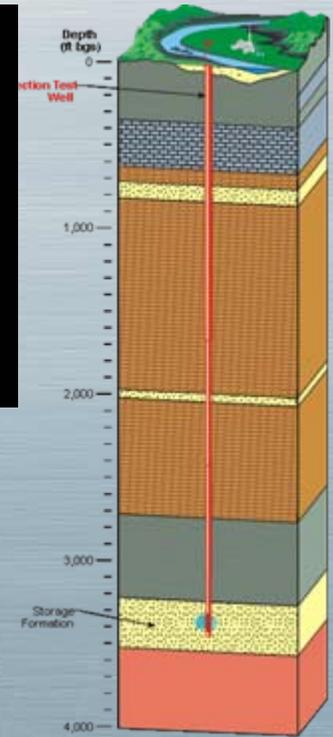
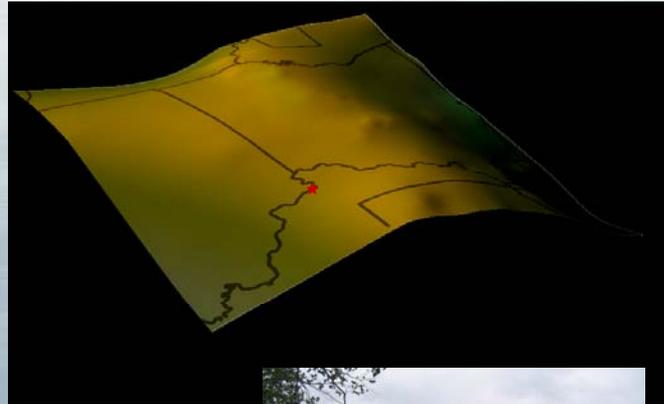


Battelle

The Business of Innovation



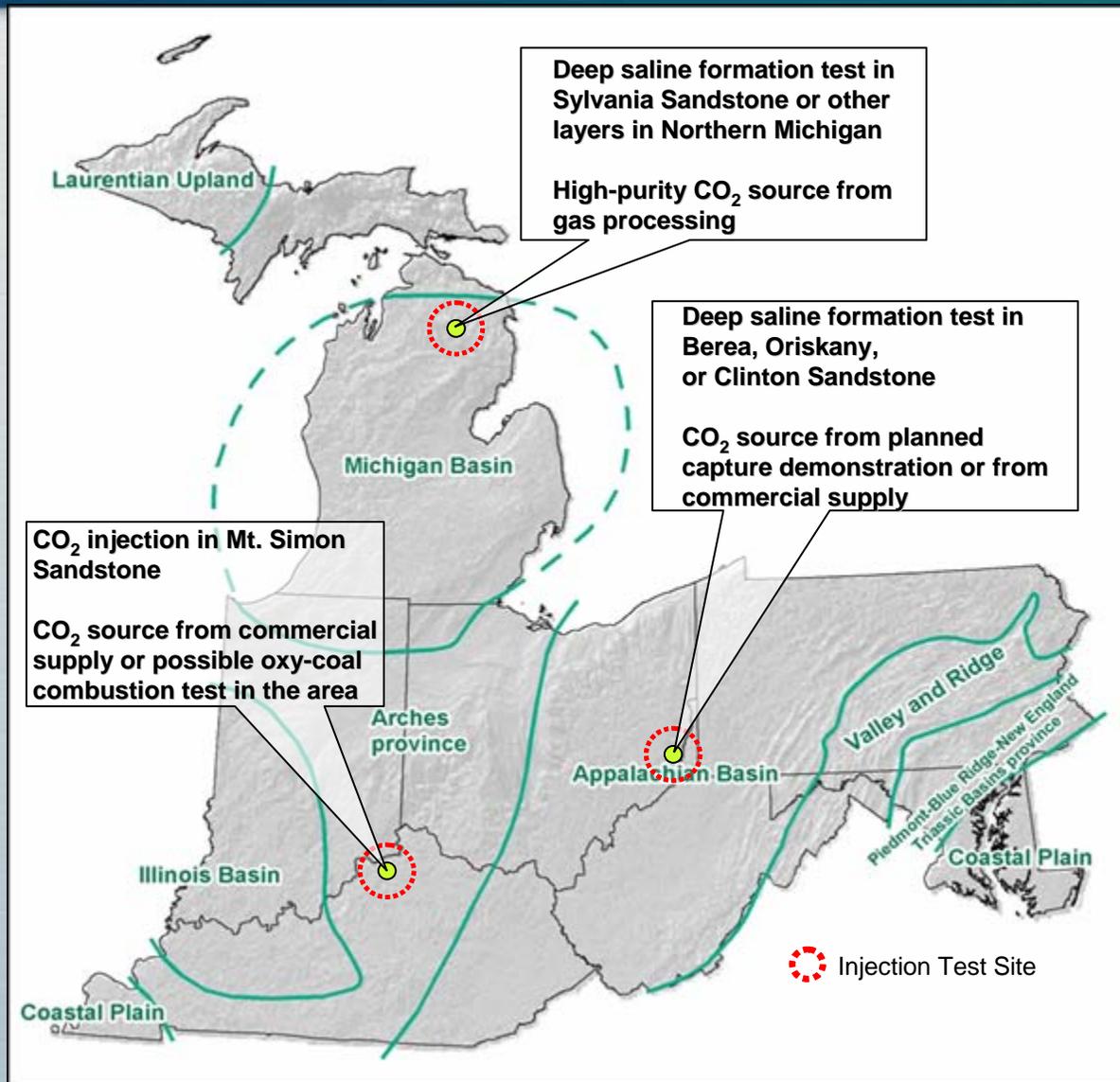
MRCSP Cincinnati Arch-East Bend Site Geologic Field Test in Mt. Simon Sandstone



***Presented By: Neeraj Gupta, Battelle
DOE/NETL Regional Partnership Annual Meeting
October 3-4, 2006, Pittsburgh, PA***



MRCSP Geologic Field Tests



East Bend Test Site Core Team



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, and others



Charlie Byrer

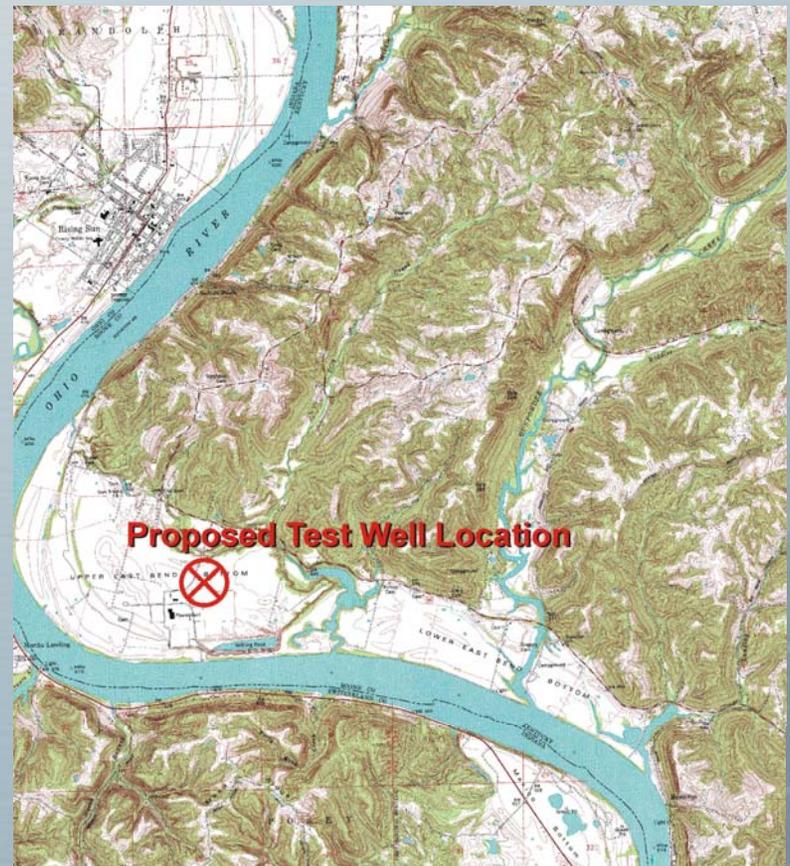
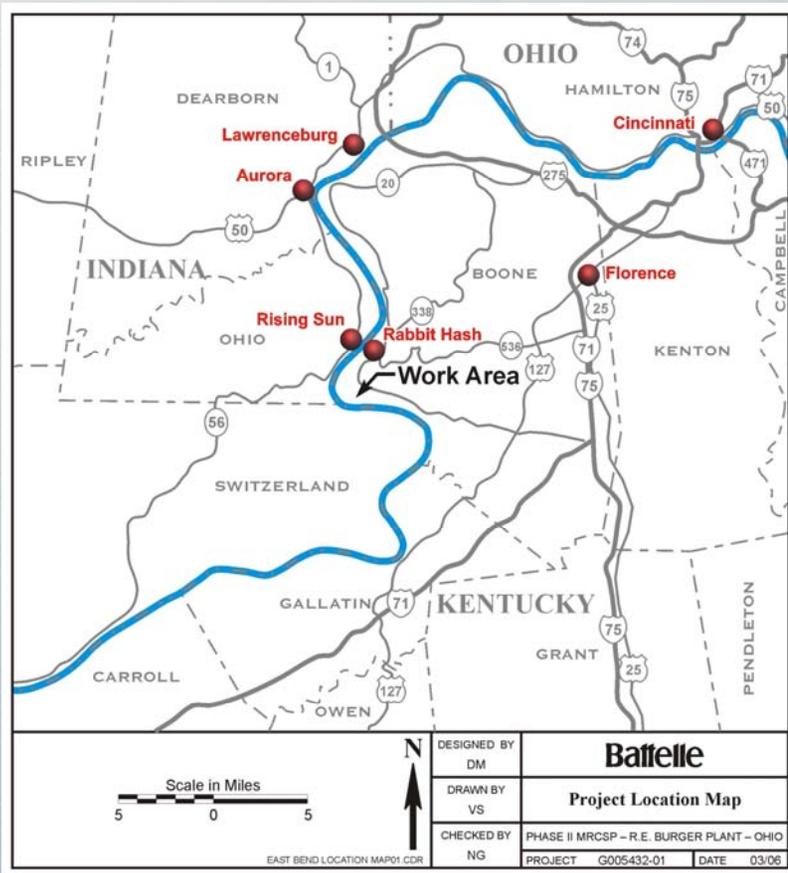


Hamid Sarv

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

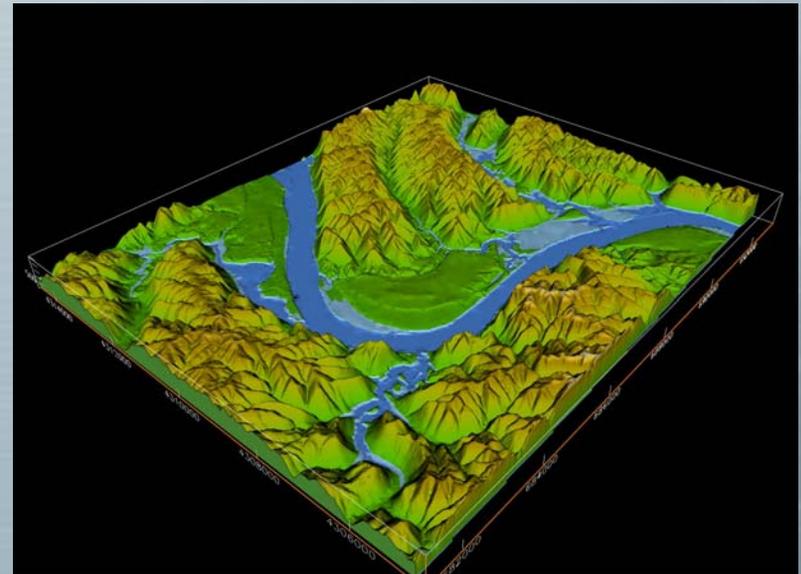


East Bend Test Site



- Duke Energy East Bend facility
- 650 MW coal-burning power plant
- SO_x and NO_x control systems

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



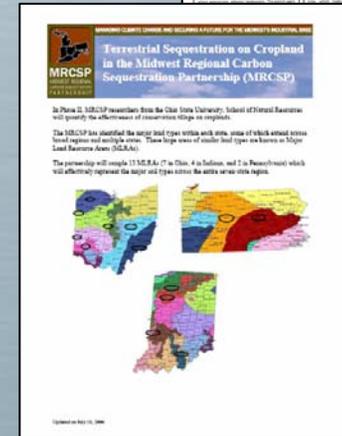
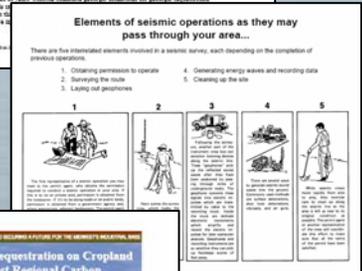
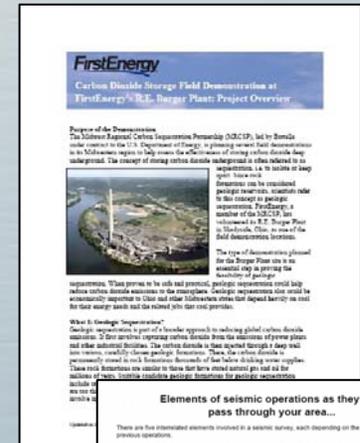
East Bend Test Site

- The plant is an industrial setting, with various generating buildings, coal staging areas, and other facilities.
- The site is located on an active plant which is providing property access for the field work and other support that should aid in completing the project.



Phase II Public Outreach General Activities

- Updated website to include Phase I report and Phase II activities
- Developed a series of generic, detailed fact sheets concerning geologic and terrestrial field tests
- Continued to collaborate with other partnerships in planning research into public perceptions
- Continued to participate in Outreach Working Group activities



East Bend Test Site- Public Outreach

- Solidified working team for each geologic pilot consisting of staff from host company and MRCSP
- Planned outreach according to planned seismic survey and injection testing
- Developed a series of site-specific fact sheets, video clips, briefing materials for each geologic field test
- Ensured that state and local officials and nearby residents received notice about the planned pilot and seismic survey (if applicable) in person, via letter or telephone call
- More than 1,300 information packets mailed within 5-miles of the plant

East Bend Test Site- Public Outreach



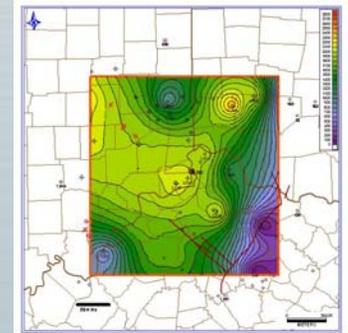
- Coordinated with Duke Energy in planning interactions with employees, officials and nearby residents prior to beginning seismic survey, scheduled for October
- Developed a series of information materials tailored to the various stakeholders (neighbor letter, fact sheet, briefings)
- At request of local officials, conducted a briefing for local officials and an 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 developing follow-on materials to address questions raised in the meetings and planning for subsequent project phases



Phase II: Geologic Field Test Plans

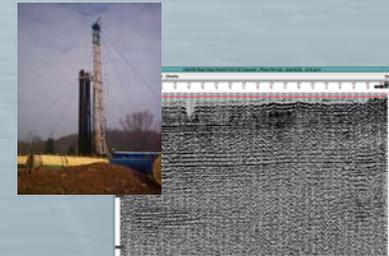
Preliminary Geologic Assessment

- **Site specific assessment of target storage reservoirs and geologic setting.**
- **Performed by state Geologic Surveys.**



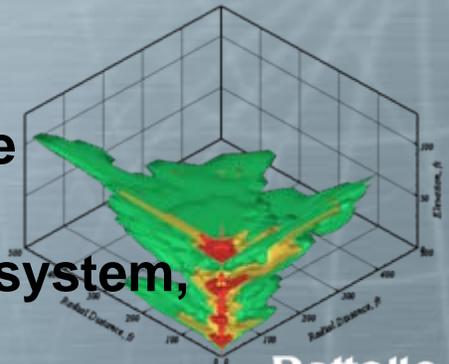
Site Characterization/Field Work

- **Seismic surveys, test-well drilling, reservoir tests, brine sampling, other field work at the demo sites.**
- **Site characterization data will be used to design injection well and monitoring programs.**



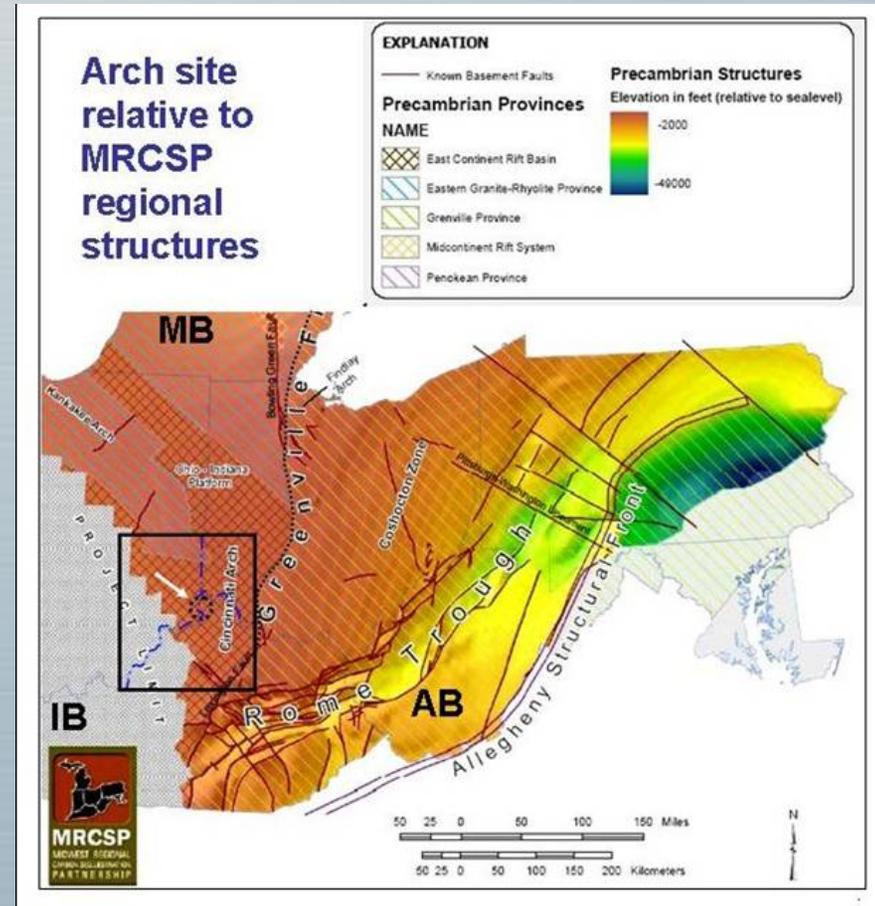
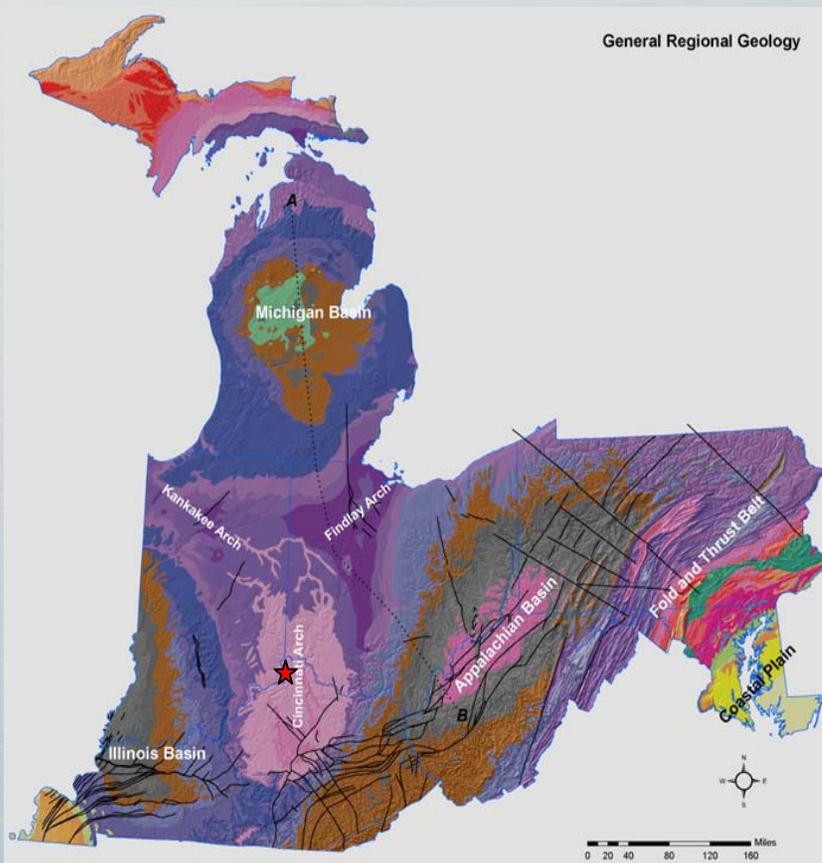
CO₂ Injection Tests and Monitoring

- **CO₂ injection testing and monitoring/verification.**
- **Objectives vary by location due to different storage targets, CO₂ sources, and system design.**
- **Monitoring will be completed to evaluate injection system, CO₂ migration, and health & safety.**



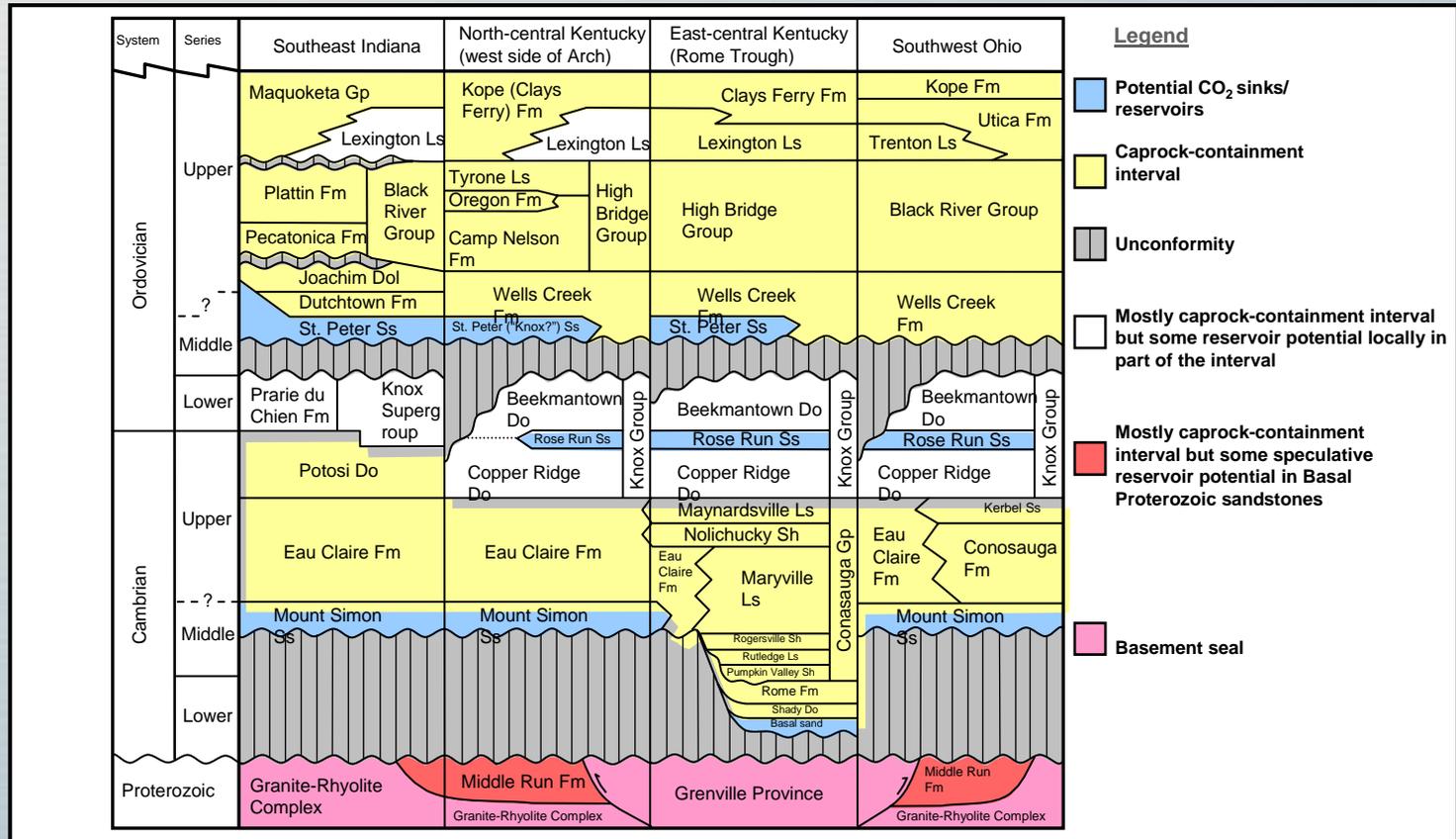
Arch Site Geologic Setting

- Preliminary geological assessment completed by Indiana and Kentucky Geological Surveys



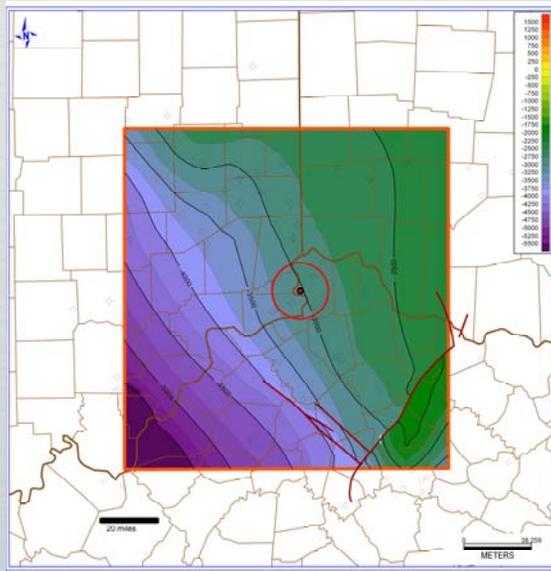
Arch Site Geologic Setting

Regional Stratigraphic nomenclature in the study region



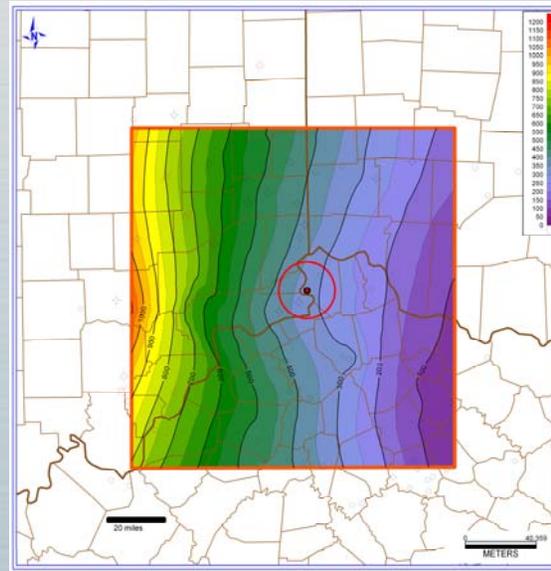
Geologic Cross-Section Through Study Area

Precambrian Bedrock Structure Map



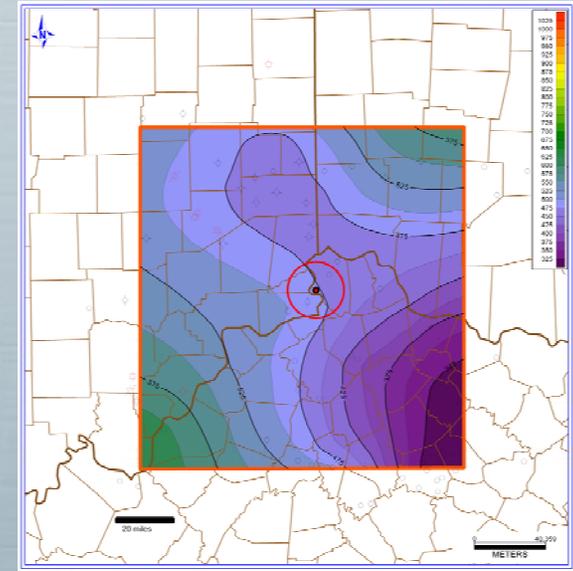
~3500 ft of sedimentary rock at test site

Mt. Simon Sandstone Thickness Map



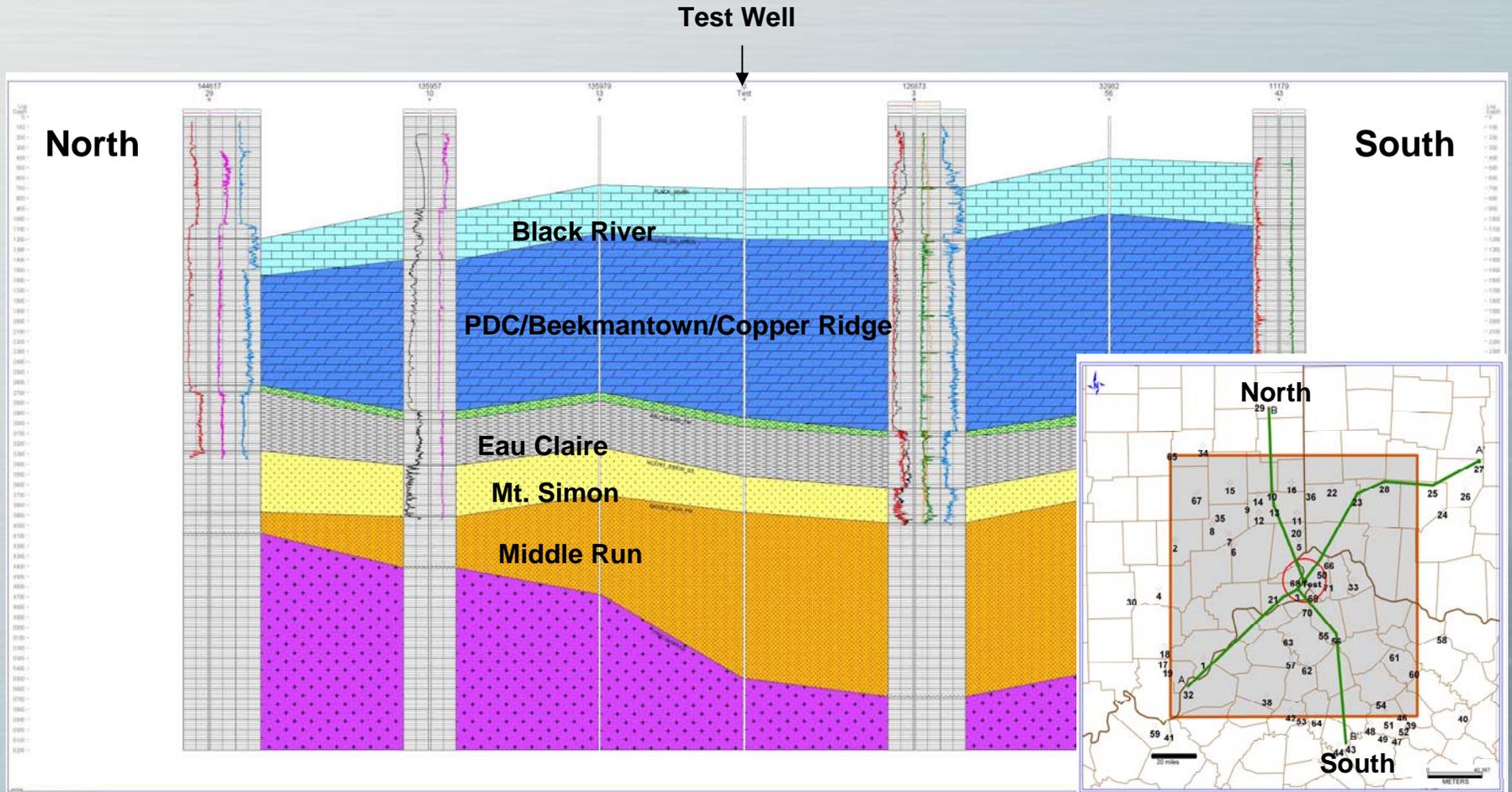
~300 ft thick Mt. Simon Sandstone unit

Eau Claire Shale Thickness Map



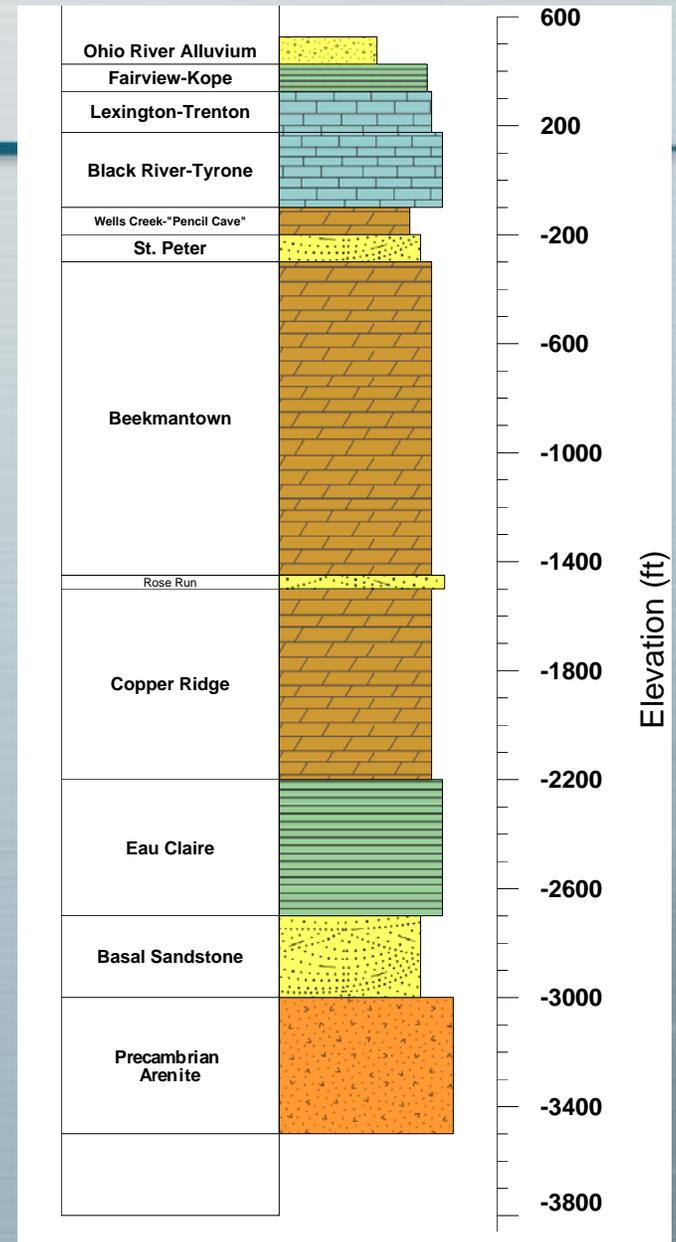
~500 ft thick containment unit

Geologic Cross-Section Through Study Area



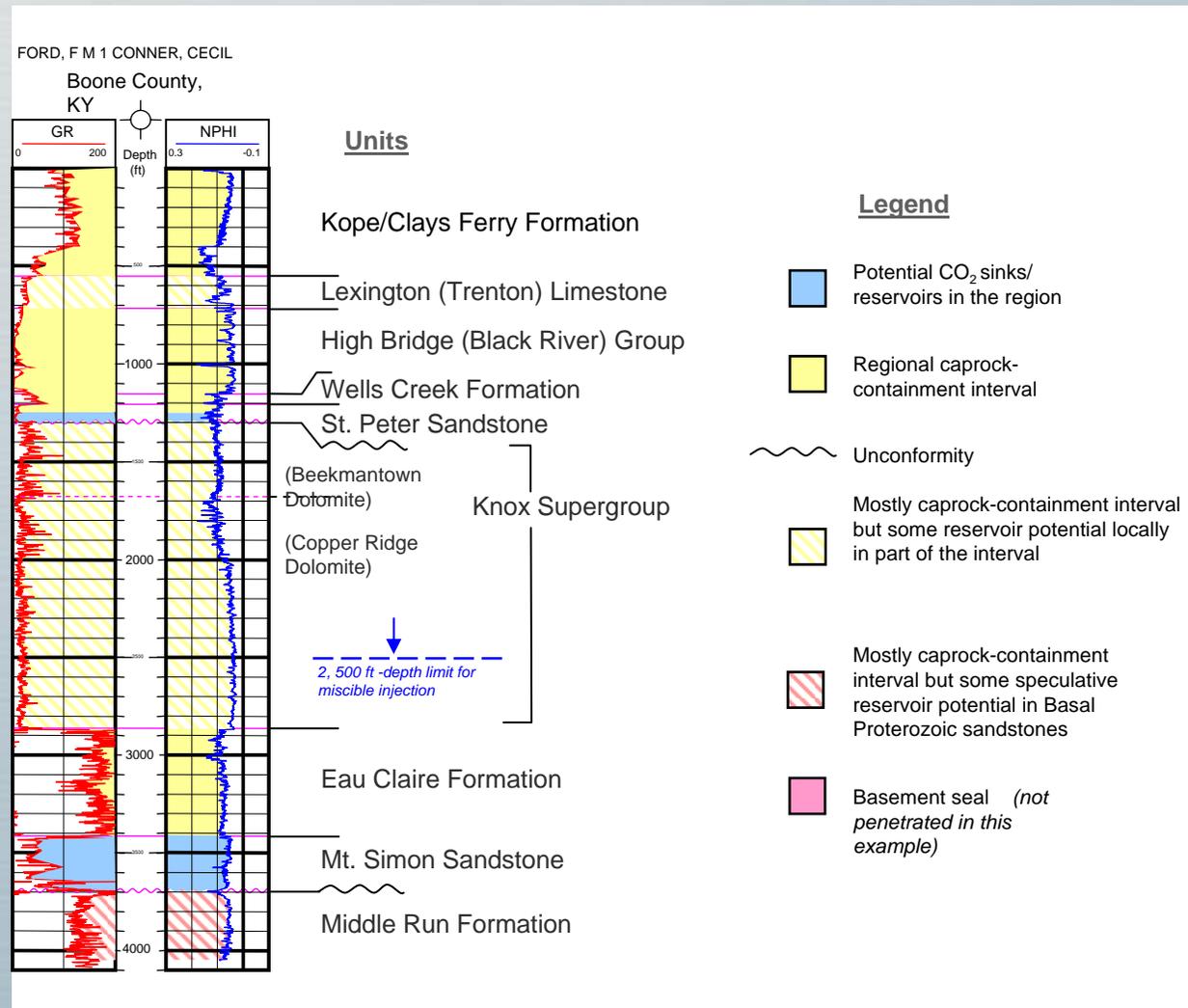
Preliminary Geology

- Sedimentary rocks ~3500 ft deep and overlie Precambrian arenite Middle Run Formation.
- Mt. Simon Sandstone/Basal Sandstone estimated at 3200-3500 ft



Preliminary Geology

- Few deep wells in area.
- Essentially no oil and gas fields nearby.
- Logs show distinct rock units.



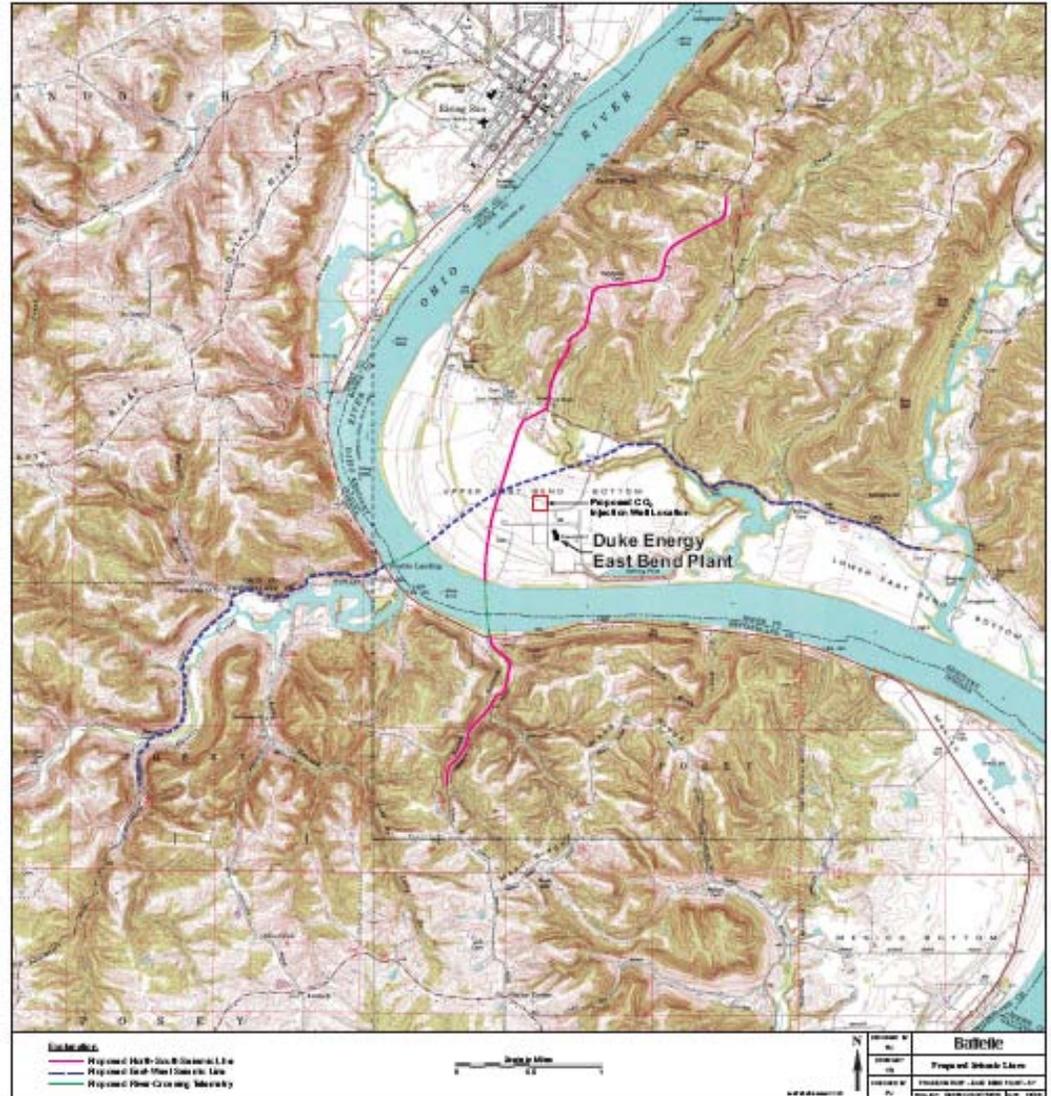
Regulatory Track

- Pursuing UIC Class V injection permit under Region 4 EPA UIC program (also working with Kentucky EPPC DNR Div. of Oil and Gas Conservation)
- Meetings/Conference Calls
 - March 2, 2006 with Region 4 EPA, Duke Energy
 - Several follow-up calls on project schedule and objectives
 - Guidance letter received September 13, 2006 outlining permitting requirements
- Permit to construct being completed for initial test well drilling
- Class V injection permit being prepared for Region4EPA
- Issues:
 - Well construction requirements
 - CO₂ stream characterization (not required if commercial CO₂)
 - Need for additional public meetings?

Seismic Survey

- 10-mile seismic survey planned for October 2006
- Survey to be completed in 2 transects along dip and strike
- Permitting and planning currently in progress

PROPOSED SEISMIC LINE LOCATIONS



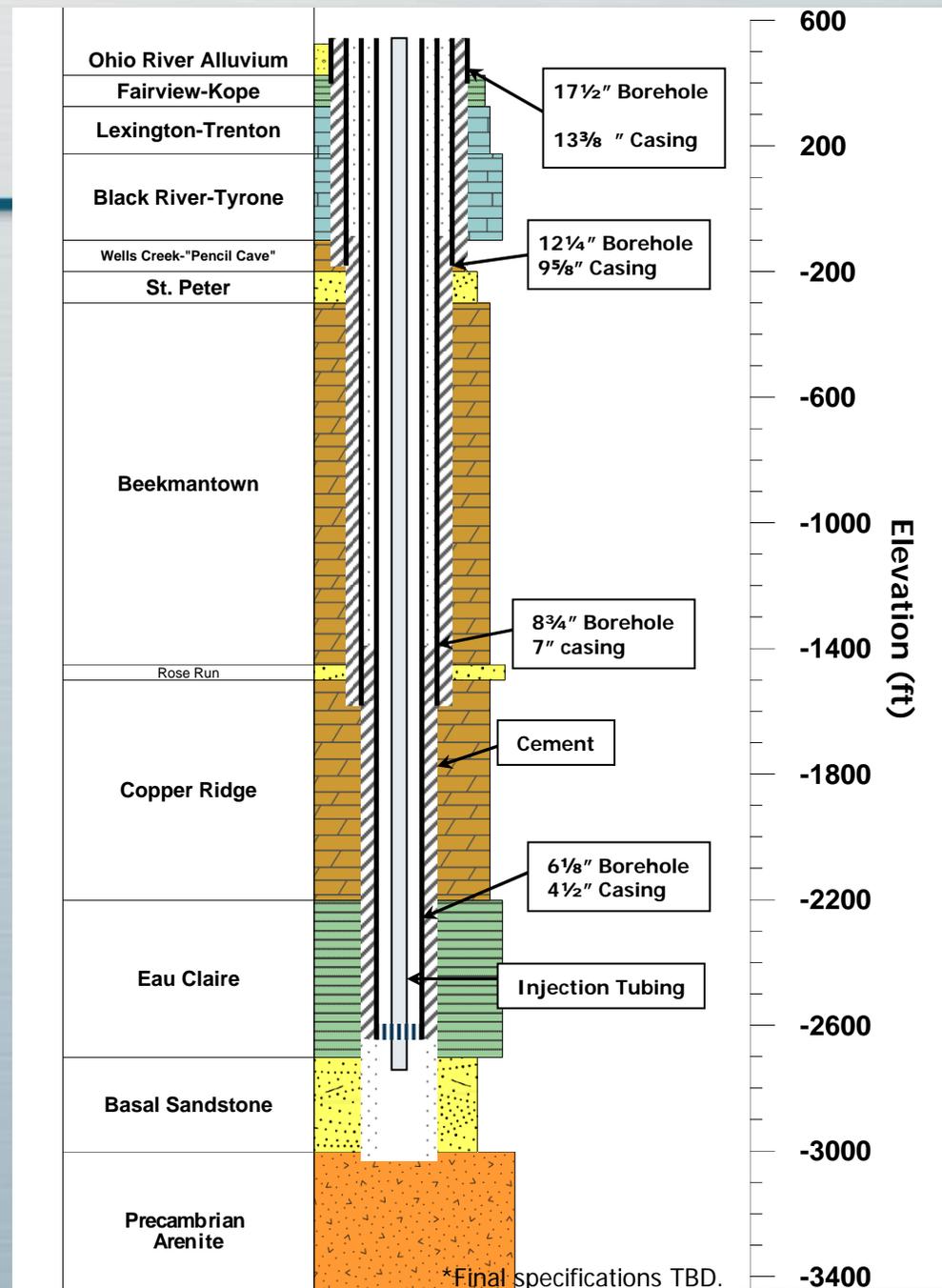
MMV – To be Finalized

- Monitoring options were reviewed and a subset of options was selected based on the proposed injection system specifications and geologic setting.
- 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 CO₂ to assess.

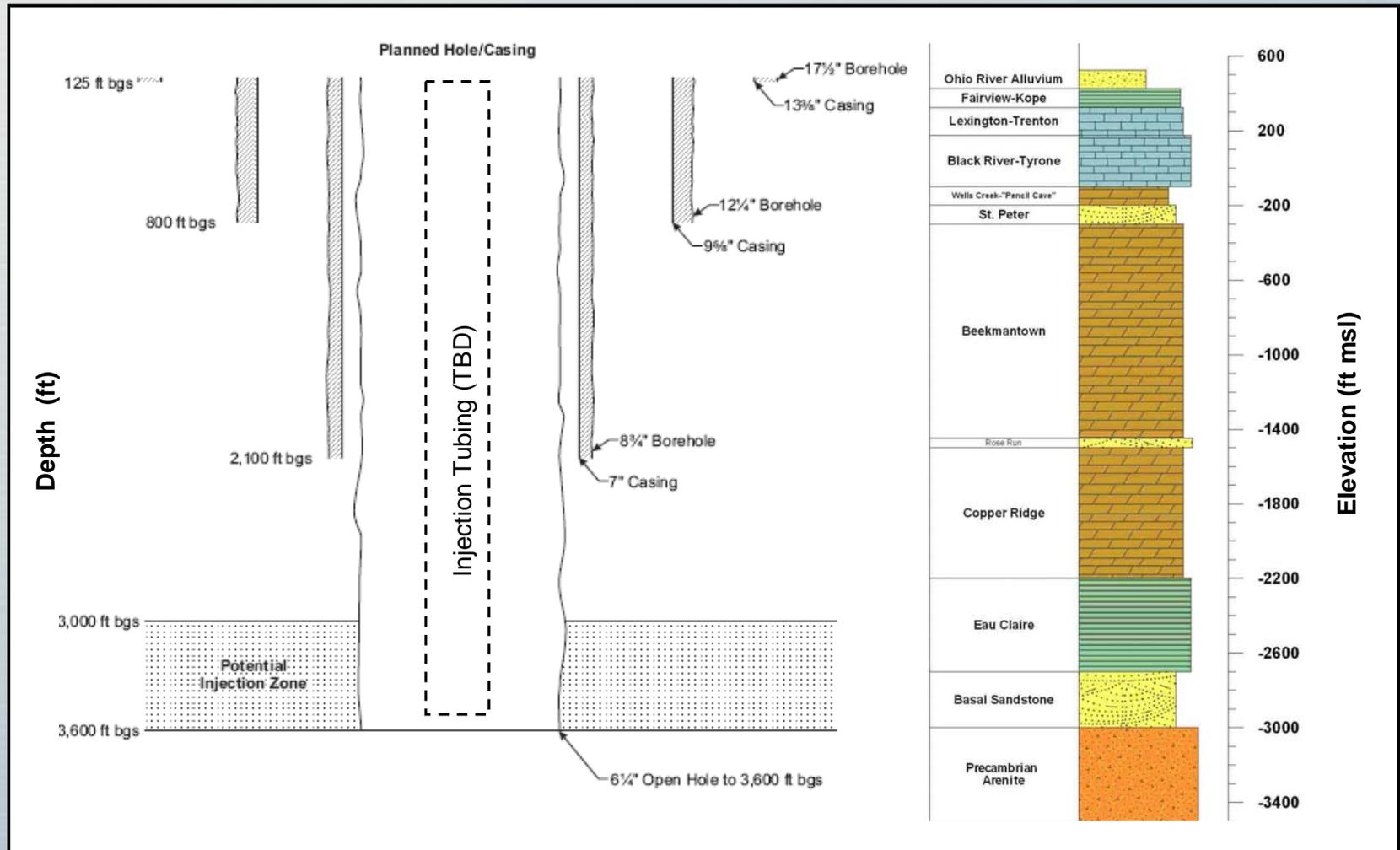
Cinci Arch									
Time (Months)	-6	-4	-2	1	2	3	2	4	6
Phase	Pre-demo			Active Injection			Post-Injection		
Injection System (PVT)				X	X	X			
Health and Safety (O ₂)				X	X	X			
Wireline (CMR, Nuutron/RST, PEX)			X		X		X		
VSP/Quasi 4-D Seismic		X						X	
Reservoir Sampling (MDT)			X		X		X		
Surface/GW/Soil Vapor			X		X		X		X
Passive Seismic	X	X	X	X	X	X	X	X	X

Injection System Design

- CO₂ injection testing and monitoring- At this early stage, the goal at the Cincinnati Arch site is to inject up to 3,000 metric tons CO₂ in the Basal Sandstone and do more detailed monitoring of its fate in the reservoir. Well completion specifications and injection schedule is being planned. Actual test conditions, injection rates, and targets will be a function of the site conditions and budget.



Preliminary Conceptual Well Diagram



Timeline and Next Steps for the Cincinnati Arch Demonstration

- Preliminary site assessment (Complete)
- Site characterization (in progress)
- Permitting (pending)
- Well construction (pending)
- Injection testing and monitoring
- Post injection and closure