

## Application of EPA Guidelines in a Bioavailability-Based Assessment of Ambient Water Quality Criteria for Zinc

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The United States Environmental Protection Agency's (EPA's) current ambient water quality criteria for zinc in fresh water are hardness-based and were last updated in 1995. Since then, two significant advancements have been made regarding the assessment of zinc toxicity to aquatic organisms. First, the acute and chronic ecotoxicity databases have been complemented by several new studies and taxonomic groups, thereby satisfying the EPA's minimum phylogenetic diversity requirements for chronic zinc toxicity (chronic criteria were historically derived using an acute-to-chronic ratio). Second, several acute and chronic biotic ligand models (BLMs) for zinc have been developed and validated for fish, invertebrates, and algae. Considered together, the objective of these efforts was to develop a unified zinc BLM that could efficiently predict both acute and chronic toxicity from published studies that evaluated a wide range of water chemistries (e.g., dissolved organic carbon, pH, hardness). Although several of the published zinc BLMs demonstrated good predictions for the available datasets, a unified model was objectively generated by averaging the biotic ligand binding constants for zinc ( $Zn^{2+}$ ) and competing cations ( $Ca^{2+}$ ,  $Mg^{2+}$ ,  $Na^+$ ,  $H^+$ ) from all studies. Moreover, toxicity predictions were further improved by optimizing the biotic ligand binding constant for the  $ZnOH^+$  species. Only the critical accumulation parameter for each species/endpoint was changed during the auto-validation of each BLM (published or unified). Following selection of the optimized model, normalized species sensitivity distributions (using geometric mean critical accumulation concentrations for each species/exposure type) were constructed for eight water types for the estimation of 5<sup>th</sup> percentile effect concentrations (analogous to EPA's final acute values and final chronic values). A comparison of results from this assessment and historical criterion derivation practices will be discussed.