



Scaling-up Transport of ZVI Particles in Aquifers

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Injecting micro and nano scaled zero-valent iron particles into the contaminated aquifers has distinct advantages as compared to the emplacement in reactive barriers: Particles may be injected underneath buildings, at any depths and into the source zone, thus potentially decreasing both remediation time and cost. To obtain an efficient and targeted injection the transport of the particles has to be optimized for given aquifer and particle properties. Most transport experiments to date were carried out in columns, in other words in a constant velocity field. In a field injection, however, the velocity decreases hyperbolically with distance from an injection point, thus transport properties obtained in column experiment are not sufficient to describe transport of ZVI particles in a radial flow field.

At VEGAS, 3D container experiments were carried out to determine the transferability of column experiments to field scale applications. The experiment consisted of a triangular container representing a 60 degrees portion of a full cylinder. Assuming radially symmetrical flow, this allowed for a detailed investigation of flow and transport without a loss of generalization at a field realistic scale.

Specially designed sensors were installed to measure the concentration of iron at different locations within the container during the injection. The sensors consisted of two coils. By measuring the magnetic susceptibility of the medium the concentration of iron within the medium could be determined.

Zero-valent iron nano particles were injected in a colloid suspension, and the influence of different injection rates and techniques as well as achievable transport distances was observed.

Based upon the result of these experiments a pilot scale application to remediate a PCE contamination was designed. After detailed site investigations nZVI particles were injected in different types of slurries and their transport in the subsurface was monitored.

The presentation will discuss the experimental set-up, the monitoring technology and the implementation of the pilot application.