Decision Orientated Risk Assessment of Chemicals
Prof. Konrad Hungerbühler, ETH, Zurich, Switzerland

Highlights

- Thousands of chemicals will require risk assessment under proposed new Chemical Policy legislation, far beyond the resources currently available for testing
- Exposure-based hazard assessment and scenario-based modeling could be useful tools for screening and prioritising chemicals for testing under new Chemicals Policy legislation
- Building the models involves simplifying complex real world interactions
- Accessing appropriate and accurate data on chemicals is essential

Summary

Mrs Dagmar Roth-Behrendt, MEP, welcomed delegates to the third AllChemE seminar at the European Parliament in Brussels. She is actively involved in the Chemical Policy working group and indicated that the parliamentary process was moving swiftly. She welcomed dialogue with all stakeholders to the process before introducing Bart Bosveld, executive director of seminar co-sponsor the Society of Environmental Toxicology and Chemistry (SETAC), who introduced Professor Hungerbühler.

The European chemicals 'portfolio' consists of over 100 000 products, the majority of which have no available toxicity data. Full risk assessments have been made on very few, but the new Chemicals Policy will extend assessment requirements. Resources for full assessment are limited, said Professor Hungerbühler, so it is clear that criteria need to be developed to prioritise testing and assessment. Hungerbühler defined four terms: Exposure - the presence/ concentration of a chemical; Effect - the (eco)toxic impact of that exposure; Risk - the possibility of occurrence of adverse effects; and hazard - the inherent potential of a chemical for effects such as human toxicity. Risk is proportional to concentration but hazard is not. In assessing risk, there were a number of problems: the number of chemicals and chemical containing products; the exhibitive cost and lengthy process of full risk assessments; the highly complex nature of ecosystems and environments; and the highly complex nature of chemical use patterns - in particular for consumers.

Hungerbühler introduced the global model 'ChemRange', which has been developed to study the duration and mobility of chemicals in the environment. The model delivers concentration in soil, water and air over time. Plots of the spatial range or distribution of a chemical against its persistence or residence time could give a useful and quick screening tool to prioritise targets for testing. The model was further developed to include transformation products of chemicals which are often neglected in risk assessments but can have a significant overall impact. Case studies showed that the total exposure and persistence, including all transformation products, could be higher by a factor of four compared to the precursor alone. Prof. Hungerbühler also demonstrated complex models for persistent organic pollutants (POPs) where effects of global temperature difference were included, replicating reported data on polar accumulation for α-Hexachlorocyclohexane.

Models using scenario building are useful for occupational and consumer exposure, said Hungerbühler. A broad range of scenarios were constructed with varying exposure. These models need relatively few parameters but give calculations of inhaled and dermal exposure of individuals and are combined with population figures. Case studies involving dry cleaning workers exposure to perchloroethylene showed declining near and far field exposure as new generation of equipment was introduced and correlated with indoor air. Modeling of exposure of consumers to artificial musk fragrances showed interesting differences between male and females.

Debate

In the following discussion Prof. Hungerbühler stressed the complex intellectual task of simplifying complex processes. The models, he said, could be useful for prioritising testing under new Chemical Policy - a key test being the proximity of risk and benefit of the chemical. He felt this concept needed to be communicated more. He also identified a key obstacle in applying the models as the lack of appropriate data. ETH had a large databank on chemicals but much more was needed and not all public data was reliable. He called upon the industry and other stakeholders to work together in establishing the databanks needed to provide useful risk assessment models.