IEAGHG CO_2 Storage

Research Highlights and Future Plans

- Supports R&D projects in capture & storage
- Organize Network meetings
  - Modelling
  - Monitoring
  - Risk Management
  - Environment
- GHGT biannual conference
- Summer school
- Webinar – offshore monitoring Oct 2015

Storage Technical Study Programme

- Technical Programme delivery over 2 years
  - 9 reports/reviews published
  - 4 studies at reporting stage
  - 3 studies planned and approved
  - 3 Combined Research Network meetings
  - 2 Network meetings planned for 2015
- General conclusions from Monitoring & Modelling Networks
- Future Research

Reports published

	Contractor / IEAGHG ✓	Report number	Publication date
CO_2 Storage Efficiency in Deep Saline Formations: A Comparison of Volumetric and Dynamic Storage resource Estimation Methods	EERC	2014-09	16/10/2014
Monitoring Network and Modelling Network – Combined Meeting	✓	2015-01	02/03/2015
Summary of the Modelling and Risk Management Network Meeting	✓	2013-14	20/11/2013
Review of CO_2 Storage in Low Permeability Strata	✓	2013-TR7	14/10/2013
Monitoring Network and Environmental Research Network – Combined Meeting	✓	2013-15	02/12/2013
Induced Seismicity and its Implications for CO2 Storage Risk	CO2CRC	2013-09	25/06/2013
Interaction of CO2 Storage with Subsurface Resources	CO2CRC	2013-08	17/04/2013
The Process of Developing a CO2 Test Injection Experience	CO2CRC	2013-13	24/10/2013

Studies Completed / in progress

	Contractor	Publication date
Criteria of Fault Geomechanical Stability during Pressure Build-up	NGI	June 2015
Operational Flexibility of CO_2 Transport and Storage	EERC	August 2015
Cost Components for CO_2-EOR	TNO	September 2015
Review of Offshore Monitoring for CCS Projects	BGS, PML, NOC, UoS'ton	June 2015

Studies planned

	Provisional Publication date
Case studies of CO_2 storage in depleted oil and gas fields	December 2015
Fault Permeability	November 2015
Application and advances in Monitoring at different CO_2 storage sites	March 2016

Research Networks 2015 meetings

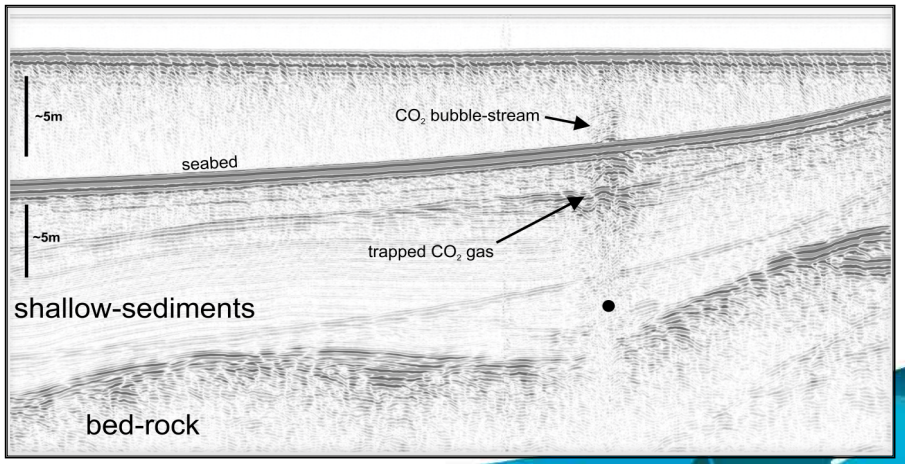
- **Monitoring Network**. LBNL, California. 10-12 June, 2015
  - Monitoring for large-scale industrial projects
  - Review of regulations – a comparison of permit requirements for monitoring
  - Induced seismicity
  - Shallow monitoring: how much do we need and how can we do it?
  - CO_2 distributions, saturations or pressure - What does geophysics actually 'see' in storage reservoirs?
  - Leakage failure scenarios
  - Pressure monitoring and its application to reservoir management / leakage detection
  - Monitoring tool development: technology R&D for shallow deep monitoring
  - Post closure monitoring: What should be required for closure?

- **Risk Management Network** and **Environmental Research Network**. National Oceanography Centre, UK. 30 Sep – 2 Oct 15

- Information on http://www.ieaghg.org/index.php?/networks.html

General Conclusions from last Network Meeting - Monitoring

- Tracers - most useful when used in combination and have shown good results for residual saturation (containment) - Australia
- Complexity at shallow depth at CO_2 Fieldlab - Norway
- New data on marine shallow subsurface and water column from QICS – UK, CO_2 retained in sediment pore fluid.
- P-cable providing high resolution data on shallow overburden - USA



General Conclusions from last Network Meeting - Monitoring

- Pressure monitoring could be an early indicator of leakage - pressure gauge data is providing new insights
- Seismic monitoring applied offshore and onshore – example of cheaper offshore per unit area
- At what point does CO_2 EOR switch from oil recovery to CO_2 storage and how is CO_2 storage efficiency (recycle rate) measured?
- Microseismic - benefits: data from current projects is identifying and reducing uncertainty e.g fracture patterns and verification of geomechanical models.
- Monitoring to modelling iteration is essential and proving effective

General Conclusions from last Network Meeting - Modelling

- Are the current numerical models limited in their ability to capture some fundamental physics? Sleipner example suggest pressure artefacts could have an influence.
- Site-specific models show good match with observed data but how do you assess their broader applicability?
- How do you link reduced order models with monitoring data?
- How many modelling realizations are needed to capture site-specific heterogeneities/uncertainties

General Conclusions from last Network Meeting - Modelling

- More similarities than differences amongst countries in regulatory requirements
  - modelling essentially required in all
  - in most, attempts to be prescriptive about what information is needed from models and not what models to use
  - still much uncertainty/variability about long-term issues (e.g., liability transfer)
- Glaciation should be accounted for in some environments

General Conclusions from last Network Meeting - Faults

- Fault permeability still remains an uncertainity
- Database of fault properties in literature, and pulled together by operators
- Other industries (rad. waste, dam construction)
- Slip event often not large enough to impact entire fault permeability
- Some experiments show fault slip in clay rich shale lowers fault permeability (range of applicability?)

Future research - Monitoring

- Surface monitoring for leak detection – large area with high sensitivity
- Will introduced tracers make it to the surface?
- Monitoring fracture zones and migration mechanism/process
- Secondary accumulations at shallower depths
- Defining baselines for CO_2 EOR projects
- Need (shallow) monitoring techniques which are continuous, real time, accurate, and cost effective – problems with accuracy of available sensors – benchmarking of available sensors
- Monitoring for commercial-scale deployment: what will be the right balance between cost and sensitivity to meet regulatory requirements

Future Research

- CO_2 storage in depleted oil & gas reservoirs
- Fault permeability
- Leakage into the overburden from reservoirs / wellbores
- Storage efficiency – estimating capacity (reservoir facies, open / closed systems / salinity)
- Brine disposal – pressure management

Thank You - Any questions?