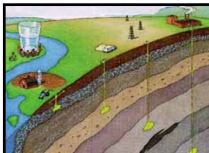


**Standards for Geologic Sequestration of Carbon Dioxide  
EPA Proposed Rulemaking  
Signed July 15, 2008**



**Gregory Schnaar, Ph.D.**  
AAAS Science and Technology Policy Fellow  
U.S. Environmental Protection Agency  
Office of Ground Water and Drinking Water  
October 2<sup>nd</sup>, 2008



**EPA's Proposed GS Rule:  
*Outline***

- Geologic Sequestration of CO<sub>2</sub>
- Proposal Development Process
- Components of the July 15 Proposal
- Schedule for Final Rule Development
- Public Comment: *Your Role*



## EPA's Proposed GS Rule: *What is GS?*

**Geological Storage Options for CO<sub>2</sub>**

- 1 Depleted oil and gas reservoirs
- 2 CO<sub>2</sub>-driven enhanced oil recovery
- 3 Deep saline formations
- 4 Deep unmineable coal seams
- 5 CO<sub>2</sub>-driven enhanced coal bed methane recovery
- 6 Deep saline filled basalts formations and other formations

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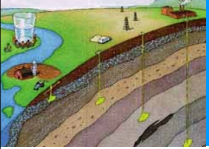
## EPA's Proposed GS Rule: *UIC Well Classes*

**Class I**

**Class II**


**Class III**

**Class V**




## EPA's Proposed GS Rule: *Rule Development Process*

- **Proposed Rule** for commercial-scale geologic sequestration of carbon dioxide
  - Announced by Administrator on October 11, 2007
  - Signed by Administrator on July 15, 2008
  - 120 day comment period with public hearings planned
- Authority: Safe Drinking Water Act (SDWA); proposal revises Underground Injection Control (UIC) Program standards for Geologic Sequestration
- Basis of rulemaking: Authority under SDWA to prevent endangerment of underground sources of drinking water




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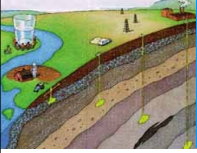


## Collaboration During Rule *Development Process*

- EPA's Offices of Water and Air and Radiation worked to:
  - Clarify and address issues across EPA statutes (SDWA, CAA, etc.) and regulations
  - Coordinate technical and cost analyses for the proposal
- Workgroup of ~48 members included DOE and 4 States (Texas, Arkansas, Alabama and Ohio)
- EPA worked closely with the Department of Energy
- EPA increasing coordination with:
  - The Department of Transportation
  - Bureau of Land Management
  - The United States Geological Survey




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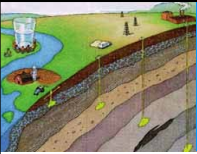


## EPA's Proposed GS Rule: *Outreach to Stakeholders*

- **Federal Advisory Committees** – National Drinking Water Advisory Council (NDWAC) and Clean Air Act Advisory Committee (CAAAC)
- **States** – Ground Water Protection Council (GWPC) and Interstate Oil & Gas Compact Commission (IOGCC)
- **Non-Governmental Organizations and Water Utilities** – National Resources Defense Council, World Resources Institute, Environmental Defense, AWWA and others
- **Industry Groups** – BP, Shell, Chevron, American Petroleum Institute, Schlumberger, Edison Electric Institute, etc.




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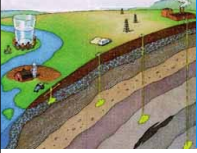


## EPA's Proposed GS Rule: *Workshops and Meetings*

- **Technical Workshop Series (2005-2008)**
  - Modeling: Houston, TX 2005
  - Risk Assessment: Portland, OR 2005
  - Site Characterization: Berkeley, CA 2006
  - Well Construction and Integrity Testing: Albuquerque, NM 2007
  - Area of Review: Washington, DC 2007
  - Measurement, Monitoring, and Verification: New Orleans, LA 2008
- **Two Stakeholder Meetings (2007 & 2008 in DC Area)**
  - EPA's rulemaking process
  - Technical and Implementation challenges




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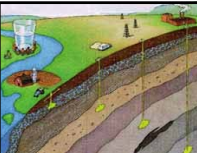


### Goals of the Rulemaking Process:

- Clear and transparent process
- Encourage development of a promising tool while ensuring protection of USDWs
- Capitalize on years of EPA and State UIC program experience
- Adaptive approach: requirements shaped as new data from early projects is acquired
- Involve, inform, and educate the public




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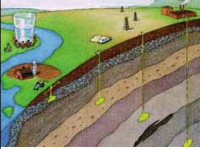
### EPA's Proposed GS Rule: Approach to Rulemaking

Special Considerations for GS	UIC Program Elements
<ul style="list-style-type: none"><li>▪ Large Volumes</li><li>▪ Buoyancy</li><li>▪ Viscosity (Mobility)</li><li>▪ Corrosivity</li></ul>	<ul style="list-style-type: none"><li>▪ Site Characterization</li><li>▪ Area Of Review</li><li>▪ Well Construction</li><li>▪ Well Operation</li><li>▪ Site Monitoring</li><li>▪ Well Plugging and Post-Injection Site Care</li><li>▪ Public Participation</li></ul>

Proposed Approach:  
A new well class: Class VI

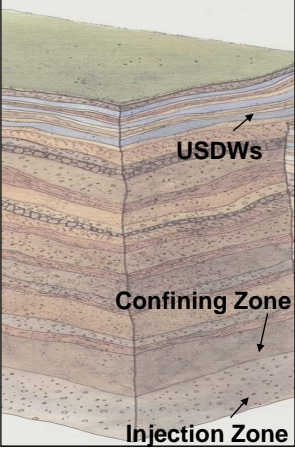


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## EPA's Proposed GS Rule: *Site Characterization*


- Proposed Approach
  - Director has discretion to require identification of additional confining zones
  - Owners and Operators submit information on the following:
    - Structure and stratigraphy
    - Seismicity
    - Baseline geochemistry



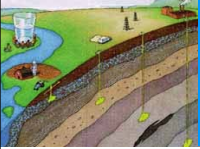
USDWs

Confining Zone

Injection Zone

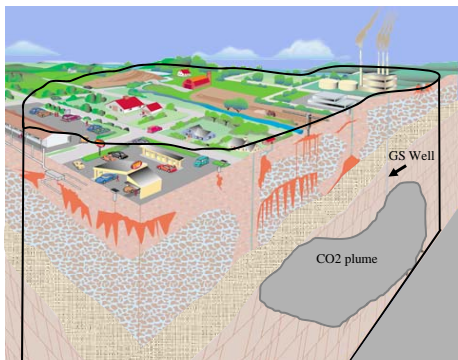


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## EPA's Proposed GS Rule: *Area of Review (AoR)*

- Region surrounding the project that may be impacted by injection activity
- Existing UIC program:
  - Fixed Radius
  - Simple Calculation



GS Well

CO<sub>2</sub> plume


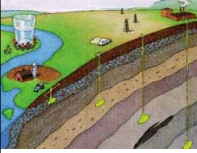
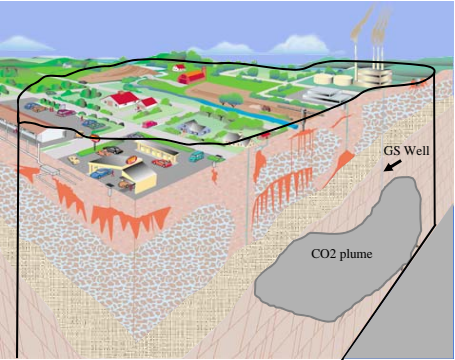


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## EPA's Proposed GS Rule: *Area of Review (AoR)*

**Proposed Approach**

- Use computational modeling
- AoR reevaluation at a minimum of every 10 years
- Use phased corrective action at Director's discretion


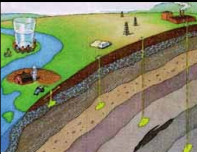
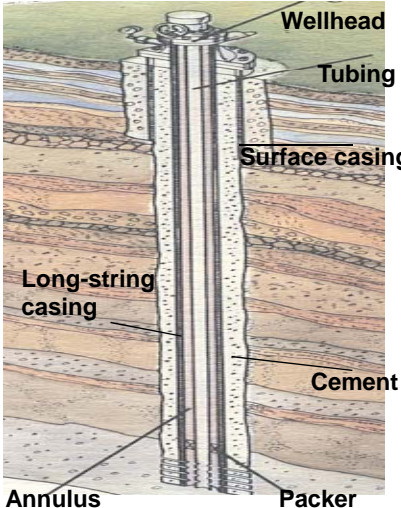


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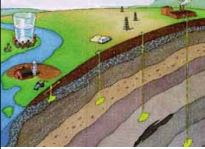
## EPA's Proposed GS Rule: *Well Construction*

**Proposed Approach**

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





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## 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 system



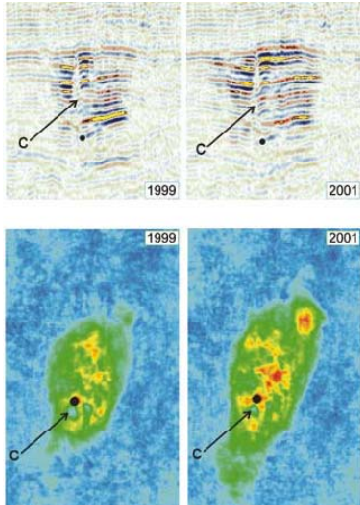
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## EPA's Proposed GS Rule: *Site Monitoring*

### Proposed Approach

- Tracking of the plume and pressure front is required, but techniques, frequency, and spatial resolution are not specified
- Tracers are not required
- Surface-air and soil-gas monitoring is at the Director's discretion

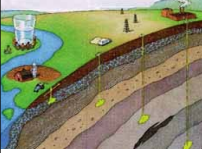


Seismic Monitoring Results, Sleipner



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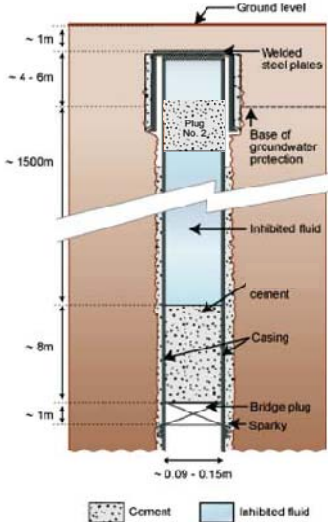




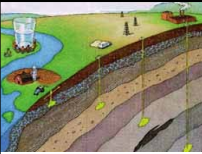
### EPA's Proposed GS Rule: *Well-Plugging and Post-Injection Site Care*

**Proposed Approach**

- Well-plugging materials must be compatible with CO<sub>2</sub> stream
- 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
- The owner or operator must demonstrate financial assurance through the end of post-injection site care




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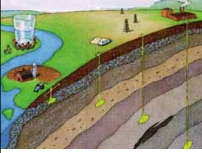
### EPA's Proposed GS Rule: *Public Participation*

**Proposed Approach**

- 30-day comment period following public notice
- Preparation of a responsiveness summary for the public record
- Seeking comment on
  - Appropriate outreach techniques and technologies
  - Other ways to engage the public early in process





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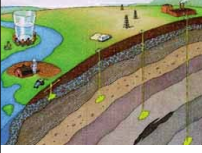
## EPA's Proposed GS Rule: *Impacts on Existing UIC Wells (Class I, II, V)*

**Proposed Approach**

- Enhanced Oil Recovery Wells (Class II) using CO<sub>2</sub> would not be required to obtain a Class VI permit until absolutely no oil is being produced from the reservoir
- Existing Class I, II or V wells that transition to a Class VI permit must comply with all new regulations
- “Cemented-in-place” components of the well itself would be grandfathered into the new permit





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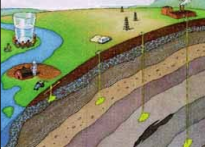


## EPA's Proposed GS Rule: *Schedule*

Activity	Milestone
Technical Workshops, Data Collection & Analysis	Ongoing
Stakeholder Meetings	December 2007/February 2008
Interagency Review of Proposed Rule	Late May - Early June 2008
Administrator's Signature of Proposed Rule	July 2008
Public Comment Period for Proposed Rule	July – October 2008
Notice of Data Availability (if appropriate)	2009
Final UIC Rule for GS of CO <sub>2</sub>	Late 2010 / Early 2011




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## EPA's Proposed GS Rule: *Public Comment, Your Role*

- **Comments**
  - Form the basis of the next publication
  - Create “logical outgrowths” from proposal
- **Public Comment & Hearing Period**
  - Discuss merits of regulatory alternatives and the proposed approach (preamble and regulatory text)
  - Review and comment on docket materials
  - Provide new data and ideas





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## EPA's Proposed GS Rule

# Questions?



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