

Comment by Karen Feridun on CCS and Pore Space

When Denise Brinley was Executive Director of Pennsylvania's Office of Energy, [she told webinar attendees](#), regarding Carbon Capture and Storage, "We have the geology to do it"

Do we?

Answering that question requires answering many others, including some that scientists are still asking. Last month, Sandra Steingraber, Senior Scientist for the Science and Environmental Health Network [provided us with an overview](#) of pore space as it relates to CCS and of the research currently underway to answer some of those questions.

When injected CO₂ encounters water, it can become Carbonic Acid. What effect, if any, does corrosive Carbonic Acid have on the rocks where the CO₂ is being stored? When Carbonic Acid moves about, what effect does it have on the cap rock that is critical to CCS' success? What happens to the brine that is removed? (Spoiler alert: the Global CCS Institute did a commentary in 2016 on "Enhanced Water Recovery" in which it suggested that removing, I mean recovering, brine would allow for "Extraction of valuable minerals dissolved in the brine, for example lithium." It's almost like we're watching a scripted play sometimes, isn't it?) How do they know when the pore space is filled up? How will we know if the CO₂ remains sequestered? What does permanent mean?

Many more questions have never been satisfactorily answered. We'd always been told that Pennsylvania's geology wasn't suited to injection wells. A few years ago, Penn State Geoscientist Andrew Nyblade spoke at a symposium I attended. He told us that Pennsylvania was going to see more Class II injection wells. We asked what had changed about our geology. CCS means we'll see a new generation of Class VI injection wells, but we still don't know what about our geology has changed.

DCNR has been studying CCS for two decades. When Governor Wolf entered into the Regional CO₂ Transport Planning initiative in 2020, Secretary Cindy Dunn said, "The Department of Conservation and Natural Resources has been engaged on the topic of carbon capture utilization and storage (CCUS) for nearly 20 years, and during this time, the department's Bureau of Geological Survey has assessed numerous subsurface geologic resources that have potential to serve as carbon storage reservoirs."

Have they?

I've spent a considerable amount of time reading through DCNR's documents on CCS and other supporting materials and their statements are never without important caveats.

One 2009 [DCNR report](#) stated, "The Marcellus Shale would likely be an appropriate cap rock, but continued exploration and potential development in this unit for natural gas production could potentially compromise the integrity of this formation as a viable cap rock in areas of natural gas production. Further evaluation of the structural geology of the Salina Group will be required to evaluate the potential for vertical migration of CO₂."

Well, what about the Onondaga Limestone? “This hydraulic fracturing will likely compromise the suitability of the Marcellus shale as a cap rock in many areas, and may impact the underlying Onondaga Limestone as well. This potential impact should be evaluated further.”

And the Oriskany? “It should be noted that the Marcellus Shale is the ultimate cap rock for the Oriskany Sandstone, although in some places other formations directly overlie the Oriskany Sandstone. The development of the Marcellus Shale creates difficulty with respect to its resulting containment of any CO₂ sequestered in the Oriskany. In terms of the deeper saline formations, wells installed into these units will penetrate through the Marcellus Shale. In addition to the Marcellus, Pennsylvania is home to an active oil and gas industry that during a typical year drills thousands of producing oil and gas wells. These wells penetrate the entire geologic section from the Upper Devonian through the Silurian. Each of the wells drilled to the saline units will penetrate these same formations. The crucial elements of containment include well integrity (increased casing and cement requirements) and cap rock integrity which results in isolation of these producing formations. The preferred approach would be to designate specific areas for CO₂ injection only, away from areas of active oil and gas operations,” which, as [Global Energy Monitor noted](#), “could prove extremely difficult at a time when gas is a tradable commodity but carbon isn’t.”

And what happens when you take into consideration all those abandoned wells? Another DCNR [2009 report](#) cautioned, “Injecting CO₂ into an area occupied by unplugged or improperly plugged wells invites leakage, especially if the injection reservoir formerly acted as an oil and/or natural-gas producing or gas-storage reservoir. In Pennsylvania’s older oil-and-gas fields, many drill holes exist that can constitute a leakage pathway for reservoir gases, including injected CO₂. The safest course of action would be to avoid the oldest of these oil fields, such as those in the northwestern counties (especially Venango, Warren, and McKean), because those areas contain large numbers of oil wells drilled in the late 19th century for which no completion records currently remain.” Today, the estimated number of abandoned wells is at least 3 times higher than the 2009 estimate. Some current estimates are closer to six times higher. Many are undocumented and may never be found.

Nevertheless, the state government continues to speak enthusiastically about carbon capture and storage and is currently considering how to handle issues pertaining to the pore space where the CO₂ would be sequestered. The concept of collective storage across multiple properties and the unpredictable path an injected CO₂ plume takes have prompted a proposal that would deny landowners the right to say no to the use of their pore space for CO₂ sequestration if enough neighboring landowners say yes.

Landowners would be justified in saying no, however. If their pore space is being sought by the industry, it means they are also dangerously close to CCS infrastructure, like CO₂ pipelines and Class VI injection wells. In 2010, Tetrattech produced a poster entitled [Risk Assessment for Geologic Carbon Sequestration in Pennsylvania](#) that provides an overview of the risks from multiple sources.

The No False Solutions PA coalition has been leading a Pore Space campaign since last month to educate the public about an issue that has received little attention in the press, but could be decided by the state government very soon. We encourage everyone to visit our website, nofalsesolutionspa/pore-space to learn more.