Subsurface Bacterial Community Dynamics in the Presence of Plutonium and Uranium

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This project has two goals. The first is to determine the effects of Pu(VI) on natural bacterial communities in anaerobic subsurface sediments, and to compare bacterial community dynamics in the presence of Pu(V/VI) or U(VI). The second is to identify groups of indigenous bacteria from subsurface sediments that are active in the presence of Pu(V/VI) or U(VI) and that may be responsible for reduction of Pu(VI) and/or U(VI) in anaerobic subsurface environments. Using subsurface sediments from DOE sites, we will conduct laboratory time-course experiments where sediment is exposed to Pu(V/VI) or U(VI). We will use a combination of methods to specifically analyze Fe(III)- and sulfate-reducing bacterial groups known to reduce U(VI), and to conduct a broader survey of potentially important soil species that are active in the presence of Pu or U. We will measure bacterial abundance of target bacterial groups using real-time quantitative PCR assays, followed by analysis of species composition in those groups found to be active and/or correlated with actinide reduction. In parallel, we will use terminal restriction fragment (T-RFLP) profiling to determine broad changes in the total bacterial community as affected by actinide presence. To insure that potentially important species that are not members of our quantitative PCR groups are not missed, we will also assess total bacterial diversity and composition by 16S clone/sequence libraries, to be conducted at certain points in our time-course experiments. This study will contribute to the NABIR program by providing information on the dynamics of natural sediment communities in the presence of Pu(V/VI) and U(VI) that complement ongoing pure culture and field studies.