

Assessing the potential impacts of CO₂ leakage on fresh groundwater: from experiments to predictive models

Julie Lions, Nicolas Devau, Clement Jakymiw, Pauline Humez, Vanessa Barsotti

► **To cite this version:**

Julie Lions, Nicolas Devau, Clement Jakymiw, Pauline Humez, Vanessa Barsotti. Assessing the potential impacts of CO₂ leakage on fresh groundwater: from experiments to predictive models. 43rd IAH congress, Sep 2016, Montpellier, France. hal-01329921

HAL Id: hal-01329921

<https://hal-brgm.archives-ouvertes.fr/hal-01329921>

Submitted on 9 Jun 2016

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Assessing the potential impacts of CO₂ leakage on fresh groundwater: from experiments to predictive models

ABSTRACT n° 1598

Authors :

| Name | Email | Country |
|------------------|--------------------------------|---------|
| Lions Julie | j.lions@brgm.fr | France |
| Devau Nicolas | n.devau@brgm.fr | France |
| Jakymiw Clément | c.jakymiw@brgm.fr | France |
| Humez Pauline | p.humez@brgm.fr | Canada |
| Barsotti Vanessa | fabrice.muller@univ-orleans.fr | France |

Topic : Topic 5 - groundwater, and global & climate change

Sub Topic :

Keywords : CCS, groundwater quality

Comments : Lions J1 , Jakymiw C1, Devau N1, Humez P2, Barsotti V3

* Corresponding author : Julie Lions, j.lions@brgm.fr

1. BRGM, UMR 7327, Orléans, France.
2. Applied Geochemistry group, University of Calgary, Calgary, Canada
3. ISTO CNRS/Université d'Orléans, UMR 7327, Orléans, France

Conflict of Interest : 0

Date of submission : 2016-03-09

ABSTRACT [317 Words]

Geological storage of CO₂ in deep saline aquifers is one of the options considered for the mitigation of CO₂ emissions into the atmosphere. A deep geological CO₂ storage is not expected to leak, however, potential impacts of CO₂ leakage into aquifers overlying deep storage site have to be addressed. . A better understanding on how it could affect groundwater quality, aquifer minerals and trace elements mobilization is necessary to fully characterize a future storage site. Moreover, this characterization is required to evaluate monitoring and remediation plans. As part of the collaborative project CIPRES co-funded by the ANR, we present reactive transport works dedicated to the impact assessment of CCS on fresh groundwaters.

In a 3D model using ToughReact v.3, we perform different CO₂ leakage scenarios in a confined aquifer. This study focuses on the Albian aquifer that is a strategic water resource in the Paris Basin. The model is based on groundwater and rock chemistry of the Albian green sand layer (i.e. Quartz, Glauconite, Kaolinite) at 700 m deep. The geochemical model was elaborated from experimental data (Barsotti et al. 2016 and Humez et al. 2014) taking into account kinetics for mineral dissolution, ion exchange and surface complexation processes. The numerical mesh consists of 200 m × 500 m × 60 m. A grid refinement near the leakage point is considered to focus on local phenomena e.g. secondary precipitation, surface processes. The total mesh comprises 21600 cells. The results highlight the importance of sorption processes on trace element mobilization and transport (As, Zn and Ni) in fresh groundwater. Moreover, we distinguish different geochemical behavior (CO₂ plume shape, secondary precipitation, desorption...) occurring at different depth and length scale according to the horizontal flow rates and density effects that are influenced by hydrodynamic properties (regional gradient). Coupling geochemical processes and regional flows influence on water chemistry evolution allows to strengthen monitoring and verification plan as well remediation perspectives.