MGSC

MIDWEST GEOLOGICAL SEQUESTRATION CONSORTIUM

FAQs

Frequently Asked Questions

What is Geologic Carbon Dioxide Storage?

Geological storage of carbon dioxide (CO_2) is one method of isolating CO_2 from the earth's atmosphere. Reducing the amount of CO_2 released into the atmosphere may slow the global warming trends that have been observed in the last decade or more. Geological storage can play a significant role in preventing continued buildup of CO_2 in the atmosphere.

Carbon Capture, Utilization and Storage (CCUS) is the capture, transport, and storage of CO_2 from a point source, such as an electrical generation or biofuel production facility. The CO_2 is stored in the pore spaces of suitable geological formations in a porous rock, such as sandstone, and sealed in place with an impermeable caprock, such as shale. Utilization focuses on the use of CO_2 to produce additional fossil fuel resources, primarily through enhanced oil recovery.

Where is the Mount Simon Sandstone?

The Mt. Simon Sandstone lies more than one mile below Decatur, Illinois, and is 1,600 ft thick at this location. It is the deepest sandstone in the Illinois Basin, a bowl-shaped geological feature that holds thousands of feet of rock and underlies most of Illinois, southwestern Indiana, and western Kentucky. The Mt. Simon Sandstone is covered by the low-porosity Eau Claire Shale, which also has very low permeability (the ability of fluids to flow through a rock) and will therefore hold the CO_2 in the Mt. Simon. The Eau Claire Shale acts as a seal or cap, holding CO_2 deep in the Mt. Simon reservoir. The Mt. Simon has a large storage capacity because of its thickness, porosity, and areal extent, and it can hold a million tons of CO_2 within a radius of just about a quarter-mile from an injection well.

How is the CO_2 gas treated before injection at IBDP?

Carbon dioxide is being captured from the ADM ethanol production facility in Decatur, dehydrated, and transported via on-site pipeline to the storage site. The captured CO_2 is compressed to a liquid-like state so that it occupies less volume than CO_2 gas. The compressed CO_2 is then injected more than a mile below ground into porous sandstone called the Mt. Simon Sandstone for long-term geological storage.

What kinds of problems do you anticipate with having CO_2 in a liquid-like state?

We have not encountered any issues with the CO_2 in liquid state. We have drawn on the experience in the oil and gas industry with transporting and injecting supercritical CO_2. Using current technology, the pipelines and wells at IBDP have been engineered to handle the high pressures necessary to keep CO_2 in this form.

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Is carbon sequestration safe?

Yes, if the storage site is correctly selected, designed, and operated. Extensive monitoring takes place during and after injection to be sure the CO_2 being stored stays in place. Monitoring techniques include using geophysical technology to confirm the position of the CO_2 underground and wells to monitor groundwater and soils. For decades, the ISGS has collected background information on the subsurface rocks of the Illinois Basin and has been investigating the sequestration potential of the Mt. Simon Sandstone for more than 10 years. The uppermost Mt. Simon Sandstone has performed well as a natural gas storage reservoir in Illinois, and we expect the same performance for the deep Mt. Simon in Decatur and other locations throughout Illinois, Kentucky, and Indiana.

How much CO_2 can the Mt. Simon Sandstone hold?

The Mt. Simon Sandstone is commonly used for natural gas storage in the Illinois Basin and has fair to good permeability and porosity. Its overlying strata contain impermeable limestone, dolomite, and shale intervals. The depth of the Mt. Simon ranges from approximately 2,000 to 14,000 ft below the surface. In the southern half of the Basin the reservoir is brine-filled, and no oil or natural gas resources have been discovered in this unit. At its greatest thickness in the Illinois Basin, the Mt. Simon is over 2,600 ft thick. The estimated storage capacity of the Mt. Simon Sandstone ranges from 11 to 150 billion tonnes of CO_2. Given the current total emissions of 291 million tonnes per year from point sources in the Illinois Basin, the Mt. Simon Sandstone has several hundred years of storage potential.

Are there any risks to pumping so much CO_2 underground?

No significant health, safety, or environmental risks should arise from a properly designed and managed storage site. Appropriate risk mitigation and management plans are an integral part of the overall project planning. Extensive monitoring takes place during and after the injection to be sure the CO_2 stays in place. The first line of monitoring begins deep below the ground, so we will know if any leakages occur long before the CO_2 reaches the surface.

How many other projects like this exist around the world?

Geological sequestration of CO_2 by injection into the Earth's subsurface is a promising technology being studied around the world. There are currently projects underway in Canada, Norway, Algeria, Australia, and under development around the world. The Illinois Basin – Decatur project is one of the first projects of similar scope in the United States to begin injection of CO_2 for geologic sequestration.

What happens to the CO_2 once injected underground?

The CO_2 is held in the small pore spaces present in rocks. The ideal saline reservoir for geological storage shares characteristics with the best oil producing rocks. This is sedimentary rock with good porosity (percentage of open pore spaces) and permeability (connectivity of open pore space).

Directly above the storage reservoir, at depths of at least 5,500 ft, is a relatively thick caprock unit (hundreds of feet thick) of very low porosity and permeability, such as shale. The caprock layer acts as a lid or a cover for the saline reservoir. The depth of the reservoir is also important. A suitable saline reservoir will be thousands of feet below drinking water levels yet economically viable for drilling.

Also, the volume of the potential storage space must be great enough to justify the expense of drilling a well, and having more than one shale caprock which will help ensure containment of the CO_2. The Illinois Basin - Decatur Site will store CO_2 more than a mile below the surface, and have two backup shale seals in addition to the primary shale seal in the mile between the Mt. Simon Sandstone and the surface.

What happens to the CO_2 in the event of an earthquake?

Earthquake energy traveling through bedrock is many times smaller than what we experience on the ground surface. In the event of an earthquake, the CO_2 in the porous spaces of the rock may react slightly to the space being momentarily compressed. But, because the Mt. Simon has good porosity and permeability, fluids can easily move laterally without damaging reservoir containment.

In water wells, a very small, momentary change in water levels because of earthquake waves passing through the area of the well has occasionally been recorded. This is believed to be caused by the earthquake wave slightly compressing the rock as it passes through, and then letting the bedrock relax back to normal.