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Remediation of CO₂ Leakage from Deep Saline Aquifer Storage Based on Reservoir and Pollution Engineering Techniques

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European Directive 2009/31/EC on the geological storage of CO₂ states:
Article 16. Measures in case of leakages or significant irregularities
- Member States shall ensure that in the event of leakages or significant irregularities, the operator immediately notifies the competent authority, and takes the necessary corrective measures.
- Significant irregularity means any irregularity in the injection or storage operations or in the condition of the storage complex itself, which implies the risk of a leakage or risk to the environment or human health;
- Corrective measures means any measures taken to correct significant irregularities or to close leakages in order to prevent or stop the release of CO₂ from the storage complex.

Available remediation measures mainly stem from the field of reservoir and pollution engineering (e.g. IEA GHG, 2007);
> But due to the uniqueness of CO₂ geological storage activities (time and spatial scale), the extent to which such measures can be used, if not adapted, for CO₂ storage in deep saline aquifers should be investigated;
> We adopt the global approach of the “source – transfer – target” approach in case of the monitoring plan has detected an accidental CO₂ leakage from the reservoir (either through faults or through abandoned wells).

Objective, in case of abnormal behaviour, control the injection-induced overpressure within the reservoir:
- Remediation technique:
  1. Pressure natural recovery;
  2. Extract the injected CO₂;
  3. Extract brine;
  4. Multiphase flow transport simulation TOUGH2/ECO2n (Pruess et al., 2005);
- Application case: 2D model of the Dogger aquifer in the Paris basin (Le Guenan et al., 2009).

- Objective: mitigate the geotechnical impact of a CO₂ intrusion (release of Al, Ba, Cd, Cu, Pb, SO₂, F, P, Pt and Zn);
- Remediation technique: monitored natural attenuation MNA;
- 3D Reactive transport simulation: TOUGHREACT (Xu et al., 2004);
- Properties based on the glauconitic sandstone Albian aquifer (France) with mineral precipitation/dissolution reactions as being the main processes (Vong et al., 2009).

References

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