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### The Use of Oxalic Acid to Mobilize Arsenic from Contaminated Aquifer Solids from Vineland, New Jersey

Arsenic is the second most common contaminant of concern after lead at U.S. Superfund Sites. Arsenic mobility and the desorption of As from Fe and Al hydroxides in soils are dependent on aquifer conditions, including pH and oxidation and reduction potential. The slow desorption of As from these (hydr)oxides can substantially decrease the efficiency of pump and treat systems, requiring protracted periods to make significant declines in the concentrations of As. The objective of the study conducted was to analyze how a two-phase oxalic acid injection affects the timing and amount of arsenic mobilization from contaminated aquifer material from the Vineland Chemical Superfund Site in Southern New Jersey. Column experiments were performed using aquifer material with different concentrations of As (37.9 -86.4 mg/kg); samples included aquifer materials obtained from the Vineland Superfund Site both before (2008) and after (2009) treatment with oxalic acid during a pilot field study. During the first phase of the column experiments, the aquifer material was treated with a relatively low concentration of oxalic acid (~2 mM) for 6 pore volumes, after which a higher concentration of oxalic acid influent is introduced (~ 18 mM) for 9 pore volumes. More As was mobilized into the groundwater when the concentration of oxalic acid influent was increased. In the column experiment with 2008 aquifer material with an original concentration of 37.9 mg/kg As, the cumulative percentage of arsenic mobilized was 31% and the peak concentration of As mobilized was 17,029  $\mu\text{g/L}$ . In the previously treated 2009 aquifer material from a 30ft depth core with 65.7 mg/kg As initially, 31% of the total As was mobilized and the peak concentration reached 22,296  $\mu\text{g/L}$  while for the post-injection 2009 core material from a 40ft depth with an initial As concentration of 86.4mg/kg, 12.1% of the total As was mobilized and peak arsenic released was 4191  $\mu\text{g/L}$ . This finding indicates that the efficiency of oxalic acid treatment and the potential for re-mobilization is affected by the location and depth of the aquifer material in the contaminated area. In our study, the % recovery of oxalic acid was >99%, indicating little or no sorption or degradation of the organic compound within the column. The chemical treatment of the Vineland sediment with oxalic acid could substantially decrease the number of years needed for cleanup by increasing the mobilization of As.