# HYDRAULIC FRACTURING ISSUES

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November 2013

The issue of hydraulic fracturing (hydrofracturing), or "fracking," coupled with horizontal drilling to obtain natural gas from bedrock for use by powerplants, other types of heating, and in vehicles is called "unconventional drilling"; unconventional because it is done in tight shales and uses horizontal-drilling techniques. The process has become political theater, as the *Times Union* mentioned in an editorial on Tuesday, Jan. 15, 2013, and as with all energy issues, has pros and cons. Even solar, wind, and geothermal energy have certain objectionable aspects, and the mining of their mineral components produces significant environmental damage. The questions to be asked in relation to hydrofracturing are (1) what are the *real* (not merely perceived) dangers, (2) what are the actual benefits, and (3) does the cost/benefit of producing natural gas compare favorably with that of other energy sources? These questions may be addressed through review of available information, and the answers may provide the basis for sound decisionmaking on the part of the public and government. Much information is available from the U.S. Geological Survey (USGS), e.g., http://www.usgs.gov/faq/?search=hydrofracking&submit=Search&action=searchv

The Association of American State Geologists (AASG) is an organization of the 50 State geologists who, despite diverse feelings about energy and environmental issues, have produced a unanimously agreed-upon position paper on hydrofracturing that can be viewed at: http:/www.stategeologists.org/temp/AASG%20Hydraulic%20Fracturing%20statement.pdf

Additional information on the topic can be obtained through a web search of *gas hydrofracking* and related terms. Most of the funding and other resources for the antifracking movement come from a single source—a foundation in Ithaca, N.Y. Research it online to find out why it contrbutes heavily to this movement.

The following discussion presents the major arguments against and for hydrofracturing.

**Cons:**

1. *The process uses contaminated fluids that come back up out of the well.* TRUE. But only about 75% returns; the other 25% or so is sand that remains in the well to prop open the fractures that are created. From 70 to 100% of the fluid that returns to the surface can be reprocessed and used in other wells; the problem is what to do with the remaining 20 to 30%, which is mainly brine some sand, and small amounts of chemicals (discussed further on). A solution suggested by the petroleum industry is to reinject it into deep geologic formations. Reinjection probably will not be done in New York State, however, because the rock section is tight enough that mini-earthquakes could result, as confirmed some years ago by a NYSGS seismologist who monitored experimental reinjection operations in western New York and detected small earthquakes. Similarly, fluid injection in Ohio has been blamed for creating small earthquakes. Thus, the question as to the safe disposal of the unusable components remains unanswered. Most gas producers in Pennsylvania reportedly are now reprocessing and reusing all of the returned fluids in new wells; those who are not are reportedly shipping the remainder to Ohio, where it is either being reinjected into the deep subsurface or spread on roads in winter for deicing.
2. *The process contaminates aquifers and surface waters.* POTENTIALLY TRUE, but the ways in which this could happen can be avoided. Many imagined potential accidents are not physically possible in the southern-tier counties for which hydrofracturing has been proposed. The ways in which the process might contaminate aquifers are:
   a. *if the well is not properly cased and completed.* This can be prevented by proper governmental monitoring of drilling and well-installation procedures.

[1] State Geologist of New York, 1978-2004

b. *if the recaptured fluid spills or leaks out of its holding ponds and facilities.* This is not a result of the hydrofracturing process, but could potentially occur in all drilling activities; it can be prevented through proper governmental monitoring. As an exmple, in Colorado one cannot park a vehicle, even a personal car, at a drilling site except in a spill-proof containment basin.

c. *If the "fracturing" fluids come up to the surface along faults or cracks.* Only one fault in central and western New York extends upward to anywhere near land surface—the Clarendon-Linden fault system[2] —which lies more than 50 mi from known Marcellus reservoirs in southern tier counties. Earthquakes occurred along this fault in the early 1970s during a brine-retrieval process that was shut down for several weeks. Later the process was allowed to start again, and no more earthquakes occurred. This fault is still being monitored by Lamont Doherty Earth Observatory of Columbia University. All of the faults in the deep subsurface in central New York extend upward from the top of the 12,000 ft deep basement rock but die out well below the gas-bearing (Marcellus) units, the deepest of which lie about 6,000 ft above basement. Drilling in the Marcellus will extend to those depths, at which the weight of the overlying material closes all cracks; that is why fracturing is needed—to hold the cracks open so the gas can be released.

d. *The hydrofracture fluids will come up to the surface through old lost wells that were poorly plugged..* POSSIBLY TRUE, but not in the eastern southern-tier counties because few, if any, deep oil or gas wells were ever drilled there. The State Department of Environmental Conservation (DEC) is often criticized for allowing old wells to be abandoned without plugging, but DEC did not exist when these practices occurred in the late 19th and early 20th century. The NYSGS has worked with DEC for the last 50 years to locate these wells and plug them, but the State will never be able to find all of them; most have probably collapsed and naturally plugged themselves. DEC continues to have these wells properly plugged as they are found.

3. *Unconventional drilling will permanently damage the surface environment.* FALSE: Horizontal drilling requires 95 percent fewer wells than standard (vertical) drilling and proportionately decreases the amount of land needed for service roads, drill platforms, and pipelines within the well's service area. The current standard gas-well spacing in western New York is about 16 wells per $mi^2$; the horizontal-drilling process used for hydrofracturing will decrease this to about 1 well per $mi^2$. This provides greater flexibility in well placement and causes far less environmental disturbance. The old vertical drilling process would require about 80,000 ft of drillpipe and the corresponding amount of hydrofracturing fluids, whereas horizontal drilling in the same area would require only about 45,000 ft of drill pipe and a corresponding amount of fluids. This 95% reduction in service equipment and facilities would decrease the number of access roads and feeder pipelines to distribution lines proportionately. Anyone who visits western New York to see the environmental damage resulting from the thousands of wells drilled and hydrofractured there during the last 50 years will find little or none. The popular rumor that hydrofracturing will turn the southern-tier counties into a wasteland is simply false: consider Chatauqua County and its holiday lake, where thousands of wells have been drilled and hydrofractured without noticeable disturbance.

4. *This new industry will produce a surge of new support industries and personnel that will create a short-term rise in the local economic well being, but this will be short lived.* PARTLY TRUE. This is true of all boom areas and must be factored into the long-term economic plans for such communities before any permanent economic activities are begun that rely on a continued booming-business environment. Once the pipelines have been installed and finished, the local economic environment will revert to its predrilling level. The resulting influx of money to the southern-tier counties may produce long-term employment, however, especially in farming, from the millions of dollars the landowners will receive in royalties.

[2] I have published several papers on this fault system.

5. *The New York City water-supply reservoirs could be contaminated by drilling in the Marcellus.* FALSE: No drilling will occur within at least 60 miles of the City's reservoirs because their watersheds contain no gas-bearing Marcellus rock, Drilling may occur, however, near or in the Delaware River watershed.

6. *Hydrofracturing will allow kitchen taps to be ignited, as in northeastern Pennsylvania.* FALSE. The kitchen tap in northeastern Pennsylvania that has been shown for years in news reports obtains water from a coal bed, and the gas is coal-bed methane that cannot be attributed to the hydrofracturing that was done several miles away. One can ignite kitchen taps in those parts of Albany County that obtain water from aquifers near or within the Utica black shale, which also contains methane (and radon, sulfur, iron, and other undesirable chemicals). Hydrofracturing in southern-tier counties will not cause the release of gas from coal beds because these counties contain no coal beds.

7. *Hydrofracturing will cause domestic wells to release radioactivity:* FALSE. The highest concentrations of radioactivity in aquifers, mostly from radon (the decay product of radium), are in the southern-tier counties, Albany County, and the town of Schodack in Rensselaer County[3]. Thus, these areas already have high radioactivity in their aquifers. The elevated radioactivity in these areas results primarily from local glacial deposits with radioactive sediments that were scraped from the Utica black shale, which crops out to the north of the southern tier and north of Rensselaer County. Hydrofracturing in the southern-tier counties should not increase the radon concentration (nor affect the water quality) of any groundwater in New York east of the Delaware River. Predrilling studies of shallow aquifers in southern-tier counties by the the water quality in many aquifers used for drinking water is already below EPA drinking-water standards. Thus, the ongoing predrilling groundwater studies are providing base-level water-chemistry data that will reveal any changes that might occur later and could be used in remediation if needed. The data also will inform users of water-quality conditions that are already present.

8. *Hydrofracture fluid is toxic and can contaminate aquifers or streams into which it seeps.* MOSTLY FALSE. Each gas well will have a hydrofracture fluid whose chemical composition addresses the local bedrock characteristics. In general, the compounds in these fluids are also used in household products, cosmetics, even foods. Some types of acids may be used. Information on the chemicals that are used in hydrofracturing fluids elsewhere can be found at:
http://fracfocus.org/chemical-use/what-chemicals-are-used
No chemical information is available for the proposed southern tier wells because neither the sites nor their geology has been formally identified; therefore the chemistry of the hydrofracturing fluids has not been established.

9. *The DEC lacks sufficient staff to monitor or regulate hydrofracturing at the present time.*
PROBABLY TRUE. This will neeed to be remedied, possibly by requiring the industry to provide additional resources to DEC for drilling oversight. This could be achieved through grants provided by the industry to the NYS Energy Research and Development Authority or some other State budget process.

**Pros:**

1. Hydrofracturing in the gas-rich southern-tier counties will give rise to an economic boom that could benefit the entire State for many years, as it already has in Pennsylvania, Ohio, and several western States. Monies from this boom should alleviate some of our State tax burden and directly benefit those southern-tier counties in which the gas is produced. Money gained from mineral leases would greatly benefit the landowners, mainly farmers.

2. New York would begin to export natural gas at a profit, rather than continuing to buy gas from Texas, Oklahoma, and now Pennsylvania, and Ohio.

[3] In 1989-91 I was chairman of the national committee that studied the radon in cellars throughout the nation

3. Making greater use of natural gas in New York will decrease our reliance on petroleum products (coal and oil) and nuclear power until at least 2050, by which time energy from alternative sources may be sufficient to run powerplants on a large scale. Drawbacks to each of these three fuels are as follows:
   - *Coal:* even the so-called "clean coal" contributes far more noxious compounds to the atmosphere than natural gas. The mining of coal devastates the landscape and alters streams.
   - *Nuclear power:* the disposal of nuclear waste will remain a major problem for the long term[4], as no one wishes to accept radioactive material whose half-life ranges from tens to millions of years, regardless of how it is processed for storage. The nuclear powerplants in New York are old and subject to problems that require periodic shutdowns.
   - *Oil:* we currently use slightly more oil from other countries than from our own supplies, which are finite. As such, oil would be better used for production of plastics, pharmaceuticals, and commodities that cannot be made from other chemicals than as a heating fuel and electric-energy source.

**What is the solution?**

Solar, wind, geothermal, tide, and other alternative energy sources are being improved gradually, but together provide less than 8% of our electric power-grid demand at present and are unlikely to become major sources of energy until at least the middle of this century. Regardless of public opinion, our choice is to either (1) continue our dependence on coal, nuclear power, and oil, or (2) produce more natural gas. Even fuel-efficient vehicles ultimately depend on rare materials, including lithium, mostly from other countries, especially China, and charging them draws electric power from the grid. The United States will be dependent upon foreign sources for these minerals for the long term because we lack economical reserves. The one exception is rare-earth mineral mine in the California desert, which is an environmental problem.

In summary, gas is less damaging than oil, coal, or nuclear power, and can be obtained safely, provided that the following requirements are met:

1. *Monitoring:* The State must provide adequate resources to the DEC for monitoring well installation and operation, and enforcement of safety regulations. Much of the funding could be provided by the gas-producing industry itself.
2. *Water testing:* All drilling must be preceded by groundwater and surface-water testing to establish a water-quality data base prior to any activity that could result in contamination.
3. *Funding* (such as bonds from the gas industry) should be established for mitigation of any environmental or health problems that could be attributed to hydrofracturing

Strict adherence to steps 1 and 2 will result in smaller and fewer environmental and health threats than those currently created by standard drilling practices.

**Additional Observations:**

- Albany County has banned hydrofracturing in response to public fear of groundwater contamination. In fact, no gas drilling will ever be done within Albany County because the county has no geological sources of gas. The Marcellus Shale in Albany County occurs only in the Helderbergs, and only in the exposed rocks of the Catskills in Green and Ulster Counties. These counties contain no useful quantities of gas, nor does the Utica black shale in Albany County. Hydrofracturing of water wells in these areas could cause contamination of local aquifers because aquifers are close to land surface, where as gas-bearing units are thousands of feet deep.

[4] I've been working on the geologic aspects of underground nuclear-waste storage for the last 40-odd years and am considered an expert by the U.S. Dept. of Energy and the N.Y. S. Energy Research and Development Aurthority.

- Geothermal energy sources for power generation, where used in the future, will require hydrofracturing, which has been done in New York for more than 50 years without major incident. As an example, an experimental geothermal well was drilled and hydrofractured in Auburn, N.Y. by the Empire State Electric Energy Research Corporation in the 1970s to assess the potential for deep-well sources of hot water for power generation. No earthquakes, upward leakage of fluid, or spillage to land surface occurred. Incidentally, no water hot enough to warrant further investigation was encountered.
- Drilling for natural gas by horizontal drilling will probably not occur in the southern tier counties in the near future because so much natural gas is being produced elsewhere in the U.S. that the startup costs for drilling far exceed the payback when compared with the low cost of gas from other areas.

**Conclusion:**

The current wave of public resistance to "fracking" is due mainly to (1) generation and dissemination of misinformation by those with a financial stake, or their own personal prejudices about the environment, or who wish to maintan the status quo—which is continued reliance on coal, nuclear power, and oil, (2) poor dissemination of accurate information by the gas industry and its proponents, and (3) political theater, as evidenced by the recent banning of hydrofracking in Albany County and widely reported fear for New York City's reservoir watersheds—despite the absence of Marcellus gas in either area.

Concerned citizens should study the science and facts behind hotly contested issues before deciding which side to take and how much personal energy, money or other resources, and time to expend.

I hope the above information has answered most of your questions.