WELLBORE INTEGRITY AND CCS

California ARB Webinar on Wellbore Integrity
12 May 2016
Reserves to production ratio:
~75 years

The Global CCS Institute

Our Vision for CCS:
CCS is an integral part of a low-carbon future

OUR MISSION
To accelerate the development, demonstration and deployment of CCS globally.

1. Fact-based, influential advice and advocacy
2. Authoritative knowledge sharing

- We are an international membership organisation.
- Our diverse international membership consists of:
  - governments,
  - global corporations,
  - small companies,
  - research bodies, and
  - non-government organisations.
- Specialist expertise covers the CCS/CCUS chain.
Actual and expected operation dates for projects in operation, construction and advanced planning

- Power Generation
- Coal-to-liquids
- Chemical production
- Iron and steel production
- Synthetic natural gas
- Fertiliser production
- Oil refining
- Natural gas processing
- Hydrogen production

Operating dates:
- 2015: Great Plains, Enid Fertilizer
- 2016: Coffeyville, Century Plant
- 2017: ACTL Agrium
- 2018: ACTL Sturgeon
- 2019: Spectra***
- 2020: Petro China Jilin

Injection currently suspended: In Salah*
Storage options under evaluation: TCEP
Institute estimate: Gorgon***

\[ = 1 \text{Mtpa of CO}_2 \text{ (areas of circle are proportional to capacity)} \]
• Annual meetings from 2005 to 2011
• Reports and presentations online
• [www.ieaghg.org](http://www.ieaghg.org), Report 2012/01
• Topic now rolled into risk assessment and other storage networks
• Follow up meeting in 2013 organized by PTRC, [www.prc.ca](http://www.prc.ca)
KEY FINDINGS FROM NETWORK

• Potential CO$_2$ effects on materials
• Discrepancy of lab versus field studies
• Importance of material interfaces
• Knowledge gaps/R&D priorities (2012!)
  – Mechanical properties of degraded materials
  – Standard definitions
  – Field testing/sampling
  – Monitoring strategies
AQUISTORE: DEEPEST WELLS IN SASKATCHEWAN

Injection Well – 3396 m

Observation Well – 3400 m
Weyburn site characterization

3D visualization of Weyburn, courtesy of PTRC
## False Claims of Weyburn CO\(_2\) Leakage

- source of problems according to local consultant...

- ‘clearly anthropogenic CO\(_2\) injected into Weyburn reservoir’

<table>
<thead>
<tr>
<th>- CO(_2) concentrations</th>
<th>- ‘oil’ sheen on dugout</th>
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</thead>
<tbody>
<tr>
<td>- (\delta^{13}C) isotopes</td>
<td>- bubbles, foam, noises…</td>
</tr>
<tr>
<td>- Methane concentrations</td>
<td>- dead animals</td>
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<tr>
<td>- Ethane+ concentrations</td>
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Pictures from Globe and Mail, Jan 12, 2011
Carbon 14 Isotope Data

Scatter plot of $^{13}\text{C}$ on CO$_2$ with $^{14}\text{C}$ on CO$_2$
- Control, Investigation (Event 1 and Event 2)
and Injection Gas samples
Pressure transient test confirms cement effectiveness
Well Integrity: Field Testing Program

Modified coring tool:
→ Direct confirmation of cement
Containment Risk Profile

The storage will retain most of the CO₂ injected

Weyburn - Containment risk profile

No further work would be required to demonstrate containment acceptability.
SaskCO$_2$ USER: Extension of Weyburn Results Analyses

US DOE sponsored program – forthcoming special issue of IJGGC journal

- Minimum dataset requirements
- Overburden monitoring
- Passive seismic monitoring
- History matching
- Wellbore design
- Casing corrosion
- Core assessment
The Institute’s key publication

Summary Report, Key Findings and other advocacy materials can be found at:

http://status.globalccsinstitute.com/

Full report is available online at the Institute’s Members Portal.
www.globalccsinstitute.com