FACTSHEET FOR PARTNERSHIP FIELD VALIDATION TEST

Partnership Name	Midwest Geological Sequestration Consortium
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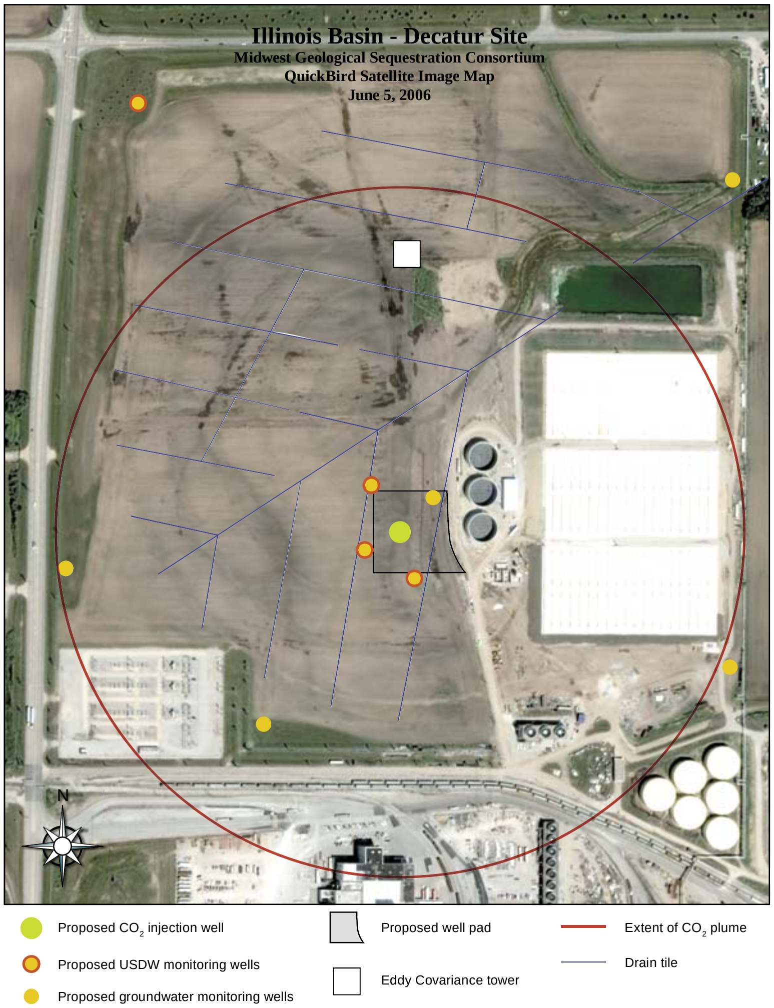
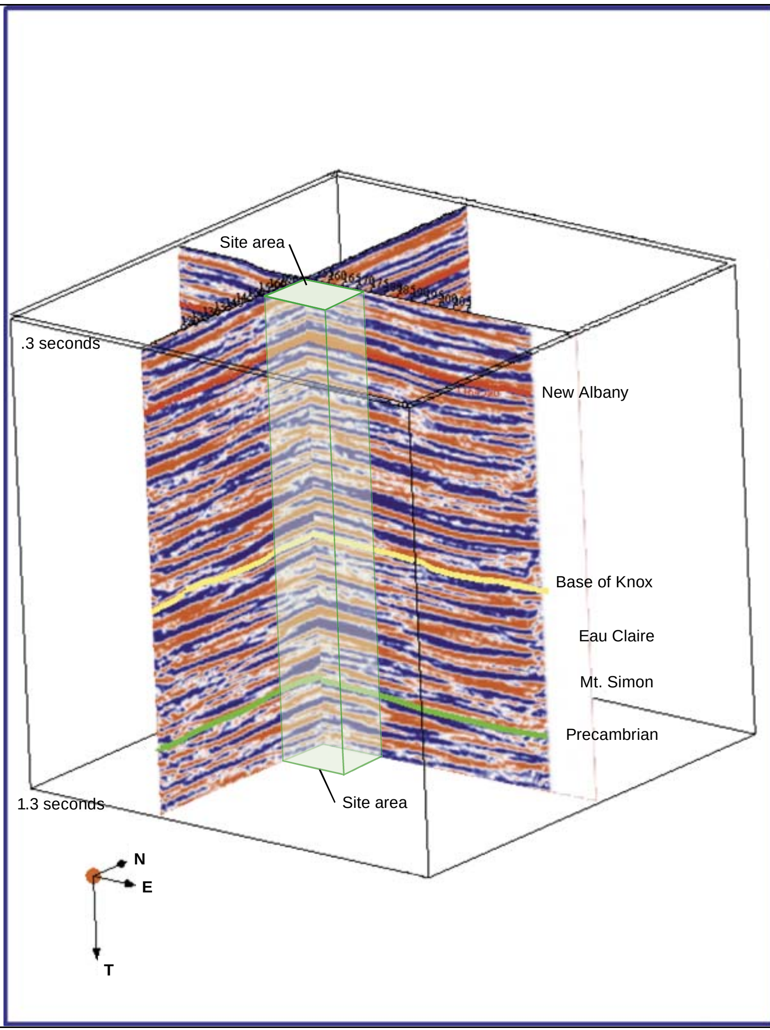
Field Test Information:	Large-Scale Deep Saline Reservoir
Test Location	Decatur, Illinois
Amount and Source of CO_2	Tons Source: 1,000,000 Archer Daniels Midland, Company (ADM) (ethanol plant)
Field Test Partners (Primary Sponsors)	ADM

Summary of Field Test Site and Operations:

The thickest and most widespread saline reservoir in the Illinois Basin is the Cambrian-age Mt. Simon Sandstone. It is overlain by the Eau Claire Formation, a regional, non-permeable shale and underlain by Precambrian granitic basement. Gas storage projects in the Illinois Basin all confirm that the Eau Claire is an effective seal in the northern and central portions of the Basin. The site for the deep saline project has been selected and contracts signed with Archer Daniels Midland (ADM) Company. The Deep Saline project will demonstrate the ability to inject and store one million metric tonnes of carbon dioxide (CO_2) in the Mt. Simon Sandstone over a period of three years. The Illinois Basin – Decatur site is on the property of ADM in Decatur, Illinois, and the CO_2 source is ADM's ethanol fermentation operation at their Decatur facility. The drill pad, cellar and reserve pits have been constructed. MMV efforts began in Spring 2008 and include resistivity surveys, installation of the Eddy Covariance tower, and drilling of a shallow groundwater monitoring well. A Class I – Non-Hazardous UIC permit application has been prepared, a draft permit written, public comment period initiated, and a public hearing held. The public comment period is scheduled to end on October 17, 2008. A monitoring well is scheduled to be drilled in Fall 2008 to determine the lowermost USDW at the site. The CO_2 injection well is scheduled to be initiated in December 2008, pending receipt of the UIC permit. A detailed pre-injection site assessment and drilling of the injection well is taking place under the saline reservoir task of the Phase II effort to characterize the site and ensure its suitability. The MGSC initially characterized the site using orthogonal 2D seismic lines to confirm the geological structure at the site and to test for any seismically resolvable faults that may exist. Preliminary interpretation has shown no such faults. A two-phase risk assessment has been conducted regarding major features, events, and processes associated with the project. The first phase focused on geospatial risks and the second phase focused on community, surface, environmental and legal risks. The data have been analyzed and risk mitigation plans will be completed for the top ranked identified risks. The injection well will then be drilled through the entire Mt. Simon Sandstone to the underlying granitic basement and will include extensive logging, core sampling, and fluid sampling to build a comprehensive reservoir model and MMV baseline of the site. The reservoir model will be used to approximate the distribution of the injected CO_2 and of the potential reactivity of the CO_2 and CO_2-laden brine with the reservoir and the seals. The model will be expanded as more data are derived from a baseline 3D seismic survey and will be used to predict where additional geophysical surveys will be deployed as CO_2 is injected. Injection at a nominal daily rate of 1,000 metric tons per day will begin in December 2009. Based on regional geology, one of the injection zone targets is expected to be near the base of the Mt. Simon Sandstone and will be identified based on the reservoir model which will be built from numerous data sources including; surface 2-D and 3-D seismic, borehole seismic, well logs, whole and sidewall core samples and reservoir tests . A site map and the 2-D seismic lines are shown below.





Research Objectives:

The goal is to demonstrate that geologic sequestration is a safe and permanent method to mitigate GHG emissions. Deep, saline water-bearing reservoirs offer the greatest potential for sequestration of large volumes of CO_2. This saline reservoir injection will evaluate the potential of sequestering CO_2 in deep saline reservoirs which have no producible resources with economic value. The Mt. Simon was selected as the optimum saline sink because of its widespread nature; it is present in the subsurface of many of the Midwestern states. An extensive MMV program will establish the effectiveness of sequestration within the Mt. Simon.

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

- ***Geophysical methods*:**

High Resolution Electrical Earth Resistivity **(HREER)** is being used to measure resistivity in the relatively shallow geologic environment to indicate changes in soil moisture that maybe caused by migrating CO_2. A permanent resistivity grid located near the injection well will allow collection of earth resistivity measurements continually prior to, during, and after CO_2 injection.
To track CO_2 in and above storage formation time-lapse seismic imaging would be applied as pre-, during, and post-injection surveys. Also, to determine the development of any micro fractures in the injection formation or cap rock, rock which could provide pathways for CO_2 migration, passive seismic (micro seismic) monitoring in or near the injection well will be run during, and post-injection.
Vertical Seismic **(VSP)** profiles will be run at the deep saline reservoir site during and-post-injection as a monitoring approach to define the plume margin in comparison to the pre-injection 3-D seismic survey.

- ***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 monitor for any impacts of CO_2 migration. In addition, chemical tracers (PFCs) may be added to the CO_2 injection stream to assist in source tracking of CO_2.

- ***Soil gas sampling:***

Concentrations of CO_2 and light hydrocarbons (C1-C6) will be measured in the vadose zone pre-injection, during injection, and post-injection to detect any elevated levels of CO_2, identify source of elevated soil gas, and evaluate any ecosystem impacts.

- ***CO_2 land surface flux monitoring:***

CO_2 surface fluxes using accumulation chambers and CO_2 fluxes in the atmosphere using Eddy Covariance will be monitored at the deep saline site pre-injection, during injection, and post-injection.

- ***Visible and infrared imaging:***

Digital Color Infrared Orthoimagery **(CIR)** acquired by airplane is being used to indicate if the cell structure of the local vegetation is affected by an outside stressor, such as seepage of CO_2 into the biosphere. CIR imagery will be collected quarterly. This technique provides a large spatial coverage of the study site with the resulting data assisting in validation of the integrity of the seal formation, injection well, and other potential migration pathways to the biosphere pre-injection, during injection, and post-injection.

- ***Well Logging:***

Well logs are the best tools to validate the integrity of the injection well, monitor the storage formation, seal, and measure seismic velocities, water saturation, gas content, salinity, and hydrocarbon content around the well casing. Multiple well logging methods will be run, such as: SP, gamma ray log, resistivity, Ultra Sonic Instrument **(USI)**, density, neutron, sonic formation micro imagery, and Reservoir Saturation Tool **(RST)** several of which are to be run pre- and post-injection.

- ***Ground water monitoring:***

Ground water monitoring will be used pre-injection, during injection, and post-injection to measure quality and flow direction in shallow ground water and to monitor any changes in water quality after CO_2 injection to validate integrity of seal formation, injection well, and other potential migration pathways to the biosphere. In addition the lowest USDW will be monitored as required by the UIC permit.

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

Gas content, fluid chemistry, pressure of formation and temperature at the wellhead, and in the annulus zone will be monitored to determine reactions of injected CO_2 to the formation, matrix fluid, provide level of safety to operators, and to insure integrity of the formation and seal (pre-, during, and post-injection). Two verification wells drilled subsequent to the injection well will be key sources of these data.

- ***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. Isotopic composition of CO_2 will be used to trace any CO_2 migration and to validate injection well and formation integrity. Tracers may be used in addition to these methods.

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

Atmospheric, geochemical, and groundwater flow models will be used to help validate the integrity of the injection formation and cap rock. Modeling results will be compared to data collected at the site. Atmospheric models will estimate the dispersion and concentrations of CO_2 into the air from the local industrial sources and potential leakage from the injection formation. Models such as **TOUGH2** coupled with **LSM** (land-surface model) will estimate the potential migration of CO_2 in the unsaturated zone and the near-surface environment in addition to atmospheric releases. Groundwater models such as **MODFLOW** and **GFLOW** will be used to develop a conceptual model for shallow groundwater flow and estimate the time for CO_2 to travel outside the area of the injection site. Results from this modeling effort will provide an estimate of any risk to nearby water supplies, should CO_2 leakage occur during or post-injection. Geochemical models such as **Geochemist's workbench**, **PHREEQCI,** and **TOUGHREACT** would be applied for thermodynamic modeling of shallow groundwater and injection-formation brine to determine the potential effects of CO_2 on the solution equilibria of groundwater and to predict the extent of mineral trapping of carbon dioxide. These models will provide insights on the long-term fate of injected CO_2 and will be used to study the regional impact of multiple injection wells on flow within a saline aquifer across the Illinois Basin. Reactive transport and geochemical modeling of the fate of injected carbon dioxide and its effects on the chemical and mineralogical composition of the injection formation and confining layers will be studied using **NUFT** (non-isothermal/thermal, unsaturated/saturated, flow and transport model). The geomechanical model **LDEC** (distinct-element geomechanical model) will be used in conjunction with NUFT to predict pressure-stress relationships. LDEC will be applied to assess cap rock geomechanical deformation by simulating the evolution of microfactures created by the pressure of injected carbon dioxide.

Accomplishments to Date:

The site for the deep saline project site has been selected and contract is in place with ADM. The well pad construction is complete. A time-lapse camera has been installed to photograph the entire well construction process. A 200-foot deep groundwater monitoring well and Eddy Covariance tower have been installed at the site. Two-dimensional seismic was collected in October 2007 and has been analyzed. Phase I of the risk assessment was completed in August 2008. The UIC permit application for this well was submitted in January 2008 and a draft permit was issued for public comment on August 1, 2008. A public hearing was held on September 16, 2008 and the comment period is scheduled to end in October 2008. Plans for a well to determine the lowermost USDW on site are underway and the well is due to be drilled Fall 2008. Injection well drilling is scheduled to begin in December 2008.

Summarize Target Sink Storage Opportunities and Benefits to the Region:

The Mt. Simon was selected as the optimum saline sink because of its widespread nature and immediately overlying Eau Claire shale seal. The Mt. Simon underlies one of the largest concentrations of coal fired power plants in the world. This makes the Mt. Simon one of the most significant carbon storage resources in the United States.

Cost:		**Field Project Key Dates:**	
Total Field Project Cost:	**$89,351,074**	**Baseline Completed:**	**Dec 2009**
(budget for oil & gas operator)		**Drilling Operations Begin:**	**Dec 2008**
DOE Share (80%):	**$71,480,859**	**Injection Operations Begin:**	**Dec 2009**
Non-Doe Share (20%):	**$17,870,215**	**MMV Events:**	**May 2008 – On-going**