Breakout Session Guide

This workshop will focus on integration of ongoing developments in exposure science and toxicity testing to advance knowledge-based decision making about the safety of chemicals. A key consideration will be application of these integrated approaches to the design, evaluation, and health risk management of chemicals. This workshop will also consider what research is needed to improve communication between scientists and decision makers, and with stakeholders, including the public, in order to develop better chemical management policies and practices.

The three major workshop themes are:

- **Exposure Science**. Consider relevant research activities for addressing gaps in exposure science required to meet both immediate needs for rapid prioritization as well as longer term objectives for chemical evaluation and risk management.

- **Innovative Approaches to Generating, Integrating, and Interpreting Hazard Data**. Examine new experimental cell systems and computational analytical and integrative methods for predictive toxicology and utilization to support chemical assessment.

- **Communicating Scientific Information**. Develop a framework for a research agenda to determine how the scientific information exchange between decision makers, scientists, and the public can better meet the needs of society.

Breakout sessions have been designed around each of the three major workshop themes and will include a mix of presentations and panel discussions. The three breakout sessions will run in parallel and meet during the afternoon of 16 June 2010 and morning of 17 June 2010. Following their conclusion, summaries from the three sessions will be presented after the morning break on 17 June 2010. Descriptions of each breakout session and its subthemes are described in the following sections.

Session 1: Exposure Science

Session Chair: **Elaine Cohen Hubal**, Environmental Protection Agency, USA
Rapporteur: **Corinna Weinz**, Bayer AG, Germany
Recorder: **Ami Parekh Gordon**, ICF International, USA

Wednesay, 16 June 2010 Theme
Chemical Evaluation for Public Health Decisions

Background

Exposure information is essential in the process to link potential toxicity of environmental contaminants with real-world health risks and outcomes. This breakout session will consider research activities relevant for addressing gaps in exposure science required to meet both immediate needs for rapid prioritization as well as longer term objectives for chemical evaluation and risk management.

In the immediate term, tools are required to characterize and classify thousands of environmental chemicals in a rapid and efficient manner to prioritize testing and assess potential for risk to human health. This prioritization effort should be based on both hazard and exposure. Indeed, as a new generation of scientific tools has emerged to rapidly measure signals from cells, tissues, and organisms following exposure to chemicals, the need to include exposure considerations has become even more apparent. Further, high visibility efforts to apply these tools for efficient toxicity testing raise important research questions in exposure science.

In addition, the framework for design, manufacture and management of chemicals is transforming in response to society's need for safe and effective chemicals. Principles of green chemistry require comprehensive consideration of integrated environmental, economic, and social factors. Exposure science is critical to achieving objectives of green chemistry. Prediction of potential exposures across the product lifecycle for all chemical classes and use scenarios is required under green engineering principles to minimize potential health risks to all vulnerable groups.

In this context, this session will ask the participants to consider the following:

1. Approaches for incorporating exposure information for rapid prioritization

2. Exposure information required to inform toxicity testing design and interpretation

3. Chemical and product design: Exposure considerations across the lifecycle

Thursday, 17 June 2010 Theme
Integrating Exposure and Health Sciences for Better Decisions

Background:

This breakout session will build on initial discussions held at the February 2010 U.S. National Academies of Science workshop entitled "The Exposome: A powerful approach to evaluating environmental exposures and their influences on human disease." Complex diseases are known to have both genetic and environmental components. Understanding the contribution of environmental factors to disease susceptibility will require a more comprehensive view of exposure and biological response than has traditionally been applied. Wild (2005) has proposed the need for a "step change" in exposure assessment and has articulated a vision for exposure measurement calling for an "exposome," or measurement of the life-course of environmental exposures to provide the evidence base for public health decisions to address environmental health. Wild and others (e.g., Weis et al, 2005) discuss the potential of emerging technologies to provide this new generation of exposure information. Additionally, in their guest editorial in Environmental Health Perspectives, Smith and Rappaport (2009) argue that if we expect to have any success at identifying the contribution of environmental factors on chronic diseases, we must develop 21st-century tools to measure exposure levels in human populations and to quantify the exposome.

In this context, this session will ask the participants to consider how the exposome approach and associated technologies can inform risk assessment and public health decision making.

References

Smith, M.T and Rappaport, S.M. (2009). Building exposure biology centers to put the E into "G × E" interaction studies. *Environmental Health Perspectives* 117: A334-A335.

Weis, B.K., Balshaw, D., Barr, J.R., Brown, D., Ellisman, M., Lioy, P., et al. (2005). Personalized exposure assessment: promising approaches for human environmental health research. *Environmental Health Perspectives* 113: 840-848.

Wild, C.P. (2005). Complementing the genome with an ''exposome'': The outstanding challenge of environmental exposure measurement in molecular epidemiology. *Cancer Epidemiology, Biomarkers & Prevention* 14(8): 1847-1850

National Academies of Science workshop "The Exposome: A powerful approach to evaluating environmental exposures and their influences on human disease. Web link to presentations - http://dels-old.nas.edu/envirohealth/exposome_presentations.shtml

Session 1: Exposure Science

Questions to Consider During Session

1. **How does the exposome approach [and associated technologies] inform public health decision making?**

   a. **What is the difference between biomonitoring and the exposome?**

   b. **Can the exposome be used to provide information required to make decisions at the general population level? At the individual level?**

   c. **Will the exposome provide information required to address the full range of environmental health questions?**

Session 2: Innovative Approaches to Generating, Integrating, and Interpreting Hazard Data Toxicity Testing

Session Chair: **Tim Gant**, University of Leicester, UK
Rapporteur: **Grace Patlewicz**, DuPont, USA
Recorder: **Alexis Castrovinci**, ICF International, USA

Wednesday, 16 June 2010 Theme
Emerging Models for Human-based Toxicity Testing

Background

This breakout session will examine new experimental cell systems, in particular differentiated embryonic stem cell systems, and their potential application in the investigation of chemical toxicity. It will look at how these emerging systems technologies may impact methods for obtaining relevant data more easily extrapolated to the human situation. This breakout session is to drive the chemical assessment field forward toward more human-based models to evaluate the effects of environmental stressors on human health. In addition this session will introduce some of the new toxicity testing methods.

Thursday, 17 June 2010 Theme
Computational and Integrative Methods for Predictive Toxicology

Background

This breakout session will focus on analytical, computational and integrative methods for predictive toxicology. The session will look at the increasing application of nuclear magnetic resonance (NMR) technology in evaluating chemical risk, understanding mechanisms, and assessing exposure. This instrumentation, like all of the high throughput technologies, generates high data volumes for comparatively little financial cost per datapoint. With the cost of data generation decreasing, the remaining challenge and cost is in data interpretation. Therefore, part of this session will focus on improving data integration by exploring existing and emerging approaches for integrating data in a meaningful manner to inform chemical risk assessments. This session will help transition knowledge integration for chemical risk assessment from being largely an academic exercise to being truly used in practice.

Session 2: Innovative Approaches to Generating, Integrating, and Interpreting Hazard Data Toxicity Testing

Questions to Consider During Session

1. Will differentiated embryonic stem cells provide a better *in vitro* system in which to understand chemical toxicity than the systems currently available?

2. Do any of the imaging methods presented have utility in chemical risk assessment?

3. What is the potential application of NMR based methods in understanding and assessing chemical toxicity?

4. What is the potential and what are the challenges for these toxicity tools to enable predictive toxicology and a better dose-response characterization?

5. How do these models address low dose and no threshold effects in toxicity testing?

6. Significant amounts of data already exist and, and additional data are emerging. Are the wheels of data interpretation and integration struggling to cope with the output from the engine?

7. Is there enough training in new methodologies and data interpretation to serve the needs of the industry now or in the future?

8. What role does, and will, computational cheminformatics play in chemical risk assessment?

9. How important is understanding mechanisms?

10. How do you extrapolate from cell systems to whole organisms? Is this necessary for making good risk assessments decisions, or can a new paradigm be constructed such that points of departure and risk decisions can be made based on signals from the cell-based assays?

11. How do we integrate toxicity testing data with emerging exposure tools for better decision making?

Session 3: Communicating Scientific Information

Session Chair: **Lynn Frewer**, Wageningen University, The Netherlands
Rapporteur: **Melanie Bausen**, BASF – The Chemical Company, Germany
Recorder: **Kim Osborn**, ICF International, USA

Wednesday, 16 June 2010 Theme
Addressing the Nodes of Disconnect

Background

There is a need to develop better practices for communicating outcomes of chemical risk assessments. This breakout session will evaluate the scientific information needs of policy/decision makers so that they are able to formulate better decisions about science-based issues. This session will also examine how risk assessors can communicate and translate potential research findings into policy as well as how they can communicate science-related findings more effectively to end-users and the general public. Through technological and informatics innovations, data are becoming cheaper and easier to generate, while the ability to interpret them and translate them into meaningful information continues to present challenges.

This session will promote discussions on how risk assessment can capitalize on these recent advances in exposure science and toxicity testing, including integration and application of information to make better risk based decisions. This breakout session will also consider the role of risk-benefit considerations in decision making. These topics will be grounded in the context of an immediate or emerging regulatory process, such as REACH biocides.

Session 3: Communicating Scientific Information

Thursday, 17 June 2010 Theme
Developing a Framework for Research: How Scientific Information Exchange Can Better Meet the Needs of Society

Background

This breakout session will serve as a venue to bring together various perspectives to produce outcomes that can be translated into something of immediate value. A specific objective for this day's breakout session will be to develop recommendations for a concrete and actionable research framework to address gaps in communications practices. Our process will use a gap analysis approach that simply asks two questions: Where are we now? Where do we want to be? Breakout session participants will actively participate in the gap analysis process to:

- Identify target areas/issues raised during the breakout session
- Describe the current state of these areas/issues
- Formulate a goal state for each of these areas/issues
- Develop action items to achieve the goal state for each of these areas/issues
- Propose a timeline to achieve the goal state

Questions to Consider During Session

1. **The link between technical expressions of risk resulting from health and environmental assessments may only tenuously link to health and environmental policy objectives. How can this link be made stronger?**

2. **It is increasingly argued that assessment of both the risks and benefits associated with an event or activity is required input for decision making. How should risks and benefits of an event or activity be communicated to all end-users, e.g., the policy community or the general public?**

3. **How should multi-criteria assessments (i.e., assessments incorporating socio-economic and ethical risk-benefit assessments as well as health and environmental impacts) be communicated? What metrics are needed as a basis for this communication?**

4. **If transparency associated with risk analysis is to be increased, it is important that all factors influencing a decision are communicated. How can risk-benefit metrics be communicated in order to make decision making explicit, rather than an implicit risk management activity as is the case at present?**

5. **What methods are available to target information to the needs of specific population groups?**