

Gas Drilling in the Marcellus Shale and Pennsylvania's Coldwater Resources

Pennsylvania Council of Trout Unlimited

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INTRODUCTION

A major natural gas boom is underway in Pennsylvania. Energy companies from across the US have come to this region to drill for gas in a geological formation known as the Marcellus Shale. PA Trout Unlimited believes the Marcellus Shale gas boom has the potential to significantly damage Pennsylvania's coldwater resources and trout fisheries, if not managed properly.

WHAT IS THE MARCELLUS SHALE?

The Marcellus Shale is located in the Appalachian region of the US. It spans approximately 600 miles from the southern tier of New York through Pennsylvania and Ohio, and into West Virginia. It is estimated to cover about 54,000 square miles, and it coincides with the location of many of Pennsylvania's wild trout streams. Marcellus Shale is variable in depth. A majority of the shale is about a mile deep, and in some areas it is as much as 9,000 feet below the surface. Marcellus Shale is a low-density rock with tight pores that hold natural gas. It is estimated that the Marcellus Formation holds 50 trillion to 350 trillion cubic feet (TCF) of recoverable gas. With natural gas consumption at about 23 trillion cubic feet per year, Marcellus Shale could supply the country with natural gas for anywhere from two to 15 years.

HOW IS GAS EXTRACTED FROM MARCELLUS SHALE?

Natural gas has long been produced from shallow shale formations. However, recent advances in deep well drilling combined with horizontal drilling, and advances in hydrofracturing (or "fracking"), have made gas extraction from deep shale formations economically feasible.

Depending on the geology, gas companies use both vertical and horizontal wells to capture the gas. Wells can be drilled vertically for several thousand feet. Then the drilling can be angled, creating an arc to the horizontal, and drilling can be continued horizontally through the shale formation for several thousands of feet. Multiple wells may be drilled from the same well pad site, radiating out horizontally from a central vertical well. Well pad sites can vary in size from 3 acres up to 30 acres, or more.

Fracking is a technique used to release natural gas from the tight pores of the shale. A mixture of water, chemicals and proppant (usually sand) is pumped down the well and into the shale at high pressures. The pressure creates fractures in the shale and the proppant holds open the fractures to allow gas flow from the shale and into the well. Chemicals used in fracking may include friction reducers, biocides, surfactants and scale inhibitors.

Fracking requires large quantities of water, typically between 3 and 5 million gallons for the initial fracking. Wells drilled in Marcellus Shale may have to be hydrofractured several times over the course of their lifetimes to keep the gas flowing.

Millions of gallons of water must be piped or transported by truck to the well site prior to a fracture treatment. The flowback water (waste water) from the fracking operation must also be trucked out to a disposal facility or stored on site for re-use. A large percentage (20% to 80%) of the injected fluid remains underground for some time. Flowback water does not come back all at once. At first, the flowback is primarily treatment/fracking fluids, but it soon develops the characteristics of the rock formation water which routinely contains high concentrations of total dissolved solids (TDS) including barium, strontium and radiological contaminants.

Flowback of fracking fluids and formation water can continue over a period of years, and can become more polluted the longer it remains underground.

Production water from Marcellus wells is currently being recycled from well to well or is being transported to permitted waste water treatment facilities throughout Pennsylvania. Unfortunately, many waste water treatment facilities are not equipped to effectively deal with recovered waters from Marcellus wells. Many facilities mainly dilute and discharge the waste water under permitted discharge guidelines authorized by DEP.

Presently there are 63,000 registered wells in Pennsylvania, including those currently producing natural gas, and those which have been drilled and capped for future production. Companies have drilled more than 600 Marcellus wells in Pennsylvania so far, and they are expected to triple that number by 2010. The rush to exploit the Marcellus shale natural gas reserve is certain to continue, and serious concerns should be raised as wells are drilled, more waste water is produced, and pipelines begin to traverse the landscape.

WHAT PERMITS ARE REQUIRED?

- Well Drilling Permit and Addendum – The operator must obtain a drilling permit, pursuant to the Oil and Gas Act, as well as an application addendum outlining a water management plan for that operation, pursuant to Title 25 PA Code 78.11-33.
- Earth Disturbance Permit (ESCGP-1) – The operator must obtain a permit from the PA Department of Environmental Protection (PA DEP) for implementation of erosion and sediment (E&S) controls, including stormwater management, if the site disturbance area is greater than 5 acres (ESCGP-1) under Chapter 102. A plan for erosion and sedimentation control is required if it's under 5 acres. An expedited permit process has been granted by PA DEP for the oil and gas industry which removes County Conservation Districts from review authority for E&S control permits. As long as a professional geologist, engineer or surveyor seals the E&S plan, the oil and gas industry can receive E&S permits in less than 5 days.
- Preparedness, Prevention and Contingency (PPC) Plan – The operator is required to prepare and implement a PPC Plan and make it available to PA DEP upon request. The plan must address the types of wastes generated, disposal methods and include a spill prevention plan. Construction and operation of on-site storage impoundments must also be described.
- Water Withdrawal Permits – PA DEP has required water withdrawal permits for all withdrawals of surface or ground water. For projects located in the Delaware or Susquehanna basins, a separate Delaware River Basin Commission (DRBC) or Susquehanna River Basin Commission (SRBC) water withdrawal permit is required.
- Chapter 105 Obstruction and Encroachment Permit – An operator must obtain a permit from PA DEP for construction, excavation, or operation in a wetland, stream, or body of water. A similar permit is also required under the Oil and Gas Act.
- Water Quality Management Permit – An operator must obtain this permit if a centralized impoundment will hold fluids other than fresh water (such as drilling or fracking fluids). The siting, construction, use and closure of temporary pits are regulated under Chapter 78. Permits are only required if the pit is part of a treatment facility. *In the case of freshwater impoundments, strict adherence to design and safety standards must be met and adequately enforced.*

PENNSYLVANIA TROUT UNLIMITED'S POSITION ON GAS DRILLING

We understand that natural gas drilling and other energy developments are important to the economy of the Commonwealth and the nation. However, we are adamant that this drilling be done in a manner that does not damage our natural resources. Deep gas well drilling is relatively new to Pennsylvania, and the environmental concerns have not been fully evaluated prior to the issuance of numerous permits. Adequate permit restrictions and oversight are necessary. We encourage our regulatory agencies to actively ensure that all protections be enforced to protect our water resources as afforded under the Clean Water Act and the Clean Streams Law.

WHAT ARE OUR CONCERNS?

1. **Excessive water use**, including the removal of millions of gallons of water from streams and aquifers to drill and frack the Marcellus gas producing zones. Each drilling site requires millions of gallons for this process.
2. **Surface and ground water contamination from chemicals and leaks** poses serious environmental damage. Storage of fracking chemicals and recovered water onsite has already shown to pose a serious threat to our streams and aquatic life due to leaks, spills and faulty containment. Companies in Pennsylvania have documented 85 to 150 different chemicals in fracking fluid. Many of these chemicals are suspected or known carcinogens that can cause serious health problems. Currently, the oil and gas industry is exempt from complying with the Safe Drinking Water Act.
3. **Drilling activity in Special Protection Watersheds** (HQ and EV streams) and Wilderness Trout Designated areas will permanently affect these areas and alter some of Pennsylvania's most outstanding natural resources.
4. **Lack of waste water treatment options** to deal with the significant increase in waste water being produced. Most wastewater treatment facilities do not have the technology to effectively treat with the industrial pollution coming from Marcellus Gas wells. This has led to relying on the assimilative capacity of a stream to dilute the pollution, rather than treatment and disposal of the waste byproducts. Dilution IS NOT the solution to pollution – PREVENTION is the solution to pollution.
5. **Bonding is inadequate** to deal with the closing and plugging of wells, and to deal with any long-term environmental implications of orphan/abandoned well sites.
6. **Increase in sediment and stormwater** from the well pad sites and pipelines. The current expedited E&S review process is inadequate, particularly in Special Protection watersheds, where a thorough anti-degradation analysis should be incorporated as required by Title 25, Chapter 93.
7. **Resource agencies are inadequately staffed** to deal with the increase in permit requests and on site enforcement. While PA DEP has increased numbers of staff dedicated to Oil and Gas Activities, resource agencies such as the Dept. of Conservation and Natural Resources (DCNR), the PA Fish and Boat Commission (PFBC) and the PA Game Commission (PGC) are inadequately staffed to deal with the increase in general inquiries, permit reviews and violation reports.
8. **The need for a dedicated fund, such as a severance tax**, to deal with the environmental damage that will surely occur during the extraction process.
9. **Regulations are inadequate** to review, inspect and enforce activities that take place during the drilling process.
10. **Leasing of public lands for gas drilling (beyond what has already been leased)**, should not be allowed until a comprehensive investigation can be conducted to identify the environmental implications from severely altering and fragmenting extensive tracts of forest land. Nearly 700,000 acres of state forest lands have been leased for gas extraction. Protection of our precious wilderness lands and watersheds producing clean water for posterity needs to be a priority. These valuable long-term assets of the Commonwealth should not be squandered to pay for subsidization of the state general fund and its short-term expense shortfalls.
11. **Lack of understanding about the cumulative impacts** on both public and private land, including, but not limited to habitat fragmentation, increased stormwater runoff, potential increase in erosion and sedimentation into our streams and loss of wetlands.

WHAT SHOULD HAPPEN?

1. Marcellus Shale drilling and production presents a new series of problems. Namely, the need for millions of gallons of water for fracking, and the need to properly treat and dispose of this water when it returns to the wellhead. Simply put, Pennsylvania must enact criteria and disposal methods not yet employed in the Commonwealth. As an organization concerned with coldwater fisheries and the water quality and quantity needed to support these fisheries, Pennsylvania Trout Unlimited (PATU) insists that PA DEP must meet this new challenge. We fully support the proposed Chapter 95 regulatory changes and understand that the technology is available to implement and effectively regulate end of pipe discharges that meet DEP's proposal of 500 mg/L for Total Dissolved Solids (TDS) and 250 mg/L each for sulfates and chlorides. Fracking water must be treated at facilities using best available technology built to meet NPDES permit requirements or treated onsite. Municipal sewage treatment plants are not capable of treating chlorides and certain other contaminants present in fracking water, and dilution is NOT the solution to pollution. We commend the industry for an increased use of recycling. However, there is still a point at which contaminated water must be disposed of.
2. PATU strongly believes that Marcellus Shale development should not be permitted within Special Protection (HQ-CWF and EV) watersheds (and their upstream tributaries), wilderness watersheds without more stringent regulatory review and inspection. We do not see how the existing Best Management Practices (BMPs) for sediment and erosion control, given the significant earth disturbances associated with road and pad construction; can comply with the anti-degradation standards required under the Clean Streams Law. PA DEP should, at minimum, require individual permits for gas development. Individual permits assure that the public has an opportunity to review, object to, or request a public meeting on, the proposed drilling operation and its associated discharges prior to the issuance of the permit. These options are not available with the present practice of issuing general permits pursuant to Chapter 102. Appeal rights, under the general permit, are limited to a short window after issuance of the permit. We find this practice unacceptable. The fast tracked permitting process should be removed, and (once again) conservation districts should be included in the permit review process.
3. Natural gas drilling and production can and must be conducted in accordance with best industry practices and well-established state oil and gas, and environmental regulations. The natural gas industry bears responsibility for mitigating the effects of any ground surface releases and using lessons learned to continually improve best management practices. The Industry should also bear responsibility and mitigate for stray gas issues that arise from faulty surface and production casing.
4. It is important that state agencies such as the PADEP and the PADCNr (where drilling on state lands) have sufficient resources to enforce existing regulations and/or propose new regulations as appropriate, and to conduct continuing research, data-gathering, and database management to document the environmental effects of Marcellus well drilling and development.
5. Careful management of effluent (drilling fluids, frac flowback water, and production brines) generated during well installation, treatment and production is a significant concern. Technical research and innovation by industry, trade associations, stakeholders, and government must continue with regard to: a) drilling waste volume reduction; b) modification/construction of existing/new treatment facilities with advanced treatment technologies; and c) use of on-site treatment and reuse and recycling systems to properly handle remaining water and wastes.
6. PATU urges state agencies to prohibit any oil and gas development in Wilderness Trout Stream watersheds, floodplains, EV wetlands, watersheds which are sole source aquifers for public drinking water, or areas containing threatened or endangered species.

7. PATU sees an urgent need for PA DEP to change its present bonding requirements for existing vertical wells, and to cover the likely higher plugging and cleanup costs for Marcellus wells. PA DEP needs to take immediate steps to determine the anticipated costs of closing Marcellus wells. PA DEP needs to consult with surrounding states regarding their existing or proposed bonding rates for this class of well. PA DEP also needs to work closely with the Interstate Oil and Gas Compact Commission (IOGCC) to assure that bonding rates meet the necessary closing costs and potential clean up costs for Marcellus wells. Without adequate bonding, Pennsylvania will inherit more abandoned wells that cannot be properly closed, and which thereby increase the risk of spewing contaminants into our waterways, much as we presently see from pre-Act drilling, and where bonding was inadequate to close the wells.
8. PATU strongly urges the Pennsylvania Legislature to require a severance fee. This fee should include a percentage to go to the Environmental Stewardship Fund, a percentage to the PA Game Commission and to the PA Fish and Boat Commission, and a percentage to the municipalities affected by drilling.
9. We insist that water withdrawal permitting by SRBC, DRBC and PA DEP be closely monitored. Namely, flows from the permitted watershed need to be fully documented and reported at the time of withdrawal to assure that the stream uses are protected. This will require that flow monitoring devices are required at the withdrawal point and that withdrawals be issued using a more conservative withdrawal rate that takes into account ecological flows modeling. Real-time reporting should be available to anyone through the PA DEP website documenting water withdrawal sites, amounts allowed to be withdrawn and by what companies. A full "cradle to grave" log, documenting where the water was withdrawn, location of wells it was used for, amount of flowback water collected that was recycled, and ultimately the amount and location of where the water was disposed of.
10. PA DEP is obligated to consider the cumulative impacts these drilling sites will pose in a watershed. In addition, resource agencies should evaluate the overall impacts to groundwater and surface flows and place a cap on permits to prevent Total Maximum Daily Loads (TMDLs) from being reached. While any one project may do minimal damage, the cumulative impacts from multiple projects could cause significant damage.
11. Surface landowners must consider the cumulative impacts of site development as it pertains to forest fragmentation and its potential impacts on our coldwater resources.
12. Roads built to and around well pad sites should be required to incorporate Environmentally Sensitive Maintenance principles as outlined by the Center for Dirt and Gravel Roads Program.
13. Legislation repealing the Oil and Gas exemption from the Safe Drinking Water Act should be passed.

WHOM SHOULD I CONTACT WITH CONCERNS?

If you believe that drilling activities have affected water resources or caused pollution, you should contact your nearest PA DEP Regional office, County Conservation District (CCD), Pennsylvania Game Commission (PGC), or the Pennsylvania Fish and Boat Commission (PFBC). The numbers are as follows:

PA DEP Regional Offices:

Northeast: (866) 255-5158
 Northcentral: (570) 327-3636
 Northwest: (814) 332-6945
 Southeast: (484) 250-5900
 Southcentral: (877) 333-1904
 Southwest: (412) 442-4000
 Toll free, after hours and weekend:
 1-800-541-2050 or 1-866-255-5158

Pennsylvania Game Commission Regional Offices:

Northeast: (570) 675-1143

Northcentral: (570) 398-4744
Northwest: (814) 432-3187
Southeast: (610) 926-3136
Southcentral: (814) 643-1831
Southwest: (724) 238-9523

Pennsylvania Fish and Boat Commission Regional Offices:

Northeast: (570) 477-5717
Northcentral: (814) 359-5250
Northwest: (814) 337-0444
Southeast: (717) 626-0228
Southcentral: (717) 486-7087
Southwest: (814) 445-8974

REFERENCES

- PA DEP's Marcellus Shale Page: http://www.dep.state.pa.us/dep/deputate/minres/oilgas/new_forms/marcellus/marcellus.htm
- Penn State Cooperative Extension Natural Gas Page: <http://naturalgas.extension.psu.edu/>
- Oil and Gas Accountability Project: www.ogap.org
- Pennsylvania Land Trust Association Oil and Gas Page: <http://conserveland.org/pp/naturalgas>
- Natural Gas Lease Forum: http://www.pagaslease.com/natural_gas_well_mapper.php
- Preserving Forests, Protecting Waterways. 2009. PennEnvironment Research & Policy Center. <http://www.pennenvironment.org/reports/clean-water/clean-water-program-reports/preserving-forests-protecting-waterways-polices-to-protect-pennsylvanias-natural-heritage-from-the-threat-of-natural-gas-drilling>