Available online at www.sciencedirect.com

ScienceDirect

Energy Procedia 114 (2017) 4524 – 4536

Energy Procedia

13th International Conference on Greenhouse Gas Control Technologies, GHGT-13, 14-18 November 2016, Lausanne, Switzerland

The Australian South West Hub Project: Developing a storage project in unconventional geology.

Sandeep Sharma[*a,d], Dominique Van Gent[a,b], Martin Burke[a,c], Louise Stelfox[a,c]

[a]*The South West Hub Project, Bunbury, Australia 6230*

[b]*Western Australia Department of Mines and Petroleum, Bunbury, Australia 6230*

[c]*Western Australia Department of Mines and Petroleum, Perth, Australia 6004*

[d]*Carbon Projects Pty Ltd, Mount Claremont, Australia 6010*

Abstract

The South West Hub project, through three generations of modelling based on new 2D and 3D seismic data and core/log information from four new wells is demonstrating that carbon dioxide storage is possible in an environment where there is no regional shale layer acting as a traditional seal. This paper summarises the work that has been undertaken in a collaborative manner into "unconventional geology" exploring migration assisted trapping in an on-shore saline aquifer by Government, private sector contractors and researchers in the south west of Western Australia.

Carbon Capture and Storage (CCS), which involves capturing carbon dioxide that would otherwise be emitted to the atmosphere and injecting it to be stored in deep geological formations, is a potential stepping stone to maintaining energy security while reducing the carbon footprint of Australia's energy sources. CCS is the only technology available to make deep cuts in greenhouse gas emissions while still using the fossil fuels that power much of today's energy infrastructure. At a State level, the Western Australian Greenhouse Strategy incorporates CCS and is helping to address the need for a long-term commitment to climate change and cleaner energy.

The Western Australia Department of Mines and Petroleum (DMP) started investigating the Lesueur site, near large CO_2 emission sources (the industrial centres of Kwinana and Collie in the South West of Western Australia) in 2007 and developed

* Corresponding author. Tel.: +61-8-93855941
E-mail address: sharmass@bigpond.com

Peer-review under responsibility of the organizing committee of GHGT-13.
doi:10.1016/j.egypro.2017.03.1569

the South West Hub (SW Hub) project concept in 2010 with the support of local industrial partners. The project was designated an "Australian Flagship" project in 2011 and has received substantial funding and support from the Federal Government, through the Department of Industry Innovation and Science) the Western Australia State Government and industry.

The SW Hub Project is progressing data acquisition and analysis aimed at establishing confidence in storage associated with migration assisted trapping (MAT) in unconfined saline aquifers. The storage complex has no regional shale layer and consists of the Lower Lesueur (Wonnerup Member) as the injection reservoir, the Upper Lesueur (Yalgorup Member) with its numerous paleosol baffles as the lower confining layer and the basal shale part of the Eneabba Formation as the upper confining layer. The injection reservoir is a heterogeneous sandstone that is over 1500 m thick with varying permeability layers that should support residual and solubility trapping.

From the very onset, the SW Hub Project has followed a rigorous stage gated decision making program. The project has been divided into phases and each phase involves targeted data acquisition plans to address technical gaps or uncertainties. These uncertainties have been documented in an Uncertainty Management Plan (UMP) and drive all technical work. "Decision Gates" ensure that, only on increased confidence of success would the project move to the next phase. The project processes are consistent with the DNV CO2QUALSTORE* steps and the workflows defined in the EU Directive 2009/31/EC guidance document.

Under the first phase of the new data acquisition program (2011-12), new geological data was gathered through 100 km of targeted 2D seismic lines and one deep exploration well drilled to 2,945 metres. Multiple modelling scenarios with differing assumptions on the geological properties supported the storage concept and identified no "show stoppers". Notwithstanding, uncertainty planning required additional data to address the gaps identified. Under the next phase of the development program (2013-15), 3D seismic was acquired over 115km^2 and additional wells planned. The area of interest is dominated by farming activity and not all landowners provided consent to acquire the seismic data. As such, while high fold data has been acquired over the deeper Wonnerup Member reservoir sections, the shallower Yalgorup Member was not as well illuminated. The drilling strategy was adapted to maximise geological coverage particularly across the shallower reservoirs. Three wells were drilled using a combination of mineral and water well drilling rigs with a deeper well to be considered following model updates.

Significant technical work has also been done to support this development through a range of research projects launched under the auspices of the Australian National Low Emissions Coal research and development program (ANLEC R&D). These projects are focused on reservoir characterisation and either consider more fundamental physics based questions or delve significantly deeper into specific geology and geophysics domains using laboratory and modelling efforts.

Clear decision criteria to support additional investment in a drilling and testing program have been defined and will be addressed by modelling. The paper will explain the project challenges and the decision making rationale, highlighting the importance of good processes, long term planning, and extensive stakeholder management supported by a robust technical program.

Results to date support MAT and validation of the SW Hub storage concept will substantially increase the number of geologic sites that can be considered for safe storage around the world. There is significant international interest in the project field and research activities.

Peer-review under responsibility of the organizing committee of GHGT-13.

Keywords: South West Hub, SWH, CCS, CO_2, Geosequestration, Policy, Legislation, Regulation, Community, Wonnerup; Yalgorup, Lesueur

1. Introduction

The Western Australian (WA) Greenhouse Strategy [1] incorporates the technology of carbon capture and storage (CCS) and recognises its potential for greenhouse gas abatement. Accordingly the WA State Government Department of Mines and Petroleum (DMP) developed a strategy to identify suitable areas for storage within its jurisdiction [2].

* CO2QUALSTORE is a guideline for selection and qualification of geologic storage sites developed by Det Norske Veritas (DNV) as part of an industry driven project in 2009. RPJ-203 are the recommended practices.