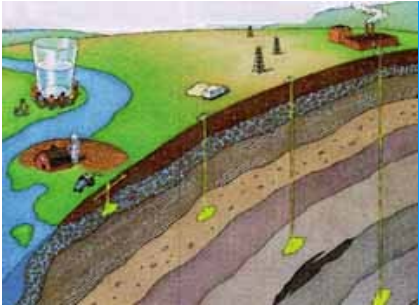


Geologic Sequestration of Carbon Dioxide

EPA Proposed Rule Making Public Hearing



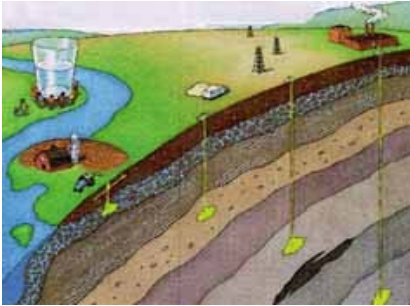
**U.S. Environmental Protection Agency
Office of Ground Water and Drinking Water
2008**



EPA's Proposed GS Rule: *Outline*

- Underground Injection Control (UIC) Program Background
- Geologic Sequestration of CO₂
- Proposal Development Process
- The Proposed Rule
- Schedule

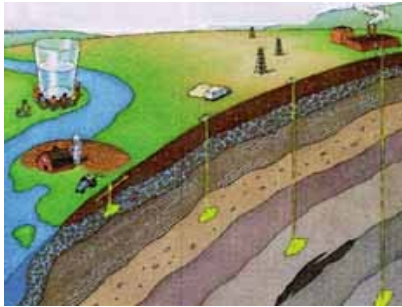




UIC Program Background

- 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

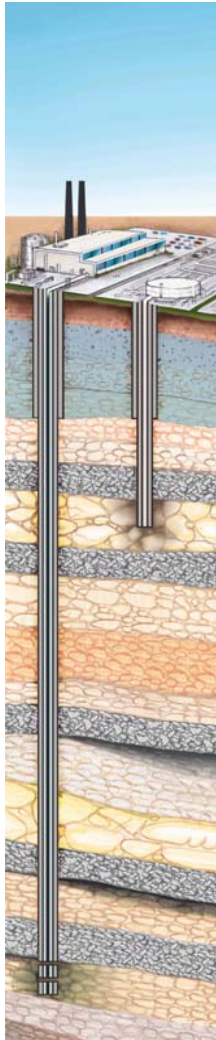
Existing UIC program provides a regulatory framework (baseline) for the Geologic Sequestration of CO₂



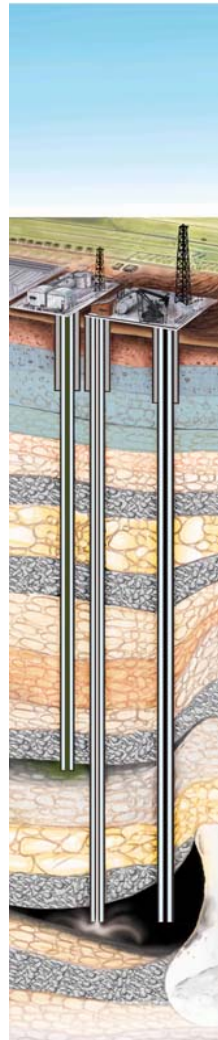
UIC Program Background

UIC Well Classes

Class I



Class II

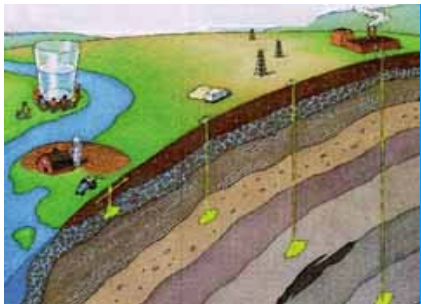


Class III



Class V

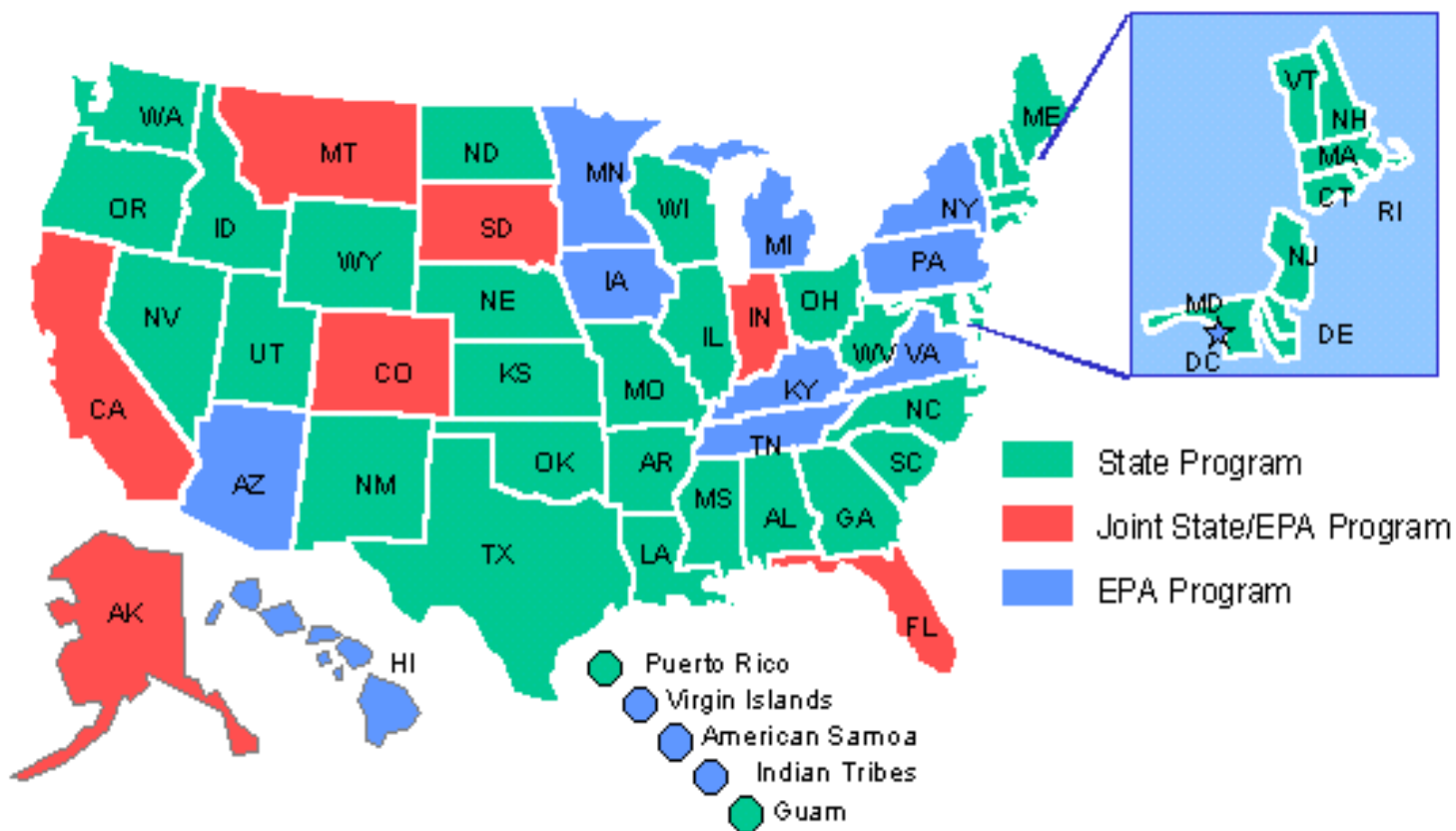


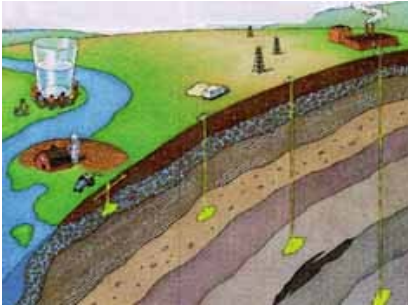


UIC Program Background

Primacy

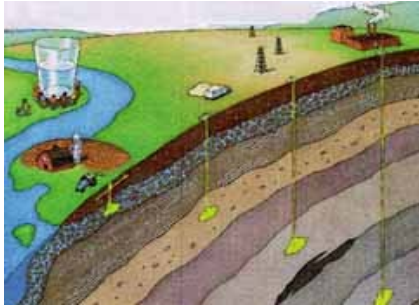
- 33 States have primary enforcement authority (primacy) for the UIC program; EPA and States share program implementation in 7 States; EPA directly implements the entire UIC Program in 10 states





Carbon Capture and Storage/Geologic Sequestration of CO₂

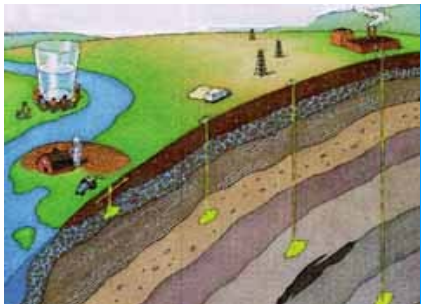
- Important terms:
 - CCS: *Carbon Capture and Storage* (includes capture, transport, and injection of carbon dioxide for long term storage)
 - GS: *Geologic Sequestration* (the injection of carbon dioxide for long term storage)
- GS is one tool that can be used to reduce emissions of carbon dioxide 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



CO₂ Storage Capacity

~3,500+ Gigatons (Gt) CO₂ capacity within 230 candidate geologic CO₂ storage reservoirs

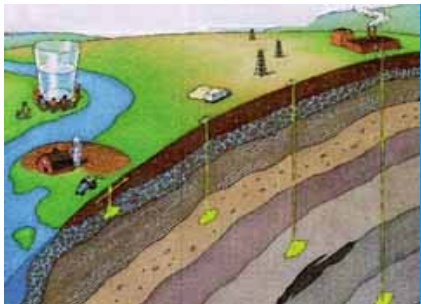
- Oil and gas reservoirs
- Deep saline formations
- Deep coal seams
- Basalt formations



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

- EPA has developed a **Proposed Rule** for Geologic Sequestration (GS) of CO₂
 - 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*

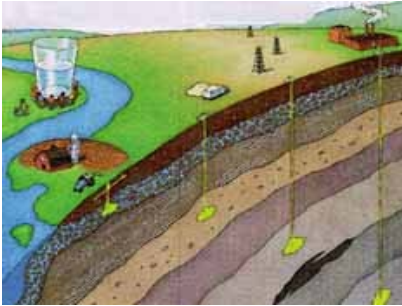
- Inter- and Intra- Agency Coordination
 - Workgroup of ~48 members
 - State co-regulators
 - Department of Energy and other Federal Agencies
- Stakeholder Outreach
 - Federal Advisory Committees
 - Non-governmental Organizations
 - Industry Groups
 - States and Tribes





EPA's Proposed GS Rule: *Goals of the Rulemaking Process*

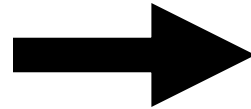
- Develop proposed rules that would protect underground sources of drinking water under SDWA
- Tailor existing UIC program requirements to unique needs of GS of CO₂ for long-term storage
- Ensure adaptive approach to incorporate new data
- Use existing experience with industrial and enhanced oil/gas recovery injection



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

Special Considerations for GS

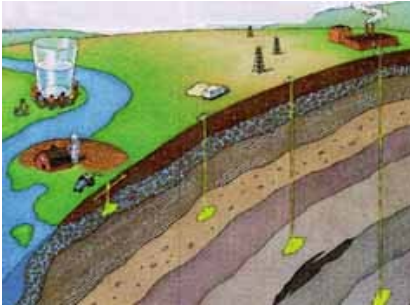
- Large Volumes
- Buoyancy
- Viscosity (Mobility)
- Corrosivity



UIC Program Elements

- Site Characterization
- Area Of Review
- Well Construction
- Well Operation
- Site Monitoring
- Post-Injection Site Care
- Public Participation
- Financial Responsibility
- Site Closure

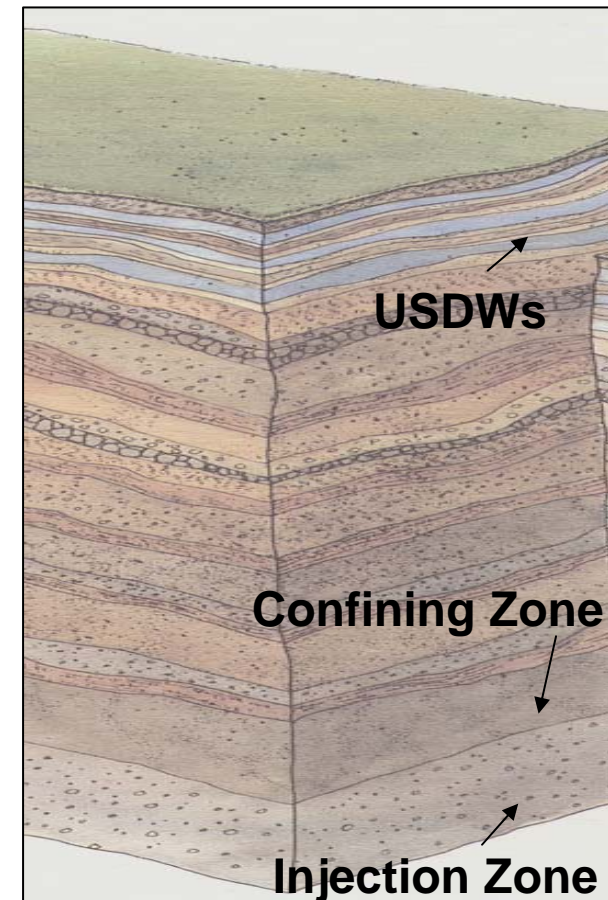
Develop new well class
for GS – Class VI



EPA's Proposed GS Rule: *Site Characterization*

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

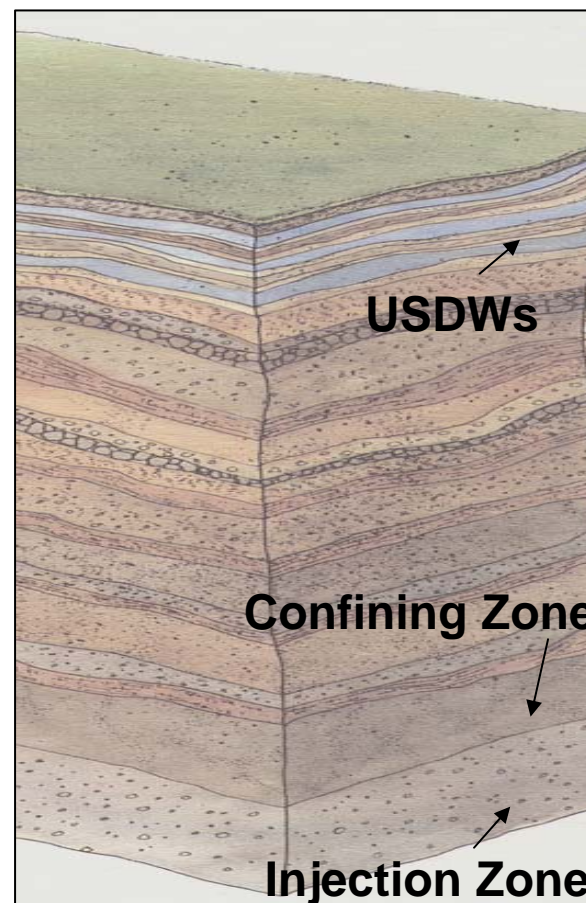


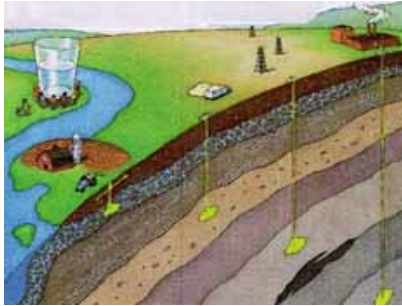


EPA's Proposed GS Rule: *Site Characterization*

Proposed Approach

- Director has discretion to require identification of additional confining zones
- Additional zones may be used for:
 - Pressure dissipation
 - Monitoring



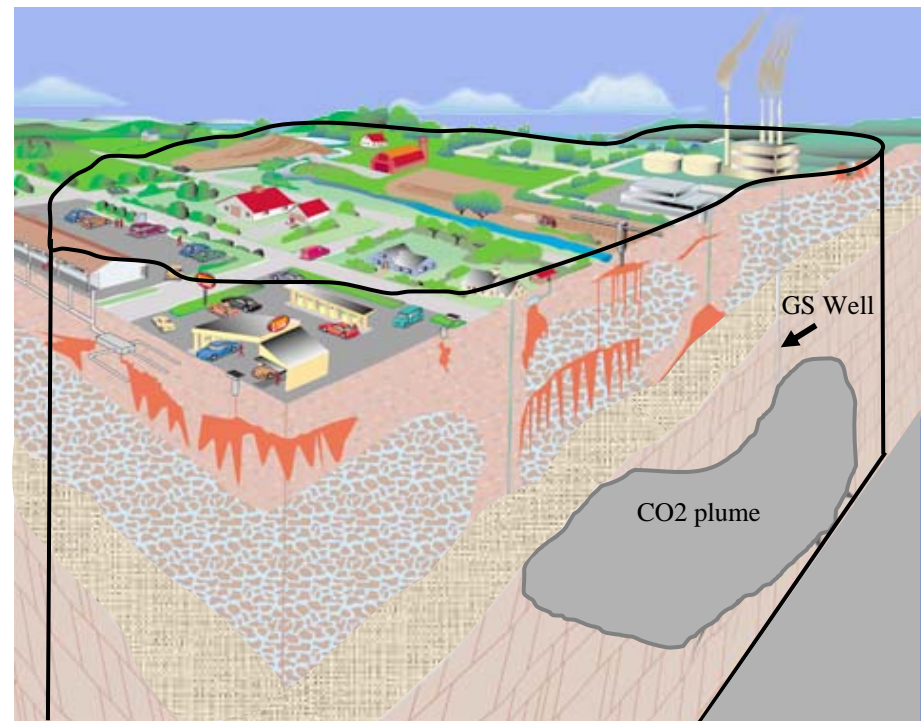


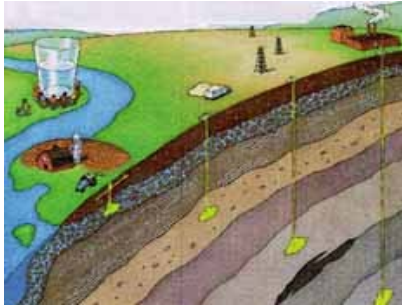
EPA's Proposed GS Rule: *Area of Review (AoR)*

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

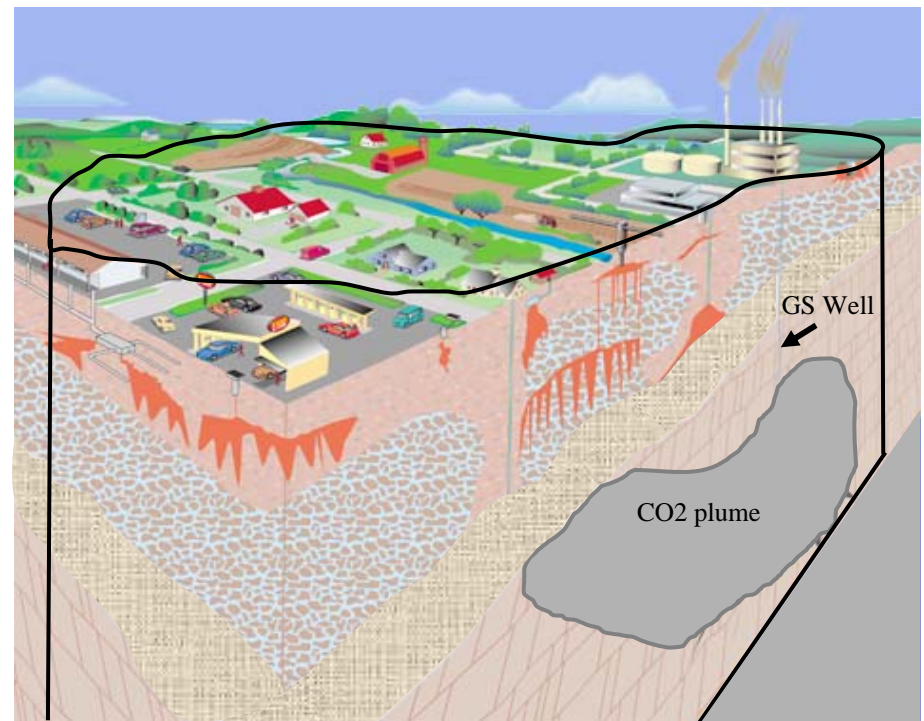


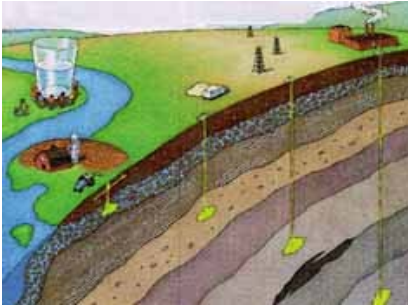


EPA's Proposed GS Rule: *Area of Review (AoR)*

Proposed Approach

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

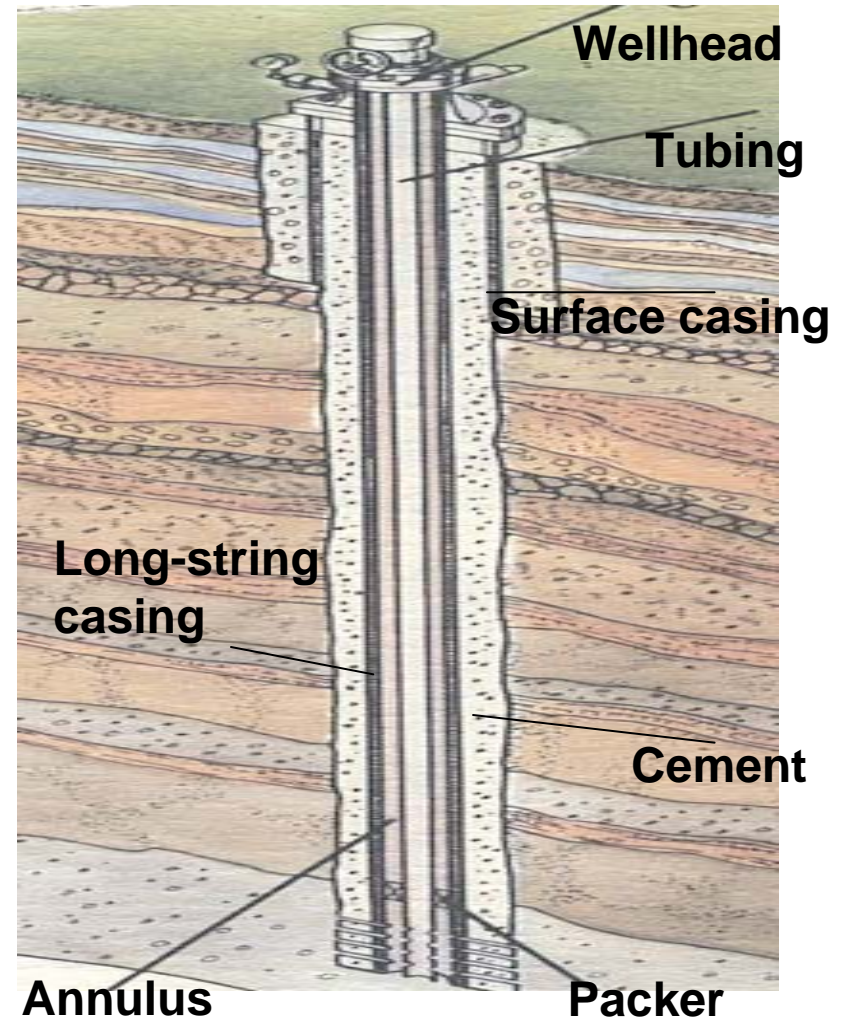


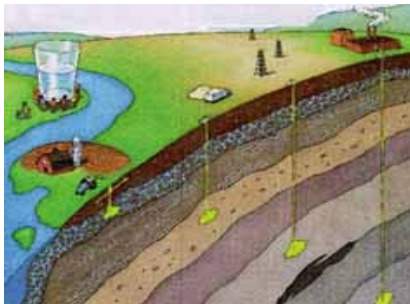


EPA's Proposed GS Rule: *Well Construction*

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

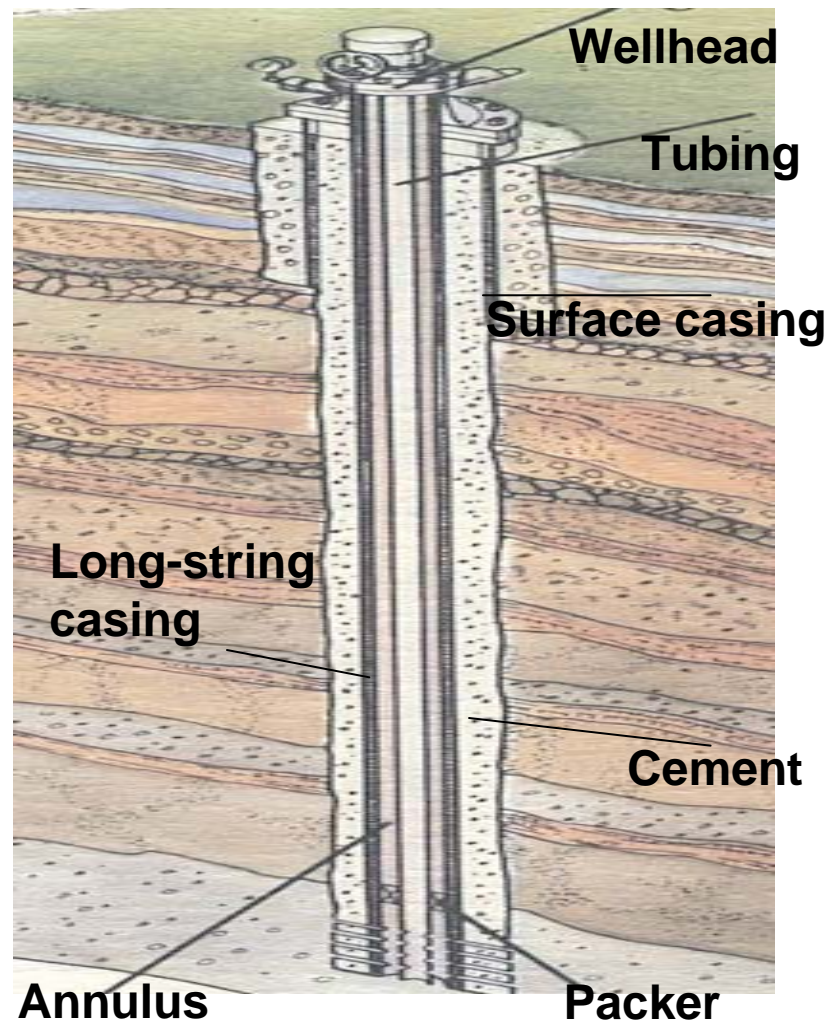


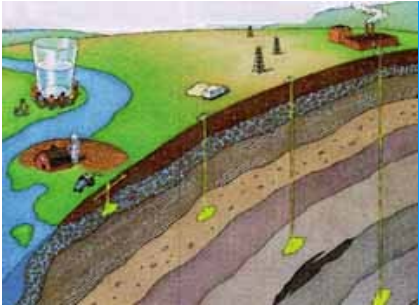


EPA's Proposed GS Rule: *Well Construction*

Proposed Approach

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



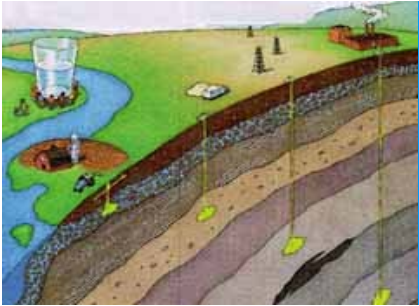


EPA's Proposed GS Rule: *Well Testing and Operation*

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



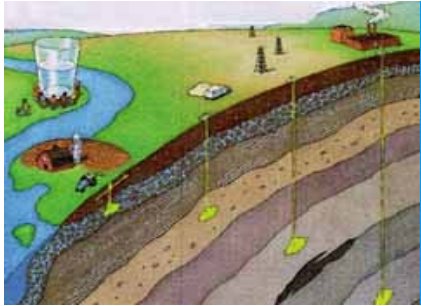


EPA's Proposed GS Rule: *Well Testing and Operation*

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

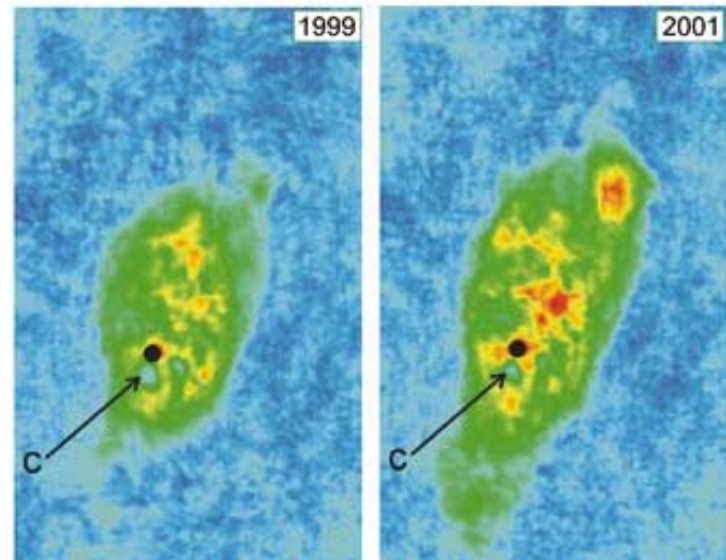
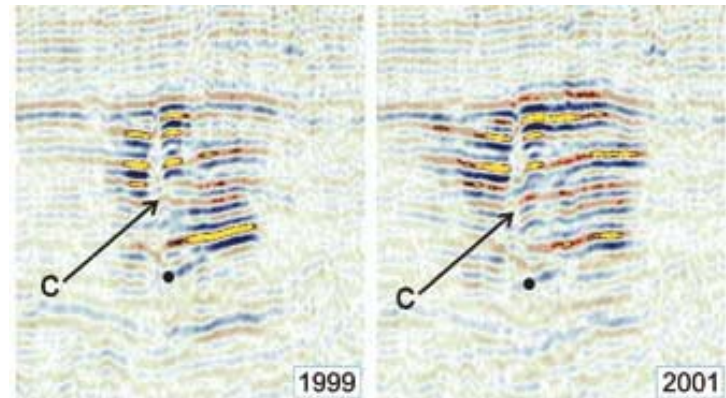




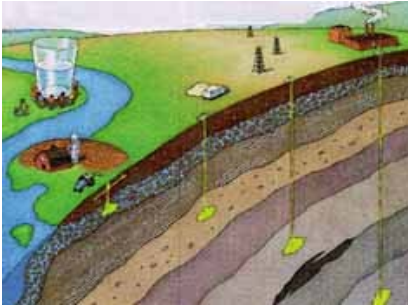
EPA's Proposed GS Rule: *Site Monitoring*

Proposed Approach

- Determine extent of CO₂ 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



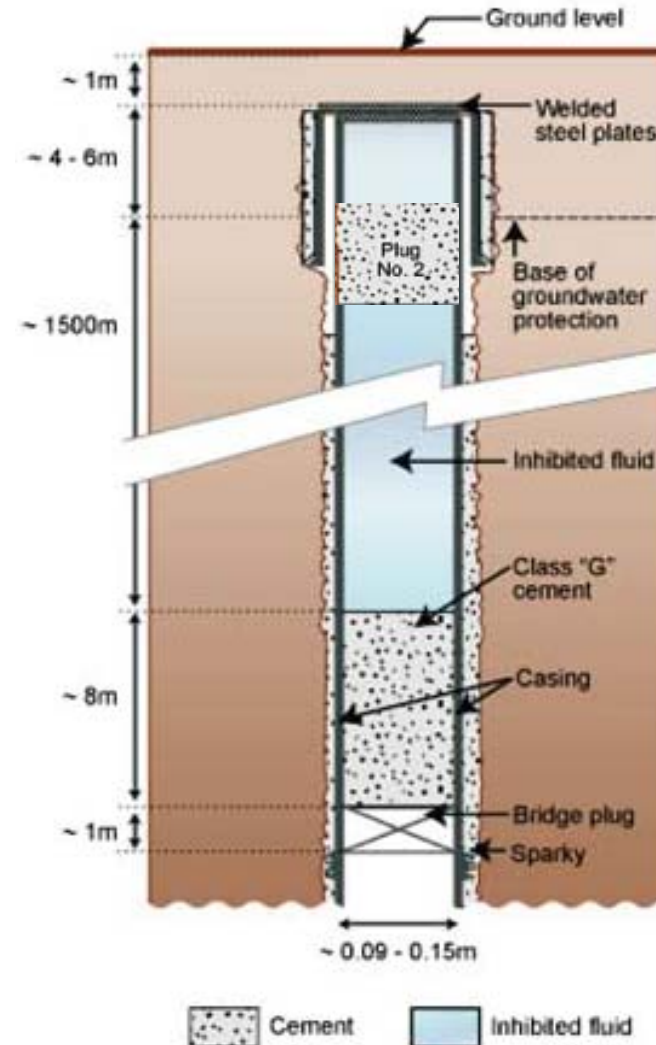
Seismic Monitoring Results, Sleipner

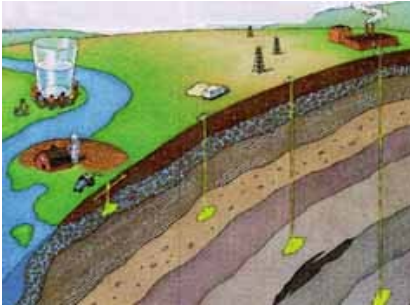


EPA's Proposed GS Rule: *Post-Injection Site Care*

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 CO₂ stream
- Liability stays with the owner/operator





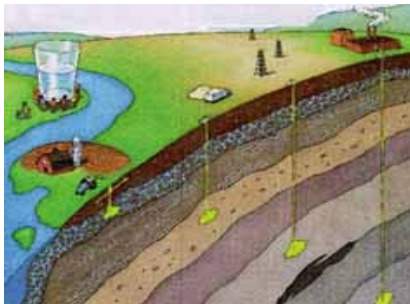
EPA's Proposed GS Rule: *Financial Responsibility*

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**



EPA's Proposed GS Rule: *Public Participation*

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

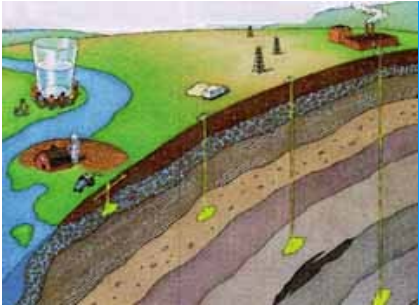




EPA's Proposed GS Rule: *Schedule*

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 15, 2008
Public Comment Period for Proposed Rule	July 25 – November 24, 2008
Notice of Data Availability (if appropriate)	2009
Final UIC Rule for GS of CO ₂	Late 2010 / Early 2011



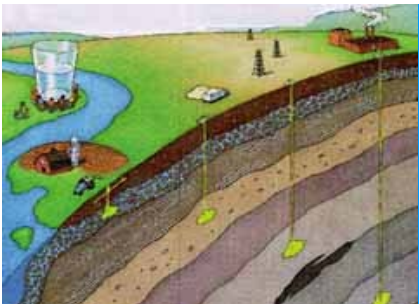


Public Comment Period

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
- Code of Federal Regulations: Underground Injection Control Regulations 40 CFR 144-148 – http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?sid=d6ee71a544eca89c533c825135913f13&c=ecfr&tpl=/ecfrbrowse/Title40/40cfrv22_02.tpl
- Written comments may be submitted at: www.regulations.gov (docket i.d.: EPA-HQ-OW-2008-0390)

