

eReport

Issue 16, April 2016

ANLEC R&D Report Summaries (December 2015 – April 2016)

The following reports are available from the ANLEC R&D website:

The Boxvale Sandstone Member, Surat Basin QLD, may be suitable for secondary containment and above-reservoir monitoring.

This project undertook detailed characterisation of the lithology and lithostratigraphy of the lower Jurassic section, with emphasis on the Precipice sandstones and the overlying Evergreen regional seal in the Surat Basin. Detailed mineral analysis of units above the Precipice Sandstone revealed the Boxvale Sandstone Member may be suitable for above-reservoir monitoring purposes. Relatively high porosity and permeability, and a thickness of several meters, are characteristic for the Boxvale Sandstone Member; making it a good secondary containment with the Evergreen Formation sealing strata above. This rock unit is also distinct in its mineral composition as it contains a large proportion of feldspar, a mineral known to dissolve relatively quickly in CO₂-enriched water. This would lead to rapid changes in the water composition and could serve as an indication of migration from the primary storage reservoir (Precipice Sandstone). The compilation of stress field data led to a much higher data density in the Surat Basin than anything previously published and thereby reduced the uncertainty in predicting the geomechanical response to CO₂ injection and storage. Preliminary rock mechanical considerations suggest faults with strikes that are approximately at 30 degrees to the maximum horizontal stress direction will be at greatest risk of reactivation due to having the highest shear to normal stress on the fault plane.

Full report: [Geochemical impacts and monitoring of CO₂ storage in low salinity aquifers](#)

Earth tides and atmospheric pressure fluctuation data ineffective to resolve reservoir continuity in the Lesueur storage complex

The research project has examined the potential for using passive forcing (earth tides and atmospheric pressure fluctuation) to assess vertical permeability using forward modelling, sensitivity analyses, and notional inversions. The analyses were performed for conditions representative of those expected at the South West Hub.

The study showed it was unlikely that reliable estimates of vertical permeability and/or continuity of the confining layer can be obtained by analysing pressure fluctuation data, because pore pressures induced by barometric and Earth-tide loading and the dissipation of these pressure perturbations are controlled by the local hydrogeomechanical properties rather than the large-scale hydrostratigraphic features of the CO₂ storage system. Accurate pressure data may be useful, however, to detect the presence and track the migration of a CO₂ plume during the operational and monitoring phase of a carbon storage project.

Full report: [Estimating Vertical Permeability Based on Responses to Barometric Pressure Fluctuations in the Lesueur Formation](#)

Are there benefits in simultaneous water alternating gas (SWAG) injection strategies?

This study aimed to demonstrate a methodology for optimising the residual and dissolution trapping in the storage formation (Lesueur formation Western Australia) by determining the most feasible injection schemes.

Most of the injection designs tested in this study show that injecting through perforations, starting at the upper-middle of the Wonnerup Member, provides the greatest potential for residual trapping, dissolution trapping and injectivity. However, to minimise CO₂ injection for the vertical well injection, it is

advantageous to locate the perforations in the middle of the formation. In addition, it appears to be more favourable to choose the longest perforation as economically possible to inject more CO₂. Horizontal wells and SWAG (simultaneous water alternating gas) scenarios show the least injectivity because layers in the formation have lower permeability. As a general conclusion, vertical wells are the most economically attractive, and show intermediate overall trapping benefit; while WAG (water alternating gas) wells are the least attractive, showing the highest overall trapping benefit, especially in the early injection period.

Full report: [Desktop design study on enhancing residual and dissolution trapping](#)

Coal-fired power plants can operate sustainably in the future using carbon management systems built on model-based optimisation frameworks.

This project investigated process integration and operation of power plants retrofitted with PCC and solar-thermal plants. Through a systematic approach involving modelling, design and optimisation, the project has identified optimal process conditions that lead to significant reductions in the capture energy penalty. The project has developed a significant body of knowledge in flexible operation of PCC plants. A key outcome has been the development of real-time routines to inform the techno-economic performance of PCC integrated with solar-thermal systems.

Full report: [Model-based optimisation of highly-integrated renewables with post-combustion carbon capture processes](#)

ANLEC R&D Technical Presentations

Botha, P. & Sheppard, A. *Mapping Permeability in Low-resolution Micro-CT Images: A Multi-scale Statistical Approach*, manuscript submitted to Water Resources Research

Michael, K. et al. 2015, *Framework for the Assessment of Interaction between CO₂ Geological Storage and other Sedimentary Basin Resources*, manuscript submitted to Environmental Sciences: Processes and Impacts (Royal Society of Chemistry)

Delle Piane, C. & Sarout, J. 2015, *Effects of water and supercritical CO₂ on the mechanical and elastic properties of Berea sandstone*, manuscript submitted to International Journal of Greenhouse Gas Control

Gao, J. et al. 2015, *Reactive Transport in Porous Media for CO₂ Sequestration - Pore Scale Modelling Using the Lattice Boltzmann Method*, manuscript submitted to International Journal of Greenhouse Gas Control

Baz, H. et al. 2016, *A field-scale investigation of residual and dissolution trapping of CO₂ in a saline formation in Western Australia*, manuscript submitted to International Journal of Greenhouse Gas Control

Saeedi, A. 2016, *Fluid rock interactions and their impact- SW Hub*, proceedings presented at 3rd International CCUS Forum, 30th March 2016, Beijing China

IEACCC Reports

Nalbandian-Sugden, H. 2015, *New regulatory trends: effects on coal fired power plants and coal demand*, Ref: CCC/262

Wiatros-Motyka, M. 2015, *Optimising fuel flow in pulverised coal and biomass-fired boilers*, Ref: CCC/263

Mills, S. 2015, *Prospects for coal and clean coal technologies in Greece*, Ref: CCC/261

Henderson, C. 2015, *Power plant CO₂ capture heat integration*, Ref: CCC/260

IEAGHG Reports

Workshop on LCA in CCUS, Mar 2016

Evaluation of Barriers to National CO₂ Geological Storage Assessments, TR2 2016

5th Social Research Network Meeting Report, Feb 2016

Impact of CO₂ Impurity on CO₂ Compression, Liquefaction and transportation, Jan 2016

Please email Becky Kemp at becky.kemp@ieaghg.org to download a copy of any of these IEAGHG reports.