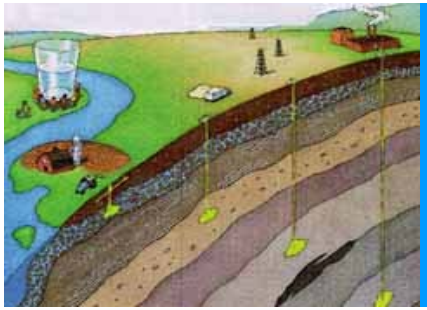
Geologic Sequestration of Carbon Dioxide

EPA Proposed Rule Making

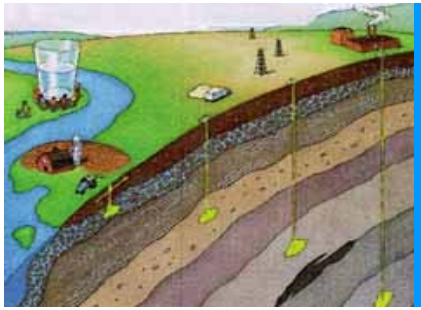
Public Hearing

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



EPA's Proposed GS Rule: *Outline*

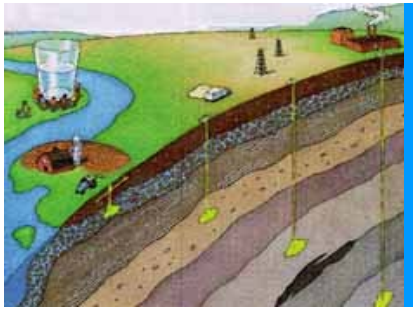
- Underground Injection Control (UIC) Program Background
- Geologic Sequestration of CO_2
- Proposal Development Process
- The Proposed Rule
- Schedule



UIC Program Background

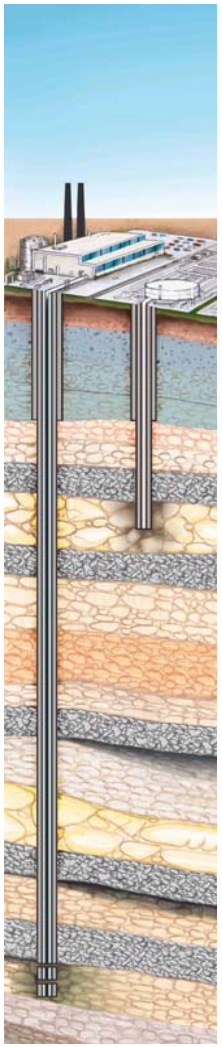
- The 1974 Safe Drinking Water Act (SDWA; Reauthorized in 1996)
  - Federal regulations for protection of Underground Sources of Drinking Water (USDWs)
  - USDW defined:
    - Any aquifer or portion of an aquifer that contains water that is less than 10,000 PPM total dissolved solids or contains a volume 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 CO_2

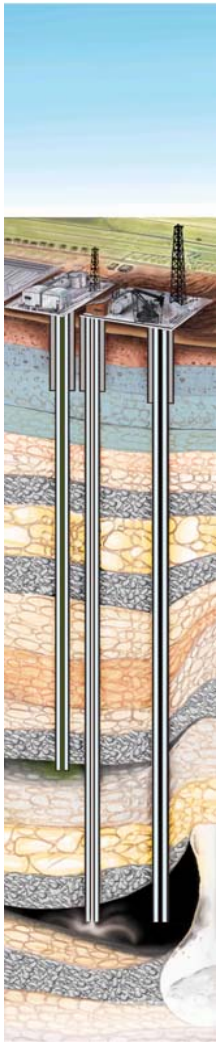


UIC Program Background
UIC Well Classes

Class I

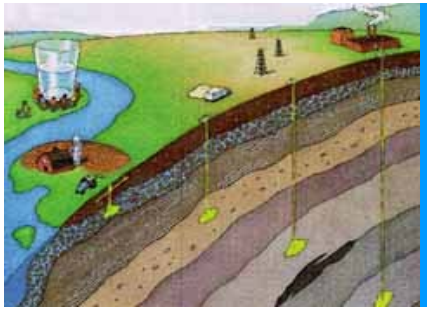


Class II



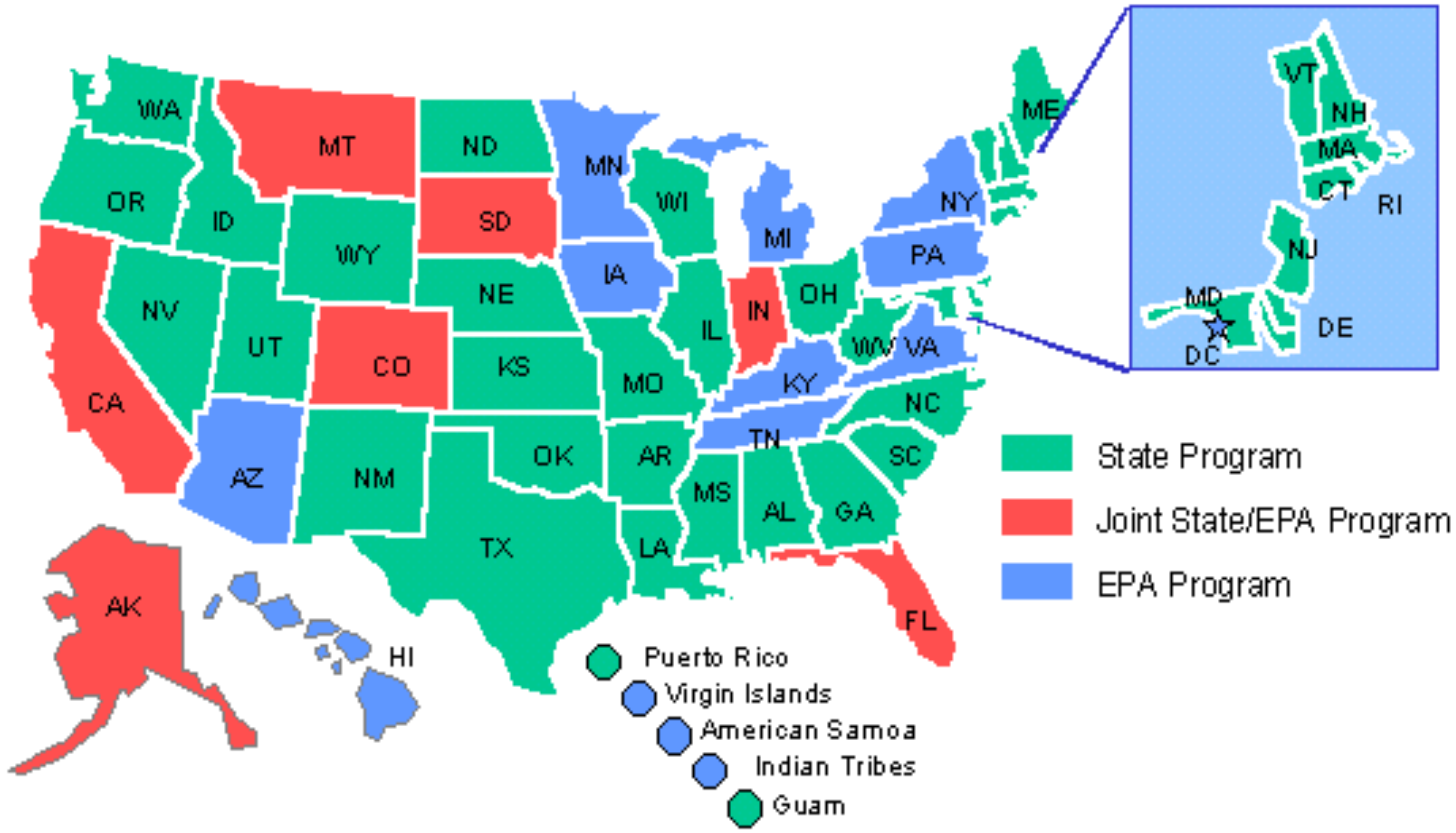
Class III

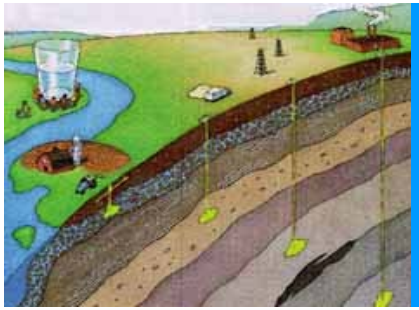
Class V



UIC Program Background
Primacy

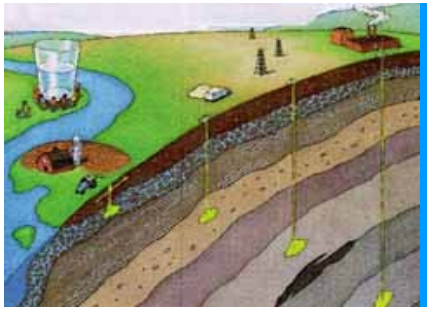
- 33 States have primary enforcement authority (primacy) for the UIC program; EPA and States share program implementation in 7 States; EPA directly implements the entire UIC Program in 10 states





Carbon Capture and Storage/Geologic Sequestration of CO_2

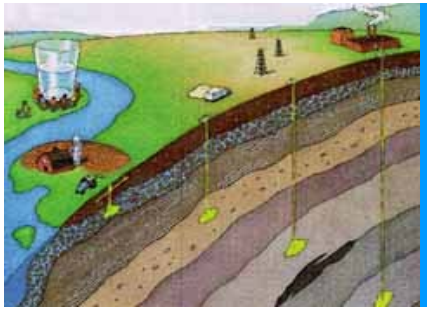
- Important terms:
  - CCS: *Carbon Capture and Storage* (includes capture, transport, and injection of carbon dioxide for long term storage)
  - GS: *Geologic Sequestration* (the injection of carbon dioxide for long term storage)
- GS is one tool that can be used to reduce emissions of carbon dioxide 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 CO_2 injection activities
  - provides consistency across US
  - provides transparency that will build public confidence



CO_2 Storage Capacity

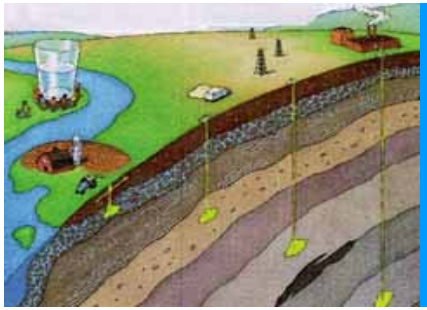
~3,500+ Gigatons (Gt) CO_2 capacity within 230 candidate geologic CO_2 storage reservoirs

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



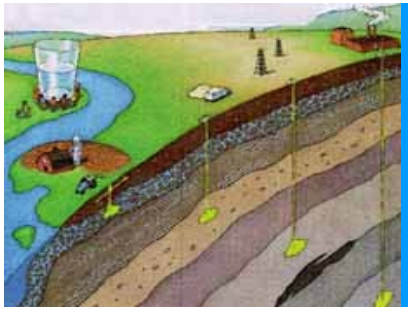
EPA's Proposed GS Rule: *Rule Development Process*

- 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



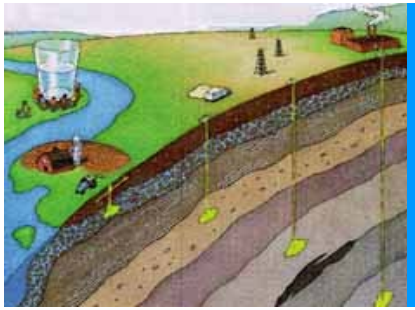
EPA's Proposed GS Rule: *Collaboration*

- 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*

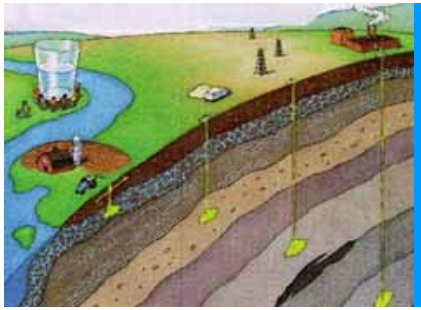
Special Considerations for GS

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

Develop new well class for GS – Class VI

UIC Program Elements

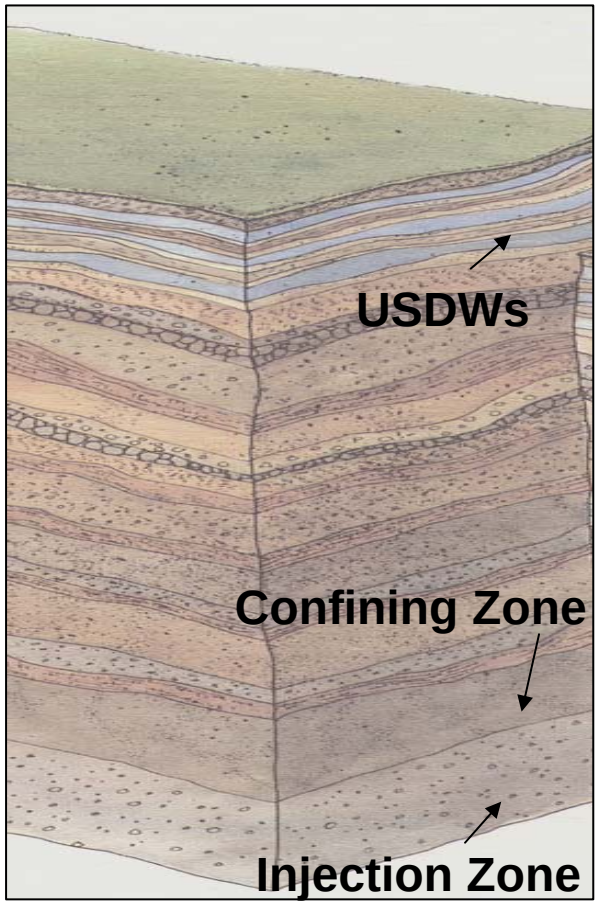
- Site Characterization
- Area Of Review
- Well Construction
- Well Operation
- Site Monitoring
- Post-Injection Site Care
- Public Participation
- Financial Responsibility
- Site Closure

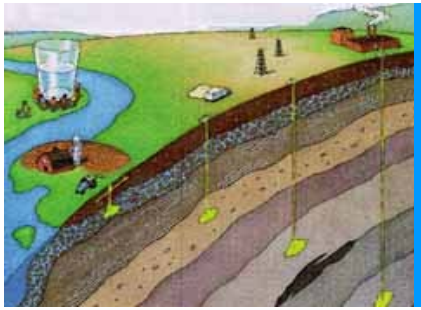


EPA's Proposed GS Rule: *Site Characterization*

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

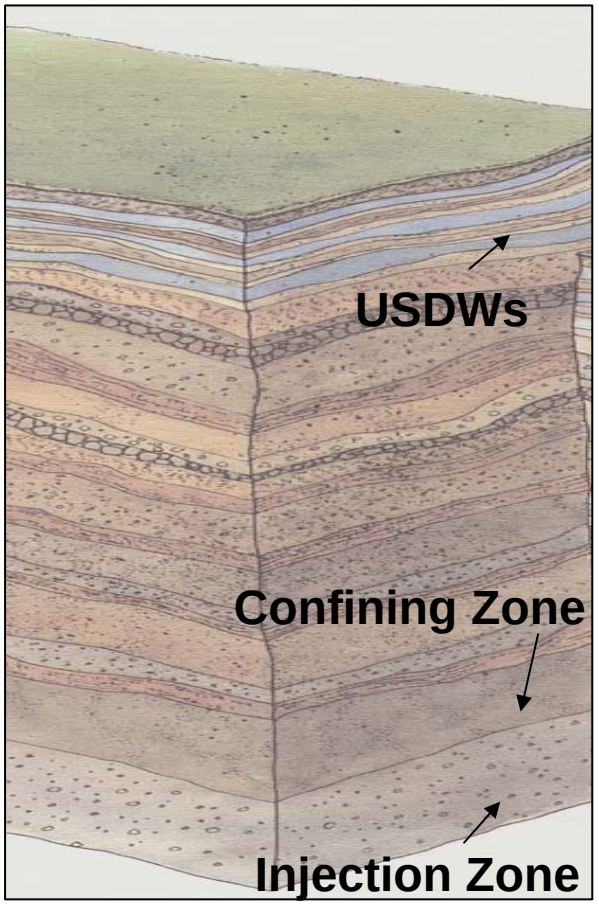


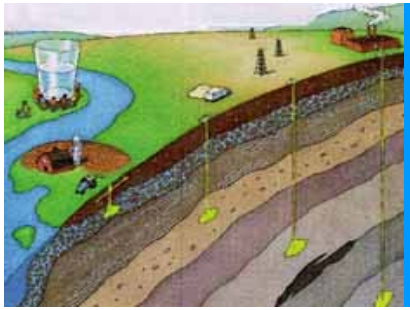


EPA's Proposed GS Rule: *Site Characterization*

Proposed Approach

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



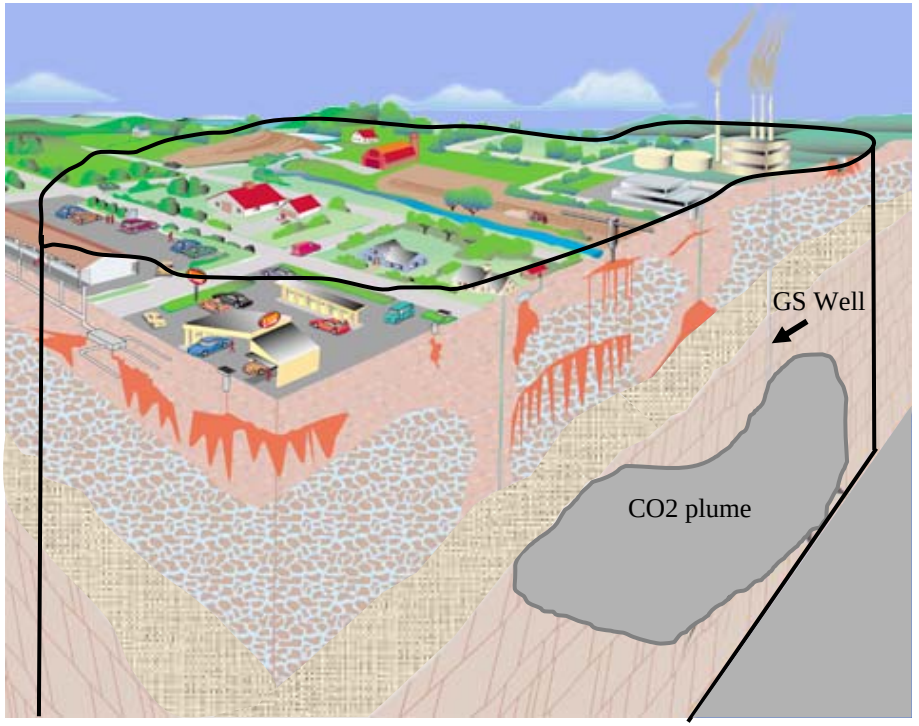


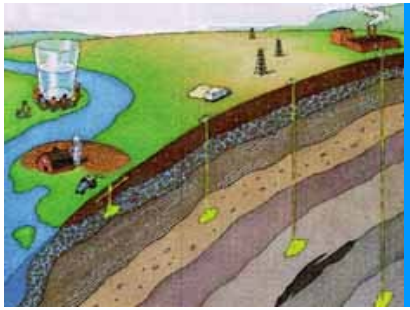
EPA's Proposed GS Rule: *Area of Review (AoR)*

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

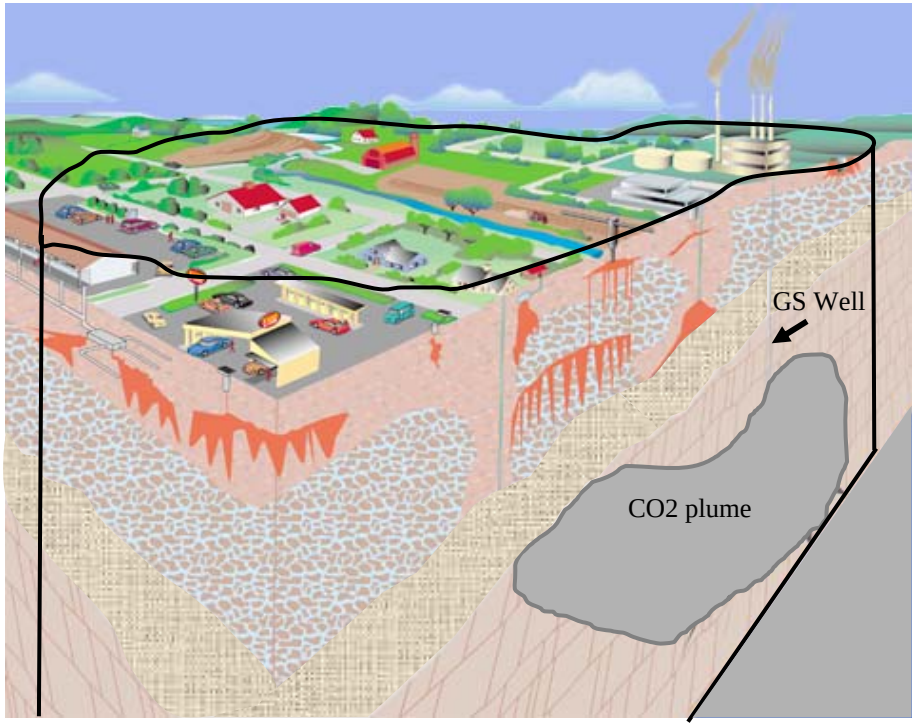


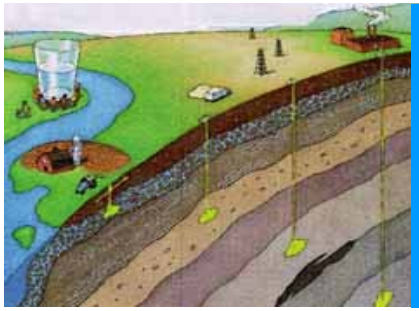


EPA's Proposed GS Rule: *Area of Review (AoR)*

Proposed Approach

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

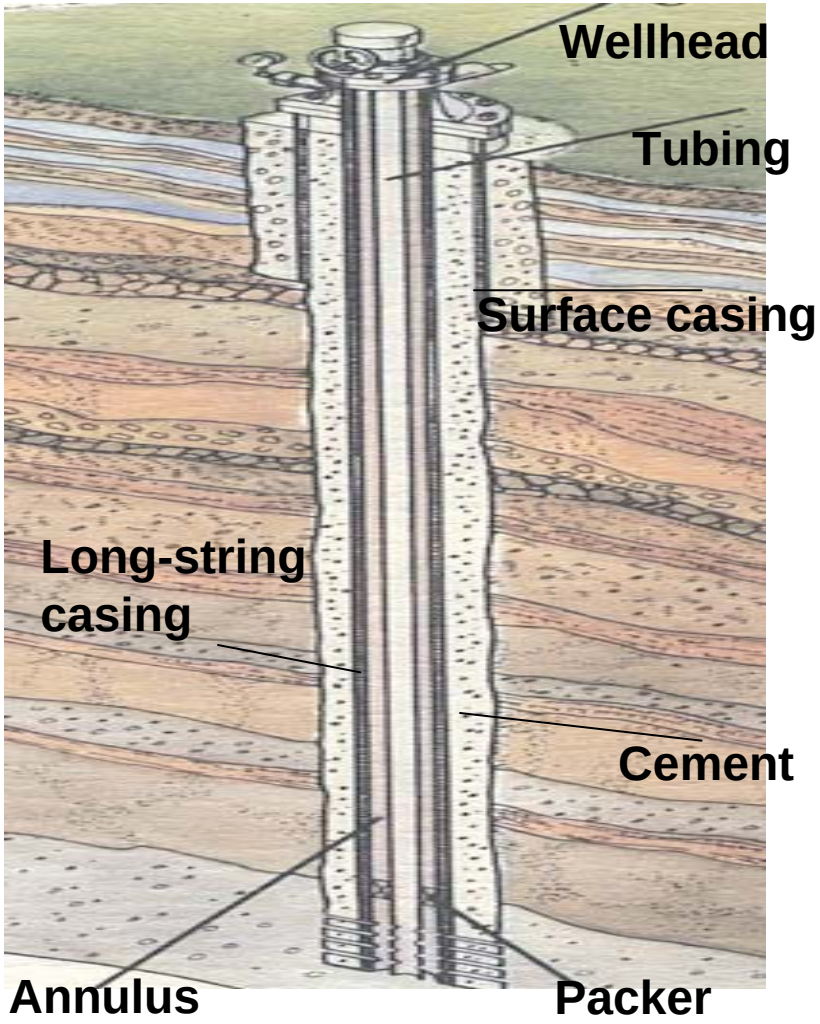


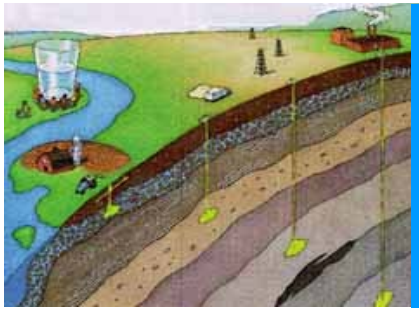


EPA's Proposed GS Rule: *Well Construction*

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

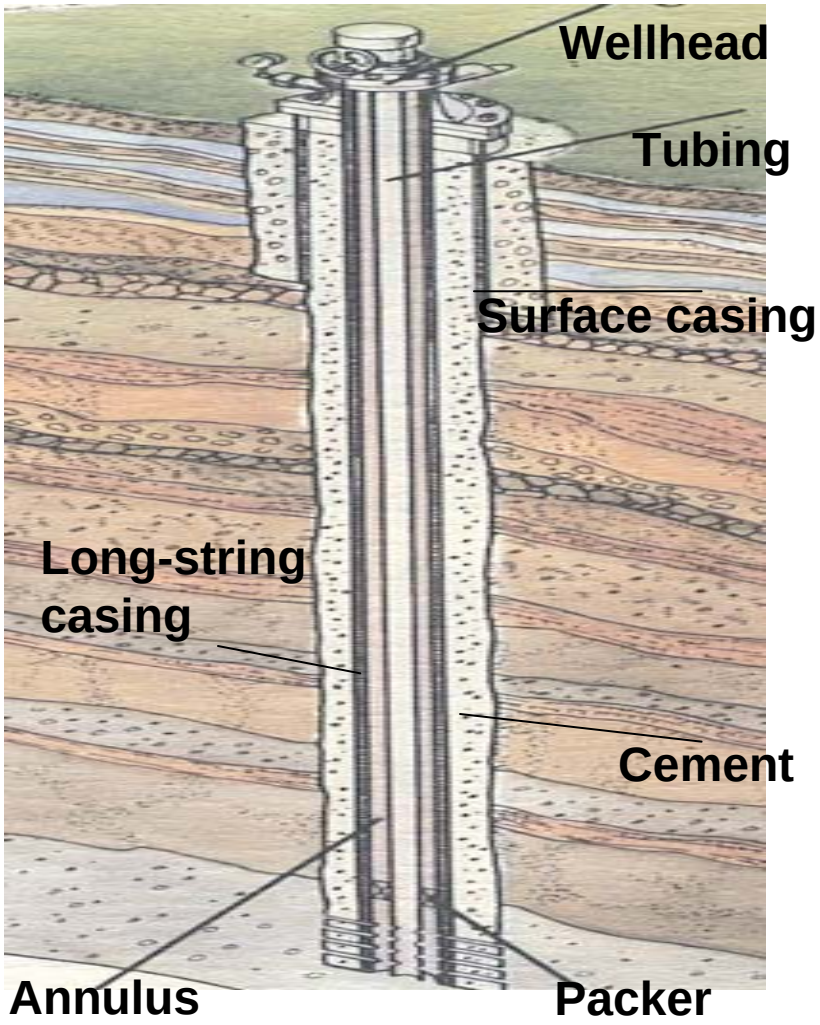


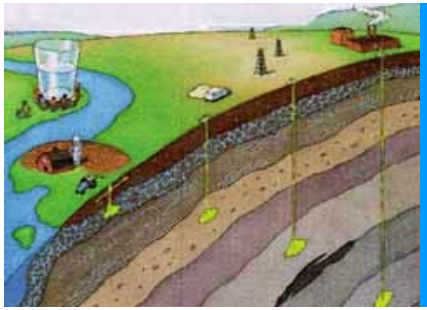


EPA's Proposed GS Rule: *Well Construction*

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

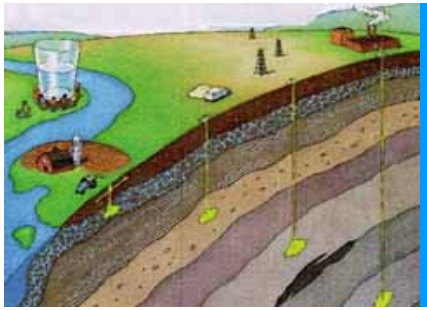




EPA's Proposed GS Rule: *Well Testing and Operation*

Basic Requirements

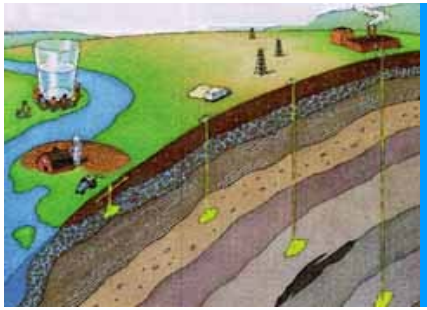
- Procedures to ensure integrity of the well before, during, and after injection
  - Injection may not fracture injection zone
  - Monitor injection pressure, flow rate and volumes, and the nature of the injected fluid
  - Perform mechanical integrity tests



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

Proposed Approach

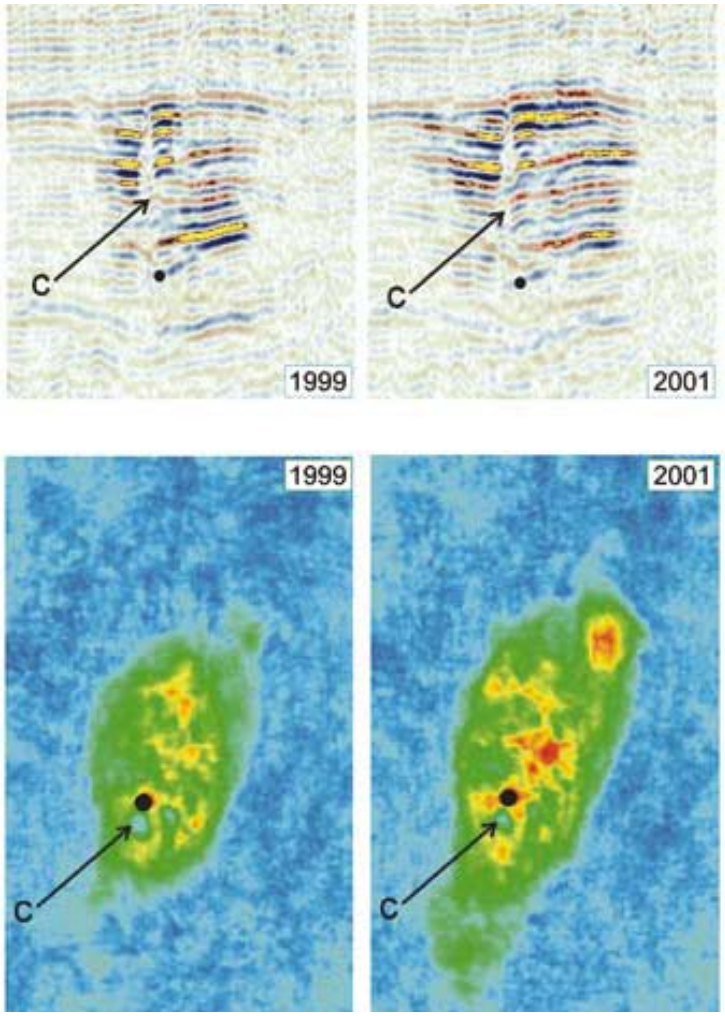
- Continuous internal well mechanical integrity tests (MIT) and annual external MITs
- Injection pressure should not exceed 90 percent of fracture pressure in the injection zone



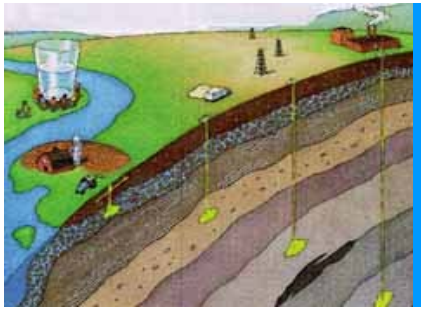
EPA's Proposed GS Rule: *Site Monitoring*

Proposed Approach

- Determine extent of 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

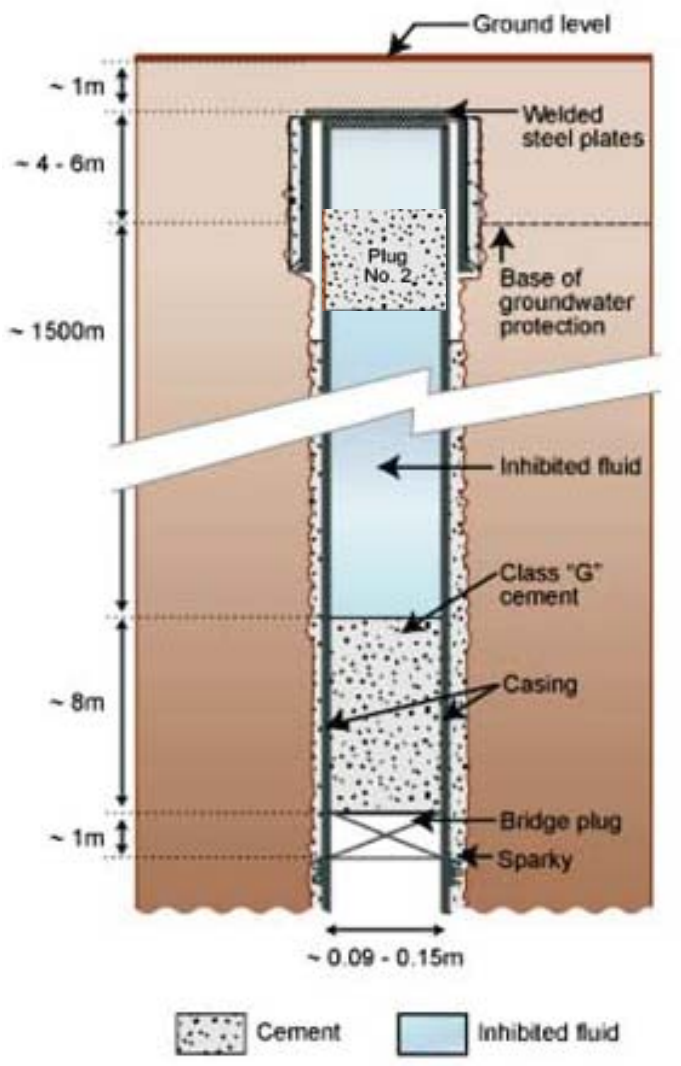


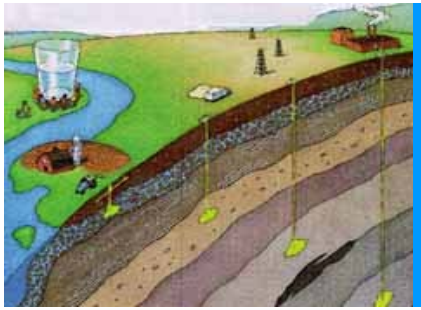
EPA's Proposed GS Rule:

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 CO_2 stream
- Liability stays with the owner/operator





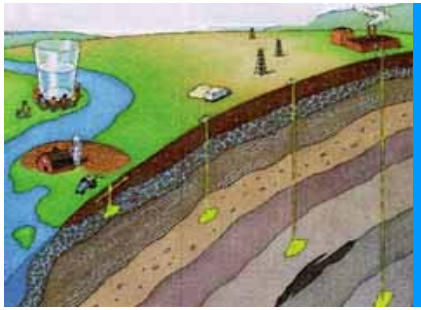
EPA's Proposed GS Rule: *Financial Responsibility*

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**



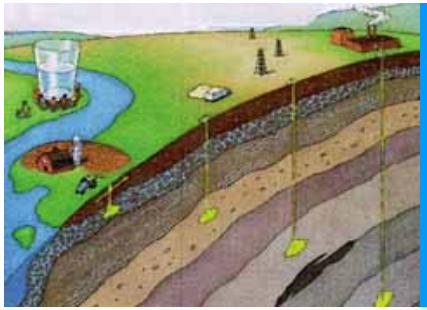
EPA's Proposed GS Rule: *Public Participation*

Basic Requirements

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

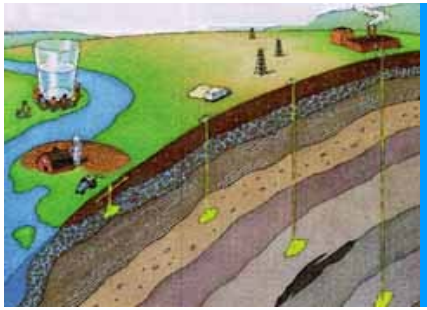
Preamble seeks comment on

- 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

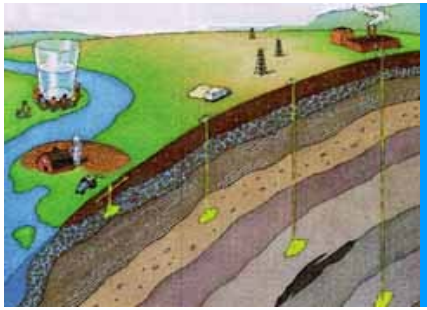


Public Comment Period

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)