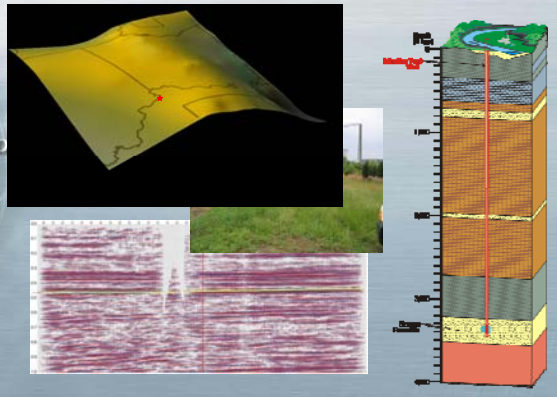
Battelle
The Business of Innovation



Cincinnati Arch, MRCSP
East Bend Geologic Field Test Site

Presented By: Neeraj Gupta, Battelle

Regional Carbon Sequestration Partnerships
Initiative Review Meeting
December 12-13, 2007, Pittsburgh, PA

NETL
U.S. Department of Energy/NETL

MRCSP
MIDWEST REGIONAL CARBON SEQUESTRATION PARTNERSHIP

East Bend Test Site Core Team

MRCSP

Darlene Radcliffe, Brian Weisker, and many others

John Rupp, Wil Solano

Steve Greb, Jim Drahovzal

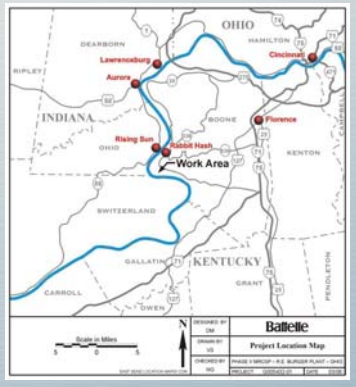
Dave Ball, Neeraj Gupta, Phil Jagucki, Joel Sminchak, Danielle Meggyesy, Judith Bradbury, Bob Janosy, Jackie Gerst, Diana Bacon, Mark Kelley, and others

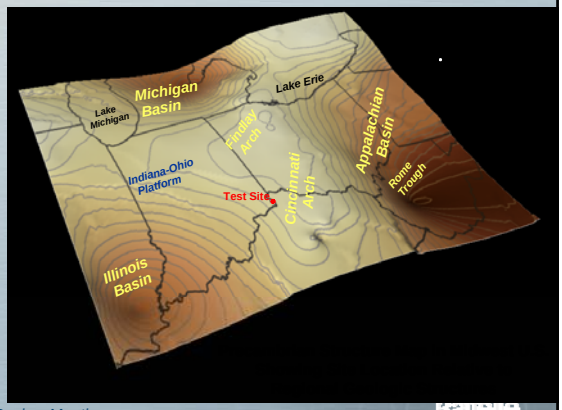
Lynn Brickett, Charlie Byrer

Additional Contributions by Numerous Other MRCSP Team Members

East Bend Test Site

- Duke Energy East Bend Plant outside of Rabbit Hash, Kentucky, 20 miles southwest of Cincinnati
- Located on the western flank of the Cincinnati Arch, a regional geologic structure between the Appalachian and Illinois basins.





East Bend Test Site

- Duke Energy East Bend facility
- 650 MW coal-burning power plant
- SOx and NOx control systems

- 1,800 acres on the floodplain along a bend in the Ohio River

East Bend Test Site- Public Outreach

• Summer 2006:
- Coordinated with Duke Energy in planning interactions and developing a series of informational materials to introduce project and describe future seismic and other activities (neighbor letter, fact sheet, briefings)
- At request of local officials, conducted a briefing for local officials and Open House for nearby residents, including a series of exhibits, seismic video and take-home materials, as well as opportunities for one-on-one discussions with technical staff
• Now preparing additional materials and planning for an informational meeting to be held prior to publication of the Notice of Availability of the draft permit for public review by EPA Region 4

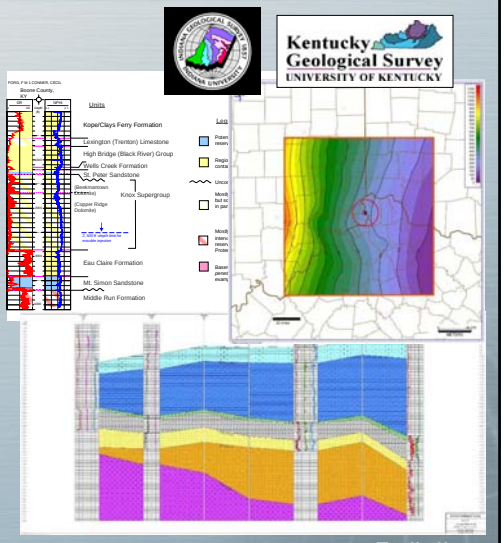
Site Characterization- Preliminary Geologic Assessment

• Preliminary geological assessment completed by Indiana and Kentucky Geological Surveys

• Paleozoic age sedimentary rocks ~3500 ft deep and overlie Precambrian arenite Middle Run Formation.

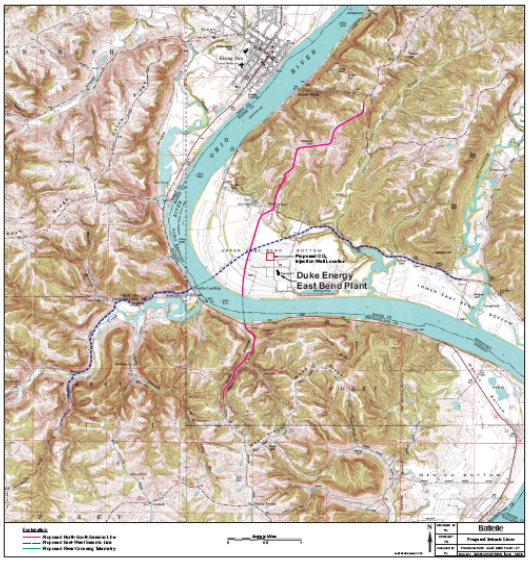
• Primary injection target is the Mt. Simon estimated at a depth of 3200-3500 ft.

• This formation is a major CO_2 storage target throughout the MRCSP region.



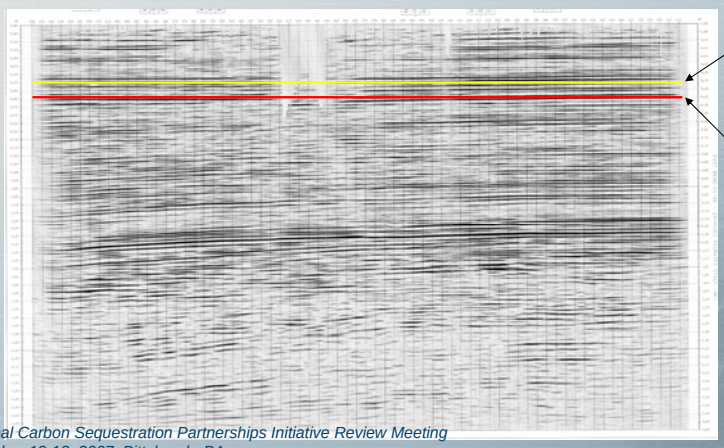
Site Characterization Seismic Survey

- 10-mile seismic survey completed in October-November 2006
- Survey completed in 2 transects along dip and strike



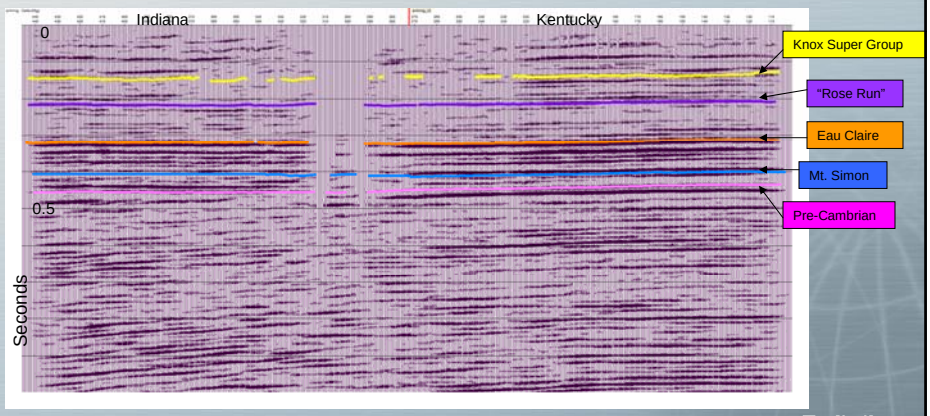
Site Characterization- East Bend Seismic (S→N Line)

- Results show continuous, flat-lying sedimentary rocks.
- Some data loss along the Ohio River Valley.
- More indication of structure in very deep Precambrian rocks (generally out of the interval of interest for this project).



Site Characterization- East Bend Seismic Section (S→N)

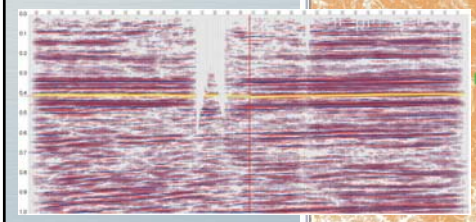
- A tighter bin size (55 ft) may have increased data quality in the flood plain
- Interpretation will need to be validated after drilling
- Numerous processing schemes were used to verify formation structure

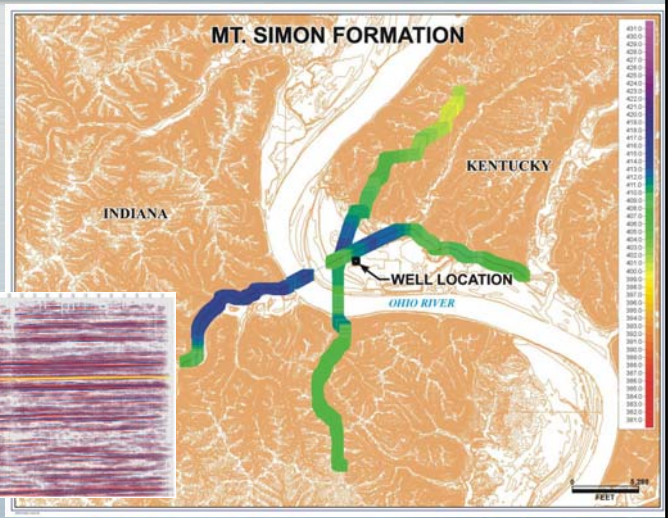


Site Characterization- Seismic Analysis of Mt. Simon SS

•There is a gentle deepening to the north west.

•No indication of any structure through the formation

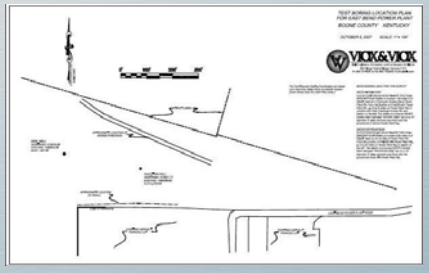




Color represents travel time ranging from red (shorter) to purple (longer)

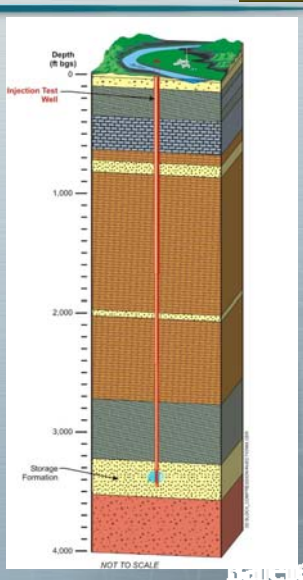
Site Characterization- Test Well Drilling and Testing

- Injection site at the East Bend Plant has been finalized and surveyed.
- Test well design and procurement has been mainly completed.
- Drilling at the East Bend site is scheduled for early summer 2008.
- A nearby monitoring well is being considered with multi-level Westbay monitoring system.

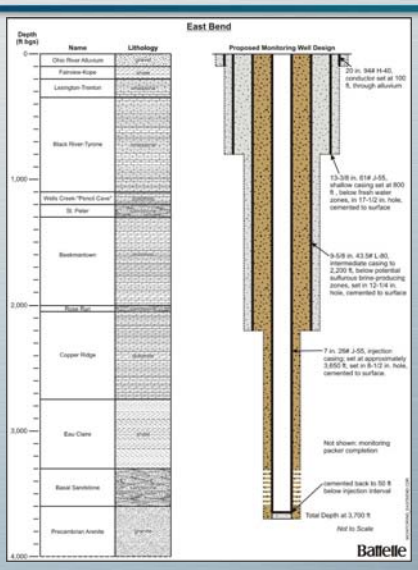


Preliminary Conceptual Injection System

- Mt. Simon = primary target, ~300 ft thick at a depth of 3200-3500 ft.
- Eau Claire Shale = primary containment unit about 500 ft thick.
- Commercial CO_2 source to be trucked into the site.
- Target injection rate = 100 metric tons per day over 30 days (total injection of 3,000 metric tons CO_2).
- Injection plans are to inject into bottom portion of Mt. Simon and track any upward migration to research long term behavior of CO_2 in this key storage unit for the region.

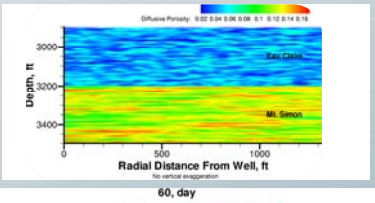


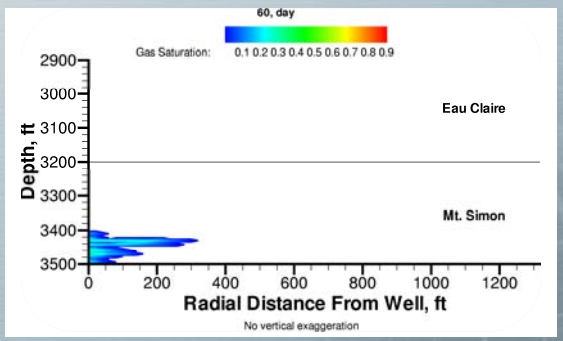
Injection System Design



Developing Preliminary Conceptual Models

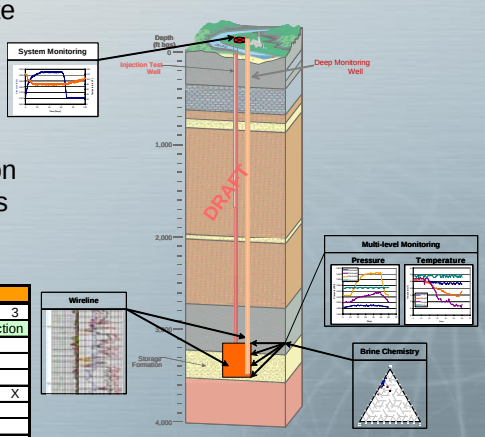
- Conceptual models are being developed based on regional data on the Mt. Simon Sandstone and Eau Claire
- These models will be used to provide guidance on MMV and permitting items.
- Models will be updated with site specific data once test well has been drilled.





MMV Program

- Complete monitoring plan and schedule will be determined after site characterization efforts are finished.
- Since the injection interval is fairly thick, the monitoring approach may involve tracking the upward migration (if any) of the injected CO_2 to assess CO_2 behavior in Mt. Simon.



Cincinnati Arch									
Time (Months)	-3	-2	-1	1	2	3	1	2	3
Phase	Pre Demo			Active Injection			Post Injection		
Injection System (PVT)				X	X	X			
Health and Safety				X	X	X			
Repeat Wireline (RST, PEX)			X		X		X		X
Tiltmeters			X	X	X	X			
Time Lapsed VSP		X						X	
Reservoir Sampling			X				X		
Surface Geochemical	X	X	X	X	X	X	X	X	X

DRAFT

Regulatory Track

- Pursuing UIC Class V injection permit under Region 4 EPA UIC program out of Atlanta (also working with Kentucky EPPC DNR Div. of Oil and Gas Conservation)
- Several meetings/calls have been held with Region 4 EPA, Duke Energy to discuss project schedule and objectives
- Class V injection permit application is in preparation prior to drilling test well.

Large property area should aid in permitting and monitoring.

East Bend Site Current Activities

- Test well drilling scheduled for Summer 2008
- Focus on permitting and procurement for injection well installation.
- Discussions with State of Kentucky and US EPA Region IV
  - Consensus reached that the preference is to go directly to the UIC permit
  - UIC Permit is in preparation – draft scheduled for later this year.
  - Monitoring well (State permit)
  - Identify CO_2 sources
- Continue with stakeholder outreach in anticipation of permit application
- Injection testing and monitoring likely in later 2008 timeframe.