Model-based analysis of injection trials in deep aquifers to predict large-scale impacts of CSG product water reinjection

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Over the next two decades coal seam gas (CSG) production in Australia will require the management of large quantities of production water. For some sites the most viable option is to treat the water to a high standard via reverse osmosis (RO) and to inject it into deep aquifers. In this study we use reactive transport modeling to integrate the results from a multi-scale hydrogeological and geochemical characterization, and to analyze a series of short-term push-pull experiments with the aim to better understand and predict long-term water quality evolution and the risks for mobilizing geogenic arsenic.

Three sequential push-pull tests with varying injectant compositions were undertaken in the Precipice aquifer near Condabri (Queensland) over a period of 250 days. A maximum arsenite concentration of 180 ppb was reached during one of the recovery phases. The highest concentration was observed in the test that used aerobic water, while de-oxygenation of the injectant lowered As concentrations significantly. The lowest As concentrations were observed when the injectant was de-oxygenated and acid-amended. The study provides evidence that pyrite oxidation and associated co-release of arsenic and desorption are the main mechanisms to potentially cause elevated dissolved As concentrations, depending on the implemented injectant pre-treatment. Predictive modeling was used to study and minimise arsenic mobilisation during large-scale injection of CSG product water.