



Field experiment on CO₂ back-production at the Ketzin pilot site

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The operational phase of the Ketzin pilot site for geological CO₂ storage in Germany started in June 2008 and ended in August 2013. Over the period of approximately five years, a total amount of 67 kt of CO₂ was successfully injected into a saline aquifer (Upper Triassic sandstone) at a depth of 630 m - 650 m. The CO₂ used was mainly of food grade quality. In addition, 1.5 kt of CO₂ from the pilot capture facility “Schwarze Pumpe” (lignite power plant CO₂) was used in 2011. At the end of the injection period, 32 t N₂ and 613 t CO₂ were co-injected during a four-week field test in July and August 2013.

In October 2014, a field experiment was carried out at Ketzin with the aim to back-produce parts of the injected CO₂ during a two-week period. This experiment addressed two main questions: (i) How do reservoir and wellbore behave during back-production of CO₂? and (ii) What is the composition of the CO₂ and the co-produced formation fluid?

The back-production was carried out through the former injection well. It was conducted continuously over the first week and with an alternating regime including production during day-time and shut-ins during night-time in the second week. During the test, a total amount of 240 t of CO₂ and 57 m³ of brine were safely back-produced from the reservoir. Production rates up to 3,200 kg/h - which corresponds to the former highest injection rate - could be tested. Vital monitoring parameters included production rates of CO₂ and brine, wellhead and bottomhole pressure and temperature at the production and observation wells and distributed temperature sensing (DTS) along the production well. A permanently installed geoelectrical array was used for crosshole electrical resistivity tomography (ERT) monitoring of the reservoir. Formation fluid and gas samples were collected and analysed. The measured compositions allow studying the geochemical interactions between CO₂, formation fluid and rocks under in-situ conditions

The field experiment indicates that a safe back-production of CO₂ is generally feasible and can be performed at both, stable reservoir and wellbore conditions. ERT monitoring shows that the geoelectrical array at the production well was capable of tracking the back-production process, e.g. the back-flow of brine into the parts formerly filled with CO₂. Preliminary results also show that the back-produced CO₂ at Ketzin has a purity > 97 per cent. Secondary component in the CO₂ stream is N₂ with < 3 per cent which probably results from former injection operation and field tests. The results will help to verify geochemical laboratory experiments which are typically performed in simplified synthetic systems. The results gained at the Ketzin site refer to the pilot scale. Upscaling of the results to industrial scale is possible but must first be tested and validated at demo projects.