

Metal and metalloid mobilisation and sequestration during CO₂-SO₂ and CO₂-SO₂-O₂ reaction of reservoir and cap-rock cores

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Many metal and metalloid concentrations in groundwater are regulated by drinking water maximum contaminant levels (MCL). CO₂-brine-rock reactions have been shown to release As, Pb, Fe, Mn, Cr etc. from CO₂ storage site cores and wellbore cement, in some cases above MCL's. This is of concern if CO₂ or gas-charged brine migrates through formations, faults or wellbores to access fresh water aquifers [1]. However, during CO₂ injection field trials initially elevated dissolved metals often subsequently decrease [2]. Understanding the behaviour of potential contaminants in storage site systems is important for evaluating risk.

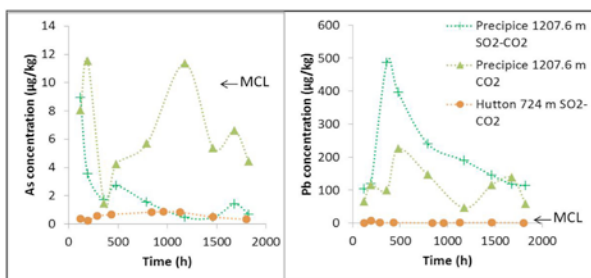


Fig. 1: As and Pb ($\mu\text{g}/\text{kg}$) with 100 ppm SO₂-CO₂ or CO₂-brine reaction of Precipice shale baffle and Hutton Sandstone.

CO₂ storage in the low salinity Precipice Sandstone, Surat Basin, Australia, is in a feasibility study. Industrial CO₂ streams may contain impurities such as SO_x, NO_x and O₂. In CO₂-brine or CO₂-SO₂±O₂-brine reactions with reservoir and cap-rock cores, dissolved Fe, Mn, had a partly mineralogical control. However the controls on Pb, As, Ni, Cr, U, Mo etc. were less clear. With co-injected SO₂±O₂, several metal concentrations subsequently decreased (Fig. 1) by co-sequestration or adsorption on precipitated minerals. In some cases Fe, Pb, Mn, and As exceeded MCL's remaining elevated. Sources, mobilisation, and fate will be evaluated with core analyses, experiments and geochemical modelling.

[1] Karamalidis et al., (2013) EST, 47, 322-329.

[2] Kharaka et al., (2010) EES 60, 273-284.