Characterizing Soil Gas Chemistry in Advance of Carbon Sequestration and Enhanced Oil Recovery in Eastern Kentucky, T.M. (Marty) Parris, Michael P. Solis, Kathryn G. Takacs, Brandon C. Nuttall, and James A. Drahovzal, Kentucky Geological Survey, University of Kentucky, Lexington, KY 40506-0107, mparris@uky.edu, msolis@uky.edu, ktakacs@uky.edu, bnuttall@uky.edu, drahovzal@uky.edu

Soil gas flux and shallow soil gas chemistry (< 1 m) was measured under winter and summer conditions at two active oil and gas fields and relatively undisturbed forests in eastern Kentucky. The measurements apportion the biologic, atmospheric, and geologic influences on soil gas composition under varying degrees of human surface disturbance. They also constitute a heretofore absent geochemical baseline critical for recognizing reservoir leakage (i.e., microseepage) that might result from CO_2 injection in carbon sequestration and enhanced oil recovery projects in and near the study sites.

Soil gas fluxes were measured using closed-chamber methods. Positive fluxes of CO_2 were measured at all locations, and summer flux magnitudes were three to four times greater than winter fluxes. Soil gas CO_2 concentrations one to two orders of magnitude greater than atmospheric CO_2 provided the driving force for positive flux. Summer and winter $\delta 13C$ composition of soil gas CO_2 was depleted in 13C, which suggests a dominant biologic influence on soil gas CO_2 relative to atmospheric and geologic sources. Soil gas CH_4 concentrations, in contrast, were slightly less than atmospheric CH_4, and the difference suggests a low magnitude negative flux for CH_4.

Microseepage anomalies were defined by positive CH_4 fluxes, soil gas CH_4 concentrations exceeding atmospheric CH_4, or positive shifts in the $\delta 13C$ CO_2 values. Microseepage was detected along two normal faults that are part of the Rome Trough fault system. A notable false microseepage anomaly was detected at a location where the surface cover consisted of reclaimed coal mine material.