



NIEHS Superfund Research Program

Health Effects and Geochemistry of Arsenic and Manganese

Columbia University



Laboratory and Field Studies Directed toward Accelerating Arsenic Remediation at a Major US Superfund Site in New Jersey

Arsenic is a prevalent contaminant at a large fraction of US Superfund sites. Therefore, establishing techniques for accelerating As remediation could benefit many contaminated sites. Remediation of As contaminated groundwater by conventional methods, i.e. pump and treat (P&T), can be impeded by slow desorption of As from Fe and Al (hydr)oxides in aquifer solids. Through experimentation at different physical scales (grain, bench, and field scale), the potential for chemical additions to increase As release from sediments and possibly accelerate P&T remediation is examined. The work described here focuses on As contamination and remediation at the Vineland Chemical Co. Superfund site in southern NJ. The site is extensively contaminated with As resulting from decades of poor chemical storage and disposal practices by the Vineland Chemical Co., which manufactured As-based biocides from 1949-1994. Despite significant intervention, including groundwater remediation by P&T and treatment of solids via soil washing, sufficient site clean up could require many decades with current technologies. Chemical amendments that either compete with As for sorption sites or dissolve Fe and Al (hydr)oxides can increase

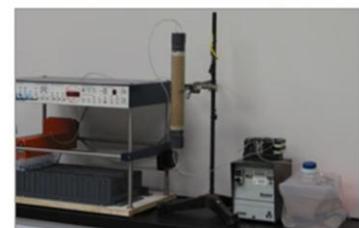
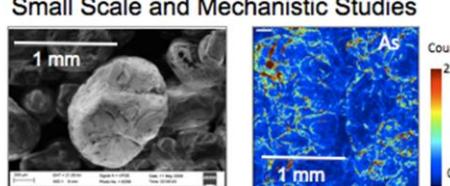
As mobility and potentially improve P&T remediation efficiency. Simple extrapolations from bench scale column experiments based on pore volumes suggest that treatment with 10 mM oxalic acid could lower the time necessary for clean up at the Vineland site from 600 years (with current techniques involving just groundwater) to potentially on the order of 4 years. Small scale ($<1 \text{ mm}^2$) X-ray fluorescence maps from columns performed within the synchrotron beamline showed As release during

oxalic acid treatment that was consistent with the bulk column materials and suggested that microscale processes can be predictive of the larger system. Finally, during a 3-month pilot study at the Vineland site, oxalic acid was injected into a small section of the aquifer via an injection manifold system that was designed and built for the experiment. Groundwater samples indicate that introduction of oxalic acid led to increased As release at a sampling well and pump and treat recovery well in the study area. Addition of oxalic acid shows promise for accelerating treatment of a highly contaminated site.

Multi-Scale Approach

Bench Scale Lab Studies

Small Scale and Mechanistic Studies



Pilot Scale Field Study

