Carbon storage project combines innovation and outreach

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Geologists are hoping to learn a great deal about geologic carbon sequestration from injecting 1 million metric tons of carbon dioxide into sandstone 7,000 feet beneath Decatur, Ill. And they're hoping the public learns a lot from the endeavor, too.

The Illinois Basin – Decatur Project (IBDP) began its injection, the first million-ton demonstration from an industrial source in the U.S., in November 2011. Over the next three years, the Midwest Geological Sequestration Consortium, led by the Illinois State Geological Survey, hopes to use innovative science and engaging outreach to evaluate the potential of carbon capture and storage techniques.

"The Illinois Basin-Decatur Project is a significant example of how science impacts society and serves as an example of how science at a local level can impact the global good," said Sallie Greenberg, the sequestration communications coordinator for the Illinois State Geological Survey, a branch of the Prairie Research Institute at the University of Illinois.

Greenberg will discuss the IBDP and the outreach efforts surrounding it in a presentation at the annual meeting of the American Association for the Advancement of Science.

Geologic sequestration, or underground carbon storage, is a process that injects compressed carbon dioxide into a porous rock layer, such as sandstone. The Illinois Basin, a large geologic formation underlying the

state of Illinois as well as western Indiana and Kentucky, has a layer of sandstone deep beneath multiple layers of shale, which act as a cap to keep the carbon dioxide permanently trapped.

The IBDP is located at the Archer Daniels Midland ethanol fermentation processing plant in Decatur, making it the first large-scale sequestration effort in the U.S. to use carbon from a biofuel production source. Ethanol fermentation emits nearly pure carbon dioxide. The IBDP captures the gas, compresses it to a liquid-like dense phase, and injects it into the underground sandstone at a rate of 1,000 metric tons per day.

"This is an opportunity to determine the safety and the effectiveness of this carbon capture and storage technology," said Robert Finley, the director of the IBDP. "Because we have exceptionally favorable geology here in the Illinois Basin region to do this, testing it out at Decatur becomes a very important opportunity for us. The geology is excellent, and we have an excellent partner in Archer Daniels Midland."

The researchers are using innovative new near-surface and deep monitoring technology to protect health and safety while keeping track of how the carbon dioxide behaves in the subsurface. In addition to the injection well, the IBDP has a 7,000-foot-deep verification well on site that allows the researchers to monitor pressure and fluid chemistry. They are also using advanced geophysical imaging technology to monitor the injected carbon dioxide by sending energy pulses into the earth and recording the reflection.

"It's essentially like taking a sonogram of the earth," Greenberg said. "Using geophysical technology allows us to create a time-lapse view of how the carbon dioxide is distributed in the sandstone reservoir."

While working to hone the technology of carbon capture and storage, the researchers also hope that their demonstration will assure the public that

geological sequestration is a safe and efficient process.

Public outreach is an important component of the program. The ISGS offers a variety of teacher education and professional development programs through a knowledge-sharing and capacity-building program called the Sequestration Training and Education Program (STEP). The survey has hosted a variety of national and international delegations to share knowledge gleaned from their project-based experience.

However, a key part of Greenberg's outreach strategy is spending time in public venues, giving residents the opportunity to interact with the scientists and voice their questions and concerns. They attend public meetings and hearings, set up booths at science expos and other local events and visit schools.

"It's interesting to me as a geoscientist who does public engagement that the questions that the public asks are the same questions, really, that the scientists are asking," Greenberg said. "People should ask those questions, and science should be able to answer those questions."

Greenberg visits schools and communities with a tabletop model that demonstrates how sequestration works, as well as rock samples so that questioning minds can see and feel a piece of the Illinois Basin. This helps to address common misunderstandings about where the carbon dioxide is going, since many people have a mental image of underground caverns or rivers being pumped full of gas.

"It's much easier to explain the concept of geologic sequestration and to resolve some of the misconceptions that people have about the subsurface when you have the actual material in your hand," Greenberg said. "When you have the opportunity to take a core sample, and put a couple of drops of water on the sandstone so people can see the water go into the rock, compared to a piece of shale where the water beads up on

top, that basic visual makes a huge impact."

To date, more than 75,000 metric tons of carbon dioxide have been stored at the Decatur site, and so far the injection has gone well. The researchers see carbon capture and storage as an important part of the portfolio of energy technology for the future.

"If you're going to achieve some of the reductions in emission by 2050 that have been set forth by international agencies, you can't come close to those targets without carbon capture and storage being a part of the process," Finley said. "For us to perfect this in a site that we believe to be safe and effective is very important. We can create a test case that demonstrates the best practices."

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