



Environmental Quality Through Science®

## Society of Environmental Toxicology and Chemistry

Asia/Pacific

Europe

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### **Emerging Issues in Chemicals Management in Developing Countries December 2008**

#### **Summary**

Developing countries are faced with several notable problems with respect to chemicals management. To ensure a better understanding of these challenges, SETAC organized three international meetings in 2008 on Emerging Issues in Chemicals Management in Developing Countries (EMERCHEM) to identify emerging, high-priority, science-based issues related to chemical contaminants, chemicals management, and chemical safety. The meetings were held during the SETAC Annual Meetings in Warsaw, Sydney, and Tampa. About one hundred scientists from government, business, and academia identified and discussed such key issues as e-waste, nanomaterials and nanotechnology, linkages between chemicals and climate change, and a need for capacity building and improved chemicals management legislation. Learning from current transition economies, sharing knowledge with developed countries, and actively stimulating collaborations and expertise centers might constitute first steps to address these problems. In 2010 SETAC plans a full workshop to provide science-based guidance and advice to support the objectives of the Strategic Approach to International Chemicals Management (SAICM).

#### **Background**

As a SAICM stakeholder, SETAC is addressing a number of scientific issues related to global chemicals management. In 2008 SETAC organized three international EMERCHEM meetings that identified emerging, high-priority, science-based issues related to chemical contaminants, chemicals management, and chemical safety in developing countries. The meetings were held during the SETAC Annual Meetings in Warsaw (26 May 2008, Sydney (6 August 2008) and Tampa (17 November 2008) and focused on Africa, Asia/Pacific, and Latin America, respectively. The meetings were attended by scientists from Africa, Latin America, North America, Asia/Pacific, and Europe and were designed to support SAICM objectives. Besides organizing these meetings, SETAC built a database of about 200 scientists within SETAC whose experience is relevant to chemicals management around the world. SETAC seeks to hold a follow-up, high-level workshop in the first half of 2010 to bring together 25 leading developed- and developing-country scientists to produce a guidance document on chemicals management in developing countries.

The EMERCHEM meetings and planned workshop build on the January 2008 SETAC workshop on persistent, bioaccumulative, toxic-persistent organic pollutants (PBT-POPs), whose participants developed a framework with guidance and recommendations on how to interpret substance-specific scientific information relative to the various PBT-POPs criteria. Both workshops will significantly assist the SAICM process and facilitate a substantive, independent scientific contribution to the 2<sup>nd</sup> Session of the International Conference on Chemicals Management (ICCM2), scheduled for May 2009, to review progress in the implementation of SAICM and to provide guidance on future directions for SAICM.

This paper summarizes the outcomes of the 2008 EMERCHEM meetings, and as such provides a first analysis of key issues that hamper chemicals management in developing countries, as well as directions for possible solutions.

## **General problems in managing chemicals in developing countries**

Developing countries face several notable problems with respect to chemicals management. Regional, ecological (climate), socioeconomic, and political differences ensure a wide range of environmental quality problems. Levels of pollution that exist in emerging economies are not necessarily equivalent to concerns identified in industrialized economies. Chemical use and exposure patterns may differ significantly. Applicability of existing datasets (e.g., fish toxicology) to different regions may be limited because of differences in the functioning of ecosystems.

Nevertheless, developing countries seem to have a number of problems in common with those faced globally. The lack of resources, capacity, and compliance monitoring, as well as the lack of education and training to identify emerging issues generally limit appropriate management of chemicals. The required integration of natural and social science approaches is often lacking. Typically, data on chemical use, ambient levels, and exposure are scarce or lacking. Regulatory procedures to monitor emerging chemicals are inadequate, development of such regulations is lacking, and there is insufficient ability or authority to restrict or prohibit the use of certain chemicals. Increased trade resulting from free trade agreements may exert pressure on emerging economies with respect to regulating or restricting chemical use.

## **Specific topics identified for managing chemicals in developing countries**

During the EMERCHEM meetings several specific topics were identified. In order to address these topics properly, further detailed specifications are needed. Heading the list: 1) clarifying regional differences and 2) taking a chemical life-cycle (“cradle to grave”) approach that integrates manufacture, risk assessment, management, and control. A first analysis of possible regional differences follows below. A region-specific chemical life-cycle approach will be addressed in the follow-up workshop.

EMERCHEM discussions identified the following specific topics:

- **Life cycle management** of chemicals
- Chemical and biological **assessment** approaches and tools (Organisation for Economic Co-operation and Development existing chemicals, new chemicals, tailoring for use in developing countries), general approach to chemical risk assessment, using examples to illustrate (e.g., pesticides)
- **Managing specific chemicals or chemical issues of growing concern** in developing countries. These may include chemicals that are considered traditional in developed countries as well as emerging chemicals for which information and management worldwide are in their infancy. Named chemicals and chemical classes are pesticides (problems with obsolete stocks), alternatives for pest and disease vector control, e-waste, disinfection byproducts, pharmaceuticals, halogenated phenols, less-studied PBT chemicals, polybrominated diphenyl ethers (PBDEs), perfluorinated compounds (PFCs), and nanomaterials. Other named issues are food and toy safety, chemical and biological problems related to mining (mercury), potable water issues (water quality, e.g., arsenic), chemical problems from open burning and handling of combustion products (ashes, coal).
- **Exposure pathways and management** (human exposure through food and inhalation, relative exposure of vulnerable groups, worker exposure, exposure of ecological receptors, education of the farmer with regard to use of pesticides)

- Linkages between chemicals and **climate change** (emissions from forest fires, increased methylation of mercury, impact of extreme events (tsunami, hurricanes), remobilization of “sequestered” chemicals)
- Scientific understanding of the links between chemicals and natural resources underpinning **sustainable development** (stresses on indigenous food sources, chemical contributions to loss of potable surface water, ground water, productive land, chemical stresses on flora and fauna)
- **Chemicals management legislation**. Effect of legislation from industrialized nations (e.g., Registration, Evaluation, Authorisation and Restriction of Chemical substances [REACH]) on economic growth in transition economies, lack of knowledge on REACH, lack of nationwide risk assessment
- **Risk management** (pollution prevention, clean up and remediation) and **risk communication**, including the science that supports the risk management
- **Scientific scaling**. Extrapolation of tools and techniques to ascertain whether existing data can be used with caution without reinventing the wheel, provision of simple tools
- **Lack of resources, capacity, and compliance monitoring**. Costs of development, lack of infrastructure for disposal, insufficient development of transportation
- **Lack of education and training** to identify how emerging issues limit the appropriate management of chemicals in developing countries.

## Regional Differences

In addition to the topics listed above, the EMERCHEM meetings identified issues specific to certain regions or countries. Eventually, the topic list will be completed and may be documented in a matrix of prioritized emerging chemical issues and regional and national scales.

In Africa, obsolete stocks of pesticides are considered a major problem. E-waste is a problem in several countries (e.g., Nigeria). Chemicals that are banned in the West are used in Africa and return in food products. Also, impacts of pharmaceuticals such as antiviral (HIV) drugs are poorly understood. Direct and indirect mining activities cause pollution (e.g., mercury from gold mining on the small scale) in several countries (e.g., Zimbabwe). There are virtually no reliable data on legacy POPs in Africa.

In Asia/Pacific (India and China), there are problems with polyaromatic hydrocarbons (PAHs). E-waste is exported to China, India, and the Philippines. In China, human health is more of a priority than ecological health; long-term, however, there is a need to understand ecological health because it affects human health. Human and environmental health risks associated with nanomaterials and nanotechnology may be relevant for transition countries such as India, where this technology constitutes a growing sector.

In Latin America, named problems related to infrastructure (transportation, waste disposal), increased exposure to chemicals and waste resulting from crowding, insufficient worker training, underdeveloped water and sewage treatment, pesticides, and historical pollution with little ability to clean up, such as transformers in Mexico.

Regionally effective capacity building may require dedicated approaches to training and education.

## Solutions

Solutions need to be defined and designed on the national or regional level by residents and local stakeholders. Given the wide variety of chemicals management problems in developing countries, solutions cannot be generalized or prescriptive. Still, it is plausible that important lessons can be learned from growth in such transition economies as Brazil, India, and China. Furthermore, knowledge about monitoring, surveillance, environmental and human health impacts, and risk assessment must be shared. Scientists in government, academia, and business, who will ultimately have to develop, support, and follow any regulations, must be educated and trained. REACH

workshops and symposia on implications and consequences of chemicals management frameworks could be organized in Asia/Pacific, Africa, and Latin America.

With data increasingly available, the compilation and dissemination of such data and knowledge is crucial task to which SETAC can contribute. SETAC can provide instruction on how to use the information gathered in monitoring, from a basic scientific level through the integration into risk assessments that will then allow particular societies to make risk-based decisions. Because of financial limitations, cost-effective measures and tools (pollution prevention, inexpensive monitoring, and prospective risk assessment using models) deserve priority. For capacity building and stimulation of the development of collaboration, "centers of excellence" have been suggested. Such centers may adopt an approach that tunes knowledge and capacity to the specific needs of that region.

In addition to the regional scale, the local population should be involved in capacity building. In this case, it is crucial that culturally appropriate social scientists cooperate with natural scientists, using an integrated approach to develop targeted communication to local stakeholders.

## **EMERCHEM Steering Committee**

**Chair: Bart Koelmans**, Wageningen University, the Netherlands, (bart.koelmans@wur.nl)

**Derek Muir**, SETAC President, Environment Canada

**Ricardo Barra**, SETAC Latin America President, University of Concepción, Chile

**Paul van den Brink**, SETAC Europe President, Wageningen University, the Netherlands

**Shu Tao**, SETAC Asia/Pacific President, Peking University, China

**Yogi Naik**, National University of Science and Technology, Zimbabwe

**Daniel Salvito**, RIFM, USA

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**Eddy Zeng**, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, China

**Tom Conway**, RFI Group, Canada

**Matthew Gubb**, SAICM Secretariat, Geneva

**Mike Mozur**, SETAC Executive Director, USA and Belgium

**Bart Bosveld**, SETAC Europe Executive Director, Belgium

**Katrien Arijs**, SETAC Europe, Manager for Scientific Affairs, Belgium

**Greg Schiefer**, SETAC North America Executive Director, USA

## **SETAC's Global Activities**

Developing and spreading the science surrounding emerging issues in chemicals management is nothing new to SETAC. Since its founding in 1979, SETAC has been engaged in a variety of activities related to such issues. Our journals, *Environmental Toxicology and Chemistry* and *Integrated Environmental Assessment and Management*, routinely publish peer-reviewed papers covering the fate and effects of chemicals in the environment, as well as practices and procedures for evaluating and managing their risks.

SETAC has published more than 100 books, many of which are the product of our signature Pellston Workshop process, which brings together a select group of international experts from government, academia, and business for "state of the science" discussions of cutting-edge environmental problems and science-based solutions.

Examples of our previous workshops and books relevant to chemicals management include the following:

- *Chemical Ranking and Scoring*
- *Contaminated Soils: From Soil–Chemical Interactions to Ecosystem Management*
- *Ecological Risk Assessment of Aquatic Resources: Linking Science to Decision-Making*
- *Ecotoxicological Risk Assessment of Chlorinated Organic Chemicals*
- *Effects of Pesticides in the Field*
- *Extrapolation Practice for Ecotoxicological Effect Characterization of Chemicals*
- *Guidelines for Life-Cycle Assessment: A Code of Practice*
- *Human Pharmaceuticals: Assessing the Impacts on Aquatic Ecosystems*
- *Interconnections between Human Health and Ecological Integrity*
- *Multi-media Fate Model: A Vital Tool for Predicting the Fate of Chemicals*
- *Procedures for Assessing the Environmental Fate and Ecotoxicology of Pesticides*
- *Risk Management: Ecological Risk-Based Decision-Making*
- *Whole Effluent Toxicity*

SETAC geographic unit annual meetings in North America, Europe, Asia/Pacific, and Latin America, and more recently in Africa, typically feature 1000 to 1500 presentations on environmental toxicology and chemistry, risk assessment, life cycle assessment, and emerging issues. In addition to these large conferences, SETAC holds smaller regional and/or special topic meetings, with the October 2008 symposium on REACH in Brussels the latest example.

SETAC also sponsors Advisory Groups, which are open to non-SETAC members, to foster in-depth discussion and activities in defined topical areas, including Ecological Risk Assessment, Pharmaceuticals, Nanotechnology, and Life Cycle Analysis, to name a few. To provide training and continuing education, SETAC sponsors short courses, which recently have included Nanotechnology and the Environment, Environmental Fate and Effects of Emerging Contaminants, and Modeling Fate and Effects of Pollutants with AQUATOX Release 3.