



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

*Prepared By:*

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***Unconventional Resources • Enhanced Recovery • Carbon Sequestration***



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# Acknowledgement & Discussion

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**Traci Rodosta**, Director, Sequestration Division & Coordinator,  
Regional Carbon Sequestration Partnership – DOE-NETL

**Mark Ackiewicz**, Division of CCS Research –Program Manager,  
DOE-FE

**Jerry Hill**, Technical Advisor, SSEB

## Topics of Discussion:

- Standards
- ISO process
- TC-265



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# Standards

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# What are Standards?

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- 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?

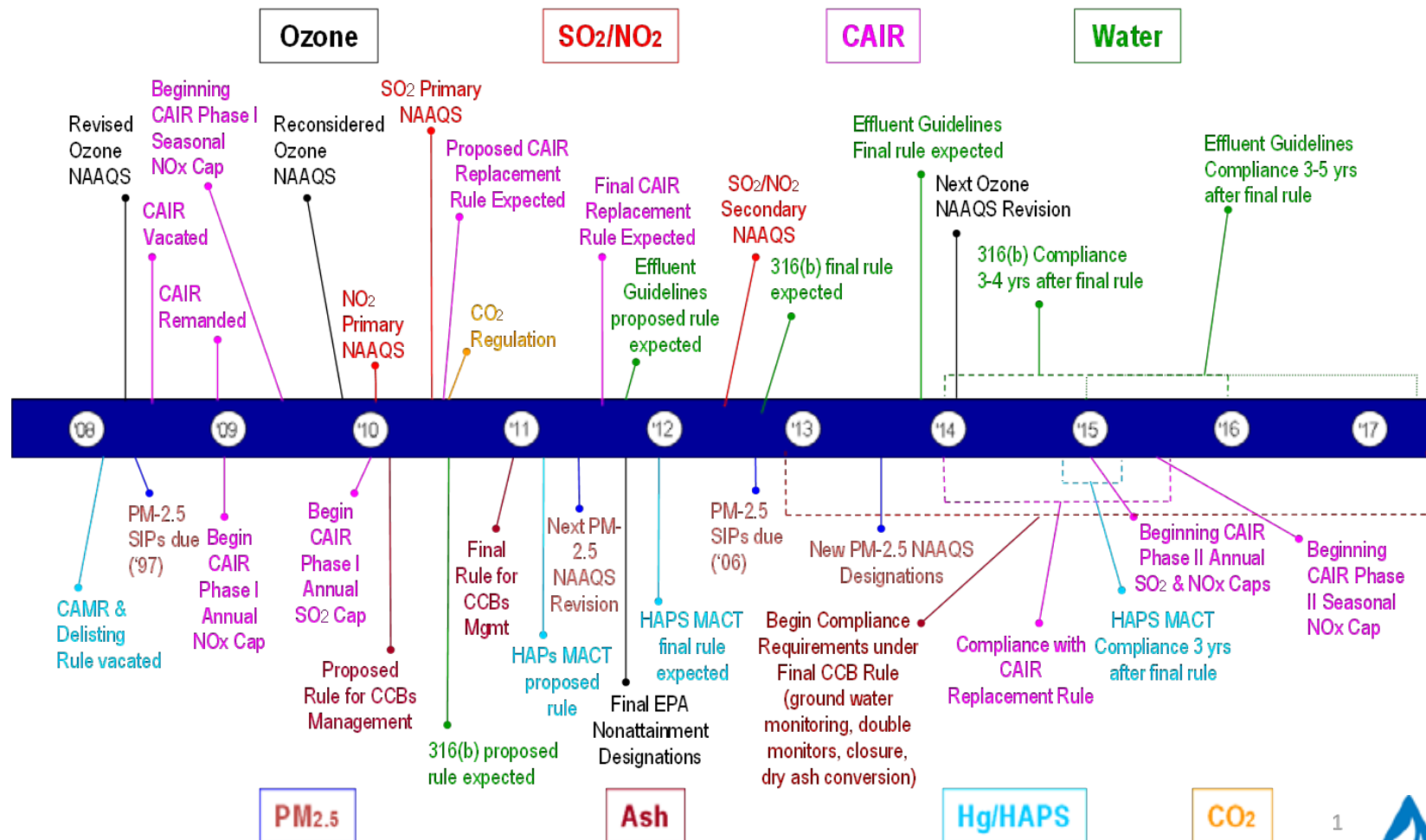
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- Because they are not laws...
  - *Standards & regulations can work together*
- Not Mandated
- Typically initiated by industry...
  - *And therefore better received and used by industry because they are part of the process*
- Demonstrate regulatory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



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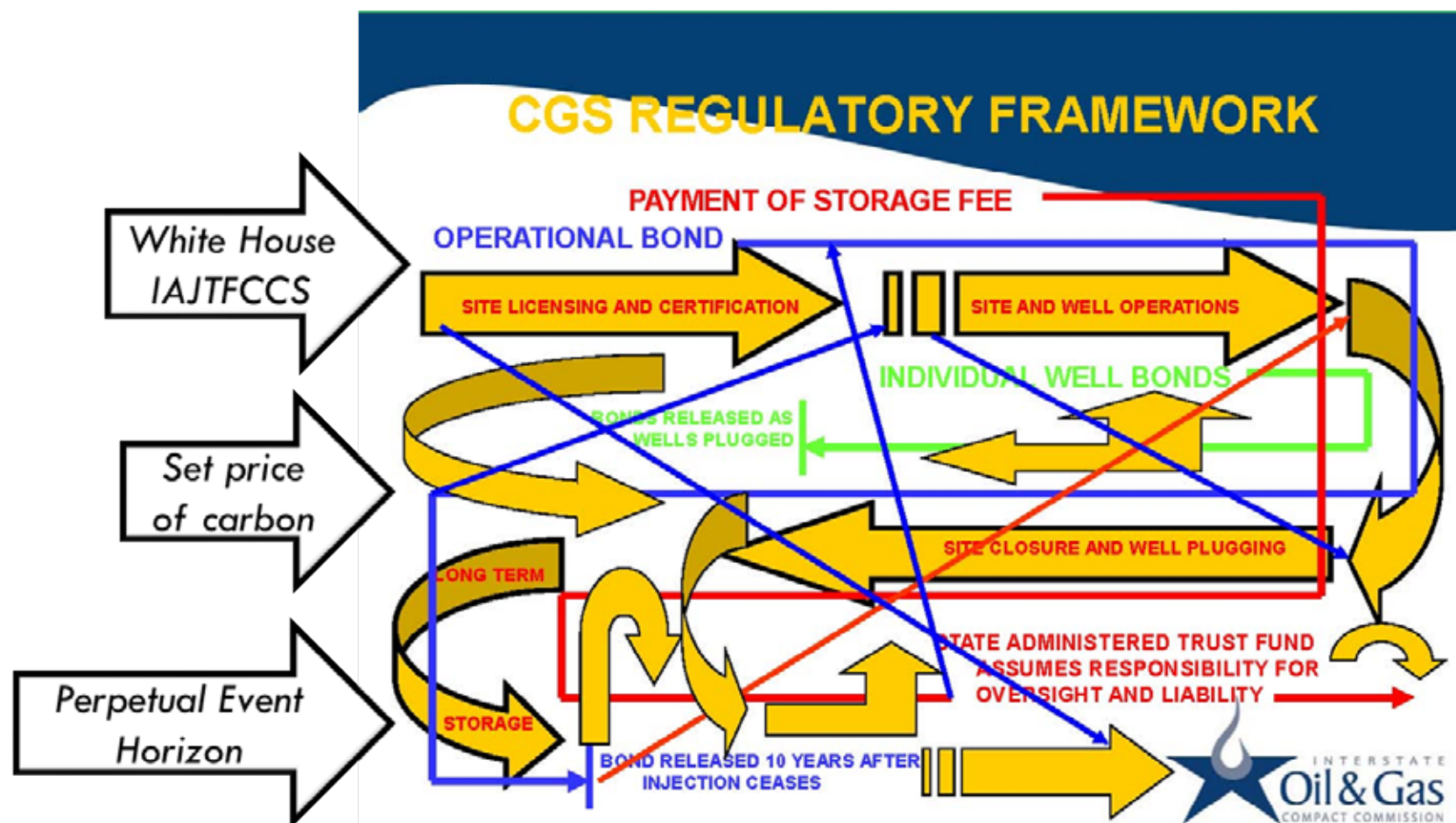
# EPA's Regulatory "Train Wreck"



Source: Edison Electric Institute and Dick Winschel, CONSOL Energy



# CCS Regulatory “Train Wreck”



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# Must INCLUDE any and all...

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



All-Inclusive



Club Viva Fortuna



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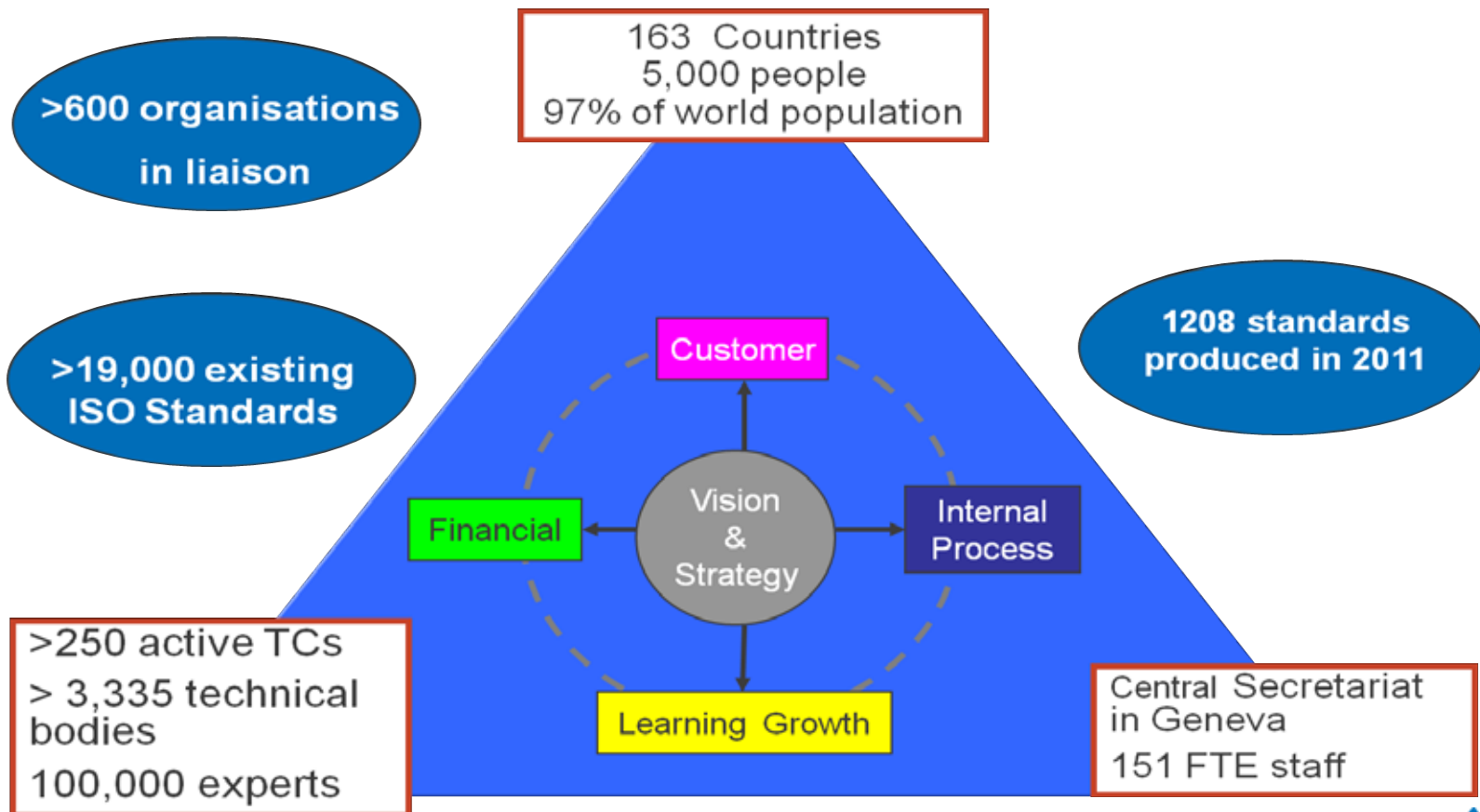


# International Organization for Standardization (ISO)



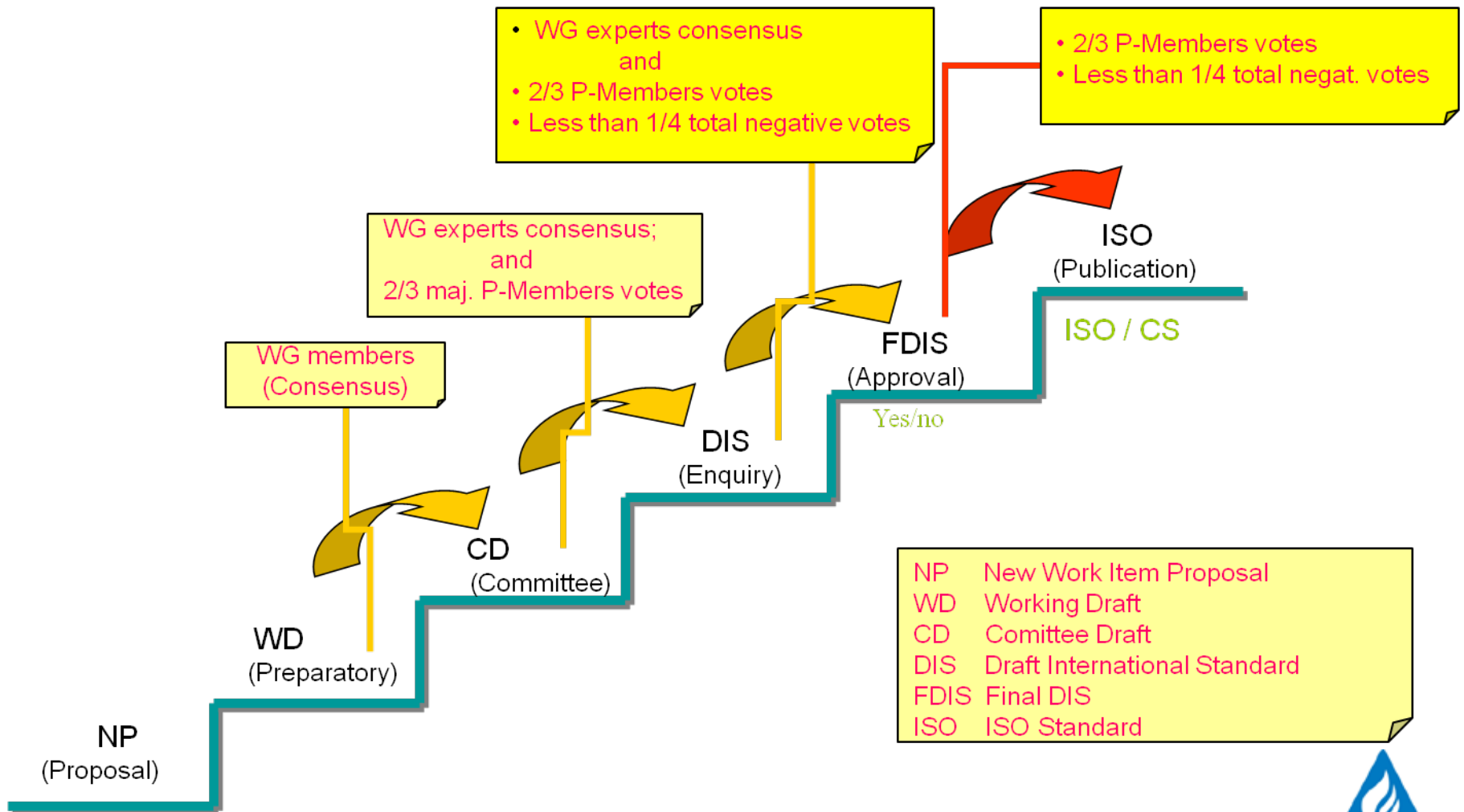
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# ISO = A Global System



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# ISO Standards Development



# ISO Standards Development

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- 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



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# SECARB...beyond the awards!

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- Carbon Sequestration Leadership Forum (CSLF) endorsement
- Favorable review by the IEAGHG Program
- State of Alabama Engineering Hall of Fame
- Chairman's Award from the Southeastern Electric Exchange



= Expertise

# SECARB Expertise Globally

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## Z-741-12 – Seed Document

- Jorg Aarnes, *DNV*
- Mike Blincow, *Denbury*
- Steve Carpenter, *ARI*
- Ian Duncan, *UT-BEG*
- Richard Esposito, *SoCo*
- Joe Kelly, *ADEM*
- Nino Ripepi, *VT*
- **3 of 8 Lead Authors**
- **19% of total expertise on the Panel**



Standards Council of Canada  
Conseil canadien des normes



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# SECARB Expertise Globally

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## US TAG to TC-265

- Richard Esposito, *SoCo*
- Sue Hovorka, *UT-BEG*
- George Koperna, *ARI*
- Shahab Mohaghegh, *WVU*
- Jack Pashin, *GSA/OSU*
- Nino Ripepi, *VT*
- Kimberly Sams, *SSEB*
- Greg Schnacke, *Denbury*
- Mike Surface, *Dominion*
- Burt Thomas, *USGS*
- Steven Carpenter, *ARI*

## International WG's:

- WG1: Capture
- WG2: Transportation
- WG3: Storage
- WG4: Q&V (MVA)
- WG6: CO2-EOR

**~40% of total expertise  
on the US TAG**



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# ISO TC-265

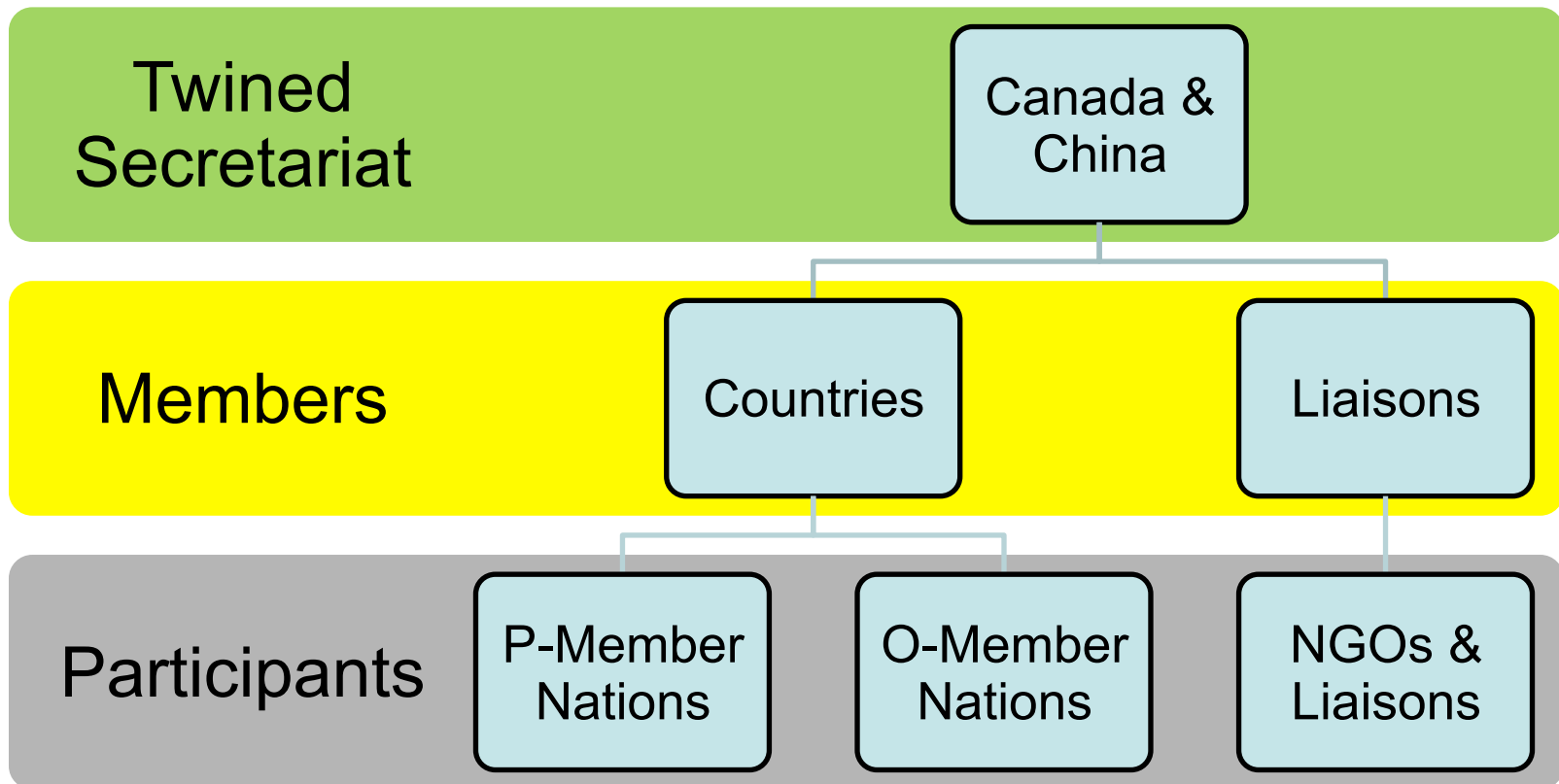
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# ISO TC 265 – CCS Organization

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# ISO TC 265 – P-Members

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## Participating Countries:

Australia

Canada

China

France

Germany

India

Italy

Japan

Korea

Malaysia

Netherlands

Norway

South Africa

Spain

Sweden

Switzerland

United Kingdom

United States (ANSI)

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



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# ISO TC 265 – O-Members

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## 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*



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# ISO TC 265 – Liaisons

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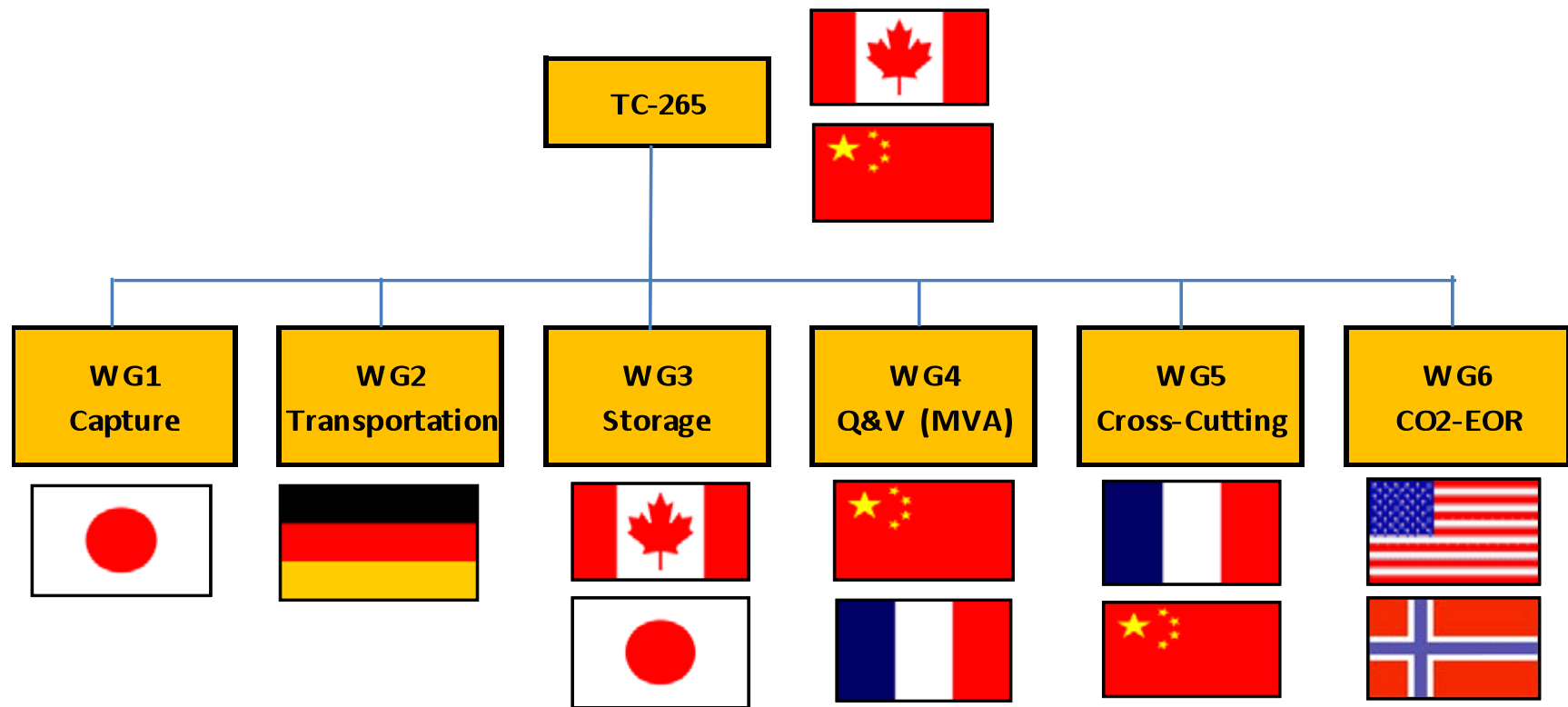
- ISO TC207 Environmental Management
- ISO TC67 Petroleum and Natural Gas
- CEN/TC 234 Gas Infrastructure
- Carbon Sequestration Leadership Forum (CSLF)
- European Industrial Gases Association (EIGA)
- Global CCS Institute (GCCSI)
- International Energy Association (IEA)
- IEAGHG
- CO2 GeoNet
- World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

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



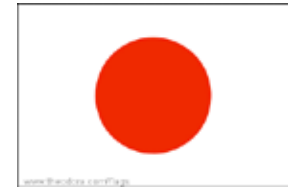
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# TC-265 Working Groups



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# 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<sub>2</sub> streams
- Monitoring, management systems
- Plant retrofitting

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



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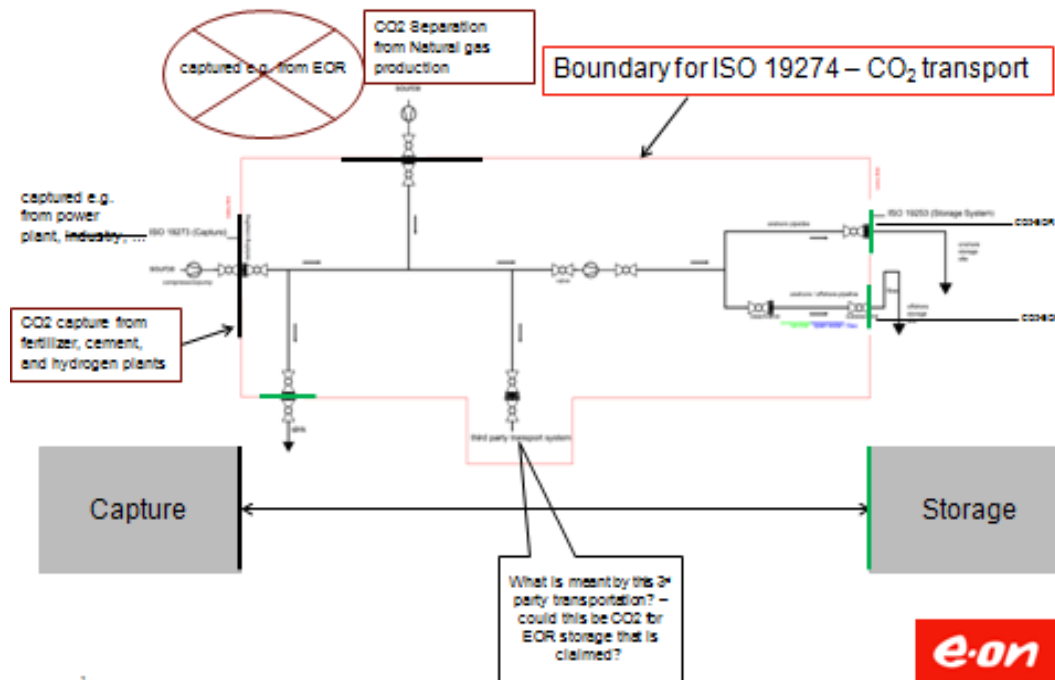


# WG2: Transportation



## Pipeline transportation systems boundaries:

### Definition of CO<sub>2</sub> 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 CO<sub>2</sub>



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# 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



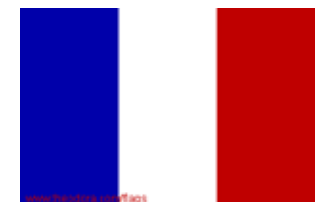
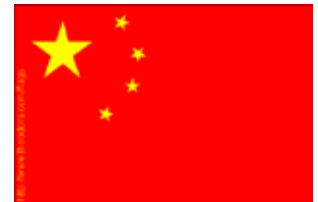
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# WG4: Quantification & Verification

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

- Project boundary & leakage
- CO<sub>2</sub> quantification
- Monitoring and reporting
- Third party verification
- Life Cycle Analysis

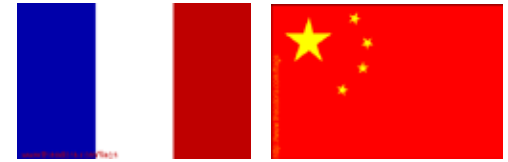


✓ 4 US  
Members



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# WG5: Crosscutting Issues



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

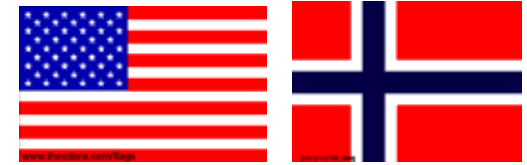
- Terminology
- Definitions
- System Integration
- Public Participation & Engagement
- Mixing of gas streams from different sources

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



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# WG6: CO<sub>2</sub>-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 WGs1-5

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

### Expected:

- China
- France
- UK
- Liaisons



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# Next Steps...

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- Three plenary meetings to date – Europe & Asia
- April 2014 – WG & Plenary Meeting – Berlin
- Summer 2014 – US TAG meeting – Cleveland
- Fall 2014 – WG & Plenary Meeting – TBD
- Spring 2015 – WG & Plenary Meeting – Norway
- 36 months to deliver draft
- 24 months to resolve issues
- *THE CLOCK IS RUNNING*



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# Thank you



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***<http://adv-res.com/>***



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# Back-up & Supporting Slides

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# US TAG Membership

Carpenter	Steven	Chair, WG2 & WG6	ARI
Batum	Melissa		BOEM
Coddington	Kipp	WG3 & WG6	NACCSA
Comello	Stephen	WG5	Stanford
Duguid	Andrew	WG3 & WG6	Schlumberger
Ekmann	Jim	WG1	Leonardo Tech
Esposito	Richard	WG3 & WG6	Southern Company
Feldman	Arnie	WG1 & WG5	JJD Environmental
Forbes	Sarah	WG5	WRI
Frailey	Scott	WG3 & WG6	Illinois GS
Greenberg	Sallie	WG5 & WG6	Illinois GS
Herzog	Howard	WG1	MIT
Hill	Bruce	WG3 & WG6	CATF
Hovorka	Sue	WG6	UT-BEG
Hnottavange-Telleen	Ken	WG5	Schlumberger
Jenvey	Nigel	WG6	BP
Koperna	George	WG6	ARI
Marston	Phil	WG5 & WG6	Marston Law
Mohaghegh	Shahab	WG4	WVU
Pashin	Jack	WG3	OSU
Ripepi	Nino	WG4	VT
Sams	Kimberly	WG3	SSEB
Schnacke	Greg	WG2 & WG6	Denbury
Surface	Michael	WG1	Dominion
Thomas	Burt	WG4	USGS
Van Voorhees	Bob	WG3 & WG5 & WG6	USCCSA
Wade	Sarah	WG4 & WG6	Wade, LLC
Woods	Mark	WG1	Booz Allen Hamilton



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Ad-hoc Working Group on Boundary Conditions  
- after discussion (Status: Dec. 16<sup>th</sup> 2013)

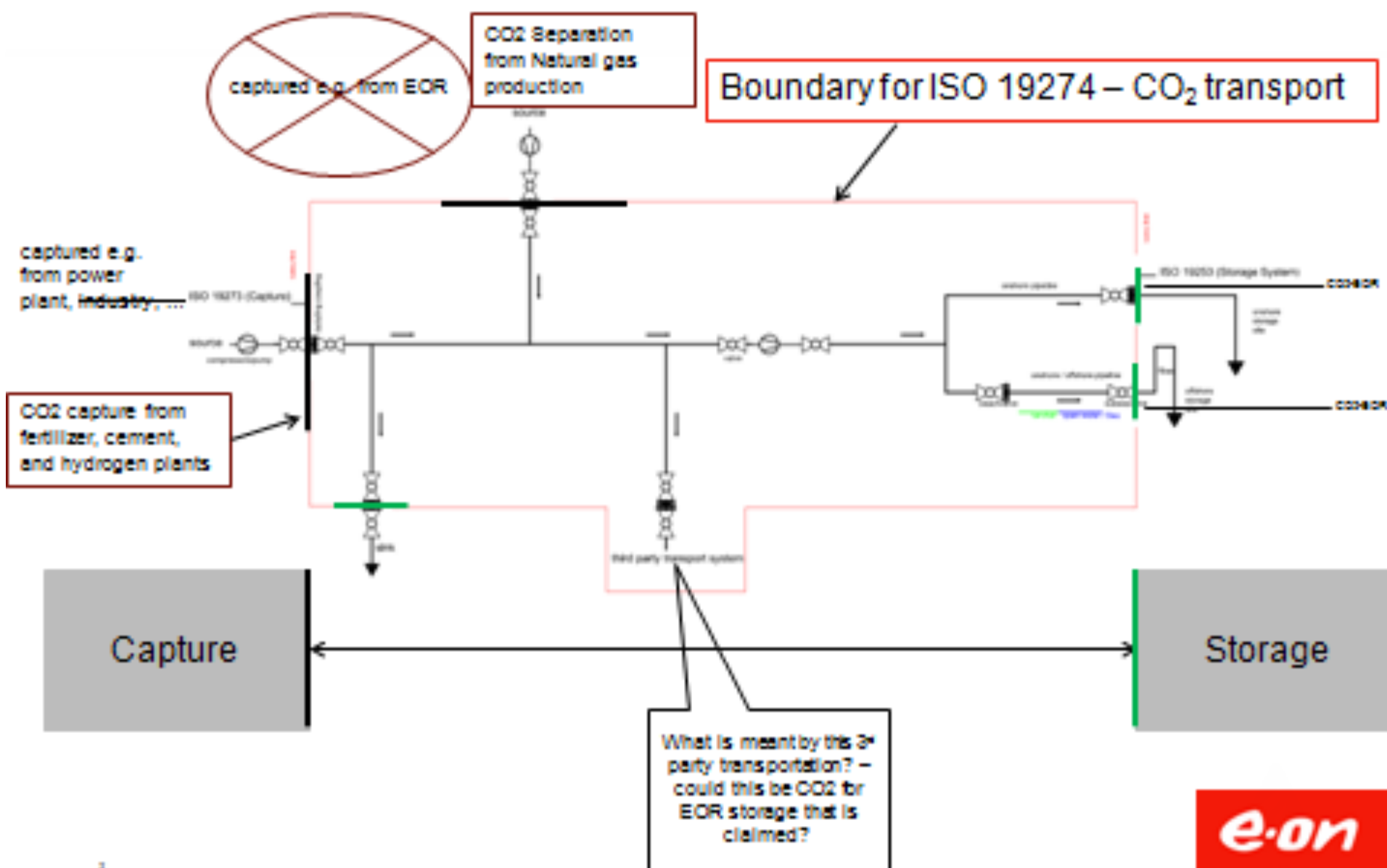
US TAG comments added (28 FEB 2014)

ISO TC 265

## Further Thoughts (still valid)

- The transport system is in most cases a buried pipeline with active corrosion protection. Hence, inlet and outlet are technically defined by an isolating joint with a ball valve to separate the transport system from the inlet and outlet.
- For off-shore pipeline systems active corrosion protection ends at the beach valve and the transport system ends at the last subsea valve before the riser to the offshore platform
- These boundaries depend on technical conditions
- Non-technical reasons, such as legal or commercial, are not considered here; such reasons may cause the boundaries between capture/transport or transport/storage to be somewhat shifted.

## Definition of CO<sub>2</sub> Transport Boundaries



## Definition of CO<sub>2</sub> Transport Boundaries

### Capture/Transportation Boundary:

From the point at the inlet valve of the pipeline, where the composition, temperature, and pressure of the CO<sub>2</sub>-stream can be guaranteed in a certain range by the capture process or processes to meet the requirements for transportation as described in ISO 18274

### Transportation/Storage Boundary:

The boundary between the transportation and storage is the point where the CO<sub>2</sub> leaves the pipeline infrastructure and enters the storage infrastructure.

#### Onshore

In most cases the boundary will be defined by an isolating joint with a ball valve to separate the storage inlet from transportation outlet.

#### Offshore

In most cases the end of the transport system will be at the last subsea valve before the riser to the offshore platform.

Capture

Storage

## Thoughts provided by US TAG to WG2 regarding boundary conditions for ISO TC-265

Slide 3 ("Definition of CO<sub>2</sub> Boundaries") has four conceptual challenges:

- (1) As a matter of infrastructure, it seems to be premised on a simple, linear "source-pipeline-sink" model. This needs to be updated to take into account network scenarios. Consideration needs to be made to account for multi-source-multi sink geometry. This is important for CCS success globally, and how this works merging the current commercial pipeline network with a GHG accounting framework needs work.
- (2) CO<sub>2</sub>-EOR may be considered at some level as a source of CO<sub>2</sub>, but it is much more likely to be considered as a sink. The process flow diagram should be updated to show CO<sub>2</sub> as a sink
- (3) Existing CO<sub>2</sub>-EOR operations that do not seek or claim storage should be explicitly excluded.



## Thoughts provided by US TAG to WG2 regarding boundary conditions for ISO TC-265

Slide 3 ("Definition of CO<sub>2</sub> Boundaries") has four conceptual challenges (con'd):

(4) Similarly, it is critically important to define the boundary where CO<sub>2</sub>-EOR wants to claim storage.

(5) Natural CO<sub>2</sub> sources should be excluded. Under US federal law, this perhaps could be done by, for example, referencing the domes/sources that are subject to subpart PP of the GHG Reporting Rule. We might also address this through a definition of "anthropogenic CO<sub>2</sub>".

(6) Increase breadth of possible sources needs consideration (e.g. CO<sub>2</sub> capture from gas processing). Where is boundary between LaBarge type gas stripping and Brave dome type CO<sub>2</sub> production?

## Thoughts provided by US TAG to WG2 regarding boundary conditions for ISO TC-265

Slide 3 ("Definition of CO2 Boundaries") has four conceptual challenges (con'd):

(7) Exclude pipeline transportation within a multi-well facility boundary (e.g. distribution and flow lines). This is especially important in EOR, but has relevance to all storage, which if commercial will be multi-well endeavors. The way it is drawn seems good, at project boundary.

(8) Differentiation needs to be suggested between CO2-EOR that is greenfield vs. brownfield.