Eleventh Annual Conference on Carbon Capture, Utilization & Sequestration

Large Scale CCS Demos

What Have We Learnt from Operational CCS Demonstrations Phase 1b

Samantha Neades, Mike Haines and Tim Dixon

IEAGHG

April 30 – May 3, 2012 • David L. Lawrence Convention Center • Pittsburgh, Pennsylvania

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IEA Greenhouse Gas R&D Programme

- A collaborative international research programme founded in 1991
- Aim: To provide information on the role that technology can play in reducing greenhouse gas emissions from use of fossil fuels.
- Focus is on Carbon Dioxide Capture and Storage (CCS)
- Producing information that is:
  - Objective, trustworthy, independent
  - Policy relevant but NOT policy prescriptive
  - Reviewed by external Expert Reviewers
- Activities: Studies and reports (>250); International Research Networks: **Risk, Monitoring, Modelling, Wells, Oxy, Capture, Social Research, Solid Looping**; GHGT conferences; IJGGC; facilitating R&D and demonstrations eg Weyburn; Summer School; peer reviews.

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What Have We Learnt study

An assessment of the learning that is being provided by operational, large-scale CCS (carbon dioxide capture and storage) projects around the world was undertaken by IEAGHG in 2009.

A total of 28 eligible projects were identified – 20 questionnaires were returned plus verbal information was provided from a further 3 projects.

This initial report looked at the extent of coverage of the CCS demonstrations and learnings from capture and storage projects.

Phase 1b

- Work sponsored by GCCSI
- A follow-up to the original 'What Have We Learned from CCS Demonstrations?'

  (2009-TR6, November 2009)

Project eligibility/criteria

Operational by the end of 2008, and satisfying one of the following criteria:

- Capturing over 10,000 tCO_2 per year from a flue gas;
- Injecting over 10,000 tCO_2 per year with the purpose of geological storage with monitoring;
- Capturing over 100,000 tCO_2 per year from any source;
- Coal-bed storage of over 10,000 tCO_2 per year.

(Commercial CO_2-EOR is excluded unless there is an associated monitoring programme)

WHWL – Phase 1b

Intended to add additional information to the original report on:

- Well injectivity
- Regulation
- Public communication

- Of the 29 projects contacted, 12 responded:

Capture Projects	Storage Projects
Chemical Co. 'A' CO2 Recovery Plant	CO2SINK (Ketzin Project)
IFFCO CO_2 Recovery Plant – Aonla	Nagaoka
IFFCO CO_2 Recovery Plant – Phulpur	Otway Basin Project
Petronas Fertiliser Plant	Pembina Cardium Project
	Schwarze Pumpe
	SECARB – Tuscaloosa Cranfield II
	MRCSP Phase II
	Zama EOR Project

Well Injectivity

- Injection conditions
- Predicting injectivity
- Injectivity in practice
- Actions to improve injectivity

Results

Injection conditions

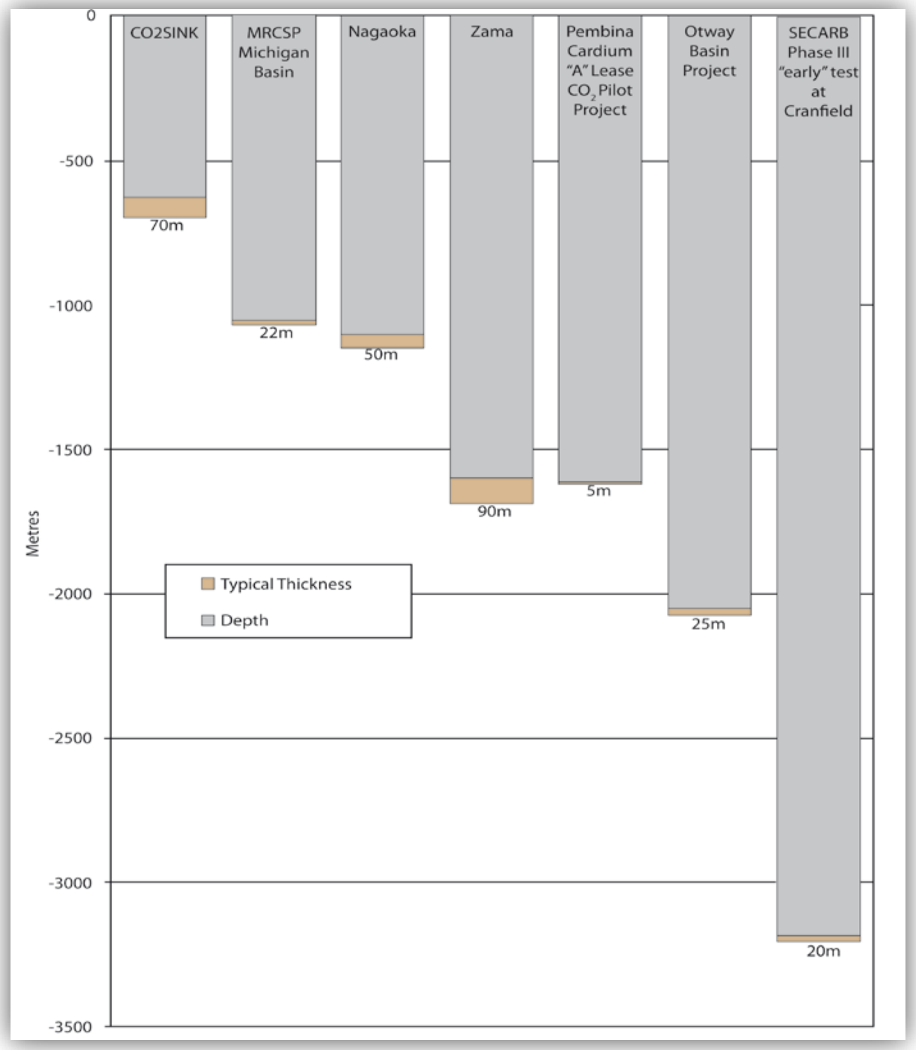
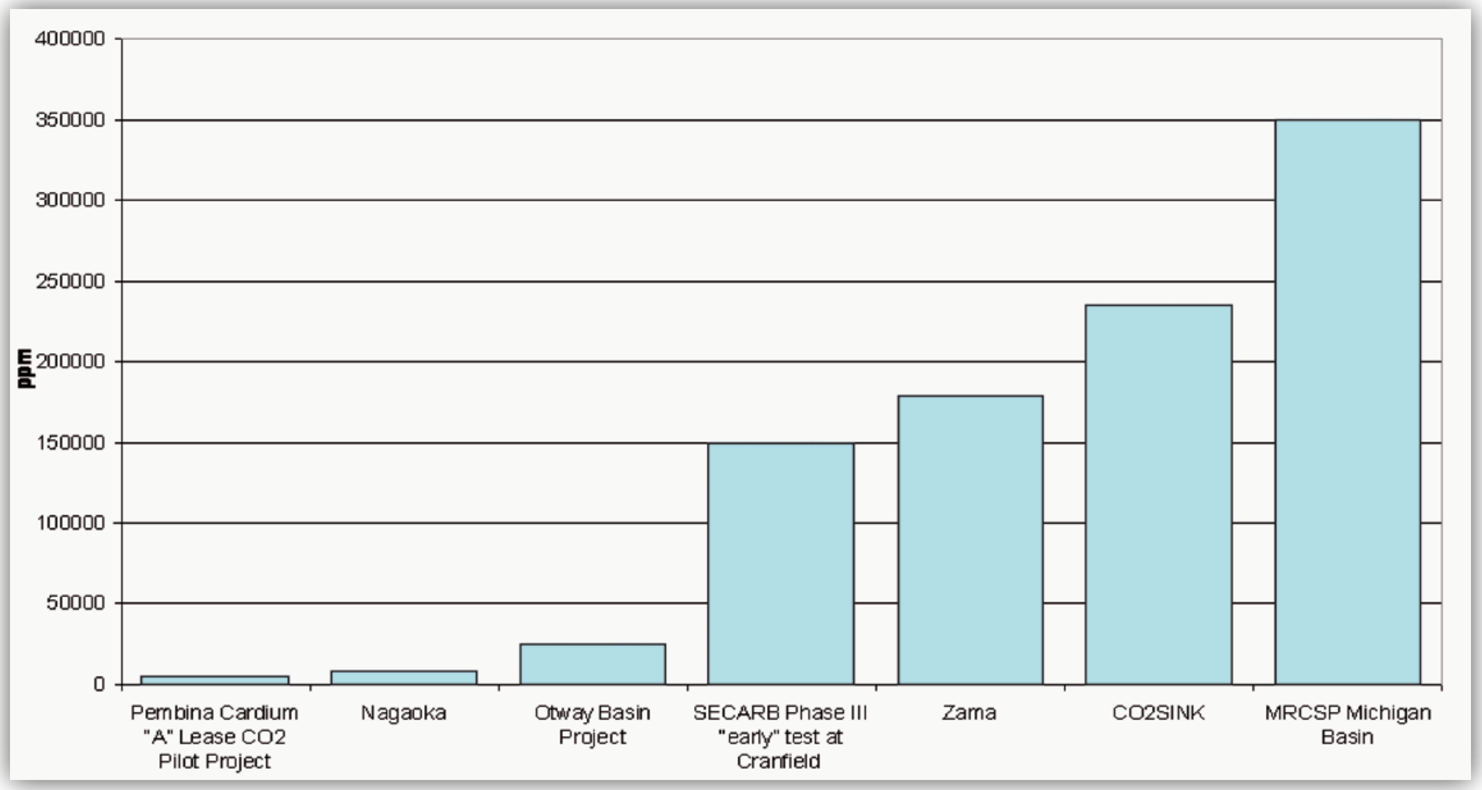


Figure to show depth and thickness of the CO_2 storage reservoirs at the relevant sites

Injection conditions



Graph to show formation water salinity at the sites

Injectivity in practice

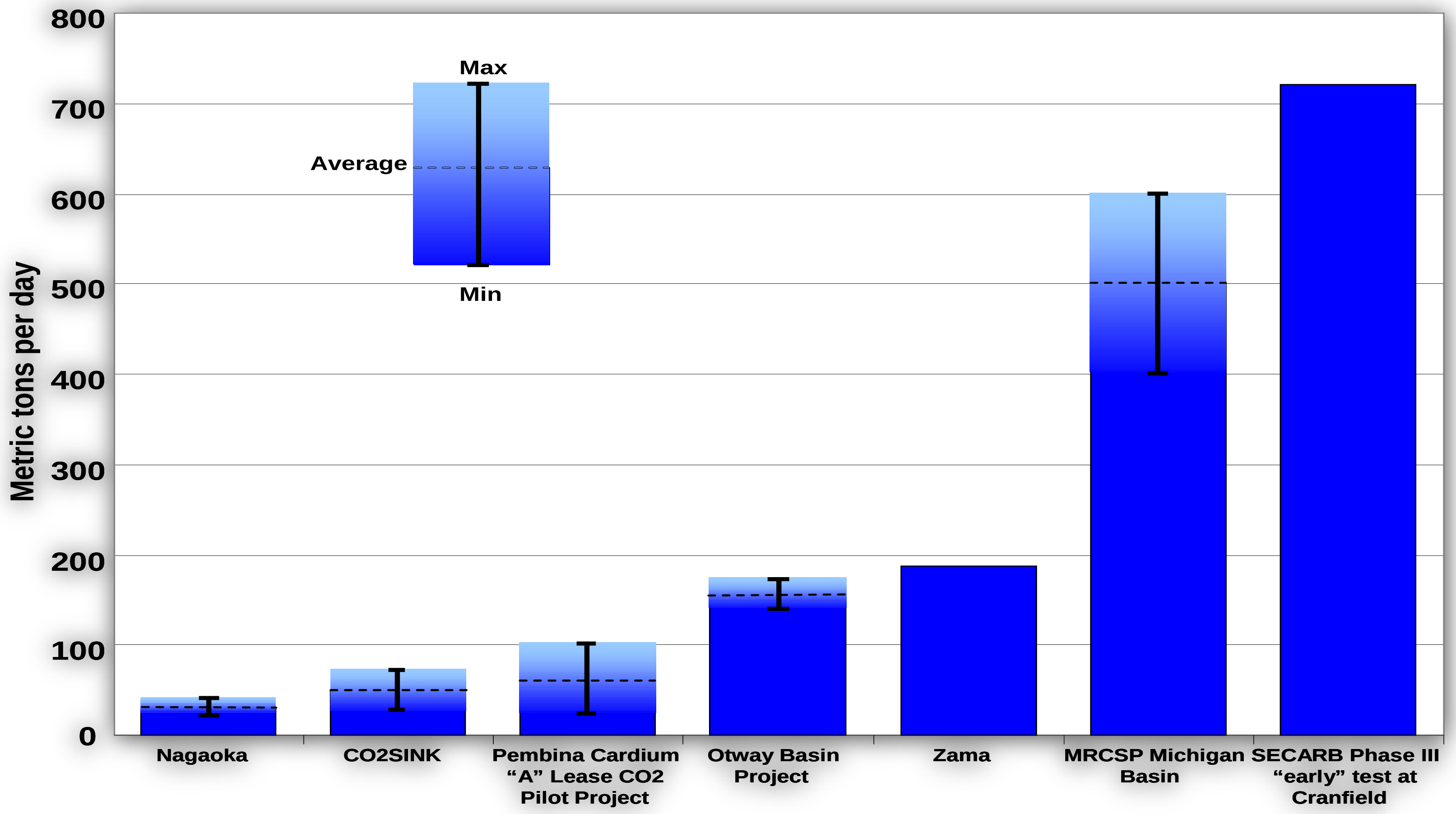


Figure to show average injection rates at the relevant projects

Improving injectivity

Techniques to improve or maintain inflows:

- Acid injection (employed by two projects in Japan and Canada),
- Re-perforation
- Horizontal drilling (employed successfully at the Pembina Cardium site, increasing well productivity)
- Pre-injection fracking and pre-injection back flushing (both employed at projects in Canada).

Regulation

Interaction with regulations and regulators

- Some issues with the Mining Safety Laws and Regulations
- Some issues arose on how to permit the observation wells for a particular project
- Interaction with regulations was generally positive – some difficulty with projects in areas where there were no regulations for CCS in place

Underground CO_2 inventory

- Most of the projects have not attempted to register any CO_2 credits at this stage
- A key learning was the better understanding of the range of characterisation activities and supporting MVA documentation that may be required in the presence of a carbon credit market

Regulation conclusions

- Little concern caused when it came to interaction with regulations and regulators.
- Regulations and standards (plus proactive community policies) led to a positive relationship with the community.
- The projects looked at are too small to come across many significant issues in terms of regulations

Public Communication

Communication methods employed

- Effectiveness of an informal approach
- Informal meetings to which local residents/interested parties were invited
- Websites with project information
- Conversations held as equals

Lessons learned

- Creating conditions for informal discussions should be a key aim
- Identifiable benefits
- Public communication efforts started early on

Conclusions

Well Injectivity

- Storage reservoir depths vary from 600 to 3300 m
- Reservoir thicknesses ranging from 5 to 90 m
- Higher injection rates than anticipated were experienced
- Average injection rate ranging from ~30 to 500 tonnes/day
- Injection pressures vary with depth and hydrostatic gradient (as expected)
- Injection of CO_2 has been successfully demonstrated at all projects.

Regulations

- Regulations and standards were found to be adequate
- Most demonstration projects are too small to come up against many significant issues with regulators
- To maintain a good relationship with the community, regulations and standards should be coupled with practical community policies

Public communication

- The careful planning of public outreach policies is crucial
- The effectiveness of an informal approach with the public is key
- Objections (from the local community) to a CCS project were unlikely if there are identifiable local benefits
- Projects should aim to be the first to provide information to the community and establish clearly identifiable benefits to the local community early on.

Thank you

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