Geologic Storage of CO_2

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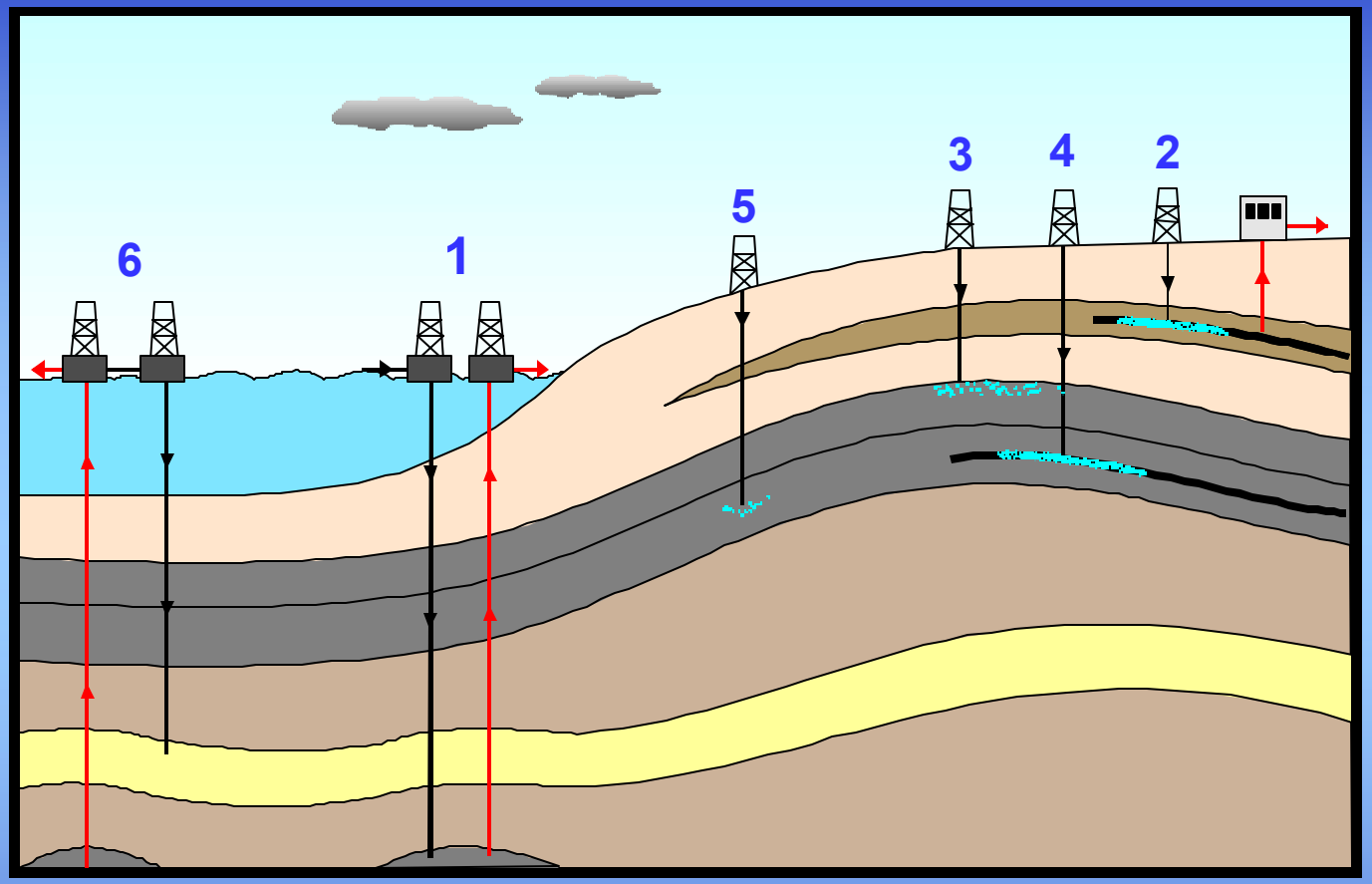
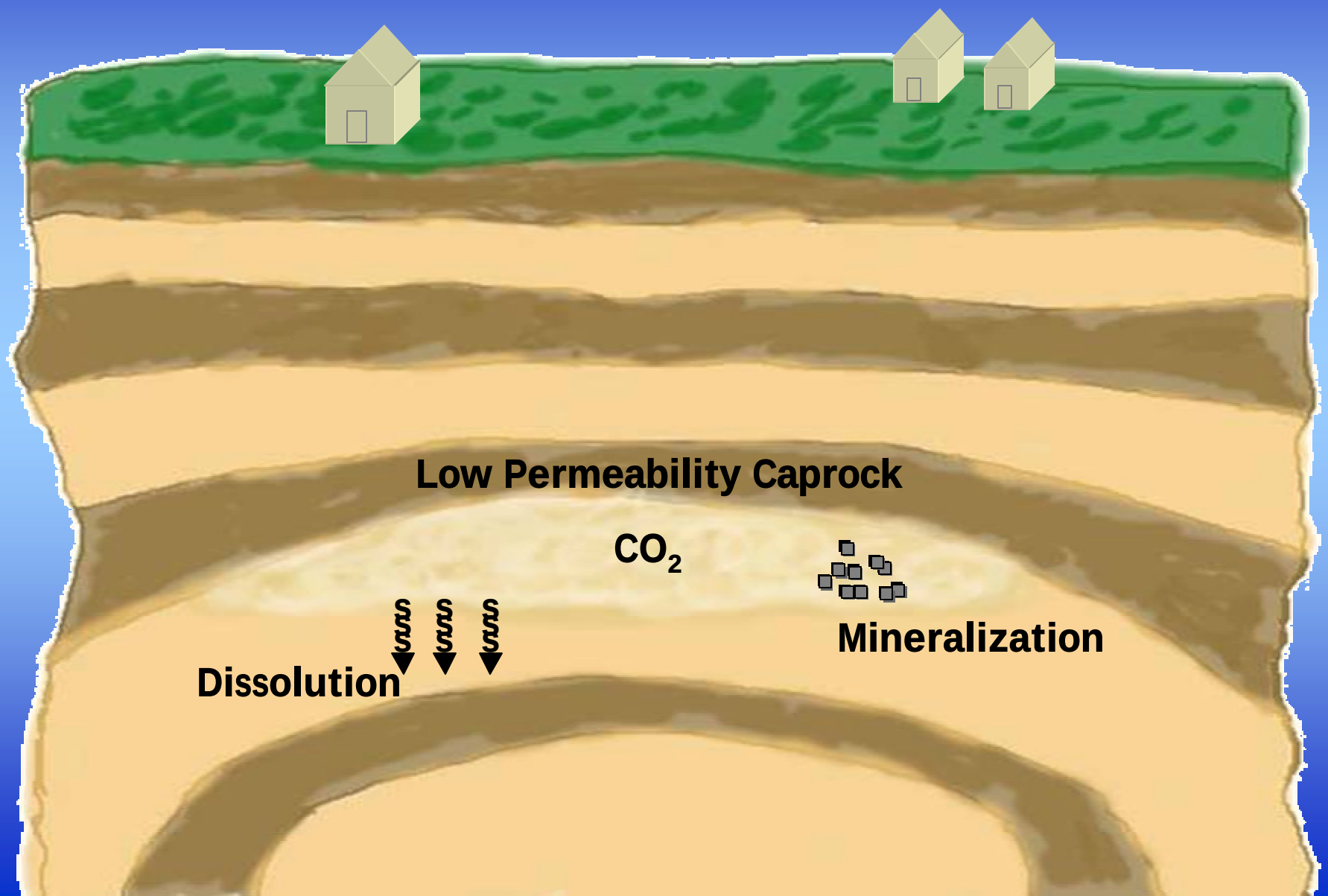
Options for Geological Sequestration



1. Enhanced Oil and Gas Recovery (EGR)
2. Enhanced Coal Bed Methane (ECBM)
3. Depleted Oil & Gas reservoirs
4. Deep un-mineable coal seams
5. Large voids & cavities
6. Deep unused saline water saturated reservoirs

CO2CRC

CO_2 Storage Mechanisms

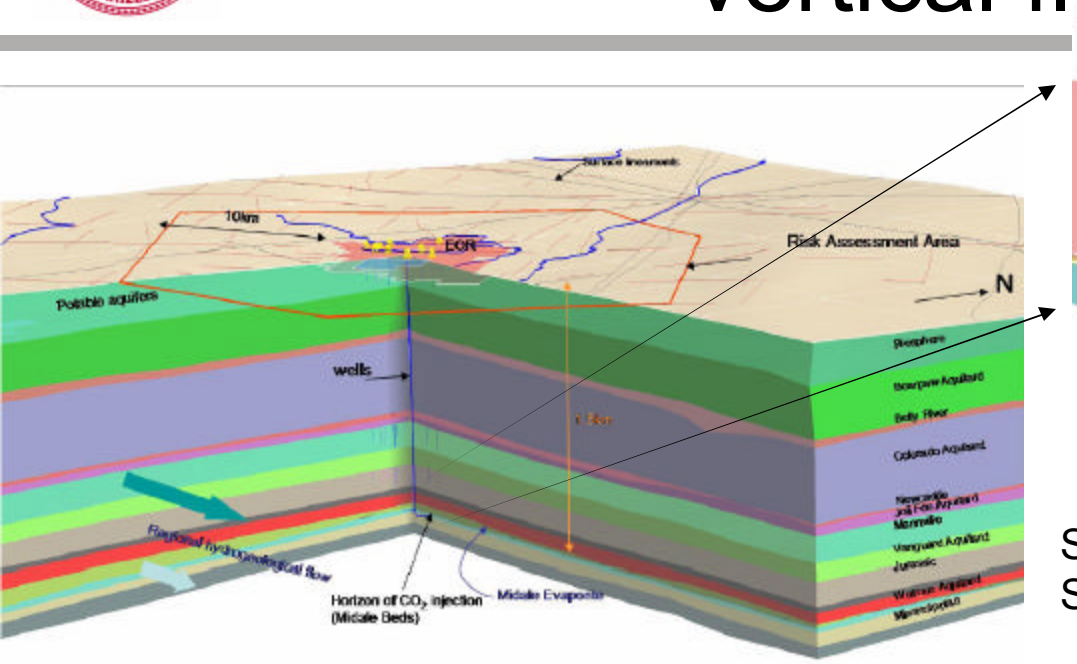


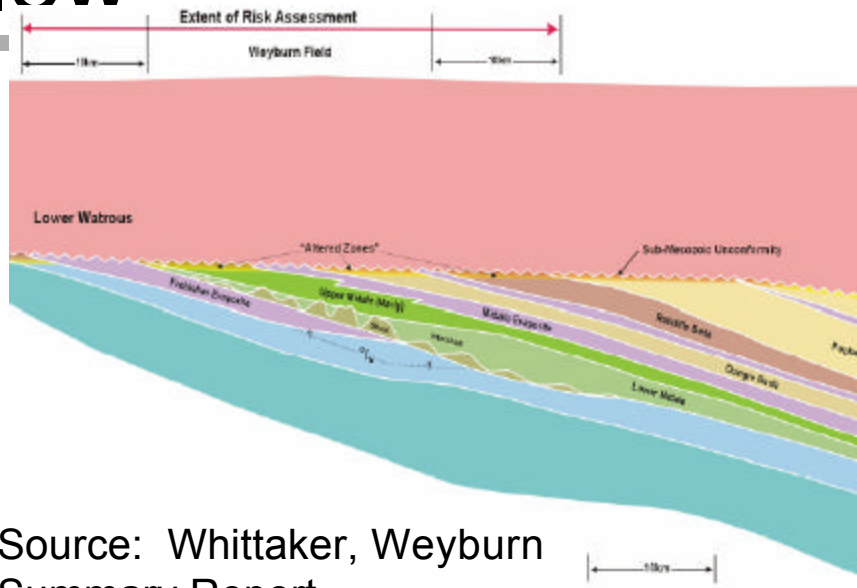
CO_2 Storage Related Activities Underway or Proposed

CO_2 for EOR

- Proven technology – 70 projects in west Texas
- Use of CO_2 for oil recovery is limited by gas supply
- 1998 production ~ 180,000 B/D
- 1998 CO_2 injection (natural CO_2) ~ 7.5 million t/yr C ~ 0.6% of fossil fuel emission

Weyburn: multiple barriers to vertical flow





Source: Whittaker, Weyburn Summary Report

The deep formations containing oil and salt water are separated from the surface by thick formations that prevent flow of oil, gas, or water.

Even if the oil were not present at Weyburn, it would be a good place to store CO_2.

Frio CO_2 Injection Pilot Project

The well

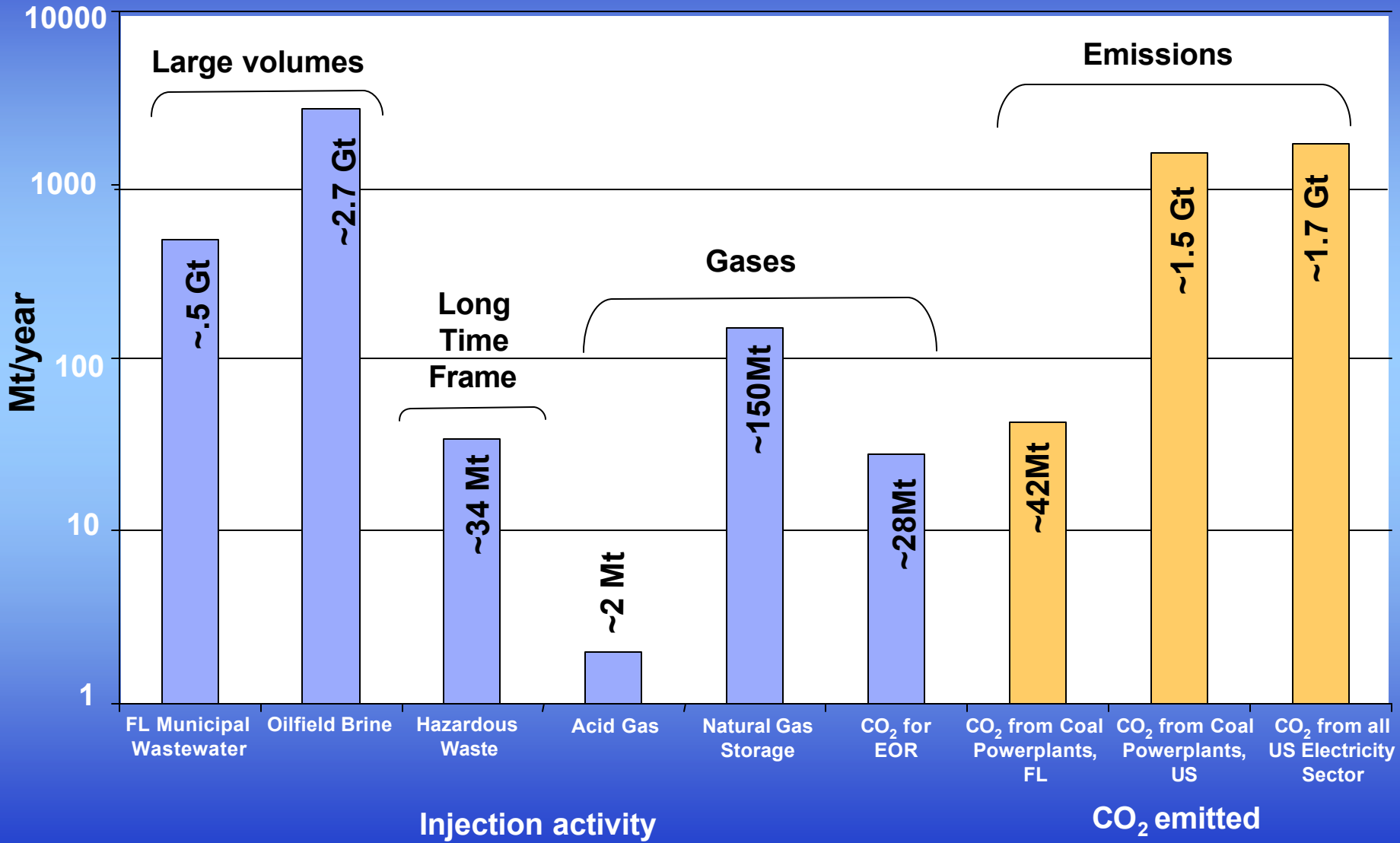
Monitoring

Sampling System

Storage trucks

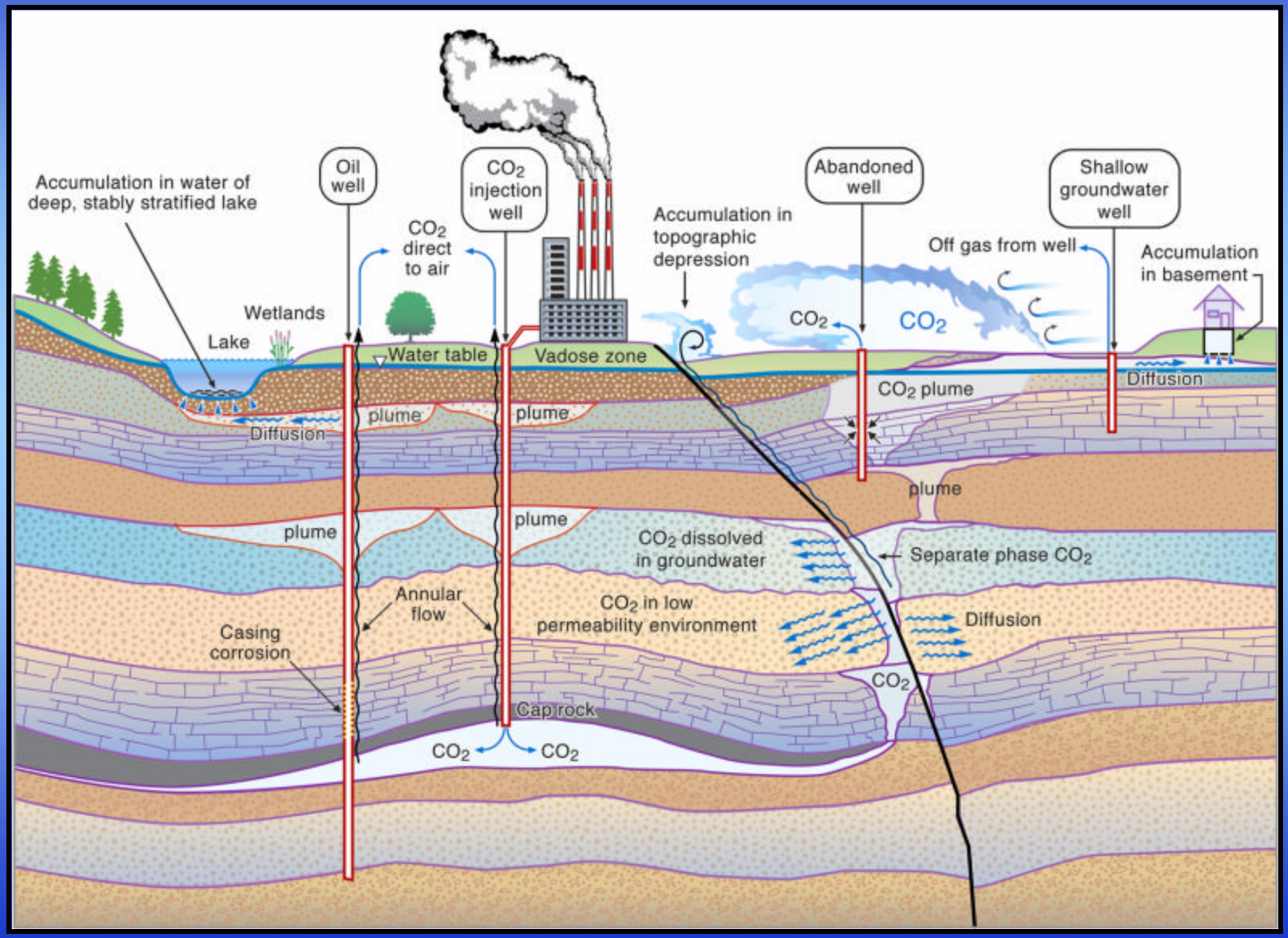
The site

Injection Activity Compared with CO_2 Emissions (Mt/year)



Sources: Wilson, Johnson, and Keith, 2003

Risk Assessment



Monitoring Options

	Basic Monitoring	Additional Measurements for Enhanced Monitoring
Pre-operational Monitoring	• Well logs • Wellhead pressure • Formation pressure • Injection and production rate testing • Seismic survey • Atmospheric CO_2 monitoring	• Gravity survey • Electromagnetic survey • CO_2 flux monitoring • Pressure and water quality above the storage formation
Operational Monitoring	• Wellhead pressure • Injection and production rates • Wellhead atmospheric CO_2 monitoring • Microseismicity • Seismic surveys	• Well logs • Gravity survey • Electromagnetic survey • Continuous CO_2 flux monitoring at 10 stations • Pressure and water quality above the storage formation
Closure Monitoring	• Seismic survey	• Gravity survey • Electromagnetic survey • Continuous CO_2 flux monitoring at 10 stations • Pressure and water quality above the storage formation • Wellhead pressure monitoring for 5 yeas, after which time the wells will be abandoned

Summary

- CO_2 storage can be safe and effective
- Technology is available and borrows from mature oil field practices
- Site specific studies are needed