

Spring 4-12-2016

Development of the first internationally accepted standard for geologic storage of carbon dioxide utilizing enhanced oil recovery (EOR) under the international standards organization (ISO) technical committee TC-265

Steven Carpenter

University of Wyoming, steven.carpenter@uwyo.edu

Follow this and additional works at: http://dc.engconfintl.org/co2_summit2



Part of the [Environmental Engineering Commons](#)

Recommended Citation

Steven Carpenter, "Development of the first internationally accepted standard for geologic storage of carbon dioxide utilizing enhanced oil recovery (EOR) under the international standards organization (ISO) technical committee TC-265" in "CO2 Summit II: Technologies and Opportunities", Holly Krutka, Tri-State Generation & Transmission Association Inc. Frank Zhu, UOP/Honeywell Eds, ECI Symposium Series, (2016). http://dc.engconfintl.org/co2_summit2/28

This Abstract and Presentation is brought to you for free and open access by the Proceedings at ECI Digital Archives. It has been accepted for inclusion in CO2 Summit II: Technologies and Opportunities by an authorized administrator of ECI Digital Archives. For more information, please contact franco@bepress.com.

***International
Organization for
Standardization (ISO)
Technical Committee
265 (TC-265):
Carbon Dioxide
Capture,
Transportation, and
Geological Storage***

***Steve Carpenter, Director UW-EORI
April 12, 2016***



**UW - Enhanced Oil
Recovery Institute**

Presentation Overview

1 ISO & Standards

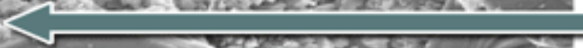
2 TC-265

3 Why Do This...Next Steps





IOR



CO₂

1: ISO & Standards



EOR



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?

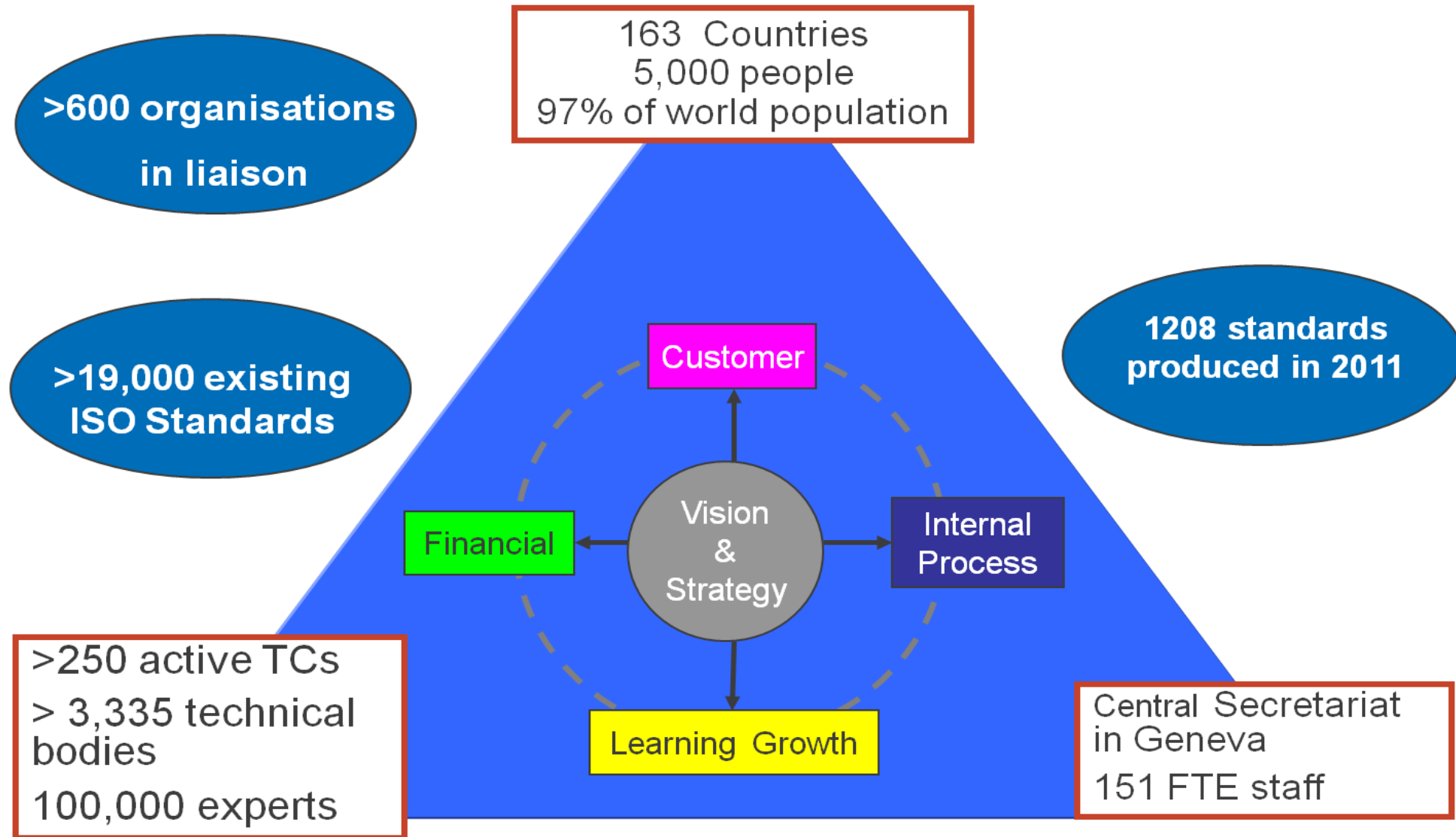
- Because they are not laws...
 - *Standards & regulations can work together*
- Not Mandated
- Typically initiated by industry...
 - *And therefore better received and used by industry because they are part of the process*
- Demonstrate regulatory compliance
- Streamline the regulatory process
- Harmonize 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

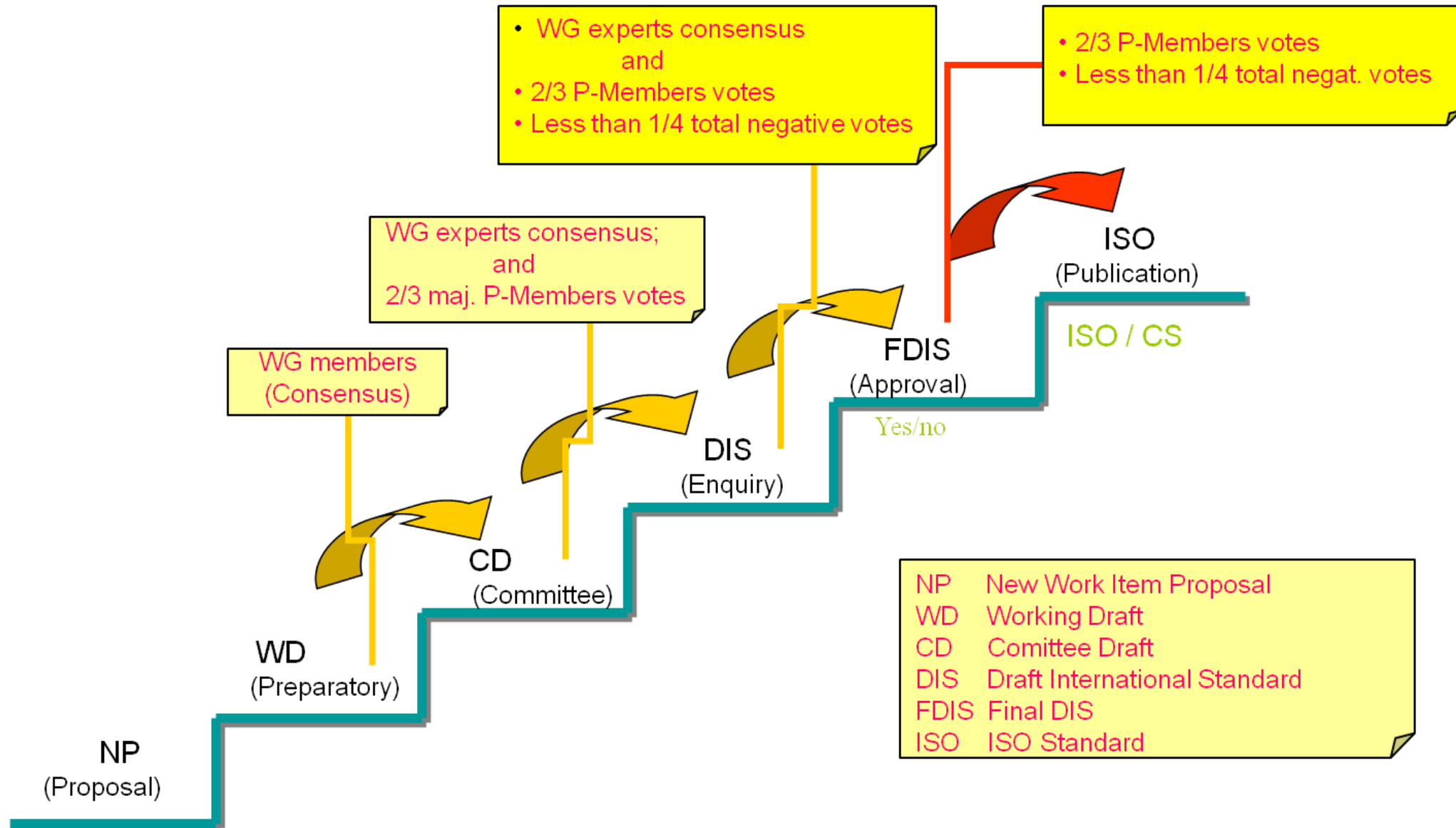


ISO Standards Development

- 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

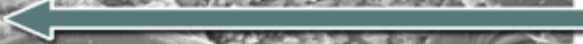


ISO Standards Process





IOR



CO₂

2: ISO TC 265



EOR

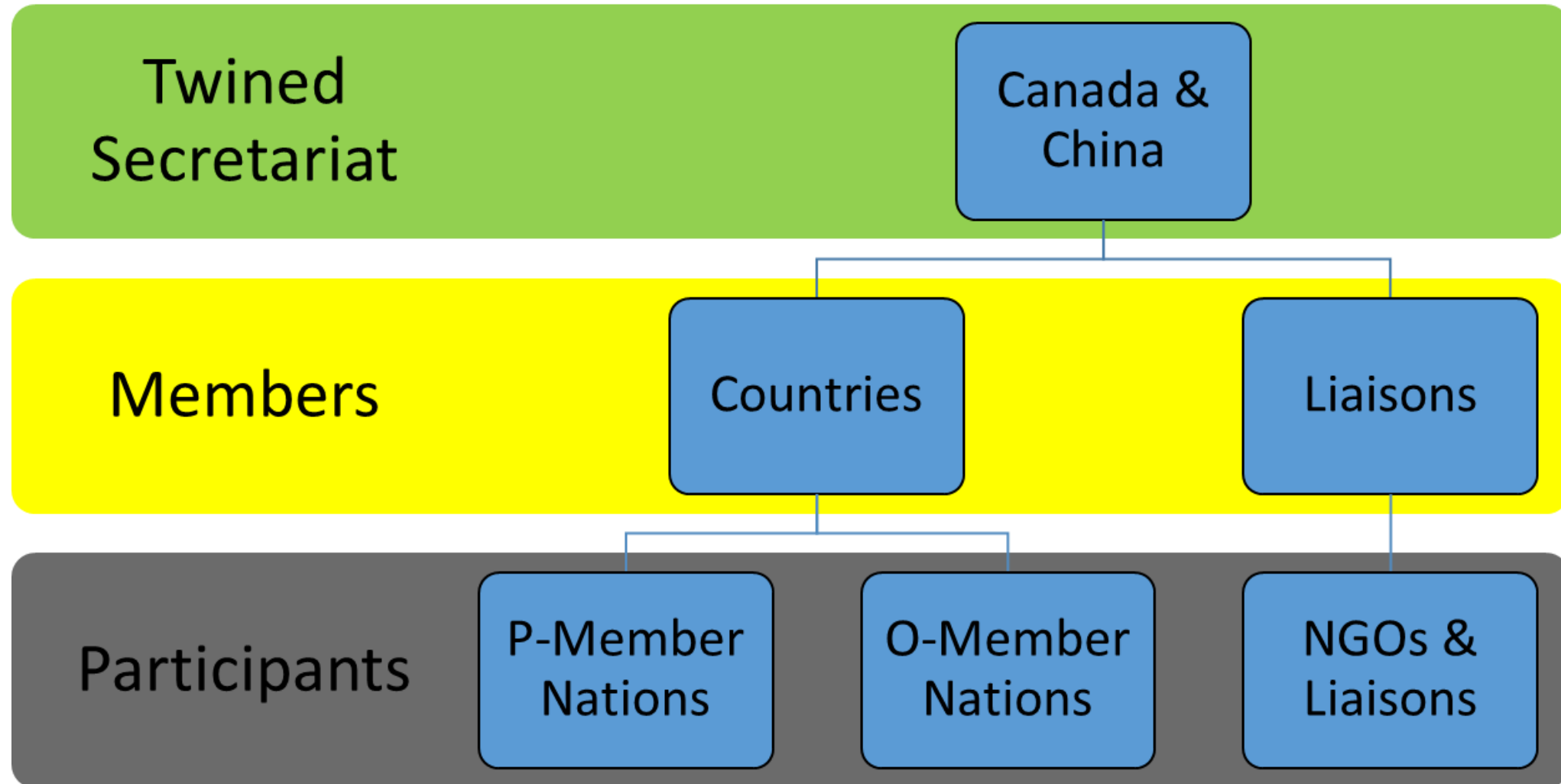


Title & Designation:

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)

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)

Argentina

Brazil

Czech Rep.

Egypt

Finland

Iran

New Zealand

Serbia

Sri Lanka

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

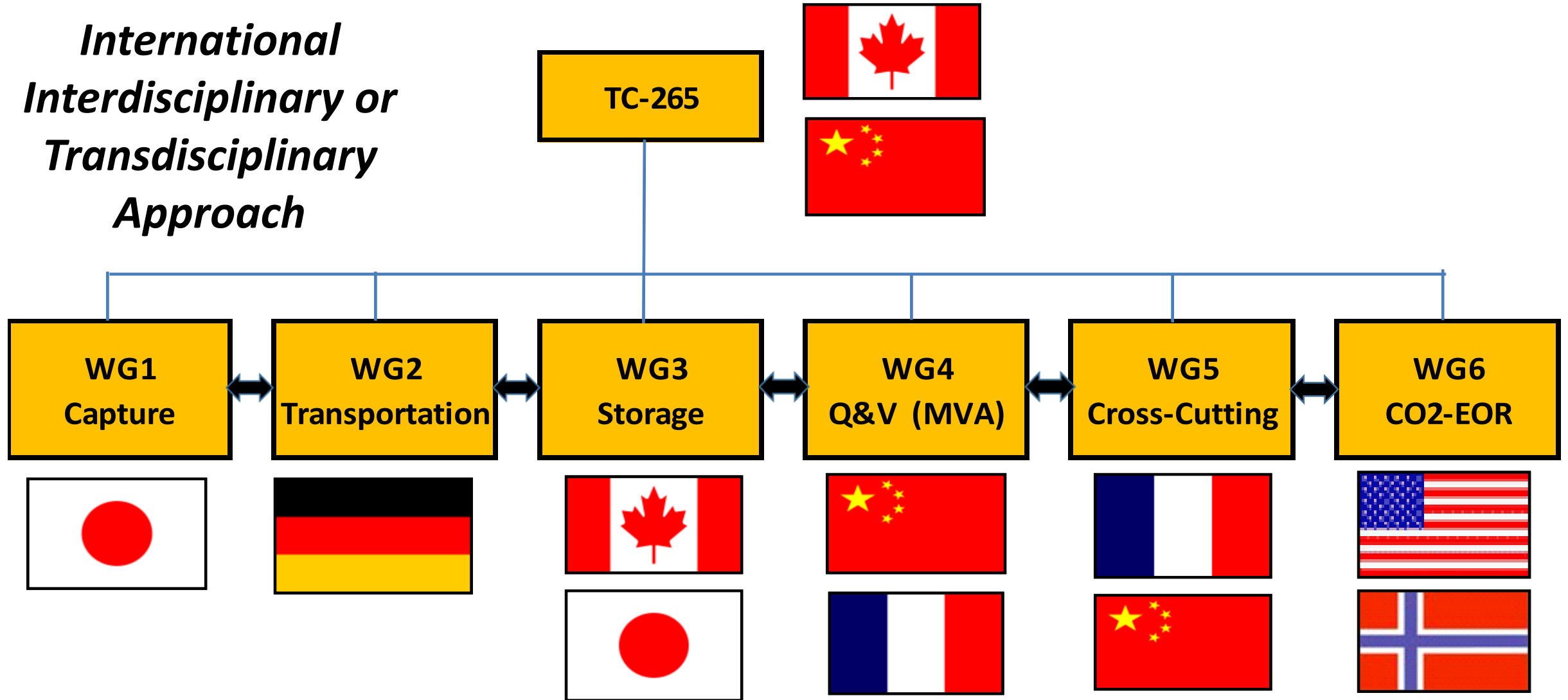
ISO TC 265 – Liaisons

- 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

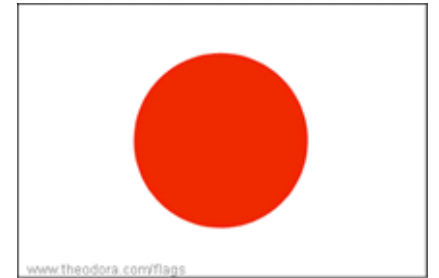
*International
Interdisciplinary or
Transdisciplinary
Approach*



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

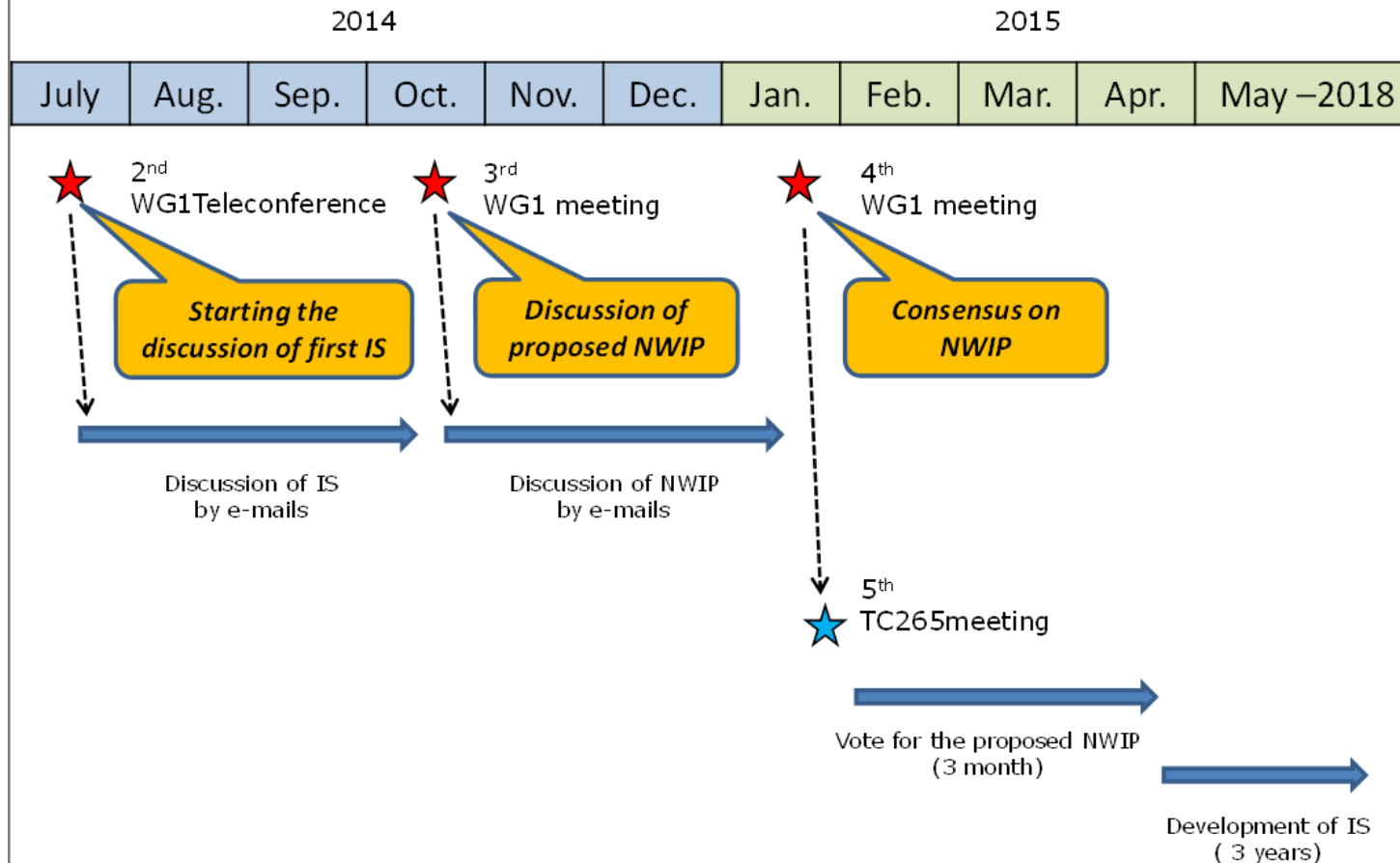


- ✓ 4 US Members
- ✓ All have lead author roles

WG1: Capture

ISO/TC 265/WG1 N053

Proposed schedule for the first IS



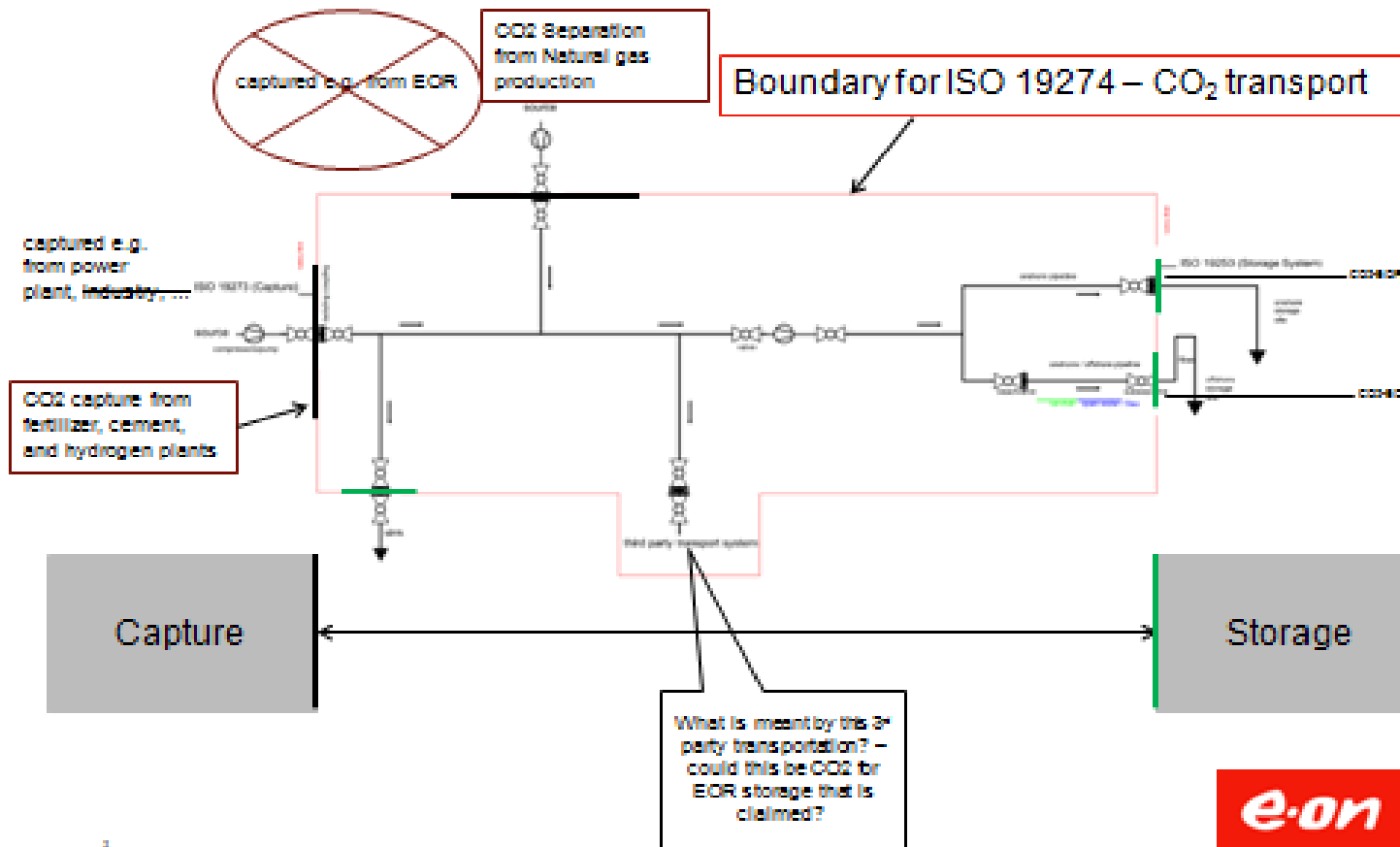
ISO/TC 265 the 2nd WG1 Teleconference, 2014-07-17



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

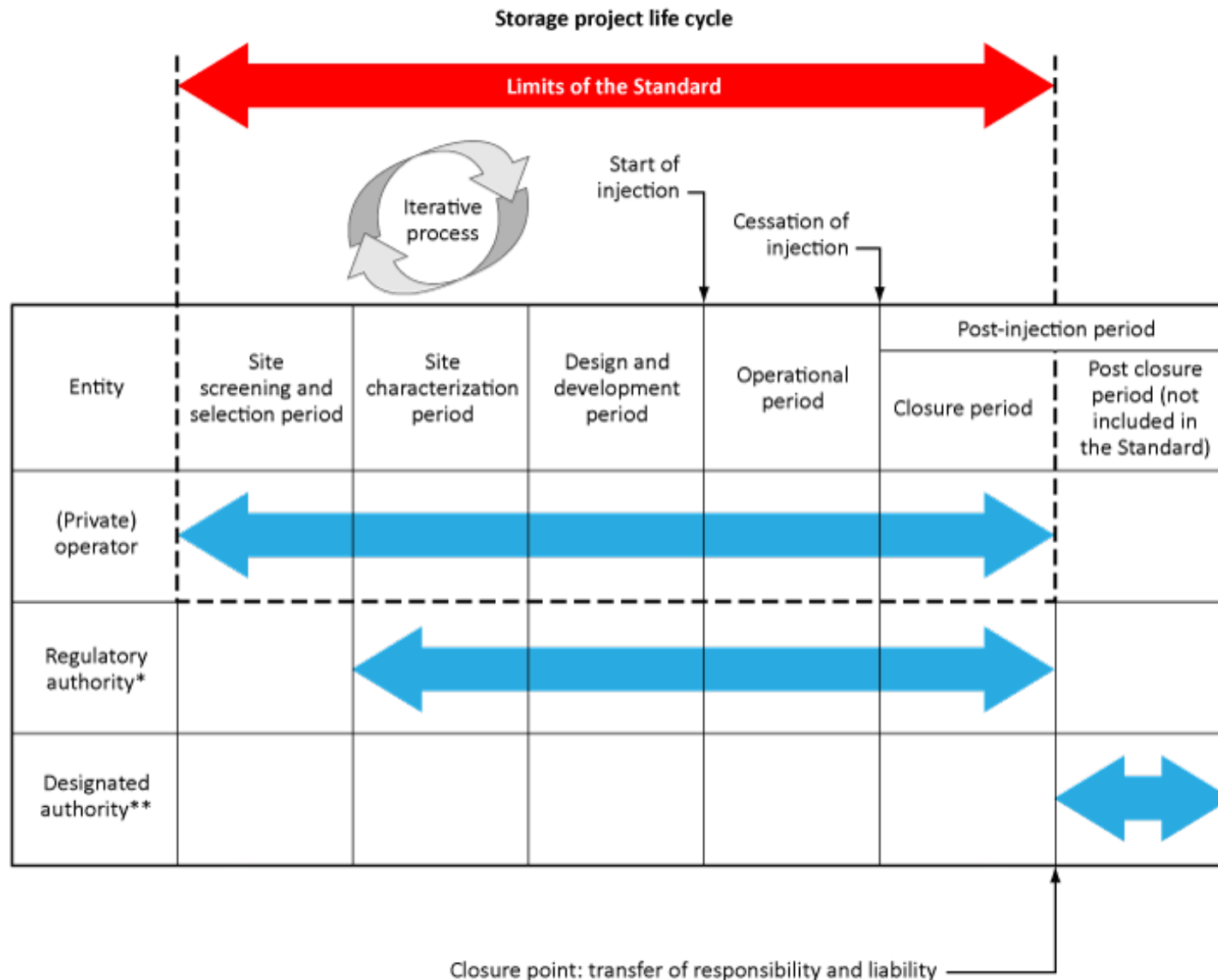
Geological storage of carbon dioxide; Canada (Onshore) Japan (Offshore):

- 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

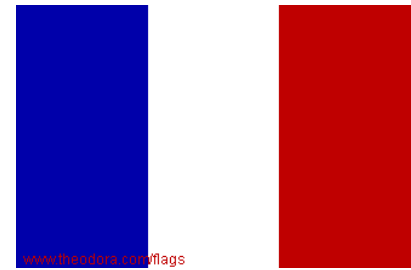
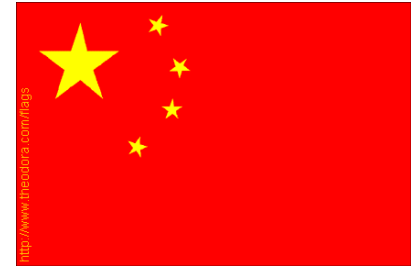


- 750 comments from the Technical Committee

WG4: Quantification & Verification (MVA)

Quantification & Verification Methodology (TR); Led by China, with support from France:

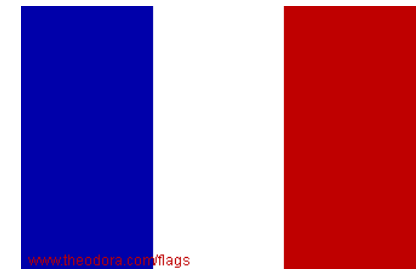
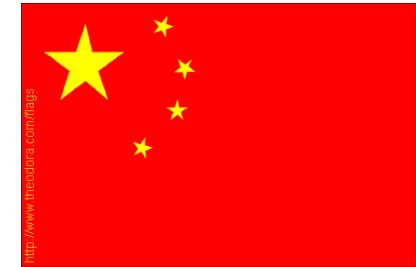
- Project boundary & leakage
- CO₂ quantification
- Monitoring and reporting
- Third party verification
- Life Cycle Analysis



✓ 4 US
Members

WG4: Quantification & Verification

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

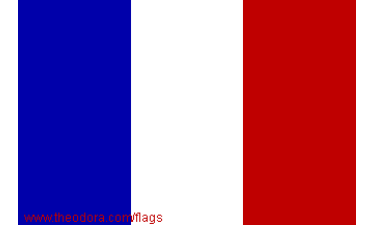


✓ 4 US Members

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



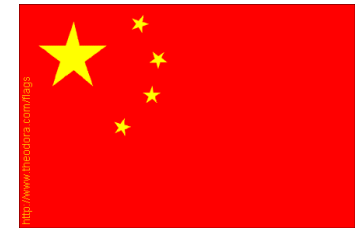
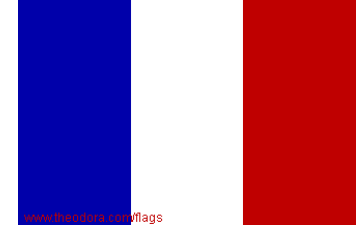
- ✓ 7 US Members
- ✓ Many have lead or co-lead author roles

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*

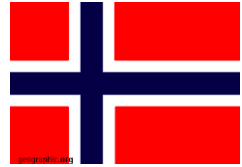
Note: It may include any incidental associated substances derived from the source materials or the capture process, added as a result of commingling for transportation, added to the stream to enable or improve the injection process and/or trace substances added to assist in CO₂ migration detection.



- ✓ 7 US Members
- ✓ Many have lead or co-lead author roles

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

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

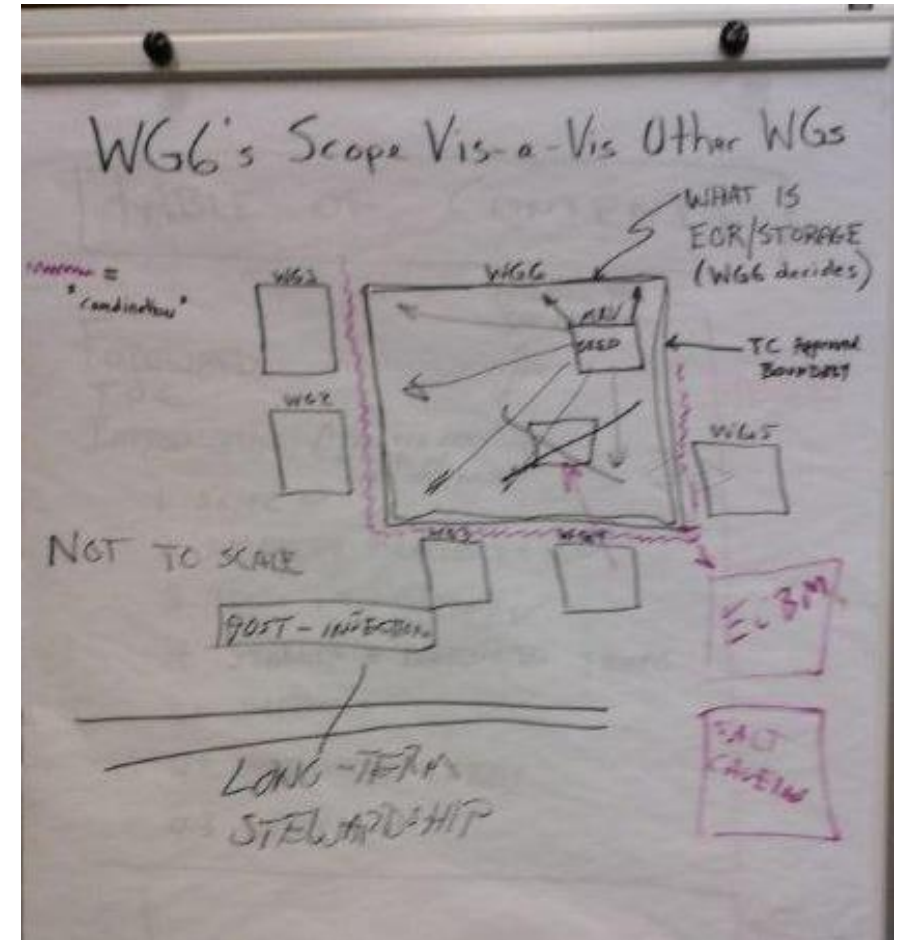
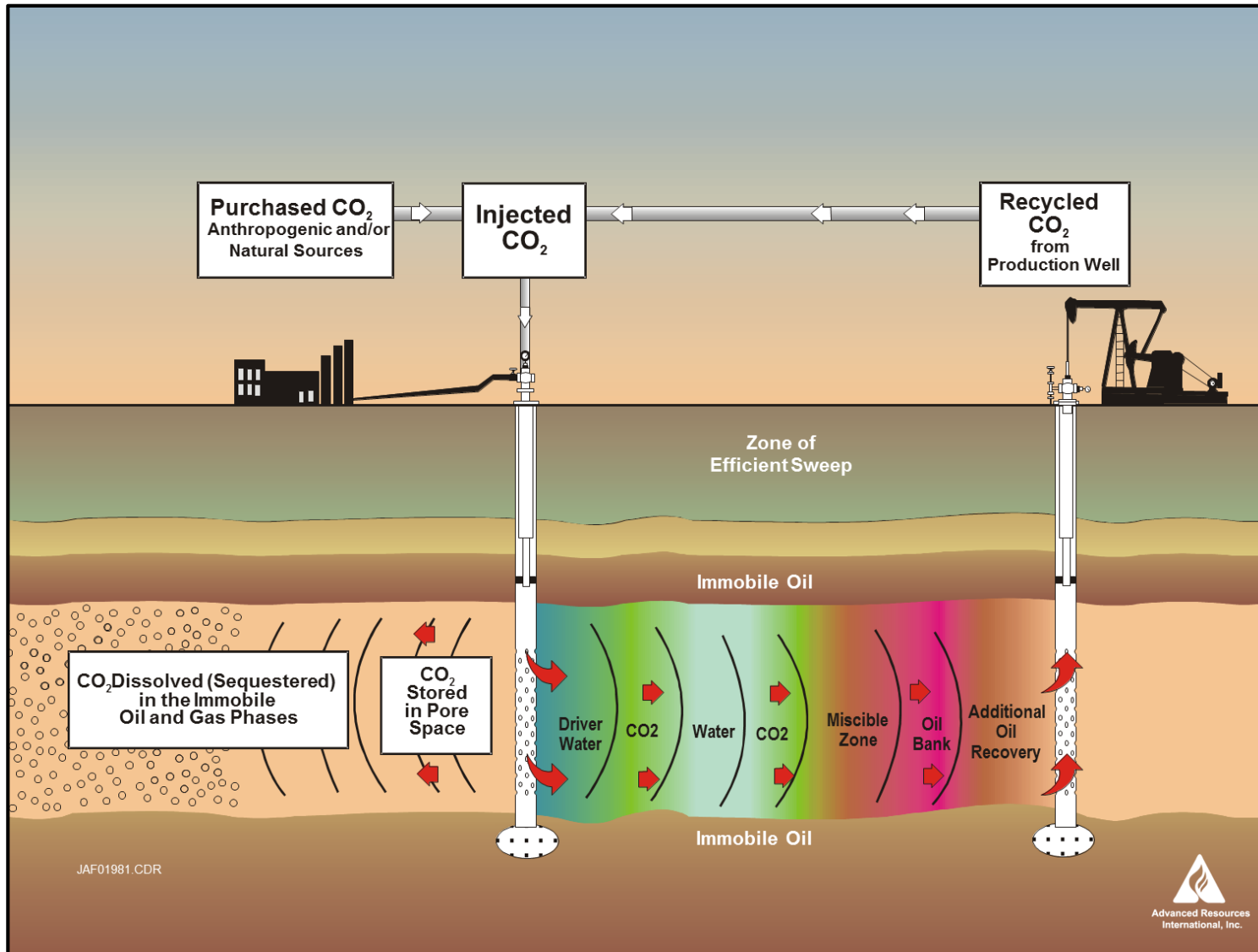
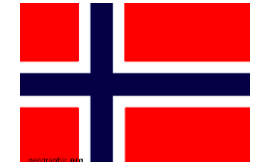


- ✓ 14 US Members
- ✓ 1 - Norway
- ✓ 5 - Canada
- ✓ 2 - Japan
- ✓ 2 - IEA
- ✓ 24 Total Members

Expected:

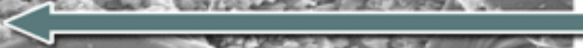
- China
- France
- UK
- Liaisons

WG6: CO2-EOR





IOR



CO₂

3: Why Do This...Next Steps



EOR



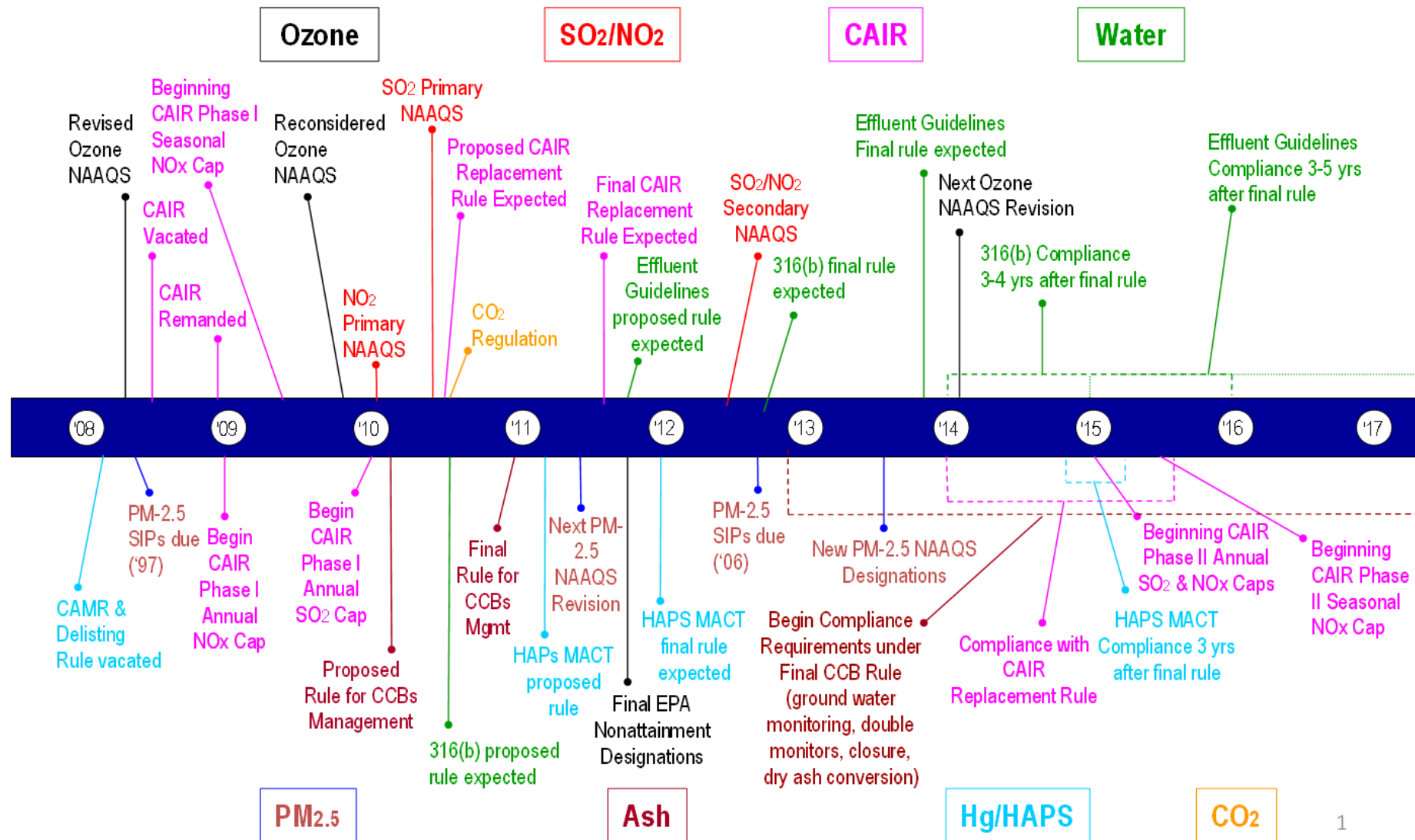
Real-world application



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.”

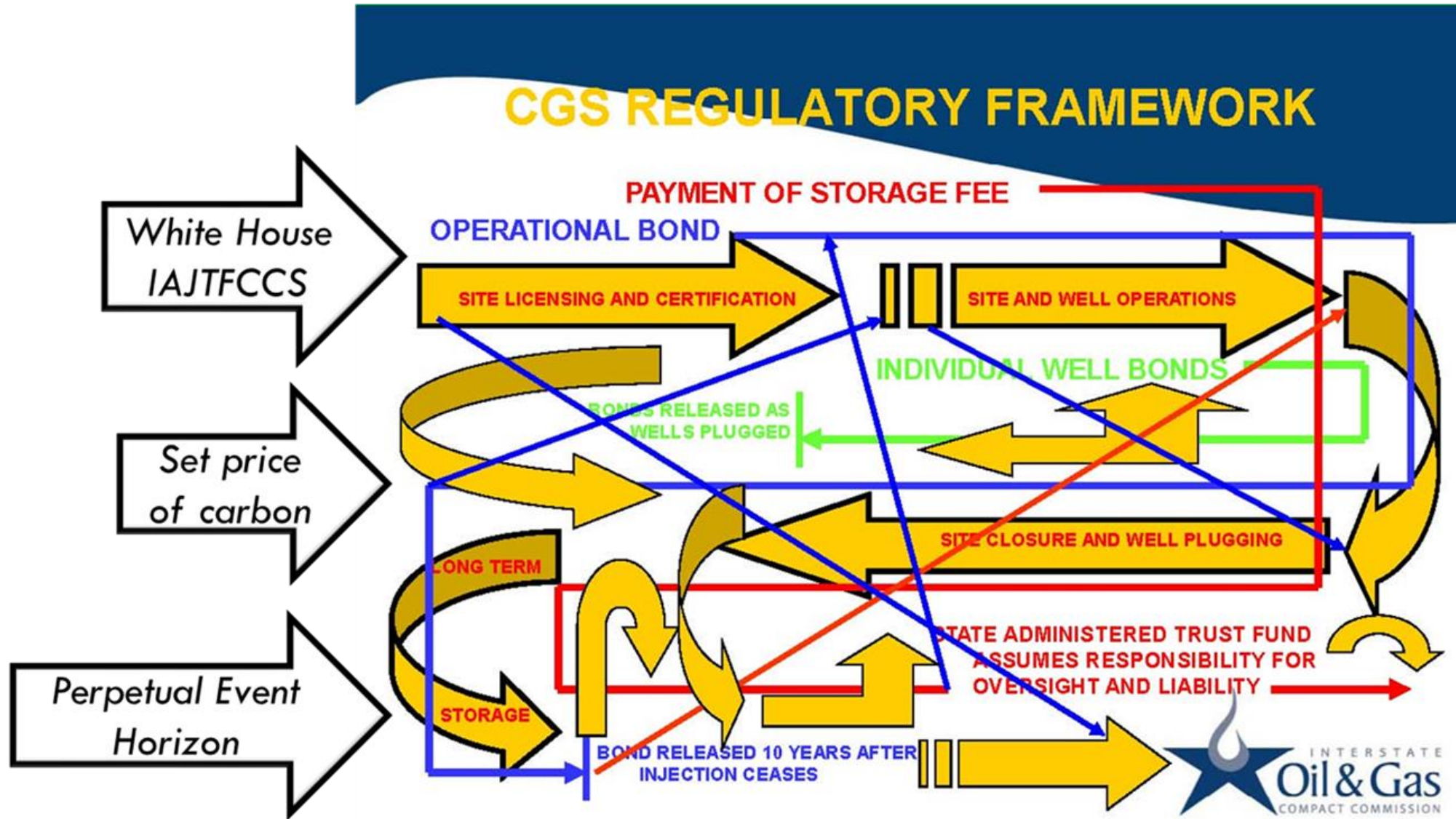
Regulatory Confusion



Source: Edison Electric Institute and Dick Winschel, CONSOL Energy



Regulatory Conflict





United Nations
Framework Convention on
Climate Change

...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 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)
- 45Q tax credits



Next Steps...

- 7th Plenary Meeting in May – Laramie, WY
- Expect draft standards for:
 - Post-combustion capture DIS
 - CO₂ transportation by pipeline DIS
 - Storage in saline/stacked reservoirs DIS
 - Risk Analysis & LCA TR
 - CO₂-EOR DIS



School of
Energy Resources

UNIVERSITY OF WYOMING



Carbon Management
Institute

UNIVERSITY OF WYOMING



Enhanced Oil
Recovery Institute

Thank You for Your Attention

Enhanced Oil Recovery Institute

www.uwyo.edu/eori/

Steven Carpenter, Director

steven.carpenter@uwyo.edu

307-315-6442

513-460-0360

