

Tucking Carbon Into the Ground

Matthew L. Wald, *New York Times*, 3-31-11

If carbon is going to be kept out of the atmosphere, a lot of it is probably going to have to be injected back into the ground from which it was mined as coal or extracted as oil or gas.

Not even the most ardent optimist about alternative energy would suggest that fossil fuels are going away soon. So carbon capture and sequestration — C.C.S. in environmental shorthand — is essential to a national energy policy. But almost all the discussion has been on the C.C. and not much on the S.

Yet there are signs of progress. The first large-scale sequestration project in North America, on the banks of the Ohio River in New Haven, W.Va., is going to complete its mission soon, with an unexpected bit of good news.

In one kind of rock, at least, carbon dioxide seems to slip into the small open spaces more easily than projected, meaning the job may be easier than thought. And more than 500 miles to the west, near Meredosia, Ill., a bigger project to try injecting carbon into a more common kind of rock is making progress toward start-up.

“We’ve been very encouraged,” said Gary O. Spitznogle, the manager of carbon capture and sequestration engineering at American Electric Power, a company that produces electricity in 11 states, mostly by burning coal. In late 2009, it began capturing carbon dioxide from a portion of the flue gases at its Mountaineer coal plant in New Haven.

With almost every kind of rock into which carbon dioxide could be pushed, the object is to let the carbon dioxide displace the water there — usually water with no economic value, because it is salty. The project near Meredosia will inject carbon dioxide into sandstone, a porous formation found under much of the Midwest and other parts of North America. Sandstone underlies Mountaineer, too, and its pores are usually too small to be seen by the naked eye. But another layer under Mountaineer is a different kind of rock, dolomite, which has pores more like the voids in a Swiss cheese. These are “vugular porosities,” known as vugs.

In the dolomite, the carbon dioxide turned out to have interesting properties, according to Mr. Spitznogle. It is more slippery than the saline water it displaces, he said, and, as a result, as more and more carbon dioxide was pumped in, and the boundary between the carbon dioxide and the saline got larger, the flow became easier.

“The system is designed to go as high as 2,800 pounds per square inch, but we haven’t needed to go anywhere near that pressure,” he said. In fact, carbon dioxide has been oozing in at a pressure of 1,500 to 1,800 pounds a square inch.

Because each additional pound of pressure means more electric power to do the work, lower pressure means sequestration will be less expensive. (The bulk of the energy consumption, though, is in the separation phase.)

Still, the Mountaineer test is merely a pilot. The separation plant is working from a slice of less than one-sixtieth of the plant’s flue gases, 20 megawatts out of a 1,300-megawatt output. The next phase is a 235-megawatt unit, he said; if carbon regulation requires it, the company would build modules of that size near its plants. Injection might then be at several wells, each going to a different depth.

The Meredosia project will use an entirely different method to separate the carbon dioxide. In February, the project sponsors said they had identified an area in Morgan County, Ill., for sequestration, in the Mount Simon Sandstone, a geologic structure that stretches under much of the Midwest. At the site in question, it is about 850 feet thick.

“The amount of pore space we’ll consume over 30 years would be on order of less than 1 percent to a few percent,” said Kenneth K. Humphreys, chief executive of the FutureGen Alliance, a consortium of companies that will build and operate the project. One problem for FutureGen is that land ownership in the area is broken up among many holders, and at the

moment, the pore space in the rock is considered the property of the surface owner. Mr. Humphreys said he did not know how much underground area the project would need — it might fit in 2,500 acres or might need 10,000, he said.

FutureGen's carbon dioxide flow will be about 10 times larger than Mountaineer's. Mountaineer, which was supposed to run for up to five years, is likely to close sooner, because the companies involved have learned what they need to. The Meredosia plant is supposed to run for 30 years.

Many national and international environmental organizations favor carbon sequestration, although they fret over the details. There has been local opposition, in some places, which might be described as "not under my backyard." The FutureGen sponsors say they picked their Illinois location partly because of local support.

And various parts of the legal framework for carbon sequestration are falling into place. In November 2010, Lisa P. Jackson, the administrator of the Environmental Protection Agency, gave final approval to a rule that had been in preparation for three years, creating a new class of wells for injection of carbon dioxide. The rule covers how operators must study the underlying geology, build the well, run it, test the underground flow, respond in an emergency and plug the well when they are done.

A main focus of the rule is protecting drinking water. While carbon dioxide itself is not toxic — in fact, humans emit it every time they exhale — it does change the acidity of water into which it is injected. That can result in underground water acting on and dissolving naturally occurring toxic materials deep underground.

So the E.P.A. does not allow carbon dioxide to be injected into underground water supplies that meet the drinking water standard. Instead, it will be injected into saline aquifers, water that is too salty for drinking or irrigation use.

The E.P.A. already has rules covering injection of carbon dioxide into old oil fields, where it is used to force oil to the surface. The new rule will cover those fields as they are "transitioned" into use as carbon storage sites.

One part of the legal framework remains largely unsettled, though. Private companies say that they will take responsibility — and accept the liability — for carbon dioxide they put in the ground for as long as they inject it, and perhaps for decades afterward. In addition, at the Illinois project, the plan is to buy commercial insurance and to set up a trust fund to handle future problems.

FutureGen said it would take responsibility for any damages while it was injecting, and for the longer term was setting aside money in a trust fund to pay for future problems, if there are any. And it will be buying commercial insurance, it said.

That makes Illinois itself the fourth line of defense, said Mr. Humphreys. But companies will not accept the liability forever, he said, and it was not a good idea for them to agree to do so, because the carbon dioxide will outlive the corporate entities.

"The one thing we can pretty well guarantee is that the United States of America, and the State of Illinois, are all going to be around in 100 years," he said. "You need someone to be the ultimate caretaker."

But getting legislatures to agree is a state-by-state process.