FACTSHEET FOR PARTNERSHIP FIELD VALIDATION TEST

Partnership Name	Midwest Geological Sequestration Consortium		
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Field Test Information: Field Test Name	Task 7: Enhanced Coalbed Methane		
Test Location	NE NW Sec.27, T1S, R14W, western Wabash County, IL		
Amount and Source of CO_2	Tons	Source	
	750	Air Liquide (refinery or ethanol plant)	
Field Test Partners (Primary Sponsors)	Gallagher Drilling Co., Evansville, IN		

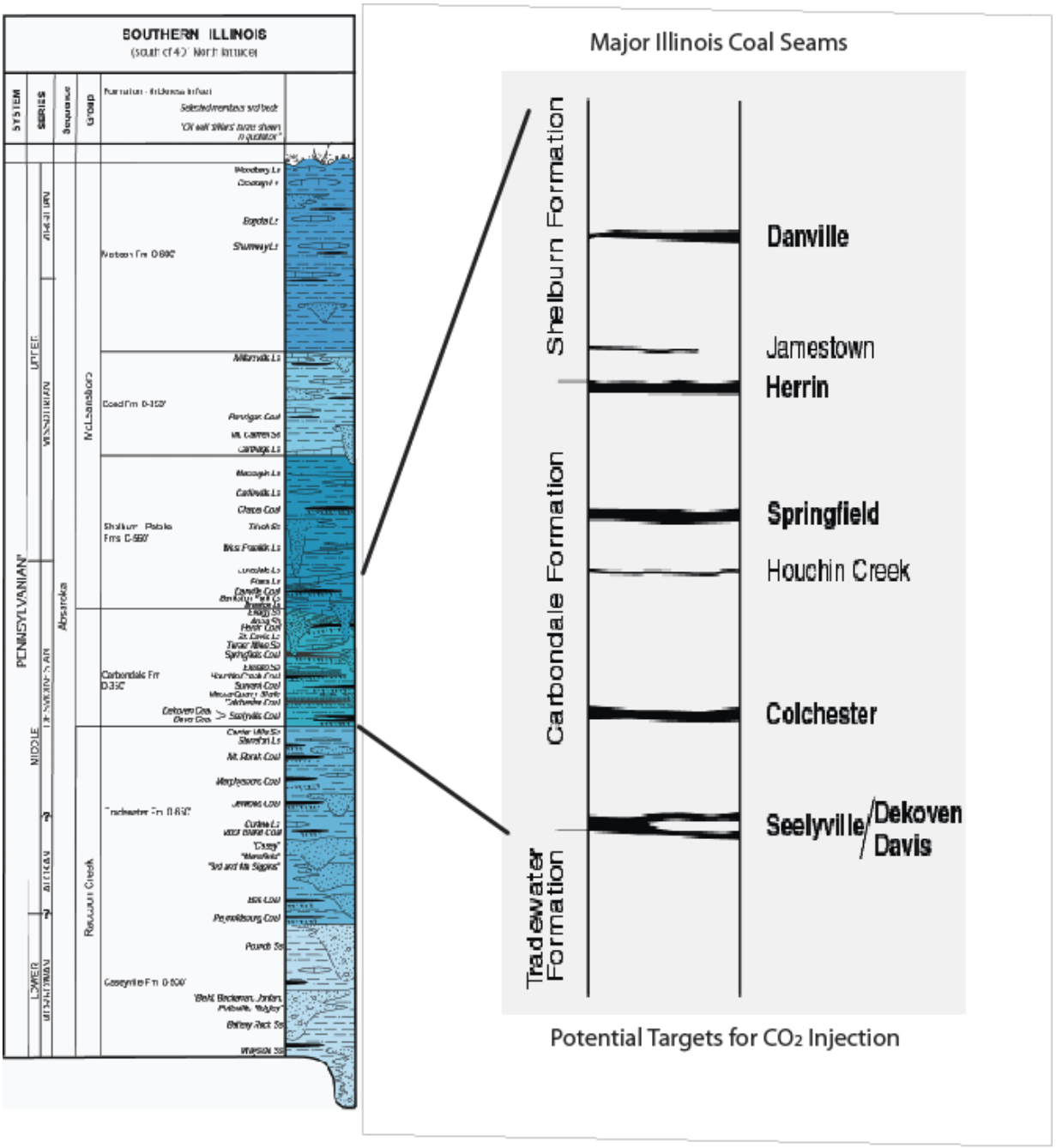
Summary of Field Test Site and Operations:

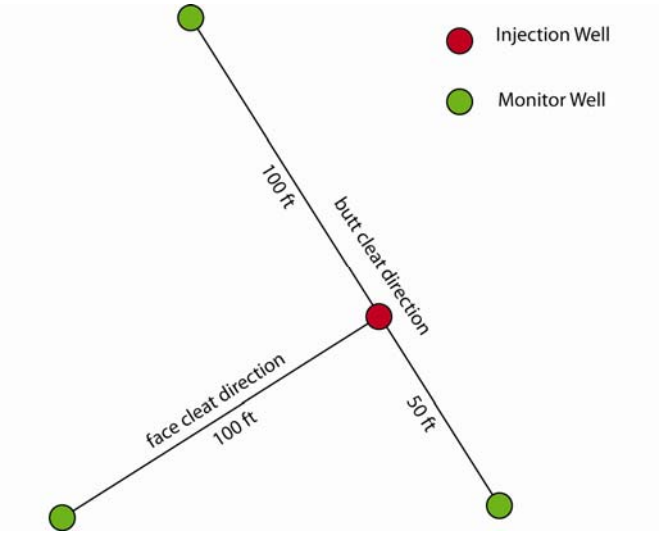
Operation Summary- This pilot project is planned to include three monitor wells. Two are located 50 and 100 feet in the butt cleat direction on each side of the injection well; the third monitor well is 100 feet from the injection well in the face cleat direction. Two of the new wells were drilled in July 2007; the remaining wells will be drilled about December 2007, prior to CO_2 injection in the summer of 2008. Cores from the July 2007 wells are being analyzed for gas content, gas chemistry and multi-gas (CH_4, CO_2 N_2) adsorption testing, coal shrinkage and swelling factor with CH_4 desorption or CO_2 adsorption, respectively. Drill stem tests of two potential coals were successfully run in one well and in one coal in the other well. Permeability from the DST data ranged from 3 to 7 md. Open hole logs (types: SP with resistivity, high resolution GR-Compensated Neutron/Density, and Full Wave Sonic) were run in both wells The wells were cased and cemented from TD to surface, then perforated in the 7-foot thick Springfield Coal at a depth of about 890 feet. Pulse and pressure build-up/fall-off tests with fresh water injection were completed in each well which verified earlier permeability measurements from the DST with permeability values in the 3 – 5 md range. The coal permeability was included in COMET coal simulation models to determine well spacing in order to have CO_2 breakthrough during the CO_2 pilot test. The well layout is shown below. MMV studies will precede any CO_2 injection field work so as to establish background groundwater, soil gas, and vegetation data. Injection pumps and the CO_2 heater will be delivered and installed prior to gas injection. CO_2 injection (750 tons, budgeted) will follow and last 40 to 80 days. This will be followed by a 60 day soak period. If coal injectivity decreases, intermittent injection will be attempted. Pressures and produced gas will be monitored in the perimeter wells. MMV equipment will be in place at the time of injection. Separation equipment will be in place for measuring and sampling produced fluids, and gas volume and composition at the monitor wells. Plans have been made to acquire additional data, develop results, and monitor the environment for upwards of six months after CO_2 injection with yearly check-ups at 12 and 24 month intervals.

Geology- Injection is planned into the 890 feet deep, 7-foot thick Springfield Coal. The Pennsylvanian rocks are predominantly shale (our seals) with thin coals, sandstones and rare limestones. No known faults are anticipated. The site was located near an existing Mississippian or deeper oil field that provided nearby well control. It is located about 6 miles from a coal mine where coal cleat orientations, a factor that could control

directional permeability, have been measured. At 890 ft, the DST confirmed that the coal was at hydrostatic pressure (385psia) and had a temperature of 65 to 75° F. Coal formation water salinity is anticipated to be on the order of 12,000 to 15,000 ppm salinity (TDS). Drinking water aquifers generally occur in the glacial till or river bottom sand and gravels that lie within about 100 ft of the ground surface, in unconsolidated sediments that lie directly above the Pennsylvanian sediments. These are protected in the wells by surface and long-string well casings that are each cemented to the surface.

Surface Location- A low relief area, near an existing oil field and in very close proximity to a road that will be used to truck the CO_2 to the site. Co-existing soybean /corn farming is likely.





Plan view of coal injection test wells.

Research Objectives:

This project is designed to measure the changes in CO_2 injectivity of Illinois coal, the amount of CO_2 that is retained by the coal, and measure the amount of methane gas that is displaced by CO_2.

Summary of Modeling and MMV Efforts: (Use the table provided for MMV)

- ***Geophysical methods*:**

Electromagnetic Induction **(EMI)** and High Resolution Electrical Earth Resistivity **(HREER)** will be used to measure conductivity and resistivity to indicate changes in soil moisture that may be caused by migrating CO_2. These methods will be run in pre- and post-injection stages (P/P).

- ***Geochemical methods:***

Monitoring the changes in major and trace constituents as well as pH, alkalinity, stable and radioactive isotopes, gases, and chemical composition of ground water will be used to define any impact of CO_2 migration.

- ***Soil gas sampling:***

Also, concentrations of CO_2 and CH_4 will be attempted in the vadose zone (P/P) to detect elevated levels of CO_2, identify source of elevated soil gas, and evaluate ecosystem impacts. Previous experience has proven that the vadose zone is often too saturated for effective analysis to take place.

- ***Aerial visible and infrared imaging:***

Digital Color Infrared Orthoimagery **(CIR)** is being used to indicate if the color and cell structure of healthy vegetation are affected by an outside stressor, such as seepage of CO_2 into the biosphere, an indicator that can validate integrity of seal formation, injection well, and other potential leak migration pathways (P/P). Two overflights were completed for baseline data, June and August 2007.

- ***Well Logging:***

Well logs are the best tools to validate the integrity of an injection well, monitor the storage formation and seal, and measure seismic velocities, moisture, gas content, salinity and hydrocarbon content around well casing. Three different types of well logging methods are considered: Gamma Ray log, Ultra Sonic Instrument **(USI)**, and Reservoir Saturation Tool **(RST)** which will be run pre- and post-injection.

- ***Ground water monitoring:***

Ground water monitoring will be used to determine quality and flow direction in shallow ground water and in production wells to monitor changes in water quality after CO_2 injection to validate the integrity of seal formation, injection well, and other potential immigration pathways to the biosphere. This would be done in pre- and post-injection steps.

- ***Subsurface pressure and temperature, gas content and fluid chemistry:***

Gas content, fluid chemistry, and pressure of formation and temperature of wellhead, downhole and annulus zones will be monitored continuously to determine reactions of injected CO_2 to formation matrix and fluid, provide a level of safety to operators, and to insure integrity of formation and seal (pre-, during-, and post-injection).

- ***Measuring CO_2 injection rate, Volume, and isotopic composition:***

To validate the volume of CO_2 injected into the formation the injection rate will be monitored during injection at injection well. Isotopic composition of CO_2 will be used to trace CO_2 migration to validate injection well and formation integrity.

- ***Groundwater and Geochemical Modeling:***

Groundwater models will be developed using **MODFLOW**, a widely accepted, finite-difference based, groundwater flow model. An analytical elements model, such as GFLOW, may be used to develop a conceptual model for groundwater flow. The results of the modeling effort will estimate the time for potential contaminants to travel outside the area of the injection site that will provide an estimate of any risk to nearby water supplies, should CO_2 leakage occur (P/P). Also the software **PHREEQC** would be applied for thermodynamic modeling of shallow groundwater samples and injection-formation brine samples to gain experience in using water quality data and chemical modeling as a technique for detecting releases of injected CO_2 (P/P).

Summarize Target Sink Storage Opportunities and Benefits to the Region:

Multiple coal seams in the Illinois Basin provide possible adsorptive sinks for CO_2 while at the same time the CO_2 can be used as an enhanced methane recovery technique. Our injection test will evaluate factors in both the lab and in the field that are critical to this recovery method.

Cost:

Total Field Project Cost: $ $768,019

DOE Share: $364,890 48%

Non-DOE Share: $403,129 52%

Field Project Key Dates:

Baseline Completed: **Feb 2007**

Drilling Operations Begin: **July 2007**

Injection Operations Begin: **May 2008**

MMV Events: **Feb 2007 – July 2009**

Field Test Schedule and Milestones (Gantt Chart):

Site Selection Process has been completed.

Lab analyses of Illinois Basin coals are in progress at the Indiana Geological Survey and Southern Illinois University.

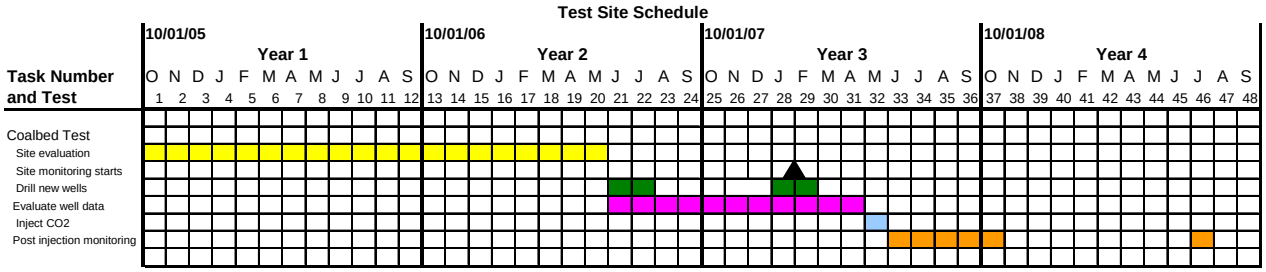
Site monitoring for MMV will begin about February 2007.

Drilling of two new wells completed July 2007; remaining two wells by January-February 2008.

Evaluation of coal and wells will follow.

CO_2 injection during May 2008.

MMV will follow until end of the project.



Additional Information