

eReport

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ANLEC R&D Report Summaries (December 2014 – February 2015)

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

[Predicting CO₂ injectivity properties for application at CCS sites](#)

Reservoir characterisation workflow developed for geological storage projects

In any geological storage project it will be necessary to characterise the reservoir from core samples taken during exploratory drilling. This project, using four co-located specialist laboratories at the Australian Resources Research Centre (ARRC) Perth, was able to demonstrate the development of a work-flow for the detailed analysis of the reservoir characteristics that will be required in the initiation of a carbon dioxide storage project.

[Chemical tracer partition coefficients for CCS](#)

Chemical tracers enable increased accuracy in CO₂ tracking

This project studies the use of chemical tracers to track the migration of CO₂ once it's injected underground and to monitor the containment security. Once injected, tracers partition between the CO₂ and the other fluids present in the system. General methodologies are established for determining supercritical CO₂/water partition coefficients for a number of chemical tracers relevant to CCS. This study improves estimates and correlations for characterising reservoir capacity.

[Mercury and SO₃ capture by the fabric filter in oxy-fuel technology](#)

Mercury removal in the presence of SO₃ from oxy-fuel flue gas

This project continues to study mercury removal from Oxy-fuel flue gas to reduce the associated costs and risks. It aims to quantify the extent of removal and the impact of impurities (SO₃ and NO_x) in the CO₂. This report focuses on removing mercury with the presence of SO₃ in the fabric filter. It concludes that, for practical carbon-in-ash levels, the competition between mercury and SO₃ by ash can be neglected. Process units which operate at temperatures below the acid dew point may be prone to acid attack.

[Membrane reactor for hydrogen production](#)

Development of membrane reactor enables intensified hydrogen production

This project aims to develop a catalytic membrane reactor (CMR), which intensifies hydrogen production processes and could lead to near-complete hydrogen conversion, purification and pre-combustion CO₂ capture in a single device. During this reporting period, a membrane module with a surface area of 500 cm² was designed, constructed and tested. This represents a 250 fold increase in membrane surface area since the beginning of the project. Hydrogen flux has been consistently achieved at 40% of the US DOE flux target. With a minimal Pd consumption, this represents a competitive flux per capital cost ratio. Ongoing developments are also reported in the embrittlement-resistant vanadium alloy and the surface preparation procedure.

[Process modelling of combined SO₂ and CO₂ capture using aqueous ammonia](#)

Novel integration process proposed for aqueous ammonia based solvent

This research project focuses on the development of the advanced aqueous ammonia based post combustion capture (PCC) technology in order to reduce CO₂ emissions from coal fired power stations in Australia. Two years into the project, a novel aqueous ammonia based solvent was developed with CO₂ absorption capacity comparable to that of current benchmark MEA based solvent. A novel process was proposed integrating CO₂ and SO₂ removal, flue gas cooling and ammonia recycle. Under the typical flue gas conditions, the proposed process has a SO₂ removal efficiency of over 99.9% and

ammonia reuse efficiency of 99.9%, which was confirmed by the experimental results. A rate based model was also developed for the aqueous ammonia based CO₂ capture process and validated using the results from Munmorah Power Station pilot plant trials.

ANLEC R&D Technical Presentations

- Abbas, A 2014, *Hybrid fossil-solar power generation with carbon capture*, proceedings presented at Chemeca 2014
- Botha, P et al 2014, *Multi-scale Imaging and Cross-Property Correlations in Heterogenous Sandstone*, proceedings presented at Society of Core Analysts, 2014, Avignon, France, 8th-11th September 2014
- Chen, G et al. 2014, *Electrodialysis for Amine Contaminant Removal and Demineralisation of Dairy Effluents*, paper manuscript submitted to International Symposium on Polymer Electrolytes
- Dong, G et al 2014, *The Effect of water vapour on the CO₂/N₂ separation performance of Matrimid Membrane with Additives*, proceedings presented at ICOM 2014 (10th International Congress on Membranes and Membrane Processes), Suzhou, China, July 20-25, 2014
- Lebedev, M et al. 2014, *Acoustic response of reservoir sandstones during injections of supercritical CO₂*, proceedings presented at GHGT-12 (12th international conference on greenhouse gas emissions) Austin, Texas USA
- Li, L et al 2014, *An assessment of technical and energy performance of an advanced aqueous ammonia-based CO₂ capture technology for a 500 MW coal fired power station*, paper manuscript submitted to International Journal of Greenhouse Gas Control
- Li, L et al 2014, *The effect of piperazine (PZ) on CO₂ absorption kinetics into aqueous ammonia solutions at 25.0C*, proceedings presented at International Journal of Greenhouse Gas Control
- Li, L et al 2014, *Rate-based modelling of combined SO₂ removal and NH₃ recycle integrated with an aqueous ammonia based CO₂ capture process*, proceedings presented at International Journal of Greenhouse Gas Control
- Lim, J et al 2014, *MEA Reclamation using Electrodialysis*, proceedings presented at International Journal of Greenhouse Gas Control
- Manafa, N et al 2014, *Control analysis of post combustion carbon dioxide capture process (PCC)*, paper manuscript submitted to 3rd International Renewable Energy and Environment Conference (IREEC 2014)
- Myers, M et al 2014, *The impact of partition coefficient data on the interpretation of chemical tracer behaviour in carbon geo-sequestration projects*, paper manuscript submitted to International Journal of Greenhouse Gas Control
- Pearce, J et al. 2014, *Visualising Co-contaminant impacts: Coupled experiments, modelling and micro computed tomography on reservoir and seal core*, proceedings presented at CO₂CRC Research Symposium, Torquay, Victoria
- Varma, S et al. 2014, *Basin resource management and carbon storage*, proceedings presented at Department of Mines and Petroleum - Petroleum Open Day 2014

IEACCC Reports

- Carpenter, A 2014, *R&D programmes for clean coal technologies*, Ref: CCC/244
- Dong, N & Baruya, P 2015 *Coal and gas competition in power generation in Asia*, Ref: CCC/246
- Nicol, K 2014, *The direct injection carbon engine*, Ref: CCC/243
- Sloss, LL 2015, *The emerging market for mercury control*, Ref: CCC/245

CO₂CRC Reports

Reports

- Aldous, R et al. 2013, *CCS Technology Development. Gaps, Opportunities and Research Fronts* (Overview Report)
- de Caritat, P, *CO₂CRC Otway Project: Groundwater monitoring and baseline determination Fieldwork Program 13-18 March 2014 Completion Report* (CO₂CRC Internal Report)
- Kuske, T et al. 2014, *Ginninderra sub-surface CO₂ release: Experiment 2, October - December 2012* (CO₂CRC Storage Report)
- Paterson, L et al. 2014, *Initial well testing requirements document - Otway stage 2C* (CO₂CRC Internal Report)

Journal Papers

- Liu, L et al. 2015, *Influence of sol-gel conditioning on the cobalt phase and the hydrothermal stability of cobalt oxide silica membranes*, Journal of Membrane Science
- Luhar, A et al. 2014, *Bayesian source estimation using concentration measurements at two locations near a geological carbon storage site*, Journal of Geophysical Research: Atmospheres
- Pandit, J et al. 2015, *Analysis of a Precipitating Solvent Absorption Process for Reducing CO₂ Emissions from Black Coal Fired Power Generation*, International Journal of Greenhouse Gas Control
- Seebeck, H et al. 2015, *Polygonal faulting and seal integrity in the Bonaparte Basin, Australia*, Marine and Petroleum Geology
- Swierczek, E et al. 2014, *3D seismic analysis of complex faulting patterns above the Snapper Field, Gippsland Basin: implications for CO₂ storage*, Australian Journal of Earth Sciences
- Tenthorey, E et al. 2014, *Fault modelling and geomechanical integrity associated with the CO₂CRC Otway 2C injection experiment*, International Journal of Greenhouse Gas Control