Noble gas isotopes in injected CO_2 as a tracer in the Cranfield enhanced oil recovery field (MS, USA)

DOMOKOS GYÖRE[1*], FINLAY STUART[1], STUART GILFILLAN[2] AND SUSAN WALDRON[3]

[1]Isotope Geoscience Unit, Scottish Universities Environmental Research Centre, East Kilbride, G75 0QF, UK; (* correspondence: d.gyore.1@research.gla.ac.uk)

[2]School of GeoScience, University of Edinburgh, EH9 3JW, UK

[3]School of Geographical and Earth Sciences, University of Glasgow, Glasgow, G12 8QQ, UK

Identifying how injected CO_2 is stored in the subsurface is a fundamental challenge for carbon capture and storage. Developing universally deployable tracing tools will increase confidence that stored CO_2 remains intact. We will present work, which examines the applicability of the isotopic composition of noble gases (He, Ne, Ar) present as minor natural components in CO_2 injected into the Cranfield oil field (MS, USA). Samples of gas from injection and production wells were taken one and three years after the start of injection in mid 2008.

Neon isotope data are consistent with simple binary mixing between the injected and in-place natural gas. Coherent correlations with He and Ar isotopes allow the natural gas end-member composition to be determined. He, Ne and Ar isotope ratios correlate with CO_2 concentration illustrating that the noble gas fingerprints of the injected gas are preserved and are effective tracers of the sequestration process. Furthermore, the noble gases identify the loss of a significant amount of CO_2 from the free gas phase in several 2009 samples. We will show that the noble gases have potential for quantifying CO_2 storage and identifying the mechanism of storage in carbon sequestration sites.