

Field Studies to Assess Biostimulation for Remediation of Radionuclides and Heavy Metals at an *In Situ* Leach Mine Site

John Willford , Kevin Chamberlain, Paul Reimus and Jim Clay,

Abstract

Restoration of in-situ recovered (ISR) uranium aquifers requires the reduction of soluble uranium (VI) back into the insoluble uranium (IV) form. It has been shown that some microorganisms catalyze this reaction as part of their natural metabolic activity. Our research group has used tryptone to stimulate the growth of the naturally-occurring microorganisms in the Smith Ranch-Highland (SRH) mined uranium aquifer to promote biological reduction of U(VI) in this system. Laboratory-based microcosm trials demonstrated upwards of a 68% reduction in the concentration of U(VI) with continued efficacy observed in continuous flow columns (82.6-99.3% reductions depending upon tryptone and starting uranium concentrations). Our follow-up analyses demonstrated a significant shift in the $^{238}\text{U}/^{235}\text{U}$ ratio in many of the treatments, generally correlating with reduction of uranium. These data alongside microbial community analyses suggest that the U(VI) reduction is biological. A longer-term field-trial at SRH demonstrated growth of naturally-occurring organisms by tryptone stimulation and that U(VI) reduction is dependent upon tryptone and starting uranium concentrations. Tryptone Effectively Stimulates Biological Reduction of Uranium (VI) to Uranium(IV) in Treatment of In-situ Uranium Aquifer Waters.