

Non Mechanically Mediated Formation Damage During CCUS

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Abstract

The potential for formation damage, mediated by the interactions of injected CO₂ with in-situ fluids and the mineralogy of the formations and the formations which provide a sealing capability must be considered as part of the process to guarantee injectivity maintenance and reservoir integrity. Within this paper we discuss the key mineralogical and fluid interactions with the injected CO₂ stream, the effects of injection stream phases, and how this changes over time, with pressure and temperature increasing as the storage reservoir is filled. Another consideration of this is the injected plume migration within the injected formation, and the effects of water evaporation and condensation upon both storage reservoirs and cap-rock lithologies; considering interactions with both clastic and carbonate materials, and comparing these. We discuss the workflows and considerations for modelling chemical interactions and assessing their potential impacts, leading ultimately to defining potential laboratory test considerations and conditions, inclusive of the water saturation state for the CO₂ to be applied, which is a key consideration for driving fluid:rock interactions. Examples of where this approach has been applied; what the initial study and laboratory data demonstrated and what this suggests the outcome of CCUS will be for reservoir and cap-rock behaviours will also be provided. Finally we will discuss the monitoring options, the key components for monitoring geochemical interactions and resulting risks to formation integrity and the considerations for implementation of monitoring strategies in the field.