









Federal Regulation of Geologic Storage

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Presented to the UT Law Carbon and Climate Change Conference
February 10, 2011




The Texas Carbon Capture & Storage Association

"Advancing America's Energy Security with Clean Texas Technology"

Federal Regulations

- ▶ GHG Permitting Guidance – November 10, 2010
- ▶ EPA's UIC Class VI Rule – November 22, 2010
- ▶ Mandatory GHG Reporting Rule
 - Subpart PP – December 17, 2010
 - Subpart RR – November 22, 2010
 - Subpart UU – November 22, 2010
- ▶ Proposed Resource Conservation Recovery Act (RCRA) Rule




Key Steps to Permitting GHGs

- ▶ **May 2007** – Supreme Court Ruling
- ▶ **December 2009** – Endangerment Finding on GHGs
- ▶ **April 2010** – GHG Emissions Standards for Light-Duty Vehicles
 - Stationary Source Permitting Triggered Beginning Jan. 2, 2011
- ▶ **May 2010** – Tailoring Rule Limits GHG Air Permitting to the Largest Sources of GHG Emissions
- ▶ **November 2010** – Guidance, Technical Resources and Training to States and Sources on Implementation of GHG Permitting

GHG Permitting Guidance November 2010

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GHG Permitting Guidance

- ▶ EPA issued GHG BACT Guidance November 10 2010
 - The "Guidance" is "non-binding"
 - Comment period closed December 1, 2010
 - Over 100 comments received
 - EPA expects to release the revised document in _____
- ▶ BACT and CCS
 - Applies to New Sources and Major Modifications
 - Will lead to significant litigation

GHG Permitting Guidance

- ▶ BACT and CCS under the Guidance
 - Step 1: CCS is "available"
 - Step 2: CCS may be "technically infeasible" if capture, transportation and storage are not all feasible for a specific project
 - e.g., no space available for CO₂ capture equipment; right of ways prevent building pipeline infrastructure; no access to suitable geology for sequestration or other storage options
 - Step 3: Rank remaining options by effectiveness
 - Step 4: Currently CCS may be too expensive and ∴ likely to be eliminated as an option

"There are now cases where the economics of CCS are more favorable, e.g. enhanced oil recovery"

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GHG Permitting Guidance

- ▶ Conclusions
 - Currently CCS is considered an expensive technology, potentially making price of electricity for a given facility uncompetitive
 - Therefore, CCS will often be eliminated from consideration in Step 4 of the BACT analysis based on cost
 - CCS may become less costly and warrant greater consideration in Step 4 in the future
 - As capital and parasitic costs decrease
 - Value of CO₂ increases

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EPA's Final UIC Class VI Rule



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UIC Program Background

- ▶ 1974 Safe Drinking Water Act (SDWA; Reauthorized in 1996)
 - Federal regs for protection of USDWs
 - USDW Defined:
 - Any aquifer or portion of an aquifer that contains water that is less than 10,000 PPM total dissolved solids or contains a volume of water such that it is a present, or viable future source of a Public Water Supply System
- ▶ UIC Program regulates underground injection of all fluids – liquid, gas, or slurry
 - Commodity designation does not change SDWA applicability
 - Natural gas storage and hydraulic frac'ing exempted
- ▶ Existing UIC Program provides a regulatory framework (baseline) for GS of CO₂

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Class VI Rule Background

- ▶ Final rule builds on the existing UIC Program criteria and standards to address GS
 - The final Class VI rule requires owners or operators that choose to inject CO₂ for the purpose of GS to comply with tailored requirements to ensure USDW protection from injection-related activities.
- ▶ Proposed Rule for GS of CO₂
 - Published: July 25, 2008
 - 150 day public comment period ended: December 24, 2008
 - EPA received 400 comment letters
- ▶ Notice of Data Availability and Request for Comment
 - Published: August 31, 2009
 - 45 day public comment period ended: October 15, 2009
 - EPA received 67 comment letters
- ▶ Final Rule Signed: November 22, 2010

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Goals of the Class VI Rulemaking Process

- ▶ Ensure protection of USDWs
- ▶ Tailor existing UIC Program Requirements for GS of CO₂
- ▶ Use a clear and transparent process
- ▶ Use an adaptive approach to incorporate new data and project information
- ▶ Capitalize on existing EPA, State, Trive and industry injection experience
- ▶ Involve, inform, and educate the public

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EPA's Approach to Class VI Rulemaking

Special Considerations for GS

- Large Volumes
- Buoyance
- Viscosity (mobility)
- Corrosivity

UIC Program Elements

- Site Characterization
- Area of Review
- Well Construction
- Well Operation
- Site monitoring
- Public Participation
- Financial Responsibility
- Site Closure

Established a new well class - Class VI

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Final Class VI Requirements

- ▶ **Permit valid for the life of the well**
- ▶ Site characterization and Class VI well permitting
- ▶ AoR delineation and reevaluation
- ▶ Class VI well construction and operation
- ▶ Testing and monitoring of the Class VI injection project
- ▶ Site-specific project plan development
- ▶ Financial responsibility for the life of the Class VI project
- ▶ **Post-injection site care monitoring - 50 yr default**
- ▶ Injection depth waiver
- ▶ **Consideration for wells transitioning from Class II ER to Class VI injection of CO2**

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State Primacy Considerations

Primacy under the SDWA

- ▶ Section 1422 of the SDWA
 - Primacy for well Classes I, III, IV, V and VI
 - State regulations must meet or exceed minimum federal requirements
 - States allowed Independent Class VI Primacy **New!**
- ▶ Section 1425 of the SDWA
 - Regulations must be effective in protecting USDWs
 - Primacy standard for Class II
- ▶ While applying for primacy
 - States (Texas) with existing UIC primacy under 1422 may issue permits under existing authority - Class I or Class V; can be re-permitted later as Class VI
 - States without existing UIC primacy must submit any Class VI GS permit application to the EPA Region.

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Class VI Rule Requirements

- ▶ Site characterization and Class VI well permitting (§§146.83 and 146.82; §146.87)
 - Identification and characterization of an appropriate injection zone and confining zone(s)
 - Establishment of baseline information and comprehensive project information prior to injection well construction and operation
- ▶ Area of review (AoR) delineation and reevaluation (§146.84)
 - Class VI AoR accounts for both the injectate and the area of elevated pressure
 - Initial delineation of an AoR using computational modeling based on site characterization data
 - **Reevaluations of the AoR based on monitoring and operational data to verify project performance every 5 years**

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Class VI Rule Requirements (cont'd)

- ▶ Class VI well construction and operation requirements
 - Injectate compatible well materials (§146.86)
 - **"Grandfathering" of existing well construction at the UIC Director's discretion (§146.81)**
 - Site-specific permit operating conditions (§146.88)
 - **Jettisoned requirement for automatic downhole shut off devices for onshore wells**
- ▶ Testing and monitoring of the Class VI injection project
 - Well testing and monitoring (§§146.88 and 146.89)
 - Project site testing and monitoring (§§146.87 and 146.90)
- ▶ **Site-specific project plans (e.g., §§146.82 & 146.84)**
 - **Facilitate project management and coordination between Class VI well owners or operators and Directors**
 - **Inform permit modifications, if appropriate**
 - **Updating of AoR, corrective action, testing, monitoring and emergency response plans**

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Class VI Rule Requirements (cont'd)

Financial responsibility for the life of the Class VI project (§146.85)

- ▶ Clarified and expanded requirements to ensure that funds are available for:
 - Corrective action
 - Well plugging
 - Emergency and remedial response
 - Post-injection site care to site closure
- ▶ Describes **"qualifying instruments"** tailored to Class VI

Trust Funds	Surety Bond
Letter of Credit	Insurance
Self Insurance	Escrow Account
Other instruments	

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Class VI Rule Requirements (cont'd)

Post-injection site care monitoring and site closure (§146.93)

- ▶ **50 year default** timeframe for post-injection site care after injection ceases or
- ▶ Demonstration, **during the permit application process, that an alternative post-injection site care timeframe is appropriate** and will ensure protection of USDWs (§ 146.84(a)(18))
- ▶ Authorization of site closure based on a demonstration of non-endangerment of USDWs

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Class VI Rule Requirements (cont'd)

Injection depth waiver allowance for Class VI wells (§146.95)

- ▶ Apply only to owners or operators that apply for a waiver to inject above the lowermost USDW or in between USDWs
- ▶ Include additional requirements to ensure protection of USDWs above and below the injection zone
 - Consideration of Public Water System Supervisor
 - Regional Administrator concurrence required
- ▶ Accommodate varied geologic settings and facilitate use of capacity at a range of depths
- ▶ **Not required by States to meet minimum federal requirements**

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Class VI Rule Requirements (cont'd)

Wells transitioning from Class II EOR to Class VI GS - A.K.A. Class IIb (§144.19)

- ▶ Owners or operators of Class II EOR wells transitioning to Class VI injection must consider the risk profile and other factors of a specific project in coordination with UIC Directors
 - Increase in reservoir pressure
 - Increase in CO₂ injection rates
 - Decrease in production
 - Suitability of the Class II AoR delineation
- ▶ Allows existing well construction requirements to be "grandfathered" at Director's discretion
- ▶ Class II "business as usual" well owners or operators are not impacted by the final Class VI requirements

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GS and the Mandatory GHG Reporting Rule

- ▶▶ Subpart PP
- ▶▶ Subpart RR
- ▶▶ Subpart UU

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Mandatory GHG Reporting Rule - Subpart PP

- ▶ **Finalized December 17, 2010**

▶ Who Must Report?

Under the GHG Reporting Program suppliers of CO₂ must report CO₂ emissions that would result from the complete release of the product that they place into commerce.

- Capture Facilities - i.e. facilities that capture for commercial use or sequestration
- CO₂ production wells
- Importers of CO₂ ≥ 25,000 metric tons
- Exporter of CO₂ ≥ 25,000 metric tons
- ▶ **What must be reported? Mass of CO₂ ...**
 - Captured from production process unites
 - Extracted from production wells
 - Imported or exported
 - End uses, if known
 - i.e. long-term storage, EOR, R&D, in a greenhouse, pulp and paper, etc.

Mandatory GHG Reporting Rule - Overview Subpart RR/ UU

- ▶ EPA has finalized GHG reporting mechanisms for facilities that conduct **geologic sequestration (subpart RR)** and all other facilities that inject carbon dioxide (CO₂) underground for **enhanced oil recovery or any other purpose (subpart UU)**
 - Proposal signed on March 22, 2010
 - Final rule signed on November 22, 2010
 - Effective December 31, 2011
- ▶ This rule is complementary to and builds on the EPA's UIC program
 - Recognizes EOR as storage
 - Designed to minimize impact on EOR business as usual

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Geologic Sequestration of Carbon Dioxide – Subpart RR

- ▶ Subpart RR source categories includes:
 - Any well or group of wells that inject CO₂ for long-term geologic storage
 - **All wells permitted as UIC Class VI wells**
 - Facilities that conduct EOR are not required to report under Subpart RR, unless
 - The owner or operator "opts-in" or,
 - The facility holds a UIC class VI permit for the well or group of Wells
- ▶ What must be reported
 - Report basic information on CO₂ received
 - Develop and implement an EPA approved site-specific monitoring, reporting, and verification (MRV) plan
 - Report the amount of CO₂ geologically sequestered using a mass balance approach and annual monitoring activities
- ▶ When does reporting begin
 - All facilities reporting under subpart RR must submit annual reports to the EPA by March 31, 2012 reporting basic information on CO₂ received in 2011
 - These facilities will add data to their annual reports on the amount of CO₂ stored and annual monitoring activities once their EPA approved MRV plans are implemented

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Injection of Carbon Dioxide – Subpart UU

- ▶ Subpart UU source category includes:
 - Any well or group of wells that inject CO₂ stream into the subsurface that does not report under Subpart RR (i.e. EOR business as usual)
 - R&D projects receiving a Subpart RR exemption
- ▶ Must report basic information on CO₂ received for injection
 - Not required to report CO₂ injected, lost or leaked
- ▶ Must submit annual reports by March 31, 2012 on CO₂ received in 2011

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Reporting Requirements

	GHGs Reported	Subpart RR	Subpart UU
1	Mass of CO ₂ received	X	X
2	Mass of CO ₂ injected	X	
3	Mass of CO ₂ produced and recycled	X	
4	Mass of CO ₂ emitted by surface leakage	X	
5	Onsite CO ₂ from equipment leakage and vented CO ₂ emissions	X	
6	CO ₂ sequestered in subsurface formations	X	
7	Cumulative CO ₂ sequestered in all years since facility required to report under subpart RR	X	

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CO₂ Received – Source

- ▶ Under both subparts RR and UU the source of the CO₂ received must be recorded, if known
- ▶ Source categories include:
 1. CO₂ production wells
 2. Electric generating units
 3. Ethanol plants
 4. Pulp and paper mills
 5. Natural gas processing
 6. Gasification operations
 7. Other anthropogenic sources
 8. Discontinued EOR project
 9. Unknown

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Subpart RR MRV Plan

- ▶ For facilities conducting GS on or before December 31, 2010, MRV plans required by June 30, 2011 (180 day extension allowed)
- ▶ Otherwise within 180 days of receiving UIC Class VI permit
- ▶ Contents of MRV Plan include
 - Delineation of maximum and active monitoring areas
 - ID potential leakage pathways
 - Strategy for detecting and quantifying surface leakage
 - Strategy for establishing surface monitoring baseline
 - Proposed date to collect data for determining total amount sequestered
- ▶ UIC Class VI reporting satisfies some of the MRV plan requirements

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Proposed RCRA Rule

On July 25, 2008, EPA published a proposed rule under the Safe Drinking Water Act Underground Injection Control Program to create a new class of injection well (Class VI) for geological sequestration (GS) of carbon dioxide (CO₂). 73 FR 43492. In response to that proposal, EPA received numerous comments asking for clarification on **how the Resource Conservation and Recovery Act (RCRA) hazardous waste requirements apply to CO₂ streams**. EPA is now considering a proposed rule under RCRA to explore options such as a **conditional exemption** from the RCRA requirements for hazardous CO₂ streams in order to facilitate implementation of GS while protecting human health and the environment.

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What does this suite of Regulations Mean?



- ▶ As a carbon management technology, CCS is “real” – and CO₂ EOR may be “more real” for the time being
 - *So called “regulatory gaps” are quickly closing*
- ▶ CCS will be considered in new source and major modification stationary source proceedings going forward
 - *Expect litigation*
- ▶ CO₂ EOR appears to have a special compliance path, the contours of which remain uncertain

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