PREDICTIVE MODELING OF CO_2 – BRINE CO-INJECTION CONDITIONS IN RE-INJECTION WELLS

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Emissions of greenhouse gases such as CO_2 emitted at Turkish geothermal power plants are an obstacle to call geothermal energy as green power. However, recent advances in carbon capture and storage technologies have enabled low emissions by re-injecting produced CO_2. The phase of injected CO_2 is crucial for the success and safety of the operation. Injecting CO_2 directly into a reservoir as pure gas or at supercritical state may cause the leakage of CO_2 via fractures, or abandoned wells. This problem can be prevented by the dissolution of CO_2 into brine prior to, or during its injection into the reservoir. Various projects have been being conducted around the world to reduce geothermal emissions. Among these projects, GECO (Geothermal Emission Control) is an EU funded project through the Horizon 2020 and aims to develop near-zero emission geothermal power plants. Through the GECO project, Zorlu Energy and METU (Turkey) aim to reduce the CO_2 emissions for more green geothermal power production while maintaining the sustainability of Kızıldere (Turkey) geothermal field (KGF).

The objective of this study is to calculate possible ranges of CO_2 molar ratios to ensure all injected CO_2 will dissolve in brine and preclude the gas formation in re-injection wells at KGF. In order to compute partial pressures of dissolved CO_2 at elevated temperatures for a given CO_2 molar ratio, chemical analysis of injection water was defined as a solution in PHREEQC and various amounts of CO_2 were irreversibly added into the solution. Temperature range in geochemical modeling was selected from injection temperature at the well head and static temperature at reservoir level of the boreholes. Pressure profiles of the wells were calculated by assuming hydrostatic condition. The model results showed that the dissolved CO_2 in the wellbore should not exceed 0.75 mole per kg water during injection. It was concluded that injection flow rates of both water and gas phases should be arranged with this constraint.