Predicting Performance of CO2 Leak Detection at Sequestration Sites

Abstract

As a near-term approach to reduce GHG emissions a number of nations are pursuing the implementation of carbon capture and sequestration (CCS). CCS involves the capture of CO2 and its subsequent injection into geologic formations. However, leakage of the injected CO2 is possible. High leakage rates could pose a threat to health, safety, or environmental quality at a site, while undetected chronic leakage back to the atmosphere could nullify the greenhouse gas mitigation benefits of the project. To detect and respond to CO2 leakage, effective monitoring technologies and networks are required. A methodology is developed to predict the probability of detecting a leak of a given size based on modeled signals from possible leakage events and statistical tests intended to distinguish these signals from natural variations in monitored concentrations and fluxes. The methodology is demonstrated for an idealized site with leak detection implemented using CO2 surface flux and injected tracer measurements. Further applications are planned using additional methods, including measurements of groundwater chemistry, isotopic ratios, and formation pressure profiles.