



Gas monitoring during the CO₂ back production field test at the Ketzin pilot site

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The GFZ German Research Centre for Geosciences operates Europe's first on-shore CO₂ storage site in Ketzin, a small town near Berlin. From June 2008 until August 2013 about 67 kt of CO₂ were injected into Upper Triassic sandstones in 630 to 650 m depth.

The injection phase ended with an experiment to evaluate the influence of additives on CO₂ storage. During this experiment 32 t N₂ and 613 t CO₂ were co-injected into the borehole over a period of 25 days followed by the final injection of 66 t pure CO₂. At the beginning of the experiment 10,000 l (10 Nm³) Kr were pumped into the borehole, to separate the previous pure CO₂ and the CO₂-N₂ mixture. For the same reason, CO₂ with a different isotopic composition ($\delta^{13}\text{C} = -3.4 \pm 0.2\text{‰}$ instead of $\delta^{13}\text{C} = -30.6 \pm 0.4\text{‰}$) was used for the first 548 t of the total 613 t.

To demonstrate that the stored CO₂ is retrievable a field test was carried out in October 2014 during a period of two weeks. Of interest, in this context, is the composition of the back-produced gas which delivers key information on possible interactions between the CO₂, formation fluid and rocks.

In total 240 t of gas were produced via the former injection well. The flow rates ranged between 800 and 3,200 kg gas/h. The gas was sampled after the gas/water separator and continuously analysed using a mass spectrometer, a gas chromatograph and a photoacoustic sensor, thus covering all gas components and concentrations. In addition, gas samples were collected for stable carbon isotopes investigations in the laboratory.

Preliminary results show that the produced gas consists of > 97% CO₂ plus mainly N₂. The N₂ was detected from the beginning, although the injection in 2013 ended with pure CO₂. The N₂ concentration decreased from about 3% to 1% during the two weeks of the experiment. In addition to these major components CH₄, CO and H₂ (up to 0.01%) as well as Kr and SF₆ (up to 0.001%, both were used as tracers in 2013) were detected.

The gas composition of natural fluids before the injection of CO₂ showed that CH₄, CO₂, H₂ and N₂ are present in the original formation fluid (0.17 mg/l, 0.08 mg/l, 0.14 mg/l, 17.9 mg/l fluid; Morozova et al., 2010).

The observed N₂ concentrations in the back-produced gas may, therefore, result from the field tests and from injection management or from the original formation fluid.

Results of the isotopic measurements are in preparation.

Morozova, D., Wandrey, M., Alawi, M., Zimmer, M., Vieth, A., Zettlitzer, M., Wuerdemann, H. (2010): Monitoring of the microbial community composition in saline aquifers during CO₂ storage by fluorescence in situ hybridisation. *International Journal of Greenhouse Gas Control*, Volume 4, Pages 981-989. doi:10.1016/j.ijggc.2009.11.014.