WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: ME2221

Title: Do Microorganisms Control Arsenic Mobility in Groundwater?

Focus Categories: Water Quality, Toxic Substances

Keywords: Trace Elements, Toxic Substances, Groundwater Management, Bacteria

Start Date: 04/01/2001

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Federal Funds: $22,375

Non-Federal Matching Funds: $70,238

Congressional District: Second

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Abstract

Arsenic contamination has emerged as a problem in groundwater drinking water supplies in the United States and Maine in particular. Since arsenic exposure through drinking water has been linked to increased risk of cancer, this issue is now a public health concern and the EPA has proposed a much lower MCL. The factors that affect arsenic concentration in drinking water are not well understood. It is well known that speciation affects adsorption and mobility of arsenic, however, and that the reduced form, As(III), is more mobile and more toxic than the more oxidized form, As(V). It is also known that microorganisms can affect the redox chemistry of arsenic compounds. Under reducing conditions, which are usually encountered in groundwater, microorganisms can catalyze the reduction of As(V) to As(III) in energy-generating reactions. Other microorganisms cause the release of adsorbed arsenic through reduction and dissolution of Fe(III) and Mn(IV). These transformations result in an increase in soluble arsenic and could contribute to contamination of the groundwater. Information on the magnitude of these microbial processes in the groundwater environment and their role(s) in As release and solubility is needed to improve As management options for water supplies.

Solid and liquid samples taken from contaminated wells will be characterized for Fe(III), Mn(IV) and As(V) reduction and release of As from the geologic matrix. Enrichments will also be made for microorganisms that can carry out reduction of these elements so that isolates can be obtained and the processes may be further characterized. The effects of organic carbon enrichment (lactate addition) on the reduction reactions and dissolution of arsenic will be investigated to simulate the effect of increased organic loading on water quality. The results of this pilot research will be used to support additional funding requests to continue arsenic biogeochemical studies.