USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2002MO6B

Title: Microbial Influences on Geophysical Signatures

Project Type: Research

Focus Categories: Geochemical Processes, Methods, Groundwater

Keywords: Spectral Induced Polarization Method, Non-Aqueous Phase Liquid, Biodegradation, Groundwater

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Congressional District: Missouri 9th

Principal Investigator:
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Abstract

We envision the need for the development of new and non-invasive technologies that can serve as a surrogate for pore water and soils sampling and analysis to assess subsurface degradational processes and to monitor the cleanup of contaminated soils and groundwater. Such methodologies would have tremendous potential to reduce cleanup costs and reduce health risks to humans and the environment. In this regard, electrical geophysical methods hold great promise in detecting soil contamination, in assessing the state of contaminant degradation activities and in monitoring the progress of active and passive remediation activities. Currently, no attempts have been made to determine how microbial and geochemical modifications of Non-Aqueous Phase Liquid (NAPL)-impacted media and subsequent changes in the subsurface geochemistry alter the geophysical response of the contaminated media. The link between geophysics and microbes is embedded in the time-dependent biogeochemical changes that occur as microbial communities actively degrade hydrocarbons at spill sites. Therefore, in the proposed study, we seek to understand the effects of biodegradation processes on measured geoelectrical properties and establish a basis for interpreting geophysical data from these sites. Our specific objective is to conduct laboratory experiments to determine how geoelectrical properties vary with biodegradation processes in NAPL-impacted soils and groundwater.

We will make Spectral Induced Polarization (SIP) measurements on contaminated Missouri sediments to test our hypothesis that microbial NAPL degradation induces time-dependent changes in the electrical properties of NAPL impacted soils. Accordingly, the degradation translates, via chemical and physical modification of the soil environment, into a geoelectrical response. Our geophysical interpretation of NAPL degradation will help discriminate between active biological, geochemical, mineralogical, and hydrological processes that accompany biodegradation.