

What Is Safe?

Integrating Multi-Disciplinary Approaches for Decision Making about the Human Health and Environmental Impacts of Chemicals

In the same way that decisions made by groups are usually better than those made by individuals, decisions about chemical safety can be improved by incorporating input from a variety of scientific disciplines. Advancing the use of multi-disciplinary approaches for research on the question of “What is Safe?” for chemicals was the focus of the 2014 International Council of Chemical Associations’ Long-Range Research Initiative (ICCA-LRI) workshop. This workshop was organized in collaboration with the European Commission’s Joint Research Centre and was held in Lugano, Switzerland on June 17th and 18th.

Workshop Highlights. An informed process for good decision making about chemical safety should actively involve academia, industry, and regulatory agencies. Based on this premise, the workshop opened with presentations by representatives from each of these perspectives. The three presentations highlighted the importance of approaches that can clearly communicate the often complex outcomes from scientific research to the regulators who review and evaluate the information. For example, while the scientific basis for evaluating possible links between chemical exposures and adverse outcomes would be improved through integration of information from human toxicology, ecotoxicology, exposure science, and epidemiology, the challenge lies in how better to do this. The presenters concurred that effective communications are the key interface among data generators, risk assessors, and regulators for making sound science-based decisions about chemical safety.

The workshop then explored the three broad areas of toxicology, exposure science, and epidemiology, which form a critical core of scientific information for decision making about chemicals. An important aspect of the presentations that followed was consideration of not only human health perspectives but also ecological perspectives; this approach was adopted to promote information linkages between these two fields and opportunities for cross-learning. The first session focused on how integration of knowledge from both human toxicology and ecotoxicology could improve our understanding of mechanisms of toxicity and adverse outcome pathways (AOPs). AOPs are a relatively recent conceptual framework that links interactions between chemicals and biological organisms from the molecular level to the population level to better understand adverse health or eco-toxicological outcomes. The presentations reflected that while previous thinking on AOPs in human toxicology and ecotoxicology has often proceeded on parallel tracks, more cross talk about innovative ideas regarding AOPs from both areas could have synergistic benefits. The subsequent session extended this discussion by focusing on how toxicokinetics, which describes the adsorption, distribution, metabolism, and

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excretion of chemicals in biological systems, can advance thinking on the mechanisms of toxicity and AOPs for both human toxicology and ecotoxicology.

Because both hazard and exposure information are essential for meaningful decisions about potential risks from chemicals, the session on exposure science explored the range of exposure data currently available and what steps are needed to improve both the amount and quality of exposure data. The first speaker opened with the recurring theme for the workshop – environmental exposures to chemicals must broadly consider the impacts to humans as well as plant and animal life. The next speakers in this session reviewed current high-throughput approaches for generating exposure data as well as new models for predicting exposures and for bridging the data gap between external exposures to chemicals and the doses that reach cells and tissues. Panel discussions considered what advances in exposure science are needed to successfully bridge epidemiology and toxicology.

The focus for the epidemiology session was what is needed to advance epidemiological studies regarding associations between environmental exposures to chemicals and adverse outcomes for human health. The presentations addressed the challenges in assessing results from current epidemiological studies due to the variety of study designs as well as the importance of discussions with toxicologists during study design to improve the relevance of the outcomes. Future studies that minimize bias and the likelihood of chance findings can improve the quality of epidemiological data and the assessment of the potential risks to human health from environmental exposures to chemicals.

Summary. The closing session considered the path forward for decision making from perspectives provided by regulators and the chemical industry. From a regulatory perspective, the importance of active and clear communication among data generators, risk assessors, and regulators was reiterated as the basis for improving both the quality and speed of chemical safety assessments. Increasing the availability and quality of exposure data for both humans and the environment remains a top priority. The multi-disciplinary approach advocated by this workshop can be advanced through recognition of the value that each scientific discipline brings to the table and the synergy that can be gained toward improved decision making for chemicals.