Development of the First Internationally Accepted Standard for Geologic Storage of Carbon Dioxide utilizing EOR under ISO Technical Committee TC-265

Prepared for:

T2. Geological Carbon Sequestration: Understanding Physical, Chemical, and Biological Processes

Prepared By:
Steven M Carpenter, VP, ARI & Chair, US TAG

Session 11-9, 19 March 2015
<table>
<thead>
<tr>
<th>1</th>
<th>Standards &amp; ISO</th>
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<tbody>
<tr>
<td>2</td>
<td>TC-265</td>
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<tr>
<td>3</td>
<td>Why Do This…Next Steps</td>
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</table>
1: Standards & ISO
What are Standards?

- Consensus based
- Designed as a rule, guideline or definition
- Revisable and updateable
- Voluntary

Standards must fit to purpose:

- Prescriptive based
- Objectives based
- Performance based
- Principles based
- Hybrids
Why Standards?

- Because they are not laws…
  - *Standards & regulations can work together*

- Not Mandated

- Typically initiated by industry…
  - *And therefore better received and used by industry because they are part of the process*

- Demonstrate regulatory compliance

- Streamline the regulatory process

- Harmonize across jurisdictions
Must INCLUDE any and all...

- UNFCCC - IPCC
- ISO
- EU European Directives
- USDOE
- USEPA
- NGO’s (WRI, GCCSI, etc.)
- Federal, Provincial, State regulations
- Future expected directives
ISO = A Global System

>600 organisations in liaison

>19,000 existing ISO Standards

163 Countries
5,000 people
97% of world population

>250 active TCs
> 3,335 technical bodies
100,000 experts

Vision & Strategy

Customer

Financial

Internal Process

Learning Growth

1208 standards produced in 2011

Central Secretariat in Geneva
151 FTE staff
ISO Standards Development

- ISO does not write standards
- Technical Committees write standards
- P-Member countries approve standards
- Nations adopt ISO standards
- ISO does not influence the technical content
ISO Standards Process

- WG experts consensus and
- 2/3 P-Members votes
- Less than 1/4 total negative votes

ISO (Publication)

- 2/3 P-Members votes
- Less than 1/4 total negative votes

DIS (Enquiry)

Yes/no

FDIS (Approval)

ISO / CS

NP (Proposal)

WD (Preparatory)

CD (Committee)

WG members (Consensus)
2: ISO TC 265
Carbon Dioxide Capture, Transportation, and Geological Storage

Title & Designation:
Standardization of design, construction, operation, and environmental planning and management, risk management, quantification, monitoring and verification, and related activities in the field of carbon dioxide capture, transportation, and geological storage (CCS).
ISO TC 265 – CCS Organization

Twined Secretariat

Members

Countries

Liaisons

Participants

P-Member Nations

O-Member Nations

NGOs & Liaisons
ISO TC 265 – P-Members

Participating Countries:

Australia  Malaysia  Netherlands
Canada    Norway    Saudi Arabia
China     South Africa
France    Spain     Sweden
Germany   Switzerland
India     United Kingdom
Italy     United States
Japan
S. Korea

✓ Voting Members
✓ Guaranteed International Expert Participation on all WGs
ISO TC 265 – O-Members

Observing Countries:

<table>
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<tr>
<th>Argentina</th>
<th>Iran</th>
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<td>Brazil</td>
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<td>Czech Rep.</td>
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<td>Finland</td>
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- ✓ Non-voting Members
- ✓ May request International Expert Participation on all WGs
- ✓ May upgrade to P-Member at any time
ISO TC 265 – Liaisons

- ISO TC207 Environmental Management
- ISO TC67 Petroleum and Natural Gas
- CEN/TC 234 Gas Infrastructure
- Carbon Sequestration Leadership Forum (CSLF)
- European Industrial Gases Association (EIGA)
- Global CCS Institute (GCCSI)
- International Energy Association (IEA)
- IEAGHG
- CO2 GeoNet
- World Resources Institute (WRI)

- ✓ Non-voting Members
- ✓ Guaranteed International Expert Participation on all WGs
WG1: Capture

Technical Report (TR):
- Pre-, post-, & oxyfuel combustion capture
- Industrial processes
- Separation, purification
- Dehydration, compression and pumping
- Liquefaction, installation, operation, maintenance
- Quality of CO$_2$ streams
- Monitoring, management systems
- Plant retrofitting

- 4 US Members
- All have lead author roles
# WG1: Capture

## Proposed schedule for the first IS

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ISO/TC 265 the 2nd WG1 Teleconference, 2014-07-17
Pipeline transportation systems boundaries:

- Pipelines not currently covered by existing ISO/TC-67 standards
- Health, safety and environment (HSE) aspects specific to transport
- Monitoring of CO₂

2 US Members
WG2: Transportation

427 comments:

- Australia: 34 comments
- Canada: 27 comments
- China: 42 comments
- France: 9 comments
- Germany: 5 comments
- Japan: 16 comments
- Norway: 19 comments
- UK: 212 comments
- USA: 63 comments
WG3: Storage

Geological storage of carbon dioxide; Canada (Onshore) Japan (Offshore):

- Z-741-12 as seed document
- Site selection
- Site characterization
- Risk assessment & risk management
- Well construction
- Closure
- Post-closure

- 8 US Members
- Many have lead or co-lead author roles
WG3: Storage

- 750 comments from the Technical Committee
WG4: Quantification & Verification Methodology (TR):

- **Project boundary & leakage**
- **CO₂ quantification**
- **Monitoring and reporting**
- **Third party verification**
- **Life Cycle Analysis**

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<th>Country</th>
<th>Number of member (2014, last plenary)</th>
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<td>Total</td>
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✓ 4 US Members
Definitions & Vocabulary; Led by France, with support from China:

- Terminology
- Definitions
- System Integration
- Public Participation & Engagement
- Mixing of gas streams from different sources

- 7 US Members
- Many have lead or co-lead author roles
Example of harmonizing cross-cutting terms among WGs: CO$_2$ stream

- **WG5**: a stream consisting overwhelmingly of carbon dioxide
- **WG2**: stream consisting overwhelmingly of carbon dioxide with a limited fraction of other chemical substances
- **WG3**: a stream of carbon dioxide that has been captured from an emission source (e.g., a fossil fuel power plant) and meets applicable regulatory requirements for CO$_2$ storage

Note: It may include any incidental associated substances derived from the source materials or the capture process, added as a result of commingling for transportation, added to the stream to enable or improve the injection process and/or trace substances added to assist in CO$_2$ migration detection.
Carbon Dioxide Storage using EOR; led by USA, with support from Norway:

- **Low-pressure subsurface oil field operating environments**
- **Reservoir & pore space management**
- **Manage known lateral stratigraphic traps in the target formation**
- **Coordination with WGs1-5**

- **14 US Members**
- **1 - Norway**
- **5 - Canada**
- **2 - Japan**
- **2 - IEA**
- **24 Total Members**

**Expected:**
- China
- France
- UK
- Liaisons
WG6: CO2-EOR
3: Why Do This…Next Steps
“Standards, smart local and global standards, are essential to the timely advancement of the technologies and equipment that will be necessary to make safe reliable power with the capture of emissions from hydrocarbon fueled power plants.”

Mike Monea
President, Carbon Capture & Storage Initiatives - Saskatchewan Power Corporation (Boundary Dam)
Regulatory Confusion

Source: Edison Electric Institute and Dick Winschel, CONSOL Energy
Regulatory Conflict

CGS REGULATORY FRAMEWORK

White House
IAJTFCCS

Set price of carbon

Perpetual Event Horizon

PAYMENT OF STORAGE FEE

OPERATIONAL BOND

SITE LICENSING AND CERTIFICATION

SITE AND WELL OPERATIONS

INDIVIDUAL WELL BONDS

BONDS RELEASED AS WELLS PLUGGED

LONG TERM

SITE CLOSURE AND WELL PLUGGING

STATE ADMINISTERED TRUST FUND ASSUMES RESPONSIBILITY FOR OVERSIGHT AND LIABILITY

BOND RELEASED 10 YEARS AFTER INJECTION CEASES

STORAGE
Lack of ...

...Regulatory Framework:
- Malaysia
- Argentina
- Iran
- Brazil
- Egypt

...Industry Experience – expands membership:
- Saudi Arabia
- Mexico
Issues Impacting CCUS in US

- Complying with Subpart RR of the GHG Reporting Program
- Categorization of CO\textsubscript{2} as a solid waste and maybe hazardous waste
- Potential conversion of State-based UIC Class II programs into UIC Class VI programs.
- EPA’s Prevention of Significant Deterioration (PSD)
International Plenary Meeting - Birmingham
Next Steps…

- 6th Plenary Meeting in September – Oslo, Norway
- Participate in UNFCCC – COP21 in Paris
- Expect draft standards for:
  - Post-combustion capture
  - CO₂ transportation by pipeline
  - Storage in saline/stacked reservoirs
  - Risk Analysis & LCA
  - CO₂-EOR
Thank You

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