**WATER RESOURCES RESEARCH GRANT PROPOSAL**

**Project ID**: NH501

**Title**: Effect of Surface Coatings and Ionic Strength on Bacterial Removal Rates in Porous Media

**Focus Categories**: Groundwater, Water Quality

**Keywords**: Surface Coatings, Pollutants, Septic Tanks, Groundwater Quality, Bacteria

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**End Date**: 02/28/2002

**Federal Funds**: $16,335

**Non-Federal Matching Funds**: $34,351

**Congressional District**: 1

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**Abstract**

The transport of pathogenic viruses and bacteria in the subsurface poses a potential threat to public health. In New England, greater than 96% of all drinking water supplies in violation of drinking water standards are contaminated with bacteria. The prevention of microbial contamination of both ground water and surface water supplies requires an understanding of the processes controlling microbial transport and removal within the subsurface. Among the most important factors shown to influence bacterial transport through porous media are ionic strength of the carrier fluid and the presence of metal-oxyhydroxide coatings on sediment surfaces. While numerous studies have been conducted looking at the effects of ionic strength and surface coatings independently on bacterial deposition rates, no systematic study yet exists looking at the combined effects of ionic strength and surface coatings on bacterial attachment rates. Recent results from a study at the University of New Hampshire suggest that metal-oxyhydroxide coatings are prevalent in glacial outwash deposits of south-central New Hampshire. The presence of these coatings suggests that bacterial removal rates may be high in southern New Hampshire resulting in shorter distances traveled by bacteria in the subsurface. However, to better understand bacterial attachment and transport in NH aquifers, research needs to be conducted on the combined effects of high ionic strength waters and metal-coated sands.

The objective of the proposed research will be to compare the effect of ionic strength on bacterial removal rates under favorable deposition conditions (oppositely charged surfaces) with bacterial removal rates under unfavorable deposition conditions (like-charged surfaces). In particular, this research will address the following question: does increasing ionic strength increase, decrease, or not affect bacterial attachment rates to iron-coated sands? Research will be conducted with laboratory columns that are homogeneously packed with Fe-coated sand grains. A short pulse of 14C-labeled bacteria will be passed through the columns at initial concentrations ranging from approximately 1 x 10^7 cells mL-1 to 2 x 10^7 cells mL-1. Effluent samples will be collected from duplicate columns and the effect of ionic strength on bacterial attachment rates will be evaluated by statistical comparison of the sticking efficiency (a) for the different treatments. Treatments will include ionic strength (ranging from 10^-4 to 10^-1 M) and the presence or absence of iron-coated sand. These results will assist regulatory agencies in establishing guidelines for protecting ground water supplies from bacterial contamination from septic tanks.