Cornell Professor Wants EPA to Take Closer Look at Fracking Technology

by Sue Smith-Heavenrich

Broader View Weekly, March 3, 2011

When you talk about hydraulic fracturing, you're not just talking about "fracking", says Tony Ingraffea. You're not just talking about Marcellus shale, either, he told nearly 400 people in Cortland on February 20. Ingraffea should know. Not only is he the Dwight C. Baum Professor of Engineering at Cornell University's School of Civil and Environmental Engineering, but he also directs the Cornell Fracture Group. Additionally, Ingraffea received his doctorate in rock fracturing.

In the intervening years, Ingraffea has conducted research in aerospace engineering. "Now, thirty years later," he jokes, "I'm back to looking at fractures in rocks." Over the past year Ingraffea has visited a number of communities to share his knowledge about geology, fractures and engineering concerns of gas wells.

The first thing Ingraffea points out is that unconventional wells are nothing like earlier gas wells in NY. He estimates that there are about 50,000 gas wells in the state, each drilled with one well to the pad, each using about 80,000 gallons of fluids to break rock and release gas trapped in the formation.

Unconventional wells in Pennsylvania currently have eight wells per pad, Ingraffea says, with each of those wells up to 10-frack-stages in length. That means that a single well pad will use about 44 million gallons of fracking fluid.

When you consider a single well, this doesn't seem like so much. But, Ingraffea says, according to PSU (Pennsylvania State University) geologist Terry Engelder there will likely be anywhere from 36,000 to 78,000 wells drilled in the Marcellus shale. "And that's not including Utica and other shale formations," Ingraffea notes.

With up to 10 fracks per well, that's 360,000 to 780,000 frack stages. Each of those frack stages uses close to 500,000 gallons of fluid, Ingraffea said. "The first one thousand gas wells unconventionally developed in NY State will use more frack fluid, and produce more waste, than all the gas wells ever drilled in the state."

This kind of development is on a scale at least two magnitudes larger than we have ever experienced, Ingraffea explains. "And right now we have no regulations guiding shale gas development."

The NY Department of Environmental Conservation (DEC) isn't the only agency seeking answers to help guide development of regulations for high volume slickwater fracturing – the U.S. Environmental Protection Agency (EPA) has also embarked on an environmental review of the fracking process. And they've asked Ingraffea to help provide some of the answers. Next week he heads to Virginia to a technical workshop focusing on the engineering aspects of drilling, fracture design and stimulation, and mechanical integrity in gas wells.

But Ingraffea doesn't plan to spend much time lecturing. He sees this meeting as the perfect opportunity to raise questions and point out the gaps in knowledge that EPA will need to address in their hydro-fracking study.

EPA needs to require that the gas industry produce data on the number of cement jobs in high-volume slickwater fracked wells that fail, Ingraffea says. “That goes right to the point of risk.” The problem is that cement failure has been a chronic problem in the industry, and no one in the industry is sharing the failure numbers in hydro-fracked wells with regulatory agencies.

“It’s a complex job in horizontal wells, many with horizontal bores running up to three miles long,” Ingraffea points out. Those horizontal bores are fracked in 500-foot sections. “The problem,” says Ingraffea, “is that each time you re-pressurize the wellbore for a frack job, it puts the cement at risk.” The industry already knows that cement that has been stressed frequently has a higher failure rate.

Ingraffea would like to see regulations require cement logs. After completing a cement job, drillers lower a device into the wellbore that sends images of the cement. That way, drillers should catch tiny cracks that might allow gas migration, Ingraffea explains. “But it doesn’t take much dis-bonding between the cement and the casing to provide a pathway for methane molecules.”

There have been tens of thousands of slickwater hydraulically fractured wells drilled into Barnett shale and Fayetteville shale, and now Marcellus shale, Ingraffea pointed out. EPA needs to demand that the industry provide data on cement reliability of these wells, not vertical wells drilled a decade or more ago.

Ingraffea also wants EPA to get clear data on the cumulative impact of intensive drilling on other wells nearby. Pennsylvania drillers estimate that they’ll be putting in 8 to 12 wells on a pad, with the vertical wellbores spaced about 20 feet apart. “What happens to the first well when the second is drilled?” asks Ingraffea. “Do the vibrations damage the cement?”

The problem with articles in professional journals is that they always focus on impacts to a single well. “But we’re talking about unconventional drilling in shale,” Ingraffea said. “We have a four-dimensional problem.” That fourth dimension is timing. Already drillers in British Columbia have reported that wells drilled as far as 350 feet from each other can send lateral fractures into neighboring wells. Ingraffea wants to know whether waiting a year or two between drilling wells on the same pad will impact casing integrity.

Another problem is aging. Over the years cement shrinks and cracks, and casings corrode, says Ingraffea. This raises a number of questions about well integrity during re-fracking.

As for frack fluid migration, Ingraffea wants EPA to ask the gas industry for their best computer models that show how long it takes for fracking fluids to migrate upwards. “We’re not going to have a single well,” he said. “EPA needs a realistic model that gauges cumulative impact. If they’re not looking at it that way, then they’re missing the point.”