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"Why is fracking controversial and what are the real or imagined risks"

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Prof. Andrew Barron gave the 667th address to the members of the Houston Philosophical Society. He spoke on hydraulic fracturing (fracking) to recover oil and gas from shale, a process that had received a great deal of press, in particular over environmental risks. He asked whether the areas of concern are real and, if not, what the real risks are, and, when risks do occur, what can be done to overcome them. He concentrated on what present research is being done and on where future research should be focused, along with presenting a vision of future oil and gas recovery.

Professor Barron began by asking, "What is fracking?" When a gas well is drilled, fracturing fluid made up of water, sand and chemicals is pumped into the well at high pressure and gas as flows out. Getting oil out of shale is, however, a problem.

Shale has the same permeability as granite. The permeability is extremely tight. Pores contain oil, but they are not connected. Thus, drilling a hole in the ground produces only a small fraction of the oil in the well. The rock must be broken up. Therefore, fracturing (fracking) fluid is forced underground at high pressure.

The "Columbus effect" applies. Columbus recalculated the circumference of the earth to show he could get around the world with his supplies by halving the actual circumference. In oil well drilling, if the distance between the water table and the shale is a mile, the fracture length may be only 100 feet. So people take out the distance by fracking.

Can fracking affect aquifer water? It is unlikely. But, can drilling and pore cementing affect aquifer water? Yes.

What goes down? What comes up? It is believed that more than 90% of fracking fluid stays in the ground and is not biodegradable. Ninety percent of the fracking fluid is water; nine percent is sand. Because gaugum, a thickening agent, and other chemicals are also used, the non-biodegradable water and sand is actually only 80% of the fracturing fluid. The reason the fracking fluid is not biodegradable is that it is primarily water and sand. Early fracturing fluid included diesel oil, but that is not the case today.

Fracking fluid injected into the ground requires complete disclosure to the government. Water need not be listed, but anything else must be. A unique CAS number is assigned to each chemical except water, so it is the actual chemical composition of the fluid which must be disclosed. Some drillers have claimed trade secret protection from disclosure; but the trade secret exception protects the amount of chemicals put in, not the type. A company can be forced to disclose trade secrets in a medical emergency only. Disclosure is not required of other chemical uses, only of the injection of chemicals into wells for fracking. Thus chemicals that can go down are limited. In addition to water, only trade secrets are exempt. These, however, must be registered with the Texas Railroad Commission.

The chemicals that come up when fracking is used are mostly water and oil. But also salt content, oil and grease; sulfur & sulfate. Every molecule down to a molecular level is identified.

The composition of fracking-produced water has few aromatics (associated with cancer), unlike coal-produced water. The oil industry uses Florine compounds as tracers. Other non-naturally produced compounds are also produced. Bacteria in the water is heated when pumped in. Thus, bacteria thrives. Therefore, bleach is used to kill the bacteria. Bromides also are used.

How not to dispose of the water? It may be put it in a tanker or put it down an oil well, a method of disposal known as “deep-well injection.” But deep-well injection is expensive. This leads to companies’ putting the fracking fluid in tank trucks and letting it pour out of the back of the trucks illegally. The expense and difficulty of disposal has led to a method of disposal that lets frack water in but removes compounds through filtration. The best method of disposal is to put the recovered fracking fluid in a frack tank, run it through membranes, and produce

filtered water that can be reused. The process does not create new chemicals when the fluid is reinjected.

Water usage: Who is playing the numbers game? The percentage of water used by fracking is very small in urban areas but huge in other areas. A shale oil or gas well needs 1-10 million gallons of fracking fluid.

Proppant transportation is the major cause of low production per well. A proppant is a solid material, typically treated sand or man-made ceramic materials, designed to keep an induced hydraulic fracture open during or following fracking. The more wells there are, the more chemicals are needed; the more chemicals needed, the more water is used and the more the traffic: 100,000 tankers may need to be used for one well.

Aim: to get as much oil out as possible the first time.

What if you design a proppant from first principles? What offers the best fluid transport? Designed materials have led to the recovery of 20% to 69 % more oil per well.

Is fracking worth it? Yes. Both job growth and per capita income benefit. And there is the indirect economic benefit of an increase in jobs and payroll during the investment and production phases.

It is unlikely that fracking contaminates aquifer water, but poor drilling can affect aquifer water. We need better control and understanding of cement (a proppant).

Fracking fluid containing toxic chemicals should be recycled and reused.

Fracking uses a lot of water. Water may not be the best fracking fluid. We need to look for alternatives.

Fracking is also not efficient. Most oil and gas are left in place, requiring that more wells must be drilled. Industry, however, does not care about the inefficiency, because the oil industry includes exploration, production, and refining. Exploration produces funding because stock prices are set by reserves. Increasing reserves increases the stock price, but it is not an efficient process of producing energy.

Question: should sea water or fresh water be used in fracking? In the United Kingdom, fracking is better done with salt water. Although the fluid includes a lot of additional chemicals, these can be separated and dumped in the ocean. Water must be cleaned each time it is used. In the United States, the distances are too great to use salt water, and so fresh water is used. Several companies, however, are looking at pumping down a goop of food plus microbes that will eat the food. Also, dishwasher liquid is being looked at as a fracking liquid. New ways of fracking are being researched because getting oil out of the ground is expensive.

Finally, fracking can create seismic disturbances, and then it must be discontinued.

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