

The Jizan (Southwest Saudi Arabia) subsurface CO₂ mineral storage pilot project: Update and outlook

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The Jizan CO₂ mineralization demonstration project was designed to develop the technology for carbon disposal by subsurface mineralization in regions of our planet where access to water resources may be limited. To this end, we adopted a new CO₂ injection approach based on the recirculation of subsurface fluids, consisting of one injection well and one production well as a doublet system. This system effectively eliminates the need for external water and avoids potential pressure buildup in the subsurface. During May and June 2023, 131 tons of CO₂ dissolved into recirculating water as it flowed down the injection well, entering 21- to 30-million-year-old basalts at a depth of 350 mbsl. A suite of three independent tracers each confirm that 70% of the injected CO₂ mineralized as carbonate minerals within ten months. Water chemistries and solids collected from the production well indicate that CO₂ was mineralized as a combination of calcite, ankerite and siderite. Although some heavy and potentially toxic metals were released when the acidic CO₂-charged waters first entered the subsurface, evidence shows that these are rapidly reincorporated into precipitated secondary phases, as the dissolution of the host basalts neutralizes these waters.

Critical to attenuating the rate of increasing atmospheric CO₂ concentrations and its detrimental effects is upscaling pilot projects. An economic and process engineering analysis of the major cost components of the Jizan pilot has been undertaken to define the favorable conditions for successful *in-situ* mineralization projects. The findings reveal that *in-situ* mineralization can be equally cost effective over a wide range of gas volumes, making it a viable CCS option for both small to large scale CO₂ emitting facilities.