

Geochemical monitoring of CO₂ and CH₄ injection in a carbonate shallow aquifer

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In order to ensure the safety of future CO₂ or natural gas geological storage sites, the implementation of monitoring system is essential. The aquifers located near the storage areas are key places of study as they represent locations where gas may accumulate before leaking into the atmosphere.

In this context, the Aquifer-CO₂Leak project is dedicated to the development of monitoring tools and methodologies for CO₂ and CH₄ detection within the saturated zone, as well as understanding the behaviour of these gases in a carbonate aquifer.

Based on numerical simulations results, an induced leakage experiment was designed and conducted on the experimental pilot site of Saint-Emilion in France. Water was saturated with a gas mixture of CO₂, CH₄, He and Kr in a specific designed tank, and was then injected in the aquifer through an injection well. Monitoring was conducted by collecting periodic samples through 3 observation wells located at a maximal distance of 10m. Analyses of concentration and δ¹³C of dissolved inorganic carbon (DIC) and methane (CH₄) were realized in laboratory.

The experiment shows that δ¹³C of DIC is a more sensitive tool than DIC concentrations to monitor CO₂ plume distribution. These two parameters allow the determination of the physicochemical processes taking place in the aquifer which involve CO₂. The CH₄ content and isotopic measurements were more difficult to realise. At such low contents (< 5 μmol.L⁻¹) several measurement methods have been tested and will be presented.