What Microbial Growth Looks Like in the Subsurface: Electrical Imaging of Impacted Sites

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Background/Objectives. Electrical imaging techniques are now commonly used to sample the subsurface to develop more accurate conceptual site models. These data are useful for understanding microbial activity due to the significant changes in electrical conductance generated by their growth. These changes are often outside the range of any natural hydrogeological values on a site. The study of the interactions of microbes and the geophysical signals they generate is termed “biogeophysics”. The objective of this talk is to review the laboratory and field understanding of biogeophysics that has developed over the last 20 years.

Approach/Activities. In a laboratory and numerical model setting, understanding microbial growth and reactions in the subsurface has advanced significantly. The geophysical signals and properties that microbes are controlling coincide with their structures and the reactions they mediate. In the field, sites that are affected or controlled by microbial processes have been investigated and the generated signatures can be the primary electrical signature within an impacted area. This work will review three-dimensional structures observed in the field setting and compare the results with monitoring well, direct push and DNA data.

Results/Lessons Learned. The availability of genetic tools and field geophysical techniques that can be integrated to locate and monitor microbial colonies, opens up a new set of possibilities in site characterization and remediation. In characterization, the presence or absence of microbial growth can be used to make decisions about appropriate site remedies, including monitored natural attenuation. During remediation, the ability to monitor colony makeup and growth may lead to better abilities to “farm” colonies to better remediate site impacts.