Assessment of CO_2 Sequestration for Enhanced Recovery in Ohio

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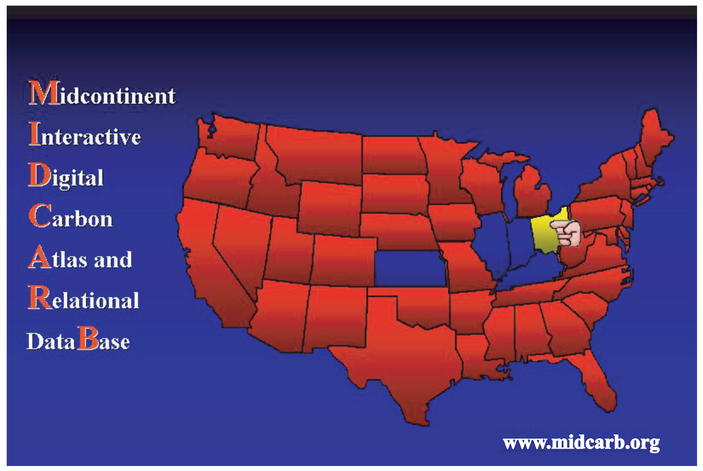
ABSTRACT

Updated oil-and-gas-fields maps of Ohio have been created using a geographic information system (GIS) to assess potential fields for CO_2 sequestration and CO_2-assisted enhanced recovery. This work was performed as part of the Midcontinent Interactive Digital Carbon Atlas and Relational Database (MIDCARB) project, a U.S. DOE-funded consortium of the Ohio, Kansas, Illinois, Indiana, and Kentucky state-geological surveys. This oil-and-gas-fields GIS has been linked to Ohio's oil-and-gas-well database, RBDMS, and oil-and-gas-production database, POGO, to permit greater flexibility of mapping and analyses.

Individual oil-and-gas fields are grouped into eight major plays defined by producing horizon to enable better reservoir characterization for potential CO_2-sequestration zones. Each oil-and-gas field contains associated attributes, where available, such as reservoir characteristics (i.e. average depth, lithology, porosity, permeability, reservoir temperature, and net thickness), production data (i.e., cumulative production, original-oil-in-place, and remaining-oil-in-place), and fluid properties (i.e., oil gravity, oil viscosity, and average water saturation). Using this data, oil-and-gas fields can be screened for CO_2-sequestration and enhanced-recovery potential, and CO_2-storage capacity can be calculated.

Oil samples from representative reservoirs throughout the state were collected to test the minimum miscibility pressure (MMP), one of the most critical screening factors for CO_2-enhanced-recovery projects. Initial test results for the Knox MMP is approximately 1500 psia, indicating many Knox reservoirs in eastern Ohio are potential candidates for CO_2 sequestration.

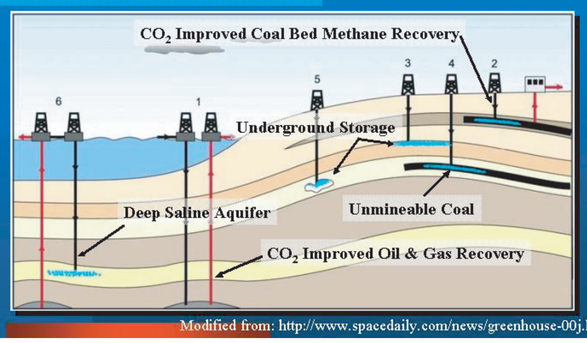


WHAT IS MIDCARB?

The Midcontinent Interactive Digital Carbon Atlas and Relational dataBase (MIDCARB) is a research consortium composed of the State Geological Survey's of Illinois, Indiana, Kansas, Kentucky, and Ohio, with funding from the US Department of Energy through the National Energy Technology Laboratory. The main objective of MIDCARB is to evaluate the potential capacity for geologic sequestration of carbon dioxide in the member states. Geologic Sequestration of carbon dioxide is viewed as one of the top technologies for reducing the amount of this greenhouse gas (GHG) into the atmosphere. Obtaining realistic estimates of the potential amounts of carbon that can be stored in geologic reservoirs, and the locations of these reservoirs, is of vital importance to establishing this technology.

To share the results of this research with decision-makers and the general public the consortium has constructed an online distributed Relational Database Management System and Geographic Information System for analyzing the spatial relationships and technical characteristics of large point sources of CO_2 and geologic sequestration options. MIDCARB provides advanced distributed computing solutions that dynamically link database servers across each state allowing data to be maintained at the local level but accessed through a single web portal. When completed, the digital spatial database will allow users to estimate the amount of carbon dioxide (CO_2) emitted by source supplies (such as power plants, refineries and other fossil fuel consuming industries) in relation to geologic reservoirs that can provide safe and secure sequestration over geologic periods of time.

CO_2 Geologic Sequestration Options



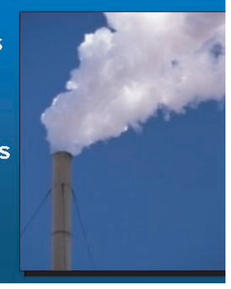
Modified from: http://www.spacedaily.com/news/greenhouse-00j.html

MIDCARB: Brings Together

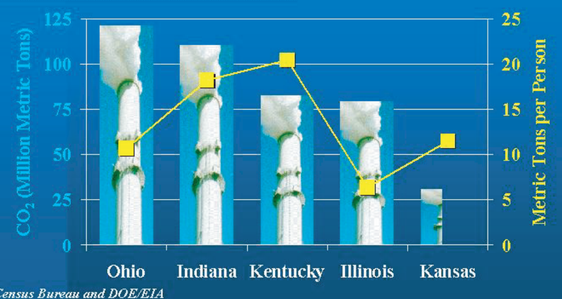
- Five Natural Resource Research Organizations
  - Illinois, Indiana, Kansas, Kentucky, Ohio Geological Surveys
- Large Natural Resources Databases
- Relational Database Management Systems
- Geographic Information Systems
- Network (Web) Expertise

CO_2 Source and Characterization

- Anthropogenic Sources
  - Power Plants
  - Other Large Stationary Sources
- Flue Gas
  - Pressure, Temperature
  - Concentrations, Output Patterns
- Location in relation to:
  - Sequestration Sites/Sinks
  - Transportation Infrastructure

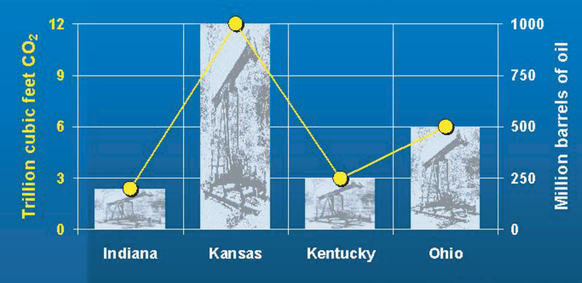


CO_2 Power Plant Emissions MIDCARB Consortium



US Census Bureau and DOE/EIA

Estimated Potential CO_2 Disposal and Incremental Oil Recovery



(Assume 12Mcf CO_2 per barrel of oil)

CO_2 Sequestration - Active Oil and Gas Reservoirs

- CO_2 Flooding (EOR Activities)
  - Miscible and Immiscible in Oil Reservoirs
  - Possible Pressure Maintenance in Gas Reservoirs
- Benefits
  - Increase Oil and Gas Production
  - Sequester CO_2: Lower Net Cost for Sequestration
- Extensive Industry CO_2 EOR Experience and Data
- MIDCARB Data
  - Reservoir Fluid and Rock Properties
  - Geologic and Engineering Data

CO_2 Sequestration - Depleted Oil and Gas Reservoirs

- Trapping
  - Same Mechanisms that Trapped Original Oil and Gas
- Benefits
  - Proven Trap
  - Existing Infrastructure
    - Simpler
    - Cheaper
  - Storage over Geologic Time Periods
- MIDCARB Data
  - Reservoir Fluid and Rock Properties
  - Geologic and Engineering Data

MIDCARB: Summary

- Quality, Size and Geologic Integrity of Sequestration Sites (Safety and Longevity)
- Location of Sequestration Sites Relative to CO_2 Sources (Cost)
- Relation of Quantity and Quality of CO_2 Source to Sequestration Options
- Economic Impact and Value of CO_2 Recovery and Sequestration
- Make Results Easily Available via Internet

MIDCARB
Kentucky Geological Survey
Midcontinent Interactive Digital Carbon Atlas and Relational dataBase