



Reestablishment of Proper Injectivity of the CO2-Injection Well Ketzin-201

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The onshore CO2 storage site Ketzin consists of one CO2 injection well Ktzi 201 and of two observation wells, Ktzi-200 and Ktzi-202. A production test at the Ktzi-201-injector in September 2007 revealed a productivity index of $0.06 \text{ m}^3/\text{d}*\text{kPa}$.

After installation of the CO2 injection string, an injection test with water in the beginning of October 2007 yielded a significantly lower injectivity of $0.002 \text{ m}^3/\text{d}*\text{kPa}$. Several possible reasons for the severe decline in injectivity were discussed, ranging from

- possible precipitation of iron oxide/hydroxide by contact of the formation brine with oxygen from air
- clay swelling by fresh water used to activate the packer
- gelling of remaining biopolymer from drilling mud with iron
- fines migration.

The industry partners in the consortium proposed several different measures to re-establish the required injectivity of injection well: acidizing the reservoir interval, injection at high wellhead pressure, controlled mini-fracs, backproduction of the well to remove plugging material. For reasons to be discussed in detail in the presentation, it was finally decided to carry out a nitrogen lift and to thoroughly analyse the back-produced fluids. The water produced by this procedure was dark-black in the beginning. Chemical and XRD-analysis proved the black solids to consist mainly of iron sulphide which had been formed as a metabolite of the activity of sulphate reducing bacteria (SRB). The lift of Ktzi-201 resulted in full restoration of the original productivity index of $0.06 \text{ m}^3/\text{d}*\text{kPa}$ and water could be injected at the same injectivity index.