


# Pilot Injection of Microscale Zerovalent Iron for Aquifer Remediation

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# Pilot Injection of Microscale Zerovalent Iron for Aquifer Remediation

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**Background/Objectives.** Concentrated suspensions of microscale and nanoscale zerovalent iron particles (MZVI and NZVI) have been studied in recent years for the remediation of contaminated aquifers. In the framework of the research project AQUAREHAB (FP7 - G. A. Nr. 226565), a pilot injection test of guar gum stabilized microsized zerovalent iron has been designed and performed under low pressure in a CAHs contaminated site in Belgium and the resulting radius of influence was determined.
**Approach/Activities.** A shear thinning guar gum solution (2 g/l) was selected as an environmentally friendly stabilizer of the iron particles. The relevant properties of the iron slurry (iron particles size and concentration, polymeric stabilizer type and concentration, slurry viscosity) were designed in the laboratory based on several tests (namely iron reactivity tests towards contaminants, sedimentation tests and rheological measurements). Since the injection regime of iron slurries depends on subsurface geotechnical parameters, aquifer hydraulic conductivity, and fluid properties, a specific injection well and monitoring strategy have been developed in order to achieve high discharge rates and radii of influence, and a more homogeneous distribution of the iron particles through low pressure injection. The injection well has been designed and sealed in order to sustain average to high discharge rates, preventing the daylighting of the product. Moreover the well has been hydraulically tested by means of innovative water and guar gum step rate tests in order to determine the most suitable injection rate for the iron slurry. The injection of 50 kg of microsized iron particles (BASF, Germany), dispersed in 5 m3 of a 2 g/l guar gum suspension, was performed at a discharge rate of 1.5 m3/h. The monitoring of the process has been conducted measuring injection rate and pressure as well as iron concentration by means of a magnetic susceptometer. After the injection, the iron distribution in the subsurface was determined through liners extraction and the iron concentration measured both via non-invasive magnetic susceptibility measurements and chemical analysis.
**Results/Lessons Learned.** Even if the field test was specifically designed to inject in a permeation regime, or on the threshold between permeation and fracturing, the results of monitoring injection pressure and iron distribution proved that particles migration in the porous medium occurred via preferential flow. Nevertheless significant radius of influence was achieved during the pilot test.