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► To cite this version:

André Burnol, Isabelle Thinon, Pascal Audigane, Aurélien Leynet. Storage of CO₂ at low temperature as liquid or solid gas hydrate - Application to the Biscay deep zone in the French EEZ. EGU General Assembly 2013, Apr 2013, Vienne, Austria. hal-00805377

HAL Id: hal-00805377

<https://brgm.hal.science/hal-00805377>

Submitted on 7 Aug 2015

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Storage of CO₂ at low temperature as liquid or solid gas hydrate - Application to the Biscay deep zone in the French EEZ

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Amongst the various CO₂ geological storage options currently under consideration, the deep saline aquifers (beyond 800-m depth) were considered to present the most interesting storage capacity due to the density of CO₂ in its supercritical state. However, at lower temperature, another form of storage is possible, either in the state of CO₂ hydrates or liquid CO₂ (1, 2). In Alaska, a first demonstrator showed recently the possibility of exchange of CO₂ and CH₄ in natural gas hydrates. At higher pressures common in deep-sea sediments, liquid CO₂ can be denser than the overlying seawater and therefore be trapped in the marine sediments (2).

We explored in this work the storage capacity at the Biscay deep zone in the French Exclusive Economic Zone (EEZ). A local bathymetry of the zone (abyssal plain and continental margin) was used to define a potential interesting zone for the CO₂ storage, considering different safety criteria. A sensitivity analysis on the geothermal gradient was carried out using two extreme scenarios (Low and High gradient) based on the available Ocean Drilling Program's data. In both cases, the Negative Buoyancy Zone (NBZ) and the CO₂ Hydrate Formation Zone (HFZ) were calculated using the GERG-2008 Equation of State for liquid CO₂ and the CSMGem code for CO₂ hydrate, respectively. Following this sensitivity analysis, a CO₂ injection depth is proposed and the French "deep offshore" storage capacity is quantitatively evaluated and compared to the "onshore" storage capacity in deep saline aquifers.

References

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