

Project Abstract: Rocky Mountain regional HSRC Proposal (Ranville, Ross, Wildeman, and Cohen)

- 1. Title:** An Improved Method for Establishing Water Quality Criteria for Mining Impacted Streams.
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- 3. Institution:** Colorado School of Mines, Golden, CO 80401
- 4. Project Period:** 11/01/03 – 10/31/05
- 5. Project Cost:** \$315,760 (\$171,703 Rocky Mountain Regional HSRC; \$144,057 cost share)

6. Project Summary: The current approach to setting ambient water quality criteria (AWQC) for metals uses either numerical values that are adjusted for site-specific hardness, or involve site-specific toxicity investigations. The former is often overprotective while the latter can be very costly. USEPA is now suggesting the use of the Biotic Ligand Model (BLM) in setting future AWQC. The BLM is a computational approach to predicting metal toxicity, which incorporates the effects of water chemistry on bioavailability. The BLM is powerful in that toxicity predictions for a given site can be made based on water quality monitoring data, without performing toxicity testing.

a. Objectives: Our objective is to evaluate the BLM for use in setting AWQC for mining impacted streams. We will test the hypothesis that the BLM approach will be able to make accurate predictions of metal toxicity in mining impacted streams. Although the BLM approach may work, the current database on which it is based may not accurately reflect the unique characteristics of these types of waters. Thus as part of meeting the objective we will modify the existing BLM data to account for the characteristics of mining impacted waters.

b. Approach: The project will focus on evaluating the existing BLM for a series of mining impacted waters while simultaneously performing experiments with reconstituted waters to test the affects of the unique water chemistry of mining impacted sites on speciation and toxicity of Zn and Cu to *Ceriodaphnia dubia*. Water samples will be collected from a number of mining-impacted streams in Colorado. The samples will be subjected to chemical analysis, acute 48-hr *C. dubia* toxicity testing, and computation of toxicity using the existing BLM models for copper and zinc with *C. dubia*. In the reconstituted water experiments, dissolved components will be varied systematically in order to determine the effects of each parameter (hardness, sulfate, metal mixtures) independently. The data will be used to optimize the BLM for mining affected waters.

c. Expected Results: Expected results include an expanded database for the BLM in waters that reflect the chemistry of mining impacted streams. A major product will be an improved BLM that will be a cost-effective approach to assessing existing mining impacts, evaluate the results of remediation approaches to abandoned mine lands, and direct the development of mining approaches that are protective of the aquatic environment. The proposed work meets a number of the specific research needs of the RMRHSRC including site characterization with respect to bioavailability of metals, assisting in the formulation of water quality management plans, and evaluating the impacts of mine wastes on the environment.