on Sustainable Development is to ensure that, by 2020, chemicals are used and produced in ways that minimize significant adverse effects to human health and the environment, using transparent science-based risk assessment and risk management procedures. The only way this goal can be met is through the adroit collaboration of the United States and other countries.

The industrialized nations share responsibility for the assessment and management of the risks of existing and new chemicals in commerce. These chemicals are commonly found in most developed economies. The HPV challenges offer a partial solution to this problem but are unlikely to finish the job within the proposed time frame. The European Union and Canada have adopted very different strategies for meeting this challenge but are examining ways of co-operating. In order to form partnerships, the US would have to document its decisions and acquire the ability to share its assessments with other regulators, subject to the necessary protections for confidential business information. Europe and Canada already have or are in the process of acquiring this capacity.

The OECD New Chemicals Task Force is undertaking a pilot of the Mutual Acceptance of Notifications (MAN). MAN would allow companies to submit one notification (assessment dossier) and then, after national review and assessment of the risks, market anywhere. This parallel process would facilitate the more efficient introduction of new chemicals to the marketplace, and improve decision-making. Like the foregoing example, United States participation will depend on its ability to exchange information with other regulators. With any pilot, the key to success is the participation of as many countries and companies as possible.

The Globally Harmonized System of Classification and Labelling of Chemicals (GHS) is a voluntary system that provides a platform upon which countries can build their own chemical safety programs. It will have to be incorporated into national legislation. Implementation will require long-term collaboration with international organizations, industry and labour. GHS will facilitate trade and promote the sound management of chemicals.

SAICM (a strategic approach to international chemical management) is an opportunity to create synergies among an alphabet soup of multilateral environmental agreements on chemicals. substances. Policy

integration would contribute to the effective management of chemicals throughout their lifecycle. SAICM could also help identify funding priorities, and capacity building needs. It may also identify gaps and emerging concerns.

Background

The global production of chemicals has increased from less than a million tonnes in 1930 to over 400 million tonnes today. Production is increasingly moving to developing countries, many of which do not have the capacity to implement regimes for the sound management of chemicals.

Chemical issues are no longer confined to the chemical industry. Chemicals are part of everyday life. Moreover, hazardous chemicals, which are not approved for use, may still enter a country through long-range transport of pollution or the importation of products and articles.

Governments and industry are being forced to become increasingly open and transparent to satisfy demands for enhanced worker's protection and the public's right-to-know. The focus of public concern has shifted from industrial accidents (e.g. Bhopal) to the effects of chronic low dose exposure to multiple pollutants (e.g. endocrine disruptors.)

Hazard information is lacking for the majority of chemicals. We have to deal with a legacy of environmental contamination by persistent toxic organic chemicals and metals. Moreover, we must constantly monitor the environment to detect emerging chemical issues.

To some extent, the Chemical Industry has exercised leadership through its Responsible Care program, reducing releases of chemical substances to the environment, and through research aimed at developing greener products and processes. However, much remains to be done.

Over half the world's chemical trade now occurs between foreign branch offices of the same company. Companies serving a North American and a world market increasingly regard different national regulatory regimes as non-tariff barriers to trade. They want governments to harmonize their requirements and they want access to an inventory of inputs that they can use and ship anywhere in the world.

Existing chemicals

Currently, the most notable initiative addressing the need for hazard data on existing chemicals in the United States is the HPV challenge. There is an interagency testing program and data can also be requested through voluntary consent orders. The EU and Canada, in contrast, have had to respond to growing public concern with their lack of progress in assessing and managing priority substances and to demands for increased public accountability and transparency.

The European Commission has presented a draft regulation called REACH (Registration, Evaluation, Authorization and Restriction of Chemicals).The aim of REACH is to address the backlog of risk assessments of existing chemicals produced or imported in quantities over 1 metric ton per year per manufacturer/importer that have never been tested and assessed, as well as streamlining requirements of new and existing chemicals. It shifts the responsibility from government to producers and downstream industries to provide data (when necessary via testing), and to ensure the safe handling and use of their chemical-based products. REACH will be gradually introduced over the next 11-12 years, beginning with the registration of HPVs and the most hazardous substances.

A Registration dossier includes the substance's identity, information on the manufacture and intended use, proposed classification and labelling, guidance on safe use, and assessment data/testing proposals. A Chemical Safety Report (CSR) will be required for substances manufactured or imported in quantities above 10 metric tonnes per year per manufacturer or importer.

The CSR must be kept evergreen, integrating any new exposure scenario. (See Figure 1.) It also covers classification and labelling, and instructions for safe handling and use. The manufacturer or importer must also complete a declaration that appropriate risk management measures are implemented on-site and have been communicated to downstream users for identified uses (Extended Safety Data Sheets – SDS).

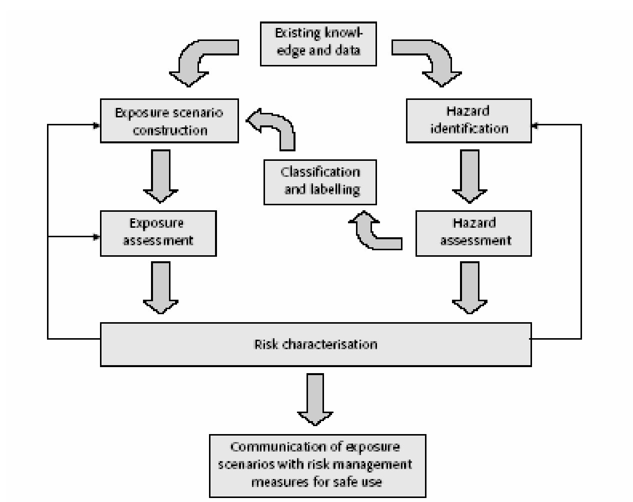

Figure 1 Chemical Safety Report (CSR)

The registration dossiers will be checked for conformity with requirements by the European Chemicals Agency (proposed) and results will be referred to the member state competent authorities in which the producer or the importer is established. Evaluation serves two purposes: to review testing proposals involving live animals; and to request additional data or assessment, where the substance's properties or use give rise to concern. In some cases, evaluations may lead to action under the authorization or restriction procedures.

Canada has a taken a different approach to the issue of existing substances. The Government uses publicly available data and industry is encouraged to submit data in its possession. Industry can be required to generate data where there is a suspicion of toxicity. The Government is also required to review decisions of other OECD nations to restrict or prohibit a substance. It has a two-track toxic management strategy: life-cycle management of toxic substances using various instruments; and virtual elimination of releases to the environment of substances that meet persistence and bioaccumulative criteria and are primarily anthropogenic.

In 1999, the Canadian Environmental Protection Act (CEPA) legislated a comprehensive review of every chemical in commerce. This review places special emphasis on chemicals that are persistent or bio-accumulative and inherently toxic (hazardous), and that have the greatest potential for human exposure. Over 23,000 substances have to be categorized by September 2006. Categorization is a priority setting tool that will systematically identify substances requiring immediate action or a further screening. Screening assessments will examine existing information from many sources, using a weight-of-evidence approach, to recommend that risk management measures be contemplated, that full-scale risk assessment be undertaken, or that no further action be taken at this time. A pilot study is testing all aspects of the screening process. Canada is finding it a challenge to move from a limited number of in-depth priority assessments to a large number of streamlined screening assessments, using information provided by industry.

Governments have minimal assessment information on chemicals in commerce. For example, Canada only has toxicity data for 8.5% and bioaccumulation data for 1% of the organic substances. Canada is using a voluntary submission challenge (June 2004) to augment publicly available data. Stakeholders were briefed about the information used, and the weight of evidence for each decision, so their attention could be brought to bear on decisions where additional data may influence the outcome. If the government is unsuccessful in getting the data it needs, it can then call for the data to be provided or testing to be undertaken by industry.

New chemicals

The OECD New Chemicals Task Force is undertaking a pilot for the Mutual Acceptance of Notifications (MAN). The pilot project is a safe way to exchange assessment information and to develop an acceptable way to document national regulatory decisions so that other regulatory agencies would have unimpeded access to the risk assessment information on which these decisions are based.

As the first step towards this goal, companies can choose (and would not be compelled) to notify under the MAN process. They would authorize inter-governmental sharing of their assessment dossier, and, where warranted, augment their notified information.

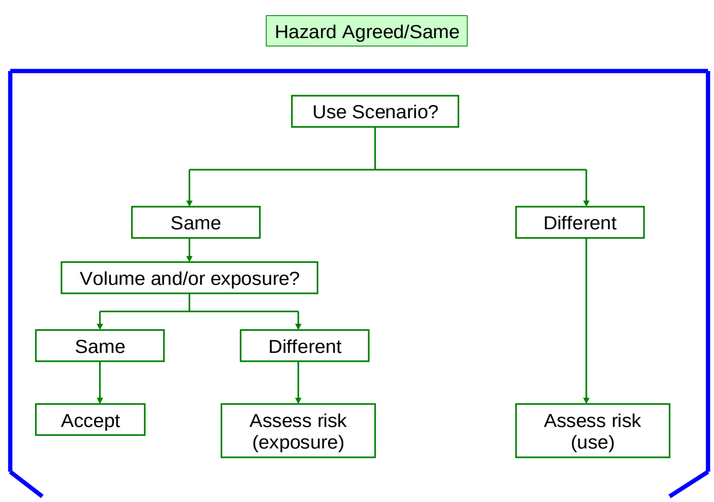

Figure 2 Equivalency Framework

The first country notified would review the notified substance, fully conduct the hazard assessment, and document and share the results. The other country when in receipt of such information would agree to use it in their risk assessment process. Each country would have to put in place measures for the effective and secure sharing of assessment information and for the protection of confidential business information. The use of common notification forms/tools would also contribute to making this vision a reality.

The participating countries may negotiate an equivalency framework (see Figure 2) so that each regulatory authority can determine whether or not they need to adapt the exposure and risk assessment findings to their local conditions. An equivalency framework would provide a decision tree providing scientific justification why a separate or new exposure and risk assessment may or may not be necessary.

Canada and the United States are on the steering committee for the pilot of the parallel process. The process will be presented to the Task Force meeting in April 2005 for approval. Canada will be the lead for the first assessment under this process. Australia and Japan will also participate. The extent of US involvement has not yet been confirmed.

Globally Harmonized System

The Globally Harmonized System of Classification and Labelling Chemicals (GHS) will establish a common basis to classify chemical hazards and to communicate this information using a labelling system based upon universally understandable pictograms and safety data sheets. Agenda 21 provided the impetus for this work, and the implementation plan was adopted in Johannesburg in September 2002 with the view to having the system operational by 2008. The GHS document is available at: http://www.unece.org/trans/danger/publi/ghs/officialtext.html Countries lacking systems for hazard classification and labelling are to adopt the GHS as the fundamental basis for national policies for the sound management of chemicals; countries that already have systems will align them with GHS.

GHS will help promote safer transportation, handling and use of chemicals. Harmonized criteria, symbols and warnings will promote improved understanding of hazards, helping to protect workers, consumers, and other potentially exposed populations. A more uniform system will enhance safety, improve compliance and reduce costs for companies involved in domestic and international trade. In the long run the system may lead to greater regulatory consistency among various jurisdictions.

Strategic Approach to International Chemicals Management (SAICM)

UNEP Governing Council has adopted a plan to develop a strategic approach to international chemicals management (SAICM) by 2005.

SAICM is an opportunity to advance the international sound management of chemicals through the co-ordination of multilateral agreements, funding agencies, and capacity building efforts. A key feature of SAICM is that all stakeholders have been brought to the table in an effort to develop a shared sense of responsibility. Policy integration across all sectors at both the national and international level will help ensure that chemical risks are managed throughout their lifecycle. SAICM will consist of an overarching policy strategy, a global plan of action, and high-level declaration. The United States would like to see SAICM develop a set of strategic priorities with time lines and targets that could be incorporated into aid programmes.

Questions to be discussed:

1) **Does the United States have the necessary legislative and policy tools it needs to collaborate with other nations? For example to**

   - **Share hazard and risk assessment information with other regulators**

   - **Share and protect confidential business information (CBI)**

2) **What more needs to be done to ensure that existing high volume and low volume chemicals in commerce are assessed and properly managed?**

   - **How can we share the burden more equitably?**

   - **How should we set priorities for assessment and management?**

3) **If the goal of mutual acceptance of notifications (notified once and reviewed every where) is to be achieved, how can we promote greater participation in the OECD Pilot of the parallel process?**

It is difficult for a country to show credible leadership if it does not ratify multilateral agreements that it has negotiated. How can the US play a more effective role in the implementation of multilateral environmental agreements

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

Workshop Report
Integration of US & Global Chemical Initiatives

Mark Rossi (rapporteur), Rob Donkers (background paper author), and John Arseneau (background paper author)

The primary task before Workgroup 4 was to identify options for integrating U.S. and global chemical initiatives. Over the course of two separate workgroups, the following six options emerged:

- Implement the Globally Harmonized System of Classification and Labeling Chemicals (GHS) in the U.S.
- Develop protocols that allow for data sharing data between the U.S. and other political entities.
- Address Confidential Business Information (CBI) issues.
- Ratify the Stockholm Convention on Persistent Organic Pollutants in the U.S.
- Expand the High Production Volume (HPV) data collection program.
- Convene a stakeholder working group to further cultivate areas of agreement.
-

1. Implement GHS in the U.S.

The central GHS questions that arose were:

- Does the U.S. Government plan to implement GHS?
  The US Environmental Protection Agency (EPA) is moving to implement GHS for pesticides. But there is no movement to implement GHS for industrial chemicals.

- Does the American business community support implementing GHS?
  There was broad support among the business community, including both chemical manufacturers and downstream users, for implementing GHS. This was especially true of multinational corporations who see the benefits in a single, labeling scheme; and for downstream users who want more chemical hazard data and consistent labeling.

Options for moving forward included:

- **De-couple GHS Implementation from Government Action**
  In the absence of the U.S. Government taking leadership on implementing GHS for industrial chemicals, participants agreed that the business community needs to take leadership and implement GHS.

- **Make the Business Case**
  Discussions explored how chemical manufacturers can begin labeling their chemicals based upon GHS while still complying with U.S. labeling requirements. Initial reaction was that this seemed possible, but would require greater research and agreement on the part of chemical manufacturers.
  Additionally, agreed that the business community should engage the US EPA in a dialogue on the need for implementing GHS for industrial chemicals; that it is insufficient for the EPA to only implement GHS for pesticides.

- **Joint Campaign in Support of Implementation**
  Given that both the environmental and business communities expressed support for implementing GHS with industrial chemicals, an opportunity was identified to jointly campaign the EPA in support of GHS.

2. Share Chemical Data

How can the data that has been generated on the physical, hazard, and toxicological properties of chemicals be shared globally?

While everyone agreed better mechanisms are needed for collecting and disseminating data, no agreements were reached on what those mechanisms are. Rather the workgroups generated a list of ideas:

- **Governments Should (or should not) be Involved in Collecting +/or Disseminating Data**
  No agreement emerged on the role of government in data collection and dissemination. Some wanted government involvement, others wanted no government involvement. Many ideas were floated on the roles that governments should play, including:
  -- Create incentives, such as financial compensation requirements or data ownership mechanisms, for making data available.
  -- Establish sanctions for failure to share data. Concerns were raised that companies will needlessly perform research on chemicals because no one knows that research has already been done. At a minimum the goal is to be sure that a comprehensive database of all tests done on a chemical are known.
  -- Be involved in the development of a chemical data clearinghouse. The potential role of governments in the clearinghouse ranged from: a) host it, b) facilitate its formation, or c) require its formation, but don't host it.

- **Create a Clearinghouse**

  There was widespread agreement that a clearinghouse is needed to collect and disseminate chemical data. Agreement was not reached on where to locate the clearinghouse. Options included having a trade association or government host the clearinghouse. Another creative option was to develop an eBay for chemical data or "ChemBay" where companies could buy and trade chemical data.

- **Data Needs to be Shared & Owners of the Data Must be Compensated**

  The model emerging in Europe is that companies owning proprietary data on a chemical have rights to that data for a set time period (much like a patent), and others that want access to the data must pay for it. There was a general inclination that such an approach is appropriate to the U.S.

- **Share Data for No Cost with Downstream Users in Exchange for Upstream Sharing of Findings**

  Chemical manufacturers should establish a quid pro quo with downstream users: in exchange for providing data for free to downstream users, the chemical manufacturers (who provided the data) receive back for free any data generated by the downstream user. This data sharing arrangement requires no government involvement.

- **How can the inter-government data exchange system, which is under development, enhance data sharing?**

  The EU and the U.S. governments are creating a global data portal for chemical data sharing among governments. Will this data sharing among governments be extended to businesses +/or the general public? No answers were generated to this question.

3. Address Confidential Business Information (CBI) Concerns

CBI concerns and claims have emerged as a major barrier to better sharing of data between governments and businesses. There was general agreement that steps need to be taken to minimize the CBI barrier to data sharing, including:

- **Agree on what information should be CBI, what information should never be CBI, & when CBI should be invoked**

  Agreed that criteria are needed for defining the appropriate and inappropriate use of CBI claims.
- **Separate CBI from proprietary data**

  How CBI claims differ from proprietary data claims needs to be clearly defined.
- **Need proposal from businesses on how to handle CBI**

  The business community needs to take the first step by developing a proposal for handling the above two issues.

4. Ratify POPs in the U.S.

The U.S. Senate has yet to ratify the Stockholm Convention on Persistent Organic Pollutants (POPs). General agreement that POPs ratification should happen. What steps should be taken to advance POPs ratification?

- **Convene NGO-Business collaboration on ratifying POPs**
  Given that both the business and environmental communities agreed on the need to ratify POPs, there was a proposal to convene a meeting of these communities to address differences and craft a joint solution for ratifying the POPs treaty. An acknowledged area of disagreement is the issue of how to add new chemicals to the treaty.
- **Ratify treaty at state level?**
  A novel idea was proposed that state governments who support POPs ratification pass legislation or executive orders acknowledging their support for the Stockholm Convention. Legal questions remain about the limits of state actions in this sphere.

5. Expand High Production Volume (HPV) Data Collection

Agreed that the generation of data on high production volume chemicals in the U.S. should be harmonized with other data collection initiatives in Europe and Canada. In particular, there was an expressed need to expand the HPV program to include:

- long-term testing data on HPV chemicals and
- lower volume chemicals.

6. Convene Stakeholder Working Group

Surprisingly many areas of common ground emerged among the diverse set of workgroup participants, which included members from business, environmental groups, and government. The areas of common ground highlighted above are: implementing GHS in the U.S., sharing data, addressing CBI issues, ratifying POPs, and expanding the HPV program. To further these common ground opportunities participants suggested convening a Stakeholder Working Group meeting. A possible venue suggested for these discussions is the NAFTA - North American Commission for Environmental Cooperation.

Workshop 5: Promotion and development of substitution and alternatives assessment

"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.

Background Paper
Promotion and development of substitution and alternatives assessment

Bev Thorpe and Mark Rossi
Clean Production Action

We have enough experience to know the characteristics of a safe chemical: it is one that will not persist or bioaccumulate in the environment and move up the food chain. It is one that is not neurotoxic or genotoxic and one that does not meet the criteria of inherent hazard when measured against a series of endpoints commonly used in chemical testing. Progressive companies are working with design consultants such as McDonough Braugart Design Chemistry to find safe materials. On the government side, Sweden has established among its national environmental objectives the generational goal, by 2020, of a non-toxics future. Achieving this goal, in Sweden and elsewhere, will require the adoption of a sustainable chemicals policy within which the principle of substitution is the primary criterion for chemical management. The principle of substitution states that hazardous chemicals should be systematically substituted by less hazardous alternatives or preferably alternatives for which no hazards can be identified. If no completely safe material exists now, the Substitution principle embodies action towards constant improvement as research in Green and Ecological chemistry advances. The Substitution Principle can be implemented at government and company level.

In effect, the substitution principle moves us towards clean production which can be defined as a way of designing products and manufacturing processes in harmony with natural ecological cycles. Clean production aims to eliminate toxic waste and inputs and promotes the use of renewable materials and energy. We would learn to mimic the properties of nature rather than attempt to control through destruction. Safer chemicals in processes and products would also allow better material reuse and recycling to occur which would help to cut our resource use. North American per capita resource use is the highest in the world and double that of western Europe, necessitating an urgent reduction in material intensity to fulfil our 'needs' as well as an exponential rise in our material efficiency. Moving to less or non hazardous alternatives provides a stimulus for innovation.

Substituting hazardous chemicals goes beyond finding a drop-in chemical alternative Implementing sustainable chemical policy means asking first what function that chemical serves. Alternatives can then be analyzed from the perspectives of *systems, products, materials, chemicals, or process change.*

Pesticide use is a case in point. Substitution would look at integrated pest management (process change), a change to organic farming techniques to reduce pests (systems change), as well as a move to less hazardous pesticide use (chemical substitution). Similarly substitutions for brominated flame retardants (BFRs) must fulfil the function of flame retardancy. But this can be achieved at several levels. A chemical change (replacing BFRs with nitrogen-phosphorous chemicals), a material change (replacing plastic with metal casings in laptops or using an inherently inflammable wool fabric barrier on mattress covers), a product change (isolating the source of potential fire from flammable materials, e.g., isolating electronic circuit in computers from plastic housing), or a system change (tackling the source of most household fires with compulsory self-extinguishing cigarettes and compulsory fire sprinklers in buildings).

Below we outline the potential roles for government and business in implementing substitution, as well as actions already taken.

Government Roles and Actions on Substitution

1. Set Aspirational Goals with Timelines

The generational goal in Europe has set an international benchmark and has influenced many countries and companies' chemical policies. Sweden, a major promoter of a new chemicals policy, has set timelines and defined specific goals to achieve a *non-toxic future* as one of fifteen environmental quality objectives. These fifteen objectives were adopted by Parliament in 1999 and they provide a coherent framework for environmental programmes and initiatives at the national, regional and local levels.[33]

For example, Sweden's interim targets for meeting its generational goal of a non-toxics future include that newly manufactured products be free from:[34]

- carcinogenic, mutagenic and reprotoxic substances, by 2007, if the products are intended to be used in such a way that they will enter natural cycles;
- new organic substances that are persistent and bioaccumulating, as soon as possible, but no later than 2005;
- other organic substances that are very persistent and very bioaccumulative, by 2010;
- other organic substances that are persistent and bioaccumulative, by 2015; and
- mercury by 2003, and cadmium and lead by 2010.

2. Incorporate the Substitution Principle into Chemicals Policy

Sweden has effectively used the Substitution Principle to decrease hazardous pesticide use. They use a seven-step process which evaluates not only the intrinsic hazards of a chemical but its efficiency, its cost and its intended use. Alternatives are monitored and assessed for effectiveness. Since the Substitution Principle has been operational, 20% of the pesticides on the Swedish market have been substituted with less hazardous products.

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[33] http://www.miljomal.nu/english/english.php

[34] visit http://www.miljomal.nu/english/objectives.php

The draft new EU chemicals policy – REACH – could lead to a wide range of substitution activities. On Oct 25th the Confederation of British industry and the Chemical industries Association issued a joint statement with Greenpeace that 'substances of very high concern should be replaced with less hazardous alternatives wherever and whenever practicable."

3. Identify Classes of Chemicals as Priorities for Reduction

For example, the UK government has targeted for elimination the entire class of nonyl phenol and its ethoxylates. Through its Stakeholder Forum, the UK government concluded that it would take a considerable period of time (up to 4 years) for marketing and use controls to be agreed in the EU and implemented via UK legislation. The Forum therefore has drawn up with industry a voluntary phase out plan to achieve quicker results. If phase out does not occur successfully in all industrial sectors, the UK will enact legislation.[35]

4. Use Economic Incentives such as Green Taxes

Research by the OECD (Organization of Economic Cooperation and Development, of which the US is a member) has found that economic instruments such as taxes or trading systems offer the most economically efficient route to environmental goals. Denmark, for example, has shifted 0.5% of its revenue by lifting some of the tax on wages and increasing by the same amount a tax on carbon emissions, pesticides and chlorinated solvent use. And ten years ago, studies by the International Joint Commission for the Virtual Elimination of Persistent Toxic Substances in the Great Lakes Basin recommended that a tax on chlorine and PVC would achieve virtual elimination and spur employment and adoption of substitutes for PVC.[36]

5. Supply R&D Funding to Advance Safer Chemicals

An example of funding research and development (R&D) for safer chemicals is the Green Chemistry Research and Development bill being discussed in the US Congress. The bill would authorize spending $26 million in 2005, $28 million in 2006, and $30 million in 2007 on green chemistry research and development. Such funding would advance the development of safer chemicals.

6. Adopt Substitution Assessment Planning for Chemical Users

Many companies, as case studies have documented, are implementing safer substitution in their organizations.[37] Companies are searching for safer substitutes to avoid regulation, reduce future liability, capture competitive advantage, increase market share, address community and worker concerns, and meet corporate ethical standards. However, the development and adoption of safer substitutes is happening slowly, in a piecemeal fashion and in some sectors not at all. Substitution assessment plans help companies to identify safer alternatives.

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[35] Partial Regulatory impact Assessment for nonylphenols, octylphenols and their ethoxylates. UK Chemicals Stakeholder Forum. DEFRA 2003.

[36] Economic Instruments for the Virtual Elimination of persistent Toxic Substances in the Great Lakes Basin. IJC. December 1994

[37] Thorpe, Beverley. (2003) Safer Chemicals Within Reach. Greenpeace Environmental Trust UK. Also at www.cleanproduction.org

A similar framework already exists in Massachusetts under the state's Toxic Use Reduction Act (TURA). Under TURA over 550 companies have assessed their toxics use reduction options with technical help supplied by university and government experts. Toxic use reduction strategies included material substitution and product reformulation. Within ten years industry has reduced the use of toxic chemicals by 40%, by-product waste by 58% and toxic emissions by 80%. A cost benefit analysis reveals that the same companies saved a total of 14 million dollars over this period through the adoption of more efficient and safer processes.[38]

7. Provide Technical Assistance to Chemical Users

In Sweden, for example, the government helps industry, through its PRIO interactive database, to identify substances of concern. PRIO provides data on the intrinsic health properties and environmental properties of substances. Through an interactive website, it allows companies to assess their chemical use, examine the opportunity for risk reduction through substitution and anticipate future legislation.[39] A variety of other software tools in other countries exist to help industry assess alternatives.[40]

The UK, Germany, Denmark and Sweden have disseminated information on safer substitutes for specific industrial sectors as well as guidance documents for industry. The UK Government agrees with the Royal Commission's assessment of the importance of substitution and has decided that they "will take a more strategic approach to discussions with industry by examining substances of concern in groups of say 10 to 12 per Forum meeting…. An approach which will, in turn, help to prepare UK industry for the requirements expected of it under REACH." [41]

In the USA various EPA programs exist to help downstream users. Most notably the EPA's Green Chemistry Program, Green Engineering program, Design for the Environment program and the Pollution prevention Framework. At the state level, Massachusetts has the Office of Technical Assistance and the Toxics Use Reduction Institute, which both assist companies in their transition to safer alternatives.

8. Identify Safer Substitutes

Examples of governments identifying safer substitutes have emerged around the case of brominated flame retardants (BFRs). Both the German Federal Department of the Environment and the Danish EPA have identified safer alternatives to BFRs; as well as the barriers to implementing substitution. Such information helps small and medium scale enterprises, which do not have the resources and capacity for performing hazard assessments and evaluating the technical feasibility of alternatives. The Danish environmental strategy prioritizes action on their dangerous substances list and encourages manufacturers and importers to find substitutes and to

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[38] *Toxic Use Reduction Institute website lists the legislation, outline of the plan procedure and results of the ten year programme. www.turi.org.*

[39]The steps presented are based on the document 'sju steg till substitution' ('seven steps to substitution') and the method presented in the Prevent document Kemiska hälsorisker (Chemical health risks) See more details at http://prio.kemi.se/templates/PRIOEngframes____970.aspx

[40] Lohse, J., et al. Never Change a Running Process? Substitution of Hazardous Chemicals in Products and Processes: Definition, Key Drivers and Barriers. Greener Management International. Issue 41, 2003.

[41] DEFRA. Government Response to the Royal Commission on Environmental Pollution Report on Chemicals in Products. August 2004

develop alternative products. The Danish EPA's ‘Cleaner Products Support Programme grants subsidies to a number of projects that promote substitution. It supports the development, testing and assessment of alternatives to BFRs, as well as the dissemination of knowledge to manufacturers about the feasibility of implementing alternatives.

Business Roles and Actions on Substitution

1. Set Aspirational Goals

Kaiser Permanente (KP) -- the largest non profit health plan in the US -- has launched a new chemicals policy that calls for the avoidance of the use of carcinogens, mutagens, reproductive toxins and persistent, bioaccumulative toxins.

Shaw Carpets is designing products with Green Engineering criteria.

Samsung has publicly committed to the phase out of PVC, organotins and all types of BFRs from its products worldwide by the end of 2005. It has conducted an inventory of chemical use to formulate a substitute development programme with targeted phase out dates. And for new chemicals the company will evaluate potential hazardous environmental effects and will only use a chemical in production “if sufficient evidence is available to demonstrate that they present no irreversible hazards to ecosystems or human health.”

2. Identify Target Chemicals and Classes of Chemicals as Priorities for Elimination

Leading companies in the information technology sector have drawn up extensive lists of chemicals for phase out with accompanying dates. For example Sony has listed three categories of chemicals (prohibited immediately, phase-out over a defined period, and reduce use pending more research). As an example, the use of all chlorinated organic compounds is set either for immediate phase out or reduction.[42]

3. Work with Supply Chain to Transform Chemical Use

Companies are setting up systems to ensure that their suppliers are meeting chemical restrictions. For example, after it was determined by Dutch authorities in 2001 that the peripherals of a Sony Game Boy console contained levels of cadmium above the limit allowed, Sony carried out a systematic review of existing supply chains and internal management systems to implement stricter management procedures and prevent similar problems from occurring, See next.

4. Base Priority Decisions on Hazard Assessments

Substitution involves a complete change, not the risk management of a problematic chemical. The head of buying for H&M, a large retailer states:

> *“H&M is applying the precautionary principle. In practice, this has meant working closely with our suppliers to phase out substances and materials, that are, or could potentially be, harmful to our customers or the environment, from our products. In doing so, we have constantly, together with our suppliers, searched for less harmful solutions.*

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[42] Sony CSR Report 2004. www.sony.net/SonyInfo/procurementinfo/ Also see their2004 report on line at www.sony.net/IR/

We have encouraged our suppliers to be innovative and when we have found a better alternative somewhere among our suppliers we have helped to spread that knowledge to other suppliers and other markets. In doing so, we have found that almost anything is possible as long as you set clear guidelines on what is not acceptable. We have not had to compromise on fashion or quality in a way that has harmed our business. Prices may have gone up temporarily but as soon as mass production has started, the prices have gone back to previous levels. With the background of this experience, we find it important that EU legislation supports the idea of substitution when a better alternative is available. Such legislation would support us in our continued effort to eliminate hazardous substances from our products and to find better solutions that are less harmful to the environment." [43]

5. Develop and Implement Substitution Plans, including Identifying Safer Alternatives

Necessary steps in implementing a chemical substitution program are identifying where chemicals of concern are used and technically feasible alternatives to these chemicals. As noted above, collecting the data on chemical use as well as identifying alternatives requires close collaboration with the supply chain.

6. Require Manufacturers to Submit Full Toxicity Data

A common complaint from downstream users of chemicals is that they lack good data from their chemical suppliers. To get this data, companies are increasingly requesting that their suppliers provide hazards data, which is more comprehensive than Materials Safety Data Sheets, on products and their chemical constituents.

Questions

- **Deciding what is 'safer': What procedures or criteria could we use to effectively compare alternatives? Could they be standardized?**
- **Disseminating information about substitutes: Businesses will argue that their use of alternative materials/chemicals is confidential. How then can we disseminate information about alternatives to stimulate uptake across industry sectors? Who can provide technical support to industries on safer substitutes?**
- **Some would argue that risk assessment perpetuates ongoing use of hazardous materials and justifies the 'status quo' by arguing that the focus should be on exposure reduction. Does risk assessment present a methodological barrier to promoting substitute materials? If so, should more emphasis be on hazard assessment?**
- Some companies would say that consumers do not care about a company's chemicals policy, eg it all comes down to the final price of the product. How can companies be rewarded for adopting a sustainable chemicals policy? Are their financial benefits in doing so?

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[43] Ingrid Schulstrom. H&M quoted in Thorpe, B. Safer Chemicals Within Reach. Greenpeace UK 2003.

Workshop Report
Substitution and Alternatives Assessment

Rapporteur: Beverley Thorpe

Herewith main subjects that were discussed during both days. This summary is meant to accompany the Substitution Paper recommendations as some participants expressly supported the points made within the background paper and wished to emphasize that workshop discussion were not meant to replace the paper but to strengthen it.

1. Alternatives Assessment – methodology

Down stream users of chemicals (DUC) bemoaned the fact there was no standard alternatives assessment procedures. As one company stated “we don’t want to keep reacting to the flavor of the month chemical problem, we need a more consistent and ideally agreed set of common indicators and criteria to first identify what may be problematic and then second, use these same indicators and criteria or other methods to identify what will be safer.” Big demand to better understand what will be future problems. Also to only focus on P,B,Ts negates other serious problems such as asthma promoters. Need wider focus when discussing priority chemicals for phase out.

A representative from the chemical industry cautioned that to simply move to another material might in itself bring in environmental problems, eg replacing brominated flame retardant plastic resin with a metal material may not be safer when taking into considering life cycle assessment of the metal involved. Response from some participants that LCA will also be based on assumptions and subjective definition of system boundaries, hence need to make all LCA transparent and public. Then methodology can be open to worker, consumer and public scrutiny

Recommendation from rapporteur. Compile current best practice on criteria and indicators used by Green Chemists and other models to predict inherent hazards of chemicals, or ideally, chemical classes. Show best practice in how chemicals can be currently screened for ‘ safer’ characteristics.

2. Information and Education

Need to create awareness of chemicals problems within companies themselves, not just an issue for consumers to be educated about. DUC felt that individual consumers had no interest in companies' chemicals policies since price and function are overriding factors in purchasing a product. The main stimulus for getting a company to adopt new chemicals policy is big procurement, eg institutional buyers. Information and change in teaching curricula also needed within chemistry departments within academia – currently huge ignorance about environmental and human health affects of chemicals. More information also needed between chemical producers and DUC.

3. Role of Government

Many participants advocated strong direction by government to legislate phase out. Activity by DUC following on from RoHS Directive in EU shows necessity of government signals to move market. DUC pointed out that some substitutes could be ' sitting on the shelf' but currently too expensive to implement. See role of government in giving tax breaks to stimulate market adoption. See background paper for other measures that government could take to spur market towards safer chemicals policy.

4. Who decides?

Many participants expressed importance of worker involvement in substitution planning, particularly as previous pilot projects have demonstrated that real working knowledge of process needed to ensure successful substitution. Also strong recommendation that consideration of worker and community transition planning be part of new chemicals policy adoption. New allies could also be formed by involving affected workers and community particularly if safer alternatives/materials pilot project proposed.

5. Training and R&D

The issue of where expertise resides and who can help move companies to adopt safer chemicals/materials also discussed. One DUC explained how much time, money and person power needed within his own company to do this type of research. Why should it be left to companies to do all the work? Where is outside support? Particularly when their efforts to find and implement safer materials is not recognized or rewarded by consumers.

Rapporteur's recommendation. Draw up current best practice to show different models of how R&D is supplied to or obtained by companies, eg government/industry/worker collaboration; industry/university collaboration; industry/private consultant collaboration; others, to ascertain how effective these collaborations are.

6. Final recommendation for next steps forward

We asked the second group for their input only as this was not stipulated in original framework of workshops. Recommendations were listed in PowerPoint presentation (copied below). However in general, people thought it extremely useful to get into more detail for issues discussed above, in particular the common indicators and criteria needed within alternatives assessment; as well as product specific workgroups, eg toy manufacturers, clothing manufacturers, etc. All expressed support for the diversity of participation within the workshop, eg most of the supply chain actors were present in second day workshop and this allowed open and useful discussion.

Other recommendations discussed:

- Duplicate this type of conference in Europe and Asia
- Common ground statement from conference (landmark conference!)
- Workshops needed for:
  - Practical Tools - eg, Alternative Assessment
  - Retailers, Advocacy groups, Labor, Government
  - Best Practices for: Specific Industry sectors (eg toys)

Workshop 6: Integrating improved chemicals management into business processes, including product design

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

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- These papers are intended as a thought starter, asking key questions; they are not a comprehensive review of the issue.

Background Paper

Integrating improved chemicals management into business processes, including product design

Tom Swarr, United Technology Corp.

Business is under intense competitive pressure to continuously innovate their product offerings. New product development is a critical leverage point for integrating precautionary chemical management concerns into business decision-making. The process is capable of handling the technical elements of a forward-looking assessment of chemical use across the full product system life cycle. The challenge is to identify emerging problems early in the development cycle, before a company has committed significant resources that create barriers to substitution.

Problem Statement

Chemicals have become ubiquitous in modern society, providing numerous benefits and conveniences but also contributing to a growing concern about toxic impacts on humans and ecosystems. Few of the chemicals being marketed have been characterized for their potential harmful effects. The current problem- focused regulatory approach starts with observed effects, and requires sufficient scientific evidence be accumulated to show the source activity imposes an unacceptable risk. Establishing these links in a legalistic and confrontational system is difficult. There are delays between discharge and exposure and between exposure and effects that make it very difficult to conclusively establish cause and effect. There is growing demand for a forward-

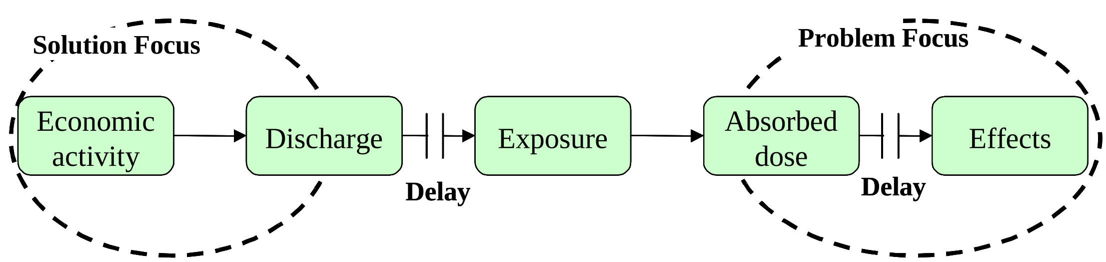

Figure 3 - Causal Links Between Activity and Effects

looking solutions approach that places the burden on the advocate of the proposed activity to demonstrate an acceptable level of safety. The situation is shown schematically in Figure 1.

A solution focus looks beyond simply obeying regulatory limits on allowable discharge rates. A precautionary approach argues that companies should look forward in time across the full product life cycle, including the network of suppliers and complementary services that support the product offering, to consider how chemicals- as actually used by suppliers, manufacturing personnel, service technicians, etc. - could cause harmful effects to humans and ecosystems. It is countered that the precautionary approach would block innovation and is simply not economically practical in today's global market.

The objective is to integrate chemical safety considerations into routine business decisions. The current approach starts with the effect and attempts to trace causal links back to the source activity, which is already challenge when considering acute effects triggered by point sources. When considering chronic effects resulting from the cumulative impacts of numerous diffuse sources (such as consumer products) it is virtually impossible. The rapid cycle of new product offerings will overwhelm any backward looking approach. Building precaution into product development practices is a critical success factor. The first section of this paper will provide an overview of a generic product development process and identify key decisions that gradually lock- in specific technologies, materials, and risks. The second part will address the arguments regarding innovation and economic practicality.

Dare to be naïve. – Buckminster Fuller

Generic Product Development Process

New product development is a business decision- making process. It is supported by technical activities, such as research and development or design and analysis, and can be described as the evolution of information punctuated by decisions (Ullman, 2001). Decisions commit resources, financial and human, to drive actions, which ultimately produce the positive benefits intended and the unanticipated negative consequences that trigger regulatory actions. A generic stage-gate new product development process shown in Figure 2 is representative for many companies, although the specific names and number of stages may vary (Cooper, 2001). A stage has a defined set of tasks that generate information, typically in the form of deliverables such as drawings, reports, etc. needed to support key business decisions. A gate is an executive level review, which decides to continue investment in the project or terminate and divert limited resources to more promising projects. It is also the responsibility of management to assure that required tasks in each stage have been adequately completed to support a quality decision.

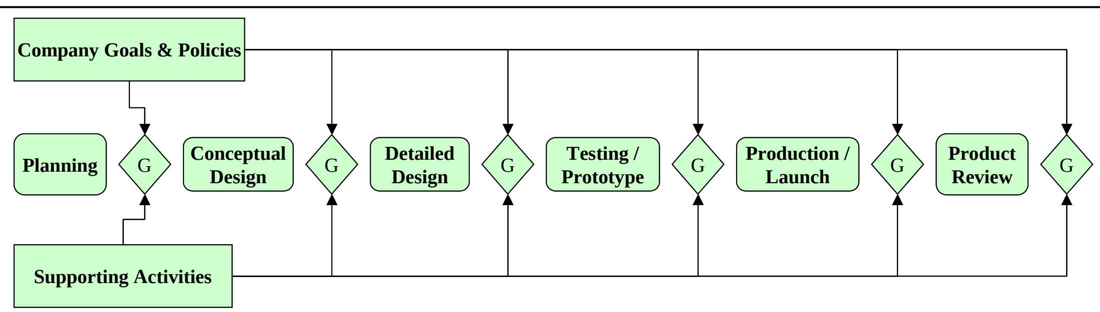

Figure 4 - Stage - Gate Product Development Process

Company goals and policies define the criteria used to make the gate go- no go decisions. These are constrained by the competitive position of the company, but will include non- financial objectives.

The initial planning stage surveys external pressures, public expectations, customer needs, and industry trends to define the requirements for a successful product offering. What will it take to excite the customer? What is the potential market and profitability? These questions determine the boundaries of the business opportunity and definition of the appropriate system boundaries for environmental evaluations.

During conceptual design, the team assesses the strategic fit of the identified business opportunity with company capabilities and objectives to assure resources are focused on the most attractive projects. Is the company excited by this opportunity? Preliminary analyses are used to assure the feasibility of a fully developed conceptual plan that satisfies the customer need consistent with the strategy and capabilities of the company.

Detailed design activities develop complete bill-of-material, drawings, manufacturing plans, etc. that meets technical specifications and enables design of the manufacturing and support processes consistent with project cost and quality goals. Can we do it? The concept is translated to hardware and business systems needed to deliver the proposed customer benefits. Detailed plans demonstrate project goals will be met, at least ‘on paper.’

Activities during the next stage demonstrate the feasibility of the product offering by testing prototypes or by analysis and simulation. Prescribed tasks confirm the producibility of the design and verify projected manufacturing costs. Can we deliver a winning solution? The go/ no go decisions are critical, because project costs escalate dramatically in subsequent stages.

Market launch introduces the product to selected markets to validate manufacturing processes at production levels. Plans are in place to ramp up volume to meet customer demand at required levels of quality. Support systems are in put place, and product performance in the customer environment is monitored to catch any surprises. If all systems perform as expected, the project is approved for full deployment as a proven product offering. The design team works with the product management function to provide technical and logistic support to maintain the offering at warranted levels of performance. Did we deliver what we promised? After a fixed period in service that will vary with product category and expected lifetime, a formal product review is held to assure lessons learned from the project are captured and used to improve subsequent projects.

The stage- gate process can be adapted to the complexity of the project. A clean sheet design of a new global platform is a high-risk project with potentially larger payoffs. These projects would be subject to rigorous analysis requiring completion of all activities and subject to gate review by top management. Derivative designs or regional products would face lower risks, but with lower potential gains. Project leaders would have the option to simplify the development process, skipping certain tasks, and the appropriate level of management would conduct gate reviews. Simple engineering changes to correct product design deficiencies or make minor enhancements are constrained projects with limited risk. The primary objective is to assure proper control to enforce design standards and avoid any new problems. These projects would skip many of the activities and lower level management would conduct the gate reviews.

Precautionary Chemical Management

A precautionary approach comprises preventative action in the face of uncertainty, shifting the burden of proof to producers, and a more robust process to generate and evaluate safer alternatives (Tickner & Geiser, 2004). The implications of a precautionary approach can be assessed on the stage- gate decisions.

Planning stage activities scan the external environment for unmet needs, market responses of competing companies, shifting social attitudes, technology development, and virtually any developing trend that can affect the future of the company. Research has shown there were early warning signals on asbestos, CFC's, and other toxic chemicals. The early warnings were ignored or resisted (European Environment Agency, 2001). Planning stage scanning activities can be expanded to consider the full product life cycle and to be more sensitive to lay knowledge that may be poorly articulated but no less valuable in identifying negative effects of chemicals. Early and comprehensive identification of the requirements for a product offering should yield improved designs that better satisfy customer needs, while also allowing timely development of substitutes. Expanding the scanning boundaries should stimulate innovation and alternatives assessment by promoting an enhanced appreciation of the larger product system.

Conceptual design activities assess the fit of the proposed business opportunity with company capabilities. Each company has developed a portfolio of technologies, manufacturing processes, supply networks, distribution channels, etc. to establish a competitive advantage in its defined market space. There is limited definition of the product design at this stage, but there is considerable information to determine likely material issues 'if we build this product the way we built the last one.' Shifting to safer alternatives could require new technologies, qualifying new suppliers, retraining manufacturing personnel, etc. Building in a more complete understanding of the human implications of safe chemical use is a necessary element for a precautionary approach. Early consideration of alternatives enables proper assessment of technical readiness to assure substitutes are available to meet the project schedule.

The gate review of detailed design activities freezes the design to support development of all production and support decisions. Specific materials and suppliers are identified enabling a comprehensive assessment of all potentially problematic materials in the fielded product. Capital appropriations are approved for modification or upgrade of manufacturing processes, product distribution, and aftermarket support systems. Risk management plans are in place to monitor deployment of alternatives to assure product functionality is not impacted. It is not sufficient to assess releases strictly in terms of regulatory limits. What is the physical form of the chemical and how will this affect the dispersal/ transport of the released material? What are reasonable user scenarios that can help determine potential exposures? What monitoring would provide early detection of unanticipated effects? This is a critical stage to avoid investments that lock in material choices that carry unnecessary liabilities or risks.

Validation with prototypes or quality tests is a final opportunity to verify all assumptions and analyses, before committing major investments for production. It is particularly important to verify the human factors involved in safe chemical use. Do people behave as expected? Are user exposure scenarios reasonable? Do protective measures and equipment work as expected and achieve the desired levels of protection? Are there any unanticipated counter effects caused by substitutes that may negate the environmental and safety benefits? Once a decision has been made to go to full production, there are significant investments at stake that will create barriers to future change. During this stage, the producer must also verify compliance of all suppliers with material restrictions and establish procedures to identify and confirm material content of all procured parts.

During market launch and product review, the company is essentially committed to specific technologies and materials. The challenge is to monitor field experience to quickly identify any surprises. Early detection and correction of any problems that impact customers or end- users is necessary to protect the reputation of the company. This is a challenging task; the profitability of the project will be severely impacted by a redesign to eliminate a defect. The cost of replacing materials can be significantly increased when the parts must be recertified to various safety codes. Conversely, early identification of deficiencies with existing products can be a valuable source of new product concepts.

Practical Barriers to Precaution

Economics and public access to information are two critical elements of success, and two significant barriers to implementation of a precautionary approach. Given a choice between a product that poisons its users and one that is inherently safe to use, few companies would consciously set out to design a toxic product. Why then have early warning of toxic products been ignored? It may be that a corporate manager’s fiduciary responsibility to protect the assets entrusted to him by the investors is inherently in conflict with the precautionary approach outlined. A company can be sustainable only if it generates sufficient returns to attract capital investment monies. If the company is overly cautious compared to its competitors, the rate of return will suffer. Investors will shift their money to the better performing companies. Companies that identify potential hazards and safer alternatives may be held liable for imposing unnecessary risks on the public, while the companies that hide potential risks escape accountability. A rigorous alternatives assessment process challenges a company to openly question all committed resources to develop and evaluate inherently safer ways of providing similar value to its customers. The same customers that want inherently safe products also want double-digit returns on their pension funds.

The highly interconnected nature of the global economy also works against the precautionary approach. It can be difficult if not impossible top predict ripple effects of any decision to move to safer alternatives. Each material system has various byproducts and wastes that can cause problems. If markets move away from a specific feedstock, there will be economic pressure top create new uses. Competitors will try to innovate to win back lost markets. Selection of a particular material or technology creates pressure for complementary products and services. Individual companies makes hundreds of separate but interrelated decisions that are eventually judged based on the cumulative effects of all those decisions. The speed of innovation can easily overwhelm a precautionary approach.

Public engagement in the identification and evaluation of to alternatives is critical to acceptance of recommended actions. Companies fear loss of business sensitive information or public backlash against open communication of risks and hazards. New product investments determine the future success of the company. Open disclosure of product concepts to help identify potential hazards can also alert competitors to planned strategic moves. Managers have a responsibility to protect company information and a civic duty to openly discuss safer alternatives that are in conflict. Rather than asking managers to make moral stands that jeopardize their economic security, we should ask what institutional changes are necessary to align fiduciary responsibilities to protect invested assets with a precautionary approach to chemical management?

Questions

- **Development of new technologies and regulation of any unwanted effects of those technologies are treated as two distinct processes. How can we open technology planning to public dialogues without compromising business sensitive information?**
- **Early warning signals of previous chemical problems were ignored. How can we better capture the lay knowledge of these early detection signals? Can we create a system that rewards open communication of potential problems?**
- **All technical advances contain risks. Technology has provided significant benefits. Our success in eliminating many acute hazards has exposed more subtle and chronic effects. People die from cancer, because they are less likely to die from childhood and communicable diseases. Can we differentiate between risks imposed by careless or illegal activities and the residual risks that escape honest and thoughtful risk mitigation practices?**
- **Companies make product development decisions based on their assessment of the available data and likely responses of competitors. The economy is highly networked, and the ultimate impacts are the collective outcome of the actions of numerous companies. How do we measure and promote effective action of individual companies in a world shaped by collective outcomes?**

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"Framing a Future Chemicals Policy", Boston, April, 28-29, 2005

- These reports are intended to reflect the discussion in the workshop, but have been written by one or more of the workshop team and have not been agreed by the other participants.
- These reports should be read with the background paper for the workshop
- The views expressed in these workshop reports are the views of the individuals concerned and the workshop participants, and do not necessarily reflect the views of their employers.

Workshop Report
Integrating improved chemicals management into business processes, including product design

Rapporteur: Tom Swarr

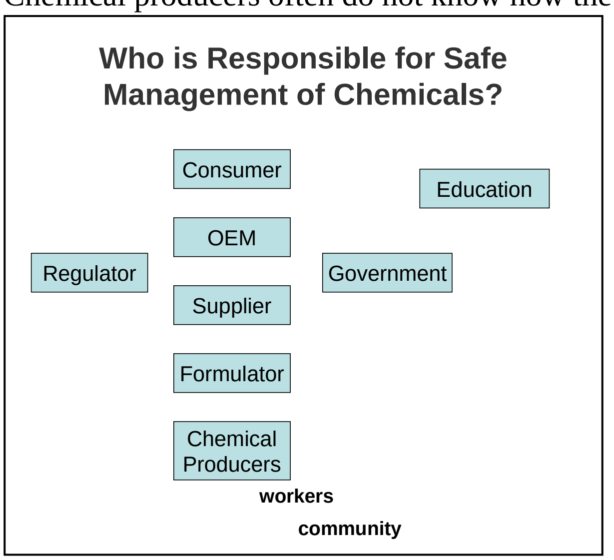
Conclusions

The supply chain of global business was complex, and responsibility for safe management of chemicals is distributed across numerous actors that are often forced to make decisions with inadequate information. Information, education, and a balance between regulation and incentives were seen as key enablers.

The workshop consensus was that original equipment manufactures (OEMs), or those putting products on the market had responsibility to set goals for the supply chain and monitor performance with quantified targets. Chemical producers had responsibility for providing high quality information on the hazards and requirements for safe handling and use of their products. Environmental management systems and toxic chemical use reduction programs similar to those in NJ and MA were seen as options for promoting a better integration of information as chemicals flowed though the value chain and into final products.

Discussion

The complexity of the supply chain was seen as a barrier to effective management of chemicals. Chemical producers often do not know how the chemicals will be used, and formulators and manufacturers may not be aware of the hazards associated with specific chemicals. Roles and responsibilities are distributed across the value chain, often leaving the consumer on his own to figure out chemical risks. A schematic of the problem is shown in Figure 1.



Information and education were seen as critical enablers. There was significant distrust of company willingness to provide adequate information. MSDSs were considered inadequate and often difficult for users to interpret. Users wanted more and higher quality information on material content, with complete disclosure of all ingredients, including the CAS reference number. There was much interest in a “one- stop shopping” reference source for obtaining chemical information and safer alternatives. Financial disclosure rules, e.g. Sarbanes – Oxley, fiduciary requirements for investments, etc. were proposed as an option for encouraging more complete disclosure by companies.

Education was considered another critical enabler. The list of target audiences and education needs/ topics expanded continually through both workshop session. A few of the topics/ groups mentioned included the following: green accounting, green chemistry, public knowledge of chemicals and manufacturing processes, worker safety, community outreach surrounding chemical plants and other manufacturing facilities, primary school through college, environmental activists, peer- to peer learning networks to diffuse safe alternatives, ecotxicity added to the curriculum, business schools, and making the case for business executives. It is not possible to do this topic justice. The conversation was rich, and there was much energy. One option for the future would be to develop a strategic plan for educational outreach to drive more sustainable chemicals policy.

There was considerable discussion about how to achieve the appropriate balance between regulating the bads and rewarding the goods. For example, all felt that chemical management was best achieved by focusing on unsafe uses. However, it was also felt that material bans were necessary to get the attention of business. This shifts the burden of proof to business to demonstrate when use of a banned material can be exempted, because the company demonstrates the use does not impose significant risks. Ecolabels were another example discussed. One option is to set a regulated minimum (similar to a UL safety code) and another is to reward exceptional performance (similar to Energy Star). Most felt it was necessary to regulate a minimum level of performance to establish a level playing field for responsible actors. Beyond this, awards and incentives should be used to encourage continuous improvement. The P2 programs of the 1990’s and toxic chemical reduction programs were offered as useful models for future action. Companies were required to report use of toxic chemicals, pay a fee based on the amounts, and undergo a planning process. There was no requirement to follow up, but monetary incentives rewarded those who did. The P2 networks were a good model for information sharing and facilitating improvement projects.

EMS systems were seen as a possible tool for driving OEM goals down through the supply chain. However, it was felt that public reporting, quantitative performance targets, and requiring the scope to cover product design would have to be added to the ISO 14001 framework for this tool to be effective.

There were many other suggestions that are not adequately captured in this executive summary- e.g. regulate based on community burden to assure holistic approaches, targeted community action against high profile facilities, the role of leadership companies in driving change, integration of quality, EMS, and design standards, assuring adequate engagement of workers and other interested stakeholders, and more. It was a great discussion with positive contributions from all participants.

Workshop 7: Substance Flow Analysis and Material Flow Accounts

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

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Background Paper
Substance Flow Analysis and Material Flow Accounts

Cheri Peele
Washington State Department of Ecology

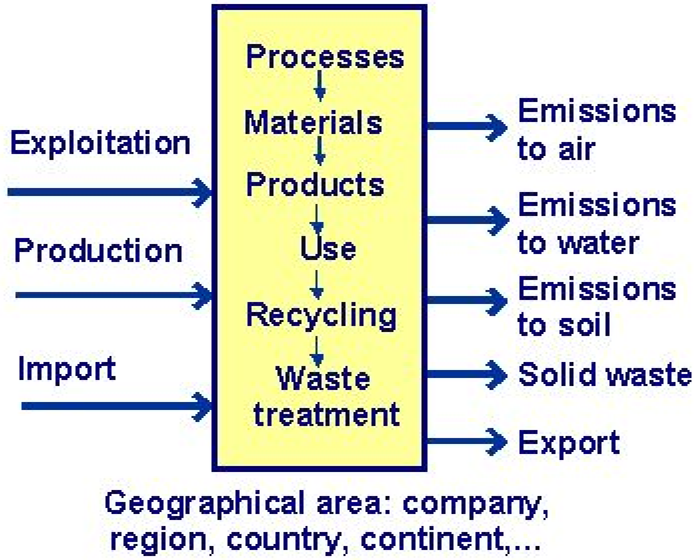
Definition and importance

Decision makers in public policy and business have long relied on well-established systems to measure and track economic activity as fundamental to the decision making process. However, standard economic indicators provide incomplete information on the environmental consequences or implications of an economic activity. To complement economic data, systems that measure and track the physical movement of chemicals and other materials through the economy are receiving increased attention as tools for informing decisions.

Substance flow analysis is a tool for tracking the movement of substances, including chemical elements, compounds, or groups of related compounds, into and out of an economic system. Substance flow analysis is one of a number of analytical approaches based on material flow accounting. Material flow accounting refers to an accounting system for materials, expressed in physical units (tons, kilograms, etc.), describing the materials’ extraction, production, transformation, consumption, recycling, and disposal as waste or emissions to air or water. “Materials” is defined more broadly than “substances,” ranging from timber and fuel to metals and agricultural products. Material flow accounting studies are defined for periods of time (fixed time period, consecutive fixed time periods) and can be carried out on different levels, from international, national and regional scales, down to the community or company level. Flows are analyzed with the assumption that a mass balance exists for the material into and out of the economic system.

Material flow accounts are in many ways similar to financial accounts. Financial accounts include such information as the balance between revenue and expenses, cash flow, reserves, and competitive financial position. National and international agreements define the terms used in financial reports, the procedures for reporting, provisions for auditing, and so forth. As with financial accounts, material flow accounts include inputs, outputs, and accumulations in stocks of materials (NAS, 2004).

National standards for materials flow accounts do not currently exist in the US, though World Resources Institute (WRI) developed a prototype national material flow database in 2000 (Matthews, 2000). Eurostat, the statistical office of the European Communities, published a methodological guide for materials flow accounts in 2001; many European Union countries, as well as Japan, have established national material flow accounts (EEA, 2005). The Organization for Economic Development and Cooperation is in the process of developing a common framework and guidance document to assist countries in implementing and using material flow accounts and related indicators, expected to be completed by 2007 (OECD, 2004).**Substance Flow Analysis**



Source: VITO, 2005

For the US prototype, WRI characterized material flows by quantity, as well as by mode of first release, quality, and velocity. "Mode of first release" describes whether the substance or material initially returns to the environment in the form of a solid, liquid, or gas. Once in the environment, the substance or material may undergo further changes, for example, becoming a gas from a liquid, but those are generally beyond the scope of a flow analysis. "Quality" refers to the physical and chemical characteristics of the substance or material, for example, whether it is biodegradable, chemically active, or persistent. "Velocity through the economy" refers to how long the substance or material remains in the economy before being dispersed to the environment. Substances or material that remain in the economy longer than a defined duration, for example, 30 years, are considered to accumulate in the economy as stock (Matthews, 2000).

Once established, national material flow accounts may be used for many applications. Of particular relevance to sustainable chemical policy, they may be used as the basis for substance flow analysis. It should be noted that most national material flow account systems developed to date treat the economy as a "black box". That is, materials are measured at the point where they are extracted from the environment and enter the economic system and when they are returned to the environment from the economic system as waste. Their movement through the economic system is not tracked. While this level of information is useful for many purposes, it does not provide the detail required to answer questions that may be of interest with regard to specific substances. The prototype developed for the US by WRI begins to disaggregate information on the movement of substances and other materials through the economy through a standard format for entering data on materials and individual substances (Irwin, 2004).

Even in the absence of a system for national material flow accounts, substance flow analyses may be developed on an individual basis. For example, in 2001, the Minnesota Pollution Control

Agency developed a substance flow analysis for mercury in products in Minnesota to evaluate and guide the state's mercury reduction efforts (Barr, 2001). The same year, New York Academy of Sciences developed a substance flow analysis for mercury in the Hudson – Raritan Basin to recommend measures for reducing mercury contamination in the New York – New Jersey Harbor (Themelis and Gregory, 2001).

Denmark has developed a number of national substance flow analyses and has defined basic components:

- International market and trends in consumption at an overview level (used as background information)
- Production, import/export, and processing of raw materials and semi-manufactured goods
- Application and consumption of finished goods by use areas in a defined geographic area, including a short description of trends in consumption
- Emissions and losses to air, soil, wastewater, solid waste, and hazardous waste for manufacturing processes and use of finished goods, defined by use
- Quantity disposed into waste treatment systems and emissions from those systems
- Consumption and emissions resulting from the presence of the substance as a trace element or contaminant in fossil fuels, wood, cement, fertilizers, etc.

Substance flow analyses may also be expanded to provide more extensive information. Denmark has identified a number of optional components for an expanded substance flow analysis:

- Detailed analysis of the international market and trends in consumption
- Qualitative description of human exposure through the use and disposal of finished products
- Scenarios for future emissions and loss of the substance
- Occurrence and fate of the substance in the environment
- National and international regulation of the use of the substance
- Assessments of substitutes
- Recycling, downcycling, and material deterioration (Hansen and Larsen, 2003)

Role of Substance Flow Analysis and Material Flow Accounts in a Sustainable Chemicals Policy

In 2004, the National Research Council (NRC) recommended the establishment of a structured material flows accounting framework for the US that can accept and integrate existing and future data to be established. The NRC identified a range of benefits that would come from a formal economy-wide materials flow accounting system:

- Federal and state agencies would gain better information on the sources and uses of mineral and renewable resources.
- Corporations would have better information on current and potential supplies of the materials they use, on potential positive and negative environmental impacts of the materials, and on substitutes they could use to supplant undesirable materials in systems and processes.

- Users of material accounts would be able to track sources, flows and dispositions of materials to determine more effective strategies for improving environmental and economic performances as well as efficient use of resources.
- National security strategists would have better data on sources of materials critical to the US economy and national security (NRC, 2004).

More narrowly, an substance flow analysis for a particular substance or group of substances may be developed for many reasons.

- To provide a common understanding of the flows of the substance, including emissions and waste generation, to all stakeholders in the substance management process: government, industry, purchasers, NGOs, consumers, etc.
- To ensure that regulatory actions directly address the main sources of emissions and wastes of the substance
- To monitor the effect of regulatory actions on consumption, emission, and waste generation
- To identify opportunities for new applications and identify the need for further studies and regulation
- To provide input to economic assessments regarding the cost of substituting new substances, economic consequences of new regulation, and consequences of environmental taxes and fees
- To provide information for reporting on releases of hazardous substances, in particular from diffuse sources
- To provide background information for regulatory actions to reduce hazardous substances in waste products
- To provide information on substances in waste use for development of life-cycle-based waste indicators (Hansen and Larsen, 2003)

Mechanisms and Tools

In the United States, a number of federal agencies, including the US Geological Survey, the Environmental Protection Agency, the Department of Energy and the Department of Agriculture, collect material flow data relevant to organizational mission and responsibilities. The data is not coordinated or integrated for analysis or public policy, but it could be used to begin national material flow accounts (NRC, 2005).

In 2000, primarily using federal data sources, WRI developed a prototype database for the United States with time series data from 1975 to 2000, on the outputs of 460 flows of materials. The database documents output quantities at the extraction, processing, manufacturing, apparent use, and post-use stages of the material cycle. “Apparent use” is defined as the domestic production of a particular commodity, plus imports and recycled quantities, minus exports. The overall output flows from the industrial economy were, for the most part, derived from data on the inputs and apparent use for each discrete material flow stream. (Matthews, 2000, p. 116)

In Denmark, substance flow analyses often rely on private companies and trade organizations for critical data on imports and exports, production processes, and industrial emissions. Specific references are only provided for purely technical information, and sources for information on turnover and production processes are often kept confidential. In recent years, Danish trade organizations have been increasingly involved in the data-gathering process, helping maintain confidentiality between the businesses involved and the researchers. (Hansen and Lassen, 2003)

Further discussion is needed on if and how material flow accounts would be constructed and how, though substance flow analysis or other types of analysis, they would be interpreted and used. If these issues are resolved, substance flow analysis and material flow accounts, could become powerful tools for decision makers in both the public and private sectors for a variety of purposes.

Questions:

- **Should a system of accounting be institutionalized to enable the development of international, national, or regional material flow analysis or substance flow analysis? What organizations should be in charge of such efforts?**
- **Material flow accounts are an information tool with many potential uses and users. What should the goal(s) of creating such accounts be with regard to chemical policy?**
- **What organizations should be responsible for collecting data to provide the basis for substance flow analysis?**
- **How should issues of confidentiality with regard to proprietary processes and products be addressed?**
- **What types of data would be most difficult to accurately collect?**
- **What type of analysis should be performed using the data collected? For what purpose(s)? By what organizations?**

Sources

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- These reports are intended to reflect the discussion in the workshop, but have been written by one or more of the workshop team and have not been agreed by the other participants.
- These reports should be read with the background paper for the workshop
- The views expressed in these workshop reports are the views of the individuals concerned and the workshop participants, and do not necessarily reflect the views of their employers.

Workshop Report
Substance Flow Analysis and Material Flow Accounts

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The two workshops on Substance Flow Analysis were somewhat lightly attended, with fewer than ten people at each. The following summary derives primarily from the second workshop, which was attended by a cross-section of participants from the chemical industry (I), academia (A), NGOs (N), and government (G). Substance flow analysis was a new topic for most workshop participants; many commented that they had come to learn more about it. For the most part, participants raised questions and possibilities about various aspects of substance flow analysis more than they offered firm opinions about its methodology or use.

Participants agreed that additional information on the movement of volumes of substances from the environment, through the economy, and returning to the environment as waste would be useful. They disagreed, however, on the value of such analysis depending on a number of variables, including which substances were analyzed, the purpose for which information would be collected, who would be able to use the information, the scope of information collected, the cost of collecting information, who would bear such cost. Participants did agree on the need for a standard methodology for collecting and analyzing information, should substance flow analysis be routinely performed.

Notes below reflect the flow of discussion in the workshops. Where recorded during the workshop, the sector of the participant making the comment is indicated. Participants’ sectors were not consistently recorded throughout; sector notations provide only a general sense of perspectives expressed by different participants.

What categories of substances might be considered for substance flow analysis?

- Persistent, bioaccumulative toxins
- High-value, recyclable materials
- Chemicals identified as being present in humans through body burden studies

- Substances that are both high-volume and hazardous
- Substances of regional concern

Who might be primary users of substance flow analysis?

- Product and process developers
- Original equipment manufacturers and other downstream users of chemicals
- “Fenceline” communities and workers
- Consumers
- Recyclers
- Regulators
- Researchers focusing on exposure to chemicals

What is the potential value of substance flow analysis?

- Ability to track substances through complicated supply chains (N)
- Act as a spur for innovation and creating demand for change among downstream users (G)
- Show possible environmental and human exposure routes (A)
- Provide information to push decisions on innovation and substituting alternatives (N)
- Improve the efficiency of the movement of materials.
- Increase material recovery (N)

Reservations expressed on the value of substance flow analysis:

- There would be a need for guidance on how information collected would be used in decision making. (I)
- Does an information gap really exist?
- Great effort may go into tracking a major chemical, but important aspects of the chemical’s movement may be missed, especially in imported goods.
- From a chemical producer’s perspective, a substance flow analysis is not useful, except to gain information on additives added later to its products. (I)
- If the use of energy is not tracked along with the movement of substances, the analysis will miss an important part of the equation. (I)
- Substance flow analysis deals only with volumes of substances and does not communicate risk or exposure. (I)

Data quality

- Reservations were expressed regarding the amount of detail and precision expected, with a caution against “garbage in, garbage out”. (G)
- Analysis could be valuable for waste stream managers while not requiring a great deal of precision. (G)

How much information should be collected?

- Substances could be tracked beyond their initial return to the environment as waste, providing the ability to track additional potential exposure routes. (A)
- A cost-benefit analysis should be performed on the amount of information collected. (I)
- Concerns were expressed regarding confidential business information, as well as the ability for companies to deal with an increased volume and complexity of data management. (A)
- The scope of information needed to track potential exposure is very different from the scope required to understand mass flows.
- How does the analysis deal with the transformation of chemicals? (unanswered question)
- What information is already available?
- Should substance flow analysis treat the economy as a “black box”, as most national material accounting systems currently do? Or should substances be tracked through the economy?
- How much information should be collected regarding environmental fate and transformation?

Who should collect information?

- First, identify how much information is already being collected by various parties. For example, EPA will be collecting some new information in 2006 as part of the Inventory Update Rule under TSCA. (I)
- Identify the most cost-effective points in the supply chain for collecting information. For example, manufacturers downstream in the supply chain may not know what substances are contained in products from their suppliers. Likewise, upstream in the supply chain, companies may not want to reveal a list of their customers, showing where their substances go.
- A standard methodology for performing substance flow analysis and a central repository for analyses analyses already completed would be useful. (G)
- A central, national repository to store data collected would be useful. (N)

Next steps:

- Investigate what data collection and analysis is already being done by all parties (government, industry, academia, NGOs).
- Develop a standard methodology for for substance flow analysis through OECD, similar to the effort currently underway for national material flow accounting systems.
- Identify best practices for substance flow analysis
- Develop case studies showing how substance flow analysis has been used.
- Provide research funding to further develop substance flow analysis methodology.