

A roadmap for establishing DEBtox in environmental risk assessment practice

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Most frameworks for chemical risk assessment work on the principle of comparing the results from an exposure assessment (what are organisms exposed to) and an effect assessment (the relationship between exposure and toxic effects). Exposure assessment is dominated by mechanistic fate models, but effects assessment currently still relies heavily on crude descriptive methods. The last decade has witnessed a rapidly increasing interest in mechanistic effect models, culminating in 2018 in a dedicated EFSA opinion on toxicokinetic-toxicodynamic (TKTD) models for pesticide risk assessment. For animals, this opinion focussed on GUTS for survival modelling and DEBtox for sub-lethal effects (DEBtox here as in: DEB-based models used to analyse/predict toxic effects on sub-lethal life-history traits). GUTS was judged “ready to be used in risk assessment” by EFSA; DEBtox was judged to have “great potential” but “currently limited to research applications.” Clearly, GUTS has a number of advantages over DEBtox when it comes to risk assessment, most specifically its simplicity, its ability to work with standard toxicity data, an easy-to-interpret and irreversible endpoint (death), and a large number of case studies with pesticides and aquatic organisms. In the next few years, GUTS will act as a trailblazer for DEBtox in pesticide risk assessment, familiarising all stakeholders with basic TKTD modelling. It is highly likely that this process will lead to an increasing demand for similar approaches to deal with sub-lethal effects. However, to facilitate the uptake of any DEBtox model into risk assessment practice, we need to address the issues that are currently hampering it. In this contribution, I will present my analysis of the issue and suggest ways forward.