

Penn State **Extension**

Water Facts #29

Testing Drinking Water Supplies Near Gas Drilling Activity

Note: this is a web-based PDF publication edited on 6/27/12 that is regularly updated. Consult <http://extension.psu.edu/water> to make sure that you have the most recent version.

Pennsylvania has over one million private water wells and springs that provide drinking water for rural homes and farms. As a result of increased gas drilling, many private water supply owners have questions about water testing that may be done on their water supply in addition to voluntary testing that they may want to conduct independently.

Types of Gas Wells

Conventional gas wells are drilled vertically into reservoirs of relatively permeable rock, from which hydrocarbons can be economically produced without large-scale fracturing operations. The natural gas in these reservoirs is derived from a deeper *source rock* where the gas originally formed but then migrated upward toward areas of lower pressure until becoming trapped in the reservoir rock. In Pennsylvania, these are also known as “traditional” or “shallow” wells.

Unconventional gas, by the broadest definition, is natural gas that is held tightly within the rock and requires horizontal drilling and fracturing to extract the gas. The natural gas found in the Marcellus and Utica shale layers requires unconventional methods of extraction such as high-volume, horizontal hydraulic fracturing, because of the way the natural gas is trapped in the formation.

Potential Pollutants Associated with Gas Drilling

Gas well waste fluids usually contain high levels of salt (sodium and chloride), metals (iron, manganese, barium, strontium, arsenic, lead and other trace metals), and various organic materials (oil, grease, surfactants, benzene, etc.).

Methane gas can be naturally occurring in soil and groundwater from near-surface biological activity or drift over millions of years. Methane may also migrate from inadequately constructed or damaged gas wells into soil, groundwater, and nearby water wells. Methane gas that is dissolved in water may cause effervescent water and spurting faucets and, once released into the air in high enough concentrations, is an explosion risk. To learn more about methane gas problems in private wells, consult the Penn State

Extension publication entitled *Methane Gas and Its Removal from Wells in Pennsylvania* available from your local Cooperative Extension office or online at: <http://extension.psu.edu/water/marcellus-shale>

Will My Water Be Tested For Free?

As of 2012 Pennsylvania Department of Environmental Protection (PaDEP) regulations stipulate that if water quality in a water supply is adversely impacted within six months and 1,000 feet of the vertical well borehole for conventional wells or twelve months or 2,500 feet of the vertical well borehole for unconventional wells, the gas company is presumed responsible, unless pre-drilling water quality test results show that the water quality problems existed prior to the gas well drilling. This presumption means that the drilling companies will be motivated to sample all drinking water supplies within the 1,000 or 2,500 foot distances to document pre-existing water quality conditions. If a water supply owner refuses the opportunity to have the pre-drilling water quality testing conducted, then the presumption of responsibility no longer applies. Therefore, to protect their legal rights, it is recommended that water supply owners cooperate with pre-drilling water testing done by the gas drilling company. Some drilling companies are voluntarily extending the sampling distance to include testing of drinking water supplies well beyond distances of presumed responsibility.

If the drilling company conducts pre-drilling water testing, the samples must be collected by an employee of a state-accredited water testing lab or a consultant working for the laboratory. This testing is usually arranged within a few weeks or months before gas drilling is scheduled to begin. There is no standard list of test parameters that must be included in this pre-drilling testing, but most gas drilling companies will include a list of over two dozen parameters.

Here are some important things to remember if you are visited by someone wanting to test your water as part of a pre-drilling survey:

- Cooperate with this testing. If you deny access for this testing, the gas drilling company will no longer have presumed responsibility for your water supply.
- Ask for identification and credentials of anyone

visiting your home to test the water. Confirm that they are affiliated with a state-accredited water lab or a consultant working with a lab.

- Provide information about your water supply to ensure that representative samples are collected.
- Ask what water quality tests will be performed by the laboratory on your water sample. This list will help you identify parameters for your own identical or more extensive testing if desired.
- Arrange to receive a free copy of these water test results either directly from the laboratory or from the gas drilling company. If you have difficulty obtaining a copy, contact your local PaDEP office.

How Do I Interpret These Water Tests?

Water test reports can be very difficult to understand. They may contain a variety of information including a listing of the tested parameters, methods, concentration units, detection limits, drinking water standards and quality control data. If you have trouble interpreting the water test report, contact the accredited laboratory or consult an unbiased source like Penn State Extension. Extension has an interpretive tool and taped webinars that will help you interpret your water test report at:

<http://extension.psu.edu/water/drinking-water/water-testing>

Keep in mind that pre-drilling testing done by the drilling company often identifies pre-existing water quality problems. Previous research by Penn State has shown that 41% of private water wells fail at least one health-based standard (bacteria, nitrate, arsenic, etc.) and many other water supplies fail standards for aesthetic pollutants (iron, manganese, pH, etc.). Because about half of the private water supplies in Pennsylvania have never been tested and many pollutants have no obvious symptoms in water, many homeowners are confused or even suspicious when pre-drilling testing documents existing water quality problems. If you disagree with or distrust these results, arrange to have your own water test done.

Should I Pay to Have My Water Tested?

If your water supply is not tested as part of pre-drilling surveys conducted by the drilling company or if you want to confirm the results collected during the pre-drill survey, you can arrange to have your water tested at your expense. This test should also be arranged through a state-accredited water lab. Labs can be state-accredited for just a few water test parameters or for many different parameters. When discussing water testing with a lab, ensure that all testing parameters will be done by a laboratory that is state accredited for that parameter. Some labs may need to subcontract with other labs to ensure that all parameters are completed by accredited labs.

It is vital that water samples collected to document impacts from gas well drilling be collected by an unbiased professional representing a PaDEP state accredited water testing laboratory. This is referred to as “chain-of-custody” or “third-party” testing. Consult <http://extension.psu.edu/water/marcellus-shale> for more details about chain-of-custody testing and a list of PaDEP state-accredited water labs. Not all labs do chain-of-custody testing and for those that do, there may be an additional charge.

What Should I Test for and What Will it Cost?

There is no standard listing of pollutants to test for related to gas well drilling activity. Consultants, water testing labs, drilling companies and regulatory agencies have all created water testing lists. For example, the PaDEP published a fact sheet entitled *PA-DEP Recommended Basic Oil and Gas Pre-Drill Parameters* (available at: www.dep.state.pa.us), which lists their recommended water tests as part of Marcellus gas drilling activity. This list can also be seen on the table on the following page.



Water testing should always be conducted by a laboratory that is accredited through the PaDEP.

Are There Less Expensive Testing Options?

Many homeowners, when confronted with the high costs of testing for all possible pollutants, seek options for lower cost testing. Keep in mind that even some basic, inexpensive testing is better than no testing as it can provide *some* legal protection, especially if the testing is targeted at pollutants that are unique to drilling. But you should strive for the most complete water test that you can comfortably afford to maximize your legal protection.

Many water testing labs and consultants offer several water testing packages with increasing numbers of tests and costs. These testing packages can be created by prioritizing pollutants based on their uniqueness to gas drilling, their concentration in drilling fluids, their risk in drinking water and their analysis cost. Packages typically range from about \$200 for the most basic tests to over \$900 for extensive lists.

The table below lists parameters that various agencies recommend for private water quality source testing in relationship to gas well drilling. Parameters are numbered according to tiers of relative importance, with 1 being the most important. See references on page 5 for more information on data sources.

Parameter	Penn State	PA DEP	NY WRI	NYSDEC	Ohio EPA
Total Dissolved Solids (TDS)	1	1	1	1	1
pH	1	1	1	1	2
Iron/Manganese	1	1	1	1	2
Chloride	1	2	1	1	1
Barium	1	2	1	1	1
Methane	1	1	1	1	3
Ethane	1	1	3	1	
Bromide	1		1		2
Sodium	2	1	2	1	1
Conductivity		2	2	1	1
Hardness	2	2	2		2
Strontium	2	2	2		1
Alkalinity	2	2	2		2
Total suspended solids (TSS)	2	2	2		2
VOC's (including BTEX)	3		2	1	3
Surfactants/Detergents (MBAS)	2		3		
Gross Alpha	3		2	1	
Gross Beta	3		3	1	
Arsenic	2		3		
Total coliform/ E. coli	2	2	3		
Oil & Grease	2	2	3		
Sulfate	2	2	3		1
Nitrate	2				
Calcium	2	2	3		2
Magnesium	2	2			1
Potassium	2	2			1
Selenium	2				
Total organic carbon	2				
Lead	3				
Total petroleum hydrocarbons	3				
Residue (filterable & non-filterable)		2			

Why do Water Test Recommendations Differ?

In a perfect world, testing on private water sources would be done on all wells and springs, include all parameters, and be done on a routine basis. However, there are some limiting factors such as cost and limited value of certain parameters that prevents that kind of testing from being practical. Some parameters may differ based upon whether the intention is to specifically determine gas drilling contamination or to determine more general water quality problems. Recommendations may also vary depending upon geology, topography, and composition of gas drilling fluids.

How Do I Know When to Test My Water?

Drilling companies typically will contract with state-accredited water labs to test private water supplies that are close to their projected drilling site within a few months of the beginning of drilling. Homeowners who receive this free testing but also wish to contract for their own duplicate sample should arrange to have this sample collected on the same day as the industry sponsored testing if possible. Homeowners doing voluntary water testing outside of the area where industry testing is provided should try to arrange for testing within one year (and preferably within a few months) before drilling begins.

Testing Before Seismic Activity?

Seismic testing involves the use of either trucks or explosives to create vibrations that are read with instruments to map underground rock formations. These vibrations could, in rare instances, mobilize and introduce sediment to a nearby water supply or change water flow. If seismic testing is to be done close to your water supply, you may want to stipulate testing in your lease or pay for water quality and quantity testing in order to document conditions in your well or spring before allowing the seismic exploration. Proper backfilling of holes after seismic testing can also be stipulated to protect groundwater.

What About Water Quantity?

Diminished or lost water supplies resulting from gas well drilling have occurred but are rare. When this does occur, it is usually an obvious, complete loss of water rather than a subtle decrease in water yield. It is important to note that water quantity issues are not included in the "presumed responsibility" that drillers have for water quality complaints. Water quantity complaints place the burden of proof on the homeowner. A well operator who is proven to affect a private water supply by pollution or diminution shall restore or replace the affected supply with an alternate source of water adequate in quantity or

quality for the purposes served by the supply. Well and spring owners who wish to document water supply conditions before and after gas well activities should hire a professional water well contractor or hydrogeologist (at significant cost) to independently measure and document these conditions. You can find a list of local water well contractors certified by the National Ground Water Association at www.wellowner.org.

Continuous Monitoring of Water Quality

In addition to water samples analyzed by labs, some water supply owners are interested in methods to continuously monitor their water quality. Inexpensive total dissolved solids (TDS) or conductivity meters can be purchased from many online suppliers for \$50 to \$100. These meters allow for quick and easy measurement of the total amount of dissolved constituents in their water. Large increases in the TDS or conductivity in conjunction with nearby drilling activity would warrant further investigation and possibly follow-up testing by a state-accredited lab.

Symptoms of Problems

If you notice changes in your water quantity or quality during or after drilling, contact your local PaDEP office along with the gas drilling company. Some obvious changes to your water supply that would warrant a complaint to PaDEP include:

- Change in the appearance of drinking water such as sediment, foaming, bubbling or spurting faucets
- Change in drinking water taste (salty, metallic, etc.)
- Change in water odor (rotten egg, fuel, oil, etc.)
- Rapid reduction or loss of water quantity

PaDEP will investigate such complaints within ten days and make a determination within 45 days about the potential cause. Water pollution complaints filed during gas well drilling or within six months after drilling or alteration was completed on a conventional well and within twelve months after drilling, alteration or stimulation on an unconventional well, place the burden of proof on the gas well operator if the water supply is within 1,000 feet of a conventional well and within 2,500 feet of an unconventional well. Water pollution complaints filed beyond those time periods and distances and *all* water quantity complaints place the burden of proof on the homeowner. During the investigation, PaDEP will obtain results from all pre-drilling water testing. They may also collect additional water samples as part of the investigation.

Testing After Gas Drilling Has Occurred

There are no requirements for gas well companies to test private water supplies after the gas well drilling has concluded. Therefore, post-drilling water testing

is a voluntary action that must be arranged by the homeowner unless the testing is included in a gas lease or part of a complaint to PaDEP. While many of the pollutants associated with gas well drilling will cause obvious stains, odors or tastes in your water, others have no obvious symptoms. For this reason, some homeowners may wish to hire an independent water laboratory or a consultant working with a lab to collect a post-drilling water sample even if no obvious change to water quality occurs. Due to the “presumed responsibility” distances and time limits for water quality problems, post-drilling water testing should be done soon after drilling ends.

Can I Ever Collect My Own Samples and Submit Them to a State Accredited Lab?

Many homeowners question whether they can collect their own water samples and deliver them to an independent laboratory to save on testing costs. While this method will save money, it is important to realize that test results from water samples collected by the homeowner are generally not recognized in legal proceedings because they are not independent. However, recognizing that cost may be a factor in a homeowner getting *any* testing done, consideration could be made to this less expensive method of sample collection and submission. This would, at least, provide some basic data for the homeowner to become aware of potential issues that may warrant further, third party testing. It could also offer a point of comparison to testing that may have been done by a lab hired by the drilling company.

Final Recommendations

With increasing amounts of information related to protecting water supplies near gas drilling, some cautions are in order. Homeowners with private water systems in gas drilling regions should be vigilant and carefully weigh comments and recommendations being made. In addition to the suggestions on page one, here are some tips to follow:

- Seek out unbiased sources to learn about the drilling process and the potential risks to water.
- Understand the existing regulations, including the testing that might be done on your water supply at no charge to the owner. Realize that you have a right to receive a copy of any results from water tests performed on your water supply.
- If you are skeptical of the industry-sponsored testing done on your water supply, or if you are outside of the area where their testing is being offered and you still feel vulnerable, consider paying for your own water testing.

- Always seek out state-accredited water labs or a consultant working with a lab who can visit your home and collect a proper, “chain-of-custody” or “third party” water test that will be legally valid.
- Discuss the testing costs with the lab or consultant to select a testing package that addresses your concerns while still being affordable.
- Also discuss with the laboratory the extent of their accreditation. Confirm with the lab that they are state-accredited for all of the individual tests that you desire. If they are not accredited for all parameters, make sure that they are subcontracting with another laboratory that does have the proper state-accreditation.
- Question the qualifications and experience of the person who will visit your home to collect the water samples. Consider asking how many pre-drilling water samples they have collected and what methods they use to ensure that a representative and accurate sample is collected.

More Information

For additional information on managing a private water system, contact your local Penn State Extension office or visit <http://extension.psu.edu/water>. For more information on gas and oil well drilling, consult the PaDEP web site at www.depweb.state.pa.us (keyword: “Oil and Gas”).

Resources for parameter comparison table on page 3:

Pennsylvania Department of Environmental Protection. 2010. *PA-DEP Recommended Basic Oil & Gas Pre-Drill Parameters*. PA DEP Fact Sheet 5500-FS-DEP4300, 2 pp. <http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-82193/5500-FS-DEP4300.pdf>

Ohio Environmental Protection Agency. 2012. *Recommendations for Drinking Water Well Sampling Before Oil and Gas Drilling*. <http://www.epa.state.oh.us/portals/0/general%20pdfs/waterwellsampling.pdf>

New York State Water Resources Institute. 2011. *Private Water Well Testing in Areas Impacted by Marcellus Shale Gas Drilling*. http://wri.eas.cornell.edu/gas_wells_18_2056378964.pdf

New York State Department of Environmental Conservation. 2011. Revised Draft Supplemental Generic Environmental Impact Statement (2011). New York State Department of Environmental Conservation <http://www.dec.ny.gov/energy/75370.html>, pages 7-44 through 7-49

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