Week of November 21, 2011 – Natural Gas and Oil from Shale and the Whole Fracking Process

During this past year, the technique known as hydraulic fracking, or simply, fracking, has surfaced (and yes, for those of you that are familiar with this process, excuse the unintentional pun) in the national media. Many of us might not even be aware of this process, or, at least, have minimal knowledge about it and therefore, do not understand the controversy that surrounds it. While most of us may think this is a new technology, it actually has been around for quite some time and today, it is rapidly becoming a major technique for retrieving natural gas and oil from locations where the natural rock formations (i.e. shale and granite) have made it difficult in the past to access and retrieve these natural energy sources.

In the early 20th Century, fracking was used in the United States at the Mt. Airy Quarry in North Carolina in 1903 (home of actor Andy Griffith and to what many believe is the actual inspiration for Mayberry – the setting for the forever famous Andy Griffith Show) where it was used to separate granite blocks from bedrock. However, the first use of fracking has been recorded to have occurred in the 1860s when liquid (and later, solidified) nitroglycerin (NG) was used to stimulate shallow, hard rock wells in Pennsylvania, New York, Kentucky, and West Virginia. Although extremely hazardous, and often used illegally, NG was spectacularly successful for oil well "shooting." The object of shooting a well was to break up, or rubblize (sic), the oil-bearing formation to increase both initial flow and ultimate recovery of oil. This same fracturing principle was soon applied with equal effectiveness to water and gas wells. In the 1930s, the idea of injecting a nonexplosive fluid (acid) into the ground to stimulate a well was tried. The "pressure parting" phenomenon was recognized in well-acidizing operations as a means of creating a fracture that would not close completely because of acid etching. This would leave a flow channel to the well and enhance productivity. The phenomenon was confirmed in the field, not only with acid treatments, but also during water injection and squeeze-cementing operations.

In the late 1940s the first commercial use for fracking was developed by Floyd Farris of Stanolind Oil and Gas Corporation (today known as Amoco) where he performed an in-depth study to establish a relationship between observed well performance and treatment pressures that "formation breakdown" during acidizing, water injection, and squeeze cementing became better understood. From this work, Farris conceived the idea of hydraulically fracturing a formation to enhance production from oil and gas wells. These studies were performed in-situ in the Hugoton field located in southwestern Kansas. The treatment used gelled gasoline (today known as napalm) and sand from the Arkansas River.

A short time later, in 1949, Halliburton conducted the first two commercial fracturing treatments in Stephens County, Oklahoma, and Archer County, Texas. Over the next 40 years, with the help of geologists, engineers and scientists, fracking became an ideal way to bring new life to old wells and became a common practice by 1988. Today fracking is one of the leading technological advances in the oil and gas industry.

Hydraulic fracturing equipment used in oil and natural gas fields usually consists of a slurry blender, one or more high pressure, high volume fracturing pumps (typically powerful triplex, or quintuplex pumps -

positive-displacement reciprocating pumps that are configured with three or five plungers) and a monitoring unit. Associated equipment includes fracturing tanks, high pressure treating iron, a chemical additive unit (used to accurately monitor chemical addition) low pressure pipes and gauges for flow rate, fluid density, and treating pressure. Fracturing equipment operates over a range of pressures and injection rates, and can reach up to 15,000 psi and 265 L/s (100 barrels per minute).

With hundreds of thousands of wells currently in operation around the world, fracking is opening up a whole new world of energy resources. Three years ago, an estimated 4,185 shale gas wells were operational in the US alone – and that number has grown exponentially since.

Yet because fracking uses a slurry (containing mostly water) that includes such chemicals as acids (to increase permeability), petroleum products and acetone, a number of organizations and environmental activists have begun questioning this process. In addition to chemicals, sand containing naturally radioactive minerals is sometimes used so that the fracture trace along the wellbore can be measured. In addition to adding substances into the ground, the process also releases hazardous materials that are naturally occurring into the environment. These include arsenic, mercury, and naturally-occurring radioactive materials, such as radon gas.

While other countries besides the US have implemented fracking processes, because of the potential environmental impacts and concern for the health of its citizens, a number of governments, including Australia, South Africa, and Canada have placed partial bans or restrictions on this process, while France has banned the process entirely.

It is interesting to note, that in the United States, hydraulic fracturing is one of only two underground injection processes exempted from the federal Safe Drinking Water Act. In addition, in most states oil and gas companies are not required to publicly disclose the types and amounts of chemicals that are injected underground in the fracturing process. In other words, nearby residents or landowners have no way of knowing what kinds of chemicals are being injected underground and therefore, have the potential of contaminating their drinking water.

Earlier this year the Fracturing Responsibility and Awareness of Chemicals Act (FRAC Act) was introduced in both the United States House (H.R. 1084) and Senate (S. 587). The bill has two purposes: to require companies to disclose the chemicals injected underground, and to eliminate the exemption of hydraulic fracturing operations from regulation under the federal the Safe Drinking Water Act (SDWA). The FRAC Act also ensures that medical professionals can access information about the chemicals in hydraulic fracturing fluids if an individual has been harmed and needs medical care – which is not now the case. To date, this legislation has been referred to congressional committees.

"Experience is one thing you can't get for nothing."
Oscar Wilde