Strategy and Techniques for Monitoring Bioremediation of Metals and Radionuclides in the Vadose Zone and Groundwater at Contaminated Sites

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The strategy and techniques for monitoring bioremediation will be considered using an example of biostimulation of Cr(VI) contaminated soils at Hanford 100H site. The idea of biostimulation is based on the application of a Hydrogen Release Compound (HRC) that will generate electron donors like lactate and hydrogen for microbial production of reducing conditions. Under reducing conditions, the reduction process, caused by adding lactate (produced by HRC) and its breakdown products, causes the microbial population to remove the oxygen, nitrate, sulfate and other competing electron acceptors, which, in turn, depress the redox potential in the aquifer, causing the transformation of dissolved Cr(VI) species to Cr(III) solid species, which are precipitated on soil particle surfaces. This renders a cost-effective aquifer treatment as compared to other remediation technologies.

We will also consider a number of limitations of bioremediation, such as aquifer geochemistry (inorganic common anions and cations, Eh, pH, temperature and DO), contaminants, such as nitrate, manganese oxide, level of radioactivity, oxidation conditions caused by recharge of infiltrating water or water from the river, or the release of oxygen from air entrapped within the zone of fluctuation of the water table.

The presentation will also include the discussion on monitoring of flow and transport in the vadose zone using geophysics and stable isotope methods.

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