5.3 **An analysis of basin-scale CO_2 emissions management for oil shale development**

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In this study, we have analyzed the feasibility of carbon capture and storage (CCS) to manage emissions associated with oil shale development in the Uinta-Piceance Basins of Utah and Colorado. CO_2 sources include coal-fired and natural gas electricity generation and the oil shale retort process. We integrate a model of geologic CO_2 sequestration (*CO_2-PENS*), a model of infrastructure optimization (*SimCCS*), and an integrated assessment model of oil production and CO_2 emissions (*$CLEAR_{uff}$*) to evaluate the nature and feasibility of CCS infrastructure in the region. *CO_2-PENS*, an injectivity/capacity and risk assessment simulator package for geologic sequestration, uses stochastic input values to characterize CO_2 migration through the reservoir, cap rock, and overlying freshwater aquifers via potential leakage pathways. Several proof-of-concept sequestration sites of varying area and depth were defined in the Castlegate and Entrada sandstones in the Uinta Basin. The CO_2 source was defined for various levels of oil production in the Piceance Basin by *$CLEAR_{uff}$*, a model that integrates various aspects of the oil shale production process, including demands for electricity, water, labor, greenhouse gas emissions and economics. Multiple *CO_2-PENS* realizations for each site provided distributions of reservoir capacity and on-site cost for various rates of CO_2 delivery. *SimCCS*, a geospatial decision optimization model for comprehensively designing CCS infrastructure, used these capacity distributions to calculate optimal pipeline networks among CO_2 sources and sinks, minimizing cost. Nine sequestration sites in a 13,300 km^2 area of the Uinta Basin have the capacity to store 6.5 Gt-CO_2, corresponding to shale-oil production of 1.3 Mbbl/day for 50 years (about 1/4 of U.S. crude oil production). Our results highlight the complex, nonlinear relationship between the spatial deployment of CCS infrastructure and the oil-shale production rate.