Poster Number

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Topic	Effect assessment
Title	**Minor Changes in Experimental Testing Procedures May Secure Better Data for Improved Future Environmental Risk Modelling**
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Summary: Whereas populations, communities and ecosystems are protection goals for Environmental Risk Assessment (ERA) of chemicals, current ERA methods are based on simple individual level effects. The link between individuals and populations is represented by the application of a safety factor, which is considered to guarantee a protective risk assessment. In recent years it has become apparent that such simplified RA methods may not provide the measures needed for value relevant RA, and mechanistic effect models (MEMs) may provide a more sophisticated and ecologically relevant tool for ERA of chemicals [1]. While the focus of the current presentation is on improving ERA of engineered metal nanoparticles the proposed testing scheme does also apply to other chemicals such as POPs and metals that will eventually end up in the sediment compartment.

The primary aim of the present work was to provide information on data requirements for parameterizing MEMs that can eventually be used for nanoparticle (NP) ERA as well as to pinpoint current data gaps. Silver nanoparticles (Ag-NP) were chosen as a model for the analysis based on two criteria: 1) general ranking of metal NP toxicity with the aim of selecting the most toxic particle type, and 2) availability of individual level toxicity data in the literature. A literature review for data on Ag-NP toxicity to parameterize selected MEMs showed a general scarcity in applicable data for modelling NP toxicity as well as in data for estimating the necessary realistic environmental exposure scenarios.

Modelled worst-case exposure concentrations of Ag-NPs in aquatic environmental compartments were combined with a qualitative assessment of potential exposure routes and biological traits of exposed organisms to provide realistic worst-case exposure scenarios

for aquatic environments. PEC values for water and sediments were recomputed from the model of Gottschalk et al [2,3], and the 85 percentile of the modelled probability distribution was used as worst-case exposure concentration. The study by Gottschalk et al [2] is currently the only published study providing model predictions of metal nanomaterial concentrations in the sediment compartment. Though the sedimentation procedures of the model are based on simple assumptions [2,3], the study clearly indicates that the major part of the released engineered nanomaterials is expected to end up in the sediment compartment. Increased focus on testing NP bioaccumulation and toxicity to sediment-associated and in particular deposit-feeding organisms, are therefore urgently needed.

Most available Ag-NP effect data represent short-term exposures measuring sub-individual level endpoints and lethality as the main individual level endpoint. A few available studies on long term exposure and sub-lethal effects measured only effects at the end of the exposure. For MEMs, effect data obtained during longer exposure periods, several census times and endpoints such as growth and reproduction in addition to lethality are needed. We advocate that such minor changes to experimental testing procedures coupled with more details in data reporting may provide appropriate NP toxicity data that can be used directly to produce MEMs. Though there are NP specific challenges in producing such data, e.g., keeping exposure concentrations constant during exposure, changes in NP sizes and properties over time and characterizing NPs in complex media (e.g., sediment), we nevertheless believe it is necessary to enhance testing procedures to help address risk of NPs for ERA protection goals.

Even if data availability for engineered NP is not currently at a stage where it is realistic to include MEMs in nanoparticle ERA, experimental tests and data reporting should still be performed such that results can eventually be used for and implemented in e.g., MEMs. This can be regarded as securing the data for future purposes; even without data integration in MEMs more relevant information may be obtained from improved testing procedures.

References:

[1] Forbes VE, Calow P, Grimm V, Hayashi TI, Jager T, Katholm A, Palmqvist A, Pastorok R, Salvito D, Sibly R, Spromberg J, Stark J, Stillman RA. 2011. Adding Value to Ecological Risk Assessment with Population Modeling. Human and Ecological Risk Assessment 17: 287-299.