Geologic Sequestration of Carbon Dioxide

EPA Proposed Rule Making

Public Hearing

U.S. Environmental Protection Agency
Office of Ground Water and Drinking Water
2008
EPA’s Proposed GS Rule: Outline

- Underground Injection Control (UIC) Program Background
- Geologic Sequestration of CO$_2$
- Proposal Development Process
- The Proposed Rule
- Schedule
The 1974 Safe Drinking Water Act (SDWA; Reauthorized in 1996)
- Federal regulations for protection of Underground Sources of Drinking Water (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 for a Public Water Supply System
- UIC Program regulates underground injection of all fluids – liquid, gas, or slurry
  - Designation as a commodity does not change SDWA applicability
  - Some natural gas (hydrocarbon) storage, oil & gas production, and some hydraulic fracturing fluids exempted

Existing UIC program provides a regulatory framework (baseline) for the Geologic Sequestration of CO₂
UIC Program Background

UIC Well Classes

Class I  Class II  Class III

Class V
33 States have primary enforcement authority (primacy) for the UIC program; EPA and States share program implementation in 7 States; EPA directly implements the entire UIC Program in 10 states.
Carbon Capture and Storage/Geologic Sequestration of CO₂

- Important terms:
  - CCS: Carbon Capture and Storage (includes capture, transport, and injection of carbon dioxide for long term storage)
  - GS: Geologic Sequestration (the injection of carbon dioxide for long term storage)
- GS is one tool that can be used to reduce emissions of carbon dioxide to the atmosphere (there are others)
- CCS is key to meeting the Administration’s climate goals
- GS rule addresses potential endangerment to underground sources of drinking water from CO₂ injection activities
  - provides consistency across US
  - provides transparency that will build public confidence
~3,500+ Gigatons (Gt) CO$_2$ capacity within 230 candidate geologic CO$_2$ storage reservoirs

- Oil and gas reservoirs
- Deep saline formations
- Deep coal seams
- Basalt formations
EPA’s Proposed GS Rule: Rule Development Process

- EPA has developed a Proposed Rule for Geologic Sequestration (GS) of CO$_2$
  - Announced October 2007
  - Signed & published July 2008
  - 120 day comment period through November 24, 2008
- Proposed rule uses Safe Drinking Water Act authorities and revises Underground Injection Control Program requirements for GS
- Priority placed on avoiding endangerment of underground sources of drinking water
EPA’s Proposed GS Rule: Collaboration

- Inter- and Intra-Agency Coordination
  - Workgroup of ~48 members
  - State co-regulators
  - Department of Energy and other Federal Agencies

- Stakeholder Outreach
  - Federal Advisory Committees
  - Non-governmental Organizations
  - Industry Groups
  - States and Tribes
EPA’s Proposed GS Rule: Goals of the Rulemaking Process

- Develop proposed rules that would protect underground sources of drinking water under SDWA
- Tailor existing UIC program requirements to unique needs of GS of CO$_2$ for long-term storage
- Ensure adaptive approach to incorporate new data
- Use existing experience with industrial and enhanced oil/gas recovery injection
EPA’s Proposed GS Rule: *Approach to Rulemaking*

Special Considerations for GS
- Large Volumes
- Buoyancy
- Viscosity (Mobility)
- Corrosivity

Develop new well class for GS – Class VI

UIC Program Elements
- Site Characterization
- Area Of Review
- Well Construction
- Well Operation
- Site Monitoring
- Post-Injection Site Care
- Public Participation
- Financial Responsibility
- Site Closure
Basic Requirements

- Injection zone that can accept fluids
- Confining zone (system) above the injection zone, that contains all fluids
- Owners and Operators submit information on the following:
  - Structure and stratigraphy
  - Seismicity
  - Baseline geochemistry
EPA’s Proposed GS Rule: 
*Site Characterization*

**Proposed Approach**

- Director has discretion to require identification of additional confining zones
- Additional zones may be used for:
  - Pressure dissipation
  - Monitoring
EPA’s Proposed GS Rule: 
*Area of Review (AoR)*

AoR: The region surrounding the project that may be impacted by injection activity

**Basic Requirements**

- Delineate the AoR
- Identify and evaluate all artificial penetrations and other features that may allow upward migration of fluids
- Plug and or remediate as appropriate
EPA’s Proposed GS Rule: Area of Review (AoR)

Proposed Approach

- Use computational modeling
- AoR reevaluation at a minimum of every 10 years
Basic Requirements

- Well components engineered to ensure protection of USDWs
  - Cased and cemented to prevent movement of fluids into an USDW
  - Surface casing and long string casing
  - Tubing and packer
Proposed Approach

- Inject below the lowermost USDW
- Long-string casing cemented in place for entire length
- Surface casing installed and cemented through the base of the lowermost USDW
- Well materials must be compatible with injectate and formation fluids
Basic Requirements

- Procedures to ensure integrity of the well before, during, and after injection
  - Injection may not fracture injection zone
  - Monitor injection pressure, flow rate and volumes, and the nature of the injected fluid
  - Perform mechanical integrity tests
EPA’s Proposed GS Rule: 
Well Testing and Operation

Proposed Approach

- Continuous internal well mechanical integrity tests (MIT) and annual external MITs
- Injection pressure should not exceed 90 percent of fracture pressure in the injection zone
EPA’s Proposed GS Rule: Site Monitoring

Proposed Approach

- Determine extent of CO$_2$ movement and associated area of pressure (pressure front)
- Tracking of the plume and pressure front is required, but techniques, frequency, and spatial resolution are not specified
- Surface-air and soil-gas monitoring are at the Director’s discretion

Seismic Monitoring Results, Sleipner
Proposed Approach

- Post-injection site care is set at 50 years; however, it may be modified with a demonstration that the plume has stabilized and the pressure has dissipated sufficiently
- Well-plugging materials must be compatible with CO$_2$ stream
- Liability stays with the owner/operator
Basic Requirements

- Show financial responsibility for well plugging, corrective action, and site closure

Proposed Requirements

- Demonstrate and maintain financial responsibility for plugging and corrective action, injection well plugging, post-injection site care, site closure, and emergency and remedial response
Basic Requirements

- 30-day comment period for permits following public notice
- Preparation of a responsiveness summary for the public record

Preamble seeks comment on

- Appropriate outreach techniques and technologies
- Engaging the public early in permitting process before siting
# EPA’s Proposed GS Rule: Schedule

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<th>Activity</th>
<th>Milestone</th>
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<td>Technical Workshops, Data Collection &amp; Analysis</td>
<td>Ongoing</td>
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<td>Stakeholder Meetings</td>
<td>December 2007/February 2008</td>
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<td>Interagency Review of Proposed Rule</td>
<td>Late May - Early June 2008</td>
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<td>Administrator’s Signature of Proposed Rule</td>
<td>July 15, 2008</td>
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<td>Notice of Data Availability (if appropriate)</td>
<td>2009</td>
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<tr>
<td>Final UIC Rule for GS of CO₂</td>
<td>Late 2010 / Early 2011</td>
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Public Comment Period
July 25 – November 24, 2008

Public Comments

- Inform future publications
- Include data and information
- Address merits of the proposal
- Identify alternatives to proposed approach/methodology
Thank you!

More information about the UIC Program

- EPA Geologic Sequestration of Carbon Dioxide Website – http://www.epa.gov/safewater/uic/wells_sequestration.html


- Written comments may be submitted at: www.regulations.gov (docket i.d.: EPA-HQ-OW-2008-0390)