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CO_2 UNDERGROUND INJECTION REGULATIONS: SELECTED DIFFERENCES FOR ENHANCED OIL RECOVERY AND GEOLOGIC SEQUESTRATION

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Introduction

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Overview

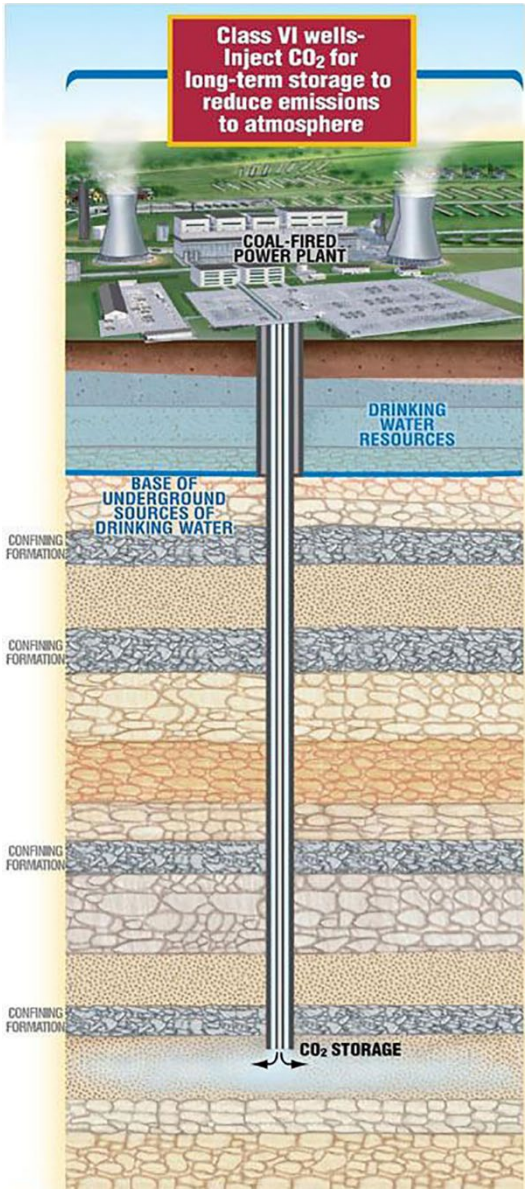
- Underground Injection of Carbon Dioxide (CO_2)
- Selected Differences in Regulation of Class II and Class VI Wells
- U.S. Environmental Protection Agency Greenhouse Gas Reporting Program
- Recent Congressional Activity and Interests Related to CO_2 Injection

UNDERGROUND INJECTION OF CO_2

Underground Injection of CO_2

- Underground injection and storage of carbon dioxide (CO_2) has been proposed as a solution for mitigating CO_2 emissions into the atmosphere from stationary sources burning fossil fuels
- CO_2 is compressed into a fluid (supercritical) state and injected underground for enhanced oil recovery (EOR) or for geologic sequestration (GS)
- Both operations use UIC wells to place CO_2 into deep subsurface geologic formations, but EOR and GS wells are regulated differently both by the U.S. Environmental Protection Agency (EPA) and states

CO2 Injection for Geologic Sequestration



- Compared to CO_2 injection for EOR, injection for geologic sequestration (GS) generally involves
  - Higher injection pressures
  - Larger fluid volumes
  - Potentially different physical and chemical properties of the injection stream
- As of June 2021 there are 2 U.S. EPA permitted GS wells, both in Illinois at the ADM ethanol production facility
  - injection into saline reservoir

Image source: U.S. EPA

Comparison of CO_2 Injection for EOR and GS

	EOR	GS
EPA Well Class	Class II	Class VI
CO_2 Source	Natural or anthropogenic	Anthropogenic
Target Reservoir	Aging oil fields	• Saline reservoirs • Depleted oil and gas reservoirs • Unmineable coal seams
Injection Purpose	Recovery of additional oil	Permanent CO_2 storage
Number of Wells in U.S.	119,467	2
CO_2 Volume Injected	68 million tons/year (as of 2014)	1.8 million total (1 project)

EOR: Enhanced Oil Recovery; GS: geologic sequestration. Sources: EPA, *FY 2019 State Injection Well Inventory and FY 2019 Tribal Injection Well Inventory and* accessed April 28, 2021; Vello Kuuskraa and Matt Wallace, "CO_2-EOR Set for Growth as New CO_2 Supplies Emerge, *Oil and Gas Journal*, vol. 112, no. 4, April 7, 2014.; DOE, 2020; CRS discussions with Department of Energy, September 21, 2020.

SELECTED DIFFERENCES IN EPA REGULATION OF CLASS II AND CLASS VI WELLS

Class II EOR Well Regulations: Federal and State

- Promulgated in 1983
- EPA regulations apply to
  - Wells where the state or tribe has primacy under Sec. 1422 of the Safe Drinking Water Act
  - Wells where EPA directly implements the UIC program
- Most states administer their own Class II programs
  - 99% of EOR wells located in states with Class II primacy

EPA Class VI Well Regulations

- Promulgated December 10, 2010
- Applies to wells used to inject CO_2 for *geological sequestration* only: the **long-term containment of CO_2 stream in subsurface geologic formations**
- Generally requires that owner/operator meet technical standards to prevent CO_2 leaks to the atmosphere and potential impacts to underground sources of drinking water (USDWs) under conditions unique to long-term containment (e.g., higher pressures and volume)
- Individual well permits (no area permits, no permits by rule)
- Permitting period is lifetime of the facility plus a 50 year post-injection period

Source: 40 C.F.R. § 146

Class VI Permitting Requirements

Select EPA permitting requirements for GS wells only:

- Requires demonstration that injection zone sufficient to receive the total anticipated volume of the CO_2 stream
- Requires owner/operator to
  - Provide information on potential seismicity in the area of the proposed injection site and demonstration that the formation's confining zone is free of faults or fractures and can contain the injected CO_2 and other formation fluids without initiating or propagating fractures in the formation
  - Designate a larger area of review (AOR) compared to Class II
  - Review the AOR every five years

Class VI Permitting Requirements (cont.)

- Permit application must also include *plans* for:
  - Well plugging,
  - Closure,
  - Post-injection site care, and
  - Emergency and remedial response to prevent endangerment of a USDW.

Class VI Construction and Operating Requirements

Select EPA construction and operating requirements for GS wells only:

- Use of materials and performance standards suitable for CO_2 contact for the life of the project
- Class II requirements for maximum injection pressure, plus
  - specific injection pressure threshold
  - continuous monitoring of injection pressure and CO_2 stream

Class VI Testing and Monitoring Requirements

Select EPA testing and monitoring requirements for GS wells only:

- Specific mechanical integrity testing to demonstrate that there is no significant leakage or fluid movement into a USDW, including annual testing to determine the absence of significant fluid movement
- More specific requirements to determine or verify the characteristics of formation fluids in all relevant geologic formations compared to Class II
- Specific requirements for testing and recording the physical and chemical characteristics of the injection and confining zone and formation fluids prior to operation
- Continuous monitoring of CO_2 injection pressure, rate, and volume

Class VI Testing and Monitoring Requirements (cont.)

- Monitoring well location and number based on site-specific factors
- Analysis of CO_2 stream characteristics
- Testing and monitoring of the underground CO_2 plume and pressure front
- Periodic monitoring of ground water quality above the confining zone(s)
- More frequent (semi-annual) reporting of testing and monitoring data and reporting of more specific information on the CO_2 stream and pressure compared to Class II

Class VI Financial Responsibility Requirements

Select EPA financial responsibility requirements for GS wells only:

- Financial responsibility instrument(s) must be sufficient to cover corrective action, injection, well plugging, post injection site care (PISC), and any emergency and remedial response that meets the regulatory requirements of those actions
- Owner or operator must maintain financial responsibility and resources until the UIC Director receives and approves the completed PISC and site closure plan and approves site closure
- Owner or operator must have a detailed written estimate of the cost of corrective action on wells in the area of review, plugging the injection wells, PISC, site closure, and emergency and remedial response

Class VI Closure and Post-Injection Requirements

Select EPA closure and post-injection requirements for GS wells only:

- More specific well plugging and site closure requirements compared to Class II (e.g., testing, planning, notification, and reporting)
- Required to implement post injection site care and site closure plan
  - Post-injection site care generally required for 50 years after injection ceases
  - Monitoring of the underground CO_2 plume and pressure front generally required for at least 50 years after injection ceases

Transition from Class II EOR to Class VI Wells

- Class VI regulations require Class II well owners or operators who inject CO_2 primarily for long-term storage (rather than oil production) to obtain a Class VI permit when there is an increased risk to USDWs compared to prior Class II operations using CO_2
- The Director (EPA or primacy state) determines whether a Class VI permit is required based on site-specific risk factors associated with USDW endangerment
- No transition has been required to date

Source: 40 C.F.R § 144.19

GREENHOUSE GAS REPORTING PROGRAM

Greenhouse Gas Reporting Program

- Mandatory Reporting of Greenhouse Gases Rule promulgated in 2009; 2010 for facilities with wells used to inject CO_2 (40 C.F.R. § 98)
- EPA's Greenhouse Gas Reporting Program
  - Requires reporting of greenhouse gases from large stationary sources and some industrial suppliers
  - Does not *regulate or limit* emissions
- EOR and GS wells are subject to different regulatory requirements
  - *Subpart RR (GS):* Facilities injecting CO_2 for GS required to report the amount of CO_2 sequestered; develop and implement a monitoring, reporting, and verification (MRV) plan; and collect data on CO_2 surface emissions from the operation
  - *Subpart UU (EOR and any other injection)*: Facilities injecting CO_2 for EOR required to report the amount and source of CO_2 received for injection

RECENT CONGRESSIONAL ACTIVITY AND INTERESTS

116th and 117th Congresses (2019-present)

Recent Congressional Activity and Interests - Section 45Q

- Internal Revenue Code "Section 45Q" Tax Credit for Carbon Oxide Sequestration
  - Provides tax credit for qualified CO_2 sequestration or utilization
  - Gradual annual increase in credit until 2026
    - up to $35/ton for EOR or utilization
    - up to $50/ton for GS
  - Credit for sequestration of CO_2 from anthropogenic sources only
  - CO_2 must be measured at the point of capture and verified at the point of disposal, injection, or other use
- Recently enacted legislation extended the start of construction deadline to 1/1/2026 (P.L. 116-260)
- In January 2021, I.R.S. issued congressionally mandated regulations for "secure geologic storage" of CO_2 for EOR and GS

Sources: 26 U.S.C. § 45Q; 26 C.F.R. 1

Recent Congressional Activity and Interests – Section 45Q (cont.)

- Implementation/oversight issues may include
  - Verification of claimed CO_2 amounts sequestered
  - Credits used primarily for oil production rather than GS
  - Deadline for starting construction
  - Amount and duration of tax credits
- Various proposals introduced in the 117th Congress would
  - Further extend start of construction deadline
  - Increase amount of tax credit for GS and/or EOR
  - Phase out tax credit for EOR by 2030

Recent Congressional Interests and Activity – RD&D

- Recent enacted legislation on CCS research, development, and deployment (RD&D) (P.L. 116-260)
  - $223 million appropriated in FY2021 for Department of Energy (DOE) Office of Fossil Energy
  - Support carbon capture technology development and program for large scale sequestration projects (over 50 million tons)
- Various proposals introduced in the 117th Congress would
  - Enhance DOE and EPA CCS RD&D
  - Establish large-scale DOE storage commercialization program
- Generally includes activities on GS and CO_2 EOR

Recent Congressional Interests and Activity – SDWA/UIC

- Various proposals introduced in the 117th Congress would
  - Authorize funding for Class VI permitting grants to EPA and for grants to states for Class VI permitting
  - Amend the Safe Drinking Water Act to establish a new class of UIC wells (Class VII) for EOR with CO_2 sequestration to
    - require transition from Class II
    - require EPA to establish minimum requirements for site characterization, design and construction, testing and monitoring, closure and PISC
    - establish requirements for "net sequestration" of CO_2

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QUESTIONS