IEAGHG Monitoring Network Meeting 2017

International updates from Canada, UK, Japan, Australia, France, Norway, and USA

Hosted by Battelle and Core Energy, 13-15 June, Traverse City, Michigan

Tim Dixon IEAGHG, Charles Jenkins CSIRO, Susan Hovorka BEG, Simon O'Brien Shell, Doug Connolly NOC, Graham Brown Sonardyne, Barry Freifeld LBNL, Neeraj Gupta Battellle, Jun Kita MERI, Kyle Worth PTRC, Katherine Romanak BEG, James Craig IEAGHG

Meeting Agenda

Overall Theme: **The Cost and Value-effectiveness of Monitoring**: Leveraging Oil and Gas Industry Experience for CO2 Storage

Day 1: Project Updates; Application of Oil and Gas Industry Experience; Innovation; Cost and Value-Effectiveness

Day 2: Offshore; Overburden; Field trip - MRCSP / Core Energy

Day 3: Near-surface and Leakage; Group Exercise; Monitoring-Modelling Loop; Wellbore; Seismicity

Key Messages and Conclusions - 1

- Commercial-scale projects are now able to evaluate and implement reductions in complexity of monitoring
- Builds on knowledge transfer & expertise from early projects (SECARB, IBDP) being transferred to commercial scale (Petra Nova, ICCS Decatur) especially being selective with different monitoring techniques. Similar with Quest, Canada
- Represents a trend in decrease in number of technologies deployed at commercial-scale projects. Eg 'Tiered' and phased MMV strategy approach at Quest, approved by regulator. Reduces monitoring and monitoring costs. Maturation, simplification. With no impact to project success

Key Messages and Conclusions - 2

- DAS technology and permanent sources and receivers advances are paying out:- emerging technology, lower cost, decreased surface impact, increased subsurface resolution.
- Stakeholders may input to MMV technology choice
- We've come a long way!
- Progress towards adoption of more derived / quantitative and targeted environmental monitoring onshore & offshore
- Environmental monitoring more for characterisation and targeted to prepare for attribution if needed, instead of simple baseline thresholds
- Converging towards more nuanced evaluation of methods wrt detection performance and probabilistic leakage detection and false positives

Key Messages and Conclusions - 3

- Use of lower cost monitoring can be effective to define where/when more expensive monitoring is required to verify the presence of CO_2 for example 2D seismic followed by 3D.
- DAS VSP can be a more cost effective monitoring technique compared with surface seismic
- Some improvements in DAS can be achieved with already installed fibre
- DAS – helical wound cable improvements moving DAS into surface seismic
- Knowing plume edge – does it matter? Different views.

Key Messages and Conclusions - 4

Offshore

- Rapid development of sensors and commercial delivery platforms - Higher TRL on many sensors (6-8)
- Sensor calibration and comparisons possible
- Data processing advancements (data hub, data pods, automated image filtering)
- Cost reduction using shore-to-shore AUVs with no ships
- Leveraging oil & gas industry and defense experience
- Care needed in using thresholds derived from baseline data!
- Marine env transport different to onshore
- Chimney characterization is progressing with implications for fluid migration in shallow subsurface

Key Messages and Conclusions 5

- Microseismic important , regulatory requirement, and for stakeholder assurance - can increase characterization costs
- Well integrity continues to be very important
- Properly designed and monitored and operated wells can reduce risk
- Demonstrated can see small amounts of CO2 at depth with seismic, eg Otway, Aquistore, Frio

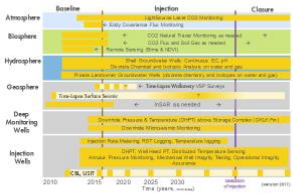
Future work needed - 1

- Deployability and durability of DAS optic fibre
- Improvements in utilisation of DAS data
- Fibre cable cemented better
- Want better marine baseline method for global use – stoichiometric approach
- AUV sea trials and CO2 release test
- Continuous monitoring ability
- Chimney investigations
- Build environmental understanding and variability
- Learn more on use of tracers
- Global response system with portable laboratory for offshore investigations

Future work needed - 2

- Standardized suite of leakage cases
- How to reconcile models with monitoring data (conformance) – needs to be risk based
- Geomechanical site characterisation - Need to improve ability to find faults, fractures and measure stress
- Which data can be stored for processing later?
- More data on abandoned well leakage

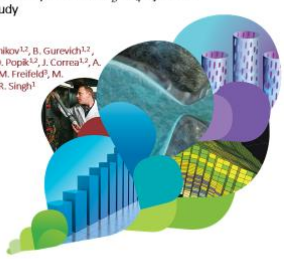
Quest MMV Plan 2017 - Updated



- Timing changed to align with other regulatory reporting requirements
- Tiered approach – much of the data analysis is on as needed basis
- Seismic planning redesigned based on plume expectations
- More emphasis on downhole technologies

Seismic Monitoring of a Small-Scale Supercritical CO_2/CH_4 Injection: CO2CRC Otway project Case Study

R. Pevzner[1,2], M. Urosevic[1,2], K. Tertyshnikov[1,2], B. Gurevich[1,2], S. V. Shulakova[2,4], S. Glubokovskikh[1,2], D. Popik[1,2], J. Correa[1,2], A. Egorov[1,2], H. AlNasser[1,2], A. Kepic[1,2], B.M. Freifeld[3], M. Robertson[3], T. Wood[3], T.M. Daley[3] and R. Singh[1]
[1]CO2CRC, [2]Curtin University, [3]Lawrence Berkeley National Lab, [4]CSIRO

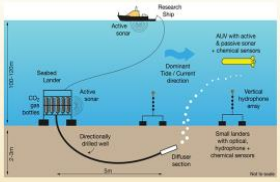


CO2CRC BUILDING A LOW EMISSIONS FUTURE | BERKELEY LAB

11th IEAGHG Monitoring Network Meeting
Traverse City, Michigan June 13th – 15th, 2017

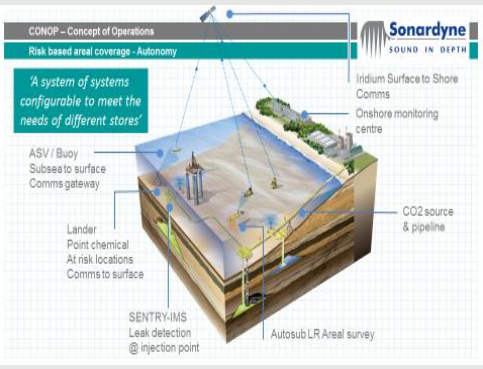
Main Experiment - 2019

STEMM-CCS



Schematic of the shallow sub-surface release of CO_2 gas in sediments (< 5 m depth) near Peterhead (Goldeneye) CCS demonstration project. Note that this small-scale release in near-surface sediment does not affect the integrity of the CCS Storage Site.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 654462



Near-surface / Surface Base line Monitoring– Commonalities / site-specific subtleties and leakage monitoring.

Tomakomai Demonstration Project

Jun Kita
Marine Ecology Research Institute

1. Given the near surface baseline data that you have collected how will you use these data to attribute a signal?
2. Have you done a sensitivity analysis or any quantitative analysis on what a leakage signal would look like given your data set?
3. What are your protocols for deciding that there is nothing in the monitoring data that justifies any action?

AQUISTORE: DEEP SALINE CO_2 STORAGE PROJECT

ptrc

107,000 CUMULATIVE TONNES OF CO_2 STORED

0 INDUCED SEISMIC EVENTS

2100 MAX INJECTION RATE TONNES/DAY

30 MONITORING TECHNOLOGIES DEPLOYED

2

Near-surface Baseline Monitoring – Commonalities and site-specific subtleties in leakage monitoring

Katherine Romanak
Gulf Coast Carbon Center
Bureau of Economic Geology
The University of Texas at Austin

SECARB (Texas, USA) | CTSCo Queensland Australia

IEAGHG Monitoring Network Meeting - June 13th - 15th, 2017, Traverse City Michigan, USA

Monitoring storage efficiency during CO_2 injection for enhanced oil recovery in depleted oilfields

Ashwin Pasumarti
Srikanta Mishra
Andrew Burchwell
Sanjay Mawalkar
Neeraj Gupta
Rick Pardini

MRCSP MIDWEST REGIONAL CARBON SEQUESTRATION PARTNERSHIP

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