CO2 Storage Capacity Estimation and Storage Site Selection

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The determination of carbon dioxide storage capacity and the selection and characterisation of potential sites for CO2 storage are key issues in taking commercial-scale carbon capture and storage (CCS) projects forward. There is a need for better understanding of the issues surrounding capacity estimation as well as for a general agreement on assessment methodologies for the selection of appropriate sites to store carbon dioxide safely and securely. There are various scales of site selection and different levels of storage capacity estimation; of concern is which of these can be utilised for bankable projects. Most current storage capacity estimates are imperfect and there is a need for more understanding of the parameters that govern the efficiency factor (E) in our capacity estimates. Various rock and fluid properties affect storage capacity estimation (in particular "E"), and how these can be evaluated is a key challenge. Properties affecting "E" in saline formations include formation properties such as depth / temp / pressure, as well as brine and CO2 properties such as salinity / composition (density and purity). In addition, rock properties such as pore geometry (pore/throat size ratios; pore shape) in conjunction with relative permeability controls potential irreducible water saturations (Swirr) and residual CO2 trapping (SrCO2). Dissolution trapping is a function of CO2 residence time, which is in turn controlled by formation dip, CO2 sweep (migration path / rate), hydrodynamics and aquifer properties. Rock/CO2/fluid interactions are the principle controls on mineral trapping. These factors, plus the potential pore space reduction caused by residual oil or gas saturations affect capacity estimates in depleted fields. The natural variability and geological, engineering and economic complexity of any potential CO2 storage site means that these properties need to be assessed individually for each potential storage site. However, a similar workflow can be applied to most capacity estimations, Such consistent and systematic methodologies can be used in assessing and classifying CO2 storage volumes of potential storage sites and provide a uniform language that is understandable to (and usable by) the scientific community but can also be accepted by industry and the financial community.