TESTIMONY

New York State Assembly

Standing Committee on Environmental Conservation

ENVIRONMENTAL IMPACTS OF NATURAL GAS AND OIL DRILLING

Wednesday, October 15, 2008

Albany, New York

Independent Oil & Gas Association of New York

Chairman Sweeney and distinguished members of the Environmental Conservation Committee, good afternoon. My name is Roger Willis, and I am President of Universal Well Services, Inc. Universal is headquartered in Meadville, Pennsylvania, which is a premier provider for hydraulic fracturing, cementing, nitrogen and acidizing services in the Appalachian Basin. Universal Well also provides specialty services including cleaning, high pressure pumping, jetting and engineering. We employ more than 900 professionals, all highly trained and experienced. I am testifying on behalf of the Independent Oil and Gas Association of New York (IOGA-NY). IOGA is a trade association of approximately 300 companies, of which Universal is a member.

As you have heard from my co-panelists, the Marcellus Shale has potential to give the State of New York an unprecedented economic development opportunity. I realize that you —along with many other New Yorkers— are concerned that the development of this valuable resource might disrupt the environment that we all cherish. I share your concern as a homeowner in New York for almost thirty years. In fact, for the last 50 years I have spent some portion of every year living in Western New York. I believe that there are many New Yorkers that are not aware of the long heritage that oil and natural gas development has had in our state. It is very possible that they are unaware of the development that has been going on for years under careful monitoring and regulation by the DEC.

Many years ago I worked in Chautauqua and Cattaraugus counties on exciting oil and gas discoveries that contributed considerable economic benefit to the state. The opportunity that faces us now has the potential to dwarf those and make New York even prouder of its resources. I hope in this brief time to cover the many protections that exist in the process of natural gas extraction and give you the assurance that state- of-the-art procedures are utilized to protect the environment while maximizing the recovery of this valuable resource.

The Marcellus Shale formation has been explored and developed for many years by operators in New York and Pennsylvania. It has long been identified as a potential source for natural gas but the technology to access it has not been available. Unfortunately, most of the reservoirs that are currently being developed in the United States will not flow quantities of natural gas large enough to make such development "economical" or will not result in large scale savings to natural gas consumers.

The vast majority of wells in the U.S require some form of "stimulation" -- such as Hydraulic Fracturing - to be economical. I'll refer to this process as "fracing" or "frac" from now on. The process of fracing involves using a fluid injected under pressure to crack or fracture the reservoir formation to better connect it to the wellbore casing. For the average conventional well in New York State, it has been necessary to perform a frac treatment before it could be economically productive. As I will outline in my testimony this is basically a "closed system", as compared to an industry such as agriculture, where it is necessary to apply the various pesticides, herbicides and fertilizers directly to the environment. In natural gas hydraulic fracking, frac fluids are isolated from the environment by cemented steel casings and only touch the rock at significant depth in the reservoir itself. Fracking is also sometimes used to increase the productivity of a well.

Shales, although they contain significant gas reserves, have always proven a particularly difficult rock from which to economically produce natural gas. Shale's very impermeable nature **never** responded well to conventional methods of fracture stimulation. As you may have already heard, the Barnett Shale underlying the Dallas/Fort Worth region of Texas was the first proof of concept confirming that the vast reserves of natural gas locked in shale could be accessed through the application of technology. Before that breakthrough, the Barnett Shale was just another rock formation that had been ignored for many years. Several companies worked diligently for years to discover the key that would unlock the potential of shale. Actually it turns out there are two principal keys that working together have resulted in greater productivity from shales- horizontal drilling and "slick water" hydraulic fracturing.

Horizontal drilling allows for a single–surface location to access a much larger piece of the subsurface with a minimal surface "footprint". A horizontal well "pad" consisting of many horizontal wells has only one site at the surface but accesses a large lateral resource at depth in the shale. Once the vertical part of the drilling is completed, the wellbore is deviated to a horizontal configuration and oriented in a direction that allows it to take advantage of the pre-existing fractures in the shale and make fracing much more productive. I'll explain this in greater detail later.

As I mentioned earlier we have drilled through the Marcellus for years to access many other reservoirs such as the Medina, Theresa and others in the state, predominately in New York's Southern Tier. Had it produced naturally or responded economically to a traditional sized stimulation treatment it is likely that we would not be here today. The same protections that are applied on traditional producing formations in New York are utilized for the Marcellus.

Initiating the drilling process for any well —whether for a water well or a gas well— involves drilling a hole through the surface left behind by the glaciers tens of thousands of years ago. Sometimes the bedrock surface is covered by a veneer of gravel or dirt which could cave in as the drilling progresses. This situation is mitigated by driving a short piece of larger diameter steel casing through the unconsolidated material to support it. The drilling process continues to a point below that of any usable aquifers. At this depth a casing "string" is run into the well and grouted or cemented in place by specialized equipment. The cement slurries are designed in a laboratory and mixed to specifications at the well site by purpose built oilfield cementing units. This cementing process should not be confused with the "ready-mix" process that is used for roads or construction purposes. These protective steel and cement casings isolate the well operations from surface waters and potable drinking aquifers.

Once the cement grouting is securely in place, the drilling process resumes with a smaller hole penetrating the target rocks at depth. Thereafter there is an analysis of the rock properties by electronic tools lowered into the wellbore. After analysis, the decision will be made to complete or plug and abandon the well. If the results of the analysis are favorable, then another "string" of high pressure casing will be run by the drilling rig and it too will be cemented in place by the same

specialized process utilized on the surface casing string. The surface casing and "long string", as the production casing is called, serve to provide a doubled steel sheath surrounded by cement, which isolate any of the well's production gasses or fluids.

At this point in the well's life it is time to perform the stimulation treatment or, as it is commonly called, the frac job. This is the point where the unique nature of shale rock presented the roadblock to economic production for years. Although long known as the hydrocarbon source, shale has such low permeability—- that is the rock is so "tight"—- that gas molecules move very-slowly through it and the gas stored within could not be accessed. The frac job that is utilized to access the gas stored in typical New York reservoirs such as the Medina did not result in a meaningful increase in produced gas from the shale. By a lucky coincidence, a geologist noticed similarities in the geologic signature on a well log with that of the Barnett Shale and proposed doing a "Barnett style" frac treatment on the Marcellus. This first well, located in Southwest Pennsylvania demonstrated that the Marcellus responded to the treatment. A "Barnett Style" frac job is in fact simply a much larger volume of water pumped at a higher injection rate than a traditional treatment. It acts to connect the many natural fractures that already exist in the shale with fractures created by the injected water as it is pumped into the strata at high pressure. The injected fluid contains sand which is essential to prop open both the natural fractures and the created cracks so the gas can migrate through the created network of connections to the well casing.

The hydraulic fracture grows or "propagates" through the reservoir rock at depth following the path of least resistance. In the case of the Marcellus, this would be in two principal directions:

1. In cracks or natural fractures from geologic forces long ago in the shale; and

2. Along a path dictated by the stresses at depth. Luckily, these two directions are not aligned, which allows the fractures that are created in the fracing process to connect to the naturally occurring fractures that were pre-existing. This whole "package" of fractures is largely contained vertically by rocks on either side of the target zone. These rocks act as barriers to vertical fracture growth due to stresses and/ or mechanical rock properties. If the created fractures gained excessive height during the stimulation treatment it would limit the effectiveness of the treatment rendering it uneconomical. Many thousands of frac jobs have been pumped in formations in New York above and below the Marcellus.

There are also concerns that potable water zones might be impacted by hydraulic fracturing. The U.S Environmental Protection Agency (EPA) conducted extensive review of the process and found no cause for alarm. With all of the hydraulic fracturing treatments that have been pumped in New York State the DEC has not found one case of documented damage to aquifers. The waters of the Marcellus have no potential to be used for potable water and have been in place without migrating for over 50 million years. We are utilizing fluids that comply with EPA regulations and all of them have been divulged to the DEC for DEC's review. Additionally, the industry continues to work to advance the technology, from "greener" additives and continues research with the Groundwater Protection Council and the DOE. Industry partners are working with the DOE on a project named "Modern Shale Gas Development" which is a nationwide shale program with emphasis on the

Barnett, Marcellus, Hanesville, Fayette and Woodford shales. We are pumping simple water based systems which I will describe to you now.

ompanies who provide such services in the United States and it is an intensely competitive, highly technical, multi billion dollar industry. Collectively we employ many thousands of Americans and purchase hundreds of millions of dollars worth of goods and services. I can't speak for all companies concerning technology or additives that might be used, but I can say that all of us in this business are governed by the same laws and regulations-- both federal and state.

The multi-year technology evolution to successfully frac shale formations has resulted in what is referred to as a "Slick water frac". In the past, frac jobs were applied to "better" rocks than shales, that is rocks that produced gas naturally but not in economical amounts. The shales produced little or no gas when penetrated by the bit. Many styles of traditional frac jobs were pumped but, they were always too small and much too expensive to scale up to the size required to contact the volume of rock necessary to make a shale productive. For years it was thought that the very nature of a shale rock would cause a water frac to swell and plug the fractures that we could create. A few visionaries tried it anyway and the rest is history. We all owe them a great debt.

As a result, the industry now uses large volume, simple chemistry water fracs to stimulate shale reservoirs. Comparatively large volumes of water are pumped through high pressure lines at the surface then down casings into the formation. We are constantly trying to minimize the additive "package" that is added to make the frac job itself simpler and more cost effective. The frac job represents a significant portion of the cost in developing a shale well. Jobs such as I'm going to describe are safely and successfully being pumped all over the country in large numbers in shale formations right now.

There are a variety of additives that can be added to the frac water for specific purposes if needed. Even though the majority of shale frac jobs utilize larger volumes of water at higher rates there is no consensus currently what represents the optimum frac job. If you were to attend the Society of Petroleum Engineers Annual Meeting, you would find literally thousands of people attending this highly technical conference and debating every aspect of shale development. Each company might have their own optimum job and it could be the result of local geological requirements, specific mechanical rock properties, depths, formation pressures, etc.

I will describe a few of the additives that we at Universal might incorporate into a customer's treatment, depending on the variety of factors that the particular well might require. Some of these additives are in dry, powdered form, while some may be in liquid form. We transport all of them in placarded vehicles in compliance with all applicable regulations. Again I'm not speaking for any other company, just ours.

To reduce the pumping pressure and in turn reduce cost, a small amount of an additive called a friction reducer is added. We run this additive at a rate of several gallons per thousand gallons of pumped water. The water is highly diluted and uses this biodegradable polymer surfactant much like a shampoo or hand soap.

Another common soap or "surfactant" that we use is to help the water return from the rock so that the well can begin producing gas. There is a natural attraction that water has for certain rocks and we want to minimize that to enable maximum recovery of the frac fluid.

In the cases where large volumes of fluid must be stored at the surface prior to pumping, a short lived biocide is added to reduce the growth of harmful bacteria in the water. Some bacteria which are normal at the surface can form a slime or residue inside the well and plug and damage the reservoir rock. This biocide is similar to the small amounts of chlorine which serves the same purpose in our drinking water.

There is a possibility that the water in the Marcellus might drop out, or precipitate, some of its minerals during production, plugging the tubular, much as hard water can affect your household plumbing. In these cases additives can be included to reduce the likelihood of this type of damage.

Sand is pumped as a propping agent to hold the created fractures open. The only difference between the sand we pump and the sand you might feel between your toes on a beach is we require a round rather than angular type to increase its strength.

The Marcellus shale exploration in New York is now practical because of the knowledge that industry has gained from the many years of intense science which were applied to other shales in the United States. Without a doubt the "optimum" frac job will evolve here as technology improves.

One question you might ask is "why now, why not wait, this gas isn't going anywhere". The answer lies in the fact that 65% of the gas we use today to fuel our economy comes from wells drilled in the last three and a half years. Red lights and alarms should be going off alerting us that besides sending seven hundred billion dollars out of our country for energy every year our own supply of natural gas needs to be developed**.**

At the end of the frac job the well is shut in and a system of "flowback" plumbing is attached to the well head so that the pumped fluids can be recovered allowing the natural gas flow to begin.

I hope the aforementioned and the enclosed may be of interest in demonstrating the highly technical – and highly regulated – nature of the frac process. We are committed to stewardship of the land and of this resource, and I hope you find in us – as with as most of us in this industry – a highly knowledgeable and well motivated community of professionals dedicated to the safe and sustainable exploration of the Marcellus shale.

Many thanks for your consideration and attention, and I would be pleased to answer whatever questions you might have in this regard.

Respectfully submitted,

Roger B. Willis

President, Universal Well Services