

Special Seminar

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“The Joy of Fugacity and Activity: Quantifying Pathways to Exposure from Toxic Chemicals.”

Toxicology Centre Distinguished Lecturer Series

Sponsored by AREVA Resources Canada Inc.



12:30 p.m.

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Room 2104, WCVM,

University of Saskatchewan



We now enjoy the benefits of living in a world pervaded, deliberately or accidentally, by chemicals such as fuels, plastics, pesticides, detergents and drugs, to which we are inevitably exposed. Accordingly, it is desirable that we improve our quantitative understanding of how these chemicals behave in our environment, how they react, are transported, bioaccumulate, how we become exposed to them and what risks they pose to us and our fellow organisms. This is the formidable task faced by environmental chemists, engineers and toxicologists. It is argued that the two concepts of fugacity and chemical activity can play a valuable role in this task, especially by contributing to mass balance modelling to quantify the pathways throughout our multi-media environment leading to exposure and adverse effects. The evolution of these concepts over the last 200 years is outlined and examples are given of evaluative and real models of chemical fate that describe aspects of chemical fate including multi-media partitioning, persistence, potential for long range transport and bioaccumulation in single aquatic species and food webs. The concepts can be extended to internal organs and tissues as physiologically based pharmacokinetic and toxicokinetic models both in test organisms and humans. Related models can address chemical fate in rivers and lakes, agricultural settings, waste water treatment plants and indoor environments. In cases of simple baseline narcosis the activity concept can be applied directly as a metric of toxicity. Using a ‘toxic ratio’ it may also be applicable for specifically or biochemically acting toxics. A key conclusion is that if consistency can be achieved between chemical properties, emission rates, monitoring data and model predictions, then with appropriate insights on toxicity, it can be claimed that environmental fate and exposure are adequately quantified, the primary routes of exposure are identified and appropriate control measures can be justified to assure a low and acceptable level of risk.