

Penn State **Extension**

Marcellus Shale Gas Well Drilling: Regulations to Protect Water Supplies in Pennsylvania

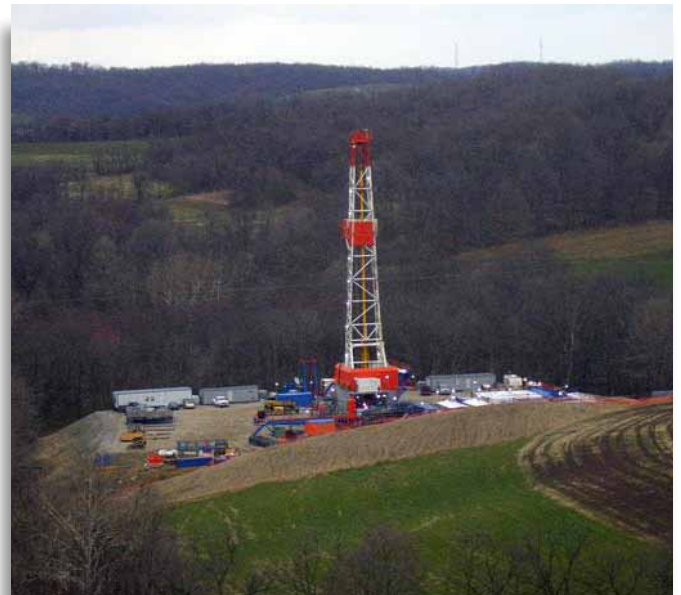
Regulatory decisions affecting shale gas exploration with implications for water resources have been made by policy makers at the federal, multi-state, state, and local level. In all cases, regulations originate with legislation, such as Pennsylvania's Oil and Gas Act or the Pennsylvania Clean Streams Law. However, government agency rule-making based on statutes and court decisions interpreting legislation and regulations also affects the impacts of gas drilling on water resources and the environment. As shale gas activities have expanded over the past several years in Pennsylvania, several important changes in agency rules have been made.

The decision in 2005 by the U.S. Congress to exempt hydraulic fracturing from the Safe Drinking Water Act has meant that regulating modern shale gas drilling has largely fallen to the states. The primary way in which Pennsylvania regulates shale gas extraction activities is through the state's Oil and Gas Act and via subsequent rulemaking provided in Chapters 78 and 79 of the Department of Environmental Protection's regulations, although a number of state water protection laws also influence aspects of the gas extraction process. The Oil and Gas Act preempts local governments from addressing many concerns relating to oil and gas extraction. Accordingly, municipalities may be preempted from addressing water supply protection. Decisions by the two multi-state river

basin commissions covering the eastern and central parts of Pennsylvania have played a key role in managing water resources as shale gas development has expanded in the state.

In 2010 and 2011, DEP finalized regulations covering allowable total dissolved solids in all oil and gas wastewater and improved well casing standards (see below). Many experts now expect a more stable regulatory climate in Pennsylvania for at least several years.

This publication summarizes the relevant components of the Oil and Gas Act, and the newly implemented regulations affecting gas well drilling and water supplies under authority of various environmental laws.



A Marcellus shale drilling pad.
Courtesy D. Yoxtheimer.

PENNSTATE



Cooperative Extension
College of Agricultural Sciences

1) Permits

Before drilling a gas well in Pennsylvania, the operator must submit an extensive permit application for approval from the DEP. Among other things, the permit application must include a map showing the location of the gas well, proximity of the gas well to coal seams, and distances to nearby surface water and water supplies. A bond must be posted with the permit to ensure compliance with environmental regulations related to the well drilling. The permit also requires notification of surface land owners at the well site along with all drinking water supply owners within 1,000 feet of the well. As a result, homeowners with private water wells or springs that are located within 1,000 feet of the proposed gas well site must receive notification by certified mail during the permit process.

2) Setback Distances

Gas wells must be at least 200 feet from any drinking water supplies. This setback may be waived by the water supply owner in a lease agreement. Gas wells must also be 100 feet from any stream, spring, or body of water. A 100-foot setback is also required from any wetland greater than one acre in size. DEP can grant a waiver of these setbacks if additional protection is put in place to protect these natural resources.

3) Protection of Drinking Water Quality

Section 208 of the Pennsylvania Oil and Gas Act includes language to protect drinking water supplies near gas wells. This includes a requirement that gas well drilling operators restore or replace any water supply determined by DEP to be polluted as a result of nearby gas well drilling. The gas well operator is presumed to be responsible for pollution of any public or private drinking water supply within 1,000 feet of the gas well **if** it occurs within six months after completion of drilling or alteration of the gas well.

During the initial six-month period, the gas well operators can use any one of five defenses to prove they are not responsible for water contamination:

- The pollution existed prior to the drilling
- The landowner or water purveyor refused to allow the operator access to conduct a pre-drilling water test
- The water supply is not within 1,000 feet of the gas well
- The pollution occurred more than six months after completion of gas well drilling
- The pollution occurred as the result of some cause other than gas well drilling

To preserve their defense, most gas well operators will collect the necessary pre-drilling water quality information from all drinking water supplies within 1,000 feet of their drilling operation. DEP has published a list of recommended pre-drilling test parameters (www.elibrary.dep.state.pa.us/dsweb/Get/Document-82193/5500-FS-DEP4300.pdf). Individual gas companies and DEP may choose additional water tests.

As part of any pre-drilling water sample survey, the gas well company is required to hire an independent state-certified water testing laboratory to conduct the water testing. An up-to-date listing of state-certified water testing labs from the DEP Bureau of Labs is linked on the Penn State Water Resources Extension site at: http://water.cas.psu.edu/WS_Testing.htm.

Do not deny access to water testing laboratory personnel. It is important to note that gas well operators are **not** presumed responsible for pollution of water supplies that they were denied access to prior to the drilling. Obtain the name and company affiliation of any person asking to sample your water supply and ask for proof of identification. For more information on conducting pre-drilling water testing, see <http://extension.psu.edu/water/marcellus-shale>.

4) Water Quantity Not Protected

Gas well drilling can occasionally change the flow of water from a water well or spring, although these changes are often temporary. Unlike water quality impacts, gas well operators are **not** presumed responsible for water quantity impacts to nearby water supplies. However, the Oil and Gas Act also states that well operators that affect a public or private water supply by pollution or *diminution* must restore or replace the affected water supply with an alternate source of water adequate in quantity or quality for the purposes served by the supply. Water flow data is often not measured during pre-drilling surveys conducted during the permitting process. Instead, impacts to water quantity would need to be investigated by DEP inspectors and/or proven by the water supply owner. Concerned water supply owners may wish to hire a well driller or water consultant to document the flow of water from their well or spring prior to the gas drilling activity.

5) Land Disturbance

Gas well construction involves extensive land disturbance, including roads, drilling pads, and pipelines. Drilling pads alone may be four to six acres in size for deeper gas wells. Various regulations are in place to protect surface water and groundwater from erosion and sedimentation due to these disturbances. Erosion and sediment plans are required. Enforcement of erosion and sediment problems related to gas well operations is overseen by personnel from the DEP, Bureau of Oil and Gas Management.

6) Groundwater Protection During Drilling

Protections were included in the 1984 Oil and Gas Act to ensure that groundwater aquifers are not contaminated by drilling fluids, brines, and wastes. A thick steel casing is cemented into place from the ground surface to below the deepest freshwater aquifer (typically several hundred feet below the ground surface). This *freshwater protection string*

segregates the fresh groundwater from the drilling process and prevents waste fluids from entering freshwater aquifers.

Regulations strengthening oil and gas well construction standards to prevent methane gas migration, among other purposes, became effective on February 5, 2011 (25 Pennsylvania Code, Chapter 78). The regulations, which outline many standards that the industry must follow in drilling and casing new wells, were developed in response to recent incidents in some parts of Pennsylvania where gas has migrated into drinking water supplies or homes, posing public health and safety threats. The regulations also require drillers to detail the chemicals found in flowback water, and to electronically report production and waste volume data. Flowback water is the approximately 10–30 percent of water (the amount varies with location) used in fracking that returns to the land surface within about 30 days of fracking.

7) Disposal of Drilling Fluids

New Regulation for Total Dissolved Solids in Gas Drilling Wastewater

Under authority of the Pennsylvania Clean Streams Law, in 2010 DEP finalized new regulations to protect Pennsylvania's water bodies and public drinking water by limiting the amount of total dissolved solids (TDS) that could be discharged into waterways. The new regulations establish an effluent standard (via revision to 25 Pennsylvania Code Chapter 95) of 2,000 mg TDS per L for new and expanding facilities. Tighter standards of 500 mg/L for TDS, 250 mg/L for chlorides, and 10 mg/L for barium and strontium apply to wastewater from the natural gas industry because of its generally much higher initial concentrations and overall loadings. These four standards are based on monthly averages. The regulations, which took effect in August 2010, apply to new or expanded TDS loads at facilities treating TDS wastewater in Pennsylvania. Existing discharge loads of TDS are exempt from the regulation unless or until they expand.

Several Options for Treatment/Disposal

Disposal of the various fluids associated with the drilling process is regulated to protect surface and groundwater resources. Marcellus wastewater treatment options have been changing quickly in response to the rapid development of the gas field. Swift innovation in new facilities and treatment technologies is likely in this area over the next few years. The capacity for treating and disposing of drilling wastewater has lagged behind industry needs. The wastewater's extremely high TDS levels present challenges for conventional technologies.

In the past year or two the reuse/recycling of flowback water in additional fracking jobs, either with or without preliminary treatment, has become more common. This reuse saves on water withdrawal permitting time and money and truck traffic. For more information about options for disposal and treatment of drilling wastewater, see Marcellus Shale Wastewater Issues in Pennsylvania—Current and Emerging Treatment and Disposal Technologies, a Penn State Extension fact sheet in this series.

8) Water Withdrawals

A major concern given new deep horizontal gas well drilling technologies has been the withdrawal of large volumes (3–8 millions of gallons) of water for hydrofracturing each well. These large water withdrawals may come from many sources (streams, ponds, lakes, etc.) and can have significant effects if not done carefully. The Clean Streams Law limits the amount of water that can be withdrawn from streams to maintain sufficient stream flows to protect aquatic life. Water withdrawals generally exceeding 10,000 gallons per day must be registered with DEP under authority of the Water Resources Planning Act, and periodic reports of water usage are required. All withdrawals for Marcellus shale–related drilling occurring in the Susquehanna or Delaware River watersheds also require permits from the Susquehanna River Basin

Commission (SRBC) or the Delaware River Basin Commission (DRBC). These various regulations have all been used to shut down gas well drilling operations that failed to acquire the proper permits or exceeded allowable withdrawals from streams.

9) Well Plugging

Once a well is no longer in production (a period of a few years to several decades or more for most wells), it must be decommissioned and plugged. In some cases, the production well casing (below the freshwater protection string) may be removed. The freshwater protection casing is left in place and the hole is filled to the ground surface with non-porous material.

10) The Role of River Basin Commissions

Because of the large volumes of water needed to frack Marcellus wells, river basin commissions in Pennsylvania have played an important role in development of the industry. Because of the water consumption requirements, gas companies may not begin gas well construction, drilling, or fracking without commission approval. This requirement allows the commission to regulate the gas industry's individual and cumulative impacts on water resources.

Because the Marcellus shale underlies much of the Susquehanna River basin, the SRBC has been at the forefront of regulating water-related Marcellus drilling issues. The commission has frequently updated their regulations to address new issues and the rapid pace of development of the Marcellus shale. See [SRBC's website](#) for updates.

DRBC has much less land underlain by gas-rich shale than does SRBC. DRBC has greater focus on water quality in its management approach and regulations than does SRBC. DRBC published draft natural gas regulations in December 2010, and in April 2011 was still receiving public comments on them. Commission consideration of natural gas production

project applications is postponed until the new regulations are adopted. See [DRBC's website](#) for updates.

11) Fast-Paced Changes

The Marcellus shale resource is being developed rapidly. Government agencies at all levels are struggling to keep pace. New technologies are being tried in both the resource development process and in managing environmental and water quality/quantity impacts. The recent implementation of the TDS standards and the strengthened well casing regulations, and the current political climate, have many observers expecting a more stable regulatory environment for several years. However, some stakeholders believe that the new technologies (e.g., deeper wells and horizontal drilling) make major parts of the state's Oil and Gas Act out of date. They favor significantly revising and updating the act through legislative action. There has been much activity by the regional river basin commissions concerning Marcellus water-related issues, and this activity may continue.

A bill (the "FRAC Act," S. 587) to amend the Safe Drinking Water Act to repeal the exemption of fracking was reintroduced in Congress in March 2011. The U.S. Environmental Protection Agency announced in March 2010 that it would study "potential human health and water quality threats" from fracking. A draft report should be available in 2012. Check back frequently to the sites listed in the Resources section below for updated information on this complex issue.

More Information

For additional information on all aspects of managing a private water system or help in reading your water test results, contact your local Penn State Cooperative Extension office or consult the Water Resources Extension web site at <http://extension.psu.edu/water>

Disclaimer

Please note that the regulations discussed in this factsheet were current as of March 2011, but are continually evolving.

Resources

Abdalla, C. W. & J. Drohan. 2010. Penn State Marcellus education fact sheet: Water withdrawals for development of Marcellus shale gas in Pennsylvania.

pubs.cas.psu.edu/FreePubs/pdfs/ua460.pdf

Delaware River Basin Commission.

www.state.nj.us/drbc

Penn State Cooperative Extension. Natural Gas Impacts. naturalgas.psu.edu

Pennsylvania Department of Environmental Protection, www.dep.state.pa.us/dep/deputate/minres/oilgas/new_forms/marcellus/marcellus.htm

Susquehanna River Basin Commission.

www.srbc.net

Swistock, B. Water Facts #28: Gas Well Drilling and Your Private Water Supply. Penn State Extension, School of Forest Resources, University Park, PA. extension.psu.edu/water/resources/publications/water-pollutants/water-quality/gasdrilling.pdf

Prepared by Charles Abdalla, professor of agricultural and environmental economics; Joy Drohan, freelance science writer and editor; Bryan Swistock, senior extension associate; and Susan Boser, extension educator.

An **OUTREACH** program of the
College of Agricultural Sciences

Penn State College of Agricultural Sciences research, extension, and resident education programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U.S. Department of Agriculture.

Visit Penn State Extension on the web: extension.psu.edu

Where trade names appear, no discrimination is intended, and no endorsement by Penn State Cooperative Extension is implied.

This publication is available in alternative media on request.

The Pennsylvania State University is committed to the policy that all persons shall have equal access to programs, facilities, admission, and employment without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. It is the policy of the University to maintain an academic and work environment free of discrimination, including harassment. The Pennsylvania State University prohibits discrimination and harassment against any person because of age, ancestry, color, disability or handicap, national origin, race, religious creed, sex, sexual orientation, gender identity, or veteran status. Discrimination or harassment against faculty, staff, or students will not be tolerated at The Pennsylvania State University. Direct all inquiries regarding the nondiscrimination policy to the Affirmative Action Director, The Pennsylvania State University, 328 Boucke Building, University Park, PA 16802-5901; Tel 814-865-4700/V, 814-863-1150/TTY.

©The Pennsylvania State University 2011

Updated March, 2011