Evaluation of Potassium Persulfate as a Permeable Reactive Barrier at Three Different Sites

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Background/Objectives. In situ chemical oxidation (ISCO) using activated persulfate has been widely applied to treat recalcitrant environmental contaminants of concern (COCs). Until recently, activated persulfate referred to highly soluble sodium persulfate activated by heat, alkalinity, hydrogen peroxide or chelated iron. These technologies have proven to be very effective, especially for source area treatment. Potassium persulfate is a lower solubility alternative that can be used to extend the period of active treatment, for application to low permeability soils and in permeable reactive barriers.

The objective of the series of column studies were to evaluate the potential application of potassium persulfate (Klozur® KP) to treat soils from three separate contaminated sites.

Approach/Activities. Two of the sites were contaminated with a mixture of 1,4-dioxane, chlorinated ethenes, and chlorinated ethanes. The third site was contaminated with a mixture of petroleum hydrocarbons and pentachlorophenol. An evaluation of the contaminant mixtures at each site indicated that both oxidative and reductive pathways resulting from activated persulfate reactions would be necessary for complete treatment. Site soils and reagents were placed in a series of column reactors. Site groundwater was then run through the columns until the potassium persulfate had been consumed. Multiple time-point samples were collected, evaluating the COCs, pH, oxidation-reduction potential, and residual persulfate.

Results. This presentation will provide the results from each site and highlight key conclusions in terms of the effectiveness of the oxidative and reductive pathways and comparative benefits of two activation schemes for potassium persulfate. The data indicated:

- Sites 1 & 2: Hydrated lime induced alkaline-activated potassium persulfate reduced 1,4-dioxane, chlorinated ethenes, and the chlorinated ethanes concentrations to below the detection limit. ZVI-activated persulfate resulted in treatment to non-detect of 1,4-dioxane and chlorinated ethenes while reducing chlorinated ethanes by 20 to 60 percent.
- Site 3: Pentachlorophenol was reduced by three orders of magnitude at the third location tested.