

## BEYOND THE MARCELLUS

*(appeared in **The Express**, June 29, 2010)*

The history of oil and gas resource extraction in our commonwealth goes back more than 200 years. Early exploration for hydrocarbons focused on the recovery of shallow oil; when present, natural gas was considered a nuisance. It was not until the late 1800s that entrepreneurs, recognizing the benefits of this “waste product,” began to target and develop natural gas resources.

As is the case with most mineral-resource extraction, as the “easy” plays deplete, economics along with continuously improving technology drive the search for “tougher” targets. Shallow gas fields used vertical wells to produce conventional plays, typically less than 5000 feet (rock units younger than Late Devonian age). Later, vertical wells tapped deep gas fields (older Devonian units) approaching 7000 feet.

Since the 1980s, directional (slant and horizontal) well-drilling has rapidly become the industry standard in accessing conventional oil and gas plays. More importantly, this game-changing technology transforms unconventional plays, like the Marcellus shale, long known as a source rock for shallow gas, into a major resource reservoir. Estimated by some to hold as much as 500 trillion cubic feet of natural gas, the Marcellus is touted as having enough recoverable gas to satisfy all of America's gas needs for more than a decade.

According the Marcellus Shale Coalition’s website, “Natural gas producers already invested more than \$4 billion in Pennsylvania in lease and land acquisition, new well drilling, infrastructure development and community partnerships, with an even greater investment expected in the future.” Clearly, this sanguine description promises rich rewards with which few could argue considering the scope of the economic distress pervasive throughout our nation today.

However, some citizens critically challenge these rosy forecasts from industry and many of our politicians. We need to look no further than the recent headlines documenting accidents associated with Marcellus development, a methane explosion in WV’s northern panhandle and the blowout in Clearfield Co., to confirm that natural-gas extraction is indeed serious and risky business. Furthermore, the spreading environmental catastrophe as crude oil and natural gas gushes from the wrecked Deepwater Horizon well in the Gulf of Mexico spotlights the false and misleading industry claims about safety. Likewise, the accident refocuses our attention and awareness of the inherent fragility of the natural environment.

Nevertheless, we should be keenly aware that Marcellus natural gas has become an integral part of the hydrocarbon continuum in our quest to extract the fossil fuels upon which we have come to so heavily rely. As extraction and production infrastructure expands, as technology becomes more sophisticated, and as the collective knowledge of the geologic framework steadily grows, industry will pursue even greater challenges in the commonwealth. Although the names Utica Shale, Trenton Group, and Black River Group, among others, may not be as familiar as the Marcellus Shale is today, these geologic units are currently under scrutiny throughout the region as the next potential natural-gas targets.

Deeper and therefore more difficult to access than the Lower Devonian Marcellus, the Upper Ordovician Utica Shale and Trenton and Black River Groups extend over much of the same area. To date, nearly 100 Trenton-Black River exploration wells have been drilled in NY and the recent announcement of significant gas potential from the Utica in Quebec likely have industry salivating in anticipation of a potential for bigger pay zones recoverable from deep within the Appalachian basin.

It is clear that natural gas drilling in the commonwealth will continue at an ever increasing pace for many years to come. What is not clear is the impact that all of this activity will have on the environment. And recognize that the environment is not simply limited to the watersheds and ecosystems at the surface or the ground-water systems that tend to be less than 500 feet in depth. Marcellus drilling penetrates a rock column a mile or more vertically and often extends horizontally equally as far. The Utica, Trenton, and Black River units lie much deeper and therefore will require more extensive efforts to tap their gas resources.

Absent are substantive scientific studies addressing any aspect of natural gas drilling in deep, unconventional plays requiring massive stimulation treatments and special recovery processes comparable to that currently associated with the Marcellus throughout the commonwealth's Appalachian Plateaus. Permit me to list a few of the questions that science is not able or may not be able to answer for some time to come relative to well drilling and the environment.

We do not know what the effects will be of drilling thousands, perhaps tens of thousands of wells on the surface waters and shallow ground-water systems. We do not know how the fracturing process will impact rock units above and below the target units. We do not know how the uncaptured flowback fluids will migrate through the rock column at depth. We do not know where a slug of spilled fracing or flowback fluid will migrate through the shallower surficial and bedrock units or what the effects might be upon the local ground-water systems. We do not know the long-term, cumulative effects of intensive drilling, fracing, and natural gas extraction.

What we are doing in our commonwealth is performing a whole series of scientific experiments with our natural environment serving as the laboratory. Unlike being required to follow standard scientific protocols, we do not really have a handle on all of the variables, and we do not have control groups. When a science experiment goes awry, following assessment as to why it failed, it can be restarted using the knowledge gained in the failure. We really do not have the option of wiping the slate clean and restarting these experiments. And, no matter how much money we throw into them, no matter how careful we are, it is absurd to assert that there will be no mistakes.

In our commonwealth, natural gas permitting, drilling, and production is regulated by the Oil and Gas Act of 1984. Industry and its proponents argue that drilling is tightly regulated. I will leave that discussion to their representatives, the politicians, and the pundits. However, cautious, proactive thinking and action should guide each stakeholder when it comes to their private water supply or favorite stream.

Industry is required to test private water supplies within 1,000 feet of a well at no charge to the owner. And, this testing must use an independent, state-certified laboratory to perform the testing. Although the list of water-quality parameters is not prescribed, tests typically analyze for standard parameters, including salts and metals. Some negotiated leases may call for a far broader range of analyses, perhaps including organics and radionuclides.

A prudent strategy for those stakeholders beyond the required distance or for those who wish to obtain corroborating data is to perform independent, pre-drilling, water-quality and quantity testing. Whether it is a private water supply, either a well or spring, or a stream in an area where drilling is anticipated, permitted, or ongoing, testing provides valuable benchmark data that will serve as a legal reference should any aspect of a supply be compromised.

Water testing is costly, and, for the data to be deemed valid, samples must be collected and analyzed by certified laboratories and their personnel. Among its many publications relevant to the Marcellus gas play, the Penn State Cooperative Extension's brochure *Water Facts #28, Gas Well Drilling and Your Private Water Supply* (available as a free PDF download) serves as a valuable resource.

As natural gas extraction activity continues to escalate, water-quality monitoring programs throughout the Susquehanna watershed are growing as well. In addition to the new real-time monitoring network initiated by the Susquehanna River Basin Commission, many of the faculty and their student interns at local academic institutions are engaged in gathering and analyzing water and biologic samples in areas impacted by Marcellus drilling.

Here, in the Beech Creek watershed of Clinton and Centre counties, a partnership among Lock Haven University's Geology program, the Beech Creek Watershed Association, and trained volunteers from the Centre County Pennsylvania Senior Environmental Corps has begun monitoring streams where drilling is anticipated or ongoing. Although limited in its scope, this program establishes a benchmark data base. In addition, the volunteers, faculty, and students provide additional eyes and ears on the ground, build community awareness of pollution problems, and serve as a first front in identifying problem sites. Regrettably, there are far more drilling sites than volunteers available to do stream monitoring.

These natural gas resources belong to all of the commonwealth's citizens, and it is our shared responsibility to see that they and the environment are managed judiciously and carefully. There is a need for ongoing monitoring and oversight. Everyone should have ready access to public records. Lastly, no one needs a reminder that disaster-response plans in which we can have confidence must be in place. Industry, drilling in the Gulf, considered an unplugable oil spill as a Black Swan event, i.e., an improbable, unpredicted event having tremendous impact. Common sense based on history dictates that we demand the highest consideration be given to "worst-case" scenarios within those plans!

John H. Way, Ph.D., P.G.  
22 Parkwood Drive  
Flemington, PA 17745  
570.748.4905