

LINKING GEOLOGICAL AND GEOCHEMICAL INFORMATION TO METAL TOXICITY IN STREAMS¹

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Abstract. The chemical speciation of metals influences their biological effects. Geologic source materials (e.g., underlying rock type, soil, and sediment) can control key attributes of water chemistry and speciation that affect metal toxicity to aquatic biota. These attributes include concentrations of potentially toxic elements, alkalinity, pH, total dissolved solids, soluble major elements, such as Na, Ca, and Mg, and dissolved organic carbon (DOC). The Biotic Ligand Model (BLM) is a computer program that predicts acute toxicological effects of metals on aquatic organisms. The BLM simultaneously considers several water-quality parameters to compute inorganic metal speciation, organic metal speciation, and metal-organism interactions. Geoscientists can use the BLM as a bridge between geochemical information and toxicological effects. For example, data about metal sources from a mined area, combined with watershed characteristics (e.g., bedrock, climate, sources of DOC), can be used in reactive transport modeling to determine likely dissolved constituents in a receiving stream. Values for the dissolved constituents can then be used by the BLM to determine potential acute toxicity to aquatic organisms. Therefore, the BLM can be used as a predictive tool in ecological and geoenvironmental risk assessments.

Additional Key Words: aquatic toxicity, environmental risk assessment, bioavailability

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