Refining a dynamic multipathway bioaccumulation model (DYNBAM) for the sensitive crustacean *Daphnia magna* Straus: Integration in ecological risk assessment practices at the regulatory level

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The MITE-RN has produced substantial new knowledge regarding the fate of metals in the environment and has committed to using this new knowledge to improve existing ecological risk assessment approaches for metals in the environment. In this study, we explore the use of a new multipathway framework for evaluation of the exposure of sensitive aquatic invertebrates to metals. In most cases, the free ion concentration is the best predictor of metal accumulation in aquatic organisms. For example, during acute exposure scenarios, the biotic ligand model, an extension of the free ion activity model (FIAM), can predict lethality to *Daphnia magna*, fathead minnows and rainbow trout. However, chronic exposure scenarios are usually considered in ecological risk assessments. Under a chronic exposure scenario, metal uptake by algae can be predicted using the FIAM but for zooplanktonic grazers, metal uptake from water and food should also be considered. Therefore, the DYNBAM proposed in this study could perhaps be more appropriate. In this study, we first modeled and validated in the laboratory, a bioaccumulation model for Cd in algae. Obtained Cd levels in algae (*Chlamydomonas reinhardtii*) were then used in a DYNBAM to predict Cd levels in *Daphnia magna*. Predicted Cd body burden in *Daphnia magna* were in close agreement with measured values obtained from laboratory experiments. We then estimated potential for harm by comparing predicted metal levels in organisms to metal body burdens associated with chronic toxicity (i.e. reduced fitness). We determined that *Daphnia magna* individuals were at risk when free Cd^{2+} concentration in water was above 0.11 μg/L. We further assess the possibility of using this model for other metals and other organisms. At present, the integration of the proposed overall assemblage model in ERA methods requires additional data (e.g., on metal concentrations in food, assimilation efficiencies, depuration rates, and concentrations in tissue associated with effects) for other metals and organisms. Environment Canada is looking for information to fill these data gaps.