USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2003MT10B

Title: Understanding and predicting changes in the microbial ecology of mine tailings in response to the addition of dissolved organic carbon

Project Type: Research

Focus Categories: Water Quality, Toxic Substances, Treatment

Keywords: acid mine drainage, microbial ecology

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Matching Funds: $30791.00

Congressional District: At-large

Principal Investigators: Sturman, Paul

Abstract: Recent field- and laboratory-scale experimentation at MSU and elsewhere has indicated that microbial populations within acid-producing mine tailings can be influenced by the addition of dissolved organic carbon. Results from this work have shown that heterotrophic bacteria can be stimulated to consume dissolved oxygen from infiltrating water, thus decreasing the oxidation-reduction (redox) potential throughout the tailings pile and promoting the activity of anaerobic sulfate reducing bacteria (SRB). However, an unintended consequence of the addition of organic carbon may be the stimulation of heterotrophic populations within the mine tailings that are also capable of iron and/or sulfur reduction. The stimulation of these populations via organic carbon addition may be detrimental to remediation efforts. Successful implementation of this technology at the field scale requires a more thorough understanding of the presence, activity, and stimulation of these potentially detrimental populations, as well as beneficial populations (e.g. SRB). In particular, it is necessary to understand and predict the response of iron-oxidizing and sulfate-reducing populations to various organic carbon addition strategies. The research proposed herein seeks to determine the specific response of these microbial populations to commonly used organic carbon sources. The proposed experiments will measure the effects of various organic carbon substrates on specific populations of IOB/SOB and SRB. Population effects will be

measured through the use of bacterial cell counts, substrate utilization and advanced molecular techniques such as polymerase chain reaction (PCR), and denaturing gradient gel electrophoresis (DGGE). The results will be used to help select the most appropriate sources of organic carbon for field application to mine tailings. These experiments will provide engineers and scientists responsible for implementing mine waste remedial schemes with tools for assessing the microbial condition of mine wastes prior to implementing a solution, and after a treatment is applied. Although remedial measures which rely on microbially catalyzed reactions are in common use, we currently lack the tools to predict (and measure) the responses of important microbial populations.
