Geophysical Research Abstracts
Vol. 13, EGU2011-3832, 2011
EGU General Assembly 2011

Accounting for Injected CO2 at the Pembina Cardium CO2 Monitoring Project, Alberta, Canada

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Carbon capture and geological storage is a potential technology to reduce CO2 emissions into the atmosphere from fossil fuel intensive industries. Monitoring of CO2 storage sites is required by many of the emerging regulations with specific interest in accounting of injected CO2 in various target reservoirs including saline aquifers. We have used chemical data and carbon and oxygen isotope ratios of produced water and gases sampled repeatedly from various observation wells to: a) trace the movement of injected CO2, b) assess pore space saturation with CO2 and c) develop an approximate carbon budget for the Pembina Cardium CO2 Monitoring Project in central Alberta, Canada. The distinct carbon isotope ratios of injected CO2 in association with gas compositional and flux data were used to determine the percentage of injected CO2 produced at several observation wells using two end-member mixing calculations. Changes of δ18O values of produced water by up to 4 ‰ were caused by oxygen isotope exchange between CO2 and H2O following CO2 injection. The changes in the δ18O values of water were used for a quantitative assessment of CO2 dissolved in the fluids and of free phase CO2 in the pore space of the reservoir. Results of partitioning calculations indicate that the majority of the CO2 remained in a free phase within the reservoir. Smaller amounts of injected CO2 were dissolved in water and oil two years after commencement of CO2 injection. This study revealed that isotopic techniques can play a crucial role in monitoring the movement and the fate of CO2 injected into geological reservoirs.