High Resolution Definition of Subsurface Heterogeneity for Understanding the Biodynamics of Natural Field Systems: Advancing the Ability for Scaling to Field Conditions

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Research Objective

This research is an integrated physical (geophysical and hydrologic) and microbial study using innovative geophysical imaging and microbial characterization methods to identify key scales of physical heterogeneities that affect the biodynamics of natural subsurface environments. Data from controlled laboratory and in situ experiments at the INEL TAN site will be used to determine the dominant physical characteristics (lithologic, structural, and hydrologic) that can be imaged in situ and correlated with the microbial properties. Emphasis will be placed on identifying fundamental scales of variation of physical parameters that control transport behavior relative to predicting subsurface microbial dynamics. A key hypothesis addressed is that nutrient flux and transport properties are key factors in controlling microbial dynamics. The outcome will be an improved understanding of the relationship between physical and microbial heterogeneity, thus facilitating the design of bioremediation strategies in similar environments. The work described here is an extension of current basic research on natural heterogeneity within the DOE/OHER Subsurface Science Program (SSP) and is intended to be one of the building blocks of an integrated and collaborative approach with an INEL/PNL effort aimed at understanding the effect of physical heterogeneity on transport properties and biodynamics in natural systems.