Geophysical Research Abstracts
Vol. 14, EGU2012-4716, 2012
EGU General Assembly 2012

Dynamics of dissolved CO_2 injection systems: Optimal design.

M. Pool (1,2), V. Vilarrasa (1,2), and J. Carrera (2)

(1) GHS, Dept Geotechnical Engineering and Geosciences, Universitat Politecnica de Catalunya, UPC - BarcelonaTech, Spain, (2) Institute of Environmental Assessment and Water Research, IDAEA-CSIC, Barcelona, Spain

Carbon dioxide (CO_2) storage in deep saline aquifers represents a promising strategy for mitigating greenhouse gas emissions to the atmosphere. The standard approach to geologic storage is based on supercritical CO_2 injection. The main risks associated with the standard approach of CO_2 sequestration are that (i) injected CO_2 may flow upward and leak to the ground because of gravity-driven flow; (ii) pressure build-up in the aquifer as a response to CO_2 injection may promote reactivation of sealed fractures or the creation of new ones in the caprock, and (iii) injected CO_2 may displace resident brine, causing it to contaminate freshwater bodies. An alternative storage approach that alleviates these concerns is to extract brine from the storage formation and then re-inject it together with the CO_2 so that they mix in the well and this CO_2-saturated brine flows into the storage formation. This strategy allows us to reduce the risk of buoyant escape of stored CO_2 and to ensure the geomechanical stability and caprock integrity because pressure build-up is reduced due to pumping. In fact, CO_2-saturated brine will sink to the aquifer bottom because it is denser than resident brine. The method is particularly favourable when the aquifer dips, because locating the extraction well upslope can ensure a very long operation without CO_2 ever breaking through into the extraction well. The maximum efficiency of this alternative storage technique is achieved through proper design and optimization of CO_2 injection rates, and the well locations. In order to define the proper design we perform numerical three-dimensional variable density flow simulations. Several sets of simulations were carried out to evaluate the parameters which play a major role in the degree of success and efficiency of this storage strategy.

Keywords: CO_2 sequestration, CO_2-saturated brine, proper design, variable density flow simulations.