**Written Testimony**

**Committee on Energy and Natural Resources**

**United States Senate**

**October 4, 2011**

Good Morning. I am Stephen A. Holditch and I am the Head of the Department of Petroleum Engineering at Texas A&M University. I am serving on the Secretary of Energy’s Advisory Board Shale Gas Subcommittee. I have been working on how to develop low permeability, unconventional gas reservoirs using hydraulic fracturing since 1970. The following testimony represents only my views of the issues and my interpretation of what the report suggests. This testimony does not speak for the other members of the subcommittee.

**Shale gas is for real**

Shale gas currently supplies around 30% of the natural gas we use in the United States. A Department of Energy Report in 2009, and recent developments suggests that new Shale Gas Development in the last 10 years has added over 900 Tcf[[1]](#endnote-1) of Technically Recoverable Resources (TRR) from Shale Gas.[[2]](#endnote-2) Not all of the 900 Tcf is currently Economically Recoverable Resources (ERR), but under the correct cost and price structure, much of it can be converted from TRR to ERR. Research into new drilling and completion technology is needed to increase shale gas recovery. In 1997, Rogner estimated the gas in place in Shale reservoirs worldwide was over 16,000 Tcf. On the basis of the research we have conducted at Texas A&M University, we think the number should be closer to 50,000 Tcf of gas in place in Shale reservoirs worldwide.

It is clear to me that the United States has a real opportunity to develop it’s unconventional gas reservoirs (shale gas, coal gas and tight gas) to dramatically improve the energy security in the United States. The U.S. can use the abundance of Natural Gas to generate electricity and for motor fuel, which should reduce oil imports. Natural gas should be used with wind, solar, and geothermal energy to create a clean energy package for the electric grid.

In addition, the same technology we are using in Shale Gas reservoirs, namely horizontal drilling and hydraulic fracturing, are currently being used in South Texas, West Texas, the Bakken Formation in Wyoming and North Dakota, and most recently in Ohio to increase oil production in the United States. Oil production in the Lower 48 states has increased during the past year for the first time in decades.

**Shale gas development must be done correctly**

The oil and gas industry understands, and the SEAB Subcommittee Shale Gas Production 90-Day Report clearly states, that there are real issues with water, air emissions, and community impact that must be addressed by the oil and gas companies. The SEAB Subcommittee suggested that the industry should improve what it measures and disclose all non-proprietary data on publically available websites. I am of the opinion that ‘you cannot improve what you do not measure’.

In my testimony today, I will deal with water issues, air quality issues and research that could help improve the development of shale gas.

Water and Fracture Fluids

If you read recent news articles on hydraulic fracturing, the process is often described as pumping in a mixture of water and toxic chemicals under high pressure. This description is far from the truth. Most fracture treatment fluids consist of 99.5% percent pure water and sand. About 0.5% of the fluid is made up of gelling agents, surfactants, and biocides. Virtually all of these chemicals can be found in a typical home. Gelling agents are typically guar gum, which is used in many food products to viscosify the product. A surfactant is just soap, like Dawn dishwashing fluid. Biocides are use to kill bacteria, like the Clorox we use in our homes. Granted, we do not want to drink these fluids, but they are all found in our homes. However, the concentration of these ‘chemicals’ is very minute and does not pose a danger to fresh water aquifers, if the field operations are conducted properly.

The SEAB Subcommittee recommended that the industry should measure and post on a publically available website

* the volume and composition of what is pumped into the wells during fracturing operations,
* the volume and composition of what flows back to the surface during clean up operations, and
* the industry should track water movement from initial collection to final disposal.

The SEAB Subcommittee also believes the industry should take baseline measurements of all water wells in the vicinity of any shale gas well prior to drilling. In fact, most operators already do this.

It is my opinion that current drilling and hydraulic fracturing activity does not adversely affect shallow drinking water aquifers. I have been working in hydraulic fracturing for 40+ years and there is absolutely no evidence hydraulic fractures can grow from miles below the surface to the fresh water aquifers.

However, for other reasons, there could be problems in aquifers. If problems do occur in fresh water aquifers, then a thorough investigation of the development history in the area needs to be conducted to find the problem. Once the problem is understood, it can be fixed.

Air Emissions

It appeared to me during the course of the work by the SEAB subcommittee, that the issues involving air emissions have not received the same focus as the issues involved with water. When you move into a new geographic area to develop shale gas, the number of diesel engines used to power drilling rigs and the truck traffic involved in the operations can be significant. Again, as with water and fracture fluids, it is not possible to make intelligent changes to improve the situation if you do not make measurements. In the case of air emissions, we need to do a better job of taking base line air quality measurements prior to shale gas development operations, and continue monitoring air quality during and after development. If there are no real issues with emissions, fine. If problems are discovered, fine also, because now we know and we can take steps to solve the problems.

We were told that if pad drilling is used to drill 6-8 wells per pad, the truck traffic involved with the operations can be reduced by over 50%. Also, in South Texas, some companies are converting rigs and trucks to run off of natural gas, rather than diesel. There are other issues involving air emissions that others on the subcommittee can discuss in more detail.

Research, Development and Data Bases

As you might expect from a University Professor, I can see a number of areas where additional research would be useful. For brevity, I am including a bulleted list of the most important areas. Some of these area are already under development by industry, but additional research funding would speed along the technology.

* We need to improve the technologies used to clean the water produced after a fracture treatment to remove impurities and make the water available for re-use.
* We need to improve the chemistry of the fracture fluid additives so that we can use saline water for fracturing rather than fresh water.
* We need to develop more affordable technology to monitor air quality and methane emissions during the entire life of a shale gas well, from drilling to production.
* We need to continue development of micro-seismic technology to remotely map the hydraulic fractures as they are being created.
* We recommend the continued funding and development of organizations such as Stronger and data bases such as FracFocus.org to allow data from shale gas wells to be posted online for any interested party to review.
* At Texas A&M University, we work in a project called Environmentally Friendly Drilling (EFD) that is funded in part by the DOE through the Research Partnership to Secure Energy for America (RPSEA) and also by the oil and gas industry. EFD is doing all the right things in terms of air emissions testing, cleanup technology for produced fracture fluids, to working on how to build disappearing roads. An increase in funding for EFD could take a successful program and improve it measurably.
1. Tcf is the terminology for Trillion Cubic Feet at standard pressure and temperature. [↑](#endnote-ref-1)
2. OGIP refers to the original volume of gas contained in a reservoir before production begins. Using current technology, and disregarding costs, prices, and other investment criteria, the proportion of OGIP that can be technically produced is called Technically Recoverable Resources (TRR). TRR is gas that we know where the gas is located and we have developed the technology to produce the gas; however, the gas may or may not be economic to produce under existing gas prices or drilling costs. TRR is also gas that can be produced but no pipeline exists to market the natural gas. When the economic conditions allow the natural gas to be produced at a profit, a portion of TRR can be economically produced and is referred to as Economically Recoverable Resources (ERR). ERR is usually booked as proved reserves. TRR can be thought of as possible or probable reserves. OGIP is the total resource base. [↑](#endnote-ref-2)