“Risk Assessment of Carbon Sequestration into a Naturally Fractured Aquifer at Kevin Dome, Montana”

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As actual CO2 injection is unlikely to take place at Kevin Dome, Montana, the Big Sky Carbon Sequestration Partnership has turned to maximizing the value of existing data acquired at the site. We present the risk assessment work done using the National Risk Assessment Partnership (NRAP) to Kevin Dome, Montana. Geologic CO2 sequestration in saline aquifers poses certain risks including CO2/brine leakage through wells or non-sealing faults into ground water or land surface. These risks are difficult to quantify due to data availability and uncertainty. One solution is running large numbers of numerical simulations on the primary CO2 injection reservoir, shallow reservoirs/aquifers, faults, and wells to assess leakage risks and uncertainties. However, a full-physics simulation is usually too computationally expensive. NRAP integrated assessment model (NRAP-IAM) uses reduced order models (ROMs) developed from numerical reservoir simulations of a primary CO2 injection reservoir to address this issue. A powerful stochastic framework allows NRAP-IAM to explore complex interactions among many uncertain variables and evaluate the likely performance of potential sequestration sites. In this study, we investigate the sensitivity of a variety of uncertain parameters to CO2/brine leakage through (1) legacy wellbore and (2) fault pathways. We found major uncertain parameters to which the potential CO2 leakage through legacy wellbore is sensitive including values of fracture permeability, end-point CO2 relative permeability, capillary pressure, and permeability of confining rocks. CO2 and brine leakage through fault pathways is sensitive to fracture permeability, length of the faults, and fault displacement.