Geophysical Research Abstracts
Vol. 18, EGU2016-8932, 2016
EGU General Assembly 2016

Optimising geological storage of CO_2 by development of multiple injection sites in regionally extensive storage sandstones

Maxine Akhurst (1), Christopher McDermott (2), John Williams (3), Eric Mackay (4), Min Jin (4), Owain Tucker (5), Tom Mallows (6), Sarah Hannis (1), and Jonathan Pearce (3)

(1) British Geological Survey, Edinburgh, United Kingdom (mcak@bgs.ac.uk), (2) School of Geosciences, University of Edinburgh, Edinburgh, United Kingdom, (3) British Geological Survey, Keyworth, Nottingham, United Kingdom, (4) Institute of Petroleum Engineering, Heriot-Watt University, Edinburgh, United Kingdom, (5) Shell Projects & Technology, Aberdeen, United Kingdom, (6) The Crown Estate, Edinburgh, United Kingdom

Carbon capture, transport and storage (CCS) is considered a key technology to provide secure, low-carbon energy supply and industrial processes to reduce the greenhouse gas emissions that contribute to the adverse effects of climatic change. Geological storage of carbon dioxide (CO_2), captured during hydrocarbon production at the Sleipner Field, in strata beneath the Norwegian sector of the North Sea has been in operation since 1996. Projects to store CO_2 captured at power plants in strata underlying the North Sea are currently in design. Storage of the CO_2 is planned in depleted hydrocarbon fields or regionally extensive sandstones containing brine (saline aquifer sandstones).

The vast majority of the UK potential storage resource is within brine-saturated sandstone formations. The sandstone formations are each hundreds to thousands of square kilometres in extent and underlie all sectors of the North Sea. The immense potential to store CO_2 in these rocks can only be fully achieved by the operation of more than one injection site within each formation. Here we report an investigation into the operation of more than one injection site within a storage formation using a UK North Sea case study of the Captain Sandstone and the included Goldeneye Field, which is part of the mature hydrocarbon province offshore Scotland.

Research by the CO_2MultiStore project was targeted to increase understanding and confidence in the operation of two sites within the Captain Sandstone. Methods were implemented to reduce the effort and resources needed to characterise the sandstone, and increase understanding of its stability and performance during operation of more than one injection site. Generic learning was captured throughout the research relevant to the characterisation of extensive storage sandstones, management of the planned injection operations and monitoring of CO_2 injection at two (or more) sites within any connected sandstone formation.

The storage of CO_2 can be optimised by the operation of more than one injection site in a geological formation by taking a regional-scale approach to site assessment. The study concludes that at least 360 million tonnes of CO_2 captured over the coming 35 years could be permanently stored using two injection sites in the Captain Sandstone. Confidence in the planned operation of two or more injection sites in a storage formation is greatly increased by the use of existing information, knowledge and data acquired during hydrocarbon exploitation. Widespread pressure changes should be expected by the injection of CO_2 at more than one site. Assessment, management and monitoring of pressure changes on a regional scale will optimise the storage capacity, ensure security of storage and prevent adverse effects to existing storage and hydrocarbon operations.

The vast offshore potential across all sectors of the North Sea could be made accessible and practical for storage of CO_2 captured at European sources by the operation of two or more sites in a storage formation by following the approach taken in CO_2MultiStore.