



# Overview of ISO:27916 Standard as an Alternative to EPA GHGRT Subpart RR

Dr. Steven M Carpenter  
Chair, US TAG/NMC ISO TC-265 CCUS  
Director, Enhanced Oil Recovery Institute

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## Speaker



**Dr. Steven M. Carpenter**



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## Discussion Topics

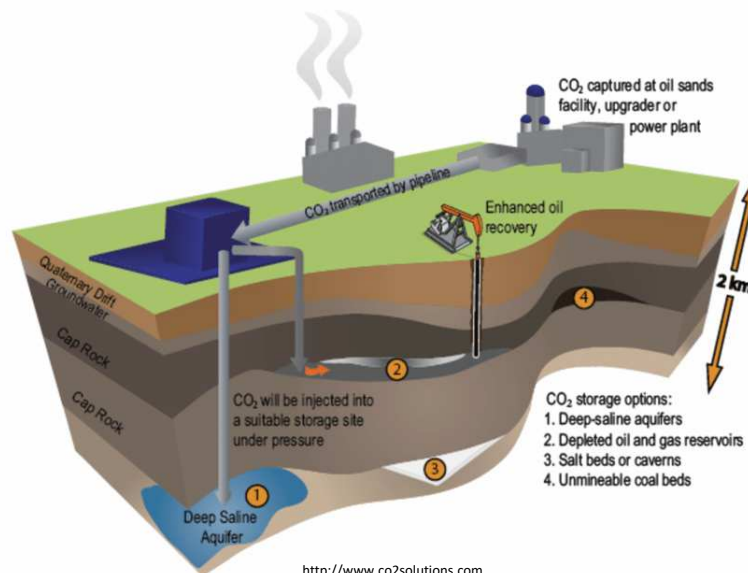


- Introductions, Ground rules, Context
- 45Q Tax Credits
- What are the issues?
- ISO:27916
- Questions, Comments, Concerns



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# Carbon Capture Utilization & Storage



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## CCUS Economics 101



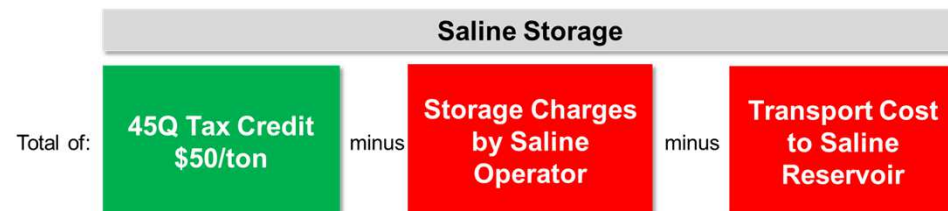
### Cost of Capture

- Equipment x Financing % Rate
- O&M
- Energy penalties

Less than:



OR



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## IRS 45 Tax Credits for CARBON OXIDES



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## EIEA & ARRA



- Section 45Q was enacted as part of the **Energy Improvement and Extension Act of 2008** and amended by the **American Recovery and Reinvestment Act of 2009**.
- Provides a tax credit for CO<sub>2</sub> storage
  - **\$20/tonne** for saline storage
  - **\$10/tonne** for EOR
  - Limited to **75 million tonnes**



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## 2018 FUTURE ACT

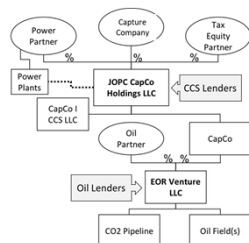
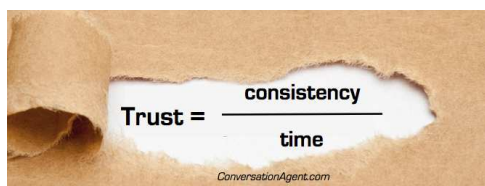


- Amended the 2008/2009 45Q tax credit
- Provides a tax **credit** for CO<sub>2</sub> storage:
  - From \$20/tonne to **\$50/tonne** for saline storage
  - From \$10/tonne to **\$35/tonne** for EOR
  - From 75 million tonnes to **no limit**
  - Must **begin** by December 31, 2023
  - Runs for **12 years**



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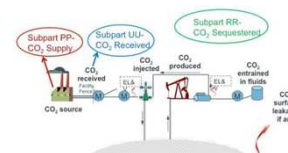
## The Issues



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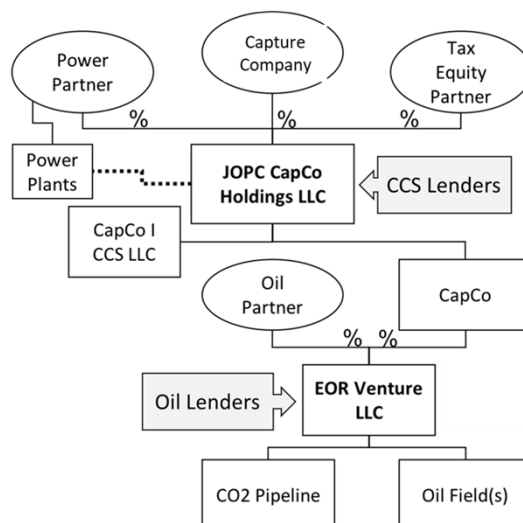
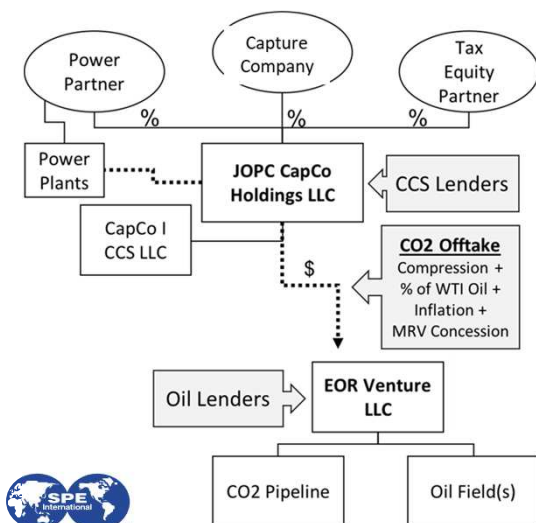
## In order to get the credit...

1. Must **"beginning of construction"** by December 31, 2023
  - What is the definition of "beginning"?
  - This provides **uncertainty** for investors to move forward with financing
2. The credit must be **transferable**
  - From the CAPCO to STORCO
  - Must have a tax liability for there to be any value
3. Must certify **"safe and secure storage"**
  - What is safe and what is secure?

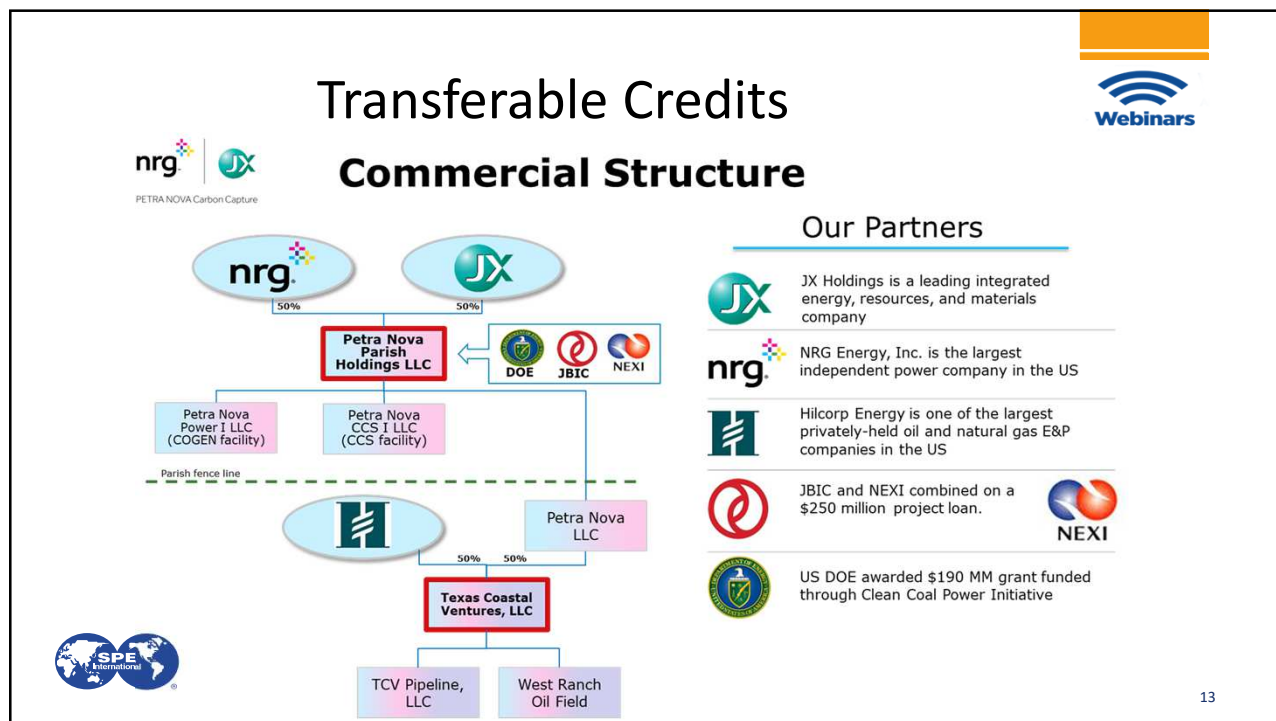


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## Transferable Credits

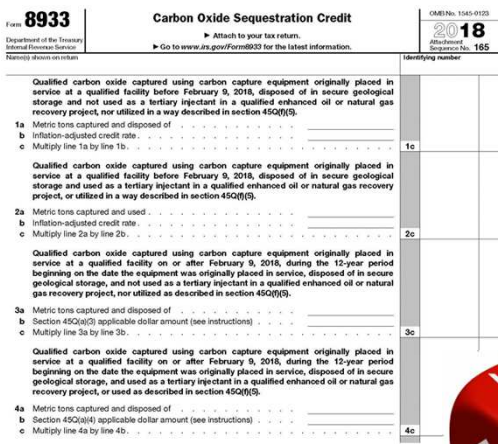


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## Safe & Secure Storage



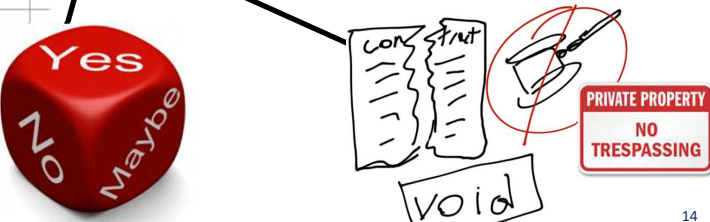


### Secure Geological Storage

This includes storage at deep saline formations, oil and gas reservoirs, and unminable coal seams under such conditions as the IRS may determine under regulations.

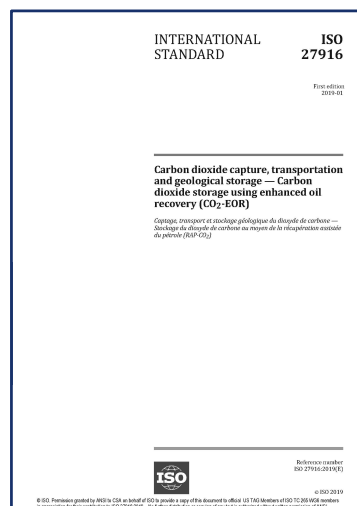
After 2010, the following apply.

- Secure geological storage requires approval by the U.S. Environmental Protection Agency (EPA) of a Monitor, Report and Verify Plan (MRV Plan) submitted by the operator of the storage facility or tertiary injection project.
- The annual amount of carbon oxide claimed for the credit must be reconciled with amounts reported to the EPA under its Greenhouse Gas Reporting Program, subpart RR.



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<https://www.hewbordenave.com/2012/01/draw-the-law>

# International Standards Organization

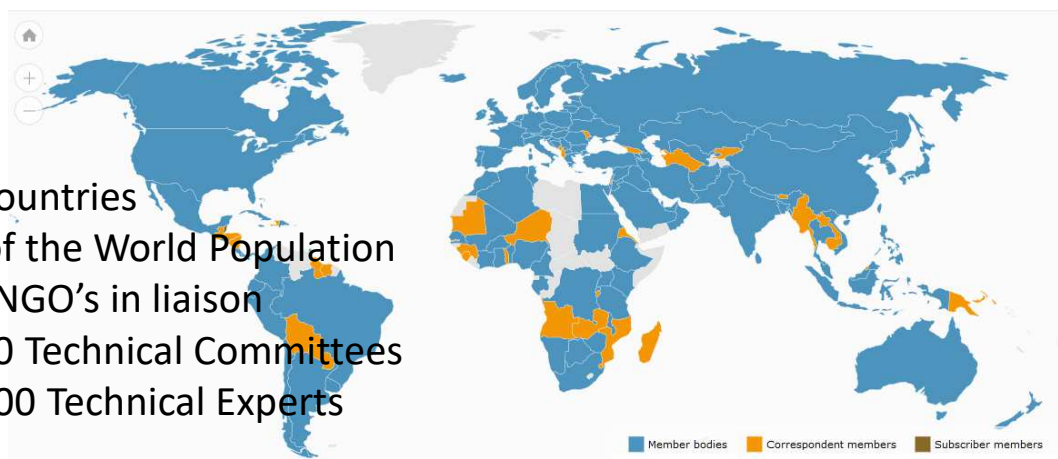


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## ISO = A Global System

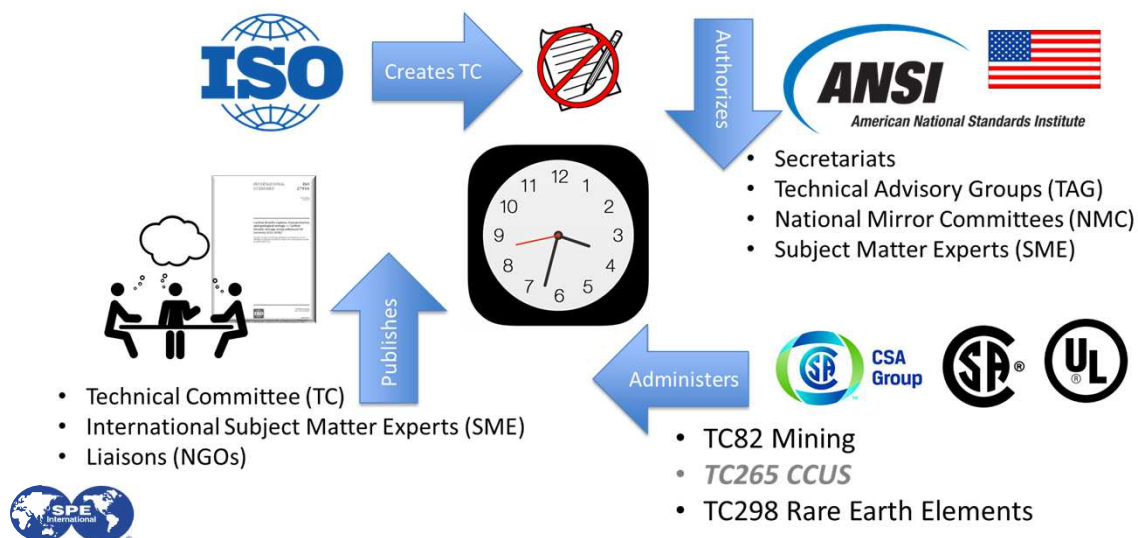


- 162 Countries
- 97% of the World Population
- >600 NGO's in liaison
- >3,000 Technical Committees
- 100,000 Technical Experts



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## ISO & United States Member Body



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## Scope of TC-265 CCUS

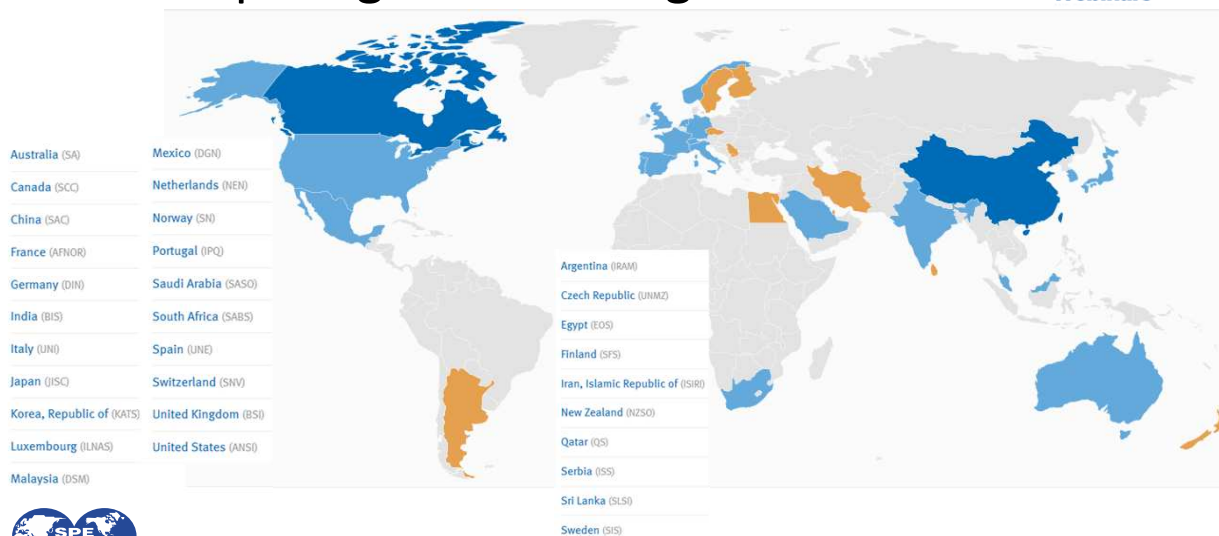


Standardization of design, construction, operation, and environmental planning and management, risk management, quantification, monitoring and verification, and related activities in the field of carbon dioxide capture, transportation, and geological storage (CCS).



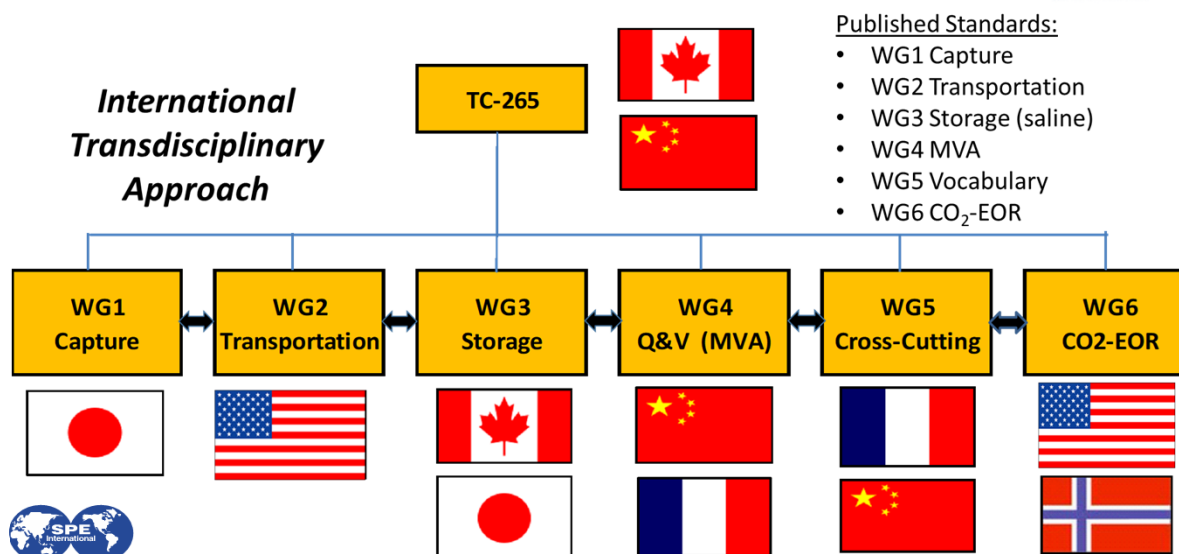
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## Participating & Observing Members



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## TC-265 Structure (Working Groups)

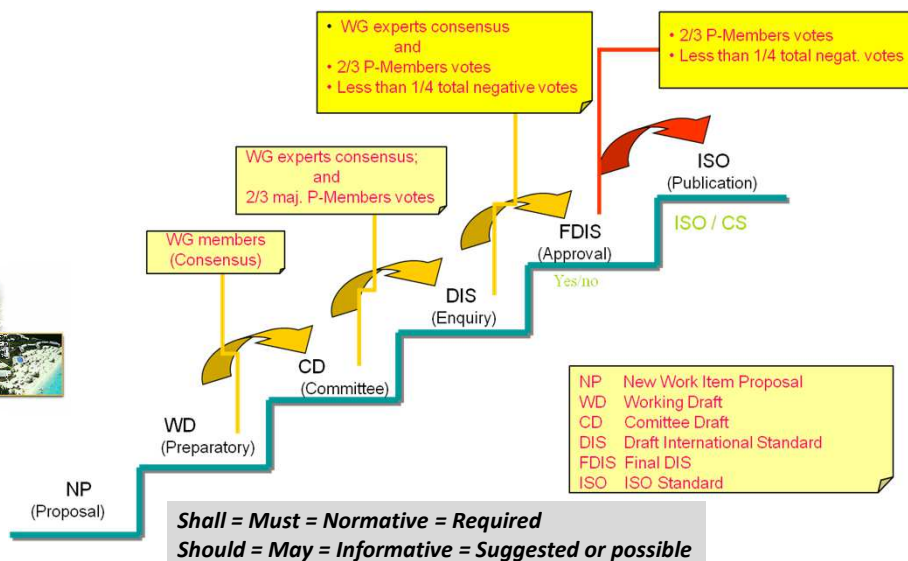


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## Process to Publish a Standard



All-Inclusive



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## 27916: CO<sub>2</sub>-EOR TOC



1. Scope
2. Normative references ISO Required Boilerplate
3. Terms and definitions
4. Documentation
5. EOR complex description, qualification, & construction
6. Containment assurance & monitoring within the EOR complex
7. Well construction
8. Quantification
9. Recordkeeping
10. Project termination



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## Section 4: Documentation



- Intended to facilitate documentation of the ***safe, long-term containment***, and the ***quantification of associated storage of CO<sub>2</sub>*** in EOR operations
- **Initial documentation** to include:
  - storage complex & site description
  - containment assurance
  - monitoring plan
  - quantification method
  - assessment of CO<sub>2</sub> injection history
- **Periodic documentation** to include:
  - quantity of CO<sub>2</sub> stored
  - back up data
  - quantification notes
  - verification statement



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## Section 5: EOR complex description



Designed to ***demonstrate*** that the EOR complex ***is adequate*** to provide ***safe, long-term containment of CO<sub>2</sub>*** and shall include site-specific and other information pertaining to:

- a) geologic characterization of the EOR complex
- b) a description of the facilities within the CO<sub>2</sub>-EOR project
- c) a description of all wells and other engineered features in the CO<sub>2</sub>-EOR project
- d) the operations history of the project reservoir.



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## Section 6: Containment Assurance



An **initial assessment** of potential leakage pathways

An **assurance** that operations consistent with containment of CO<sub>2</sub> that may include:

- a) unexpected changes in project performance that have potential to influence storage
- b) addition or abandonment of injection zones
- c) change to the areal extent of the project reservoir
- d) addition or abandonment of wells
- e) anomalous change of injection-withdrawal ratio
- f) development of reservoirs which are located above or below the project reservoir
- g) discovery of CO<sub>2</sub> beyond the boundary of the CO<sub>2</sub>-EOR complex

A **monitoring plan** including plans to monitor for leakage and methods



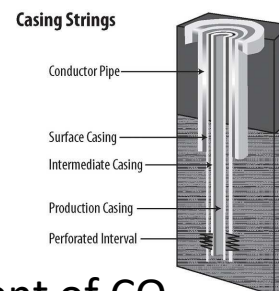
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## Section 7: Well Construction



Information to demonstrate that **new & existing** wells, AND **well interventions**, are:

- ✓ Designed...
- ✓ Constructed...
- ✓ Tested...
- ✓ ...to provide safe, long-term containment of CO<sub>2</sub>

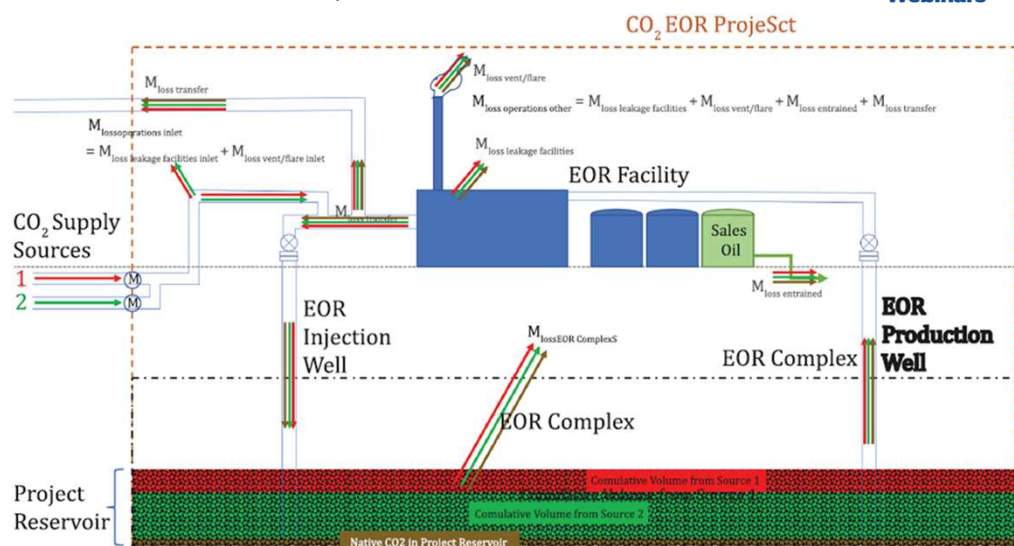


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## Section 8: Quantification



**Mass balance approach:**  
 $\text{CO}_2 \text{ stored} = \text{CO}_2 \text{ input} - \text{CO}_2 \text{ lost from operations \& subsurface}$



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## Section 10: Project Termination



- Allows for ***operation beyond period of reporting storage***
- Requires a ***termination plan***
- 5 ***criteria for termination*** including:
  1. Absence of leakage
  2. Compliance with decommissioning rules
  3. Demonstration of containment of CO<sub>2</sub> in the EOR complex
  4. Risks managed throughout the project life
  5. Facilities removed/retained as necessary by lease or contract



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## EPA Subpart RR vs. ISO 27916



|                      | EPA GHGRT Subpart RR                                                                                                                                 | ISO 27916 (CO <sub>2</sub> -EOR)                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Context</b>       | Federal reporting framework to quantify and verify greenhouse gas emissions, including for geologic storage of CO <sub>2</sub> .                     | Documentation and demonstration of safe, long-term containment of CO <sub>2</sub> stored in association with CO <sub>2</sub> -EOR and quantification of associated storage in CO <sub>2</sub> -EOR operations. Assumes and acknowledges that there are existing regulatory programs and standards apply to CO <sub>2</sub> -EOR projects, from permitting to corrective action, and that this standard does not address those topics - meaning UIC Class II does apply |
| <b>Authority</b>     | EPA                                                                                                                                                  | "competent governmental entity or entities with legal power to regulate or permit CO <sub>2</sub> -EOR to regulate storage of CO <sub>2</sub> in associate CO <sub>2</sub> -EOR operation, or to regulate quantification of the storage of CO <sub>2</sub> in association with a CO <sub>2</sub> -EOR operation." = <b>EPA or State</b>                                                                                                                                |
| <b>Applicability</b> | UIC Class II permit holders that have opted-in to report under RR (reporting under RR is optional for facilities operating under a Class II permit). | CO <sub>2</sub> that is injected in EOR operations for oil and other hydrocarbons (CO <sub>2</sub> -EOR) for which quantification of CO <sub>2</sub> that is safely stored long-term in association with the CO <sub>2</sub> -EOR project is sought = <b>UIC Class II</b>                                                                                                                                                                                              |



**Shall = Must = Normative = Required**  
**Should = May = Informative = Suggested or possible**

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## EPA Subpart RR vs. ISO 27916



|                 | EPA GHGRT Subpart RR                                                                                               | ISO 27916 (CO <sub>2</sub> -EOR)                                                                                                                                       |
|-----------------|--------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>MRV Plan</b> | <b>5 components:</b>                                                                                               | <b>5 components:</b>                                                                                                                                                   |
|                 | Delineation of the <b>maximum monitoring area (MMA)</b> and the <b>active monitoring area (AMA)</b>                | EOR operations management plan (6.1.1) that specifies procedures for field management and an <b>operational containment assurance</b> during the quantification period |
|                 | Identification and evaluation of the potential surface <b>leakage pathways</b>                                     | An initial containment assurance plan (6.1.2) to identify potential <b>leakage pathways</b>                                                                            |
|                 | A strategy for <b>detecting and quantifying any surface leakage</b> of CO <sub>2</sub> in the event leakage occurs | <b>Monitoring of potential leakage pathways</b> from the containment assurance plan (6.2.1)                                                                            |
|                 | An approach for establishing the <b>expected baselines</b> for monitoring CO <sub>2</sub> surface leakage          | <b>Initial containment assurance</b> (6.1.2)                                                                                                                           |
|                 | <b>Site-specific mass balance equation</b>                                                                         | <b>Site-specific mass balance equation</b> (8.2)                                                                                                                       |



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Gray box = ISO exceeds Subpart RR



## EPA Subpart RR vs. ISO 27916

|                    | EPA GHGRT Subpart RR                                                                                                                                                                         | ISO 27916 (CO2-EOR)                                   |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| Mass Balance (CO2) | (a) Mass of CO <sub>2</sub> received                                                                                                                                                         | Mass received                                         |
|                    | (b) Mass of CO <sub>2</sub> injected into the subsurface                                                                                                                                     | Mass input (received + native)                        |
|                    | (c) Mass of CO <sub>2</sub> produced (i.e., mixed with produced oil, gas, or other fluids)                                                                                                   | Mass loss entrained                                   |
|                    | (d) Mass of CO <sub>2</sub> emitted by surface leakage                                                                                                                                       | Mass loss operations (may be called fugitive)         |
|                    |                                                                                                                                                                                              | Mass loss vent/flare                                  |
|                    | (e) Mass of CO <sub>2</sub> equipment leakage and vented CO <sub>2</sub> emissions from surface equipment located between the injection flow meter and the injection wellhead                | Mass loss leakage facilities (may be called fugitive) |
|                    | (f) Mass of CO <sub>2</sub> equipment leakage and vented CO <sub>2</sub> emissions from surface equipment located between the production flow meter and the production wellhead              | Mass loss leakage facilities (may be called fugitive) |
|                    |                                                                                                                                                                                              | Mass loss transfer                                    |
|                    | (g) Mass of CO <sub>2</sub> sequestered in subsurface geologic formations                                                                                                                    | Mass stored (annual)                                  |
|                    |                                                                                                                                                                                              | Mass loss EOR complex                                 |
|                    | (h) Cumulative mass of CO <sub>2</sub> reported as sequestered in subsurface geologic formations in all years since the facility became subject to reporting requirements under this subpart | Mass stored (cumulative)                              |
|                    |                                                                                                                                                                                              | Mass native (non-anthropogenic)                       |



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## EPA Subpart RR vs. ISO 27916



|                     | EPA GHGRT Subpart RR                                                                                                                                                                                     | ISO 27916 (CO2-EOR)                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reporting           | Annually                                                                                                                                                                                                 | Annually                                                                                                                                                                                                                                                                                                                                                                                      |
| Revised MRV         | Within 180 days if:                                                                                                                                                                                      | Periodically, and when:                                                                                                                                                                                                                                                                                                                                                                       |
|                     | (1) A <b>material change</b> was made to monitoring and/or operational parameters that was not anticipated in the original MRV plan.                                                                     | (1) A <b>material change</b> was made to monitoring and/or operational parameters that was not anticipated                                                                                                                                                                                                                                                                                    |
|                     | (2) A <b>change in the permit class</b> of your Underground Injection Control permit.                                                                                                                    | (2) If required by a <b>change in permit</b>                                                                                                                                                                                                                                                                                                                                                  |
|                     | (3) If you are <b>notified by EPA</b> of substantive errors in your MRV plan or monitoring report.                                                                                                       | (3) If <b>required by the authority</b>                                                                                                                                                                                                                                                                                                                                                       |
| Measurement Devices | (4) You <b>choose to revise</b> your MRV plan for any other reason in any reporting year.                                                                                                                | (4) You <b>choose to revise</b> your MRV plan for any other reason in any reporting year.                                                                                                                                                                                                                                                                                                     |
|                     | Subpart RR includes <b>detailed requirements</b> in § 98.444 (e) and (f) for operation and maintenance of measurement devices, including what recognized standards may be followed for the methods used. | The monitoring program shall <b>describe tools, methods, applicability, and frequency for detecting</b> and quantifying losses (see 8.4), along with the <b>threshold beneath which there would be no detection</b> . The method of quantification for quantities of CO <sub>2</sub> below the detection threshold <b>shall be specified</b> in the EOR operations management plan (see 8.6). |



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## EPA Subpart RR vs. ISO 27916



|                          | EPA GHGRT Subpart RR                                                                                                                          | ISO 27916 (CO2-EOR)                                                                                                                                                                             |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Records Retention</b> | Quarterly and annual requirements depending on the type of data being retained. All records must be <b>retained for at least three years.</b> | Periodic and annual and shall be retained for the duration of the project, and shall be <b>offered to the authority after termination</b> of the lease/permit pertaining to the CO2-EOR project |
| <b>Well construction</b> | EPA UIC Program Class II, with most states with active oil and gas operations having <b>primacy</b>                                           | Authority = <b>EPA or State with primacy</b>                                                                                                                                                    |



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Gray box = ISO exceeds Subpart RR

## EPA Subpart RR vs. ISO 27916



|                            | EPA GHGRT Subpart RR                                                                                                                                                             | ISO 27916 (CO2-EOR)                                                                                                                                                                                                                                                                            |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Project Termination</b> | <b>May request</b> to discontinue reporting at any time                                                                                                                          | In addition to any existing permitting, regulatory, and contractual framework by the authority                                                                                                                                                                                                 |
|                            | Approved by the Administrator                                                                                                                                                    | Only when:                                                                                                                                                                                                                                                                                     |
|                            | a demonstration that current monitoring and model(s) show that the injected CO2 stream is not expected to migrate in the future in a manner likely to result in surface leakage. | a) the absence of detectable leakage (see 6.2) or open conduits to the surface out of the EOR complex, and that the injected CO2 is, at the time of project termination, safely contained;                                                                                                     |
|                            |                                                                                                                                                                                  | b) compliance with all well decommissioning and plugging requirements for all CO2-EOR project wells (see 7.2 g)), that wells do not allow fluid movement out of the EOR complex, and that the CO2-EOR project wells do not pose a leakage risk                                                 |
|                            |                                                                                                                                                                                  | c) the injected CO2 is safely contained with sufficient documentation of the characteristics of the EOR complex and operational history of the CO2-EOR project to demonstrate long-term stability and predictability of the associated storage;                                                |
|                            |                                                                                                                                                                                  | d) risks and uncertainties relating to the associated storage of CO2 were managed throughout the EOR project life; and                                                                                                                                                                         |
|                            |                                                                                                                                                                                  | e) facilities and ancillary equipment associated with the CO2-EOR project have been removed, except those required to be retained by lease or contractual obligations, integral to other operations, or intended for different uses which may be left in place with approval of the authority. |



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## Next Steps for Adoption/Use of ISO:27916

1) ANSI creates National Mirror Committee (NMC) to “Americanize” the standard for use in US via the National Technology Transfer and Advancement Act 1995, expected September or October 2019

2) **IRS issues guidance** that clarifies the definition of **“safe and secure storage”** via application of ISO:27916 (or Subpart RR) for 45Q, expected late 2019/early 2020



## Questions, Comments, Concerns

Thank you!

# Steven Carpenter

steven.carpenter@uwyo.edu

O: +1-307-315-6442

C: +1-513-460-0360

<https://www.eoriwyoming.org/>

