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Numerical-analytical studies of CO2 leakage through fault with retardation due to matrix diffusion

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One of the concerns related to CO2 underground storage is the possibility of CO2 leakage from the injection formation. Leakage results due to CO2 being mobile, positively buoyant with respect to resident brine and large-scale groundwater motion. This study presents results of numerical-analytical simulations of CO2 leakage through fault(s) with retardation due to matrix diffusion as well as permanent removal caused by mineralization. Buoyancy drives the mobility of CO2 and causes it to migrate to the top of the injection zone and subsequent upwards leakage after encountering the weaker zones. Rock matrix diffusion significantly slows down the mobility of CO2 and implies that significantly larger mineral surfaces are available for mineralization of CO2.