An Update on the Midcontinent Interactive Digital Carbon Atlas and Relational dataBase (MIDCARB) Project

Scott W. White, Timothy R. Carr, James A. Drahovzal , J. Hickman, Brandon Nuttall, R. Riley, John A. Rupp, Beverly Seyler, and Ernie Slucher

www.midcarb.org

DE-FC26-OONT40936 A005

What is MIDCARB?

- It 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 is to evaluate the potential capacity for geologic sequestration of Carbon Dioxide in the member states.
- 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.

The MIDCARB Website

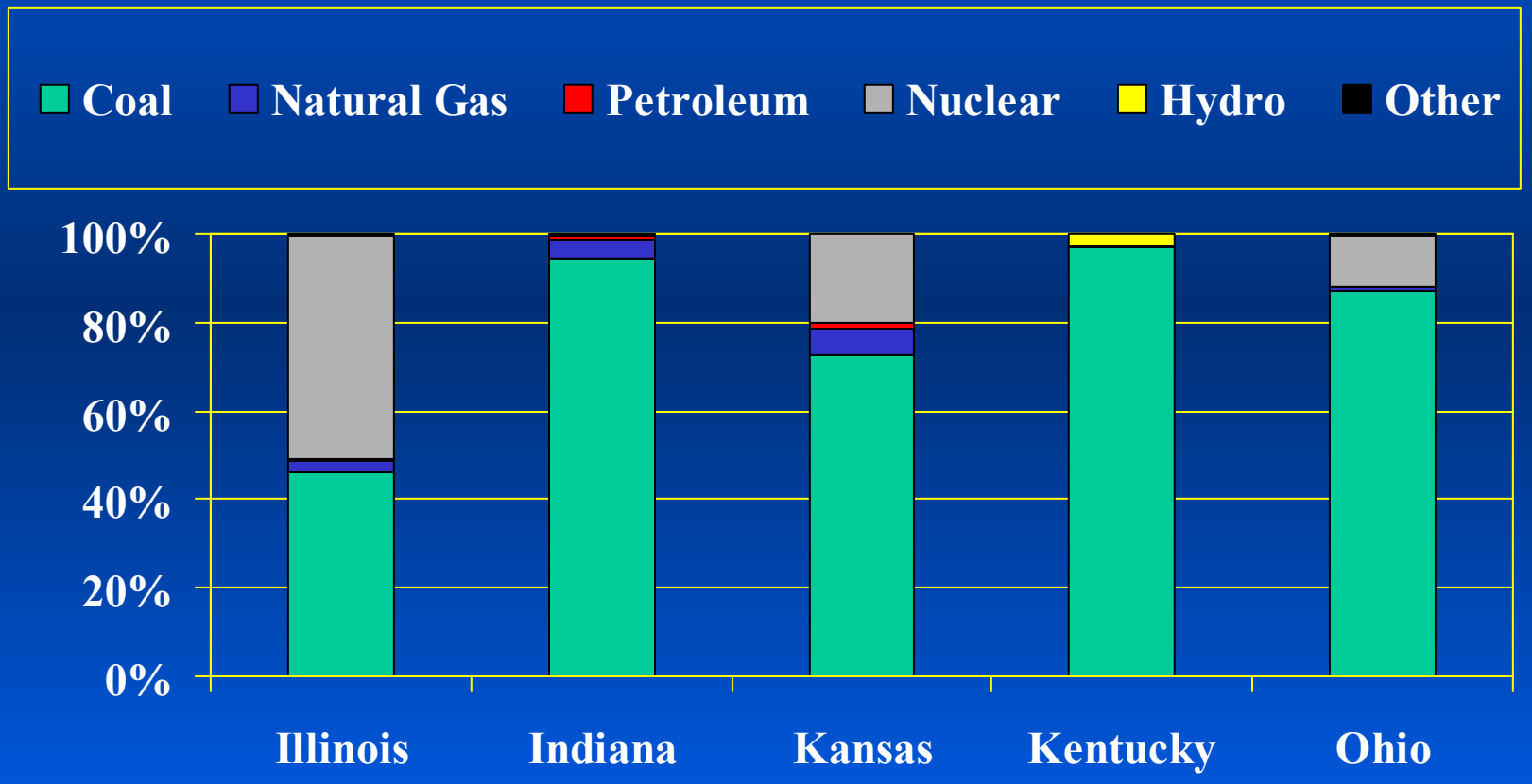
- To share the results of this research MIDCARB has constructed an online distributed Database Management and Geographic Information System for analyzing the spatial relationships and technical characteristics of large point sources of CO_2 and geologic sequestration options.
- The data presented on the MIDCARB web site actually reside on the local computers at each state geological survey.
- The MIDCARB system is the first DISTRIBUTED system of natural resource data focused on CO_2 sources and potential geologic sequestration sites.

The MIDCARB states have solid fossil energy industries with varying production amounts in each state.

	Coal	Natural Gas	Petroleum
State	**Thousand Short Tons**	**Million Cubic Feet**	**Thousand Barrels**
Illinois	33,783	185	10,092
Indiana	36,738	1,064	2,022
Kansas	176	481,445	33,942
Kentucky	133,834	81,723	2,970
Ohio	25,400	100,107	6,050

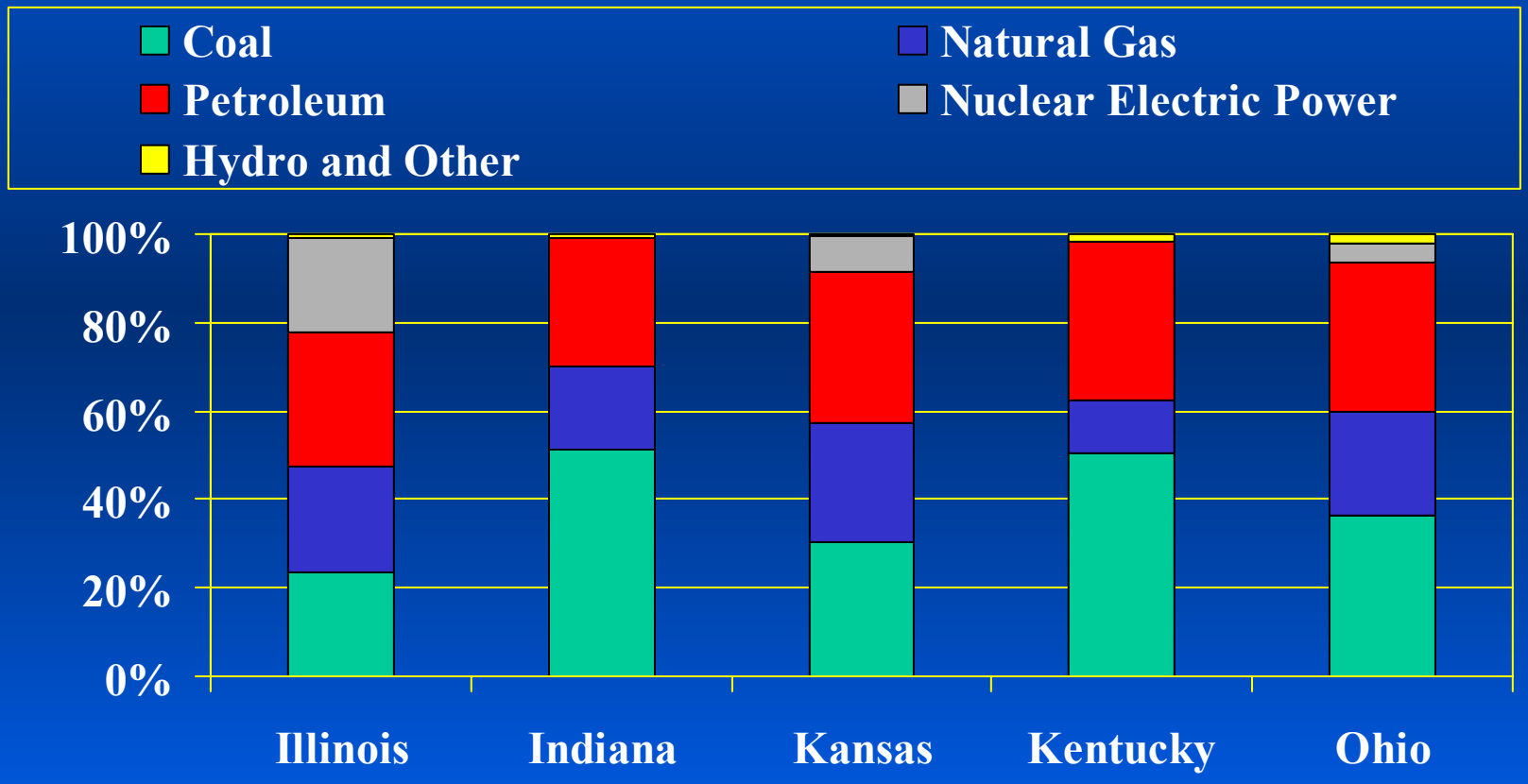
Source: DOE/EIA, Annual Coal Report 2001, Natural Gas Annual 2001, Petroleum Supply Annual 2001.

Fuel Mix for Electricity Production Varies Widely in MIDCARB States (2001)



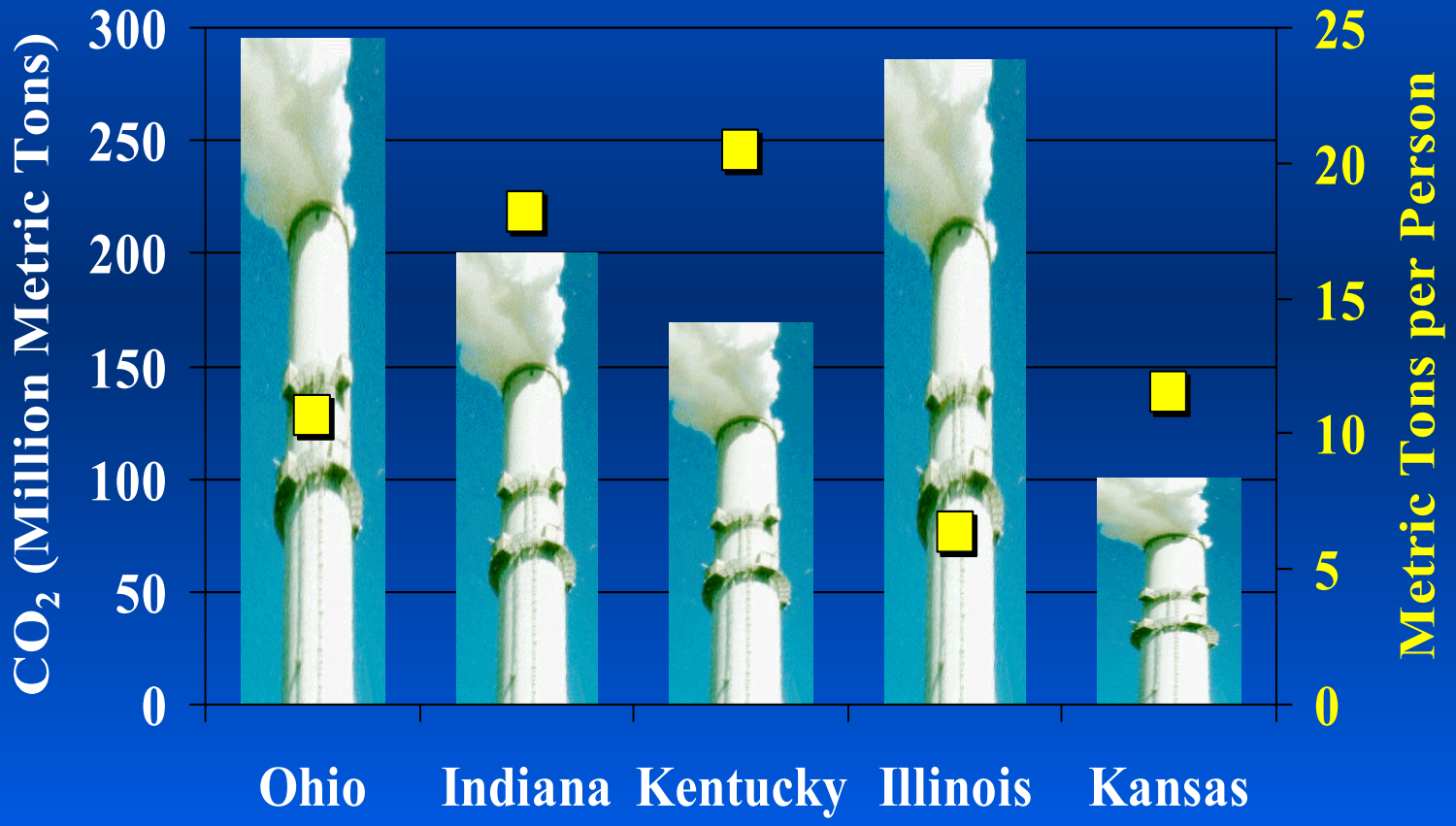
Source: 2001 DOE/EIA data.

Total Energy Consumed in MIDCARB States (2001)



Source: 2001 DOE/EIA data.

Total CO_2 Emissions in MIDCARB States, 2000



2000 US Census Bureau and 2000 DOE/EIA data

Geologic Sequestration Potential

- **Active and Depleted Oil and Gas Reservoirs**
  - **Value-Added Sequestration from High Quality Sources**
- **Saline Aquifers**
- **Deep and non-economical Coal Beds**
  - **Value-Added Sequestration**
- **Unconventional Gas Reservoirs**
  - **Devonian Black Shale**
  - **Tight gas sands**

Industrial Sources of CO_2

- Power Plants – Coal, Oil and Natural Gas
- Ethanol Plants
- Cement Plants
- Fertilizer Plants
- Solid Waste Landfills
- Other industrial plants that burn fossil fuels

Carbon Management Data Online

- **Data is Maintained at Local Level**
  - Current
  - Detailed
  - Accurate
- **Online Access**
  - Users Driven
  - Flexible Query and Display
  - Access to Products and Data

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MIDCARB The Website

ArcIMS Viewer - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Midcarb Maps

A Five State GIS Compilation

Guided Tour

Tool mode: Zoom In
Active layer: IL - CO2 Sources

Home

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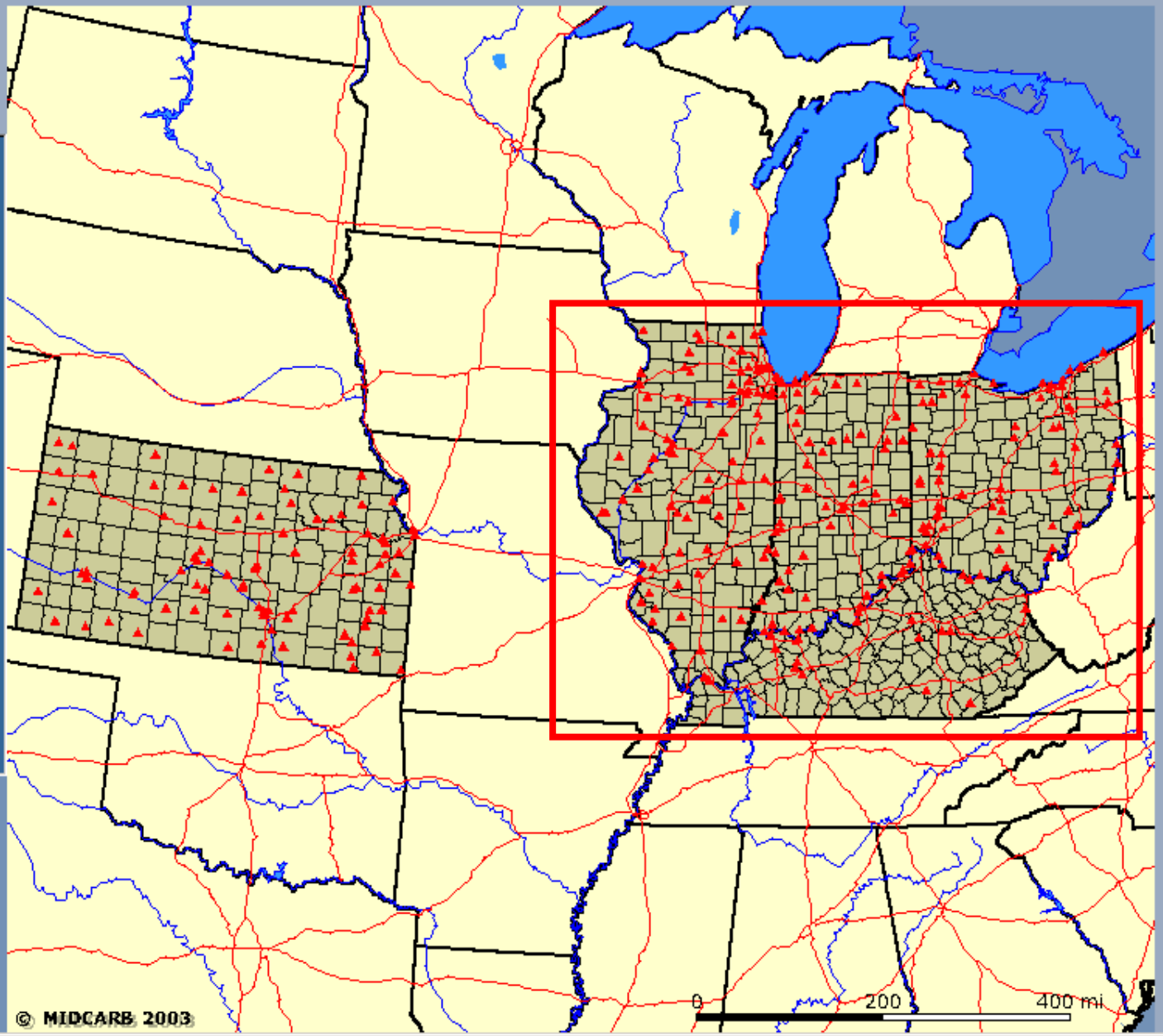
Map Layers

Select Active Layer

IL - CO2 Sources

- CO2 Sources
- Infrastructure
- Base
- Petroleum
- Coal
- Geology
- Aquifer
- Non-Conventional

AutoRefresh Map



Map Coordinates: -832682 meters (East), 4378801 meters (North) [UTM Zone 16 NAD83]

Internet

ArcIMS Viewer - Microsoft Internet Explorer

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Back Search Favorites History Links

--Illinois--Facility Emissions - Microsoft Internet Explorer

Go

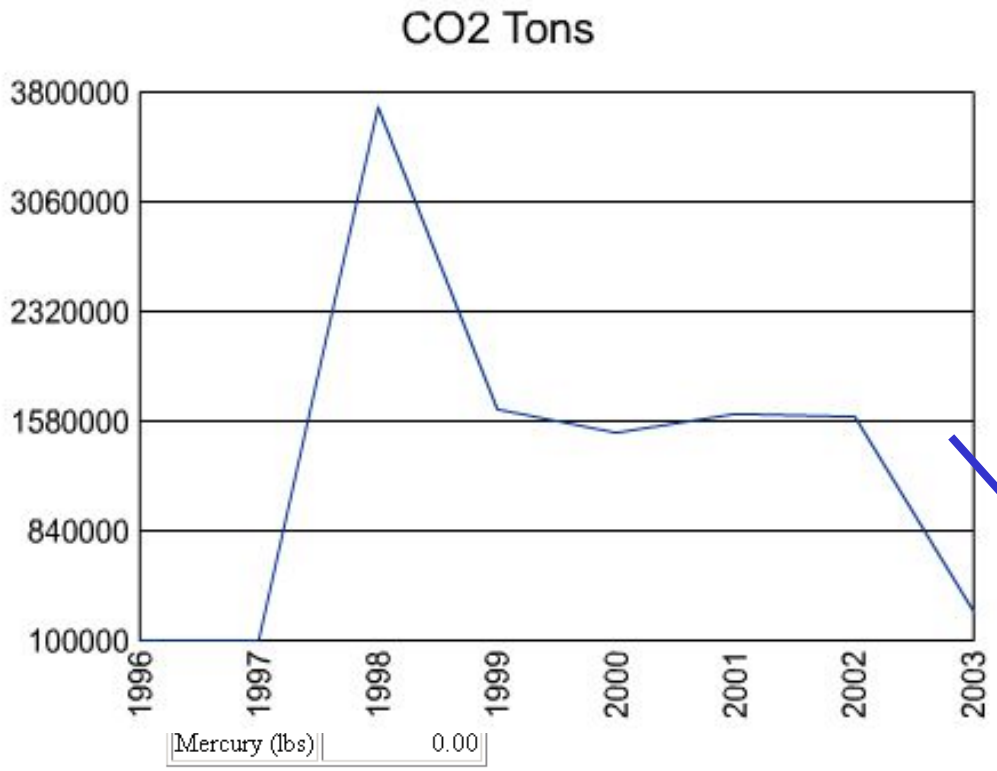
Illinois

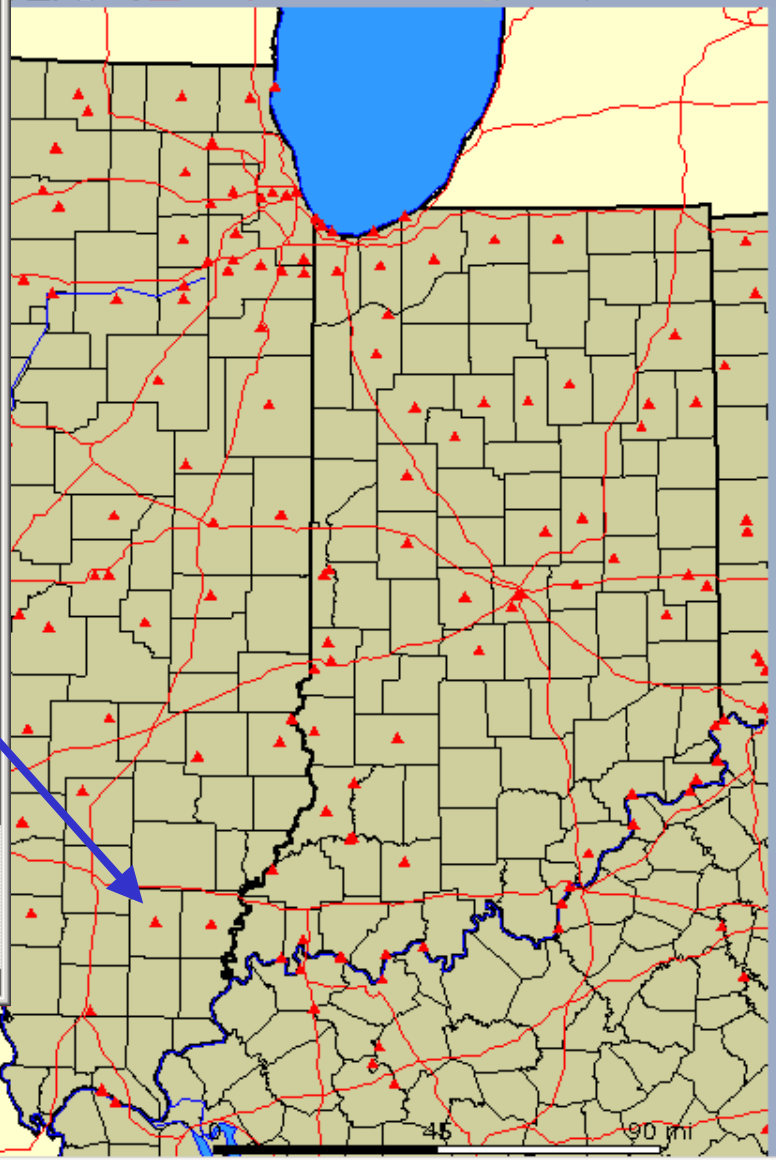
MARION

Facility is a UTILITY owned by Southern Illinois Power Coop

Also available is a summary of total Illinois emissions

Select chart desired: CO2 || SO2 || NOX || Mercury





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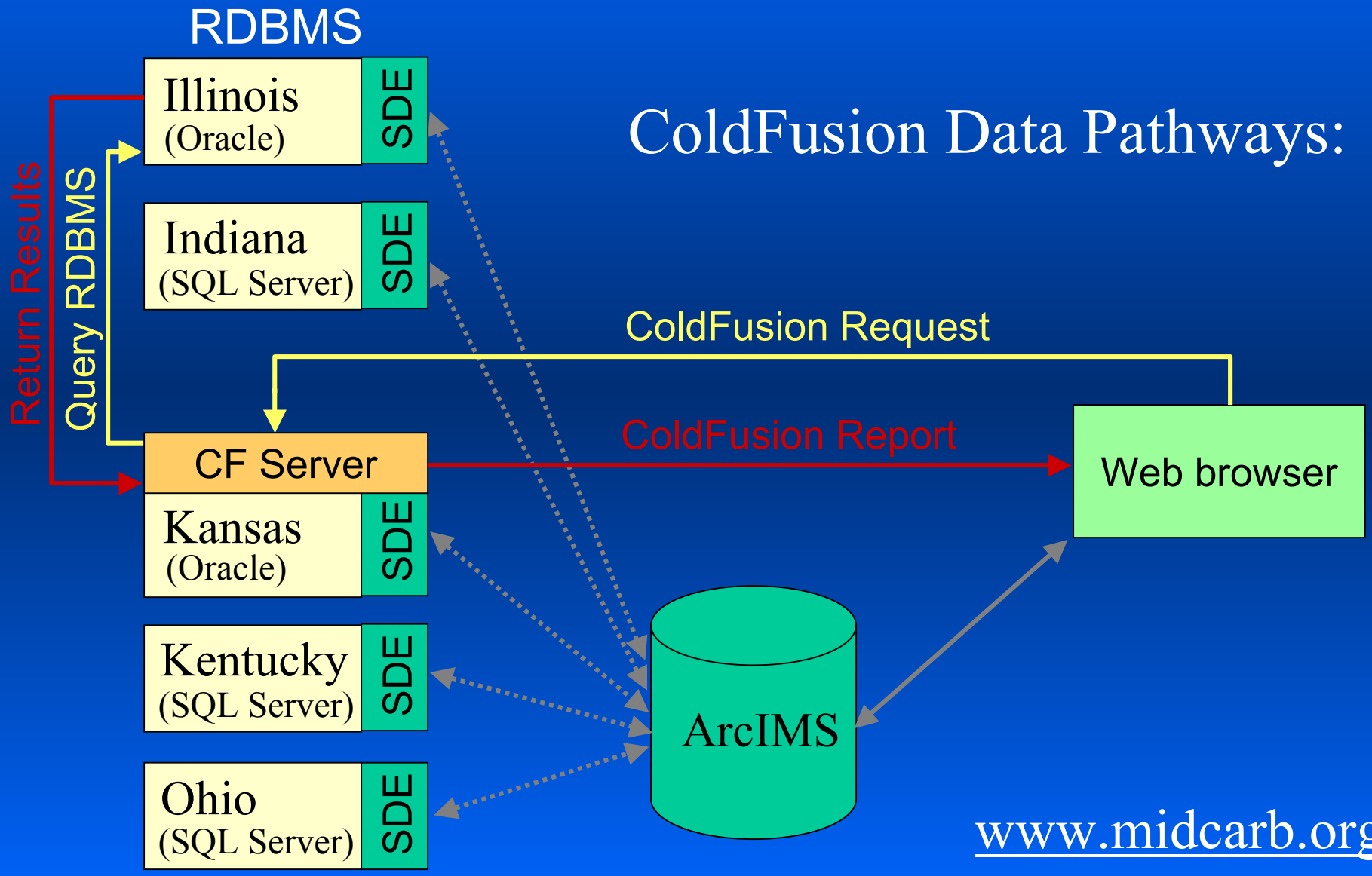
Start Inbo... MID... CO2... CO2... Micr... ArcI... MID... Acro... Ove... 4:00 PM

Data Integration



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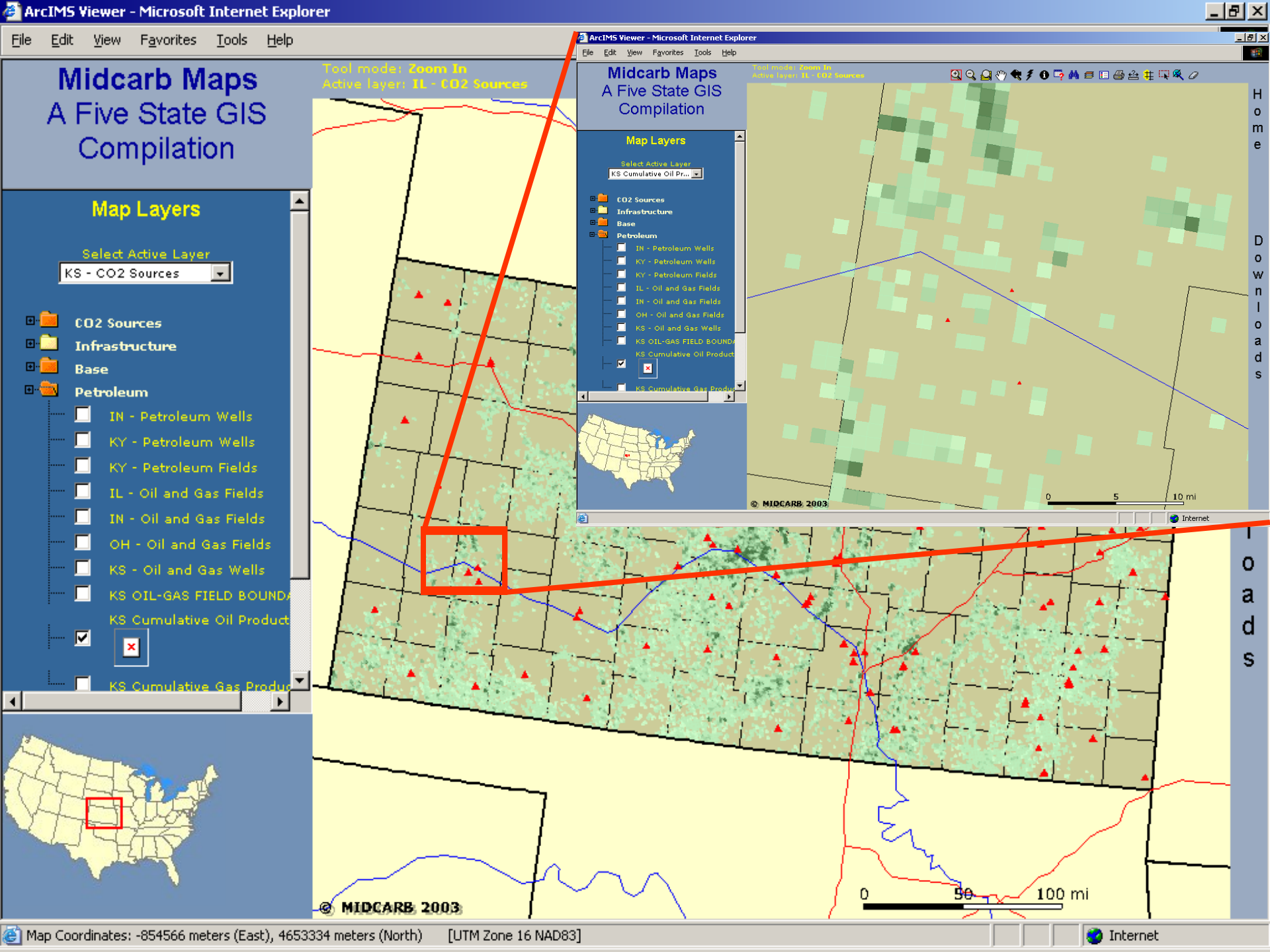
ArcIMS Viewer - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Midcarb Maps
A Five State GIS Compilation
Tool mode: Zoom In
Active layer: IL - CO2 Sources
Map Layers
Select Active Layer
KS - CO2 Sources
CO2 Sources
Infrastructure
Base
Petroleum
IN - Petroleum Wells
KY - Petroleum Wells
KY - Petroleum Fields
IL - Oil and Gas Fields
IN - Oil and Gas Fields
OH - Oil and Gas Fields
KS - Oil and Gas Wells
KS OIL-GAS FIELD BOUNDA
KS Cumulative Oil Product
KS Cumulative Gas Produc
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0 50 100 mi
Home
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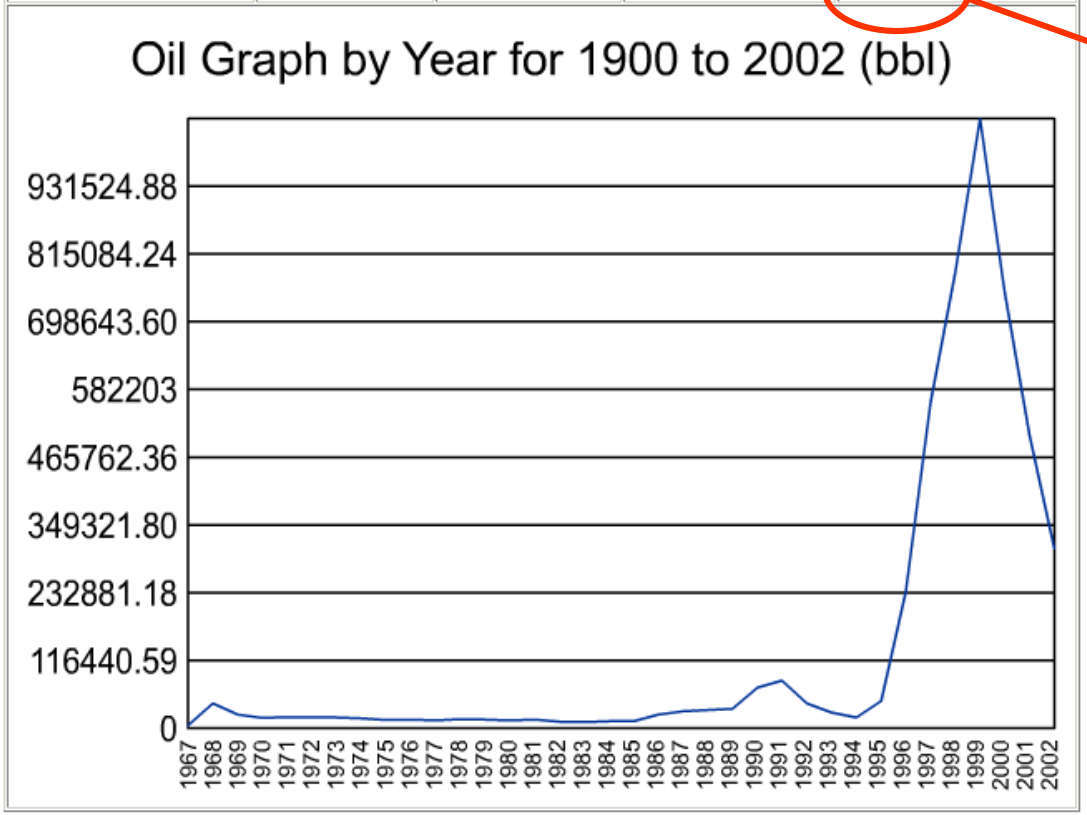
Internet
Map Coordinates: -854566 meters (East), 4653334 meters (North) [UTM Zone 16 NAD83]

File Edit View Favorites Tools Help

Section Details - Microsoft Internet Explorer

Legal Location Information for 23S31W12

Field Name	Produces Oil	Produces Gas	Section Coverage	Detailed Information
HUGOTON GAS AREA	Yes	Yes	ALL	Field Summary
STEWART	Yes	No	N2 & W2	Field Summary



Stewart--Oil and Gas Production - Microsoft Internet Explorer

Kansas Geological Survey | Oil and Gas | Field Oil & Gas Production

Stewart--Oil and Gas Production

Discoveries currently listed:

Operator: CRA **Lease:** Stewart, Well 1 **Location:** 23S-30W: NE SW NW 6 **Discovery Date:** 10/07/1952 **Producing zone:** Miss Oil	**Operator:** Davidor and Davidor **Lease:** Hagg Est, Well 1 **Location:** 23S-31W: NE NE 12 **Discovery Date:** 10/04/1967 **Producing zone:** Mrw Oil

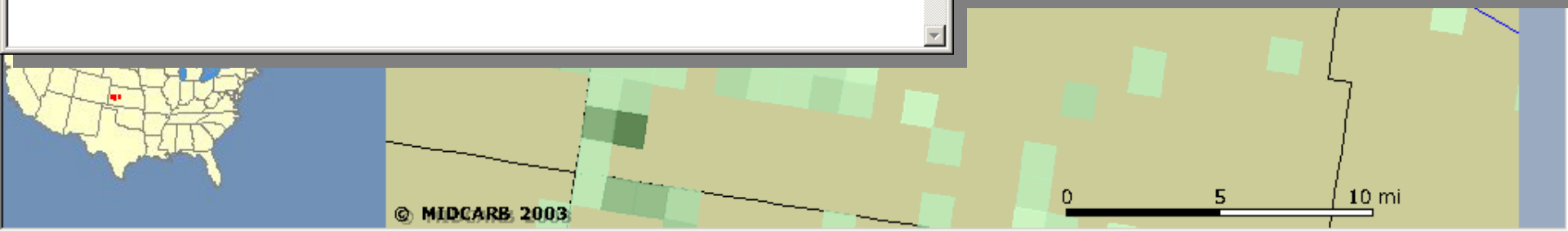
Counties: Finney
Leases: View list of leases for this field
Producing Formations

Name	Depth (ft.)	Thickness (ft.)	Oil Grav	Produces	Temperature
MISSISSIPPIAN	4710	-	28	Oil	120
MORROWAN	4753	12	-	Oil	120

Field Map (opens in new window): View Field Map
Field map is presented as an interactive ArcView map.
This system is under development and may not work with all fields.

View production charts

Year	Oil			Gas		
	Production (bbls)	Wells	Cumulative (bbls)	Production (mcf)	Wells	Cumulative (mcf)
1966	1,565	1	48,034	-	-	0



Map Coordinates: -753149 meters (East), 4312586 meters (North) [UTM Zone 16 NAD83]
Internet

Kansas Image Viewer - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Oil and Gas

State of Kansas Geographic Information Systems Policy Board, Data Access and Support Center, and the Kansas Geological Survey.
Please email questions and comments on the field viewer to Jeremy Bartley

Kansas Oil and Gas Field Viewer

help

Overview Map

STEWART
MISSISSIPPIAN & MORROWAN
Produces Oil
Active
Legal Field Definition

Legend
- PLSS
- Highways
- Interstate
- US Highway
- KS Highway
- Roads
- Rivers and Streams
- County Boundary

Zoom Level: 1.5 | Zoom In | Zoom Out | Pan
Identify Field | Identify Well | Full Field Extent

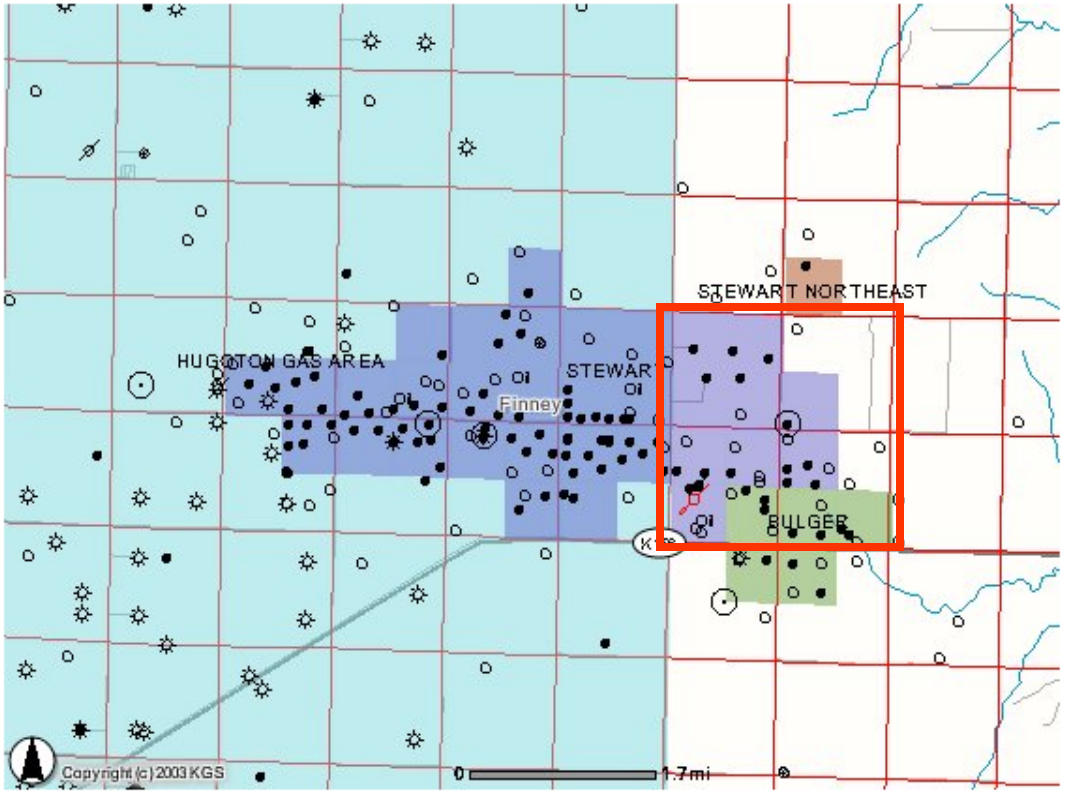


Table of Contents

Visible

- [ ] Current Oil & Gas Wells (STEWART)
  Download Wells
- [x] Current Field (STEWART)
- [ ] Other Fields in Same Formation(s)
- [x] All Fields in Area
- [x] All Wells in Area
- [x] PLSS
- [x] Highways
- [x] Roads
- [x] Rivers and Streams
- [ ] Major Streams
- [ ] Water Bodies
- [ ] City Boundary
- [x] County Boundary
- [ ] View Aerials
- [ ] View Topo

update map

Done

Internet

Kansas Image Viewer - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Oil and Gas

State of Kansas Geographic Information Systems Policy

Kansas Oil and Gas Field Viewer

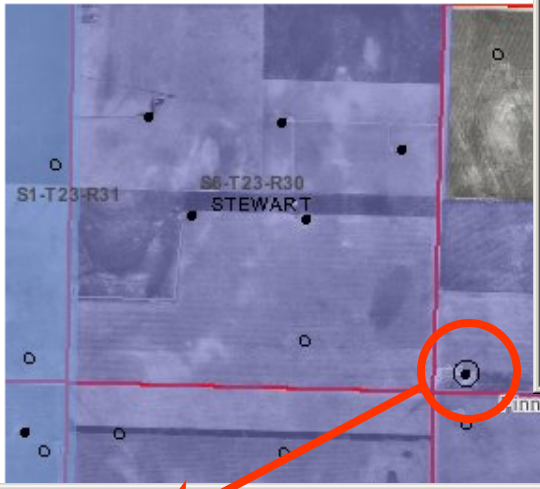
Overview Map

Zoom Level: 2

Identify Field

STEWART
MISSISSIPPIAN & MORROWAN
Produces Oil
Active
Legal Field Definition

Legend
PLSS
Highways
Interstate
US Highway



KGS--Oil and Gas Wells--Specific Well--15-055-20879 - Microsoft Internet Explorer

Back Search Favorites Media

Address http://abyss.kgs.ku.edu/pls/abyss/qualified.well_page.DisplayWell?f_kid=1006052757

KGS Oil & Gas | Oil and Gas Well Database

Specific Well--15-055-20879

All Well Data

API: 15-055-20879 **Operator:** NORTH AMERICAN RES **Field:** Stewart **Lease:** WYLIE **Well** 5-1	**Location:** T23S R30W, Sec. 5, SW SW SW 330 North, 4950 West, from SE corner **Longitude:** -100.64468 **Latitude:** 38.07572 **County:** Finney	**Spud Date:** 26-SEP-1989 **Completion Date:** 23-NOV-1989 **Plugging Date:** **Status:** OIL	**Total Depth:** 4950 **Elevation:** 2853 GL **Formation:** ST. LOUIS LIMESTONE

Tops Data

Form.	Top	Base	Source	Updated
HEEBNER SHALE	4000		ACO-1	22-FEB-2000
HEEBNER SHALE	4000		ELOG-MM	06-SEP-2000
LANSING GROUP	4085		ACO-1	22-FEB-2000
LANSING GROUP	4085		ELOG-MM	06-SEP-2000
MARMATON GROUP	4515		ACO-1	22-FEB-2000
MARMATON GROUP	4515		ELOG-MM	06-SEP-2000
CHEROKEE GROUP	4620		ACO-1	22-FEB-2000
CHEROKEE GROUP	4620		ELOG-MM	06-SEP-2000
BASAL PENNSYLVANIAN LIMESTONE	4772		ACO-1	22-FEB-2000
MISSISSIPPIAN	4772		ELOG-MM	06-SEP-2000

Selected Wells - Microsoft Internet Explorer

Identify Results - Number of Records Found: 2

WELL KID	API NUMBER	LONGITUDE	LATITUDE	USPLS	STATUS	DETAIL INFO
1006052757	15-055-20879	-100.644680	38.075720	SWSWSW523S30W	OIL	WELL INFO
1027706181	15-055-20871	-100.644680	38.075720	SWSWSW523S30W		WELL INFO

Rivers and Streams
Major Streams
Water Bodies
City Boundary
County Boundary
View Aerials
View Topo

update map

Done

Internet

Potential Geologic Sinks

- Examples of MIDCARB Products

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http://hercules.kgs.ku.edu/website/midcarb/MIDCARB_NEW/viewer.htm

Go Links

Midcarb Maps

A Five State GIS Compilation

Guided Tour

Tool mode: Zoom In
Active layer: Not defined

Springfield Coal, Storage Capacity of 488 MMT in unmined coals below 1,000

- Herrin Structure
- Springfield Mines
- Springfield Thickness
  - Springfield Thickness
    - 1 to 28 in
    - 28 to 42 in
    - 42 to 66 in
    - Channeled or not depos
    - Greater than 66 in
    - Insufficient data
    - No data
    - Split or less than 28 in
- Springfield Depth
- Springfield Elevation
- Seelyville-Davis Thickness

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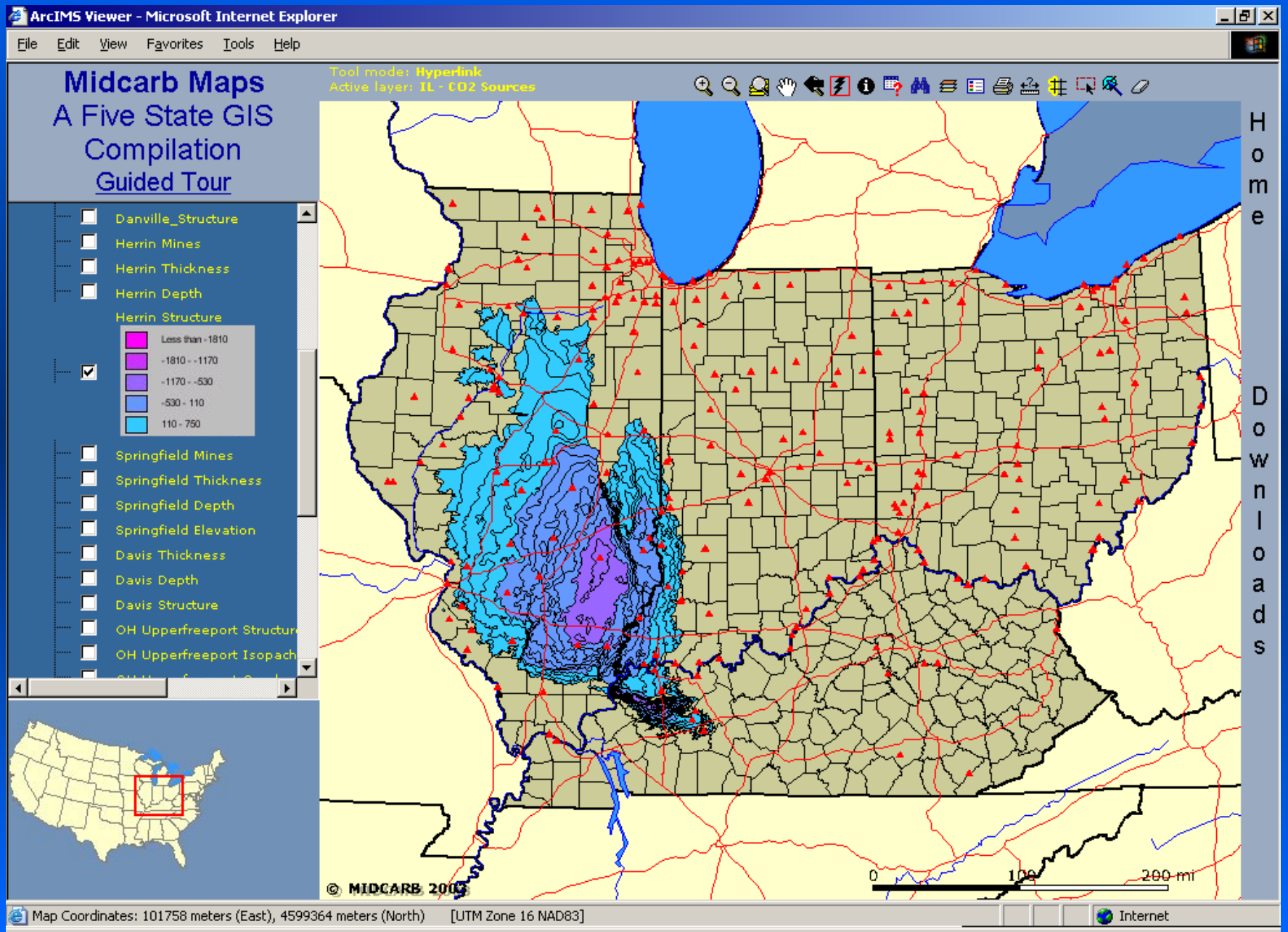
0 100 200 mi

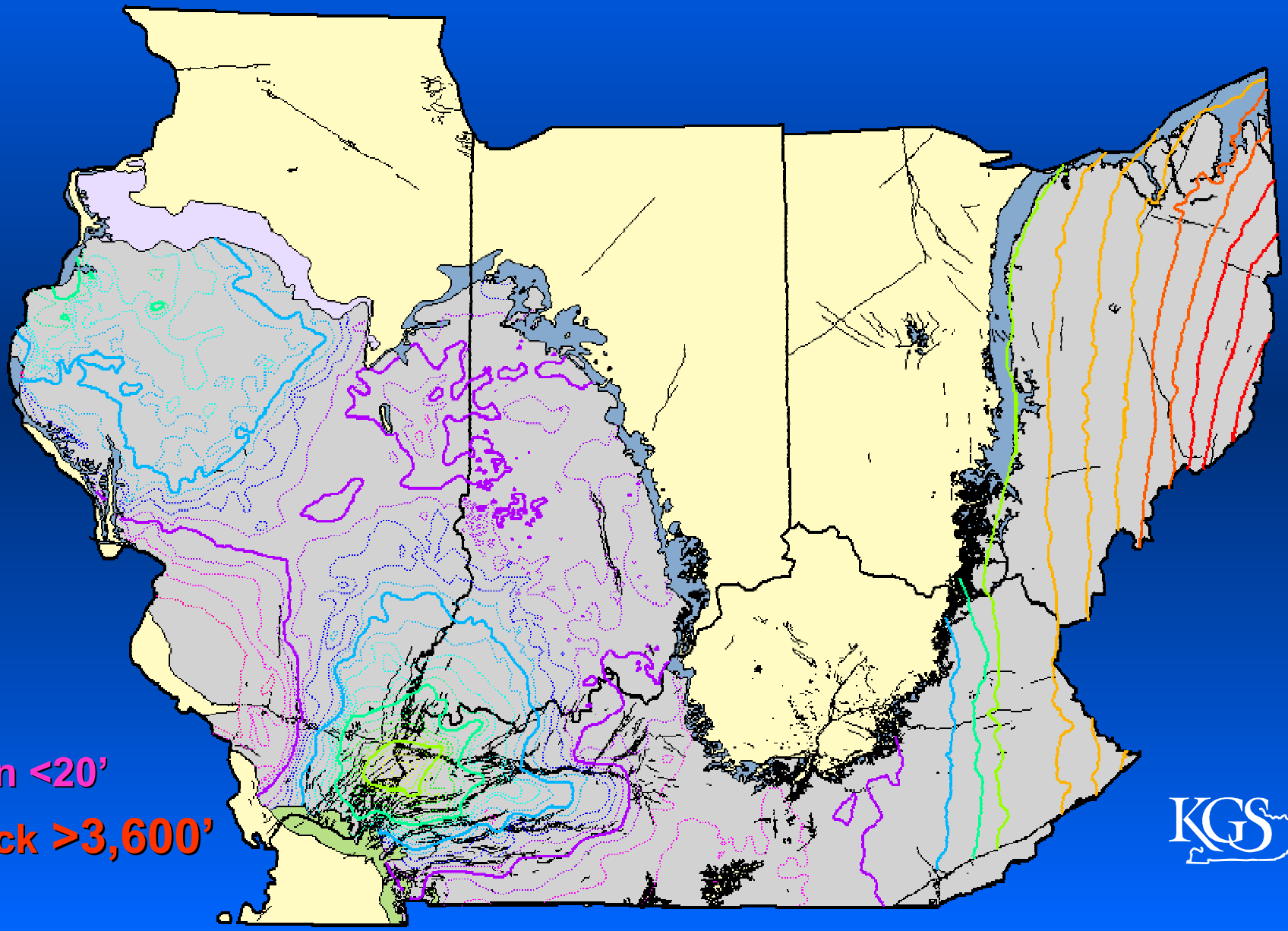
Coordinates: 464518 meters (East), 4708714 meters (North) [UTM Zone 16 NAD83]

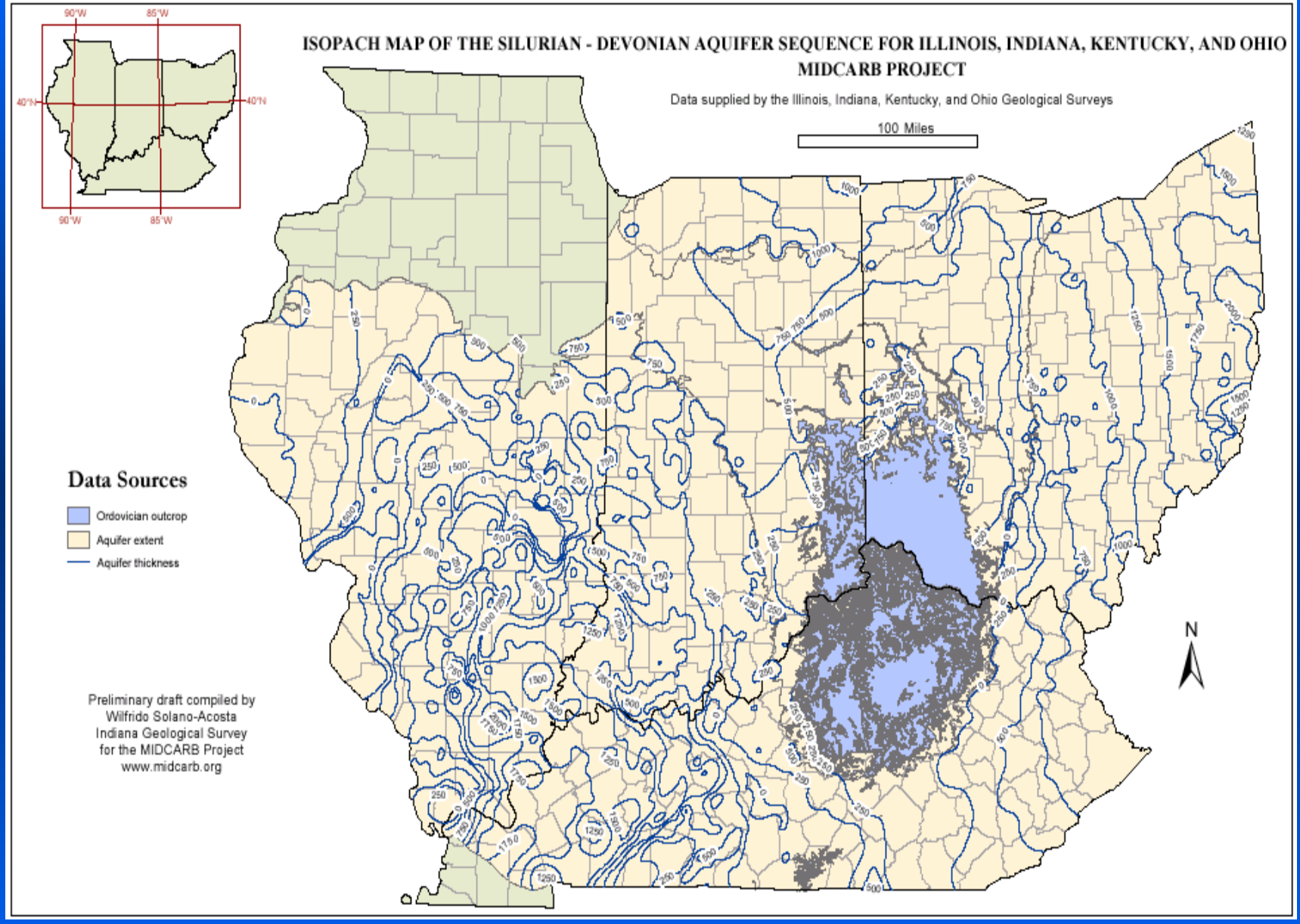
Internet

Coalbed Structure Over Multiple States: Herrin

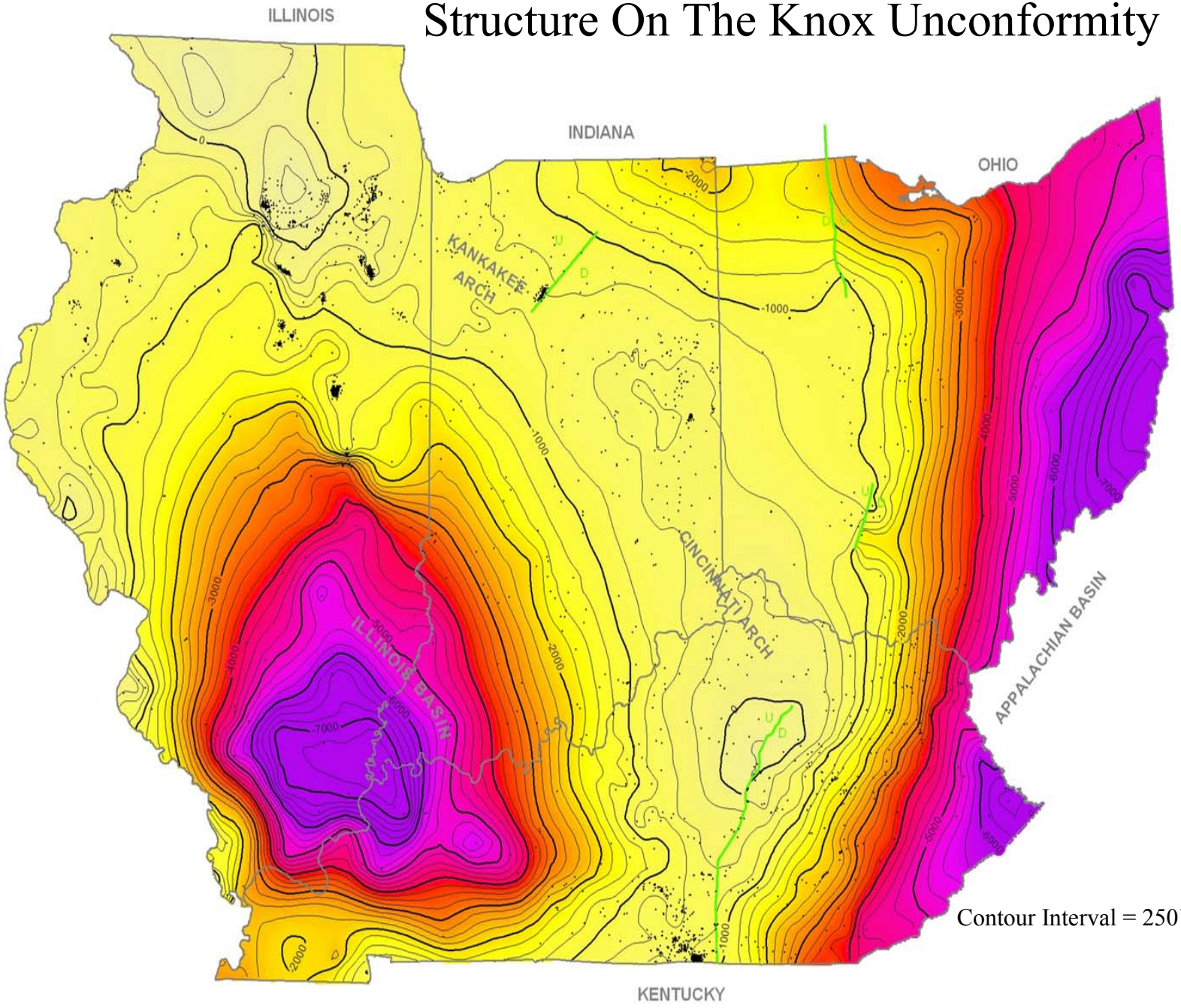


Unconventional Reservoir: Mississippian-Devonian Shale Thickness



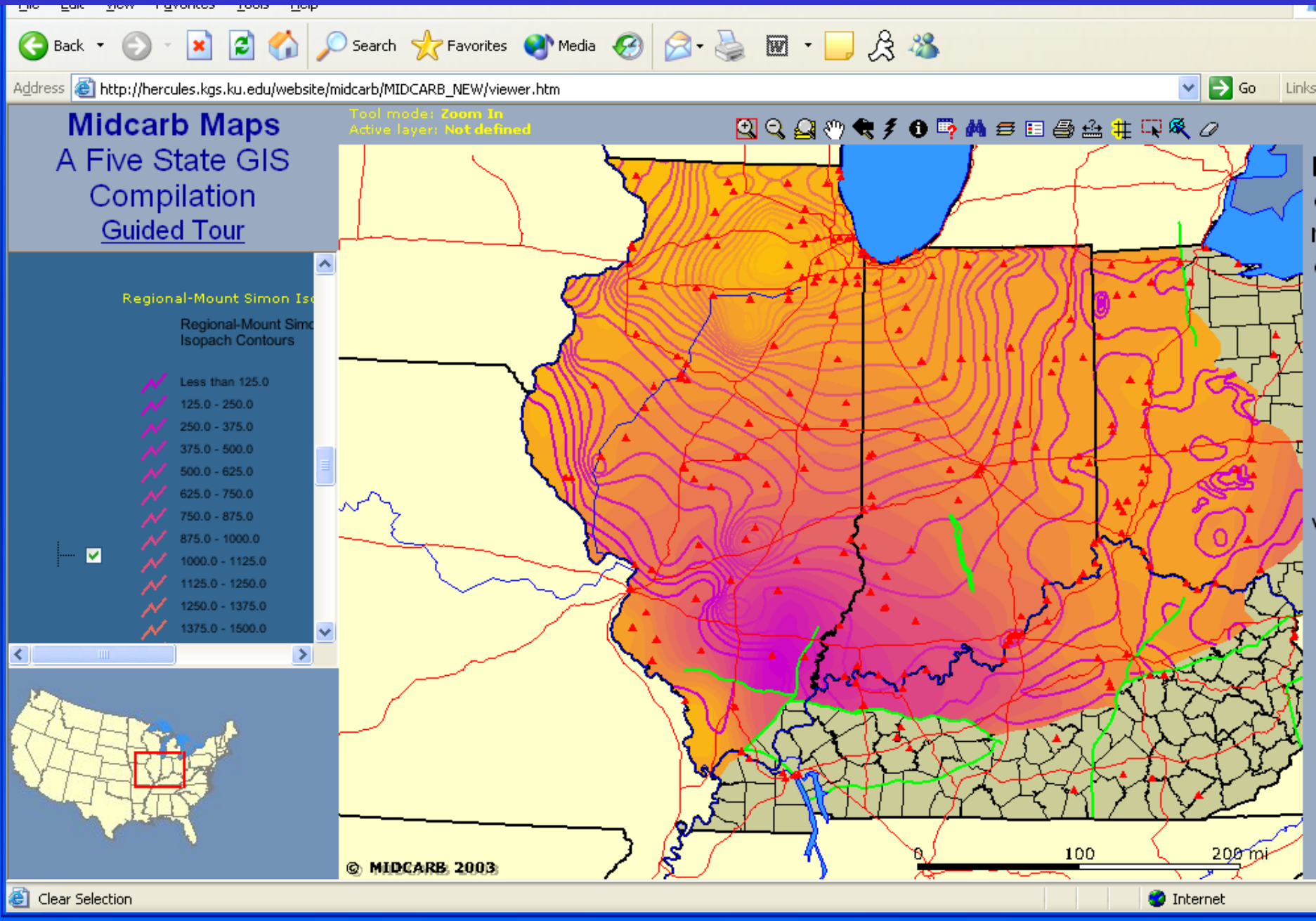

90°W
85°W
40°N
ISOPACH MAP OF THE SILURIAN - DEVONIAN AQUIFER SEQUENCE FOR ILLINOIS, INDIANA, KENTUCKY, AND OHIO
MIDCARB PROJECT
Data supplied by the Illinois, Indiana, Kentucky, and Ohio Geological Surveys
100 Miles
Data Sources
Ordovician outcrop
Aquifer extent
Aquifer thickness
Preliminary draft compiled by
Wilfrido Solano-Acosta
Indiana Geological Survey
for the MIDCARB Project
www.midcarb.org
N

Structure On The Knox Unconformity

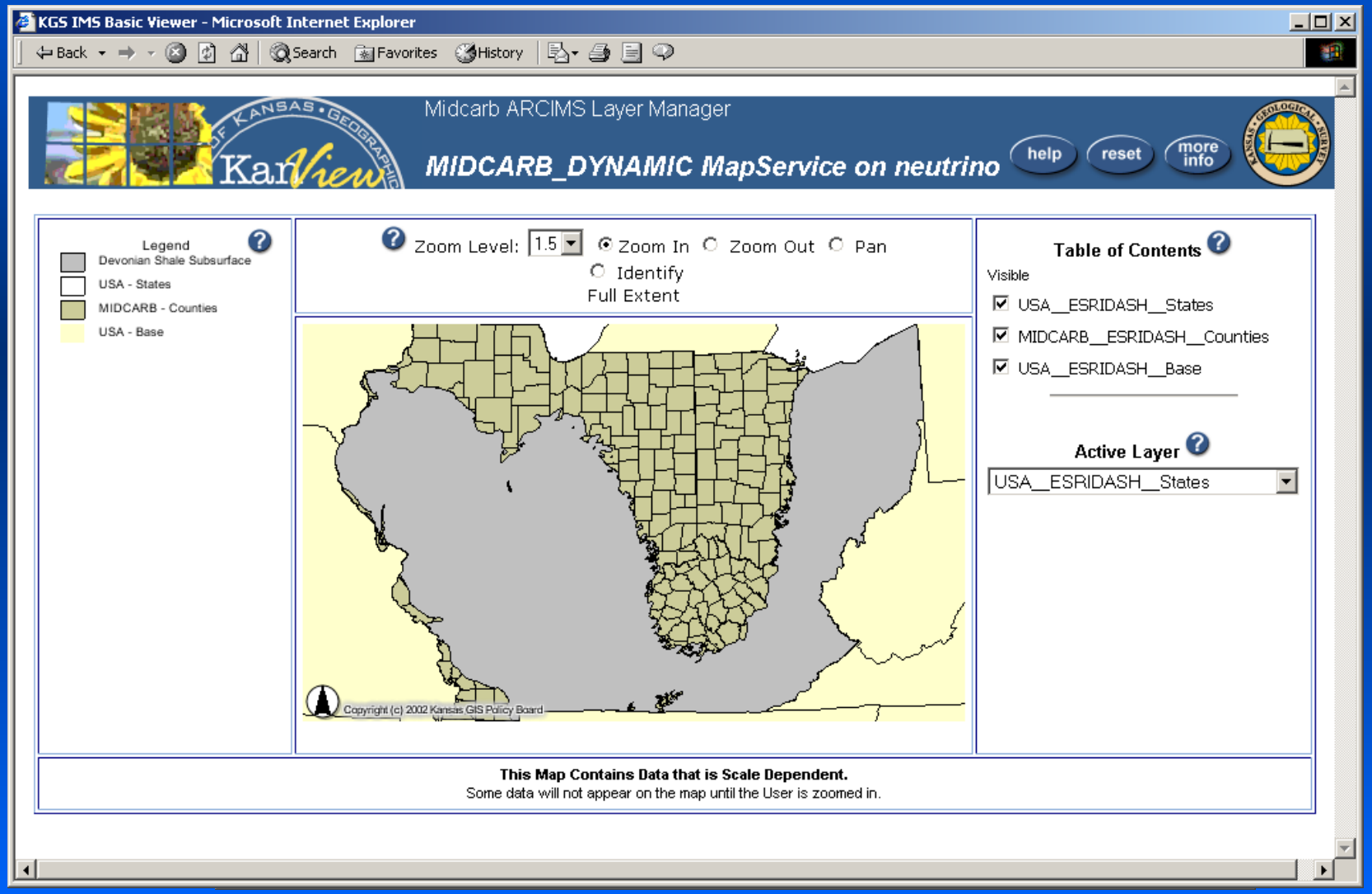


Contour Interval = 250’

ISOPACH MT SIMON SANDSTONE

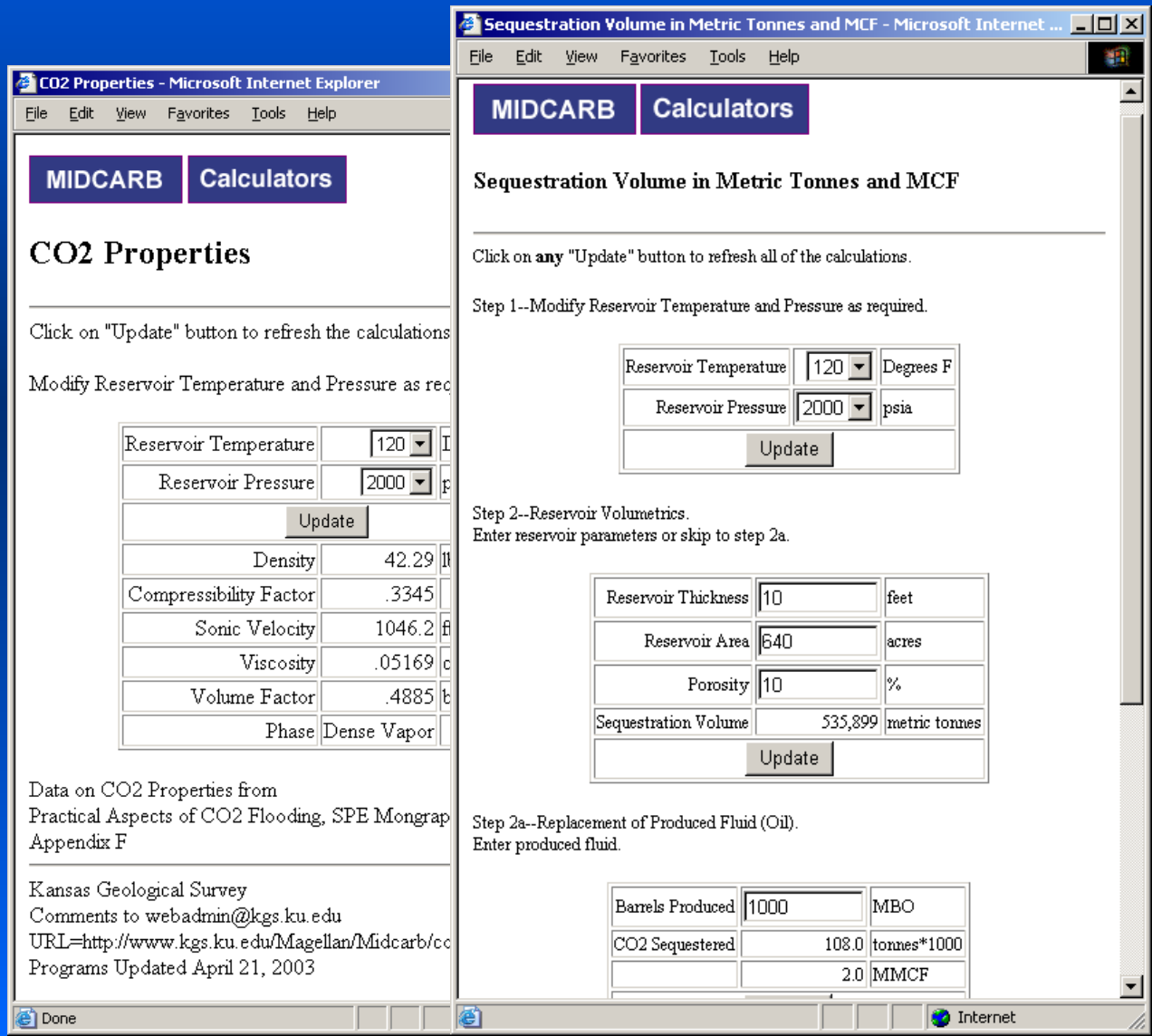


Distributed Management



MIDCARB calculators

- CO_2 Properties
- Power Plant Locator
  - By State
  - By Facility type
  - By Air Emissions
- Sequestration Potential
  - In Oil Reservoirs
  - In Aquifers



NEW FEATURES ON

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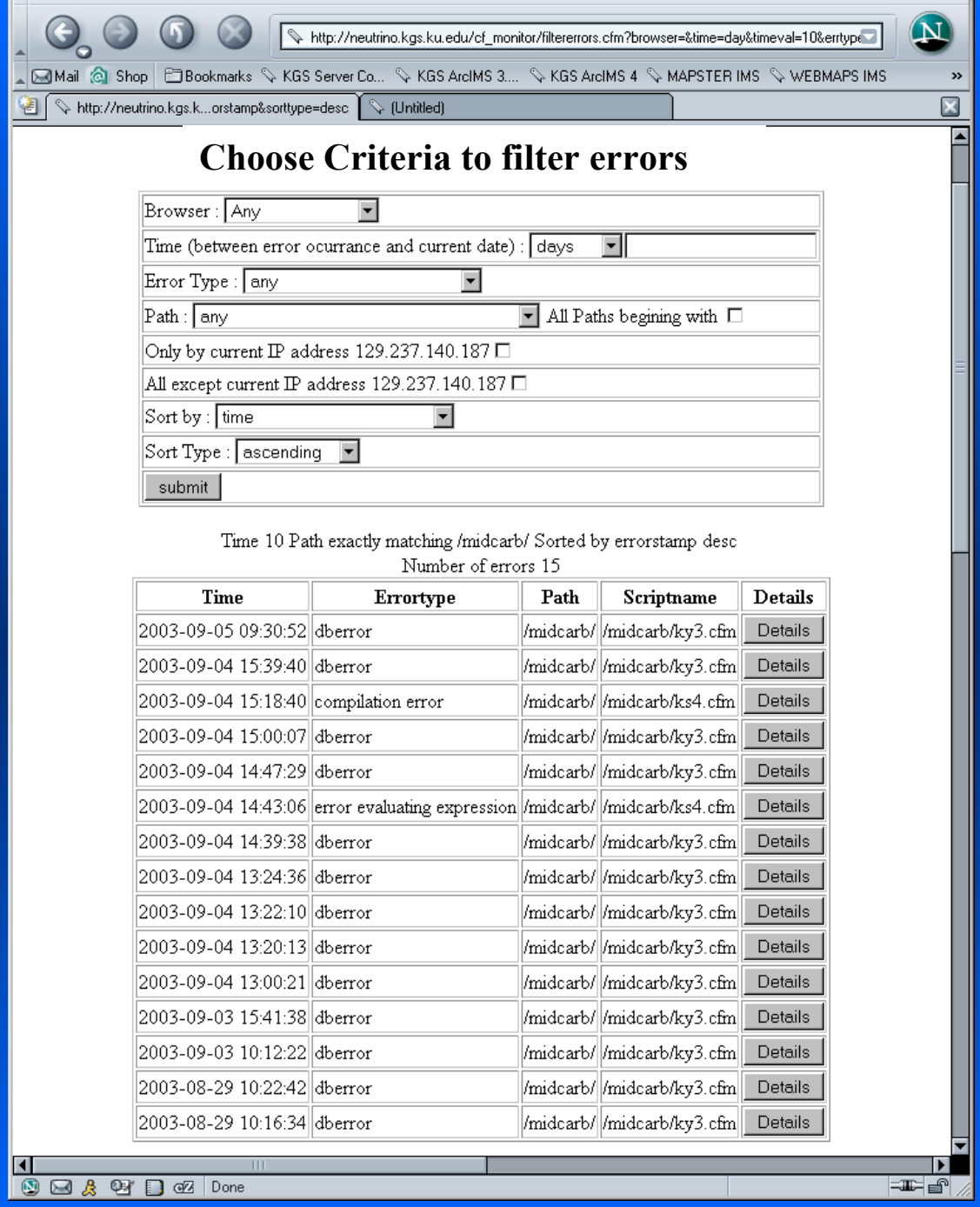


Choose Criteria to filter errors

Browser : Any

Time (between error ocurrance and current date) : days

Error Type : any

Path : any All Paths begining with

Only by current IP address 129.237.140.187

All except current IP address 129.237.140.187

Sort by : time

Sort Type : ascending

submit

Time 10 Path exactly matching /midcarb/ Sorted by errorstamp desc

Number of errors 15

Time	Errortype	Path	Scriptname	Details
2003-09-05 09:30:52	dberror	/midcarb/	/midcarb/ky3.cfm	Details
2003-09-04 15:39:40	dberror	/midcarb/	/midcarb/ky3.cfm	Details
2003-09-04 15:18:40	compilation error	/midcarb/	/midcarb/ks4.cfm	Details
2003-09-04 15:00:07	dberror	/midcarb/	/midcarb/ky3.cfm	Details
2003-09-04 14:47:29	dberror	/midcarb/	/midcarb/ky3.cfm	Details
2003-09-04 14:43:06	error evaluating expression	/midcarb/	/midcarb/ks4.cfm	Details
2003-09-04 14:39:38	dberror	/midcarb/	/midcarb/ky3.cfm	Details
2003-09-04 13:24:36	dberror	/midcarb/	/midcarb/ky3.cfm	Details
2003-09-04 13:22:10	dberror	/midcarb/	/midcarb/ky3.cfm	Details
2003-09-04 13:20:13	dberror	/midcarb/	/midcarb/ky3.cfm	Details
2003-09-04 13:00:21	dberror	/midcarb/	/midcarb/ky3.cfm	Details
2003-09-03 15:41:38	dberror	/midcarb/	/midcarb/ky3.cfm	Details
2003-09-03 10:12:22	dberror	/midcarb/	/midcarb/ky3.cfm	Details
2003-08-29 10:22:42	dberror	/midcarb/	/midcarb/ky3.cfm	Details
2003-08-29 10:16:34	dberror	/midcarb/	/midcarb/ky3.cfm	Details

Address http://hercules.kgs.ku.edu/website/midcarb/MIDCARB_NEW/viewer.htm Go

Midcarb Maps

A Five State GIS Compilation

Guided Tour

Tool mode: **Buffer**
Active layer: **OH - CO2 Sources**

Buffer

Highlight features from

OH - Oil and Gas Fields

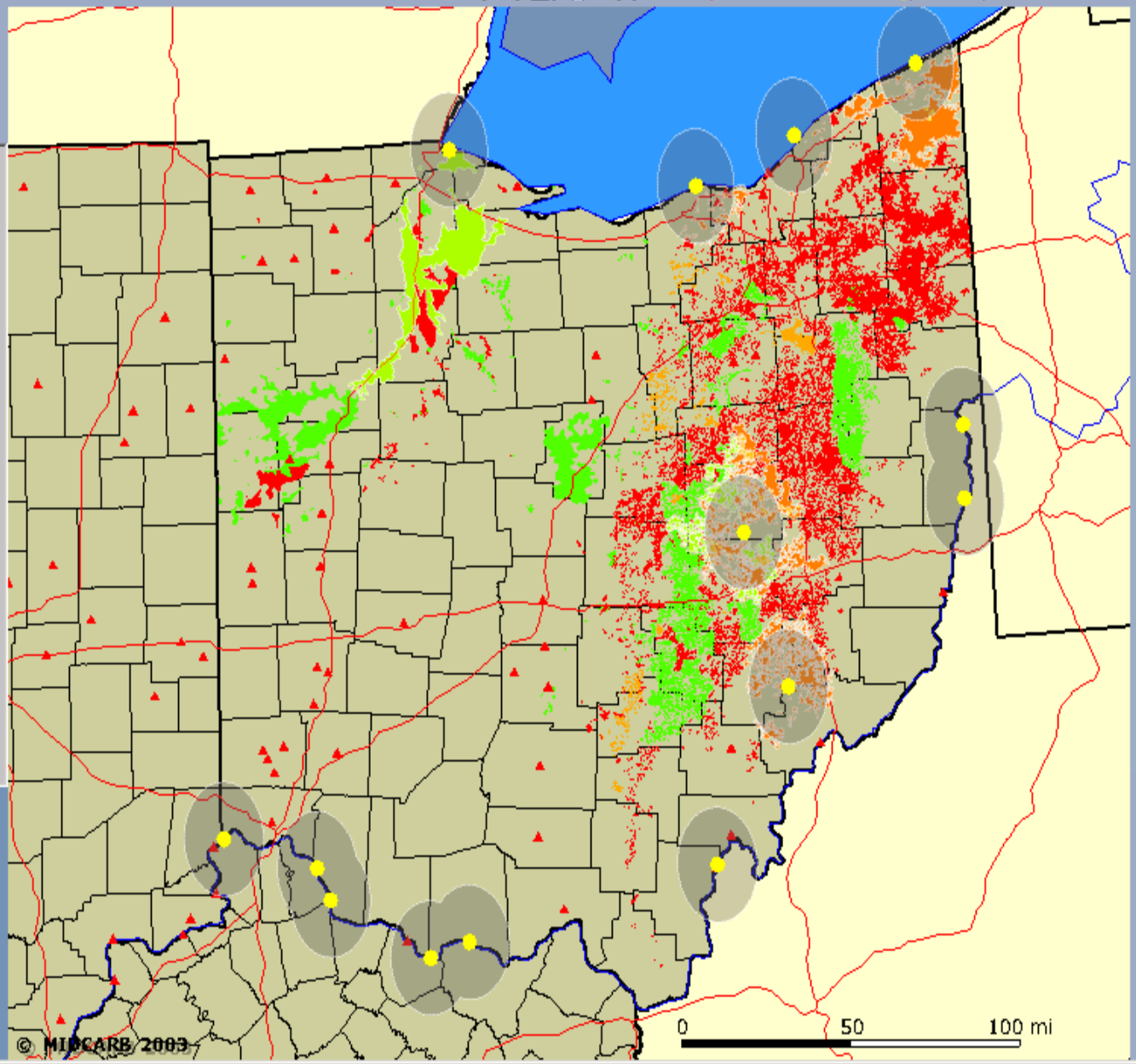
within a distance of

15 MILES

around the selected features of
OH - CO2 Sources

Create Buffer

Display Attributes



Home

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Map Coordinates: 595629 meters (East), 4443196 meters (North) [UTM Zone 16 NAD83]

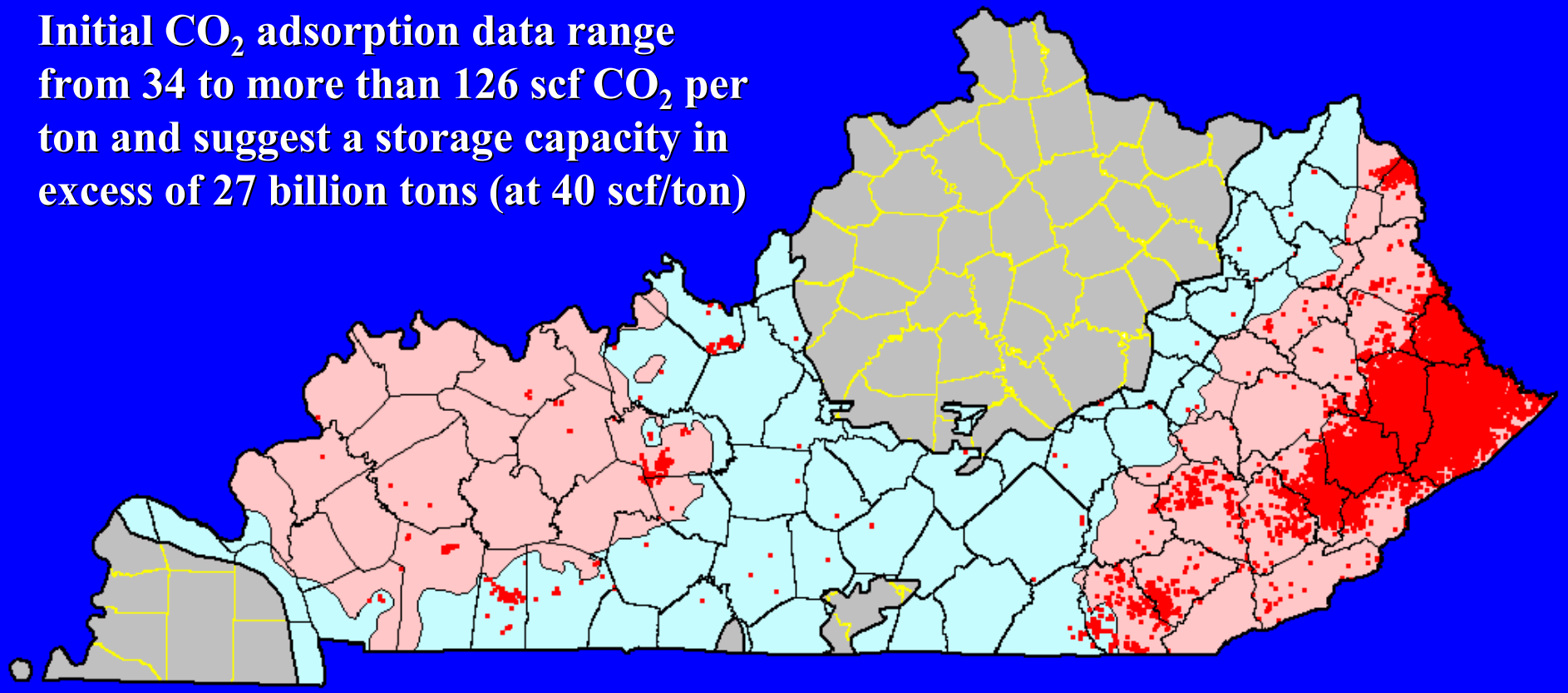
Internet

Related Projects

- Illinois, Indiana, Kentucky, Ohio Regional Sequestration Partnership
- Analysis of Devonian Black Shale, Kentucky
- Every State Improving websites adding data, increasing accessibility

Analysis of the Devonian Shale in Kentucky for Potential CO_2 Sequestration and Enhanced Natural Gas Production

Initial CO_2 adsorption data range from 34 to more than 126 scf CO_2 per ton and suggest a storage capacity in excess of 27 billion tons (at 40 scf/ton)



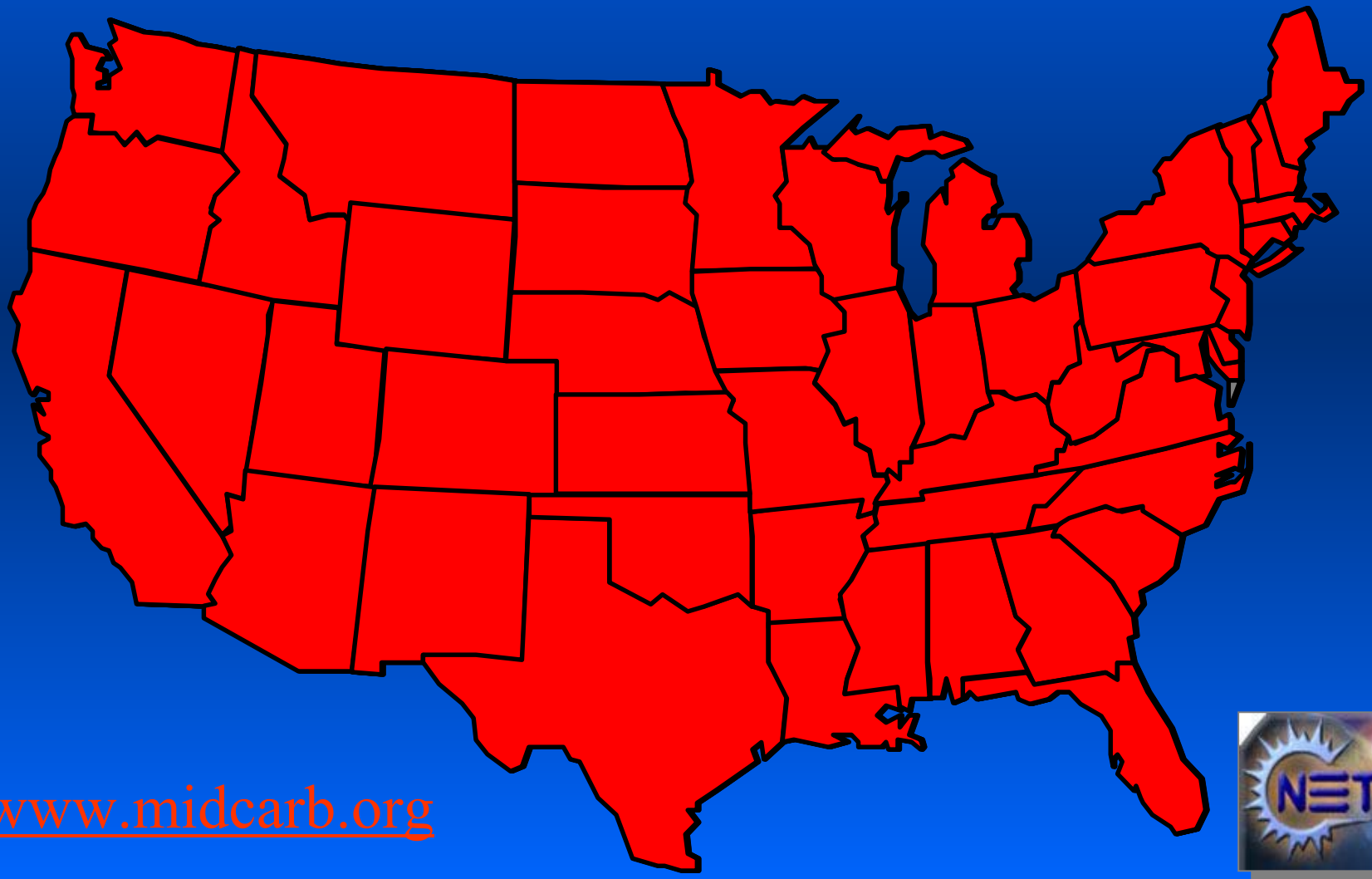
Present in subsurface
>1000' deep and >100' thick
Producing area

U.S. DOE/NETL DE-FC26-02NT41442

Future of MIDCARB

- Improve Data and Coverages
- Move to support
  - Open GIS Consortium/Web Map Service (OGC/WMS)
  - XML and other open access tools
- Improve Distributed Management Tools
  - Multiple Servers (Hand-Off to Local Server)
- Modify the current MIDCARB Internet Map Server to support additional states in the CO2 sequestration regional partnership project
- Educate decision makers and public on CO2 sequestration potential
  - Feasibility studies
  - Site planning
  - Regional assessments

Future of MIDCARB?



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