



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

 THE GEOLOGICAL SOCIETY
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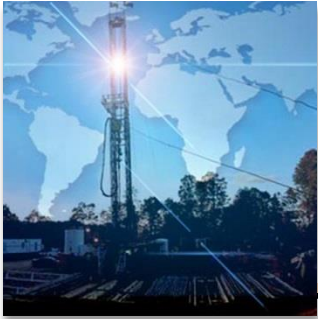




1 Standards & ISO

2 TC-265

3 Why Do This...Next Steps



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

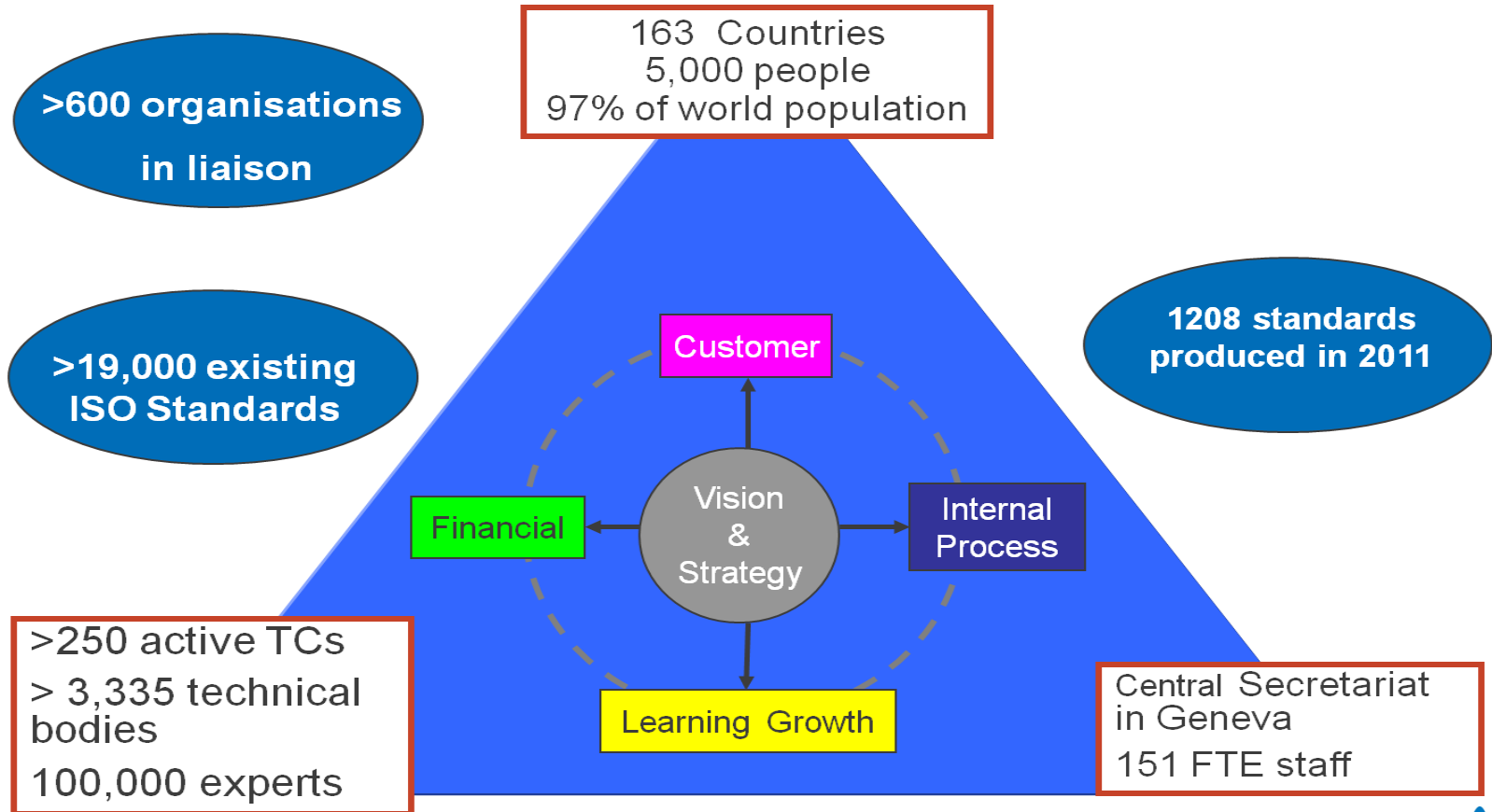


Must INCLUDE any and all...

- *UNFCCC - IPCC*
- *ISO*
- *EU European Directives*
- *USDOE*
- *USEPA*
- *NGO's (WRI, GCCSI, etc.)*
- *Federal, Provincial, State regulations*
- *Future expected directives*



ISO = A Global System

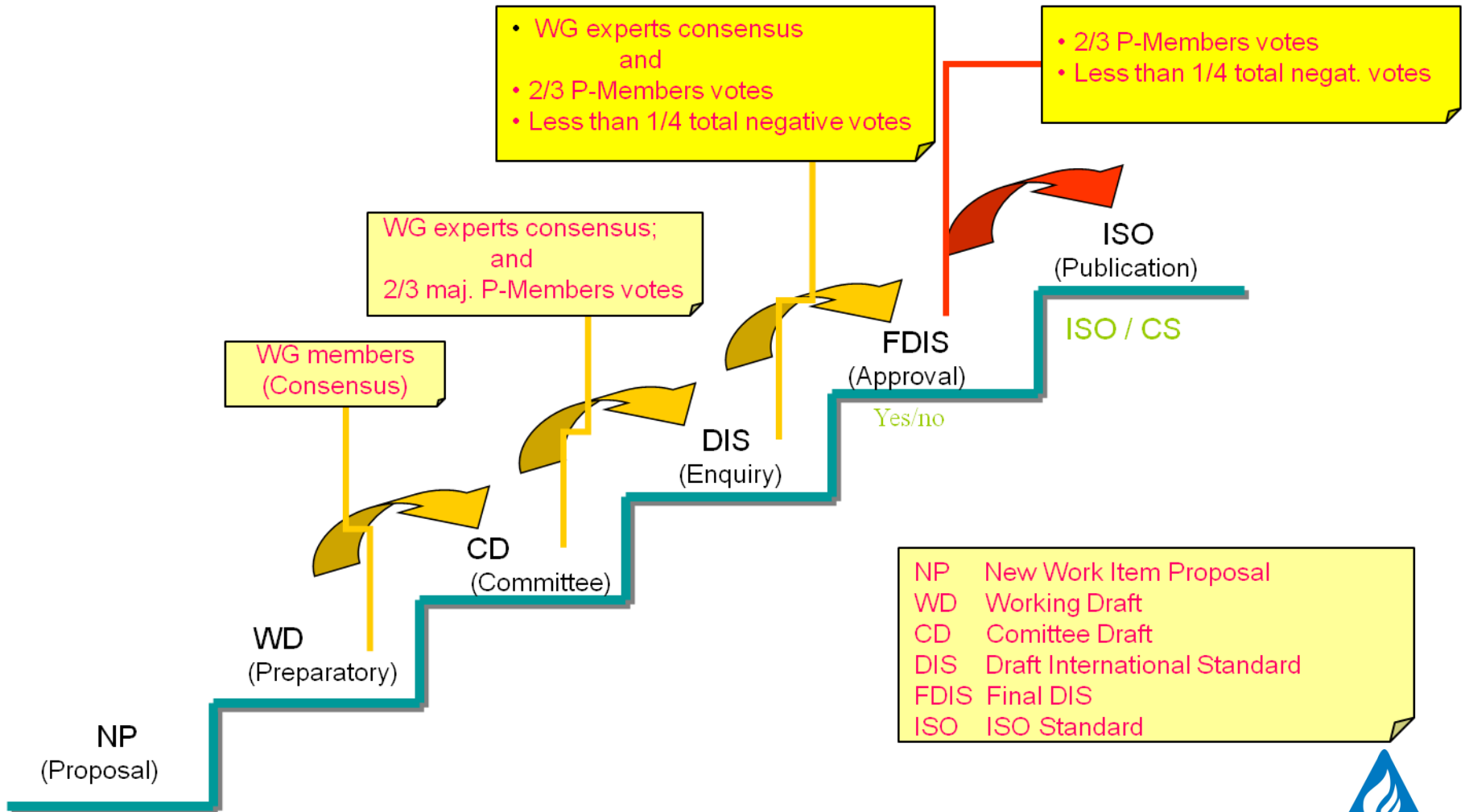


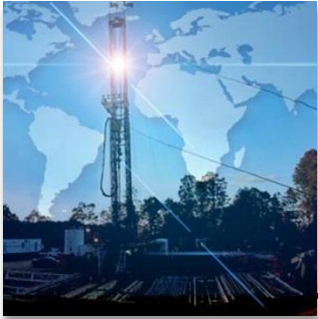
ISO Standards Development

- *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





2: ISO TC 265

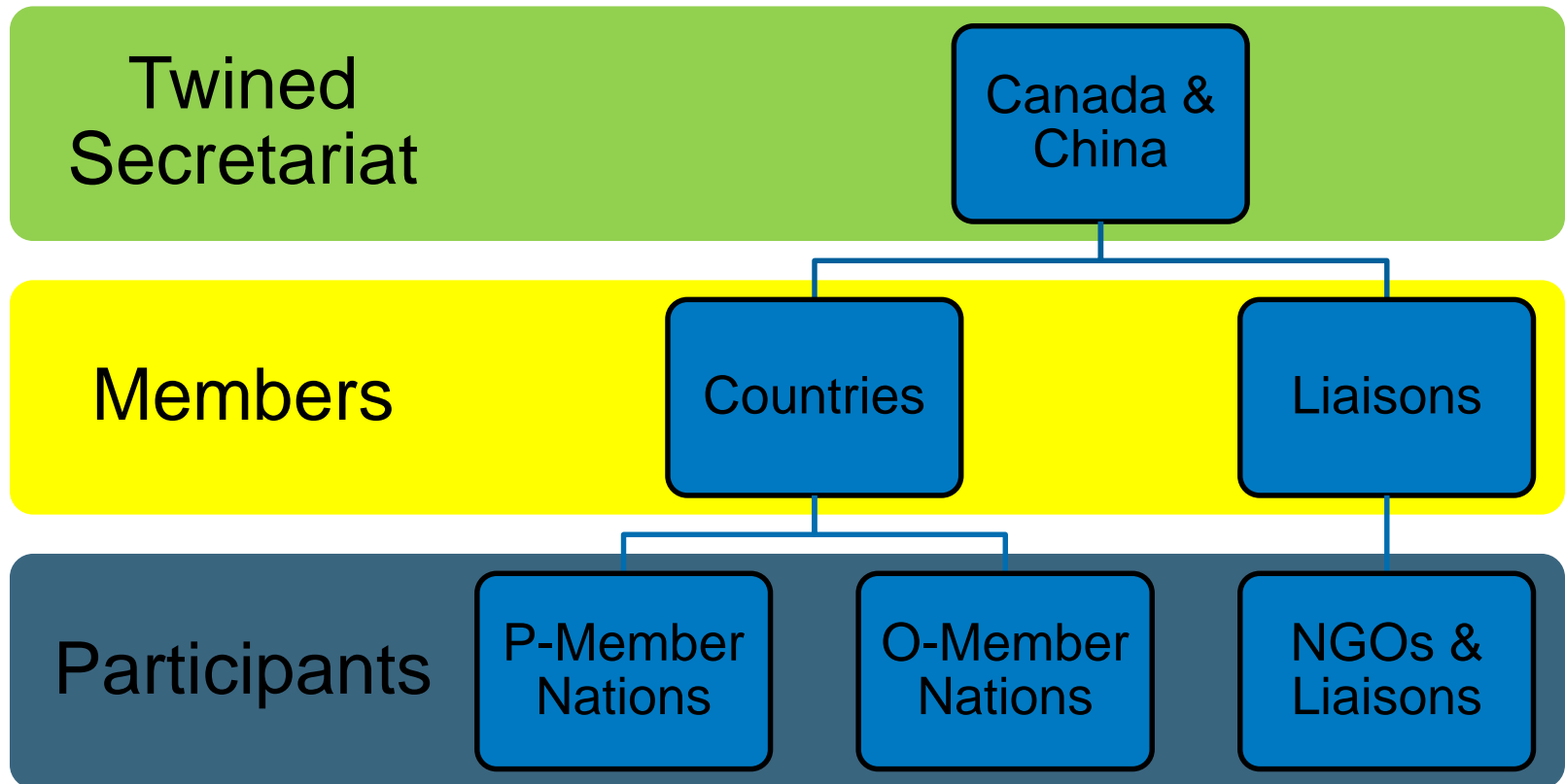
Carbon Dioxide Capture, Transportation, and Geological Storage

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



ISO TC 265 – P-Members

Participating Countries:

Australia

Canada

China

France

Germany

India

Italy

Japan

S. Korea

Malaysia

Netherlands

Norway

Saudi Arabia

South Africa

Spain

Sweden

Switzerland

United Kingdom

United States

- ✓ *Voting Members*
- ✓ *Guaranteed International Expert Participation on all WGs*



ISO TC 265 – O-Members

Observing Countries:

Argentina

Iran

Brazil

New Zealand

Czech Rep.

Serbia

Egypt

Sri Lanka

Finland

- ✓ *Non-voting Members*
- ✓ *May request International Expert Participation on all WGs*
- ✓ *May upgrade to P-Member at any time*



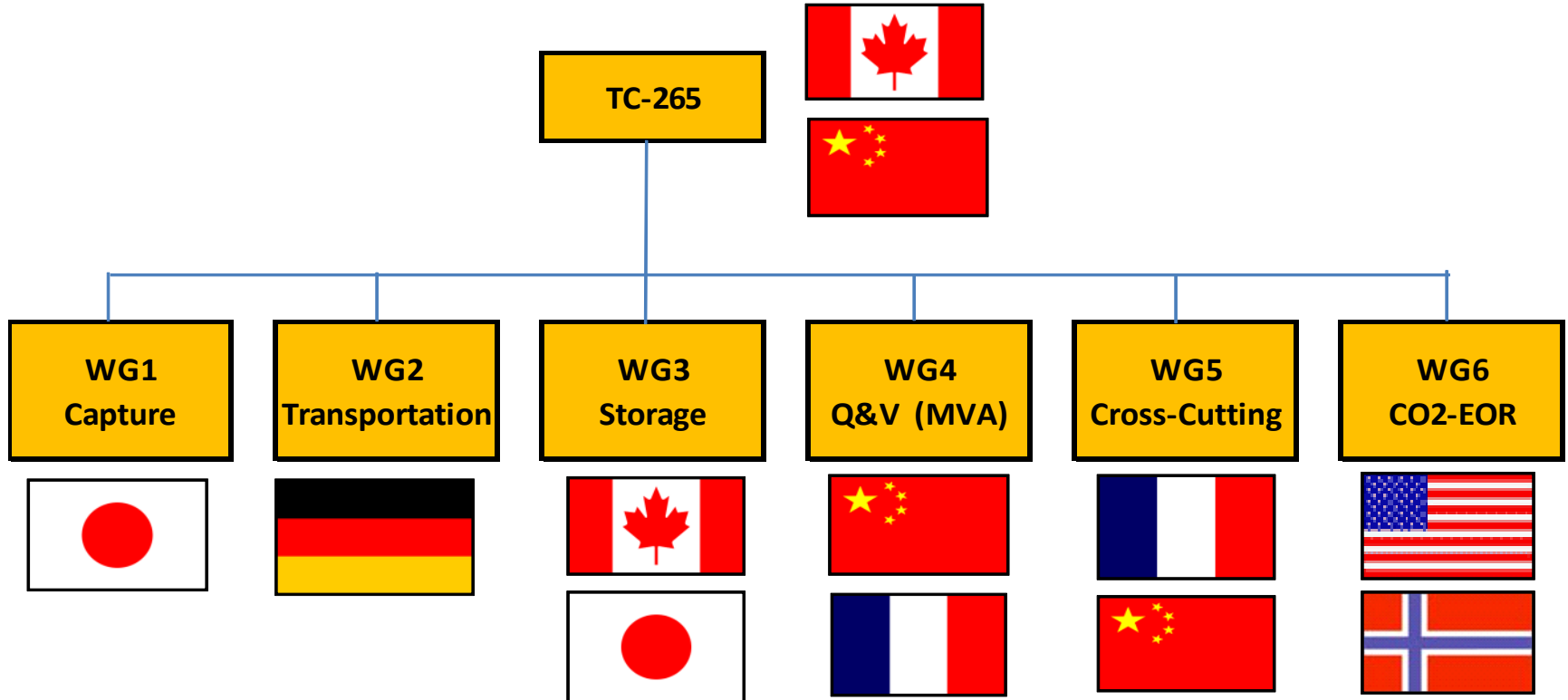
ISO TC 265 – Liaisons

- *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)*

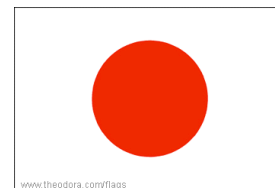
- ✓ *Non-voting Members*
- ✓ *Guaranteed International Expert Participation on all WGs*



TC-265 Working Groups



WG1: Capture



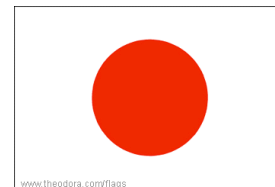
Technical Report (TR):

- Pre-, post-, & oxyfuel combustion capture
- Industrial processes
- Separation, purification
- Dehydration, compression and pumping
- Liquefaction, installation, operation, maintenance
- Quality of CO₂ streams
- Monitoring, management systems
- Plant retrofitting

- ✓ *4 US Members*
- ✓ *All have lead author roles*



WG1: Capture

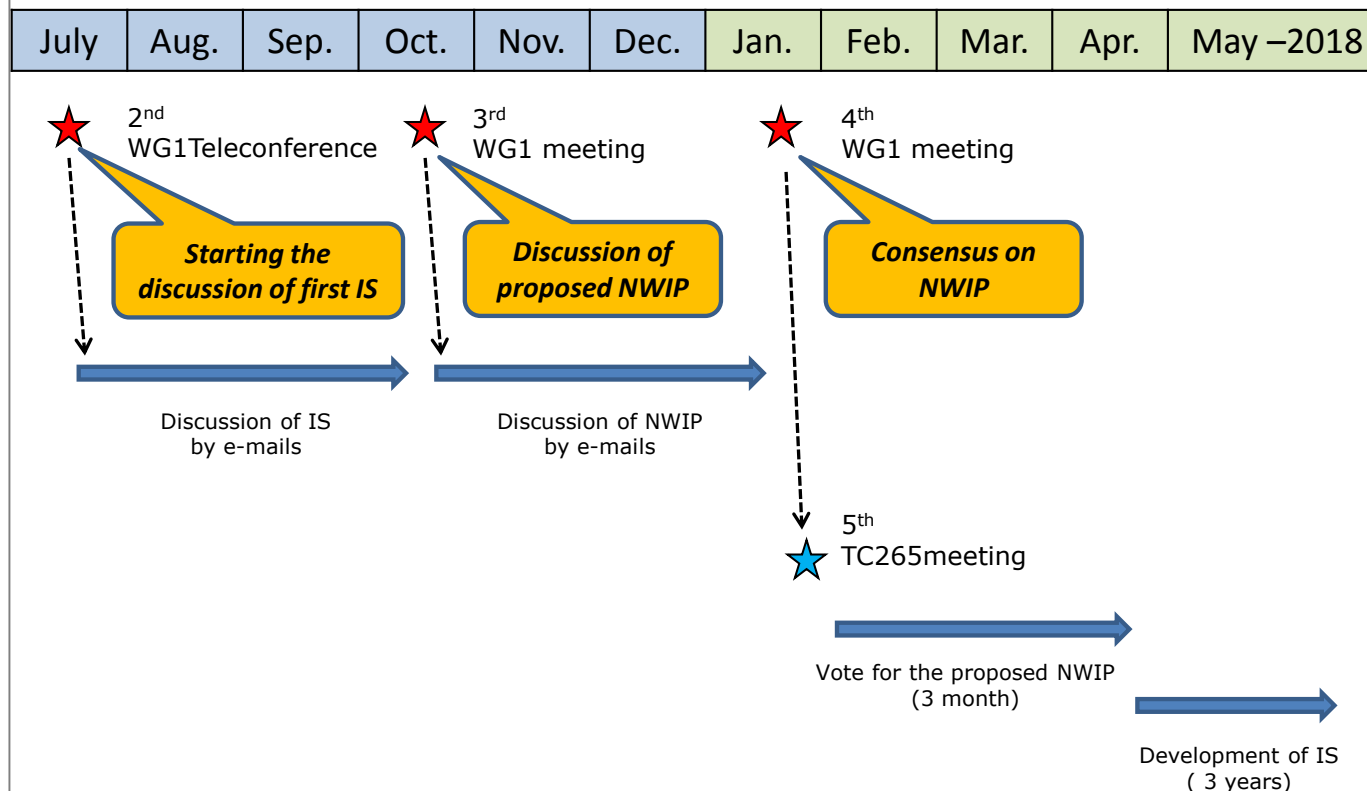


ISO/TC 265/WG1 N053

Proposed schedule for the first IS

2014

2015



ISO/TC 265 the 2nd WG1 Teleconference, 2014-07-17



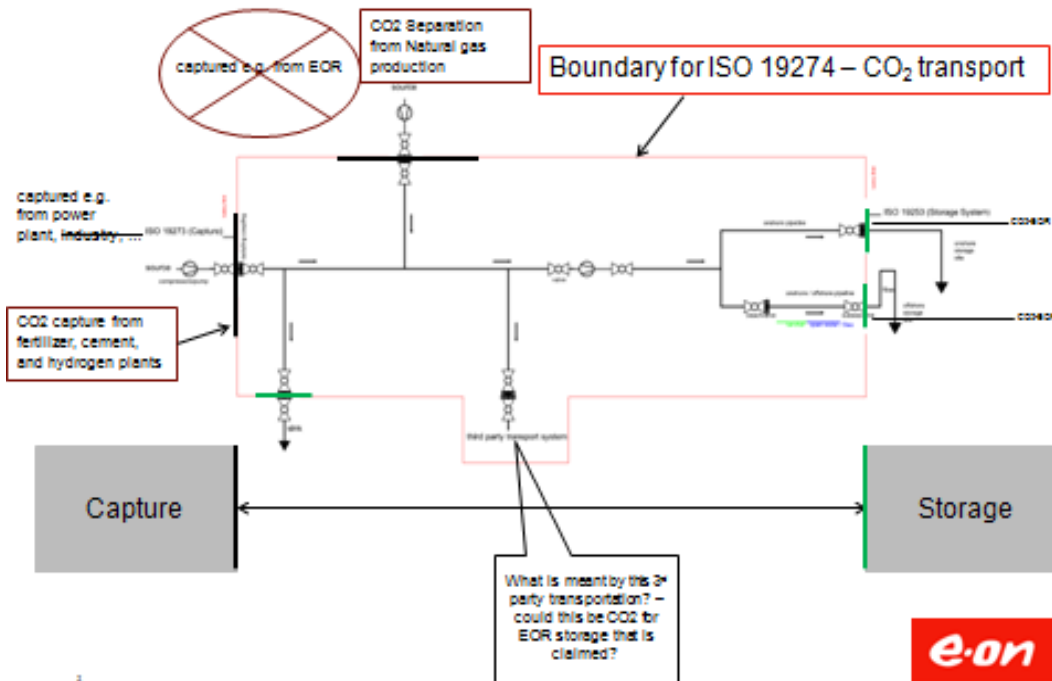
Advanced Resources International, Inc.

WG2: Transportation



Pipeline transportation systems boundaries:

Definition of CO₂ Transport Boundaries



✓ 2 US Members

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



WG2: Transportation

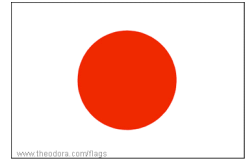


427 comments:

- 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



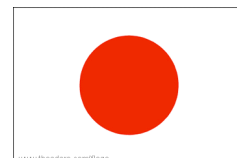
Geological storage of carbon dioxide; Canada (Onshore) Japan (Offshore):

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

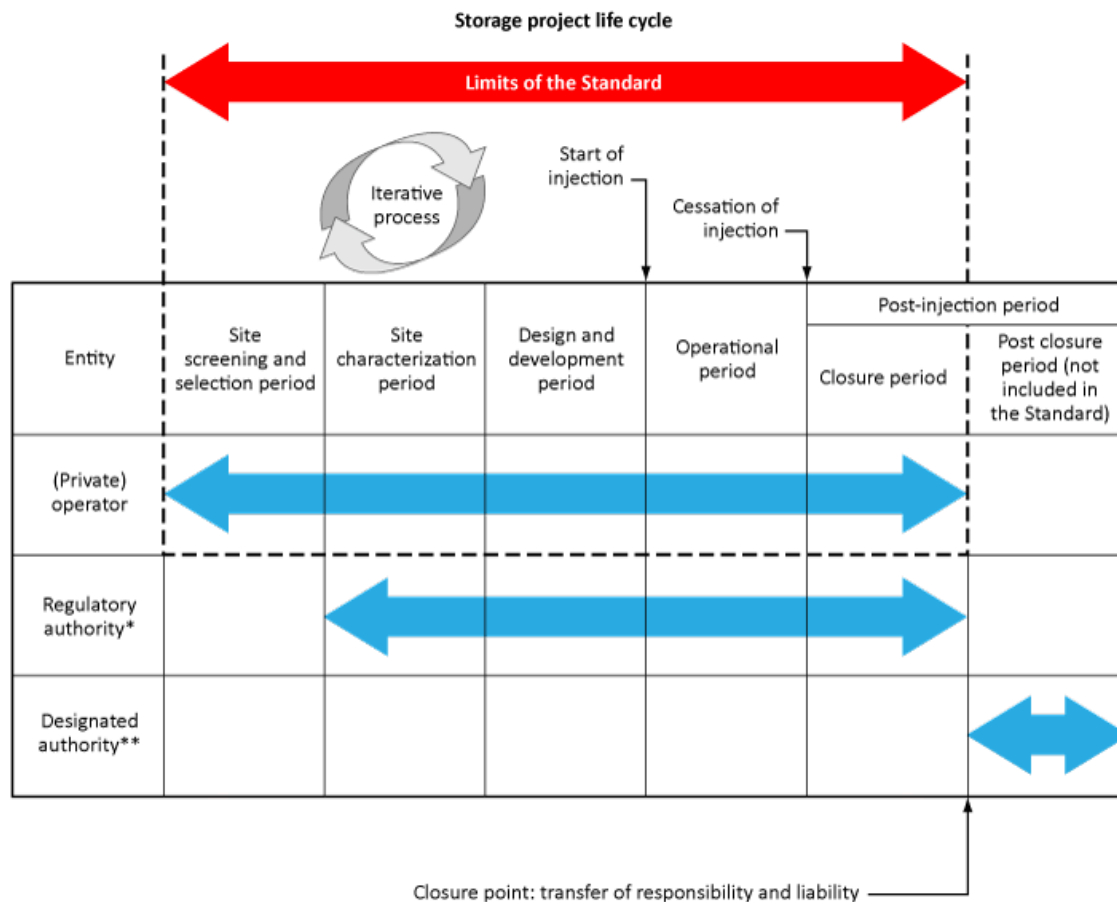
- ✓ *8 US Members*
- ✓ *Many have lead or co-lead author roles*



WG3: Storage



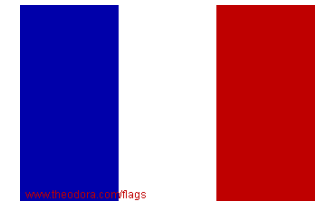
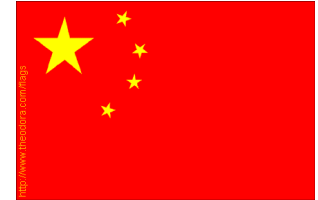
- 750 comments from the Technical Committee



WG4: Quantification & Verification

Quantification & Verification Methodology (TR):

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

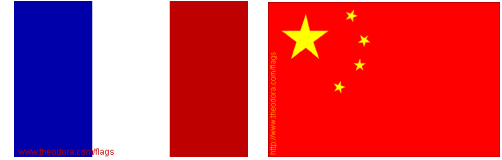


Country	Number of member (2014, last plenary)	Current membership
Australia	1	1
Canada	2	4
China	4	4
France	1	4
Germany	2	2
Japan	6	6
Korea	1	2
Norway	2	2
Spain	2	2
Sweden		1
UK	1	2
US	4	5
Liaison	1	2
Total	27	37

✓ 4 US Members



WG5: Crosscutting Issues



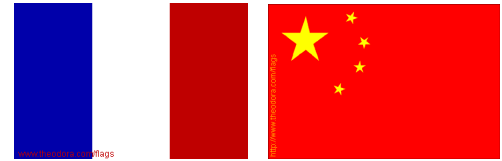
Definitions & Vocabulary; Led by France, with support from China:

- 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*



WG5: Crosscutting Issues



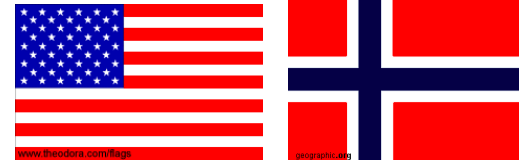
Example of harmonizing cross-cutting terms among WGs: CO₂ stream

- **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 CO₂ 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 CO₂ migration detection.



WG6: CO2-EOR



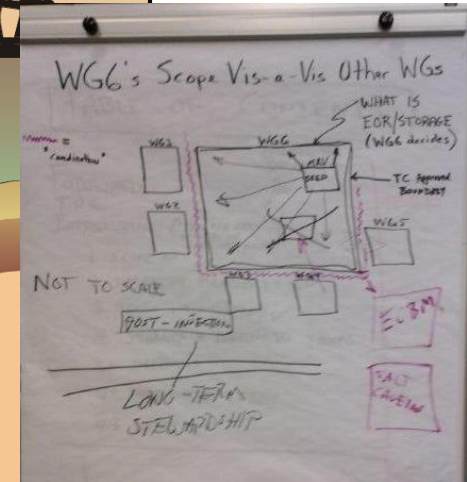
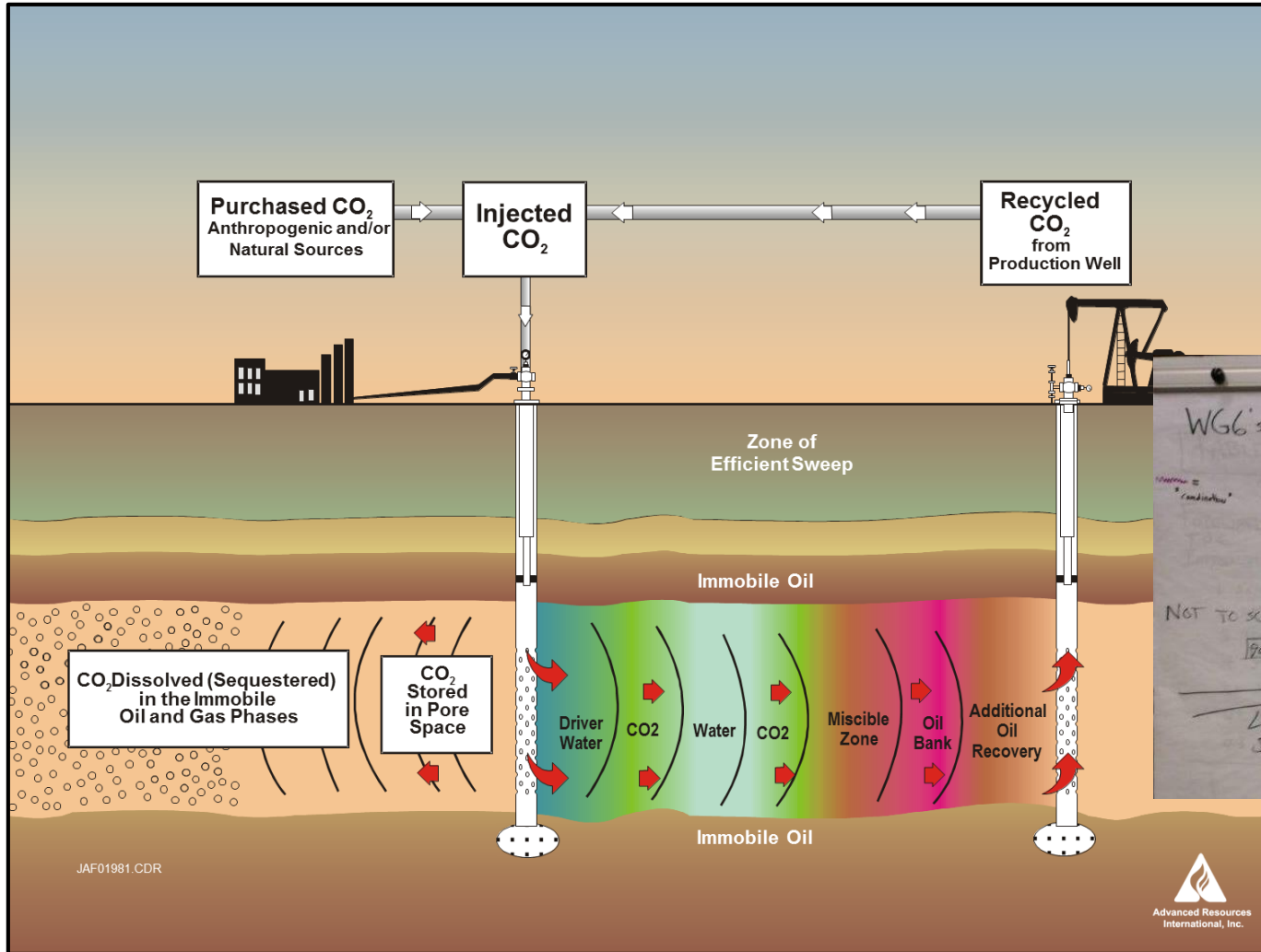
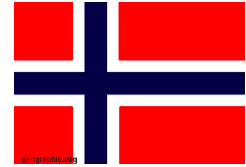
Carbon Dioxide Storage using EOR; led by USA, with support from Norway:

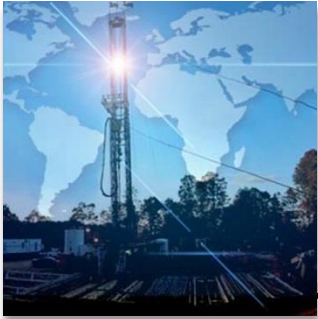
- *Low-pressure subsurface oil field operating environments*
- *Reservoir & pore space management*
- *Manage known lateral stratigraphic traps in the target formation*
- *Coordination with WGs 1-5*

- ✓ *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

Real-world application



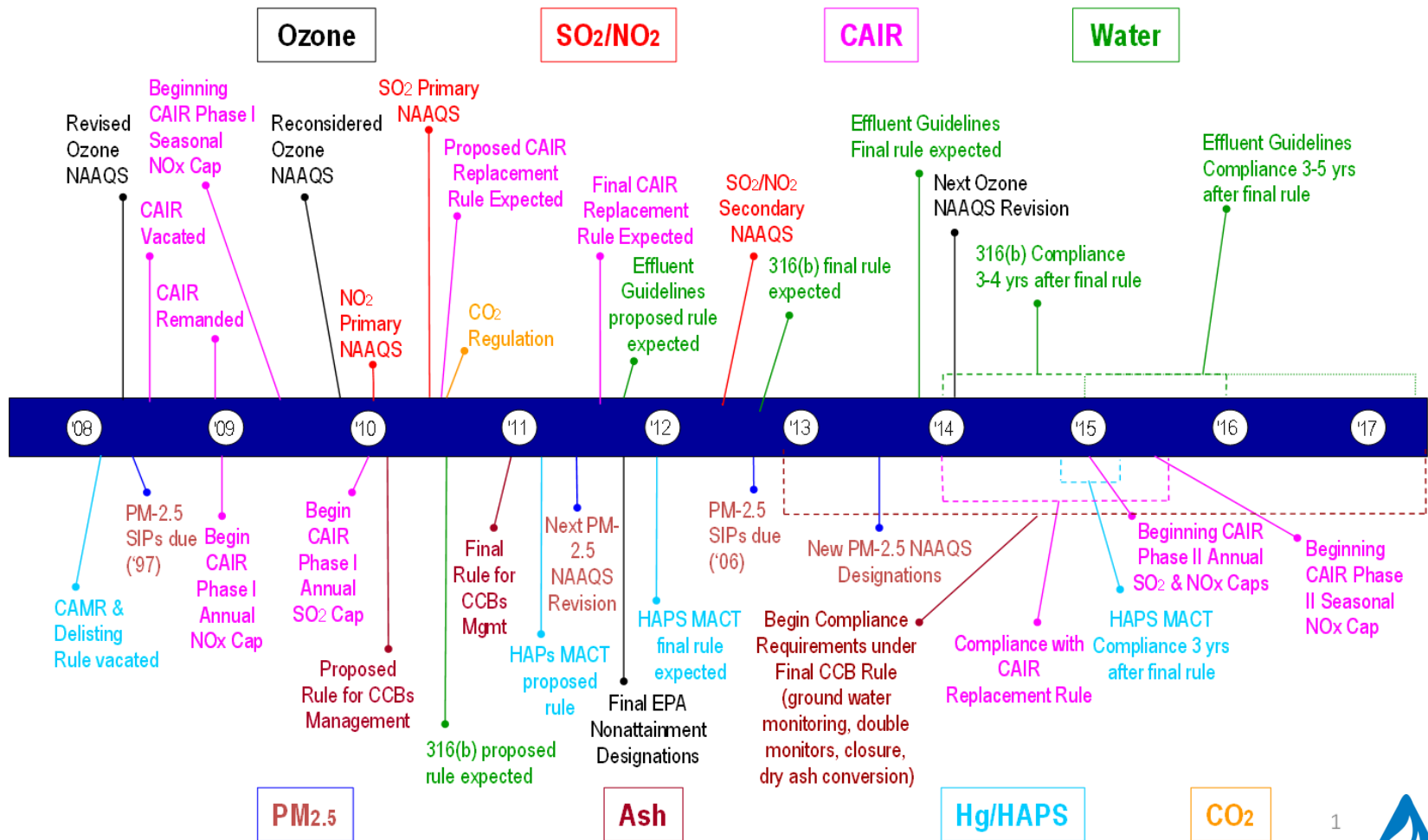
*Mike Monea
President, Carbon Capture & Storage
Initiatives - Saskatchewan Power
Corporation (Boundary Dam)*

“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.”



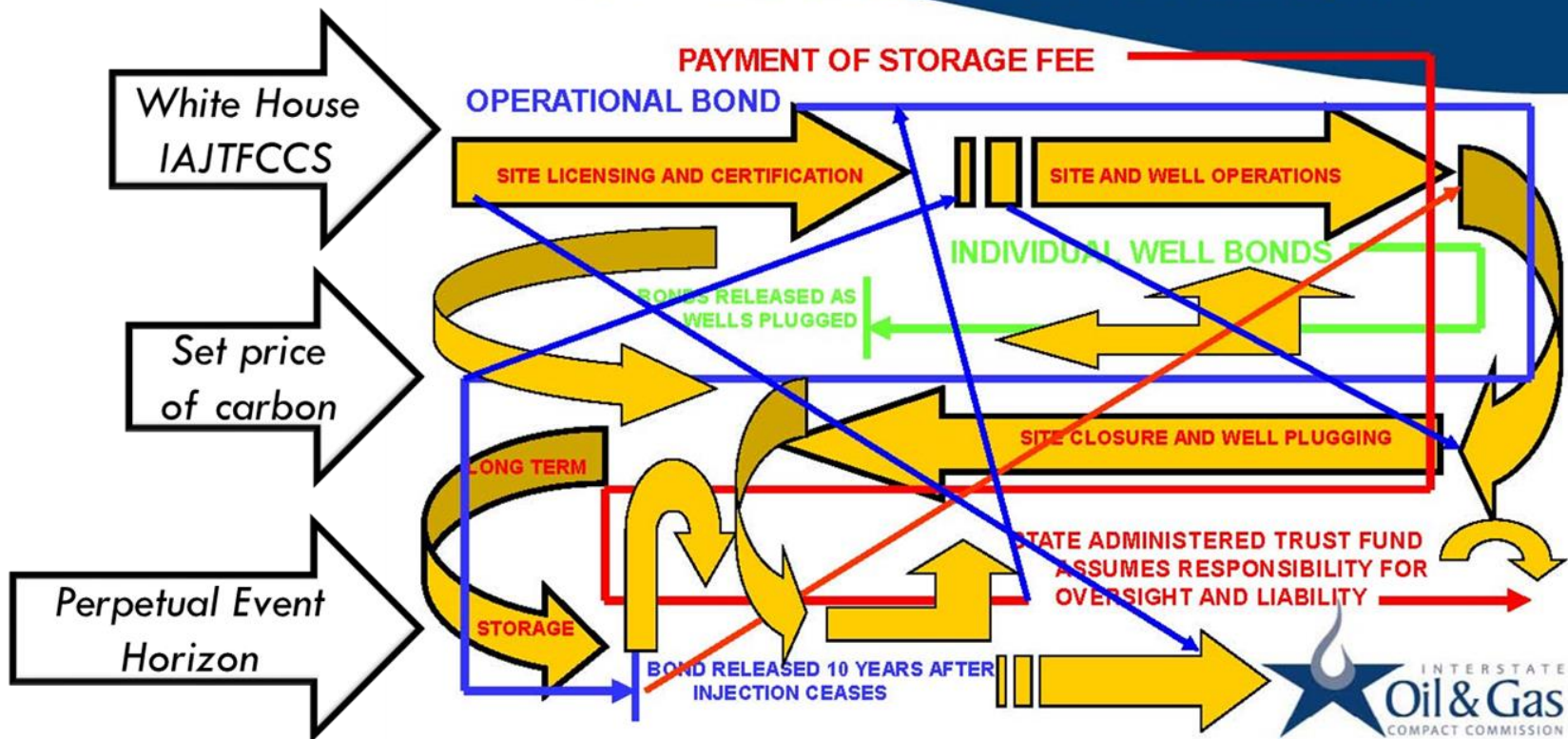
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Regulatory Confusion



Regulatory Conflict

CGS REGULATORY FRAMEWORK



Lack of ...



**Asia-Pacific
Economic Cooperation**



United Nations
Framework Convention on
Climate Change

...Regulatory Framework:

- *Malaysia*
- *Argentina*
- *Iran*
- *Brazil*
- *Egypt*

...Industry Experience – expands membership:

- *Saudi Arabia*
- *Mexico*



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Issues Impacting CCUS in US

- Complying with Subpart RR of the GHG Reporting Program
- Categorization of CO₂ 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



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International Plenary Meeting - Birmingham



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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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