

## **Linking As, Se, V, and Mn Behavior to Natural and Biostimulated Uranium Cycling**

### *University-Led Research*

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Biogeochemical redox cycles in groundwater systems frequently mobilize metals and metalloids that directly impact human health. These same biogeochemical cycles can also alter uranium speciation and mobility thus directly impacting groundwater quality at DOE legacy sites. Interestingly, the reducing conditions that immobilize uranium may be optimal for mobilizing metals such as As, Mn, Se, and V. These processes are occurring at the Department of Energy's Field Research Challenge (IFRC) site near Rifle, Colorado and offer a unique opportunity to study biogeochemical redox cycles. At well U01 near the Colorado river, natural redox fluctuations occur with changing river stages. When the river stage is high the aquifer appears oxidized. When the river stage is low the aquifer becomes reducing and Mn, As, and sometimes Fe becomes mobilized. Interestingly, little change in U concentrations are observed. During biostimulation at the IFRC As concentrations dramatically increase in the groundwater. During Fe(III) reduction, As levels increase to concentrations similar to levels observed in well U01 (~1.0  $\mu\text{M}$ ). However under sulfate reducing conditions As concentrations can be over ten times higher. Initial speciation work by IC-ICP-MS from samples collected during the "Super 8" experiment in 2011 indicated that arsenite was the dominant species during Fe(III) reduction but thioarsenates, in particular trithioarsenate, become dominant during sulfate reduction. No thioarsenites were observed. Speciation results were in close agreement with geochemical modeling. Future work will focus on understanding the sorption properties of thioarsenates along with the observed speciation during natural redox fluctuations. The goal is to better constrain the mobility of thioarsenate species and the species present and extent of As transport under natural and stimulated redox conditions.