

# SHALE GAS HYDRAULIC FRACKING: Poisoned Water. Inducing Earthquakes

By [F. William Engdahl](#)

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—The new technologies to explode gas out of shale rock have serious consequences

There is a global rush to embrace a new technique to extract hydrocarbons from the Earth. From Germany to Poland and France, from China and above all in the USA where the technique of hydraulic fracturing of shale rocks is most developed, governments and major oil companies are producing huge volumes of shale gas.

A number of energy importing countries around the world are planning a major investment in extracting natural gas from their shale rock formations. The most ambitious plans are coming from China and from Poland in the EU. Germany is also heatedly debating the technique.

The US Government's Department of Energy together with a Washington energy consultancy has just released a mammoth global report estimating resources of shale gas. Significantly, the report estimates that the largest untapped shale gas reserves worldwide lie in China. The study puts Poland and France at the top of the shale gas list in the EU. The rest of Europe they estimate has significant shale gas formations as well, though in smaller volumes where shale rock is present.<sup>1</sup>

Even in Germany some states and private oil companies are seriously looking at shale gas. ExxonMobil, the world's largest oil company is planning major projects in the densely-populated North-Rhein Westphalia region. The company's head for Central Europe, Gernot Kalkoffen, stated in a recent interview, "Germany is most definitely an interesting market. We cannot achieve the energy strategy shift without gas." ExxonMobil estimates shale gas is potentially available in six of Germany's 16 states.<sup>2</sup>

The US Energy Department estimates that Germany could have some 8 trillion cubic feet of technically recoverable shale gas, three years' total consumption. Citizen protest groups and Parliamentary skepticism about health and safety of shale gas so far is braking a German shale gas bonanza.<sup>3</sup> Not only ExxonMobil but also BASF's Wintershall, Gaz de France, BNK Petroleum from the US and a daughter of Britain's Royal Dutch Shell are salivating over German shale gas prospects.

The Polish government is in a state of near euphoria over the prospects of exploiting its shale gas resources. Prime Minister Donald Tusk calls shale gas Poland's "great chance," because it could cut its dependence on Russian gas, create tens of thousands of jobs (highly unlikely as gas is a capital-intensive not labor-intensive industry-w.e.) and fill state coffers.

In tests at one well in northern Poland done last August, the Polish Geological Institute claimed that Hydraulic fracturing didn't affect the quality or quantity of surface and ground water and didn't cause tremors that would pose a threat to buildings or other infrastructure. The US oilfield services giant Schlumberger did the fracking. 4 Of course one test in one well is hardly conclusive, though the Tusk government doesn't seem to care, as they push Brussels to back a major Polish shale gas exploitation program.

In China, shale gas looks about to take off as a major new focus for addressing the country's enormous energy requirements. The governing State Council has recently approved shale gas as an "independent mineral resource," and the Ministry of Land and Resources will conduct an appraisal of shale gas resources this year to expedite discovery and development of China shale deposits. Until now China's rough mountainous terrain and lack of shale gas fracking know-how has kept it out of the shale gas game, with coal far the major source of electric power. The French oil giant, Total, has just signed a deal with China's Sinopec to produce shale gas in China. China has around 31 trillion cubic meters of natural gas trapped in shale, some 50% greater than the United States according to the US Department of Energy estimate.<sup>5</sup> These are volumes to make the head of any respectable state official spin.

In the US, oil industry people have quickly forgotten the recent scare about oil and gas depletion, popularly known as the Peak Oil theory, in their new euphoria over huge new volumes of gas and also oil obtained by fracking of shale and coal beds. Now even the Obama Administration is talking about a renaissance in domestic oil production. The reason is the dramatic rise in domestic extraction of gas from hydraulic fracking of shale, using new fracking techniques first developed by Halliburton, expensive techniques made financially attractive with the advent of \$100 a barrel oil and record high gas prices since 2008.

### **Myth and reality: The Halliburton Loophole**

Fracking techniques have been around since the end of World War II. Why then suddenly is the world going gaga over shale gas hydraulic fracking? One answer is that the record high oil and gas prices of the recent few years have made inefficient processes such as extracting oil from Canada's tar sands or the costly fracking profitable. The second reason is the advance of various horizontal underground drilling techniques that allow companies like Schlumberger to enter a large shale rock formation and inject substances to "free" the trapped gas.

But the real reason for the recent explosion of fracking in the country where it has most been applied, the United States, is the passage of legislation in 2005 by the US Congress that exempts the oil industry's hydraulic fracking activity from regulatory supervision by the US Environmental Protection Agency (EPA) under the Safe Drinking Water Act. The oil and gas industry is the only industry in America that is allowed by EPA to inject known hazardous materials — unchecked — directly into or adjacent to underground drinking water supplies.<sup>6</sup>

The law is known as the "Halliburton Loophole." That's because it was introduced with lobbying pressure from the company that produces the lion's share of chemical hydraulic fracking fluids—Dick Cheney's old company, Halliburton. When he became Vice President under George W. Bush in early 2001, Bush immediately gave Cheney responsibility for a major Energy Task Force to make a comprehensive national energy strategy. Aside from looking at Iraq oil potentials as documents later revealed, Cheney's task force used Cheney's considerable political muscle and industry lobbying money to win exemption from

the Safe Drinking Water Act.<sup>7</sup>

During Cheney's term as vice president he moved to make sure the Government's Environmental Protection Agency (EPA) would give a green light to a major expansion of shale gas drilling in the US. In 2004 the EPA issued a study of the environmental effects of fracking. That study has been called "scientifically unsound" by EPA whistleblower Weston Wilson. In March of 2005, EPA Inspector General Nikki Tinsley found enough evidence of potential mishandling of the EPA hydraulic fracturing study to justify a review of Wilson's complaints. The Oil and Gas Accountability Project conducted a review of the EPA study which found that EPA removed information from earlier drafts that suggested unregulated fracturing poses a threat to human health, and that the Agency did not include information that suggests "fracturing fluids may pose a threat to drinking water long after drilling operations are completed."<sup>8</sup> These warnings all were simply ignored by the EPA and White House.

The Halliburton Loophole is no minor affair. The process of hydraulic fracking to extract gas involves staggering volumes of water and of some of the most toxic chemicals known. During the uproar over the BP Deepwater Horizon Gulf of Mexico oil spill, the Obama Administration and the Energy Department formed an advisory commission on Shale Gas. Their report was released in November 2011. It was what could only be called a "whitewash" of the dangers of shale gas.

The commission was headed by former CIA director John Deutch. Deutch sits on the board of Citigroup, one of the world's most active energy industry banks, tied to the Rockefeller family. He also sits on the board of Schlumberger which, along with Halliburton, is one of the major companies doing hydraulic fracking. In fact, of the seven panel members, six had ties to the energy industry. Little surprise that the Deutch report called shale gas, "the best piece of news about energy in the last 50 years." Deutch added, "Over the long term it has the potential to displace liquid fuels in the United States."<sup>9</sup>

Attempts by citizen organizations and individual litigants to force oil services company disclosure of the composition of chemicals used in hydraulic fracking have met a stone wall of silence. The companies argue that the chemicals are proprietary secrets and that disclosing them would hurt their competitiveness. They also insist the process is "basically safe and that regulating it would deter domestic production."<sup>10</sup> This legal sleight of hand lets the fracking lobby have their cake and eat it too. They claim it is safe, refuse to say what chemicals are used and insist it be free from the Environmental Protection Administration rules under the Safe Drinking Water Act. If they are right about how safe their chemical fracking fluids are why are they afraid of regulation like other chemical companies?

### **Poisoned water**

In a typical shale gas fracturing operation, a company drills a hole several thousand meters below surface; then they drill a horizontal branch perhaps one kilometer in length. As one expert described the fracking, once the horizontal drilling into the shale formation is done, "you send down a kind of subterranean pipe bomb, a small package of ball-bearing-like shrapnel and light explosives. The package is detonated, and the shrapnel pierces the bore hole, opening up small perforations in the pipe. They then pump up to 7 million gallons of a substance known as slick water to fracture the shale and release the gas. It blasts through

those perforations in the pipe into the shale at such force—more than nine thousand pounds of pressure per square inch—that it shatters the shale for a few yards on either side of the pipe, allowing the gas embedded in it to rise under its own pressure and escape.”<sup>11</sup>

The shale rock in which the gas is trapped is so tight that it has to be broken in order for the gas to escape. Therein come the problems. A combination of sand and water laced with chemicals — including benzene — is pumped into the well bore at high pressure, shattering the rock and opening millions of tiny fissures, enabling the shale gas to seep into the pipeline.

Not only does it liberate gas or in the case of Bakken in North Dakota, oil. It also floods the shale formation with millions of gallons of toxic fluids. A study conducted by Theo Colburn, director of the Endocrine Disruption Exchange in Paonia, Colorado, identified 65 chemicals that are probable components of the fracking fluids used by shale gas drillers. These chemicals included benzene, glycol-ethers, toluene, 2-(2-methoxyethoxy) ethanol, and nonylphenols. All of those chemicals have been linked to health disorders when human exposure is too high.<sup>12</sup>

Dr. Anthony Ingraffea, D. C. Baum Professor of Engineering at Cornell University, who has researched fracture mechanics for more than 30 years, has said that drilling and hydraulic fracturing “can liberate biogenic natural gas into a fresh water aquifer.”<sup>13</sup> In other words the chemicals and gas can pollute water aquifers.

A new study authorized by two New York State organizations, Catskill Mountainkeeper and the Park Foundation, of the effects of fracking in the Marcellus Shale in New York and Pennsylvania puts the lie to the gas industry claims fracking is harmless to ground water. The study, just published in the journal *Ground Water*, concludes, “More than 5,000 wells were drilled in the Marcellus between mid-2009 and mid-2010...Operators inject up to 4 million gallons of fluid, under more than 10,000 pounds of pressure, to drill and frack each well.” To date, little sampling has been done to analyze where fracking fluids go after being injected underground. <sup>14</sup>

Contrary to the industry assertion that fracking takes place in rocks (shale) that are impermeable thereby preventing leaking of toxins into ground water, the scientists concluded, in a peer-reviewed article, that natural faults and fractures in the Marcellus, exacerbated by the effects of fracking itself, could allow chemicals to reach the surface in as little as “just a few years.” Tom Myers, the study head who is an independent hydrologist whose clients include the US Government and environmental groups, states, “Simply put, [the rock layers] are not impermeable. The Marcellus shale is being fracked into a very high permeability. Fluids could move from most any injection process.”<sup>15</sup>

### **Inducing Earthquakes**

Not only possible poisoning of the fresh water underground aquifers, hydraulic fracking is done with such force that it has been also known to cause earthquakes. In the UK, Cuadrilla was doing shale gas drilling in Lancashire. They suspended their shale gas test drilling in June 2011, following two earthquakes—one tremor of magnitude 2.3 hit the Fylde coast on 1 April, followed by a second of magnitude 1.4 on 27 May. <sup>16</sup> A UK Government study of the earthquakes, released this April concluded that the fracking drilling operations had caused the quakes.<sup>17</sup> Earthquake activity in fracking regions across the US have also been reported.

Alarming, in the case of exploiting shale gas in China, the largest shale formation lies in Sechuan Province in China's east, one of the most active earthquake zones in Asia. Additionally, given the documented dangers to ground water from extensive fracking, China's chronic water shortages are threatened as well.

The new technique of hydraulic fracking was first used successfully in the late 1990s in the Barnett Shale in Texas, and is now being used to liberate oil from beneath the Bakken Shale in North Dakota. But the largest shale gas fracking activity in the US has been a literal gas bonanza drilling boom in the Marcellus Shale that runs from West Virginia into upstate New York, estimated to hold as much gas as the whole United States consumes in a century.<sup>18</sup> More recent estimates put the figure at half that or lower, suggesting the energy industry is using hype to promote its methods.

### **Good news... bad news**

Good news is shale gas shows how wrong the peak oil lobby is about depletion of global hydrocarbons. Gas like coal and oil are according to their definition all "fossil fuels." While we leave aside whether in fact they are from dinosaur detritus or fossilized algae, clearly the Earth is far from peaking in its hydrocarbon resources. Bad news is that the frenzy over shale gas and oil extraction is a highly dangerous and destructive method that is diverting valuable resources from finding abundant conventional gas or oil using advanced new methods to locate natural gas and oil in abundance. That will be the theme of a series of future articles in this space.

*F. William Engdahl author of A Century of War: Anglo-American Oil Politics*

### Notes

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