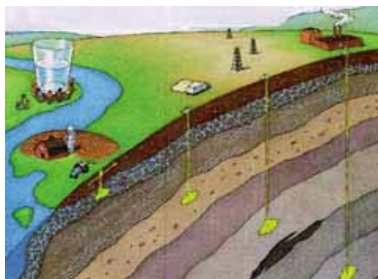




The U.S. Regulatory Approach to Geologic Sequestration

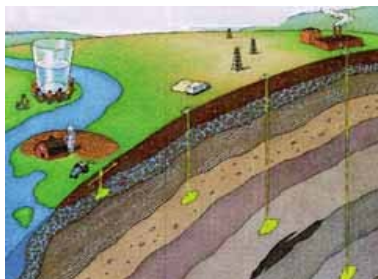
Workshop on Sub-Seabed
Carbon Dioxide Storage
Berlin, Germany
June 16, 2008

Mindy Nigoff
Office of General Counsel – Water Law Office
USEPA



Introduction

- Safe Drinking Water Act (SDWA)
- Underground Injection Control (UIC) Program
- Proposed Geologic Sequestration Rulemaking

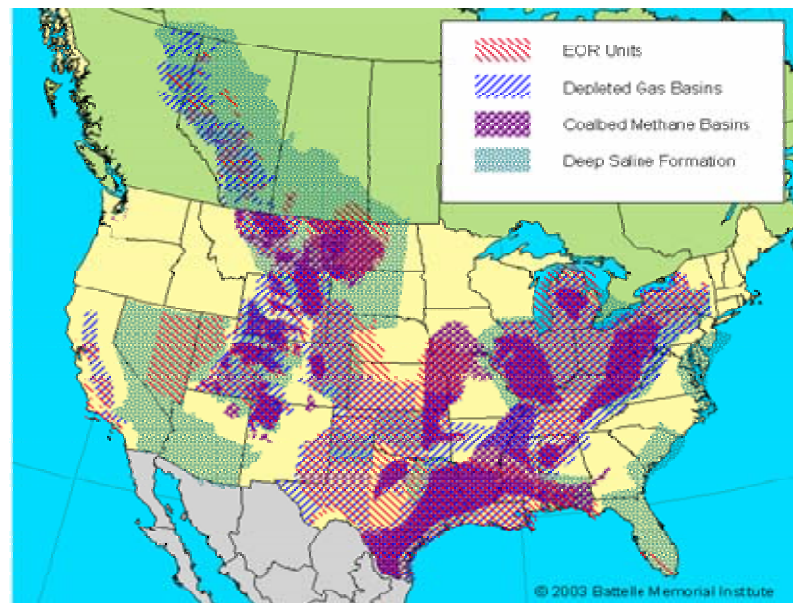


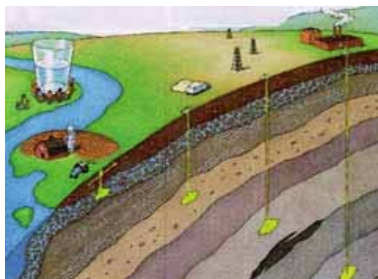
Importance of GS

*“America's the leader in technology and innovation. We all believe technology offers great promise to significantly reduce greenhouse gas emissions—**especially carbon capture, storage and sequestration technologies.**”*

—President George W. Bush

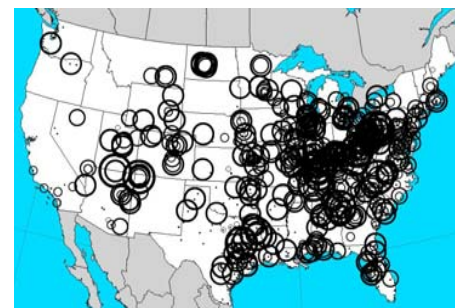
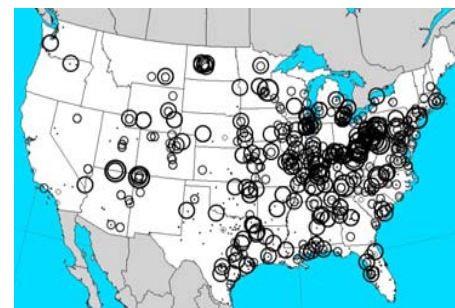
- Carbon Dioxide Capture and Storage (CCS) is a major component of US climate policy
- With success, CCS could represent a significant amount of all carbon mitigation
- Significant US storage capacity for geologic sequestration (GS)

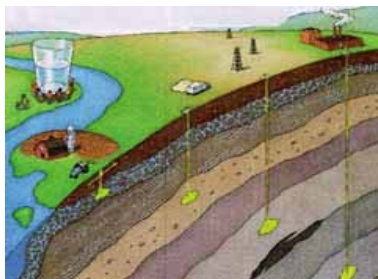




Scale of Implementation

- The potential deployment of GS in the US could be massive:
 - 1,000s of power plants and industrial facilities capturing CO₂, 24-7-365.
 - 100s to 1000s of communities living nearby CO₂ capture and/or storage facilities.
 - 10,000s of injection wells.
 - 1,000s of miles of dedicated CO₂ pipelines.
 - 100s of millions of tons of CO₂ being injected into the subsurface annually.









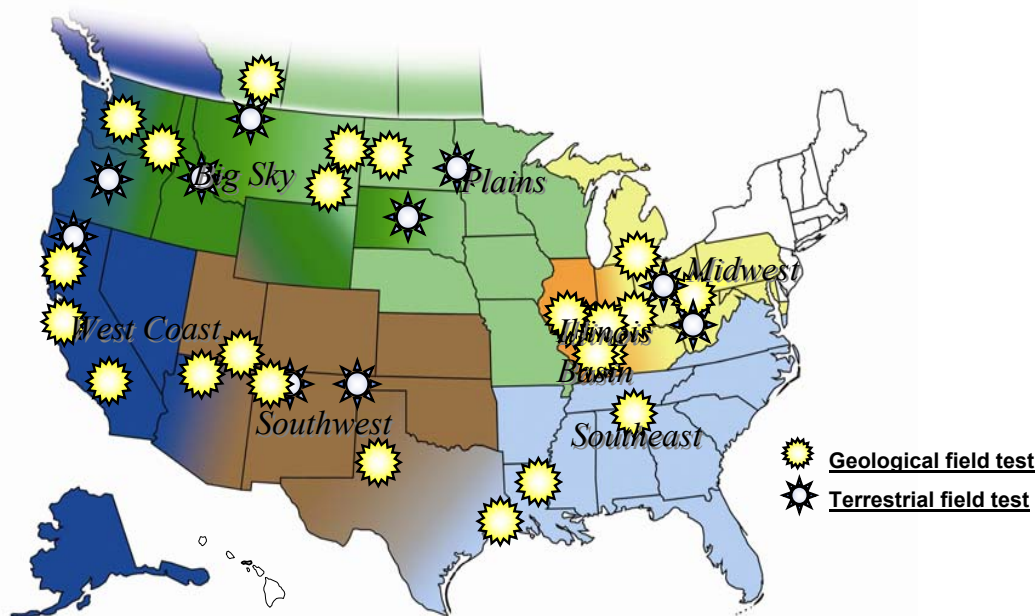


EPA and DOE

DOE is leading U.S. research efforts

DOE Regional GS Demonstration Projects

-  12 small/medium scale projects will be underway by FY2008 in 9 states; EPA receiving, reviewing and issuing permits (Class II and Class V)
-  First large scale carbon sequestration projects to take place between 2008 – 2017
-  Testing storage in oil and gas fields, coal seams, and saline formations
-  Validating injectivity, capacity, and containment
-  Testing monitoring, mitigation, and verification (MM&V) technologies (e.g., reservoir modeling)
-  Investigating well bore construction methods

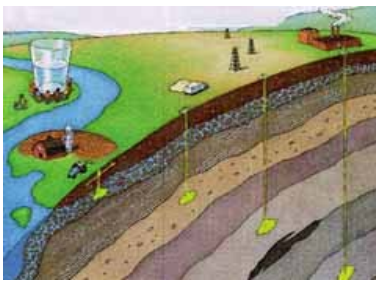


Source: NETL



Rulemaking Background: Process

- EPA Administrator announced a proposed rule will be published by summer 2008
 - The rule will propose minimum federal requirements for GS of CO₂
 - Builds on the existing UIC regulatory framework and adapts to accommodate new information
- A proposed rule is comprised of:
 - Preamble
 - Amended rule text
 - Docket



Safe Drinking Water Act Authority

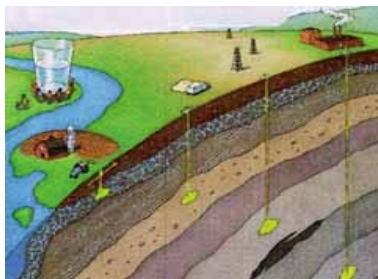
- The 1974 Safe Drinking Water Act (SDWA) requires EPA regulate “underground injection” so that it does not “endanger” *underground sources of drinking water (USDW)*
- The SDWA defines “underground injection” as “the subsurface emplacement of fluids by well injection.”
- The UIC program regulates underground injection of *all fluids* – liquid, gas, or slurry
- USDW are defined as aquifers or portions of aquifers that:
 - have sufficient quantity of ground water to supply a public water system and
 - contain fewer than 10,000 mg/l or ppm total dissolved solids
- The existing UIC program provides a regulatory framework for geologic sequestration of carbon dioxide



Safe Drinking Water Act Limitations

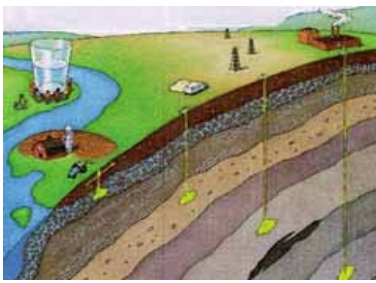
- SDWA requires EPA and the states to prevent underground injection that “endangers” underground sources of drinking water (USDWs).
 - Endangerment occurs if (1) an injection may result in the presence of any contaminant in underground water which supplies or may reasonably be expected to supply any public water system and (2) if the presence of that contaminant may violate the public water system's drinking water standards or may otherwise adversely affect the health of persons.
- SDWA only covers protection of public health to the extent that it may be impacted by endangerment of drinking water.





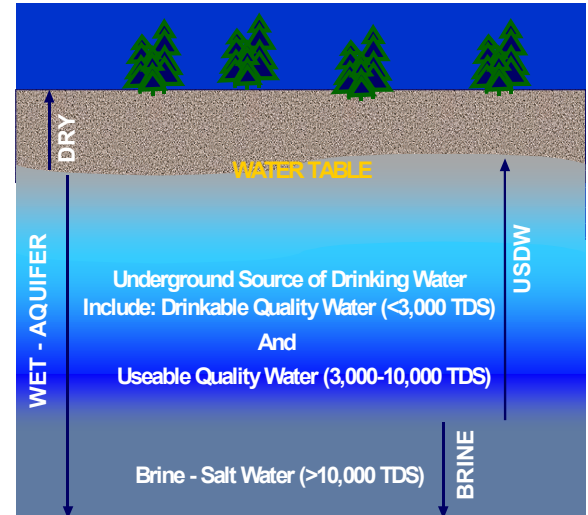
Relationship Between SDWA and Off-Shore CCS

- The U.S is a party to the London Convention and has submitted a legislative proposal to Congress to implement the 1996 Protocol to the London Convention.
- The London Convention is implemented in the U.S. through Title I of the Marine Protection, Research, and Sanctuaries Act (MPRSA)
- The SDWA's jurisdiction under the UIC program extends out, in most cases, to 3 miles from the shore.



UIC General Overview

- SDWA requires EPA to develop minimum federal regulations for state and tribal Underground Injection Control (UIC) Programs to *protect underground sources of drinking water*
- 33 states have primary enforcement authority (primacy); EPA directly implements the program in 10 states; 7 split programs
- Primacy States can be more stringent than the minimum federal regulations
- The UIC regulations address the siting, construction, operation, and closure of injection wells to protect human health by preventing "endangerment" of underground sources of drinking water.





Map of the United States showing the implementation of the Clean Air Act by state. The map is color-coded to indicate the type of program implemented in each state:

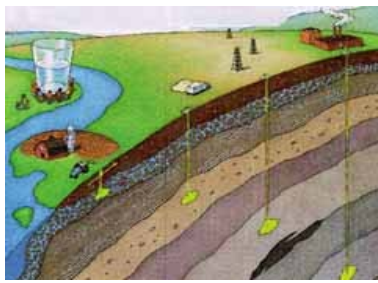
- State Program (Green):** Includes states such as WA, OR, ID, MT, ND, SD, WY, UT, CO, NM, TX, OK, KS, NE, MN, IA, MO, IL, IN, OH, MI, NY, PA, NJ, DE, MD, VA, WV, NC, SC, GA, AL, MS, AR, LA, FL, HI, and AK.
- Joint State/EPA Program (Red):** Includes states such as CA, AZ, and NV.
- EPA Program (Blue):** Includes states such as ME, VT, NH, MA, CT, RI, NY, PA, NJ, DE, MD, VA, WV, NC, SC, GA, AL, MS, AR, LA, HI, and AK.

An inset map shows the Northeast region, highlighting the states of VT, NH, MA, CT, RI, NY, PA, NJ, DE, MD, VA, WV, NC, SC, GA, AL, MS, AR, LA, HI, and AK.

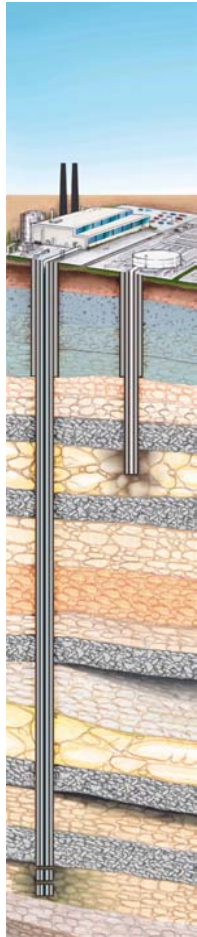
Legend:

- State Program
- Joint State/EPA Program
- EPA Program
- Puerto Rico
- Virgin Islands
- American Samoa
- Indian Tribes
- Guam

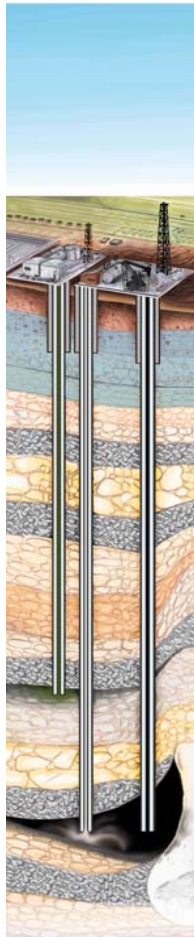




Class I



Class II



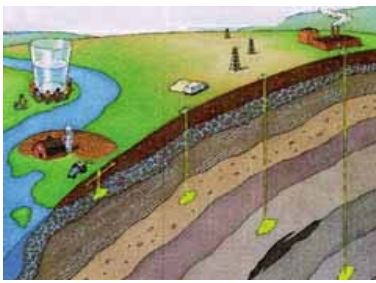
Class III



UIC WELL CLASSES

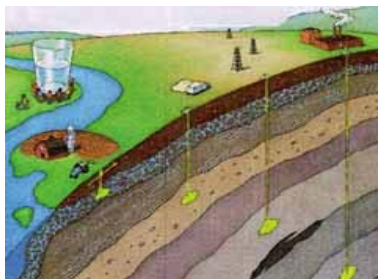
Class V





Current UIC Regulations

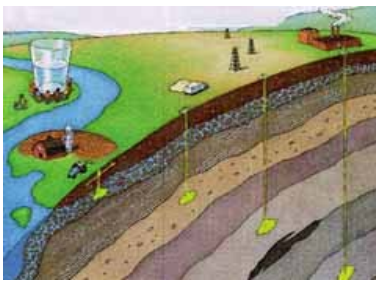
- UIC Regulations contain the following program elements:
 - Site Characterization
 - Area Of Review
 - Well Construction
 - Well Operation
 - Monitoring
 - Post Closure Care
 - Public Participation



EPA Proposed Rulemaking for GS

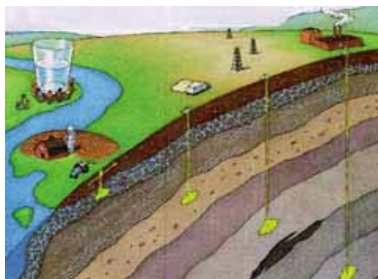
Special Considerations for GS

- Large Volumes
- Buoyancy
- Viscosity
- Corrosivity



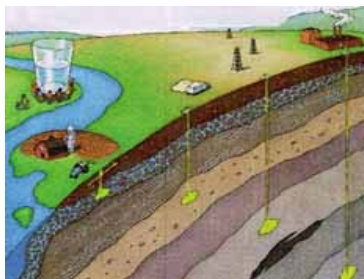
UIC Considerations for Proposed Rulemaking

- Site Characterization – Considering what type of confinement system is necessary.
- Area of Review - Should periodic re-evaluation of AoR be required?
- Well Construction - Should corrosion resistant construction materials be required?
- Well Operation and Monitoring - Should tracers or surface air/soil gas monitoring be required to protect USDWs?
- Well Closure and Post-Closure Care - Should the owner/operator be required to demonstrate and maintain financial assurance for corrective action, remediation and post closure monitoring in addition to well closure?



GS Legal Issues

- Financial Responsibility
- Long Term Liability
 - Resource Conservation and Recovery Act (RCRA) Applicability
 - Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Applicability
- Pore Space and Subsurface Property Rights

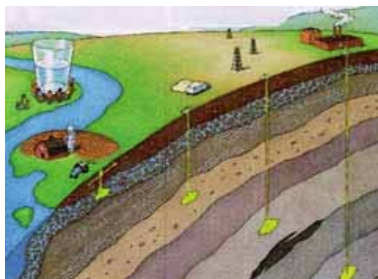


For More Info

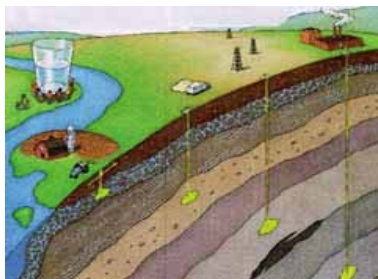
More information about the UIC Program:

- EPA Website: Geologic Sequestration of Carbon Dioxide:

http://www.epa.gov/safewater/uic/wells_sequestration.html

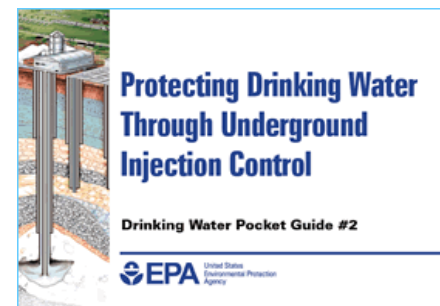
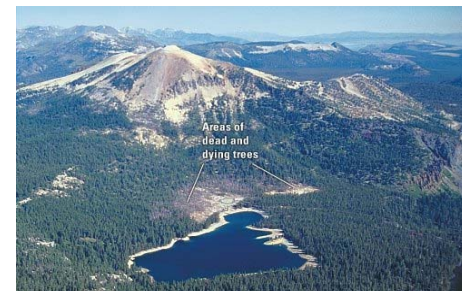
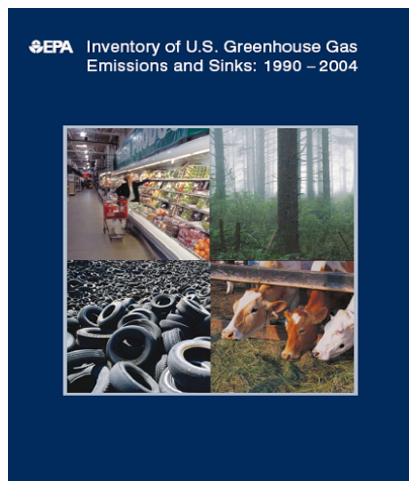


BACKGROUND

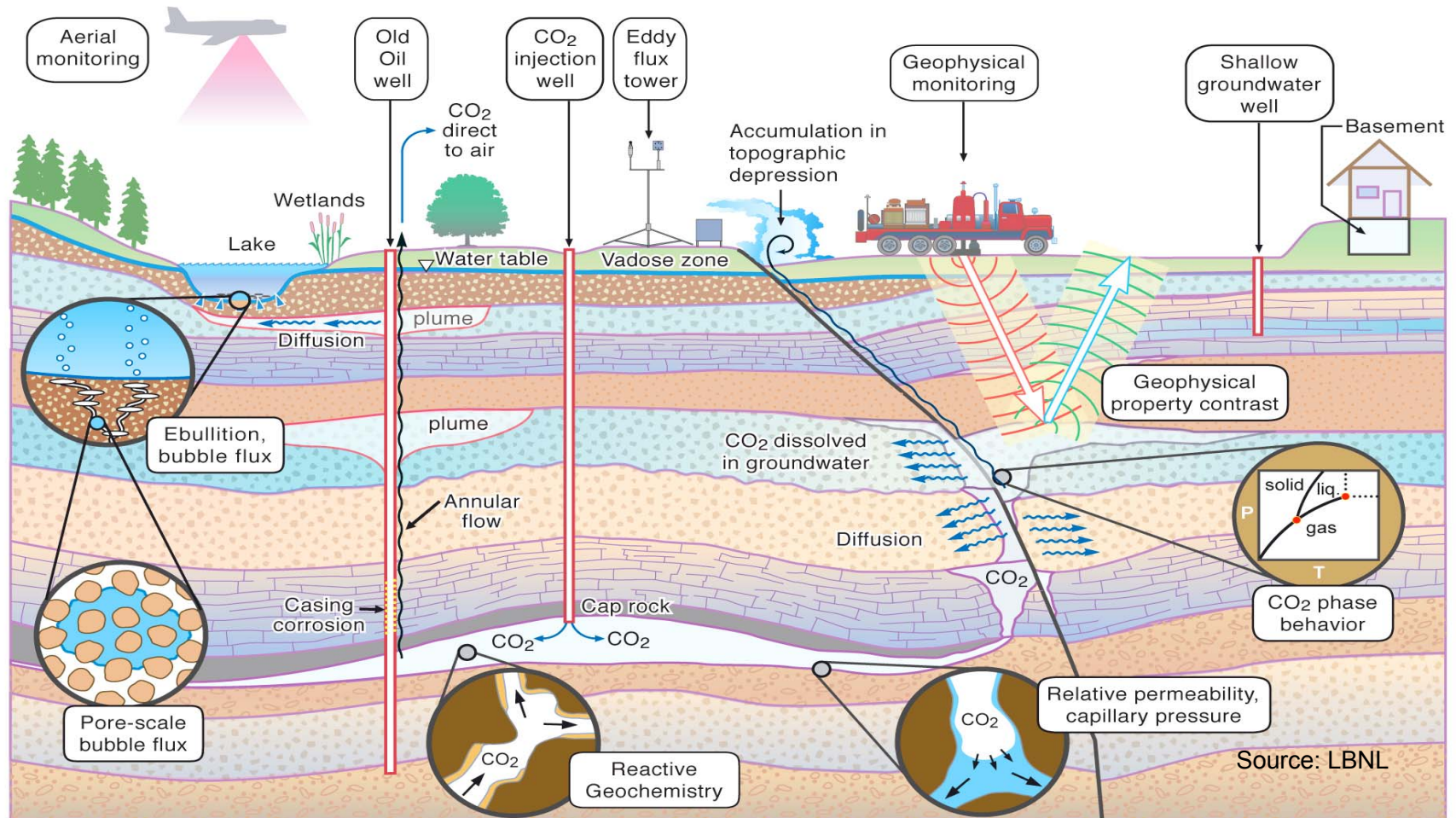


EPA Efforts in GS

- Evaluating risks to human health and the environment
- Developing regulatory guidance and a risk management framework under the SDWA
- Designing inventory and accounting methodologies for CCS
- Facilitating discussions on advanced coal technologies under the Clean Air Act Advisory Committee



A colorful cross-section diagram of the Earth's crust. From top to bottom, the layers are: a green surface with a blue river, a brown layer with a wind turbine, a grey layer with a small white building, a dark brown layer with a small black building, a light brown layer with a small yellow building, and a dark brown layer with a small black building. A large glass of water is shown on the left, and a small boat is on the river. A large red building is on the right. The diagram illustrates the different layers of the Earth's crust and the various resources and structures found within them.



Research: *World-wide CO₂ Projects*

